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The Engineering Record in 1916

WITH this issue the Engineering Record enters its seventy-third volume. To its readers the editors cannot refrain from expressing their gratitude for the support and encouragement they have received. Without that stimulus the journal could not have reached its present level, and upon the continuance of the co-operation of its enthusiastic, responsive clientele, the editors rest their hope of being of still greater service to the field during 1916 and in the years to come. With this volume few changes are made. The editors feel that for the present the field can better be served by developing present departments than by establishing new ones. Of present features, special stress will be placed on the "Hints to the Contractor" pages—a section established only a year ago, yet already strongly intrenched with the contractors and rapidly becoming a storehouse of money-saving ideas. The news section will continue its rapid development, that it may deserve to hold its characterization as the engineers' and the contractors' newspaper. The technical pages will maintain their reputation for intrinsic value, accuracy and definiteness—the last a trait that has received special commendation—while the editorials will speak freely and illuminatingly on the issues that concern the engineer and the contractor. Finally, the journal will continue to be thoroughly representative of the clientele it serves—energetic and vigorous, enthusiastic for all that is sound, just and of service to its field. It would not deserve well of its readers if it promised anything less.

Review of the Year

DEPARTING from the custom established two years ago, the Engineering Record, instead of publishing signed retrospects and prospects, presents in this, the first number of the new year, a series of editorial reviews. Believing that the annual advances in most fields, taken in their entirety, are exceedingly small, those particular features have been selected for discussion which clearly represent important advances. Fields or specialties in which there has been no progress of note have not been touched upon. The reader will find in these pages, therefore, a presentation of only the outstanding features of the past year's development. Figures as to volume of work, while interesting, are likely to mar the perspective. They have, therefore, been avoided. The main issues are briefly presented, their strong points thrown into relief, so that a correct view of the present status of the field may be quickly secured.

Year's Feature in Paving Practice

IN SPITE of the fact that construction activities in the highway field during 1915 were not curtailed by the war to the same degree as in other lines of engineering, there was but one development which indicated an important change in the standard practice of former years. This was the rise to favor of the monolithic type of brick pavement, in which a thin mortar bed, instead of a sand cushion, is used, and in which the blocks are laid before the concrete base has hardened. The subject has been treated at length in articles and editorials in this journal, and there is no need, therefore, of describing the details of construction. While engineers are not in entire agreement as to the wisdom of discarding the sand cushion, the new type has such intrinsic merits that its rapid spread is certain. Moreover, as pointed out in this journal Oct. 9, 1915, pages 453 to 456, the new method, so far at least as the mortar bed is concerned, is not entirely new. To its intrinsic merits is added the argument of good service—and what indorses a mortar bed still more strongly indorses the monolithic type. It is being more and more recognized that the chief cause of the failure of brick pavements, outside the use of poor filler, is a cushion which shrinks unequally and is subject to displacement. It is true that if a surface is absolutely waterproof there should be but little trouble from displacement, but investigations, previously reported in this journal, indicate that the shrinkage of the sand, due to unequal moisture content and variations in thickness of the cushion, are chiefly responsible for the hollow spots, which are points of weakness and are first to break down. This shrinkage, obviously, is eliminated by the mortar cushion. It may confidentally be expected, therefore, that the new type will quickly gain in favor. Certainly experience with its nearest neighbor in design—the mortar bed pavement—gives warrant for believing that the new construction will prove a success.

Advance in Timber Specifications

TWO YEARS ago a paper presented by Mr. Hoxie before the American Society of Mechanical Engineers started a vigorous discussion regarding the quality of structural timbers and specifications under which they are purchased. This discussion developed into an agitation for securing better conditions in the structural timber business, and that agitation developed with such rapidity that within two years' time timber has taken a new place in the minds of those who are particular about the materials they use and the specifications under which they are purchased. Briefly put, the density specification for buying structural timber now rules the timber field. Not only has it received the backing of the engineers, as evidenced in its adoption by the American Society for Testing Materials and its advocacy by the U. S. Forest Service, but producers have indorsed and adopted it as their standard. The Yellow Pine Manufacturers' Association, through its board of directors, adopted the rule a year and a half ago, while within a few months the Southern Pine Association, which will have a great influence on the lumber market, has accepted the specifications of the American Society for Testing Materials as the standard for its members. The action of the latter association is particularly commendable. It strikes right at the root of the whole question. If the producer can be induced to accept the proper specification, and will take the still farther step of branding his material so that responsibility for it is definitely and surely fixed, the battle will be won. That there was great need for reform for timber purchasing none who has had experience with the lumber market will deny. That the reform, however, has come within two years is a tribute to the influence of the engineers who have advocated the change and to the producers, such as those in the Yellow Pine Manufacturers' Association and the Southern Pine Association, who have been open-minded enough to see the correctness of the engineers' stand and have determined to co-operate with them.

Concrete Progress

CONCRETE progress during 1915 lay chiefly in a keener appreciation of the relation which mixing and handling methods bear to the quality of their product. It has been known for years that short mixing periods, spouting of wet concrete, carting over long distances, etc., tend toward a non-uniform and unsatisfactory concrete. Appreciation of these facts, however, to the extent of allowing them to have an influence upon methods of construction, was confined very largely to the engineers. Contractors recognized them, but passed them off with the remark that concrete on the whole is good and that these methods have a comparatively small bearing on the end and result. Now, however, even among contractors the evils of improper mixing and handling methods are being appreciated. Indeed, mixer manufacturers are changing their selling arguments to conform with what the engineers enunciate as good concrete-mixing and handling practice. Specifically, there are strong movements in favor of longer mixing and against the use of spouting. The remedy on the one hand is very easy—to keep the material in the drum longer. This will cut down production, of course, and Nathan C. Johnson has therefore proposed that the grout be mixed in a preliminary operation and then incorporated with the larger aggregate. In the matter of spouting, too, the difficulties are not insurmountable, though the opinion is gaining strength that it is practically impossible to enforce proper conditions. If this feeling grows and contractors fail to take the necessary precautions, one can expect engineers to forbid spouting methods to be used on their work. Certainly the present feeling against poor mixing and improper handling of spouting will not, and should not, down till better methods are enforced.

Highways Lead in Activity

JUST as in 1914, the most active branch of engineering during the year just closed was the highway field. Statistics gathered by the Office of Public Roads indicate that $240,000,000 were spent upon new construction. Estimates so far made indicate that approximately $270,000,000 will be spent in 1916. Moreover, the growth in local highway associations and the interest taken by all classes of citizens is steadily increasing, so that one can safely expect still larger appropriations in future years. While this activity is highly commendable, on account of the tremendous economic influence of better roads, it is regrettable that funds for maintenance do not seem to keep pace with those appropriated for new work. It is unnecessary to impress upon engineers the need for proper maintenance. Laymen road officials, on the other hand, sorely need education on this matter, and it is the plain duty of every highway official of technical training and experience to do all in his power to impress the need of adequate maintenance funds on the laymen officials with whom he is associated. Continuance of the policy of allowing roads to go to pieces before they are given repair attention means a large financial loss to the community and very great inconvenience during the period when the road is in bad condition. As far as highway construction is concerned, it is particularly notable that within the last two years many large contracting firms, with long experience and excellent organizations, have engaged in the work. This has been due to lack of contracts in other lines. With the resumption of normal activity, work for them will probably be found in the fields where they originally operated. It is quite certain that having gained the experience and purchased the needed plant they are quite likely to stay in highway work. Needless to say, this is an advantage to the public, for the larger organization as a rule can be relied upon to do better work and to operate at lower cost. The situation, therefore, in the field is most encouraging. If the one unsatisfactory condition, the failure to give maintenance its proper place, is corrected engineers will be able to look with still greater complacence upon the wonderful strides which have been made for better roads and pavements.

The Business Situation

FINANCIALLY the past year presented the unusual condition of a plentiful supply of money with everyone afraid to invest it in anything from which an immediate return was not in sight. No one knew during its early months how the European war would affect our economic structure, and because of lack of confidence in the future stability of business projects for which the funds had not already been provided were unable to procure backing. Curiously enough, one of the first influences which set to work to restore confidence was the war itself. Foreign nations came to us to buy, first steel and munitions, then everything we could sell. Exports grew by leaps and bounds, records were broken every week, and in spite of imports in nearly normal volume, a balance of trade piled up in our favor which threatened seriously to affect foreign credit. Fortunately the situation was adjusted before any harm was done. It soon became evident, however, that instead of needing every cent our bankers could scrape to pay back the tremendous debt of foreign-held American securities, we were able to pay for them in goods, and to go yet further and shift the gold movement in our favor by half a billion dollars.

This money had to have outlet. It could not lie idle; yet it was, and to some extent is yet, chary of private enterprise. The credit of our governmental bodies, however, had weathered the first shock of the war unshaken, and the investor naturally turned to municipal, county and state bonds. Little wonder that sales of municipal bonds for the eight months ending with August exceeded those of any like period in our history, and that the total value of municipal bonds issued during the ten months ended with October have threatened the previous high record. All this meant public work—a new capitol for Oklahoma, new municipal buildings in Detroit, large school construction programs for practically all of our leading cities, and city, county and state road improvements in extraordinary volume. Waterworks, sewers, and other municipal work lagged somewhat behind, but still came in for a nearly normal share of funds.

Privately-financed construction, except in the steel industry and elsewhere when immediate returns from export trade were in sight, have scarcely yet begun to follow the lead of public work. The steel industry itself, generally an excellent index to conditions, has run far ahead of its usual place because of favoring circumstances. Its present status, perhaps the best in its history, is due to increased exports of steel products, which brought up prices and brought out domestic buying on a tremendous scale. The size of the latter movement can be appreciated when the present railroad buying is contrasted with the rigid economy in equipment practised for the past two years. Another large factor in this buying movement was the low point to which stocks of all sorts of steel had been reduced by the warehouses. With the steel industry's expansion came gains in railway earnings, first due to export movement and then to the handling of record crops. This improvement itself, aided by two small rate increases, reacted again in favor of the steel business.

Under the circumstances, it could hardly have been expected that large construction contracts would be as numerous as in past years. However, more than one hundred contracts ranging from $500,000 up have been reported as let in the columns of this journal. New York, Philadelphia and Boston rapid-transit contracts form a large part of the total. The remaining projects are scattered, including industrial plants, terminals, drydocks, two government locks, sections of the Calumet-Sag channel at Chicago, a few large railroad contracts and a good number of big buildings. Bridge work, of course, was slack, as it usually lags behind other work except in periods of expansion. Nevertheless, at least twenty-five contracts amounting to $100,000 or more were reported.

In the past two months the gain in business has broadened to a country-wide basis, and depends no longer for its maintenance on foreign trade. Construction work does not measure the actual improvement at present, however, because of the lateness of the season, but prospective work which seems destined to go through with the opening of the spring of 1916 promises substantial gains over the present year in every respect. If the rising prices in construction materials, such as cement and lumber, may be interpreted as in normal times, the contractors are going to have a busy season after the lean years. These rising prices, of course, will mean higher construction costs, while labor also is sure to be high. In fact labor shortage may actually curtail the execution of works now confidently planned. This is a matter with which contractors must reckon in preparing bids for the new year's work.

The danger to our market from increased cost of production, which will make it hard for us to meet foreign competition after the war, even in our own country, still exists. However, this danger is realized on all hands, business is preparing to meet it, and it is hoped that Congress will render material aid by passing the necessary legislation. If this, the one cloud on the horizon, dissolves, the country will come into a period of great expansion on a sounder basis and on a much larger scale than such expansion has ever had before.

War and Waterworks Chemicals

IN WATER PURIFICATION the outstanding feature of the year has not been any new technical development, but a commercial situation arising out of the European war. The cost of the chemicals usually employed in purification work has gone up enormously, thus increasing filter operating costs and directing the attention of investigators toward new sources of chemical supplies. Alum, for example, is now quoted at from $40 to $50 per ton, more than double former prices, while soda ash has advanced from $14 or $15 to $30. Even at the higher figures it is almost impossible to secure sufficient quantities. The rise in the price of hypochlorite has been equally sensational, for the large amounts imported in normal times have been cut off by military operations. Whereas $37 per ton was quite an ordinary figure before the war, now $90 to $100 per ton must be paid. Curiously, however, the price on liquid chlorine has not risen, though primarily the materials come from the same source. From $8 to $10 per hundred pounds is the present quotation on the liquid article. As a consequence many large plants formerly using hypochlorite have recently been changed over so as to use the liquid form.

Lime has not advanced and there seems to be no reason for raising the price, although increased demands by the broadening building activity may operate to that end later on. In any event, however, the increase in price is not apt to be serious. Sulphate of iron has remained at the former figure.

In the minor chemical supplies, those for laboratory uses, the advances have been from fifty to several hundred per cent.

Apparently, however, the war and the price consequences have not been without compensation. This journal has already had the privilege of recording what has been done at Columbus. In the issue of May 8, page 576, an alum plant established by the city was described. Reports now show that it has proved its case, the average cost of producing 648 tons of alum from January to September, inclusive, being $7.38 per ton, representing a saving of $6,000 over the market price of the material. This cost, however, does not include interest on investment and plant depreciation, so that the saving must be taken with appropriate allowance. At Columbus, too, still further experimentation has been going on. When it was found that the price of sulphuric acid had gone up very materially over the 1915 contract price of $12.50 per ton, an experimental acid plant was set up and preliminary runs thus far made indicate that the acid can probably be produced at a cost not to exceed $10 per ton.

It is not safe to predict what may happen in this local development of chemicals for water purification use, but if conditions in the chemical industry following the war prove to be unsatisfactory, and chemical manufacture becomes a regular part of water-plant operations, operators of such installations will have before them still greater technical responsibility than at present. Theoretically, of course, the assumption of a wide variety of duties by an organization fashioned for one particular class of work does not lead to efficiency. Consequently, whatever is done now along the lines being pursued at Columbus must await for final judgment the return of normal times. Nevertheless, it is gratifying to see that engineers engaged in this line are fully competent to cope with situations when emergencies arise.

Engineers' Response to Call for Military Preparedness

WITH the passing of the year 1915 a new engineering movement has been born—a mobilization of the country's technical resources as a measure of defense in the event of war. Until very recently, engineers were inclined to regard military preparedness merely as a general term with which they had no professional connection—in the same category as the tariff and methods of taxation. In other words, they felt that it was one of many subjects with which all good citizens should be familiar if only they had time to gain more than a superficial understanding of its meaning.

Within the last few months, however, there has been a decided change in the attitude of technical men toward national defense. The European conflict has demonstrated that modern warfare is, very largely, a matter of engineering, and that in the event of a threatened invasion by foreign forces this country would have to place a heavy burden of responsibility upon the engineering profession. To equip its members to discharge this responsibility is now the aim of the profession at large.

In the Corps of Engineers of the U. S. Army on Oct. 1 there were 230 officers. In case of attack by a foreign power thousands more would be needed. Where is the supply coming from? This is the question which has set technical men thinking, and as its import is being grasped, a great wave of interest is sweeping over the country, and at every turn there are evidences of the engineer's eagerness to play his part in any plan of national defense that Congress may adopt.

There was little real progress as to ways and means until late in the year just passed, yet much has been accomplished. Five of the national engineering societies—civil, mechanical, electrical, mining and consulting—through a joint committee headed by William Barclay Parsons, have co-operated with the War Department and members of Congress in the drafting of a tentative bill creating a reserve corps of engineer officers. The object of the measure is to provide means, by intensive training at summer camps and by correspondence courses, for the engineer in civil life to familiarize himself in some measure with military duties. Of course, a seasoned soldier cannot be made by a month's training. This is not to be expected. But a man who wants to learn can absorb a great deal at camp. Should there even be a call to arms the time needed to develop capable engineer officers would be very considerably reduced if the men had previously been grounded in the elements of the duties they would be called upon to perform.

But engineers have gone further than this. There is a manifest desire for results even without waiting for Congress to announce a definite program, and local engineering societies in the larger cities are planning for courses of military instruction this winter. City engineering departments also are displaying keen interest in the subject, and although no actual courses of military training have been begun by engineering organizations, so far as the Engineering Record knows, there is every probability of such action in the near future. Of course, a number of engineers attended training camps like the one at Plattsburg last summer.

Then, too, there are the contractor and the manufacturer of engineering equipment. Each is a vital factor in the defense program. A plan of organizing the manufacturers of the country, so as to eliminate lost motion and red tape in turning out supplies for the government's use, has been suggested. Its chief features were discussed in the Engineering Record of Nov. 13, page 589.

This, then, is the status of the engineer's activities in preparedness: He realizes that it is his job; he wants to learn more about it; and has taken the first steps toward acquiring this knowledge. A study of texts on military engineering will show how well the civil engineer is trained to take up the tasks that fall to the army engineer. Surveying, mapping, laying out defenses, camps and railroad lines; the building of water-supply systems and of sanitary works; the construction of fortifications, the driving of tunnels and the placing of mines; the building of bridges and roads—all are included in the military engineer's work. To the engineer in civil life much of this has a familiar ring. It all seems like part of the day's work. But the engineer who would be useful in war must be a soldier first of all, and this means military training and plenty of it. He must reconstruct his views as to methods of doing things in the field. Economy must give way to speed. Quick results are what count. These and scores of other things he must learn and he must learn them now. He cannot learn them so well at the eleventh hour, nor with such advantage to the country. No one appreciates this fact better than the technical man, for advance planning and organization are the very essence of his work. Unless all indications miscarry, the present year will see something definite accomplished in the matter of preparedness, and if a call should come the country's engineers will not be found wanting.

Progress in Society Co-Operation and Publicity

THE INCEPTION, both as to time and place, of significant movements is often difficult to trace. Generally the beginnings are small and no single individual bears the whole responsibility. In fact, if the movement be truly important, both in its object and the vigor with which it proceeds, it is likely to have been in the minds of many persons, more or less definitely, for some time. Expression from one quarter has then been met with response from others, and almost without effort minds become prepared for action.

It would be difficult to trace the present movement for improving the status of the engineer back to its inception. It has been in evidence for some time, though its recent vigor indicates that new relations have been discovered and that new minds are at work on the problem. Certainly the interest in the engineer's status was never keener nor so broad. From the top of the profession even to the bottom the question is discussed, even though the motive be different. In the higher ranks pride in the profession and solicitude for the engineer's standing are the stimuli; among the younger men, the relatively unsatisfactory scale of remuneration.

And though the stimuli are different, the remedies proposed are, in part, the same. Both classes see the need of better co-operation and proper publicity. The first class advocates co-operation in order that a stronger body may stand before the public in advocacy of plans or policies that received professional indorsement; the other, that employment may more readily be found and that compensation may be increased by fitting men to the right jobs. For both ends publicity is deemed to be a necessary agent. And because interest is found from top to bottom and society co-operation is suggested most commonly as the means for accomplishing desired results, one may safely conclude that engineering societies have been acquiring strength rapidly. Such, indeed, is the case, and while it may not be said that epochal steps were taken in 1915, certainly the growth of the movement in breadth and depth was notable and evident.

Nationally various events tended to bring the big engineering societies together. Early in the year Mr. Swasey made his gift of $200,000 for the establishment of the Engineering Foundation, in the direction of which the four leading national engineering societies participate. Then came the important work in New York State of formulating the views of engineers upon desirable revisions of the New York State Constitution, a work again in which all of the national societies, and a number of New York local bodies, participated. Upon the heels of that work followed the International Engineering Congress at San Francisco. Naturally these instances, where it was plain that the best results could be accomplished by bringing all branches of the profession together, have indicated the need of a more constant co-operation. As a result there have been a number of suggestions that some permanent and continuing basis be arranged, and at the International Engineering Congress it was clearly indicated by a number of speakers that plans for such co-operation are under consideration.

And while consciousness of the need for co-operation nationally has been growing, the advantages of closer relations between local bodies have been becoming apparent to a greater and greater number of men. A movement to bring together local branches of the national societies is in full swing. In relatively few cases has the co-operation been fully worked out, though there are conspicuous examples of success. In a number of large centers, Chicago and Cleveland among them, the matter has been under advisement, and it would be surprising, indeed, if the new year did not witness the consummation of some of the plans. At St. Louis, as is well known, the co-operative work has been carried on with success for some years, while the triumph—and the word is advisedly used—of the Philadelphia Engineers' Club in its great campaign for membership has attracted the attention of the entire profession. That campaign grew out of a plan of local-branch co-operation.

Another phase that must be reckoned with in the future development of professional organization is the movement started at Chicago to bring together the younger and lower paid members of the profession. The Associated Technical Men and the American Association of Engineers have been criticised as attempts to unionize the profession. To dismiss these organizations, however, with such a characterization is not only to do them an injustice but to close one's eyes to certain needs which must be provided for. Provisions for an employment exchange and for aiding in local legislation are proper functions of a professional organization, and these seem to be the leading objects of the associations in question. It is properly contended that these objects could be satisfactorily handled by existing local and national societies. These bodies, however, have not taken care of these matters, and until they do one can safely look for an increase of membership of the Chicago organizations.

Insofar as publicity for engineering matters is concerned, the movement in full swing during 1913 and 1914 has gathered greater force. The antagonism to publicity, due to mistaken ideas as to its purposes and means, is rapidly disappearing, and few engineers will now contend, if good taste be not violated, that publicity for engineering plans or movements of public moment is undesirable or improper. The conspicuous position of the Cleveland Engineering Society, due to its excellent publicity work, has often been commented upon. Its signal success, however, has now been eclipsed by the wonderfully successful campaign which quadrupled the membership of the Philadelphia Engineers' Club, making it the largest local engineering organization in the United States. Such successes as these, enhancing the society's standing in its community without lowering its dignity, will go far in establishing publicity methods as a legitimate agency in advancing the engineer's position in public life.

It is apparent, therefore, that in the profession as a whole the determination is clear to marshal the forces and to fit the engineering societies to serve better their members and the profession. Nationally and locally the societies are strong. They need now to be massed, to be co-ordinated, to be inter-organized for effective work. At the top it means closer co-operation between the national bodies. On another plane, serving an entirely different but most important purpose, will come co-operation and co-ordination between the local engineering societies in each of the large cities. With such a massing of forces, unified action on important matters will be relatively easy to secure. The channels of communication will be properly established and plans can be made broadly with certainty that the machinery for carrying them out can be promptly and effectively put into action. This is a consummation "devoutly to be wished." It is not, in this time of professional readiness for action, an idle dream, an impossible project. On the contrary, with interest at white heat, it is fairly easy of accomplishment. Forces are stirring, plans are under way; good-will and the spirit of compromise were never in more evidence. What a step might not be recorded in American engineering history if the close of the year 1916 should find the entire profession welded together, unified for all action tending toward professional advancement?

Activated-Sludge Sewage Treatment

THE MOST interesting and promising sanitary engineering development of the past year has been the activated-sludge method of sewage treatment. More enthusiasm has been occasioned by it than by any other development since the Imhoff tank.

The fundamental idea connected with the activated-sludge method was first worked out in Manchester, England, in 1914, by Messrs. Ardern and Lockett, under the inspiration of Professor Fowler, of the University of Manchester. The English experiments prior to the awakening of interest in the problem in this country were outlined in the Engineering Record on March 6 last, page 288. These English experiments had demonstrated the "operative" success of the process on the fill-and-draw plan, both on a laboratory and on a larger out-door scale. They had not demonstrated its economic success.

In this country the first experimental work, also on the fill-and-draw plan, was done by Professor Bartow, of the University of Illinois. A little later the Milwaukee Sewerage Commission began to experiment with the fill-and-draw plan. In December, 1914, paper studies of the method were made at the Hygienic Laboratory of the U. S. Public Health Service and plans devised whereby the fill-and-draw process might be translated to the continuous-flow process. A patent was granted to the service in May, 1915, covering these paper studies. The patent gives two fundamental designs for the continuous flow process: (1) a method, involving oxidation and settling chambers, in which the activated sludge is returned by gravity through a communicating slot into the oxidation chamber; and (2) a method, involving oxidation and settling chambers, in which the activated sludge is returned by pumps or other propelling means from the settling into the oxidation chamber. Joint experiments between the Health Service and the Baltimore Sewerage Commission were begun at Baltimore on the first of these two methods, as it appeared to be comparatively inexpensive to convert one of the new Imhoff tanks at Baltimore for the purpose. Unfortunately money shortage is delaying these experiments considerably.

In the meantime the second of the two methods given in the health service patent was worked out independently at Milwaukee and experiments thereon begun. T. Chalkley Hatton, chief engineer of the Milwaukee Sewerage Commission, read a paper at Dayton, Ohio, in October in which he outlined some of the results of these experiments. The outstanding point made in this paper was that it seemed possible, under the conditions obtaining at Milwaukee, to purify the sewage of that city in summer weather by the continuous-flow activated-sludge process at a cost of about $5 per million gallons, exclusive of sludge-treatment costs. This figure was apparently based upon the ability to manufacture power at ⅝ to ¾ cents per kilowatt hour. Incidentally, it should be recorded that the first activated-sludge tanks to be put in service in this country are nearing completion under Mr. Hatton's direction at Milwaukee.

Activated-sludge experiments are being conducted at a great many other places in this country. Brooklyn experimented on a small scale with the fill-and-draw method and with the first of the two methods given in the Public Health Service patent. A paper upon these experiments was read by W. T. Carpenter at Lakewood, N. J., on Dec. 3, before the New Jersey Sanitary Association. Apparently none of the other experiments have as yet proceeded to a point where publication of results is considered advisable.

A judicial appraisal of the process at the present time is not easy. There are too many unsolved problems involved. However, an appraisal will be attempted by discussing: First, the unsolved problems, and second, the advantages of the method if these problems be solved.

The unsolved problems include: (1) The winter-weather problem. (2) The plant-supervision problem. (3) The sludge problem. (4) The cost problem.

The winter-weather problem may resolve itself in one of two ways: It may prove that the process will be economically possible in any part of this country, or that it will be applicable only for cities where the sewage throughout the year remains above a certain critical temperature. In this connection it should be stated that the temperature of the sewage itself will likely be a greater controlling factor than the temperature of the air introduced, as the air can probably be heated sufficiently at a low cost. The nearer the outfall sewer is to the center of population, the more likely will the sewage remain throughout the year above the critical temperature, and hence the more likely will the activated-sludge process be possible for that city.

The plant-supervision problem is an almost entirely unknown quantity for the new method. The lack of intelligent supervision of sewage-treatment plants in general has often been discussed in engineering periodicals and in text-books, and it is unfortunately an extremely pertinent subject for discussion. It seems probable, from the nature of the activated-sludge process, that it will require more intelligent supervision than most processes that have hitherto been in use. This is so, primarily, because of the comparative ease with which the sludge tends to lose its "activated" properties. The neglect of any one of a number of factors, such as air supply, sludge percentage, or detention period, will cause this loss of "activation." Should the process come into general use, it seems probable that in any plant where a sufficiently high standard of supervision does not obtain poor operation will at times occur and the effluent be below the required standard. In general, therefore, it is probably true that the successful application of this new process will enforce a higher standard of supervision. The necessity for such higher standard should be viewed by communities as a distinct advantage rather than as an evil, as it will help to keep that part of the public works above the influence of the political element.

The sludge problem cannot as yet be said to be definitely solved. It has been demonstrated that activated sludge has a higher fertilizing value than ordinary sewage sludge, and this fact has caused such firms as Armour & Company and Sulzberger & Sons Company to begin an active investigation of the process. The cost of realizing this fertilizer value, however, depends largely upon the cost of removing the moisture, and this is the feature regarding which no final figures are yet available.

The cost problem is obviously related to each of the three foregoing problems, but it is related much more intimately to the air problem. The greater portion of the cost of the activated-sludge process, exclusive of sludge handling, lies in the cost of air compression. Probably at least $3 of the $5 cost figure given by Mr. Hatton refers to air cost. If this cost estimate is based on power at ¾ cents or less per kilowatt-hour it is obvious that for a great many communities which are not able to secure power at less than 1½ cents the cost of sewage treatment by the activated-sludge method will be $8 or more per million gallons, *exclusive of sludge-handling costs.* It is highly desirable, therefore, that the cost of the process be reduced still further, and the most fruitful point of attack would seem off-hand to be the air cost.

If it be assumed now, for purposes of discussion, that all of the above problems will be solved—that winter weather will not prohibitively retard the biologic forces involved, that adequate supervision will be provided, that the sludge problem will be successfully solved, that the total cost of treatment is brought within the means of the average community—it is pertinent to consider the advantages of the new method compared with others.

The following will probably be its most important advantages: (1) Ability to control the quality of the effluent. (2) Lack of odor development. (3) Small plant area. (4) Low first cost.

If we assume that the plant has adequately intelligent supervision and that it is designed with a sufficiently flexible air supply, it will be comparatively easy to regulate the quality of the effluent to current requirements. This is not so true of a plant composed of Imhoff tanks and sprinkling filters. In the latter case the sprinkling filters must be designed sufficiently large to be capable of delivering the highest quality of effluent that will be required at any time. The cost of flexibility in such a plant is therefore first cost, which is a constant expense. In the activated-sludge method the cost of flexibility is principally operation cost, since the quality of the effluent may be largely controlled by varying the rate of air introduction. This advantage of the new method is more important than may appear at first sight. There are many communities for which the sewage-treatment problem involves simply nuisance prevention. For such communities it will be unnecessary to deliver as pure an effluent in cold weather as in warm weather, and for them the ability to regulate the quality of the effluent by means of a variable operating expense (which is never more than is actually required), rather than by means of a constant first-cost expense (which is for part of the year excessive), will be an unmistakable advantage.

The new method does not appear to develop objectionable odors in any part of the process, if we make a slight reservation in the matter of sludge treatment, regarding whose odor characteristics we are not as yet finally informed.

It is definitely established that the new method will require much less plant area than present methods delivering a corresponding quality of effluent. This will reduce the cost of land per unit of sewage flow to a much lower plane of importance and will make it possible to select sites nearer the center of population, thus reducing the length of outfall and increasing the freshness of the sewage.

The relatively low first cost of the method is primarily due to the fact that its "cubic performance" (for definition of term see Engineering Record, Dec. 18, 1915, page 751) is much higher than, for example, that of sedimentation and sprinkling filtration. The daily cubic performance of the activated-sludge method will probably be about two or three volumes of sewage per volume of device, whereas the sprinkling filter method has a daily cubic performance of only about 0.5 to 0.7 volumes of sewage per volume of device. Other factors such as the lessened land area and the lessened length of outfall sewer also help to reduce the first cost. Low first cost is important, because, for a great many communities the economic limit is not determined by annual cost but rather by bond issue, and for such cities it will be financially easier to install a "low first cost—high operating cost" system than a "high first cost—low operating cost" system.

Evidently then the process deserves the most painstaking investigation. Its possibilities appear to be very large. If the present difficulties can be overcome, we shall have added to engineering knowledge a valuable, if not the most valuable, method of disposing of liquid wastes.

Leading Situations in the Waterworks Field

During the year which has just passed, events of some significance have transpired in two cities of large population, in which the supply of water is not under municipal ownership—Denver and San Francisco. In both, there has been either decided or under trial litigations that are the aftermath of efforts to settle by agreement controversies of long standing, and, occasionally in their history, of intense bitterness of feeling. Litigation has followed upon the rejection by the citizens, in one case, of a plan proposed by a business organization, in the other, requiring a two-thirds vote, of an agreement between the city administration and the water company. In neither instance is it likely that this last word will drive the citizens to the construction of new plants, to the wasteful duplication of serviceable property, a possibility only, with the continued existence of exaggerated passion, of the passing away of which there are strong evidences.

In Denver, following upon the rejection by the citizens of a plan for the appraisal of the company's property for purchase, the City Commission passed an ordinance for a schedule of rates which had been drafted by the Public Utilities Commission and had been regularly initiated under the terms of the charter. The company sought injunctive relief in the U. S. District Court.

The special master, appointed to hear the issues, made a valuation of $13,415,899, found that the rates under the ordinance would yield a return of 3.64 per cent upon that valuation, and found that such rate was "not a fair or just return for the use of the property of the water company by the public." The report has not been approved by the court, pending arguments on exceptions to be heard in January.

From the valuation, "for rate-making purposes," the master excluded the item of pavement over mains, on the authority of the U. S. Supreme Court in the case of Des Moines Gas Company vs. City of Des Moines, and included the sum of $800,000 for "going concern value" on the same authority, setting forth that the valuation of the physical property had been estimated "as if the plant were about to commence serving the public, with its business yet to be established." As the property was "an assembled and established plant doing business and earning money," that "property right" had to be added to the valuation.

No additional sum was allowed for service connections, for preliminary expenses and organization, nor for working capital.

For water rights, the master found a value of $2,947,617, determining that these water rights were in the ownership of the company and not in the consumers, as had so clamorously been contended in this particular instance.

Should the court adopt the master's report, it is not improbable that it may form the basis of a final solution of the prolonged controversy. It finds the property to be in excellent condition, and states that "a new plant capable of serving the public with like efficiency cannot, according to the evidence, be built for $13,415,899."

The Public Utilities Commission has made no progress with the construction of a new plant, to be owned by the city, which they were directed, in 1910, to build at a cost not to exceed $8,000,000. Recently, a contract was let by the commission for the surveys for such new plant, and, soon thereafter, the commission contracted to purchase [illegible] reservoir and irrigation canal for $1,050,000, which contract was immediately met with injunction proceedings and a number of lawsuits attacking the ability of the assignor to convey.

The valuation found by the master has special interest to the engineering profession, because of its indorsement of that found by the board of engineers appointed in 1907 to make an appraisal of the same property. The board consisted of Messrs. Hazen, Freeman, Harrison, Holman and Stearns, and submitted a majority-report valuation of $14,400,000, for purchase. The substantial agreement, considering progressive depreciation, betterments and exclusion of certain items for rate-making, is a vindication of the much-assailed finding of the engineers, and especially so, in the matter of water rights, valued by the engineers at $2,845,925, and by the master at $2,947,617.

In San Francisco, the standing master in chancery is now hearing testimony on the ordinance rates, established by the Board of Supervisors since 1907. These rates have been imposed, annually, under the charter, injunction has been regularly secured by the Spring Valley Water Company, and over $2,000,000 is now impounded in court, pending this court decision. The submission of evidence has continued since early in July and will probably continue for some months.

Failing to secure the approval of two-thirds of the vote at an election held in April last, on the agreement to purchase the property for $34,500,000, made between the city administration and the company, it is probable that proceedings in condemnation, in all likelihood to be heard by the State Railroad Commission, will follow upon the report of the master in the rate cases.

Meantime, beyond building a small diversion dam and awarding a contract for the construction of a railroad leading to the dam site in the Hetch Hetchy Valley, the city has made no serious movement toward the construction of the new waterworks from the Tuolumne River, under the powers granted to it by the Raker Bill. Recently, the mayor vetoed the resolution of the Board of Supervisors to dispose immediately of $45,000,000 bonds for the Hetch Hetchy project.

In both cases, the progress toward actual municipal ownership is still tortoise slow. In neither case are the conditions favorable to rapid consummation of such policies; in both, and in Denver particularly so, there is evidence of a saner realization of the responsibilities such policies involve, and a growing disposition to a more just and reasonable attitude toward the water companies.

Irrigation in 1915

IN THE IRRIGATION FIELD the year just passed has brought little or no development of moment. With projects generally only partially taken up and practically none on a paying basis, neither the government nor the private interests could be expected to engage in new work. That which has been done has been in the way of completing projects already well along.

Conditions, moreover, are only a trifle more hopeful than they were a year ago. Settlers, generally, have not yet worked out their salvation, and the financial responsibility of the government, in the case of public projects, and of promoting companies, in the case of private ventures, is not yet at an end. The condition of the settlers, however, is improving and on some projects the real farmers are able to see the light, though the professional agitators are unwilling to admit it and are as loud as ever in protesting the hopelessness of irrigation farming.

The effort to repudiate the obligations to the government seems not to have lessened during the year, though it must be distinctly borne in mind that in times past as well as now the clamor comes from the speculative element rather than from the real farmers. This does not mean that the latter have not had very great, and in some cases insurmountable, difficulties. It does mean, however, that on the whole those who were fitted for the work and have toiled faithfully are in as good a condition as one might expect, and are not peddling their troubles in the press and on the street. Irrigation farming is development work, similar to the establishment of a business or of a manufacturing enterprise. One must expect a period of hard work, many disappointments and discouragements, and a goodly percentage of failures. To expect otherwise is to invest irrigation farming with a magic charm, differentiating it from all other development work.

The twenty-year extension law, passed in 1914, should now presumably be operative, but every effort is being made, on some projects at least, to postpone the date when it is made effective and the first payment will be due. In cases there may be warrant for such postponement, but those loudest in advocating it are the speculators who have unloaded their holdings on present owners and who know that repayments to them will be delayed if the government steps in and demands its first installment.

One would be more likely to take an attitude favorable to postponement were it not quite clear that strenuous efforts are being made to repudiate as large a part of the debt to the government as possible. The proceedings before some of the boards of reviews, which have been in session during the year, aiming to decide as to the fairness of charges against the projects, have been disgraceful orgies. With a lack of conscience that is positively astounding, efforts have been made to have the settlers relieved of almost every possible item of cost regarding which a clever lawyer could raise a question. Moreover, it is plainly said on the projects that if the fight is kept up long enough the government will eventually give the works to the settlers and expect nothing in return. With this feeling existing, one's temper is naturally not over generous. Unfortunately the bona fide hard-working farmer must suffer for the sins of the agitators, through whose wailings the attitude, or supposed attitude, principally becomes known.

One bright ray appears on the horizon—a disposition to make a fair and full investigation of conditions as they actually exist, with a view to supplying the needed remedy. Such views are those expressed by Dr. Elwood Mead before various conferences during the year and in the article by Edward Gillette in the issue of the Engineering Record of Dec. 25, page 789. This view—as to the necessity for a full and impartial study of conditions in an arid West—is finding many advocates at present and deserves to be supported.

When, however, the discussions favorable to such an investigation result in advocacy of a rural-credit system to be applied to the irrigation districts, without qualification as to the conditions of its application, one must dissent. Rural-credit systems when they come, under either state or federal auspices, should be generally applied and not merely restricted to irrigation projects. Moreover, so far as the U. S. Reclamation Service projects are concerned, no greater mistake could be made than to place a rural-credit system under the direction of the service. If in addition to the expenditures by the government in the engineering work, money were advanced to settlers for stock and improvements there would be all the more reason for the agitators continuing their campaign, for the stakes would be larger. If, on the other hand, the money were loaned by a banking department of the government, the settlers would appreciate that they would have to meet their obligations both as to interest and principal.

While, therefore, the Engineering Record is heartily in favor of a rural-credit system, it feels that it must be of broad application and must be administered under banking conditions.

While much activity in the way of construction cannot be expected during the new year, funds will probably be available for strengthening old enterprises and curing cripples. In fact, there is good reason for believing that considerable sums will be spent in the West in 1916 in this way. A year hence still further progress should have been made toward making existing projects pay, though it is useless to hope for really satisfactory conditions by the end of another twelvemonth.

Record-Breaking Bridge Work in 1915

While there has been no distinctive technical development in the structural-steel field during the past year, several record-breaking structures have been under way or brought to completion. Two long steel-arch bridges have been closed, one the longest arch in the world, and the other the third longest. The desired progress in the construction of the Quebec bridge, containing the world's longest span, 1800 ft., has been made, the schedule for the working season of 1915 being completed as planned by Nov. 9.

About 32,000 tons of steel were placed in the Quebec bridge this season in somewhat over six months. The work included the erection of the falsework on the south shore, the south 515-ft. cantilever arm and main posts, part of the north anchor arm and the 580-ft. north cantilever arm. This means that about 44,000 tons of the total 63,000 tons of steel in the bridge have been erected. The double pins at the joints, driven in two or three minutes each, the extreme accuracy of the shop work, the yard-assembly reaming and the excellent field appliances, including flying falsework and electrically operated travelers, all contributed to rapid work. While the record day's tonnage in 1914 was 410 for one traveler, in 1915 the figure was 670.

The tonnage erected in the construction of the record-breaking 977½-ft. Hell Gate arch is naturally relatively small when compared with the Quebec structure. The work progressed with no special attempt at speed, and arch closure was successfully accomplished on Oct. 1, or four months after work on the main arches began. In that time 13,000 tons were placed. There is every prospect that by the end of the year all of the steel in the floor will be in position; in that event 19,000 tons will have been erected in seven months. During the erection of the plate girder approach spans for this bridge, a world's record of 1504 tons of steel placed in one day was made on March 8.

Another steel arch, the third longest in the country, but of much lighter construction than the Hell Gate, was successfully closed in Cleveland. The 591-ft. arch span with double-deck floor was erected in a little over three months—from July 29 to Nov. 5. Closure was made Oct. 8, by the use of screw toggles and telephone control, in about 1 hr. 50 min., while the corresponding closure operations for the Hell Gate arch, in which hydraulic jacks were used for the adjustment, required about 1¼ hr.

In both the Quebec and the Hell Gate bridges, special safety appliances were used in the erection, with the gratifying record of practically no accidents on work of monumental and unprecedented character. This was accomplished through the use of well-protected riveting stages and solid pin-driving or working platforms, and marks a new era in bridge erection.

Of the other record-breaking spans under construction, the erection of the superstructure of the Sciotoville riveted continuous truss bridge of two 750-ft. spans has not yet been started, while the longest simple truss span, 720 ft., in the Metropolis Bridge, will not be erected until next spring. The Tunkhannock viaduct, the world's largest reinforced-concrete bridge, 240 ft. high, was completed and put in service Nov. 7.

In spite of the two months' delay in starting, due to high water, the superstructure of the Harahan cantilever bridge over the Mississippi River at Memphis has been rapidly placed. The fixed span has just been swung and the anchor arm, one cantilever arm and one-half of the suspended span on the Memphis end have been erected.

The progress on these large structures and the successful completion of the steel erection on the longest arch span in the world mark the year 1915 as notable in structural history.

Valuation—Its Present Status

A FEW YEARS AGO the valuation problem was in the main treated by engineers as a subject for dispassionate scientific investigation, and the attempt was being made to formulate a set of fundamental principles applicable to all utilities. Now the scientific investigation has been disrupted by a grim battle for the inclusion or rejection in the inventory of items involving millions of dollars. The federal valuation of the carriers, which even two years ago was scarcely taken seriously, has become a great fact. It occupies most of the picture and its problems are clamoring loudest for attention. At the same time the non-engineering theorists have been indulging in a riot of generalities, resisted little by the engineering profession. Engineers as a body, following the failure of the special committee of the American Society of Civil Engineers to produce an acceptable code, have virtually stood still while the procession has moved by under other direction, until now their right is being challenged in some quarters even to discuss the larger problems.

One thing much needed is a rational classification of utilities and the principles applying thereto in order to offset the sweeping generalizations of theorists who see no difference between a railroad and a gas plant, and know nothing of practical operating difficulties. Specific matters that are pressing for consideration are depreciation and the depreciation reserve, the intangibles, and the reproduction cost of railroad land. The question of unearned increment is highly important, but as that is founded upon the very status of the utility with respect to the public, pure theorists, economists and the lawyers will probably exercise the greatest influence in determining the answer.

The land question is being handled by the railroads strictly from the legal point of view. This is unfortunate. The lawyers bow to a decision which many engineers believe was the inevitable result of faulty presentation of a particular case. Because in the Minnesota rate case Justice Hughes rejected pyramided multipliers, the railroads admit that all multipliers are illegitimate—saying which they disguise them under other forms, because there is no other way by which to arrive at reasonable reproduction land values. It would be better to carry the multiplier issue to the Supreme Court again, undisguised but properly supported, and in a case where the main issue is joined on this point, and then rely on the reasonableness—nay, inevitableness—of their use for victory.

Up to last spring the "other values and elements of value" called for by Congress floated around like a will-o'-the-wisp. They were frequently mentioned, but seemingly nobody had ever seen them. At the conference last May they were suddenly produced—five of them—by the railroads. One proved to be an old friend, "going value." Some said the other four—value of unity of use and connected operation, location value with respect to traffic, location value with respect to operation, and franchise value—looked so much alike that their own parents could not tell them apart. The railroads could not always distinguish them, and admitted that they had no scales to weigh them.

This journal would like to see going value put in its proper place as a tangible item, as real as crossties when defined as development cost, and readily estimated. The other four elements could probably be retired, with advantage to the railroad cause. Considering two competitive railroads, the advantage of one, in respect of each of these other elements, can only equal the disadvantage of the other, and the algebraic sum of all of these elements throughout the country will be zero. The interdependence of railroad rates has been pointed out by Director Prouty of the Division of Valuation. Certainly no individual railroad of any considerable length, whatever its value, can base its rates solely on that value. The country's rate structure is like a thick heavy fabric—a carpet, if you will. No single thread or small section can be dealt with independently. The sum of the valuations over a large area must be used to determine whether the fabric over that area shall be bodily raised or lowered. Manifestly, then, intangibles that cancel out in the addition have no significance.

Granted the foregoing, there still remains the question whether the intangibles of real value enjoyed by the local monopoly, by virtue of its being protected against competition, are entitled to inclusion in fair value for rate purposes. This applies to waterworks, lighting plants, short railroads and numerous other utilities. There is need for a more thorough analysis of this problem.

The depreciation question is as far from settlement as ever. This journal firmly believes that the railroads are right in their contention that with proper maintenance depreciation should not be deducted for rate-making purposes, and has supported the railroad argument for considering the whole track as the unit, and not the ties, rails and spikes. Nevertheless, with the Division of Valuation feeling that the law compels it to record estimated condition per cent and accrued depreciation for individual units, the railroads are evidently standing in their own light in opposing this. There are many possible uses of the valuations, and different values attach to different uses. The railroads are arguing for one value only, but surely the railroad itself, in purchasing a branch line, would not be indifferent to condition per cent, or the existence or non-existence of renewal funds. The possible hardship for the railroads is not in the recording of accrued depreciation, but in its deduction in determining a basis for rates.

It seems to the Engineering Record that the time has arrived for more consideration of the depreciation reserve. All agree that earnings should cover necessary renewals. Opinions differ as to the extent to which this should be done by the forehanded accumulation of renewal funds throughout the lives of the perishable parts, and as to the significance of the status of such funds prior to the time they are needed. Perhaps one difficulty is that in all the discussion of reserves we are dealing with something that, as far as railway road accounts are concerned, has not existed, and for that reason we have failed to note the problems that would arise with the creation of reserves. It would be well for both sides to declare more fully just what they think ought in the future to be covered by advance funds, how these funds should be calculated, to what extent they should be segregated, and how they should be rated in future valuations.

It is probable that during the coming year the special committee of the American Society of Civil Engineers will present another report. This is bound to be interesting, owing to the change in the personnel of the committee after the preliminary report was issued. By presenting doctrines that are at once ethical and practical, doctrines that the society at large will accept, thereby enabling the engineering profession to go on record as having definite views on the subject, the committee can do much to clarify the present confused situation. Two years ago, before the material side had been brought into prominence by the government's gigantic undertaking, it is likely that the public would readily have followed the leadership of the engineers. The task of gaining such leadership is far greater now than then, but with concerted action it can be done. And judging from the failure of those leading in valuation discussions to sweep away pernicious and unpractical theories on the one hand, and subserviency to legal precedent on the other, a new leadership is sorely needed. Charlatans seeking a cheap fame by railroad baiting there always will be, but by and large the public wants the truth, and will deal fairly if the views of agitators are properly exposed by those who see clearly, who know their subject thoroughly and are disposed to be fair. Surely no other group is so well qualified for exposing the fallacies and commanding confidence as the country's engineers.

The Hydroelectric Field

BUSINESS stagnation and lack of proper legislation are responsible for a practical cessation of activity in the hydroelectric field. Projects under way at the beginning of the year were completed, but little new work was undertaken.

Chief interest now centers in pushing through Congress legislation which will invite the investment of capital for projects on navigable streams and on the public domain. The Adamson and the Ferris bills, upon which so much work was put in the last Congress, died with the close of the session on March 4. The present Congress, however, will probably enact these measures, if not in the form in which they finally came from the Senate committees early this year, at least in some modification, and likely more favorable to investors than the committee measures were when they died last March. These measures are ever so much better than the existing rules under which the government grants permission for hydroelectric development. They are not, however, conducive to the greatest activity in development in their present shape and modification seems desirable. The large measure of discretionary power vested in executive officers of the government tends to deter capital, while the rejection of payment for appreciation, if the government should take over the plant, is economically unsound, denying to the investors the increase they normally expect and receive in connection with ventures not dependent upon government franchise.

The wastage of power is now nothing short of criminal, particularly since, if legislative conditions were favorable, development would certainly proceed. It must be granted that in some locations market for additional power does not at present exist, but on the other hand there are localities where development could proceed with full expectation of a paying, if not a capacity, load at profitable figures. In this connection the government itself is bringing pressure to bear upon Congress, for it realizes that the time may come when nitrogen fixation will be a necessary military measure.

This has been impressed upon the government by the reports of the Secretaries of the Interior and of War. Moreover, Dr. L. H. Baekeland, member of the Naval Advisory Board and chairman of its committee on ordnance and explosives, has reported to the Secretary of the Navy, advising that a fixation plant be built, so that a staff may be trained in the necessary scientific methods and act as a nucleus for the extension of the process should military necessity so require.

With pressure coming thus from both sides—from the capitalists who stand ready to invest in water-power development and from the government departments—one may safely predict that hydroelectric legislation which will unlock the present wasting resources is nearer at hand than ever before. This is particularly so, because a great amount of work, in which engineers have participated, has already been done on the needed bills.

Technically there is but little to record in hydroelectric progress. Well authenticated reports indicate that new records for sizes of units will be set when activity is resumed. Manufacturers stand ready to make guarantees on a 40,000-hp. unit under a head of about 100 ft. This is a tremendous undertaking and speaks volumes for the ability and courage of turbine manufacturers in this country. Speaking generally, one cannot look in the next few years for such rapid progress as was experienced in the last decade, for hydraulic design, then in embryo, has advanced sufficiently far to bring about standardization. Refinements are to be expected but radical departures are less likely than in the immediate past.

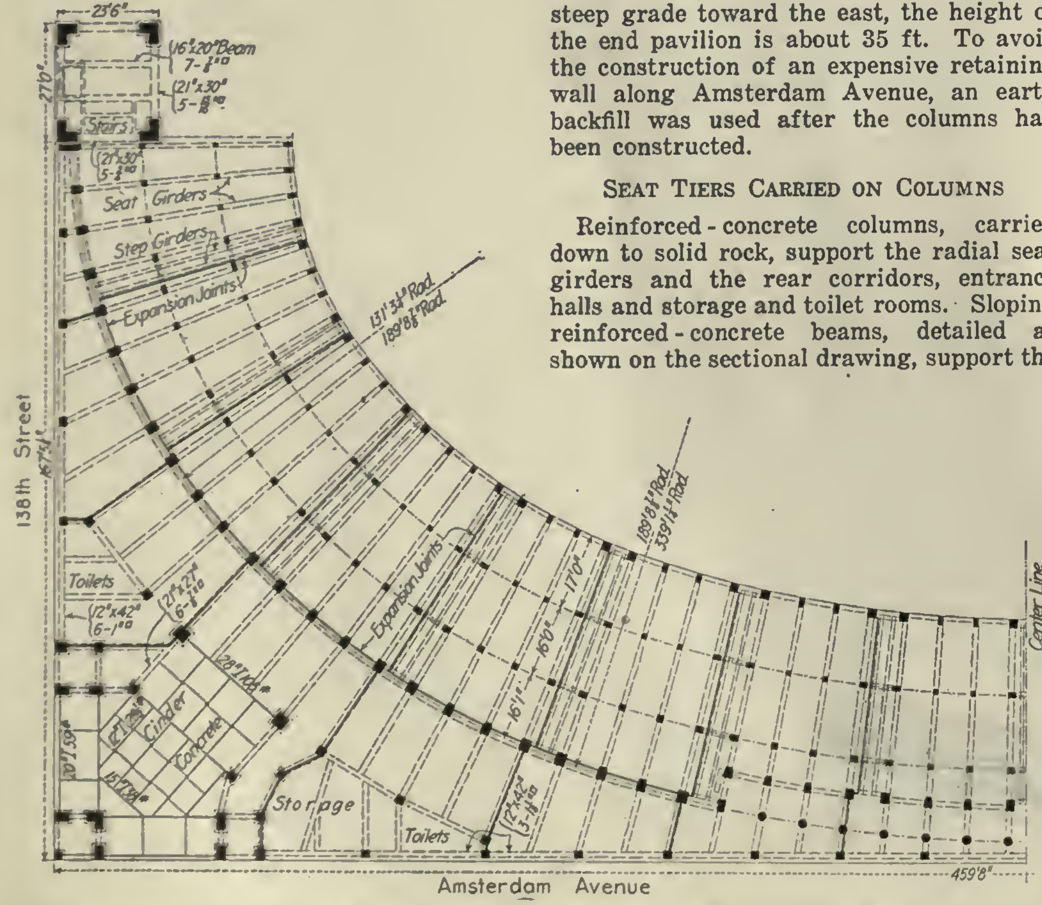
Architectural Possibilities of Reinforced Concrete Shown in City College Stadium

New York City Structure, Though Comparatively Small, Has Striking Appearance —Curved Seat Tiers and Corridor with Ornamental Columns and End Pavilions

Unusually striking in general appearance is the recently completed stadium of the College of the City of New York. Designed with structural economy to fit the given location, using reinforced concrete with float finish, the architectural treatment in classic style is worthy of its commanding situation on the brow of a relatively high hill. In appearance the structure is in a class by itself when compared with other college stadiums throughout the country, many recently completed and described in the Engineering Record during the latter part of the year 1914. Although relatively small, seating about 7000 as compared with the 61,000 capacity of the Yale Bowl, the New York stadium contains several unusual features in addition to the effective architectural plan. Expansion joints are introduced every 30 or 40 ft. The layout of the columns was facilitated by the use of rectangular co-ordinates. Special cantilever beams support the upper ends of the central stairs.

Construction Begun in 1914

Construction was begun in the spring of 1914 and the main structure, including the step-supporting girders, was placed by December of that year. Some of the float finish was also completed. The excavation of the rock for the athletic field, which consists of a level rectangular space about 270 x 460 ft. containing a cinder running track 1/5 mile long, together with a baseball diamond and football field, did not begin until September, 1914.



HALF PLAN—EXPANSION JOINTS ARE LOCATED EVERY 30 OR 40 FEET

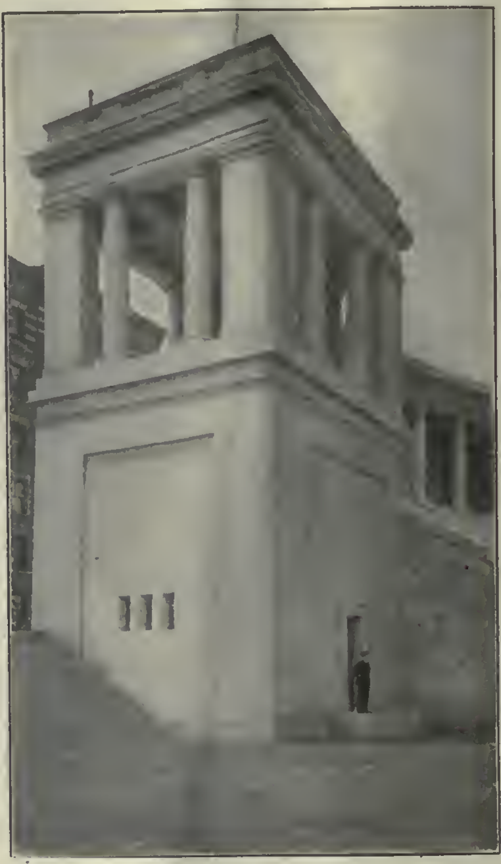
"The Stadium of the College of the City of New York" is inscribed in the upper panels of the Amsterdam Avenue side of the new structure, which is located on a lot extending about 460 ft. from 136th to 138th Streets, and about 350 ft. from Amsterdam Avenue to Convent Avenue. As Amsterdam Avenue runs along the brow of a hill at this point, and Convent Avenue is about 30 ft. lower, the structure was designed with sloping seat tiers on the Amsterdam Avenue side, curving in plan as shown and sloping toward the east to the field level, which is about the same level as Convent Avenue.

The circular rows of reinforced-concrete seats are constructed in sixteen panels between radial stairs leading to the main covered corridor. This corridor is inclosed on the outside by tile walls with cement finish, the reinforced-concrete columns giving rectangular panels as shown in one of the accompanying photographs. A modern renaissance architectural effect was produced by the row of cylindrical columns lining the inner edge of the corridor, and the treatment of the end pavilion and corner entrance halls. The main entrances are at each Amsterdam Avenue corner, and the structure is practically symmetrical about its center line.

At each end of the main corridors a two-story pavilion about 24 x 27 ft. in plan, containing on the lower floor the dressing rooms, shower baths, etc., for contestants, combines utility with architectural effect. The height of the roof above the sidewalk level on Amsterdam Avenue is about 24 ft., while on the side streets, which slope at a steep grade toward the east, the height of the end pavilion is about 35 ft. To avoid the construction of an expensive retaining wall along Amsterdam Avenue, an earth backfill was used after the columns had been constructed.

Seat Tiers Carried on Columns

Reinforced-concrete columns, carried down to solid rock, support the radial seat girders and the rear corridors, entrance halls and storage and toilet rooms. Sloping reinforced-concrete beams, detailed as shown on the sectional drawing, support the concrete seat tiers. The latter span about 9 ft., varying according to height and position, and are designed as simple slabs and beams to carry a total live load of 90 lb. per square foot, the nearly vertical riser portion acting as the beam, being reinforced by one rod top and bottom, as noted. Stone concrete of 1:2:4 proportions, designed according to the New York building code, was used.



ARCHITECTURAL DETAILS OF PAVILION

The seat tiers are about 49 ft. in total width, each step having 28-in. tread and 16-in. rise. No permanent seats are provided. The slope was fixed by the total rise and the necessity for clear lines of sight from each spectator to any part of the field. The interior four panels contain special boxes with concrete walls, as shown in the photographs and plans.

The floors of the entrance halls are of steel beam and cinder-concrete slab construction, while the corridor floors are of 6-in. reinforced concrete between reinforced-concrete beams. The lower concrete columns are square or rectangular, reinforced with longitudinal steel rods resting upon steel plates as noted, while the upper cylindrical columns are reinforced with four rods and wire mesh and tied into the lower by the four ½-in. rods shown in the section.

Locating Columns by Co-ordinates—Special Cantilever Beams

The fact that the many columns supporting the curved seat banks are placed on compound curves of very long radii made their location rather difficult. A very sat-

GENERAL VIEW SHOWS ARCHITECTURAL POSSIBILITIES IN REINFORCED CONCRETE

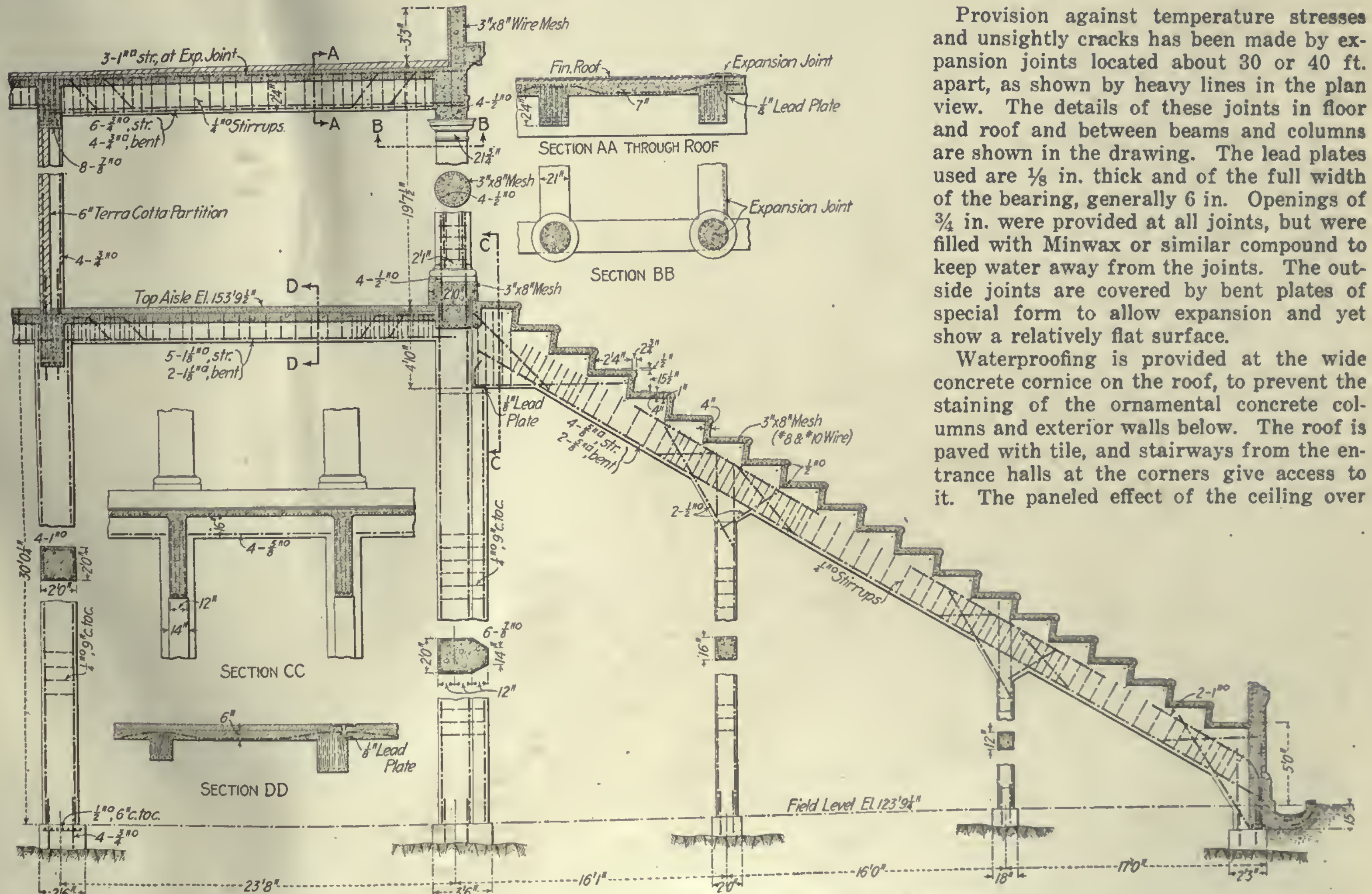
isfactory scheme was adopted. The x and y co-ordinates to a working point for each column were computed, using the building lines as axes and working from the intersection of Amsterdam Avenue and 138th Street as the origin of co-ordinates. Plans showing the relation of the sides of each column to its working point were drawn, and the forms were easily placed in accordance therewith.

The sloping radial beams supporting the aisle steps are carried on cross beams to the adjacent main radial beams. In the interior panels, where the boxes occur, it was necessary to cantilever the upper ends of these beams over the upper supporting girder, as shown in one of the drawings, where details of the inclosing walls of these boxes are also indicated. The steps are thus carried up to the level of the main corridor.

EXPANSION-JOINT DETAILS

Provision against temperature stresses and unsightly cracks has been made by expansion joints located about 30 or 40 ft. apart, as shown by heavy lines in the plan view. The details of these joints in floor and roof and between beams and columns are shown in the drawing. The lead plates used are ⅛ in. thick and of the full width of the bearing, generally 6 in. Openings of ¾ in. were provided at all joints, but were filled with Minwax or similar compound to keep water away from the joints. The outside joints are covered by bent plates of special form to allow expansion and yet show a relatively flat surface.

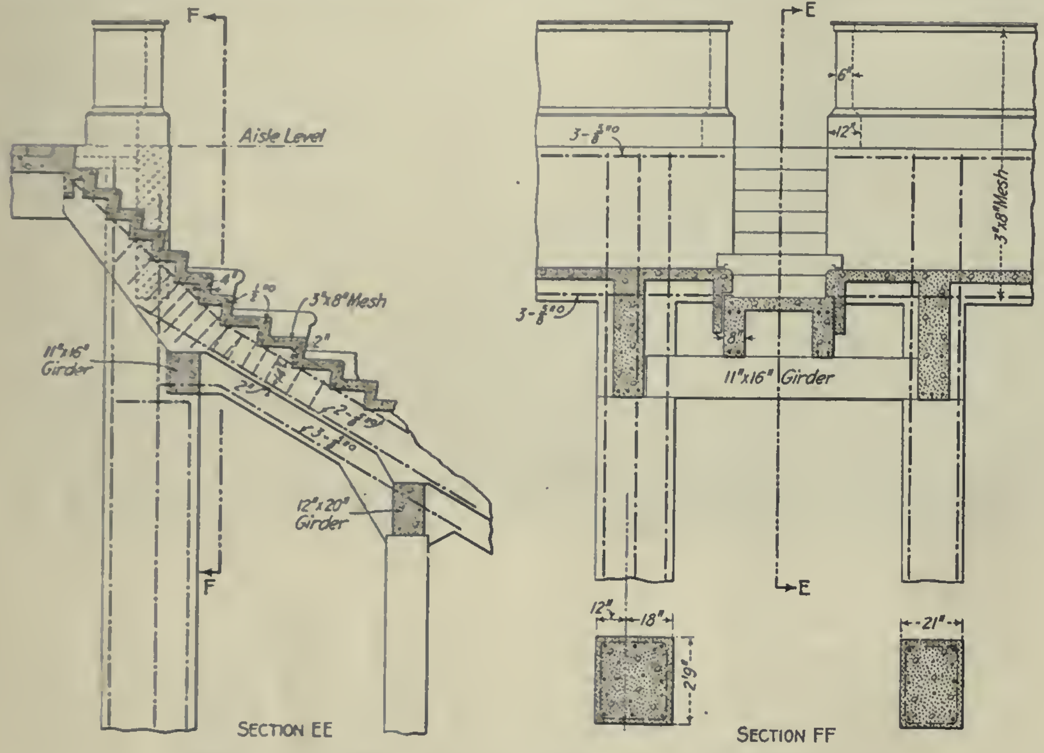
Waterproofing is provided at the wide concrete cornice on the roof, to prevent the staining of the ornamental concrete columns and exterior walls below. The roof is paved with tile, and stairways from the entrance halls at the corners give access to it. The paneled effect of the ceiling over



TYPICAL SECTION WITH DETAILS OF SEAT TIER CONSTRUCTION AND EXPANSION JOINTS the main corridors, resulting from the beam-and-slab construction, can be clearly seen in picture on the front cover.

The field was excavated 1½ ft. below final grade and then refilled with broken stone, cinders and loam, and provision for adequate drainage was made by a system of tile drains.

The architect of the stadium was Arnold W. Brunner, and Charles Mayer was the designing engineer. The general contractor was Jacob A. Zimmermann. The total cost was $250,000, the gift of Adolph Lewisohn. The site was furnished by the city.



DETAILS OF CANTILEVER GIRDERS AT TOP OF CENTER STAIRWAYS

Miter Gates for Balboa Drydock Nearing Completion

THE MITER GATES for the 1000-ft. drydock at Balboa are approaching completion, states the *Canal Record*. Both leaves have been swung. Except for their greenheart miter and quoin posts, the leaves are exactly like those of the lock gates, will be maintained from the same stock of spare parts, and are swung and operated in the same manner. In the case of the drydock gate, however, the leaves will be supported on carriages, running on the floor, when swung in the dry, to avoid severe strains on the pintle and anchorage. The carriages for the drydock leaves run on curved steel rails, embedded in the masonry of the floor.

Work is now in progress for the adjustment of greenheart miter and quoin posts on the south leaf. During the adjustment of these it will be necessary to swing the leaf in the dry, and it was for these operations principally that the carriages were devised. In the construction of the lock-gate leaves the miter and quoin posts were made of steel castings, to which bearing surfaces were attached and planed in place.

The greenheart timber posts were adopted for the drydock gate principally on account of the greater degree of watertightness anticipated, which is of more importance in a drydock which stands dry for the greater part of the time.

Minnesota Commission Offers Novel Valuation Views

In Brief Answering That of Railroads Before Interstate Commerce Commission Reproduction Is Assumed to Be Instantaneous

IN A BRIEF recently filed with the Interstate Commerce Commission the Minnesota Railroad and Warehouse Commission takes exception to the interpretation of reproduction cost set forth by the carriers at the conference of Sept. 30 and Oct. 1, 1915, on the ground that it is exactly what was rejected by the Supreme Court in the Minnesota rate case. Among the items objected to are various overhead charges claimed by the railroads. Some of the Minnesota Commission's logic is contained in the following quoted paragraphs:

"We submit that all such items as organization, promotion and legal expenses are so vague and indefinite as to clearly come within the condemnation of the Supreme Court as being entirely conjectural and solely based upon the false assumptions of non-existence and necessity of reconstruction. They have no bearing upon any item of property now being valued."

INTEREST

"The commission is asked to add to the value of the property an item for interest, upon the theory that during the time to be occupied by construction the property will be idle and unremunerative. The fact is, there is to be no construction, that the property being valued is not idle nor unremunerative.

"The only rational reason for the reproduction method is for ascertaining what advantages, if any, exist in prices of labor and materials between the present and the time of original construction.

"It is entirely irrational to assume any given length of time to be occupied by reconstruction. Presumptively it is instantaneous, and interest during construction has no place in determining present cost.

"It may be stated that railroads habitually are compelled to pay interest upon borrowed money during construction. Whether or not such a charge is proper when ascertaining original or actual cost is one question, but cost of reproduction ignores the original cost. It is intended to ascertain the present value of a physical item of property and the history of the acquisition of that article of property by its present owner, and the misfortune, loss or expense which may have attached to his original acquisition are entirely immaterial when the inquiry is not as to original or actual cost."

CONTINGENCIES

"It is impossible to imagine any rational grounds for allowing the item 'Contingencies' if the assumption of non-existence and necessity for reconstruction are irrational. . . . Since it is a matter of mere assumption, conjecture and imagination, no limit can be placed upon the item, and it is impossible to make an estimate which may be designated as reasonable. Everyone realizes that in actual construction contingencies and enhanced cost are met with. In imaginary construction, however, such items are solely imaginary and conjectural."

ENGINEERING

"In so far as engineering may be considered a labor item it is possible that in an estimate of reproduction cost some allowance should be made for it."

LAND

The commission recommends "that land be taken at no more than its market value for general use as measured by the value of contiguous lands, without any additions for special values, known as 'railway values,' or any additions by the use of multiples or hypothetical outlays, arising from payment of severance damages, or cost of acquisition." The commission then quotes from the familiar Minnesota rate decision in support of the foregoing.

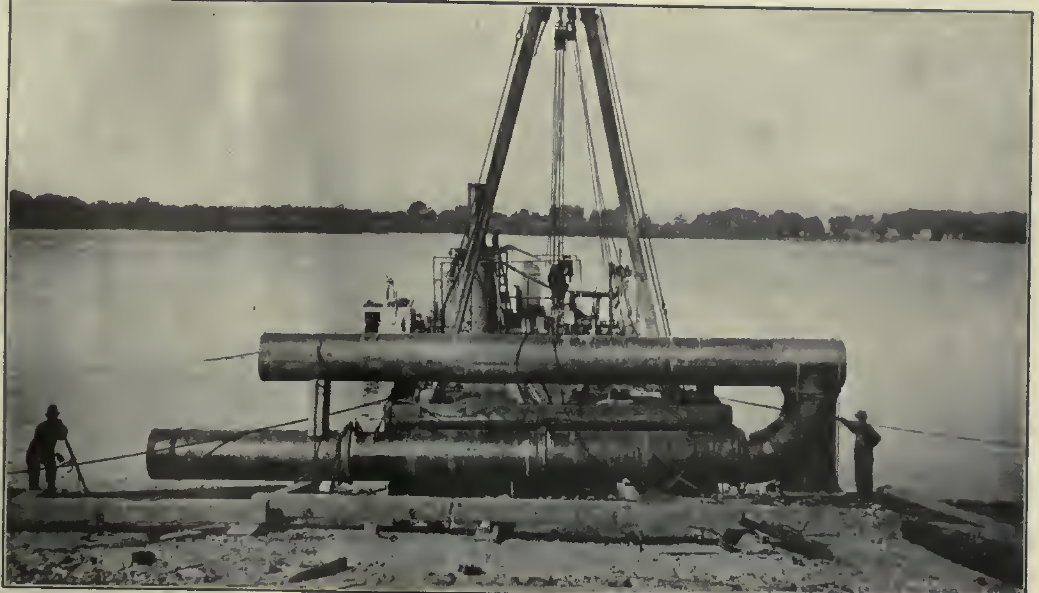
Two Large Government Sales

NATIONAL forest timber estimated at 188,100,000 ft. b.m. has been sold by the U. S. Department of Agriculture. The timber is on two tracts, one in the Plumas National Forest in California, the other in the Wasatch National Forest in Utah. Sugar pine is the most valuable timber in the former tract, and the bid price was $3.25 per thousand, it being estimated that there is nearly 26,000,000 ft. b.m. on the tract. The bid for yellow pine, the amount of which is put at more than 37,000,000 ft., was $2.60. Douglas fir, white fir and incense cedar, aggregating 43,000,000 ft., brought an average bid of about 70 cents. The purchaser is allowed an operating period of fifteen years, but the prices are subject to readjustment every five years. The Utah timber will be cut chiefly for railroad ties. It comprises, according to the government's estimate, 82,100,000 ft. of green and dead lodgepole pine, Engelmann spruce and Alpine fir. The sale price is 10 cents for each tie cut and ½ cent per linear foot for mine timbers. These two sales are, with one exception, by far the most important made this fiscal year. The year is expected to run considerably above last year in receipts for timber sales, the first five months having shown an increase of nearly 40 per cent.

New Quincy Intake Characterized by Provision Against Accumulation of Sand

Line Laid in Gravelly River Bed to Replace Old Wood-Stave Line—Constructed in Sections on Skids on Shore

IN CONSTRUCTING the new intake for the water supply of Quincy, Ill., the entrance of sand from the gravelly river bed was provided against by locating the 36-ft. screen with its longitudinal axis approximately parallel to the direction of the flow of the river, so that water drawn through it must flow against the current to pass into the intake pipe. To conform to the contour of the bed of the stream two abrupt changes in the grade were necessary. At the foot of the rising grade a tee was inserted in the line, with the side opening turned up and flanged. It was assumed that if any sand did get by the screen it would lodge at this point. The opening in the tee is sufficient to provide ample room for a diver to enter the pipe or for the suction pipe of a dredge pump to be inserted to remove the accumulation. The trench for the pipe line was excavated by dredges, and the line made up in sections on skids on shore, which were taken up by an A-frame derrick on a scow, towed out to the proper location and lowered into place.



INTAKE SCREEN SECTION MADE UP READY TO BE TRANSPORTED AND PLACED

The intake line is 1823 ft. long, with the shore end in a brick intake well 15 ft. in diameter and 30 ft. deep. This well was built in 1887 and is located about 20 ft. from the water's edge at ordinary stages of the river. The water flows by gravity into it and is drawn out by a low service pump under a suction lift of 15 ft. with the river at low-water mark. The submerged end of the pipe is made up of a 36-in. 90-deg. bend, with a bell end, into which is threaded and securely clamped a steel frame. The screen is 36 in. in diameter and 36 ft. long, with both ends closed. The downstream end and 31 ft. of the total length are perforated with ⅝-in. holes totaling in number 29,293. The total area of the perforations is equivalent to 8.8 times the area of the intake pipe.

This was landed in a trench in the river bed with the screen above the pipe. The highest point of the screen is 8 1/3 ft. below low-water mark in the river. The normal depth of water at the point is 14 ft. It is tied in place by white-oak piles and 1⅛-in. steel rods. As the bed of the river is sand and gravel the screen was located in the main channel in such a way that the direction of the flow is approximately parallel to the longitudinal axis of the screen, so the water drawn through must flow against the current to pass into the intake pipe.

The connection through the wall of the well was made by means of a special casting 6 ft. long, with a standard bell on the river end and a standard flange on the well end, to which was bolted a 36-in. flange gate valve and a second flange which came flush with the outside wall of the well to resist the thrust of the water when the valve is closed.

Due to the class of material encountered the excavation at the well was somewhat difficult. The trench was 24 ft. deep, through a filling of earth, cinders, brickbats and loose stone. The digging at this point was done by an orange-peel bucket suspended from a 60-ft. swinging boom. For other excavation a 10-in. centrifugal dredge pump mounted on a scow was used.

The excavation on shore was carried down to the water line to a width sufficient for the driving of sheet piling for a cofferdam 8 ft. wide. The planks were driven to bedrock, which was from 3 to 8 ft. below low-water mark. Two lengths of bell-and-spigot pipe and one-half of a Falcon flexible ball-joint pipe were placed and calked inside the cofferdam.

In the work of pipe laying skids were laid out and leveled up at a convenient point just above low-water mark on shore and arranged so as to support four lengths of pipe parallel to the shore line. The pipe was rolled upon the skids and made up with lead joints calked with pneumatic hammer, usually in sections of 48 ft.

All of the sections, except at two points where flexible ball-joints were used in order to make changes in the grade line, were made up with a special bell, 6 in. deep, at the forward end and a special machined spigot at the rear end. There was also a bead cast on the pipe 18 in. from this spigot end. The lead was poured into the bell at the forward end, around a cast-iron form which was turned to the exact shape of the machined spigots used on the rear end of the sections. After the joint was set this form was drawn out, leaving the lead in the bell, and heavy steel clamps were bolted around the pipe back of the forward bell and around the bead at the spigot end.

When a section of pipe was to be taken out for laying, a large scow was anchored with the A-frame derrick over the section to be hoisted at the middle point, and with the end of the scow against the side of the pipe. Two hitches were then made around the section, which was hoisted off the skids, and the scow was pushed out to an anchorage over the pipe line. A trench was prepared by the dredge pump and the scow was moved sufficiently to bring the A-frame with the suspended section to proper position over the line. The pipe was then lowered and the spigot end entered into the bell of the preceding section by a diver. Two heavy bolts were passed through the clamps which had been bolted around the bell and spigot, and the spigot was forced as deeply as possible into the cold lead in the bell by tightening the nuts on the bolts. The diver then calked around the pipe with a pneumatic hammer. All of the clamps and bolts were left in place. No backfilling was done over the pipe, as the sand drifted into the trench very rapidly.

TWO FLEXIBLE JOINTS

Two Falcon type flexible joints were used at points where the contour of the river bed required abrupt changes of grade. The first was placed within the cofferdam, 30 ft. outside the wall of the well, and the second 147 ft. from the first. In this distance the grade line dropped 12 ft., which placed the top of the pipe 11 ft. below low-water mark. The remainder of the line was carried at this elevation practically to the end. This required the dredging of a depth from 2 to 9 ft. of sand.

It was assumed that if any sand ever accumulated in the pipe it would lodge at the foot of the rising grade, 175 ft. from the well. A 30-in. tee was therefore inserted at the second flexible joint. The side opening of this tee, which was turned upward, was flanged and closed by means of a blind flange, which may be removed at any time by a diver, and the opening is large enough to permit the entrance of a man or the suction pipe of a dredge pump.

The intake was designed by W. R. Gelston, superintendent of the Citizens' Waterworks Company, who also had charge of the construction. Joseph G. Falcon, of Evanston, Ill., was the contractor. The line was laid to replace a 30-in. wood-stave pipe installed in 1887 and still in good, serviceable condition, but so located that the supply was sometimes contaminated by the city's sewage.

The cost of the line was as follows:

356.395 tons 36-in. B. & S. pipe at $22.65 per ton f.o.b. Quincy	$8,072.34
1 36-in. flanged tee, 5470 lb. at 3¾ cents	205.13
1 piece 36-in. special pipe, 2920 lb. at 3¼ cents	94.90
1 90-deg. ell, 5060 lb. at 2¾ cents	139.15
36 x 3-ft. steel screen furnished by the contractor as an extra	100.00
20,400 lb. pig lead at $4.025 per hundred-weight	821.10
600 lb. yarn at 5 cents	30.00
1823 ft. of pipe laid at $7 per foot as per contract	12,761.00
	$22,223.62

The total cost averaged $12.19 per foot. For the price of $7 per foot paid the contractor he was obliged to unload all of the material at Quincy and to furnish the necessary piling, clamps, bolts and all other material not listed above.

Soft-Ground Tunneling Has Advanced Rapidly Since Early Days

THE FIRST tunnel driven in soft ground with the aid of a shield was that under the Thames River in London, begun in 1828 and finished in 1843. An outline of the progress of the art of tunneling in soft ground since that date was given to the Municipal Engineers of the City of New York on Dec. 22 by Howard B. Gates in a paper on the Harlem River crossing of the Lexington Avenue subway (See Engineering Record of Sept. 13, 1913, page 284; Oct. 4, 1913, page 390; Oct. 11, 1913, page 404, and May 15, 1915, page 616).

The shield used on the first Thames River tunnel was invented by Sir Isambard Brunel. In driving the second tunnel under the Thames in 1869 Peter William Barlow used iron lining in connections with a shield. From these inventions has grown the shield method as we know it at present. The first application of the shield to tunneling in America was made in 1869 when a short piece of tunnel was built under Broadway in New York City by the use of a shield designed by A. E. Beach. It is claimed that he was the first to make use of hydraulic pressure to force the shield forward. The original franchise for the project contemplated the construction of a tube 8 ft. in internal diameter, beginning at the post office at Warren Street and extending northerly under Broadway, to be operated by pneumatic methods, presumably for the transportation of mail, parcels and light freight. Altogether 250 ft. of this tunnel was constructed, 200 ft. of it being straight and lined with brick, and 50 ft. being constructed on a curve and built of light cast-iron segments. During the construction of section 2 of the Broadway-Lexington Avenue subway in 1912 this tunnel was unearthed and removed. The shield was found intact, except for wooden parts which had rotted away. An experimental car designed to fit the interior with very little clearance also was found in the main tunnel, bearing evidence of an attempted practical demonstration of the scheme.

FIRST USE OF COMPRESSED AIR

The first subaqueous tunnel attempted in New York City was begun in 1879 at the Jersey end of what is now known as the McAdoo or Hudson & Manhattan uptown tunnels. DeWitt C. Haskins proposed to tunnel the Hudson River silt by an application of building caisson methods. He planned to build the working chamber of light iron segments bolted together. By the use of compressed air, the escape of which he sought to prevent by placing a painted canvas on the river bed, he believed it possible to excavate safely for the top center segment, and, with this one in place and bolted, to gradually add others, completing the ring. The method was tried, but following accidents of lesser importance, an inrush of mud and water caused the loss of about twenty lives and necessitated a change of plans.

A pilot tube method was then devised for continuing the work. This consisted of building a smaller tunnel about 6 ft. in diameter along the axis of the larger one and lining it with plates similar to those previously used. The pilot tunnel was kept from 50 to 60 ft. in advance of the full-sized excavation, which followed and was lined with thin plates supported by radial struts bearing upon the pilot tube. A brick lining completed the structure. As the full section advanced the plates of the pilot tube were unbolted and reassembled at the advanced face. After many vicissitudes, Haskins was obliged to stop work in 1888, having completed about 2,700 of the 11,500 ft. contemplated. He had, however, demonstrated the possibilities of compressed-air support. This was the first use of compressed air in any important tunnel, and Haskins believed the idea to be original with himself. However, a compressed-air tunneling system had been patented in England by Admiral Cockrane fifty years before.

In 1889 the Hudson tunnel enterprise was taken up by English contractors and work was resumed by the shield method. This was the first application of the shield to subaqueous tunneling in this country. Owing to a shortage of funds, this work was interrupted again after a progress of 1700 ft. had been made. Nothing further was done until 1902, when the railroad company was reorganized under the management of William G. McAdoo and the tunnels were completed.

Broken Track Stringers in Bascule Bridge Lead to Proposed New Floor Design

Coping of I-Beams to Increase Clearance Is Probable Cause of Cracks in Webs—Proposed Stringer to Support Rail on Cast-Steel Separators

BY F. H. AVERY
Engineer in Charge of Bridge Construction and Design, City of Chicago

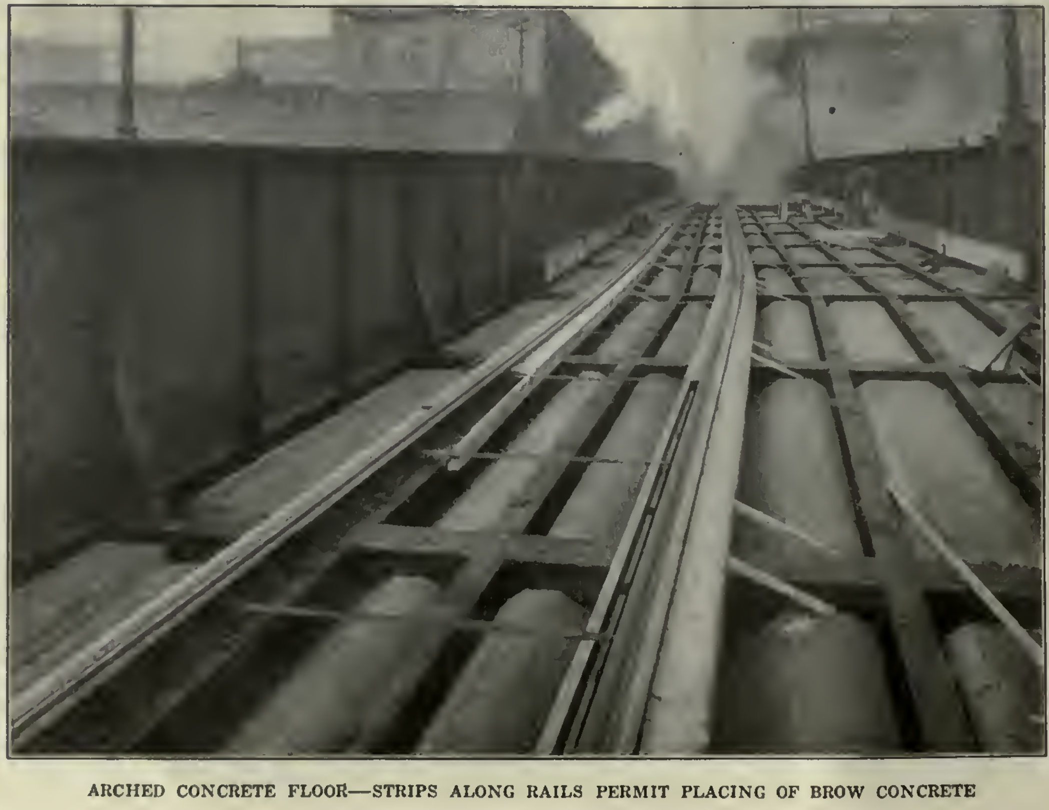
AFTER the timber decking of the State Street bascule bridge, Chicago, was removed, in order to replace it with a concrete slab, examination disclosed the fact that twenty-one out of twenty-four track stringers on one roadway of the viaduct were badly shear-cracked, the cracks starting at the cope in the top flange of the I-beam. About the same number with broken webs were found in the other roadway.

The viaduct is of through girder construction with shallow floor and I-beam stringers coped to fit the top flange angles and cover plate of the floorbeam, in order to decrease the floor depth. The track stringers were 12-in., 31½-lb. beams with a 12 x ⅜-in. plate on top to receive the old 6-in. tram rail. The decking consisted of 4 x 6-in. subplanking laid at 45 deg. on 12-in. centers, and 4-in. oak planking for a wearing surface. The nature of the cracks discovered in the stringer webs upon removal of this decking is clearly shown in the photograph on page 16.

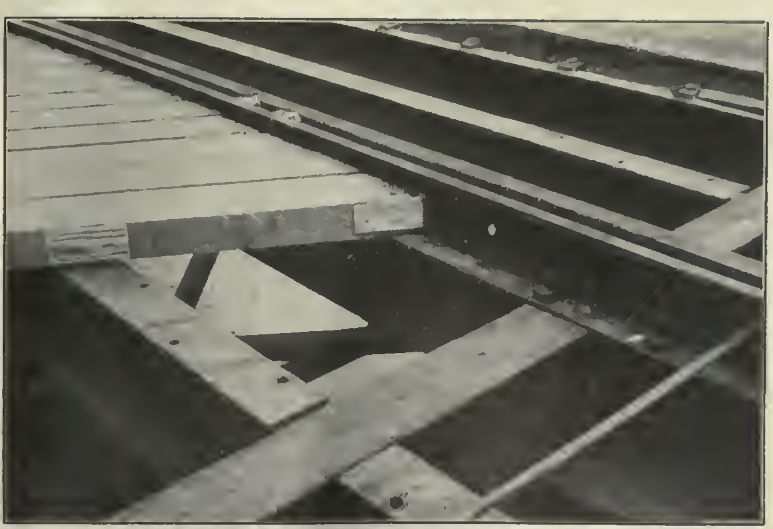
New stringers were ordered, using 40-lb. instead of 31½-lb. I-beams, and coped the same as before. It was not practicable to avoid the coping, and the increased weight of the I-beam in addition to the concrete floor is relied upon to prevent a repetition of this method of failure. New rail has been laid on the viaduct, and the joints have been made at the center of the stringer so that the deflection of the stringers will aid in taking up the pounding of the wheels at the rail joints.

COPING SHOULD BE FORBIDDEN

The coping of I-beams originated in building construction and established itself so thoroughly that not much thought was given when the same construction was used in bridge floors. This particular floor shows very plainly that for the stringers under street-car rails the practice should be absolutely forbidden. It should be forbidden for all the roadway stringers of bridges in cities having heavy team traffic, owing to the high speed and heavy axle load of auto trucks, which cause pounding as severe as



ARCHED CONCRETE FLOOR—STRIPS ALONG RAILS PERMIT PLACING OF BROW CONCRETE



SUBPLANKING CUT AT ENDS TO FIT OVER RAIL FASTENINGS

HEXAGONAL PAVING BLOCKS LAID WITHOUT CUSHION

the street-car wheels, especially after the pavement becomes worn.

Another fault in bridge floors noted in this bridge is that the rail plate, due to the movement of the rail, is worn down a good quarter of an inch, so as to cause the plate to crack along the edge of the I-beam. This rail plate and the top flange plate of the floorbeam are level, hence the same groove is plowed across the top of the floorbeam. This again is due to making the floor too shallow. The rail should be at least ½ in. above the floorbeam and should never bear on it.

A second photograph shows another bad feature of most floor designs. The rail fastenings as seen in this photograph project 2½ in. above the rail plate. The result is that there is but 1 in. of timber above the top of the rail fastening. This condition, since it occurs alongside of the rail, is particularly bad, as the wagon wheels drop off the rail and soon break these weak ends of the subplanking, and then the destruction spreads in the subplanks until they begin to loosen and see-saw up and down under traffic.

This design has been accepted practice and is still used to-day. It is time, however, to devise better construction for floors carrying the heavy cars and trucks of present-day traffic.

FORMS AND PAVING BLOCKS

One of the photographs shows the forms in place and the method of keeping an open space next to the rail to permit setting the brow paving, which is 1½ in. deeper than the wooden blocks. The slabs were reinforced with ½-in. square bars on 9-in. centers and bent down alternately to the bottom flange of the stringers to act as stirrups and hold the thin piece of concrete next to the I-beam web in case it cracked.

Hexagonal paving blocks were used for two reasons: First, to avoid most of the expansion troubles, since each block is the entire log of wood and hence is subjected to radial expansion only, which is about one-third as much as the tangential expansion of the rectangular block. Second, each block is 100 per cent heart wood and so can be face-nailed to the subplanking without the block cracking. This is necessary on a bascule bridge in order to hold the pavement when the span is raised.

This nailing was tried experimentally on several well dried blocks, and it was found that not only could a 60d wire nail be driven to the head of the nail into the block, but that a follower could be placed on the nail and the head driven clear through without splitting the block. This is impossible with a rectangular block and was the deciding factor in the selection of the hexagonal type.

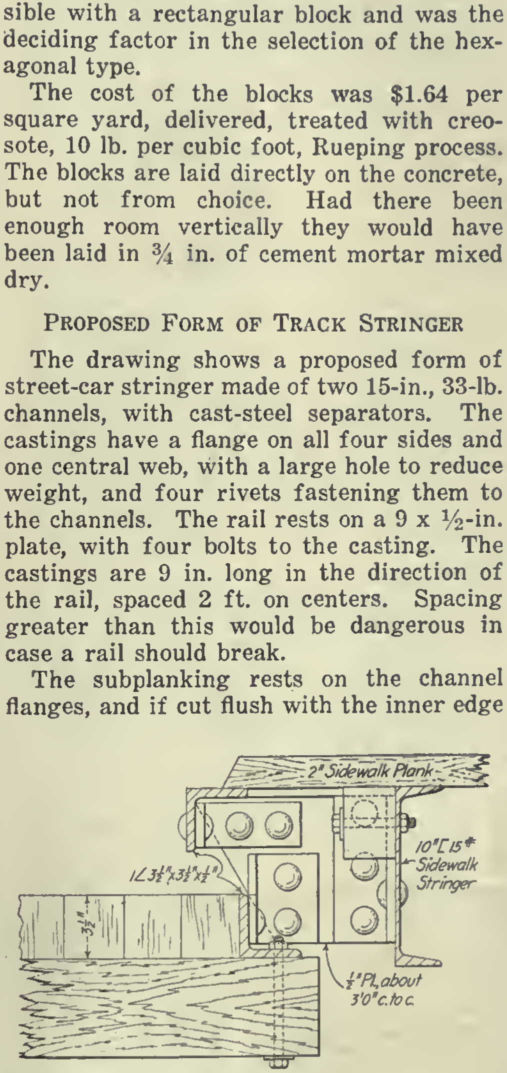
The cost of the blocks was $1.64 per square yard, delivered, treated with creosote, 10 lb. per cubic foot, Rueping process. The blocks are laid directly on the concrete, but not from choice. Had there been enough room vertically they would have been laid in ¾ in. of cement mortar mixed dry.

PROPOSED FORM OF TRACK STRINGER

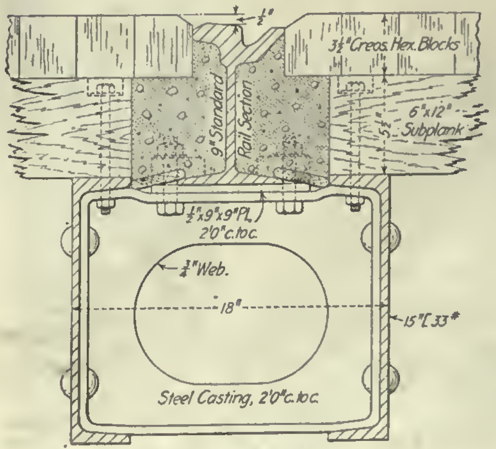
The drawing shows a proposed form of street-car stringer made of two 15-in., 33-lb. channels, with cast-steel separators. The castings have a flange on all four sides and one central web, with a large hole to reduce weight, and four rivets fastening them to the channels. The rail rests on a 9 x ½-in. plate, with four bolts to the casting. The castings are 9 in. long in the direction of the rail, spaced 2 ft. on centers. Spacing greater than this would be dangerous in case a rail should break.

The subplanking rests on the channel flanges, and if cut flush with the inner edge of the channels gives 2½ in. clear opening between the planking and the rail, or enough room to remove and renew the track bolts through the casting without touching the subplank. This is the greatest advantage of the proposed floor; that is, the ability to renew the rail without removing the entire floor. The importance of this feature cannot be too strongly emphasized, for in many cases where minor repairs have been made to the rails, the street-railway gangs have deliberately cut away the subplank with an ax, beveling it at 45 deg. in order to get at the bolts. Such a plank would fail shortly afterward, and thus disclose what had caused the failure.

To hold the concrete, shown in the sketch, between the castings, place a piece of ½-in. wood about 3 in. wide between the rail and the subplank, and place the concrete, which is shown on the drawing as concrete, but which is really cement mortar and can be readily dug out if necessary to give access to the rail bolts.



SECTION AT CURB



SECTION AT CAR RAIL STRINGER

PROPOSED STRINGER AND CURB DETAILS

COMPARISON OF STRINGER WEIGHTS

On a Chicago-type bascule bridge the street-car stringer is a 15-in., 42-lb. beam and a 12 x ⅜-in. plate, making the total weight 57 lb. per foot. The proposed section weighs 66 lb. for the channels and 46 lb. per foot of beam for the castings and ½-in. rail plate, or a total of 112 lb., about double the old weight. The length of rail on one leaf is 90 ft. or 360 ft. for four rails, so that this means an increase in weight of 10 tons.

The center of gravity of the rails is 51 ft. ahead of the trunnion and for the counterweight 21 ft. back of the trunnion, so that this increase of 10 tons means 24 tons added to the counterweight. As the counterweight for one leaf weighs 550 tons this is not a great increase.

The saving in repairs on a bridge with the proposed type of floor would far offset the increased cost due to additional steel and counterweight, for not only could the track repairs be made without disturbing the subplanking, but the subplanking would last longer, since the ends would not be cut to pieces in order to allow notching over the track bolts.

CHANGED DETAIL AT CURB

The drawing shows the curb end of the subplank, and a change introduced in order to cheapen repairs. In the usual type of bridge floor removal of the subplank required tearing out the 10 x 12-in. oak guards, and this meant to tear out the chord cover and sidewalk plank. The new type of guard has a clear space between the guard angle and pavement so that the street dirt will blow under it and not come pouring down on the pedestrians every time a lift is made. It is possible to repair the subplank without disturbing the guard angle or sidewalk.

This floor change, simple as it seems, will result in a great saving. In the old form, the street dirt lodged against the guard timber and soon rotted it, while the removal of subplanks meant chopping out the guard timber, as a rule, and always required removing the guard angle and sidewalk or chord cover.

COPED STRINGERS SHEAR-CRACKED BY IMPACT OF CAR WHEELS

The repairs to the viaduct were made by the Department of Public Works of the city of Chicago, under the direction of John Ericson, city engineer, and Thomas G. Pihlfedt, engineer of bridges and harbors. The field work was in charge of H. J. McDargh, bridge designing engineer.

LIME FROM SLUDGE AT COLUMBUS, OHIO, has been made experimentally of 65 per cent CaO. About 2½ tons were prepared in a rotary kiln into the upper end of which the wet sludge is pumped. The lime comes out in rounded pebbles 1 in. in diameter and smaller. C. P. Hoover, chemist in charge of water purification, says it is the intention to build a rotary kiln 100 ft. long and 5 ft. in diameter to burn a large part of the lime needed from the sludge.

Work on Hetch Hetchy Water Project Begins

Preliminary Construction Well Under Way on San Francisco Water Supply—Plans Include Roadbuilding, Tunnels, Hydroelectric Plants and 67-Mile Railroad

FINANCIAL conditions limited the work done during the past year on San Francisco's Hetch Hetchy water supply project, but surveys, designs of structures and preliminary construction have been actively under way. The grading of the first section of the main road from Hog Ranch to the dam site, 9.09 miles in length, was completed this year. This section of the route, which is to be followed by the railroad to the dam site, involved the most difficult construction on the entire line. It lies in extremely rough country and the roadbed had to be excavated almost entirely in solid granite. A total of over 152,000 cu. yd. of material was handled in the 9-mile stretch at a total cost, including culverts, retaining walls, etc., of about $190,000.

SAWMILL REDUCES LUMBER COSTS

Owing to the cost of lumber in the open market it was considered wise to erect a sawmill for utilizing some of the timber on the area owned by the city. The sawmill installed at Canyon Ranch began operations on Aug. 1 and has already cut more than 1,000,000 ft., board measure, for use in camp construction, concrete forms, etc. In addition to all timber for forms it is expected that the railroad ties for use on the line to the dam will be cut by this mill. The mill is operated by a sawmill logging engine which will be used after mill work is finished on the construction of the dam proper.

The 800 acres to be submerged by the diverting dam are being cleared by a crew of 100 men, who have been rushing the work in order to clear the site before there is sufficient snow to interfere. This diversion dam will direct the waters of the Tuolumne River into a tunnel around the main dam site while the large impounding dam is being built next year. With the river diverted it will be possible to make borings to determine more accurately the character of foundation for the main dam.

SOUTH ABUTMENT OF HETCH HETCHY DAM

After an extensive study of the type of dam to be built, a gravity section, arched to afford additional safety, was tentatively chosen. The detailed designs of this structure, the cost of which will be approximately $4,000,000, are now practically complete, but before final approval they are to be passed upon by an expert who has not yet been named by the city. The tentative designs call for a structure 750 ft. long on the crest and 300 ft. high. After the more detailed examination of the unwatered dam site by diamond drill test borings and an examination of the geology the present plans for the main dam may be altered somewhat.

Work is now under way on the Early intake, which is a tunnel 10½ to 13 ft. in diameter, 20 miles in length, traversing, for the most part, solid granite formation between a point 12 miles below the dam and a forebay above the Moccasin Creek power plant.

Work is also under way on the diversion tunnel, 20 ft. in diameter, which will bypass the flow of the Tuolumne River while the main dam is under construction. This tunnel must be completed before the diversion dam can be of service and is expected to be ready before the first of the year. Progress has been made in this tunnel at the rate of 36 ft. per week, working double shifts of 8 hr. each. Materials for the diversion dam have been delayed somewhat, and it is thought possible that it may not be completed until next spring. The borings at the diversion dam have developed bed rock at a depth of only 22 ft. below water surface.

POWER DEVELOPMENT PLANNED

After studying the topography of the route to be followed by the aqueduct a board of consulting engineers recommended a definite plan for the development of power which has been, with some modifications, adopted by the city. In order that the capital invested should be a minimum the power is to be developed and sold progressively; the most important site, Moccasin Creek, where it is expected ultimately to develop a total of 72,000 kw., will be laid out for this capacity at the outset, but will be equipped unit by unit as the market for power develops.

In its ultimate equipment this plant will

SAWMILL WAS ERECTED TO SUPPLY TIMBER FOR HETCH HETCHY CONSTRUCTION be able to handle the capacity flow of 620 sec.-ft. under a head of 1250 ft. Space will be provided for six 12,000-kw. generators operating on a load factor of 65 per cent, one generator to be a spare unit. This plant will be expected to carry a peak load of 76,300 kw. at the switchboard, the average power being 49,600 kw. Conduits are to be built at the outset for the full capacity of 400,000,000 gal. per day, which is said to be ample for the future needs of greater San Francisco.

HETCH HETCHY RAILROAD

The site of the Hetch Hetchy dam is on the headwaters of the Tuolumne River in a deep valley of the Sierras about 4000 ft. above sea level and nearly 70 miles from the nearest railway line. It has been determined that the amount of material to be hauled to the dam during construction is so much that it would pay to build a railroad, even though its entire cost had to be added to the cost of the dam. Plans and specifications have accordingly been made by the city engineer for a railway 67 miles in length extending from the junction with the Sierra Railway at Rosasco to the dam. Six bids on this work, ranging from $1,543,080 to $2,000,000, were recently received. This line follows the general course of the Tuolumne River through extremely rough and broken country. Most of the line going toward the dam is on a 3.4-per cent grade. Since the line is for freight traffic only, sharp curvature has been permitted in location; the sharpest curve is 30 deg. and curves of 18 to 26 deg. are common; guard rails are to be laid on all curves sharper than 12 deg.

NORTH ABUTMENT OF HETCH HETCHY DAM, SHOWING PROFILE PROPOSED

The construction of this line involves excavation totaling about 1,000,000 cu. yd., of which more than one-half is rock. The line will require about 6,700 lin. ft. of culverts; 40 miles of fencing and about 500,000 ft., board measure, of timber in trestles. The roadbed will be 16 ft. wide at subgrade with embankment slopes specified as 1½:1. Redwood or cedar ties 8 ft. long and 60-lb. rails are to be used. The specifications call for 6 in. of ballast underneath the ties.

The only bridge of long span is that required in crossing the Tuolumne River near Jacksonville, which will have a maximum span of 220 ft. and with three-plate girder spans on the apparatus will require 600,000 lb. of steel. Terms of the contract require the entire line ready for operation within 300 days from date of award, with the specified penalty of $750 per day for each day's delay in final completion.

The entire work is being carried out under the supervision of M. M. O'Shaughnessy, city engineer of San Francisco.

General Goethals Reports on First Year of Operation of Panama Canal

Operation of Locks Satisfactory—Waterworks Completed—Death Rate Lowered—Slide Situation Not Covered, as Fiscal Year Ended June 30, 1915

INTEREST in the Panama Canal during the last three months has centered on the slide troubles. As the series of slides which closed the waterway did not begin until late in the summer, they are not touched upon in the annual report, just issued, of the Governor of the canal, Gen. George W. Goethals, covering the year ended June 30, 1915. The report, which is the first since the canal was opened to traffic, deals with the construction, operation, maintenance, sanitation and protection of the canal. Following are extracts from the report:

POWER

The average production cost of current during the last six months of the fiscal year was 0.09 cents per kilowatt-hour, and the average cost delivered from all substations was 0.65 cents per kilowatt-hour. These costs do not include the charge for functional depreciation of 3 per cent of the capital cost of the entire power system. Including this, the costs were 0.44 and 0.99 cents per kilowatt-hour respectively.

The decision concerning size and number of generating units to provide power for the canal was determined in May, 1911, and was based on studies made prior to that date of the probable power demands that would be required. The result of the studies showed a probable day load of about 4000 kw., assuming that the Panama Railroad was not electrified, while if this were done the probable day load was computed at approximately 5000 kw., with one hour's peak of 5700 kw. This assumption was also based on the fact that electric current would be generally used for domestic purposes. Under these circumstances the generating equipment installed, furnishing 6000 kw., allowed for a reserve for future growth of about 1000 kw.

In August, 1912, Congress authorized the construction of coaling stations, drydocks and machine shops, and, though estimates for the probable amount of power that would be required for these purposes were prepared and considered in determining the power plant, the completed designs show power requirements greater than the estimates. Additional demands are made upon the power by reason of the U. S. Navy submarines stationed in the Canal Zone; by the light and power loads at Forts Randolph, Sherman and Grant, and by the new waterworks for the south end of the canal, designed and undertaken since the original studies. The result is that the time is not far distant when additional power will be required, and provision should be made for increasing the capacity of the existing plant and installing a reserve unit. Estimates to be submitted for the latter will include the duplication of the present power house and the installation of one additional unit. Anticipating that an extension might become necessary with time, the penstocks and tailraces were provided in the construction of the spillway during the construction period.

WATERWORKS

The work on the Panama waterworks, which was undertaken during the previous fiscal year, was completed. As previously reported, the original plan contemplated the location of a pump station at Miraflores, utilizing the waters of the lake as the supply; but this had to be abandoned, due to the heavy rise in chlorine in the Miraflores Lake. This pump station, which was nearly completed when the source of supply had to be changed, was remodeled and transferred to the fortification division for use as a storehouse. A station was then built at Gamboa, and the pipe line, extending from Gamboa to Miraflores, was installed during the year. It required the laying of 59,762 lin. ft. of cast-iron pipe, varying from 24 to 36 in. in diameter. The trench was excavated by contract at a total cost of $22,000, and the total cost of the pipe line, including the cost of pipe, fittings, excava- and backfill, was $356,951.10.

The construction of the Miraflores purification plant was about 45 per cent completed on June 30, 1914. The plant was completed and put in operation on March 16, 1915. [See the Engineering Record of Dec. 25, 1915, page 787.] It consists of the wash-water tank, aeration basin, head house, sedimentation basin, filter building and pipe gallery, laboratory and quarters, clear-water basin, and injection chamber. The total cost of the plant was $558,168.41, of which $203,625.12 was for work done during the year. Walks and a roadway were constructed around the plant and the latter was connected with the Canal Zone road to Panama.

The delivery of water from the purification plant at Miraflores to the pump station at Balboa is through three parallel lines, each 21,000 ft. in length, the diameters being 30, 20 and 16 in. respectively; this work was also completed during the fiscal year.

As part of the new waterworks, an extension was made to the existing high-service reservoir on Ancon Hill, at elevation 300, by constructing an addition having a capacity of 1,500,000 gal. This work was practically completed at the close of the last fiscal year.

Three pump stations, one at Gamboa, one at Miraflores and one at Balboa, were constructed, together with the necessary grading and paving and the installation of the machinery and fittings, at a total cost of $200,654.22. The total cost of the new Panama waterworks was $1,387,490.57.

The most important hydrographic feature

of the year was the consumption of water from Gatun Lake for lockages, hydroelectric power and municipal purposes. During the dry season of 1915 about two and one-fourth times as much water was used for hydroelectric power as for lockages, but this ratio is steadily decreasing on account of the increase in the number of lockages.

The elevation of Gatun Lake Jan. 1, 1914, was 84.32, which represented a storage of 180.09 billion cubic feet of water. The total yield for Gatun Lake watershed for the year was 185,686 million cubic feet. The evaporation of the lake surface for the same period was 23,970 million cubic feet, which gave a net yield of 161,716 million cubic feet. Of this amount, 139,285 million cubic feet were wasted at the spillway, 5182 million cubic feet were used for lockages and tests, 3604 million cubic feet for hydroelectric power, 397 million cubic feet for municipal purposes, 265 million cubic feet for suction dredges, and 829 million cubic feet for leakage. Jan. 1, 1915, the lake was at elevation 87, which represented an increase in storage of 12,154 million cubic feet during the year, or a total of 192.24 billion cubic feet at the beginning of the dry season of 1915. During the year 508 lockages were made at Gatun and 502 at Pedro Miguel.

The total yield for Gatun Lake watershed for the dry season 1915 was 43,924 million cubic feet. The evaporation on the lake surface for the same period was 9427.5 million cubic feet, which gave a net yield of 34,496.5 million cubic feet. Of this amount 23,263.5 million cubic feet were wasted at the spillway, 8311.8 million cubic feet were used for hydroelectric power, 3724.6 million cubic feet were used for lockages and tests, 182.2 million cubic feet for municipal purposes, 97 million cubic feet for suction dredges, and 174.4 million cubic feet for leakage. May 1, 1915, the lake was at elevation 86.44, which represented a decrease in storage of 1257 million cubic feet. During the dry season 492 lockages were made at Gatun and 491 at Pedro Miguel.

DRY SEASON RUN-OFF

The 1915 dry season run-off was unusually large. The spillway discharge from the freshets of Feb. 9, 10 and 11, 1915, and April 3 and 4, 1915, alone, had they been stored, would have raised the lake from 87 to 89.95. The direct rainfall on the surface of the lake practically equaled the loss by evaporation during the dry season. No large freshet occurred during the year; there was, however, an unusually well sustained run-off, well distributed as to time.

The total yield from Gatun Lake watershed for 1914 was 102 per cent of the capacity of the lake at elevation 85. The lake elevation has been maintained between elevations 84.75 and 87 by the operation of the spillway gates. In September, 1914, it was raised to 86, and in November, 1914, it was raised to 86.70. From December, 1914, to April, 1915, it was maintained at elevation about 87. Since then it has varied between elevation 87 and 85.50.

During the fiscal year there was an average constant spillway discharge of 5300 sec.-ft.

It has been determined that the Gatun spillway discharge per gate is higher than expected. At elevation 85, the wet-season elevation, one gate discharged 10,460 sec.-ft., an increase of about 20 per cent over what was anticipated. Investigations with velocity current meters show that there are no currents during freshets that will interfere with the handling of ships.

OPERATION OF CANAL

At the close of the previous fiscal year Cucaracha slide was the only obstacle to the passage of ships. During July, 1914, a channel had been dredged through the obstruction 150 ft. wide and of sufficient draft to pass vessels drawing not in excess of 30 ft. The dredges were excavating material faster than it was falling in, and there seemed no likelihood that any further movements at the slide could obstruct the channel. These facts were reported and authority was received to make a trial of the canal by the passage of one of the Panama Railroad ships, which, if successful, would be followed by another to inaugurate the use of the canal by commerce. The ship selected for the trial was the Cristobal, and she made the passage through the canal, with slight delays at Gatun and Pedro Miguel, on Aug. 3, 1914. This was followed by the Ancon, which opened the canal to commerce Aug. 15, 1914. During the balance of the year vessels passed daily, except from Oct. 14 to 20, Oct. 31 to Nov. 4, 1914, and March 4 to 10, 1915, during which periods the canal was closed by reason of the break in the bank which occurred at East Culebra Oct. 14.

Settlement occurred at Gatun Dam, particularly that part west of the spillway over the diversion channel. As this had settled below grade, it was decided in February to raise it to full height, with allowance for future settlement, thereby giving employment to some of the employees whose services would be dispensed with on account of suspension of work on the east breakwater. A total of 67,581 cu. yd. of material, rock on the outside, clay in the center, was placed; rock was procured from the borrow pit west of the dam, and clay from a borrow pit north of the dam.

The Mindi Levee, constructed to keep the discharge from the spillway having access to the canal below the Gatun Locks, was the source of trouble, due to the current of the discharge and to the poor material under and in the levee. During the year 86,199 cu. yd. were dumped on the levee, the material being obtained from the west borrow pit.

MAINTENANCE

The maintenance work on the locks was performed for the most part by the lock operating forces while not engaged in making lockages, and the maintenance of the channels by the dredging division, as already noted.

After the floating caisson was accepted, it was used for unwatering the locks at Miraflores for the purpose of cleaning and painting the miter gates and the rising stem valves. The inspection that was made of the machinery revealed the fact that galvanic action was taking place in the salt water between metals of different kinds. Tests are being made with preservative coatings having insulating properties, and it is hoped that this action can be eliminated. The rising stem valves were coated with bitumastic enamel.

The gate valves and fixed irons of the Pacific locks were painted. Experiments have been made with various kinds of paints, but the most satisfactory coating thus far has been bitumastic enamel, and a contract was entered into with the American Bitumastic Enamels Company to paint all the submerged parts of the lock-gate structures, and maintain them in first-class condition under a five-year guarantee.

LOCKAGES

The time of lockages was reduced and the operations of the various parts of the machinery have met all expectations. Under normal conditions, with both flights in use, the average time for locking through Gatun Locks is 55 min., Pedro Miguel 25 min. and Miraflores 45 min.

As the vessel approaches the locks the pilot in charge is informed by means of an arrow signal the locks that are to be used and their readiness for the approaching vessel; the locomotives are attached, generally four on ships less than 300 ft. long and eight on battleships or ships of exceptional size. The ships are handled through the locks by a lock pilot, who works in cooperation with the towing locomotive operators and directs their movements by signals from the ship. During the lockages the ships' engines are used only to assist the locomotives in starting and stopping the ship. The various operations are under the control of the operators in the control houses, and the course of the lockages is followed by tunnel operators, who stand by to see that all parts of the machinery work properly. Tandem lockages, two ships in the same chamber at the same time, are made, but have been limited in number by the towing locomotives available. Parallel lockages are made only in emergencies, to avoid undue delays to vessels.

The lighting system on the lock walls is satisfactory, and with trained lock pilots no special difficulty is experienced during night operations and no appreciable time lost.

Several instances have occurred where vessels have had difficulty in tying up to the approach piers. At the upper entrance this difficulty has come generally from high winds, especially with ships that do not handle easily. At the lower entrances the difficulty is due principally to the discharge or to currents caused by the meeting of fresh and salt water when the gates are opened. To facilitate the arrival of ships at the lower entrance the gates are left open as long as possible, so that the currents may die out before the arrival of the ship.

The number of lockages made at Gatun during the year was 1216, of which 1066 were for commercial vessels; at Pedro Miguel, 1260 lockages were performed, of which 1085 were for commercial vessels, and at Miraflores there were 1236 operations, of which 1085 were for commercial vessels.

LOWER DEATH RATES

Health conditions were very good. The total death rate was 5.72, as against 7.92 for 1914, and the death rate of disease alone 3.61, as compared with 5.17 for 1914. With regard to malaria, which is our principal cause of disability, the hospital admission rate was reduced 20 per cent, and the death rate more than 32 per cent since 1914. The admission rate for typhoid fever was reduced more than 76 per cent during the year, the admission rate for dysentery 50 per cent, and the death rate for pneumonia more than 39 per cent.

In the Canal Zone the total death rate from disease was reduced from 14.46 in 1914 to 11.77 in 1915; in Panama City from 34.25 to 30.74, and in Colon from 24.12 to 21.25.

Highly Erratic Stream Flow Utilized Efficiently

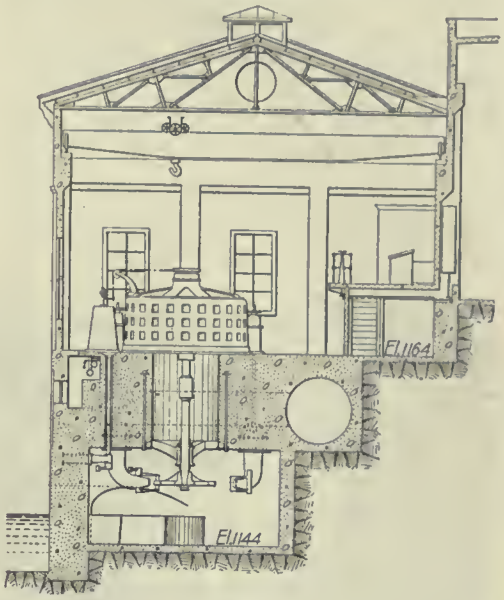
Hydroelectric Plant on the Salt River Project, Using Only Surplus Flow, Designed for Low Depreciation

THE Crosscut hydroelectric plant, recently built by the U. S. Reclamation Service on the Salt River project, is designed for operation under a more erratic stream flow, it is asserted, than that at any site heretofore considered suitable for power development. The plant is supplied with water from the Crosscut Canal, a 4-mile connecting link between the Arizona Canal and the Grand Canal, which have a difference of level of about 120 ft. This connection was located so as to concentrate the drop in the shortest possible length of canal in order to make the power available to best advantage. Water is transferred from the higher to the lower canals only under certain conditions of flow in the two systems, so that on some days in the year the Crosscut Canal carries practically nothing and at other times it is full continuously for weeks. The variation in flow, therefore, ranges from zero to capacity, with an average not much greater than 70 per cent of the maximum.

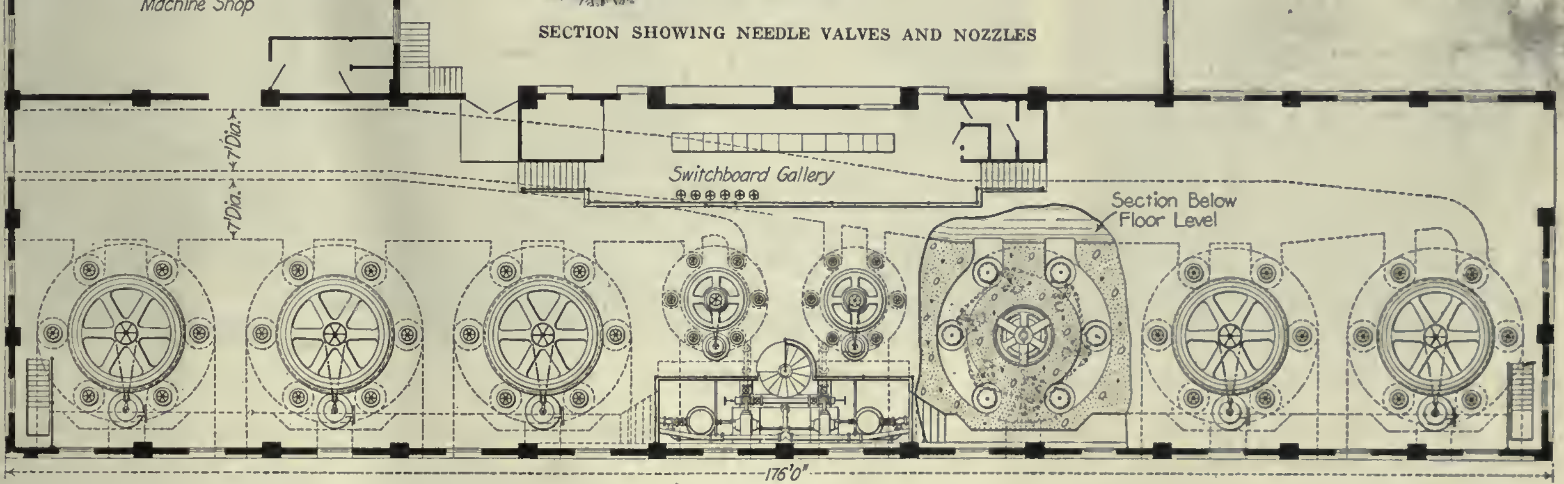
FEATURES CONTROLLING DESIGN

A power-generating capacity totaling about 18,000 kw. has been installed on the Salt River project, 11,000 kw. being at the Roosevelt dam and the remainder in the valley. The valley plants serve as a relay, so that when the rainfall below the dam supplies water for irrigation and the reservoir behind the dam is not drawn upon the valley plants carry all the load possible. Power contracts in effect for years to come take all of the surplus, and the contractors supplement by steam whatever deficiency occurs. Thus it was profitable to build the Crosscut plant to generate as much power as might be economically taken from the erratic flow in the connecting line.

The controlling feature of the design was that the discharge from the waterwheels must equal the erratic inflow at the forebay and at the same time make efficient use of the varying power in this flow. In addition, because the load factor would be low, it was necessary to have the plant so designed that the depreciation would be slight. An obstacle in the way of accomplishing this was that throughout the year 90 per cent of the water carries a very high percentage of silt in addition to the salt and alkali always present, which means the disintegration of any paint or pipe coatings on steel pipe, and the erosion of pipes, wicket gates, wheel runners and shroudings, as well as any synchronous by-passes installed for maintaining constant flow.



SECTION SHOWING NEEDLE VALVES AND NOZZLES



PLAN OF HYDRAULIC UNIT ARRANGEMENT, CROSS CUT POWER PLANT

Plants operating under similar conditions in the vicinity indicated that a complete renewal of the moving parts of the turbine would likely be required each year, with a corresponding loss of power due to the lowered average efficiency throughout the year. Also, since the pipe line was to be laid on nearly solid rock, a steel pipe would require expansion joints on concrete piers capable of taking up the changes due to the extreme temperature variations. There was also the necessity for a surge chamber at the power house, if turbines were to be used, or synchronous by-passes that would be subject to rapid depreciation.

LAYOUT AND EQUIPMENT

For the 2400-ft. force mains it was decided to use concrete, because this material could be bonded to the rock and would compensate for temperature changes by microscopic cracks in the concrete without the use of expansion joints. Also, it was thought that the painting, erosion, rusting and repairs to steel penstocks would thus be eliminated. The flow into the force mains is controlled at the upper end by an 8-ft. butterfly valve, arranged to be opened by hand, but which may be closed in emergencies by stored compressed air from the power plant. The penstocks have an inside diameter of 7 ft. and deliver water to the wheels under an effective head of 111 ft.

Six vertical impulse wheels are installed, each equipped with six oil-operated needle valves. Governing is accomplished by means of stream deflectors, and the water passages from the force main to the individual nozzles are of reinforced concrete. It is asserted that this arrangement provides for permanent connections to the nozzles in a solid mass of concrete beneath the plant floor which cannot depreciate; enables the operator to cut in or out quickly individual nozzles on any unit, and accommodates any stream flow without variation of the working head.

Under this arrangement the efficiency of the unit is the efficiency of each nozzle, and down to one-sixth load the efficiency of the hydraulic end of the unit is at a maximum. Under the working head of 111 ft. the experience of six months' operation indicated that repairs to the nozzles and wheel buckets will be slight and their life indefinitely long. The principal wear comes on the deflectors, which are easily and cheaply renewed. With no water hammer to contend with, no relief valves or surge tank, and with slow-speed wheels subjected to no heavy governing stresses, the operating strains on each unit as a whole are very slight.

Two exciters are installed to supply the six main units. The switchboard is of the double-busbar type and is arranged to include the necessary switches and panels so that it can handle the central switching for the entire valley, including 10,000 and 44,000-volt systems.

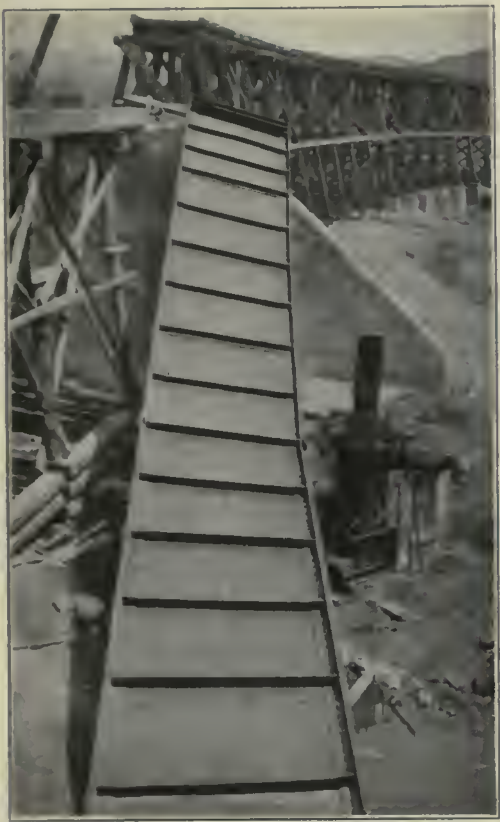
Preliminary tests in controlling the capacity of the plant have shown that an overload of at least 23 per cent may be carried on the individual units. Efficiency tests of the wheels have not yet been made. As the capacity of the plant is limited to the capacity of the canal, and some of the units will be shut down frequently, the nozzles are limited to the normal capacity of the units at the operating temperature. This is necessary because the power-house temperature will be about 120 deg. Fahr. for 24-hr. periods for weeks at a time. It has been demonstrated that but one operator need be on duty at any time, and that his principal occupation will be janitor work. The crew will consist of the general foreman, three operators and one helper.

In spite of the extent to which concrete water passages are used, all seepage stopped very soon after operations were begun, it is stated, and in the several months since the plant was started there has been no indication of any further leaks.

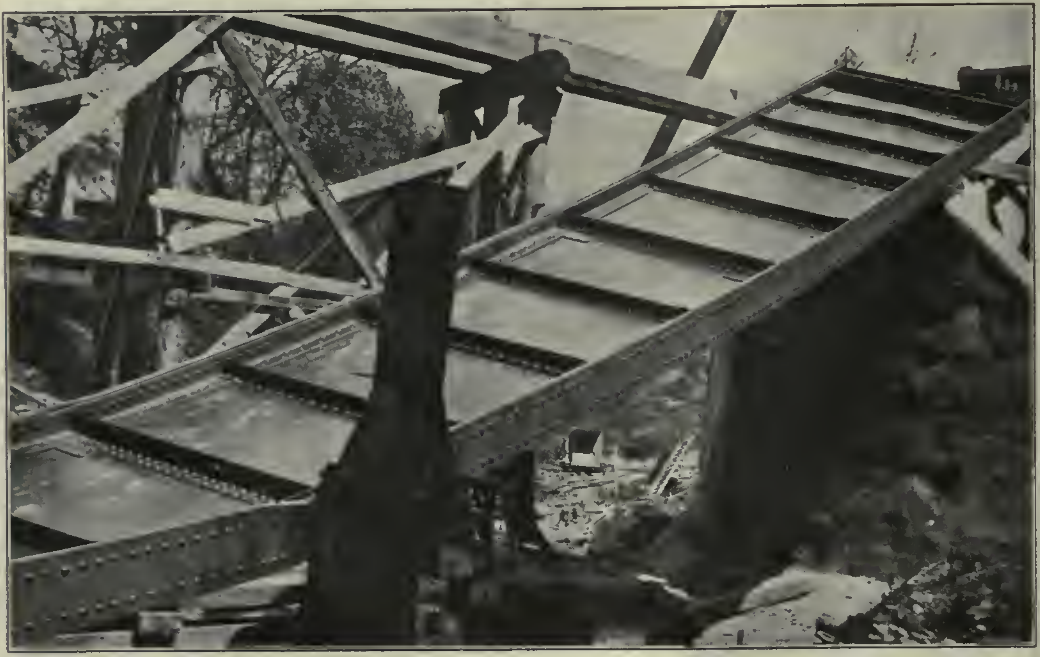
The plant has been designed and constructed under the direction of O. H. Ensign, chief electrical engineer of the U. S. Reclamation Service.

A 25-Foot Fall Ruins a 90-Foot Railroad Girder

A NINETY-FOOT girder 9 ft. deep for a railroad spur was recently maliciously pushed from the abutments into the ravine below the track. It fell about 25 ft. on its side and sustained the injuries shown clearly in the accompanying photographs, buckling in several places on both top and bottom chords. In one of the views the rivets are shown missing from a great number of places, indicating more severe injuries than are apparent at first sight. The girder was damaged too badly for further use.



GIRDER PUSHED FROM ABUTMENT IS RUINED



COVER PLATE RIVETS WERE SNAPPED, DUE TO BUCKLING

Steam Engine Indicators for Determining Governor Effort have been employed successfully in the River Mill plant of the Portland Railway, Light & Power Company. Company engineers working on this problem concluded that simultaneous pressure records, secured on each end of the governor cylinder, form the most satisfactory basis of rating, because under test the conditions are identical with those of normal operation, and elaborate changes of the mechanism are unnecessary. Graphic record pressure gages were used, equipped so as to increase the speed of chart travel and produce a record with appreciable length in the space required for the governor to operate through a considerable part of its travel. Charts were taken from indicators on each end of the governor cylinder so as to secure a continuous record on the cards of the varying pressures from each side of the governor piston throughout two complete strokes or one cycle of operation.

Experts Testify on Means of Eliminating Odors in Garbage Reduction

Suit at Springfield, Mass., Evokes Opinions Regarding Best Methods of Treating Foul Gases from Digester Tanks

BEFORE Hon. Samuel D. Conant, special master, a suit has recently been heard at Springfield, Mass., bearing upon the operation of a garbage reduction plant by the Springfield Merg Reduction Company. The complainants were Jones et al who endeavored to secure relief from odors disseminated in a residential district adjacent to the installation. The plant was completed in the early part of 1913 on the basis of a contract with the city which requires that the gases from the digesters shall be burned. The burden of the expert testimony presented was that this method does not guarantee freedom from odors, but that substantial immunity might be gained through scrubbing and susbequent treatment with chloride of lime. Recent developments of the Cobwell process were also discussed as of interest in this connection. Extracts from the engineering testimony in the case are given below.

Equipment of Plant

The plant is located in the eastern part of the city near the Springfield almshouse and approximately 2.5 miles from the business center. It contains five digesters of the tilting type, a steam boiler plant, conveyor system, tanks, and other equipment common in this class of service. The distinctive feature is the provision by which the digesters revolve on horizontal trunnions to facilitate emptying the material after cooking. The attempted destruction of digester gases by burning is also unusual.

In ordinary operation about 9 tons of garbage are treated daily in each digester. Pressing is accomplished by steam and an auxiliary press has lately been added. The usual production of grease and fertilizer is the result of operation. The installation provides for burning the digester gases in either an oil furnace or in the boiler furnaces, or in both together, and the plant has a chimney 50 ft. high. The main building is 86 ft. long, 60 ft. wide and 38 ft. high, with a boiler house one story in height, 27 x 44 ft., equipped with two 60-in. horizontal return tubular boilers designed to operate at 100 lb. per square inch, 80 lb. being used in practice. An 80-hp. non-condensing engine drives an electric generator furnishing energy to various motors in the establishment, and the lighting is supplied from this unit. The cost of the plant was about $90,000, including various alterations designed to increase its efficiency and diminish the odors.

Since the plant was opened for service various improvements have been made. An additional tank to enable excess collections to be cared for was installed and the practice of pressing into a sealed tank was modified by the installation of catch basins, so that the water pressed out from the tanks no longer passed directly into the sewer, but was allowed to settle and cool, diminishing the odors in the sewer and enabling more grease to be recovered. The original oil furnace for burning the digester gases was found to be too small, and was enlarged. Attempts were made to dry the tankage in part, but the practice was abandoned because the existing form of drier was inefficient and the driers appeared to increase the gases.

At first some of the digesters did not press satisfactorily, due to clogging of the strainer plates on the inside. This was remedied by changing the plates, making larger perforations and in some cases installing screen wire over the plates on the inside to prevent clogging. A secondary press was added because it was found that a longer time was required to press than at first appeared likely. E. G. Whittemore, superintendent of the plant, testified that the use of the driers was discontinued on account of odors. Another improvement was the relocation of a burner away from a party wall in the fire room on account of its affecting the wall. There was also installed a pressure tank for fuel oil, the piping was changed to permit alternate or simultaneous burning of gases from the digesters in the oil-fired retort or in the boiler furnaces, and other minor improvements were made.

TESTIMONY ON ODOR REDUCTION

Irving Blount, consulting engineer, New York City, testified that the principal odor in garbage reduction plants arises from the digester process, the local odors due to raw garbage, water after pressing, tankage or dirt being less pervasive. The witness doubted the efficacy of fire alone as a means of destroying the odor of the digester gases, and held that better results might be secured by condensing the steam vapor from the cooking garbage in a surface condenser. Jet condensing, the witness thought, would not be as well adapted to an inland town on account of the scarcity of fresh water supply. It was recommended that the condensed vapors be treated with chloride of lime, the final gases discharged being freed from their offensive character by the action of the chlorine. The soluble gases would pass through the same water solution and be deodorized. The estimated cost of installing such equipment at the Springfield plant was approximately $3,000.

The witness stated that about three years ago he had made experiments along this line at the plant of the then New York Sanitary Utilization Company. A pipe was run from the vent of the digester to a set of submerged coils, the condensate then being passed through a chloride of lime solution. None of the plants of either the dry process or reduction types visited by the witness in this country discharged the digester gases into the furnace as in Springfield. In all the other cooking plants the gases are condensed with water. The purpose of the jet condenser in practice is to condense the soluble gases and to cool the insoluble gases, the cooling effect being to limit the odor arising from the latter to the proximity of the plant. The opinion was advanced that the action of fire on the digester gases probably changes their chemical form and may produce other compounds of a disagreeable character. From an economical standpoint condensing by water appears superior to the attempted deodorizing of gases by fire.

From the standpoint of efficiency the practice of attempting to burn the digester gases in the boiler furnaces was criticised on account of the securing of a forced draft in such cases by resorting to a steam jet. On elevated ground a plant can be placed nearer a residential district than in a depressed section. The scrubber installed at Springfield is not used to scrub the digester gases but to scrub the gases collected from the plant interior. The stick water is passed into the sewer, but does not have an offensive odor unless allowed to stand in the catch basin 48 hours, when fermentation sets in. The effluent water from a plant the size of that in New York totals 200,000 gal. per day, but when passed away directly in its first condition and cooled off no perceptibly disagreeable odor results.

CONDENSERS FOR DRIER GASES

Next to the digester system the greatest volume of objectionable gases that are produced by these reduction plants comes from the driers, on account of the large amount of air necessary for drying. The use of a condenser to destroy the local gases collected in the building appears practicable. At Springfield the local room gases are exhausted under the fire after being sprayed. Craft claims that sulphur dioxide gas is not totally soluble until after it has been heated up to a certain temperature sufficient to change the chemical composition. The height of stack necessary depends on the draft required for the boilers and not upon the requirements of gas dissemination.

Regarding the chloride of lime process, Mr. Blount said that this material costs from 1.5 to 1.75 cents per pound and that about 4 parts available chlorine to 1000 parts water is sufficient to deodorize the gases. It would be feasible from the engineering standpoint to turn the gases from the Springfield furnaces into a surface condenser. The Springfield plant is one of the smallest plants in the country, while that in New York has 172 digesters of 10 and 15 tons' capacity and reduces a maximum of 2500 tons in a day. At Springfield the digesters are filled to within about 3 ft. of the top, and from 70 to 80 per cent water is present in the material. The vapor is carried to the furnaces or retort through ¼-in. vents, one from each digester. About 90 per cent of this vapor is water. The witness agreed that odors from such a plant might be noted at a distance of ½ mile.

COBWELL PROCESS DESCRIBED

William J. Springbaum of New Bedford, Mass., manager of the reduction plant in that city, described the application of the new Cobwell process, invented by Raymond Wells, of Homer, N. Y. An experimental unit of this system was installed at New Bedford in May, 1914, and after one year's trial was taken out and replaced by six new units. The process consists of placing the garbage, delivered by wagons, in a sealed, jacketed tank. After the tank is sealed, a solvent (gasoline) is pumped into the material and steam is turned into the jacketed tank, but the steam does not come into contact with the garbage. The steam is turned on long enough to boil or set in motion the solvent and water inside. During this period the material is stirred by an agitator so as to thoroughly mix the solvent and garbage. The solvent vaporizes and so does the water in the garbage. The two vapors then combine and pass through a pipe to the condenser, and are then again restored to their liquid state by cooling. The water and solvent, having different specific gravities, are separated, the solvent being drawn off at the top and after being returned to storage tanks it is used again. The water that has been boiled out of the garbage, having just a trace of foul smell to distinguish it from ordinary water, perfectly clear and carrying no solids, is then run off to the sewer. No insoluble gases are created, because the garbage is not decomposed as in other systems. A corn husk comes out similar to a shoe lacing, in the shape of a long, stringy material. No pressure is used in this system above 2 lb. per square inch and operation in a vacuum would give still better results. The bad odors are entirely eliminated, and boiling takes place at the point where the vapor pressure from the solvent and the vapor pressure of the water combine, viz., at from 190 to 196 deg. Fahr. The garbage disposal plant at the Panama-Pacific Exposition is of this type.

Relative to the possibilities of disposing of odors through heating, Mr. Springbaum said that heating dries the vapor or gas to a degree that it becomes much lighter than air, and until mingled with air long enough to become saturated again hovers some distance above the stack. As soon as there is sufficient moisture in the atmosphere to load the gases again, they fall to the earth, and an odor can be detected. The witness favored condensation and treatment with chloride of lime for the Springfield plant, but preferred the jet type of condenser on account of the first cost and maintenance of a surface type for such service. Acids or gases in digester vapor are destructive to piping and would be likely to lead to excessive maintenance costs in a surface condenser. About 32 lb. of water are required to condense 1 lb. of steam in a jet equipment compared with 45 lb. in a surface equipment. About 75 per cent of the objectionable odors now noticeable at a distance should be destroyed by this treatment. Entire freedom from odors under all conditions is practically out of the question.

The cost of changing over the Springfield plant to operate under the Cobwell process would be from $35,000 to $40,000. The cost of removing the present Springfield Merg plant to another site would be perhaps 90 per cent of the initial outlay already made. The witness said that he had detected odors 3000 ft. from a Cleveland plant installed under his direction, under certain atmosphere conditions, with a stack 60 ft. high through which nothing passed but the vapor from the driers or cookers.

WOULD ELIMINATE STACK

In designing another furnace Mr. Springbaum said that if he had a stack he would lay it flat on the ground and would simply use a mechanical fan to draw or force the gases through the furnace and saturate them with water at every foot of their travel, allowing them to escape on the ground at the back and localizing instead of sending them abroad. Scrubbing is an essential part of a successful process, since so large a proportion of the vapor is moist and condensable. In digesting garbage a plant accomplishes in 7 hours what nature does in 7 weeks. The witness thought that scrubbing the gases before burning would help somewhat at Springfield, but that scrubbing after burning would not eliminate the gases. Mr. Springbaum said that a better location for a garbage plant is in the manufacturing districts, near railroad yards and in places where there is less objection to wagons passing through the streets. The bulk of garbage in any city is produced in its heart, and unnecessary cartage is also objectionable.

Called to the stand at the final session, Mr. Whittemore said that in theory the process of filling, cooking, floating off grease and pressing in one tank is excellent, but that in practice an unusual amount of work is entailed by this arrangement, involving considerable extra labor and loss of time.

WATER FOR ROAD SPRINKLING is piped 12 miles on the ridge route recently constructed by the California Highway Commission to connect Los Angeles and Bakersfield. The road is built at a high level in a naturally dry district, and in order to avoid pumping, the long pipe lines were laid to bring spring water to a series of five reservoirs at as many different "high points" on the road profile. The reservoirs are excavations lined with concrete.

Two Relief Gates Considered for Handling Cross-Canal Flood Waters

Experimental Installations Now in Service Will Determine Which Type Will Be Adopted for Long Ditch

By Joseph Jenson
Consulting Engineer, Salt Lake City

Many irrigation canals, especially in the Rocky Mountain states, are built along the base of a mountain range for the purpose of supplying irrigation water to a long but comparatively narrow strip of bench land lying between the mountain range and the low lands of the valley. One of the perplexing problems which confront the engineer in such cases is to take care of the cross-canal waters which come from sudden violent rainfalls or rapidly melting snows in the mountain range above the canal. To handle these waters successfully the two types of gates herein described were developed.

Piute Main Canal

An aggravated case with cross-water troubles which has recently come within the experience of the writer is the main canal of the State of Utah Piute project. This canal is situated along the base of the western range of mountains in the Sevier Valley, in Sevier and Sanpete counties. The canal has a length of about 55 miles. The transverse slope of the country varies from about 3 per cent to as steep as one in two. The capacity of the canal at the head is 500 cu. ft. per second, decreasing gradually to 300 cu. ft. in 40 miles and thence to 60 cu. ft. in the remaining 15 miles. In the stretch of 55 miles the canal crosses more that one hundred canyons and washes, emerging from the mountain range on the west. All of these have been provided with either under or over-canal channels to convey water across the canal. These canyons and washes are for the most part dry; that is, they do not contain a permanent stream. All are subjected to heavy and sudden floods due to violent local storms in the adjacent mountains.

A calculation of culvert capacity by the common rules based upon the area of the watershed and precipitation records would be entirely misleading and inadequate in this case. So also, observation of the old water channels in these canyons do not furnish a criterion on which to base a rational design for culverts. Some washes whose channels have grown up with brush and show no signs of having had for years streams of any considerable size have suddenly been transformed into raging torrents, usually of not more than one or two hours' duration. These floods carry with them great quantities of debris, large boulders and trees. Not infrequently the breast of such floods consist of a great rolling mass of debris several feet high, resembling more an avalanche than a flood. It is not uncommon that as these emerge from the usual narrow gorge onto the alluvial cone the original wash or channel is completely clogged and the rushing torrent must find a new course to the valley. A culvert or overshot on the canal at the original crossing, even if adequate should the flood follow its old course, is not infrequently rendered useless. Attempts to maintain a permanent channel for these flood waters or to protect the canal by embankments along its upper edge have proved equally futile as a permanent safeguard.

Floods at Height of Irrigation Season

To aggravate the situation, the floods are most frequent and of greatest violence during the latter part of July and August, just when irrigation is most urgently needed and the canal is carrying full capacity. Any considerable amount of water entering from extraneous sources is an overburden, and not only results in damage to the canal, but also in shutdowns for repairs when the crops are in greatest need of water.

These conditions led to the plan of providing relief devices whereby the canal could quickly and effectively be relieved of its load so as to allow it to carry during a flood interval up to its full capacity such water as may enter it laterally and thereby lessen the probability of disastrous breaks. Two such devices were designed and installed by the writer. Both are experimental in character and only one of each has been built to date. It is obvious that to afford protection to the entire length of canal a number of such devices will be needed at intervals along the canal. Which one, if either, of these structures will be adopted will probably depend upon the experience with these trial installations. The devices contain some features of design which, so far as the writer is aware, are novel, and are here presented in sufficient detail to make these features clear.

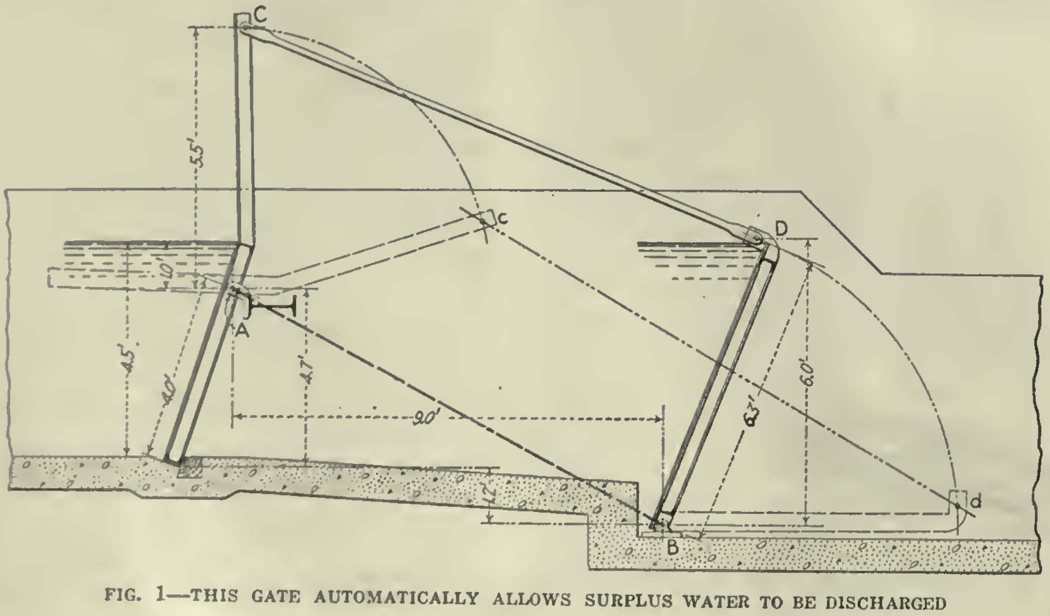


FIG. 1—THIS GATE AUTOMATICALLY ALLOWS SURPLUS WATER TO BE DISCHARGED

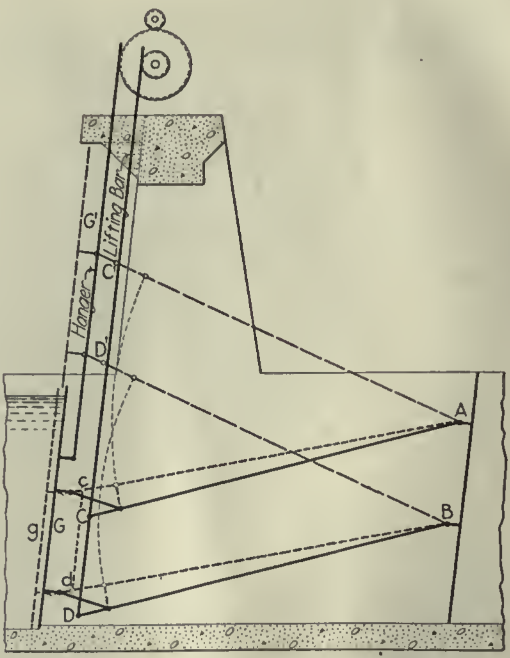


FIG. 2—ILLUSTRATING PRINCIPLE OF WINCH-OPERATED GATE

First Design

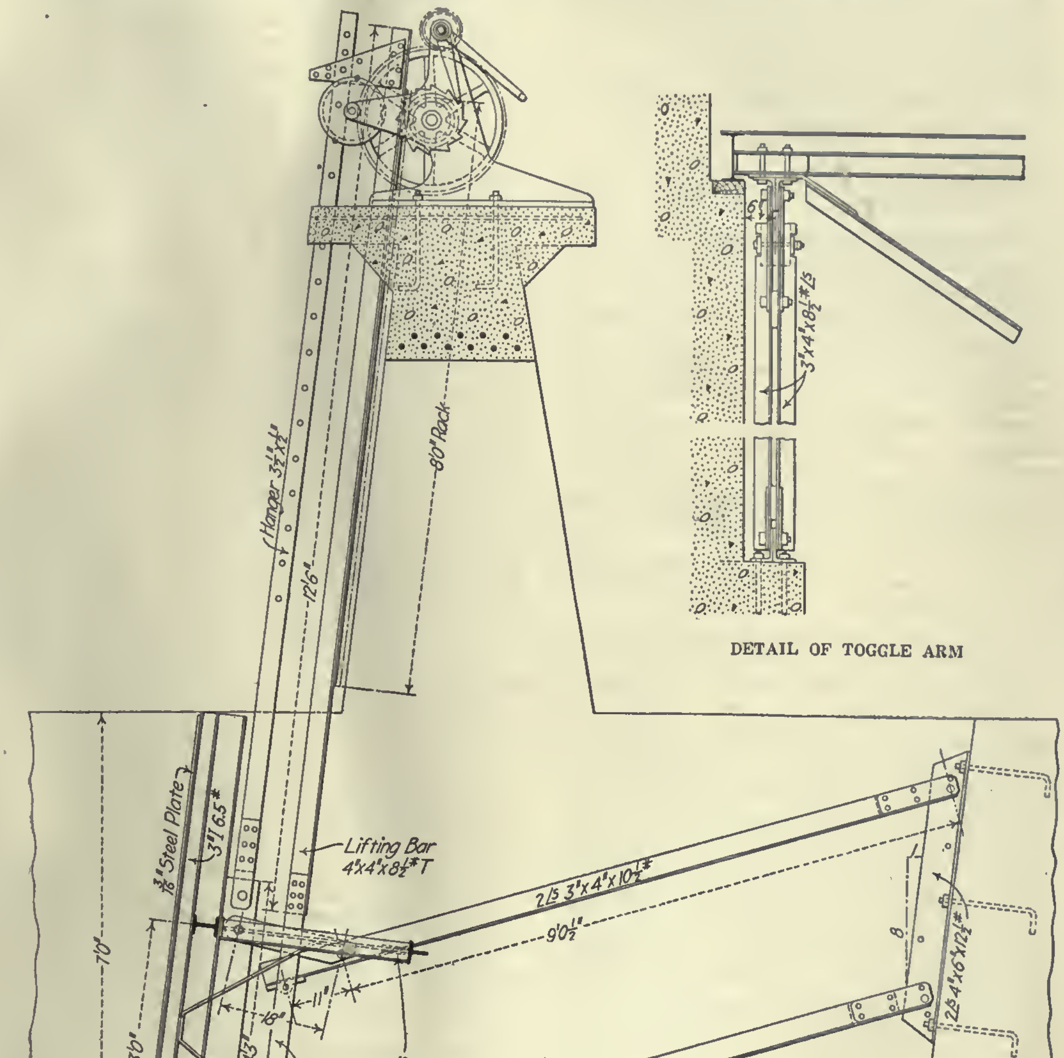
The first, Fig. 1, is intended to be automatic in operation. It consists essentially of a pair of hinged gates, set in a reinforced concrete box extending through the lower bank of the canal and communicating thence with a waste channel to the natural drainage course of the valley. The first gate is hung on a horizontal I-beam extending across the gate box about one-third the depth below the maximum high-water surface in the canal. The gate itself consists of a frame of T- and channel bars, with a sheet-steel skin on the canal side. The vertical members of the frame are extended as shown to form lever arms. These are connected by means of a corresponding set of links to the upper edge of the second gate. The latter is built on the same general plan as the first gate, except that the vertical members are provided with a hinge connection at the lower instead of the upper end. A vertical step in the bottom of the channel, immediately in front of the second gate, provides the extra pressure required on the second gate to operate the mechanism and also allows the gate to drop below the current when the gates are open.

The first gate when closed is seated both at the sides and bottom and swings away from the seat when in operation. The second gate is hinged at the bottom and swings free, no attempt being made to make a water-tight joint either at the bottom or the ends. The first gate when closed prevents leakage from the canal. Any leakage around the second gate when water flows over the first is of no consequence.

Operation

The combination forms a common "four-bar linkage," A-B-C-D, the heavy dotted line constituting the stationary link. When an excess of water enters the canal the water overflows the upper edge of the first gate. As the elevation of the water in the box approaches that in the canal, the whole mechanism swings into the position shown by the light lines and the waste channel is open to relieve the canal not only of the excess water, but of its entire flow. The calculation for proper dimensions is simple and is not here given. The dimensions in Fig. 1 will enable anyone familiar with elementary mechanics to check the results and show that the pressure on the second gate is sufficient to overcome the pressure on the first, even without taking into account the back pressure on the first gate due to the filling of the box behind it.

It is apparent that this device is not adapted to hand operation. This, however, may be facilitated by placing in the body of the first gate a small hand-operated sluice of sufficient capacity to fill the box between the gates.



DETAIL OF TOGGLE ARM

FIG. 3—WINCH-OPERATED GATE FOR SAME SERVICE AS AUTOMATIC GATE, FIG. 1

SECOND DESIGN

The second structure, Figs. 2 and 3, referred to above is intended to be a power-operated device. It is a single gate, which, as installed, is 7 ft. high by 28 ft. long. It is constructed on a T and channel-bar frame, which in turn is supported on two steel trusses, so spaced vertically that each truss will sustain one-half the water-pressure load when the canal is carrying its maximum normal flow. The gate when closed is fully seated in the usual way both at the sides and the bottom. About 10 ft. back of the gate on each side of the concrete channel in which the gate is set is an off-set in the wall to which a thrust plate is anchored. Each end of each truss is connected to this thrust plate by means of a toggle-joint link consisting of one long and one short member, the short member joining onto the gate truss. These links are designed to sustain safely a column action equal to one-fourth the total water pressure on the gate. The long member of the link is continued beyond the hinge to a point near the back of the gate and there connected in vertical pairs by means of a halter to the lifting bars, one at each end of the gate, and geared to a pair of winches, driven by an electric motor, both from the same shaft. As is evident from Fig. 2, the first action of the mechanism is to straighten out the toggle joint and thrust the gate forward to the position shown by the dotted lines. The gate is now free from its seat, and the continued action of the lift is to swing the gate without sliding friction, into the position shown by the dash lines, and the gate opening is completed.

The motor is thrown into motion by closing a switch in the office of the canal superintendent. Its motion is discontinued by pulling a switch automatically at the gate end of the line when the gate has been raised its full height. A pawl and pawl-wheel secures it from slipping back. To close the gate it is necessary to keep the toggle in line until the gate is completely lowered. In order to do this a second bar, called the "hanger," is fastened directly to the gate and extends above the bridge alongside the lifting bar. By slipping a pin through this and a shoe fastened to the lifting bar the toggle is locked in line and the links on each side become a simple parallel four-bar linkage. The gate may now be lowered without contact with the gate seat. When the gate is completely down the toggle is unlocked and the gate seats itself. The gate is lowered by simply raising the pawls, applying a simple brake and allowing the gate to slip down of its own weight. In order that the gate may be used at part opening a series of holes is punched in the hangers so that a pin may be slipped in, hanging the gate at any desired stage. When the gate is thus hung the toggle may be unlocked and the gate seated.

The elements of the mechanism are shown in Fig. 2. The details of construction, not including the motor connections, are shown in Fig. 3.

WIDE OPENINGS SECURED

One other matter which was taken into account in the design of these structures remains to be mentioned. Vacant land on both sides of the canal produces a prolific growth of Russian thistle or Tumble weed. During certain seasons great numbers of these roll into the canal. They show a wonderful tendency to attach themselves to any obstruction, such as piers or posts, in the canal and thus interfere with the flow of water. This made it desirable that canal structures should have clear, wide openings, such as these designs possess.

In conclusion, it is proper to state that the writer does not claim to have effected a final solution of the problem herein set forth, but submits his experience in the hope that others will add to the discussion.

TWELVE THOUSAND FOREST FIRES, large and small, occurred in Canada during the spring, summer and fall of 1915, according to the report of the Canadian Forestry Association. This represents an average of 1400 a month for the season. Settlers' fires caused 35 per cent of the losses in British Columbia, Ontario, Quebec and New Brunswick, it is estimated. In British Columbia "permit laws" are enforced by which all settlers are obliged to obtain the supervision of a forest ranger before setting out their clearing fires, and while 10,000 acres of logged-off land were burned, the fires were kept out of all but 36 acres of merchantable timber. Manitoba suffered a loss of $1,000,000 by forest fires which burned approximately 80,000 acres during the dry season. In the province of Saskatchewan the damage is estimated at $170,000, with a burned area of approximately 140,000 acres. In southern Alberta, thanks to the heavy rainfall, the fires have been comparatively small, only about 25,000 acres having been burned over, suffering an estimated damage of $1 per acre. In the Peace River valley, where the season was dry, many destructive fires occurred.

Literature

For the Civil Engineer and Contractor

The Construction of the Panama Canal

Authors, William L. Sibert, brigadier general U. S. A., and John F. Stevens, formerly chief engineer and member of the Isthmian Canal Commission. Cloth, 239 pages, 23 illustrations. New York, D. Appleton & Company. $2.

This book gives an excellent idea of the design and construction of the Panama Canal, without going into wearisome details. It is intended for general reading rather than as a reference book for the technical man.

It is divided into two parts: the first discusses the preparatory period, from 1904 to March, 1907, and the second the construction, from March, 1907, to April, 1914. The first part is written by Mr. Stevens and the second by General Sibert.

An idea of the scope of the book can readily be obtained from the chapter headings, which are as follows: Preparatory Period—Sea Level vs. Lock Type of Canal, Reconstruction of the Panama Railroad, Prosecution of the Work, Development of Working Plans, Housing and Feeding of the Force, Assemblage and Management of the Force. Construction Period—Adopted Project, Changes in Adopted Project, Changes in Dimensions of Parts of Canal, Designs for Permanent Buildings and Locks, Construction from Colon to Gatun, Excavation and Concrete Work at Gatun, Construction of Gatun Dam, Gatun Lake, Construction from Gatun to Pedro Miguel (Culebra Cut), South End of Culebra Cut to the Pacific Ocean, Municipal Engineering, Shops and Terminal Facilities, Operation of Panama Canal, The Work and Its Cost.

Because of General Sibert's intimate connection with the work in the Atlantic Division, the construction there is treated at somewhat greater length than that in Culebra Cut and on the Pacific side. The general features, however, are stated with reference to all of the work. Passing incidents that have a human flavor are worked in, particularly by General Sibert, making the volume even more readable than a mere recital of facts could make it.

Ford Methods and the Ford Shops

Authors, Horace Lucien Arnold and Fay Leone Faurote. Cloth, 7 x 10½ in.; 440 pages, illustrated. New York, The Engineering Magazine Company. $5.

This is a volume which while devoted chiefly to the production methods of the Ford shops, should be of value and interest to every industrial engineer, even though his work be the designing of the structures only. The influence upon them of the operations they are to house is necessarily large, and this book shows how the intensive work of the remarkable Ford shops is carried on. As is known in a general way, remarkable special machines, working routine and management system have been developed by the Ford organization. An understanding of them is well worth while, even if for the mere purpose of keeping in touch with the progress in manufacturing methods.

One chapter is devoted to the new Ford factory buildings and to the factors which influenced their arrangement and design. A final chapter on methods for safeguarding the workmen contains some information regarding fire protective devices and danger warnings. It includes a full treatment, too, of the protective devices used in connection with moving machinery.

The Building Estimator's Reference Book

Author, Frank R. Wallace. Limp leather, 4½ x 6½ in.; 612 pages; illustrated. Chicago, published by the author, 30 Michigan Avenue. $10.

Estimating costs of modern buildings is a highly specialized science which requires either large experience or exact data. The author of this 612-page book has compiled data taken from his own experience and the best available sources of reliable information. Realizing the vital influence of the local conditions on the costs, special emphasis is placed on complete description and illustration to explain all the items of methods and plant which affect the work. Inside figures of costs are sometimes given for buildings which have not been mentioned by name because the information was confidential.

Costs are given in actual hours per unit of measure, so that the data can be used with any prevailing local rate of wage.

After considering general conditions and overhead expenses, the author gives costs of wrecking and excavating, caissons, concrete, wood and sheet piles and concrete for foundations. The next two chapters consider waterproofing and concrete floors and pavements, mainly by the citation of examples. Reinforced concrete and reinforcing steel are similarly treated, followed by brick masonry, stonework, fireproofing, rough carpentry for timber framing, flooring, etc., mill work and interior finish, including plastering, doors and windows, art metal and sheet metal.

Slate, tile and composition roofing and felts are treated in one chapter, followed by chapters on exterior and interior marble, slate and scagliola, tiling, glass and glazing, painting and varnishing. Structural iron and steel costs are given in a chapter of 27 pages. Building specialties (including vault doors, prismatic sidewalk lights, blackboards, etc.), hardware, plumbing, steam and hot-water heating and electric wiring are considered in the concluding chapters.

Elasticity and Resistance of the Materials of Engineering

Authors, William H. Burr, professor of civil engineering, Columbia University, New York City. Seventh edition, thoroughly revised. Cloth, 6 x 9 in.; 928 pages. New York, John Wiley & Sons. $6.50 net.

Reviewed by F. H. Constant

Professor of Civil Engineering, Princeton University.

The present edition has been completely rewritten and re-arranged, much of the older matter has been displaced by new topics of greater present practical importance, and a new book has virtually been created. Although smaller than the last edition, it still contains 928 pages. To those familiar with the older editions, a list of the chapter headings will indicate the character of the revision. The subject matter is still classified under two parts, devoted to the analytical and technical aspects of the work respectively.

Chapter 1, "Elementary Theory of Elasticity," has been expanded from 13 to 50 pages and now includes the ellipse and ellipsoid of stress. Chapter 2, "Flexure," replaces the old chapter 3 on this subject, and is much enlarged. Chapters 3 and 4, on torsion and on hollow cylinders and spheres, have been rewritten.

Part II, "Technical," contains many tables and much practical data, and has been almost completely rewritten in order to bring it up to date. Chapters 7 and 8, "Tension" and "Compression" respectively, take up in order cast iron, wrought iron, steel, copper, cement and timber. The specifications for the steel of the Manhattan Bridge in New York are included. Forty pages are devoted to riveted joints and pin connections in chapter 9. In chapter 10, "Long Columns," the new matter includes the principles of the moments of inertia, a new treatment of Gordon's formula, new column sections and recent tests of various steel columns, with the typical formulas now in use. Chapters 11, "Shear and Torsion," and 12, "Bending," contain much tabular data of recent tests.

Much interest will center upon the author's treatment of concrete-steel members in chapter 13. It contains 70 pages and covers the theory and practical application of this form of construction. In this field Professor Burr was one of the earliest writers, and he has contributed much to the development of the present rational and simplified methods. It is to be regretted that he did not finally adopt the notation now generally used in practice, and most familiar to engineers.

In flexure the most general case is treated first; viz., that of the T-beam with steel on both compression and tension sides. The tensile resistance of the concrete is included, and the neutral axis is assumed to lie below the flange. When the various practical conditions are introduced, such as steel on the tension side only, tensile resistance of concrete neglected, and the width of flange assumed equal to the width of web (the case of the ordinary rectangular beam), the formulas reduce to the familiar simple expressions used in practice. A study of this general analysis, although it involves some superfluous terms and seemingly complicated mathematical expressions, should result in a sound knowledge of the mechanics of the composite beam.

The practical value of this part of the book would be greatly enhanced if the author were to include tables and diagrams to expedite the use of the formulas.

The author recommends that the entire transverse shear be provided for by steel stirrups or bent rods independently of the shearing resistance of the concrete. These steel rods are treated like the diagonals and verticals of a Pratt truss, the stress being obtained by multiplying the total transverse shear by the secant of the vertical angle, the spacing of the bent rods or stirrups being limited to the depth, or preferably three-fourths of the depth, of the tensile steel. In computing the value of bond shear for the stirrups, the author allows the use of the entire length of stirrup instead of only the part lying above the neutral axis.

The confusion in the present methods of establishing the working stresses in reinforced-concrete columns is again apparent. In column tests the yield point of the longitudinal steel and the ultimate strength of the concrete are reached at about the same time. Should the working stresses be based upon the ultimate strength of the column or upon the stress conditions existent at the time when the working stresses occur? The author uses the former method and recommends the high unit of 16,000 lb. per square inch for the steel, while retaining the A. S. C. E. specification of 22½ per cent of the ultimate strength of the concrete, about 500 lb. per square inch. It is impossible, of course, for these working stresses to exist side by side, their relative values being determined by the ratio of their moduli of elasticity at any time. For this reason many engineers prefer to use units that are consistent with each other at the working load, employing a much smaller value for the steel even though the allowance in the concrete (especially when well banded), is sometimes increased over that recommended by the American Society of Civil Engineers.

Chapter 14 covers rolled and cast flanged beams. Chapter 15, "Plate Girders," is rewritten and includes the complete computations for a 70-ft. single-track railway deck plate-girder span in accordance with the A. R. E. A. specifications. Chapter 16, "Miscellaneous Problems," includes a number of new topics, such as curved beams, hooks, eccentric loading, general flexure by the core method, oblique flexure, elastic action in a composite material, helical and plane spiral springs, flat plates, and the theory of least work applied to a bridge portal. Chapter 17, "Fatigue of Metals," and 18, "Flow of Solids," as well as the three appendices covering the mathematical theory of elasticity, thick hollow cylinders and spheres, and the theory of flexure are, in the main, unchanged. Some new matter, including Clavarino's formula and the resisting capacity of natural and artificial ice, is introduced at the end of the book.

Some typographical errors have crept in, equation 3 on page 662, for example, containing two. The author is not always consistent in the use of his symbols.

This classic work has long been regarded as the leading American authority in the field of the elasticity and resistance of materials. It is a source of gratification to the engineering profession that Professor Burr has been willing to undertake the arduous task of revision, and has completed this work in so thorough and satisfactory a manner.

Letters to the Editor

Comment on matters of interest to engineers and contractors will be welcomed

Why Is Registration in Civil Engineering Decreasing?

SIR: The decreasing enrollment in our engineering schools as noted in the Engineering Record of Dec. 18, 1915, has been a matter of interest to the writer for several years. The enormous increase in the number of engineering students from 1890 to 1910 could hardly have been expected to continue, and the subsequent decrease should cause no alarm. It is but the natural result of deep underlying economic conditions.

First of all, the figures for 1915-16 should be discounted because of the depressed financial condition of our own country as well as of Latin America and the Orient, from where we have been drawing large numbers of students. In this connection, figures of a large Eastern university before the writer show marked decreases in number after the depressions of 1893 and 1907. Omitting these figures then, a glance at the curves shows that the decrease had reached its maximum effect some three years ago, the curves being horizontal for the following years.

There are a number of reasons for the general falling off in numbers. An examination of statistics of leading universities will show an increasing interest in agricultural courses for the past decade or two, far surpassing any similar period of expansion of the corresponding technical departments. In the case of the university referred to, the greatest increase in engineering students for a ten-year period was from 1899 to 1909, namely from 950 to 1900. In the case of agriculture the increase from 1904 to 1914 was from 189 to 1670.

The deluded popular notion concerning reward for technical ability has gradually been dispelled by actual statistics, as for example, the recent figures compiled by the American Society of Civil Engineers, resulting in the search for greater remuneration along other lines of endeavor.

Nor can it be overlooked that with the development of the profession the technical schools have been raising both their entrance requirements and their standards of work. The result in numbers is evident. The introduction of six and seven-year courses with less time spent in the engineering college also has a slight but misleading effect upon enrollment statistics.

Finally, a number of factors combine to decrease the enrollment for individual schools, but which if anything have the opposite effect upon the total number of engineering students in the United States. Among these may be mentioned the establishment of new schools, the expansion of others hitherto unrecognized, the introduction of night courses leading to a professional degree, and finally the development of correspondence courses.

It is the belief of the writer that a stable, healthy condition has about been reached which will result in a supply more suitable to the demand; for while the increasing participation on the part of the engineer in public and executive duties may cause the curves to ascend in the future, an ascent as steep as that of ten or fifteen years ago is unwarranted.

CHARLES WEISS, C. E.

Pittsburgh.

SIR: I read the article and editorial concerning registration in civil engineering in the Engineering Record of Dec. 18, 1915, and found them very interesting. After being employed by a large structural company for nearly three years on a variety of design and construction, and having come into rather close contact with engineers and engineering departments of a number of large and small concerns, I offer the following replies to the questions asked:

1. The decline in registration of civil engineering students is, undoubtedly, due to the discouragements offered to those engaged in the profession. (a) A just return—that is, sufficient to enable an engineer to support a home as any professional man should, comes to very few. The complete statement of an employer of engineers, that it is an easy matter to get plenty of good, experienced structural engineers at $150 per month, is known to him to be as untrue as it is to the employed engineer to be a "bluff" to hold his salary down. It is unfortunately true that men can be hired for that amount, but they are too often merely engineers. (b) Engineers in general are little respected by field superintendents and non-technical practical men in general. This, I believe, comes about from the following causes: Superintendents are usually older, are better versed in practical methods and have keener judgments; they are among the better paid men, so are able to live without worrying whether prunes are 11 or 12 cents per pound, and their efficiency is therefore higher; the engineer, young because the older men will not assume the responsibility at the market salaries, is compelled to employ his leisure time, if he has any, in some immediately remunerative occupation, thereby reducing his efficiency and depriving him of the privilege of bettering himself as an engineer.

While in college I often listened to the advice, and I believe it sound, to young prospective engineers to overlook the small salary in the early years of practice and to put their maximum energy into the profession. This is clearly indicative of the high ideals of the advisors, but the fact cannot be sidestepped that a man must earn more than the average engineer now does before he can cease to think at almost every turn, "I would like to, but cannot afford it." The engineer must face the unfortunate high cost of living. A man with no taste for art, music or literature, no appreciation of the value of friends, and no idea of the relation of living well to efficiency—the one without the personality to make a real man—can live on his income, can save money, can even become an engineer—at the expense of his development as a member of society, as a real man. There are unfortunately plenty of these already in the field of engineering.

2. Instead of the question, "What is the remedy?" (for the decline), I would substitute "Will the decline be a remedy for the present conditions?" It will in that a smaller supply of engineers with an equal, or, from present indications in the business world, a greater demand for them will make the field more attractive. The decline in registration is accentuated by the large number of men, and capable men, leaving the field, so that it is already becoming difficult to obtain *good* engineers. The decline will be a remedy for the decline.

3. The principal reason for alarm to the business man is that he is not, in many cases, broad-minded enough to see one of the most important sources of his own profit. The engineer is, to him, not a source of profit, but a "necessary evil," employed merely because the project cannot be ac-

complished without him. His vision, narrowed by seeing only money, *money*, MONEY, causes him to think that the smaller the salaries of his force, the larger will be his profit. Nothing is more absurd. When the supply of engineers becomes sufficiently limited to cause their demands for a better living to be listened to, better men will be attracted to and remain in their field, and just as surely will the poor engineers be driven from the field. An increase in salary is just as sure to show up a weak man as it is to hold a good one. A small number of good men can accomplish more than the equivalent, from the salary standpoint, of cheaper men, and while the majority of employers seem unable to comprehend it, their organization would be far more efficient. The larger salaries will probably attract sufficient men to the colleges, along with the men who choose the profession because they love it, to change the slope of the registration curve from minus to plus, and at the same time will eliminate those unable to make good from the practical field. This will be a much better condition for both engineer and employer than to have the better men forced into other occupations to obtain sufficient remuneration. Higher salaries will surely increase efficiency by enabling the young engineer, especially, to use his spare time for the profession instead of being compelled to use it to earn a living at any sort of occupation.

The salvation of engineering, for the present, seems to lie with those who have an independent income, and with those who are in it because they love it.

CLYDE B. PYLE.

Wilkinsburg, Pa.

SIR: The Engineering Record asks "Why is registration in civil engineering decreasing?" and invites answers to its interrogatory. The writer believes he has a partial answer to the inquiry, but desires to preface it with the statement that what he shall say are matters of personal knowledge, and perhaps apply only to the locality with which he is familiar.

The usual cycle of operations, leading to the graduation of a young engineer are substantially as follows: Little Willie has completed his high-school education, and coming into the possession of some one of the "Best Books for Boys" reads a glowing account therein where some poor but honest young man, with only a tow string, a handful of shingle nails, a saw and a hatchet, designs and constructs a bridge over a yawning chasm that has, up to the time of his advent, defied the efforts of the most eminent engineers. Incidentally, of course, little Willie later marries the daughter of the mighty railroad magnate and lives in happiness and luxury forever thereafter.

Now little Willie probably could not, naturally, make a decent button for a smokehouse door, but with his youthful imagination fired by the compelling experience of the poor young man aforesaid, he tells Mamma that he wants to be a civil engineer, with big capital letters. Mamma, of course, knows that engineering is considered one of the learned professions and "so dignified, you know," and she intercedes with Dad. Now Dad, like the father of most of our young engineers is, if not rich, at least comfortably well to do, so little Willie is entered in some institution where engineering is taught.

During his college experience, in the few lucid periods intervening between the mad rush of intercollegiate football, baseball, rowing, Frat rushes, etc., he succeeds in storing, partly in his head and partly on his shirt cuffs, sufficient theoretical knowledge to enable him to pass his final examinations and be graduated as a full-fledged C. E.

When he returns home he is somewhat surprised to find that no brass band and throng of admiring friends meet him, and still more surprised, as the days go by, to find that the community in general is not tumbling over itself to secure his valuable services; consequently he loafs.

Dad at last wakes up to the fact that little Willie is much more ornamental than useful, and some fine morning takes him to task. "Say, young man," says he, "do you appreciate the fact that I spent a lot of good hard money to put you through college?" The young man admits the fact. "Then," says the old man, "get out and do something." The young man is forced to admit that no flaw can be found in his father's reasoning, but tells him that it is considered undignified and "unethical" for a professional man to solicit employment. Then the old man goes up in the air. "Ethics be d——d!" says he. "If it were unethical for me to get out and hustle to sell lard, pork, beans, codfish and lots of other things, where would you be? Get out, get into the game. Show what you are good for, if you are good for anything. Get a move on."

Little Willie goes out in search of employment, and comes back a sadder and wiser man. He finds the field fully filled, and work as he may, finds no employment. He reports to Dad, and he, being wise in the ways of the world and knowing that if he can sell pork cheaper than his competitors he gets the business, suggests to Willie that he cut the price. And here comes in one of the queer things about engineering. To the average person, the man who owns, or can borrow a transit, set it up and squint through it, is an engineer. Well, Willie goes out again and does cut the price and gets a provisional promise of employment, but when he appears to his prospective employer, to consummate the contract, he finds, much to his amazement, that some other young engineer has underbid him and secured the work.

He reports to Dad and that at once arouses the old man's commercial pugnacity. "So that's the game, is it?" says Dad. "Well, we'll show those cheap skates a trick with a hole in it. Get out and get the work. Don't make any difference what the price is. Do it for nothing, if necessary. Get the work and I'll make up any loss there is in it. Get into the game."

Well, Willie does go out and get the work, but to get it he does it for substantially nothing, with the result that he spoils the business for legitimate practitioners. Of course, his customers, as a rule, get just what they pay for, but as "a sucker is born every minute" the supply is equal to the demand.

Now this is not an overdrawn picture. Its counterpart can be found in nearly every community, and it proves to the writer, at least, that the profession is now overcrowded. As the late Harriman said, relative to a different subject, the community has too many "undigested" engineers.

When we find, as we do, in the locality in which the writer resides, that large employers of engineering skill are paying for it less per diem, or per year, than they pay for purely mechanical capacity, it furnishes conclusive evidence that the supply exceeds the demand.

ENGINEER.

Utica, N. Y.

SIR: In response to your invitation to readers of the Engineering Record to discuss the reasons for the evident decrease in registration in civil engineering courses, I would offer the following:

Every man who intelligently makes the choice of his life work is governed, to a large extent, by individual reasons peculiar to himself only. This, as well as the fact that one's judgment as to the cause of this decrease is apt to be governed unconsciously by his personal viewpoint, which in turn has largely been determined by his experiences in the profession, makes it difficult to observe all of the existing general causes. But may we not safely say that to other reasons which have been contributed to this fact might be added this, the desire on the part of the student to associate himself in after years with some movement, profession or business occupation which will be reasonably permanent in respect to duration of time and locality? No one with a college education, if he will only use it consistently, can afford to overlook the advantages to be enjoyed in becoming a part of a community, thereby gaining recognition and prestige through constant contact with the life of that community, whether it be public or private.

The salary or income to be derived from such an occupation does not have to be large to equal the majority of salaries derived from the profession in question. Look under the heading of Personal Notes in each issue of the Engineering Record and read of recent appointments made together with previous employments which these men have had. One of the most important facts always remains untold—previous and present salaries. If the truth were known, we would find, in too large a percentage of cases, that these salaries have fluctuated greatly; yet who can truthfully say that the ability or qualifications of these men have been in direct and constant conformity with their pay? Steadiness and dependability on the part of an individual is bound to receive a reward, and these qualities directed along almost any line of employment which has a future, coupled with the advantage of a limited diversity of activities enjoyed only by a permanent resident of a community, will offset a very tempting salary in an engineering position which, in too many cases, to-day is and to-morrow very likely will not be.

Somebody has said that one rises in his position in life as far as he deserves to go. That may be true in many cases, but the completion of a piece of work on which an engineer may have spent the best years of his life and there attained success many times leaves him in an uncomfortable position in this time of intense specialization in a profession which demands, in most cases, quite as much of physical as of mental strength.

J. L. HERBER.

Watertown, N. Y.

APPROXIMATELY $3,000,000 will be spent for road construction and maintenance during 1916 in Kings County, Washington, according to figures recently compiled by the board of county commissioners. Practically all of this sum will be expended on roads outside the limits of cities, it is reported.

HINTS FOR THE CONTRACTOR

Details Which Save Time and Labor on Construction Work

Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

[*Contributions to this section are solicited, and if found available will be paid for. They must be* SHORT, *and should be accompanied, if possible, by photographs or sketches.*—EDITOR.]

Railroad's Car-Float Mixing-Plant Mounts Locomotive Crane

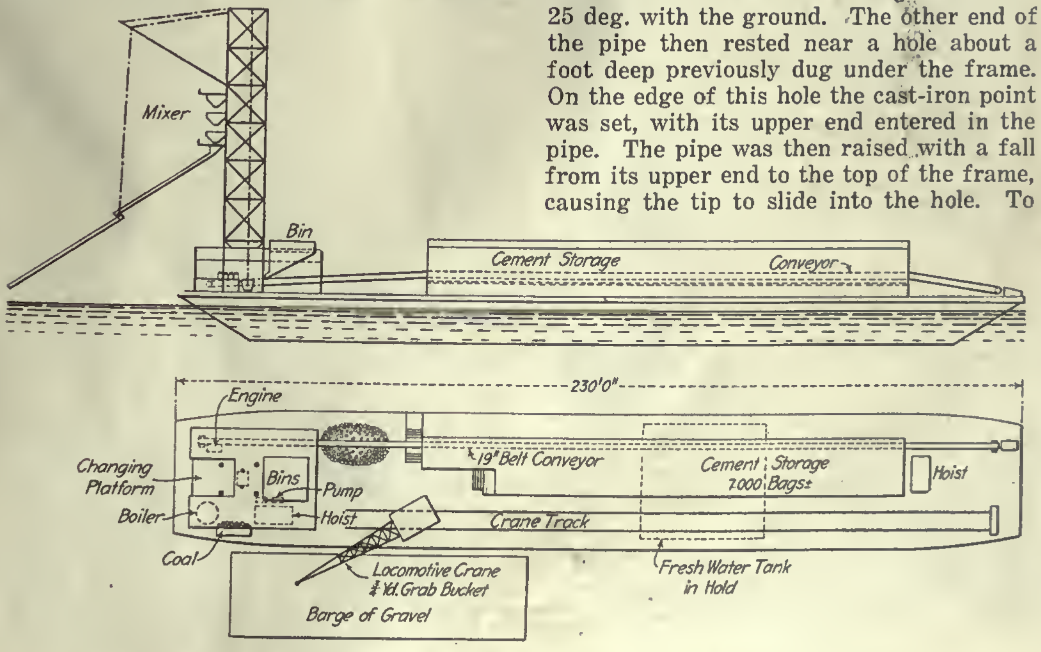
BY L. A. FRANCISCO
New York City

AN OLD Jersey Central car float has been converted into a well-designed floating concrete plant, which is now being used on pier construction for that railroad in New York harbor. The barge carries the concrete plant on its forward end, has a track on one side on which runs a locomotive crane which feeds the material bins, and carries a cement storage house with a capacity of 7000 bags through which runs a belt conveyor. In the hold under the cement house has been built a large tank for fresh water, which is delivered to the mixer by a pump under the material bins.

The car float is 230 x 36 ft. in plan, with its deck from four to five feet above the water. The cement shed has been made 112 ft. long and only 15 ft. wide, to save labor in handling the sacks from storage to the belt conveyor, which runs from end to end of the float and is used to fill the cement house as well as to convey sacks to the charging platform. The door of the cement shed is 4 ft. above the deck, and its roof 9 ft. above the floor. At the rear of the cement shed is a hoisting engine, which is used in moving the float. The crane track extends far enough beyond the cement shed so that the crane can swing in a complete circle.

The concrete plant, boiler, pump, conveyor engine, and tower hoist at the forward end of the boat are housed in a building 30 x 34 ft., built around the hoisting tower. The Haines gravity mixer is hung in front of the tower between two platforms, and discharges directly into the chutes. The concrete materials are drawn from the bins by gravity and measured in the hoisting skip. The mixer is suspended about 60 ft. above the deck, and the chutes, the first section of which is suspended from a boom, swing through an angle of 180 deg.

As will be seen from the accompanying drawing, the large space available on the float has been utilized so as to distribute the weight evenly, and yet to permit handling the concrete materials mechanically at a low cost.



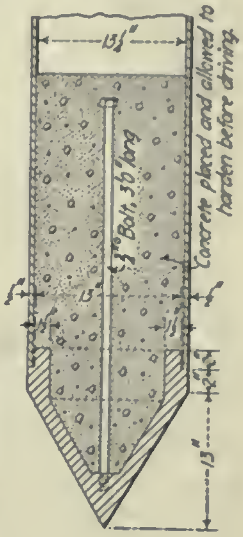
MECHANICAL HANDLING OF MATERIALS COMBINED WITH EVEN LOADING ON HULL

Standing Big Pipe Piles on End to Cast Tips

BY ALEX. P. CRARY
Ancon, Canal Zone

A LENGTH of 14-in. pipe had to be stood on end to cast each of the 3-ft. concrete plugs required to anchor the cast-iron tips to the 60-ft. pipe piles driven for the quarantine landing stage at Balboa, Canal Zone, described on page 801 of the Engineering Record for Dec. 25, 1915. As shown in the accompanying drawing, these tips were held on for driving by a bolt anchored in a concrete plug which also served to keep the piles dry inside until they could be filled with reinforced concrete after driving. Although only the first length of pipe was handled in concreting the points, the other two lengths being screwed on later, this lower section with its weighted tip made an unwieldy load. These sections were handled by hand, as there were only 56 piles required. The easiest method, apparently, was dropping the pipes down a convenient bank over the points, and raising them up from a low frame on top of the bank. This worked all right with the first batch till it came to lowering the piles to screw on the additional lengths of pipe. Then it was found that the weighted tips made the business of getting them back up the bank entirely too slow. The majority of the piles were therefore raised by a high frame. One end of each pipe was first set on a high horse so that it made an angle of about 25 deg. with the ground. The other end of the pipe then rested near a hole about a foot deep previously dug under the frame. On the edge of this hole the cast-iron point was set, with its upper end entered in the pipe. The pipe was then raised with a fall from its upper end to the top of the frame, causing the tip to slide into the hole. To keep the point from plowing through the far side of the hole, two snub lines from the lower end of the pipe to a near-by track were kept taut till the pile neared a vertical position. After the concrete deposited in the points had set, the pipes were lowered, the extra lengths screwed on and the piles were ready for driving.

It cost $1.60 per pile to place and concrete the points, and $3 per pile to screw on the two extra lengths. These costs, and those given in the previous article, might be considerably reduced on a second job under the same conditions, as the new methods developed made some experimenting necessary.



The writer was contractor for the work described, which was done under the direction of Rear Admiral H. H. Rousseau, engineer of terminal construction.

Handling Pipe Line Under 15-Lb. Pressure While Bridge Is Raised

BY R. C. HARDMAN
Colorado Springs, Colorado

AN EIGHT-INCH pipe line under 115-lb. pressure was recently suspended from a through-truss steel bridge successfully while one end of the latter was raised 5 ft. The highway bridge, which was 105 ft. long, and contained six panels, was raised by the writer. The water line came up out of the ground at either end with two 90-deg. bends and was laid across the bridge under the floor of a sidewalk and on top of the cross-girders. It was out of the question to disconnect the line and raise it with the bridge, as it was the only supply of quite a large population. The line, therefore, had to be raised and connected again in as small a time as possible. It was cut in advance of raising the bridge, brought up to its new level, and a 5-ft. length put in the vertical rise. It was not feasible to support the pipe line except from the bridge, which would be a constantly rising support, because of a swift current and the presence of more or less drift ice. Therefore, at four panel points of the upper chord a railroad tie was lashed so as to cantilever over the pipe. From the end of each tie was hung a set of falls which was connected to the pipe. The leading part of the line was then made fast to the lower end of the intermediate bridge posts. As the bridge was slowly raised, one man slacking off falls was able to keep the pipe close enough to grade to prevent springing open any of the calked joints.

Falls were placed at four of the panel points. At the fifth panel point where the total rise was only 0.83 ft., a block was placed under the pipe and slipped along on the bottom of the box in which the pipe rested as the bridge rose to meet the pipe. As the pipe was under very heavy pressure, and in crossing the bridge was several feet higher than in the trench, precautions had to be taken to prevent longitudinal movement. This was done by means of struts between the vertical section of the pipe at each end and the sides of the excavation. Even then the end pressure, about 5750 lb., forced one pipe far enough from its hub to cause a bad leak. The results on a whole were fairly satisfactory, considering that an 8-in. pipe under 115-lb. pressure suspended in the air for a distance of 110 ft. is a ticklish thing to handle.

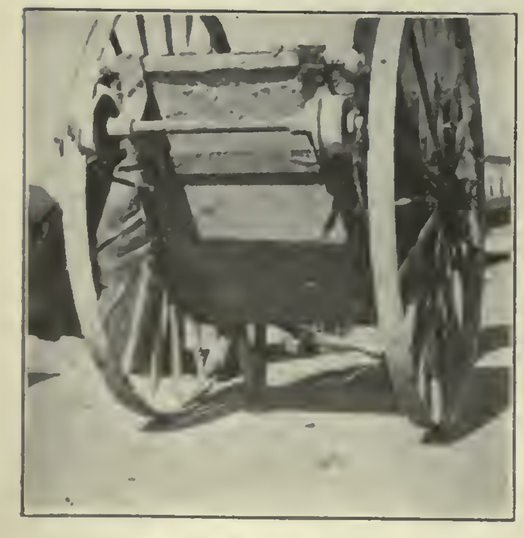
Traveling Elevator Dumps Buggies Into Form Above Runway

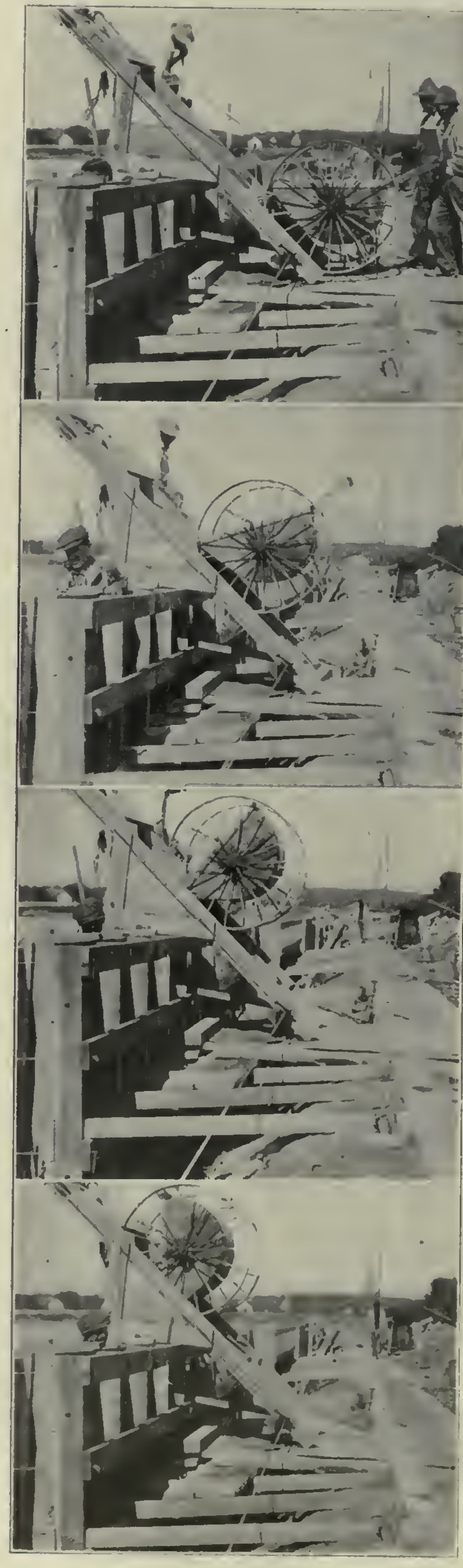
By Homer V. Knouse
Construction Engineer, Metropolitan Water District of Omaha

THE accompanying photographs illustrate a handy substitute for shoveling when the forms are a little higher than the runway used by the concrete wheelers. In building basin No. 6 at the Florence Station of the Metropolitan Water District of the city of Omaha it was found desirable to use for pouring the 9-ft. vertical wall section the same buggies that had been used in pouring the slopes of the basin. The top of this wall was 3 ft. above the top of the basin embankment, and without the elevator used it would have been necessary to dump the buggies onto platforms and shovel the concrete into the forms, or to build runways around the entire basin at the height of the top of the forms.

A small removable truck with two flanged wheels was attached to the front end of the buggy, and an eye-bolt placed slightly above and back of the axle through each side of the body. This auxiliary truck tracked on a pair of rails on the inclined runway of narrower gage than the channel track for the large wheels. These inner rails had a "drop-over" at the upper end for stopping and holding the nose of the buggy at the point where dumping should begin. Twin hooks attached to the hoisting cable were slipped into the eye-bolts in the side of the buggy, and by a suitable arrangement of sheaves the cable was led to a small single-drum steam hoist. Six buggies were equipped with the necessary studs and eye-bolts, and the auxiliary truck attached to each turn as it was brought to the form. After dumping, the clutch on the hoist was released and the buggy returned to the bottom of the runway by its own weight. The attaching and removal of the hooks and truck required but a few seconds' time after the men had systematized their movements, and it was possible to dump from fifty to seventy loads per hour under these conditions. Considerably greater speed could have been obtained by providing each buggy with a truck, to be left in place while on this work. Owing to the steep slope of the bottom of the body when in the top position the load was very quickly dumped, and no scraping or hammering was necessary to get a clean discharge.

The satisfactory operation of this device has made it evident that by using longer rails and increasing the angle of inclination it may be used in pouring walls of considerably greater height. Its portability permits frequent moving to suit the progress of the pour, and on long walls it might advantageously take the place of a tower and chute installation. The device was designed by the writer and built in the shops of the water district.


EXTRA WHEELS ON BUGGY


HOW THE INCLINE WORKS

Can of Boiling Water in a Barrel Thaws Dynamite

BY PACKING the sticks around a 10-gal. oil can filled with boiling water and placed in an old barrel, and filling the barrel full of empty sacks to retain the heat, 50 lb. of dynamite may be safely thawed at a time. The barrel used should have one or two ½-in. auger holes in the bottom, which should be covered with two or three inches of straw, hay, sawdust or anything that will allow water to filter through easily. This precaution is necessary to let any water that might be spilled drain out. In filling the can with boiling water it is a good plan to leave an air space of about 2 in. at the top. If the weather is not very cold, it is best to wrap the can of hot water in a sack to prevent the dynamite from coming in direct contact with the heated metal. The cartridges should be placed loosely around the can, so as to leave plenty of space for the hot air to circulate about them. In rainy weather the barrel should, of course, be covered to keep the water out, and if a strong wind is blowing it should be placed in a sheltered place. In very cold weather it is best to sink the barrel in the ground. As it takes a temperature of 356 deg. Fahr. to explode pure nitroglycerine, there is no danger of accidents in using this arrangement. Tests have shown that the highest temperature in the barrel will not exceed 80 deg.

This method of thawing dynamite is described by J. H. Carse in the *DuPont Magazine*, and has been used by him for some time.

Cotton Rope in Groove Makes Sheet Piling Watertight

By N. G. Near
New York City

SMALL cotton ropes threaded into the grooves of the steel sheet piles were used recently with success to make three cofferdams watertight by A. J. Twiggs & Son, contractors, of Augusta, Ga. The piling, 16 ft. in length, was under a head of 12 ft. at the bottom, where it was driven into shale. It was necessary for all three of the cofferdams to be practically watertight. This, the contractors state, was accomplished by the cotton swelling under water and cutting off the flow. No trouble was experienced in pulling the piles. The rope was laid in the interlock at the time the piles were threaded.

A Three-Mile Tunnel in Asiatic Turkey, piercing the Amanus Mountains on the the border between Asia Minor and Syria, on the line of the Bagdad Railroad now under construction, has just been completed, states a recent consular report. The bore is known as the Baghtché tunnel; it is about 75 miles east of Adana and 60 miles northwest of Aleppo. The exact length of the tunnel is 16,028 ft. It has a summit in the middle 246 ft. higher than the lower portal.

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

General Wood Addresses Yale Engineering Society

Reserve Corps of Engineers' and Contractors' Men Would Be Useful Even Without Military Training

Pointing out the Boston defenses as an example, and calling attention to the great usefulness of engineer reserve corps, even without military training, and the value to the army of men with construction experience, Major General Leonard Wood addressed a stirring talk to the annual meeting of the Yale Engineering Association, held on the evening of Dec. 29 at the Yale Club in New York City. Following this address, N. C. Kingsbury, vice-president of the American Telephone & Telegraph Company, described with the aid of motion pictures the building of the transcontinental telephone line, and its relation to preparedness. The guests then talked over this line with other gatherings of Yale men in Chicago and San Francisco. The association, whose membership has increased 20 per cent to more than 600 since its first meeting in New Haven a short time ago, then proceeded with the annual election of officers, the president, Edwin M. Herr, and secretary, Richard T. Dana, being re-elected.

Report Made on Division Street Bridge Failure in Spokane

The Division Street bridge in Spokane, Wash., failed on Dec. 18, dropping a street car into the river, killing five passengers and injuring twelve. The failure has been investigated by a board of four engineers appointed by Morton Macartney, city engineer. The unanimous report, made after an examination of the lower chord eyebars in the end panels and of the wrecked structure lying partly in the water and partly on the bank, says in part:

"The failure was due to the simultaneous breaking of the bottom chord bars of the first panel of the north end of the east truss because of granulation. There was no excessive load on the bridge at the time it collapsed. We noticed breaks in the steelwork other than those above mentioned, caused by the falling of the bridge, and these show silky fractures, indicating first-class material, and we are of the opinion that, had the structure been examined by experts the day before its failure, they would have reported the same entirely safe for the duty it was fulfilling, and that there was no reason to expect defects of any character."

This report was signed by the four engineers: S. H. Hedges, president of the Puget Sound Bridge Company; Bertram D. Dean, consulting engineer, of Seattle; Frank M. Cortelyou, resident engineer of Columbia Interstate Bridge, and F. W. Crocker, engineer of the Pacific Bridge Company.

Hugh L. Cooper of New York City was the designer of the bridge, which was built in 1892 and fabricated by the Edgemoor Bridge Company. It was a through sub-divided Pratt truss bridge, 180 ft. long, of ten 18-ft. panels, with a 40-ft. roadway and two sidewalks. Mr. Cooper, who happened to be in Spokane at the time of the catastrophe, stated to a representative of the Engineering Record that the failure was probably caused by the fact that the broken 5 x 1½-in. eyebars had been injured in 1894, when struck by the flood wreckage from a collapsed Howe-truss railroad bridge, and had been removed, heated and straightened without subsequent annealing. He says the bars showed every evidence of sudden failure without elongation, which would explain the crystalline appearance. The unit stress in the bars at the time of failure was probably only about 7800 lb. per square inch.

Mr. Cooper understands that the authorities at Spokane consider the above as a preliminary report and that a full technical and scientific investigation is to be made in order to determine the exact cause of the failure.

Center Headings Meet at Rogers Pass Tunnel

With no noticeable variation in grade and line the center headings of the Canadian Pacific Railway tunnel under Rogers Pass at Glacier, British Columbia, met Dec. 19. Two women, the wives of J. G. Sullivan, chief engineer of the Canadian Pacific, and A. C. Dennis, general superintendent for the contractors, Foley Bros., Welch & Stewart, were with the railway officials in the heading when the final blast was fired, and were the first to step through the newly-opened passage.

Three and one half miles of the center heading have been completed during the past year, progress on this tunnel having broken all American records. A summary of recent rapid driving done at this tunnel will be found on page 209 of the Engineering Record for Aug. 14, 1915, and a description of the work and methods used was published on page 604 of the Dec. 5, 1914, issue of this journal.

Part of Memphis Bridge Falsework Carried Out

About midnight on Thursday, Dec. 23, a flood stage of 30 ft. in the Mississippi River carried out the falsework between piers 3 and 4 of the new Harahan cantilever bridge at Memphis, Tenn., taking with it some of the lower chord members and floor stringers. Fortunately, the adjacent 621-ft. fixed span was completed and swung two days previously, and from last reports the falsework for this span, upon which it still rests at some points, was still intact.

Urge Licensing of Engineers in Pennsylvania

The state engineer's commission is expected to make a report to Gov. Martin G. Brumbaugh within a few days on the question of licensing engineers engaged in the construction or operation of public or private hazardous works. F. Herbert Snow, chief engineer of the State Public Service, heads the commission, the other members being: Dr. John Price Jackson, head of the State Department of Labor & Industry; George S. Webster, director of the Department of Wharves, Docks & Ferries, Philadelphia; Samuel A. Taylor, consulting engineer of Pittsburgh, and J. Murray Africa, city engineer of Huntingdon. It is thought that the licensing of engineers will be urged in the report.

Concrete Institute to Hold Convention Feb. 14-17

In order that the members present may have an opportunity to attend the Cement Show, the annual convention of the American Concrete Institute, at Chicago, will be held Feb. 14-17. The sessions will be held in the morning and evening, and it is expected that joint sessions with other organizations will be arranged for some of the afternoons. The annual banquet will be held on the evening of Feb. 16.

New Refuse Disposal Contracts for New York City

Commissioner John T. Fetherston Prepares Alternative Forms of Proposal—Law Limits Term to Five Years

With existing contracts for the disposal of garbage, ashes and rubbish due to expire Jan. 1, 1917, the city of New York, through John T. Fetherston, commissioner of the Department of Street Cleaning, has prepared new alternative forms of proposal on which bids will be received until Jan. 18. One of the proposed forms of contract specifies a private plant on private land, while the other provides for a site on city land, the installation to be purchased by the city at the end of five years.

New York City is restricted to contracts for a 5-year term for the final disposition of various classes of refuse. Although the existing disposal contracts expire next year, the city has the privilege of renewing them for a further period of two years. For the purpose of determining the advisability of such renewal the new contracts are being advertised.

Contract form 1 provides for the disposal of garbage at private plants located on private lands for a period of 5 years. The feature of this contract requires the contractor to pay the city an amount per annum for the privilege of disposing of the garbage. The total amount of garbage delivered in 1914 was 412,200 cartloads of 2 cu. yd. capacity, and weighing approximately 2330 pounds per cartload. Plans and specifications showing the general outline of plant and methods of treatment proposed for use by the contractor are to accompany the bid. Stringent provisions cover design of plant and equipment so as to obviate nuisance due to the escape of odorous gases or other obnoxious wastes.

City Will Purchase Plant

Contract form 2 differs from the preceding contract in that the plant will be erected on a site provided by the city. The contract term is limited by law to a period of 5 years, and the city agrees to purchase the plant on the termination of the contract at a price to be fixed in the bid or estimate by the contractor. The contract likewise requires the bidders to submit general plans and a guaranteed maximum estimated cost for the construction of the plant and appurtenances. The methods proposed to be used and the design of apparatus are subject to approval by the commissioner of street cleaning, and definite guarantees covering nuisances and odors are required, as in contract form 1.

Under the conditions noted in form 1 the contractor would naturally amortize his plant during the 5-year term of contract, while in form 2 the contractor finances the undertaking and is required to make any profits out of the operation of the plant during the term of the contract, as the plant is to be built at actual cost under the supervision of the city.

On account of the difficulty of securing city funds for the construction of a municipal plant at the present time, the authorities decided to attempt to interest private capital in financing the undertaking under form 2. As there is but a slight risk in the investment on account of the city's agreement to purchase the plant it would seem as if this would be the more attractive proposal to contractors.

Last year Commissioner Fetherston attempted to secure legislation which would enable the city to make a 15-year profit-sharing contract for the disposal of all classes of wastes, and the bill passed both houses of the State Legislature, but was vetoed by the Governor. Thus the city has available only two means of disposing of its waste: First, by contract for a period not to exceed 5 years; and, second, by municipal construction and operation of the disposal works.

Indiana Commission Fixes Value of Terre Haute Waterworks

A rate of return not to exceed 6½ per cent on a seemingly rather liberal valuation is allowed the Terre Haute Waterworks Company in a decision just handed down by the Public Service Commission of Indiana. The Commercial Club of that city had sought to have the water rates reduced, and the petition was granted in part by a reduction in the metered-service rate of from 30 to 20 cents per 1000 gal. for the first 20,000 gal. consumed in any one month. On an estimated valuation of $1,200,000 the commission finds that the company should be allowed to earn operating expenses of $60,000 annually, taxes of $22,000, depreciation of $10,000 and a profit of $78,000. The commission holds that, because much of the value of the plant has been built up in past years from surplus earnings, the rate of return now allowed should not exceed 6½ per cent.

In making up the valuation of $1,200,000 the commission fixed the reasonable cost of reproduction new of the distribution system at about $640,000, and the present value at $590,000. A greater allowance for labor than that figured by the commission's engineers was granted, owing to the treacherous soil conditions in Terre Haute, and the tendency of trenches to cave in. On the other hand, although the commission's staff allowed $106,910 for paving over mains, the commission cut this down to $8,000, which covers only paving actually done by the company.

For the pumping station and equipment, which the commission called antiquated, there is allowed a present value of $145,000, based on a reproduction cost of $200,000. Other buildings, fixtures and grounds were depreciated from a reproduction cost new of $120,000 to a present value of $100,000. The allowance of the commission's staff of $18,400 for land the commission increased to $25,000, this including $1,000 for a certain easement.

Going value was placed at $80,000, as compared with $239,948 claimed by the company. For working capital $22,500 was allowed. Thirteen per cent of the total valuation was allowed for contingencies.

Not much was said as to the basis for the seemingly small allowance of $10,000 annually for depreciation. The Engineering Record has no information as to the original cost of the property. The total reproduction cost new, exclusive of going value, was fixed at $1,259,845, which was depreciated about 12 per cent, to $1,106,335. After the going value of $80,000 was added the sum was rounded out to an even $1,200,000.

Want Government Nitrate Plant

The establishment of a government nitrate plant to make nitric acid as a defense precaution was recommended by the Naval Advisory Board in a report sent to Secretary Daniels, Dec. 22. Brig.-Gen. William M. Crozier, chief of ordnance of the U. S. Army, also recommends the establishment of such a plant in his annual report.

The plan is that the government shall make use of some water power in the interior, in a spot inaccessible to an invading enemy, and make the acid by extracting nitrogen from the air by electrical processes.

U. S. Chamber of Commerce to Hold Annual Meeting

The fourth annual meeting of the Chamber of Commerce of the United States will be held at the New Willard Hotel, Washington, D. C., Feb. 8-10.

Members of Chicago Traction Commission Selected

The subcommittee, of which Henry B. Capitain is the chairman, has begun the work of selecting the three members of the Chicago Traction Commission who can be recommended to the local transportation committee and later be confirmed by the Chicago City Council. Bion J. Arnold has tentatively been selected as the Chicago member of this commission, and William Barclay Parsons of New York has been tentatively selected as the second member. The committee is considering a third member, whose qualifications will make him especially fitted to round out a commission made up of the two members who have been tentatively decided upon. The subcommittee is making a strenuous effort to decide on the three members, so that it can report to the local transportation committee and obtain the approval of the Chicago City Council. This would permit actual investigation of Chicago transportation problems to begin early this month.

Changes Contemplated in Indianapolis Building Code

R. F. Dagget and Herbert Foltz, appointed by the Architects' Association of Indianapolis, are working in co-operation with Jacob H. Hilkens, city building inspector, in drafting possible changes in the city's building code. Similar committees are to be appointed from the builders and the material supply men. Mr. Hilkens is advocating the restriction of stairways in public buildings to non-combustible materials. Wooden floors in motion picture houses also may be forbidden.

Montana Expects Repetition of Success in Forestry Short Course

The University of Montana, Missoula, has had unusual success with its short course for forest rangers, and has now announced the course for the year 1916, which will begin Jan. 4 and close April 8. The course includes surveying and mapping, scaling and cruising, fire protection, forest improvement, forest administration, lumbering, botany and silviculture, and grazing and seminar. Various electives are also available. The course will be given by the regular faculty of the Forest School, aided by special lecturers. The principal courses will be under the direction of Dorr Skeels, dean of the Forest School, James H. Bonner, professor of forest engineering, W. M. Drake, professor of forestry, and T. C. Spaulding, professor of forest utilization.

It is expected that the coming session will be the most popular in the seven years' history of the short course. Last year students were attracted from every state west of the Mississippi that contained a national forest. This year it is expected, on account of the unavailability of the German forestry schools, there will be students from other countries. Already word has been received that the forester of New South Wales will attend and at least two men are expected from Canada. In the regular four year course there are students representing half the states of the Union.

Pan-American Scientific Congress Opens in Washington

The Pan-American Scientific Congress opened in Washington Dec. 27, with several hundred engineers, scientists, educators, lawyers, bankers, physicians and railroad men from the United States and the Latin-American countries in attendance. The formal opening took place in Memorial Continental Hall, the national headquarters of the Daughters of the American Revolution.

Short Highway Course at Michigan

The University of Michigan will hold a short course in highway engineering, Feb. 21-25.

Material Men Cannot Recover on Contractor's Bond in New Jersey

The Standard Gas Power Corporation of New York has lost its suit to recover from a $20,000 performance-of-contract bond, written by the Maryland Casualty Company in favor of the Passaic Valley Sewer Commission for the Healy Contracting Company, the sum of $3,862.25. The amount was for materials furnished the contracting company shortly before it became bankrupt in attempting to execute a contract for a section of the Passaic sewer under the streets of Newark. The Casualty Company was defendant in the action. The case was tried without a jury by Judge William H. Speer of the Supreme Court of New Jersey. The Court said in part: "It must be manifest that in each case the question is, what is the intention of the parties to the contract? The courts of several of the states, whose decisions are cited in the brief of the plaintiff's counsel, have laid hold of the absence of mechanics' liens or other protection furnished to a material man or laborer in those jurisdictions, and of language of a more or less general and ambiguous character as facts tending to demonstrate that the parties, in entering into the contract, must have entertained the intention of extending the benefits of this contract to third parties, so as to enable them to sue thereon.

"In this case there exist no such facts nor evidence of any such intention, but, on the contrary, it seems perfectly clear that this was a mere contract of indemnity running solely to the Passaic Valley Sewer Commissioners and was not intended to create any obligation in favor of laborers and material men, and I so hold."

$2,000 Spent by New Society Saves $3,000 to Profession

More than 100 engineers put in touch with positions, at no cost to the engineer or employer, thereby saving them about $3,000, all at a total cost of less than $2,000, is the gist of the report of the activities of the service clearing house of the American Association of Engineers, presented by the secretary at the first annual convention held in Chicago, Dec. 10 and 11. The $2,000 represents all the moneys spent since this organization, devoted to the welfare of the engineer, started its existence 7 months ago. The work of the clearing house has practically all been done since Sept. 15.

In one-half of the applications filed, reported the secretary, there is a steady decrease in the average pay of the engineer from $150 in 1910 to $110 now, a fact that he felt ought to be given serious consideration. While dishonest and incompetent employment agencies are not nearly as prevalent as commonly believed, still instances were given of exorbitant fees charged for positions held only a few days.

The organization has now about 300 members and received 40 additional applications at the Saturday afternoon meeting, which was attended by 400 engineers, 200 of whom were visitors.

In an address by J. H. Prior, chief engineer of the Illinois Public Utilities Commission, on "The Economic Aspects of Engineering Pay," he demonstrated by diagrams that the pay of the lowest "marginal" man in an organization had a direct effect on that of the highest paid. He also pictured the law of supply and demand, showing that the same result was obtained in case free bargaining was indulged in and full knowledge of conditions was known by both the engineer and his prospective employer.

Prof. F. H. Newell outlined the problems of the engineer from the welfare standpoint. He emphasized the idea that this organization is in no wise antagonizing any other good movement, but will stimulate and help the existing organizations far more than it will draw from their membership. He spoke at length on the duty of the society to the engineer and suggested that younger men be chosen more often as officers.

Capt. Horace B. Wild, aviator, gave an illustrated address on the advances in aviation with special reference to the recent improvements made in Europe. He predicted New York to San Francisco passenger service similar to that maintained in Germany before the war started and showed a cross-section of an airship by which it could be attained.

Bond of Irrigation Company Forfeited for Not Completing Works

The $25,000 bond of the Rio Mimbres Irrigation Company of Luna County, New Mexico, was forfeited to the state, during the week ending Dec. 18, the federal court holding that the company had failed to build any of the projected dams or reservoirs on lands purchased from the state, and had also lost its rights under the contracts entered into with the state. The decision was made after hearing the suit of the company against R. P. Ervien, state land commissioner.

The court ordered an examination of the land by State Engineer French to determine just what portion of it should be left under control of the company, the court holding that the company had the right to dispose of such lands to investors as it was prepared to furnish with water.

The examinations ordered, which will cover the wells put down by the company, are now in progress and the final decree will be entered this month. The company claims to be able to irrigate from 5000 to 7000 acres with water pumped from 28 wells. Several other wells have been put down and are classed as probable producers of water for irrigation.

According to a statement made on the witness stand by L. G. Fisher, Jr., of Chicago, vice-president of the company, the concern has spent approximately $325,000 in its efforts to develop an extensive water supply in Luna County. The suit was brought by the company following the refusal of Commissioner Ervien to issue a deed to a 40-acre tract of land upon its application. In the trial of the case the company admitted that it had failed to build dams and reservoirs, but sought to explain this on the ground that it was impossible to develop water for irrigation by such means.

White River Levee Improvement Almost Completed

Work on the White River levee improvement, which is expected to prevent a recurrence of such flood disasters as were sustained by Indianapolis in 1913, will probably be completed within the next three months. The cost will total in the neighborhood of $1,200,000. The city administration is at present planning methods of making the final payments.

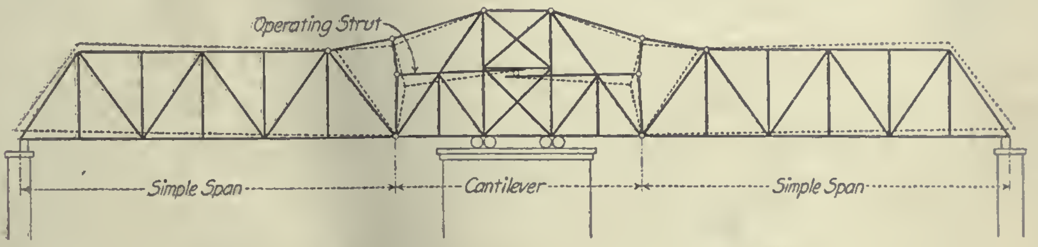
Wire-Drag Has Revolutionized Hydrographic Surveying

The use of the wire-drag has revolutionized hydrographic surveying, according to the annual report of the superintendent of the U. S. Coast and Geodetic Survey. Soundings with leadline have not proved by any means infallible, and submerged rocks and ledges were often missed with consequent damages to shipping. With the development of the wire-drag hydrography, these submerged dangers have been discovered and chartered. During the past year four wire-drag parties were in the field, and the results proved the wisdom of doing the work on the larger scale.

Strauss Cantilever Swing Bridge Lays Claim to Economy

During the past fifteen or twenty years improvement in movable bridges has been confined largely to the very great advances in bascule design. More recently the vertical lift type has also undergone extensive development. The swing bridge or horizontal draw type, however, has received comparatively little attention. J. B. Strauss, consulting engineer, Chicago, whose last contributions to bridge engineering was the counterbalanced lever lift bridge, has now developed a swing bridge which lays claim to much originality.

This design, known as the Strauss cantilever swing bridge, departs radically from all existing types, while at the same time having no elements which are unknown and untried. Its characteristic features are: First, the use of direct driven trucks running upon ordinary railroad rails to effect rotation; and second, the construction of the central portion of the draw span as a cantilever projecting beyond the center pier with the arms pin-connected at their ends to as to constitute simple spans from the ends of the cantilever to the abutments.



NEW DRAW SPAN OF CANTILEVER TYPE LIFTS BY TOGGLE METHOD

END LIFTING AND TURNING MECHANISM

The top chord of each arm is connected to the top chord of the central draw portion by a two-panel link, which is in turn connected to a pivoted vertical. The pivot point of that vertical connects with an operating strut and a driving motor on the central draw portion, so that when the strut is drawn backward, the four linked elements on each side of the center act as a double toggle, raising the end of each arm off its bearings on the abutment until the span is free to turn.

The turning mechanism comprises a series of trucks, mounted under the central draw at four points, the intersections of the four verticals of the central span with the chords. Each truck is swiveled about a vertical axis through the truss post and travels on rails on the pier. For large bridges the number of wheels on each truck is eight, traveling on four concentric rails. For very large bridges, the number of wheels per truck may be increased still further without altering the principle of equal distribution of load upon each wheel. For smaller bridges, four- and two-wheel trucks are sufficient.

LIVE LOAD WEDGES

Associated with each truck is a wedge located directly under its center and which, when the bridge is in its closed position, engages with a wedge seat on the pier. This wedge is automatically operated by the raising of the arms already referred to. When these arms are lowered into position, the wedges are driven home and the live load of the bridge is then taken off the trucks and directly transmitted to the piers. When the arms are lifted, as already described, the wedges are automatically withdrawn and the bridge is then free to move with the trucks.

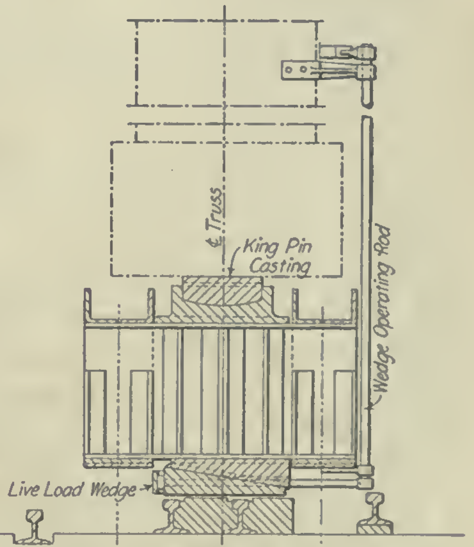
The operating machinery proper comprises driving mechanism on the trucks, or on the connecting bracing, and imparting motion to the wheels directly by means of the customary gear train driven by a street-car type of motor or other prime mover. Braking is effected either through the gearing or directly on the rails.

ECONOMY AND ADVANTAGES CLAIMED

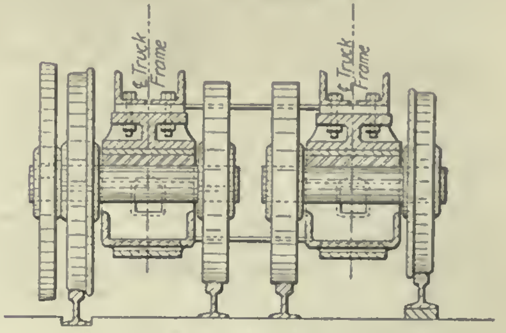
The economy of the design as compared with other swing bridges is claimed to be pronounced. The trucks replace the drum, roller and tread of one type of swing or the corresponding center bearing and trailer wheels of the other, effecting a very material saving both in steel and cost of fabrication, the direct drive replaces the costly circular rack used in all types, while the cantilever and simple span construction of the trusses in place of the continuous girders, reduces the weight per foot as well as the total loads. Furthermore, the elimination of the spider and end lifts, the lesser weight to move and the greater simplicity of the bridge as a whole make the cost of its operation and maintenance less than that of other types of corresponding size and capacity.

In addition to its economy in first cost and upkeep, the design possesses other important advantages as follows: The elimination of the drum reduces the required distance from floor to top of center pier and makes it possible to place the floor close to the water line. For the same reason the difficult problem of equal distribution of the load upon the track is thus solved. The lifting of the arms from the central draw portion does away with both the rail and end lifts and accomplishes with one device what is now done by two. The double-toggle system used also overcomes the objections to other devices which have from time to time been proposed for this purpose. The independence of the two arms from the central draw portion does away with the indeterminacy and uncertainty of stress and converts the bridge into a definite, positive structure throughout. There is, further, no uplift at the ends and the reactions are exactly computable.

The design is patented by J. B. Strauss, president of the Strauss Bascule Bridge Company, consulting engineers, Chicago.



DETAIL OF WEDGE AND KING PIN



SECTION OF TRUCK THROUGH AXLES

SECTIONS OF 8-WHEEL TRUCK

Falsework in Chattanooga Bridge Washed Out

On Monday morning, Dec. 19, the falsework for span 3 of the Market Street bridge in Chattanooga, Tenn., now under construction over the Tennessee River, was washed out by the 28-ft. stage flood just the day before concreting was to begin. The reinforcing steel was in place, so that unless there is some salvage from the timber and steel now in the river the loss will be about $40,000, according to early reports, or at least $20,000 as stated later.

This span is the third reinforced-concrete arch from the Chattanooga shore on the south, and is 180 ft. long. The falsework under span 2 is still in place, but the concrete has been poured and it is not expected that any further damage will be done to this part of the bridge. The cofferdam for pier 4, which is to carry one end of the bascule span, was also washed out, and much of the plant is reported lost. This is the third time the cofferdam has been washed out by floods. The construction work is being done by the Vang Construction Company of Cumberland, Md., and the bridge is being built for Hamilton County under the direction of the Tennessee River Bridge Commission.

Illinois Central Presents Locomotive to University of Illinois

The Illinois Central Railroad has presented a 150-ton freight locomotive to the University of Illinois. It will be used for experimental purposes in the Department of Locomotive Engineerings.

News of Engineering Societies

The Association of Engineering Societies of St. Louis officially disbanded Dec. 31, 1915.

The New England Waterworks Association will hold its annual meeting at the Hotel Brunswick, Boston, Jan. 12.

The Michigan Chicago-Detroit Highway Association has been organized at Battle Creek to promote the movement to build a permanent paved road across the State to link Detroit with Chicago.

The Illinois Association of County Superintendents of Highways will hold its annual convention at Urbana, Jan. 10-12, during the time of the short course in highway engineering at the University of Illinois.

The American Society of Civil Engineers will hold a meeting at the Society House, New York City, Jan. 5. William P. Creager will present a paper on "The Economical Top Width of Non-Overflow Dams."

The Cornell Society of Civil Engineers will hold its annual banquet at the Hotel Breslin, New York City, Jan. 21. Clyde Potts, consulting engineer, 30 Church Street, New York City, is chairman of the committee.

The Engineers' Society of Western Pennsylvania will hold its annual meeting in Pittsburgh, Jan. 18. The subject of the presidential address by A. Stucki will be "Some Details Often Neglected by Engineers."

The Manitoba Branch of the Canadian Society of Civil Engineers will hold a meeting at Winnipeg, Jan. 6. W. G. Chace and D. L. McLean will present a paper on "Studies for, and Experiments with, Mixtures for Winnipeg Concrete Aqueduct."

The Illinois Section of the American Waterworks Association will meet at Urbana, Ill., in joint session with the Illinois Society of Engineers and Surveyors Jan. 26 and 27. The former organization will meet by itself on Jan. 25 and the latter on Jan. 28. Paul Hansen, Urbana, Ill., will have charge of exhibits.

The San Francisco Association of Members of the American Society of Civil Engineers held its annual meeting in that city on Dec. 17. The following officers were elected for the ensuing year: President, H. L. Haehl; vice-president, Jerome Newman. Mr. Haehl presented a paper on "Water-Right Litigation in the Santa Clara Valley."

The Philadelphia Association of Members of the American Society of Civil Engineers will hear George Gibbs, consulting electrical engineer of the Pennsylvania Railroad, speak on "The Electrification of the Pennsylvania Railroad from Philadelphia to Paoli" at a meeting to be held at the Engineers' Club in that city Jan. 3.

The Engineers' Club of St. Louis, which constituted about 72 per cent. of the membership of the recently disbanded Association of Engineering Societies, will begin the publication of a bi-monthly journal to be known as the "Journal of the Engineers' Club of St. Louis." Its board of editors will include civil, mechanical and electrical engineers.

The Engineers Division of the Chicago Association of Commerce has re-elected Edmund T. Perkins, consulting engineer, as its chairman for 1916. Harold Almert was made vice-chairman. R. M. Shankland, Arthur Maldaner and Robert I. Randolph were elected as additional members of the division to represent it in the ways and means committee of the association.

The Engineers' Society of Pennsylvania elected the following officers for the ensuing year, at the December meeting, held in Harrisburg: President, R. Boone Abbot, division engineer, Philadelphia & Reading Railway; first vice-president, W. W. Davis, district superintendent, Semet-Solvay Company; second vice-president, Morris Knowles, consulting engineer; directors, Frank A. Robbins, Jr., D. E. Tracy and Elton D. Walker; treasurer, John O'Connell; secretary, Edward R. Dasher.

The Engineers and Architects Association of Southern California made a trip by special Pacific Electric train from Los Angeles on Dec. 18 to visit points of engineering interest at Long Beach. The recently completed sewage screening and sludge-burning plant at that city was inspected, after which the party was shown the submarines under consideration at the Craig Ship Building Works, and then a launch took the party, numbering about 60, for an inspection of the harbor works.

Personal Notes

G. B. SHIPLEY, consulting engineer, of Pittsburgh, has been retained to design a creosoting plant for the Boston Elevated Railroad to be used for treating ties and other material for that company.

O. W. CONNET, for the past ten years division engineer for the Baltimore Sewerage Commission, has completed the work under his charge and has left the city's service. Previous to becoming connected with the sewerage commission, Mr. Connet had been employed on the engineering forces of Baltimore for about ten years.

F. J. MARAN, assistant engineer for the Great Northern Railway, has been transferred for the winter from the field forces in North Dakota to the general offices at St. Paul.

FRANK MCLAUGHLIN, formerly superintendent for James Stewart & Company, Inc., Contractors, of New York City, on the construction of the new plant for the Remington Arms & Ammunition Company at Bridgeport, Conn., is now engaged in a similar capacity on the construction of the new buildings for the Remington company at Ilion, N. Y.

E. B. NEWELL has left the service of the U. S. Engineer's Office, with which he has been connected 4½ years, on survey work and construction at Louisville, Ky., and is now located at Santa Barbara, Cal.

GUSTAV J. REQUARDT, acting division engineer of the sewage disposal plant for the Baltimore Sewerage Commission, has resigned from the city's service, upon the completion of that commission's work, and will probably engage in private practice as civil and sanitary engineer. He was six years with the sewerage commission on design and construction.

RALPH D. WICHMANN is preparing plans and specifications for a new sub-station and an extension to the steam plant for the Mount Whitney Power & Electric Company at Visalia, Cal. Later he will probably have charge of the construction of the work.

CHAUNCEY A. BURNETTE and S. H. HEDGES have been retained by Morton Macartney, city engineer, of Spokane, Wash., to advise with him on the repairs to the Division Street bridge, the collapse of which is noted elsewhere in this issue. Mr. Burnette is consulting engineer and local representative of the Illinois Steel Bridge Company at Spokane and Mr. Hedges is president of the Puget Sound Bridge & Dredging Company of Seattle.

LELAND B. RAAB has been appointed city engineer of Tracy, Cal., succeeding J. H. Smith.

F. E. KURZENKNABE, formerly connected with the Louisville & Nashville Railroad as designer of reinforced-concrete structures and resident engineer in charge of the new terminal at Lexington, Ky., has become engineer and manager of the Congleton Construction Company of Lexington. Mr. Kurzenknabe was in the service of the Louisville & Nashville for about four years, one as designer of reinforced-concrete structures, and three as resident engineer of the Lexington work. In the latter capacity he had charge of the construction of two large reinforced-concrete viaducts and a 400-ft. concrete conduit to carry the waters of a creek, the grading for a large railroad yard and the building of a roundhouse, freight house and other terminal structures, as well as sewers, water mains and drainage lines. The Congleton Company will handle all kinds of concrete construction, and furnish designs and engineering service where required.

C. N. BECKNER, formerly assistant signal engineer of the Louisville & Nashville Railroad at Louisville, Ky., has been appointed superintendent of construction in western territory for the Federal Signal Company. His headquarters are at Chicago.

EDWIN H. MARKS has been promoted to the rank of captain in the Corps of Engineers, U. S. A.

G. E. NORRIS, formerly superintendent of the Maryland & Pennsylvania Railroad, has been appointed chief engineer of the Virginian Railway with headquarters at Norfolk.

CHARLES O. LENZ, engineer, of New York City, has moved his office to the Equitable Building, 120 Broadway.

GEORGE F. MAITLAND, formerly division engineer for the Union Pacific Railroad at Cheyenne, Wyo., has been appointed division engineer of the Kansas division for the same company at Kansas City, Mo.

K. B. DUNCAN has been appointed valuation Engineer of the eastern lines of the Atchison, Topeka & Santa Fé Railway.

W. B. GOENTNER, formerly assistant engineer for the Department of Water Supply, Gas & Electricity, New York City, has been appointed superintendent of the factory of the McCabe Chemical Company at Charlotte, N. C.

THOMAS H. MATHER has resigned from the office of commissioner of public works of the city of Syracuse, N. Y.

F. A. BONZ, formerly assistant engineer for the Buffalo, Rochester & Pittsburgh Railway, has been appointed division engineer for the same road at Rochester.

G. J. ADAMSON, formerly special engineer of construction for the Union Pacific Railroad at Omaha, Neb., has been appointed division engineer of the Wyoming division with office at Cheyenne.

HENRY WELLES DURHAM, consulting engineer, of New York City, has been appointed county engineer of Bergen County, N. J. The duties of his new position will not take all of his time, and he will continue his consulting practice.

O. S. BEYER, JR., formerly connected with the Rock Island Lines, has been appointed first assistant in the Engineering Experiment Station of the University of Illinois.

PAUL E. MERCIER, formerly deputy chief engineer of the public works department of Montreal, Canada, has been appointed chief engineer of public works of that city. He received his professional education at *L'Ecole Polytechnique* and has been engaged in active practice since 1899, principally on municipal and railway work.

W. EARL WELLER, formerly acting city engineer of Schenectady, has been appointed city engineer of Binghamton, N. Y. This appointment was announced in these columns last week, but Mr. Weller's name was given as Kellar.

G. S. V. WILLIAMS, public service commissioner of the First District, New York State, has resigned from that office, to be effective Jan. 31.

MAJOR ROBERT R. RAYMOND, in charge of the U. S. Army engineers' office in Los Angeles, is to be transferred to Honolulu, Hawaii, in February. Since his arrival in Los Angeles from Wilmington, Del., in January, 1914, Major Raymond has been in charge of the construction of fortifications at Fort MacArthur, guarding Los Angeles harbor, the estimated cost of which is approximately $4,000,000. Rapid progress has been made on this work, it is reported, and the first units of foundations for the batteries are ready for the guns that are to be delivered in the spring. Major Raymond has also taken an active part in Los Angeles harbor improvements, having recommended many important changes, including the widening and deepening of the channels.

E. R. LEWIS, assistant to the general manager of the Duluth, South Shore & Atlantic Railway, will, beginning to-day, have charge of all matters pertaining to engineering, maintenance of way and structures, and federal valuation. Mr. Lewis is a native of New Jersey, and was graduated from the State University of Iowa in 1890. His early experience was acquired with the Missouri Pacific and the Omaha Southern railways, and in private practice. From 1897 to 1901 and from 1902 to 1906 he was engaged in railroad work in South Africa. Returning to the United States in 1906 he became division engineer of the Michigan Central Railroad, where he remained until 1912, when he went to the Duluth, South Shore & Atlantic as assistant to the general manager.

Obituary Notes

THOMAS F. RICHARDSON, retired civil engineer, of Rutherford, N. J., who built the cogwheel railroad to the top of Pike's Peak, died Dec. 26, 1915, at Rutherford, N. J. He was 61 years of age Mr. Richardson first engaged in engineering work with the Boston Waterworks. After this service he went to the West, where he engaged in railway location and construction. He also worked in Mexico. Returning to the East, he was for many years with the Metropolitan Waterworks in Boston. His last engineering service was as chief civil engineer for J. G. White & Company, Inc., from which office he retired about a year ago.

COL. ALEXANDER W. SWANITZ, a civil engineer, who has been engaged on the construction of the Alaska Central Railroad for the United States government, died Dec. 22 at his home in Alameda, Cal., at the age of 64.

CHARLES H. SHARP, vice-president of the Sharp & Fellows Contracting Company, Los Angeles, Cal., died in that city, Dec. 22, 1915, at the age of fifty-six. Mr. Sharp was engaged in the construction of railroads in practically every section of the United States, and in parts of Canada, for the last forty years. He went to the West in early manhood from Washington, D. C., and located in Kansas City. In a few years he had established himself there as a railroad contractor. Work on the Pacific Coast took him to Los Angeles six years ago, where, with C. A. Fellows, he organized the Sharp & Fellows Contracting Company. Among the large contracts executed in the Southwest by the firm were the Cajon Cut-off, across the mountains east of San Bernardino, for the Atchison, Topeka & Santa Fé Railway, and the line of the San Diego & Arizona Railroad through the mountains east of San Diego, these being two of the heaviest pieces of recent railway construction work in that section.

Civil Service Examinations

United States.—The Civil Service Commission announces an open competitive examination for civil engineers in the Philippine Service, to be held Jan. 18. The salary ranges from $1,800 to $3,000 a year. The requirements include, among other things, 3 years' training or a technical education of recognized reputation, and 2 years of responsible work in the design or construction of irrigation or water supply systems or in that of steel or concrete buildings or bridges. Applicants must be 25 years of age and not over 40 years. They must also be physically qualified to perform such duties as are required. Application should be made for form B. I. A. 2, stating the title of the examination for which it is desired. These forms may be secured from Washington, D. C., or from the civil service boards of the large cities and of the territories.

Another open competition examination announced by the Civil Service Commission is to be held Jan. 19 for sanitary engineers for the Bureau of Science, Manila, P. I., at salaries of $1,600 a year. This examination will require that applicants shall have had a college or university education in sanitary engineering or at least 4 years' experience in such work; also that applicants must be between 21 and 40 years of age and physically qualified for the work. The form for this examination is B. I. A. 2, and is secured in the same manner as that for civil engineers noted above.

Structural engineer and draftsman is the title of an examination to be held Jan. 19-20, under the supervision of the Civil Service Commission for eligibles for a position with the Supervising Architect, Treasury Department. The salary of this position is $1,800 a year. Applicants should be technically qualified as to training and should have 5 years' practical experience, two of which shall have been in either steel designing or construction work. The age minimum for taking the examination is 23 years. The duties are said to involve engineering problems of first-class building construction. The form number for this examination is 1312, and in applying it should not be forgotten to specify the title.

New York.—An examination for architectural draftsman, salary from $1,201 to $1,500 a year, is to be held Jan. 22. Candidates must have had 2 years' practical experience in architectural drafting, or, in the case of graduating from a school of satisfactory standard, one year's experience subsequent to graduation. The application blank must be in the office of the Civil Service Commission at Albany on or before Jan. 12, otherwise it will not be accepted.

November Exports Reach Large Proportions

A total trade of a half billion dollars in the month, and of five billion dollars in the year, with exports comprising two-thirds of the whole, is the unparalleled record of American commerce in November and the twelve months ending with November. Figures made public by the Bureau of Foreign and Domestic Commerce, Department of Commerce, show that November imports were valued at $164,319,169, as against $126,467,062 in November, 1914, and that they exceeded by $11,000,000 the former November record made in 1912. Twelve months' imports to Nov. 30, 1915, aggregated $1,730,243,229, as compared with $1,858,645,027 in the preceding year.

November exports broke all prior records. Last months' total was $331,144,527, as against $328,030,281 in October, 1915, also a record. The export balance for November was $166,825,358, as compared with $79,411,271 for November, 1914, and, for the twelve months ending with November last, $1,707,049,304, as against $242,542,093 one year ago and $738,472,118 two years ago.

Gold imports during November, 1915, amounted to $60,981,540, as against $7,391,729 in November, 1914. Twelve months' imports of gold aggregated $410,650,976 as compared with $58,352,035 in the preceding year. November exports of gold were valued at $3,661,153 as against $14,526,482 in November, 1914; while for twelve months ending with November the total was $19,667,557 as compared with $233,057,825 in the preceding year. Instead of a net outward gold movement of $174,705,790 as in the twelve months ending with November, 1914, the year just ended shows a net inward gold movement of $390,983,419.

Turbine Runs Almost Three Years Without Stop

After carrying a load continuously for two years and eight months, without the steam being turned off at the throttle, a 500-kw. Westinghouse Parsons turbine in the plant of the Quincy Market Cold Storage & Warehouse Company at Boston, was shut down for an inspection. Examination showed that the machine was in perfect running condition, and it was immediately started up and put into service again.

Powdered Zinc Used for Coating Structural Steel

Powdered zinc, compressed air and heat are the three elements which are used in the "Cyclone" zinc spraying apparatus for coating any exposed surface and in particular structural steel or other metals. The apparatus which has just been placed on the market, consists of a brass shell-shaped container which holds from 25 to 30 lb. of powdered zinc, and to which are attached two tubes, through one of which compressed air enters the machine, the other which serves as a carrier of the powdered zinc to the spraying nozzle. The nozzle or burner consists of two tubes, the inner tube being connected directly to the zinc supply tube. The outer tube of the nozzle is attached in turn to a gas tube. When the device is to be operated the gas is turned on and the burner lighted—either acetylene or ordinary city gas can be used. The compressed air under 25 lb. pressure is then turned on the powdered zinc, which is forced out to the tip of the nozzle where it comes in contact with the heat of the burning gas and is turned into an atomized state. When the metal strikes any object capable of sustaining the force of its impact it cools instantly and adheres.

The machine, which can be run 10 hours without refilling, is manufactured by the Metals Coating Company of America, Chicago.

Locomotive Without Tender Adds Car to Train

A 2-6-2 locomotive with side tanks and rear oil tank that is probably one of the largest saddle-tank locomotives ever built has been recently completed for use on a switchback railway where a locomotive with a tender attached would have necessitated a lengthening of the tail tracks or the dropping of a car from the train, besides being objectionable on account of the added weight on the steep grades over which engine will operate. On account of the contour of the ground the former course would have been very expensive.

The cylinders of the locomotive are 21 in. in diameter by a 26-in. stroke. It weighs about 100 tons in working order and is equipped with the Walschaert valve gear and superheater. It will do the switching and yard work for the Inspiration Consolidated Copper Company, whose mine will have a daily capacity of 14,000 tons of ore. It was built by the H. K. Porter Company, manufacturer of steam, compressed air and gasoline locomotives of Pittsburgh.

Hauling Equipment That Proved Economical on Road Work

Fifteen teams and ten men were saved on a road contract recently carried out by Thomas Levene near Griffin, Ill., by the use of a White truck and trailer and Lee portable unloaders. In building the asphalt-penetration road, surfaced with three grades of stone, nine dump wagons, each with a team and driver, and three asphalt penetration tanks, each requiring two teams, a driver and a fireman, were in use before the truck was employed. The truck and trailer, making the 4½ mile round trip in less than an hour including stops, not only hauled as much stone as the nine teams, but also picked up the empty and full tanks as the work progressed, and made the trip from the siding to the job so quickly that firemen were not needed on the tanks. Four men, shoveling all the time into the unloaders, were able to keep the truck and trailer moving without delay.

THIS OUTFIT EFFECTED LARGE SAVING OVER TEAMS IN HAULING ROAD MATERIALS

Business Notes

The Loggers and Contractors' Machinery Company of Portland, Ore., has moved its office from 71 Fifth Street to 70 Fourth Street, Portland.

The Lehigh Portland Cement Company has purchased the Old Dominion Portland Cement Company, thereby adding 1,000,000 barrels, it is said, to its annual capacity.

The Weller Manufacturing Company, maker of conveying apparatus and grain elevator machinery, has recently occupied its new and greatly enlarged plant at 1820 to 1856 North Kostner Avenue, Chicago.

H. C. Beckwith, formerly Chicago manager of the T. L. Smith Company, manufacturer of concrete mixers and other equipment, of Milwaukee, has been appointed treasurer and general manager of the Byers Machine Company, at Ravenna, Ohio.

The Electric Steel Company, Chicago, has been organized to make small castings in that city. A Snyder electric furnace will be used. The officers of the company are: Charles Piez, president, and P. L. Coonley, secretary and treasurer, who are respectively president and vice-president of the Link-Belt Company. The active management will be in the hands of John M. Olmsted, vice-president, who has been a member of the sales force of Link-Belt Company. In order to commence operations with the least possible delay, and to offer quick delivery, the company has leased the plant at Thirty-first Street and Wood Street, formerly occupied by the Wildman Boiler Works. The location has a switch off the main line of the Chicago & Alton. Power is supplied by the Commonwealth Edison Company from its high-tension lines.

Trade Publications

The following companies have recently issued trade literature:

Foundation Company, Ltd., Montreal and Vancouver. Catalog, 11 x 8 in., 48 pages, illustrated. Foundations, substructures and subaqueous works in Canada.

Mesta Machine Company, Pittsburgh. Bulletin R, 6 x 9 in., pages 5 to 8, illustrated. The Mesta 72-in. and 84-in. barometric condensers and 14-in. and 36 x 24-in. dry-air pump.

Ball Engine Company, Erie, Pa. Bulletin S-12, 8½ x 11 in., 12 pages, illustrated. Describes Erie revolving shovels and their operation, the illustrations showing them at work on various jobs.

Bruno, Grosche & Company, 90 Wall Street, New York. Catalog, 6 x 9 in., 24 pages, illustrated. Treats of wood preserving oils and coal tar products. Describes S. P. F. Carbolineum and its effect on timber. The illustrations show various buildings and structures in which Carbolineum has been used.

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. Special Publication 1562, "Railway Equipments and Locomotives in the War West," 8½ x 11 in., 48 pages, illustrated. An ornate booklet describing by text and picture numerous installations of this company in and beyond the Rockies.

Ruggles Machine Company, Poultney, Vt. Catalog, 7 x 10 in., 64 pages, illustrated. Describes quarrying and stone-finishing machinery, including the Ruggles aerial, automatic carrier and cableway, which has also been used in the construction of dams, canals, etc., and excavations of all kinds. Its simplicity of construction and operation is one of the advantages claimed for it in work of this nature.

Pelton Water Wheel Company, San Francisco and New York City. Three folders; 10¾ x 7¾ in.; 4 pages, illustrated. Describes Pelton waterwheels for small power developments in remote districts and illustrates the various uses to which they may be put, in English, Spanish and Portuguese. Gives instructions for measurements to be made so company may advise in regard to type of wheel best suited to meet the requirements. It is an attractively prepared booklet and should prove very useful.

James B. Clow & Sons, Chicago. Catalog, 9 x 12 in., 54 pages. The book is devoted primarily to plumbing fixtures, but is written along new lines. It is entitled "Wasting a Million a Day," and aims to interest the executives of big corporations in the problem of water waste. It is very effectively gotten up and even the busy executive will be willing to stop long enough to go through it. The waste in leaky faucets, and in improperly designed flush-tanks and fixtures of other classes is clearly brought out. Of direct value to engineers are data on cast-iron pipe and the various types of valves made by the company.

Berger Manufacturing Company, Canton, Ohio. Catalog, 8½ x 10¾ in., 30 pages, illustrated. Confines itself entirely to fire resistant tests of Berger metal lumber pressed steel construction, made officially and unofficially, and their results. Takes up the subject in the form of reports and treats each test separately, considering the method of the test, the test itself and the various results. Photographic reproductions of the tests before and after and temperature and deflection charts are included in the text. Interesting facts are indicated in the charts. These various tests have to do with floor, wall and roof construction, the floor test being made as well under loading conditions. Summarizing the results of the tests the last page of the book enumerates the reasons for such results.

Allis-Chalmers Manufacturing Company Milwaukee. Bulletin 1636, 7¾ x 10½ in., 56 pages, illustrated. This booklet is intended to show the range of manufacture of Allis-Chalmers hydraulic turbines and accessories, hydroelectric units of the vertical and of the horizontal shaft types and recent large installations of units placed under one contract by this company for hydroelectric plants. In the text, besides the general descriptions of Francis and impulse type turbines, governors and auxiliaries and accessories are discussions on unit efficiency, selection of types and turbines and power house tests. The illustrations, showing recent installations of Allis-Chalmers machinery, are unique in the fact that each photographic reproduction is accompanied with plan and elevation drawings, and, invariably, cross-sections. In this manner a clear idea is obtained of the unit. Other illustrations are presented picturing the various pieces of machinery, and are accompanied by description and specifications which explain the parts in detail.

Wellman-Seaver-Morgan Company, Cleveland, Ohio. Catalog, 8½ x 11 in., 100 pages. This is a catalog of unusual character. The introduction points out that the development of hydraulic-turbine building in the United States in the last ten years has been phenomenal—and the book very appropriately pictures and describes much of the best of this development. The typography and arrangement of the book accord with the importance of the subject. An introductory chapter on turbine characteristics states briefly but clearly the important performance features of modern types of wheels. Then follows a brief discussion of plant design, and then a very thorough treatment of details of construction, which contains much of value to the hydraulic engineer. A chapter is devoted to the Johnson hydraulic valve and thereafter are descriptions of some of the great installations in which Wellman-Seaver-Morgan wheels have been used—the Keokuk plant, the Ontario Power Company's plant at Niagara Falls, the Cedar Rapids plant on the St. Lawrence, the Salmon River Power Company's installation and several smaller plants. In all, the book is one that the hydraulic engineer will be glad to have on his shelves.

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Catskill Water Reaches New York

ALTHOUGH admitted merely for the purposes of testing, Catskill aqueduct water entered into the distribution mains of New York City for the first time about a week ago. This does not mean that the $175,000,000 additional water supply project for the first installment of 250,000,000 gal. daily is finished, and ready for service. J. Waldo Smith, chief engineer of the Board of Water Supply, explained at the convention of the New England Waterworks Association last September that practically all of the year 1916 will be devoted to "tuning up" the great system before attempting to make regular delivery of the flow impounded by the Ashokan dam 100 miles north of City Hall. The event is not without significance, however, for it indicates that the first note in this tuning-up process has been sounded. It means that the great waterway is open from the foothills of the Catskills to Manhattan and Brooklyn. Large quantities of water are already stored in both the Ashokan and Kensico reservoirs; and the Hill View reservoir or equalizing basin, serving as a feeder to the city aqueduct distribution tunnel, began to fill on Nov. 30. The city aqueduct tunnel is under pressure as far as the shaft near Ninety-third Street, and tests of the connections with the distribution mains in the city streets are in progress. It is not possible, however, to predict when the great waterworks system will be placed in regular service. Many finishing touches are still needed, and the Board of Water Supply will take every precaution to insure the proper co-ordination of the many parts of the complex machine before announcing that it is ready for actual use.

Crystallization Doubtful

PROBABLY few, if any, structural engineers who have studied the behavior of steel under stress will accept without criticism the report made by an investigating board on the cause of the Division Street bridge failure in Spokane. As noted on page 29 of last week's issue, these engineers place the responsibility upon the "granulation" of the eyebars. The idea of progressive crystallization under service, accompanied by growing weakness and final failure, is an old one, probably caused through the observation of fractures which, for one cause or another, have been sudden and not accompanied by elongation. Such fractures will appear crystalline instead of silky mainly because the fibers are not elongated and drawn close together, as is the case in the usual laboratory test with gradually applied load. The explanation offered by Mr. Cooper, the designer, seems much more credible, as the effects of bending and heating upon the crystalline structure and strength are easily understood. The results of further investigation will be awaited with interest. In the meantime, the lesson forced home by this catastrophe, apparently caused by a striking failure in such usually reliable members as eyebars in direct tension, is the danger of allowing shop manipulations and heating without subsequent annealing.

New York's Building Code

AFTER three previous attempts at a revision of the building code of New York City had failed and years of effort to remove many obsolete and unsatisfactory provisions had been defeated, largely through the opposition of manufacturers of building materials, a complete and thorough overhauling and recasting of the code has been finally accomplished. This highly satisfactory result is directly due to the ability of the code committee's engineer, Rudolph P. Miller, in harmonizing conflicting interests and demonstrating the possibilities of compromise. The committee is to be congratulated on having selected an engineer whose qualifications so eminently fitted him for this work. While an effective method of procedure was adopted, i. e., revision, article by article, after tentative drafts had been published, suggestions had been received and a public hearing held, the work could not have been done had not a man been selected in whom conflicting interests had absolute confidence. Of Mr. Miller's ability and integrity there could be no question. While the work of revision is complete, only two articles—one on unsafe buildings and the other on the enforcement of the law—have become effective; the others become operative three months after enactment, the last one on March 14, 1916.

Shear Cracks or Tension Failure?

THE reason given for the cracks found in the webs of a large number of I-beam track stringers in the State Street bascule bridge in Chicago, described in the article by F. H. Avery on page 14 of last week's issue, is not wholly convincing. These webs are designated as badly "shear-cracked." Examination of the nature of the breaks shows that the cracks begin at the corner of the coped part near the top flange, as would be expected, and then curve downward toward the lower flange at about a 45-deg. angle. This slope is just opposite in direction to that which would result from a diagonal tension failure due to shear. Further, a rough computation of the probable unit stress in the web, including 90 per cent impact, shows a unit stress not exceeding about 8000 lb. per square inch under the 32-ton cars actually in use. Another explanation of this kind of failure is the presence of negative bending moment near the ends due to the relatively stiff end connection, and the resulting tensile stress in the upper flange, which would tend to start the crack at the weak section just where the metal is injured at the coped corner. Without having examined the beams it is difficult to judge how far the failure may be due to corrosion of the webs, but the evidence from the photograph and the apparently low shear stress certainly raise the question, whether shear was the primary cause of these failures.

Engineer on Service Commission

THE appointment of Henry W. Hodge as a member of the Public Service Commission of the First District of New York marks the successful issue of efforts made for many years in New York State to secure the appointment of an engineer to the important service commission having supervision of the utilities in New York City. In the forefront of this movement has been the American Institute of Consulting Engineers, which has appeared before successive governors, urging the benefit to the public from having a technical man on the commission. It is patent, of course, that the appointment of any engineer whatsoever might not have given satisfaction. An engineer of narrow views and training, of little experience in business affairs, would have been of no advantage to the public or to the profession. Mr. Hodge's appointment, however, is fortunate. An engineer of eminent attainments, a gentleman of broad sympathy and gifted with business acumen, he will shed luster on the office, serve the public ably and help to establish the engineer's position as an important factor in the administration of large public affairs. A few weeks ago the New York press was loud in its praise of the appointment of Oscar Straus as chairman of the same commission. While Mr. Straus is a gentleman above suspicion, there is little in his experience to recommend him for membership on a public-service commission. No man could give more than he will give within the limits of his experience and his ability, and no one will carry out with loftier motives the allotted duties. Nevertheless, there was needed for the position something more than integrity and general experience—specific acquaintance with the engineering and economic problems involved. This specific acquaintance Mr. Hodge has. The commission, the public and the profession will benefit by his appointment.

Shore Protection

BECAUSE the United States is blessed with thousands of miles of ocean front, to much of which little present value is attached, and because the inroads of the sea are usually gradual, and not overnight, as is the case with inland rivers that suddenly break bounds and engulf whole communities, scientific protection of beaches has been even more backward than other flood protection and prevention measures and is, in fact, in its infancy. Individuals and communities have for a long time, it is true, resorted to makeshift devices, such as bulkheads, to withstand the waves, and breakwaters have been built to protect harbors. The breakwater, however, can hardly be considered a feasible or suitable protection for long open beaches, and the futility of the random bulkhead has been repeatedly shown by the coastal storms of recent years. Indeed, the report to which this note would direct attention lists bulkheads themselves as one of the causes, under certain conditions, of damage to beaches. The report in question is that of Messrs. Leeds & Barnard on the situation at Venice, Cal.; an abstract of it appears on page 51 of this issue. While these engineers feature three types of sea walls and a form of groin that they deem especially suited to the needs of Venice—designs that should of themselves interest all concerned in beach protection—they also discuss the general subjects of erosion and sand accretion, and the best means of preventing the one and utilizing the other. The entire abstract should be read by all interested in the "war against the waves," and by others, too, who have not realized the importance and engineering possibilities of coast protection.

Instantaneous Reproduction

SPACE was not available last week for editorial comment on the choice logic of the Minnesota Railroad and Warehouse Commission on reproduction cost, a bit of which appeared on page 12. More of this logic can be found in the brief filed by this commission with the Interstate Commerce Commission in answer to the argument submitted to the national body Sept. 1, 1915, by the railroads. Once more it has been discovered that the Minnesota rate decision puts out of the running all reproduction cost as the railroads interpret it, on the ground that "the assumption of its (the railroad's) non-existence, and at the same time that the values that rest upon it remain unchanged, is impossible and cannot be entertained." Of course the Minnesota commissioners conveniently overlook the fact that Justice Hughes was discussing land only, and make him put the curse on almost the whole reproduction theory, with its assumed legal expenses, its conjectural time of construction and rate of interest, its imaginary contingencies. The Minnesota magicians, however, have rescued the theory by the simple process of *instantaneous* reproduction. By this means all assumptions are eliminated. The landowners, the steel mills, the equipment builders, the contractors, name their prices, are immediately paid in full and the railroad is finished. Of course there has been no time for interest or contingencies. Nothing counts except the actual visible material and the labor of placing it. Absurdities seem never to end in valuation discussion.

Another Plot Exposed

THE Minnesota guardians of the public have also exposed another plot of the soulless corporations to delude the trusting federal authorities. To show the loss the railroads would incur if the values of their perfectly serviceable crossties were written off in part in accordance with their various ages, the carriers used an average of 3000 ties per mile. The Minnesota detectives point out, however, that 2916 per mile would be a liberal allowance. Evidently to them the confiscation of $486,000,000 seems a totally different matter from the confiscation of $500,000,000. But that is not all. The Minnesota statesmen find that the railroads in Minnesota are paying on the average only 62 cents per tie instead of the $1 claimed by the railroads (railroads paying $1.40 apiece for creosoted ties please take notice), and that in 1890 they were paying only 36 cents, so that they are now 24 cents—the commission's arithmetic, not ours—ahead. The fact that these 36-cent ties are several generations removed from those now in the track is deemed to be immaterial, for the reason that the successive advances in the prices of these ties have been charged to operating expenses. Consequently, by overlooking the railroads that have been built recently at nearly 62 cents per tie, the Minnesota mathematicians are able to show that the railroads, instead of losing $500,000,000 by the writing off of accrued depreciation of ties, are still making $13,156,992 over original cost.

The Truth of the Matter

THIS BALDERDASH about ties and that relating to instantaneous reproduction could be treated as light comedy and quickly forgotten if it were not the official utterance of a sovereign state, apparently typical of the amazingly unfair attitude of the commissions of many states. The railroads have been accused of ignoring equity in their attempts to drag in any item that will swell the total, but certainly their efforts are less reprehensible than those of state commissioners who are frantically striving to keep reproduction cost down to original cost by mere technicalities. As conjecture, instantaneous reproduction outdoes the wildest fancies of the railroads concerning multipliers, contingencies and the like. The attempt to warp the Minnesota rate decision into a defense of such a theory is an insult to public intelligence. The Minnesota gentlemen and those of their type should understand that all the laws and all the courts cannot make reproduction cost anything else than what it would actually cost to reproduce, and the Engineering Record has full confidence that just as soon as the Supreme Court is accurately shown what it would cost to reproduce property all doubt on this point will be removed. And in the matter of the ties there is no justice whatever in a proposal that depends on the fact that prices have happened to go up, so that although half of the plant is wiped out the remainder, measured in terms of what it would cost now to replace it, keeps the value up to the original figure. It is patent that if ties had gone down in price instead of up, the Minnesota commissioners would have devised some other technical argument for making the railroads stand the loss. The commissioners, who accuse the carriers of confusing cost and value, are doing the same. They are desperately afraid that proper reproduction cost will fully justify a value ample to warrant increased rates, and they seem to be capable of any subterfuge to prevent those increases.

Summing Up a City's Work

A CLEAR, concise résumé of a large city's activities from those outside the official family is valuable, provided it be prepared from a sympathetic and constructive point of view. Such a review is found in a 16-page pamphlet issued by the Cincinnati Bureau of Municipal Research. The review is the work of an engineer, the director in charge, H. S. Morse, and shows in how small a space six years of activity of a city of 400,000 can be briefed, still leaving room for one and a half pages of retrospect and double that amount for a "look ahead." The engineers' direct way of going to the point is exemplified in some of the admonitions of the pamphlet. For example, Mr. Morse says, "A new reputation as the best governed city in the country, based on facts, calls for work, nothing less." And again, "Caution and inaction are by no means synonymous, and caution and openmindedness can well travel the same road with good results. . . . What we need for civic progress is work—hard work, thoughtful work and, above all, team work." In this month of getting matters in shape for annual reports, a perusal of this little pamphlet is worth while as a suggestion of what should be sent out to the citizens, as distinguished from the statistical data and technical discussions which should go into the appendices of the more bulky document.

Science and Engineering

DR. BRASHEAR'S presidential address last month before the American Society of Mechanical Engineers on the relation of science to engineering, is an interesting exposition of the relations which exist between the scientist and the engineer. Dr. Brashear is both, and the same is true of most really great men in these branches. In fact the difference between the two turns more on a psychological than on a genuinely rigid distinction. If one may venture to discriminate, the scientist is a seeker after truth, the engineer a seeker after the practical applications of truth, whether ascertained by himself or somebody else. The engineer who tries to dodge the rigid implications of science is extremely likely sooner or later to get himself into serious difficulties. The scientist, on the other hand, needs occasionally to pin down his truth to the earth by practical applications, lest he wander so far into the cosmos as to lose his bearings.

In mechanical engineering, science and its practice are wonderfully welded together, so closely indeed that as between the man who is characteristically a devotee of research and him who is bound to its practical applications, the difference is rather one of point of view than of actual achievement. Perhaps one might even go so far as to call an engineer merely a scientist with a sense of proportion, an intuitive grip of the relative value of things in actual performance. A metrologist, for example, may spend laborious months over errors in the eighth decimal place. The engineer is just as vitally interested in the eighth decimal place as a matter of principle, but knows instinctively when to stop and when not to stop at the first or second. He also, by a sort of seventh sense of scientific propriety, understands when a quick method not comparable in refinement to a slower one will yet give results amply precise for the purpose in hand. The engineer does not deceive himself about the need for precision, nor is he willing to work by rule of thumb, but he has developed a sense of the relative importance of things, so that he does not waste labor where labor is absolutely unnecessary. The ordinary mechanic fails of being an engineer, because he does not fully understand the bearings of precision on practical performance, but trusts to what seems well enough on general principles rather than as a result of precise and well-defined knowledge. From this standpoint the engineer is a development of the scientist and at every step depends upon scientific method. As Dr. Brashear well says, there is nothing but a hazy line of demarcation between pure and applied science, for the investigations in the former find their way into the latter in most extraordinary fashion. That which is finical precision in one generation is clumsy empiricism in the next.

The mistake made by the average man in considering this matter is his lack of foresight in not realizing that a use may be found for data apparently of the most impractical character if the real relations are properly understood. It is the business of the trained engineer to grip these very ideas, and to see how some investigation made in a far off laboratory by a patient student of science may give precisely the information needed to make the difference between failure and success in some considerable undertaking. The engineer, if he is to rise to greatness, must have both a broad knowledge and a broad view of the phenomena which are being brought to light, for they must become his tools in working out the problems set before him. If he does not appreciate the bearing of results obtained in pure science he can never apply them. It is a high conception, this, of the qualifications of the engineer, the combination of scientific certainty with the insight and foresight that makes sure of its easy application, yet it is just in this that the great men of all the engineering professions differ from the grubbing rank and file. And this very thing has a direct bearing upon that other definition of the engineer which says he is the man who can do for fifty cents what any fool can do for a dollar. It is a comparatively easy thing for a man with push and self-confidence, a few useful tables and plenty of catalogs compiled by the hard-working manufacturer's draftsman, to shove through a possible job in almost any line. The "catalog engineer" indeed is a humdrum creature only too well known in the profession, but the big man who is destined in one way or another to come to the front rank must have originality and imagination, and, more than all, intuitive grasp of the relation between the results of research and the problems that lie before him.

Drill Carriages for Tunneling

HAS the day of the heavy drill in tunneling passed? This question has presented itself with increased frequency during recent years. It is a natural outgrowth of the trend toward the use of the comparatively light drilling equipment which has enjoyed such a rapid advance in popularity in the United States.

That the light drill offers possibilities in speed and economy undreamed of a few years ago cannot be denied. Manufacturers have devoted painstaking study to the improvement of the light machine and have evolved equipment which has been responsible for important advances in tunneling practice. Tunnel men have not been slow in adapting themselves to the changing standards of practice. But is the light drill the panacea for tunneling ills? Stephen P. Brown, chief engineer of the Mount Royal Tunnel & Terminal Company in Montreal, thinks not. It has its place—in stopes, break-ups and enlargements of all kinds—but for heading work the heavy drill, he thinks, is still supreme. He bases his opinion not merely upon the results of his work in the 3½-mile Canadian Northern Railway bore, but also upon an extensive study of methods employed in the principal European tunnels. In a series of three articles, the first of which appears in this issue, he arrays his facts and from them deduces his findings.

The choice of drilling equipment for a particular job cannot be decided by an arbitrary rule. There are too many variables—the size of the heading and its location, top or bottom; the toughness of the rock; the length of the tunnel between portals or shafts; and the importance which, under the particular conditions of each job, must be attached to speed of driving. No intelligent selection of tunneling methods and equipment can be made without taking all these factors into consideration.

In arriving at a just estimate of the present value of the heavy drill for tunnel work very little attention has been given, in this country, at least, to an accessory which holds great economic possibilities—the drill carriage. It is this feature to which Mr. Brown devotes most attention. Without some means of handling the heavy equipment mechanically much valuable time is lost in getting the drills at work after a round is shot. The drill carriage's function is to cut down on this lost time by extending the machines, with air hose connections unbroken, over the muck pile and into the heading by means of a long cantilever arm.

So much attention has been devoted to pneumatic hand drill development of late that the drill carriage has been pretty generally neglected. But it has a place in modern tunneling practice. The crude carriages of the past are hardly recognizable in the equipment of to-day, and yet, so limited has been the use of the modern devices in America that few engineers realize what advances have been made at the Mount Royal Tunnel and in Europe, and how the lesson learned there could be applied elsewhere.

The inherent advantages of the drill carriage are easily summed up: It minimizes the time for setting up and taking down; it allows the workmen to begin drilling unfatigued by hauling and placing heavy equipment in the heading; it saves wear and tear on the drills; it permits of the use of massive drills and supports, designed to give the best results without regard to weight; and it eliminates the necessity for disconnecting the drills from the manifold before firing a round. At Mount Royal, however, all of the tunneling was not done with drill carriages, so that this work offers an exceptional opportunity for comparing results obtained with and without the carriages. On this point the following statement by Mr. Brown is significant: "Had the drill carriages been used in the Mount Royal tunnel from the beginning a much higher average of speed, as well as greater economy, might have been attained." And this in spite of the fact that in one heading 810 ft. of tunnel were driven in 31 working days when the drilling equipment was carried and erected by hand!

So much for the heading drill carriage. Anyone who studies Mr. Brown's articles cannot fail to be impressed with his faith in this type of equipment when used under conditions for which it is suited; and, what is most important, it is faith founded upon actual performance.

Two other features of the Mount Royal work furnish food for thought. They are drill carriages specially designed for bench and for trimming work—something unique in tunneling practice. The bench drill carriage, Mr. Brown found, was the greatest money saver in the excavation equipment at Mount Royal.

Enough has been said to indicate that Mr. Brown's articles chronicle the results of new methods in a field which is gaining in importance each year, and which is still rich in opportunities for progress. For this reason no tunnel man can afford to pass them over lightly. When conditions justify its use the drill carriage seems destined to play no small part in the tunneling of the future.

Tunnel Drill Carriages—Their Economic Possibilities

First of a Series of Three Articles Discussing American and European Practice, with Particular Reference to Experiences in Driving Mount Royal Tunnel for Canadian Northern Railway in Montreal

By S. P. BROWN
Chief Engineer, Mount Royal Tunnel & Terminal Company, Limited, Montreal

When a man has succeeded in driving a single tunnel heading 810 ft. through hard rock in thirty-one working days, establishing an American record which has only recently been exceeded at Rogers Pass, he is entitled to speak with authority on tunneling methods. This remarkable feat was accomplished by S. P. Brown, chief engineer in charge of the Mount Royal Tunnel in Montreal.

One feature of the work was the use of drill carriages, about which the Engineering Record has induced Mr. Brown to tell in a series of three articles, the first of which appears in this issue. The series is based not merely upon the Mount Royal work, but also upon exhaustive studies of European practice. The tendency toward the use of lighter drilling equipment in tunneling has diverted attention, in America, at least, from the economic possibilities of the drill carriage. Tunnel men, therefore, may secure from Mr. Brown's articles new ideas applicable to their own work.

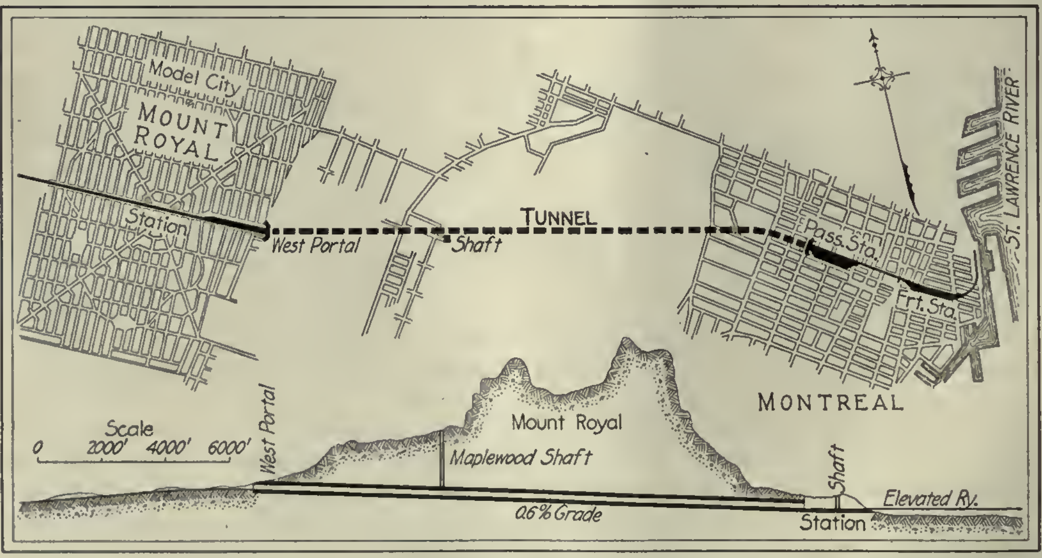
The author is a graduate of the Massachusetts Institute of Technology, and his tunneling experience has covered a wide field. In 1904-05 he was resident engineer for the United Engineering & Contracting Company on the Port Morris depression work of the New York Central Railroad and the St. Mary's Park tunnel. He was advanced to the position of principal assistant engineer with the same company, and when this firm secured one of the big Pennsylvania Railroad tunnel contracts in New York City Mr. Brown was placed in charge as superintendent of all work west of Fifth Avenue.

When the Pennsylvania work was finished Mr. Brown spent two years in France, Switzerland, Austria and Italy studying European tunneling practice as exemplified in such works as the Metropolitan Subways in Paris, the Loetschberg tunnel in Switzerland, the Tauern bore in Austria and the Formatza Valley tunnel in Italy. Returning to the United States in 1909 he became chief engineer for the Tidewater Building Company and T. B. Bryson, who had the contract for a section of the Fourth Avenue Subway in Brooklyn, N. Y. Here he remained until 1912, when he was called to Montreal to take charge of the Canadian Northern Railway's Mount Royal tunnel as chief engineer of the Mount Royal Tunnel & Terminal Company and managing engineer for Mackenzie, Mann & Company.—EDITOR.

As THE TREND of drill design is toward the lightening of equipment, not only by improved materials and workmanship in the drill and the adoption of the hammer type in many cases, but also by the increasing use of pneumatic hand drills, the question arises as to the permanent value in modern tunnel practice of the drill carriage and drill carriage methods. Developed where the rock was hard, requiring very heavy drills, the drill carriage is the result of an increasing desire for speed in economical tunnel driving, but until the Mount Royal tunnel in Montreal was started drill carriage work was practically untried on this continent. In fact, the use of the horizontal drill-bar, instead of the old-fashioned vertical columns, was so rare as to excite unusual comment and necessitated considerable education, on behalf of the workmen, to make it a success.

While most space in this series of articles will be devoted to the work accomplished in Montreal, considerable attention will be given to other forms of drill carriages, both American and European. Part 1 will be introductory and general, with a more or less detailed description of various European and American drill carriages other than those used in Montreal. Part 2 deals with the Mount Royal heading work and carriages, with a summary of the most desirable points in heading drill carriage design. Part 3 covers the carriages used on the bench and trimming work in the Mount Royal tunnel, dealing with a type of carriage that, in the writer's belief, is entirely unique.

In the Mount Royal tunnel (see Engineering Record, June 28, 1913, page 708) a greater variety of drill carriage work has been done than on any other job. The writer is particularly familiar with this work, being in general charge of both the design and construction, first as chief engineer of the Mount Royal Tunnel & Terminal Company, Limited, and second, as managing engineer for Mackenzie, Mann & Company, Limited. The latter company, which is actually doing the work with its own forces, controls not only the Mount Royal Tunnel & Terminal Company, Limited, but also the Canadian Northern Railway System, of which the present project will form a part.

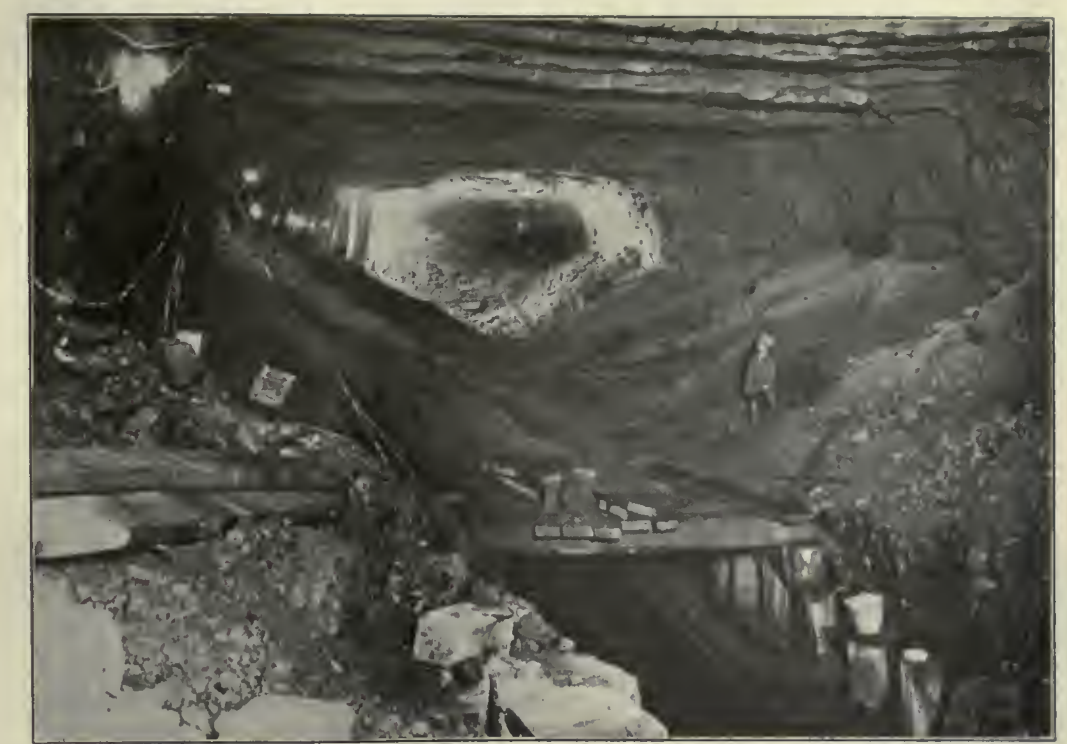


1.—MOUNT ROYAL TUNNEL WAS DRIVEN THROUGH HARD, TOUGH ROCK BY BOTTOM HEADING METHOD FROM PORTALS 3½ MILES APART AND FROM AN INTERMEDIATE SHAFT

FEATURES OF MOUNT ROYAL TUNNEL

The Mount Royal tunnel, Fig. 1, forms the entry into Montreal for the Canadian Northern Railway, the new transcontinental line. This railway lies generally between the Canadian Pacific on the south and the new National Transcontinental (Grand Trunk Pacific) on the north, and aggregates nearly 10,000 miles of track. The present tunnel and terminal development embraces electrical transfer yards back of the mountain (the terminal zone will be operated electrically at 2400 volts direct current); a model city at the west portal of the tunnel, designed at the outset for about 50,000 people; the tunnel and main passenger terminal, designed for 18 tracks on the first level, with 1200-ft. platforms; a double-track elevated viaduct across the lower town to connect the tunnel, at level grade, with the proposed harbor elevated, and an elevated freight station in the commercial part of town, capable of holding over 700 cars when fully developed.

The tunnel under Mount Royal, 3.1 miles



2.—BOTTOM HEADING TIMBERED AT BREAK-UPS TO RECEIVE MUCK WHICH IS DROPPED INTO CARS BELOW WITH MINIMUM OF LABOR

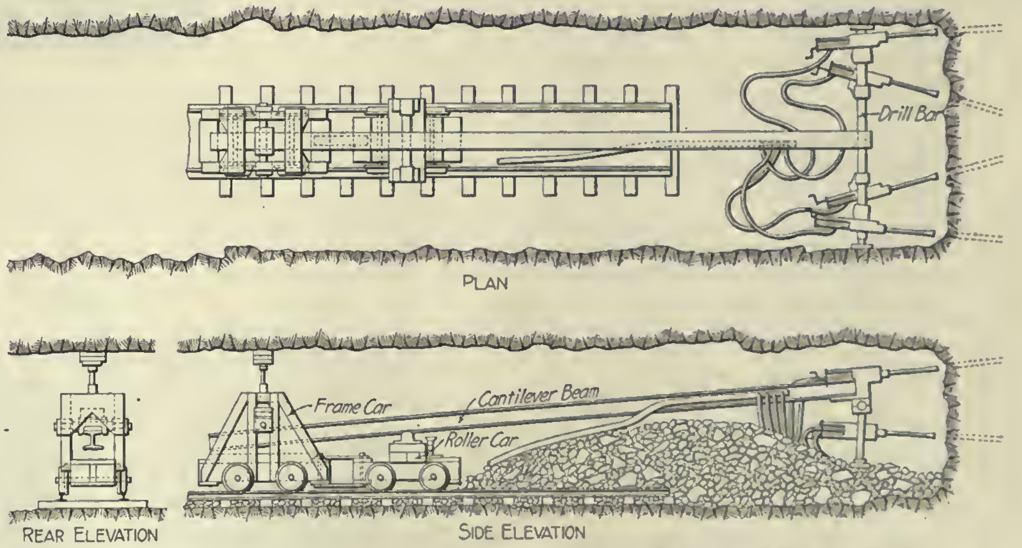
long between station sites, is double-track, roughly 22 x 30 ft. in excavation, sufficient space being allowed for a central wall and bench between the tracks. In general it will be lined throughout with concrete.

The character of the ground encountered was very diverse and in places extremely complex. The headings were in soft ground in both station sites, and at the city end the tunnel roof was in soft ground for about ¼ mile. Here a roof shield was used with O'Rourke interlocking blocks. The rock at the two ends of the tunnel was Trenton limestone, massive at the west end and somewhat stratified at the city end for the first 1800 ft. Toward the mountain proper the limestone became more crystalline, especially on the west side, where it was unusually hard and dense. The main body of the mountain is an igneous intrusion of Essexite, very hard and tough with a specific gravity of about 3.4. The number of steels dulled per foot of hole in this rock often ran from five to seven, although as a usual thing it required only about 1000 steels sharpened per day in one heading averaging 20 ft. of progress. All the main bodies of rock in the mountain were cut by numerous dikes and sheets of other very hard igneous rock, such as Bostonite, Camptonite, Tinguite, Nepheline Syenite, etc., running up to several feet in thickness. These dikes intersected the tunnel and each other in every direction, sometimes averaging several score in 100 ft. This necessitated drawing the temper of every steel to color suitable for the particular rock encountered. The ordinary method of plunging the steel proved an absolute failure. Of many steels tried, the best was F.J.A.B. (Swedish).

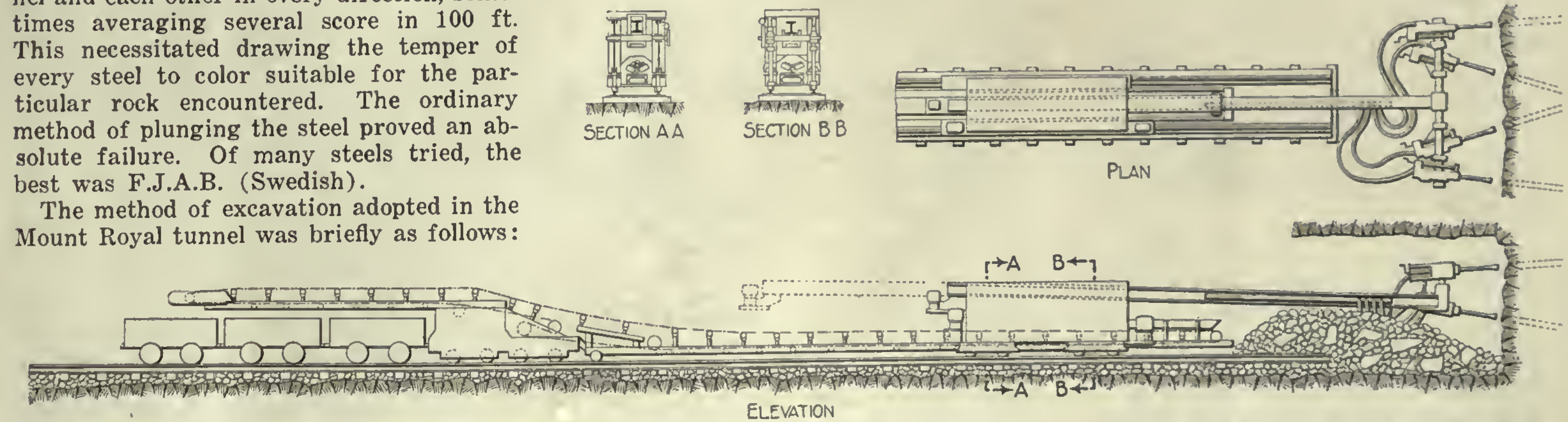
The method of excavation adopted in the Mount Royal tunnel was briefly as follows: First, a bottom heading, 7½ to 10 ft. high by 12 to 14 ft. wide was driven on subgrade along the center line. The points of attack were in the two portal station sites, 3.5 miles apart, and at an intermediate shaft, 234 ft. deep, one mile from the west portal. As the headings progressed break-ups were started, at 500 to 800-ft. intervals, along the heading, where the full-sized tunnel was excavated above the grade of the heading roof. At these break-ups, Fig. 2, the heading was timbered, so as to give a substantial roof over the tracks, upon which the upper portion of the tunnel excavation could be blasted down safely and through which the muck, thus dislodged, could slide into cars in the gangway below, with a minimum of labor. After the break-up excavation was completed the timbering was removed and the benches, remaining on either side of the heading gangway, were drilled and blasted for air-operated steam shovel excavation. This completed the entire excavation of the tunnel cross-section. Drill carriages were used, first, in the headings, second, on the bench ahead of the steam shovel, and finally for trimming the finished section. In common with all modern drill carriages, these carried the full drilling equipment assembled complete and permanently connected with the manifolds and main hose lines.

DRILL CARRIAGE TYPES

The heading carriages, described fully in Part 2 of this article, were of two types. One was a very simple affair that transported the drills to and from the heading and extended them out over the muck pile, fully erected on the horizontal bar, by means of a long adjustable cantilever arm (Fig. 3). This carriage left drills, bar and cantilever beam in the heading and was withdrawn to give room for mucking in the usual way. The other carriage (Fig. 4) was a much more complicated affair, having not only all the properties of the simple carriage, plus entire mechanical operation in extending and adjusting the bar, but also a mechanical mucking device which transported the muck from the heading



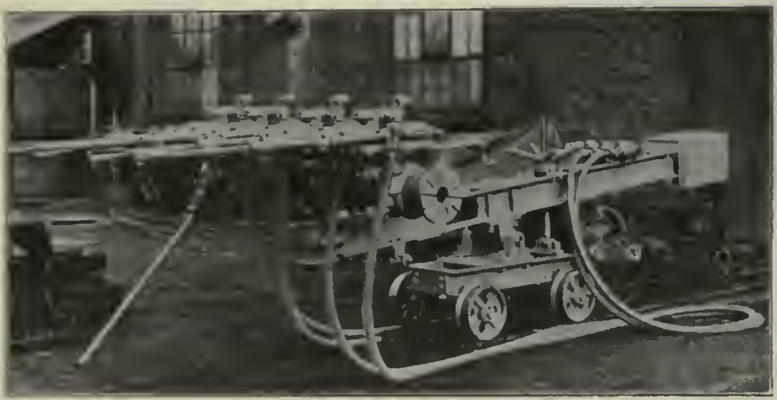
3.—IN SIMPLEST TYPE OF CARRIAGE A LONG ADJUSTABLE CANTILEVER ARM EXTENDS DRILLS ON HORIZONTAL BAR OVER MUCK PILE



4.—A MORE COMPLICATED CARRIAGE PROVIDES FOR MECHANICAL OPERATION IN EXTENDING AND ADJUSTING BAR AND WAS EQUIPPED WITH MECHANICAL MUCKING DEVICE AND TRANSPORTER through the carriage (remaining in the heading during drilling and mucking) to cars in the rear.

The bench carriages, described and illustrated fully in Part 3, were large travelers erected and moved in the heading gangway after the completion of the break-ups. They had adjustable arms or outriggers at the sides which jacked against the rib of the tunnel above the benches and supported quarry bars upon which the drills were mounted. These carriages were 30 ft. long and mounted from 8 to 12 drills each. The writer believes these bench carriages are entirely unique in tunnel work.

The trimming carriages, also fully described and illustrated in Part 3, are very similar to the bench carriages, except that they are much lighter and support not only quarry bars for mounting the heavy drills used in drilling the grade corners of the tunnel, but also platforms for pneumatic hand drill operation. They provide for the use of heavy drills where required for squaring up the "hitch" which forms the normal skewback for the concrete roof arch.



5.—OLD EUROPEAN CARRIAGE, WITHOUT OVERHANG, MERELY TRANSPORTS DRILLS TO WORKING FACE

It is to be remembered that a drill carriage performs several functions and produces a number of economies that are fundamentally and peculiarly a part of its operation. It carried the drills to and from the working face. It enables the drilling equipment, including the supports, to be designed to give the best possible results without particular regard to weight. It enables the drill, once assembled and erected on the bar, to remain so until it has to be removed for repairs. The drills are not only left on the bar while being moved, but they are never disconnected from the manifold, nor is it necessary to disconnect the main feed hose from the manifold. Thus the only connection to be made in setting up is that between the main feed hose and the supply pipes in the tunnel.

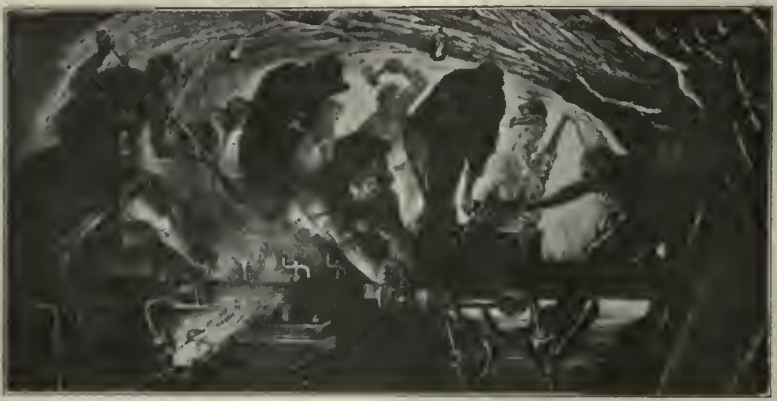
Economies Obtainable

It is evident, therefore, that several important economies are directly obtained. The time required for setting up and taking down is minimized. The workmen are fresh when they commence drilling. The drills are not abused in dragging them in and out over the muck, and broken parts are rare. The drills and hose are always clean and free from grit and dirt other than dust, which means a vast saving in wear. The equipment, especially that supporting the drills, may be so massive as to practically eliminate vibration, thus greatly improving the rate of drilling. The whole procedure falls naturally into a regular routine, systematizing itself so as to reduce lost motion and delays to a minimum.

There are fundamentally three types of modern drill carriages for heading work. The first is the old European drill carriage with no material overhang, designed merely for transporting the drilling equipment to and from the working face (Fig. 5). The second is the cantilever drill carriage, which not only transports the drills, but extends them, fully erected on their drill bar, out over the muck pile to the operating position (Fig. 3). The third is the muck-handling drill carriage, which adds a mechanical conveyor to the second type, in order to expedite the mucking where the volume of excavation is very considerable (Fig. 4).

European Drill Carriages

The first of these types was originally designed for the enormously heavy and cumbersome Brandt drills, as used, for instance, in the Simplon and Tauern tunnels. Fig. 6 shows such a carriage, with the Brandt drills actually working, in the Tauern tunnel. This picture was drawn by an Austrian artist, in the heading of the Tauern tunnel, to be used as a memento of the international celebration when the tunnel was holed through connecting Austria and Italy. It was given to the writer by Carl Redlich, president of the company building the tunnel. It is interesting to note not only the massiveness of everything but the flexible steel pipe connections between the manifold and the drill. This is required by the high water pressure used to operate the drills, often exceeding 1500 lb. per square inch. It will also be observed that the heading is quite clear of muck. This condition is common to all drill carriages of this type where the overhang of the cantilever arm, supporting the drill bar, is so small as to preclude erecting the drills before the heading is mucked out.



6.—EARLY TYPE OF EUROPEAN CARRIAGE DESIGNED FOR ENORMOUSLY HEAVY AND CUMBERSOME DRILLS

Fig. 5 shows a later adaptation of this type of carriage, being the second designed for use in the southern end of the Loetschberg tunnel in Switzerland. The same absence of overhang will be observed. In this case air drills of the reciprocating type were used, both drills and carriage being made by the Ingersoll-Rand Company. The first carriage designed there anticipated two horizontal drill bars, one above the other, but was quite impracticable. Even the one illustrated in Fig. 3 was too awkward to handle in practical use. The main reason for this awkwardness was, first, that the point of support of the cantilever arm was entirely too high for the breadth of gage and length of wheel base; and second, that, as there was no longitudinal adjustment in this arm, a very massive counterweight was required to offset the drill bar and equipment at the other end. This brought the center of gravity of the entire carriage very high, with the load widely separated on a somewhat flexible support. The net result was such frequent derailment that its manipulation became uneconomical.

The carriage illustrated in Fig. 7 was designed to correct much of this trouble; it was also built by the Ingersoll-Rand Company. It has no overhang, the idea of simultaneous drilling and mucking not having been then developed. The drill bar is pivoted over the center of the truck and may be lowered right onto the frame so as to increase greatly the carriage's mobility during transportation.

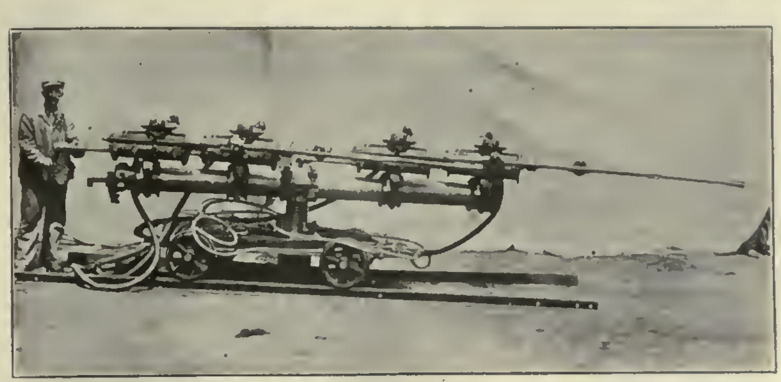
It was in this tunnel, although at the northern end where Myers drills were used, that the famous record of 1013 ft. in one month was made. The writer regrets that he has no direct illustrations connected with that end.

At first thought a carriage requiring a clean heading for operation seems a rather cumbersome affair, but when the conditions are fully analyzed the economies are evident. In the European headings, where this type of drill carriage originated, the quantity of muck was insignificant compared with the headings used, for instance, in the Mount Royal tunnel. In Europe the common heading of 6 x 9 ft. gives an excavation of only 2 cu. yd. per running foot. In the Mount Royal heading, running up to 10 x 14 ft., the volume of muck was sometimes over 5 cu. yd. per foot. Thus the actual quantity of muck to be cleared away after a blast in the European heading is so small that it can be done in a very short time.

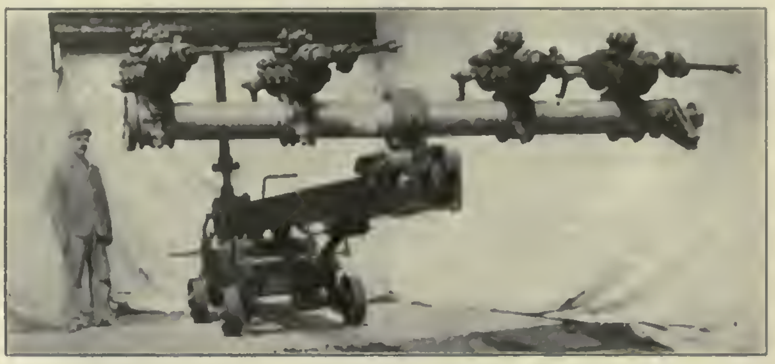
It is quite common in the very small headings, where double tracking and turnouts are difficult, to design, for the actual heading, work cars so small and light that they may be merely tipped off the track to one side when empty to permit the loaded cars to pass out. The drill carriage had, of course, to be side-tracked, and as these side tracks occurred only occasionally, where the heading had been purposely widened, the mobility of the carriage was of very great importance.

Carter Adjustable Carriage

The writer believes that one of the first carriages designed with an adjustment for extending the drilling equipment out over the muck pile, was built also by the Ingersoll-Rand Company, although its details were not made public, nor was practical application made until quite recently. This, the Carter patented drill carriage, is illustrated in Fig. 8. As will be observed the carriage consists of one truck, of rather short wheel



7.—MOBILE CARRIAGE DESIGNED TO CORRECT CERTAIN FAULTS IN THE DEVICE SHOWN IN FIG. 6



8.—CARTER DRILL CARRIAGE, THE PIONEER DEVICE WITH ADJUSTMENT FOR EXTENDING DRILLS OVER MUCK PILE

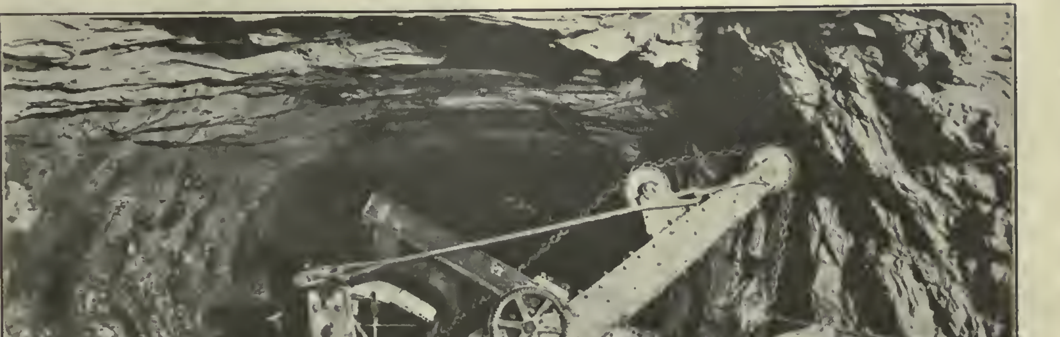
base, with a permanently extended cantilever arm, hinged for vertical movement over the center of the carriage. The whole device is low and compact. The beam consists of a light box girder which forms a track upon which the drill bar, mounted on a small carriage, travels forward and back. When the drill carriage is travelling out and in from the heading the drill bar is run back directly over the center of the truck or a little back of this point, so as to counterbalance the extended arm and bring the center of gravity of the whole apparatus well within the wheel base of the truck. This movement of the drill bar on the arm is actuated by means of a sprocket chain running over a crank wheel on the rear of the carriage. The cantilever arm is supported, during the movement of the drill bar, by either blocking off the muck pile or bracing the rear end down from the roof at a point behind the fulcrum.

Placing Drill Bar

After blasting, the muck is shoveled off the track to a point sufficiently near the face for the cantilever arm to place the drill bar in its proper position. The carriage is then run into the heading, hard up against the muck pile, and the drill bar run into position and jacked firmly between the sides of the heading. Next, the bar is disconnected from the beam and the carriage drawn back to a siding out of the way of the muck trains. This operation is reversed when the drilling is completed, and the carriage carrying the whole equipment is run back to a siding out of range of flying rocks.

This is an extremely good apparatus, although open to some criticism. It embodies many valuable novelties and if properly proportioned may be made durable and effective. A lateral swing should have been provided at the point of support in the main truck. The drill bar in this carriage should be exceptionally heavy to avoid vibration. The drills should be mounted on column arms or some form of movable saddle to give them a vertical adjustment. The grips of the end jacks of the bar should be so designed as to prevent the drills from rotating the bar, or an auxiliary leg should be used. The beam should be, in itself, slidable through the support on the truck, so that when the carriage is being moved out and into the heading it could be slid back to bring its center of gravity nearly over the center of the truck and reduce the sway of the long extended member. The principle of the carriage, however, is good and has, the writer understands, already done satisfactory work. The length of the beam will, of course, depend on the character of the rock and the manner in which it is blasted out. If the method of drilling and blasting the heading is properly devised and executed the bulk of the muck will be piled a few feet back from the face and will not extend sufficiently along the gangway to cause material trouble in clearing the tracks expeditiously to within reach of the face.

Slick sheets are often used in heading work to expedite the mucking, both in Europe and America. In Europe the cars and drill carriage are both usually run off the rails out onto these slick sheets, which, of course, are kept as close to the heading face as possible. In the Mount Royal tunnel, however, no attempt was made to run either muck cars or drill carriage onto the sheets in this manner. The steel plates were cut about 5 x 10 ft. and laid crosswise of the tunnel on top of the rails, where they did not form part of the track itself, as will be described later. As the heading was mucked out after each blast, ties were laid in advance and "drive rails" were used to extend the tracks as the work progressed.



9.—SHOVEL LOADING MUCK INTO CAR ON "DRIVE RAILS," LAID FLAT AS SHOWN IN DETAIL IN RIGHT-HAND LOWER CORNER OF PICTURE, THUS ALLOWING CAR TO RUN RIGHT UP TO MUCK PILE

Drive rails consist of 15 to 18-ft. lengths of standard rails, weighing 40 lb. in the case of the Mount Royal tunnel (see small enlarged detail in lower right-hand corner of Fig. 9). They are laid on their sides with the ball of the rail fitting into the sockets against the web of the rail already spiked in place. They are held in this position by temporary spikes and driven ahead a few feet at a time as the muck is cleared away and ties placed. The cars can thus be run forward on the balls of these capsized rails right up to the muck pile, or last slick sheet, at all times. When the full length has been driven out the drive rail is turned right side up and spiked lightly in place. As soon as two lengths have thus been driven out they are taken up and full length rails laid in their place ready for the process to be repeated. This method was used both in the heading and at the steam shovel (Fig. 9), where it was of great importance that the muck cars should be kept hard up against the muck pile at all times. The writer has given this detail of drive rails because he has found, to his great surprise, that it is an important economy.

Slick Sheet Track

In all drill carriage work in Montreal the track used near the face, within the radius of flying muck, was made up in lengths of about 5 ft. so as to make up exactly a standard rail length selected. In these sections the rails were riveted to steel sheets of the same length as the track section and about a foot wider than the track. Drive rails were unnecessary here as the sections were short and the track was always well ahead of the drill carriage. After the heading was fully mucked out before blasting the advance ties were laid and the new section of slick sheet track laid down on them without spikes, being merely connected to the last section by ordinary strap fish-plates. Each slick sheet had holes punched in its corners for convenience in handling. As the work progressed the track sections were taken up behind and replaced with standard rails, spiked to the ties laid in advance.

After a blast the muck was easily and rapidly cast off the slick sheets to the side of the track until the track was cleared near enough to the face for the drill carriage to be run in.

[In Part 2, which will be published next week, Mr. Brown discusses in detail the Mount Royal heading work and carriages and summarizes the most desirable points in heading drill carriage design.—EDITOR.]

No Attempt Yet to Fix Prices in Federal Valuation

Division of Valuation Is Collecting Data as to Market Prices, and Studying Experiences of Carriers as to Actual Costs

EXCEPT for the tentative prices applied to certain railroads selected for initial valuation the Division of Valuation, Interstate Commerce Commission, in connection with the valuation of the carriers, has made no attempt to fix prices. The commission has the following to say on the subject in its annual report recently transmitted to Congress:

"It is manifestly of first importance that correct prices should be applied, and the commission has not felt up to the present time that the information before it was sufficient."

MARKET AND ACTUAL PRICES

"In the determination of prices the two principal sources of information are the market prices and those actually paid by the carriers. By market price is meant the price at which dealers profess to sell. Such prices can be obtained from catalogs, quotations, correspondence and personal investigation. The commission has collected and is collecting in all these ways a great mass of information, which is being arranged and classified. While these facts will be of assistance in finally establishing a just price, it is apparent that they cannot be alone relied upon. The prices thus obtained are not those which would be paid by an actual purchaser if a railroad were under construction.

"In applying the test of actual cost, however, it would not be proper to use the prices ascertained from the experience of a single railroad. In this view carriers have been required to furnish information as to prices actually paid for the various items, including labor, which enter into the construction of a railroad. Most of these figures have been received and are being tabulated.

"But the figures so furnished should not be relied upon without examination of the records of the carriers. Accountants in each district make such examination and obtain much additional information of different kinds with respect to cost of construction. Since, however, the prices obtained from a single property are not sufficient, it will not be possible to reach a just and certain conclusion until these accounting investigations have been extended to an adequate number of railroads in each section."

OVERHEAD CHARGES

"There is still another reason why it has seemed best to defer for the immediate present any attempt to put an actual money value upon the inventories which are being prepared. It seems to be universally conceded that in addition to the amounts obtained by the application of unit prices to the quantities shown upon the inventory, certain additions, commonly known as overhead charges, must be made. These items are of significance and no opinion should be expressed upon them without the fullest possible information. Here, again, an examination of the accounts of carriers for the purpose of ascertaining what these items have actually amounted to in the past is of first importance, nor would it be safe to accept the result obtained from one or even from several carriers.

"For the above reasons the commission has believed that it was wise to defer the application of prices and the final statement in dollars of the cost of reproduction new, and the cost of reproduction new less depreciation, until such information was available as would permit the formation of a reliable opinion. It should be noted that this will not involve delay in the final completion of the work, since as soon as the application of prices can be properly begun the work can be speedily brought up."

PRICES ON SIX ROADS MAY BE FIXED NEXT MONTH

In this connection a circular issued by Thomas W. Hulme, general secretary of the Presidents' Conference Committee, states that "it is expected that the consideration of unit prices by the cost data bureau of the Division of Valuation, Interstate Commerce Commission, will permit of the application of prices in February, 1916, to the following roads: Texas Midland; Kansas City Southern; Atlanta, Birmingham & Atlantic; Norfolk Southern; Elgin, Joliet & Eastern, and San Pedro, Los Angeles & Salt Lake. It is the intention of the director of valuation that the carriers shall be afforded an opportunity to discuss these prices with the local government representatives before the member of the Engineering Board sends the inventory to Washington, following which an opportunity will be afforded the carriers' organization and the representatives of the states to consider the inventory and offer other suggestions in connection therewith."

October Railroad Earnings Continue Upward Trend

GROSS operating revenues for October, 1915, on the large steam railroads of the United States, according to a bulletin issued by the Bureau of Railway Economics, were $1,323 per mile, showing an increase of $152 or 13.0 per cent as compared with October, 1914. Operating expenses were $815, an increase of only $28 or 3.6 per cent. Net operating revenue, therefore, was $508—an increase of $128 or 32.4 per cent, and operating income was $456—an increase of $123 or 36.9 per cent. The comparison is with the lowest October in six years; in comparison with the average October for five years the gain is only 19.6 per cent. The operating ratio was 61.6 per cent, as compared with 67.2 per cent in October, 1914, and 67.8 in October, 1913. Considering the three main districts, the respective ratios for October, 1915, and October, 1914, were as follows: Eastern district, 63.4 and 70.5; Southern, 66.2 and 73.7; Western, 58.2 and 61.9.

THE TOTAL CUT from all of the national forests of the United States last year was 689,000,000 ft. b.m.

Field Lithography Permits Rapid Production of Maps

Though Specially Developed for Military Operations, the Process Could Be Used to Advantage by Civilian Engineers

By D. A. TOMLINSON
Company A, First Battalion of Engineers, Illinois National Guard

FIELD LITHOGRAPHY, or more properly, "zincography," has been developed by the army engineers to meet the need for quick preparation and duplication of maps giving complete and accurate information about the surrounding country in military operations. All data brought in by scouts and reconnaissance parties must be distributed to the various officers very rapidly, for news 24 hours old is worthless. When an army is advancing into enemy territory, about which little information is available, parties of sketchers in advance of the main army must make rough sketches each day of as much ground as the army will cover the next day, and in the evening these sketches must be assembled into maps and distributed. As these must be made in all sorts of conditions, night or day, tracing and blueprinting has serious drawbacks. Hence the lithographic process has been developed. Because it could be used to advantage in many cases by engineers in civil life it is described in detail.

THE PROCESS

A drawing is made on specially prepared tracing paper, and is then etched on a zinc plate, from which any number of copies can be made. The plate can be engraved in less than half an hour, and several impressions a minute can be made.

The drawing is made on the smooth side of a special "Autographic Transfer" paper, which is so sensitive that it records and reproduces finger prints, with an ink that is a mixture of four parts autographic ink and one part liquid touche. While the drawing is being made the zinc plate is prepared to receive the impression. It is first washed with clean water, and then with caustic soda or pumice stone, to remove any dirt or grease. It is then sensitized by a bath in a solution of dilute nitric acid (½ oz. of nitric acid and 32 oz. of water). To neutralize the oxidation caused by the nitric acid the plate is bathed with a dilute solution of hydrochloric acid (¼ oz. hydrochloric acid to 8 oz. of water). The plate is then thoroughly washed with clean water and dried, and is ready for the impression.

MAKING THE IMPRESSION

The drawing, backed up with two or three sheets of paper, is dampened and placed face downward on the plate, which is run through rollers several times. An ordinary laundry wringer will do. The ink on the drawing is transferred to the plate, and the drawing is peeled from the plate, coming off clean. The plate is washed with clean water, and the impression is strengthened by a bath with a solution of turpentine and printers' ink. It is then washed in gum arabic. The plate is dried and washed with turpentine and asphaltum. It is dried again and washed with water. Then printers' ink is applied with a roller until the lines stand out distinctly, after which it is dried and powdered with powdered rosin and French chalk, which protects the lines from the etching solution. During this preparation for etching the plate is washed and dried so often that the militia engineers become expert "fan artists" while learning the process.

ETCHING THE PLATE

The plate is now ready to be etched. The etching solution is a mixture of phosphoric, tannic and chromic acids. These are carried in solid form, and are dissolved in water in the following proportions: 5½ oz. phosphoric acid to 10 oz. water; ½ oz. tannic acid to 4 oz. water; 4 oz. chromic acid to 6 oz. water.

From these diluted acids, the etching solution is made in the proportion of 1 oz. phosphoric, 1½ oz. tannic and 1 oz. chromic acid, mixed in that rotation with 12 oz. of strained gum arabic (dissolved in water, in the ratio of 2 lb. of gum arabic to 1 gal. of water). The plate is bathed for several minutes with this solution, is then washed, bathed in gum arabic, and dried. The impression is washed out with a solution of turpentine and asphaltum, dried and washed with clean water, and the plate is ready for printing. The preparation of the plate is the longest part of the process and sounds formidable, but after a little practice can be done very rapidly.

PRINTING

For the printing the plate is dampened slightly with a weak solution of gum arabic and water, and is then thoroughly rolled with printers' ink (the ink adhering only to the impression). Paper is placed on the plate, covered by a rubber blanket or other suitable backing, the plate is passed through a pair of rollers, and the print is removed. This is repeated indefinitely, several copies a minute being taken off.

The plate can be stored indefinitely, altered or revised, and more copies taken off; or the impression can be removed and the plate prepared for another. Once the impression is on the plate, prints can be obtained rapidly, are durable, do not fade, and have an excellent appearance. Moreover, they can be made under almost any conditions that may arise, and the necessary equipment is small, light and portable.

Water Consumption Lowest Where Most of It Is Metered

WATER consumption per capita in the city of Tacoma, Wash., is reported as 430 gal. per day, the largest rate in the United States. The lowest rate is reported from Woonsocket, R. I., where the consumption is 34 gal. per capita per day. In the former city 8 per cent of the water is metered and in the latter 98 per cent. The tendency of meters to curtail water consumption is illustrated by a comparison of statistics for twenty-six cities in which the entire supply is metered with those for twenty-six cities in which only 25 per cent of the service is metered. In the former group the average daily consumption per inhabitant is reported to range from 42 gal. in Brockton, Mass., to 179 gal. in Columbia, S. C., and to exceed 100 gal. in only seven cities. In the twenty-six cities where service is not metered, on the other hand, the rate is reported to vary from 43 gal. in Savannah, Ga., to 430 gal. in Tacoma, Wash., and in only three of the latter cities did the rate fall below 100 gal. per capita per day.

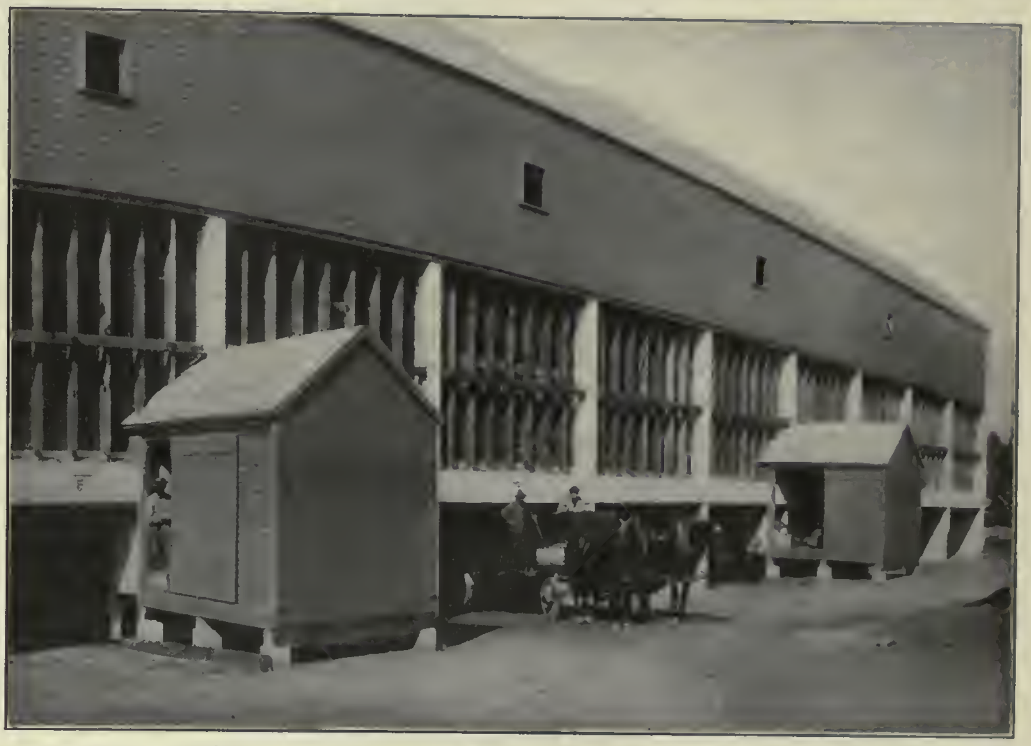
Reinforced Concrete Combined with Timber for Coal Pockets and Trestle

Combination Structure at Poughkeepsie, N. Y., on Central New England Railway Designed for Future All-Concrete Construction

By CHARLES F. DINGMAN
Engineer, Flynt Building & Construction Company

SEVERAL tentative schemes were suggested for meeting the special conditions encountered in replacing the old wooden trestle and coal pockets of the Collingwood & Seaman yard at Poughkeepsie, N. Y., on the Central New England Railway. The accepted design, using a combination of timber and reinforced concrete, best fulfilled all the requirements and called for the least expenditure per ton of capacity.

The engineers of the railway company stipulated that if a wooden trestle were built the pockets must have supports entirely independent of the track bents. The old bents were spaced approximately 16 ft. apart on centers, while the railway company's engineers advised reducing the spacing to 14 ft. The owners desired to maintain the old spacing and to have as wide a dumping space as possible between the track stringers.



EFFECTIVE COMBINATION OF TIMBER AND CONCRETE FOR COAL POCKETS

The adopted design keeps the 16-ft. spacing by using reinforced-concrete bents carried on mass concrete piers, which could be built around the old, low masonry piers and reinforced-concrete stringers 18-in. wide. The coal pockets are built mainly of timber, with concrete division walls and lower outside stringers, as shown on the drawing, supporting the wooden beams and studs.

GENERAL FEATURES

The Central New England Railway, which serves the trestle, is about 21 ft. above grade at this point, and this allows the cars to be dumped into the pockets, under which the wagons can be backed and loaded. The grade from the siding to the trestle is very slight. The trestle is built on thirteen reinforced-concrete bents and one end retaining wall which supports the approach fill and serves as the end bent.

It was the original intention to use the old rubble masonry foundations, which were believed to extend down to firm bearing, by simply incasing them with the new concrete. Further inspection, however, disclosed the fact that they were only just below the surface of the ground, which made it necessary to remove them entirely and build new footings on firm bearing and below frost line.

The completed structure is 210 ft. long and has a net capacity of 1680 tons of anthracite coal. The timber shed presents no unusual features except the allowance of very ample clearances at the sides and tops of the railroad cars and the use of Eterno asbestos roofing. The latter was applied in sheets 40 x 32 x 5/16 in. and nailed directly to the rafters. The end joints were lapped 4 in. and the side joints butted and covered with 4 x 32 x 5/16-in. batten strips.

PARTITIONS AND TRACK STRINGERS

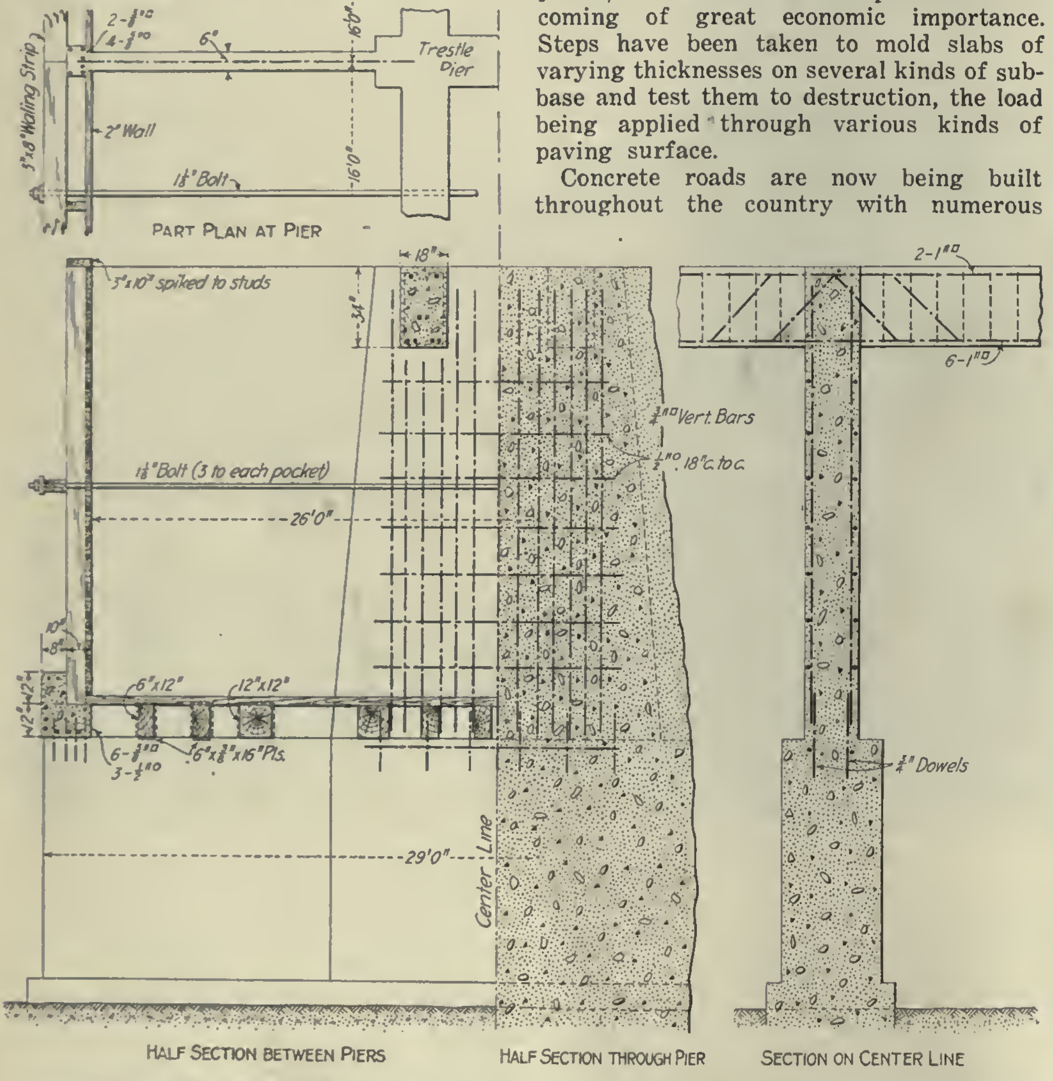
The partitions between bins are of concrete 6 in. thick, reinforced with a sheet of 24-gage Corr Mesh ¾ in. from each face. The inner end of the partition is retained by the trestle bent, while the outer end is held by the end post, which also serves to retain the ends of the wall plank. Much of the old yellow-pine plank and timber from the original structure was in good condition and could be used again. All new timber and plank was Douglas fir. All woodwork in the pockets was treated with three brush coats of Avenarius Carbolineum at the ends of each piece as an insurance against decay.

In the design of the track stringers a

loaded car, having a total weight of 210,000 lb. was assumed to have one of its trucks over a pocket, thus loading each beam with two concentrated loads of 26,250 lb. spaced 5 ft. apart. A unit stress of 12,000 lb. per square inch was allowed in the steel reinforcement. The track rails were secured directly to the stringers by Carnegie standard rail clips, held by anchor bolts embedded in the concrete.

SPECIAL REINFORCED-CONCRETE STRINGERS

A special feature of the design is the reinforced-concrete stringer which serves to retain the bottom of the studs along the sides of the coal pockets. The outward pressure at the bottom of a coal pocket is very great—in this case about 700 lb. per linear foot. This design in reinforced concrete was adopted after several other coal trestles were visited in an effort to find a satisfactory timber design for this point.



DETAILS OF REINFORCED-CONCRETE BENTS AND STRINGERS—TIMBER COAL POCKETS

The stringer also serves to carry out one of the general ideas of the design, which is that the entire wooden part of the pockets may be removed and reinforced-concrete construction substituted at any future time. The wooden part is also designed with the idea that if the floor system of any pocket should fail no additional stress would come on any part of the track structure.

A mixture of 1:3:6 concrete was used for the footings, requiring 214 cu. yd.; for the piers a 1:2½:5 concrete was used, requiring 338 cu. yd., while 122 cu. yd. of 1:2:4 concrete were used in the bents, track stringers, partitions and side stringers. Dragon Portland cement, crushed trap rock (1½-in. for mass concrete and ¾-in. for reinforced work) and Kingston sand were used throughout.

The structure was designed and constructed by the Flynt Building & Construction Company, of Palmer, Mass.

To Determine Proper Concrete Base Thickness for Roads by Test

THE U. S. Office of Public Roads and Rural Engineering has begun a series of tests at Arlington, Va., to determine the proper thickness of the concrete base for roads of different types when subjected to loads of different magnitudes and when placed on various kinds of sub-base. In view of the increasing intensity of wheel loads to which roads are now being subjected, the solution of this problem is becoming of great economic importance. Steps have been taken to mold slabs of varying thicknesses on several kinds of sub-base and test them to destruction, the load being applied through various kinds of paving surface.

Concrete roads are now being built throughout the country with numerous kinds of aggregate and under various construction methods. There is a noticeable difference in the amount of wear suffered by these surfaces, and it is a much mooted question as to which kind of aggregate will prove most economical under particular conditions of traffic and location of source of supply.

WEAR TO BE MEASURED

In order to gain information of value in this connection an instrument has been devised and constructed in the concrete laboratory at Arlington, Va., for the purpose of measuring the amount of wear of concrete roads of different types. Periodical wear measurements will be taken of concrete-road surfaces on which the traffic conditions are known.

It has long been known, the Office of Public Roads states, that concrete is not elastic, but attains permanent deformation under working loads. During the course of a series of tests on reinforced-concrete slabs recently made by the Office of Public Roads and Rural Engineering, and now being continued, it was very forcibly brought to the notice of the observers that the concrete continued to deform slowly as long as the load was applied. This fact is significant, as it helps to explain certain stress conditions in concrete roads and bridges when subjected to temperature changes. In order to study this phenomenon more fully, a series of tests has been begun to determine the "flow" of concrete and reinforced concrete when subjected to direct compression and to bending stresses. Working conditions will be maintained on the specimens as long as they exhibit "flow," and finally the specimens will be broken in comparison with like specimens that have not been previously loaded.

Twenty-Foot Depth of Driftwood Buckles Automatic Gates

AUTOMATIC crest gates 15 ft. high and 18½ ft. wide are used on the new dam at Austin, Tex. They were placed in service early in 1915, and within a few months of their installation demonstrated their adaptability to their purpose. They passed not only ordinary floods satisfactorily, but also one heavy flood carrying from 50 to 60 acres of driftwood which had accumulated in the pond prior to the full opening of the gates. With 14 ft. of water going over the crest, the velocity and volume were such that large trees were carried through the space between the piers and over the upper surface of the gates. When the spread of the branches was larger than the openings, the force of the water broke off the limbs and carried the broken trees through.

However, in the largest storm experienced since the dam was completed, which occurred the latter part of September last, a depth of driftwood of about 20 ft. accumulated in front of the structure, and, upon the opening of the gates, jammed between them and the crest of the dam, buckling them upward. As a result some of the gates will have to be replaced. The buckled gates were carried over the spillway and destroyed.

The gates were designed to resist only the forces acting in a downstream direction. The accumulation of driftwood to a depth below that of the gate surface when in the horizontal position was not considered as a possibility. To insure safety, however, from unforeseen effects of drift, the engineer's original plans provided for suitable log booms upstream near the head of the lake. Had these been constructed the damage would probably not have occurred.

It is hardly to be expected that such an accumulation of driftwood will again be experienced. This was the heaviest flood since the construction of the dam, or that has occurred in many years, and naturally it cleared out all the floating material within the reservoir area.

TWO HUNDRED EIGHTY-THREE KILOWATTS per barrel of oil is the normal operating record claimed for the Long Beach steam generating station for the Southern California Edison Company. The plant has a capacity of 47,000 kw. and is equipped with Curtis vertical turbines, operated condensing, under a high load factor.

Privately Financed Sewer System for Small Town Produces $2,000 Yearly Revenue

Citizens of Troy, Pa., Secure Public Improvement Without Exceeding Limit of Bonded Indebtedness—Tannery Wastes Cause Trouble

By HENRY W. TAYLOR
Consulting Engineer, Albany, New York

FINANCED entirely by private capital the sewerage system and treatment plant of the borough of Troy, Pa., involving a number of uncommon legal features described in the Engineering Record of Jan. 16, 1915, page 79, have just been completed. Although the borough could not pay for a sewer system without exceeding the limit of its bonded indebtedness, such a system has been supplied by private capital and has an earning power such that the total cost of $25,000 will, in a 20-yr. period, be reduced to not over $7,000. No tax for the installation or maintenance of the system is imposed upon the general taxpayer who has no desire for a sewer system or connection thereto, while such an individual is now afforded, without charge, the opportunity of connection, should he desire to pay $10 a year for same. The borough has the right to take over the system at any time by purchase of individual interests, and in the meantime, without municipal taxes has the use of a system which it could not itself legally afford.

The system, as installed, includes 22,000 lin. ft. of 6, 8 and 10-in. sewer with 80 manholes and four double inverted siphons consisting of duplicate lines of 8-in. Universal cast-iron pipe with special manholes and screens. The treatment plant consists of an Imhoff tank with superstructure over half of tank, containing a hypochlorite dosing apparatus, a back-flooded 18-in. outfall sewer and a sludge bed. The whole system was installed with special care and the inverted siphons required for stream crossings, long and deep cuts, repairs to improved state highways, interference with existing drains, water pipes and service connections, considerably affected the total cost of the work. The treatment plant was installed in about 10 ft. of ground water and the major part of the excavation lay in a semi-quicksand.

GROUND WATER INFILTRATION

As the sewer construction committee supplied all material for the laying of the sewer it was possible to take especial pains with construction in wet trenches. A good quantity of cement was used in the joints which were wrapped with muslin in the wetter trenches. There was a large percentage of wet trenches where the sewer will be under a considerable hydrostatic pressure from ground water levels, but when the system was completed and all dead ends closed the ground water infiltration amounted to about 5500 gal. per mile of sewer in the trunk line and the main street laterals. It is thought by the engineer that during extremely wet seasons this ground water infiltration will be increased to about 7000 gal. per mile, but the results of care in laying the sewer amply justified the extra cost of material and inspection. Measurement of infiltration was made by the trapezoidal weir in the outlet manhole of the Imhoff tank.

The sewer system receives wastes from a tannery, a creamery, and the domestic sewage of the borough. The tannery wastes gave rise in warm weather to a distinct odor which escaped from the hook holes of the manhole covers. The manhole covers are cast without vent holes. The nuisance from the tannery wastes developed before these wastes were diluted by domestic sewage from house connections to the system, and the tannery wastes were first turned into the system for the purpose of studying the results of the tannery odors and their effect upon the sewer system.

TANNERY WASTES CAUSE TROUBLE

It was found that a standard 45-deg. drop manhole, with a drop of 2 ft., was not suited to undiluted tannery wastes, the drop being so abrupt as to give rise to a frothing scum which filled the drop manhole from the floor to the manhole casting with brownish soap suds. These suds trapped the sewer ventilation and produced a distinct nuisance in the next lower manhole. The drop in the manhole was changed so as to form a ramp in which the 2-ft. drop was made in a distance of 10 ft. and since this change has been made the suds formation has been prevented.

The three inverted siphons on the trunk line air-trapped the trunk sewers into three separate sections. The high manhole in each one of these sections ventilated its particular section and a distinct nuisance, with the undiluted tannery wastes, was observable during warm weather. It was first thought that each section could best be vented through lateral sewers extending to the higher points of the borough, but it was finally decided to install air lines between the two inverted siphon manholes so that a continuous ventilation could take place from the treatment plant to the end of the trunk sewer at the tannery. At this point a 20-ft. riser was installed and the ventilation from the whole sewer line will be returned to the tannery property. Between the top of the vent riser and the inlet manhole of the Imhoff tank, which acts as an air inlet, there is a difference of elevation of about 130 ft.

LOOSE-LEAF ACCOUNTING SYSTEM

The sewer construction committee purchased its own materials and built the treatment plant and accessories with day labor under the direct supervision of the engineer. The excavation, backfilling and laying of sewer pipe and building of manholes were let out by contract on a unit price basis. A special form of accounting was developed whereby all proposals for supplying material, labor, etc., were entered in a loose-leaf booking system with special stationery. All payments made are shown on orders. The book includes a list of checks and each check is referred to a given order which explains every payment made. The file also includes copies of essential correspondence. The complete file, when turned over to the committee, will thus indicate all the steps in the process of construction, and it is so indexed that those interested can quickly go over the whole matter for their own information. As the borough will eventually buy out the present investors this special method of bookkeeping was devised for the benefit of a borough auditing committee and for any taxpayer who might be interested in the items making up the total cost of work.

The sewer system receives about 40,000 gal. of tannery wastes and 15,000 gal. of creamery wastes per day, together with the domestic sewage. The tannery wastes add a strong color to the sewage but by dilution and sedimentation, and apparently some precipitation, the original black color of the tannery wastes is converted into a yellowish tinge as the sewage leaves the outfall sewer. Two hundred feet from the submerged outlet of the outfall sewer this color disappears, even when the stream is clear. When the stream is turbid or colored with organic matter the point of discharge of the outfall sewer can hardly be seen. The effects of dilution and some precipitation can be noted in the sewer system itself as the tannery wastes become thoroughly mixed with the sewage and other wastes.

At present the Imhoff tank affords a detention for maximum flows of about 3.5 hr. The effluent is very free from suspended matter, though the tannery waste color is still apparent. The inlet and outlet manholes of the Imhoff tank are located at its mid-length and hence equidistant from the ends of the tank and its longitudinal axis is at right angles to the line of the trunk sewer and outfall sewer. This arrangement does away with the usual troubles experienced in the process of changing the direction of flow in the tank. The water depth of this tank is 17 ft.

PRECIPITATION IN OUTFALL

The outfall sewer consists of an 18-in. line about 400 ft. long, which is flooded to three-fourths of its depth. After the plant had been in operation for about six weeks a very considerable precipitation was noted in this outfall sewer, this precipitate being turned black by the tannery wastes. The precipitate formed as a result of the interaction of the tannery wastes, creamery wastes and sewage and has thus far aided in reducing the color of the final effluent.

The sludge bed is of usual construction. The tank sludge is pitch black in color and very finely divided; thus far no gaseous action has taken place. The vent compartments of the Imhoff tank are practically free from scum, and the flow compartments are absolutely clear of any floating matter, after two months operation.

FINANCIAL STATUS OF PROJECT

The total cost of the complete installation, including charges for land, rights of way, legal expenses, printing, engineering expenses for design and supervision of construction, together with the interest to date on capital during construction and an allowance for extensions will amount to about $25,000. The capital for the work was subscribed by private individuals, who, according to their subscription contract, are to receive 5 per cent on money invested. This 5 per cent is paid to the investor by the borough as a rental for the entire system. The borough maintains the system, makes all collections, etc., while the individual property owner leases from the borough the right to make a connection to the sewer. The complete scheme of contracts between the borough, the investor and the user of the system were fully detailed in the former article on the project, referred to previously.

The cost of maintenance of the system will amount to about $150 per year. The present street commissioner will have charge of the sewer system, and the principal maintenance charge will be the cost of hypochlorite of lime for the dosing of the tank effluent. Collections and rentals of the system will be in charge of the borough clerk, as a part of his general duties.

A $10 fee is charged for the ordinary house connection. The cost to hotels, factories, railroad station, etc., ranges from $25 to $150. The total assured income at present is $1,800, representing about 100 house connections. Additional house connections, however, are being rapidly made, and it will be safe to say that the average total income from the system for the next 20 yr. will be at least $2,000. This revenue from the system can be used only for payment, to the investors, of the 5 per cent on cost and for maintenance and purchasing investors' interests in the ownership of the system.

The financial status of the scheme may be briefly summarized as follows:

STATEMENT OF FINANCES

Approximate cost of system	$25,000	
Average revenue		$2,000
Borough rental at 5 per cent of cost.	$1;250	
Maintenance	150	
Total charges		1,400
Net revenue		$600

Allowing for interest on this yearly net revenue of $600 at 5 per cent, or the purchase of individual interests from year to year, which thereby reduces the rental, the proposition will show a balance of $18,600, in a period of 20 yr. At the end of the 20-yr. period, the borough could then purchase the entire system by bond issue, if it so desired, for the sum of $6,400. The above statement is conservative, since any public utility of this sort is unexpectedly used, and an additional revenue may be expected or the individual rentals reduced.

Cedar Logs in Good Condition After 55-Year Service in Dam

IN CONSTRUCTING the Strawberry rock-fill dam on the Stanislaus River in California it was recently necessary to remove a timber dam built by a mining company in 1861. After that part of the old structure which had been exposed to the action of the weather had been removed, the underlying cedar logs, which were from 3 to 4 ft. in diameter, were found to be sound and apparently in an excellent state of preservation. The surface of the timbers in some instances was slightly softened, but below a depth of about ½ in. the grain was as firm as that of freshly seasoned timber.

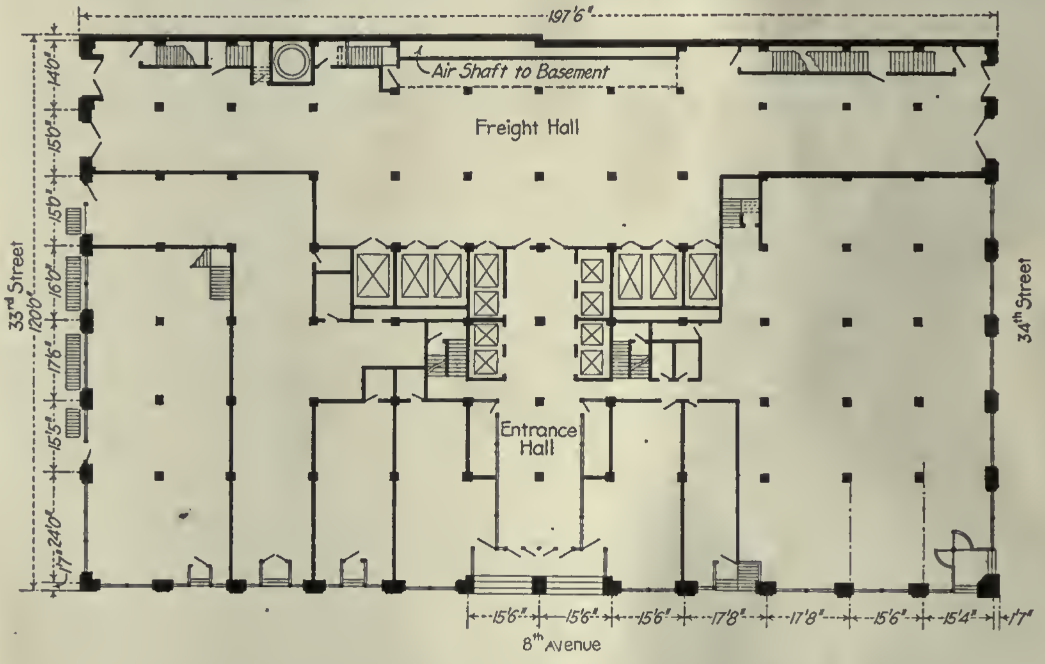
A FOUR-TON CLOCK WHEEL about 20 ft. in diameter was recently conveyed on an auto truck to the summit of Mount Wilson (Cal.) for use in the Carnegie observatory. The wheel, which is for driving the 100-in. telescope, will be attached to a solid steel shaft nearly 2 ft. in diameter, which will revolve with the exact speed of the earth, but in the opposite direction. The wheel was carried up the mountain in two pieces over a road 9 miles long with an average grade of 10 per cent and a maximum grade of 19 per cent.

Steel Frame of Printing Crafts Building Designed to Prevent Vibration

Heavy Modern Printing Presses Can Be Placed on Any Floor of New Building Now Being Erected in New York City

EVIDENCE of the shifting of business centers in New York City is furnished by the present active construction of a new twenty-two-story building at the corner of Eighth Avenue and Thirty-fourth Street. This building, called the Printing Crafts Building, is to be used almost exclusively for printing and allied trades, and marks the movement which has been active during the past ten years in changing the printing center from the old "Newspaper Row" to uptown New York in the vicinity of the new post-office building.

As ordinary office buildings are totally unfit to withstand the constant vibration and jarring due to the operation of heavy printing presses, it is necessary to design a building which is to be used for this purpose with special provisions against vibration. In addition, the necessity for maintaining relatively high temperatures in order to keep the ink in the requisite condition makes imperative an unusually efficient heating system, with reserve boilers sufficient to guarantee continuous operation. The danger from fires among the great quantities of paper is of such serious importance that fire-resistive construction with full sprinkler protection is a necessity. This new building is to contain all these features.



FIRST-FLOOR PLAN OF NEW PRINTING CRAFTS' BUILDING IN NEW YORK

GOVERNING REQUIREMENTS

The new building is situated on a nearly rectangular lot, running for the whole block length between Thirty-third and Thirty-fourth Streets on Eight Avenue, with dimensions of about 120 x 197½ ft. Much blasting at this location, where rock is found near the surface, was necessary for the basement, which is about 20 ft. below the sidewalk and covers the entire lot. A mezzanine basement floor is used. The column foundations are ordinary rectangular piers of concrete on solid rock.

All the story heights are 14 ft. except the first, which is 22 ft. and a mezzanine floor in the rear, and the seventeenth, which is 15 ft. 10 in. Solid fire-resistant walls of terra cotta and brick are used for the two fire towers on the west side and a safety zone in the center of the building, where the seven passenger elevators and seven combination passenger and freight elevators are located.

As shown on the first-floor plan, the width of the building, which runs approximately east and west, is divided into panels of about 15 ft., with the exception of the 24-ft. front panel, while the length is divided into bays of unequal length, with four panels 17 ft. 8 in. to allow the use of exceptionally wide presses. It is planned to place the presses with their main axes east and west, and as vibration and wind stresses both will be greater in that direction, the columns are placed with their webs east and west, thus giving greater resistance and stiffness for the knee braces and brackets connecting to the heavier main girder beams between the columns.

FULL LIVE LOAD ASSUMED ON COLUMNS

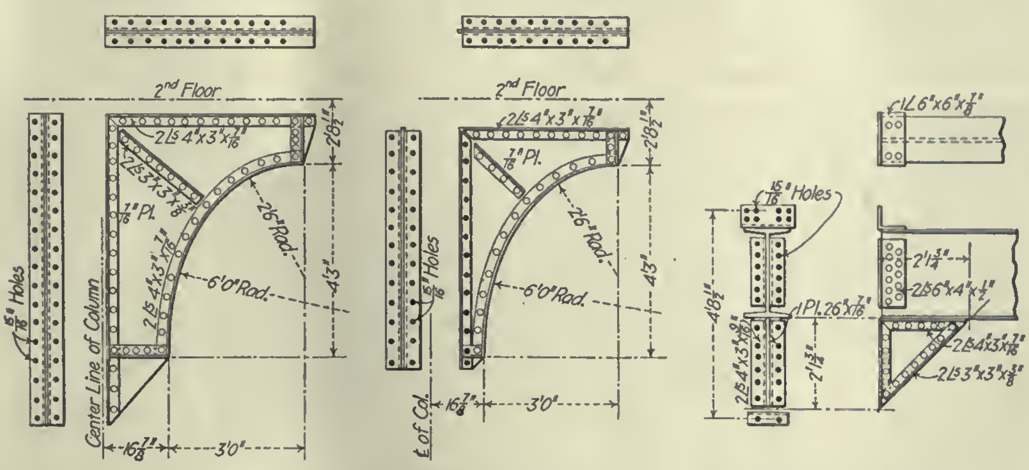
All floors are designed of steel beams and reinforced-concrete floor slabs to carry a live load of 240 lb. per square foot, using the usual types of reinforcement and details, with two lines of ¾-in. tie rods between the steel beams, the latter spaced from 5 to 6 ft. apart. The columns are designed to support the total live load on all floors from the top down, without any reduction.

The allowable unit stresses are the usual values specified in the New York building code. The columns are of Bethlehem H-section, reinforced by enough plates to provide the varying required sectional area. Splice plates having an exceptionally large number of rivets are used.

BRACKETS TO PREVENT VIBRATION

Above the tenth floor the typical knee brace used in both directions at each column consists of two angles 4 x 3 x ⅜ in. at a 45-deg. slope and extending 2 ft. out on the beams. Below the tenth floor the typical brackets are as shown in the accompanying diagram. Special curved brackets are placed in the high first story below the second floor in both directions at all columns. For the wall columns the brackets are placed above instead of below the beams whenever they interfere with the windows.

Heavy top connection angles and standard-angle web connections are used for stiffness. In the north-and-south direction, where connections are made to the webs of the columns, the brackets connect to the ordinary floorbeams. These beams between the columns have been increased in depth for the purpose of increasing the stiffness and resistance to vibration. The building is so long in this direction that the wind stresses are relatively insignificant.



Connection to Web Connection to Flange Connection to Flange

TYPICAL BRACKETS FOR FIRST STORY TYPICAL BRACKET BELOW TENTH FLOOR

DETAILS OF TYPICAL BRACKETS AND CONNECTIONS IN PRINTING CRAFTS BUILDING

DETAILS OF FINISH

The building is to be finished in rough gray stone with terra-cotta trimmings up to the fourth floor, and above this with plain gray brick carried on the steel frame. An effective band course of terra cotta at the seventeenth floor and pilasters extending from the seventeenth to the twentieth floors add to the architectural appearance, which is further enhanced by making the walls of the corner panels project beyond the walls of the interior panels, and by ornamental cornices at the roof. All windows are movable, with wire glass in the upper sash.

The building was designed by Edward L. Larkin, architect and engineer, and Frank J. McCabe, structural engineer, both of New York City. The owners and builders are the 461-Eighth-Avenue Company, which is erecting the steel frame. The contract for the steel was let to the Bethlehem Steel Company, which sublet the fabrication to the Hay Foundry & Iron Works of Newark, N. J.

THE ESTIMATED COST of the reservoir, dam and tunnel to be constructed in connection with the proposed new water supply for the city of Providence, R. I., is $12,000,000. The reservoir and dam will cover approximately 6 square miles and have a watershed of 92 square miles. The tunnel will be 6 miles long. This system, which will furnish a daily supply of 85,000,000 gal. of water, will do away with the present system of pumping water from the polluted Pawtuxet River. From five to seven years will be required to complete the work.

Requirements for Acceptance of Concrete Aggregates Based Upon Standard Tests

Materials Testing Division of New York Public Service Commission Develops Methods for Continuous Sampling and Testing of Concrete

STANDARD METHODS for the continuous testing of the aggregates and concrete used on the many contracts for New York City subway and rapid-transit railroad construction work, referred to in a previous article in the Engineering Record of Sept. 4, 1915, page 296, have been developed by the engineers of the Materials Testing Division of the Public Service Commission for the First District, New York, for all work under its supervision. These standard-practice instructions are believed to be of sufficiently distinctive character to justify reproduction of the more important details. In addition, the requirements or specifications for both fine and coarse aggregate as proposed and used for acceptance or rejection by the Materials Testing Division are here given.

In order to insure uniform results and scientific exactness in procedure, standard methods for testing and sampling have been adopted, and definite instructions issued. The concrete section of the Materials Testing Division provides inspectors at the plants whence the concrete aggregates are shipped to the works, and it tests these materials at a laboratory used exclusively for tests of concrete and concrete aggregates, the cement being tested elsewhere.

In addition to laboratory tests of fine and coarse aggregates, field specimens from the concrete as it goes into the structures and check laboratory specimens are made and tested. Special tests to assist in writing specifications are often necessary. The equipment and general arrangement of the laboratory have been adopted for efficiency of operation and economy in cost. The accompanying photographs illustrate some of the special features. The 2-in. molds shown are much cheaper than the usual form.

The permeability apparatus is unusually simple, being constructed by a plumber from standard supplies. The pressure in the tank is supplied by an ordinary automobile tire pump. The 4 x 11-in. pipe flanges with rubber gaskets 1-in. thick and 4-in. inside diameter effectively hold the specimen under test.

A chronological system of filing 3 x 5-in. cards is used to keep track of specimens and the time for testing. Printed blanks are furnished for each test to insure accurate, complete and uniform records.

TESTS OF FINE AGGREGATES

Complete tests of a fine aggregate comprise: (1) Determination of per cent retained on No. 4 square-hole sieve, (2) mechanical analysis of portion passing No. 4

VIEW OF TESTING LABORATORY—MOLDS SHOWN ARE CHEAPER THAN USUAL FORM square-hole sieve, (3) determination of silt by washing on No. 100 sieve, (4) determination of silt by decantation, (5) compressive tests of 2-in. cubes, (6) microscopical examination, (7) weight per cubic foot, (8) voids, (9) specific gravity, (10) reaction to litmus, (11) quantitative test for organic matter as indicated by loss on ignition, (12) density in mortar, (13) determination of insoluble silica.

It is usually necessary to make only the first six of these tests, and frequently only one or two are required. Extracts from the instructions for making tests 3, 4 and 5 follow:

(3) Silt by Washing on No. 100 Sieve

Separate 220 grams of moist sand by quartering and dry it at a temperature low enough to avoid baking any clay or similar matter, which would thus be rendered incapable of passing the sieve. If time permits, dry it at room temperature by spreading on a plate of glass. Use 200 grams of dry sand for the test. Extra care must be taken in dividing dry aggregate to prevent separation of fine from coarse.

After weighing allow the material to soak in water for a few minutes in order to soften hard lumps. Wash very thoroughly under a gentle stream of water (a violent stream would injure the sieve) and dry under a gas burner. Be extremely careful to avoid heating the sieve to a high temperature, which would melt the solder holding the sieve cloth to the frame. When dry weigh the residue on the sieve. The percentage of silt is the loss of weight multiplied by 100, divided by 200. State result clearly on report.

(4) Silt Determination by Decantation

Using two or more 100-cu. cm. glass cylinders graduated to 0.5 cu. cm.:

1. Take a fair sample of the sand to be tested by mixing portions from different parts of the pile. Mix thoroughly and spread out into a flat heap. Take opposite quarters of the heap, mix and spread as before. Repeat until the original sample is reduced to a small quantity.
2. Take approximately 20 cu. cm. of the small sample in one of the graduated cylinders. Add approximately 30 cu. cm. of lukewarm water and stir with a wire for 30 sec.
3. Allow to settle for 30 sec. Then decant the water into an empty cylinder, stir up the sand left in the bottom of the first cylinder with a fresh portion of water and repeat. Do this four times, then place the two cylinders on a level surface for 1 hr.
5. At the end of 1 hr. record the height of silt and sand which has settled to the bottom of the cylinders.
6. Compute the per cent of silt as in Table 1.

TABLE 1—SILT DETERMINATION—SAND SAMPLE 45

Route 2, Section 20, P. Smith Contracting Company. From subway excavation at Eighty-first Street. Sampled by J. Jones. Remarks: This sand is being stored at Eighty-third Street for future use. Tested by J. Jones.

19.0 cu.cm. = volume of clean sand remaining in cylinder 1
4.2 cu.cm. = volume of silt in cylinder 2
23.2 cu. cm. = total volume
18 = per cent of silt = 4.2 × 100 ÷ 23.2

A number of independent tests should be made and the average value used. This test is for field use only.

(5) Compression Tests of 2-in. Cubes

Use the methods recommended by the Committee on Uniform Tests of Cement of the American Society of Civil Engineers, except where the following instructions require otherwise.

To avoid the removal of any coating on the grains, which may affect the strength, fine aggregate must not be dried before being made into mortar, but must contain natural moisture. The percentage of moisture may be determined on a separate sample for correcting the weight. The weight of moisture is counted as a part of the water used for mixing and not as a part of the weight of the sand.

Proportions are to be 1 : 3 by weight. Since the sand is weighed in a moist condition the actual weight will be three times the weight of cement plus the moisture contained. The cement should be screened through a No. 30 sieve and then worked over dry with a trowel to break up any remaining lumps.

Special Consistency Specified

Mortar is to be made of the same consistency as that of Ottawa sand mortar when mixed with 60 per cent of water above what is required for normal consistency; that is, if 10 per cent of water is required to make Ottawa sand mortar of normal consistency, then 16 per cent of water will be required to make Ottawa sand mortar of Public Service Commission consistency.

Since the amount of water necessary to give a particular consistency varies with different aggregates, the only known way to determine the correct amount of water to use is experimentation. The temperature of the gage water must be about 70 deg. Fahr. Mortar must be mixed hard with the hands for the time specified and thoroughly worked into the molds with the hands and trowel.

Ten specimens are to be made in each test, to be broken as follows: Four after 3 days, three after 7 days, and three after 28 days. Three-day specimens must be tested within one or two hours of the correct time. Ottawa sand specimens of the same consistency are to be made with each test.

Specimens which vary in weight more than 3 per cent from the average should be rejected.

No tensile tests are required, because it is believed that comprehensive tests more nearly represent working conditions.

Tests of Coarse Aggregates

Complete tests of a coarse aggregate include: (1) Mechanical analysis, (2) cleanliness, (3) weight per cubic foot, (4) voids, (5) specific gravity, (6) crushing strength. It is usually necessary to make only the first two of the tests, the instructions for which are as follows:

Ordinarily for the mechanical analysis use a 25-lb. sample reduced from a larger sample, if necessary, by quartering. Carelessness in selecting or dividing the sample makes the test worthless. If necessary to use a smaller sample, use as large a one as possible, the results being easily reduced by slide rule. Screen in rocker 100 bumps (50-cycles), using 2-in., 1½-in., ¾-in., ½-in. and ¼-in. screens. Weigh residue on each sieve and record in regular record blank. Record also the weight of the sample used. This will give a permanent record of the accuracy of the test. The sum of weights retained on the different screens, together with the weight passing the ¼-in. screen should equal the weight of the sample used. If a large sample is used some of the screens will be found to be overloaded. The material on these must then be divided and rescreened in such a way as to give correct results.

Cleanliness is judged by inspection only.

Field Samples of Concrete

In taking samples of field concrete for compressive tests, the large standard molds, 8 x 16-in. iron pipe (described in the article of Sept. 4, 1915) should be used. A smaller size is too small for coarse aggregates. If the edges do not register accurately when the bolts are tightened, try changing the position of the straps. Iron molds are oiled with heavy machine oil. Set the molds on level iron plates, also oiled. It is not well to set them on a piece of board, because it may be warped and permit leakage from the specimen. Place sand or mud around the bottom of the mold to prevent leakage.

Concrete for the specimens should be taken directly from the forms at a place where it has been rammed or spaded to its final condition. A fairer sample can be obtained after the concrete is spaded than before. Great care must be used to take an average sample. The molds should be placed as near the forms as possible in order to avoid separation of coarse aggregate from the concrete during transportation. In order to overcome the effects of such separation as may be unavoidable, distribute each pailful of concrete to several specimens. A little care in finishing the top surfaces of specimens will save much trouble when they are tested. If the concrete is very wet it will shrink and expel water after standing. The ends of such specimens may be finished with dry sand and cement after standing for a few minutes.

If there is danger of the specimens being dishonestly tampered with, place a small piece of paper on the bottom of the molds for identification. The molds are filled in not less than three layers, each layer being worked well with a trowel to remove air bubbles. Each test consists of six specimens, three to be broken 28 days after mixing and three to be broken 90 days after mixing.

Samples of Aggregates—Storage

Obtain a 25-lb. average sample of coarse aggregate and 3 qt. of fine aggregate to be tested in the laboratory. Record the make of mixer used and be particular to give correct consistency, since the consistency largely affects the strength. The following terms describe consistency: Dry, medium, wet, very wet and extra wet.

Specimens are left on the work two days and are then brought to the moist room before the molds are removed. In the moist room remove the molds and paint on the cylinder the contractor's initials, test number and specimen number. Specimens are stored in the moist room and sprinkled daily with the hose until two days before being tested. Two days before breaking each set send a standard notice to the section engineer concerned. Specimens must be removed from the moist room to the laboratory two days before breaking in order that they may become dry.

Methods Used in Testing Cylinders

A specimen whose ends are planes and fairly smooth need not be plastered. The ends of all specimens not plastered are to be cushioned against plain board, compo-board or some similar material. This should be turned over after each test in order that the dented side may not be next to the specimen. Soft material, like sheet lead or felt, must not be used, because it will spread laterally and split the specimen. If difficulty is had with other materials on this account it is possible that a piece of tin inserted between the specimen and the cushion may be of advantage. Further experiment in this direction is desirable.

The manner in which a specimen breaks indicates the character of its end bearings. The first cracks should appear in the middle (not at the ends), and the ends should remain intact after the specimen has failed. Avoid coming down on the specimen at fast speed with a shock or jar. Use the medium-speed or the low-speed gear for testing. The report of the test will not be very valuable unless the operator is alert to note and report important details. Notes such as the following greatly increase the value of the report:

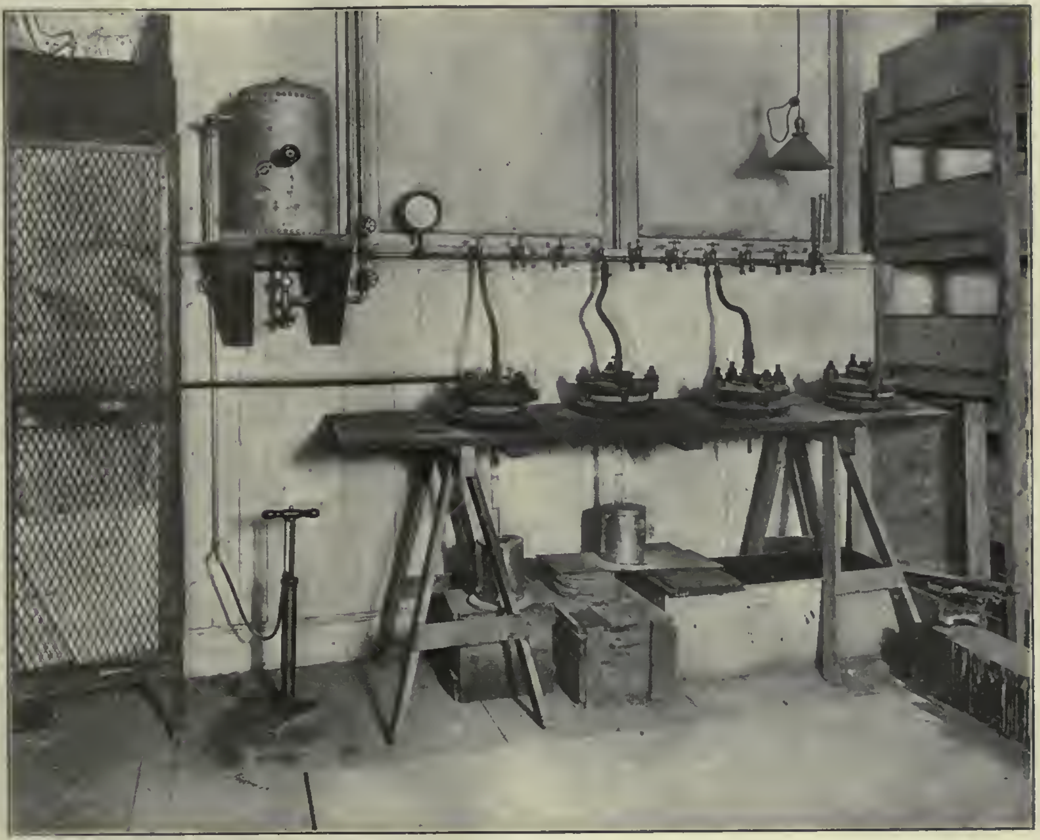
Specimen No. 2 had excess of stone at center. Concrete so wet that a fair sample could not be obtained.

Gravel sheared in specimen No. 3.

Mortar not bonded to coarse aggregate. Latter appears as if stones were surrounded with film of water during hardening of concrete.

Extreme cold injured specimens while stored on the work.

Gravel used contained considerable sand.



PERMEABILITY APPARATUS CONSTRUCTED BY PLUMBER FROM STANDARD SUPPLIES

A daily record of outdoor temperature should be kept in order that the cause of variations due to extremes of temperature may be known.

PERMEABILITY SPECIMENS

Mix the mortar according to directions accompanying the waterproofing compound which is to be tested. Make several specimens to be tested after 7 days and several more to be tested after 28 days. In no case make fewer than eight treated specimens and eight untreated specimens for comparison. Use extra clean, coarse sand (not Ottawa sand) for these specimens in order that the waterproofing compound may receive no assistance from silt in the sand. In the absence of different directions mix the mortar to the same consistency as herein specified for 2-in. cubes. Place the mortar in the 8-in. pipe sections in the same way as specified for the cubes. Specimens are to be ½ in. thick unless otherwise noted. The iron plates under specimens must be thoroughly greased. Strike off tops of specimens with a straight edge.

Store the specimens in moist air 24 hr., then brush both surfaces with a wire brush, mark and place in water until tested. Paint must not be placed on the surfaces which are to be tested. The specimen is not removed from the mold until after it has been tested. Upon removing specimens from the water, brush both surfaces again with a wire brush. Test under a pressure of 50 lb. per square inch for at least 7 hr. Some means must be used to prevent water from the outside from leaking into the measuring glass, since it has a tendency to follow down the outside of the outlet pipe.

Record results at 15-min. intervals. On the report show time elapsed from application of pressure to first leakage, average leakage for the time after specimen began to leak, and maximum leakage for one hour. Express results in cubic centimeters per square foot per hour.

REQUIREMENTS FOR FINE AGGREGATE

The specifications in the contracts for fine aggregate require "clean sand approved by the engineer." In order to reduce inspection to a definite standard the Division of Materials Inspection proposes that fine aggregate for concrete shall conform to the requirements in Table 2.

TABLE 2—MECHANICAL GRADING LIMITS—FINE AGGREGATE

Size of opening. (Square holes.)	Commercial number of sieve.	Limit of fineness (per cent passing). Not more may pass.	Limit of coarseness (per cent passing). Not less must pass.
0.20	4	100	95
0.10	8	95	85
0.042	16	75	40
0.021	30	50	20
0.011	50	30	2
0.006	100	6	..

Not over 6 per cent dry weight shall pass a No. 100 sieve when screened dry. Not over 10 per cent dry weight shall pass a No. 100 sieve when washed on the sieve with a stream of water. Both of the above tests shall be made and neither limit shall be exceeded.

The following test is for field use only: Not over 10 per cent by volume shall be silt when the test is made by decanting from test tubes, as previously described in standard-practice test 4 of fine aggregate.

Fine aggregate shall be of such quality that mortar composed of one part Portland cement and three parts fine aggregate by weight will show a tensile and compressive strength at least equal to the strength of 1:3 mortar of the same consistency made with the same cement and standard Ottawa sand. Fine aggregate shall not be dried before being made into mortar, but shall contain natural moisture.

Loss on ignition shall not exceed 0.1 per cent of the total dry sand by weight, nor 10 per cent of the silt obtained by decantation, as described in standard-practice instructions previously given.

REQUIREMENTS FOR COARSE AGGREGATE

Coarse aggregate for concrete shall conform to the requirements in Table 3.

TABLE 3—MECHANICAL GRADING LIMITS—COARSE AGGREGATE

Size of opening (square holes), in.	Limit of fineness (per cent passing). Not more may pass.	Limit of coarseness (percent passing). Not less must pass
2	...	100
1½	100	95
1	80	40
¾	60	25
½	40	10
¼	5	..

All broken stone aggregates must be so free from dust that samples caught as the material falls from the conveyor belt at the plant will be within the limit of fineness. All gravel must be thoroughly washed at the plant.

FIXING LIMITS FOR MECHANICAL GRADING

In deciding upon the limits specified in the mechanical grading of sand, the limits of fineness were modified from those given by various authorities to give a curve of the same general shape as the curve for maximum density. The object was to obtain a sand whose strength will equal that of Ottawa sand in mortar. The limit of coarseness was prescribed because a very coarse sand tends to produce a mortar which is not cohesive enough to prevent the separation of coarse aggregates. The values given are based on experiments, but are not considered to be exact enough to use as rigid requirements.

The limit for maximum size of coarse aggregates is fixed in the specifications at 1¾ in. The values given above are based on the assumption that ideal grading is a straight-line variation from maximum size of sand to maximum size of stone, as shown by experiment. Variations are permitted in order to meet practical conditions.

Alfred Craven is chief engineer, Robert Ridgway is engineer of subway construction and George L. Lucas is general inspector of materials for the New York Public Service Commission. R. E. Goodwin, who furnished the foregoing data, is in charge of the tests of concrete and concrete aggregates.

Dual Type of Brick Paving Aids Traffic on Grades

Smooth and Hillside Brick Sections on Same Street in Oakwood, Ohio, Accommodate Horses and Motors

BY USING two types of brick paving on a single street with a 4 per cent grade in Oakwood, a residential suburb of Dayton, Ohio, slow and fast-moving traffic has been automatically separated, wear distributed uniformly from curb to curb, horses provided with a secure footing on both uphill and downhill slopes, and accidents due to slipping of animals or skidding of vehicles practically eliminated. Farhills Avenue was one of the thoroughfares selected by K. B. Allen, city engineer, for the dual type of surfacing. The central trafficway is 18 ft. wide and is paved with standard wire-cut lug brick; the flanking routes are each 11 ft. wide and are surfaced with hillside brick, which, with its specially designed grooves, allows horses to haul loads up and down grade without danger of falling. This plan also was carried out on 30-ft. streets with an 8½-ft. hillside brick surfacing along each curb and a 13-ft. smooth roadway in the center.

Three Gangs Work Together

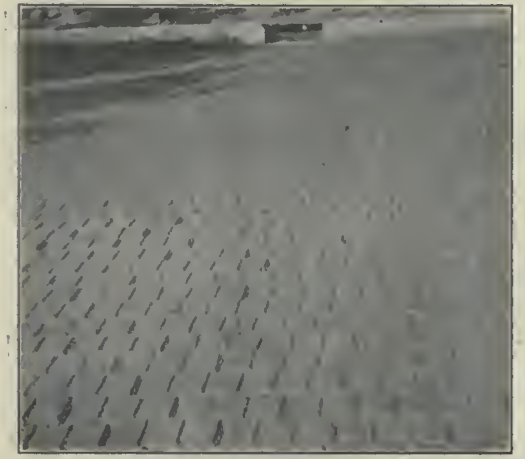
Considerable opposition to this type of construction developed on account of its novelty, and because the contractor and others assumed that the laying of the two kinds of pavement together would entail extra work and present costly constructional problems. Mr. Allen was confident, however, and the work began. Within a very short time the contractor confessed his entire conversion to the new plan. Three paving gangs could work at the same time. The sidehill brick, being laid longitudinally and not requiring batting, progressed faster than the center, in which the brick were laid transversely. Thus the hillside brick work was kept out of the way of the center gang, which had to bat the transverse courses in closing up the courses where they joined the hillside stretches. The batting was of the same nature as if it had been done against the curb, and it would have been necessary in any case.

Sometimes only two gangs of pavers were at work, but as the gang working on the hillside stretch made more rapid progress than did the men working on the smooth section it was possible to transfer the former from one side of the street to the corresponding hillside stretch on the opposite side, thereby expediting construction and keeping all hands busy all the time.

It was possible to lay the brick on the entire roadway in one-half the time, or one-third of the time, required for an ordinary brick pavement, because two or three separate gangs could be worked simultaneously.

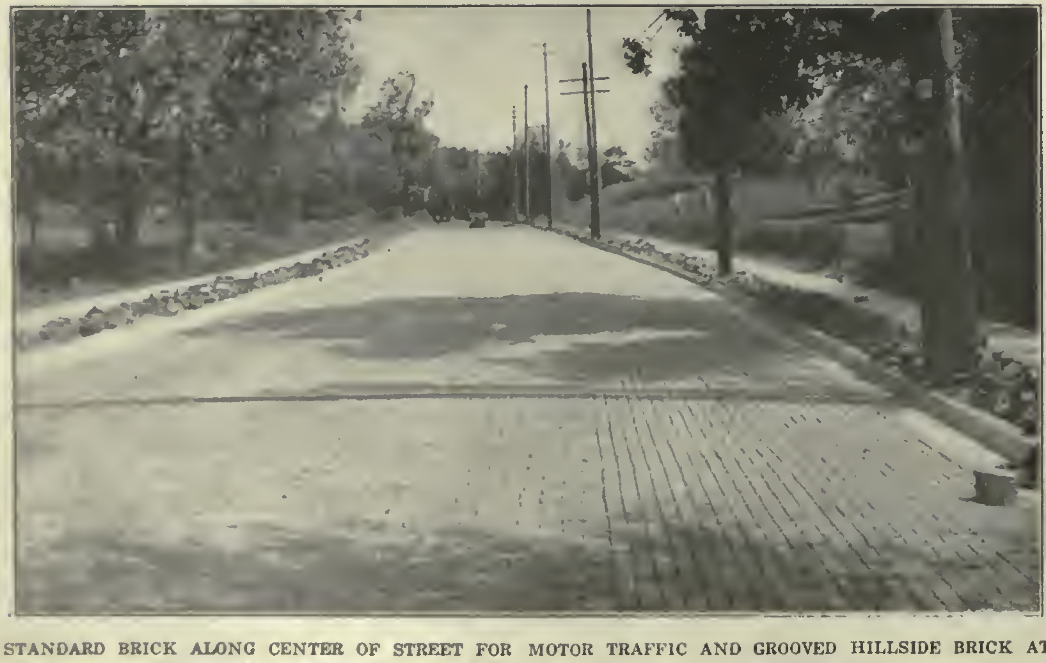
Grouting

In grouting this type of pavement the usual practice was followed on all sections, but in removing the surplus grout from the transverse grooves of the hillside brick the grout was swept from the grooves before it had attained its initial set, and just as it began to reach the thickening stage. By doing the sweeping at that stage the grout was removed from the grooves easily and completely.


FINISHED BRICK PAVEMENT WITH DUAL SURFACING IN OAKWOOD, OHIO

There has been laid in Oakwood 27,000 sq. yd. or 8000 lin. ft. of this type of brick pavement, using wire-cut lug brick made by the Hocking Valley Brick Company of Columbus, Ohio. Horse-drawn vehicles ascend the grade on one side of the street and descend on the other side, while motor vehicles keep to the smooth center. Thus, not only is traffic distributed so that all parts of the pavement, from curb to curb, are in constant use, but congestion of traffic is prevented. After two or three trips over the pavement, horses voluntarily seek the hillside stretches, and remain there, going easily up one side without slipping and trotting confidently down on the other side. Teams that are driven on the smooth central stretch as a test immediately swing over to the hillside brick for a secure footing. Thus, there are four separate and distinct lines of travel on these streets, the middle stretch being of ample width for ascending and descending auto traffic, and the sides dividing traffic between upgoing and downgoing horse-vehicle traffic.

HILLSIDE BRICK STRIPS WERE LAID FASTER THAN PLAIN BRICK


STANDARD BRICK ALONG CENTER OF STREET FOR MOTOR TRAFFIC AND GROOVED HILLSIDE BRICK AT SIDES FOR HORSES; VIEW TAKEN PRIOR TO GROUTING THE PAVEMENT

Advantages of Smooth and Rough Surfaces on Same Street.

The practical advantages of this type of surfacing have diverted traffic from a paralleling smooth brick pavement on a grade street which runs into the same loop with which the new pavement connects. The result has been a cessation of complaints arising from minor accidents caused by horses slipping and vehicles skidding on steep grades in bad weather.

Experience has shown that autos do not skid on the new pavement, either in wet weather or in the winter season. In the worst weather, it is claimed, autos can run over the hillside brick stretch with safety, nor do the transverse grooves of the hillside brick cause any inconvenience, as the grooves are so broken up that while a horse can readily find a grip for his toe calks, a broad tire runs over the pavement on a plane surface, without jolting.

Another reason, on streets occupied by traction lines the hillside brick keep horse-drawn vehicles off the car tracks. On grades, smooth wire-cut lug brick are used between car tracks and for 10 in. each side. The remainder of the street is laid with hillside brick. Actual service has shown that teams keep off the car tracks and walk right up the hillside brick stretches. There is no stopping to rest teams and no trouble in starting with loads, as the horses are sure of a foothold.

The specifications for the paving provided for a 6-in. concrete foundation, 1:3:6 mixture, a 1½-in. sand cushion, and a cement grout filler, 1 to 1 mixture, of cement and sand.

The work was done by Bigler Brothers, contractors, of Dayton.

THE COST OF POLICING New York City's Catskill Aqueduct during the course of construction amounted to $1,995,050.28 at the end of the year 1914. The police bureau was not organized until 1908, while the project was started in 1905. The sum spent on policing amounts to more than 1.6 per cent of the total money spent on the additional water supply project to the end of 1914.

Shore at Venice, California, Best Protected by Permanent Sea Wall and Low Groins

Report of Leeds & Barnard Discusses Coast Preservation Fully—Defective Bulkheads, as Well as Piers and Other Obstructions, Cause Damage

IN A REPORT on the best means of protecting the ocean front at Venice, Cal., against the action of the elements, the investigating engineers, Leeds & Barnard, of Los Angeles, have given an extensive discussion of the principal forms of protection. They hold that defective bulkheads themselves may contribute to erosion, while projecting piers and other obstructions, by arresting accretion that might otherwise replace the erosion. They advocate durable sea walls and long low groins for Venice, where the attractive beach is a valuable asset to the city, where breakwaters would destroy the beauty of the surf, and where high groins would break up the continuity of the beach. They emphasize the importance of proper design of the wall, with a curved and slightly overhanging outer face to turn the waves gradually and keep them from breaking over the wall, and a wide apron so that the returning waves will fall on the apron and not on the erodible beach in front of it. Following is a presentation of the report in somewhat curtailed form.

The damage to the waterfront in the city of Venice wrought by high tides, combined with storm conditions, and for which it is the purpose of this report to recommend measures of repair and future prevention, consists of two principal kinds—particular physical damage to abutting property, and general damage to the valuable reputation of the whole city as a seaside resort.

The immediate damage to property fronting on the beach is too fully appreciated and its amount and extent are too well realized by the owners to need any comment here. The future extent of this damage is impossible to estimate, unless an absolute protection from the direct action of the waves is devised, installed and maintained. The damage to the reputation of the city as a beach resort is less immediate in its consequence, but none the less real. It is evidenced by marked depreciation of high-priced beach-front property values, with corresponding depreciation of other city property values.

The physical damage done consists of the erosion of the bathing beach, the destruction of most of the concrete bulkhead and promenade, the partial or complete destruction of buildings and improvements, and the washing away of large parts of the lots between the ocean front and the Speedway.

CAUSES OF DAMAGE

Venice naturally has a smooth, gently curving beach, facing southwest. The prevailing swell in summer is from the west and northwest. At such times the beach builds naturally. In winter the heaviest storms come from the south and southwest, and it is the southwest storm waves in conjunction with high tides which seriously erode the beach. What are known as tide rips also occur at uncertain intervals and cause serious erosion.

The prime cause of this damage along the waterfront has been, of course, the combination of high tide and heavy seas described above. Several other causes, however, may have contributed to this, and will contribute to further damage, among which may be mentioned the following:

1. Bulkheads.
2. Piers and other artificial projections from the normal shore line.
3. The alignment and contour of the shore itself.
4. The nature of the material of which the coast consists.

BULKHEADS THEMSELVES CAUSE DAMAGE

These are in themselves a frequent and almost certain cause of damage to the beach, and agents of their own destruction, unless protected from the direct impact of the waves by a naturally or artificially maintained beach. During high tides and heavy on-shore gales, the waves strike the bulkhead and are suddenly stopped in their course. A large volume of water is thrown upward to a height depending on the depth of the water in front of the bulkhead. This, in falling back, cuts out the beach, carrying away the loosened material with the return wave. The beach thus becomes lowered, the depth of the water is increased, and the volume and force of the waves are augmented as the storm continues.

The destructive effect of the waves is also increased by the large quantities of water which, driven by the on-shore wind, fall on the roadway or ground behind the bulkhead, and saturate the same. This water of saturation increases very largely the pressure against the back of the bulkhead, which has been already weakened by the removal of the sand from the seaward side thereof. In the case of non-watertight concrete sheet-pile bulkhead this water of saturation joins with the water which has been jetted through the openings in the bulkhead by the impact of the waves, and escaping through the same openings, carries away the sand from behind the bulkhead and under the promenade, causing the collapse of the whole structure.

PIERS AND OTHER ARTIFICIAL PROJECTIONS

The prevailing littoral drift of the sand along this shore is toward the south. When the beach is in its natural condition this drift is not evident, for what is eroded from one spot is replaced by other material from just northerly thereof. If, however, a slight obstruction be made, the sand will be accumulated on the northerly side of it. On the leeward or southerly side the sand travel continues, but is not replaced by other sand, and a depletion therefore results.

This sand movement is due to the combination of a number of forces. Each wave which strikes the beach at a slight angle carries some of the sand up the beach diagonally, dragging it straight down the beach again, to be again carried diagonally up the beach and be again dragged straight down the beach. Each particle thus progresses along the beach in a zig-zag fashion.

In addition to this there will be found intermittently a trough in the beach, parallel to the beach front and a short distance below low water line. The sand which is dragged down the beach by returning waves is carried along parallel to the beach in this trough by the littoral current. This trough is found only at certain times, and for this reason the littoral sand movement is not as pronounced here as in some places on the Atlantic seaboard, where such troughs are more continuous. This shows, however, how essential it is that any groins constructed should be carried out to a point beyond this trough, and must be especially strong at the outer end.

SAND EROSION AND ACCRETIONS

Wherever the waves are broken up and the water is quieted, this sand travel along the coast is interrupted, and an accretion of sand results. The more complete the interference, the greater will be the accretion. This may be seen in the shelter of every pier along this shore, the greater the number of piles or other obstructions, the more sand being collected.

When storms occur with a gale blowing from another quarter than that of the prevailing winds, the influence of the projections mentioned above is changed or even reversed, and where filling normally takes place, cutting results, and vice versa.

The effect of an outlying reef in shoal water can be seen in frequent instances by an inspection of the coast line. The action of such a rock or reef is to create a quiet area under the lee of the reef. The shore being protected from the waves (which form the principal factor in sand travel) there is no power to move the sand along, unless there be a strong current.

ALIGNMENT OF SHORE AND NATURE OF MATERIAL

The same processes mentioned above, as occasioned by artificial projections from the coast line, are also occasioned by certain sharper natural projections of the coast itself. In addition to this, submerged valleys and shoals influence the force and direction of shore currents and so affect the erosion and accretion of material making up the beach.

The nature of the material has much to do with the rate at which erosion may take place. In the case of steep sand beaches, material is cut away to depths of several feet over considerable stretches of beach, in a single storm. Where the beach is underlaid with clay or rock, it is often scoured to this substratum and further erosion is checked thereby.

The beach material along Santa Monica Bay is undoubtedly the result of the erosion of the cliffs to the northward, toward Point Dume.

PREVENTING OR REPAIRING DAMAGE

The approved methods of preventing or repairing coast damage are of four principal kinds: (1) Sea walls or bulkheads, parallel to the shore and situated about the high-water line, or even farther seaward, in the case of recovery or protection of streets or promenades; (2) groins, or projections across the beach from above high water to or below low water; (3) breakwaters or reefs, parallel to, and connected by spurs with the shore, and (4) beach revetment, or slope protection between high and low water.

The purpose of sea walls or bulkheads is to protect low-lying lands from erosion and inundation by the sea, to preserve the cliffs where land above is of sufficient value to warrant the cost of the protection, and, at seaside towns, to hold up the roads and promenades along the shore and protect them from damage by waves. The profile of the wall should be such that the waves will be reflected and not break directly against the wall. It should also guide the wave so that in returning it will not fall behind the wall or at its foot.

A sea wall, or bulkhead, should ordinarily be placed at or above the line of ordinary high water. On the other hand a properly designed and well constructed sea wall may, if the additional expense be justified, be placed seaward of this line in order to provide additional land behind the sea wall for roadways or promenades.

At Venice the line of normal high tide under existing conditions lies back of the line of the now destroyed concrete bulkhead. This condition must be recognized in planning any shore protection at this location.

SHAPE OF WALL IMPORTANT

A sea wall or bulkhead almost always induces scour at the toe. This is the more true the more nearly vertical the wall is. The waves strike the vertical wall with great force and throw great masses of water into the air, and this, falling at the toe of the wall, loosens and scours out the material, which is carried away by the waves. When the wall is inclined the force of the wave stroke is decreased. There is still a tendency to scour, however, from the back wash of the waves.

The top of the wall should have a slight coping to turn the wave seaward, rather than allow it to be thrown straight up and then be blown on to the promenade. The best form of sea wall is one which has a curved face. This, instead of opposing a flat perpendicular face to the direct impact of the wave, guides the wave from the beach to the wall in the easiest manner possible and rolls it upward and backward. The projection of the upper part should be only just sufficient to deflect the upward wave out from the wall. As the water falls it is received again on the curved face, which extends far enough to the front to prevent scour, and delivers the return wave parallel to the surface of the beach, without disturbing the same.

This necessity for an extension or apron in front of the wall is evident from the experience at numerous places, where subsequent to the construction of the sea wall, either groins or an apron had to be added to stop further scour.

Timber walls or bulkheads are used where a less expensive and more temporary construction is desired, because property values will not warrant a more expensive and permanent type, or in the absence of a determination of the final location of a permanent structure. Such timber bulkheads cannot be so constructed as to present as favorable a profile to the action of the waves as can sea walls, and are generally constructed in a nearly vertical position. Under such conditions they are not to be recommended even for temporary construction, except where the beach can be maintained reasonably close to its normal level. On the other hand, it must be admitted that the great resiliency of wooden construction in resisting wave impact is a strong argument in its favor.

PURPOSE OF GROINS

The purpose of groins is to build up a beach or maintain it at a given level by catching and holding the littoral drift. Groins are of three classes: (1) High, substantial groins placed at short intervals; (2) less expensive, low groins, rising only a short distance above the beach; (3) single, longer, permanent structures, to accumulate material over considerable length of coast.

High groins tend to bank the beach material high up on the windward side and leave it far below this height on the leeward side, thus offering considerable obstruction to travel along the beach. To build up a depleted beach uniformly without interfering too much with the use of the beach, low groins of the second class are more satisfactory. A jetty extending for several hundred feet out to sea constitutes a groin of the third class, and will tend to build up the beach for a considerable distance on its windward side. This is usually of more permanent construction.

PURPOSE OF BREAKWATERS

The purpose of parallel breakwaters, as their name indicates, is to break the force of the waves, producing comparatively quiet water between them and the shore. In order that these breakwaters shall not be undermined and damaged in heavy seas, they should be located at or seaward of the line of formation of breakers, as it is at this point that the sand movement due to wave action becomes considerable.

Beach revetment, which has been used to a great extent in Holland and elsewhere for the protection of embankments, consists simply in facing the slope with some form of wood, concrete or other protective material. Because of the flat slope necessarily given to this form of protection it occupies a great width of beach. For this reason, and because of its appearance, it is not believed suitable for use at Venice.

There may be numerous other devices which have been proposed for shore protection, but others than the ones above mentioned have not proved successful.

METHODS APPLICABLE AT VENICE

We will now consider the applicability to Venice conditions of the three types of protection (breakwaters, sea walls and groins). For convenience breakwaters will be considered first.

It may be stated in favor of breakwaters that if the interval between them is not too great in proportion to their length they would undoubtedly thoroughly protect the beach. The probability of the growth of the beach behind the breakwater is not so easy of determination, however. Breakwaters should be built of large random rock, laid on a mattress of smaller rock, with a wide base and slopes flat enough to give reasonable assurance of the stability of the structure. Too flat slopes will entail very great expense, whereas too steep slopes will result in the top being constantly damaged in storms, and extensive replacements will be made necessary.

Such a breakwater as is considered safe would have a top width of 10 ft., a slope of 1 on 2 on the sea side and a slope of 1 on 1½ on the land side. The top should be at least as high as a high-water level. A careful analysis shows that such a breakwater should cost in the vicinity of $120 per linear foot of breakwater, or $80 per front foot of the beach.

It must be foreseen that the benefit to be derived from protection by breakwaters would fall very unequally on the beach front. The sections of the shore directly behind the breakwaters would be much more protected than those directly behind the gaps between the breakwaters. Furthermore, the beauty of the waves breaking on the beach would be lost. Even with such protection some form of sea wall or bulkhead will be necessary to maintain the walk and property behind it. This would add probably $10 or $20 per linear foot of beach, making the total cost of such protection about $115 per front foot. Because of the expense, the inequality of the protection and the loss of the beauty of the surf this type of protection is not believed advisable.

GROINS

High, short groins we do not recommend in this case, as they obstruct the beach and would not be adequate in this location. Low groins are the most common type, and the best under conditions such as those at Venice, particularly where it is desired to interfere as little as possible with the use of the beach for bathing and pleasure. If properly designed and maintained there is little question of their success. The cost of these low groins should be about $2 per linear foot. As they are usually spaced at an interval of about twice their length their cost per front foot of beach protected should be about $1. Using creosoted material throughout would bring the cost up to about $1.50 per front foot of beach.

Long permanent groins are designed to cause the accumulation of beach material for a considerable distance. They should extend oceanward far enough to intercept all littoral drift. They should be located at intervals of about a third of a mile. In the absence of a survey below low water mark, it is believed that 400 ft. will be a sufficient length to intercept the littoral drift. This would make the cost approximately $2.50 per front foot of beach protected.

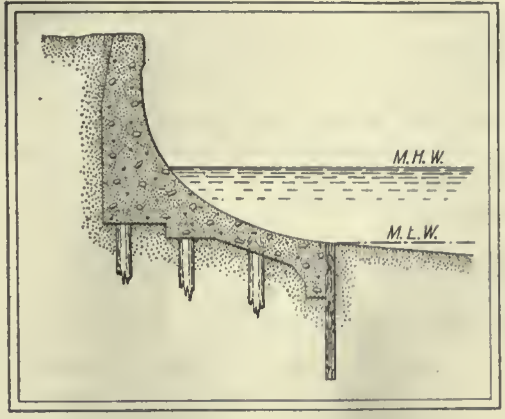
NEITHER GROINS NOR SEA WALLS ALONE ARE SUFFICIENT

Concerning sea walls and groins it should be understood that neither by itself alone is sufficient. A sea wall protects the ground back of it from destruction, but by the obstruction which it interposes to the waves always tends to lower the beach in front of it. By a proper design of its cross-section this tendency may be minimized, but a sea wall certainly will never build up a beach.

Groins, on the other hand, by arresting the littoral travel of the sand, tend to build up the beach and extend the same seaward. This cushion of sand collected in summer is, however, never sufficient of itself entirely to protect the shore against the inroads of the storms in winter.

The excellent beach at Venice with its beautiful surf is one of its greatest assets. Effort should therefore be made to protect it from further erosion and to extend it seaward. The present accumulation of sand northward from the Del Rey jetties shows what may be done. By the construction of other permanent groins northward, the beach may be built out progressively.

These groins must be long enough to cross the trough which intermittently forms parallel to the beach, and along which the greatest sand travel occurs. They should be constructed of rock, and thus will be secure against destruction from storms. The outer ends will be the most subject

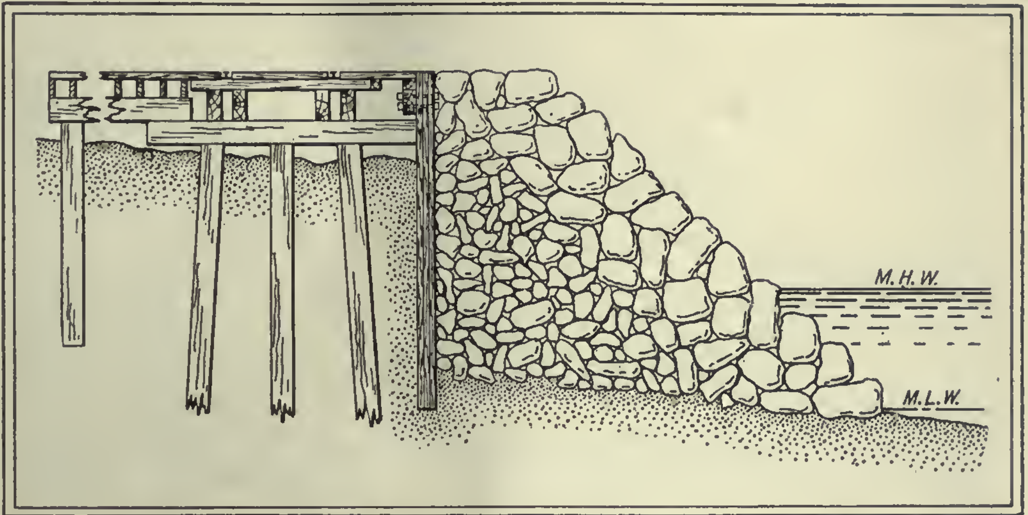


CONCRETE SEA WALL IS MOST DURABLE

to attack, and hence should be made stronger. Any tendency to scour under them will be promptly counteracted by the stone settling in place.

Probably Three or Four Groins Are Needed

As they extend so far seaward, their influence will be correspondingly greater than shorter groins, the volume of sand collected will be greater and the distance between them can be much greater than with shorter groins. Consequently they will not disfigure the beach. The number necessary can be better determined after a detailed survey of the beach, but three or four will probably be sufficient. They should be low to allow the waves to pass over them.



RANDOM ROCK WALL IS EASILY REPAIRED BY REPLENISHMENT AT TOP AS BOTTOM SETTLES

The most southerly groin should be constructed first, and after the pocket formed by it has filled with sand, then the next, and so on. Otherwise the northerly groin will catch all the sand and those south thereof will be useless.

In order to afford early protection to the section previously damaged, however, it would probably be advisable to build first a short permanent groin at about the southerly limit of the beach erosion which took place in the storms of the last two winters. This can later be extended to a length equal to the others.

Sea Wall

To hold the shore line it is necessary to construct a sea wall. This is ordinarily placed at or above high water. Since the line which it is desired to hold at Venice is in some places seaward of high-water mark, it is the more necessary to construct a substantial sea wall, and this must be stronger in this location than if placed farther back.

It is good practice, wherever possible, to found the sea wall upon some solid material, such as clay, shale or hard pan. At Venice there is apparently no suitable foundation at an economical depth. Accordingly it is proposed to found the concrete sea wall on piles, as was done at Galveston. This will be amply strong. Should subsequent investigation show the existence of a good foundation at a less depth, the cost may be decreased. Sheet piling, which will be necessary during the construction, will be used as a form, and will then be simply sawed off at the toe. This will serve as an added safeguard against undercutting, should any unusual storm lower the beach level before the groins have had time to accumulate sand in front of the wall.

Sheet-Pile Bulkheads Inadequate

The only safe shore protection is a wall on a sound foundation sufficient of its own weight to resist the onslaught of the waves. For this reason any form of sheet-pile bulkhead is believed adequate. Such a bulkhead must be absolutely watertight and be driven deep enough to be certain of not being underscoured. It should slope at least 45 deg. and should go several feet below low-water line. It will be noted that the concrete apron of the sea wall that is recommended extends 4 ft. below low-water line, exclusive of the sheet piling. The probable scour with an incline sheet-pile bulkhead would necessitate going deeper than that.

Another serious objection to concrete sheet piles is the abrasion during storms by the shingle or pebbles thrown up by the waves. There has been noted an erosion 1½ in. deep in the old reinforced-concrete sheet-pile bulkheads, caused by the gravel thrown against it. This is sufficient to expose the steel reinforcing rods. It is evident, therefore, that any reinforced-concrete slabs exposed to the beach section would last but a few years. Where once a weak point in a bulkhead fails, letting the sea in, it is but a short time until the damage extends.

With a sea wall of gravity section there is no such danger. If the concrete be made of cement of the proper chemical composition, there is no danger of its chemical disintegration by sea water. Where concrete sea walls have apparently suffered from the action of the sea water between high and low tide, the damage has been due not to chemical disintegration of the concrete by the action of the salt water, but to the saturation of the concrete surface, with alternative freezing and thawing of the contained water, the resultant contraction and expansion of which mechanically destroys the face of the wall. Needless to say, this trouble will not be encountered in Southern California.

Proposed Concrete Wall

The proposed concrete wall at Venice embodies the best principles of sea-wall design. It has an elliptically curved face, which is the natural form of the wave, and is therefore best suited to changing the motion of the water from horizontal to vertical. At the bottom the curve is tangent to the slope of the beach. It therefore guides the wave from the beach to the wall and vice versa with the least possible disturbance.

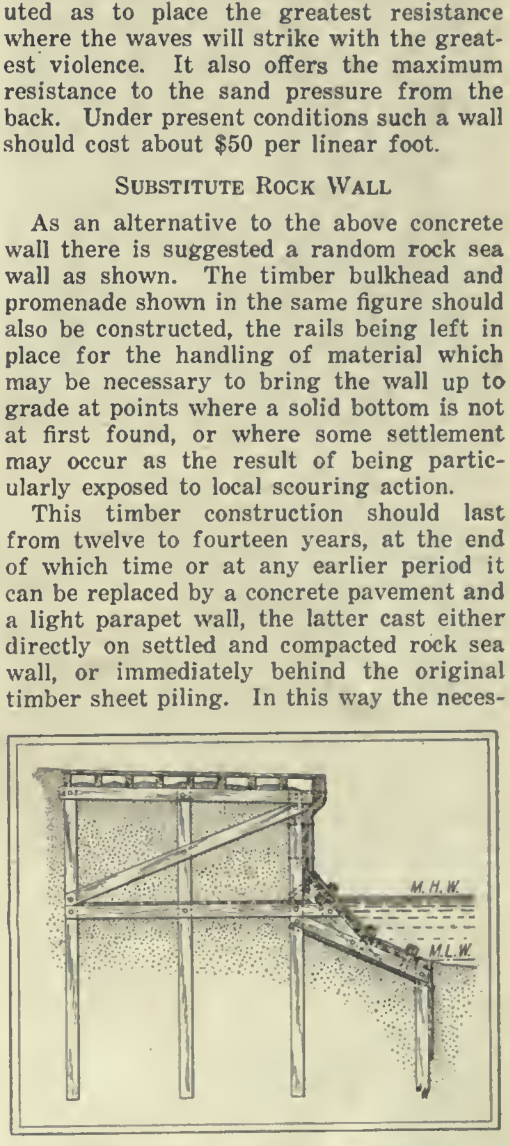
Above the curve the wall slopes slightly backward, but has a slight coping at the top, just sufficient to prevent the wave being thrown upon the promenade back of the wall. This coping is carefully designed to turn the wave so that it shall fall on the apron, rather than on the beach in front of the wall. Scour of the beach at the toe of the wall will therefore be eliminated. To prevent undermining of the wall by a lowering of the beach in any exceptional storm, the sheet piling necessary during construction will be cut off at the toe and left in place.

The mass of the concrete is so distributed as to place the greatest resistance where the waves will strike with the greatest violence. It also offers the maximum resistance to the sand pressure from the back. Under present conditions such a wall should cost about $50 per linear foot.

Substitute Rock Wall

As an alternative to the above concrete wall there is suggested a random rock sea wall as shown. The timber bulkhead and promenade shown in the same figure should also be constructed, the rails being left in place for the handling of material which may be necessary to bring the wall up to grade at points where a solid bottom is not at first found, or where some settlement may occur as the result of being particularly exposed to local scouring action.

This timber construction should last from twelve to fourteen years, at the end of which time or at any earlier period it can be replaced by a concrete pavement and a light parapet wall, the latter cast either directly on settled and compacted rock sea wall, or immediately behind the original timber sheet piling. In this way the neces-



TIMBER IS EFFECTIVE BUT LESS DURABLE

sary settlement and solidifying of the sea wall would be provided for and a considerable saving effected in first cost.

This wall has much to commend in its flexibility, low cost and ease of maintenance. By flexibility is meant the power to adjust itself to any local scour which may take place from time to time. In the case of any rigid construction, such as a concrete wall, unless a solid natural foundation is reached or an expensive pile foundation driven, an undermining of the wall might result in the failure and destruction of a considerable part of the wall, with resultant damage to property and heavy expense for reconstruction. With a wall of random rocks this could never occur, as scouring at the base of the wall would only make the rocks settle more firmly into place, offering additional protection to the bulkhead and walk in its rear. Repairs could be made easily and inexpensively by placing additional rock on the top of the wall from cars placed directly where needed on the track remaining in the promenade floor. The cost of such a wall should be about $40 per linear foot, including pile-supported walk.

Timber Sea Wall

Should even the rock wall be deemed too expensive a timber wall such as is shown in cross-section may be used. A wall similar to this has been recommended by the New Jersey Harbor Commission for the protection of the New Jersey beaches. It will be noted that it is really the adaptation to timber construction of the principles embodied in the design of the concrete sea wall recommended in an earlier paragraph. It has longitudinal waling places on the face which serve to break up the return wave and prevent scour at the toe. It has the advantage of resiliency of timber which concrete does not possess. Additional stability is obtained by the placing of the middle horizontal brace opposite the point of greatest wave shock. The platform on this brace gives to the wall the added weight of the superimposed sand. This timber wall should cost about $30 per linear foot. It should be noted that this includes a board walk 20 ft. wide. The life of this timber sea wall should be about 12 years.

Conclusions and Recommendations

After a careful and thoughtful study of all phases of the problem of the protection of the water front at Venice, we make the following recommendations:

1. That a sea wall of one of the three above recommended types be immediately constructed along the line of the old concrete bulkhead. The most satisfactory type will be a concrete sea wall of gravity section. A cheaper but equally safe type is the random rock sea wall. The timber sea wall will give equal protection, excellent appearance and less cost. Its main disadvantage is the necessity of its later renewal.
2. That a permanent groin about 300 ft. long be immediately constructed at the southerly limit of the erosion in last winter's storms. This groin should be lengthened later.
3. That long, permanent groins be successively constructed from Playa del Rey northward, at intervals of about one-third of a mile.
4. That the conditions at Windward Avenue be improved as much as possible immediately. To accomplish this all unnecessary piling under the various structures should be removed. No renewals should be allowed except those of a permanent nature, driven in accordance with a complete plan to be designed for the entire pier and adjacent structures. The intake pipe should also be relocated, so as not to interfere with the littoral drift. After the substructure of the pier and adjacent buildings has been, in the regular course of maintenance and renewals, reconstructed on permanent lines as above indicated, the breakwater should be entirely removed.

Mammoth Screw Pumps of New Design Develop High Efficiencies for Low Lifts

Performance of New Units Installed at New Orleans Drainage Station Exceeds Expectations During Recent Tests—Power Consumption Decreased

Relatively high efficiencies, with particularly good discharges at low working heads, were shown in the recent tests of the new Wood screw pumps installed by the Sewerage and Water Board of New Orleans to increase the capacity of the drainage stations. The tests were made on Sept. 27 and Nov. 24, 1915, and demonstrated that the new form of pump, designed by A. B. Wood, engineer of the Board, and now patented by him, is superior to the older units. The noteworthy advantage of the new screw pump, which differs from the older screw pumps in having a 12-ft. screw placed at the top of the siphon instead of being submerged, is found in the relatively high discharge per horsepower at low working heads—a very essential requirement in times of flood. The following is taken from information furnished by George G. Earl, general superintendent for the Board, and from a report of test made for the Board by W. H. P. Creighton.

ONE NEW PUMP DISCHARGING AGAINST PARTLY CLOSED CONTROL GATES

General Description of Pump

The pump tested is one of the eleven similar units installed or to be installed in the various drainage stations for pumping the storm drainage of the city of New Orleans. The pump proper, shown by Fig. 1 and the photographs, consists of a cylindrical casing, 12 ft. in diameter and 13 ft. 9 in. long with its axis horizontal, and containing the impeller, or moving blades, and the stationary or diffusion blades. The diffusion blades are mounted in a watertight cone-shaped housing, within which is located a self aligning main bearing and a marine type thrust bearing. The inner cone is 8 ft. in diameter at the larger section and is reached through an oval-shaped watertight manhole opening through the top of the pump. In this way, this inner cone or chamber is at all times accessible for inspection or adjustment of the bearings during the operation of the pump.

On the suction side the pump is connected to a cast-iron 45-deg. bend, through which the shaft, provided with the proper stuffing box, extends and beyond which the riveted steel casing increases in cross-sectional area to 15-ft. in diameter at the lower end. Between the stuffing box on the pump and the 600-hp. motor, there is another bearing and a flexible coupling. The discharge pipe is also of riveted sheet steel, bolted to the pump casing, and contains a 45-deg. bend and sections of uniformly increasing diameter up to 15-ft. at the lower end.

Corrections In Testing

As the tests could not be made under normal conditions of operation certain artificial conditions had to be created. The water on the suction side of the canal was allowed to accumulate by not pumping every day. To secure the necessary lift, the gates controlling the direction of discharge from the new discharge basin were almost entirely closed, so that in the basin an artificial discharge head of any desired height could be obtained by increasing or decreasing the opening of the gates, which are of the partially-balanced ships' rudder type, operated by hydraulic pistons.

Under these artificial conditions, when the water on the suction side was higher than on the discharge side, there was a slight leakage of water through all the gates and valves of the old station, found to be 1.83 cu. ft. per second. When condi-

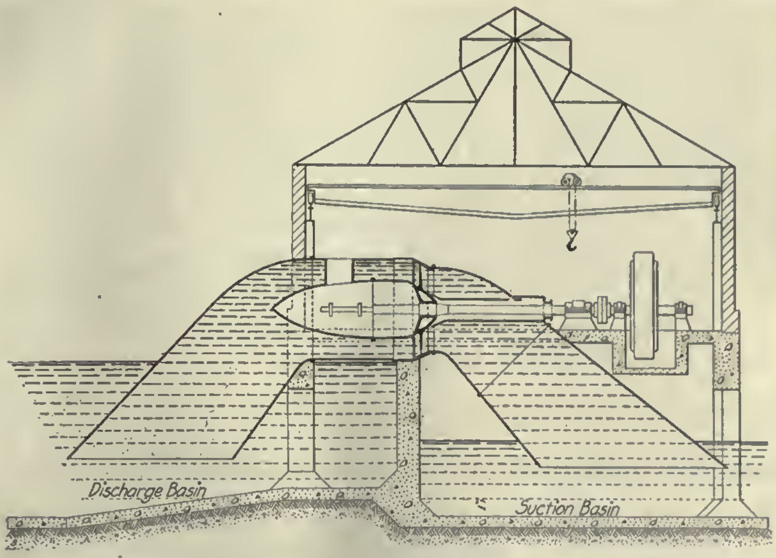
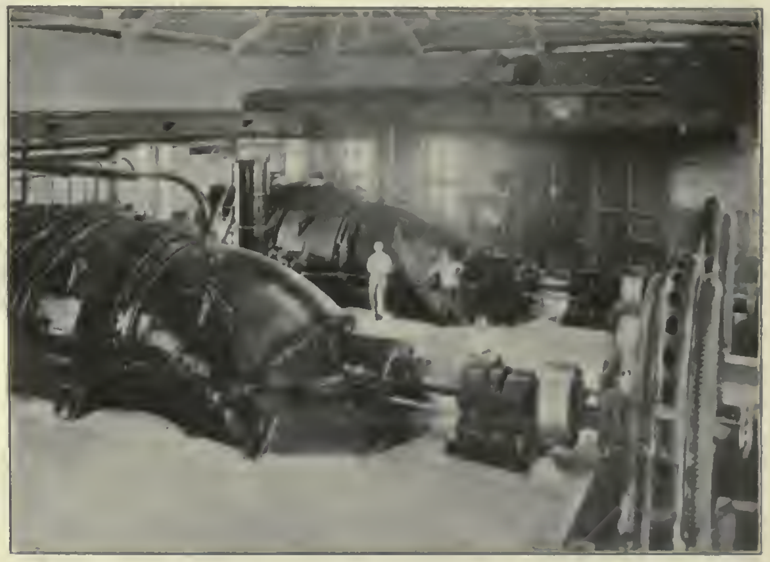


FIG. 1—DIAGRAMMATIC SECTION THROUGH NEW PUMP



INTERIOR VIEW OF PUMPING STATION WITH TWO NEW UNITS

tions are reversed, the amount of leakage becomes uncertain, but it could not be less, especially during the latter part of the test when the difference of head is greater and the water tends to press the gates from their seats.

A more important correction, which could be quite accurately measured, arose also from the artificial conditions necessary. The water was discharged into an empty canal 3 miles long. As the length of the water flow increased the head necessary to cause the flow at the pump end increased, which resulted not only in a constant increase in the area of the water cross-section at the measuring platform 600-ft. from the pumping station, but also in a reservoir of water of increasing volume, which had been discharged from the pump and did not pass the measuring station during the time the Pitot tube traverse of this cross-section was being made. This reservoir effect was considerable until the pump at the other end of the canal was started, and the water level of the canal assumed a nearly constant slope.

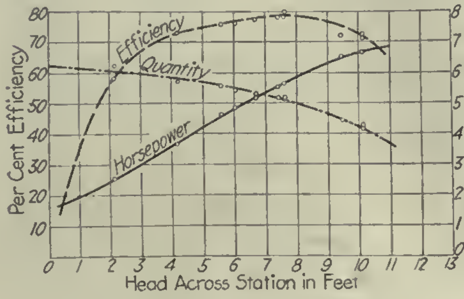


FIG. 2—TESTS OF 12-FT. SCREW PUMP

RESULTS OF TESTS

The result of one test shows that the pump raised 559 cu. ft. of water per second through a height of 5.572 ft., and 519.8 cu. ft. of water per second through a height of 7.6 ft., the pump making between 75 and 76 r.p.m. as driven by the 600-hp. synchronous motor, and the efficiency varying between 76 per cent and 80 per cent. The specifications required a maximum delivery of 550 cu. ft. of water per second, through a lift varying from 5 to 9 ft. when the motor was making 75 r.p.m. The efficiency expected was 70 per cent. The pump not only shows a remarkably high efficiency at the higher lifts, but uniformly high efficiency at varying lifts.

The curves in Fig. 2 show the characteristics of the new pump as shown by the tests, when working at the constant speed of 75 r.p.m. Figs. 2, 3 and 4 are plotted with lifts instead of quantity as abscissas, because for low lift pumps this brings out the essential characteristics more clearly. The efficiency curve of the new 12-ft. screw pump is practically the same as the calculated curve. It is also substantially the same curve as was demonstrated in the 30-in. pump of the same type, which was originally built and very thoroughly tested before the 12-ft. pumps were contracted for.

Fig. 3 shows the comparative efficiency curves, and the relation between the old and the new pumps. The new screw pump, which gives its best efficiency at 7 to 8-ft. lift, shows a higher efficiency than the best of the old pumps at its best point, an 11-ft. lift. Fig. 4 shows the discharge in cubic feet per second per applied brake horsepower for the 75 r.p.m. wood screw pumps, and for the groups of pumps considered in Fig 3. The best one of these old pumps, measured in this way, adds only 50 per cent to its capacity per applied horsepower as its lift drops from its point of maximum efficiency down to zero, while the new screw pump increases its capacity per applied brake horsepower 300 per cent from its lift for maximum efficiency down to zero.

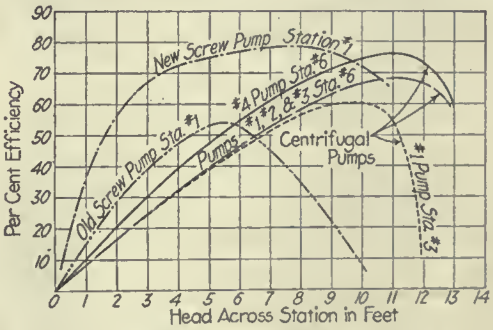


FIG. 3—COMPARATIVE EFFICIENCY CURVES

COMPARISON WITH CENTRIFUGAL PUMPS

The tendency to increase the quantity of water discharged at constant speed of operation as the lift decreases from the point of best efficiency exists in both types, and is slightly greater in the centrifugal pump; to do this, however, the centrifugal pump frequently requires a constantly increasing applied horsepower, with the result that its power requirements must be applied with an especial view of meeting the overload which its lack of efficiency at its lowest lift produces. The new screw pump, on the other hand, when operating at a constant speed, shows a rapidly decreasing power demand as its lift decreases, and while it still maintains an increasing discharge it only uses its maximum power at its maximum lift.

In a system operated electrically from a power station at constant speed, as exists in New Orleans, with power and pump capacity designed to give the required output under those low lift conditions which require the greatest quantity of discharge, the power required to operate all units will be much less with screw than with centrifugal pumps; and since, as the lift increases the available flow approaching the station decreases and less pumping units have to be operated, the power required to operate the pumps at a low lift will still suffice to operate enough units as the lift increases to take care of the decreasing flow. With pumps driven by power units capable of some speed variations, the characteristic of the screw pump is such that available power can be utilized at an increased speed at lifts far below the rated lift without the serious sacrifice of efficiency which an increase of speed entails with centrifugal pumps.

ADVANTAGES IN FLOOD TIMES

The function of a drainage pumping station is to maintain the water level on its suction side lower than the water on its discharge side. When it has just ceased to do this it really becomes an obstruction instead of an asset, and its crucial test is its capacity to discharge more and more water with less and less power per unit as the lift per unit discharged de-

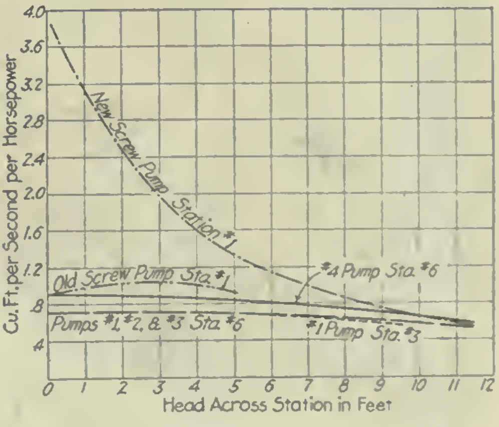


FIG. 4—COMPARATIVE CAPACITY CURVES

creases and the necessity to pump, therefore, is most urgent. Just at the most crucial point when many pumping stations begin to act as an obstruction, because of the water being at the same level on both sides, from three to five times as much water per applied brake horsepower can be disposed of with pumps having the characteristics of these new pumps as with pumps having those indicated in the diagram for the earlier pump installations in New Orleans, or with the best design of centrifugal units.

The experience heretofore at New Orleans has been that during great storms, when lifts were much below the rated lift, the older forms of pumps overloaded their motors and also overloaded the power stations, so that all pumping station units could not be maintained in service. With the eleven additional screw pumps and less than enough additional power to operate them at their rated lift, because the flow at rated lift can never supply all pumps, this condition will be reversed, and the decreasing amount of power required to operate the new pumps, as their lift decreases, will more than compensate for the excess amount required by the old ones when their lift decreases and the necessity to pump is greatest.

In connection with the tests of the new screw pumps, and in comparing their efficiency with the efficiencies frequently quoted, especially on centrifugal pumps, it should be remembered that the lift in this case is measured from still water in the suction canal to still water in the discharge basin. Thus no credit is given to the pump for the friction in the suction and discharge pipes and the lost head both at the entrance of the suction pipe and at the exit from the discharge pipe, all of which losses are eliminated in tests which credit the pump with the efficiency indicated by piezometer heads taken on each side of the pump itself.

ADVANTAGES IN OPERATION

In order to start the submerged pumps of the older installation with synchronous motors, it was necessary to have telephone communication with the power station and to slow down an engine and bring the pumps up to speed gradually, and when in synchronism to throw them over to the operating bus. This was a tedious and delicate operation not always successfully accomplished on the first trial, and much time was lost in its accomplishment just when this time was of the utmost importance.

In designing the new extensions it was recognized that the new pumping units must be as large as possible and their method of starting more simple and certain than that above described if they were to be of the greatest possible use. By adopting screw pumps there was precedent for much larger units than have ever been built in centrifugal pumps, and by setting these screw pumps in the summit of the siphon they can be started in an empty case by the mere throwing in of a switch, after which the air is exhausted from the pump case, and the pump takes its load gradually without any telephoning to the power station or any chance of being put out of step.

The new pumps were designed for the Sewerage and Water Board of the city of New Orleans, of which George G. Earl is general superintendent and Alfred Raymond, general manager of drainage, by A. B. Wood, mechanical engineer, who holds patents covering this type of pump. The manufacturer was supplied with all shop and detailed drawings. The pump castings and parts were manufactured and erected by the Nordberg Manufacturing Company, of Milwaukee, Wis. The motors were manufactured and installed by the Allis-Chalmers Manufacturing Company, of the same city. The tests were made under the supervision of W. H. P. Creighton, dean of the department of technology, Tulane University. S. G. F. Haas had charge of all preliminary tests and worked out the results of the tests, and assistant engineer Louis C. Frantz had charge of the electrical calculations and observations.

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For the Civil Engineer and Contractor

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Experiments on the Distribution of Vertical Pressure in Earth. By R. B. Fehr and C. R. Thomas. Bulletin 8, Engineering Series, Pennsylvania State College. Paper, 6 x 9 in.; 75 pages; illustrated. State College, Pa., Pennsylvania State College Engineering Experiment Station.

The Architects' and Builders' Pocket-Book. A Handbook for Architects, Structural Engineers, Builders and Draftsmen. By the late Frank E. Kidder. Compiled by a staff of specialists; Thomas Nolan, professor of architectural construction, University of Pennsylvania, editor-in-chief. Sixteenth edition, rewritten. Flexible leather, 4½ x 7 in.; 1816 pages; illustrated. New York, John Wiley & Sons, Inc., $5 net.

Proposed Standard Schedule for Grading Cities and Towns of the United States with reference to Their Fire Defenses and Physical Conditions. Prepared by the National Board of Fire Underwriters. Flexible leather, 5½ x 9 in.; 61 pages. New York, National Board of Fire Underwriters.

Books Reviewed

Railway Maintenance Engineering

Author, William H. Sellew, non-resident lecturer on railway engineering, University of Michigan. Cloth, 5 x 7½ in.; 360 pages; 194 illustrations; 6 folding plates. New York, D. Van Nostrand Company. $2.50 net.

REVIEWED BY A. F. COMSTOCK

Associate in Railway Engineering, University of Illinois.

The unabridged title of this book is "Railway Maintenance Engineering with Notes on Construction." The reader, after viewing this heading and reading the preface, naturally expects to find the subject of maintenance-of-way adequately covered. In this expectation he is likely to be disappointed. Maintenance organization, which is certainly one of the vital problems of the maintenance engineer, has not been touched upon. The important subjects of track inspection, and of reports, records and accounts are also among those missing. Besides these errors of omission, there are two other prominent defects; one is the sketchy and apparently hurried treatment which characterizes the fifteen chapters; the other is the small and inappropriate size of book. The latter stricture has given the book a general appearance of mediocrity; and small, indistinct half-tones have robbed the illustrations of much of their potential value.

The usual claim that the book is suited to the needs of both students and practical engineers, is made in this case; but the reviewer feels that neither viewpoint has been well preserved. Thoroughness and breadth have been sacrificed to variety and haste. For instance, in referring on page 219 to "Section Work," this typical sentence occurs, constituting, by the way, almost the sole reference to section organization: "The length of a section, or the track under each foreman, is in the neighborhood of 3 or 4 miles of line, but may be considerably larger on lines where the traffic is light." Such radical condensation is especially unwarranted in view of the relatively large space given to the last two chapters on the minor subjects of "Icing Stations" and "Signals and Interlockers." Substantially one-fifth of the entire 350 pages of text is devoted to these two topics. The chapter on "Signals and Interlockers," incidentally, is the longest in the book.

Following are the fifteen chapter headings: "Engineering," "Land," "Grading," "Bridges, Trestles and Culverts," "Ties," "Other Track Material," "Ballast," "Maintaining Track and Right-of-Way," "Station and Roadway Buildings," "Water Stations," "Fuel Stations," "Shops and Engine Houses," "Icing Stations" and "Signals and Interlockers."

Water Power Engineering

Author, Daniel W. Mead, professor of hydraulic and sanitary engineering. University of Wisconsin. Cloth, 6 x 9 in.; 843 pages; 437 illustrations. New York, McGraw-Hill Book Company, Inc. $5 net.

REVIEWED BY D. R. COOPER

Consulting Hydraulic Engineer, New York City

This book is so important in its field that it seems proper to review it somewhat more fully than is customary with new editions of standard works. As to its scope, the book may be said to be the most satisfactory work published on this important branch of engineering. It comprises a substantially complete outline and discussion of the principles and processes involved in water-power engineering. The treatment of the subject and its various phases is generally comprehensive and is descriptive of practice rather than an exposition of set theories. The volume will probably prove more useful to the student than to the designing engineer, but considerable portions may be read with interest and profit by most practising engineers.

Chapter 1 is largely historical. Chapter 2 contains a good elementary discussion of power and energy. Chapter 3 is an excellent discussion of power-plant load characteristics and their influence on plant design and equipment.

Chapters 4 and 5 treat of the factors affecting the flow of water in open channels and the various methods used in the determination of the velocity of flow. Chapter 6 analyzes the effect of variable flow on available power, while the next two chapters deal with the influence of pondage, storage and variable head. The use of duration curves to supplement the hydrographic diagrams is an improvement conducive to accuracy and clearness in the determination of these influences.

The next five chapters relate to waterwheels, the hydraulics of the turbine, turbine details and appurtenances, and the selection, arrangement and testing of turbines. The chapter on turbine analysis and selection is very good and properly omits any extended consideration of the subject of detail design of runners as being of interest to turbine designers rather than to the average hydraulic engineer.

An excellent explanation of specific speed is given, and its significance and use in turbine comparisons is thoroughly explained. A description of various diagrams for comparing turbine characteristics is presented in such manner as to direct the intelligent selection of turbine equipment. The author continues to use the unfortunate term "characteristic curve" to describe the somewhat complicated diagrams showing the interrelationship of factors affecting turbine performances. The use of the factor "specific power" is an innovation in the literature of hydraulic turbines. The section on turbine testing relates more to the history of testing and to details of Holyoke tests than to modern field tests of units in place.

Chapter 14 deals with speed regulation in a generally satisfactory manner, but gives rather scant consideration to the subject of surge-tank design except as affecting speed regulation. The discussion of surge tanks is practically confined to simple standpipes.

In referring to the differential regulator the misleading statement is made that the relatively rapid drop in effective head is opposed to good speed regulation, giving the impression that the device as a whole is unsatisfactory, which is contrary to experience with these regulators.

The design of surge tanks calls for very thorough engineering and seriously affects water economy and the cost of feeder pipes, penstocks, penstock valves and waterwheels, all of which are therefore important considerations in surge-tank design, although they do not receive much if any attention as such in this treatise.

The next three chapters relate to governors, arrangement of réaction wheels and the selection of machinery and the general design of water-power plants. The sections on economic friction losses and the determination of economic diameters of feeder pipes and conduits contain some confusing statements. In justice to the author it may be stated that his treatment of these topics follows the stereotyped processes used by many engineers in the solution of these problems. Nevertheless it seems to the reviewer that the time is ripe for pointing out the inadequacy of the procedure outlined by Professor Mead.

Chapters 18 to 21 contain descriptions of various plants and general arrangements of dam, power house, etc., and a statement of the general principles involved in the design and construction of dams and appurtenant structures. The last three chapters relate to costs of plants and power, and include an admirable exposition of the hazards of water-power enterprises. The financial and commercial considerations involved in the engineering examination of a water-power project are clearly set forth. These chapters are calculated to effect the disillusionment of many readers as to water-power values, and are commended to all who would gain a clear conception of the economics of water-power development.

Such details of design and construction as the author seriously essays to cover are treated thoroughly, and include the features that usually receive the most consideration at the hands of the majority of hydraulic engineers. Some of these have been rather exhaustively treated at the expense of certain others that many engineers would consider equally important. For example, the design of large conduits, large curved draft tubes, low-head concrete scroll cases, large head gates, trash racks and trash-disposal apparatus, and the testing of turbines in place, are subjects which many readers will wish might have been treated more fully.

There are some noteworthy differences between this and the first edition. The treatise has been materially improved in the parts that have been retained and expanded. The chapter on hydraulics has been omitted as being not simple enough for the beginner and not complete enough for the hydraulic engineer, although some of the same matter has been included in other chapters. The chapters on rainfall, meteorology and related topics have been omitted, but the preface contains an announcement of the author's intention to cover these subjects in a separate volume on hydrology.

This volume is printed on thinner paper and the book is somewhat thinner than the first edition although it contains some sixty pages more. The lists of references to other literature have been extended and made more useful by adding references to recent literature and eliminating references to foreign works not generally accessible.

Letters to the Editor

Comment on matters of interest to engineers and contractors will be welcomed

Roots Crack Cistern

SIR: I have before me a problem which I suppose has been solved many times before, but as there seems to be little literature dealing with the subject, I should appreciate any help your readers may be able to give me. A cistern has been dug in a clay soil and made sufficiently watertight by a coat of cement about 1½ in. thick plastered directly upon the earth. The cistern has given good service for five years. Recently it was discovered that one side of the cistern has become cracked open by the roots of a Carolina poplar tree which stands near by. How may I make repairs and not injure the tree?

STEWART T. SMITH.

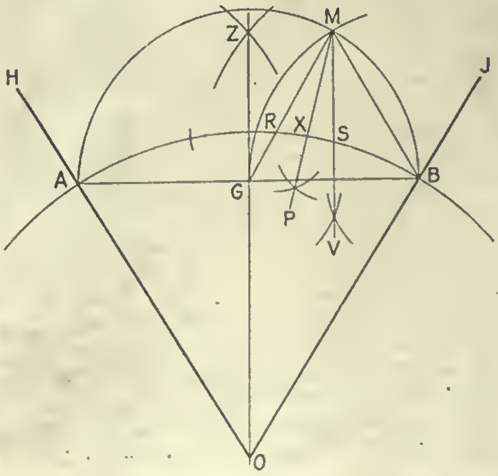
Bridgeport, Conn.

To Trisect an Angle

SIR: In the Engineering Record of July 31, 1915, I saw a very interesting solution to the question "how to divide an angle into three equal parts," signed by B. K. Coghlan.

Another solution of the problem, requiring only a rule and a pair of dividers is the following:

From the point O as center, draw an arbitrary arc and chord AB; bisect AB by OZ and from G as a center draw the semicircle AMB with a radius GB. Then swing the arc GM with B as a center to locate M; bisect GB by MV and from R and S as centers with a radius RS draw two arcs and join their intersection P with the point M, locating X. The portion XB of the arc is equal to one-third of the total arc AB.



NATAL ARNAUD,
Lieutenant, Brazilian Navy.

Rio de Janiero.

Why Is Registration in Civil Engineering Decreasing?

SIR: I am much interested in your editorial and the statistics on the registration in civil engineering and in engineering in American universities and technical schools, in your issue of Dec. 18, 1915. As you doubtless recognize, the curves would have a greater value if they included a larger proportion of the schools. For instance, the Worcester Polytechnic Institute has shown great vitality in civil engineering and there has been a steady gain for the past ten years. The numbers have grown from 48 to 81 between 1905 and 1910, and from 81 to 112 between 1910 and 1915. I cannot state what the exact registration for 1916 will be, because there are always additional students in the second term. These numbers include only three classes, as the freshmen do not designate their choice of department until they have been promoted to the sophomore class.

Your analysis of the reason for the decrease in civil engineering registration seems to me sound, but there are other considerations besides the readjustments due to changes in the profession and salaries and in the opening up of new fields for applied science. The graduate school idea must affect the apparent registration in universities. At Harvard the establishment of a graduate department threw all undergraduate students in engineering into the college where their names disappeared from registration as engineering students.

The consequence was that the total registration was confined to those in the last years of professional study. I think the same thing would be true in a large number of universities where the preliminary training is in the academic departments.

The graduate school must also affect the total number of men who enter the profession of civil engineering, as well as those who go into other branches. In the first place, it is likely to scare off young men who are not fitted for engineering at all; and, in the second place, it raises the standard to the apprenticeship or novitiate in the profession. I am inclined to think that putting engineering on a graduate basis may tend to make broader citizens of our engineers, but whether it will make better engineers or not remains to be determined by many years of experience. Some of our greatest engineers have had little or no schooling. Another side of this is that the large corporations have had a decided effect upon the distribution of men in the different branches of engineering and, by reflex action, upon the student registration. The profession has become standardized more or less and there is a tendency to make all engineers salaried men. Doubtless there are as many independent engineers who are doing consulting work as there ever were, but the percentage of those who by their own initiative have become successful engineers seems to me decidedly smaller.

The statistics and diagrams of college registration are not altogether satisfying, as many young men transfer from one branch of the profession to another during the school period or afterward. This is particularly true as between electrical and mechanical engineering, and to some extent for civil engineers, especially when sanitary engineering is taken as a separate profession.

This whole subject is an interesting one and it is gratifying to have a periodical of your standing take the matter up. We need the advice and help of outside men in the colleges and technical schools.

IRA N. HOLLIS,
President, Worcester Polytechnic Institute.
Worcester, Mass.

SIR: I have read your article entitled "Registration in Civil Engineering Is Decreasing," and your editorial comments on it. Our own experience in the University of Iowa, as you will note from your diagrams, has not been such as to give us any anxiety or to disturb our operating conditions, except to require a couple of years ago a slight increase in our instructional staff. And, so far as the enrollment of all engineering students is concerned, I am not sure that there is anything to be alarmed about anywhere, unless in the case of some particular institution that is suffering for local causes.

If you will go back further than 1910-11 and plot the engineering attendance for the past 30 or 40 years I think you will find, as I believe it was at one time shown by President Ricketts, that engineering attendance curves follow pretty well the financial prosperity curves, the low points of the attendance curves generally lagging a little behind the low points of the prosperity curves. I have been accustomed as a result of a study of these curves to say that I expect a maximum attendance in the year of the beginning of a financial depression and a minimum attendance some five years thereafter. I am rather inclined to think that this will, at least in part, explain anything that may seem for the moment peculiar about total enrollment.

As to the decline in civil engineering enrollment, I am disposed to attribute this more to the interest in electrical engineering aroused in the high school boy when he studies physics, together with the great amount of publicity that is given the more spectacular electrical phenomena; and all this in spite of the fact that, so far as our experience goes in recent years, electrical engineering graduates are slower to secure positions than either mechanical or civil engineering graduates.

I agree with you that scientific agriculture is probably responsible for some falling off in engineering attendance, but I am inclined to believe that this is a good tendency. And it is possible that the better understanding of engineering compensation is responsible somewhat for the falling off in total attendance. I have tried to be perfectly fair with the young men in the state in this matter, as a bulletin sent some time ago to high school seniors will indicate, and either in spite of or because of this frank statement our attendance has gradually increased. However, there is evidence of a halt just now, which perhaps, because of the apparent approach of more prosperous conditions, may be only temporary.

I am rather inclined to think that in the electrical field the supply has perhaps fully reached the demand and possibly is in excess. We know that there are in certain parts of the country many idle civil engineers, in spite of which I have had more calls several times over for young civil engineers to fill subordinate positions this fall than I could supply.

DECLINE IN INTEREST IN RAILROAD CIVIL ENGINEERING

There is perhaps one reason for falling off of civil engineering students that has not been mentioned. I refer to the decline of interest in railroad civil engineering. I believe it is a fact that the standard of engineering labor on railroads as a rule throughout the country is rather low. The young man who can learn to read the rod and do a few sums in arithmetic and is willing to work for a low wage is doing the work that some college people think should be done by their graduates. If the young man who can read the rod and do the sums in arithmetic has intelligence and energy he is undoubtedly a better assistant than the college graduate who has not these characteristics, and unfortunately there are such. But from my observation I am inclined to think that railroad engineering work would be better done if salaries were so improved as to make it possible to employ more thoroughly-trained men for subordinate positions. Although my own specialty is railroad engineering, I have been unable to interest many of my graduates in that branch of work. With few exceptions those whom I have interested have not cared to remain in it. Of course, as an offset for this, there has been some growth in municipal and sanitary work, and I presume that it is but a minor influence.

On the whole, I fancy we are merely at or approaching a low point in an irregular curve that has a general, though slow, upward tendency; and, except for the possible temporary embarrassment of those institutions that have prepared for larger bodies of students than they are now receiving, I think there is not very much to be concerned about. Although we are not one of the larger schools, we were ourselves embarrassed in this way some three or four years ago, at which time we slightly reduced our faculty.

WILLIAM G. RAYMOND,
Dean, College of Applied Science, State
University of Iowa.
Iowa City, Iowa.

SIR: Attention has been directed to the gradual decline in attendance at engineering schools. Some of the causes for this have probably been given. There may be other causes which are more fundamental, although possibly not so evident. American engineers are inclined to be individualists of an extreme type. The few who reach the heights seldom stretch forth their hands to aid the many who struggle against almost overwhelming difficulties below them. During the early history of the profession surveying furnished the most attractive field to the engineer. Considering the large number of men engaged in this kind of work, the literature of the past fifty years is very limited and unsatisfactory. Surveying furnishes an example which serves to illustrate the characteristic of the engineer which I propose to discuss.

The work of the General Land Office began at a time when qualified surveyors were almost unknown. Land surveying improved but slowly, if at all, even after engineering schools furnished men adequately trained for the work. While surveying, properly performed, is purely scientific in character, yet it is on a scientific basis only here and there throughout the country. All civil engineers are interested in surveying in a general way, because much of their work begins with measurements on the ground. As a separate branch in which they might specialize they have come to regard it as something elementary and something that may be performed by any man who chooses to call himself a surveyor.

SURVEYING IS POORLY TAUGHT IN THE ENGINEERING SCHOOLS

Even engineering schools have been tainted with this kind of false sentiment. Generally speaking, there is no subject so poorly taught in our engineering schools as is surveying. It is generally a minor subdivision of the civil engineering department. It is frequently taught to freshmen and commonly to sophomores. Many of the heads of departments have long since lost interest in surveying as a specialty. The financial reward for surveying work today offers them no inducement. They probably had some sad experience, during their earlier years, when thrown into competition with incompetent and irresponsible surveyors. Because employers could not judge the relative quality of work performed by competent and incompetent men, those who were willing to accept employment at starvation wages and furnish results that "seemed" to be precise, were given all the advantage. Only the capable man realized the situation. The engineer who has become familiar with the public land surveys appreciates how detrimental this example has been to his profession. The early engineer began to lay a foundation for his professional edifice at a time when the General Land Office was openly breaking down his every effort to place surveying on a scientific basis.

As a result, many of our schools, which should be teaching young men how to recover ground already lost, almost forget that surveying has any relation to science, and lay all stress on branches that seem more promising at the time. The young instructor, who has not won his spurs in the fields which interest the heads of departments, is intrusted with the courses in surveying. He is being "tried out." His limited experience does not enable him to arouse much enthusiasm among his students. He does not know, probably, why it is that those higher up in his department look upon the subject assigned him with some contempt. He does not know that, where surveying is protected by specifications which demand results of high quality, engineers have opportunities that are inviting to the best of engineering talent. He has not become familiar with those branches of government service which have always performed surveying work in a highly creditable manner. He does not know what the states have done to place surveying and other branches of engineering on a better basis. Students leaving schools where such instruction prevails are not inclined to be helpful in any movement which tends to improve the practice of surveying or to uphold professional standards generally.

Sliding Scale of Accuracy in Surveying

The surveyor has acquiesced in a system which prescribes a sliding scale of accuracy depending upon the value of the lands surveyed. Unfortunately, some texts on surveying advocate such a practice. The measurement of distance involves scientific considerations. The value of lands involves financial considerations. The two are not connected in any way. A line measured to-day over lands having a value of $1 per acre has the same length as when measured fifty years hence, when the lands have a value of $1,000 per acre. Where an engineer fails to do his best work because of land values he establishes a reputation which retrogrades as the value of the land increases. We would not support a surgeon who performs operations in a more or less scientific way depending upon the financial ability of the patient. There may be professions which thrive on theories which permit practitioners to regulate their usefulness to employers and to the public in accordance with monetary standards alone. These professions are not supported on a scientific foundation. No scientific profession can live and continue to enjoy the esteem and respect of the people it is presumed to serve unless it adheres to the letter and spirit of the natural laws which should support it.

Surveying furnishes one, but not the single, "horrible example" for engineers to study. When we review its history, we must admit that the engineer has never exerted an influence there which has brought about any general improvement. The object lesson it furnishes should be plain to all. The engineer is satisfied, for the time being, to remain in a narrow channel and to retreat from one field to another as the greedy, the incompetent and the irresponsible order him to move on. He labors to-day between elements that are fully organized. Even his bretheren in architecture have a definite life work that is their own. With every other profession organized for its own protection, with labor united in its strife against centralized capital, the engineer occupies a field which is one month a vacuum and the next an area of extreme pressure. Between the upper and lower mill stones he is ground to fit whatever holes there may be for him in the social fabric.

Engineers have organizations. These are for the purpose of providing an opportunity for discussions of matters of "shop." Engineers might learn something to their advantage by attending meetings of some good labor union. An engineer would probably anticipate, should he be invited to attend a session of a plumber's union, that the members thereof would discuss the methods used in threading pipe and wiping lead joints. He would be greatly surprised to find these men interested in matters of government; to find that they are far in advance of him in the study of economics; that they know what plumbers are doing in foreign countries and what they are accomplishing here under an organization that is personal, sympathetic and effective.

There may be something in this brief review which will disclose at least one reason for the decrease in attendance at engineering schools. Parents, and young men who are considering a life occupation, probably know that engineers are good servants, but that they rarely become masters, in the broad sense of the term. Young men who spend from four to six years in preparation at our universities prefer to select a field, in the beginning, which has some well-defined limits and in which only qualified men may practice. While many parents and prospective students may not be able to analyze the objectionable features of the field of the engineer, yet these are plain, superficially, to all who observe.

CLARENCE T. JOHNSTON,
Professor of Surveying, University of Michigan.
Ann Arbor, Mich.

Decimals of the Degree and of the Full Circle

SIR: Relative to F. H. Frankland's letter in your issue of Nov. 27, page 671, I should like to make a few remarks and additions. Contrary to Mr. Frankland's assumption, I was not under the impression that the centesimal division of the degree is something new. In addition to the tables of Briggs, Roe and Oughtred, in which the decimal or centesimal division of the degree was used instead of the sexagesimal, French mathematicians of the latter part of the eighteenth century, among them being Prony and Legendre, used the centesimal division of the quadrant. As I mentioned in my previous letter, some French and Spanish instruments are still made for the use of this system.

The tables devised by C. Bremiker, mentioned by Mr. Frankland, were published in 1872. A tenth edition of these tables, revised by A. Kallius, was published in 1906. This edition contains 158 pages and gives five-place figures for each hundredth of a degree (centesimal), besides logarithms, and addition and subtraction logarithms ("Logarithmisch-Trigonometrische Tafeln mit fünf Decimal-Stellen").

Tables giving functions of the centesimally divided quadrant were published in Berlin in 1799 by J. P. Hobert and L. Ideler under the title of "Nouvelles Tables Trigonométriques," and in 1801 C. Borda and J. B. J. Delambre published in Paris the "Tables Trigonométriques Décimales." In 1891 the French Government published an eight-figure table containing log sines and tangents for every ten seconds (centesimal) of the quadrant. This work is the "Service Géographique de l'Armée: Tables des Logarithmes à Huit Décimales . . . Publiées par Ordre du Ministre de la Guerre" (Paris, Imprimerie Nationale, 1891). The log sines and tangents in these tables were taken from the manuscript of the "Tables du Cadastre" of Prony, who in 1784 was commissioned by the French Government to undertake the work. The tables calculated by Prony and his associates have never been published in their entirety. They were calculated to fourteen places and occupied the time of about 100 men for two years.

While the subject of the centesimal division of the degree and quadrant is not a new one, it is practically new in this country. The non-use of the centesimal division is attributed in great measure to Vlacq's "Trigonometria Artificialis" using the nonagesimal division, which appeared the same year (1633) as Briggs' "Trigonometria Brittannica."

In any event, new or old, it is sincerely to be hoped that success will attend the venture of introducing the centesimal system.

R. C. HARDMAN.
Colorado Springs, Col.

SIR: Noting the discussion of the above subject in your columns in several recent numbers, I am prompted to say that in the early seventies of last century I had the vernier of a transit graduated in decimals of a degree instead of the usual sixtieths, to facilitate laying out railroad curves on location.

I found it vastly more convenient in the calculations and chord deflections to use decimals of a degree instead of minutes.

T. G. DABNEY.
Clarksdale, Miss.

SIR: The communications of R. C. Harding and F. H. Frankland concerning the decimal division of the degree in place of the sexagesimal calls to mind a unite of angle which was introduced by French mathematicians at the time of the French Revolution. This unit, called the grade, was defined as being one-hundredth of a right angle. A grade was divided into one hundred equal parts called minutes, and each minute was divided into one hundred equal parts called seconds. The symbols representing the grade, the minute and the second were ^{g}, ${}^{\backprime}$ and ${}^{\backprime\backprime}$ respectively. The great advantage of this centesimal system, as it is called, is that any angle, say 49 grades, 16 minutes, 77 seconds may be written in any one of the three ways: 49^{g}, $16^{\backprime}$, $77^{\backprime\backprime}$, 49^{g}, $16.77^{\backprime}$, or 49.1677^{g}. This system, it should be observed, was never completely accepted by mathematicians, and its use has now been completely abandoned. It is, however, of some historical interest.

ALBERT LOUIS WECHSLER,
Columbia University.
New York City.

BEQUESTS received by the Massachusetts Institute of Technology during 1914 totaled $750,000. This sum is exclusive of a number of items in which the institute is the residual legatee or one of a group of institutions to be benefited in the future.

HINTS FOR THE CONTRACTOR

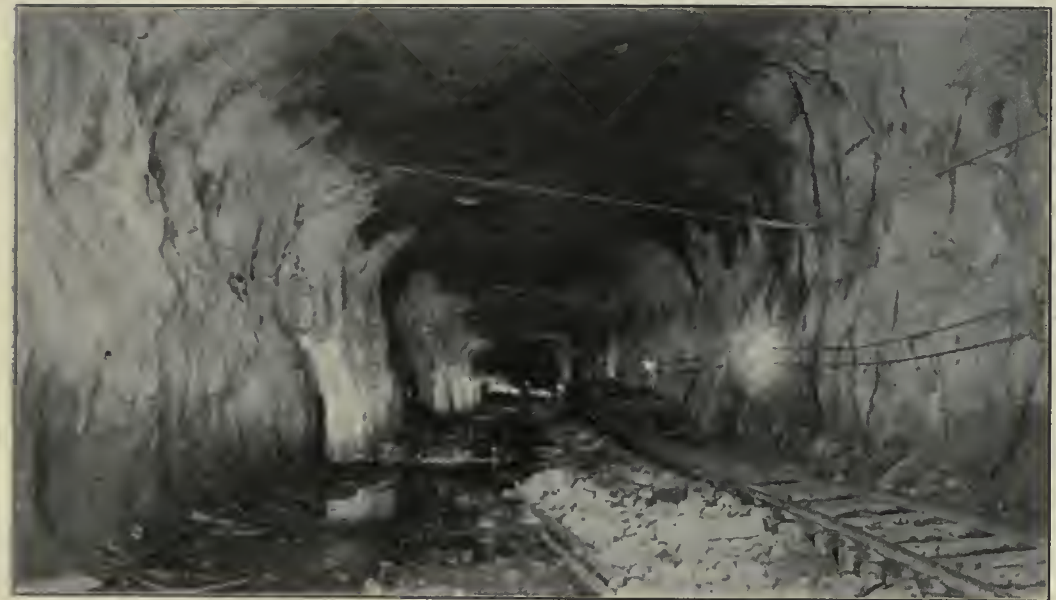
Details Which Save Time and Labor on Construction Work

Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

[*Contributions to this section are solicited, and if found available will be paid for. They must be* SHORT, *and should be accompanied, if possible, by photographs or sketches.*—EDITOR.]

Progressive Illumination Makes Good Tunnel Pictures Possible

CONTRACTORS who have to take progress pictures of tunnels often find it difficult to get good results. Flashlights of the ordinary type illuminate only a comparatively short stretch of the bore and the resulting negatives lack perspective. To overcome this trouble, S. P. Brown, chief engineer of the Mount Royal Tunnel & Terminal Company, of Montreal, adopted a different scheme in making the photograph shown herewith. After the camera had been set up and the lens opened, a man with a magnesium blow torch mounted in front of a large screen was ordered to walk through the tunnel away from the camera. Thus the perimeter of the bore was illuminated for a long distance without having the direct rays of the light reach the camera and fog the plate. The result was a picture of unusually great perspective.



MOVING LIGHT USED TO GIVE THIS TUNNEL PICTURE UNUSUALLY GOOD PERSPECTIVE

Filling Scows to Dump Them

A GOOD method of removing a load of rock from a wooden deck scow, not generally known to river contractors in many parts of this country, was originated some time ago by one of the Porter Brothers, associated with Foley Bros., Welch, Stewart & Farquier in the construction of the Halifax ocean terminals. The method, now being used on that contract, consists of loading the scow with a list, towing it to the dumping place, opening a valve and filling the hull partly full of water. As the hull fills, the water runs to the low side and increases the list until the load begins to slide. The scow then shakes itself free of its burden and rights up. It can be siphoned out by the tug on the return trip. There is no chance of sinking the scow unless the load is confined so that it is unable to slide. In a long experience with this method, the Porter Brothers have never lost a boat.

Combined Electric and Time Fuses Give Best Blasting Results

By S. P. BROWN

Chief Engineer, Mount Royal Tunnel & Terminal Company, Montreal

OF the various methods of blasting which have been tried in tunnel heading work, electric fuses are commonly used in eastern America, while time fuses are more popular in the West. While the character of the ground and the local conditions must govern the choice of system to a very large degree, the writer has found that a judicious combination of both methods may usually be used to a very good advantage.

It is possible to get, at least through the Canadian Explosives, Ltd., or the Nobel's of Glasgow, Scotland, an electric igniter to fire time fuses in circuit with electric detonators of the match-head type. Thus the cut may be loaded with electric detonators and the side rounds, breakdown holes and line holes may be loaded with electrically ignited time fuses. By using the electric igniters the time fuses may be cut very short, from 2 in. long up, thus practically eliminating the danger of cut off holes and very much expediting the time required for blasting. Where the rock is very hard and tough, so that the cut holes do not always break to the bottom, it is usually wise to fire the cut first independently. Then if a second charge is necessary it may be connected up with the time fuses and the remainder of the heading holes ignited when the second cut shot is fired.

By using the time fuses around the cut the inside holes may be fired first in proper rotation for the most economical use of powder. By placing the longest fuses in the two bottom corner holes these will explode last, throwing the muck back from the face. This very much expedites setting up the drills after the blasting.

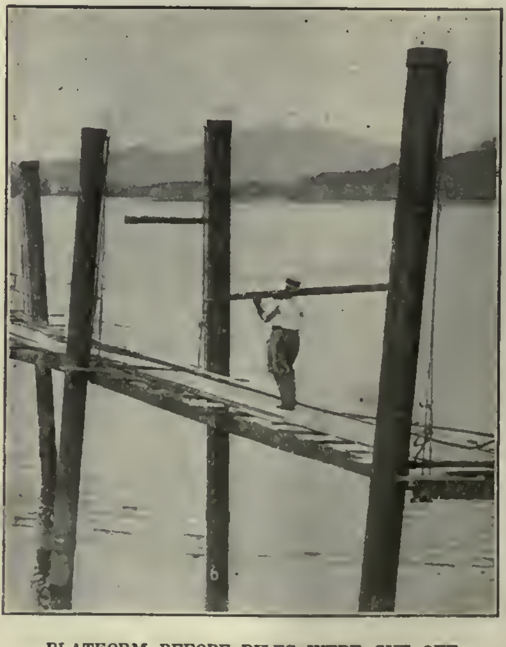
The electrically ignited time fuses were also used in the break-ups from the bottom heading of the Mount Royal tunnel in Montreal with equal success. There a great many lightly charged holes had to be fired in definite and regular sequence. In none of this work has the writer had any serious accidents or delays from the use of this method of shooting.

Pipe Piles Cut Off While Platform is Hung from Them

By ALEX. P. CRARY

Ancon, Canal Zone

A WORKING PLATFORM hung with hooks from the tops of 14-in. pipe piles 21 ft. apart was supported while the piles were cut off and concreted by first burning a hole in each pipe at cut-off grade with an oxy-acetylene torch. Other hooks were then slipped into these holes and the load of the platform transferred to them, after which the top hooks were removed and the piles cut off at the proper elevation with the torch. The stringers of this platform, which may be seen in the accompanying photograph, were set as fast as the piles were driven. They were carried out along the platform and a rope and S-hook attached to each end. As soon as the advance bent was driven the outer end of each stringer, carrying a man, was raised to the top of the next pile, over which the hook was caught, and the stringer lowered till the line held it. The back ends of the stringers were, of course, handled from the platform. The writer was contractor for the job on which this was done, that of constructing a landing stage for the quarantine station at Balboa, Canal Zone. Other features of the work, of which Rear Admiral H. H. Rousseau, engineer of terminal construction, had general charge, were described in this section of the Engineering Record for Dec. 25, 1915, page 801, and Jan. 1, 1916, page 27.



PLATFORM BEFORE PILES WERE CUT OFF

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

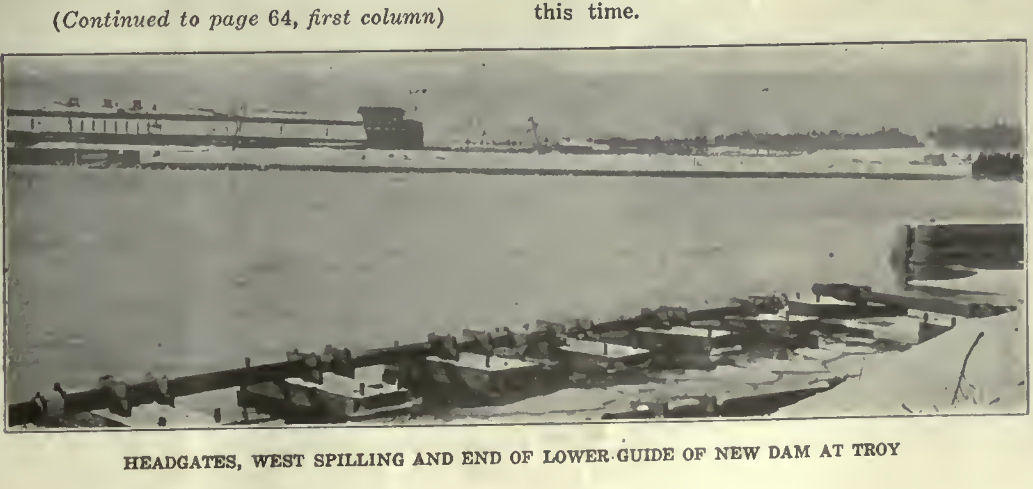
Ninety-Year-Old Dam Removed on Completion of New Structure

Old Landmark on the Hudson River at Troy Makes Way for New 22,000-Yd. Concrete Power and Navigation Dam

The completion of the new government dam across the Hudson River at Troy, N. Y., built in connection with the new tidewater outlet of the Barge Canal, was marked by the cutting last week of the first section of the earth dike behind which half of the old dam was torn out and the blasting five days later, on Dec. 31, of a channel through the remaining section of the dike. The old state dam, a short distance below the new structure, has marked the head of tidewater on the Hudson River since 1825. Between it and the new dam, which raises the pool level 2 ft. above the crest of the old dam and provides deep water up to the eastern terminus of the State Barge Canal, remained a pool, the head of which on the old dam varied from about 2 to 15 feet, according to tide and floods. The cutting of the earth dike, built to protect the floating plant from a rush of water while the western half of the old structure was being removed, has now lowered the pool and will ultimately bring tidewater to the foot of the new dam.

BLAST THAT CUT SECTION OF EARTH DIKE

(*Continued to page* 64, *first column*)


HEADGATES, WEST SPILLING AND END OF LOWER GUIDE OF NEW DAM AT TROY

Flood Breaks Concrete Cofferdam at Rochester, New York

A flood on the Genesee River at Rochester, N. Y., overtopped at midnight, Jan. 2, the 6-ft. concrete cofferdam behind which the rock bed of the river was being deepened on one side, and carried out 150 ft. of the wall. The work of lowering the rock channel of the Genesee River 6 ft. for ½ mile above the upper falls in the heart of the city is being carried on under contract by the Shongo Construction Company. A concrete center wall was built in the river, 3 ft. 8 in. thick at the bottom, 1 ft. 6 in. at the top and 6 ft. high, surmounted by 12-in. flash boards. Behind this dam the east half of the river bed was pumped dry and the rock excavation attacked with drills, three steam shovels and four channelling machines. The channel left west of the dam was 100 ft. wide.

About 8000 sec. ft. was flowing when the center wall was overtopped, according to information received from John F. Skinner, principle assistant to the city engineer of Rochester. Approximately 150 ft. of the wall broke into several sections and slid forward without overturning. Besides the heavier plant, three motor-driven pumps and six drills were in the excavation at the time, but all the drills and two of the pumps were gotten out. The other pump and 1000 ft. of standard-gage track were lost, and one workman came near being carried over the falls, which are 98 ft. high. The heavier plant is still in sight in the water, which on Jan. 5 was receding.

Worst Wind Storm in Twenty-six Years Visits San Francisco

On the night of Jan. 2 San Francisco was visited by the worst wind storm in twenty-six years. Although no extremely heavy loss centered at any one point, damage was general throughout the entire bay region. Of the 140,000 lines of the Pacific Telephone & Telegraph Company, 1500 were out of commission, it is reported.

Public buildings suffered an estimated damage of $15,000. Street railway service in outlying districts was stopped by landslides, inundations and drifting sand. The interurban schedules of the Southern Pacific were deranged by washouts and fallen trees.

One man was killed and others injured in San Francisco by falling signs. Other casualties were reported from suburban points due to drowning in the floods that followed the heavy rain. Watsonville reported a 3.5-in. rainfall and a fall of 4.6 in. was reported at Oroville.

The Spring Valley Water Company reports that the quantity of stored water is now 4,000,000,000 gallons greater than last year at this time.

Engineer Is Appointed New York State Public Service Commissioner

Henry W. Hodge, Whose Firm Designed Singer Tower and Duluth & Superior Bridge, to Succeed Robert C. Wood

Henry W. Hodge, consulting engineer, of New York City, has been appointed a member of the Public Service Commission of the First District, New York State, succeeding Robert C. Wood, resigned. Mr. Hodge has been engaged in engineering work for 34 years. The firm of Boller, Hodge & Baird, 149 Broadway, New York City, of which he has been senior member since 1912, designed many of the largest bridges and buildings in the country, among them being the Duluth & Superior Bridge, the cantilevers across the Monongahela and Ohio rivers at Pittsburgh and Steubenville, Ohio, and the Singer tower and Metropolitan tower in New York City. As a commissioner for the state of New York he passed upon the original design of the Blackwell's Island and Manhattan bridges in New York City. Later he was again appointed to pass upon the carrying capacity of the former structure. He also served the Canadian government as consulting engineer on the new design of the Quebec Bridge.

NEWLY APPOINTED PUBLIC SERVICE COMMISSIONER HENRY W. HODGE

He was born in Washington, D. C., in 1865 and received his early education at Charles B. Young's private school in that city. He took up engineering work in 1881 as a member of the field force on surveys of various branch lines of the Chesapeake & Ohio Railroad in West Virginia under O. A. Veasey. In 1882 he entered the Rensselaer Polytechnic Institute, from which he was graduated as a civil engineer in 1885. He then became one of the assistant engineers of the Phoenix Bridge Company of Phoenixville, Pa., where he remained until 1891, when he became chief engineer of the Union Iron Works, New York City, engaged in steel building construction. In 1893 he resigned from that office to engage in private practice. He became assistant to Alfred P. Boller, in charge of bridge design and construction, in 1895, and a partner in the firm of Boller & Hodge in 1899. In 1912 the firm was enlarged by the admission of Howard C. Baird, and the name changed to Boller, Hodge & Baird. Mr. Boller died in the latter part of 1912, and Mr. Hodge became senior member.

Large Structures for Which Mr. Hodge's Firm Has Been Engineer

The firm has been engineer for some of the largest bridges and buildings in the country, among others being the Duluth & Superior Bridge, the cantilevers across the Monongahela and Ohio rivers at Pittsburgh and Steubenville for the Wabash Railway, the Municipal Bridge across the Mississippi River for the city of St. Louis, the bridges across the Connecticut River at Hartford, Saybrook and East Haddam for the state of Connecticut; the Singer tower, the Metropolitan tower and many other large structures. The Central Bridge, Melrose Avenue Viaduct, Riverside Drive Viaduct at 96th Street and the proposed steel arch to cross Spuyten Duyvil Creek on the proposed extension of Riverside Drive are among the structures designed by Mr. Hodge's firm for New York City. It has also been retained by the United States government, by several states and many cities, and is engineer for all structures on the National Lines of Mexico as well as for bridges in Hayti, Peru, Bolivia, Brazil and other foreign countries.

Mr. Hodge served as a commissioner appointed by the State of New York to pass upon the original design of the Blackwells Island Bridge in New York City, and, later, was again appointed to make a report on the carrying capacity of the structure. He was also appointed a commissioner to pass upon the original design of the Manhattan Bridge. He served the Canadian government as consulting engineer on the new design for the Quebec Bridge. At present he is consulting engineer to the New York and New Jersey Interstate Bridge & Tunnel Commission on the proposed 3000-ft. suspension bridge across the North River at Fifty-seventh Street.

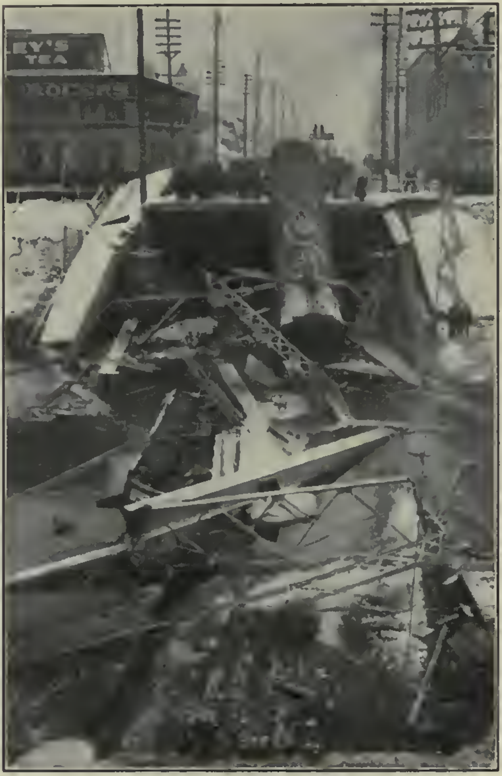
He is a member of the council of the American Institute of Consulting Engineers, a director of the American Society of Civil Engineers, a member of the Institute of Civil Engineers of Great Britain, the Canadian Society of Civil Engineers and the Railroad Club.

Second Annual Arizona Irrigation Congress to be Held Jan. 15

The second annual Arizona Irrigation Congress will be held at the University of Arizona, Jan. 15.

H. E. Cleland Joins McGraw Publishing Company's Staff

It is a pleasure for the McGraw Publishing Company to announce that H. E. Cleland will join its staff Jan. 10. Mr. Cleland's long experience, proven ability and brilliant service as advertising manager and manager of the Service Department of the Hill Publishing Company are well known and fully appreciated by advertisers in the engineering field. His acquisition is further evidence of the McGraw Publishing Company's desire to give to advertisers in the Engineering Record and the three other papers it controls the most efficient service which it is possible to render.



GENERAL WRECKAGE OF SPOKANE BRIDGE FAILURE

Two trolley cars fell with the bridge; one, however, is still supported by the end abutment. Six lives were crushed out by the falling upper chord striking the car seen with seats exposed in the center of the picture.

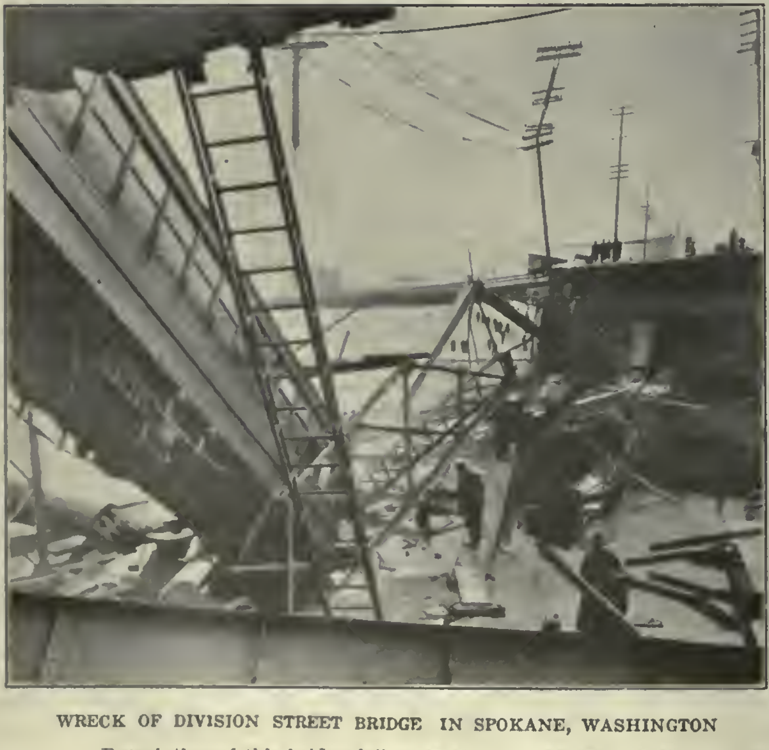
Memphis Bridge Falsework for Fixed Span Still Holds

Although two more bents of the falsework between piers 3 and 4 and one bent of the fixed span falsework of the Harahan Bridge over the Missisippi River went out on Dec. 29, following the fourteen bents which were washed out on Dec. 23 and one on Dec. 25, at last reports the adjacent fixed span was still safe and the balance of its falsework in place. The pictures on the opposite page show the bridge before and after the failure which resulted not only in the loss of over 100 of the track stringers being used temporarily for the traveler runway and some lower chord members, but also the traveler, four donkey engines and other erection equipment.

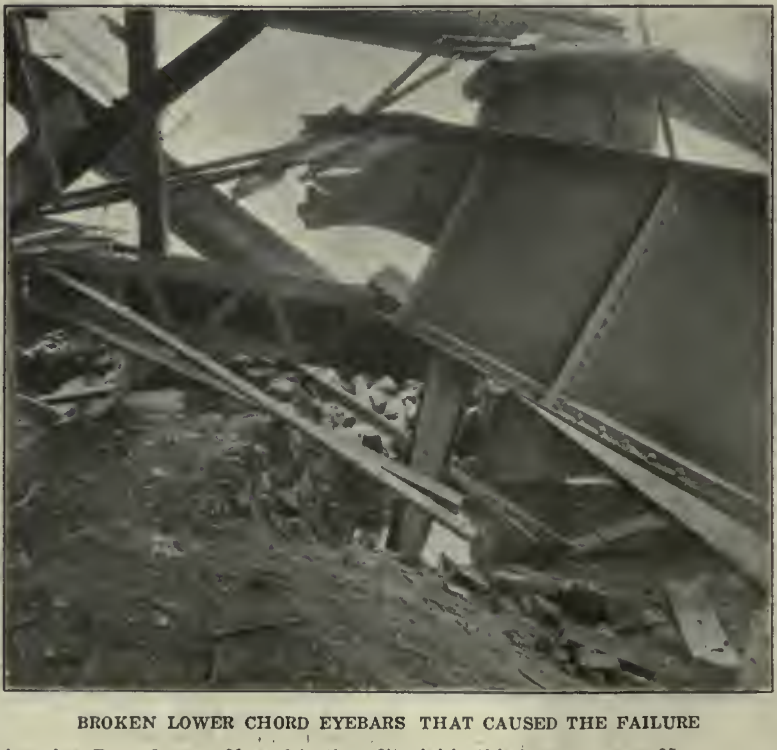
The pile bents each contained thirty-two piles ranging from 84 to 91 ft. in length, upon which the 12 x 12-in. timber legs of the falsework rested, the height being about 65 ft. A total number of nineteen bents were in place in the 604 ft. between piers 3 and 4, and on Dec. 29 only two bents were still standing. This falsework was to carry the travelers and the semi-suspended span on the west or Arkansas end.

The bridge, which is a cantilever structure, was described in Engineering Record of Nov. 8, 1913, page 516. Owing to unprecedented high water during the summer, erection of the 621-ft. fixed span and the west span could not be begun until the middle of September. In order to complete the work without unnecessary delay it was therefore necessary to use falsework in both openings. The excessive rise in the Mississippi the latter part of December resulted in a river stage of 28.2 ft. on Dec. 24, 32.2 ft. on Dec. 29, and 34.6 ft. on Jan. 4. A great amount of driftwood accumulated behind the falsework. The entire bridge had been erected except the two 186-ft. cantilever arms, the 418-ft. semi-suspended span and one-half of the 418-ft. suspended span.

This bridge is being fabricated and erected by the Pennsylvania Steel Company of Steelton, Pa., for the Arkansas and Memphis Railway Bridge and Terminal Company. Ralph Modjeski of Modjeski and Angier, Chicago, is the designing engineer. Thomas Earle, vice-president of the Pennsylvania Steel Company, kindly furnished the photographs with the above information, through the courtesy of Mr. Modjeski.



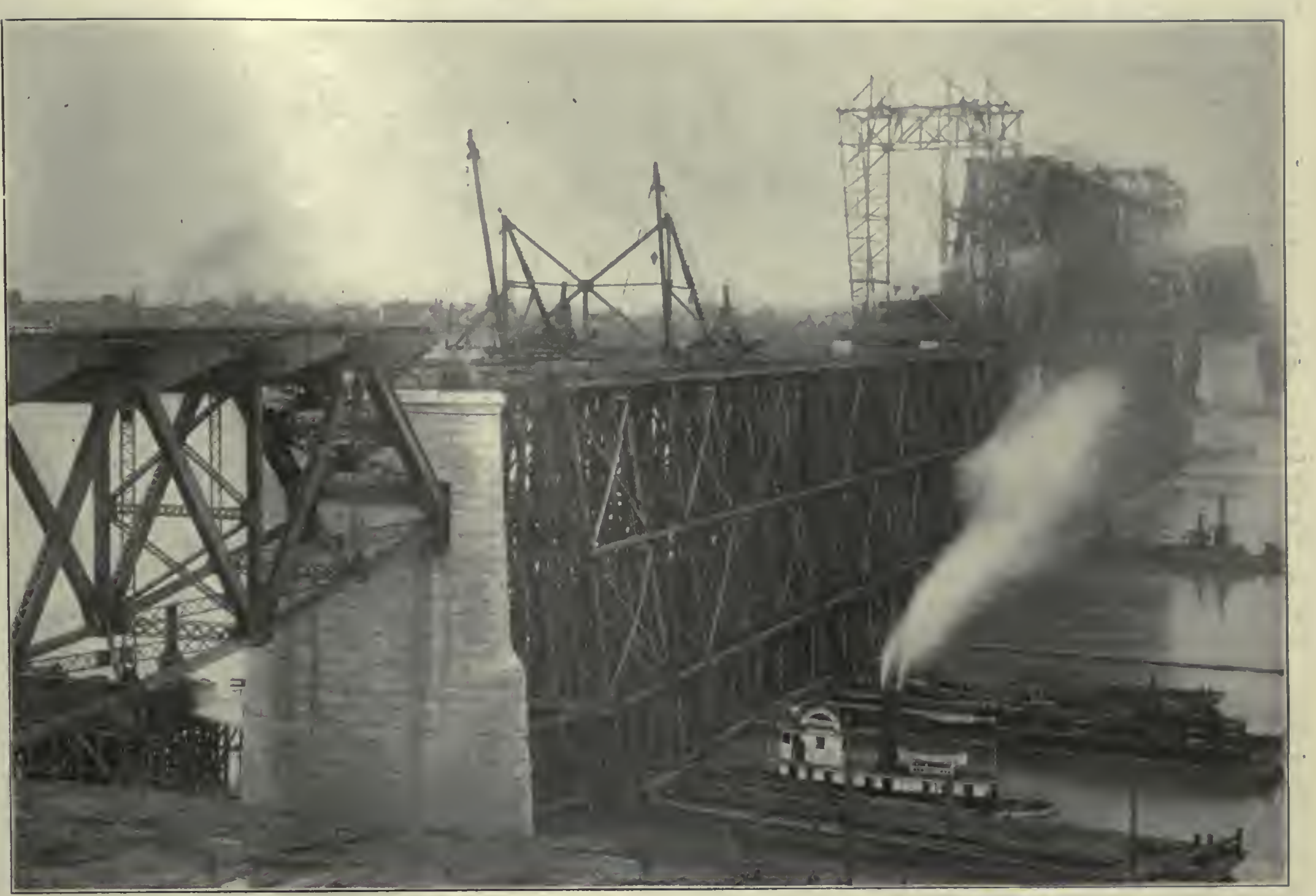
WRECK OF DIVISION STREET BRIDGE IN SPOKANE, WASHINGTON



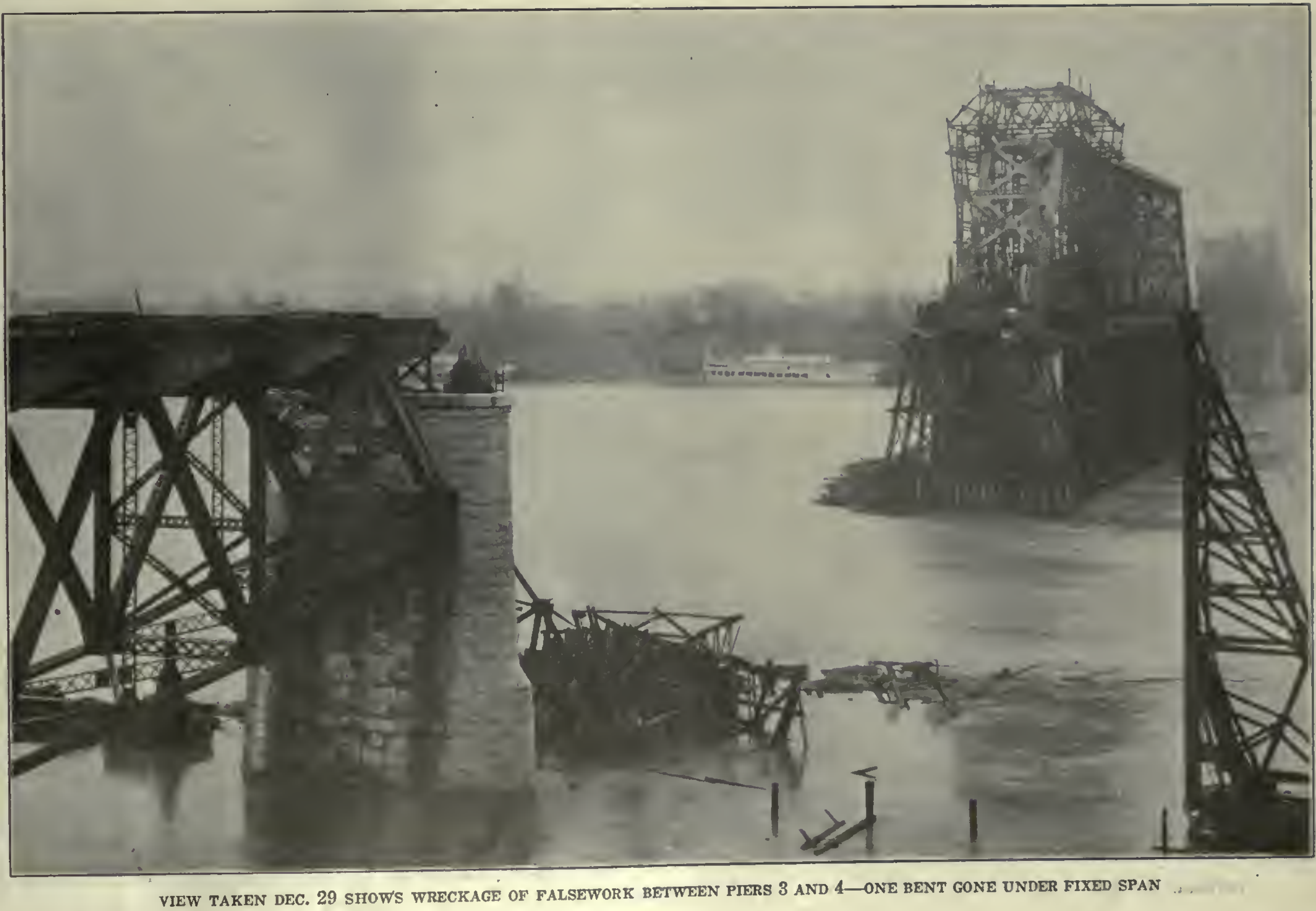
BROKEN LOWER CHORD EYEBARS THAT CAUSED THE FAILURE

Description of this bridge failure is given in last week's issue of the Engineering Record, page 29, and in the editorial in this issue on page 35.

Memphis Bridge Before and After Accident



VIEW OF FALSEWORK BETWEEN PIERS 3 AND 4 TAKEN FROM THE WEST SHORE DEC. 19 SHOWS ERECTION EQUIPMENT



VIEW TAKEN DEC. 29 SHOWS WRECKAGE OF FALSEWORK BETWEEN PIERS 3 AND 4—ONE BENT GONE UNDER FIXED SPAN

Ninety-Year-Old Dam Removed on Completion of New Structure

(*Continued from Page* 61, *First Column*)

The new concrete dam, which is of solid section, runs from a series of headgates on the west bank to a navigation lock on the east bank. The headgates will be leased to the highest bidder for the purpose of utilizing them for a hydroelectric power plant. The lock is the same width, 45 ft., as those of the Barge Canal, but is about 520 ft. long between its upper and lower mitering steel gates. About one-half of the spillway is constructed on a considerable skew with the river, and runs for some 600 ft. from the headgates, opposite the lower guide wall, to a point opposite the middle of the lock. Its crest is about 4 ft. above that of the old dam. It was built complete in a large wooden cofferdam during the season of 1914. The second section of the dam, which is also about 600 ft. in length, extends from the north end of the first spillway straight across the river to the lock, and has a crest 2 ft. lower than that of the first spillway. It also was built in a single cofferdam of steel sheet piling, and was completed in the season just closed. This coffer was made by driving isolated circular pockets or anchor cylinders, part up-stream and part down-stream from the site of the dam.

Original Plan for New Dam Modified

The original plan contemplated ten of these cylinders, spaced from about 30 ft. to about 130 ft. clear distance, but owing to the constantly-recurring high water their locations had to be modified somewhat. Between each of these pockets was set up on the river bed, without being driven, a single line of steel piling, held together by the interlocks of the piles, and depending on the mass of the banking for stability. The cofferdam was therefore heavily banked inside with dredged material, and a bank sloping down from the water line was placed outside to increase the watertightness. The deepest excavation close enough to the coffer banking to produce an effective head equal to its depth was about 33 ft. below the upstream pool level, and the deepest water in which any portion of the cofferdam was built was about 28 ft. Each of the two sections of the main dam was built in a single season, little trouble being experienced with floods during the first season, but much during the second season. The lock which contains about 45,000 cu. yds. of concrete, as compared with 22,000 cu. yds. for the dam and headgates, was under construction for two years, counting from the time of commencing work upon its cofferdam, and the latter had to be flooded a number of times. The walls of the lock are about 10 ft. higher than the low crest of the dam. Although the maximum flood stage expected, about 30 ft. above low water, will submerge them, navigation will not have to be suspended except for short periods, as extreme high water during the season of traffic is very rare.

FIRST BREAK IN DIKE, CORNERS OF WHICH WERE PROTECTED WITH SHEET PILING

Old Dam Timber Crib Structure

The old dam was a timber crib structure filled with stone and having timber decks which sloped down and up stream. Its abutment on the west end was also of stone and timber, and rested upon the shale rock. The old lock on the east bank, also built upon rock, was of ashlar masonry with timber guide walls and gates. The structure had been patched repeatedly, and the lock itself now contains some concrete. The first half of the 1000-ft. dam was removed chiefly by derrick boats with orangepeel buckets behind the protection of the earth dike referred to. During the removal two other dams were uncovered, with their crests immediately below that of the present dam. The lowest dam had its crest some 2 or 3 ft. above tide, and the second dam had its crest about 4 ft. higher. The timbers of both of these dams were fastened together with hardwood pins, and some of the sticks were 18 in. square. Remains of old breaks, such as masses of displaced sheathing and cribs lying on their sides in the body of the dam, also came to light. The east half will also be dredged out behind earth dikes of much less height.

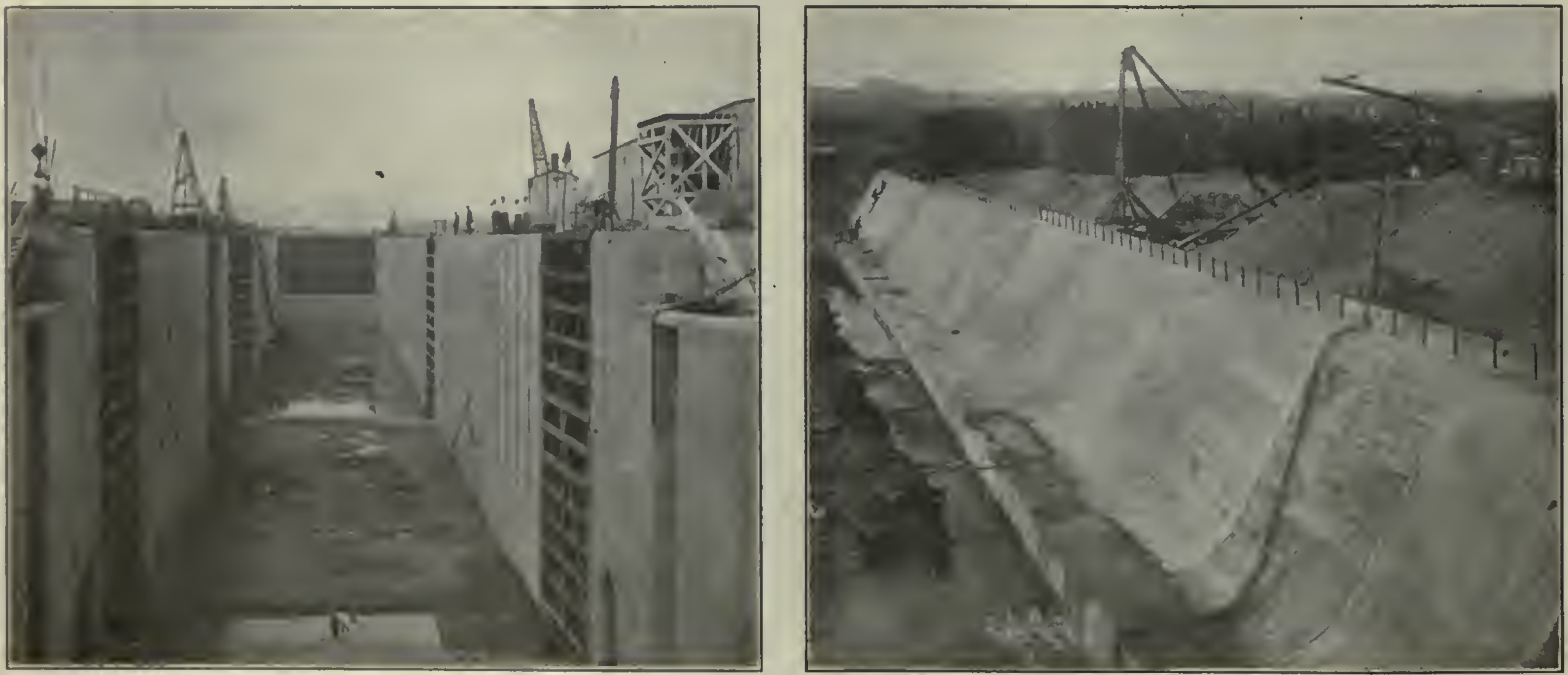
The Troy lock and dam has been built under the direction of the Corps of Engineers, U. S. A., Col. William M. Black being in general charge of the district. All the work was carried out by Government forces under the local direction of Major M. J. McDonough, Corps of Engineers, with D. A. Watt as principal assistant engineer and J. J. McCabe junior engineer in charge of Troy.

Photos of City College Stadium

In the article describing the new concrete stadium for the College of the City of New York, published in last week's issue, credit should have been given to the American Architect for the copyrighted photographs of the structure. The fact that the pictures which the Engineering Record received lacked the usual copyright mark and carried no other information which indicated that acknowledgement of their source was due was responsible for this omission.

Time Extended for Liability Insurance Premium Payments

The State Insurance Fund Board has extended the time for payment of premiums for liability insurance in the state fund until Jan. 15. Hundreds of contractors throughout the state have taken out insurance in the fund to protect themselves under the workmen's compensation act. Many of the contractors however, continue to take out insurance in the old line companies.



INTERIOR OF TROY LOCK SHOWN AT LEFT JUST BEFORE FINAL FLOODING—RIGHT VIEW SHOWS COMPLETED SECTION OF MAIN DAM

Grenville Mellen Dodge Dead

General Grenville Mellen Dodge, builder of the Union Pacific Railroad and honorary member of the American Society of Civil Engineers, died at Council Bluffs, Iowa, Jan. 3. He was born at Danvers, Mass., in 1831 and was educated at Captain Partridge's Military Academy and Norwich University in Vermont, receiving the degree of civil engineer from the latter in 1850. His first engineering service was with the Illinois Central Railroad, the Rock Island lines and on the survey for the Union Pacific. He served through the Civil War as colonel of volunteers, brigadier-general and major-general successively, being promoted on each occasion for distinguished service. While in command of the District of the Mississippi he built the Mississippi & Ohio Railroad.

Railroad Builder and Last Surviving Civil War Corps Commander Dies

GENERAL GRENVILLE MELLEN DODGE

After the war he was appointed chief engineer of the Union Pacific Railroad, then in the course of construction. In this work he was frequently hampered by attacks of hostile Indians.

In 1870 he became chief engineer of the Texas & Pacific, in which office he remained ten years. Later he was retained as consulting engineer on the St. Gothard tunnel and the planning of the Black Forest Railway in Europe. He was elected an honorary member of the American Society of Civil Engineers in the early part of last year.

New Business Manager of Engineering Record Appointed

L. W. Seeligsberg has been appointed business manager of the Engineering Record, succeeding A. B. Gilbert, who will devote his time to the circulation and searchlight departments. Mr. Seeligsberg is a graduate of Stevens Institute of Technology where he received his degree in mechanical engineering in 1896. For a number of years he has directed the work of the copy service department of the McGraw publications and for a year was the Engineering Record's advertising representative in charge of the Philadelphia territory. His long and well-rounded experience in sales promotion and publicity work in the engineering field makes him particularly well fitted for his new duties.

Urge Schoharie Addition to Catskill Water Supply

Merchants' Association of New York Recommends Immediate Action on Project for 250,000,000 Gallons Daily

Basing its action upon a report by Henry R. Towne of the Yale & Towne Manufacturing Company, chairman of its committee on water supply, the Merchants' Association of New York on Jan. 4 adopted resolutions in favor of the immediate extension of the Catskill water supply system to the Schoharie watershed. Thus far the Board of Water Supply has directed the efforts to the development of the Esopus watershed, where the great Ashokan reservoir is located. From this source the estimated daily yield is 250,000,000 gal. and the works for delivering this amount to New York, including dams, aqueducts, pipe lines and connections to the existing distribution system, are practically completed and ready for the "tuning-up" process prior to the placing of the system in regular service.

The Catskill project, however, contemplated a daily supply of 500,000,000 gal., and of this amount the Schoharie project, with a drainage area of 228 sq. miles was counted upon to yield about 250,000,000 gal., at a cost of $22,000,000; the estimated time required for its completion is 8 years. The Schoharie works involve a large dam and reservoir at Prattsville and a 10-mile tunnel connection with the Ashokan reservoir.

The Merchants' Association report bases its plea for the immediate construction of the Schoharie unit of the Catskill project upon the following statistics of water consumption and available supply: The present safe delivery from all existing sources is 550,000,000 gal. daily, the population in 1915 being estimated at 5,200,000. With 250,000,000 gal. added from the first installment of the Catskill supply a total of 800,000,000 gal. daily would be available, but of this quantity, according to the report, only the yields of the Croton and Catskill watersheds, aggregating 550,000,000 gal., should be considered. This would eliminate the present yields from municipal and private works in all of the city boroughs except Manhattan. To make up this deficiency, the report states, the 250,000,000 gal. daily from the Schoharie shed is imperative to meet the consumption of 800,000,000 gal. daily in the year 1921.

The report characterizes as illogical the suggestion that the new Catskill work be taken from the Board of Water Supply and turned over to the Department of Water Supply, Gas and Electricity. Mr. Towne says in conclusion:

"Viewed from every side and from every angle, the question at issue appears to admit of but one satisfactory solution, namely, that the city should now authorize the planning and undertaking of the work needed to utilize the Schoharie watershed as an additional source of supply, and, before this becomes available, should also undertake the work of completing the Catskill aqueduct to make available its full capacity of 500,000,000 gal. daily, and should intrust the execution of the work thus implied to the present Board of Water Supply, created expressly for this purpose. Its honorable, efficient and honest administration in the past, under which the city has wisely and safely invested the great sum of $160,000,000, constitutes the best possible guaranty that like conditions of skillful planning, efficient execution and honest management will prevail until the last unit of the great work has been completed. Then, and not until then, should the operation and upkeep of the great system be transferred from its builders to the care of the proper city department."

The Board of Estimate and Apportionment will hold a hearing on the Schoharie proposal Jan. 18.

Greater Caution Shown in Avoiding Overproduction of Cement

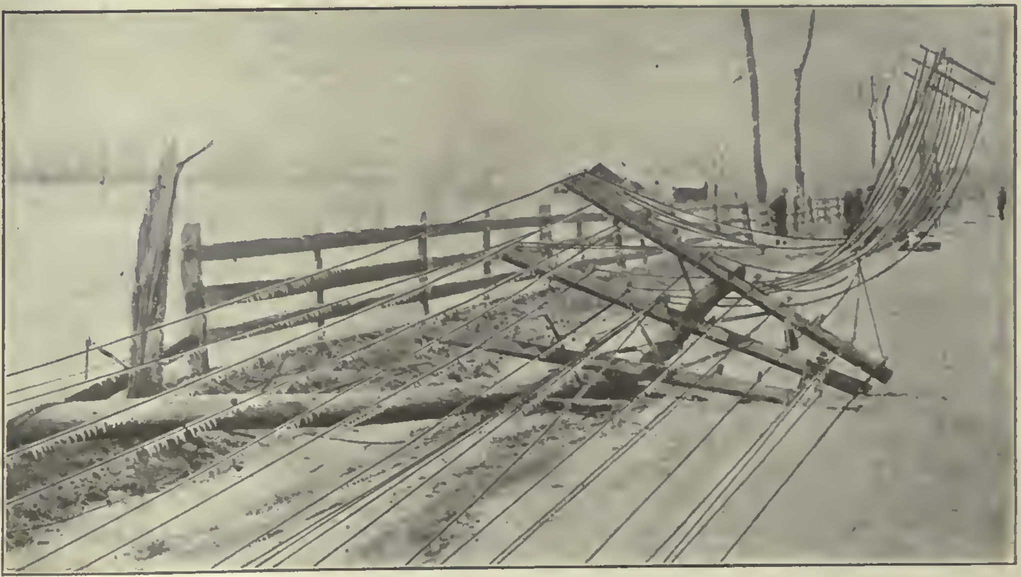
An estimate of Portland cement produced in the United States in 1915, just made by Ernest F. Burchard of the United States Geological Survey, indicates that the shipments from the mills amounted to 86,524,500 barrels, as compared with 86,437,956 barrels in 1914, and that the production was about 85,732,000 barrels, as compared with 88,230,170 barrels in 1914.

The stocks of finished cement at the mills were about 11,583,000 barrels, as compared with 12,893,863 barrels in 1914. The slight decrease in production and the considerable decrease in stock is thought to indicate greater caution in the industry, which in the preceding few years showed a tendency toward overproduction.

Storm Does Heavy Damage to Wires in Pennsylvania

The sleet and ice storm of Dec. 29 and 30 did heavy damage to electric wires and poles in Pennsylvania. The property of the Bell Telephone Company and the Western Union Telegraph Company suffered considerably, poles going down under the great weight of the ice frozen on the wires for hundreds of rods at a stretch. Harrisburg suffered more than most cities in the East from wire trouble.

All poles on the north side of the Pennsylvania Railroad yards at Enola were broken off and the trunk lines of the Bell Company and the Western Union to the West were thrown out of service.



POLES DOWN FOR NEARLY A MILE AT A STRETCH NEAR SHIREMANSTOWN, PA.

Smith, Hauser & Mac Isaac Organize Underpinning Department

With practically all of its difficult underpinning and foundation work on the William Street section of New York's new subway system completed the firm of Smith, Hauser & Mac Isaac, Inc., of New York City, has decided to capitalize its experience in this field by maintaining its present underpinning organization as a special permanent department of the company, which is now prepared to undertake contracts for subsurface work in any part of the country. The William Street subway extends through the heart of the city's financial district and is flanked by skyscrapers representing many millions in property values. These conditions necessitated unusual care in the underpinning operations, and special methods were developed for safely transferring the building loads from old to new foundations, the latter involving the use of steel-jacketed concrete piles, the casings of which were put down in 1 or 2-ft. sections. Among the buildings which had to be supported alongside of the subway excavation were the New York Cotton Exchange, the National City Bank, the Kuhn-Loeb Building, the Bank of New York and the Bank of America.

The unusual extent of the underpinning work in connection with the subway construction called for a large force of highly trained specialists and these men, now that the William Street work is nearly finished, will form the nucleus of Smith, Hauser & Mac Isaac's newly created underpinning and foundation department. In its future operations the department will have the benefit of general supervision by Lazarus White, the firm's managing engineer, who several years ago was division engineer in charge of the Rondout siphon tunnel and the city tunnel of the Catskill aqueduct, and F. J. Mac Isaac, member of the firm.

Personal Notes

H. J. HANMER has been reappointed city engineer of Gloversville, N. Y.

J. L. PIPER, resident engineer for the California Highway Commission, has completed the supervision of contracts of 7½ miles of concrete highway between Folsom and White Rock in Sacramento County and has been transferred to Placer County to have charge of the construction of ten miles of concrete highway between Lincoln and Wheatland.

JULIUS ADLER has been appointed engineer of tests of the Bureau of Surveys, Department of Public Works of Philadelphia. He was graduated from the University of Pennsylvania in 1908, and served there as instructor in civil engineering until 1909, when he was appointed instructor in charge of the highway engineering course at the University of Washington. He entered the employ of the city of Philadelphia in 1912, and was appointed assistant engineer in charge of material inspection and the inspection of asphalt paving plants, creosoting plants and bituminous road materials plants in 1913. During the summers of 1908 and 1909 he was with the U. S. Office of Public Roads as civil engineer student, engaged in laboratory tests of highway materials and field work on construction and, during the summers of 1910 and 1911, he served in the office of the city engineer of Seattle, Wash., on similar work and on the field investigation of local concrete materials for the Cedar River dam.

HAROLD O. HICKS, formerly transitman in the track department of the Cleveland Railway Company, has been appointed engineer in the division engineer's office of the Public Service Railway at Camden, N. J.

CARLETON E. DAVIS has been reappointed chief of the Bureau of Water, Philadelphia, by Mayor-elect Smith of that city. Mr. Davis was graduated from Massachusetts Institute of Technology in 1893 and was engaged continuously in water supply and water power work in the New England States until 1900, when he was appointed resident engineer in charge of surveys, plans and construction of the Cedar Grove Reservoir, 8 miles of 60-in. riveted steel pipe line and 3000 ft. of pressure tunnel for the Board of Water Commissioners of Newark, N. J. From 1904 to 1905 he was engineer of the waterworks and sewers for the Isthmian Canal Comission at Panama and, from the latter year until 1912, he served as engineer in charge of the reservoir department of the Board of Water Supply of New York City on the Catskill aqueduct work. He has been chief of the Philadelphia water bureau for about 3½ years.

JOHN G. ROSE, formerly with the Consolidation Coal Company on the development of its properties in the Elkhorn region in eastern Kentucky, has associated himself with the Kennicott Company of Chicago Heights, Ill. Previous to his work with the Consolidation Coal Company, with which he was connected for about three years, Mr. Rose was engaged as civil, hydraulic and irrigation engineer at Denver, Col. In his new connection he will be engaged in the design and manufacture of water softening and pressure filter plants.

WALTER M. SQUIRES has resigned his position as deputy city smoke inspector of Cincinnati to become superintendent of the smoke abatement league of that city.

CHARLES M. SPOFFORD, consulting engineer, of Boston, and professor of civil engineering at the Massachusetts Institute of Technology, has been requested by Edward F. McSweeney, chairman of the Directors of the Port of Boston, to act with Guy C. Emerson, consulting engineer of the Boston Finance Commission, and F. W. Hodgdon, engineer for the board, as consulting engineers on the new drydock being constructed in that city.

J. W. SHIELDS has been reappointed city engineer of Altoona, Pa.

ALFRED H. HARTMAN, division engineer of the Baltimore Sewerage Commission, will carry to completion the work of the combined storm-water, low-level and high-level sanitary divisions. Mr. Hartman has been connected with the Baltimore work since 1906, first as designing engineer, and, for the past six years, as division engineer. The storm-water drainage system, Jones Falls improvement, sewage pumping station, Forest Park sewage disposal plant and the low-level sanitary sewerage system were constructed under his immediate direction as division engineer.

J. F. POLAND AND R. E. MILLER have organized the Poland-Miller Company, Erie Building, Cleveland, to conduct a general engineering business, specializing in the design and inspection of coal, coke and ore handling machinery, docks and industrial plants. Mr. Poland was formerly associated with the Brown Hoisting Machinery Company and the J. W. Frazier Company as civil and structural engineer. Mr. Miller was formerly connected with the latter company as mechanical and electrical engineer.

JOHN B. DICKSON, general superintendent of the Erie Railroad at Cleveland, has been appointed general manager of the lines west, with office in the same city. Mr. Dickson entered railway service in 1881 on the Pennsylvania, where he remained until 1893, attaining the grade of supervisor in 1897. From this service he went to the Chicago & Northwestern for a period of nine years. In 1902 he was appointed assistant engineer maintenance-of-way for the Baltimore & Ohio, and, in 1905, he became chief engineer maintenance-of-way. He became connected with the Erie in 1907 as division superintendent at Rochester.

D. W. CHAMBERLAIN, formerly division engineer for the California State Highway Commission at Fresno, has been appointed county highway engineer of El Paso County, Texas.

EDGAR S. CLOSSON has been reappointed town engineer of Montclair, N. J.

AETNA ENGINEERING BUREAU, civil and sanitary engineers, 17 North La Salle Street, Chicago, will hereafter conduct business under the firm name of Marr, Green & Company, civil and sanitary engineers, with offices at the same address.

E. E. HARPER, consulting engineer, of Kansas City, Mo., specializing in water supplies, water purification and power plants, has moved his offices from Grand Avenue Temple to 2404 East Thirtieth Street, Kansas City.

ARTHUR LAROCHE, formerly city engineer of Binghamton, N. Y., has been appointed deputy city engineer. Mr. LaRoche was graduated from Union College in 1908. The appointment gives him practically the same office as he formerly held, except for an increase in salary. The change in title is due to the change of Binghamton from a third to a second class city.

O. E. BULKELEY, assistant superintendent and engineer of the water department of Rockford, Ill., has been made superintendent of the water department at Jackson, Mich., under Gaylord Cummin, city manager.

GEORGE W. TOWNSEND has resigned from the office of assistant engineer with the Sewerage Commission of Baltimore.

C. C. KIDD, formerly connected with the valuation department of the Chicago & Eastern Illinois Railroad, has been appointed designing draftsman in the bridge department of the Baltimore & Ohio at Baltimore.

ROBERT S. PARSONS, formerly general manager of the Erie Railroad, lines west, has been appointed chief engineer and assistant to the president. He was graduated from Rutgers College in 1895 and entered railway service on the Erie that year as transitman in the New York division. In 1903 he was appointed engineer of maintenance-of-way of the lines east of Buffalo and Salamanca and the following year engineer maintenance-of-way of the lines west. He became superintendent of the New York division in 1907, and attained the grade of general manager in 1914.

Obituary Notes

OLE N. TROOIEN, who served as an engineer on the construction of the Pennsylvania Railroad Tunnels under the Hudson River, New York City, died at Brookings, S. D., Dec. 21, 1915.

GEORGE V. SNEDEN, engineer maintenance-of-way of the New York & Long Branch Railroad, died in Long Branch, N. J., Dec. 24, 1915.

THOMAS J. IVEY, one of the leading contractors of Johnstown, Pa., died Dec. 30, 1915, of typhoid fever. He was 44 years of age.

MARSEILLUS N. NURSE, who for sixteen years served as engineer of the Department of Public Works of California, died at his home in Sacramento, Dec. 28, at the age of sixty-nine. Mr. Nurse was at one time civil engineer of the Clear Lake Water Company of San Francisco, and is said to have been the original promoter of the project to conserve the water of Clear Lake for power and irrigation purposes. Later he became identified with various reclamation enterprises in the Sacramento Valley. He was also a member of the Dabney commission of engineers for formulating a plan of flood control for the State.

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The Contractor in Foreign Fields

A MOST important announcement is that contained in the interview in the news section of this issue with Willard Straight, formerly of the firm of J. P. Morgan & Company and now vice-president of the American International Corporation, the $50,000,000 company recently formed for exploitation in the foreign field. He points out that there is now available a way through which American contracting firms can enter the foreign field with assurance that the handling of the securities they must take will impose no grave obstacles. Opportunities for trade extension in the foreign field have been fairly well understood, but contractors, with few exceptions, have not known just what to expect when they engaged in foreign work. Certainly their activities should be apace with the manufacturers, and Mr. Straight's words are sure to direct their attention in this promising direction.

An Unusual Convention

THE Third National Foreign Trade convention, which will be held in New Orleans Jan. 27 to 29 under the auspices of the National Foreign Trade Council, will be a meeting of quite unusual character. Instead of indulging in the platitudes which are usually expected at a gathering of this sort, the entire meeting is to be predicated on the acceptance of proved principles of foreign trade. Instead of arguing the necessity of adequate banking facilities and transportation, adaptation of product and sales methods to market, proper packing, knowledge of foreign tariffs and the relation of investment to export trade, the papers and discussions will relate to the *practical application* of these principles. Moreover, trade experts, some of them from the Federal Department of Commerce, will be on hand to give specific advice on foreign trade questions. The meeting would be a good one for American contractors considering entry into the foreign field to attend.

Pan-American Congress

DURING the two weeks ended last Saturday the newspapers of the country devoted space almost daily to the meetings of the Pan-American Scientific Congress, which met in Washington. The reports, generally, emphasized not the scientific but the international aspects of the gatherings, and in so doing they gave a correct picture, in the main, of the activities of the congress. While there were scientific sessions of interest, they were overshadowed by the international questions which were the topics for the general sessions, and which kept cropping up in the section sessions and in the corridor discussions. The Secretary of State voiced the keynote in his now famous "one for all, and all for one" speech on Pan-American unity, while the President, near the close of the congress, announced the principles which, in his judgment, should form the basis for an agreement between the American republics. It is patent that nothing is being left undone to cement the bonds between the 'three Americas." The congress, therefore, in its larger aspects is but a part of the whole general movement, of which the Pan-American Financial Congress held in Washington last May was the beginning. Any intercourse, even if it be merely scientific and literary, cannot but aid in bettering international relations, and this byproduct may be of greater value in time than the immediate gain from the interchange of ideas. Ultimately, too, a clear insight by nations into each other's intellectual points of view is bound to develop sympathy and confidence, and these in turn are the surest foundations for permanent commercial relations.

Paint as a Conserver of Light

ENGINEERS are apt to overlook the fact that the type of illuminant they install in factories, railroad stations, and other buildings is only one factor in the solution of the lighting problem. A neglected element, discussed by Henry A. Gardner, assistant director of the Institute of Industrial Research, of Washington, in a paper before the Master House Painters and Decorators' Association Jan. 10, is the color of the interior surfaces. In industrial establishments increased output, improved workmanship and fewer accidents have resulted where better lighting systems have been installed. In such places, wall treatment as a means of conserving the illumination has generally been adopted. These advances have come as a result of practical observations, which show that the rays from powerful lights, falling upon dark brick or stone walls, give less light to a room than the rays from less powerful lights falling upon similar walls that have been painted in light colors with dust-resisting, washable paints. Moreover, the monthly cost of illuminants for lighting dark-walled factories may be enormously reduced by the occasional application of such paints.

Accession to the Safety Movement

ANY large addition to the long list of those who are actively working for greater safety on streets and highways is to be heartily welcomed, but when the addition is that of an industry whose product has largely contributed to the increase in the number of accidents there is special reason for satisfaction. Last week the National Automobile Chamber of Commerce, meeting in New York, appointed a Safety First Committee, which not only will engage in general publicity to curb reckless driving, but will exercise its influence to impress on automobile dealers and manufacturers the need for sane driving if the automobile industry is to escape severe censure and harmful and unnecessary restrictive legislation. In the past, some of the members of the chamber admitted, dealers and manufacturers have strongly opposed perfectly justifiable restrictions, drawn up for safeguarding pedestrians. This course, manifestly, is shortsighted, for it results in encouraging the reckless to continue to disregard the rights of others. Inevitably there would result legislation which might become a serious bar to the most effective, yet reasonable, use of the motor car. The manufacturers who are members of the chamber are broad enough to see this. It will be to their own interests and those of the public at large if they succeed in impressing their views upon everyone engaged in the automobile industry.

Cheap Insurance for Employees

THE Brooklyn Rapid Transit Company of New York City, taking advantage of the fact that the collective insurance premiums of its employees amount to a large sum, has secured for them at their option what is said to be the cheapest life insurance ever offered under a group plan. For men under 32, the annual premium on $1,000 is only $7.28. Furthermore, one-half of the premium is paid by the company and no physical examination is required if the employee applies for his insurance within six months of the date his length of service (two years) permits him so to apply. When a man is retired on pension the company assumes his premiums, so that he has a paid-up policy at that time. Should he leave the employ of the company for any reason, he can convert his insurance practically at its face value, including the premiums paid by the company, into a standard life or endowment policy without physical examination. Already 65 per cent of this company's employees have availed themselves of this arrangement to take out policies on which their share of the premium will be $28,000 annually. A like sum to be spent annually by the company will prove to be a good investment. It is a very encouraging sign to see the management of a large public-service corporation appreciating the value of spending a little money and effort in the interests of its employees. Action of this kind is well worth the study of engineers and contractors handling large numbers of men.

Steel Column Test Series

THE REPORT of progress made in the extensive series of steel column tests being conducted by a special committee of the American Society of Civil Engineers and the American Railway Engineering Association, while emphasizing one noteworthy result in the evident relative weakness found for columns of thicker material, still leaves the impression that the great mass of scientific data which has been obtained in the conduct of these tests at the Bureau of Standards remains comparatively untouched.

As pointed out in the editorial published in this journal May 8, page 574, a thorough analysis of results should progress with the tests, in order that any apparent laws may be observed early and the series modified to give more definite evidence, if necessary. The modification in the method of testing there suggested—carrying the load up repeatedly to the same unit stress to determine evidence of progressive set, which should be considered as marking the life limit of the column—is believed to be so important that it should again be emphasized. The committee recognizes the vital influence of the yield point on column strength, and yet the determination of that point, or of the true elastic limit, is confessedly impracticable from the results of tests conducted as these have been.

This journal further questions whether the purposes in view can be best accomplished through a large committee of well-qualified, but busy, engineers who very probably cannot make the careful analysis so needful for full returns from the time and money expended on this elaborate investigation. Is the situation not one which would warrant the engagement of a consulting engineer at a suitable compensation for the critical study of these tests as soon as the results become available, one who would stand in the relation of technical counselor to the committee? The society is in excellent condition to lend liberal financial support to this important investigation. The columns themselves having been furnished by others, it is particularly incumbent upon the society to see that the analysis of the results shall be the best and most thorough possible, and that the tests yet to be made shall be conducted in the light of any new knowledge gained from previous observations.

Progress of Structural Design

THIS country has passed through a period in which there has been an abundance of raw material and in which a manufacturing plant with any reasonable degree of efficiency could operate at a profit. Raw materials have now become less abundant and a manufacturer must operate with a high degree of efficiency in order to survive. This change in conditions is affecting structural engineering as well as other lines of endeavor.

Too many structures are designed in such haste that proper attention is not given to their general scheme. Not only may such a policy result in expensive and poorly planned structures, but it may actually postpone the date at which the structure is completed. One hundred dollars spent in perfecting plans may save $1,000 in the construction. This is well illustrated by the plans submitted for the two floating cranes for the Panama Canal. The prices per ton bid by the German firm and by the American firm were practically the same, but for the total, the German bid was $871,300 and the American bid $1,450,000, a difference of $578,700. The lighter structure was also considered to be superior to the heavier one. The fact that one crane failed under test load was due to the failure of one member rather than because of any inferiority in the general design. This is an extreme example, but it illustrates the saving that may be obtained by carefully planning a structure.

Not only must the general scheme of a design be good, but the design must be carried out so as to result in a safe and economical structure. In order to design such a structure, it is necessary to determine the stress to which a member is subject and it is necessary to know the stress which a member will resist.

The secondary stress in a member may be as great as 50 per cent of the primary stress. If only the primary stress be considered the safety of the structure is involved. When it is difficult to determine the stress in a member, the section is often made much greater than is necessary and material is wasted. Good engineering is insurance against failure; wasted material is a tribute to ignorance. The difficulty of making an exact determination of stresses is much overestimated. To be sure it requires mathematical ability and patience, but when once the methods are mastered they seem no more difficult than many other mathematical processes. One objection to the use of the more exact analyses is the fact that they are often based upon assumptions which have not been verified by tests. This objection is valid and it is important that such tests be made.

Large structures have been destroyed through the failure of some relatively unimportant member and investigations have shown that failure was due to the inability of the member to carry the load for which it was designed. The failure of the floating crane for the Panama Canal referred to above is a striking illustration of such an occurrence. Professor McKibben has proved by tests that an angle connected by rivets through one leg can develop from 75 to 80 per cent of the strength of the net area of its section. There is but little information relative to the strength of the built-up sections usually used. No one knows their exact strength, and no one knows which ones are the most efficient. Yet the amount of material used in such members is so great that if a small fraction of one per cent of its cost were available for tests it would be possible to determine with some assurance the types of members which should be used.

It is true that time is often an important element in construction work, but the portion of the total time which is devoted to the preliminary design is so small and the opportunities to effect a saving and to produce a better structure are so great that undue haste is not justifiable in this part of the work. While it is true that it does not pay to fuss over the analysis of unimportant details, neglect of the more important parts may result in unsafe structures and in a waste of material. The structural engineer must discriminate between that which is and that which is not important enough to warrant careful investigation.

Progress in structural engineering, therefore, evidently requires a more careful consideration of the general scheme of structures, a more exact analysis of the stresses, the experimental determination of the accuracy of the assumptions upon which the analyses are based, and the experimental determination of the strength of full size built-up members.

Allocating Maintenance Between Classes of Service

IN CONNECTION with the recent Western passenger-rate case the Interstate Commerce Commission went extensively into the matter of allocating maintenance-of-way expenses between passenger and freight service. No less than twelve different methods were considered, giving passenger percentages of the total ranging from 45 per cent down to 17 per cent. Six methods were suggested by the carriers and six by the state commissions, although each faction chose one of the six as its preference.

It appears to this journal that all concerned could profitably look further into the report of W. J. Wilgus in the Ulster & Delaware case, abstracted in the Engineering Record of Aug. 21, 1915, page 226. Strange enough, the state-commission method, using the gross ton-mile as the basis, is most nearly that of Mr. Wilgus. The carriers, believing that the higher speed of the passenger train should be regarded as causing greater destruction to track, advocate the locomotive ton-mile, which, because as much locomotive tonnage is required to haul a light train at high speed as a heavy one at low speed, makes the passenger train a bigger factor in maintenance. But while the speed factor is important, Mr. Wilgus made it very clear that there were potent arguments on the other side of the case, such as drippings, imperfections of freight equipment, and heavier wheel concentrations. It would unquestionably be well if a means could be devised of measuring the comparative effect of these things, but certainly the railroads are not making a scientific argument when they disregard all of the destructive forces peculiar to freight service.

While the Interstate Commerce Commission evidently leans toward the ton-mile method, it thinks the facts and arguments presented are insufficient to warrant the approval of either of the methods. Perhaps one reason is that the state commissions did not, judging from the national commission's report, fully develop the fact that the application of the ton-mile basis is limited to certain of the items of maintenance, and that more than one other basis should be used for other items. The states did, it is true, show their realization of this in two of their methods, charging wear to the gross ton-mile and weather to either the car-mile or the net ton-mile. The report states, however, that the assumptions are not convincing. It does not say just how they were applied, and how the different maintenance items were divided and classified. The Engineering Record suspects, however, that it was not done with the completeness that characterizes the Ulster & Delaware study, and again suggests that all interested in the subject give Mr. Wilgus' report another careful reading.

The Evolution of the Aeroplane

ONE of the things which can be placed on the credit side of the ledger of the present European war is the evolution of the heavier-than-air flying machine from a sporting device to an every-day, hard-working necessity. When one reads the repeated accounts of raids by bomb-carrying aeroplanes in squadons ranging from a dozen to several score, working in long flights over the enemy's country, and generally returning unscathed, one awakes to a sudden realization that the great feat of conquest of the air is very near to being an accomplished fact. Now and then, of course, in a furious raid an engine goes wrong or a plane is hit by flying shrapnel or machine gun bullets, but on the whole the number of casualties, considering the risks from projectiles, is astonishingly small. It seems to be nothing uncommon for a squadron to depart, drop a hundred bombs or so on an enemy's position fifty or a hundred miles away and come back complete to patch a few rents in the wings and be off again the next day.

Even during the past year of active hostilities the evolution of the plane as a reliable machine for the hardest kind of scouting purposes has proceeded at an astonishing rate. At first the aviators were unarmed save for service rifles or automatic pistols, and the fusilage was quite unprotected. Within a few months came light armor for the vulnerable parts and a light machine gun for offence. Armoring the aeroplane would seem at first rather a difficult task, and so indeed it would be if the machines were to be exposed to rifle fire at short range. A modern army rifle bullet will penetrate a half inch of boiler plate, but a machine high in air catches the bullets, if at all, at a greatly reduced velocity and almost always at quite oblique incidence, so that a comparatively thin sheet of carefully tempered steel will give adequate protection. Even shrapnel bullets and fragments of shell have still less penetrating power, so that armoring under service conditions has proved to be a rather simple matter.

Means of offence have also increased with equal rapidity. Powerful machine guns are now regularly mounted on war planes, together with suitable devices for dropping incendiary and high explosive bombs, but the time seems now at hand when still further evolution in power of offence and defence is at hand. The Russians are reported to have developed some giant flying machines with double fusilage and engines of much greater power than hitherto tried. The French are known to have similar equipment under way, and even in this country experiments along the same line have been actively carried out. If these prove as successful as there is reason to expect, the next year of war will see armored aeroplanes capable of flying hundreds of miles at great speed while carrying half a ton or more of explosive. Even now some of the largest French planes are equipped with one-pounder rapid fire guns, and these probably will be replaced with light cannon of still larger caliber ere long. Thus armed and armored, the heavier-than-air machine becomes formidable either for offence, or for defence against raiding air craft of various sorts.

England is also reputed to be building air craft of great power in large numbers. In view of all this it seems reasonably certain that by the end of the war the aeroplane will be in position to take its place as a rather reliable means of emergency transportation, perhaps even as an aerial vehicle capable of performing regular service at high speed. The change which the year has produced is of a very startling character and another year will bring still further surprises. It is certainly the duty of engineers and aviators in our own country to see to it that we are not left behind in the race for command of the air.

The Engineer in Administration

A PAPER read by Dr. Hollis Godfrey before the American Society of Mechanical Engineers last month brings to the front the importance of orderly engineering methods, skillfully applied, in the administration of large affairs. Those who have charge of the policies of important organizations necessarily see them chiefly from the inside and when, as often happens, they call for the assistance of the engineer with respect to details of work in hand, what they chiefly require, although they may not put it to themselves in precisely that way, is the broad view of a trained mind working from the outside, quite as much as technical resources in dealing with special matters. It is the business of the engineer in such a case to coordinate the facts which are to serve as a basis of his judgment, and to organize them in such way as to show directly their bearing on the policy and success of the business to which they are related. If petty details alone were to be concerned, almost every large concern has within its own staff plenty of ability for dealing with them.

Mr. Godfrey presents the tasks of the consulting engineer, called in to look at affairs from the larger view point, in a most effective and orderly fashion, putting into words the methods which the trained mind follows almost instinctively and setting them forth so that their relation can be plainly seen. The examples of such organized study which Mr. Godfrey gives are well worth investigation by every young engineer applying his training to intricate concrete problems. The schedule drawn up to deal with the study of street lighting is a type of that which might be used, with its terms changed, in the investigation of many another engineering problem. In the mind of an experienced investigator like Mr. Godfrey such a codification leads to speedy and accurate conclusions, although one should properly add a word of warning lest lack of a proper sense of proportion as to the importance of the various items may lead to the waste of a great deal of good and valuable time in ascertaining to an unnecessary degree of precision details which are of secondary importance. This is the danger that besets the comparatively inexperienced in dealing with large tasks in engineering. Just as over-devotion to an efficiency system may lead to mazes of red tape that actually impede the doing of business, so somewhat slavish adherence to a schedule may result in a costly accumulation of minor facts that are only incidentally needful. That Mr. Godfrey clearly appreciates these limitations is evident from his paper, yet it is not amiss to call attention to them. One of the old jokes launched at the patient German investigator was that in measuring a base line he was prone to run off ninety-nine one-hundredths of it with a yard stick and then finish it up with a micrometer screw held rigorously at constant temperature.

The skilled engineer, like the really skilled mechanic, knows by experience or instinct where to go in for extreme precision, and where to save labor by carrying his work only so far as is necessary. To appreciate the difference, however, just the systematic attack on the task that Mr. Godfrey sets forth is necessary as a preliminary. The preliminary work having been done the conclusions must be drawn up in such form as to be of definite use and one may well emphasize the suggestions of brevity and clarity which Mr. Godfrey makes.

It is hard to lay too much stress on the necessity for the expression of facts in clear concise English, without long winded digressions, and without beating about the bush. In reading an engineer's report it should be possible to see exactly what is mean and to appreciate at once the bearing of the facts upon their use. Reports of this kind are unhappily all too rare. There is a place in an engineering work even for elaborate details which may be at some time of large value, but it is the bearing of these on the general conclusions which is the important matter from the standpoint of the executive who wants advice and not mere erudition. The young engineer can very profitably study this discussion of Mr. Godfrey's and take much of its contents to heart in his daily life.

DAM WAS BUILT IN THREE SECTIONS MAINLY ON ROCK LEDGE

Five Schemes Considered for Power Development at Kananaskis Falls, Alberta

Part 1—Reasons Indicated for Adoption of the Plan Selected—Objections to Others Carefully Analyzed—Time Element Important

By HAROLD S. JOHNSTON
Banff, Alberta, Canada

IN ORDER to supplement the service of its Horseshoe Falls plant, which was described in the Engineering Record of Feb. 7, 1914, page 152, the Calgary Power Company, of Calgary, Alta., after carefully weighing the advantages of five different schemes, designed and constructed a 11,600-hp. plant at Kananaskis Falls. The time element had considerable weight in the decision as to the plan to adopt, as it was necessary to have the work completed in a limited time in order to fulfill contracts that the first plant could not take care of alone. Protection against ice damage had to be provided, and a tunnel was run through the dam sections to permit observation of possible percolation and to take care of uplift action from water underneath. The lining of the canal was carefully considered on account of the ice danger.

The Kananaskis Falls plant is situated on the Bow River about 54 miles from Calgary, directly below its junction with the Kananaskis River. It is about two miles upstream from the Horseshoe Falls plant. The latter plant supplied power to the City of Calgary and to two cement mills of the Canada Cement Company, one in Calgary, and one in Exshaw, 8 miles distance. It had sufficient machinery to supply all immediate demands, but the low-water flow, which averaged about 800 sec.-ft., was insufficient.

Reasons for Selecting Kananaskis Falls

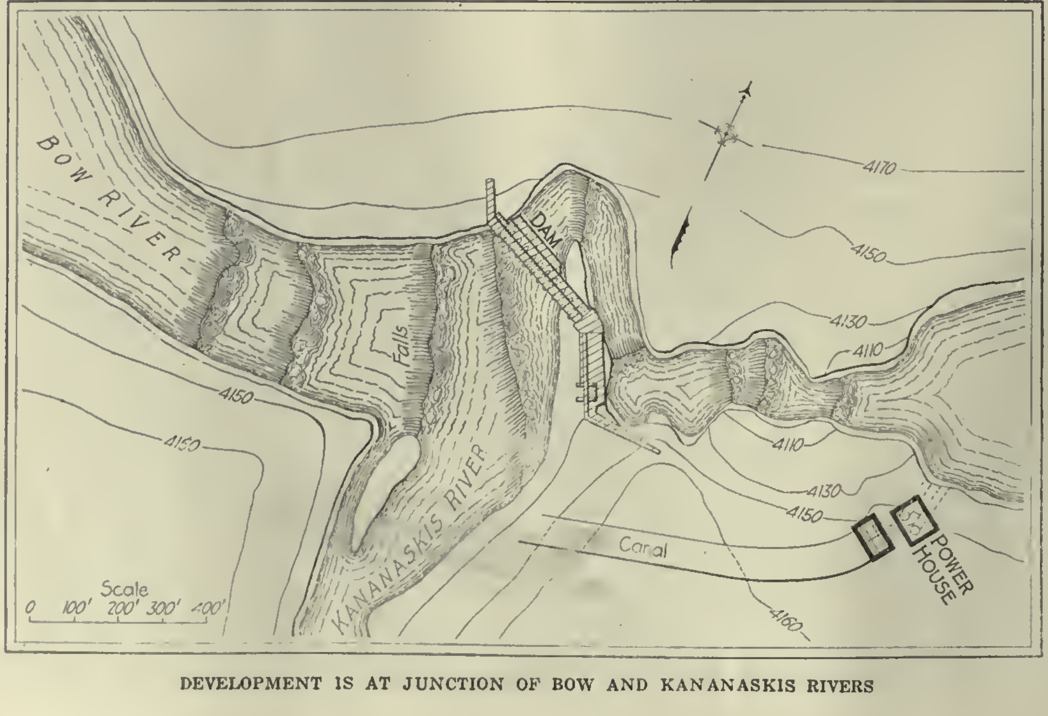
Main storage-reservoir sites were available at three points above the Kananaskis Falls plant, of which one, at Lake Minnewanka, on the Cascade River, a tributary of the Bow, and 33 miles distant from the plant, has been developed to the extent of 44,000 acre-feet. The other sites were at Spray Lakes, 60 miles away, and at Bow Lake, 90 miles away.

It had been found that it would be difficult to obtain a regulation that would make economical use of the Lake Minnewanka storage, because the released water takes a minimum of eighteen hours to reach the plant, and also because of the low winter temperature. If all these storages could have been developed, and gave maximum efficiency, it would have been possible to obtain a continuous low-water flow of 1500 sec.-ft. The creation of such storages would have been a lengthy process, however, and it was doubtful whether an efficiency of more than 6 per cent could have been obtained until a few years had elapsed to give the necessary data for more economical regulation. To develop the Spray and Bow Lake storages would have cost $625,000, and the construction period would have covered possibly two years. Besides, even with a regulated flow of 1500 sec.-ft., after all available main storages had been built there could have been no absolute certainty of being able continuously to fulfill contracts made for power delivery from the Horseshoe Falls plant alone.

In addition it is the recommended policy of the Department of the Interior of the Dominion Government to develop these storages under federal auspices and control. Consequently, when an additional source of power had to be obtained to fulfill contracts made for power delivery during the low-water season, the company proceeded with the construction of the Kananaskis Falls plant. This would give a known and assured amount of power in contrast with placing dependence on the questionable efficiency of distant storages which would probably, in any case, be developed in a few years under government auspices. When that time came, both plants would reap the benefit of whatever increase there might be in the low-period flow. This double increase of power output would also come at a time when Calgary's demands, and those of the industrial plants had increased to a point where more power would be necessary than could be guaranteed throughout the whole year.

Falls Considered Most Feasible of Six Sites Available

Kananaskis Falls forms the most interesting, most feasible and cheapest power site of six which are available on the Bow River between there and the city. Bow River rises in Bow Lake in the Rocky Mountains, near the Continental Divide, and flows southeast to the foothills, and thence easterly and, later, southeasterly through the foothills and the prairie to its junction with the South Saskatchewan River in southern Alberta, about 300 miles from its source. The drainage area above Kananaskis Falls is 1990 square miles and may be considered as lying entirely within the mountains. The mean yearly precipitation at Calgary, on the prairie, is 16 in., averaged from a period of twenty-nine years, and at Banff, in the mountains, 30 miles distant, 19 in. for a period of nineteen years. The mean temperatures at the site are 60 deg. Fahr. in July and 13 deg. Fahr. in January, with extremes greatly above and below these temperatures—45 deg. below zero having been recorded as an instance. The maximum flood discharge recorded is 14,770 sec.-ft. on June 24, 1911. On Jan. 24, 1911, a minimum of 590 sec.-ft. was noted. Records are not available over a long period of years, but from general data in relation to extreme floods it is estimated that in 1879 the maximum flood of 40,000 sec.-ft. occurred. Hence the ratio between maximum and minimum flow is



DEVELOPMENT IS AT JUNCTION OF BOW AND KANANASKIS RIVERS about 80 to 1, a ratio typical of mountain streams, but abnormal in this instance.

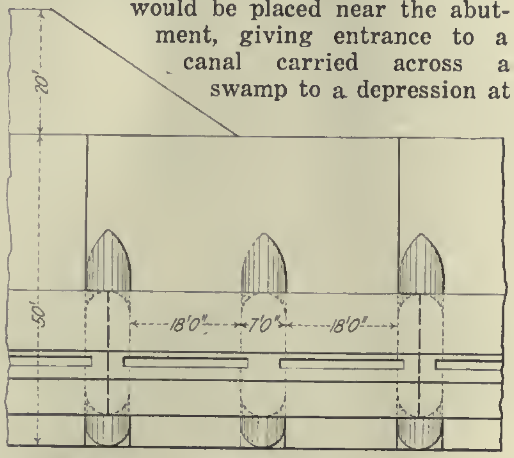
Rights to proceed with construction were not obtained until Nov. 25, 1912. On account of the contracts made for power delivery it was essential that the plant should be in operation not later than December, 1913. It was also essential that the plant should be capable of operating in parallel with the plant at Horseshoe Falls.

The total fall in the stream is 55 ft. The Canadian Pacific Railway crosses the Kananaskis River about 700 ft. above the canal and the Bow River about three-quarters of a mile above the falls.

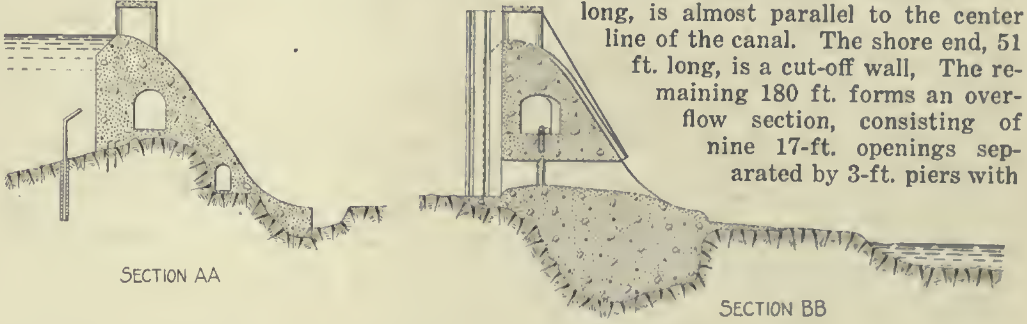
FIVE SCHEMES CONSIDERED

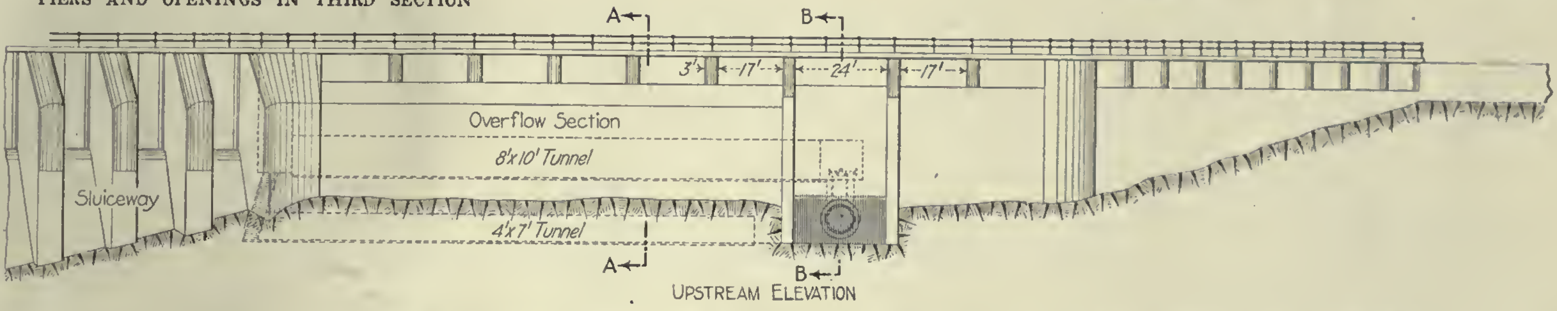
Five main schemes of development were proposed for purposes of study.

The first proposed a dam which, at the center of the river, would swing across it at right angles to the stream. An intake would be placed near the abutment, giving entrance to a canal carried across a swamp to a depression at El. 4112, where the combined head works and power house would be placed with horizontal shaft turbines submerged in open vertical cylinders. The concrete draft tubes would discharge into the bay uninfluenced by the stream flow.



PIERS AND OPENINGS IN THIRD SECTION





TUNNEL BUILT IN DAM TO PERMIT OBSERVATIONS OF SEEPAGE AND RELIEVE UPLIFT ACTION DUE TO PERCOLATION UNDERNEATH

The objections to this scheme were: The necessity of two cofferdams—one above and one below the section of dam crossing the river—on a very rough bottom, marred by potholes, and affording small chance of examination; the line of the canal crossing a swamp; the necessity of bridges for the transportation of all machinery, construction plant, and the consequent awkwardness of construction on both sides of the river; and the time element.

By the second scheme the power house, with floor level at El. 4160, would be located at the beginning of the canal, as shown on the contour map, on the bank of the Kananaskis River, with vertical shaft turbines set in wheel pits at El. 4100, discharging through the draft tubes into a tailrace tunnel with the exit in the vicinity of the sharp point below the lower falls.

The objections to this scheme were: The long vertical shaft from turbines to generators, which turbine manufacturers deprecated, feeling that vibratory effects would be serious, and the 650-ft. tailrace tunnel, which would be difficult of access.

By the third scheme an intake works would be placed at the same point as the power house in the second scheme, giving entrance to a pressure tunnel, and to concrete scroll chambers for vertical shaft turbines set between contours 25 and 30 on the flat opposite the lower falls, with the discharge from the draft tubes carried into a tailrace in the deeply indented bay. Tunnels of a size such as would be impracticable in view of the fact that the rock is Benton shale, very seamy and friable, with occasional layers of cardium sandstone, would be required in the working out of this scheme, and the test pits showed that near the site of the power house they would not have sufficient cover, particularly in view of their being pressure tunnels.

SCHEME PROPOSED AFTER WORK WAS STARTED

The fourth scheme was not proposed at the same time as the others. A plan had been adopted and construction started when a consulting engineer arrived at the work, having been unavoidably delayed. He proposed a horizontal-arch gravity-section dam located with subtangents just above the lower falls, with the head works a continuation of the dam, and in the same structure as the power house, which would be at the edge of the river bank. The penstocks would be of steel surrounded with concrete.

Objections to this plan were as follows: Soundings showed a depth of 40 ft. as a maximum in the pool just below the lower falls where the main section of the dam would be located; the cofferdamming of this pool and its pumping out for exploration and concrete work would be most expensive and time-consuming; the cofferdam would be of considerable length, and built on gravel at some distance below the pool to get reasonably shallow water; a sluiceway or tunnel would have to be left through the dam for passing the flood from May 15 to Sept. 15, leaving two months to do the work outlined in the first objection, which was too short, and the scheme was believed by officials of the company to be as expensive as, and probably more expensive than, the scheme adopted. It had many recognized and outstanding advantages, but time was a controlling feature, and there were many unknown conditions in connection with the dam foundations at an essential point that would be most vexatious and time-consuming.

PLAN ADOPTED

The layout adopted called for a dam located mainly on a ledge of rock extending almost across the river. The dam is built in three main sections. The water, by this means, is raised into a canal with rock bottom by which it is conducted to an intake works with the necessary racks and gates. From here it is conveyed, in pressure tunnels lined with concrete, to vertical shaft wheels placed in concrete scroll chambers, and, thence, by concrete draft tubes to two tailrace tunnels 156 ft. long and discharged into the Bow River in a protected bay.

Some of the reasons for the adoption of this layout will be apparent from the other schemes proposed, and more will develop with further description.

The first section of the dam, 321 ft. long, is almost parallel to the center line of the canal. The shore end, 51 ft. long, is a cut-off wall. The remaining 180 ft. forms an overflow section, consisting of nine 17-ft. openings separated by 3-ft. piers with the crest elevation at 4155, the normal pond elevation.

The spillway crest is fitted with 1½-in. pipe set into the concrete, to be used for the insertion of soft-iron flashboard pins which will support flashboards raising the pond elevation to 4155.75, giving 300 sec.-ft. of water for five hours during peak periods. A concrete deck 10 ft. wide covers this section.

CENTRAL SECTION OF DAM

The central section from angle block to angle block is 184 ft. long and is provided with eight 17-ft. overflow openings, similar to the first section, and a 24-ft. opening intended for a log run. The section was built partly on and partly beyond the ledge of rock, the greatest economy in the use of concrete being sought. As first designed it lacked the 5 ft. at the heel with the sloping top surface to take care of ice pressure. This was added to the main section upon the recommendation of J. R. Freeman, the reason being that "there will probably be a crack form opposite the level of the crest of the bedrock due to difference of temperatures and shrinkage."

Reinforcing steel was added to the first and central sections, 9 in. from the heel face, to take care of ice pressure. This was calculated as assuming a maximum horizontal thrust of 40,000 lb. per linear foot at El. 4155. Ice conditions are always an anxiety for hydroelectric plants in such latitudes, and precautions must be taken to eliminate the troubles caused by them.

TEMPORARY SLUICE LEFT IN DAM DURING CONSTRUCTION WAS LATER FILLED IN

The foundation upon which the whole of these sections and part of the last section was placed is a very hard quartzose sandstone in strata from 1 to 3 ft. thick, loosely adherent to one another, and with softer shales intervening between groups of sandstone strata. The stratification inclines downward, upstream at an angle of about 20 deg., and the strike is almost at right angles to the main line of the stream. Sandstone covers the stream bed at the toe of the dam, except for 100 ft. at the west end of the end section, where there is soft shale. This was protected against scour with a reinforced-concrete blanket tied into the main dam. The sandstone strata have many small cross joints and the seams to the adjacent strata are not tight. These conditions necessitated the grouting of the foundations.

TUNNELS IN THE CENTRAL SECTION

For observation purposes two tunnels were placed in this central section—one in the main body allowing observation of any percolation through the dam—and with 2-in. pipe carried to the foundation rock every 10 ft. so as to free any uplift due to percolation underneath. This tunnel also has running into it at the upstream springing line 1 x 18-in. spaces, inclined upstream and carried close to the crest of the dam, to intercept percolation and bring it away before it reaches the ogee and causes scaling of the concrete through frost. These openings were placed every 16 ft., but it was later found by the writer, through examination at the dam of the plant at Horseshoe Falls, that they would have given even better service if spaced at 10-ft. centers.

The second tunnel was located below the rock ledge, and observation spaces 2 ft. wide were carried to the ledge from this tunnel at the more dangerous points, which gives an opportunity to watch any seepage through the rock seams, and a chance to grout the seams, should the seepage become serious. The two tunnels were connected in the central block at the end of the second section, where an outlet was also made to the one lower side of the dam. Communication to the tunnels is afforded by a shaft from the deck.

NO HEEL TRENCH USED

No heel trench was used in either the first or second sections. The danger of cutting through a stratum of sandstone is apparent. Two rows of 1¾-in. anchor bolts staggered 4 ft. apart, extending 3 ft. into both the rock and the concrete, were used.

The third section runs upstream, making an angle of 30 deg. with the central section to avoid a fall of 4 ft. in the river, and the consequent washed-out pool below it. It is 268 ft. in length between abutments, and is provided with eleven 18-ft. openings with 7-ft. intermediate piers. These openings are controlled with stoplogs. The sill is at El. 4138.

A tunnel runs through this section and will ultimately be carried into the rock of the abutment, should there be any sign of leakage making a way around the end. A retaining wall is carried beyond the spillway section, which also acts as a cut-off wall. From the tunnel 3-in. pipe is carried to the foundation rock every 10 ft. to relieve uplift pressure, and, later, holes were drilled through these pipes into the rock for an average distance of 25 ft. so that any percolation under pressure might be brought into the tunnel, and the pressure relieved. These "escape valves" are doing their work extremely well. There is a continual flow from many of them.

Expansion joints are allowed for in all sections at a distance apart of approximately 50 ft. Three-inch plank with beveled edges for convenience in removing were used to form checks, which were not continuous, but staggered. The expansion joints were not carried in a vertical plane, but broken back 3 in. and then out again 3 in. at a point 14 ft. above. The joint was coated with one layer of pitch and, because of the nature of the rock formation, it was deemed advisable to pressure-grout the foundations.

At the end of December, 1912, with some grouting still to be done, the total leakage through the dam was estimated to be about 50 gal. per minute, of which probably 20 gal. came from a spring in the center of the sluiceway section that was piped to the apron to give it relief. At the time of writing the leakage is almost negligible.

(To be concluded)

OXY-ACETYLENE WELDING FOR A WATER-PIPE OFFSET proved to be not only cheaper and a time saver, but also much neater in appearance when compared with ordinary pipe-fitting connections, in running branches from a 6-in. water main of the sprinkler system in the Indianapolis plant of the Presto-O-Lite Company, Inc. Because the main had been hung too close to the ceiling, it was found necessary to make offsets on one side 7¼ in. and on the other 5¼ in. to pass girders and other piping. On one side the standard fittings were used with a 45-deg. elbow giving a 12-in. drop. On the other side a short section of pipe, with ends cut at the proper angles, was welded into the line at a total cost of $3.40, as compared with a total cost of $17.50 for the standard fittings.

Sheet Piling a Remedy for Soft Spots in Wet Cuts

Concrete Side Walls Still Cheaper—Either Should Be Effective, and Less Expensive Than Concrete Slabs Under Track

By E. L. SINCLAIR
Assistant Engineer, Chicago, Milwaukee & St. Paul, Railway, Chicago

REFERRING to J. T. Bowser's article "Concrete Eliminates Soft Spots in Railway Roadbed" in the Engineering Record of Oct. 23, 1915, page 506, I submit herewith a sketch, Fig. 1, showing sheet piling along both sides of track which has been used successfully in just the kind of spots referred to by Mr. Bowser; that is, soft spots in cuts where the track settles badly for the length of a rail or two. Two rows of 3 x 6-in. x 8-ft. fir were used and were driven with a track driver, the ballast being first removed and a small trench dug to start the sheet piling in.

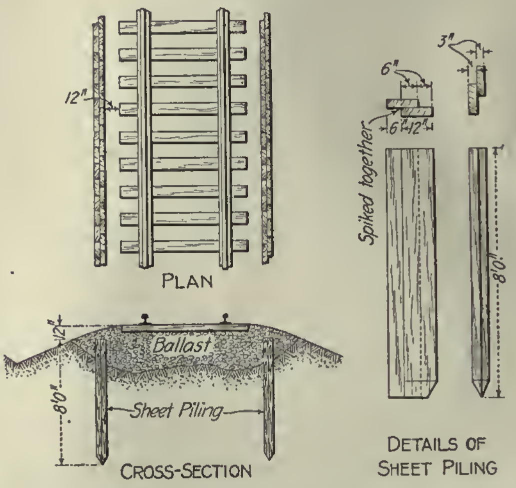


FIG. 1—SHEET PILING OF THIS TYPE HAS PROVED SUCCESSFUL

In July, this year, I examined a number of places where the sheet piling was driven in 1909, and in every case I found that the sheet piling had not pushed out of line, and the section foremen reported that they had had no trouble to maintain track since the sheet piling was driven. Before this, water stood in the bottom of the ballast in wet weather, and as it could not be drained out, the churning action of passing trains worked the clay next to the ballast into a semi-fluid state, and it was forced upward in very thin layers along the outside of the ballast, filling the cut ditches and causing the track to settle constantly. Since the sheet piling was driven it has been impossible for the clay to push out from under the ballast, and the settlement stopped in a short time after the piling was placed.

CONCRETE WALLS

I seen no reason why concrete walls, as shown in Fig. 2, would not serve the purpose fully as well as the sheet piling, and at less cost. While Mr. Bowser does not give the cost of placing concrete under the track, it must be much more expensive than it would be to dig trenches with a tile spade parallel with the track and fill them with concrete. In either case, it would be necessary to do the work in dry weather after the subgrade had dried out thoroughly.

Costs will vary greatly in different parts of the country, and if second-hand material is available for sheet piling the cost will be greatly reduced. For purposes of com-

COST OF 100 FT. OF SHEET PILING, BOTH SIDES OF TRACK

9600 ft. b.m. 3 x 12-in. x 8-ft. piling at $25	$240.00
300 lb. 40d spikes at $2.50	7.50
Driving	60.00
	$307.50

parison, however, I submit the accompanying tables. They show that the cost of sheet piling is about $3 per linear foot of track and that of the concrete walls about $1.30 per linear foot.

COST OF TWO CONCRETE WALLS 8 IN. X 4 FT. X 100 FT.

20 cu. yd. gravel, at $1	$20.00
140 sacks cement, at 0.35	49.00
595 lb reinforcing, at 0.02	11.90
Labor	50.00
	$130.90

FARM DRAIN TILE USELESS

I am a firm believer in drainage, but am convinced that ordinary farm drain tile placed below the bottom of the cut ditch parallel to the track in a soft cut is money wasted in many cases. Unless the soil is porous, the water in the bottom of the ballast does not reach the tile, and the working of the subgrade will separate the tile at the joints, so that it will be found that no water flows from the tile after it has been in service for a year or two. The cost of 6-in. bell-end vitrified sewer pipe is about twice that of ordinary drain tile, but I would recommend its use, and if the subgrade is unstable, the tile should be supported and kept in line by a plank trough, as shown in Fig. 3.

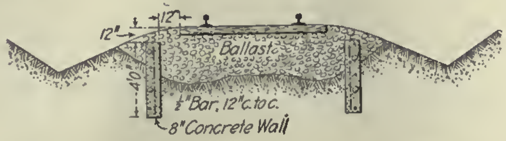


FIG. 2—CONCRETE SIDE WALLS SHOULD BE CHEAP AND EFFECTIVE

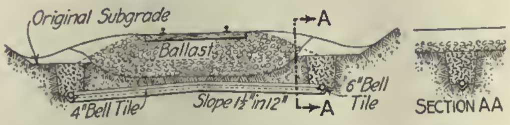


FIG. 3—DRAIN PIPE IN UNSTABLE SOIL SHOULD BE SUPPORTED BY PLANK TROUGHS

THE PRICE of "Elasticity and Resistance of the Materials of Construction," by William H. Burr, has been changed from $6.50, as stated in the review on page 24 of the issue of Jan. 1, to $5.50 net.

2500-Ton Concrete Cribs Are Built and Launched in a "Shipyard"

Combined Casting Yard and Marine Railway at Victoria Handles Heavy Cribs for Government Piers—Work Progresses Simultaneously on Five Cribs

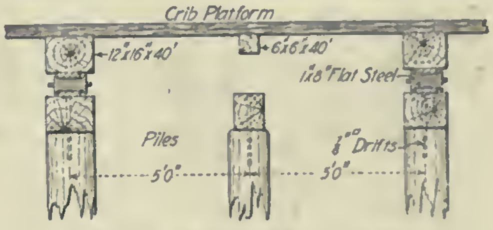
THE QUESTION of how to launch the heavy concrete cribs for the Government piers at Victoria, B. C., has presented new problems in requiring some method which could safely handle the great weights without interfering with the steady and speedy progress of the work nor exceeding the reasonable cost limit. The first scheme, using a large floating drydock on which two cribs could be cast and launched simultaneously, resulted in failure and was abandoned. An account of the accident that occurred when the first cribs were launched appeared in the Engineering Record of Feb. 20, 1915, page 247. Since then an entirely new plan has been evolved and used successfully which permits of the simultaneous construction of five cribs on a solid structure, and provides for launching on marine ways by slow stages so that there are never sudden excessive strains to endanger cribs or structure.

The general scheme of constructing the new government piers, which was explained in detail in the Engineering Record of Aug. 7, 1915, page 165, requires the construction of fifty-three concrete cribs, for the most part 80 x 35 ft. in plan, 39 ft. high and weighing about 2500 tons each. The first two of these cribs, constructed on the drydock, were found to be intact after the accident that occurred at the launching, and were later towed to the pier site and properly placed. The marine-way scheme for handling the cribs was then adopted and the first crib launched from the ways on Sept. 25. This was followed by another on Sept. 30 and still another on Oct. 8, all of which were launched without the slightest hitch. With the plant well under way and in regular running order it is expected that it will be possible to launch a crib every seven days.

BUILDING THE "SHIPYARD"

Each of the cribs, when floating, draws 27 ft. of water, and in order to secure the necessary depth of water in a place well sheltered from storms, it was found best to construct the plant entirely on pile foundations. The most favorable location was in Esquimalt Harbor, about six miles from the pier site. At this point the water is about 40 ft. deep at high tide and the bottom is mud and clay to a depth of from 45 to 60 ft., at which level bedrock is found. Construction of the plant was started here in February, 1915.

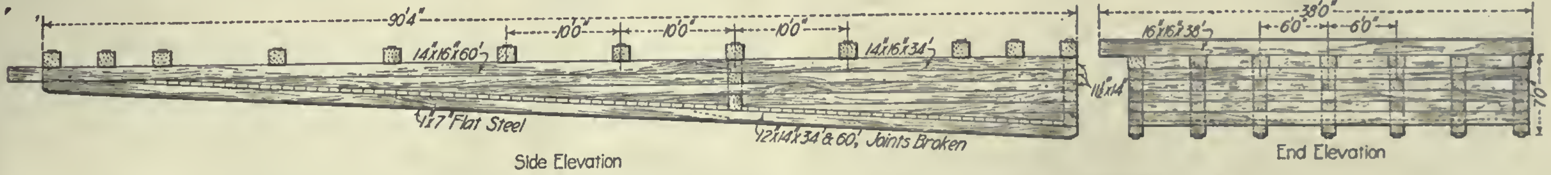
In order to have room for the simultaneous construction of five cribs it was decided to construct a skeleton wharf 90 x 225 ft. in plan. This wharf consisted principally of twelve parallel rows of piling capped with 12 x 16-in. timbers. The rows were spaced 10 ft. apart, except the two outer rows, which were on 4-ft. 9-in. centers. The piling in each of these rows was driven on approximately 2½-ft. centers. Only large Douglas-fir piles with the bark on were driven, and the average length exceeded 100 ft. Under the wharf a strong cross and sway bracing of 3 x 10-in. plank was used. On each of the 12 x 16-in. caps in this skeleton wharf a track of 1 x 8-in. iron was placed and held in position by ⅝-in. countersunk driftbolts.



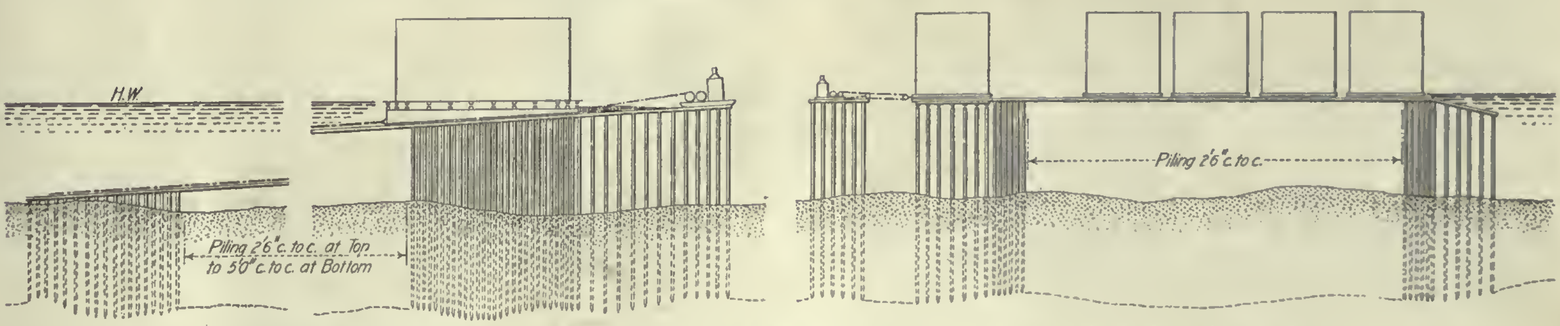
DETAILS OF THE CRIB PLATFORM

Five construction platforms 40 x 100 ft. in plan were built with parallel bottom timbers spaced the same as the caps of the skeleton wharf. The platform timbers thus furnished a bed for 1 x 8-in. iron tracks, which corresponded with the tracks on the skeleton wharf over which they moved on twelve rows of cast-iron rollers. These rollers are 4 in. in diameter and have flanges on each end to fit over the 8-in. iron tracks, as shown in one of the accompanying drawings. They are spaced on 10-in. centers and held in position in wooden frames in nests of ten rollers each.

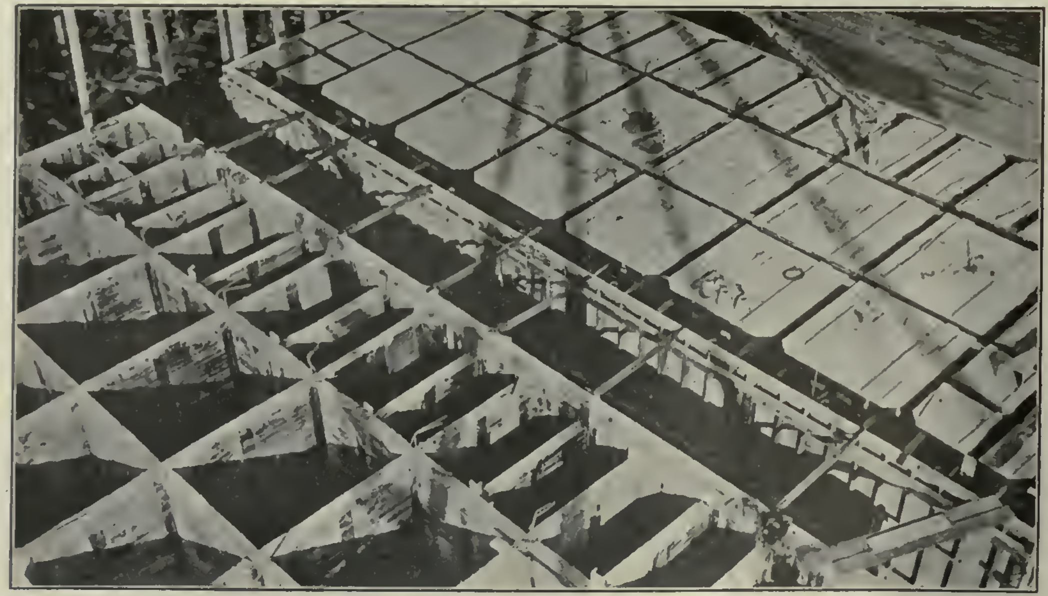
When the platforms are in position on the wharf the top planking is 6 in. above high water and the cribs are constructed directly on them. A layer of roofing felt is laid on the platform prior to the begin-



LAUNCHING CRADLE IS BUILT OF TIMBER AND FILLED WITH GRAVEL BALLAST TO OVERCOME ITS BUOYANCY



ENGINES CROSS HAUL CRIB AND PLATFORM ON SKELETON WHARF AND LOWER DOWN 700-FOOT MARINE WAY ning of work on each crib. This prevents the concrete from adhering to the platforms.



INSIDE FORMS AND REINFORCING STEEL OF CRIB IN POSITION

MARINE RAILWAY

The marine ways for launching the cribs is at one end of the skeleton wharf and at right angles to it. The track is 700 ft. long and has a grade of 1 in 18. It consists principally of seven rows of timbers constructed on piling, tied together with cross timbers and carefully braced. Additional support is furnished by batter piles placed along the outer piling of the structure proper. The piles in the incline are all selected Douglas fir and are driven on 2½-ft. centers at the top of the track. They are gradually spaced wider apart toward the lower end of the track, where the buoyancy of the water reduces the weight of the crib. The piles were cut off under water on the required batter by a specially designed circular saw operated from the surface.

A 7-in. iron track for rollers is placed on top of each of the seven lines of timber. It is 1 in. thick at the upper end and gradually reduces to ⅝ in. at the bottom. The track is spiked to the timbers with ⅞-in. driftbolts.

The launching cradle is built of timber as shown in one of the drawings and is filled with gravel ballast to overcome its buoyancy. It moves up and down the incline on seven rows of 4-in. rollers with spacings varying from 10 in. between centers at the upper end of the track to 14 in. between centers at the lower end, where the buoyancy of the water lessens the weight of the crib. These rollers are held in position in wooden frames coupled together in each of the seven rows. The 16 x 16-in. cross timbers on the top of the cradle are spaced to coincide with the twelve-track timbers of the skeleton wharf, thus allowing the iron tracks on cradle and wharf to connect, so it is possible to roll the successive construction platforms with their respective cribs direct from skeleton wharf to cradle.

This cross hauling of the platform and crib to the cradle is accomplished by means of two sets of six-sheave blocks with ¾-in. wire rope, power being furnished by two 7 x 10 hoisting engines. The cradle is held rigid during this time by four 1 x 8-in. steel straps, which are released as soon as the crib is on the cradle, so as to allow the latter to move down the incline.

The rigging for lowering the cradle consists of two 14-sheave tandem blocks, one of which is fastened to the front end of the cradle and the other to the engine bed timbers at the upper end of the launching track. These blocks are reeved with ¾-in. and ⅞-in. wire rope in such a way that the ⅞-in. rope is in play during the heaviest pull and the ¾-in. rope comes into use as the buoyancy and resistance of the water decrease the load. A two-drum highly-geared 10 x 12 hoisting engine is used for lowering the cradle.

Owing to the resistance of the water and the power required to overhaul the 14-sheave blocks, the weight of the crib is not sufficient to carry the cradle to the bottom of the incline. A 7 x 10 hoisting engine located alongside the lowering engine furnishes the additional power required to do this. As soon as the first crib is launched, each remaining crib on the skeleton wharf is moved one space nearer by means of the same rigging used to move the completed crib from the wharf to the cradle. The empty platform taken from the crib at the time of launching is towed to the far end of the skeleton wharf and pulled up on the track by means of a short incline. It is then ready to receive the reinforcing steel and forms for another crib.

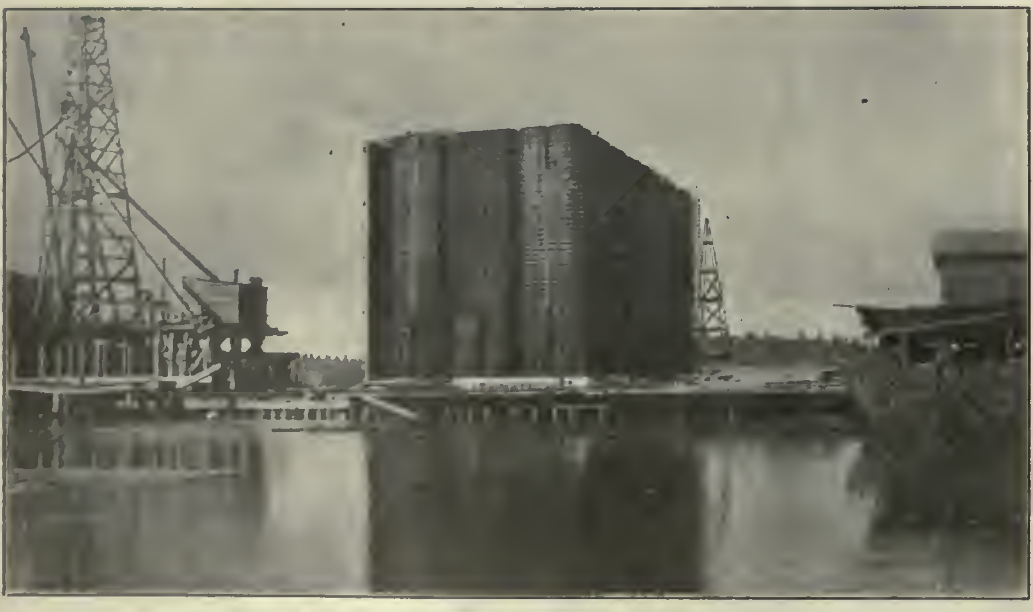
CONCRETE PLANT

The mixing plant consists of a 1-cu-yd. Smith mixer installed on one end of a 1200-ton scow. Hoppers for sand and gravel were built on the deck to accommodate about 500 cu. yd. of material and were arranged to feed by gravity into measuring hoppers. A 30-in. conveyor belt running underneath the measuring hoppers conveys the sand and gravel to an elevator belt, which carries it to the charging hoppers. The cement is added in the charging hoppers and is handled by compressed air through a 4-in. hose from the cement shed.

The mixed concrete is deposited in the forms by the "open spouting" method, after being elevated 100 ft. in a tower on one end of the mixer scow. The sand and gravel is delivered from barges to the mixer scow by a derrick operating a 2½-yd. clamshell bucket. The capacity of the plant is 50 cu. yd. per hour. The contractors operate their own hydraulic screening plant in furnishing the sand and gravel.

The numerous longitudinal and transverse bulkhead walls in each of the cribs made it necessary to adopt some type of collapsible inside forms for these bulkhead walls. The method in use and which is working successfully involves the use of sectional unit forms. Each section is so hinged together that when the inside braces are loosened and the form is subjected to a lifting pull, it automatically "collapses" and frees itself from the concrete. It is lifted out with a derrick and after the inside braces are replaced in position the form is again ready for use.

The "shipyard" has been constructed by Grant Smith & Company & McDonnell, Ltd., who have the contract for the two government piers now under construction. The design and construction of the plant was carried out under the supervision of H. W. Bassett, and plans and details were drawn by D. D. Updegraff.



FINISHED CRIB BESIDE ONE UNDER CONSTRUCTION ON WHARF

TWO HUNDRED AND FIVE MILES of new lines were added to the British railways in South Africa during 1914, according to a report of the general manager of the Union Railways quoted in the London *Economist.* The mileage of the four railways is now 3705 for Cape, 2436 for the Transvaal, 1180 for the Free State and 1164 for the Natal, making a total of 8485 miles. Part of the new mileage was a railroad built in record time from Prieska to Upington for military purposes, which is expected, however, to develop into an important commercial line.

Co-operation of Societies Needed to Secure Equitable Specifications and Contracts

Says President of Society of Engineering Contractors in St. Louis Address to Engineers' Club and Associated Engineering Societies

ENGINEERING societies and organizations of contractors can, it is admitted, do a great deal to cheapen the cost and improve the quality of construction and to decrease the uncertainties of contract work by agreeing on standard and equitable forms of specifications and contracts. The need for such action was clearly brought out by Hillis F. Hackedorn, president of the American Society of Engineering Contractors, in addressing on Dec. 1 last the St. Louis Engineers' Club and Associated Engineering Societies. He pointed out that specifications on most contract work are now incomplete, carelessly drawn or badly enforced; that most contracts are inequitable; that the English practice of making the engineer instead of the contractor responsible for the correctness of estimated quantities is much superior to our own; that arbitration by true third parties should replace arbitration by engineers, and that great advantage both to architects and builders has followed in the past three years joint action such as he advocates, which was taken by the National Association of Builders' Exchanges and the American Institute of Architects. Mr. Hackedorn said, in part:

There is one of our ideals which we of the present generation sincerely hope may be realized in all parts of the United States, and that is the ideal of equitable specifications and contracts; specifications that are written fully and completely describing the work down to the minutest detail, eliminating all guesswork and conveying to the contractor completely the ideas of the engineer. One of the greatest impositions that is ever placed on a contractor is caused by the engineer whose specifications fairly teem with the expression "to the satisfaction of the engineer." This much-abused, impossible-to-forecast expression is about as serious a handicap as can be hung on a contractor who is making up an estimate of cost for any type of construction. It leaves too wide a field for guesswork and opens up too broad an avenue of opportunity for the engineer or the inspector to "get even" with the contractor for some fancied or real grievance. It is something against which a contractor has no opportunity whatever to protect himself. I have seen contractors practically ruined in an effort to satisfy an engineer who was unreasonable, but who nevertheless was backed by brass-bound specifications containing this damnable clause. The phrase impresses the contractor as an evidence of either lack of knowledge on the part of the engineer or laziness in preparing the specifications.

ENGLISH PRACTICE GOOD

In Great Britain carefully prepared schedules as to quantities are submitted to the contractor. These quantities are guaranteed, and in case of error the contractor has a ground of action against the quantity surveyor. This method enables the contractor to estimate the cost of work much more closely than can be done in this country, where all estimates of quantities are frankly labeled as guesses, and the engineer dodges all responsibility by stating that the contractor must assume all the hazard as to errors in such estimates. Of course under these conditions the contractor must charge for an element of chance which should not enter into the proposition. The engineer should make his estimates carefully and thoroughly and be ready to stand behind them in case of error. I know of but one bridge engineer who guarantees his quantity estimates. As a result, bidders can make much closer estimates on this man's work, knowing as they do that he will stand responsible for any errors in his quantity statements.

An unfair engineering practice frequently resorted to in the writing of specifications is to require the contractor to prepare the detailed working drawings for a job, including, for reinforced concrete, bending diagrams and special details as to connections of reinforcement. This makes it necessary for the contractor to maintain a much more expensive engineering and drafting department than would otherwise be required. In addition to this, some specifications require that the contractor, "having checked the plans, shall be responsible for the correctness of all drawings as to dimensions, elevations and corelation of the various parts," thus making the contractor absolutely responsible for the correctness of the engineer's design and drawings, and throwing on him in case of error the expense of correction. The contractor is given no extra allowance for preparing his drawings, but must do it at his own expense and deduct it from his estimated profits, when it should be taken from the engineer's fee. Many engineers even require that the contractor shall furnish several sets of cloth-mounted drawings, and as many sets of paper blueprint copies as the purchaser and engineer may desire. This might result in an almost unlimited abuse, and while it is a small item on a large job, it is one of the mice that eat away the substance of the contractor's estimated profit.

GIVE BIDDERS COMPLETE PLANS

Our position in the matter of detailed specifications is that we know of no legitimate reason why the contractor should not have full detailed information as to what will be required in the execution of a given contract before the contract is signed. He should not be required to make haphazard guesses on small-scale drawings and indefinite specifications frequently lacking in vital information. If detail drawings have not been completed before the date on which bids are requested, the date should be postponed to give the engineer an opportunity to prepare complete working drawings. It takes no longer to study the details of a structure before the contract is executed than after. A careful preparation of detailed drawings and the writing of complete specifications will result in a saving of cost to the owner, because when this is not done the contractor has to add a certain per cent to cover the uncertainties of the contract.

It has been our experience that where the engineer co-operates with the contractor the quality of work is very much improved, resulting in a great benefit to the owner. Of course if the contractor knows that the engineer is disposed to treat him fairly and not impose unnecessary hardships on him, he will in return for this confidence exert every effort to give the owner the benefit of his experience in producing the highest class of results.

The classification of excavated materials is one that has probably caused as many controversies as any other single item in an engineer's specifications. This point should be fully covered in all specifications so as to eliminate entirely the necessity for guessing at information which the engineer himself might supply. It would be far better for the owner if some preliminary money were spent more frequently in test pits and borings to ascertain the character of the soil to be encountered in excavation.

One of the most dangerous conditions in the great majority of specifications is the clause providing that the engineer shall be the final judge of the interpretation of the specifications. The lawyer would call this ex parte, for the reason that the engineer is in the employ of the owner and his judgment is bound to be biased toward that side. Of course I realize that the engineering profession takes the high and lofty position that the engineer's judgment will be fair to both contractor and owner; that he, like Caesar's wife, is above reproach, and that the contractor should have faith enough in him to believe that the engineer will give him a square deal. Investigation and inquiry among hundreds of contractors has convinced me that this presumed fairness and equity on the part of the engineer is the exception and not the rule.

CHANGING PLANS UNFAIRLY

One manifestly unfair condition in many specifications is that giving the engineers the right to make minor changes in the plans without extra compensation to the contractor, unless, "in the opinion of the engineer," he is entitled to such extra compensation, the amount of which is to be determined solely by the engineer. This condition leaves a very large opening for the engineer to abuse his authority over a contractor whom he does not like, or to seriously cripple him when, in the opinion of the engineer, the wrong man has landed the job.

One of the ideals of the American Society of Engineering Contractors is that the specifications should provide in the event of any disagreement between the contractor and the engineer that such question shall be submitted to arbitration, the engineer and the owner on one side and the contractor on the other being bound beyond appeal to the decision of the arbitrators. In our opinion this removes the danger of the contractor's being injured by the decision of the engineer, or of the owner's being defrauded by unfair work of the contractor. It would mean the elimination of controversies between the engineer and contractor.

One of the greatest injustices, to my mind, and one which enters into nearly all of the specifications, is the clause requiring the contractor to assume the responsibility for the infringement of any patent used in the performance of the contract. The engineer prepares his design, specifies his materials and method of construction and puts the responsibility on the contractor for ascertaining whether or not there are any patents on the type of design or materials used or on the method of construction. It seems to me that this is part of the duty of the engineer and that in making his design he should ascertain beyond the possibility of a doubt whether or not it infringes any of the many patents which have been granted. In case he cannot make a design without infringing a patent, either he should notify all bidders of the existence of the patent, and the fact that his design infringes, or he should obtain from the owner of the patent the right to use it for a specific price on the work.

Engineer Should Not Run the Job

Another inequity is that giving the engineer the right to direct the sequence of the work and issue orders as to the manner and time in which the various parts of the work shall be done, and the force required to complete it within the time specified. I believe that I can state without fear of contradiction that no two contractors would handle the same job in the same manner and sequence. It is customary in making up estimates to plan carefully the manner and sequence of the construction. If the contractor is not permitted to follow his own methods it frequently results in turning a contract that would otherwise be profitable into one that shows a loss. The contractor is the man who pays the bills, who furnishes the surety bond guaranteeing the construction according to the plans and specifications and in a given time, and, in my opinion, he should not be hindered by the ideas of the engineer.

Cutting Estimates on Principle

Another practice followed by some engineers is the pruning of monthly estimates for payment. As a general proposition the engineer or inspector directly in charge of a job, who is frequently a young man, will make a decided practice of underestimating work actually done. As a result, after taking off the percentage held back as provided by the contract, a contractor is paid in reality 50 or 60 per cent of the work actually done, where he should get 80 or 90 per cent. Of course this has no bearing on the engineer's ability, but it frequently embarrasses the contractor in financing big jobs. An important point in the preparation of estimates for pay, in which I believe contractors will bear me out, is that engineers should make an allowance for material on the ground ready to be worked up, a sum covering forms and preliminary work, and in some instances a sum approximating the cost of new equipment that is bought to handle the special job. Of course I realize that the engineer will say that many contractors will be unreasonable in these plans. If, however, engineers will show a disposition to help the contractor along these lines, I believe that 90 per cent of the contractors would be disposed to strain points in favor of the engineer and owner, and give them a higher type of construction. It would be nothing more than an appreciation of a favor extended, and along this line we are all human and willing to show our appreciation of any such help.

Contractors Blamed for Engineering Errors

The business relations between the contractor and engineer are little understood by the public at large. We frequently hear a contractor on public works condemned for failures in bridges, roads or pavements when he was entirely innocent, having built the work in strict accordance with the specifications furnished. Yet the general public makes him the goat, and the engineer, who has prepared faulty specifications, goes scot free. Of course the engineer may take the high position that if the contractor does not like his specifications he need not bid on the work. This is not only unfair to the contractor, but also to the owner, because it reduces competition by eliminating intelligent and responsible contractors. Some contractors go so far as to refuse to bid on work where the specifications are not fair and completely detailed; but where a contractor has a large organization with a certain amount of overhead expense, he is of course anxious to make as good a showing on the capital invested as he can. If he were to pass up unfair specifications he would lose many pieces of work which he could do at a profit under fair specifications.

A prominent engineer in a paper recently read refers to the personality of the engineer as probably the most important factor in the relations between engineer and contractor, stating that some engineers have a notoriously bad name and do not appreciate the responsibility of the honorable position they occupy. The wise engineer knows that many contract conditions can be ignored without any harm being done, and that many facilities can be given the contractor to expedite the work. We believe that contractors as a body will not take unfair advantage of these concessions, but will in their turn go out of their way to meet some special request of the engineer, playing the game of give and take in a reasonable way without expecting extra pay for every trifling piece of work.

Work of Builders' Exchange a Model

The National Association of Builders' Exchanges, of which H. L. Lewman of Louisville, Ky., is president, has been working for a number of years in conjunction with the American Institute of Architects to secure standard specifications and contracts for the use of builders. How well they have accomplished this work is evidenced by "The Standard Documents of the American Institute of Architects in collaboration with the National Association of Builders' Exchanges." These documents define the duties, scope and power of the architect, the duty of the contractor, the scope and limit of arbitration, and the rights of subcontractors. The specifications and contract forms have been so carefully prepared and revised that it is difficult to find any point wherein there can be criticism. Their theory is to insist upon the use of the principle of arbitration on every possible question that can be settled without resort to the courts. But the greatest lesson to be derived from the joint work of these two national organizations is the accomplishment of beneficial and just results by means of joint organization, co-operation and close affiliation. As a consequence of this work the membership of the National Association of Builders' Exchanges more than doubled during the year 1913, again doubled in 1914, and has almost doubled again in 1915. If it were possible to bring about such close relations between the various national engineering societies and all of the national contractors' organizations the result would be beneficial to all engineers and contractors, and losses caused by misunderstandings of contracts and specifications would be almost entirely eliminated. Such uniform action could bring about the adoption of standard specifications and contracts based upon equity, intelligence and fair dealing, ever guarded by the idea of arbitration.

Admits That Market Value Will Not Reproduce Land

California Commission Concedes Need of Multiples to Get Cost to Reproduce, but Says Reproduction Cost Is Not Cost to Reproduce

Virtual admission by the Railroad Commission of California that multiples in some form or other are necessary for determining the true cost to reproduce land is found in the commission's report, dated Dec. 8, 1915, in the matter of the valuation of a part of the Central Pacific Railway. The commission takes the stand, however, that the Minnesota rate decision necessitates the use of a different figure, "market value," in an estimate of reproduction cost.

The case is not one brought to settle a definite point in dispute, but is an investigation on the commission's own initiative to determine original cost, reproduction cost and reproduction cost less depreciation. The commission defines "reproduction cost" as follows, the italics being those of the Engineering Record:

"The term 'reproduction cost' means the estimated *cost* in cash of reproducing, in the condition (new or second-hand) in which it was acquired, the *physical property* of the public utility in the State of California, as of the date of valuation; to which is added the *value* of all operative *lands*, based on the market value of adjacent and similar lands, the actual or estimated *cost* of acquiring franchises and the estimated *cost* of overhead expenditures for engineering, law, interest and similar items."

This combination of cost and value to get a cost figure the commission justifies, as previously stated, by the familiar passage from the Minnesota rate decision. According to the commission, the U. S. Supreme Court "disapproves of the 'cost to reproduce' theory of fixing right-of-way valuations," even in estimating reproduction cost.

In the case in question the commission finds these three figures for the land: Original cost, $31,540.53; reproduction cost, including interest, $34,959.54; market value (which is the figure used by the commission in its final estimate of the reproduction cost of the whole property), $20,717. The commission does not discuss the moral side of the allowing of only two-thirds of what the land actually cost, as compared with a figure but 10 per cent in excess of the actual cost.

A Method for Accelerating the hardening of concrete, in order that the material might be used instead of willow mats in Mississippi River revetment work, has been the objective of experiments made by the U. S. Bureau of Standards. The bureau finds that 4 per cent of calcium chloride added to the mixing water increases the strength of the concrete at the age of one day 100 per cent or more. In some cases the strength of the concrete in which the calcium chloride was used at the age of two days equaled 75 per cent or more of the strength normally attained in one month.

Tunnel Drill Carriages—Their Economic Possibilities

Second of a Series of Three Articles Dealing with Heading Work at Mount Royal Tunnel and Showing How Best Features of Several Machines Could Be Used to Produce Ideal Drill Carriage

By S. P. BROWN
Chief Engineer, Mount Royal Tunnel & Terminal Company, Limited, Montreal

[*In the first article of this series, published last week, Mr. Brown discussed the general features of American and European drill carriages, differentiating the several types of equipment and describing the developments which have been made from the simplest machine, without overhang, to the latest device with cantilever arm and muck-handling conveyor. This week's article, Part 2, deals with the Mount Royal tunnel heading work and carriages, and presents a summary of the essential points in heading drill carrying design.*

Certain illustrations used in Part 1 are referred to in Part 2. These have been repeated so as to bring text and illustrations together, thus allowing the reader to gain a clear understanding of the subject without having to refer back to last week's issue to identify pictures and drawings.—EDITOR.]

IN the Mount Royal tunnel the ordinary method of heading excavation was by means of a horizontal bar mounting four drills. The drills were supported on arms similar to those used on the columns common to American tunneling operations, or on special saddle arms particularly designed for this job. Sullivan reciprocating, or percussive, drills were used, so constructed that where the ground made it economically desirable a jet of water and air could be injected through the pistons and steel into the bottom of the holes being drilled. For this reason hollow steel was generally used. (See double hose connections in Fig. 10.)

HEADING WITHOUT DRILL CARRIAGE

Before the rock in the heading became so hard as to require very heavy drills, no drill carriage was used, the drilling equipment being carried and erected by hand (Fig. 10). By this method in Trenton Limestone, before the rack had become too crystalline, the maximum progress of 810 ft. was made in an 8 x 12-ft. heading in 31 working days, a record-breaking performance. Six rounds were drilled and fired each day, two each shift. The maximum day's progress was something over 30 ft., while on days when igneous dikes of importance were encountered the progress would sometimes drop below 20 ft., and occasionally a shot would be lost.

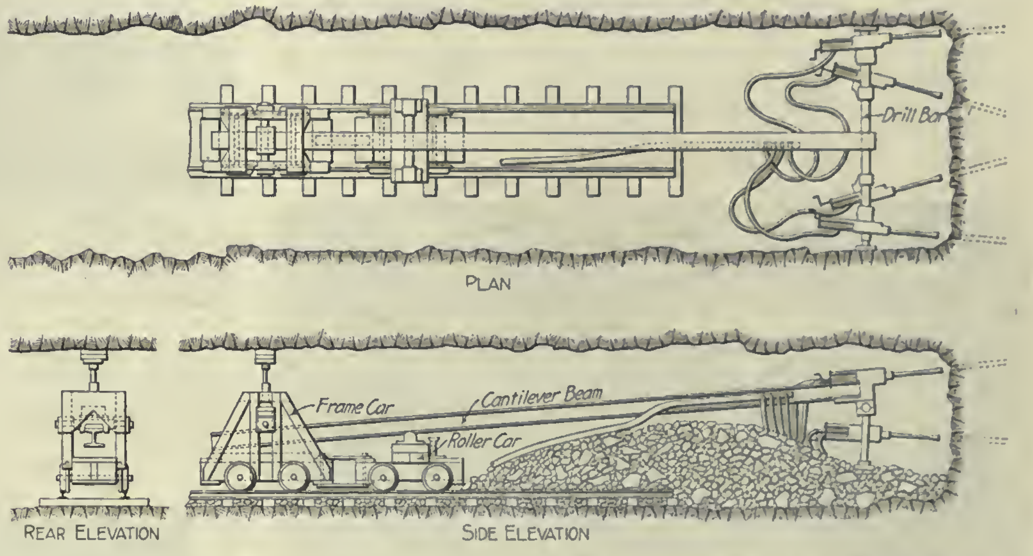
Seven muckers were used to handle this excavation, three casting back from the face and four shoveling into the cars. All mucking was done off slick sheets and the cars were designed especially low. Thus the four muckers shoveling into the car handled all the muck made on their shift, which amounted to from 12 to 15 cu. yd. per man per shift. This record is particularly interesting when it is remembered that nearly 2 hours out of each 8-hour shift were lost in blasting.

To break this rock required from 18 to 22 holes and about 500 steels per day for an advance of 26 ft. Four 2⅝-in. Sullivan water drills were used, with the water emulsion through the steel. Each driller averaged about 12.5 ft. per hour, deducting only the time lost in blasting. About 6.8 ft. of hole were drilled per cubic yard of place measurement and about 5.5 lb. of 60 per cent Forcite powder were used per cubic yard with 30-grain detonators.

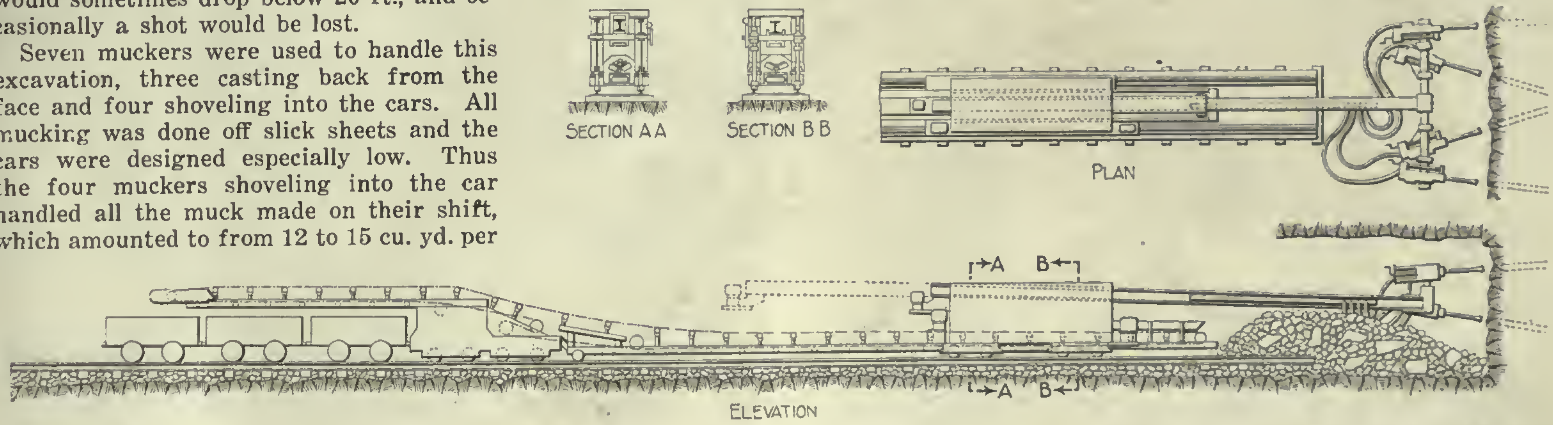
HEADINGS WITH DRILL CARRIAGES

As the rock became harder and more complex, requiring more powerful drills, it became imperative to devise some mechanical means of handling the equipment, which had attained a weight of several tons. The common type of European drill carriage, already described in Part 1 and shown in Fig. 5, was not suitable in the present case. This was principally because the Mount Royal headings, averaging from 50 to 100 per cent larger than the Alpine tunnel headings, broke so much ground that time could not be spared to muck out the heading before setting up the drills. It was, therefore, necessary to devise a drill carriage with a long cantilever arm by which the drilling equipment could be extended ahead over the muck pile in the heading, without any material delay after the blasting was completed.

In order to bring the carriage near enough the face for an arm of reasonable dimensions to reach the point where the drills were to be set up the track on which the carriage ran was riveted to steel plates, which could act as slick sheets and could be mucked off rapidly, as described in Part 1. Thus, after the blasting, the muckers cleared this track to within about 25 ft. of the face by throwing the muck that had fallen on it to the sides. As soon as this was done the drill carriage was run in, hard up against the muck pile, the cantilever arm carrying the drill bar was extended, and the drill bar jacked into place. The drills were thus always in the heading by the time drillers had the roof and sides barred down and sufficient muck thrown back from the face to permit the drill bar to be set. While the drillers were jacking up the bar the pipe-fitter was connecting the



3.—IN SIMPLEST TYPE OF CARRIAGE A LONG ADJUSTABLE CANTILEVER ARM EXTENDS DRILLS ON HORIZONTAL BAR OVER MUCK PILE

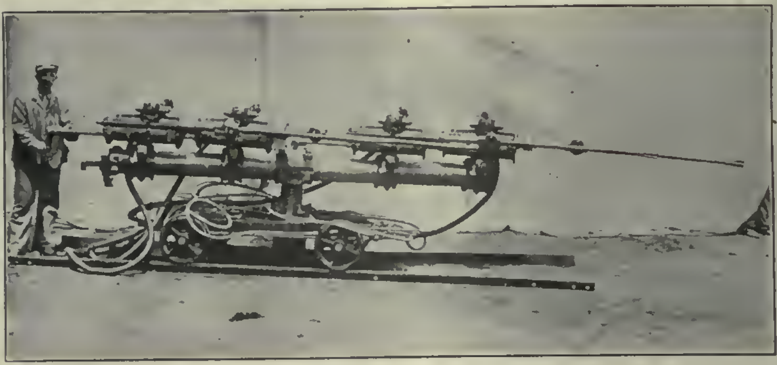


4.—A MORE COMPLICATED CARRIAGE PROVIDES FOR MECHANICAL OPERATION IN EXTENDING AND ADJUSTING BAR AND WAS EQUIPPED WITH MECHANICAL MUCKING DEVICE AND TRANSPORTER two large drill carriage hoses to the ends of the water and air pipes entering the heading. None of the drills was ever dismounted from the bar or disconnected from its manifold. The drillers started work as soon as the bar was tight.

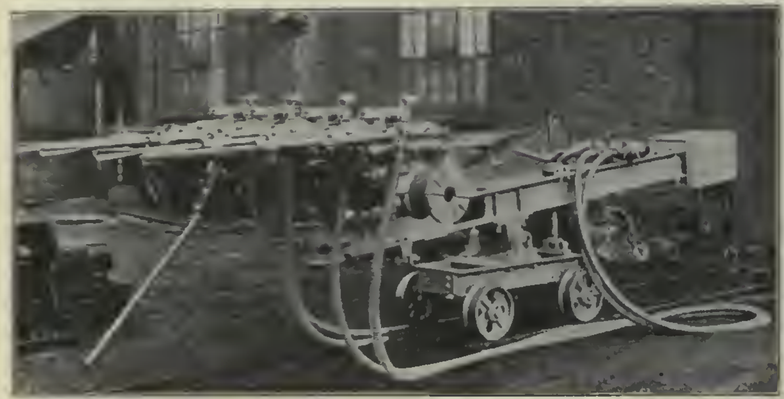
Two types of carriages were designed and built. One (Fig. 3) was very simple, for use in the small 8 x 12-ft. heading; it was merely a carriage proper somewhat similar to the Carter carriage (Fig. 8), described in Part 1, except that the cantilever beam moved with the drill bar instead of having the bar slide on the beam. The other (Fig. 4) had the moving beam, but as it was for use in the large heading, 10 x 13 to 14 ft., it also had a muck-handling attachment for transporting the excavated material from the face to cars in the rear.

Drill Carriage Increases Progress

The effect of drill carriage work is shown by the results obtained, for instance, in heading 3 E where the muck-handling drill carriage operated for over six months. For the six months prior to the installation of the drill carriage in this heading the average progress was 350 ft. per month in crystalline limestone cut by numerous dikes and in places highly impregnated with various contact minerals. For the six months after the installation of the drill carriage the average progress was 485 ft. per month, almost entirely in Essexite. The hardness of the rock may be realized from the fact that 20 to 24 holes were required to break the ground and about 1000 steels were used a day for an advance of 19 ft.



7.—Mobile carriage designed to correct certain faults in previous types of apparatus



5.—Old European carriage, without overhang, merely transports drills to working face

Saving Effected

Four $3\frac{5}{8}$-in. Sullivan drills were used. The water attachment was not used, as the length of time required to put down a hole caused the water to freeze and gave trouble in operation. Each driller averaged about 8 ft. per hour, deducting only the time lost in blasting. About 7 ft. of hole were drilled per cubic yard of place measurement, figuring the heading $9\frac{1}{2}$ ft. high by 13 ft. wide. About 7 lb. of 60 per cent powder were used per cubic yard with 30-grain detonators. As the force employed with the drill carriage was practically the same as that employed without it the increase of 38 per cent was made at a considerable saving.

It is interesting to note that the progress made with the simple drill carriage was almost identical with that made with the muck-handling drill carriage, the former requiring slightly more muckers per cubic yard. Fig. 11 shows graphically the last few weeks of progress of both simple and muck-handling drill carriages. The abscissæ are distance by stations and the ordinates are time. The remarkable regularity of drill carriage progress is here shown quite clearly.

Simple Carriage

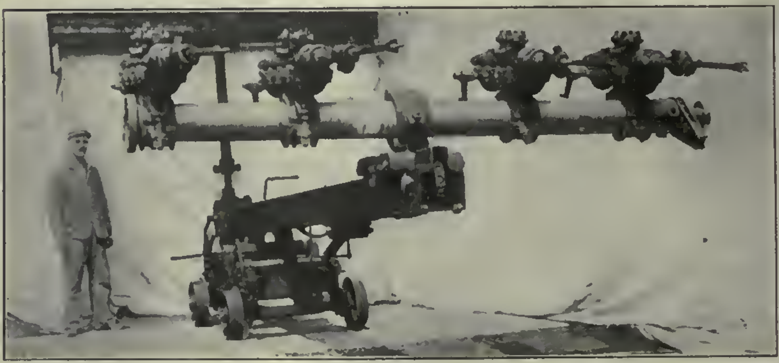
The simple drill carriage (Fig. 3) was a much lighter affair than the muck-handling one. A drill carriage was not required in this heading until the latter part of the run, when the very hard rock was encountered. The carriage had a 36-ft., 11 x 11-in. beam, which supported the horizontal drill bar and cantilevered out over the muck pile, as already described. At the forward end a special steel casting, similar to a pillow block, was attached to the beam with a vertical swivel so that the drill bar, which was clamped into the casting, might be swung about in a horizontal plane. Thus, when working, the bar was at approximately right angles to the beam and when being moved in and out of the heading, it was swung almost parallel with the beam to give ample clearance at the sides of the gangway.

The carriage consisted of two cars, each having four wheels brass-bushed to 4-in. axles. These axles were square and fitted into vertical slots in the platforms of the cars with bolts giving about 1 in. play vertically. This permitted the wheels and axles to play up and down in the slots and follow the local irregularities in the track, thus avoiding derailment in moving to and from the face. As the wheel base of each car was short no trouble was experienced from curves or switches.

The front car consisted of a platform of 12 x 12 in. maple, heavily cross-bolted. This body supported an 8-in. steel-faced roller over which the cantilever beam traveled. Just in front of the roller was a screw jack which cleared the track when in its lowest position, and was capable of raising the beam about $4\frac{1}{2}$ ft. above the track when fully extended. Immediately behind the roller was a base for another jack, by which the beam could be further elevated when desired.

The rear or A-frame car consisted of a platform similar to the ones just described, with a steel plate and angle A-frame extending about 5 ft. 6 in. above the track. This A-frame had vertical guides at the sides, in which a horizontal roller, at right angles to the longitudinal center-line of the carriage, played up and down. This roller, under which the cantilever beam traveled, supported a babbitted saddle, which formed the bed for a screw jack that was placed between the roller saddle and the heading roof when the beam was being rammed ahead. The two cars were coupled together so as to give articulated travel in passing switches and curves.

When the carriage was moving out and in, the beam was slid back so that the weight of the drilling equipment was well overbalanced by the weight of the beam behind the forward roller. After the track had been mucked off to within about 25 ft. of the face, the carriage was pushed in by a locomotive until the front roller car was jammed hard up against the muck pile. Then the jack was set between the rear roller saddle and the heading roof and the beam rammed ahead, through the rollers, by the locomotive. Vertical adjustment was obtained by means of the roof jack. The lateral movement was usually small and could be obtained by the drillers swinging the forward end of the beam to right or left by hand. As the front roller was machined smooth and kept well greased no difficulty was experienced in sliding the beam from side to side as required. Fig. 12 shows the beam shoved ahead and the drill bar being set.

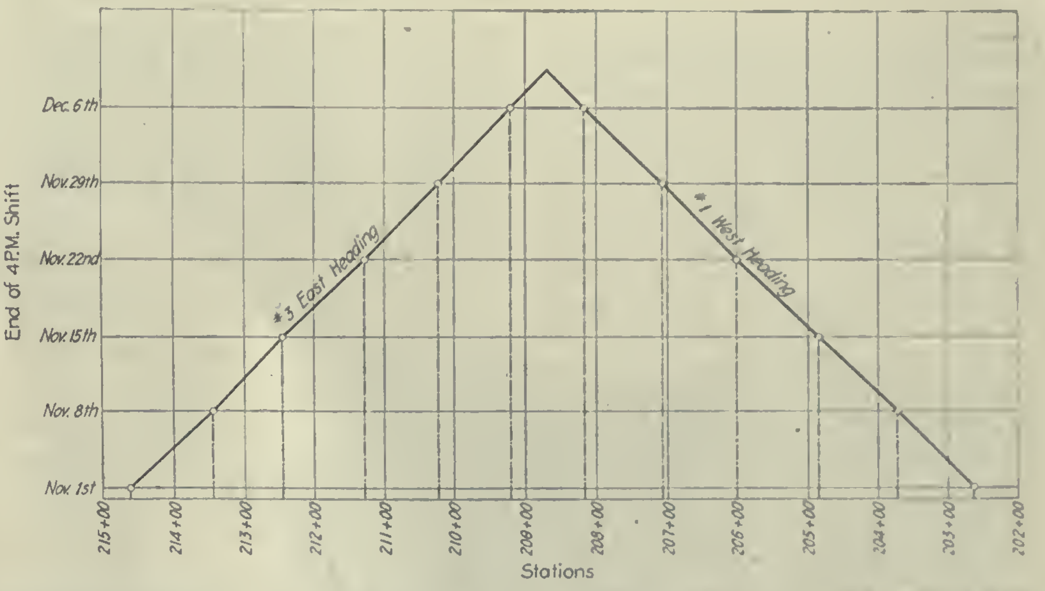


8.—Carter drill carriage, the pioneer device with adjustment for extending drills over muck pile

Preparing for Drilling

After the drill bar had been jacked into place a short, vertical jack leg was screwed tight between the bar, close to the beam connection and the muck pile underneath, to give additional support and rigidity. Next, the roof jack was removed and the carriage drawn back until the rear end of the beam would rise clear of the A-frame. Then the front vertical jack was extended and the beam raised, pivoting around the drill bar until it was close to the roof of the heading. When this was done a gallows frame was set up, consisting of two strong horses, one on each side of the gangway and a 6-in. pipe which spanned the gangway between the horses under the beam. This permitted the passage of muck cars and the usual mucking operations to go on as though no drill carriage had been used, the carriage itself having been hauled back to a siding out of the way. Fig. 13 shows the beam on the gallows frame and mucking in progress.

Although the muckers lost a few minutes during this operation, and only one central track was used at the face, no more muckers were required to clear out the heading with the drill carriage than were used before the drill carriage was installed. This was probably due to having the track cleared down the center of the heading, which permitted all the muckers to work to better advantage while the mucking was actually going on.



11.—Remarkable regularity of drill carriage progress shown by last few weeks' work with simple and muck-handling devices

Muck-Handling Carriage

The muck-handling drill carriage, which was the first one to be actually built (Fig. 4), was a very heavy machine, having all of its parts operated mechanically, and was designed to remain in the heading while the drilling and mucking were going on. The conveying belt, 16 in. wide by 75 ft. between head and tail pulleys, was driven by a Dake air engine. All other power was electrical. The carriage consisted actually of two separate machines or carriages: First, the drill carriage proper, which supported and operated the cantilever arm carrying the drill bar; and, second, the muck conveyor, which slipped through the lower part of the drill carriage and was supported a few inches above the track on cross shafts. The belt was elevated in order to cantilever out over three muck cars in the rear.

Eight wheels were used on each car or carriage. Four-wheeled trucks, with through axles, could not be used on account of the low position of the belt conveyor. Special trucks were, therefore, designed, by which the two wheels on each side were held in a special steel casting with a king-pin to the frame above, thus giving the necessary flexibility for traveling over curves and switches. No springs were used, but the same effect was obtained, in regard to staying on the track, by having the brass axle boxes fitted to vertical guides, with about an inch play below them. Thus when local depressions in the track were encountered the wheel could drop down in its guide to follow the rail, as described in the simple carriage, and derailment was almost unheard of. Similar trucks were used on the conveyor car. The bodies of both cars or carriages were built of steel plate, heavily reinforced with angles, so that the frames could not warp or twist under the heavy strains to which they were subjected.

The cantilever arm was similar to that in the simple carriage. At the rear end of the cantilever arm an electric motor was attached, geared to a long threaded shaft running close to the web between the flanges of the I-beam. This threaded shaft screwed through a nut that was attached to the frame of the carriage, thus giving the beam its longitudinal motion. The beam was supported in saddles, with rollers to reduce the friction in its longitudinal motion. Fig. 14 shows the rear of the drill carriage proper with the beam extended.

10.—Double hose connection to reciprocating drills on horizontal bar allowed use of air and water jet through hollow steels in Mount Royal Tunnel

The saddles supporting the beam were in turn supported on 5-in. threaded shafts at right angles to the longitudinal center line of the carriage. The threaded shafts were rotated in opposite directions by an electric motor at the rear end of the carriage to give the beam its lateral swing. The rear shaft, just described, was fixed in position, but the front one was so arranged that it could be raised and lowered in guides by means of large screw jacks running on ball bearings. These jacks were operated through worm and gear reductions by an electric motor on the front of the carriage, thus giving the beam its vertical swing.

One-Man Operation

Thus it may be seen that when the tracks were cleared and the drill carriage run in, one man at the electric switches was able to extend the beam over the muck pile, raise or lower it, or swing it to right or left, as the case might be, to fit the heading as it happened to break. Although this machine appears at first glance to be cumbersome and complicated it is an interesting fact that breakdowns of any sort were very rare. In fact, during the six months of its operation the total delays in any way connected with the drill carriage did not aggregate one shift in lost time. Fig. 15 shows the drilling in progress with this carriage.

The principal advantages of the muck-handling drill carriage are these: As the carriage remains in the heading after the drills are set up the mass behind the drills is so great as to practically eliminate all vibration during the drilling. Its movements are mechanical, so that the setting up and taking down are more rapid. Since the muck is thrown off the track to the side, the carriage track being laid at one side of the gangway, the muckers can work with equal efficiency anywhere along the line. As the conveyor is very low, less exertion is required by the men than in shoveling into the higher cars. Three cars are run in at a time by the locomotive so that the muckers lose less time through the shifting of cars.

Heading Carriage Conclusions

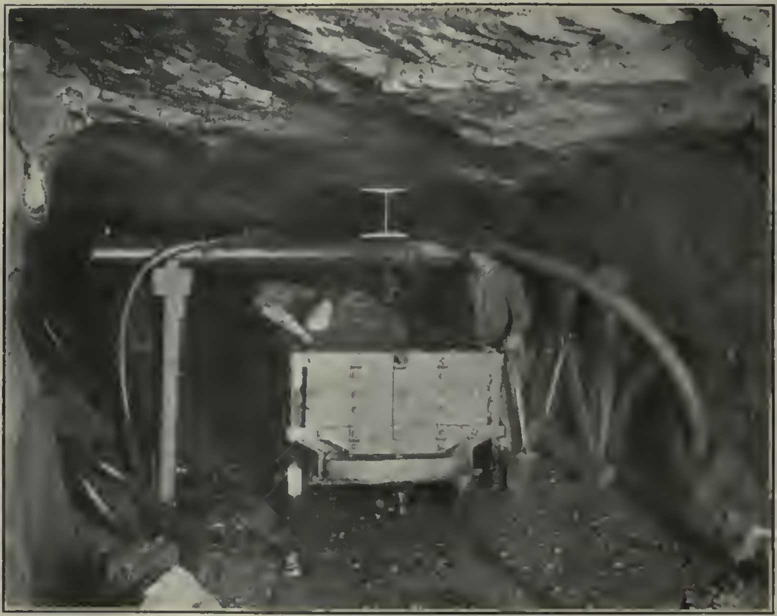
In a heading where the section is large, or the rock reasonably soft, so that the yardage to be handled each day is very considerable, the muck-handling drill carriage is far preferable to the simple carriage. This is especially so where the drilling is rapid, so that a good number of shots per day are obtained, since the time saved in setting up and taking down, as well as the rapidity of mucking, is an important factor. If, however, the rock is hard and the heading small the simple drill carriage will give just as good progress and for a reasonable amount of muck the cost per yard is just as low.

It is the writer's opinion, after having operated both machines under very similar conditions, that the simple carriage is superior to the heavier machine except where a large volume of muck has to be handled or inefficient muckers must be employed. This is principally on account of first cost, since that of the simple carriage is insignificant.

Light vs. Heavy Drills

The question of the permanency of the heading drill carriage in tunnel work depends mainly upon one thing—the rapid development and growing popularity of pneumatic hand drills. Should these be perfected and made thoroughly adaptable to heading excavation it is probable that the heavier and less convenient drill, either of the reciprocating or hammer type, will have to go. In this case the drill carriage would, of course, have no further use.

The writer believes that while the pneumatic hand drills are bound to become a very important factor in every tunnel work, outside of actual heading excavation, they will never replace the heavier machines at the heading face—at least until some decidedly radical changes are made in their design. He has used them in almost every combination possible in order to replace, as far as practical, the heavier type of drill. He has used almost every make in America, besides what he believes to be the best European drills. In stopes, break-ups and enlargements of all kinds these drills are excellent. In headings, however, where the space and available air supply are so limited and where a comparatively large number of drills must be operated simultaneously, they are not practicable. The dust becomes so dense that even with respirators it is only a little while before the men develop throat and lung trouble. There are various apparatus and methods for laying the dust as it blows out of the hole, but these, in the writer's experience, have either proved infeasible, inconvenient or inefficient. Where solid steel has been used much trouble has been experienced from the steel sticking in the hole. Where water is introduced through the steel with the air, the drill becomes awkward and changes in type.



13.—AFTER DRILL BAR HAD BEEN JACKED IN PLACE THE CARRIAGE WAS HAULED TO SIDING, LEAVING I-BEAM SUPPORTED BY GALLOWS FRAME UNDER WHICH MUCK CARS PASSED

12.—I-BEAM OF SIMPLE CARRIAGE EXTENDED ON ROLLER TO CARRY DRILLS OVER MUCK PILE INTO HEADING WHERE DRILL BAR IS BEING SET

Mechanical Handling an Advantage

Regarding the general lightening of drilling equipment, both by improving the materials used in manufacture and by the more extensive use of the hammer drill, the writer does not believe the effect will reduce the popularity of the drill carriage methods. Although light drills greatly reduce the labor in taking down and setting up, as long as a drill is used that requires a substantial mounting it is almost axiomatic that an apparatus which will handle the entire equipment at one operation mechanically is not only quicker but far more economical in human energy.

In comparatively free drilling rock of low specific gravity, where very light drills may be used, it is sometimes possible to make exceptional spurts of speed without the aid of a drill carriage. Such efforts, however, take it out of the men and often have their reactions to the detriment of the general welfare of the job. Even with light equipment men who have carried it over the debris into a heading through the smoke and have had to assemble and erect it are already half worn out before the drilling actually commences. Had drill carriages been used in the Mount Royal tunnel from the beginning, a much higher average of speed, as well as greater economy, might have been attained. Although the writer realized this at the time, since the workmen had to be educated even in the use of the horizontal bar, he considered it unwise to make too many innovations, in the face of a very general doubt and opposition, until the first steps in the development were proved to be all that were expected, regarding both speed and economy.

Considering all the economies inherent in drill carriage work, as detailed in Part I of this article, the conclusion, therefore, is that in a heading where the length will justify the first cost and where rapidity of progress is of consequence, the drill carriage is essential for economical work. This is especially so where a bottom heading is used and where really long tunnels are to be driven. Of course, when a top heading is used and the slowly excavated bench governs the rapidity of progress the drill carriage is of less economical value.

A Model Carriage

To design an ideal heading drill carriage features from several of those described might well be used. In the Carter carriage the idea of having the drilling equipment slide on the cantilever arm is its principal novelty and most valuable feature. In order to obtain sufficient reach in its beam to extend out over 25 ft. or so of muck pile this beam must be a pretty substantial affair and, therefore, heavy. To obtain the greatest flexibility with the greatest economy in both labor and materials the writer would advise two trucks. If the Carter carriage were used, very much as shown in Fig. 8, only with a very much larger arm and with an additional roller car in front, an almost ideal carriage could be obtained. The rear truck, to which the beam is hinged vertically, should also provide for a lateral swing. This could be arranged in a vertical screw which would also provide a vertical adjustment similar to the one shown in the third Lœtschberg carriage, Fig. 7. The forward truck would be similar to the forward truck in the simple carriage used in Montreal, shown in Fig. 3. The weight of the rear truck would depend entirely on the weight and length of the cantilever beam and entirely independent of the drilling equipment. All axles should be either provided with springs or give vertical play so that the wheels would always follow the local irregularities of the track. This enormously reduces the number of derailments.

When moving in and out of the heading the two trucks would be separated so that the forward or roller truck would be well toward the front end of the beam. This would give the outfit perfect equilibrium and flexibility in passing switches, curves, etc. As the rear car will naturally be the heavier it would be better to hold the drill car over or near the forward car when moving. This would not, however, be absolutely essential.

After a blast the track, made up of rails riveted to slick sheets, as described in the case of the Mount Royal headings, would be cleared to within 25 or 30 ft. of the face, the muck being thrown to the sides. The carriage would then be run in until the front car was hard up against the muck pile, and the rear car shoved ahead until hard up against the front one. If the drill bar were close to the forward car, arrangement would have to be made to hold it from passing the big roller, letting the beam slide under it as the rear car and beam were pushed ahead. When the beam had thus been advanced, approximate vertical and lateral adjustment could be made, after which the rear car would be braced down from the roof and the drill bar slid ahead into position. Probably the only further adjustment necessary would be a slight lateral swing to make the bar fit the heading.

14.—REAR OF MUCK-HANDLING DRILL CARRIAGE WITH CANTILEVER BEAM EXTENDED

As soon as the bar was tight the beam would be disconnected, the rear car loosened and drawn back from the front one, so as to get the beam stably supported, and the whole carriage drawn back, light, to the passing track. The mucking would then proceed as usual. After the mucking was completed the carriage would be run back into the heading, the above process reversed, and the drills brought back for the ensuing blast. Of course, as previously mentioned, the drill bar should be very heavy and special grips or a jack leg provided to avoid bar rotation and vibration during the drilling. Provision should also be made on the carriage for carrying a certain amount of steel as well as all jacks, tools, manifolds, hose, etc.

A carriage embodying the features described could be built at a very small expense and would be simplicity itself in operation. As already pointed out the economies of this method of work are very great, both in time and cost, and in this carriage the maintenance and repairs would be almost negligible.

[*In the third and final installment of this series, which will be published next week, Mr. Brown describes the design and operation of two new types of drill carriage, one for bench work and the other for trimming the tunnel section. He also crystallizes the main points made in the three articles in a terse summing up of results and the inferences to be drawn from them.*—EDITOR.]

Steel Columns of Thick Material Relatively Weak

Progress Report by Special A. S. C. E. Committee on Tests at Bureau of Standards Proposes Extension of Original Program

THAT STEEL COLUMNS composed of thicker material are consistently lower in ultimate strength than light sections is the principal conclusion from the results of tests given in the progress report of the Special Committee on Steel Columns and Struts of the American Society of Civil Engineers, published in the December *Proceedings*, page 2753, and to be presented at the annual meeting Jan. 19. The original plan is extended to include columns with length ratios of 155 and, by testing short parts of the longer columns after their failure, columns with length ratios of 20. Tests of the latter for one type are reported; however, the uncertain influence of the previous testing of the material is recognized.

The following abstract covers the more important parts of this progress report, and the accompanying table gives, in condensed form, the average results of the tests reported. In the Engineering Record of May 1, 1915, page 549, will be found an abstract of the previously reported tests and of the results published by the American Railway Engineering Association for a similar series.

PROGRESS DURING YEAR

During the past year the Bureau of Standards has tested 110 additional columns, making a total of 180 now available for study and discussion. These include the light and heavy sections as shown in the last report, eighteen Bethlehem H-columns and eighteen Carnegie mine-section H-columns, light sections. These mine sections were donated by the Carnegie Steel Company.

Studies of the records of the seventy tests reported last year showed that it would assist in interpreting the results if comparisons could be made with columns of different slenderness ratios than the 50, 85 and 120 provided for in the original program. It was decided to extend the series, maintaining the same progressive ratio and adopting a new series with a slenderness ratio of 155, using three types, 1, 2 and 4, as probably giving sufficient information from which to draw conclusions.

After the first series of tests on light columns was completed it was suggested that it would be possible to take some of the long columns and cut pieces from them which would be available for tests of short struts. Three light and three heavy struts were cut from the plate-and-angle column, type 1, so as to give a slenderness ratio of 20. These were tested, and the results are shown in the table.

15.—FRONT END OF DRILL CARRIAGE BEAM SHOWING HORIZONTAL BAR IN PLACE AND DRILLING IN PROGRESS

TO CHECK RESULTS ON EFFECT OF SECTION

It was thought advisable to begin an investigation to learn whether the drop in ultimate strength of the heavy sections was progressive as the thickness of the metal increased, and additional columns, with very much heavier metal, are to be provided by the Bureau of Standards. The committee has chosen one set of three columns of type 1, slenderness ratio 85, with metal 13/16 and ⅞ in. thick, and an area of 28.61 sq. in. as against 11.475 sq. in. for the original light sections, and 22.19 sq. in. for the original heavy sections. Three slenderness ratios, 50, 85 and 120, have been chosen for columns of type 5, an 8-in. Bethlehem H-section, with an area of 26.64 sq. in. as against 9.17 sq. in. for the original light section, and 18.27 sq. in. for the original heavy section. When the tests are completed this additional series will be of value when compared with the lighter sections of the same types.

Failure may frequently be due to the fact that thin outstanding legs cripple before the main section of the column is seriously affected by the load, and therefore types 4, 7 and 8 were selected to determine the effect of a square corner or bulb on the edge of the outstanding legs. Study seems to show very little difference in the results, so far as the types are concerned, but there is a marked difference in favor of the thin material. The general falling off of the ultimate strength for heavy sections carries through all the other types of columns, and it will be noted that this is also true for the Bethlehem H-columns, which are solid rolled sections, as well as for the riveted sections.

RESULTS FOR SHORT COLUMNS

The study of the stress-strain curves for the short columns with a slenderness ratio of 20 indicates that, though the heavy sections of these short columns have a unit ultimate strength considerably higher than

Average Results of Tests on Steel Columns

Each value is the average of three tests.

Type	Length ratio. l/r	Average ultimate strength in pounds per square inch	
		Light sections	Heavy sections
1 Built-up 1-section	20	36,400	44,400
	50	32,700	29,200
	85	31,200	28,100
	120	28,300	25,400
2 Box section, 6-in. channels	50	33,900	32,300
	85	32,600	30,600
	120	29,300	28,100
3 Box section, 5-in. channels	50	34,100	29,500
	85	32,400	28,000
	120	30,600	26,900
4 8-in. I-beam and 2 channels	50	36,900	29,100
	85	34,000	26,600
	120	31,900	23,900
5 8-in. Bethlehem H-section	50	38,000	35,400
	85	34,300	32,300
	120	32,000	30,000
6 10-in. I-beam and 2 plates	50	31,600	32,100
	85	29,100	26,800
	120	27,200	24,800
10 Built-up box-section	50	35,800	31,800
	85	32,100	28,300
	120	28,400	26,300
7 Built-up bulb I-section	50	33,400	.....
	85	31,600	......
	120	28,100	.....
8 Z-bar section	50	35,700	32,900
	85	32,800	29,400
	120	29,700	27,300

that of the light sections, the yield point of the heavy sections is lower than that of the light sections. Until tests can be made on short columns with the same slenderness ratio, which have not been previously tested, the committee does not care to do any more than call attention to these relative yield points, with the thought that this information may indicate the way toward the correct solution.

In order that the subject may have careful investigation, the Bureau of Standards is now making a series of re-tests on the steel from each melt number. These tests are to be made on short specimen sections in compression as well as in tension, and it is to be hoped that they will throw additional light on the problem.

Yield-Point Indications

There has been no attempt to indicate a yield point for the columns with a slenderness ratio of from 50 to 120. It is true that for the columns with a slenderness ratio of 20 there is a clearly indicated yield point, and the committee has given this question careful study to see if such a yield point can be accurately determined for the longer columns. From the study of this series of tests it seems that the initial sets occurred at very small loadings, and that these initial sets could be measured, provided the instruments could be obtained precise enough for the purpose. It would seem from the tests thus far studied that the yield point for the short columns is appreciably below the ultimate strength, but for longer columns, in which bending action is shown, the yield point and the ultimate are probably very close together.

The voluminousness of these records precludes their complete publication by the society, but arrangements will ultimately be made whereby copies will be filed in the library, to be available for those who desire to study them in detail. The committee desires to express its appreciation of the cordial assistance it has received from Dr. S. W. Stratton, director, and Dr. G. R. Olshausen, engineer-physicist, of the Bureau of Standards. George H. Pegram is chairman, and Lewis D. Rights is secretary of the committee.

Unique Helical Stairway Is Within Center Well

Tower in Southwest Museum, Los Angeles, Contains Probably the Only Reinforced-Concrete Stairway of Its Kind in the World

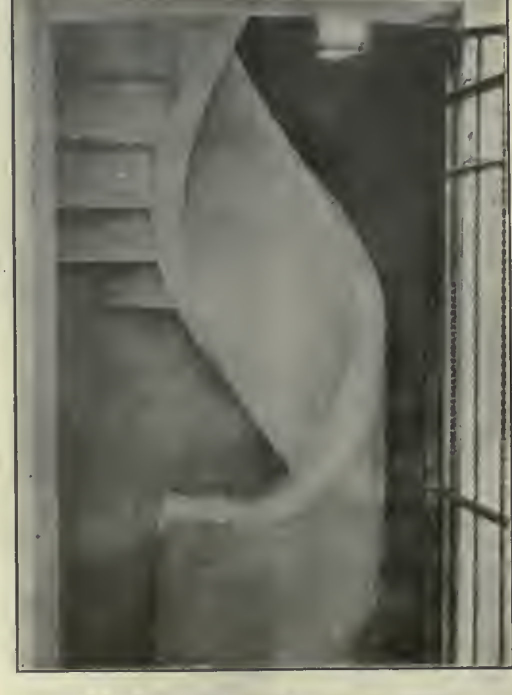
By FRANK REED
Los Angeles, California

THE TOWER of the Southwest Museum in Los Angeles, Cal., contains what is believed to be the only helical stairway of its kind built of concrete to be found in the world. It is, for its purpose here, an improvement over Sir Christopher Wren's masterpiece, the spiral stairway ascending the interior wall in the tower of St. Paul's Cathedral, London. The Southwest Museum helical staircase is built inside a well in the center of the tower, thus not only preserving for shelves or mounted objects the entire interior wall space of the tower, but also supplying on its own exterior wall additional space which may be employed for museum purposes. A short spiral stairway of a different type was described in the Engineering Record of Nov. 6, 1915, page 574.

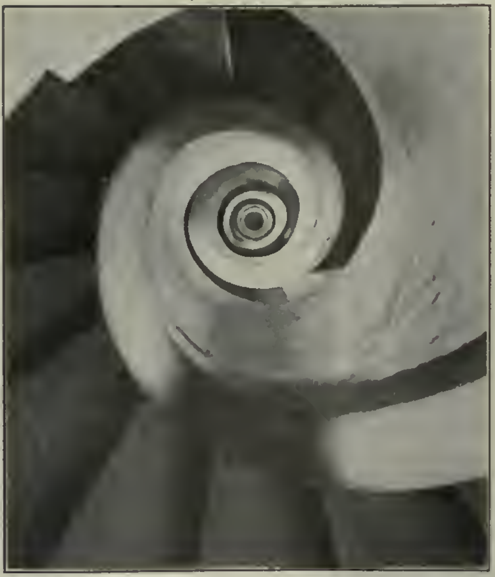
The tower containing the stairway is seven stories in height, with three mezzanine balconies in the three upper stories, giving the equivalent of ten stories. The tower is 35 ft. square, and is supported by twelve columns and external walls 8 in. thick, reinforced with steel. It rests on a solid concrete slab or raft 3 ft. 6 in. thick. The total height is 125 ft. and the weight is 1000 tons. The construction was carried on continuously, a story being poured at a time.

Staircase Well

The staircase well is 9 ft. 2 in. in external diameter and is supported by four corner columns with 8-in. walls between them, with light and ventilation openings at each story. The stair is known as a caracol, on account of the likeness to a snail shell presented by a vertical view, as shown in one of the photographs. With one exception it is the only helical staircase in America having a hollow center, the other one being an ancient stone staircase in the tower of the cathedral in the city of Mexico. The stairway contains 160 steps with 7½ in. rise each, and was built around a galvanized iron form in the shape of a pipe, while wooden forms were placed for the stairs. Material was prepared at a special rock-crushing and sand plant located about one mile from the building, in a dry river bed. The mixture employed was a 1:5 concrete.



VIEW OF STAIRS FROM ROOM IN TOWER



TOP VIEW SHOWING FOUR STORIES OF STAIRS

This stairway is called a caracol, which is Spanish for snail-shell.

Dr. Charles F. Lummis, founder of the Southwest Museum, supervised personally the construction of this stairway. The museum was designed by Hunt & Burns, architects of Los Angeles, and built by the C. J. Kubach Company of the same city.

Sewage Works for Military Camp

Military camp sewage works at a site near Ripon, England, were completed last year. The data on which the designs were based were given by Arthur W. Smith, manager of the plant, in a paper presented recently at a meeting of the Royal Sanitary Institute and reported in the *Surveyor*. The camp occupies an area of about 1080 acres, and is designed to provide accommodation for a complete army corps of 42,000 men with 10,000 horses, and a large military hospital for general purposes, together with an infectious diseases hospital. It was expected that the water consumed would be 500,000 imp. gal. per day, made up as follows: Officers, 15 imp. gal. per head per day; men, 8 imp. gal. per head per day; horses, 10 imp. gal. per head per day; and that the sewage from the camp would be of a very strong character. It was for the purpose of diluting this very strong sewage with the weak city sewage that suggested the idea of treating both sewages together. The city sewers take in a good deal of subsoil water, and it was intended to take as much sewage from the city as would make the total flow 1,000,000 imp. gal. per day. Experience has shown that the consumption of water in the camp exceeds the estimate, and amounts to about 700,000 imp. gal. when the camp is fully occupied.

The sewage disposal works consist of two screening tanks, four deep and four long subsidence tanks—the deep tanks being on the Dortmund principle, the long tanks having floors with a back fall to the sludge pipes. The total tank capacity is 500,000 imp. gal., and the system is one of continuous flow. The percolating bacteria bed is rectangular in shape, 10,000 sq. yd. in area, the filtering media 6 ft. deep, consisting principally of slag, with a proportion of local gravel.

The sewage is distributed on the bed by eight reciprocating sprinklers. The effluent from the bed is conveyed to three humus tanks, also formed on the Dortmund principle, the final effluent being discharged into the river Ure.

All the tanks are of concrete construction throughout, and the walls are finished with artificial stone coping, made on the works of local gravel and sand. Work was commenced at the end of last March, and by the latter part of July a portion of the tanks and a section of the bed was ready to treat sewage, ten days before the main sewer was put into operation by camp sewage. The remainder of the tanks, beds, and pumping stations were fully completed by Sept. 1, and it is claimed that the short period occupied by construction constitutes a record.

Paving Maintenance Should Include Cost of Cleaning

Gus H. Hanna, Street Cleaning Commissioner of Cleveland, Makes Plea for Smooth Grouted Block Streets as Economy Measure

THAT the cost of cleaning streets is properly chargeable to paving maintenance, and, therefore, should be given due consideration in the selection of types of street surfacing, was the contention of Gus H. Hanna, commissioner of street cleaning, of Cleveland, Ohio, in an address before the recent road congress organized by the chamber of commerce of Worcester, Mass. Flushers, he said, are not only the cheapest but the most satisfactory method of street cleaning with which Cleveland has had experience. As for types of surfacing, granite block or brick are easy to clean, provided the joints are grouted instead of being filled with bituminous material. Mr. Hanna concluded his paper with statistics dealing with street-cleaning costs in Cleveland. An abstract follows:

CLEVELAND WHITE-WING REMOVING RUBBISH FROM BRICK STREET

Cleaning, a Maintenance Charge

It is a continual wonder that so little weight is given to cleaning cost when paving questions are settled. An annual expense of $500 a mile in repairing residence streets would be considered an appreciable item of maintenance, yet that figure for cleaning a mile of residence street through a season is extremely low. A cost of $500 for maintaining a mile of one kind of pavement for a year as against a cost of $1,500 for maintaining another kind would be sufficient grounds, in most cases, to decide in favor of the former material. Yet greater differences than this in cleaning coat as between competing types are blandly overlooked.

A street cleaner looks for two qualities in a pavement. It must be smooth and particles of litter must not stick to the surface. The question of smoothness opens up the whole matter of durability. Any material that deteriorates and roughens becomes more difficult each year to clean. Any neglect of needed repairs means a larger cleaning bill until the repairs have been completed.

Additional calculation of cleaning expense must be made for all bituminous pavements on account of the sticking of particles of litter to the surface. These surfaces are never quite so clean as non-adhesive materials, and it costs from 25 per cent upward in additional cost to put them in a reasonably presentable condition, on account of this quality. In a new creosoted wood block pavement, when the oil is gradually working out, steel scrapers must often be employed, as flushing by water is not effective in removing the dirt from such a surface.

Brick and Stone Easily Cleaned

The pavements most easily cleaned are brick and stone. Neither of them originates any form of dirt and both wash off readily. The only ground for discrimination between them is on the question of smoothness, where brick has a slight advantage as a rule. But in the use of these materials the choice of a filler is all-important. A bituminous filler has all the disadvantages of a bituminous surface, from a cleaner's standpoint, and some others besides. Being softer than the brick or block, it recedes, leaving a crevice that invites the lodgment of dirt. With the edges of the brick or block unprotected it is sure to roughen, thus adding to the difficulties of cleaning.

Cleaning Costs

West Fourteenth Street, in Cleveland is a grouted brick thoroughfare that has been paved ten years and is in good enough condition to serve as a model of minimum cleaning cost. This street has a traffic of about two vehicles a minute. It has been cleaned, on an average, five times a week, being flushed by night and hand-swept in the daytime. The sweeper worked almost exclusively in the gutters, as most of the dust on such a pavement will be blown to the curbing in dry weather. The cost, per cleaning, amounts almost exactly to 15 cents per 10,000 sq. ft., called a "square," and used as the unit of calculation. This is the lowest figure obtained in Cleveland on any type of pavement. The cost on the best asphalt pavement would be not less than 20 cents and would rise to 30 as the surface became wavy or rough. A wood block pavement costs practically $1 a square to clean in its initial condition, and it will be at least two years before the oil will have dried out sufficiently to admit of its being cleaned for 30 cents a square. A tar-filled block pavement will cost not less than 30 cents per square, and, as the filler disappears and the blocks roughen, this cost will amount to 60 cents or more.

FLUSHERS HAVE GIVEN BEST CLEANING RESULTS IN CLEVELAND

In the case of a pavement 40 ft. wide, there are about twenty-one squares to the mile. As between a material that can be cleaned for 15 cents and one that can be cleaned for 30 cents, there is a difference of $3.15 per mile per cleaning, a difference of $15.75 per week, of $630 per season of 40 weeks, and $6,300 in ten years. And if instead of 30 cents the cost of cleaning the pavement mounts to 60 cents per square, as is not uncommon under conditions of wear, the excess of cleaning cost will be $1,800 for a year, or $18,000 for a decade above the figures shown to be attainable on West Fourteenth Street.

Prompt Repairs Needed

Cleaning costs can be greatly reduced by a policy of prompt repairs. Mr. Hanna believes in the continual patrol of all city streets by men whose duty it is to discover defects in pavements and prescribe repairs. Even from the standpoint of repair cost such a system saves money. When cleaning is considered, as well as repairs, the saving of a patrol system is very great.

New Formulas and Diagrams Give Deflections of Beams Under Any Loading

Application of Area-Moment Method to the Computation of Deflections of Simple Beams with Constant Moment of Inertia

By CHARLES A. ELLIS
Professor of Structural Engineering, University of Illinois

APPLICATION of the area-moment method to the problem of finding the deflection of simple beams of constant section is much simpler than the usual method of deriving and integrating the equation of the elastic curve. Furthermore, the new formulas thus derived can be given in terms of factors easily obtained from diagrams to facilitate the computation for deflection of any point, due to uniform loading and to any number of concentrated loads.

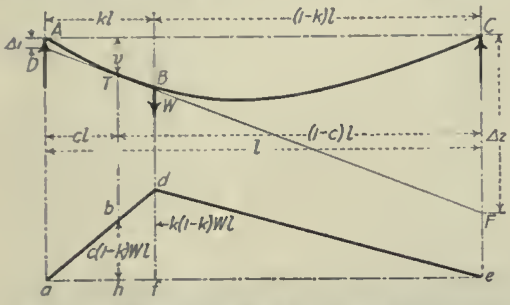


FIG. 1—THEORETICAL DEFLECTION RELATIONS FOR SINGLE CONCENTRATED LOAD

General formulas will be derived for the cases of a single concentrated load and of a uniform loading, and useful diagrams will be given, with an example of their application. It will be shown that these diagrams can also be used to find the intermediate reaction of a continuous beam on three supports.

SINGLE CONCENTRATED LOAD

Let the line ABC in Fig. 1 represent the elastic curve of a bent beam simply supported at A and C and carrying the single load W at B, a distance kl from A. The line ade represents the bending moment. The deflection v at any point T, at the distance cl from A, can be found by using the line DTF tangent to the elastic curve at T, and the end intercepts AD = Δ_1, and CF = Δ_2. Thus, $v = \Delta_1 + c(\Delta_2 - \Delta_1)$.

To find the vertical deflections Δ_1 and Δ_2 from the tangent at T, apply the area-moment method (as given in textbooks on mechanics or Greene's Trusses and Arches, Vol. 2, page 103) to the areas abh and bdeh of the moment diagram. Assuming constant moment of inertia, I, the value of Δ_1 is equal to the moment of the triangle abh about Aa divided by EI. Similarly the value of Δ_2 is equal to the moment of the area bdeh about Ce divided by EI.

Using the dimensions and usual notation, shown on the figure, and noting that the area bdeh equals the area of the triangle def plus the triangle adf minus the triangle abh, there is found:

$$\Delta_1 = \frac{c(1-k)Wl(cl/2)(2cl/3)}{EI}$$

or

$$\Delta_1 = \frac{2c^3Wl^3(1-k)}{6EI}$$

Using the moments of the triangles composing the area bdeh and reducing,

$$\Delta_2 = \frac{Wl^3}{6EI}(1-k)(2k-k^2-3c^2+2c^3)$$

Then

$$v = \Delta_1 + c(\Delta_2 - \Delta_1)$$

$$= \frac{Wl^3}{6EI}(2ck - 3ck^2 - c^3 + ck^3 + c^3k) \qquad (1)$$

When c is greater than k, the point T lies between B and C, and by analogy, interchanging c and k, there is found

$$v = \frac{Wl^3}{6EI}(2ck - 3c^2k - k^3 + c^3k + ck^3) \qquad (2)$$

If, in general, the value of v is

$$v = \frac{Wl^3}{6EI}F \qquad (3)$$

the value of F is given by the parenthesis of equation 1 when c is less than or equal to k, and by the parenthesis of equation 2 when c is greater than k.

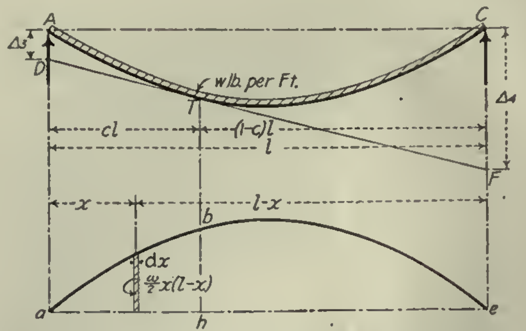


FIG. 3—THEORETICAL DEFLECTION RELATIONS FOR UNIFORM LOADING

MAXIMUM DEFLECTION—DIAGRAM FOR F

The maximum deflection occurs in the longer segment when c is greater than k and the tangent DTF is horizontal. It is obtained by equating the values of the deflections of the ends from this tangent. There is thus found

$$c = 1 - \sqrt{(1-k^2)/3} \qquad (4)$$

Since the limits of k are 0 and 0.5, all values of c for maximum deflection under a single load will fall between 0.4227 and 0.5—hence the point of maximum deflection is between the load and the center of the span and always near the center.

Fig. 2 gives the values of F for various values of c and k, and also the values of c for maximum deflection under a single load.

UNIFORM LOAD EQUATION AND DIAGRAM

By a similar derivation, based upon Fig. 3 and the notation there shown, using the

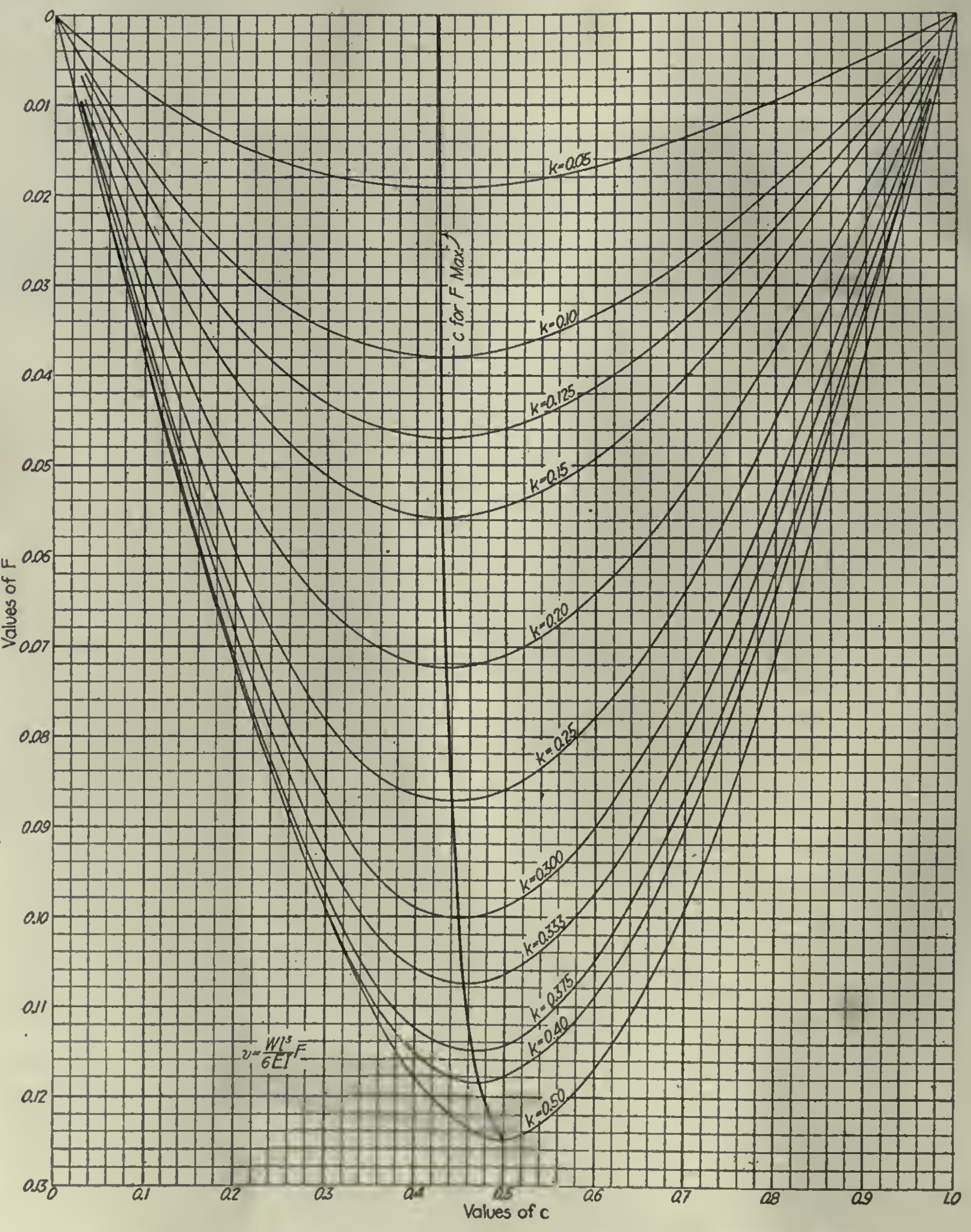


FIG. 2—VALUES OF COEFFICIENTS F FOR SINGLE CONCENTRATED LOADS

moment of the area abh about aA to give Δ_3 and the moment of the area beh about Ce to give Δ_4, there is obtained

$$\Delta_3 = \frac{wl^2}{2EI}\int_0^{cl} x^2(l - x)\,dx$$

$$= \frac{wl^4}{24EI}(4c^3 - 3c^4)$$

and

$$\Delta_4 = \frac{wl^3}{2EI}\int_{cl}^{l} x(l - x)^2\,dx$$

$$= \frac{wl^4}{24EI}(1 - 6c^2 + 8c^3 - 3c^4)$$

Then

$$v = \Delta_3 + c(\Delta_4 - \Delta_3)$$

$$= \frac{wl^4}{24EI}(c - 2c^3 + c^4)$$

$$= \frac{(wl)l^3}{24EI}J \qquad (5)$$

The values of J may be found from Fig. 4, and the resulting value of v easily computed for any desired point. In these equations, of course, the length l is in inches to agree with the values E and I, and wl is the total load uniformly distributed.

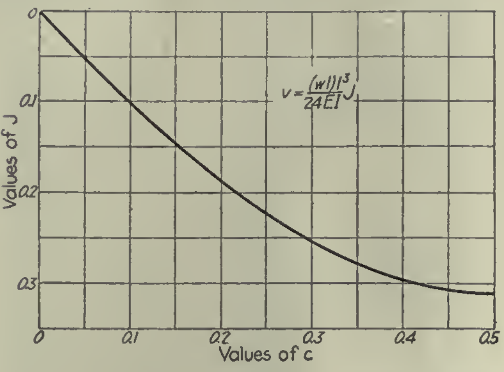


FIG. 4—VALUES OF COEFFICIENTS J FOR UNIFORM LOADING

APPLICATION OF DIAGRAMS

As an example of the application of the diagrams, consider a beam loaded as shown in Fig. 5. In computing v_1 due to W_1, c is 0.2 and k is 0.2, while for W_2, c is 0.8 and k is 0.3. Similarly, in computing v_2 for W_1, c is 0.7 and k is 0.2, and for W_2, c is 0.3 and k is 0.3. Entering the diagram, Fig. 2, with these values and using Fig. 4 to obtain the uniform load coefficients, the deflections v_1 and v_2 at each load, and v_c at the center are

$$v_1 = \frac{l^3}{6EI}\left(0.051W_1 + 0.052W_2 + 0.186\frac{wl}{4}\right)$$

$$v_2 = \frac{l^3}{6EI}\left(0.052W_1 + 0.088W_2 + 0.254\frac{wl}{4}\right)$$

$$v_c = \frac{l^3}{6EI}\left(0.071W_1 + 0.099W_2 + 0.313\frac{wl}{4}\right)$$

The point of maximum deflection for the case of several concentrated loads can be found by trial, but it is evident that it will occur very close to the center of the span and differ but slightly from the value v_c found for the center deflection.

CONTINUOUS BEAM ON THREE SUPPORTS

The reactions of a continuous beam on three supports can be obtained by the use of the coefficients given in the diagrams. Since the deflection at the intermediate support must be zero, the intermediate reaction R_2 must produce the same deflection as that produced by the given loading upon the assumption that the beam is simply supported at the ends. For instance, if the beam of the previous example be supported at the center, the deflection produced by the reaction R_2 at that point would be

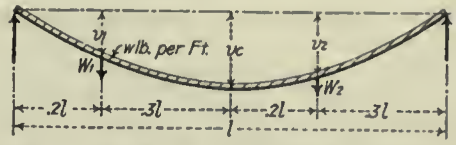


FIG. 5—EXAMPLE OF COMBINED LOADING

$$\frac{R_2 l^3}{6EI} \times 0.125$$

This is equated to the expression for v_c previously given, and the value of the intermediate reaction reduces to

$$R_2 = \frac{0.071W_1 + 0.099W_2 + 0.313wl/4}{0.125}$$

If the center reaction be known, the end reactions are statically determinate. A similar computation can be made for any continuous beam with constant moment of inertia, any loading and unequal length of adjacent spans.

The diagram, Fig. 2, complies with Maxwell's theorem of reciprocal deflections. For example, $F = 0.0658$ when k is 0.2 and c is 0.3, and also when k is 0.3 and c is 0.2. The coefficient F, and hence the deflection, will remain constant for any interchanged values of k and c.

Government Has Now Inventoried 41,607 Miles of Railroads

SINCE the publication in the Engineering Record of Nov. 13, 1915, page 601, of a table showing the mileages covered to Sept. 30, 1915, by the various field parties of the Division of Valuation, Interstate Commerce Commission, another table has been issued by Thomas W. Hulme, general secretary of the Presidents' Conference Committee, bringing the figures up to Nov. 30. In the months of October and November the work of all field parties was practically completed on the Chicago & Eastern Illinois and the Cleveland, Cincinnati, Chicago & St. Louis, as was that of the road and track parties of the Boston & Maine. Considerable mileage was covered on some of the large Western systems, notably the Great Northern, the Rock Island and the Santa Fé.

PROGRESS OF FIELD INSPECTION, NOVEMBER 30, 1915, FOR GOVERNMENT VALUATION OF RAILROADS

Road	Date Division of Valuation forces began work	Miles of road	Total miles inspected and inventoried to date: Road and track	Bridges	Buildings	Signals	Telegraph and telephone	Total miles "Adjacent Similar Land" inspected
Eastern Group								
Boston & Maine	4-29-14	2,434	2,400	1,026	1,026	1,334	2,326	1,520
Chicago & Eastern Illinois	5-2-14	1,140	1,140	1,140	1,140	1,140	1,123	1,100
Cleveland, Cincinnati, Chicago & St. Louis	8-24-14	2,262	2,247	2,262	1,783	2,262	2,262	....
Pennsylvania	1-1-15	5,919	1,395	1,072	1,072	890	1,284	511
New York, New Haven & Hartford	3-31-15	2,046	873	58	22	....	495	290
Boston & Albany	4-21-15	392	360	252	17	25	90	....
Chicago, Indianapolis & Louisville	5-25-15	610	548	610	610	....	610	....
Ann Arbor	6-1-15	292	292	292	292	292	292	286
Chicago, Terre Haute & Southeastern	7-26-15	362	232	....	....	362	362	....
Maine Central	8-14-15	1,057	102	....	....	....	63	....
Bangor & Aroostook	8-16-15	626	172	....	....	....	....	....
Vandalia	8-16-15	910	526	542	....	....	805	....
Philadelphia & Reading	11-4-15	1,582	41	....	....	....	....	....
Total	....	19,632	10,328	7,254	5,962	6,305	9,712	3,707
Western Group								
Texas Midland	....	111	* 111	111	111	111	111	111
New Orleans, Texas & Mexico	....	173	* 173	173	173	173	173	173
Kansas City Southern	....	878	* 878	878	878	878	878	878
San Pedro, Los Angeles & Salt Lake	....	994	* 994	994	994	994	994	994
Elgin, Joliet & Eastern	....	211	* 211	211	211	211	211	211
Western Pacific	....	981	* 981	981	981	981	981	981
Quincy Western	....	6	* 6	....	....	....	....	....
Missouri Southern	....	54	* 54	54	54	54	54	54
Mississippi River & Bonne Terre	....	54	* 54	54	54	54	54	54
Arizona & Swansea	....	21	* 21	....	....	....	....	....
United Verde & Pacific	....	26	* 26	....	....	....	....	....
Cape Girardeau Northern	....	106	* 106	106	106	106	106	....
Spokane & British Columbia	10-20-15	36	* 36	....	....	....	....	....
Butte, Anaconda & Pacific	10-9-15	62	* 62	....	....	....	....	....
Minneapolis, St. Paul & Sault Ste. Marie	5-1-14	4,125	2,381	404	404	404	None	500
Great Northern	5-3-14	7,321	5,403	2,705	2,705	3,504	7,127	592
Rock Island lines	8-1-14	7,680	6,746	3,579	3,579	870	7,210	891
Chicago & North Western	9-2-14	8,346	91	91	91	91	91	91
St. Louis Southwestern	11-12-14	1,568	747	747	747	....	747	747
Illinois Central	11-18-14	5,960	2,043	1,819	1,819	1,620	4,077	2,178
Santa Fé	12-4-14	11,117	1,707	1,109	1,109	....	4,748	None
Southern Pacific	1-3-15	6,906	248	....	....	561	705	....
Chicago, Milwaukee & St. Paul	5-22-15	9,611	1,609	None	None	....	None	498
Total	....	66,347	24,688	14,016	14,016	10,612	28,267	8,953
Southern Group								
Norfolk Southern	2-27-14	903	* 903	903	903	903	903	....
Atlanta, Birmingham & Atlantic	2-19-14	658	* 658	658	658	658	658	....
Central of Georgia	7-8-14	1,972	1,972	1,959	1,902	1,972	1,972	....
Savannah & Northwestern	2-18-15	109	109	109	109	....	109	None
Charleston & Western Carolina	5-29-15	341	341	None	None	....	341	None
Georgia Southern & Florida	1-2-15	392	392	392	392	392	None	None
Hawkinsville & Florida Southern	1-3-15	96	96	96	96	96	33	None
Macon & Birmingham	1-25-15	97	97	97	97	97	67	None
St. John's River Terminal	1-21-15	7	7	7	7	7	None	None
Mobile & Ohio	6-15-15	1,114	879	None	None	None	791	None
Okolona Branch	....	39	39	None	None	None	39	None
Southern	7-14-15	7,000	681	None	None	None	475	None
Southern in Mississippi	9-15-15	292	268	None	None	None	None	None
Virginia	9-8-15	488	149	149	149	None	None	None
Total	....	13,608	6,591	4,370	4,313	4,125	5,388	....
Grand total	....	99,487	41,607	25,640	24,291	21,042	43,367	12,660

*Field work on roadway and track parties completed.

Monolithic Brick Paving Slabs Show High Bond

Tests Begun at University of Illinois to Determine Feasibility of Reducing Concrete Base Thickness

By C. C. WILEY
Instructor in Highway Engineering, University of Illinois

TO COLLECT evidence in support of the assumption that the cost of brick paving can be considerably lowered by reducing the thickness of the concrete base when the monolithic, instead of the sand-cushion, form of construction is used, the civil engineering department of the University of Illinois has undertaken a series of tests of brick pavement slabs, and the results from the breaking of the first group of specimens are given herewith. The ordinary brick pavement with a sand cushion consists essentially of two separate slabs, unbonded. The strength of the pavement, therefore, is determined largely by the strength of the individual slabs. In the monolithic type of pavement described in the Engineering Record of July 10, 1915, the blocks are laid on a thin mortar bed before the concrete base has set and, when grouted, the structure becomes a solid unit. There appears, therefore, to be no good reason why the ordinary base thickness, when a sand cushion is employed, can not be reduced when the monolithic type of construction is followed.

PAVEMENT SLABS TESTED

The first set of test slabs consisted of only four specimens, one of each kind, as follows:

Slab 1—A 4-in. base of 1:2:4 concrete, while still unset, was covered with a ⅛-in. layer of a 1:5 dry mixture to form a smooth bed on which to lay the brick. Three-inch wire-cut-lug brick were laid on this base, tamped, and grouted with a 1:1 grout. The slab was allowed to set for 24 hr. and was then covered with sand and kept moist until tested. The slab consisted of six courses of five brick each and measured 23 x 45 in.

Slab 2—The second slab was built like Slab 1 except that 4-in. wire-cut-lug brick were used.

Slab 3—A 1-in. base of 1:3 dry mixture was prepared. Four-inch wire-cut-lug brick were laid on this base and grouted. The length and width were the same as Slab 1.

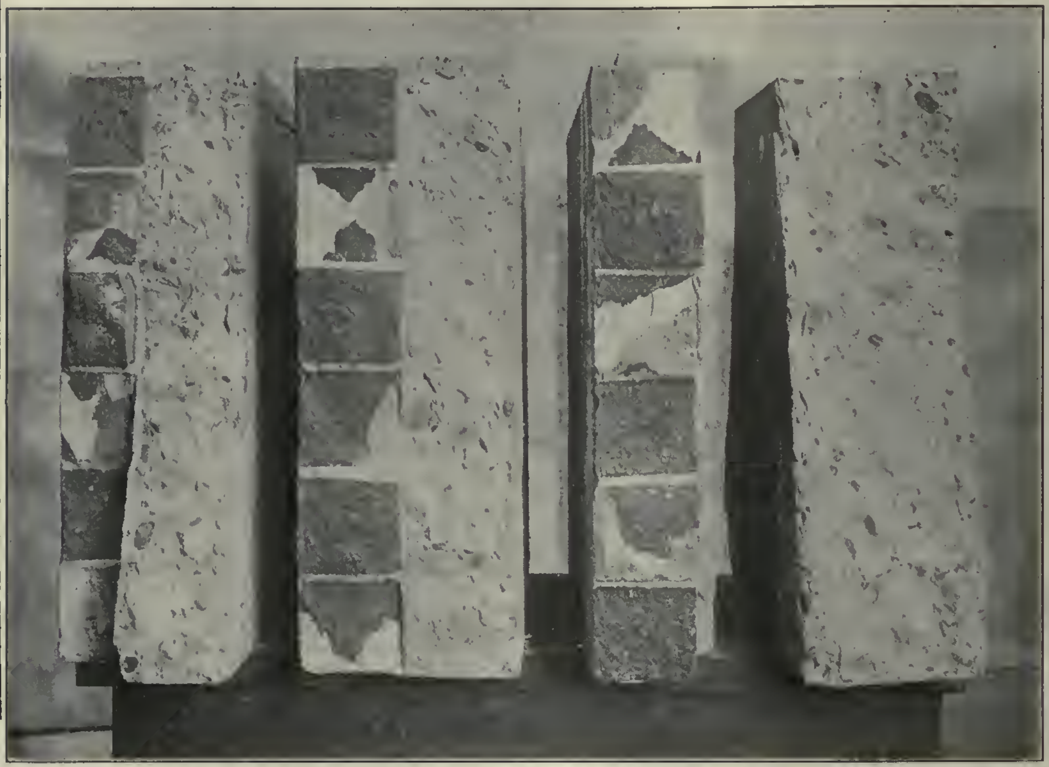
Slab 4—This was a concrete slab 7 in. thick and intended to represent standard concrete pavement construction. The proportions were 1:2:3, using a good gravel aggregate. The length and width were the same as Slab 1.

The specimens were tested when 28 days old as simple beams on a 42-in. span with the load applied at the one-third points. The numerical results of these tests are summarized in the table.

RESULTS OF PAVING SLAB TESTS; SPECIMENS 28 DAYS OLD

Slab No.	Total thickness, in.	Base thickness, in.	Brick thickness, in.	Total load, lbs.	Modulus of rupture, lbs. per sq. in.
1	7 3/16	4 3/16	3	13,100	465
2	8¼	4 ¼	4	21,500	580
3	5	1	4	6,700	490
4	7 1/16	7 1/16	..	12,500	460

The accompanying photograph shows the fractured faces of the four slabs. In Slab 1 it will be noted that three courses of the brick broke squarely across, while the other three separated at the joints, but with many indications of a very strong bond between the grout and the brick. There was a slight separation of the brick from the base, as evidenced by the different planes of fracture in the brick and concrete. In Slab 2 this separation of the brick and concrete is not found, indicating a relatively high bond between them. A very high bond between the brick and the grout filler is shown by the fact that in all three courses which broke at the joints a thin layer of brick pulled away from the body of the brick and remains adhering to the filler, which is still intact. In both of these slabs the thin layer of dry material is quite distinct. It proved to be quite porous and soft as compared with the concrete base, as would be expected from the very lean mixture used. Slab 4 shows a concrete of high quality, very uniform and dense. Strong adhesion between the cement and aggregate is evidenced by the numerous fractured pebbles.



FRACTURED FACES OF FOUR PAVING SLABS AFTER BEAM TESTS

HIGH BOND DEVELOPED

Since only a single slab of each kind was tested, the data are insufficient for conclusions as to economical dimensions or strength of the brick slabs as compared with concrete slabs. On the other hand, the three brick slabs are quite consistent in indicating that the wire-cut-lug brick makes it possible to fill the joints completely with grout, and that when this is done a very high bond will be developed between the brick and the filler. The three brick slabs further indicate that a bond can be developed between the brick and the base, or, in other words, that the brick and concrete can be united into a monolithic structure.

In the original pavement of this type built at Paris, Ill., no attempt was made to secure a bond between the brick and the base, the desire being simply to secure a firm, unyielding bed for the brick. In making the test specimens, however, the concrete was mixed to a quaking consistency or slightly wetter than had been the practice at Paris, and it was found that the ⅛-in. dry layer absorbed sufficient water to become well moistened by the time that the brick were laid. It was thought at the time that there would be considerable adhesion between the brick and the base. This opinion was borne out by the results of the tests. It was also thought that it might be desirable to develop this bond, so as to make the slabs truly monolithic, by increasing the amount of cement in the ⅛-in. layer to at least the same proportion as is used in the concrete base. It appears desirable that this ⅛-in. layer should be at least a 1:3 mixture in order to avoid a soft, porous stratum in the middle of the slab, and at the same time firmly unite the brick with the base. This richer mixture has been used in several pieces of pavement constructed since these tests were made, and was adopted by the Illinois State Highway Department on a state-aid road near Monticello which was begun late in the fall. The new series of test slabs has also been made with a 1:3 mixture in the ⅛-in. layer and should give some valuable data.

The department is indebted to Harvey C. Adams, president of the Danville Brick Company, of Danville, Ill., whose interest and co-operation in furnishing brick and other materials are largely responsible for making these tests a possibility.

THE CUBAN SOCIETY OF ENGINEERS, founded seven years ago, has grown up steadily until it now numbers 200 members, all, necessarily, graduated engineers and architects, besides some associates. Among the members are numbered the President of Cuba, himself a civil engineer and a graduate of an American university; the secretary of the National department of public works, and the foremost engineers in the country, both in Government service and private practice. The home of the society, at Paseo de Marti, 76, Havana, is centrally located and includes a carefully selected library and keeps on file technical journals from Europe and the Americas. The official publication of the society is the *Revista de la Sociedad Cubana de Ingenieros*, which is issued monthly.

Letters to the Editor

Comment on matters of interest to engineers and contractors will be welcomed

Relief for Irrigation Settlers

SIR: My attention has been called to your editorial of Nov. 27, 1915, page 650, on the question of whether the irrigation settlers shall be given relief. While I heartily agree with most of it and indorse every word that Amicus Curiæ says, I wish to say that there has never been a hint of repudiation in this project. I was at the Washington (D. C.) conference in May, 1913. When repudiation was hinted at by one or two Senators and Congressmen, it was indignantly denied by every representative of every reclamation project, who considered it a gratuitous insult.

I have been a water user in this project ever since the government took it over from the Washington Irrigation Company. For seven years continuously, until Dec. 4 last, I was a trustee of the S. W. U. Association. The last three years I have been its president. I have met Secretary Lane at different times since the conference mentioned. the last time last winter in Washington, and I do not believe he is "losing faith in the Lane policy."

FARWELL MORRIS,
Former President, Sunnyside Water Users' Association.
Grandview, Yakima County, Washington.

Six Civilians Qualify as Lieutenants in Corps of Engineers

SIR: I take pleasure in sending you the following information:

As a result of the examination for appointment as probational second lieutenant in the Corps of Engineers, U. S. A., held Oct. 25-30, 1915, the nominations of the six successful candidates are about to be sent to the Senate. These are Gilbert D. Fish, New York City; George Mayo, Washington, D. C.; Paul T. Bock, New York City; Charles O. Boynton, San Francisco; Arthur P. von Deesten, Brooklyn, N. Y., and Edward N. Whitney, Madison, Wis. Mr. Boynton is a junior engineer who has been several years in the government service, under the Engineer Department.

The number of candidates who actually took and completed the examination was seventeen. In addition, three candidates withdrew during the progress of the examination, while two were found physically ineligible as a result of the physical examination which preceded the mental examination.

The nomination of the six successful candidates marks the completion of a vigorous effort on the part of the chief of engineers of the Army to secure thoroughly well qualified young engineers for appointment to the Corps of Engineers under the provisions of the river and harbor act approved Feb. 27, 1911.

The number of candidates presenting themselves for this examination in previous years was disappointingly small, and very few of the candidates who presented themselves had the necessary qualifications. In the period from January, 1912, to February, 1915, four examinations were held. The total number of persons who took the examinations was eleven; of these three were commissioned as probational lieutenants.

In order to secure a larger number of candidates the chief of engineers, on April 1, 1915, addressed letters to the presidents of all the approved technical schools, about fifty in number, requesting that they draw the attention of suitable graduates of their institutions to the opportunity for appointment as lieutenants in the Corps of Engineers. The chief of engineers also issued instructions to all of the district engineer officers in the United States to facilitate in every way the candidacy of junior engineers in the employ of the Engineer Department and of any other candidates who might make inquiry regarding the examinations.

Arrangements were made with the Civil Service Commission by which a special examination was held to permit candidates to establish eligibility for junior engineer as required by law.

As a result twenty-five persons were authorized to take the examination beginning Oct. 25; of these two withdrew before the examination, and one failed to appear, leaving twenty-two who presented themselves for the examination as already indicated.

It is anticipated that the next examination for appointment to the Corps of Engineers will be held at a convenient time after the termination of this college year.

DAN C. KINGMAN,
Chief of Engineers, U. S. Army.
Washington, D. C.

The Panama Slides

SIR: After thirty years of patient waiting, unwilling to put myself in the position of a prophet of evil, but myself even hoping against belief and the results of careful investigations, it seems to me the time has come to look back in order to take into account what has happened during this long period when the attention of the world has been centered on the Isthmian problem and now ask, What of the future?

In 1885, thirty years ago, it was my professional duty to make a careful investigation of the physical conditions at Panama to ascertain what would be the probable result of the plans of a sea-level canal, which was then contemplated.

The surveys, while not completed by the French engineers, were well advanced. The topography, ascertained by careful levelings, had made it possible to draw the contours with some precision. Also, diamond-drill borings had been made at all critical points to below the proposed level of the bottom of the canal in the backbone of the continental divide along the 9 miles of the high land then generally termed "Culebra."

The material disclosed by these borings had been examined and studied and the assumed stable slope had been decided upon. The channel was to have been 9 m. deep and 31 m. wide at the surface of the water (29½ ft. and 101½ ft. respectively).

From the surface of the ground to about 15 m. (49 ft.) the material was assumed to be hard clay, and the slope was to have been about 1 on 1. Below the clay the material was assumed to be a quasi rock and the slope was to have been about 1 on ½, with terraces about every 20 m. (66 ft.) 3 m. (10 ft.) wide.

In order to form an opinion of the stability of these slopes it was necessary for me to ascertain independently as closely as practicable the character of the material to be encountered. Fortunately I had access to the diamond-drill cores and to the reports of the Panama Railroad Company, which made mention from time to time of the effect of slides in its comparatively slight excavations, where they had entered the toe of the natural slopes of the surface at several points in the 9 miles of the heavy ground in the center of the Isthmus. It was seen from these reports that at times suddenly the track would be covered with sliding material several feet in depth and, in one instance, as I recollect it, to a depth of about 18 ft.

The cores from the diamond drills disclosed a great variety of material, and in a single core several apparently different kinds. In any one location there could be found many varieties in the length of the hole, which sometimes reached more than 300 ft. Some of the holes were vertical and some inclined, and all, to appearances, went through a great variety of strata. If the general character of the material could be called rock no engineer, experienced in excavations, would trust it, when disturbed or exposed to water and air.

From these studies I decided that the slope designed would not be stable. In order to ascertain where what I would consider a stable slope would extend to, I plotted the section as shown by the contours of the official reports, using the Culebra hill for one side of a proposed excavation. The results on that, the west, side of the cut are as follows: The section of the De Lesseps engineers, with a slope of 1 on ½, and the slope in clay 1 on 1, reached the surface 127 m. above the surface of the water and 90 m. from the center line of the canal (respectively 416.6 ft. and 295.3 ft.). A slope of 1 on 1 reached at the surface of ground 180 m. above the surface of the water and 190 m. from the center line of the canal (respectively 590.4 ft. and 623.4 ft.). A slope of 1 on 1½ reached 201 m., 300 m. from the center line of the canal (respectively 659.3 ft. and 984 ft.), but this slope cut through *behind* the summit of the hill and 40 m. (131 ft.) back of it, and this summit was 213 m. (about 700 ft.) high. A slope of 1 on 2 would come out 80 m. (262 ft.) *back* of the summit and 360 m. (1181 ft.) from the center line of the canal; yet this slope was not, in my opinion at the time, a stable one, and I then thought, and so stated (and results since then have confirmed it) that at least a 1 on 3 slope would be required.

The summit nearly opposite Culebra on the east side of the canal is nearly 230 m. (744 ft.) high, and others are as high. I went through the Culebra cut with Colonel Gaillard in January, 1911, and pointing up to where a break had started dropping down at Gold Hill, I asked him how high it was above the bottom of the canal. He replied 656 ft. I then related what I have stated above, and he complimented me by saying I was a prophet.

I am not quoting his remark or giving the results of my investigations in 1885—thirty years ago—for any selfish purpose.

but to endeavor to show the American people, through the Engineering Record, that infinite patience is still required of them, and to urge them to brace up under the present serious disappointment to meet more serious results that may develop before a permanent channel is secured.

I have been told that the whole set of diamond-drill cores and all the data obtained during the De Lesseps régime were turned over at the time to the U. S. Government, and are, or were, in the State Department. If these data were available to our boards of engineers at a later date it is hard to understand why they decided that Culebra would stand firmly at an average slope of "three vertical on two horizontal".

The very terms used by the geologists who investigated the material would themselves be sufficient to put a practical engineer on his guard—such terms, for instance, as "indurated clay", and "argillaceous and calcareous sandstone", all of which material is likely to go to pieces under weather and water and especially under saturation and, if a correct term, internal supersaturation.

My opinion has never been asked and I always hesitated to give it, but being absolutely certain that the canal would be blocked to navigation if opened when it was proposed to do so, I felt it my duty as an American citizen to suggest that the opening of the canal should be postponed, as it would be much wiser to have the world's commerce wait awhile than to have it obstructed when once its streams had begun to flow through this waterway. The fact that 10,000,000 cu. yd. has held up 100 vessels at the present time, with the resulting inconvenience, cost and general disturbance of interoceanic traffic, is sufficient to attest the unwisdom of having opened the canal to navigation before it was ready for it.

ELMER L. CORTHELL, DR. SC.,
Civil and Consulting Engineer.
North Egremont, Mass.

[A copy of this letter was sent to General Goethals, with an invitation to comment on it. He replies that he considers comment on it unnecessary in view of the publication of his report on the slides. This report was published in full in the Engineering Record of Nov. 27, 1915, page 652.—EDITOR.]

Prejudicing the Young Engineer

SIR: I am pleased with your editorial paragraph on "Prejudicing the Young Engineer" in your issue of Dec. 18, 1915, page 745. College instructors and perhaps teachers generally are inclined to consider the letter of the law in the matter of public as well as private honesty both of action and purpose, particularly in those lines in which they themselves are not immediately concerned. And my experience goes to indicate that in this they are not unlike other people, but that as a rule, having no immediate connection with public or other business, they are inclined to criticism wherever they think they see something to criticise. In this they do no more than the newspapers do, but I think the instructor criticises as a rule with an honest purpose and the newspaper criticises in accordance with its political bias.

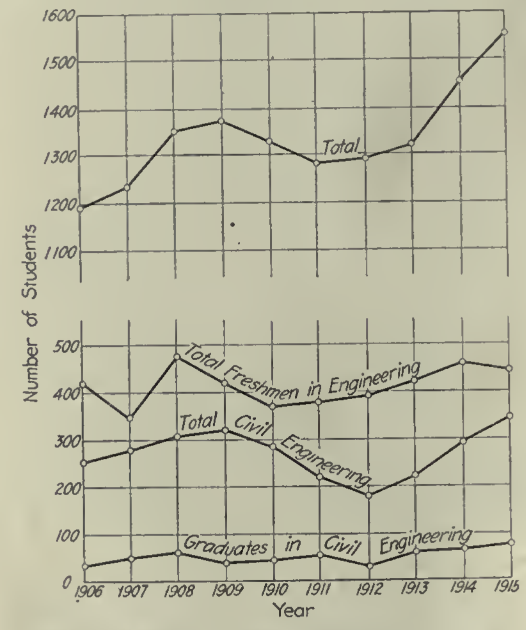
What the instructor should do, it seems to me, is, so far as he is able in the time at his command, to explain fully and frankly to his students methods, honest and dishonest, of doing business, and to try by both his own life and his teaching to impress upon them the desirability of a spirit of tolerance for the shortcomings of others and of intolerance toward their own shortcomings, not with a view to leading them to look lightly upon or to tolerate public dishonesty, but that they may judge upon known facts only and without prejudice.

He should teach them, too, to be slow to express criticism except when there is good ground, well proved, and the possibility of accomplishing a betterment.

WILLIAM G. RAYMOND,
Dean of the College of Applied Science,
State University of Iowa.
Iowa City, Iowa.

Why Is Registration in Civil Engineering Decreasing?

SIR: In connection with the article in the Engineering Record of Dec. 18, 1915, page 766, relative to enrollment in civil engineering, I am sending you herewith the data covering the department of civil engineering, University of Michigan, for the years 1906 to 1915 inclusive. I am also enclosing the total enrollment in the College of Engineering, and the freshmen enrollment. In our system of classification at Michigan there is no election made by the freshmen, and the work in the first year is all required and is identical for all students of engineering.



UPWARD TREND IN LATER YEARS SHOWN IN ENROLLMENT OF ENGINEERING STUDENTS AT UNIVERSITY OF MICHIGAN

Prior to 1911 the graduate school was not specially organized and all graduate students in engineering were enrolled in the College of Engineering and appear in the total enrollment in the engineering catalog for those years. In 1911 the graduate school was organized to include all graduate work on the campus. Since that time engineering students taking a fifth year's work for the Master's degree and candidates for the degree of Civil, Mechanical or Electrical Engineer, which is held equivalent to the Doctor's degree here, are enrolled in the graduate school and do not appear in the total engineering enrollment.

I have included in the civil engineering enrollment those graduate students whose entire work is in civil engineering. In addition to these, a large number of graduate students are taking a number of engineering courses, but are not enrolled as candidates for engineering degrees. All such are omitted. Our first semester enrollment this year is 32 behind the entire enrollment for last year. The normal increase, due to new men coming in the upper classes or the graduate school in February, is about 28 to 30, so that the total enrollment for 1915-1916 in the department of civil engineering should very nearly equal that of last year.

I think that we may seek for the decline in civil engineering registration in a number of causes. You will note from the chart that Michigan had her drop during the period 1908-1909 to the period 1911-1912, and that since the reorganization in the spring of 1912 there has been a fairly steady increase.

Undoubtedly the closing down of work on the Panama Canal and the New York Barge Canal, the decrease in the activity of the Reclamation Service and the suspension during the past few years of all except the most necessary railroad construction, have had their effect. Whenever a considerable number of engineers, particularly men who are not technical graduates but who have come up from the ranks and been in service for a number of years, are thrown out of employment they have a very decided tendency to check young men from going into the profession.

Possibly not enough work has been done in the way of bringing to the attention of the public at large and particularly to the teachers of high schools the very rapidly increasing field for engineering graduates in manufacturing, sales and other business engineering lines which have not been looked upon in the past as the field of engineers. We have had but little difficulty in placing our graduates in good positions. All of the correspondence relative to employment of alumni in my department passes through my hands, and at the present time there are no more men seeking changes than is normal at this time of the year. We have a record of perhaps ten men whose work is about to finish. We have advised every one of these men of three or four openings. In other words, the demand for our graduates remains a little ahead of the available supply.

I think it might be a good thing to go a little further in the investigation and try to secure answers to three or four questions other than have already been suggested.

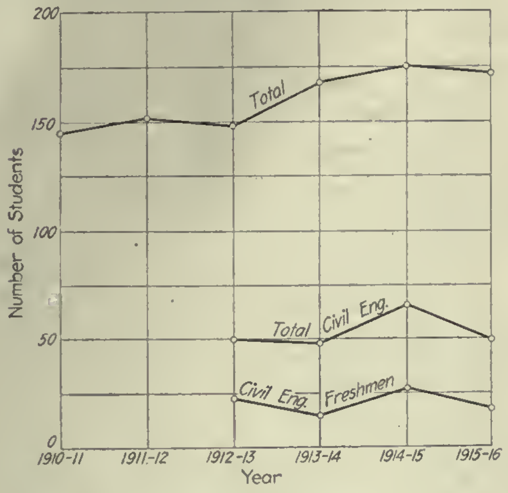
1. Are not the large schools, those having an enrollment in engineering of from 600 to 700 up to 1500, a little inclined to lose sight of the personality of the student and treat the students as so many units, each one of whom must go through a machine and acquire certain degrees of polish and at the end when they come out all of those who do not come up to the required specification are rejected? We are trying to remedy that criticism here at Michigan through the working of the Mentor and Assembly system, which has been one of Dean Cooley's developments and which has shown a most wonderful increase in the effectiveness of work, not only on the part of the students but on the part of the faculty. We have also aimed at the same thing by the adoption of our group system, which gives the men in their senior year a very much wider range of work than formerly, permits them to give a little special preparation for some particular line of work, and gives the faculty the opportunity of directing work of some of the students who either show a marked inclination and ability for certain lines or an apparent inability to handle the work of certain other lines.

2. Are the best results in teaching secured by the employment of men on the teaching staff who have grown up in the atmosphere of college and who have not come into contact, to any large degree, with the active work of the profession, who are thoroughly qualified, perhaps, on the theory of pure science but are to some extent lacking in the practical application of that theory in everyday work? Or, will better results be had if men are chosen for the various teaching positions who have had the training and then have been for a given number of years in practice?

It has been the privilege of the writer to go into university work after 25 years of practice in the profession. In the reorganization of the civil engineering department which took place in 1911 and 1913 the teaching staff was filled with men who had had from 10 to 18 years of active practice in the special line of work which they were asked to teach, while all instructors are chosen from men who have had 5 years or more of active outside work, not done in connection with a teaching position. This seems to be working well. I think that the criticism that was made at the outset that a man who had been 10 years in practice would never be able to teach theory has not been sustained. The present plan at Michigan has the merit of commanding the confidence of the student body and the cordial support of the alumni.

H. E. RIGGS,
Professor of Civil Engineering, University of Michigan.
Ann Arbor, Mich.

SIR: The accompanying diagram shows the enrollment of engineering students at Washington University. You will note that the statements concerning the civil engineering students begin with the year 1912-13. This is due to the fact that students here did not choose between the engineering courses before that date. Furthermore, it seems to me that the time covered has been so short and the curves are so irregular that practically no conclusion with regard to general increase or decrease can be drawn from them.



NO DEFINITE TREND IN ENROLLMENT AT WASHINGTON UNIVERSITY

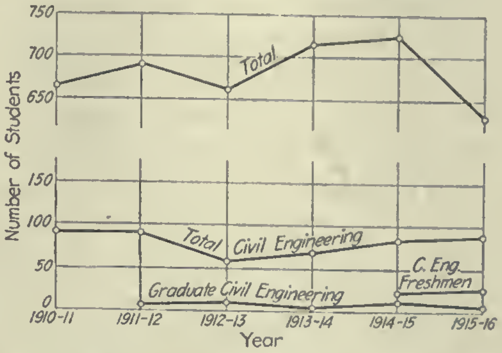
Concerning the reasons for the conditions discussed, it seems to me the reasons given in the last half of your editorial, page 746, cover the essential situation.

J. L. VAN ORNUM,
Professor of Civil Engineering, Washington University.
St. Louis.

SIR: The accompanying diagram gives information concerning the registration in the Civil Engineering Department at the Georgia Tech. for the years 1910-11 to 1915-16 included. Until September, 1914, freshmen were in the general course. There has been a great increase in the number of students in the Civil Engineering Department. Probably this would have been larger had the head of this department been authorized to push the work as he desired.

In my judgment students are going into the electrical course rather than the civil because it is spectacular and appeals to the parents as well as the boy. They go into the mechanical often for business reasons, and the further fact that this work appears to give a man permanent residence. I believe, lastly, that there is an apparent rather than a real falling off in the Civil Engineering Department because of the subdivision of these departments into railway engineering, highway engineering, sanitary engineering, etc.

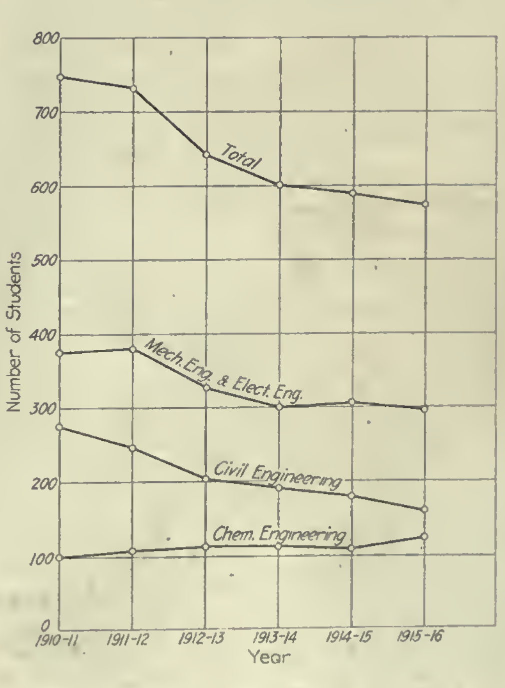
THOS. P. BRANCH,
Professor of Civil Engineering, Georgia School of Technology.
Atlanta.



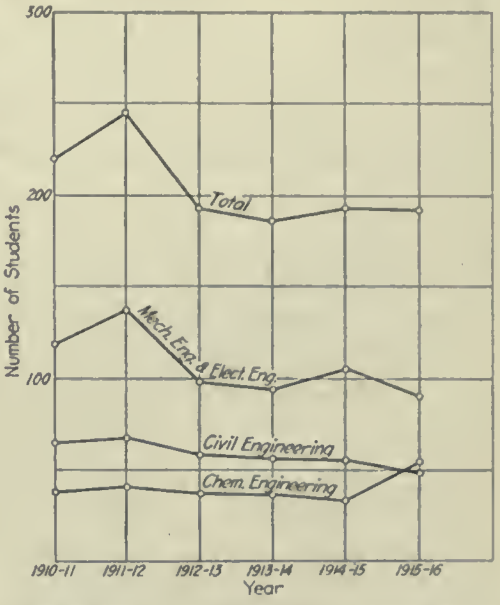
ENROLLMENT AT GEORGIA SCHOOL OF TECHNOLOGY—UNTIL 1914 FRESHMEN WERE IN GENERAL COURSE

SIR: The accompanying diagrams show certain statistics of attendance in the engineering courses of the University of Pennsylvania as to separate courses and totals, both for the attendance in the aggregate and that in the freshman class.

In my judgment, the popularity of engineering courses was artificially stimulated some years ago, when trusts were in their heyday, through sensational magazine articles concerning the rise of young captains of industry, and similar propaganda, which led to an abnormally large influx of aspiring youth upon the engineering schools.



CLASSIFICATION OF ENGINEERING STUDENTS AT UNIVERSITY OF PENNSYLVANIA



CLASSIFICATION OF FRESHMAN ENGINEERING STUDENTS AT UNIVERSITY OF PENNSYLVANIA

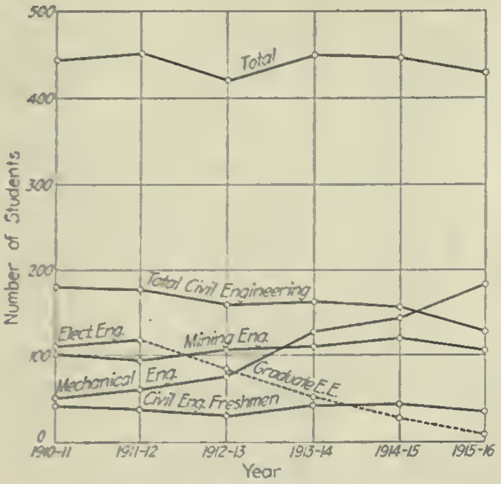
During a period which gradually drew to a close about a year ago, the engineering profession passed through some of its worst days. It is a well-known fact that, toward the end of that period thousands of engineers found themselves out of employment. Happily, that condition is now at an end and, in my judgment, there is little likelihood of its early recurrence. Its unfavorable effect upon the attendance on engineering schools, and especially on the sizes of the incoming classes, may be regarded as inevitable. That chemical engineering proved an exception to that tendency at this institution and, I understand, elsewhere, may be attributed to the fact that that field had been neglected in this country, and that its possibilities are at length being more clearly recognized, especially in the light of the changed conditions brought about by the European war.

I am strongly of the opinion that the decline in the attendance in civil engineering courses within the past few years will prove a temporary one, and that the curves will soon resume the ascending trend which they should exhibit under normal conditions—that is, under conditions of average business prosperity and industrial development.

EDGAR MARBURG,
Professor-in-Charge, Civil Engineering Department, University of Pennsylvania.
Philadelphia.

SIR: The accompanying diagram indicates the registration of students in engineering courses at Leland Stanford, Jr., University for the years 1910-11 to 1915-16, inclusive. The effect of the low registration in 1912 is being felt now, which, added to the general business depression along engineering lines on the Coast, accounts for the slight falling off in freshman civil engineers and in the total registration of engineering students.

It seems to me that prospective opportunity for employment influences many students when choosing their course. The policy of the Department of Civil Engineering has always been to discourage young men from taking up the study of civil engineering unless they feel reasonably certain that



CLASSIFICATION OF ENGINEERING STUDENTS AT LELAND STANFORD, JR., UNIVERSITY

they want to take up the work because they like it. The prospective student is told that he faces the probabilities of hard work and small pay, and must find part of his reward in the knowledge that his work is of the highest service to mankind.

Since the total registration of students in the University has increased from 1770 in 1910-11 to 2037 for the first semester of 1915-16, it is evident that the students are entering some of the other courses more freely than formerly. With us, the Departments of Economics and of Law show the greatest growth.

Charles D. Marx,
Professor of Civil Engineering, Leland Stanford, Jr., University.
Stanford University, Cal.

Sir: The article and editorial on the decrease in civil engineering registration in a number of universities, appearing in your issue of Dec. 18, 1915, are indeed instructive, but not entirely alarming, as one might conclude from the data given. To say just what the cause, or causes, of this decline are is rather difficult, since it most likely is not the same in all details for different schools. In the writer's opinion it is due mainly to preponderance of supply over demand, a condition in trade which, except in the case of monopoly, results in a drop in price. The oversupply of engineers has correspondingly decreased the value of their services. It is likewise logical to assume that if the demand exceeded the supply, premiums would be placed on engineers' services, and we know this is not the case at present.

Many of the men who took up the study of engineering because of the vision of fabulous salaries, induced by the reading of highly colored and exaggerated stories and advertisements, have found to their sorrow that the compensation does not meet up with the capital invested. They naturally are more pessimistic than they should be, and through their advice many students are persuaded not to take up engineering as a profession. Then, too, the natural reaction of untruthful advertising combines to cut down the registration of engineering colleges. The increased popularity of business and agricultural courses may be attracting some young men who might otherwise take up engineering, but it is more than likely that realization of the meager financial returns and lack of recognition of the engineering profession by the public is mainly operating to decrease the registration.

The situation may be alarming from the viewpoint of the colleges, but, even so, it has, in the writer's opinion, a silver lining. With the decrease in registration comes the chance to urge upon students the desirability of taking a longer and broader course, covering a period of five or six years, and thereby remedy the situation. This increased stay of a comparatively small percentage of students will keep up the quota and at the same time result in a more finished product, with a resulting elevation of the status of the junior engineer just out of college. Four years is not sufficient time for any thorough engineering course, and I believe this is more or less the general opinion among engineers; but when the colleges were crowded with students the natural desire was to turn out engineers as rapidly as possible to make room for the newcomers; and four years being the absolute minimum for satisfactory instruction, it was naturaly accepted as the most suitable period, all things being considered.

This seems to be a very opportune time to make a change in the length of engineering courses. Such a move will check the decrease in registration to a large extent and cut down on the oversupply of young engineers. The four-year courses should not be abandoned entirely, but they should be made the secondary rather than the primary courses and be limited to the stronger and more experienced students. Then the product of the longer and shorter courses would be more nearly uniform. The longer courses would relieve the menace of overspecialization which, no doubt, is the cause of many of the troubles of the profession.

In the past the desire of the engineering schools has been to train the students in a certain particular line as rapidly as possible and without including any more studies than are absolutely necessary for the completion of the purely technical training. Languages, literature, writing, public speaking, economics and business training have been pushed so far into the background in many cases that even if some or all of such studies were given they were so general, vague and poorly presented as to be a mere waste of time. As a result, the student detests these courses and avoids them whenever possible, since he can see no good in them. The result is the narrow-minded engineer, out of place in any company but that of his fellows.

The consensus of opinion now is that engineers must have a broader education if they are to take their proper places among members of the other learned professions. Doctors and lawyers are in general broad-minded men, since their preliminary education is of a broad character. The great majority in these professions graduate from a regular college course before entering the law or medical colleges. If such training makes men of these professions broader minded, more public spirited, and popular, can we rightfully deny that to supplement specialization in engineering schools with a broader general training, will not aid in solving the present problems confronting the engineering profession? Experience has shown that there is something fundamentally wrong in the engineering profession, and, taking all things into consideration, it seems that our educational system is somewhat at fault—too much specialization and hurry.

For the average high-school graduate, four years at college is not really enough, even for the required scientific studies. Some schools have recognized this fact for some time and are offering and planning five and six-year engineering courses; but it is difficult and slow work to overcome the momentum of the rapid-fire, hurry-up engineering education advocated by the majority. It is safe to say, however, that ere long the agitation among educators and engineers for a broader education of engineers will become so strong that the four-year courses will be practically discontinued.

From the standpoint of the practising engineer it is the writer's opinion that the field is somewhat overcrowded as a result of questionable advertising and publicity campaigns which were, and in a few cases are still, being waged. This overcrowding has had the tendency to curb the salary of engineers in general, for at present men can nearly always be found who, on account of circumstances, will work for much less than a rightful wage. The decrease in registration is the reaction caused by the general condition of under-pay and a demonstration of the natural law of equalization and tendency of things to preserve a certain balance or average. When the conditions of pay are improved there will no doubt be another increase, marked or gradual, in the engineering registration of colleges. Whether this will be sudden, with a resulting decrease in wages to preserve the balance, or gradual, without the attendant drop in remuneration, depends upon how the practising engineers and educators make use of the present lull. Let them get together and, in the light of their combined experience, work out the salvation of engineering as a profession now.

Chicago. Albert M. Wolf.

Fine and Coarse Aggregates

Sir: I read with much interest the article of Prof. Robert H. McNeilly in your issue of Nov. 26, 1915, page 659, the more so because at the time of its publication I was myself busy on a similar theoretical study of the most advantageous proportions of the coarse gravel aggregates. The conclusions reached are of course practically identical as to jump of sizes.

In view of Professor McNeilly's exhaustive and accurate study of the proportions of fine aggregates I would be very glad if you would encourage him to make a similar study of the effect of similar practice from the largest size aggregate down in the case of gravel or pebbles.

The application of the same theoretical principles used by Professor McNeilly in the proportioning of both coarse and fine aggregates promises to my mind the most important advance in the quality and economical manufacture of concrete that has been made in the last few years. I recognize that it is more reasonable to apply the same theory to round pebbles such as occur in gravels than to a coarse aggregate composed of crushed rock of angular formation.

I should be very glad to have you reconsider your editorial on Professor McNeilly's article published in your issue of Dec. 4, page 681. It seems to me that nothing is of more practical importance than the introduction of refinements in the proportioning of the materials that promise a remarkable improvement in the quality of concrete and at the same time a material reduction in its cost.

T. F. Nichols,
Office Engineer, Arizona Highway Department.
Phoenix, Ariz.

HINTS FOR THE CONTRACTOR

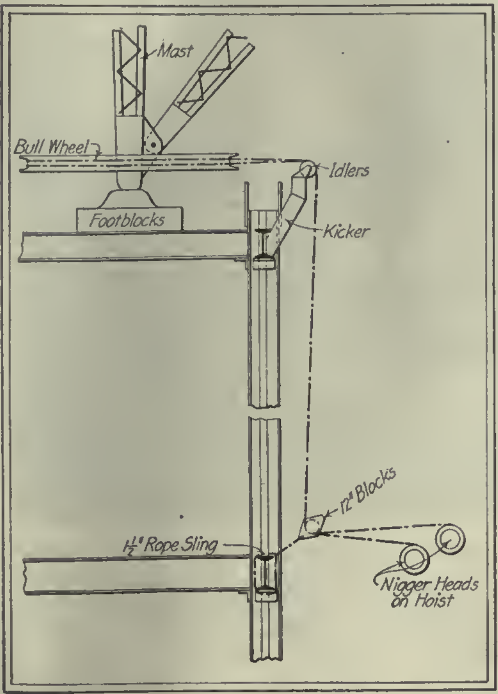
Details Which Save Time and Labor on Construction Work

Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

[*Contributions to this section are solicited, and if found available will be paid for. They must be* SHORT, *and should be accompanied, if possible, by photographs or sketches.*—EDITOR.]

Bull-Wheel Adapted to Building-Erection Derricks

THE DRAWING published herewith shows how F. E. Warren, superintendent of construction for the George A. Fuller Company on the new Arcade Building in Pittsburgh, is successfully swinging the familiar steel-erection derrick with a bull-wheel. It has never been considered feasible to swing such derricks in any manner except by a hand lever, as they are raised, sometimes oftener than once a week, during the progress of erection, while the hoists which operate them remain on the ground. When one of these big derricks is handling a heavy load it is often so hard to swing that several men are required on the lever. By using ball bearings in the construction of some of the derricks on this job, only two men were at first required. Now, however, only one man, at the hoist below, is required, and loads can be swung much more quickly. It is estimated that 50 cents a ton is saved in the handling cost. The rig has been operated successfully on this building to a height of 210 ft., and could probably be used much higher. It is evident that the ordinary single-drum swinging engine could be used in the same way, winding the bight of a full coil of wire rope on the drum, carrying the ends to and around the bull-wheel, clamping them in the usual way, and lashing the two coils of surplus rope to the inside of the wheel. The cable would have to be paid out from above and readjusted on the bull-wheel, however, when the derrick was raised, which would take more time than is the case with the rig operated with nigger-heads.



BULL-WHEEL APPLIED TO ERECTION DERRICK

Concrete Reinforcing in Long Pipe Piles Lowered in Sections

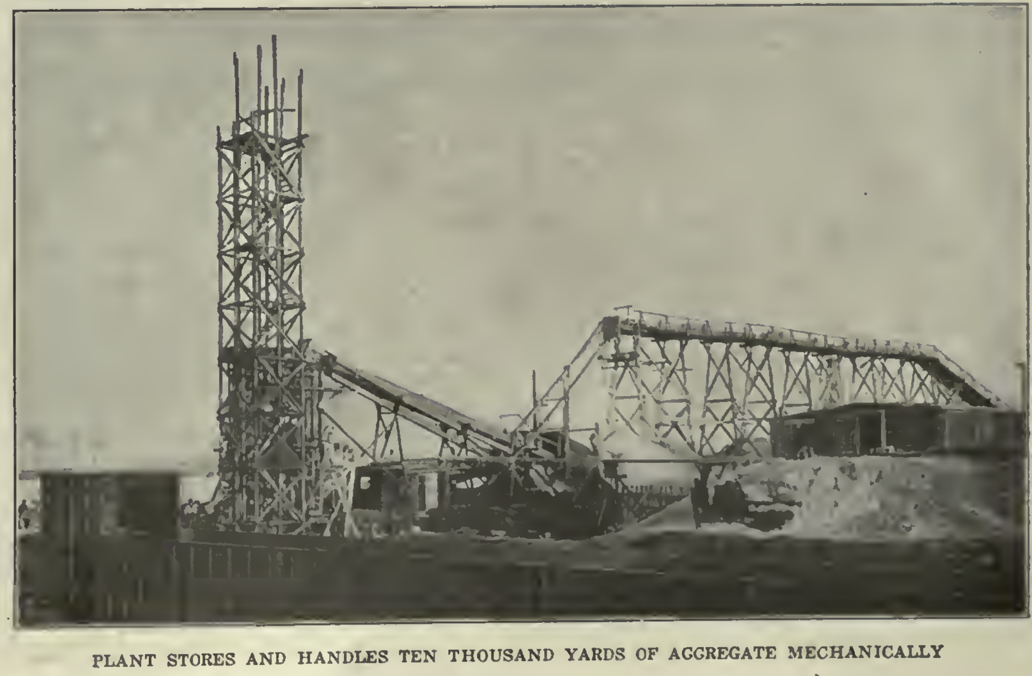
By ALEX. P. CRARY
Ancon, Canal Zone

FIFTY to sixty feet of reinforcing, composed of four vertical 1-in. square bars bound with $\frac{3}{8}$-in. hoops on 1-ft. centers had to be placed after driving in each of the 14-in. pipe piles for the quarantine landing stage at Balboa, Canal Zone, described in this section of the three preceding issues of the Engineering Record.

The units for each pile had to be built up by splicing individual bars. The length of bars mostly used was 24 ft., but as the joints had to be staggered, shorter pieces of various lengths were used in the bottom and the top of the sections. The bottom section was partly assembled on the platform and placed in the pile, being prevented from dropping by clips which caught on the top of the pipe. The part which projected above the pile was then further assembled. Next, at a point above the part last placed, the whole was gripped by clips and a tackle, raised so as to release the clips at the top of the pile and lowered until all of the assembled part was within the pipe. This process was repeated several times in placing each complete unit. The total weight of steel in each pile averaged 1000 lb., and it cost 67 cents per 100 lb. to place the reinforcing. The work was done by the writer as contractor under the direction of Rear Admiral H. H. Rousseau, engineer of terminal construction.

Conveyors Handle Materials Cheaply on Big Concrete Job

TEN THOUSAND yards of concrete materials may be stored, heated and rehandled to the mixer mechanically at low cost by the belt-conveyor layout illustrated in the accompanying photograph. This plant, installed by Barnett & Record, contractors of St. Paul, for building the new Milwaukee grain elevator of the Chicago & North Western Railroad, illustrates the growing appreciation of the saving to be made by handling the aggregate as well as the finished concrete mechanically. The upper conveyor, 350 ft. long and 40 ft. high delivers material to the storage pile. Under it in a gallery, fed by gates at frequent intervals, is the second Weller conveyor, which discharges material into a small bin from which it is drawn directly to the Milwaukee mixer. Inside the gallery of the lower conveyor are steam lines with coils every 16 ft., so that the sections of the pile from which the material is being drawn can be readily heated.



PLANT STORES AND HANDLES TEN THOUSAND YARDS OF AGGREGATE MECHANICALLY

Electric Lights and Heaters Cure Concrete

SMALL CAR heaters and banks of electric lights were used to maintain a hardening temperature on the concrete floor of the State Street viaduct, Chicago, repair of which was described in the Engineering Record for Jan. 1, 1916, on page 14.

Concrete was placed on the viaduct floor on Dec. 3 and 4, on which days the lowest temperature was 33 deg. Fahr. with a mean temperature ranging from 34 to 35 deg. On Dec. 5 the temperature dropped to 32 and on the 6th a heating system was installed. On the 6th, 7th and 8th the concrete was covered with heavy tar building paper and steam blown under this covering to supply the necessary warmth and moisture to hasten the hardening action. On the 10th electric heaters supplied with current from the trolley line were placed under the forms and enclosed with tar building paper to retain the heat generated. The fact that there was only 3 in. clearance between locomotive smoke stacks and the under side of the floor made it impossible to use any heating system that would necessitate considerable space for housing. The small car heaters, however, were of such dimensions as to fit under the bays between I-beams. Ten sets of heaters were used, but experiment showed that additional heat was necessary. Therefore, forty banks of five 32-candlepower, 120-volt incandescent lights were added to the heating equipment. The effect of this addition was very noticeable. The exposed surface of the floor was warm to the touch, light snow which fell upon it immediately melted and the moisture resulting from the melting snow evaporated quickly.

Although some of the floor was completed before the mean temperature had gone below 32 deg. Fahr., the last sections were placed during freezing weather, the last two panels being placed on Dec. 15. As it was desirable to resume traffic on Dec. 20, unusual precautions had to be taken to supply and maintain warmth that would insure the concrete attaining sufficient strength to permit street cars passing over the bridge.

Forms Cleaned with Steam

On the night of Dec. 14 the temperature was 8 deg. above zero but at 10 a. m., on the 15th, it had risen to 25 deg. Forms and steel members were in place coated with ice and snow and it required 1 hr. to melt the ice and warm up the steel with steam supplied through a 2-in. hose. Following this procedure forms were washed with clean, scalding hot water. At 11:15 a. m., Dec. 15, deposition of concrete was begun. Mixing water was heated by steam to 190 deg. Sand and gravel had previously been heated to a temperature of from 140 to 190 deg. Concrete came from the mixer at a temperature of 120 deg. Even after it had been in the forms for 15 min. the temperature ranged from 100 to 110 deg. At 11:30 a. m. the temperature of the air had risen to 31 deg. but by 1 p. m. had dropped to 27 deg. At 1:30 p. m. concrete that was first placed still had a temperature on the surface of 61 deg. At 5 p. m. the surface temperature of the concrete was at no place lower than 58 deg. Surface troweling was commenced at 5:30 p. m., and the job completed, heating apparatus installed, tarpaulins spread over the panels, and the workmen were on their way home by 9 p. m.

The bridge repairs were carried out under the general direction of John Ericson, city engineer, and Thomas G. Pihlfedt, engineer of bridges and harbors, by the engineer in charge of bridge construction and repairs, F. H. Avery. H. J. McDargh, assistant engineer, had the work, which was carried on by day labor, immediately in charge.

→ USING LIVE STEAM TO CLEAN ICE FROM FORMS AND STEEL-WORK

← HEATERS AND LAMP BANKS PUT IN BAYS BETWEEN BEAMS

Dynamite Proves Effective in Grubbing Reservoir Site

As a preliminary to admitting water to the Kensico reservoir of the Catskill water supply system for New York City the contractor was required to clear the site of the huge basin, which will flood 2218 acres of land, to a line 30 ft. outside of the flow line. How the work was done was described by George A. Winsor, section engineer of the Board of Water Supply, in a paper presented at the last convention of the New England Waterworks Association.

Under the specifications, grubbing included all designated areas within the 30-ft. margin of the reservoir, the reservoir bottom wherever the depth below the flow line is 35 ft. or less, and other areas wherever ordered. The grubbing consisted of the removal of all stumps and roots larger than 2 in. in diameter to a depth of 6 in. below the surface of the ground, and all holes left after grubbing the margins of the reservoir and its bottom to a depth of 10 ft. below the flow line had to be satisfactorily refilled. The principal natural timber growths around the basin consist of oak, maple, whitewood, birch, hickory, elm, locust, ash, dogwood, cedar, chestnut, and many fruit trees of different kinds. The chestnuts had been killed by the "bark disease."

Most of the clearing on the areas to be grubbed was done during the years 1910 and 1911, and the stumps of the trees were cut off close to the ground. For this reason the old method of pulling the stumps with a stump puller of capstan type, pulling the stump with the tree as a lever, using a block and fall, or the use of the caterpillar traction engine as used at Ashokan reservoir, were not adapted to the work at the Kensico reservoir.

The grubbing was sublet by the reservoir contractor, and a portion of it was again sublet. The method employed by the subcontractors was as follows: All small stumps from 2 in. to about 5 in. in diameter were grubbed by hand, using axes and mattocks, and all sprouts were cut off of the larger stumps, which were then removed with the aid of an explosive. Sixty per cent dynamite was used most of the time, the quantity depending upon the size of the stump, variety of tree, and the quality of soil around the roots. Many areas covered with a thick growth of small locusts were encountered; these were pulled with a pair of horses or yoke of oxen with a chain hitched around the tree; usually a little grubbing was done on one side only. This proved to be a very effective and rapid method for removing these species of trees when not too large.

The contractor usually worked about three weeks after a monthly estimate on the grubbing and blasting, as he found it required the remainder of the month to clean up and burn the brush and stumps before his next succeeding monthly estimate. Work was carried on through the winter months with very little interruption, it being a very mild winter with but little snow; during the spring months, which were very dry, the contractor was forbidden to build fires because of the fire hazard to city property adjacent to the clearing limits. He continued with the grubbing operations and burned the stumps later when the grass was green and the weather suitable.

A daily record of the dynamite used was kept by the contractors for the estimate months, and the quantities used per acre have been computed as follows: Maximum dynamite used, September, 1914, 170 lb. per acre; minimum dynamite used, January, 1915, 44 lb. per acre; average dynamite used, for entire work, 95 lb. per acre.

It was further demonstrated that it required less explosive to shatter a stump when the ground was frozen than when there was no frost. In the former case very little earth was disturbed by the blast; while in the latter case a large hole was made. A hole was made in the ground with an iron bar, and the explosive was placed under the stump; fuse exploders were always used.

The contract price for grubbing, which included refilling holes, disposing of stumps and brush, and all expenses incidental to the work, was $100 per acre. Mr. Winsor believes that the method employed in doing this work was the most economical and the best, under the circumstances. However, had it been possible to do the clearing and grubbing in one operation, the latter would have cost the contractor less, as there would be a considerable saving in both labor and explosive if one of the other mentioned methods had been employed.

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

Expect to Begin First Unit of Cleveland Subway by Early Spring

Euclid Avenue Line, 4.4 Miles Long, Will Probably Cost $4,840,000—Removal of Water Connections Already Begun

Actual construction work on Cleveland's first passenger subway—a double barrelled tube under the 4.4 miles of Euclid Avenue between University Circle and the Public Square—is promised by early spring by the Cleveland Rapid Transit Railway. The city waterworks, at the request of the company, began Jan. 8 the removing of water connections in Euclid Avenue between East Seventy-first and Seventy-fifth Streets. The city engineers have approved the plans of typical cross-sections and stations. The company officials state that they are ready to let the general contract to a New York firm as soon as final details of financial backing are closed. The total to be expended on the tubes, exclusive of rolling stock, station embellishments and the Public Square terminal, is estimated at $4,840,000.

Plans which have received the city's approval call for a double-barrelled reinforced-concrete subway. Each barrel will have inside dimensions of 10 ft. 4 in. by 12 ft. 6 in. Overall dimensions of both barrels, which will be contiguous, are 25 ft. wide by 16 ft. high. The open-trench type of construction will be used, and at all points the sand-crushed stone foundation of the Euclid Avenue paving will rest directly on the subway roof.

The rapid transit company's franchise reads: "Actual construction work or the removal of obstructions shall be begun within twelve months (Jan. 23 is the expiration date), and at least one double-track line from the Public Square to the city limits shall be completed and in operation within thirty months after such construction is begun. After the completion of the first line at least 5 miles of double-track line shall be completed in the next succeeding period of three years, and thereafter at the rate of not less than 5 miles in each succeeding three years. At the end of the first year of construction at least $500,000 shall have been expended, and by the end of the second year at least $1,500,000." The rapid transit company's franchise gives it the right to dig subways under every important street in Cleveland, and to locate its downtown terminal under the Public Square. It is expected that the quicksand that underlies much of Cleveland's downtown section will present unusual difficulties.

Designs for the Euclid Avenue tubes have been prepared by the W. S. Ferguson Company, of Cleveland. Traffic data compiled by Ford, Bacon & Davis, of New York, led to the decision to construct the Euclid Avenue line first. The estimated cost per single-track mile of the first subway is $550,000.

Robert Ridgway Named for Chicago Traction Commission

Robert Ridgway, engineer of subway construction of the New York Public Service Commission, has been named by the sub-committee of the Chicago local transportation committee of the City Council as the third member of the Chicago Traction Commission.

Ferris Water Power Bill Passed

The House of Representatives passed the Ferris water power bill, Jan. 8.

Water Main Breaks Shut Off Supply of Section of Seattle

The entire southern portion of the city of Seattle, Wash., was shut off from its water supply by a series of breaks that occurred Jan. 11 in a 51½-in. wood-stave main leading from the intake to the city. Three breaks occurred within a ½-mile radius, uncovering from 200 to 300 ft. of the line. A proposition to build a permanent aqueduct of concrete and steel to replace the damaged line has been indorsed by Mayor Gill of the city, Superintendent of Waterworks Youngs, and City Engineer Dimock.

Supreme Court Decides Oregon Highway Engineer Controversy

The controversy which has been waged for the last 6 months over the supervision of the Oregon State Highway Department was settled Dec. 28 when the Supreme Court of that state handed down an opinion written by Justice Bean. This opinion declares that State Engineer Lewis is in reality in charge of the state road work instead of E. I. Cantine, chief deputy engineer. The decision was rendered in mandamus proceedings instituted by Petersen & Johnson, contractors.

In allowing the application for the writ the court construed the measure passed by the last Legislature consolidating the state highway department with the office of the state engineer, to make invalid the provision which placed the state highway work in charge of a chief deputy engineer. The court held that this provision conflicted with the title of the act.

Start Work on 87-Mile Pipe Line

The Prairie Pipe Line Company of Independence, Kan., has started the laying of an 87-mile pipe line from the Augusta oil field to the company's tank farm at Neodesna. From the latter point the Standard Oil Company will pipe the oil to New Jersey.

State Commissions' Valuation Views to Be Discussed Jan. 26

Wednesday, Jan. 26, has been set by the Interstate Commerce Commission for the oral discussion of the briefs on valuation filed by the National Association of Railway Commissioners and by the several state commissions. These are in answer to the brief presented by the railroads at the conference of Sept. 30 and Oct. 1, 1915. Excerpts from the brief of the Minnesota Railroad and Warehouse Commission appeared in the Engineering Record of Jan. 1, page 12, and editorial comments thereon in the issue of Jan. 8, page 36. Briefs have also been filed by the state commissions of California, Kansas and Oregon.

Move Toward Merging of Chicago Railway Terminals

Another step was taken in Chicago Jan. 10 toward the merging of railway terminals for roads entering from the south, when the City Council took up a resolution calling for consultation with the Illinois Central Railroad over suggested terminals either at Twelfth Street or at Randolph Street, the station to have sufficient capacity to accommodate the roads now terminating at the LaSalle Street, the Dearborn and the Grand Central stations. Electrification is one of the questions to be decided.

Will Help American Contractors in Handling Work in Foreign Fields

Willard Straight Points Out Opportunities Opened to Constructors by American International Corporation

The American International Corporation, the $50,000,000 company organized recently for the exploitation of foreign trade, stands ready to aid American contracting organizations which undertake work abroad to the extent of taking over and floating the securities which the contractor must take in payment. This point was strongly emphasized by Willard Straight, formerly of J. P. Morgan & Company, and now vice-president of the new corporation, in an interview with a representative of the Engineering Record early last week. Mr. Straight pointed out that in the past no matter how competent a contracting company might be, so far as the actual execution of work was concerned, it had no future in the foreign field unless it were able to dispose of the bonds taken in payment for the work. Save in unusual cases this could not be done and American firms, therefore, with few exceptions, have been obliged to refrain from taking contracts abroad. This obstacle the American International Corporation is now prepared to overcome.

Object of Corporation

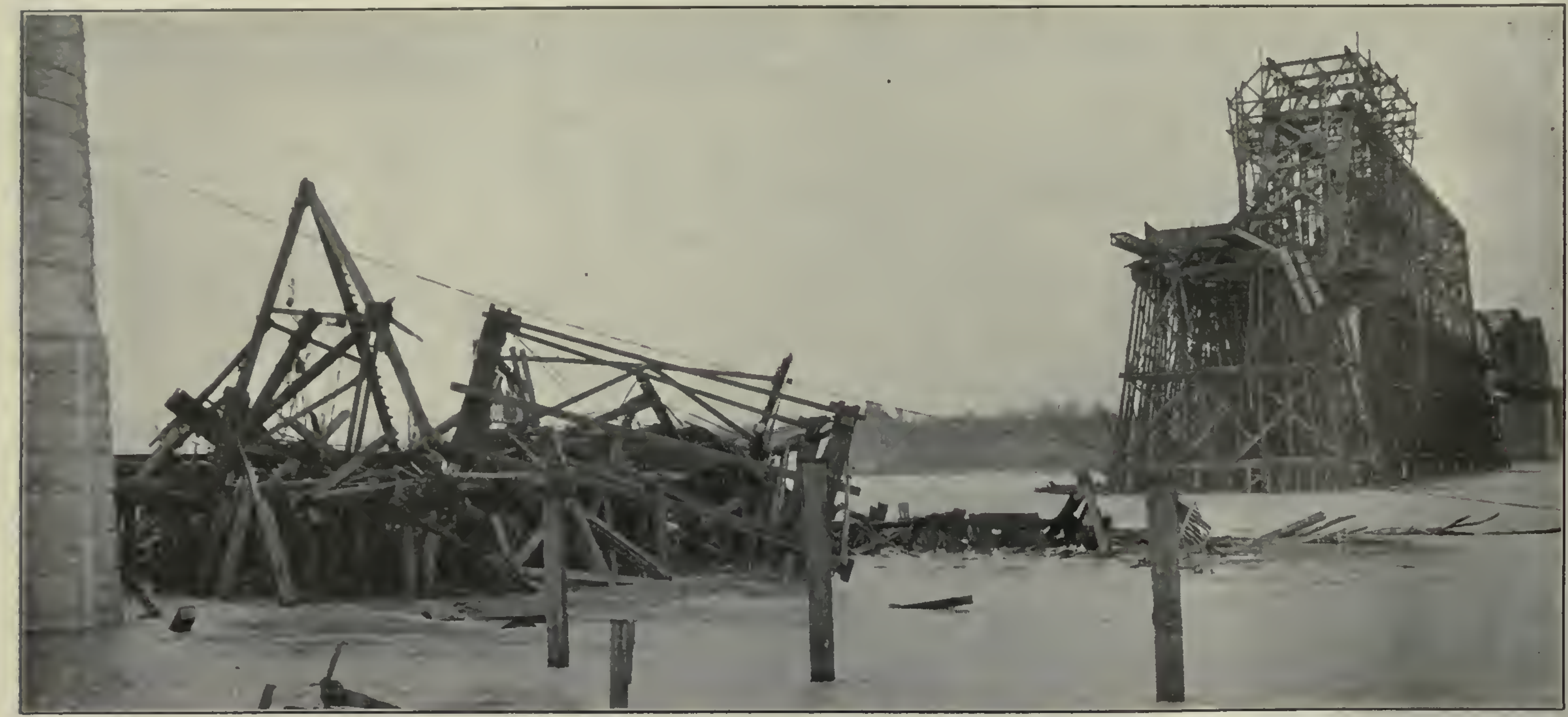
"The new corporation," said Mr. Straight, "was organized for the purpose not only of aiding in the opening of the foreign field to American investment, but of developing new outlets for American commerce and enterprise of every kind. Naturally, it desires to have American contractors execute the works for which it handles the securities.

"It is manifest, of course, that this is not an opportunity for the inexperienced or unstable contracting company. There are difficulties out of the ordinary in handling large works at a distance and the American International Corporation will not be disposed to lend assistance unless the organizations have the necessary technical ability and financial resources. Each proposition will be carefully investigated by the new corporation, and when the credit of the issuing country or municipality is satisfactory and the contractor has the required financial standing and technical ability, the corporation will be prepared to take the bonds and relieve the contractor of the burden of their disposal."

Investigation Needed

Questioned as to his views of the possibilities in other countries, Mr. Straight replied that they were very large. He made it plain, though, that work is not going begging, and that it is not to be had by anyone merely because under sudden enthusiasm he resolves to go into foreign fields. Careful investigation of those fields is necessary by anyone contemplating entry into them, and that investigation must be made by someone thoroughly competent to appraise conditions from the contractor's viewpoint and especially as to the labor situation. "Though not absolutely necessary," said Mr. Straight in discussing investigations in South America, "a knowledge of Spanish is desirable for all countries except Brazil. There Portuguese is the national tongue. As an alternative to Spanish and Portuguese, French would be preferable to English, since practically all South Americans of position speak French."

Asked as to the countries in which the op-



MEMPHIS BRIDGE FALSEWORK FAILURE AND WRECKAGE OF GANTRY TRAVELER, NOTED IN LAST WEEK'S ISSUE
Photograph by C. H. Poland furnished by A. L. Dabney of the Dabney Engineering Company, Memphis, Tenn.

portunities are greatest, Mr. Straight pointed out that the most immediate field is South America, since it is at peace. There are great opportunities, however, in Russia, while China deserves careful consideration.

Foreign Contracts as a Stabilizer

"Viewing the question broadly," Mr. Straight said by way of conclusion, "the foreign field offers to the American contractor the same advantage which export trade offers the manufacturer—the stabilization of his business by diversification of his outlets. It spreads his risk, and he is more certain of normal business than if all his activities are confined to one country. Manifestly, though, it is only the organization of some size that can command sufficient resources to operate on a goodly scale both here and abroad."

Division Street Bridge Failure in Spokane Due to Poor Material?

Supplementing the engineers' report printed, in part, on page 29 of the Engineering Record of Jan. 1, and the photographs of the wrecked structure on page 62 of last week's issue, in connection with the Division Street bridge failure in Spokane, Wash., another report has just been made which contains the statement that the material in the eyebars which failed was inferior at the time the bridge was built, and would probably have been rejected under careful engineering inspection. This report was made to the coroner of Spokane County by John W. Cunningham, of Boar & Cunningham, civil engineers, of Portland, Ore.

Examination of the eyebars indicates a poor grade of steel, according to the report. Mr. Cunningham says further: "I understand that crystallization has been blamed for the failure. It is my opinion, based upon some of the best authorities, that there is no change in the crystalline form of steel after it is cooled. There is, however, a progressive weakening of metal under repeated stresses, which is known as fatigue. Fatigue is caused by a gradual spreading of microscopic flaws and cracks, and occurs when the metal is stressed close to the elastic limit. Fatigue occurs with the best grade of steel, but is most evident with poor quality."

Three causes of failure are stated: First, the condition of the material, aggravated by fatigue; second, the fact that at the time of failure the bridge was loaded to give maximum stress conditions in these end lower chords—possibly this was the first time that two cars had passed at this point since the creosoted block pavement had been laid and, third, the low temperature at the time of failure—16 deg. Fahr. The end shoe apparently did not allow for expansion and contraction, hence the low temperature would produce a definite additional tensile stress, which with the existing tension may have made a large total.

Cincinnati Preliminary Rapid-Transit Plans Near Completion

The Cincinnati Rapid Transit Commission expects to complete all preliminary plans for the city's proposed rapid-transit system in time so that the question of issuing the $6,000,000 worth of bonds needed to finance the construction may be submitted to a popular vote in April. Prof. George F. Swain, of Harvard University, who made the original survey, and who, together with Prof. Ward Baldwin, of Cincinnati, has been retained as consulting engineer by the city, met with the commission Jan. 8 and 9 to go over certain modifications of the original plans. Professor Swain announced himself as satisfied with the scheme in general as tentatively selected by the commission.

The project is to serve the double purpose of a rapid-transit loop connecting the city's various hilltop suburbs, and an entrance for interurban lines, all of which now have their termini on the outskirts of the city. One of the present problems facing the commission is that of getting these interurban lines to establish connections at convenient points with the loop system. Frank S. Krug, city engineer, and chief engineer of the commission, is at present negotiating with the officials of these lines on this matter.

Rapid Tunnel Progress

During the past calendar year 3.5 miles of heading and 2.8 miles of double-track tunnel enlargement were completed at the Rogers Pass Tunnel of the Canadian Pacific Railway at Glacier, B. C. The heading has been completed, as noted on page 29 of the Engineering Record for Jan. 1, 1916. The double-track enlargement is now progressing at an average rate of somewhat more than 50 ft. per day.

STEAM SHOVEL AVERAGES 50 FEET A DAY IN ENLARGING ROGERS PASS TUNNEL

C. C. Schneider, Eminent Bridge Engineer, Dead

Charles Conrad Schneider, eminent bridge engineer, past-president of the American Society of Civil Engineers, and for the past 14 years consulting engineer of the American Bridge Company died at his home in Philadelphia Jan. 8. He was 72 years old and during his professional career had been the recipient of many high honors. He was appointed a member of the Quebec Bridge Commission, which investigated the failure of the old Quebec bridge in 1907, and of the later commission appointed in 1911 by the Canadian government to supervise the construction of the new bridge. He was awarded the Rowland prize and the Norman medals by the American Society of Civil Engineers for excellent papers on his design of the Niagara cantilever bridge (1886), on structural design of buildings (1905), and on movable bridges (1908).

Bridge Engineer Whose Professional Attainments Were Recognized by Many Honors

CHARLES CONRAD SCHNEIDER

As a concrete instance of the almost universal regard for Mr. Schneider's sense of fair play, it is related that in one case of a disagreement between the general contractor and the sub-contractor, at the time when Mr. Schneider was consulting engineer for the latter, the general contractor voluntarily agreed to accept his decision with regard to a disputed point involving a considerable sum. Mr. Schneider, further, had an exceptional intuitive sense of the right way to accomplish results, not only in general design problems, but in the sometimes more difficult questions of detail, and his advanced methods were widely disseminated through younger associates.

It is probable that Mr. Schneider was largely responsible for the pound-price method of letting contracts, now so largely superseding the lump sum basis. His specifications for bridges and buildings, used for years at the Pencoyd Iron Works, was a forerunner of many of the more important provisions, such as impact and allowable stresses, in the American Railway Engineering Association specifications now so widely adopted.

Mr. Schneider was born in Saxony, Germany, in 1843, and graduated as a mechanical engineer from the Royal School of Technology at Chemnitz in 1864. He married in Paterson, N. J., in 1880. After machine-shop practice in Germany, and drafting work with the Rogers Locomotive Works in Paterson, he became assistant engineer with the Michigan Bridge Company of Detroit, and later engineer with the Erie Railroad Company. In 1876 he worked with engineers of the Long Island Bridge Company on a proposed design for a Blackwell's Island bridge. He was designer for the Delaware Bridge Company, New York City, and then for eight years in consulting practice in that city when he designed several long span bridges, among them the Fraser River cantilever bridge for the Canadian Pacific Railway in 1882 and the Niagara cantilever bridge in 1883.

He was called as chief engineer to the bridge and construction department of the Pencoyd Iron Works, Philadelphia, in 1886, and became vice-president for the American Bridge Company, in charge of engineering, in 1900. Since 1901 he has been consulting engineer for that company, with outside practice in Philadelphia. During this time he has acted on the Quebec Bridge Commissions already referred to, and has been consulting engineer for the Canadian Pacific Railway. He designed, with F. B. Kunz, the Reversible Falls steel arch bridge at St. John, N. B., and was consulting engineer until its completion in 1915.

He was a member of the American Society of Civil Engineers, the American Railway Engineering Association, the American Society for Testing Materials, the Verein Deutscher Ingenieure of Berlin, and the Engineers' Club of New York. He was the author of General Specifications for Railroad Bridges (1886), for Highway Bridges (1901), and for Structural Steel Work in Buildings (1905). A more complete article on his work and influence as one of the most eminent bridge engineers in this country will be found in the Engineering Record of Sept. 12, 1903, page 315.

Smoke Prevention Campaign in Cincinnati Progressing

Charles W. Heath, city smoke inspector of Cincinnati, has induced the railroads entering that city to equip 304 locomotives with satisfactory smoke prevention devices. Eighteen months ago, when the campaign was started, not a single locomotive in the city was equipped with any such device. By Jan. 1, 1915, successful installations had been made on 99 locomotives since when 205 additional installations have been made. The list includes practically all of the switch engines and local freight locomotives operating in the city.

Nominate American Concrete Institute Officers

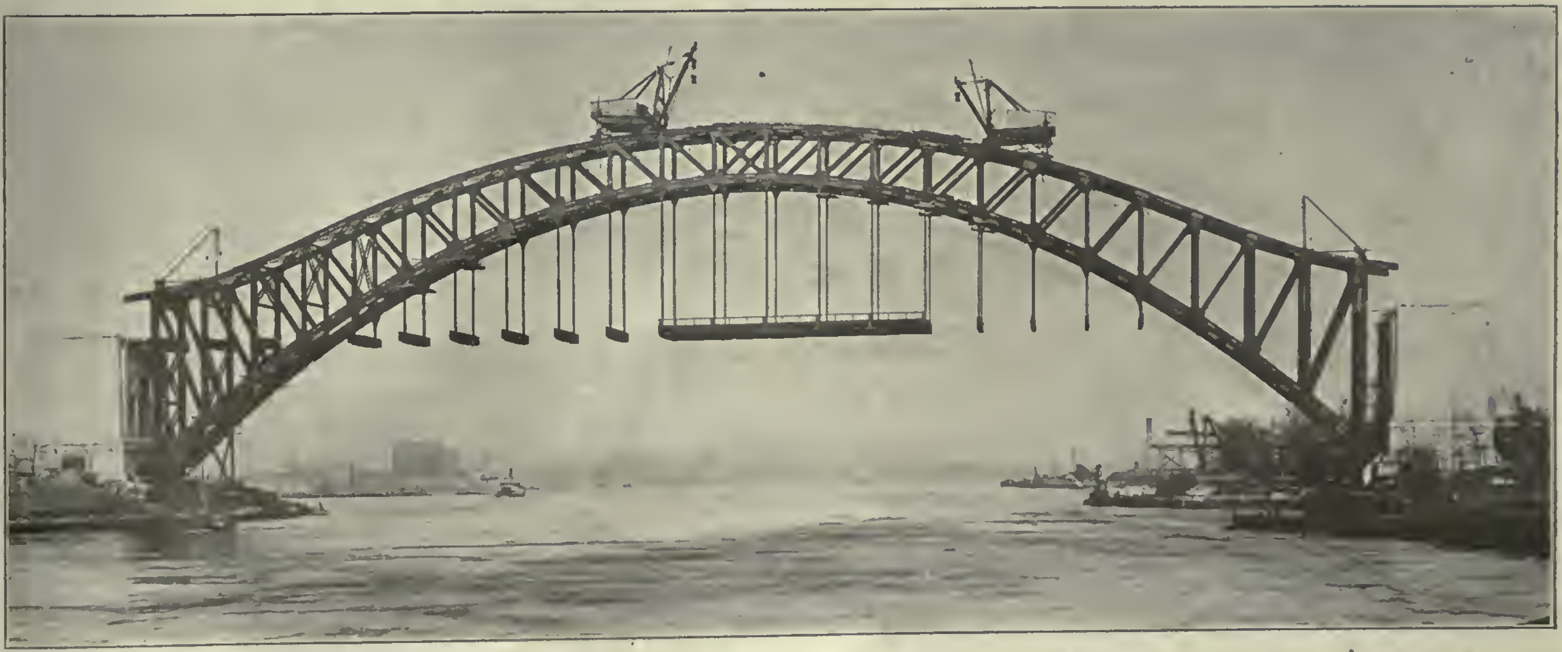
The following nominations have been made for offices to be filled in the American Concrete Institute at the election to be held this winter: President, Leonard C. Wason; vice-president, Henry C. Turner; treasurer, Robert W. Leslie; directors, Charles R. Gow, Edward D. Boyer and J. G. Treanor.

Pasadena Decides on Sewage Disposal Plant

Plans have been completed for the installation of a sewage disposal system which will handle the combined sewage of the cities of Alhambra, Pasadena and South Pasadena, the total population of which is 60,000 at the present time, with an estimated increase in thirty-five years to about 250,000.

The sewage disposal farm laid out by the Tri-City committee is located near the city of Alhambra and consists of nearly 600 acres of partially hilly and partially level land. The

Suspended Floor System on Hell Gate Bridge Is Nearly Completed



IT IS ESTIMATED THAT THE BRIDGE WILL BE OPEN FOR TRAFFIC EARLY IN 1917—17,500 TONS OF TOTAL OF 19,500 TONS IN PLACE JAN. 3

proposed sewage disposal works are located on the south slope of the roughest part of the area at a point where the topographical features are such that there is the least likelihood of any nuisance from odors. As an additional safeguard against odors an extensive grove of eucalyptus trees is to be set out on that part of the area adjacent to the disposal works.

A 48-in. outfall sewer conveying the combined sewage of the three cities will deliver sewage through a Venturi meter to a battery of six Imhoff tanks. After the solids have been separated from the sewage in these tanks, the effluent will be delivered to sprinkling filters covering 3 acres of ground where the clarified sewage will be further purified. From the sprinkling filters the liquid will pass through a secondary tank in which any particles still held in suspension will be removed. If found necessary, a chlorination plant will be added to further purify the effluent. From this last stage of the treatment the water will be used for irrigating purposes and is expected to be pure enough to insure safety for any desired agricultural use.

The Tri-City committee consists of R. V. Orbison, city engineer of Pasadena, president; Charles E. Hewes, city engineer of Alhambra, secretary, and John MacMillan, city engineer of South Pasadena.

Second Pan-American Scientific Congress Terminates Sessions

The Second Pan-American Scientific Congress came to an end in Washington, Jan. 8, after sessions which lasted two weeks and which were participated in by delegates officially sent to Washington by the governments of twenty American republics in addition to those of the United States. The First Congress was held in Santiago, Chile, in 1908, and the second was held in Washington, because of the changed conditions brought about by the war in Europe, and the desire for closer co-operation between the American republics as a result of the war, which was given its first official impetus at the Pan-American Financial Conference held in Washington last May.

While many of the newspapers of the country, in their reports of the proceedings of the Second Pan-American Scientific Congress have paid principal attention to the political aspect of the Congress, and its object of drawing the American republics closer in spirit, as a result of the war, and to the hope of a trade stimulation between the countries of this hemisphere, again due to the war, the fact is that many questions of scientific interest were taken up by the delegates to the Congress, in engineering, electrical, metallurgical, chemical and transportation fields. The foremost men in South and Central America were sent to Washington by their respective governments to discuss these questions with men equally prominent in these lines in the United States, and in addition there were a number of unofficial delegates from Latin America attending the Congress. There were 81 official delegates from Latin America, 46 unofficial delegates, representing societies, institutions, etc., and, in addition, 53 members of the Congress, who went to Washington as the guests of the Carnegie Endowment. Many of these Latin Americans were accompanied by the members of their families, making a total representation of 299. In addition, there were about 800 delegates, official and unofficial, from the United States.

The work of the Congress was organized in sections, there being nine of these groups. They met in various Washington hotel and other auditoriums, including the New National Museum, the Carnegie Endowment Building, the Pan-American Building and in other places, and the section meetings continued simultaneously. The United States Government appropriated $85,000 for the expense of the Congress, and each of the governments of other countries appropriated large sums, the Argentine delegation having been allowed $90,000 for its expenses. Fifteen national and international societies also held conventions in Washington in connection with the Congress, meeting in joint session with the sections of the Congress in whose work they were particularly interested.

Questions of interest to the engineering profession were taken up in Section III, devoted to the conservation of natural resources, of which Dr. George M. Rommel, of the United States Department of Agriculture, was chairman, and in Section IV, devoted to engineering, of which Brig.-Gen. W. H. Bixby, U. S. A., retired, was chairman. Questions of interest to the metallurgical and chemical industries were also taken up in Section III and Section IV, and in Section VII, devoted to mining, metallurgy, economic geology and applied chemistry, of which Hennen Jennings, former president of the London Institute of Mining and Metallurgy, was chairman. Questions of interest to the electric railway field were taken up in Section IX, devoted to transportation, commerce, finance and taxation, of which Dr. Leo S. Rowe, of the University of Pennsylvania, was chairman.

Among the papers of engineering interest were: "Scientific Work of the U. S. Office of Public Roads," by L. W. Page, director of the U. S. Office of Public Roads and Rural Engineering; "Municipal Water Supply," by Prof. George C. Whipple, Harvard School of Engineering; "Reservoirs for Municipal Water Supply," by Alfred D. Flinn, deputy chief engineer, Board of Water Supply, New York City; "Vertical Lift Bridges," by J. A. L. Waddell, consulting engineer, Kansas City; "Contracting and Regulating Works at the Mouths of Rivers," by Dr. E. L. Corthell; "Engineering Work of the U. S. Reclamation Service," by A. P. Davis, director of the U. S. Reclamation Service; "Best Type of Construction for Piers and Quays on Water Fronts of Great Depths and Swift Currents," by J. F. Coleman, New Orleans; "Final Disposition of City Sewage," by Rudolph Hering; "Disposal of Sewage and Garbage," by Morris Knowles, consulting engineer, Pittsburgh; "Sandy Seacoast Shore Protection," by B. F. Cresson, Jr., New Jersey State Board of Commerce and Navigation, and "Uniform Gage for Railways in Pan-America," by Fred Lavis, consulting engineer, New York City.

Work on Government's Alaskan Railway Up to Schedule

The close of the construction season found work on the railway under construction by the government in Alaska up to schedule. Grading, so the chairman of the commission states, has been completed for 35 miles, from Anchorage, the base on Cook's Inlet, to Mantanuska Junction, and rail has been laid for 14 miles. Winter work will be confined to some rock excavation and a small amount of track laying.

During the next construction season, the line will be pushed eastward from Mantanuska Junction to the coal fields—a distance of 40 miles, through very rough country. The connecting line from Anchorage southward to the head of the Alaska Northern Railway, at Kern Creek, a distance of 35 miles, will also be built next year. So far as additional funds then allow, the line from Mantanuska Junction northward to Fairbanks, via Broad Pass, will be pushed forward.

At present the base town, Anchorage, at the head of navigation on Cook's Inlet, has a population of 1500. Reports which have appeared in some newspapers, to the effect that the inhabitants were threatened with starvation, because of the difficulty of getting in supply boats, are absolutely without foundation. The commission has two storehouses filled with provisions while the merchants are fully stocked.

This winter Lieut. Frederick Mears is in charge in Alaska, while the two other members of the commission, William C. Edes, chairman, and Thomas Riggs, Jr., are in Washington.

Engineers Honor Henry W. Hodge at Luncheon

Praise Appointment of Engineer to Public Service Commission in Charge of Utilities of New York City

Professional associates and friends of Henry W. Hodge, who was recently appointed a member of the Public Service Commission of the First District, New York, tendered him a luncheon at the Railroad Club, Jan. 12. In an informal address the chairman, William J. Wilgus, consulting engineer, formerly vice-president and chief engineer of the New York Central & Hudson River Railroad, emphasized the importance of the appointment of Mr. Hodge from the standpoints of the public and of the profession. His specialized knowledge, Mr. Wilgus believed, would be invaluable to the public in the interpretation of engineering matters which he can make to his fellow members of the commission. That interpretation will have the more attention when coming from a member of the commission than if it should come from an engineer in subordinate capacity. With these sentiments, Mr. Wilgus and succeeding speakers joined most heartfelt congratulations to Mr. Hodge on his appointment, together with pledges of the earnest support of the profession. Lewis B. Stillwell, past president of the American Institute of Electrical Engineers, pointed out a practical direction in which Mr. Hodge's professional brethren might aid. They could come to the defense of positions he might take when such positions were misinterpreted in the newspapers and unfairly attacked.

Replying to the felicitations, Mr. Hodge said that for personal reasons he preferred not to accept the position. He had yielded, however, as a matter of duty to the profession, since engineers had long urged the advisability of having engineers on such bodies. He declared that already many engineering problems had arisen, in his brief membership on the commission, with which his professional work had never brought him in contact. The advantage he possessed in considering them was that he could always pick specialists who could by a mere suggestion guide him correctly or, if need be, make a thorough study of the problem. He promised to avail himself of the proffers of assistance for guidance in the difficult technical matters that might arise.

In addition to those already mentioned the following made brief remarks: Gustave Lindenthal, consulting engineer for the Hell Gate and other large bridges; C. O. Moilloux, past president of the American Institute of Electrical Engineers; E. W. Stern, chief engineer of highways, Borough of Manhattan, New York; Lincoln Bush, former chief engineer of the Delaware, Lackawanna & Western Railroad; E. S. Jarrett, consulting engineer; E. P. Casey and C. W. Leavitt, consulting engineers; C. W. Baker, editor of *Engineering News*, and E. J. Mehren, editor of Engineering Record.

Among those present were also F. A. Molitor, who was in charge of arrangements for the luncheon; Allen Hazen, Colin M. Ingersoll, Rudolph P. Miller, Henry B. Seaman, Mason R. Strong, O. E. Hovey, Emil Diebitsch, P. W. Henry, E. P. Goodrich, James B. French, P. H. Ashmead, and T. Kennard Thomson.

Wood Preservers to Meet in Chicago January 18-20

Interest in the twelfth annual convention of the American Wood Preservers' Association, to be held at the Hotel Sherman, Chicago, Jan. 18-20, is enhanced by the effect of the European war on the supply of creosote oil. Two of the papers will be on the foreign creosote-oil situation and the zinc-chloride situation, by G. A. Lembcke and William Townsley, Jr., respectively.

Other papers to be presented include "Fungi Which Grow on Untreated Ties," by Dr. Hermann von Schrenk; "Woods Suitable for Crossties," by R. Van Metre; "Wood-Block Flooring," by Clyde H. Teesdale; "Methods of Creosoting Douglas Fir Timbers," by O. P. M. Goss, and "Creosote Piling and Poles," by Frank W. Cherrington. The standing committees on preservatives, specifications, wood-block paving and plant operation, those on service tests of crossties, wood-block paving and bridge and structural timber, and the special committee on specifications for preservatives for wood paving blocks will also report.

A banquet will be held Wednesday evening, Jan. 19, at which Prof. F. H. Newell, head of the Department of Civil Engineering at the University of Illinois, and at one time secretary of the American Forestry Association, will be the guest of honor.

Western Society of Engineers Holds Annual Dinner

Samuel Insull, president of the Commonwealth Edison Company, Chicago, made the main address at the annual dinner of the Western Society of Engineers, Jan. 12. His subject was "Universal Electric Supply." If all energy requirements in the United States could be supplied from one system of production and distribution, the diversity of demand is such that the present 43,000,000 hp. required could be reduced to 30,000,000 hp. The saving would be 250,000,000 tons of coal per year. A universal system of electric supply, in Mr. Insull's opinion, is as inevitable as day or night.

W. B. Jackson, the outgoing president, in his address discussed the ethics of the profession, and announced that John W. Alvord had given the society $1,000 without restrictions to provide funds for a medal to reward men who have performed great and inconspicuous service to the engineering profession, particularly in connection with public works.

B. E. Grant, the newly elected president, spoke briefly on the problems of the society and the visible means of overcoming them. How to increase the membership, possibly by the Philadelphia method, and how to meet the needs of the younger members and to get more men working were topics discussed.

The Chanute medals were awarded to Andrews Allen, consulting engineer, for the best general engineering paper on "The Engineering Opportunities of our Coal Mining Fields," to N. M. Stineman for the best civil engineering paper on "Reactions in a Three-Legged Stiff Frame with Hinged Column Bases," and to H. E. Goldberg for a mechanical engineering paper on "Arithmetical Machines."

Dr. Edwin H. Lewis, dean of Lewis Institute, gave a rapid fire presentation to each speaker. He also had a chance to characterize the past presidents of the society as their youthful pictures were thrown on the screen.

The officers elected to head the society for 1916 are as follows: President, B. E. Grant, division engineer, Board of Local Improvements, city of Chicago; first vice-president, C. H. Cartlidge, bridge engineer, Chicago, Burlington & Quincy; second vice-president, D. W. Roper, assistant chief operating engineer, Commonwealth Edison Company; third vice-president, Prof. F. H. Newell; trustee, Ernest McCullough, consulting engineer.

To Form Waterworks Section

To organize the "Four State Section" of the American Waterworks Association members from Delaware, Maryland, southern New Jersey and eastern Pennsylvania are invited to attend a meeting to be held at the Bellevue-Stratford Hotel in Philadelphia, Jan. 18; luncheon will be served at 12.30 p. m. The organization committee consists of N. Emory Bartlett, W. H. Boardman, Carleton E. Davis and Charles R. Wood.

New Water Supply at Wellington, Kan.

The new water supply at Wellington, Kans., that provides water from underground sources, 14 miles from the city, has been completed.

Personal Notes

BERTRAND E. GRANT, division engineer, Chicago Board of Local Improvements, who was elected president of the Western Society of Engineers in the three-cornered campaign ending Jan. 7, has been an active member of the society for twenty-five years. Graduated from Rensselaer Polytechnic Institute in 1890, at the age of twenty-two years he went directly to Chicago to work with L. E. Cooley on the first Drainage Canal engineering corps. This work was soon stopped, and Mr. Grant spent a year as assistant city engineer in Waterbury, Conn. In 1892 the Drainage Canal work was resumed, and he returned to Chicago and was for six years on its engineering staff. Following this he was resident engineer on the Snoqualmie Power Company work as the personal representative of T. T. Johnson, consulting engineer. The field of the consulting structural engineer claimed his attention from 1890 to 1905. In the latter year he entered the service of the Chicago local improvements board. His first work in this connection was the original design of the so-called Michigan Boulevard Link. He was then given charge of sewers and sewage pumping stations in the southern sandy section of the city.

New President of Western Society of Engineers

BERTRAND E. GRANT

DANIEL C. HAYNE, assistant city civil engineer of Indianapolis, has been assigned by B. J. T. Jeup, city engineer, to have charge of the engineering department of the Indianapolis Board of Park Commissioners.

E. B. HILLEGASS, formerly assistant engineer of the Atlantic Coast Line Railroad at Rocky Mount, N. C., has been appointed engineer of roadway at Savannah, Ga., succeeding C. J. Chenworth, whose promotion to another office is noted elsewhere in these columns.

W. B. KESTER, formerly assistant engineer of the St. Louis division of the Vandalia Railroad, has been appointed assistant division engineer, succeeding R. T. Simpson, whose appointment to another position is noted elsewhere in these columns.

JAMES R. STEELE, JR., formerly connected with the New York State Board of Tax Commissioners, has been appointed appraiser in the real estate department of the Pennsylvania Railroad. Mr. Steele received his professional education at Rensselaer Polytechnic Institute, and was engaged in business as a road contractor in New York State, previous to entering the service of the tax commissioners.

R. T. SIMPSON, formerly assistant division engineer on the St. Louis division of the Vandalia Railroad at Terre Haute, Ind., has been appointed assistant engineer on the Western division of the Pennsylvania.

SAMUEL G. BENNET has resigned from the office of city engineer of Oxnard, Cal., to accept appointment as field engineer for the Ventura County (Cal.) Highway Commission. Mr. Bennet first engaged in engineering work in 1886 as chainman for E. T. Wright. In 1890 he was appointed assistant engineer for the Redondo Railway Company and, in 1896, he became engineer for the Chicala Water Company at Rialto, Cal. Previous to his appointment as city engineer of Oxnard, he also served as assistant resident hydrographer in California for the U. S. Geological Survey and as engineer in the U. S. Reclamation Service.

MAJOR-GENERAL WILLIAM C. GORGAS received the Geographic Society of Chicago gold medal for his work in the Panama Canal Zone, Jan. 8, and addressed the Society on "Sanitation in its Relation to Geography." The honor conferred on General Gorgas has been conferred on but two occasions previously, once to Captain Roald Amundsen for the discovery of the South Pole, and, the second time, to Major-General George W. Goethals for the construction of the Panama Canal. While in Chicago General Gorgas also spoke on "Sanitation and Single Tax" at a banquet given in his honor Jan. 10 by the Chicago Single Tax Club, the Chicago Medical Society, the Illinois Manufacturers' Association, the Chicago Dental Society, the Lawyers' Association of Illinois, the Women's City Club, the American Chemical Society, the Medical Reserve Corps of the U. S. Army and the Illinois National Guard.

I. J. STANDER, formerly connected with the Department of Docks and Ferries of New York City, has organized the firm of I. J. Stander & Company, Inc., 118 East Twenty-eighth Street, New York City, to conduct an engineering and contracting business, with special reference to the construction of bulkhead walls, piers, docks, and submarine and heavy foundation work. Mr. Stander was connected with the Department of Docks & Ferries for about sixteen years.

CHESTER E. ALBRIGHT, consulting engineer, of Philadelphia, has been appointed chief engineer of the Bureau of Surveys of the Department of Public Works of that city, succeeding George S. Webster, whose appointment as director of the Department of Wharves, Docks and Ferries of the city was noted on page 771 of the Dec. 18, 1915, issue of this journal. Mr. Albright was graduated from Lafayette College in 1883, and has been engaged in engineering work since that time. For twenty-five years he was engaged in private practice in Philadelphia. Among the works he designed, in addition to considerable construction for private estates, are: landscaping and special work for the Imperial Exposition, London, England (1909): the structures for the Centennial Exposition at Buenos Aires, Argentine (1910); model city for the General Electric Company at Erie, Pa.; several sewerage and sewage disposal systems, and numerous buildings. He served as assistant engineer for the Lehigh Valley Railroad for three years and was engineer for the Glenside & Willow Grove Railroad and Willow Grove terminal. For the Pennsylvania and Philadelphia & Reading Railroads he served as supervising engineer on various bridges.

C. M. JAMES, formerly assistant to the third vice-president of the Atlantic Coast Line Railroad at Wilmington, S. C., has been appointed engineer of construction.

C. J. CHENWORTH, formerly engineer of roadway for the Atlantic Coast Line Railroad at Savannah, Ga., has been appointed assistant to the third vice-president at Wilmington, S. C., succeeding C. M. James, whose appointment to another post is noted elsewhere in these columns.

F. V. BERKEY, formerly assistant engineer on the central division of the Pennsylvania Lines West of Pittsburgh, has been appointed assistant engineer on the St. Louis division of the Vandalia Railroad.

GUY A. RUPP, formerly connected with the maintenance-of-way department of the Lehigh Valley Railroad, has been appointed constructing engineer for the Pennsylvania Trojan Powder Company at Allentown, Pa.

ANTHONY J. BEMIS has been appointed general manager of the Public Utilities Company of St. Cloud, Minn.

CLAUDE L. VAN AUKEN, formerly employed in the valuation department of the Chicago, Milwaukee & St. Paul Railway, has been appointed assistant engineer on the valuation of Chicago Terminals for the Chicago, Rock Island & Pacific Railway.

O. E. CARR, formerly city manager of Cadillac, Mich., has been appointed city manager of Niagara Falls, N. Y.

ARTHUR W. KREINHEDER has been elected commissioner of public works of Buffalo, succeeding the late Col. Francis G. Ward.

GEORGE H. NORTON, deputy engineer commissioner of the Department of Public Works of Buffalo, N. Y., was unanimously elected city engineer of that city at a meeting of the councilmen held Jan. 6. Mr. Norton was graduated from Cornell University in 1887, and first engaged in practical work as a rodman and leveler on the Duluth, South Shore & Atlantic Railroad. He entered the service of the city of Buffalo in 1898 as assistant engineer. He was appointed deputy engineer commissioner of the Department of Public Works in 1909.

FRANK P. COBB has been reappointed city engineer of Chicopee, Mass.

RALSTON H. WILLIS, formerly inspector of concrete roads for the Association of American Portland Cement Manufacturers, has been appointed assistant on the engineering forces of the Pittsburgh division of the Pittsburgh, Cincinnati, Chicago & St. Louis Railway. He was graduated from the University of Pennsylvania in 1915.

ELLIS R. GOLDMAN of the city engineering department of Rockford, Ill., has been appointed assistant superintendent and engineer of the water department.

Obituary Notes

S. FOSTER JACQUES, assistant city engineer of Binghamton, N. Y., and municipal engineer for Johnson City, was killed in a motorcycle accident Jan. 8. His technical training was received at Massachusetts Institute of Technology. He went to Binghamton about ten years ago to handle the installation of a sewerage system for the village of Lestershire, and, on the completion of that work, entered the city engineer's office in Binghamton. Previous to this service he was in the city engineering department of Worcester, Mass. While there he was engaged in some of the pioneer work in sanitary sewage disposal. Later he engaged in private practice for about three years in Dover, N. H., following which he spent several years on engineering work in the South.

WILLIAM W. FOLLETT, a well known engineer of the Southwest, died at his home in El Paso, Tex., Dec. 30, 1915, at the age of fifty-eight. Mr. Follett was at one time consulting engineer under the Geological Survey in the investigation of the proposed international dam project for the Rio Grande near El Paso. Later he was appointed consulting engineer of the American section of the International Boundary Commission, United States and Mexico and for some years served as consulting engineer for the El Paso & Southwestern system in planning the water supply from the White Mountains of New Mexico. He was afterward tendered the position of consulting engineer for the Elephant Butte project and the El Paso Valley Water Users' Association, but was unable to accept it owing to ill health. He received his professional education at the University of Michigan and was for several years engaged in railway work on the New Orleans & Northwestern, the Vicksburg, Shreveport & Pacific and the Atchison, Topeka & Santa Fé. He was consulting engineer of the International Boundary Commission for sixteen years, resigning from the office in June, 1914, and being succeeded by H. P. Corbin.

JAMES K. WILKES, formerly chief engineer of the Department of Public Works of New Rochelle, N. Y., died in that city, Jan. 8. He was born at Danbury, Conn., in 1859. His first engineering work was as assistant to D. G. Penfield, civil engineer, of that city, from 1880 to 1884, on general work including the construction of the New York & New England Railroad between Danbury and Hopewell Junction, N. Y. In the latter year he was appointed borough and city engineer of Danbury. He entered the service of the City of New Rochelle in 1890 as assistant engineer in charge of sewer construction.

ALBERT WILBER, former city engineer of Herkimer, N. Y., died in Syracuse, Jan. 5. Mr. Wilber spent the greater part of his life in railroad construction. Five years ago, he was appointed city engineer of Herkimer, which position he held two years, retiring then from active work. He was seventy-six years of age.

OLIVER C. GAYLEY, vice-president of the Pressed Steel Car Company of New York City, died in New York, Jan. 9. Mr. Gayley started his business career as a civil engineer and served for eight years in the engineering department of the Pennsylvania Railroad. Later he was a division engineer on the Philadelphia & Reading.

Civil Service Examinations

United States.—An examination for surveyor, salary from $90 to $150 per month, is to be held Feb. 2 and 3 at the principal cities of the states. This position is in connection with the engineering department of the War Department. The requirements include mathematics to plane trigonometry and use of logarithms or slide rule, plane surveying and drawing. Applicants must be 20 years old and less than 40. Technical school graduates will receive credit, as well as those who have had more extensive experience.

Chicago.—The Civil Service Board announces an examination for rodman, salary from $40 to $75 per month, to be held Jan. 26. This examination is open to non-residents, who must be over 18 years of age. The subject pertains to the important features of surveying.

Examinations Previously Announced

UNITED STATES.—Civil Engineers, Philippine Service, salary from $1,800 to $3,000 a year, to be held Jan. 18; sanitary engineers, Bureau of Science, Manila, P. I., salary $1,600 a year, to be held Jan. 19; and structural engineer and draftsman, Supervising Architect, Treasury Department, salary $1,800 a year, to be held Jan. 19-20 (See Engineering Record, Jan. 1).

NEW YORK.—Architectural draftsman, salary from $1,201 to $1,500 a year, to be held Jan. 22 (See Engineering Record, Jan. 1).

Business Notes

The Bailey Meter Company, 141 Milk Street, Boston, has been incorporated to manufacture and sell a complete line of recording meters for power plant and similar uses. The meters have been developed during the past six years in the mechanical engineering department of the Fuel Testing Company of Boston. E. G. Bailey, of the latter company, will devote his entire time to the new company. The work of the Fuel Testing Company will be under the direction of W. B. Calkins. The Bailey meters are adapted, it is claimed, to accurately measure steam, water, air and gases.

Leroy A. King has resigned from his position as sales manager of the road machinery department of the Wheeling Mold & Foundry Company of Wheeling, W. Va.

The American Rotary Valve Company of Anderson, Ind., has discontinued the manufacture of electric motors, press drives and vacuum cleaners to devote its entire effort to the manufacture of the Arvac universal joint. Orders in hand for the former products will be filled and the company will continue to provide repair service on them.

Walter H. Bell, formerly with the Kettle River Company, has been employed by the National Lumber Manufacturers' Association under the direction of E. A. Sterling, manager of the trade extension department. He is to visit retailers and co-operate with them in teaching the public the best uses of wood.

Ralph S. Townsend, formerly superintendent in the road oil department of the Atlantic Refining Company in eastern Pennsylvania, is now connected with the sales department of that company, covering Eastern New England, in the interest of asphalt and bituminous products. His headquarters are in the Turks Head Building, Providence, R. I.

William E. McDonald, treasurer of the Flynt Building & Construction Company of Palmer, Mass., died Dec. 11, 1915.

William Claflin Andrews, advertising manager of the Edison Storage Battery Company, Orange, N. J., died in New York City, Dec. 21. After graduating from Columbia University, Mr. Andrews became sales engineer for the Stanley Instrument Company of Great Barrington, Mass., and later was connected with the General Electric Company in Schenectady, N. Y., and Harrison, N. J. He was for two years secretary of the Rae Company, New York City, leaving that office to join the Edison Storage Battery Company in April, 1913.

T. L. Hughes has been appointed district sales manager of the Lehigh Portland Cement Company of Chicago, at New Castle, Pa., succeeding P. A. Jandernal, resigned.

J. S. Cabanis, formerly with the Ludowici-Celuden Company, Minneapolis, has become assistant manager of the Chicago office of the Atlas Portland Cement Company.

The A. Lietz Company, San Francisco, makers of civil engineering instruments, is opening a new office at 61 Post Street, San Francisco. The head office will be moved to the new location, which will be fitted up as a show salesroom, thus giving additional space in the company's factory at 632 Commercial Street.

Trade Publication

Holyoke Machine Company, Holyoke, Mass. Catalogs 11 and 13, 6 x 9 in., 28 and 64 pages respectively, illustrated. The first catalog deals with head gate hoists, illustrating numerous patterns. The second catalog, which is more comprehensive, covers water-power generation and transmission, the most important feature of which is the Hercules turbine. Special types of this turbine are treated in considerable detail, tables showing their horsepower, cubic-feet-per-second performance and revolution per minute for sizes of from 9 to 60 in., and of heads from 3 to 12 ft., covering turbines ranging from 0.6 to 3274 hp. being included.

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The Nation's Call

WITHOUT question the greatest act of recognition of the part the engineer can play in the life of the nation was the letter written last week by President Wilson to the engineering societies, asking that their members undertake a census of the industries of the country. The plans and object of this census are discussed elsewhere in these pages. Here attention is directed merely to the importance of the President's request as marking a great step forward in recognizing the engineer's function in the nation's life. No greater tribute could be paid to the integrity of the profession than to call upon it for such a service. The work must be well and thoroughly done. It must be performed with a freedom from bias and a clearness of vision which only those of judicial temperament possess. The President professes his faith in the engineers of the country when he calls upon them for so important a service. The appointment of the Naval Consulting Board, an engineering body essentially, was a great move in advance. The industrial census plan perfects and rounds out the work of that body by bringing into the movement not merely a few representatives of the national bodies, but the rank and file—36,000 members scattered from the Atlantic to the Pacific, from the Canadian line to the Gulf. Surely the engineers of the country will respond to the President's appeal and will show that they are fully worthy of the position in public affairs which in their addresses and their society meetings they have so ardently prayed for.

Bad Liability Legislation

AN amendment, now before the committee of the judiciary of the New York state assembly, to amend the workmen's compensation law, should be defeated if medical attention for injured employees is to be secured with promptness and at reasonable expense. This amendment provides that the injured employee may select his own doctor, who will be entitled only to usual and reasonable fees. It is aimed at the "company doctor," an institution that furnishes a fruitful source of complaint for chronic objectors. While this institution is not free from abuse, it insures prompt attention, day or night, to every injury, and equal treatment to all employees. It makes possible, by guaranteeing to one doctor a rather definite volume of business, much cheaper and more efficient service. Medical supplies can be bought in quantity, and assistants and nurses employed and kept busy. The abuses of the system, in the opinion of this journal, can be remedied without throwing away these advantages, creating endless confusion and dragging the whole matter into the courts. Such would be the effect of this amendment. A solution might be reached by authorizing the state to designate, or to approve the selection of, company doctors. This might be cheaply done by permitting the employer to make arrangements with any local doctor who had passed a simple examination before the state medical board, and disbarring any doctor against whom neglect of his contract patients was proved. The plan proposed in the assembly, however, would not secure even as good a grade of medical attendance as now obtains on contract work.

Shore Protection in Holland

TWO WEEKS AGO, in connection with a comprehensive report on shore protection for Venice, Cal., this journal pointed out the importance of the subject, and the little attention it has received. For Holland, with so much of her area below sea level, the question is vital, and here, naturally, we have some of the most elaborate protective works. A general conception of these works was given the readers of the Engineering Record by Dr. Elmer L. Corthell, the new president of the American Society of Civil Engineers, in his classic, "The War Against the Waves," in the issue of April 11, 1914. There have been developments along the Holland shore since Dr. Corthell's investigations, however, and some of these are discussed on page 118 of this issue. The discussion deals solely with groins. Most noteworthy is the recent use of reinforced concrete. In the form of beams and slabs, which are used virtually as paving blocks, they have already proved their worth. The first attempts at a more elaborate construction, using reinforced-concrete vaults and sheet piling, seem not to have been successful. The test is hardly conclusive, however, as the structures are less than six years old and are pioneer designs. Certainly the experiences in Holland should be read by all interested in shore protection.

A Memory to Be Treasured

CALLOUS, indeed, must be he who is not touched by the deep affection which has been expressed for C. C. Schneider since his death on Jan. 8. There is a sense of personal loss in the profession at large, quite different from the more or less perfunctory expressions of sorrow which are heard after the death of those who have risen to power and fame, unmindful of the interests and ambitions of those about them. Such was not Mr. Schneider's characteristic. On the contrary, he took an unusual interest in the personal and professional welfare of his associates. He was always anxious for the success of the young men with whom he came in contact, and would never hesitate to go out of his way to assist in their advancement and in fitting them into the positions they were best qualified to fill. He did this with no expectation of return, but out of the fullness of his heart. Such characteristics always go with true greatness, nor must it be understood that his efforts for the good of the profession were confined only to such work. His influence could always be relied upon to support high standards of professional ethics, and where good "horse-sense" was needed no counsel could be better than his. Through his geniality and sterling character the technical advances he made received quickly a wide acceptance. It is not surprising, in view of all this, that there should have been a most affecting scene at the annual meeting of the American Institute of Consulting Engineers, when, after a few words of appreciation, Mr. Lindenthal called upon those present to rise and stand silently for a brief period in honor of the departed veteran. A memory such as his deserves to be treasured, for it is an inspiration to the younger men who are to maintain, and carry still higher, the standards of the profession.

Halifax Ocean Terminals

WITH THIS ISSUE begins a series of articles on the mammoth ocean terminals at Halifax. The carefully thought-out project has so many interesting features that any attempt to treat them all adequately in one issue would be futile. The originator, with his plan to make Halifax a rival of New York and Boston as a port; the designer, with his huge concrete shells for the pier and bulkhead substructures; and the constructor, with his exceptional plant for carrying out the work—all have applied their skill and daring to no small degree, and each will be featured in a separate issue. The present article is confined to the conception of the whole scheme, its aims and possibilities, the selection of the site, the main features of the project. As regards the aims and possibilities of the improvement, the Engineering Record is inclined to doubt the ability of the connecting railroads in our own United States ever to put Halifax on an equal footing with Boston and New York for mail and other transatlantic business now existing. But the development of Western Canada has just begun, and Canada is wise in taking steps to prevent the bulk of the new business from coming to the United States. Certainly the terminal plant as being constructed leaves little to be desired locally, and the fact that the Dominion government owns the Intercolonial and National Transcontinental Railways will give the opportunity for a closer co-ordination of interests in the handling of through traffic than any United States ports or railroads enjoy. Although this journal is entirely opposed to government ownership of railroads, it believes the new port of Halifax will be well worth watching.

Instructions in Report-Writing

AS BEFITS a school which may fairly claim to be a university of technical instruction, the Massachusetts Institute of Technology at Boston has done well to provide a course in report-writing this year for about eighty junior students in the course in engineering administration. Although some engineers possess powers of written expression which are the admiration of their colleagues and the source of their increasing influence in public and industrial councils, the great majority of technical men are not natural or easy writers. As they rise in the scale above the levels of routine work, their broader success in advisory capacities comes to depend more and more upon their ability to express themselves clearly, concisely, and yet completely, in presenting or discussing problems and propositions before boards, commissions, employers and at meetings. The new course includes introductory letter-writing, followed by the investigation of matters of industrial or engineering interest, with written discussions and conclusions in both popular and semi-technical form. The use of power-driven fare boxes in the stations of the Boston Elevated Railway was one topic which was considered from several angles leading toward the determination of the applicability of this equipment elsewhere. Other subjects were an application for a position, with statement of personal qualifications; a study of the desirability of establishing a dye-manufacturing plant; and an investigation of the feasibility of an electric blueprinting outfit for the new buildings of the institute at Cambridge. The work is under the direction of an instructor in the English department, but the reports have the benefit of being criticised from the technical, as well as from the literary, point of view, through the co-operation of other members of the staff.

Resignations in Coast Survey

IN his annual report for 1915, E. Lester Jones, superintendent of the U. S. Coast and Geodetic Survey, calls attention to the number of men who resign each year, "just when they have reached a high standard of efficiency." In answer to his own question as to what is wrong with the service under existing conditions he says in part: "The service offers a future so unattractive that few men, when they learn what is in store for them, have the courage to continue in it. The dangers and hardships endured, the sacrifices made, are out of all proportion to the rewards received. The men must devote the best years of their life to the service in all parts of the United States, Alaska and the Philippines, must go to sea in small craft, and at the risk of storms and unknown dangers—must give up the home life, which every man sooner or later desires, and must endure hardships and discomforts inseparable from the work of the service. They receive during the period of their greatest efficiency a moderate salary, hardly sufficient to meet present needs." Such being the case the wonder is that there are not even more resignations. Hardships and discomforts, in the earlier years are almost a part of the average engineer's life, and the type of man who enters the profession generally expects to encounter them. But in any service he has a right to expect compensation that is in some degree proportionate to the kind of work he is doing and to the amount of hazard involved. A salary that barely equals his present needs can hardly be called just compensation. Mr. Jones urges that the employees of the service be assured of a small competency in old age, when unfit for field duty. The logic of pensioning engineers when they are no longer able, physically, to endure hardships and exposure is not, at the present time, generally conceded, though many governing bodies and excellently managed corporations have adopted the practice. The question of compensation, however, has been fully threshed out. It is generally conceded that "the laborer is worthy of his hire." If the men in the Coast and Geodetic Survey are not being paid for their services at a rate approximately equal to what they would obtain for similar work, under similar conditions, with private firms, the situation should be remedied, and at once. The government should not be a laggard in matters of just payment for services rendered.

Taking a Census of Industry for Preparedness

THIS journal has taken occasion since the commencement of the great European conflict to point out, several times each month, the engineering aspects of modern warfare. It has clearly demonstrated by a dozen or more editorials the part that the engineer must take, and is taking, abroad, in military affairs. Latterly, too, it has devoted an unusual amount of space to the place of engineers, contractors and the industries in any adequate preparation for national defense. These ideas, little appreciated at first, are daily meeting increased support from technical men, so that now the profession is ready to respond at once to any call which the constituted authorities will make. That such calls will come is clearly shown by the request made by the President of the United States last week that the national societies of civil, electrical, mining and mechanical engineers and chemists bear the burden of making an industrial census of the country. The purpose of the census is to organize the industries for national defense.

Of course, the profession has already been called upon for assistance in connection with the preparedness movement. The Naval Consulting Board is an engineering body, while a joint committee of engineers has prepared a bill for the formation of an officer's reserve corps, the provisions of which have been incorporated in the administration's preparedness program. These activities have, necessarily, been participated in only by one or two representatives of each of the societies. The proposal of the President, as elaborated by the Naval Consulting Board, will call into the work members of the societies in every state of the Union. In fact, a goodly number of the great total of 36,000 members will find themselves drafted, ere long, for the work of preparing the needed information regarding their own plants or of collating the data furnished by their professional brethren.

The purpose of the census is to learn the characteristics, equipment and capacity of every plant in the country, large and small, which can be used to manufacture supplies needed in military operations—for the transportation, subsistence and equipment of an army. Evidently, though, this is only the first, even if the most necessary step. As explained in the Engineering Record of Nov. 13, 1915, page 589, in connection with the Gillen plan for organizing industries for defense, after it is known what plants are available and what can reasonably be expected of them, the next move will be to inform the manufacturers in turn as to the kind and quality of product which the government would need. Details of this subsequent procedure have not yet been developed, but the plan of letting small contracts for the supplies in question, so that the plants may have actual experience, has such merits that it will undoubtedly be adopted.

The procedure proposed for the census is to ask each of the societies addressed to appoint one representative in each of the states of the Union. These five men in each state will form a central board which will request the members of the profession in that particular commonwealth for the information needed regarding their plants and those in their vicinity.

Obviously, technical men, thoroughly familiar with quality of products, characteristics and capacities of equipment and tools, are exceptionally well qualified to record industrial conditions. One need only to advert to other possible alternatives to see the advantages of the scheme which has been adopted. Under one plan, form letters might be sent from a central office in Washington to the manufacturers of the country requesting specific information. Another scheme would be to hire a body of men to go from place to place and collect the needed data. Both of these alternatives have very evident disadvantages. Technical questionnaires seldom are thoroughly answered, because of the difficulty of conveying to the non-technical mind of the man in charge of a plant the character of the intimate information needed. On the other hand, the plan of having personal investigators would involve a tremendous expense, would necessarily send to many plants investigators unfamiliar with the industry in question and would be exceedingly slow.

It is not surprising, then, that the engineers of the country have been enlisted in this most necessary and most patriotic service. With the guidance of the very able men constituting the committee on production of the Naval Consulting Board the plan should prove a success.

Qualifications for Tunnel Men

IN this issue S. P. Brown concludes his series of three articles on the economic possibilities of tunnel drill carriages by describing unique types of carriage for bench and for trimming work, and telling how they effected a substantial saving in the cost of driving the Mount Royal bore for the Canadian Northern Railway in Montreal. The case of the drill carriage has been presented so completely that there is no need of an elaborate summing up. Obviously, drill carriage methods cannot be employed successfully in every tunnel; the character of the ground and the system of excavation must be such as to justify them. Then, too, it is necessary to decide whether the plant investment in drill carriages will yield an adequate return, and this consideration, of course, depends upon the length of the tunnel and the important factor of speed. No two cases in tunnel driving are alike and each must be studied as an individual problem. In its proper place, however, the drill carriage has proved its claim to recognition.

But the proper selection of mechanical equipment is only one feature of successful tunneling. Men are fully as important as methods. There is no scarcity of engineers and superintendents who can drive tunnels, but the men who can do it economically and expeditiously are rare. Alignment work is comparatively simple and direct, requiring mainly patience and accuracy. Tunnels have been driven successfully, in this respect, from opposite ends and intermediate shafts, for thousands of years. It is in the final court of actual costs that the really skillful tunnel man appears.

Not only must this man be conversant with the diverse methods of tunnel driving commonly used in different parts of the world, but he must also be intimately familiar with the detailed and different methods of drilling, blasting, mucking, timbering, shield operation, etc., that the individual case may demand for its most economical prosecution. All this, too, is so closely affected by the material at hand—men, materials of construction, plant, geological formation, etc.—that his judgment must be unusually sound and agile. He must not only be able to judge wisely as to the best general method to be adopted in the beginning but also be ever ready to change and modify this method promptly when emergencies arise; and this must result in the greatest economy and least confusion of the work and organization.

The primary ability of such men is, of course, inherent in them, although the intimate knowledge of the details of the work can only be had by experience in "the hole." The knowledge of systems and methods used under different general conditions may, to a certain extent, be obtained from books, although the number of tunnel books worth reading is distinctly limited. The greatest source of really useful and constructive information is the engineering press and the proceedings of the various engineering societies.

It is not the generally descriptive article that the experienced engineer finds useful. What he wants is detail—how obstacles were overcome; how unusual economies were obtained; what the economical result was, resulting from a sudden change of plan; why a certain system of drilling and blasting was used which normally would have broken the rock irregularly, increasing both the quantities of excavation and masonry. This is what the engineer should get in engineering literature. It is, however, regrettable that more of the really eminent and actively successful tunnel engineers do not publish such data. The exchange of opinion, experience, and discussions would greatly aid the profession as a whole, and help develop a class of men now rather hard to find in the engineering field.

Significant Features of New York's New Building Code

NEW YORK'S new building code, the completion of which was noted editorially in this journal Jan. 8, has been acclaimed the best code in the country. Rightly much attention has been given to the procedure by which this very desirable result was secured. The adoption of a code at a cost of only $15,000, when $200,000 had been spent in three previous unsuccessful attempts naturally attracts unusual attention, while the intrusting of the revision to a single individual is a radical innovation, as municipal and government matters generally are carried on to-day. So fortunate, however, was New York City in the selection of Rudolph P. Miller to carry on the work, and in the system of hearings preceding the final adoption, that even the opposing commercial interests have been well satisfied, while competent engineers who have followed the matter are loud in their approval of the purely technical features of the code. For these reasons, and the further one that the new document escapes the damning accusation, visited on its abortive predecessors, of being a "specification" code, both the document itself and the procedure become models which will be followed by other cities.

The document being of such high worth, it is appropriate to sum up briefly its significant features. In addition to marked improvement in arrangement and logical subdivision, with resulting ease of reference, there are technical features of more than passing interest to engineers. One of the most radical of the changes was commented upon in this journal in an editorial June 5, 1915, when the new formulas for the design of fire-resistive floor slabs of concrete between steel beams were discussed. It was pointed out that the coefficients given, which have been fixed as conforming to the results of previous tests and the prevailing practice based thereon, imply bending moment coefficients which are much lower than those required in standard concrete floor design. One laudable object thus obtained, however, was the placing of cinder concrete and terra cotta upon a fair comparative basis—a result which had never before been possible of accomplishment.

The treatment of standard reinforced concrete design is entirely in accord with the best practice. Greater definiteness and exact limitations are found in the new section covering specifications for materials, and in the section on projections beyond the building line. A notable characteristic traceable throughout the new code is the successful attempt to increase the safeguards against fire and danger of loss of life, due to fire. The latter important requirement is attained through the use of a new basis for the requirements for exits and stairways. These are determined by the number of persons per floor, and are made less severe when sprinkler protection is furnished. By specifying the number of stairways and the limiting distances which are allowed between exits and the remote parts of a floor, basing width of stairways upon number of persons, and the number of persons upon rules according to class of occupancy, the rapid emptying of such buildings as hotels and apartment houses is made possible. Fire-resistive walls are required around stairways in buildings over 40 ft. in height and fire escapes must be designed for 100 lb. live load.

In the article on strength of materials, the live floor loads are modified somewhat and the allowable working unit stresses made to conform more nearly to the usual standard practice, so that, on the whole, no radical change in the design will result. A concentrated load of 4000 lb. at the center of beams is specified as a possible alternative loading. The field of use for hollow tile partitions is extended. In the article on foundations a new provision is found in sections specifying allowable stresses for three classes of concrete piles.

Among the new general requirements is the regulation which forbids the use of any new building before a certificate of occupancy has been issued by the superintendent of buildings, stating the nature of use or occupancy, the allowable floor loads, the number of persons per floor, and that all requirements in the code have been met. No change in occupancy of a building will be permitted without a new certificate from the superintendent. The regulation allowing the amount of the fine for violation to be fixed, within certain limits, by the superintendent of buildings may be criticised as tending to give the latter a power which he might use unjustly. A drastic revision makes it a misdemeanor to continue violation of a peremptory order issued by the superintendent because of danger to public health or safety. In view of recent events this provision is urgently needed.

Ocean Terminals Under Construction Expected to Make Halifax an Important Port

Project Involves Piers 1250 x 340 Feet in Water Up to 45 Feet Deep, Together with 6-Mile Connecting Railway—Cellular Design for Concrete Bulkheads

POSSESSING in the city of Halifax the most easterly established seaport in North America, a point a good day's journey nearer Europe than New York is even by the fastest steamships, the Canadian government is preparing to make a determined bid for the new trans-Atlantic traffic to be created by the Canadian transcontinental railways, if not for some of the older business now conceded to belong to New York or Boston. Heretofore, however, both the terminal facilities at Halifax and the railway connections have been inadequate to handle any considerable amount of business. Following an extensive investigation made in 1912 and 1913 as to the exact site and type of construction, work is now well advanced on the first unit of a large and modern steamship terminal on the south side of the city together with a 6-mile railroad passing around west of the city and connecting with the Intercolonial Railway on the north. The terminal, like the harbor, will accommodate the largest boats afloat. It will also, it is believed, with the facilities proposed, be one of the most convenient in the world for the transfer of passengers and cargo. Completion of the Quebec bridge and the contemplated improvement of the Dominion-owned Intercolonial Railway together with the New National Transcontinental Railway will give the port excellent direct connections with the West, and may even reduce the time for mails between Europe and New York. From the technical point of view the project has added interest because the piers are 1250 ft. long and 340 ft. wide and upward, because they are in water up to 45 ft. deep, because an original cellular design has been adopted for the concrete bulkheads and quay walls, because unusual equipment has been developed to cast and place these "shells," as they are called, and because the whole scheme has been so worked out that despite a large amount of wet and dry excavation there will be little borrow and no waste of material.

Halifax as a Port

The geographical advantages of Halifax are shown on the accompanying map of eastern Canada and the United States. As compared with New York the port is 539 miles nearer England by the northern route and 477 miles by the longer southern route. The harbor and approach channel are from 50 ft. deep upward. While well protected from the elements, the harbor is close to the open sea, and harbor and channels are so wide and easily navigated that the largest ships can enter, turn around and leave by their own power, at all hours of night or day. Also, the harbor is open all the year around. The Intercolonial Railway extends from Halifax to Moncton, N. B., where it forks one line going to Levis, opposite Quebec, near which point it will ultimately connect with the Quebec Bridge, the other line going southwest to St. John, where it connects with the Canadian Pacific and thence with the Maine Central, Boston & Maine and New York, New Haven & Hartford to Boston and New York. At Moncton the Intercolonial also joins the government-owned and operated National Transcontinental Railway, which, with its light grades and excellent roadbed gives direct connection to Winnipeg and the Canadian West.

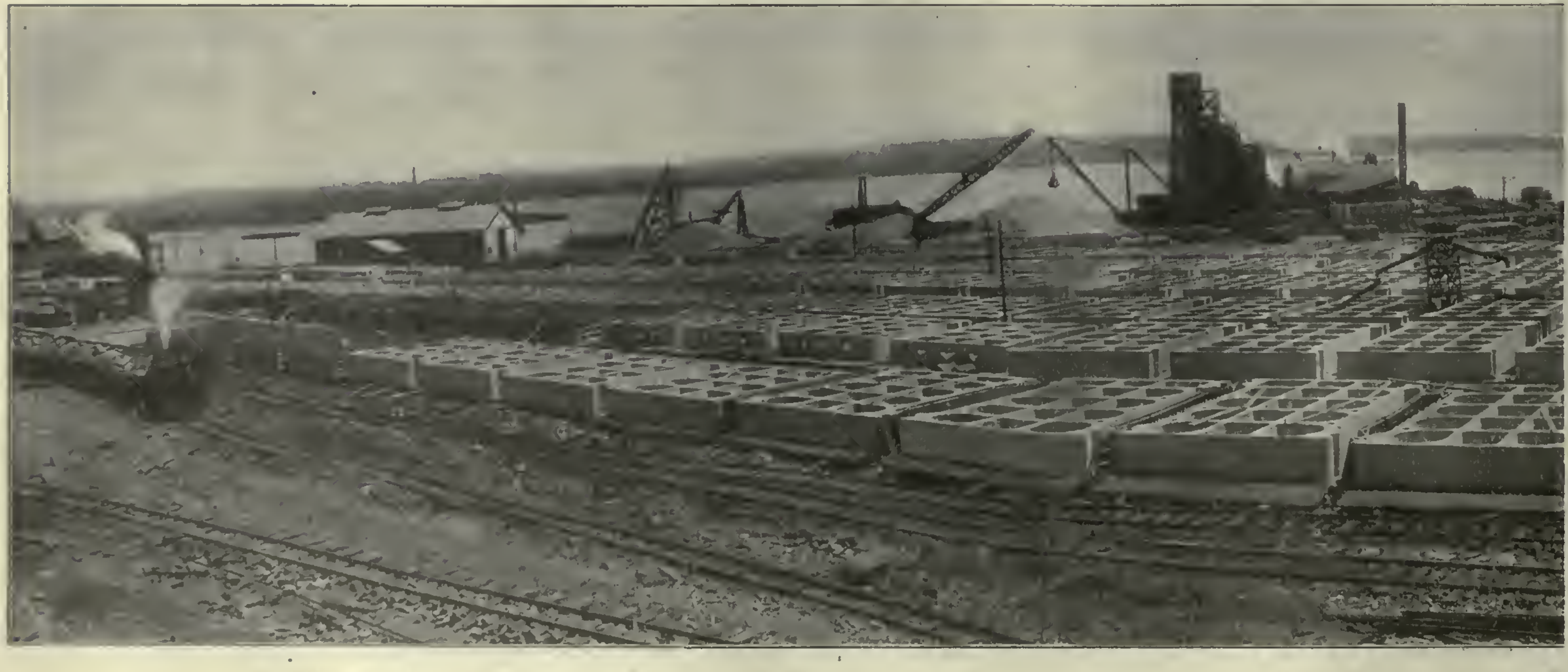
These are the main advantages of the port. The chief disadvantages are that the existing piers are inadequate and do not lend themselves readily to expansion; that the local railroad facilities are cramped; that the port depends on one railroad, which is not yet fully equipped to handle very heavy traffic; and that the connecting railroads reaching toward Boston, not owned by the Dominion government, are likewise not well equipped for heavy traffic and fast service. Consequently Halifax has never for long been able to compete successfully with other American ports.

All things considered, no other Canadian port is better equipped than Halifax to compete with the ports of the United States. Consequently, with two new Canadian transcontinental railways under construction and practically completed the Dominion was confronted with the likelihood that the bulk of the foreign business created by these lines would pass through the ports of the United States. A government investigation was instituted in 1912, therefore, to rectify conditions so far as possible and put Halifax in a position to take care of the new business. Incidentally, as plans had already been developed for improving the Intercolonial Railway, it was seen that the running time for mails by railroad from Halifax to New York could be so cut as to give Halifax the advantage over the all-water route between New York and Europe.

Four Sites for Terminal Considered

The first question taken up in the 1912 investigation was the site for the proposed terminals. Four schemes, A, B, C and D were considered.

Scheme A embraced the existing facilities and extended on both sides of them with accommodations for twenty-six large steamships. (Pier 2, under construction at the time of the investigation, was described in the Engineering Record of June 13, 1914, page 662.) This scheme had a central location and existing railroad facilities. It would have required condemning the principal businesses in the city, however, and driving them to a new location, and it would have necessitated the removal and reconstruction of the naval dock yard on another site. During the construction both railway and ocean traffic would have been hampered, and this traffic would in turn have hampered the construction work and delayed its execution. The railway ap-



OF FIVE DESIGNS CONSIDERED FOR THE SUBSTRUCTURES OF THE HALIFAX OCEAN TERMINALS, STACKS OF CELLULAR REINFORCED-

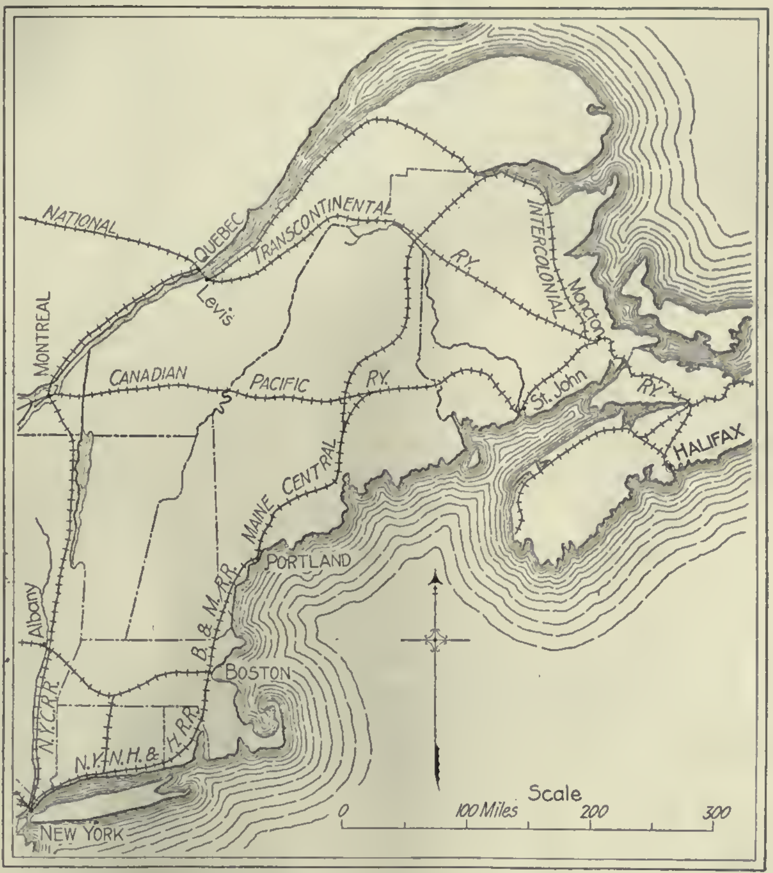


FIG. 1—HALIFAX AND HER RAILROAD CONNECTIONS TO THE WEST

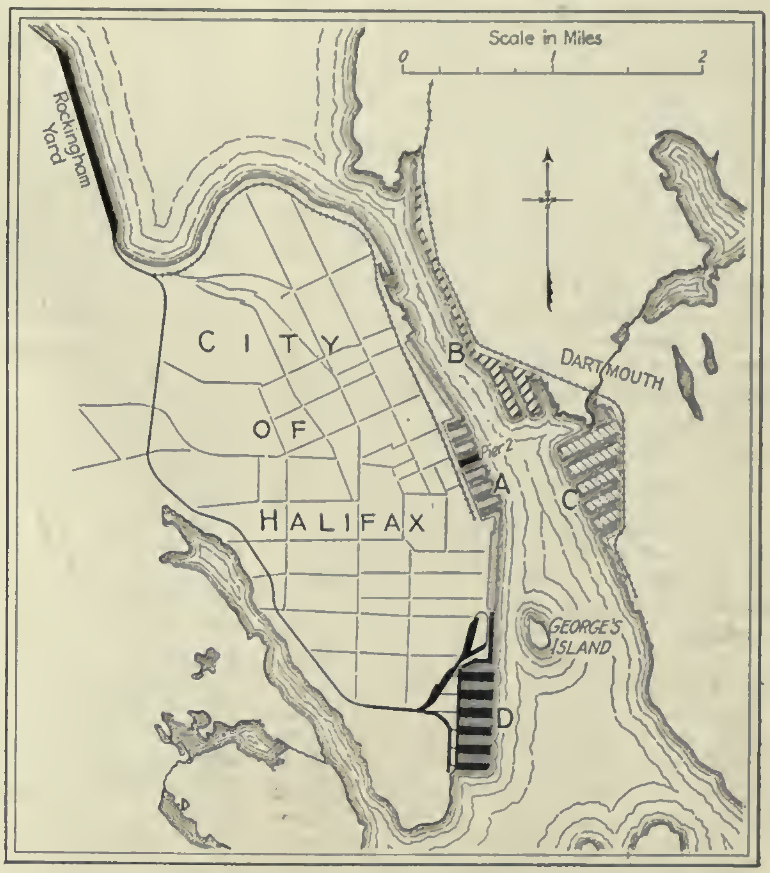


FIG. 2—THE FOUR SITES STUDIED, AND THE CONNECTING RAILWAY

proach, furthermore, was unsatisfactory. The scheme would have been the most expensive of the four, the estimated cost being $1,235,000 per berth, this figure including land, quays, sheds and equipment.

Scheme B, on the opposite side of the harbor, from Tufts Cove to Dartmouth, would have afforded accommodation for twenty-four steamship berths. Land and construction would have been comparatively cheap, no extensive existing business would have been dislocated, and there was an existing railway connection which could have been made very good. The main disadvantage of the scheme was that it was without convenient access to the city, and the investigators had found that no harbor removed from the business-center of a city had ever been made successful. Furthermore, extensive improvement of the railway would have been necessary, duplicate train service would have been required to the ocean terminals and to Halifax, and difficulty would have been experienced in maneuvering and turning ships in the Narrows. This scheme it was estimated, would have cost $800,000 per berth.

Scheme C, would also have been across the harbor from Halifax, south of Dartmouth. It would have been a little larger than scheme B, giving accommodations for twenty-eight steamships and costing $880,000 per berth. Its advantages and disadvantages were much the same as those of scheme B.

PLAN ADOPTED

Scheme D, the one adopted, is located on the Halifax side of the harbor, south of the business center and George's Island. It has many advantages. The union passenger station and steamship terminals are located very close and convenient to the center of the city. The passenger landing quay is of the bulkhead type, facilitating the docking and departure of ships, and is located on a part of the waterfront where pier construction would not be permissible on account of George's Island, which island, however, protects the site from north and northeast winds, and leaves a deep-water channel at least 800 ft. wide. It is believed that this landing quay will provide the safest and most rapid exchange between steamships and railways of any port in the world.

The scheme utilizes a part of the city waterfront hitherto little developed. The piers will be of uniform length, and owing to the great width and depth of the harbor opposite them the maneuvering of the largest ships and their access to the pier berths will be attended with unusual facility.

CONCRETE SHELLS WERE CHOSEN—THE SHELLS ARE CAST IN A LARGE YARD ON THE SITE OF THE FUTURE RAILROAD YARDS

While a new railroad connection had to be built, this has been so located around the west side of the city as to give ample facilities, which the existing lines could not do.

The only disadvantages established up to the present time are that the new railway passes through a high-class residential section, and that the terminals will encroach to a certain extent on Point Pleasant Park. Care is being taken to minimize these disadvantages by artistic treatment of the railroad slopes and bridges.

This scheme gives berthing space for twenty-seven steamships, at an estimated cost of $860,000 per berth. The scheme is progressive and lends itself to extension as conditions demand.

General Scheme of Terminal

Fig. 3 shows the general scheme of the terminal, as at present planned; the details are subject to change. On the north nearest the business district of the city, is the landing quay for passengers, baggage and mail. South of this, at right angles to the shore line, will be five full-width piers, and beyond the last one will be a combination breakwater and narrow pier. Extending across the end of the tracks from the north end of the quay shed will be the railroad concourse and station. Alongside the passenger terminal will be the passenger coach yards, parlor, sleeping and dining car department buildings, and central light, heat and power plant. Yards, engine house, grain elevator and subway under tracks will be located as shown. The main freight terminal yard will be on land reclaimed from Bedford Basin at Rockingham, shown on Fig. 2, where the new railroad connection leaves the present Intercolonial Railway. The main engine house will also be located away from the terminal, that shown in the plan being for yard engines only.

Only the steamship facilities shown in full lines will be built at the present time, although most of the core filling for pier B has been placed from material obtained from the grading of the yard opposite, to form an additional breakwater until the remaining piers are built. The immediate construction will accommodate nine steamships, the plan being to build two more piers in three or four years when better railroad facilities have been provided, and to finish the project three or four years after, that when the Quebec bridge is in service and traffic has been developed.

Passenger Facilities

The movement of passengers between trains and ships has been fully separated from the handling of baggage, mail and express. The passenger landing quay will be 2006 ft. long, with the principal passenger and immigration building, which is about 600 ft. long, located at the north end directly connected with the railway passenger station, trainshed and baggage rooms. The remainder of the quay will be surmounted for its full length by a two-story building 116 ft. wide. The ground floor will be used for freight and the upper floor for passengers, baggage, mails and express, and also for freight when required. From the north end of this building the two-story train-concourse building will connect over the track and paved roadways to the city station building, which will front on Hollis Street and a large open square or plaza. The upper floor of the concourse will be used exclusively by passengers, the baggage and express being lowered to the first floor by elevators in the quay building. This arrangement will permit the examination of baggage by the customs officials on the second floor of the quay building in the presence of its owners. The ten tracks in the trainshed will be located singly, with passenger and baggage platforms alternating between them. From each platform a ramp will lead up or down as the case may be to the baggage floor or the passenger level. Thus nowhere in the short journey between boats and trains will the passenger encounter baggage trucks. The platforms will have lengths up to 1000 ft. and the trainshed roof will be after the Bush type of steel and concrete.

Part of the upper stories of the principal passenger building will be divided into separate quarters for United States and Canadian immigrants and customs and immigration officials. By means of tracks alongside the passenger and immigration building at the quay level mails, express, freight, baggage and immigrants can be loaded direct on trains without passing through the train concourse proper.

There will be four 600-ft. berths to each pier, and each berth will be provided with its own two-story steel and concrete shed and facilities, including railway tracks and platforms, and independent railway connections for switching cars, together with team entrances and ramps, so that the operations at any berth will not be interfered with by those at any other berth adjoining or opposite. The lower floors of the sheds will be at the car-floor level and will be used for outbound or ocean-going freight, while the upper floors will be used for inbound freight and outbound passengers.

Substructures

Much study was given to the question of material and design for the pier and quay substructures. The activities of the teredo and limnoria, together with heavy maintenance and fire risks, made timber practically out of the question, while on the other hand much trouble has been experienced with concrete in these waters by spalling within the range of the tides, due to the combined action of sea water and frost. The investigators concluded, however, that the frost action could be eliminated by proper construction.

The following five types of design were studied at considerable length: (A) A block-work facing with a mass-concrete heart; (B) a series of reinforced-concrete caissons 110 ft. long, filled with concrete; (C) solid concrete block work; (D) a reinforced-concrete deck supported on concrete cylinders, and (E) stacks of cellular rein-

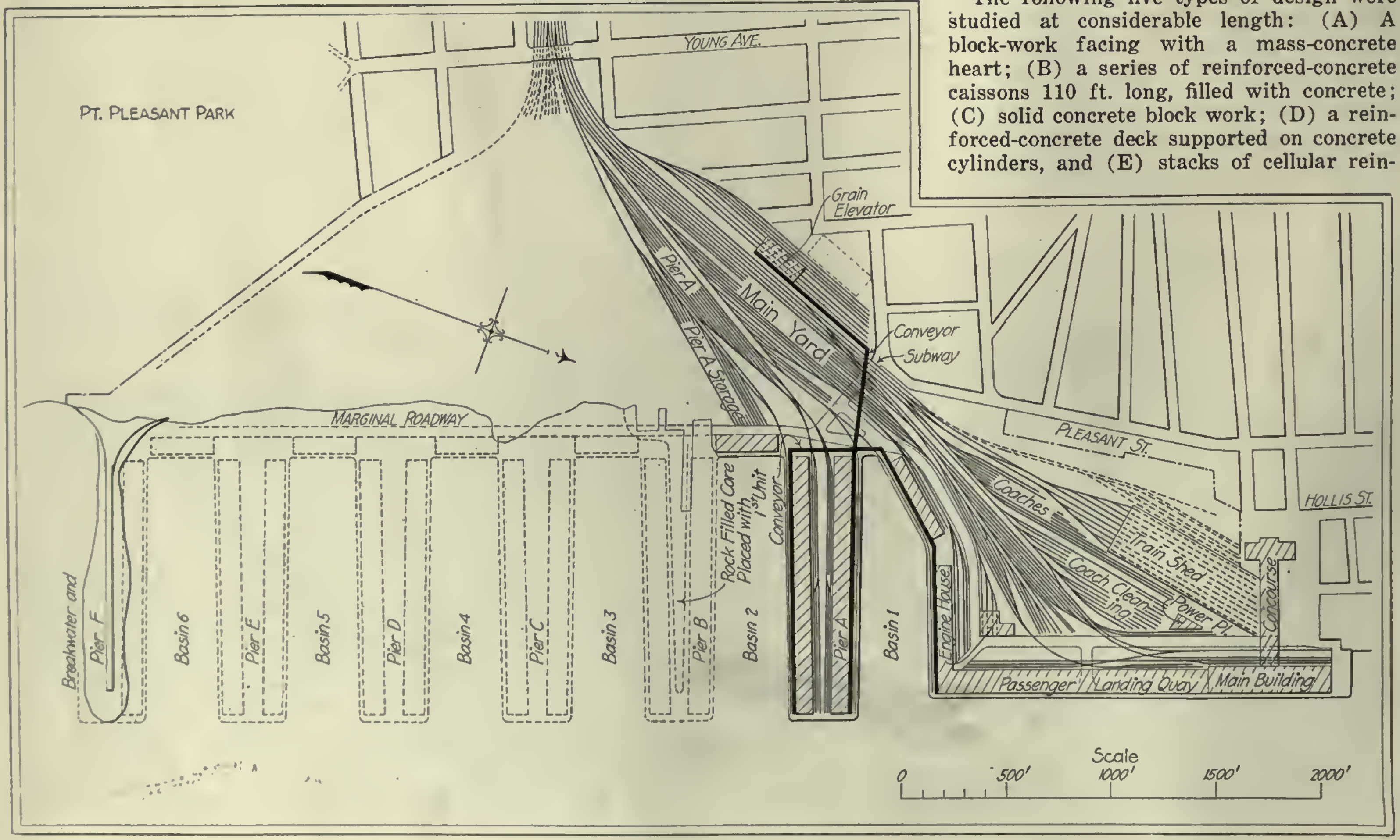
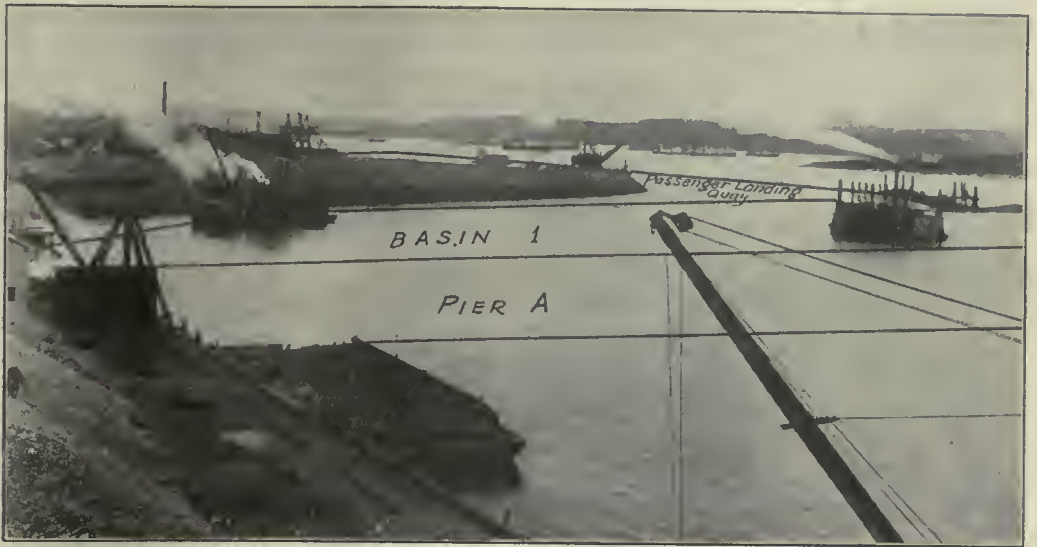


Fig. 3—Immediate and ultimate dock construction, and such of the track work as has been settled upon

forced-concrete shells, placed one above the other and securely bonded and bedded by means of mass concrete and grout in some of the compartments, the other compartments being filled with rock or other material. The last type was adopted. The reasons why, the theoretical analysis of the design, and the unusual plant developed to handle the construction efficiently will be discussed in subsequent articles.

LITTLE WASTAGE OF EXCAVATED MATERIAL

As stated in the first paragraph, there is practically no wastage of excavated material and very little borrow. Material dredged from the basins is placed in the adjoining piers, as is that excavated from the yards opposite. The railroad connection, especially at the terminal, requires a large amount of excavation, providing material for the main yard at Rockingham, which will be partly on low ground along the waterfront, but for the most part on land reclaimed from Bedford Basin by filling. The yard west of piers C, D and E will not be built at the present time, but a track has been graded for hauling the materials from the railway cuttings for the construction of the breakwater, which consists of rock fill protected with rough blocks of rocks weighing from 5 to 10 tons each.



A GLIMPSE OF HALIFAX HARBOR AND PART OF THE SITE AS IT APPEARED JUNE 24, 1915

Outlines of new works indicated.

The improvement is being carried out under the Hon. Frank Cochrane, minister of the Department of Railways and Canals, of Canada. F. P. Gutelius, general manager of the Canadian Government Railways, is in general charge of the whole project, and directs and supervises its construction. Frederick W. Cowie, chief engineer, Montreal Harbor Commissioners, and C. B. Brown, chief engineer of the Canadian Government Railways, are consulting engineers on the dock and railroad works respectively. James McGregor is superintending engineer at Halifax, in direct charge of design and construction. A. C. Brown is the resident engineer on the dock works, for which Foley Brothers, Welch, Stewart & Fauquier are the contractors. The Cook Construction Company, Ltd., and Wheaton Brothers are building the railroad connection, on which R. H. Smith is resident engineer. The architects for the passenger station and immigration buildings are Ross & Macdonald of Montreal.

[*The construction features of the Halifax Terminal work will be described in another article to be published next week.*—EDITOR.]

Butt Treatment of Piles and Poles Effective

Vulnerable Parts as Well Protected as by Creosoting Entire Piece—Painting or Dipping Only Makeshifts

BUTT TREATMENT under pressure of only those parts of poles and piles especially subject to rapid decay was proposed by Frank W. Cherrington, at the wood preservers' convention in Chicago this week, as a suitable and economical substitute for the treatment of the entire piece. While he holds that the creosoting of poles and piles in their entirety is an economical investment, he believes that a butt treatment with pressure by means of a vertical cylinder would be effective, whereas dipping or painting are only makeshifts. His remarks before the convention were in part as follows:

Many engineers would more generally specify creosoted piling and poles for structural purposes if it were possible efficiently to creosote under pressure, at low cost, only those parts of such materials as are exposed to rapid decay. The city of Chicago, for instance, although now using creosoted piling of necessity, pays for creosoting the entire length of the pile, when about 75 per cent will not be exposed to decay. About 30 ft. of a 45-ft. pile is constantly submerged beneath the river and would never decay, while about 12 ft. only protrudes and is subject to deterioration, unless creosoted. Piling and sheeting below the water are always in perfect condition, unless the water is infested by marine borers.

TREATMENT OF ENTIRE PIECE BEST

Beyond question the most efficacious method of treating any timber is by using some process employing a hydraulic pressure to insure a thorough penetration of the preservative throughout the wood volume. Penetration is essential to the permanence and effectiveness of the treatment, and without pressure, maximum penetration may not be secured. Any superficial coating of preservative oil upon the surface of the exposed portion of the timber, such as painting with a creosote or carbolineum, or dipping a part of the timber in the preservative, are at best but temporary expedients. Therefore, any process which may do away with makeshift treatments, and place the butt treatment of poles and piling upon a scientific, economical and efficient basis, deserves careful consideration.

From the above data it is seen that a thoroughly creosoted butt treatment of the woods now generally used and treated in their entirety, to protect the piles or poles at the wind and water or the air and ground lines, respectively, should give very satisfactory results. Especially in more northern climates where that part of the timber above the ground line of poles, and below the water line of piling, seldom if ever decays.

Until recently engineers have considered it impractical as well as impossible to treat, by the injection of creosote oil under pressure, the butt only of piling or telephone poles. The writer understands that there is now in process of development at least one practical means of accomplishing this long-sought end, by providing a vertical cylinder for injecting by any standard process, any required amount of preservative into the butts only of piling or poles, while the upper parts of the timbers are merely surrounded by the compressing medium air.

WHAT PROPER BUTT TREATMENT MAY ACCOMPLISH

Such a butt treatment of piling or poles with pressure by means of a vertical cylinder would accomplish the following results:

1. It would place the butt treatment upon a strictly reliable and scientific basis.
2. It would permit more than a mere treatment of the sap wood.
3. It would place under control the amount of creosote injected per cubic foot of timber.
4. It would allow any desired process of preservative treatment to be utilized at the butt only of a pole or pile.
5. It would reduce the cost of pressure treatment without reducing the efficiency of preservation, as the same penetration of preservative is secured at the vulnerable air-and-water line, or air-and-ground line portion, as if the entire timber is treated under pressure.

Creosoted piling and poles treated in their entirety are an economical investment. And a lower-priced, equally efficient means of treating only these parts of such timbers so susceptible to rapid decay should, upon perfection, accelerate the adoption of creosoted piling and poles on a much larger scale.

Light-Soil Roads Not Suitable for Traffic Unless Surfaced

WHEN highway traffic exceeds 2000 tons per year on roads constructed of light soil it is time to adopt some form of hard surfacing, according to a statement by A. P. Anderson, highway engineer, office of Public Roads and Rural Engineering, in the *Reclamation Record*. Dragging many of these roads has not the cumulative effects, such as obtain on clay roads, as the only binding power is the capillary moisture lost when the road gets dry. The maintenance must be directed toward retaining the moisture by incorporating with the surface soil some natural binder, such as clay or adobe, or adding some temporary fibrous binder, such as straw or sage brush. In irrigated districts flooding is worth considering, one side at a time, or, where the rate of lateral percolation is rapid, flooding the side ditches.

High Unit Pressures Found in Experiments on Distribution of Vertical Loading Through Sand

Results Indicate Practically No Decrease in Maximum Intensity of Pressure with an Increase in Bearing Area

By MELVIN L. ENGER
Assistant Professor of Mechanics and Hydraulics, University of Illinois, Urbana

RELATIVELY high intensities of unit pressure directly under the loads have been observed as the result of a series of experiments made at the laboratory of the University of Illinois for the purpose of determining the distribution of vertical pressure as it is transmitted through sand. The effect of the size of the area of application of the load upon maximum pressure is found to be much less than is usually assumed. The pressure on any horizontal plane is found to be far from uniform, and photographs of actual sand movement under load have been taken to picture the direction of pressure distribution.

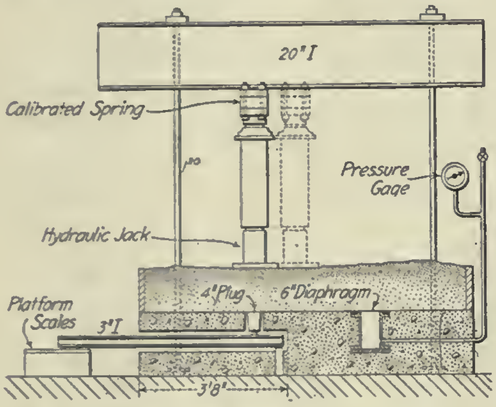


FIG. 1—ARRANGEMENT OF APPARATUS

The results obtained and experience gained have been found helpful in planning the more elaborate series of experiments being conducted at the University of Illinois by the Joint Committee on Stresses in Railroad Track of the American Society of Civil Engineers and the American Railway Engineering Association.

Description of Apparatus

Fig. 1 is a sectional view of the apparatus used in most of the tests. A concrete slab, 9 x 8½ ft. x 16 in., was used to support the sand. A 6 x 6-in. opening extends horizontally into the slab about 3 ft. 8 in. from one side. A short vertical opening having an internal diameter of 4⅛ in. connects with the opening about 3 ft. from the edge of the slab. A 4-in. wooden plug, or plunger, with its upper surface flush with the top of the slab fits loosely in the vertical opening and rests on a knife edge on a 3-in. I-beam in the horizontal opening, which acts as a lever to transmit the load to a platform scale; the ratio of the load weighed on the scales to the load on the plug is 1:8.09.

In some of the experiments the vertical pressure transmitted through the sand was measured by means of the water pressure under a 6-in. diaphragm placed flush with the surface of the slab. A flange with a beveled edge was screwed to the top of a 6-in. pipe, and a diaphragm of packing rubber was clamped over the beveled edge by means of a beveled collar. The 6-in. pipe was connected to a pressure gage by means of a short ¾-in. pipe line. The loading device of the apparatus was movable, and in order to get pressures away from the axis of the applied load the loading device was shifted to any desired position.

In the apparatus used in the earlier experiments the sand rested on a plank floor laid on closely spaced I-beams, but the results were not entirely satisfactory. It is thought that the yielding of the floor had a considerable effect upon the distribution of the pressure.

Conducting the Experiments

In most of the experiments the load was applied to the sand through a circular plate 13½ in. in diameter. The load was applied by means of a hydraulic jack which reacted against a 20-in. I-beam connected with the slab by means of four 1-in. steel rods. The load was weighed with a calibrated steel spring whose deflection was indicated on an Ames dial gage.

ARRANGEMENT FOR MAKING SAND-MOVEMENT PHOTOGRAPHS

Experiments were made with depths of sand of 6, 12 and 18 in., using building sand which was rather fine and very dry. Pressures were determined with the center of the load on the vertical axis of the plug (or diaphragm), and at horizontal distances of 3, 6, 12 and 18 in. from it. The sand was thoroughly compacted before readings were taken. For example, when experiments were being made on a depth of sand of 12 in. the plate was started on a layer of sand about 15 in. deep and forced down to the 12-in. depth. The load was then released and applied several times, and readings were taken of the applied load and of the load transmitted to the plug.

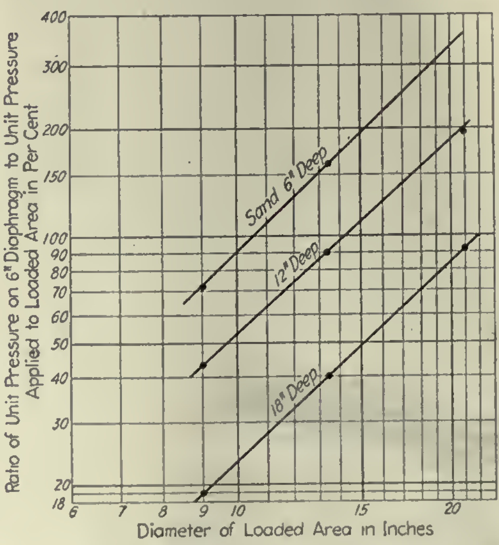


FIG. 2—RELATION BETWEEN DIAMETER OF LOADED AREA AND RATIO OF LOAD TRANSMITTED

Effect of Size of Loaded Area

In order to determine the effect of the size of the loaded area upon the way the pressure is transmitted through the sand, the load was applied to plates 9, 13½ and 21 in. in diameter and measured with the 6-in. diaphragm. In these experiments the center of the diaphragm was directly below the center of the plate to which the load was applied. The average results of these tests are shown in Fig. 2. It will be noted that the size of the loaded area has an important effect on the proportion of the applied average unit pressure transmitted through sand of a given depth to the diaphragm. In these tests the 21-in. plate carried loads up to 18,000 lb., the 13½-in. plate loads up to 9000 lb. and the 9-in. plate loads up to 2500 lb.

In Fig. 2 the average values of the ratio of the unit pressure on the 6-in. diaphragm to the average unit pressure applied to the loaded area are plotted as ordinates and the diameter of the loaded area as abscissas, using logarithmic scales. It will be seen that parallel straight lines pass through the points plotted for each given depth of sand. From the slope of the lines it is found that the proportion of the applied average unit load which is transmitted through sand of a given depth to a diaphragm directly below varies as the 1.86 power of the diameter of the loaded area.

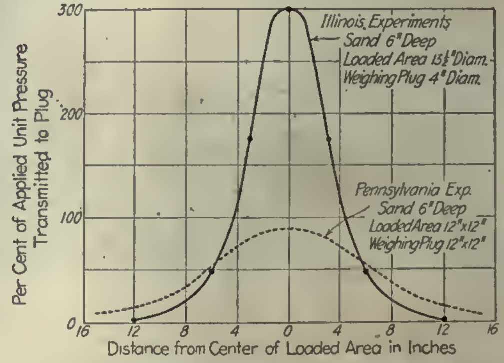


FIG. 3—VARIATION IN RATIO OF PRESSURES WITH DISTANCE—SAND 6-IN. DEEP

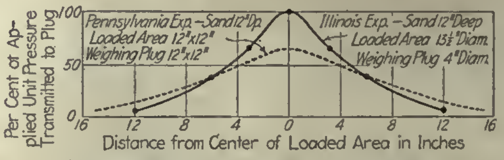


FIG. 4—VARIATION IN RATIO OF PRESSURES WITH DISTANCE—SAND 12-IN. DEEP

It follows, for example, that if a load is applied to a 9-in. plate such that the intensity of pressure on a small area at a certain distance directly below the center of the plate is 10 lb. per square inch, then if the same total load is applied to a 21-in. plate the intensity of pressure on the same small area would be 8.9 lb. per square inch. That is, with the area carrying the load increased 5.44 times, the intensity of the pressure in the sand directly below the plate at a given depth has been decreased but little, a conclusion very different from the usual assumptions.

Pressure Variation in Per Cent

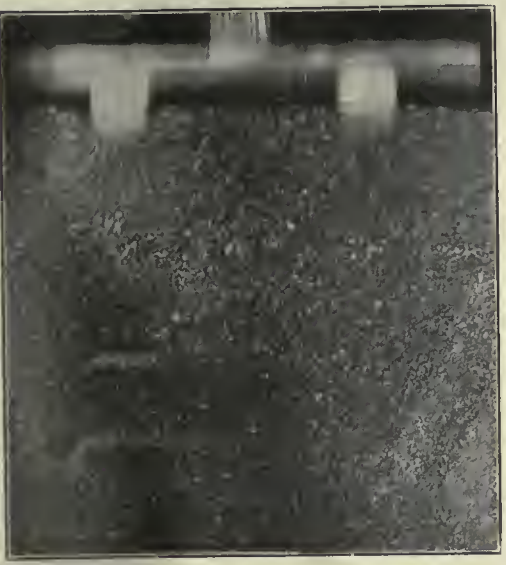
No experiments were made by the plug method to determine the effect of the diameter of the loaded area on the intensity of the vertical pressure at any given depth. According to the plug experiments made with the 13½-in. plate the ratio which the intensity of pressure directly below the center of the loaded area bears to the applied average unit load varies inversely as the 1.95 power of the depth of the sand above the plug. Assuming that this relation holds for other diameters of loaded area, and combining this result with the effect of the variation in diameter previously described, the following equation was found:

$$p = 91d^{1.86}/h^{1.95}$$

in which p is the ratio, expressed as per cent, which the intensity of the transmitted pressure at a point h inches directly below the center of the loaded area bears to the average applied unit load, and d is the diameter of the plate in inches. The equation represents roughly the results of the experiments, but it is not probable that it has general application.

DIAPHRAGM LESS SATISFACTORY THAN PLUG

In the experimental work the diaphragm has been found to be a less satisfactory method for measuring the transmitted pressures than the method of weighing the load on the plug. The reason is that the diaphragm becomes distorted when the load is applied, the center being depressed and the outside part raised by the water pressure, and the distortion increases with a repetition of the load. For off-center loadings the depression occurs in the part of the diaphragm nearest to the center line of the applied load, while the part farthest away is forced up. So much trouble was experienced with the bursting of the diaphragm that it could not be used for off-center loads on thin layers of sand.

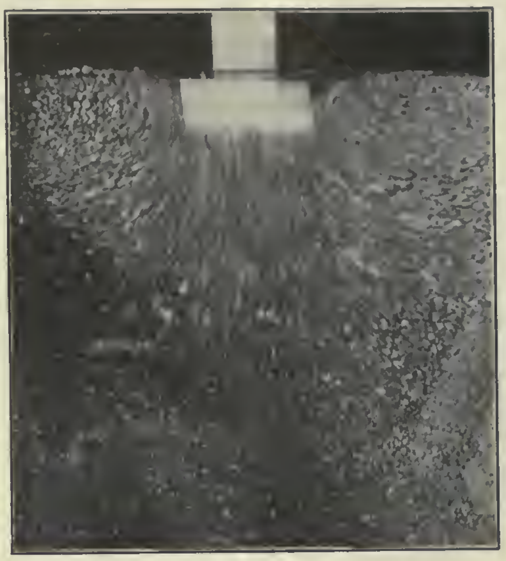


MOVEMENT UNDER TWO 2-IN. BLOCKS ON 8-IN. CENTERS

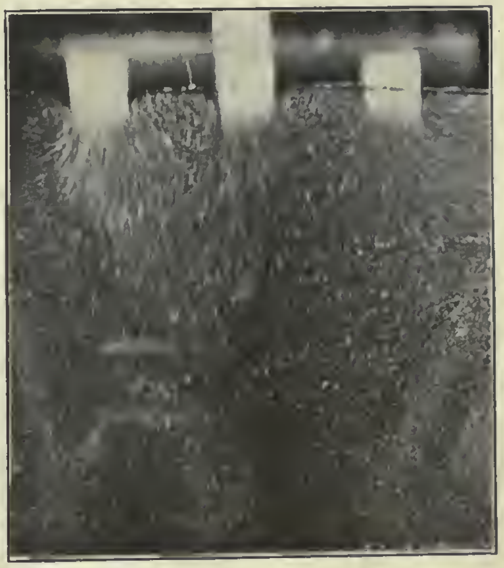
TRANSMITTED LOAD MEASURED BY PLUG

In Fig. 3 and Fig. 4 have been plotted curves showing the intensity of the transmitted pressure at different distances from the center line of the applied load in terms of the applied average unit load, as determined by experiments in which the transmitted pressure was measured by the 4-in. plug, Fig. 3 being for a depth of sand of 6 in. and Fig. 4 for 12 in. The curves are of interest in showing the lateral distribution of pressure over a horizontal plane at a given depth. Dotted lines giving the results of experiments made at Pennsylvania State College, and reported by J. A. Moyer in the Engineering Record of May 30, 1914, page 608, and March 13, 1915, page 330, are also plotted in the two figures. In the Pennsylvania experiments the load was applied to an area 12 x 12 in. and the pressure was measured on a plug of the same size. The measured pressure was therefore the average over a relatively large part of the base.

The Illinois and Pennsylvania experiments have one inconsistency in common—the sum of the upward pressures under a 6-in. layer of sand exceeds the sum of the applied load and the weight of the sand. The reason in the case of the Illinois experiments is that center loadings were taken first, leaving a pillar of compacted sand above the plug which carried more than average pressures to the plug for the off-center loadings which followed. For depths greater than 6 in. the effect of the compacting was not as great. It is probable therefore that the readings at 3 and 6 in. away from the center are too high for the 6-in. depth of sand.

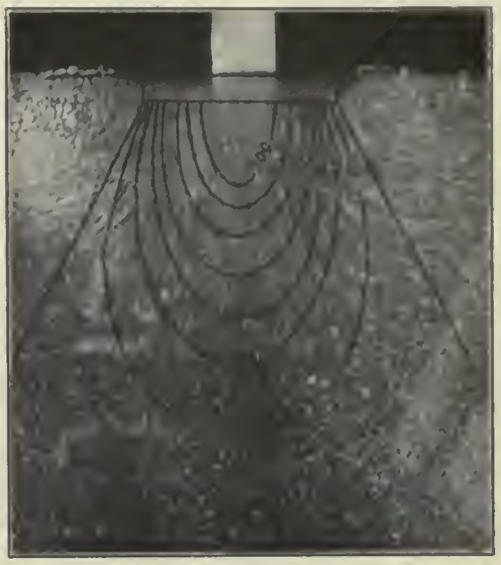


MOVEMENT UNDER SINGLE 4-IN. BLOCK



MOVEMENT UNDER THREE 2-IN. BLOCKS ON 5-IN. CENTERS

In Fig. 5 the results of the experiments are plotted to show lines of equal vertical pressure in the sand below the plate. The line of zero vertical pressure has been drawn downward on a 1:2 slope, and an inspection of the experimental results indicates that the vertical pressure outside of this line must be very small. It will be noticed that the region below the center of the load is one of high pressure, a fact of importance which seems generally to have been overlooked. The diagram is instructive in showing the manner of the distribution of the vertical pressure at different depths and different distances from the axis of the load. It is seen that the pressure on any horizontal plane is far from uniform.



MOVEMENT UNDER SINGLE 8-IN. BLOCK—LINES OF EQUAL PRESSURE TRANSFERRED FROM FIG. 5

PHOTOGRAPHS SHOW SAND MOVEMENT

A number of photographs to show the direction of the movement of the sand under the action of a load were taken, some of which are reproduced herewith. The arrangement used for this purpose is seen in one of them. Sand which had the finer material screened out was piled against a sheet of plate glass, and the camera was placed about 3 ft. from the glass on the block shown. Time exposures of from 60 to 90 sec. duration were taken while the blocks were forced slowly and uniformly into the sand. As the sand moved, elongated images of the grains were formed on the photographic plate. The lines formed in this manner therefore show the direction of the movement of the sand for various conditions of loading. In one case the lines of equal vertical pressure from Fig. 5 have been plotted on the photograph.

Some of the views are suggestive in showing the manner in which the pressure in the ballast under a railroad tie is affected by the loading and spacing of the adjacent ties which restrain the horizontal movement of the ballast. It is evident also from Fig. 5 that the pressure in the ballast will not approach uniformity until a considerable depth is attained. Both the tests and the photographs suggest that the transmission and distribution of pressure downward through earth and ballast are different from the assumptions frequently held in explanation of such behavior.

This work was carried on at the Uni-

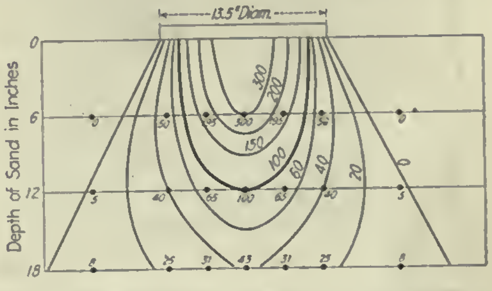


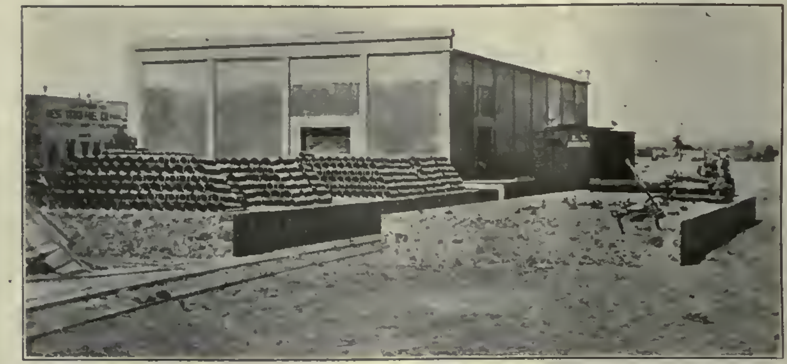
FIG. 5—LINES OF EQUAL VERTICAL UNIT PRESSURE IN PER CENT BASED ON 4-IN. PLUG TESTS

versity of Illinois by K. A. Burnell, 1910, W. C. Eells and J. Van Dervoort, 1911, L. N. Fisher and H. F. Wagner, 1912, and A. W. Kimbell and M. C. Taylor, 1913, as undergraduate thesis work.

Concrete Corrals Withstand Mule Heels

Municipal Warehouse and Yard Walls in a Southern Border City Are Built Like a Fort from Heavy Masonry

THE REINFORCED-CONCRETE stables at the El Paso (Tex.) municipal warehouse and corral were built during the early period of the troubles in Mexico, but they were not built primarily for protection from anything more strenuous than a vigorous mule's heels. At first 130 stalls of the type shown in the photograph were constructed. The side walls are 3 or 4 in. thick and rest on 6 x 10-in. bases. The 4-in. roof is also of reinforced concrete, but the mangers are of wood with special feed boxes hinged so that they may be easily turned out. Industrial tracks for feed cars are laid down the center of the double-stall structure and in front of the single stalls.

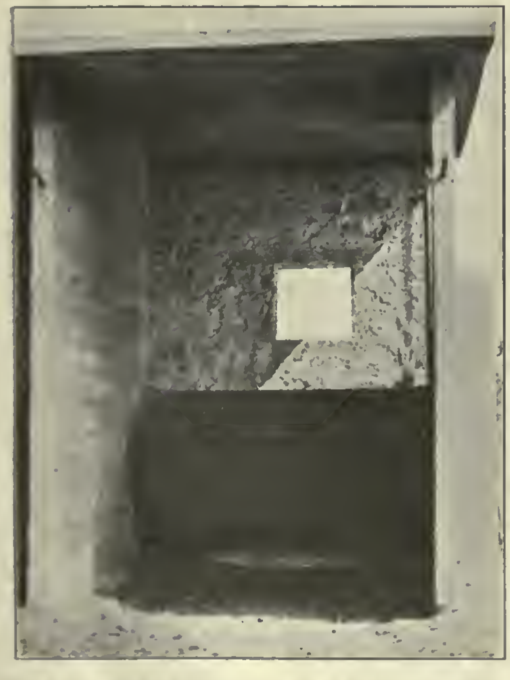


MASONRY WALLS INCLOSE EARTH STORAGE PLATFORMS

IN THE CENTER IS A DOUBLE-STALL STRUCTURE

In the same yard is a municipal storehouse for feed and waterworks accessories. Two earth platforms with stone retaining walls for pipe, valves and hydrants are 30 in. high to facilitate loading from railroad cars and to wagons.

The municipal plant was designed by and built under the direction of Herbert Nunn, city engineer. J. N. Gladding is now city engineer.



THE ROOF, SIDE WALLS, AND FLOOR ARE OF CONCRETE; THE MANGERS ONLY ARE OF WOOD

Tar Coating Protects High-Velocity Conduits

Arrowrock Dam Outlets of Concrete, Discharging at 60 Ft. per Second, Are Painted with Water-Gas Tar and Coal Tar

REFINED water-gas tar and coal tar, the same combination that has been used on metal subjected to water action by the U. S. Reclamation Service for several years, has been applied to the concrete outlets of the Arrowrock dam with success, according to an article by Charles H. Paul in the January *Reclamation Record*, from which the following notes are taken. The idea was not so much to waterproof the concrete as to fill all the minute voids in the surface so as to prevent the erosion caused by the formation of a vacuum in the small voids or pockets due to velocities of 60 ft. per second or higher obtaining under full-reservoir conditions.

The regulating outlets are molded in 1:2 Portland cement mortar, except for a 28-ft. section adjacent to the upstream face of the dam, which part is lined with semisteel pipe. The outlets are 4 ft. 4 in. in diameter, the upper ones being 70 ft. in length and the lower ones 130 ft. Wood pipe staves were used for lagging the forms, and great care was taken to secure a smooth and straight surface. After the removal of the forms they were trimmed, scraped and washed with grout in the usual way, after which they were painted with two coats of water-gas tar and two coats of coal tar. Preliminary experiments had indicated that the water-gas tar would penetrate the concrete, and that the coal tar would follow it in and bind to the concrete much better than if it were applied direct, thereby completely filling the voids at and near the surface and coating the concrete with a sleek and fairly durable finish, cheap and easily applied.

Condition After Season's Use

This coating was applied to all outlets during the fall of 1914. Five of the lower outlets and six of the upper outlets were in service during the irrigation season of 1915, some of them working for four and one-half months under heads varying up to a maximum of 100 ft., with corresponding velocities up to 64 ft. per second. All of the outlets passed through a fairly normal winter and summer. The one that was used most was operated nearly all the time with its valve only partly open. After this service careful inspection was made, and the tar coating was found to be in excellent condition. In a few small spots the outer coating had come off, but even there the concrete surface was well filled with the tar and was still well protected, apparently, against water action. It is the opinion of the men familiar with all the conditions that the use of this tar coating gave thoroughly satisfactory results.

Get Thin Tar

In obtaining material for work of this kind it is very important that the water-gas tar be of very thin consistency. The manufacturers can supply it that way if it is made plain to them that this thin consistency is important, otherwise it is likely to come too thick. The manufacturers can also supply an oil for thinning this water-gas tar, and it is advisable to have some of this oil on hand in case it is needed, but it is believed that the success of the whole operation depends upon the very thin, water-like consistency of the water-gas tar. Both the water-gas tar and the coal tar should be refined.

It is necessary to have the concrete thoroughly dry at the time the first coat is applied. The water-gas tar may be applied without heating, and the second coat may follow the first immediately. The first coat of coal tar may be applied as soon as the water-gas tar has soaked in a little, but the second coat of coal tar should not be applied until after the first coat has set. Both coats of coal tar should be applied hot and brushed out as thin as possible, as a thick coating is much more likely to peel and run.

Cost Small

The approximate cost of painting 1000 sq. ft. of surface in an outlet 52 in. in diameter with two coats of water gas and two of coal tar as described, was as follows:

Labor:	
4½ days at $2.50	$11.25
Material:	
12 gal. water-gas tar at 16 cents	1.92
15 gal. coal tar at 16 cents	2.40
Brushes and miscellaneous	1.43
	$17.00

The refined water-gas tar and refined coal tar were purchased from the Barrett Manufacturing Company at $4 per barrel of 50 gal., f.o.b. Chicago. Freight to Boise was about $4 per barrel.

HALF OF THE PRISONERS in the State of Arizona are employed in highway and bridge construction camps, according to a statement by Governor George W. P. Hunt to the National Committee on Prisons and Prison Labor. The practice of employing convicts on road work in Arizona has been in effect more than three years.

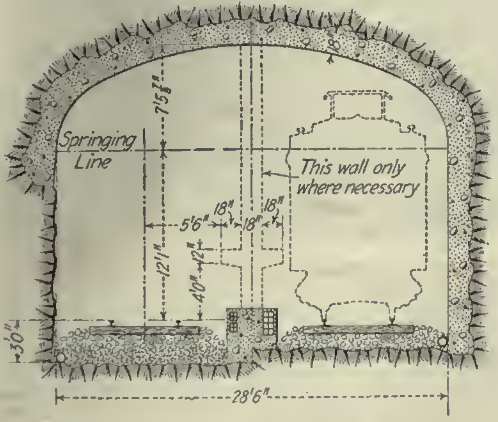
Tunnel Drill Carriages—Their Economic Possibilities

Third and Final Article of the Series Describing Economics Effected in Mount Royal Tunnel by Bench and Trimming Drill Carriages, Pioneers in Their Field

By S. P. BROWN
Chief Engineer, Mount Royal Tunnel & Terminal Company, Limited, Montreal

[*In the two preceding articles of this series Mr. Brown discussed the evolution of the drill carriage and the adaptation of European and American ideas to an advanced type of heading carriage used in the Mount Royal tunnel. In this last article he tells of the work done by unique types of drill carriage for bench work and trimming.* —EDITOR.]

AFTER the heading and break-up work in the Mount Royal tunnel had been completed, as described in Part 1 of this article, in the issue of Jan. 8, page 33, two benches remained to be excavated, one on either side of the original heading gangway. These benches aggregated from 8 to 10 cu. yd. of solid excavation per foot of tunnel. The problem of drilling on the benches was a particularly difficult one, owing to their general tendency to slope toward the gangway and the extreme irregularity of their tops. To move and set up tripods under such conditions was not impossible, but very awkward and expensive, and the varying height and shape of the benches practically precluded columns. Another complication was added by the continuous traffic in the gangway, since the bench drilling had to be started long before the completion of the break-up excavation in the central part of the mountain.



16.—TYPICAL CROSS-SECTION OF TUNNEL WAS DESIGNED FOR DOUBLE-TRACK ARCH

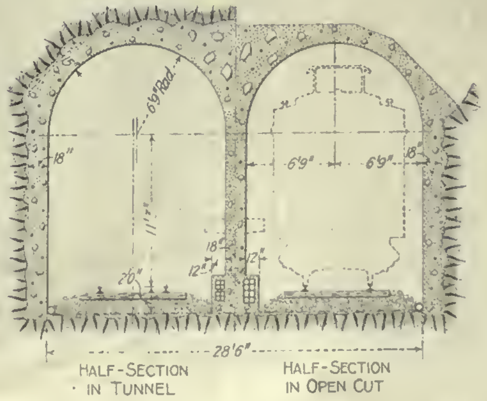
TUNNEL LINING METHODS

The typical cross-section of the tunnel, in excavation, was designed normally for a single double-track arch, as shown in Fig. 16. Where the roof was unusually bad or liable to develop heavy pressures a twin-tube section (Fig. 17) could be substituted without an excessive waste of concrete. In general, the rock in the tunnel was good. Except where gypsum or a deceased form of Essexite was encountered, there was no tendency in the rock to disintegrate, and few mud seams or voids were encountered except near the portals. The main danger in the tunnel from rock movement or falls was due to the broken and distorted conditions of the original main bodies, resulting from ancient volcanic activities and the multitude of igneous dikes and sheets that cut the rock into a patchwork of most intricate design, as shown in Fig. 18. This condition made the roof treacherous and sometimes subject to initial strains. It was decided, therefore, to line the tunnel, practically throughout its length. Where the rock was very hard and dependable in character it was concluded that masonry side walls could be practically dispensed with. (See Fig. 19.) As most of the arch was designed to restrain original movement more than to support a severe or varying load, a somewhat flat single arch was selected, the excavation for which would permit the use of a twin section economically where conditions required it.

While the concrete is often brought right down to subgrade, the thickness of the sidewall concrete is at times very small, since the arch takes its bearing from a hitch cut in the tunnel haunch at about the level of the top of the bench. In order to economize in concrete to the greatest possible extent, somewhat flexible side-wall forms were used in concreting the section. They were attached to the arch forms like a curtain. The bottom was jammed hard out against the rock at the base of the rib and sprung out of line, so far as their flexibility permitted, to follow the irregularities of the rock face and at the same time to give the necessary haunch and support to the arch. This, of course, gave an extremely irregular and unsightly face to the side walls, but as such features cannot be seen in a tunnel under operation, the economical features were allowed to prevail in the design.

COST OF LINING LOW

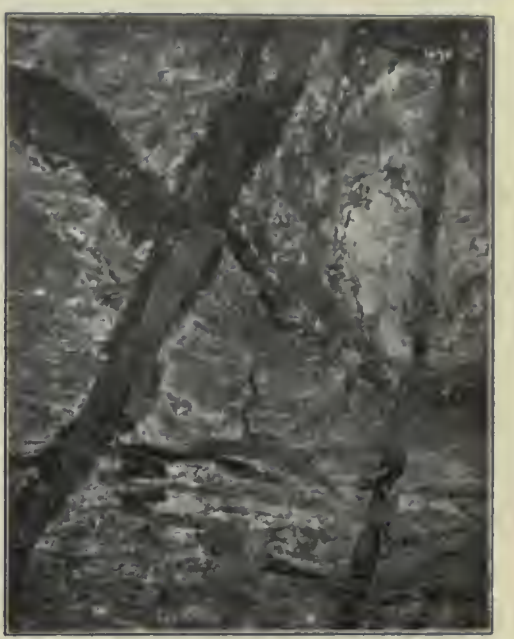
This design of section and the peculiar design of forms resulted in a variety of economies. The quantity of concrete was greatly reduced. The labor required in moving and setting forms was reduced more than 60 per cent. The waste of lumber and bracing was greatly reduced. The excavation was also considerably reduced; by carrying the break-up width, at the haunch of the arch, wider than the tunnel width below the top of the bench the drilling was much facilitated. It was, in fact, this last point which made this method of bench excavation an assured success and determined the use of the bench drill carriage. Without the additional space provided above the bench by the widening of the excavation section at the haunch required for the "hitch" of the concrete arch, it would have been almost impossible to drill the channel holes along the rib to which the bench was broken in excavation.



17.—WHERE ROOF WAS BAD A TWIN-TUBE SECTION WAS BUILT

BENCH DRILL CARRIAGE UNIQUE

The bench drill carriage is, the writer believes, quite original in the Mount Royal tunnel, both in type and detail. As finally designed, it is shown in Fig. 20. Eight to twelve drills were used on each carriage, equally divided between the two benches. As was the case on the heading carriages, these drills were never dismounted from their bar nor disconnected from the manifold except for repairs. As a small air-operated pump was carried on the carriage, water under pressure was always available for the drills without extra work for piping and connections. It will thus be seen that many of the economies inherent in ordinary drill carriage work, as detailed in Part 1 of this article, are also common to this type of carriage.



18.—IGNEOUS DIKES CUT ROCK INTO PATCHWORK OF INTRICATE DESIGN

The carriage proper consisted of a heavy traveler, 30 ft. long, which was moved along the heading gangway as the drilling progressed. The wheels were double-flanged and had very heavy axles, sufficiently long to give lateral play that would enable the wheels to follow the local irregularities of the track horizontally. The vertical play required was given by the spring of the traveler frame itself. The gage of the carriage track was of such a width that the side trusses comfortably cleared the gangway sides in all places and at the same time permitted a single muck track to operate between them. The traveler was fitted at each side with an adjustable outrigger supporting a horizontal quarry bar, which in turn carried the drills.

A heavy platform was built between the

side trusses of the carriage, sufficiently high to clear the traffic in the gangway below and yet to act as a very substantial brace for the carriage structure. The total height of the carriage was such as to clear the tunnel roof comfortably at all places. The longitudinal bracing was sufficiently strong to hold the carriage square and make it reasonably rigid. The lateral braces, especially the cross struts between the main side trusses, were extremely heavy to take up the thrust from the jack arms supporting the drill bars. The vertical posts of the carriage were also very heavy, being reinforced with steel angles, as they had to span between the repair platforms and the top braces, and carry the thrust from the jack arms. Thus the carriage was very rigid, so far as the drilling equipment was concerned. On the platform above the gangway tracks, used for repairing drills, was a workbench, testing blocks, etc.

Outriggers Support Drills

The angles reinforcing the vertical posts were punched at regular intervals to give a hinge connection to the outrigger arms that could be shifted vertically as the height of the bench required. These arms were attached to the post angles by a pin connection, as seen in Fig. 20, thus giving them a vertical swing, which was used especially in moving from one location to another. Each outrigger, one on either side of the carriage, consisted of four jack-arms and a 30-ft. quarry bar. The arms were hinged to the carriage, as just described, and had janks at the outer ends which screwed against the tunnel haunch, fixing the carriage, as a whole, firmly in position. The arms were made up of 4-in. extra heavy pipe with the same end jacks that were used with the drill bars in the heading and break-ups. In fact, these bars were actually used in this drill carriage, so far as the number available would permit.

The drills were mounted on column arms, or the special saddle arms described for heading work in Part 2. These were clamped to the horizontal quarry bar, as in the case of the heading drill bar, so that the drills had every flexibility in setting up and operating. The rigidity of the carriage and supporting apparatus reduced vibration to a minimum, while the ease of moving ahead and fitting local irregularities in the bench expedited the work to the greatest degree.

The extra width in the tunnel allowed at the haunch for the arch support very much facilitated the drilling. Two parallel lines of bench holes were usually drilled. The outside line next the rib acted as channel or line holes, varying in spacing from about 4 ft. to 8 in., depending on the character of the rock and the accuracy of the line required in the tunnel wall. The second line of breaker holes was spaced farther apart. The line holes were only loaded when the rock was such that it would not break to line from the breaking holes. Thus the sides of the tunnel were not shattered by heavy blasting, and the overbreak was unusually small. This was also true of the break-up excavation, since all the blasting there, being to two faces, required only the lightest kind of shooting. While the headings used 5 to 7 lb. of 60 per cent powder per cubic yard, the break-up and bench excavation averaged less than 1 lb. to the yard.

As the drill carriages kept well ahead of the blasting, and as all the bench muck was handled by steam shovel, only two muckers were required in each drill-carriage crew. These two men cleaned off the top of the bench and extended the drill carriage track, with the aid of the helpers, as the carriage moved ahead. One electrician attended to all the trolley and lighting work connected with both drill carriages, and one mechanic did all the pipe-fitting and drill repairs necessary for both drill carriage outfits. The platform on each carriage above the muck track was mainly used for repairing drills and the storage of extra drills, spare parts, steel and supplies for daily use.

How Carriage Was Moved

When moving the jacks were released and the outriggers, including the quarry bars with the drills on them, were raised by blocks and tackle attached to the top of the carriage posts. The tackle was worked by 10-in. pipe-winding rollers, 30 ft. long, at the top of the carriage frame, one on each side of the carriage. These rollers were turned by hand by means of drill steels through holes drilled at right angles near the ends of the rollers. The quarry bar was so set on the jack arms of the outriggers that the drillers worked on the outside of the bar when drilling the line holes and on the inside when drilling the breaking holes.

Progress 90 Feet a Day

The progress obtained with this drill carriage amounted to from 30 to 90 ft. of tunnel per day, depending principally upon the character of the rock and the configuration and condition of the bench. When the ground was particularly irregular and was cut by dikes or when the bench was found to be somewhat shattered from previous blasts the drilling would be slow and uncertain, often several holes being necessary to secure one of the proper depth and direction. Again, when the top of the bench was very irregular or sloped at a steep angle, it was often tedious work to start the holes. Compared with the time required for drilling with columns or tripods, however, the progress was more than merely satisfactory.

It has been found that even under favorable conditions on outside rock the lost time in tripod drilling often amounts to 50 per cent of the time actually spent with the machines. This is due not only to the delay in setting up, but to the time lost in shifting the tripod to "follow the hole." It can be readily seen that practically all of this lost time is eliminated in the case of the drill carriage, where the drill supports are rigid and the drills may be shifted accurately and expeditiously with a minimum of labor.

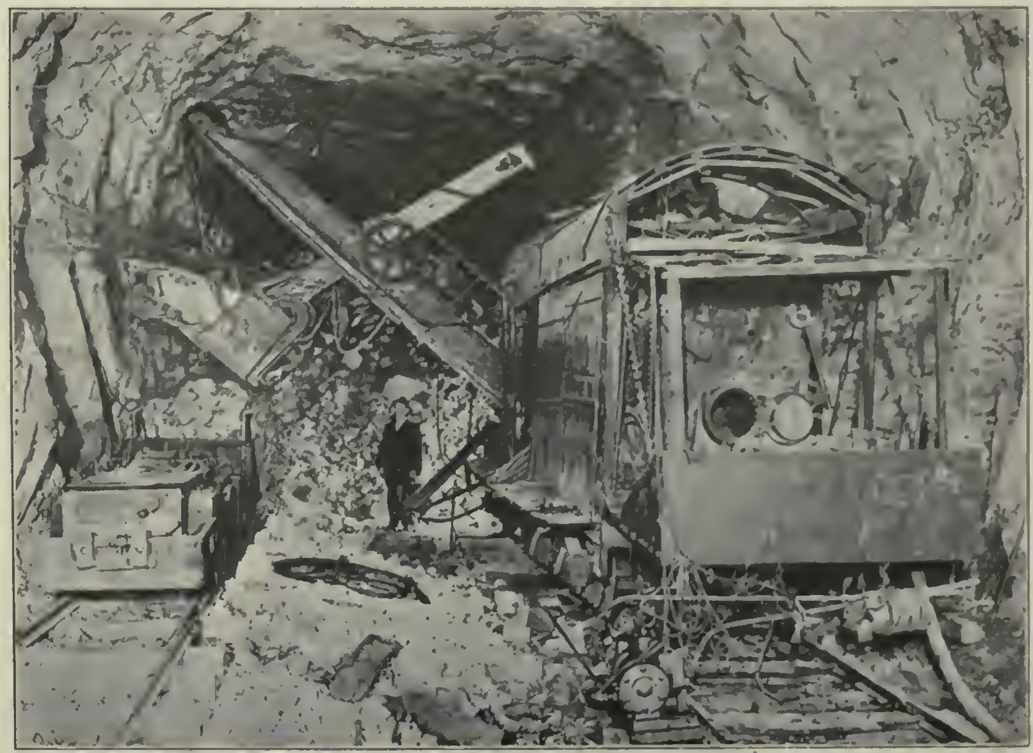
After the drill carriage had got a good start a powder crew was sent in from the west portal and the benches blasted well ahead of the steam shovel. By this method the shovel, a model 41 Marion, never had to back up for shooting, full time being spent in excavation. Five to six hundred cars of muck were usually handled per day of two 10-hr. shifts. This aggregated 1200 to 1500 cu. yd. of loose material, or about 700 to 1000 cu. yd. solid. The linear progress of the shovel sometimes exceeded 600 ft. per week where there was nothing but bench excavation removed. Fig. 21 shows the shovel working in the standard bench section.

The yardage price received for the crushed stone at the west portal crushing plant, all of which was sold except that required for the company's tunnel and railroad purposes, was more than sufficient to

19.—WHERE THE ROCK WAS HARD AND DEPENDABLE, MASONRY SIDE WALLS WERE OMITTED IN MOUNT ROYAL TUNNEL

cover the yardage cost of drilling, blasting, powder, mucking, transporting, crushing, marketing, power, supplies and overhead charges in the case of the bench excavation. This unusual economy, of course, was not entirely due to the bench drill carriage. As the bench was already somewhat shaken and very much exposed, it required comparatively little drilling and powder to break it. The mucking conditions were as nearly ideal for a tunnel as one could ever hope for. Then, too, the price of stone was high—70 to 75 cents per net ton. On the other hand, had it not been for the drill carriage there is no doubt but that the cost of drilling would have been very excessive and the progress heart-breakingly slow.

The writer considers the bench drill carriage not only the most unique feature in the Mount Royal tunnel excavation equipment, but by all odds the greatest money saver in comparison with the amount involved.



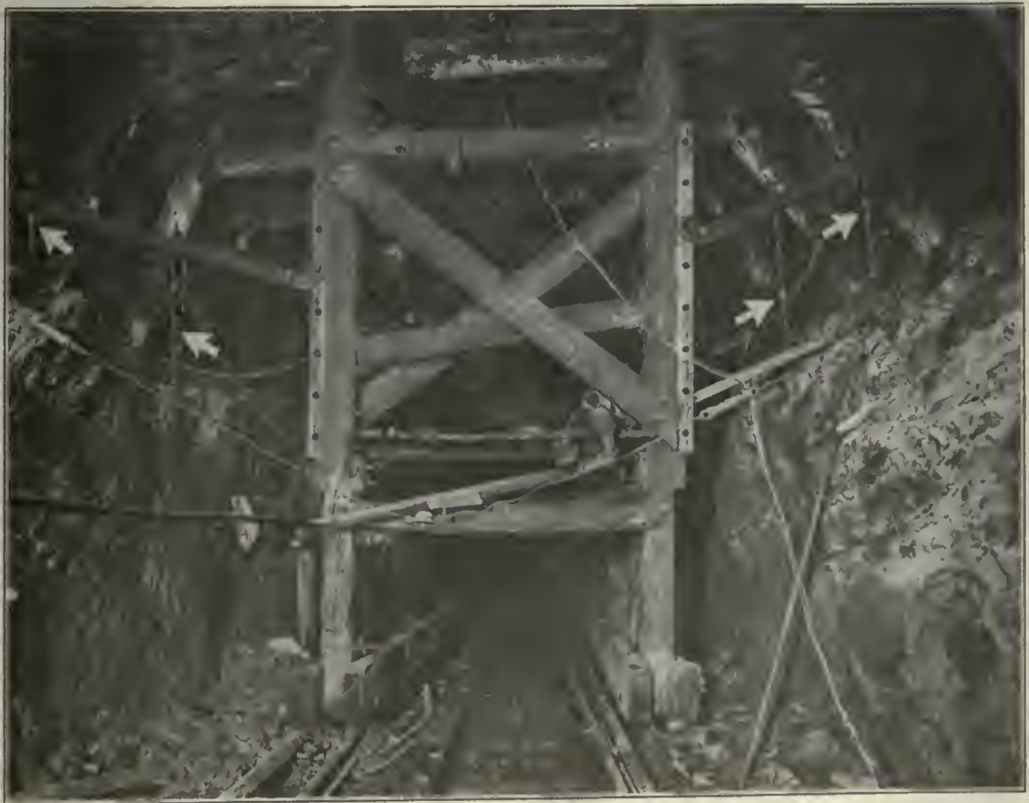
21.—STEAM SHOVEL, WORKING IN STANDARD BENCH BEHIND DRILL CARRIAGE, LOADED 600 MUCK CARS WITH 1500 CUBIC YARDS OF LOOSE MATERIAL PER DAY OF TWO TEN-HOUR SHIFTS

THE TRIMMING CARRIAGE

The final trimming of the tunnel section, preparatory to lining, is too often a very measurable percentage of the total cost of any tunnel excavation. There are many cases where the cost of trimming, added to the cost of extra concrete and packing required to fill in cavities left by falls and careless or inaccurate excavation, has exceeded the actual first cost of excavation. For some reason this is an item very often overlooked by a contractor, especially if he is not thoroughly experienced in making up his bids for tunnel work.

This was one of the very important factors in determining the system finally adopted for excavating the Mount Royal tunnel. While the blasting in the heading was necessarily quite heavy, this heading was in the center of the tunnel and along its subgrade. All blasting immediately adjoining the actual perimeter of the finished tunnel excavation was very light, and all outside holes were drilled practically parallel to the face of the tunnel walls and roof. This not only resulted in remarkably cheap excavation, but enabled the tunnel to be driven very close to the theoretical neat line of excavation, and, as the blasting was light, the surrounding ground was hardly shattered at all. The scaling, therefore, was simple and expeditious, and in spite of the broken and uneven character of the ground, serious falls were very rare. The actual overbreak averaged less than 5 per cent, and the amount of trimming was comparatively small and very conveniently located for its economical removal, only heavy trimming being in the lower corners of the tunnel cross-section.

This trimming, if such it may be called, was left because in places the bench was so high that the line holes could not be drilled to subgrade—at least without bending the steel, which was not practical under the circumstances. With the line holes not down to subgrade, the breaking holes could not break the rock back to the neat line, thus leaving a very appreciable toe of rock along the sides in many places.



20.—EACH BENCH DRILL CARRIAGE, A HEAVY TRAVELER 30 FEET LONG, CARRIED FROM EIGHT TO TWELVE DRILLS, WHICH WERE NEVER DISMOUNTED FROM THEIR BARS OR DISCONNECTED FROM MANIFOLD; THE DRILLS WERE CARRIED BY OUTRIGGERS AS SHOWN BY ARROWS

The trimming on the sides of the tunnel was insignificant, except where the hitch was required for the arch. Here, while there was a general difference in line of about 18 in. between the haunch and the sides of the tunnel below, the shoulder had to be squared up to give a firm and reliable bearing for the masonry. This hitch commonly occurs about 10 ft. above subgrade, but there was no effort made to have this line uniform. The hitch was cut wherever it happened to come, its elevation sometimes ranging from nearly subgrade to the actual springing line of the arch, in the same form section. In Fig. 22 the men may be seen drilling for the hitch on each side of the drill carriage at about its normal elevation.

HAND DRILLS FOR TRIMMING

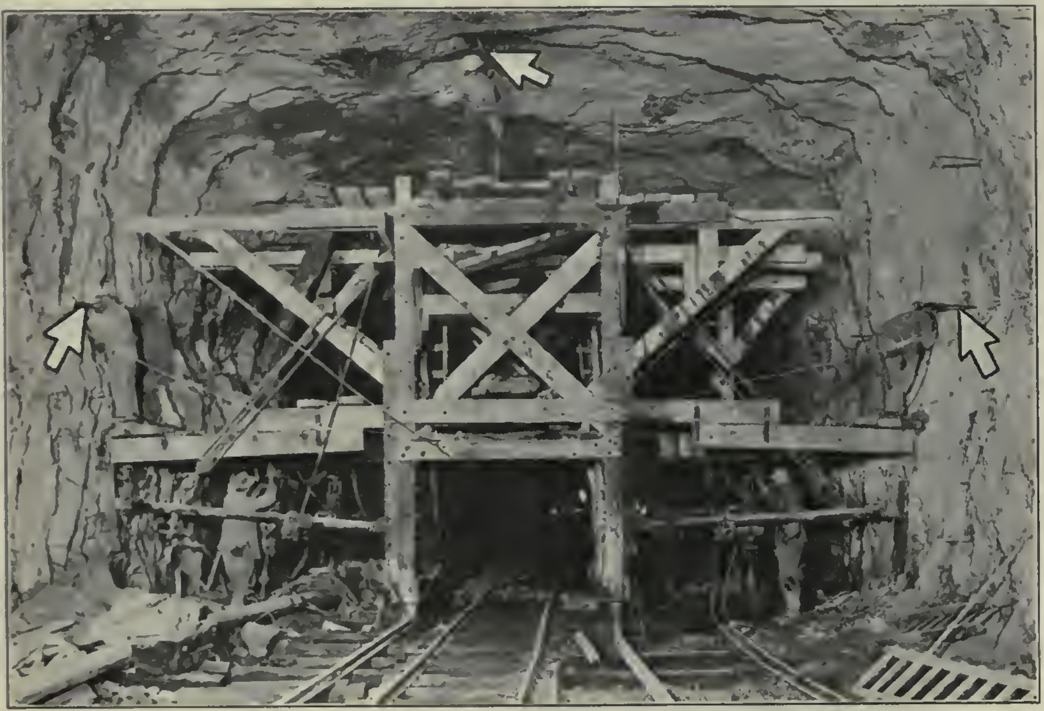
The roof trimming was unimportant, except where the general elevation had to be raised owing to the development of the ground when fully exposed, making a heavier arch advisable than was at first thought necessary. Nowhere, however, was this trimming heavier than to require pneumatic hand drills for its removal.

The trimming drill carriage (Fig. 22) is very similar in construction to the bench carriage except that it is only 20 ft. long instead of 30 ft. In fact, much of the material used in its construction came from one of the bench drill carriages. It consists of two side trusses, 20 ft. long, traveling on six double-flanged wheels. As in the former carriages these trusses are so spaced as to permit the passage of a train of tunnel cars, both for muck and concreting materials. Immediately above the track is a platform for storage and repairs. In this carriage, however, the outriggers with their quarry bars and heavy drilling equipment are at the bottom, where the only heavy drilling occurs. The outriggers are attached to the frame of the carriage and are operated very like those already described, except that, since they are shorter and lighter, no winding rolls are provided.

PLATFORMS ADJUSTABLE

On about the level of the repair deck are side platforms carrying the men who drill for the hitch of the arch. These platforms extend the whole length of the carriage, on either side, and have a lateral adjustment which enables them to be drawn in when moving the carriage and extended when desired to fit any irregularity of the tunnel wall. The top deck, where the driller stands who scales and trims the tunnel roof and haunches, also has wings, bracketed out on either side to enable him to reach any part of the roof. As these wings are, however, considerably narrower than the tunnel section at that height, no lateral adjustment is required.

All drills used on this carriage are self-rotating pneumatic hand drills except those mounted on the quarry bars at the bottom, where the standard piston drills are used.



22.—IN TRIMMING CARRIAGE OUTRIGGERS WITH THEIR HEAVY DRILLING EQUIPMENT ARE AT BOTTOM; MEN ON PLATFORMS AT SIDES ARE DRILLING HITCH FOR ARCH LINING SUPPORT

As in the case of the bench drill carriage, water is provided for drills at the carriage, and the heavy drilling equipment, once mounted, remains undisturbed on its bar from move to move. With this carriage the blasting is carried immediately behind the drill carriage as it progresses, but as it is very light it seldom obstructs the track for more than a few minutes, and causes no particular damage.

Aside from the usual advantages common to all drill carriages, the main value of this carriage is its lightness and ease of movement from place to place as it proceeds down the tunnel. Of course, it is self-evident that in this case the usual laborious scaffolding required in ordinary trimming operations is eliminated. The danger to workmen from hurriedly and often carelessly erected scaffolding is also eliminated, and it is a noteworthy fact that a man works faster and more effectively where he has a sense of security and is entirely familiar with his immediate surroundings.

It has been noted that the amount of trimming actually required is small. This may be particularly appreciated from the fact that the cost of trimming, including squaring up the hitch and removing the débris ready for the concrete form carriages, adds less than 5 cents to the yardage cost of the tunnel excavation.

CONCLUSION

In concluding this series of articles there is little to add to what has already been said. The use of tunnel drill carriages must depend upon each tunnel which comes under consideration. In general, they are serviceable and economical, lending much to the accuracy of line, regularity and rapidity of progress, and saving much wear and tear on both men and equipment. If certain systems of excavation are adopted, or if the ground is particularly bad, they become impractical. Where the tunnel is very short or very much subdivided they might add unduly to the plant charge or have no opportunity for systematic and continuous operation. It is absurd to try to lay down hard and fast rules or to say that they are universally advisable. It is equally absurd for an engineer, if he is acquainted with their use, to fail to take advantage of their economic possibilities where the opportunities exist for their operation. This is especially so where the tunnel is long and the time of completion is important.

ACKNOWLEDGMENTS

The writer wishes to mention the keen interest, co-operation and undivided loyalty of his staff and entire organization in all of the work on the Mount Royal tunnel, without which neither the records for progress which have been made nor the economies which have been obtained would have been possible. This acknowledgment is particularly due to W. C. Lancaster, electrical-mechanical engineer; J. C. K. Stuart, principal assistant engineer; H. T. Fisher, lately tunnel engineer; Richard Byers, general superintendent, and Rufus Gent, electrical-mechanical superintendent. Mr. Fisher's advice on the heading drill carriages was invaluable. The idea for the bench carriages came from Mr. Gent, while much of the detailed design, especially of the latter carriages, was due to Mr. Stuart, who has been directly in charge of the construction work.

Most important, however, for the success of this work, where so much originality has been required, has been the absolute confidence and co-operation of the company's principals, Sir William Mackenzie, president, and Sir Donald Mann, vice-president, of Mackenzie, Mann & Company, Ltd. This was particularly so of Sir Donald Mann, who is more directly responsible for all the construction work, not only that of Mackenzie, Mann & Company, Ltd., but also that of the Mount Royal Tunnel & Terminal Company, Ltd., and the Canadian Northern Railway, which they also control. This co-operation enabled advantages to be taken of conditions as they arose and made possible many economies that cannot usually be effected on ordinary contract work.

Proposes Numerical Rating of Woods for Ties

Would Develop Standard Table of All Species According to Mechanical Properties—Urges More Attention to Seasoning

DISCUSSING woods suitable for cross-ties R. Van Metre, at the convention of the American Wood Preservers' Association in Chicago this week, mentioned a rating system on which the U. S. Forest Products Laboratory has been working, and presented a table of relative values of timbers for tie purposes, based on tests made at the laboratory. He suggested the desirability of developing a standard table of this sort to include every species available, based on a large number of tests. He also urged that more consideration be given to the matter of seasoning, which, he said, would make so-called softwoods serviceable and conserve the supply of red oaks. These notes are taken from his paper.

VALUE OF WOODS FOR TIES

In considering the value of any species for a tie, aside from the natural durability and its capacity for treatment, there are three points of importance: (1) That it be sufficiently strong to withstand the ordinary strains due to center binding, etc.; (2) that it be sufficiently dense to resist spike pulling and lateral pressure on spikes, and (3) that it be sufficiently hard to have a proper resistance to rail wear.

It is desirable that some classification of the mechanical suitability of the different species as ties be established from a comparison of their mechanical properties. The Forest Products Laboratory has been working on this, and has suggested the practicability of basing a classification upon a composite figure involving the following mechanical properties:

1. Static bending.
    a. Modulus of rupture.
    b. Fiber stress at elastic limit.
2. Impact bending.
    a. Fiber stress at elastic limit.
3. Compression parallel to grain.
    a. Maximum crushing strength.
    b. Fiber stress at elastic limit.
4. Compression perpendicular to grain.
    a. Fiber stress at elastic limit.
5. Hardness.
    a. End hardness.
    b. Side hardness.

Such a method, using the results secured in the many thousands of tests conducted at the laboratory on small clear specimens, and combining the data on a basis which would seem to give to the different properties a proper and reasonable weight in the composite figure, would result in the accompanying classification of some well known species. The figures given are for average forest-grown material, and individual pieces of any of the species may vary as much as 30 per cent above or below the average.

TIMBERS ARRANGED IN ORDER OF THEIR MECHANICAL VALUE AS TIES

No.	Species	Average composite value
1	Black locust	1666
2	Sugar maple	1140
3	White oak	1050
4	Red oak	972
5	Beech	955
6	Longleaf pine	914
7	Red gum	825
8	Shortleaf pine	800
9	Western larch	790
10	Tamarack	740
11	Eastern hemlock	700
12	White fir	610
13	Lodgepole pine	590
14	Western yellow pine	560
15	Northern white cedar	420

The idea of attempting to develop a standard table of this kind based on a large number of mechanical tests is worthy of careful consideration. It can be enlarged to include every species which is available in sufficient quantities, and would be of considerable value to anyone facing the situation caused by the decreasing supply of oaks.

CONTROL OF SEASONING IMPORTANT

In addition to the mechanical properties, an important factor in determining the suitability of any species as tie material, is the question of how a wood undergoes seasoning. A few years ago the specifications of many of the roads required that ties be winter-cut, but in most cases this requirement has been eliminated or entirely ignored. If that requirement had been rigidly insisted on, with regard to the so-called softwoods, such truly serviceable woods as beech, gum, the maples, birch and elm, would probably be standing favorably with the red-oak group, instead of having yet to prove their merit. Summer-cut ties of these species are subject to severe checking and deterioration by incipient decay before treatment that winter-cut ties escape to a great extent.

The solution of the problem of handling these softwoods is simple in theory, though more difficult in practical operation. It requires two things: Rigid restriction of the cutting period to the months between Oct. 1 and March 1, and the proper piling of ties for seasoning at every stage from the woods to river bank or right-of-way to the treating plant yard. Unfavorable results from treated ties made of these woods can usually be traced to failure to observe these precautions.

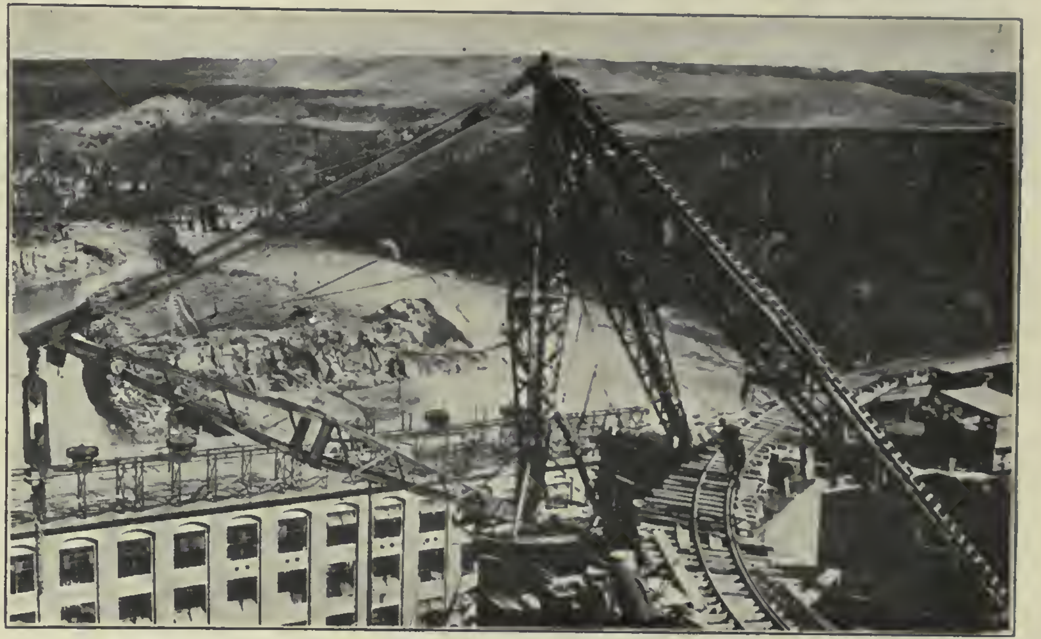
It is generally conceded that red oak is the very best wood for ties. It is strong, easy to treat, easy to handle to avoid deterioration before treatment, hard to resist rail cutting and spike pulling. For these reasons all concerned would gladly limit their operations in treating ties to this wood, if there were sufficient timber available to supply the demand. But the red oaks for ties are fast going the way of the white oaks. The so-called inferior woods must make up the shortage, and of these, the timber supply and rate of growth will take care of the demand for many years.

It is not too early to begin to conserve the supply of red oaks for future use in track where the service is severe. This can be accomplished by letting down the bars to other woods on their merits as proved in the test tracks maintained by most large roads that are most earnest in their efforts to determine each wood's value as tie material. It is only a matter of time when every wood having the requisite mechanical properties will be used for ties. That time will come when the producers and consumers of ties will co-operate to control the period of cutting and method of seasoning, so that ties will reach the treating plant with their natural condition unimpaired by checking and incipient decay.

Stresses in 50-Ton Steel Derrick Reduced by Elimination of Goosenecks

Easy Swinging Secured by Transferring Stress from Boom Line to Mast Below Stiffleg Connection—Rocker Arm Is Feature of Boom End

THE UNDESIRABLE bending moments which have to be considered in the design of the stifflegs and goosenecks of derricks as ordinarily constructed were entirely avoided in the case of a 50-ton steel stiffleg derrick of recent construction. This was accomplished by the development of a cast-steel head which takes the place of goosenecks and directs the stresses in the stifflegs along lines coincident with their longitudinal axes.



FIFTY-TON DERRICK DESIGNED TO ALLOW AXIAL STRESSES ONLY IN EVERY MEMBER

One of the accompanying illustrations shows a sectional view of this head, together with the terminal of the mast and stiffleg, the gudgeon pin, and the link leading to the boom line. It will be noted that the axis of the stiffleg and that of the mast intersect exactly in the center of the opening in the top of the steel head through which passes the gudgeon pin. This gives a direct application of stresses not only in the stifflegs but in the head as well.

Another important feature, but one not so apparent, is the arrangement whereby the vertical stresses resulting from tension in the boom line at low boom are transmitted directly through the gudgeon pin to the mast without in any way reacting upon the steel head or influencing the moment required to swing the boom in a horizontal plane at full load. This is accomplished by articulating the boom-line link with the gudgeon pin by means of the semi-circular recess at the upper extremity of the latter, and the introduction of a heavy bridge, or key, of rectangular cross-section, which passes through the mast and the lower end of the gudgeon pin, securing the one to the other. A small space, about ⅛ in., is provided between the steel head and the clevis which secures the boom-line link to the gudgeon pin, to insure freedom of action. The boom-line link is cast steel, of I-section, curved to clear the head and allow for free swinging at low boom.

ROCKER ARM GIVES ADDED HEADROOM

A further unusual feature embodied in this derrick is the arrangement which forms the junction of the outer end of the boom, the boom line and the fall line. It is a rocker arm built of two pieces of heavy 15-in. channel 5 ft. long, set back to back 15 in. apart and riveted to a cover plate of ⅜-in. sheet steel. This rocker arm is provided with three pins passing through it transversely, one at either end and one located about three-quarters of the way between these two. The last-mentioned pin hinges the rocker arm to the end of the boom, the longer end of the rocker arm pointing upward and toward the mast of the derrick and the short end projecting beyond the end of the boom. The shorter end supports the upper sheave block of the fall line, and the boom-line sheave block connects to the long end. When the derrick is loaded the rocker arm assumes a position which establishes equilibrium and directs the stress in the boom along the line of its longitudinal axis, whether at high or low boom. Obviously this feature accomplishes nothing more than would two bails, or bridles, but it is much cheaper for heavy duty, and is accompanied by much less loss of headroom than attends the use of bridles.

The derrick consists of a 48-ft. boom, 41-ft. mast and 58-ft. stifflegs. The mast, stifflegs and boom were built of 6 x 6-in. angles, 9/16 in., ½ in. and 7/16 in. thick,

ROCKER ARM IS MUCH SHORTER THAN BRIDLE OF SAME STRENGTH

in the order named. The lacing is 2½-in. and 3-in. angles, double-riveted. The gudgeon pin is 9 in. in diameter. The derrick was located on existing concrete walls, which largely determined its general dimensions, and for this reason also it has no sills. The back end of each stiffleg was secured to the concrete by being pin-connected to two straps, each 1 in. thick and 8 in. wide, extending 16 ft. into the concrete in a direction exactly in alignment with the axis of the stiffleg. These straps or bars were reinforced at their upper extremities so as to provide for pinning without loss of effective cross-section.

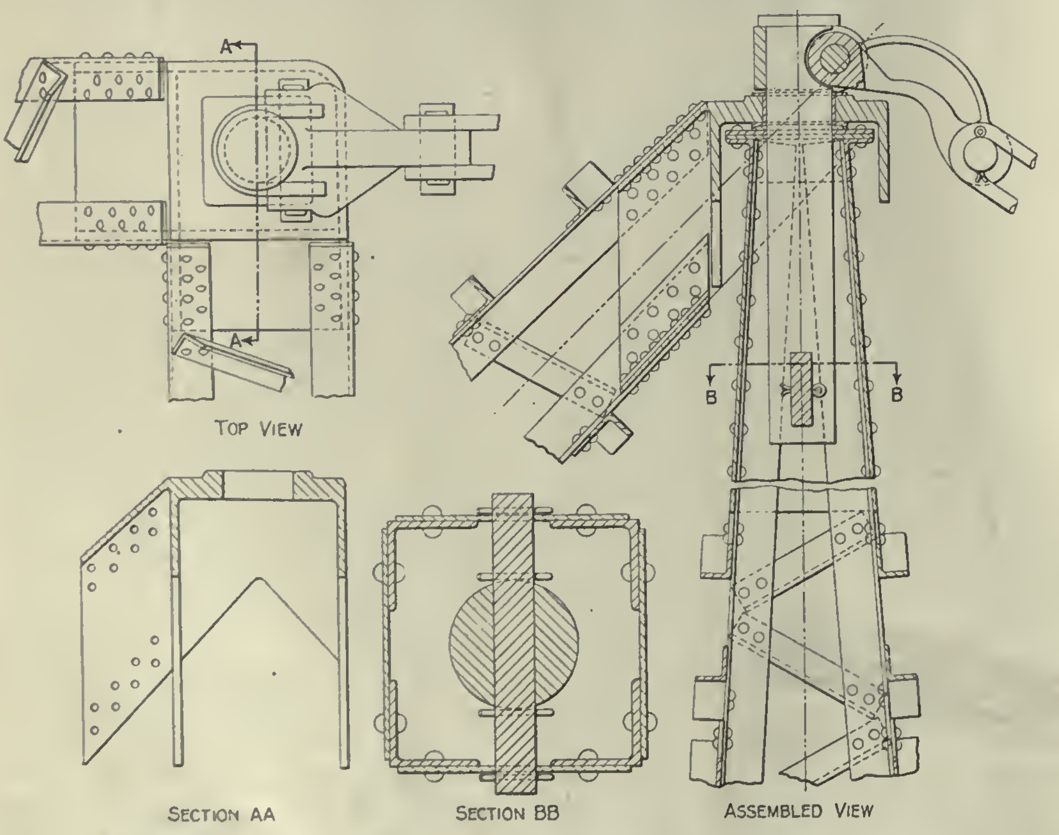
The rigging consisted of nineteen parts of ¾-in. boom line and sixteen parts of fall line of the same diameter. The boom line was led into the mast near the top and thence down to the hoist. The load line was led down the inside of the boom to the foot of the mast to protect the derrick against the possibility of a careless operator lowering his boom against his load line and parting it. The load line, due to the considerable distance through which loads were handled, was more than 2000 ft. long. The derrick was provided with a bullwheel 14 ft. in diameter, and its operation was so free that it was swung with ease by a ⅝-in. cable, even when loaded. Power was supplied by an 8 x 10-in. three-drum, extra-heavy hoist.

LOW UNIT STRESSES ADOPTED

The unit stress taken was approximately 10,000 lb. per square inch throughout, except the riveting, which was taken at 8000 lb. per square inch. In determining the stress in pins, that resulting from bending moments was in all cases considered, and applied whenever it exceeded shear.

The derrick was built by the Great Falls Power Company to lower machinery to the power house of its new 90,000-hp. hydroelectric development at Great Falls, Mont. It was designed and its construction supervised by M. T. Thompson, assistant superintendent during construction of that development. The steel was sheared and punched in a small shop within 12 miles of the job, while the rest of the work was done in the company's field shop, even to the manufacture of the sheave blocks.

TO POPULARIZE GEOLOGY the U. S. Geological Survey has printed on the backs of several of its topographic maps nontechnical descriptions of the physical features of the area mapped, and of their origin. That the general public appreciates these descriptions, states a bulletin issued by the Survey, is shown by the increased demands for the maps. Consequently, such matter is to be published for the map of the Crater Lake National Park, Oregon; the Bright Angel area in the Grand Canyon of Arizona; the Delaware Water Gap, and other areas. The work involves comparatively little expense.



DETAILS INSURE AXIAL STRESS IN MAST AND STIFFLEGS AND MAKE SWINGING EASY

Wood-Block Flooring Said to Have Proved Its Worth

C. H. Teesdale Tells American Wood Preservers' Association of Favorable Reports Received from Many Users of the Blocks

IT IS ONLY a few years that creosoted wood blocks have been used for the flooring of factories, warehouses and other buildings. Yet they have already proved their worth, judging from information presented at the wood preservers' convention in Chicago this week by C. H. Teesdale of the U. S. Forest Products Laboratory. Mr. Teesdale has summed up and tabulated the answers to questions submitted to a large number of users of wood-block flooring, as well as the manufacturers of the creosoted blocks. His summarizing of the data received is as follows:

FEW CASES WHERE TROUBLE HAS DEVELOPED

The results of this investigation indicate that treated wood block makes a desirable type of flooring for many purposes, and it is likely that its use for interior work will increase. Since its large use for these purposes is just beginning, one might expect that unforeseen trouble would develop. The records of 160 floors indicate, however, that serious trouble has developed in a very low percentage of cases.

Most of the trouble has come from shrinkage or expansion of the blocks. To prevent these troubles it is necessary to study each case where blocks are to be laid, and to treat the blocks accordingly. For dry situations the blocks should be well seasoned before treatment and laid in the floor while thoroughly dry. In wet or alternately wet and dry situations dry blocks would give expansion trouble, hence the timber should be green or only semi-air-dry when laid. Even dry interiors are liable to be accidentally subjected to water, however; hence it would seem desirable as a rule to use bituminous fillers instead of sand filler.

Sand cushions were probably a source of trouble in several cases. If there is any vibration, or if the sand is at all liable to shift, a bituminous or cement grout cushion is to be preferred. Sand cushions are also liable to cause uneven floors if the blocks shrink, and it seems likely that many cases of shrinking would not give serious trouble where bituminous filler and bituminous or cement grout cushions are used.

Bleeding caused very little trouble. In dry and very warm situations, where it is most likely to occur, it would be desirable to consider carefully the method of treating and handling the blocks in order to avoid objectionable bleeding.

WOOD BLOCKS NOT ALWAYS SUITABLE

In a few cases it seems likely that wood block should not be used. For example, it should not be used where butter or tobacco products are stored. In some foundries, where hot castings are thrown upon the floor, the blocks have burned through to the foundation. Wood blocks may be objectionable where the soiling or staining of certain classes of merchandise would lower the value, and in one case where used in a tennis court wood blocks were a failure and had to be removed.

Wood block has been found to be very satisfactory in many cases where heavy castings are thrown about or where heavy trucks are moved, and it is liked by workmen because it is warm and easy on their feet.

The replies from the users of wood-block flooring indicate quite strongly that when new wood-block floors are to be laid a careful investigation of all the conditions existing or likely to develop should be made by the manufacturer. The method of treatment and construction of the floor should then be adapted to the special conditions found. If this is not done many cases of dissatisfaction are very liable to develop.

Santa Barbara Has Subterranean Storage Reservoir

Tunnel Running 2 Miles Into Hill Has, Near Portal, Watertight Bulkhead Through Which Passes 8-Inch Pipe with Valve

THE CITY of Santa Barbara, Cal., has, as part of its water-supply system, a natural underground reservoir, tapped by what is known as the Cold Springs Canyon Tunnel. This tunnel, built nearly twenty years ago, is about 5 x 7 ft. in section and penetrates some 2 miles into the hill through sandstone and shale of usually vertical strata. The tunnel has a rubble-masonry, watertight bulkhead about 2000 ft. from the portal, and through this bulkhead passes an 8-in. pipe which conveys water from the underground supply to the city reservoirs.

A valve in this pipe line near the outer face of the bulkhead is closed in the fall of the year when the city no longer has immediate need for water from this source, and during the winter the pressure behind the bulkhead rises rapidly. In the spring of the year a flow of 60 miner's inches can be drawn from the tunnel for a period of three months. It is estimated that the storage capacity tapped by this tunnel is 45,000,000 gal., in addition to the natural flow of from 25 to 30 miner's inches. The flow from the tunnel in the summer season continues to be 25 to 30 miner's inches after the capacity of the reservoir has been exhausted, and it has been found that the normal summer flow from the tunnel can be drawn off through the winter without decreasing the total quantity of stored water available for the following dry season.

Five Schemes Considered for Power Development at Kananaskis Falls, Alberta

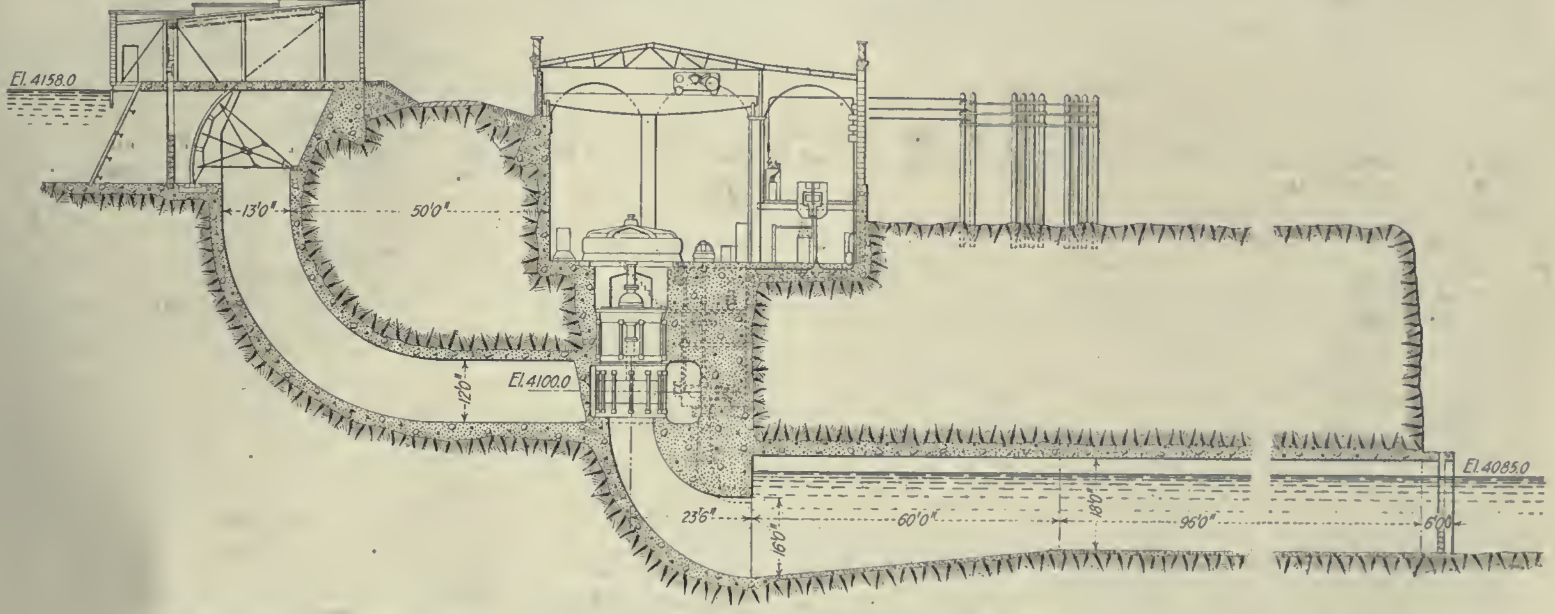
Part 2—Type of Canal Lining Carefully Studied—Power House Built Mainly Below Ground Surface to Lessen Vibratory Effects

By HAROLD S. JOHNSTON
Banff, Alberta, Canada

THE TYPE of canal lining for the Kananaskis Falls plant was carefully considered, four methods being proposed and studied. The power house was built mainly below ground level, principally to shorten the turbine shaft length and lessen vibratory effects.

CANAL LOCATION

The location of the canal was decided by the sinking of test pits. Rock outcropped from the Kananaskis River to the eastern edge of contour 4165. Beyond this the rock dropped off abruptly to between El. 4140 and El. 4137. Therefore El. 4140 was assumed as the bottom of the canal. Where the rock surface dropped naturally below this level, all dirt was cleaned off and backfilled with boulders and niggerheads to El. 4140. The requirements of design were:



POWER HOUSE BUILT MOSTLY BELOW GROUND SURFACE TO SHORTEN TURBINE SHAFT LENGTH AND LESSEN VIBRATORY EFFECTS

That ample proportions be used so that under the most abnormal conditions the velocity of the water should not exceed 1½ ft. per second; that the section through dirt, consisting of layers of gravel sand, loam and clay, should be lined with concrete on a slope; that the section through rock should be unlined and have vertical sides, and that allowance should be made in the section for the roughness of the surface; that ice pressure should be taken care of by putting a slope of 2:1 on the upper section of the lining, from El. 4153 to El. 4158, and that access should be easy.

DIMENSIONS OF CANAL SECTIONS

The section through rock was made 72 ft. wide with the bottom elevation at El. 4140, and through dirt it was made 50 ft. wide at the bottom, with the sides sloping 1:1 from El. 4140 to El. 4153, and 2:1 from El. 4158, the crest of the canal wall. Transitions were placed between the vertical and sloping sections. The total length of the canal is 670 ft., the last 60 ft. of which is constructed on a curve to join the forebay perpendicularly.

Four methods were proposed for lining the canal, due consideration being given to the fact that the sloping bank of the river was but a short distance away and the formation was mainly sand and gravel. The four were a gravity-section concrete wall; a vertical-section reinforced-concrete counterfort wall, a sloping-section reinforced-concrete counterfort wall, and a 4-in. lining of plain concrete laid on 12 in. of niggerhead riprap. The writer favored the third method for its efficiency, permanent economy and ease of construction. The fourth was adopted.

OPENING TO TAKE CARE OF ICE

In the wall on the river side, adjacent to the head works, a decked opening 6 ft. wide was left as an ice run to clear the intake racks and keep the forebay clear of ice. A timber runway carries the ice and débris from this point to the river. The opening is closed with stoplogs.

Operation has shown that the lining on the river side is leaking considerably, and steps are now being taken to remedy this. It has also become clear that a 15-ft. opening on the center of the river canal wall would have been most serviceable in the removal of ice, which has a tendency to become very thick because of fluctuations in the pond level, and which exerts an enormous pressure on the canal lining in spite of its slopes.

INTAKE AND PRESSURE TUBES

To serve two main units and the exciter unit two pressure tubes were provided, with the dimensions so arranged that the maximum velocity at entrance would be 2 ft. per second, and the maximum velocity at entrance to the scroll chambers of the turbines 6 ft. per second. The intakes were, therefore, made 35 x 13 ft., narrowing by easy smooth curves and lines to a 12 x 12-ft. section with filleted corners.

To support the upper lining at the curve upward to the intake, heavily reinforced pillars 3 ft. x 18 in. in the shape of sharp-ended ellipses, pointing upstream, were placed midway in each tube, and the shale in which the tubes were built was grouted.

WATER CONTROL

The intakes are served by two 15-ft. openings in the head works. The usual style of racks are placed in front of these openings. Back of the racks grooves are left for stoplogs, which form the final protection to the intakes. The main water control is effected through a system of four Tainter gates, two to each intake, each of which swings on a 2-in. steel shaft supported by eight bearings, which are separately anchor-bolted to concrete seats at El. 4142.48. The gate when fully up swings to rest against the slope of the back gravity-section wall, the top edge of the gate entering a space left for it in the floor, and chains being provided to tie it securely.

Closure between the face lagging of the gate and the concrete side walls is made by an 8-in. piece of ¼-in. oil-tanned leather attached to the face edge by a brass bearing plate and lag screws. The mechanism for the operation of the gates and the control of the stoplogs is supplied by two double-drum winches attached to the columns. Steel cables run from each of these winches to the gate through sheaves, and by means of a bridge attachment to the gate any racking in raising is avoided.

DRAINAGE SYSTEM PROVIDED

A drainage system is provided to take care of any leakage through the gates or the stoplogs when they are down, controlled by flap valves operated by chains from the floor of the head works. Sluice gates 16 in. in diameter and the necessary passageways are also provided to fill the pressure tubes before raising the Tainter gates.

A warm building was constructed over the intake works of hollow tile plastered inside and out, with Fenestra steel arched window sash. The roof is of 2 x 4-in. timber, on edge and set tight, with a Johns-Manville asbestos three-ply coating. The front wall of the building is carried on a 12-in I-beam and a 12-in. channel attached to beams cantilevered out from the piers. This allows for a heavy wooden door to be hinged from the bottom of the 12-in. wall-supporting I-beam. The door projects into the water, to keep the weather out of the building, and also gives wind and ice freedom without danger to the structure. The space between the cantilever beam is left open for convenience in raking.

DRAFT-TUBE SECTION BEING SET UP

POWER HOUSE

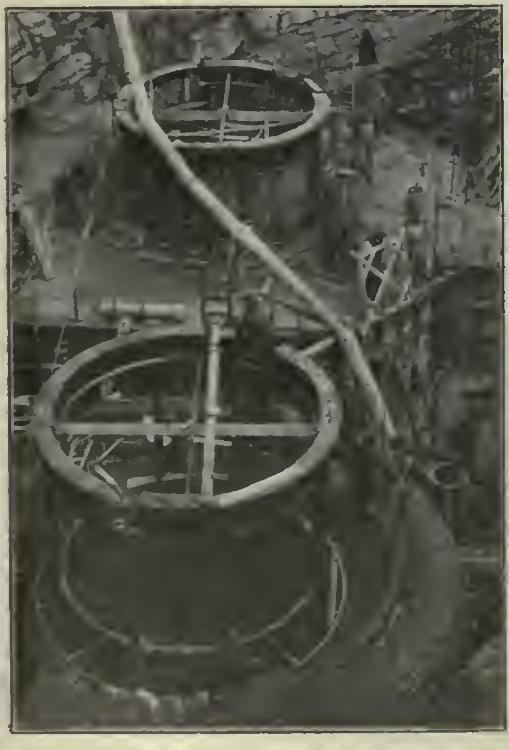
The two main turbines are of the vertical-shaft single-runner type, delivering 5800 hp. at 164 r.p.m. under a normal effective head of 68 ft. for 85 per cent efficiency at three-quarters gate, guaranteed to maintain normal speed and capacity under heads varying from 65 to 72 ft. and for the runaway speed not to exceed 280 r.p.m. at full gate and no load. Each main unit is controlled by a governor guaranteed to operate in parallel turbines provided with a different type of governor.

The exciter turbine is a 150-hp. single-runner, vertical-shaft machine guaranteed for 82 per cent efficiency. The casing is of the cast-iron scroll type. Inlet pipe connections between the concrete scroll chambers of the main units and the cast-iron scroll are provided of cast iron and furnished with the necessary control valves. No flywheels are provided for the main units, because of the flywheel action of the rotor, but for the exciter turbine a flywheel is provided, since the exciter armature has small flywheel capacity. A self-contained oil-pressure-type governor is provided for this unit. The turbines and governors complete installed in place were supplied by the Canadian Allis-Chalmers Company.

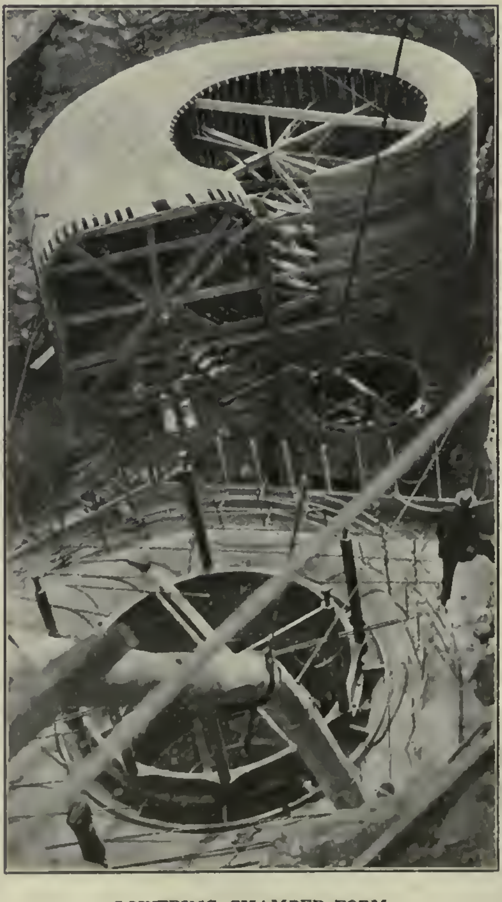
The generators were designed to carry 25 per cent overload continuously, and will stand a momentary overload of 100 per cent and a dead short circuit for two minutes without injury. They were designed to operate successfully in multiple with the generators at the Horseshoe Falls plant.

BUILDING BELOW GROUND LEVEL

The power house is mainly below ground level. This shortens the turbine shaft length, lessens vibratory effects and saves considerable foundation concrete. The excavation was in solid rock, mostly shale, and to the bottom of the draft tubes was 100 ft. deep. The exciter-turbine draft tube, also formed in concrete, joins to the wall of No. 2 tailrace tunnel. The first lift of concrete was brought up 3½ ft. short of the foundation ring of the turbine, which was set on concrete pedestals and fitted with its anchor bolts. The scroll chamber forms were made complete at the ground surface and swung into place complete by derrick. The concrete around the scroll chambers was strongly reinforced. A thrust deck chamber or floor is provided, access to which from the main floor is given by stairway. The inside dimensions of the power house are 90 x 60 ft. The west wall is of plain and reinforced concrete, the other walls being of plain concrete to the ground surface and hollow tile plastered from that point. The crane is carried on steel columns and on the concrete of the west wall. A gallery 20 ft.



EXCAVATION MOSTLY IN SHALE



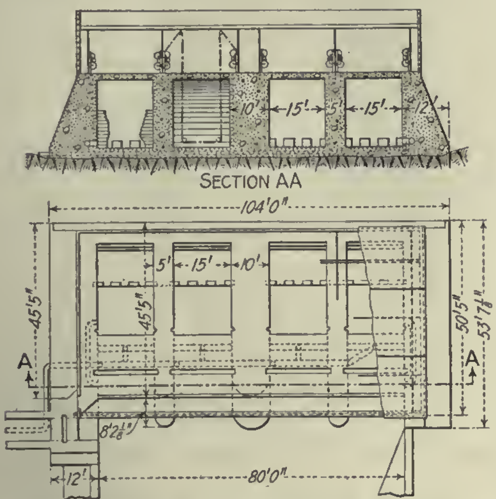
LOWERING CHAMBER FORM

SCROLL CHAMBER COMPLETED

wide over 69 ft. of its length provides for the upper section of the bus structure and the electrolytic lightning arresters, and affords access to the line switches.

TAILRACE

As shown by the general section, the water is carried from the draft tubes through the tailrace tunnels each about 156 ft. long. The normal tailwater level is El. 4085. The inside crest of the tunnel arch was placed at El. 4088. The level of the bottom of the draft tubes is El. 4064.35. The tunnel section at this point was made 23.65 ft. high and 14 ft. wide with a semicircular arch of 7-ft. radius. The floor rises from the end of the draft tubes to El. 4070.13 at a point 60 ft. distant, when the dimensions become 18 ft. high and 14 ft. wide with the same semicircular arch of 7-ft. radius. The tunnels are driven through a soft, seamy shale and had to be heavily timbered. They are lined with concrete of a minimum thickness of 9 in.



WATER CONTROL EFFECTED THROUGH SYSTEM OF TAINTER GATES

The work in its entirety was put through with the company's own forces. All the detail designing for the whole work had to be done as the work progressed, due to the limited time, and was under the writer's supervision, as well as all the field engineering.

At the time the plant was built H. A. Moore was general manager and chief engineer, C. W. Allen was superintendent of construction, and the writer was resident engineer. E. Barnes was general superintendent of operation. At the present time F. J. Robertson is general superintendent over both plants and to him the writer's thanks are due for help afforded in the preparation of this article.

AN ALUM SYRUP PLANT for the Omaha waterworks is now under construction, and Andrew Jacobson, chemist, states that the plant is expected to be put into operation by March, 1916. It is to be similar to the one in Columbus, described in the Engineering Record of May 8, page 576. Apparatus will also be installed to use the alum-iron process which has been developed at Omaha. By a combination of the two processes decided reductions in the cost of coagulation are expected. Charles P. Hoover, inventor of the alum syrup process, saved Columbus $6000 for the city during the first nine months of the present year. Flint, Mich., will soon be using a similar installation in connection with the filter plant.

Leonard Metcalf Suggests Improvements in Public Utility Control and Valuation

Constructive Measures Advocated for Simplifying Litigation and Co-ordinating Efforts of Commissions and Corporations

HIGHER standards of fitness for the personnel of public service commissions, reasonable control rather than dictation of operating policies, and departures from ordinary legal methods of trial are a few of the measures advocated by Leonard Metcalf, in his presidential address before the New England Waterworks Association Jan. 12, for improving the relations between public utility corporations and regulating boards and for reducing the unwarranted high cost of litigation and waste time in cases of valuation and rate-making. In the rating case of the Spring Valley Water Company in San Francisco Mr. Metcalf cited certain modifications of court procedure in segregating evidence of different classes and allowing an exchange of questions among experts on both sides, which halved the time ordinarily consumed in such cases. As a general rule governing the operation of public utilities, Mr. Metcalf said, liberal rates for adequate service are preferred by the public to lower rates for poor service. It is well, too, to bear in mind that good service cannot long follow inadequate returns.

DANGERS OF COMMISSION CONTROL

After emphasizing the desirable features of commission control Mr. Metcalf pointed out certain of its shortcomings. The intrusion of politics is an ever-present danger—the bringing of political or corporate pressure to bear upon individuals where judicial considerations alone should govern. Lack of experience in the construction and operation of public utilities on the part of some men who have been appointed to the commissions, and more particularly of some of the engineering staffs appointed by them, has already resulted in litigation and expense which would have been avoided had these men but had greater experience in the actual difficulties and hazards of construction and operation. Commissions, however, have been seriously hampered through lack of appropriations to command the services of men of mature judgment and breadth of experience in the operation as well as the design and construction of public utilities. Moreover, the uncertain tenure of office in such work has sometimes militated against the commissions and the public.

HIGH COST OF LITIGATION

The lack of breadth of experience of men employed by the commissions in the valuation of public utility properties sometimes causes burdensome expense of litigation. This results from the fact that men of experience often can arrive at results, by methods of approximation growing out of the breadth of their knowledge and experience, which would be equitable, authoritative and acceptable. Thus the extent and cost of preparation of evidence would be confined to narrow limits, whereas with lack of experience on the part of the commission or of its staff, the corporations and the representatives of the public feel it necessary to present evidence in great detail, to make clear to the inexperienced reviewer the force of their claims.

It is clear that if appealed cases become numerous the cost of the utilities' service to the public will necessarily be increased thereby. In waterworks valuation and rating cases the joint expenses of trial to the parties at issue have often amounted to from 10 to 15 per cent of the total value of the property.

Not only have courts, commissions and arbitration boards recognized the burdensome character of this expense, but also lawyers and experts. Conscientious effort has generally been made by the latter to eliminate by agreement, in advance of the trial, as many of the issues at bar as possible, with a view to decreasing unnecessary expense. Often it happens in court trials that while both parties may in good faith desire to bring about such agreement, the political situation may make it practically impossible to undertake it without running the danger of possibly having the subsequent decision called into question by reason of such joint effort. In these cases, the public utilities commissions are in a position to be of marked service to the parties at issue.

TIME-SAVING METHODS

Some interesting and significant departures have been made from the ordinary legal methods of trial with a view to decreasing the expenses involved in such litigation. In the valuation of the waterworks property of the Macon Gas, Light & Water Company, the board of seven arbitrators, consisting of five engineers and two bankers, outlined and adopted the following course of precedure in the interest of economy of time and expense: First, counsel opened with a historic sketch of the situation; second, the witnesses of the corporation and then of the city stated their qualifications, the nature and extent of their investigations, and their findings, briefly and without the intervention of counsel, either in direct or cross-examination; third, counsel on both sides then discussed intangible or semi-intangible values; and, finally, any witnesses desired were recalled by the board at the request of counsel on either side, for cross-examination. This program outlined proved acceptable to the parties at issue. The trial was concluded in two weeks at a cost of about 3 per cent of the amount of the award, instead of 15 per cent, more or less, which might have resulted had the ordinary legal methods of procedure been followed.

SPRING VALLEY CASE SIMPLIFIED

Similarly, the procedure before some of the public utilities commissions is conducted on informal lines, instead of by categorical question and answer with explanation. Also the witness is interrupted by the members of the commission at will in order to make clear, as they arise, any doubtful points and to bring home to the witness any considerations overlooked, which might influence his judgment. Last year the master in chancery of the Federal Court of the District of California, Hon. H. M. Wright, in the trial of the Spring Valley Water Company rating cases at San Francisco, modified the ordinary order and methods of court procedure, first, by hearing all of the evidence upon real estate values before admitting evidence upon structural values; second, by hearing the evidence upon structural plant; and then by having all of the experts give their evidence, simply and in the form of a connected story unaided by counsel, upon a single group of property, such as earth dams, or pumps, or conduits, and by permitting counsel to cross-examine the witnesses after the giving of this testimony and before taking up the next class of items. The experts upon the one side were at liberty to question the experts of the other and to assist the court by statements of their own experience, in the nature of rebuttal, in reply to and as tending to meet the statements of the other experts. The plan worked admirably and the master has said that the time consumed has probably not been over one-third to one-half as great as it would have been if the ordinary methods of court procedure had been followed. Furthermore, the master was thus able to form judgment fairly conclusively upon the various phases of the case as the evidence was adduced, and while the subject was still freshly in mind, instead of being obliged to carry an enormous mass of detail and review the previous testimony.

Limiting Testimony

In a recent hearing before Judge Sessions at Grand Rapids, upon the suit of Ann Arbor vs. State of Michigan, the court limited the introduction of evidence and expenditure of time in the trial, by limiting the cross-examination practically to questions touching upon the qualifications of the witnesses, their honesty of purpose, the soundness of the theories advanced by them, and only the major items entering into the estimates of the engineers. The court refused to consider petty items as likely to have little effect upon the decision. The trial was concluded in six days, which is certainly a remarkably brief hearing for a case involving property values of $10,000,000, more or less. It is of significance, however, as indicating the viewpoint of the court upon methods of trial and the desirability of considering these problems upon broad lines, rather than in petty detail. This case again brings into prominence the necessity for the review of such questions by men of breadth of experience in the construction and operation of such properties.

Another departure which has been suggested is to be found in the appointment, by the court, of a disinterested engineer of experience to aid it in the formation of sound judgment—in effect, calling the engineer to sit upon the bench with the judge to pass upon technical matters and to aid in limiting the lines of investigation to matters of fundamental importance and weight.

The observations here made upon court trials apply in some measure to trial by commission and serve to accentuate the desirability of having competent engineers, as well as lawyers and business men, appointed to our public utilities commissions. The engineering, as well as the legal, point of view is of great importance in assisting to an expeditious and equitable solution of public utilities problems.

Dictation Versus Control

If our commissions are to dictate policies they will require greater opportunity, better facilities and far greater financial support to form and exercise sound, far-sighted judgment. If they then dictate the policies to be pursued in management of the public utilities, the corporations should be relieved of the hazard incident to the enforcement of these policies. If, on the other hand, the corporations are still to be made to bear all responsibility and hazard, they should be given reasonable latitude in determining policies and the demands of future service, and should be accorded rates of return commensurate with the hazards involved in their business.

Adequate Value

The failure to place adequate value upon public-utility properties or to make proper allowance for appreciation in value; the elimination of portions of the property from the rating base, as not actively and immediately necessary to the service of the public, and the reduction of the rates to a point which will not produce a return fairly commensurate with the hazard of the business and in keeping with rates of return prevailing thereabout in other classes of enterprise, all carry with them real dangers to the public, the character and ultimate result of which the public little realizes. Thus, if the difference in value between the mere assemblage of the structures and real estate, "the bare bones of the property," and the living, going concern, with established profitable business—which it has involved time, effort and real cost to develop—be not fully recognized; if spare machinery, reserve structures and reserve properties held for the service of the public or bought for use in the reasonably near future, be excluded from the rating base, or if the rate of return fail to provide reasonable depreciation allowance as well as fair return commensurate with actual hazard, the final result is much the same. The commission may temporarily determine operation and values even to confiscation of a portion of the property value and cutting off of the market for the corporations' securities, but in the long run economic principles will control and this inevitable cycle will follow: Declining service, inadequate service, inability to borrow new capital, and, finally, withdrawal of capital from new enterprises.

If public ownership be the real goal sought, a more direct method of approach would effect a saving in the ultimate cost of acquisition of the desired properties. But various recent occurrences indicates that the general public is by no means prepared as yet to embark upon municipal or government ownership and operation of public utilities, generally or upon a large scale.

It is well recognized by intelligent managers that the public will more cheerfully pay liberal rates for adequate service than lower or even inadequate rates for bad service. Under normal operating conditions the rule is, "Look to your service first; fair rates will follow," though it is equally true that good service cannot long follow inadequate return.

The Remedies

Promising remedies for the dangers and abuses cited may be summed up as follows: 1. Nonpolitical appointments and freedom from political or corporate pressure or control for the public service commissions and their staffs. 2. Long tenure in office. 3. Higher salaries, adequate to attract and hold men experienced in corporate affairs and in the construction and operation of public utilities. 4. As brief and direct methods as possible of establishing value and fair rate of return. 5. Reasonable regulation or control of the utilities by the commission rather than dictation of operating policies. 6. Broad and fairly liberal treatment of the question of value and fair rate of return, particularly in the transition stage from no regulation to full control. 7. Support by the public of disinterested and sound findings in public utility disputes made by competent tribunals, commissions or men—whether these findings bear heavily upon the corporation or fail to meet public expectation.

Many people have a tendency to lose sight of the judicial or impartial stand which commissions should take and to think of them mainly, if not solely, as agencies for reducing rates. The true function of a public service commission is to act as a referee, charged with seeing, on the one hand, that the public has to pay no more than a fair price for the service rendered, and that it receives service of the character for which it pays; and, on the other hand, that the utility receive fair treatment and compensation. The public, and the corporation as well, can derive benefit only from the regulation of utilities by an able and impartial commission. This is equally a fact whether the utilities be owned by corporations or by the public themselves; and the writer would not be surprised to see the jurisdiction of the commissions more generally extended in the near future to cover matters relating to the accounting, financing and making of rates of municipally-owned utilities.

Holland Develops New Types of Shore Protection

Reinforced-Concrete Beams and Slabs Used Extensively in Groins in Late Years—Only Partly Successful to Date

PROBABLY no other country has been forced to fight against the inroads of the sea to the extent that Holland has. The peculiar geographical and topographical conditions, with dikes or dunes protecting the lower land behind them, the wide tidal range, the prevalence of severe storms have all made imperative the study of the best methods of shore protection. In his memorable article, "The War Against the Waves," published in the Engineering Record of April 11, 1914, page 408, Dr. Elmer L. Corthell, consulting engineer, discussed at considerable length the protective devices in use in Holland, as well as elsewhere. Since his study abroad, however, there have been new developments. A recent report to Dr. Corthell from John W. Thierry, of Haarlem, Netherlands, which Dr. Corthell in turn transmitted to the recent Pan-American Scientific Congress, as a discussion of the paper by B. F. Cresson, Jr., on "The Protection of Sandy Seashores," gives much data relative to new departures in groin construction. A characteristic feature is the growing use of reinforced concrete. In some forms this has already justified itself. In others the experiment to date has been unsuccessful. These notes are taken from Mr. Thierry's paper.

Only Groins Are Successful in Holland

In Holland groins have proved the only successful means of flattening the shore and consequently raising the feet of the dunes. Even these have not always proved

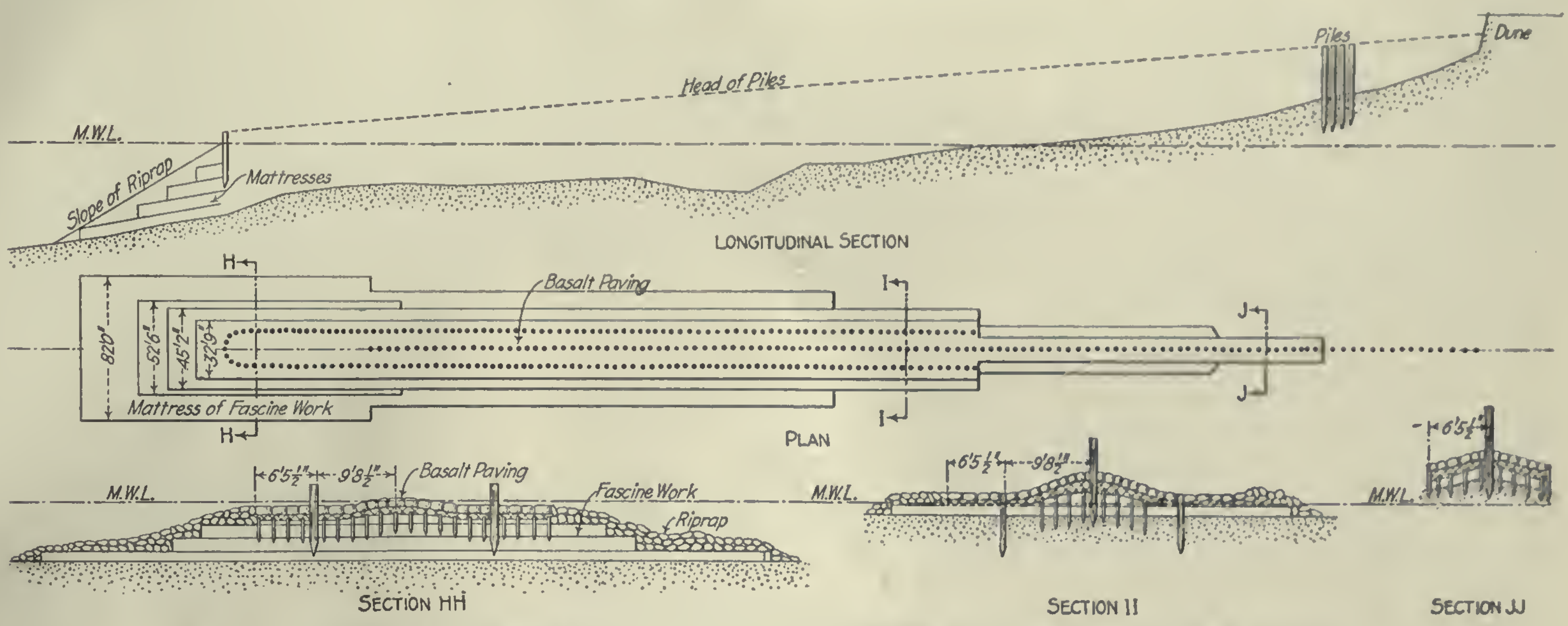


FIG. 1—FASCINE MATTRESSES AND BASALT PAVING CHARACTERIZED THE CONSTRUCTION OF 1895 TO 1902

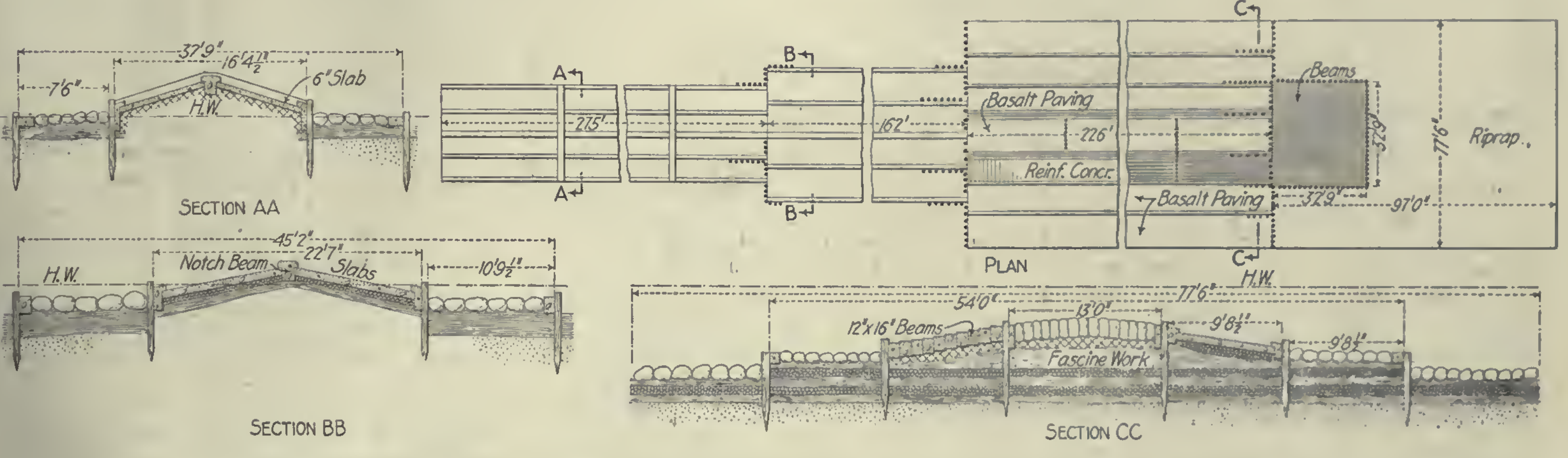


FIG. 2—REINFORCED-CONCRETE BEAMS AND SLABS, AS FIRST USED IN 1906, HAVE PROVED VERY SUCCESSFUL

successful, as some sections of the coast, though defended by groins, have continued to decrease. This points to the fact that the groins were not long enough, and two remedies have been applied: Retiring before the sea, that is, extending the groins landward; and attacking the sea by extending them seaward. The latter method is much more expensive, but is more effective, and is imperative where the dunes are too narrow to permit any further loss.

Beginning in the eighteenth century forty-six groins have been built along the Dutch coast between Hook van Holland and Scheveningen, a distance of 21 km. (about 13 miles). Fig. 1 shows details of the latest six of these, built between 1895 and 1902. Despite the groins the shore near Ter Heide continued to recede, and the landward-extension method was used, until hardly any dunes were left. Then the other form of extension was adopted. A succession of fascine mattresses was laid from the outer ends outward and paved with basalt blocks as in the original design. The lowest of these mattresses was 132 ft. wide.

REINFORCED CONCRETE PROVES SUCCESSFUL

Reinforced-concrete beams were adopted in 1906 at the Hondsbossche Dam in place of the basalt pitching or paving for the side parts of the groins. They can be used only where they can be shut up between piles. Fig. 2 shows details of a new groin constructed at this point in 1912. Both reinforced-concrete beams and reinforced-concrete slabs were employed. At the landward end the center beams disappear and the middle part is composed of concrete slabs held by a notch beam and groove beams.

The groin was very successful in building up the beach. During a severe gale last winter, however, it was severely damaged. For a distance of 200 ft. all of the beams in the narrowest secton were torn away. Probably the heavy wave impact transmitted through the interstices between the beams lifted up the notch beam. Consequently all of the beams worked loose

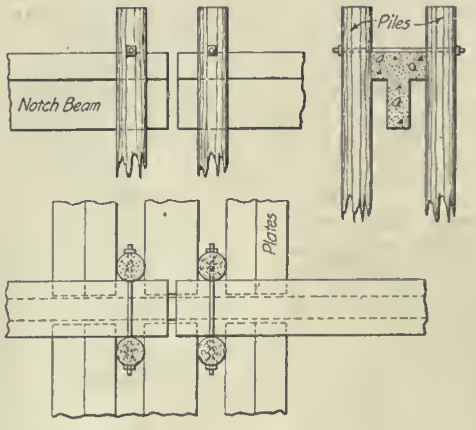
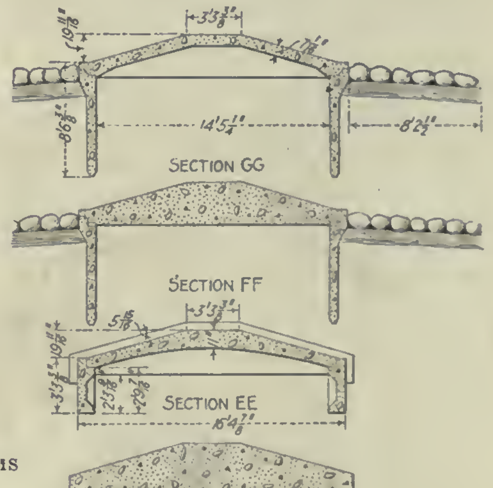


FIG. 3—METHOD OF TYING DOWN NOTCH BEAMS



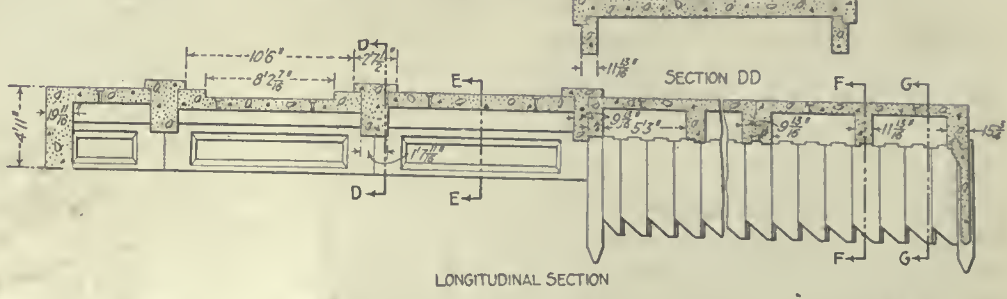


FIG. 4—THESE FORMS OF CONCRETE CONSTRUCTION, PLACED IN 1910 AND 1912, HAVE NOT BEEN WHOLLY SATISFACTORY

and were thrown up on the shore. Within six days, however, the whole groin was repaired with the old beams, only six or seven of which were broken or lost. To prevent recurrence of the damage the notch beams were tied down with ¾-in. rods connecting piles driven into the body of the groin at the ends of the beams, as shown in Fig. 3.

Recent Concrete Vault Construction Not Satisfactory to Date

In 1910 there was applied to the land end of the groins a reinforced-concrete construction consisting of slabs in the form of a vault, supported by side beams and kept in place by heavy cross beams. Under the side beams were beams of fascine work. This construction was not a success, as the gales undermined the fascines and threatened the side beams. Consequently the seaward end of the land section was changed in 1912 in the new groins to the design shown in Fig. 4. Over a length of about 50 ft. the beams were replaced by sheet piling. Side beams were retained for the remainder of the inner end, and the figure shows details of both types. During the last winter, however, the side beams landward of the sheet piling were severely injured, and it was decided to turn back to the fascine construction.

There is a remarkable phenomenon connected with the construction of groins on a sandy shore. The unprotected shore at the ends of a set of groins is eroded more strongly after than before the coast was defended. This is probably caused by the currents along the coast, which are diverted from their course by the groins, and which, when they have reached the last groin, turn toward the shore and erode it. Because of this the provincial government of Zuid-Holland has forbidden the lengthening of any more groins on the Delfland coast.

Literature

For the Civil Engineer and Contractor

New Publications

Report of the Chief of Engineers of United States Army to the Secretary of War, 1915. Paper, 6 x 9 in.; 1727 pages, with 48-page index; illustrated. Washington, Government Printing Office.

Electrolysis and Its Mitigation. By E. B. Rosa, chief physicist, and Burton McCollum, electrical engineer, Bureau of Standards. Technologic Paper No. 52. Paper, 6 x 9 in.; 143 pages; illustrated. Washington, Government Printing Office.

The Structure and Properties of the More Common Materials of Construction. By G. B. Upton, assistant professor of experimental engineering, Sibley College, Cornell University. Cloth, 6 x 9 in.; 327 pages; illustrated. New York, John Wiley & Sons, Inc. $2.50 net.

Earth Resistance and Its Relation to Electrolysis of Underground Structures. By Burton McCollum, electrical engineer and K. H. Logan, assistant physicist. Technologic Paper 26, U. S. Bureau of Standards. Paper, 7 x 10 in., 48 pages; illustrated. Washington, Government Printing Office.

City Planning with Special Reference to the Planning of Streets and Lots. By Charles Milford Robinson. Reissue, revised with much additional material, of the original work entitled, "The Width and Arrangement of Streets." Cloth, 6 x 9 in., 344 pages; illustrated. New York and London. G. P. Putnam's Sons. $2.50.

Reinforced Concrete Construction—Vol. 3. Bridges and Culverts. By George A. Hool, associate professor of structural engineering, University of Wisconsin, assisted by Frank C. Thiessen, instructor in structural engineering, University of Wisconsin. Cloth, 6 x 9 in.; 688 pages; illustrated. New York, McGraw-Hill Book Company, Inc. $5 net.

The Broad Pass Region, Alaska. By F. H. Moffit. Bulletin 608, U. S. Geological Survey. Paper, 6 x 9 in. Washington, Government Printing Office.

Description of the topography and geology of the Broad Pass Region, Alaska, based on work carried on by the U. S. Geological Survey since 1913. Prepared "in anticipation of the probable demand for information about this region because it is traversed by the new government railroad connecting the Pacific Coast with the interior of Alaska."

Books Reviewed

Irrigation in the United States

Author, Ray Palmer Teele, M. A., Irrigation Economist, Office of Public Roads and Rural Engineering, United States Department of Agriculture. Cloth. 5 x 7½ in.; 251 pages. New York and London, D. Appleton & Co., $1.50.

Reviewed by F. H. Newell

Head of Civil Engineering Department, University of Illinois, Urbana.

That "the writer knows of no subject on which there is more public misinformation than the subject of irrigation" is the keynote of this book. Mr. Teele endeavors to present in a clear, readable form some of the elementary facts which will remove much of the misapprehension concerning this subject. Had this little book and the information it contains been available to engineers and investors two decades ago, it would undoubtedly have saved the loss of many millions of dollars. It is not too late, however, for its value to be appreciated.

Proceeding from the elementary historic statements and description of climatic conditions in the arid regions, there is taken up the matter of water supply and crops, but the principal part of the work and one which gives the largest amount of original information is under the head of legislation, irrigation investigations and the organization and operation of irrigation enterprises. A clear but simple analysis of these is given, and it is shown that "the financial success of a project depends upon rapid and successful settlement of the lands to be reclaimed."

In considering irrigation investments, Mr. Teele calls attention to the fact "that the harm has come from the sale of such bonds to small investors on false representation, that they are, in the case of districts, municipal bonds backed in some way by the states and counties, and in the case of irrigation bonds that they are liens on the lands and are backed by the states and the Federal Government."

The long and involved history of these irrigation investments is condensed into readable form; every engineer may learn a useful lesson not merely with respect to irrigation enterprises, but regarding many other projects which appeal to popular enthusiasm. In the past the engineers have been too negligent of this important phase of the works in which they have been employed and have neglected, to their own detriment, the study of the financing of these and the danger which comes to the public through recklessness in the promotion of half explainable schemes.

In conclusion the author discusses the present and future of irrigation and the duty of the Federal Government to continue to assist in various ways. He points out the facts that the present stagnation must gradually be overcome and that there is little doubt but that the arid lands of the West will be utilized ultimately to the full extent of the water supply. There will be a gradual extension of the acreage by individual or community effort and by private agencies, but the development of the larger projects must rest upon some method of co-operation to be worked out between the public and private agencies—one involving a high degree of public supervision and some contribution of public funds, the latter not to be repaid directly. Here is the crucial or danger point, namely in the distribution of subsidies of this kind giving rise to the "pork barrel" allurements. The author makes clear the need and limitations of future growth which will inevitably follow unless some wise contributions are made directly or indirectly out of the public purse.

The book is the result of many years of study of the subject in connection with the investigations of the Department of Agriculture and of the Census, making available in convenient form the larger conclusions derived from these very elaborate undertakings.

Maintenance of Way and Structures

Author, William C. Willard, assistant professor of railway engineering, McGill University. Cloth, 6 x 9 in.; 451 pages, 232 illustrations. New York, McGraw-Hill Book Company, Inc. $4 net.

This is a work for which there has been a great need. Maintenance-of-way literature in book form has been confined to a handful of books. Two or three of these were good when issued, but have not been kept up to date. Furthermore, they were detail discussions, suitable for the reference shelves of the practising engineer, but not for textbooks. Two or three more recent works have been written especially for the classroom, but have fallen short technically. Professor Willard, however, has succeeded in producing a combination work not too voluminous for student consumption, yet technically sound and useful for the roadmaster's library.

Having said this, the reviewer cannot hold back a little pity for the student who must absorb the book; he wishes less of an encyclopedia and more of a human document could have been produced. Whole pages of rules of the American Railway Engineering Association, and conclusions from special investigations, are printed verbatim, with none of the journalistic effort to discard the shell and save the kernel only. Much dry statistical matter is run into long paragraphs, sparing use having been made of tables. The author's expressed opinions are few, the unsophisticated student getting little help as to the choice between two or more types or systems in use. The reviewer does not believe the student called upon to study the book will forthwith become a maintenance enthusiast. Practising maintenance engineers will want it on their shelves, because, as previously stated, the supply of literature on the subject is limited and this is no half-prepared work—but they will keep it for reference, not for recreation.

After a short introductory chapter arguing the importance of the subject the author takes up organization. He sets forth the characteristics of the departmental and divisional systems, but does not state his choice, although his students will presumably ask him which is preferable. He gives detail rules of conduct that could probably be deferred to a poster in the division office.

Chapters 3 to 10 inclusive, with chapter 16, which relates to switches, frogs and turnouts, embrace practically everything that goes to make up track—roadbed, ballast, ties, rail and track fastenings—and do so in comprehensive fashion. The importance of drainage is well brought out. Sundry statistical matter relative to ties, such as the percentages of track in America laid with ties of various dimensions, could well have been tabulated or omitted. A chapter is given to timber preservation, and here the author is probably wise in withholding his opinions. In the chapter on turnouts the author is to be congratulated for having omitted the usual useless matter on circular turnouts.

Chapters 11 and 12 deal respectively with stress in track and the design of track. The author tells considerable about prevailing axle loads and speeds, and gives mathematical demonstrations of impact and the like, but when the student reaches the end he will perceive that somehow he has not learned how to translate these things into something tangible to help him design track. The author would have been kinder if he had let the student into the secret—that this has not been done yet, and that a joint committee of two national engineering societies is trying to learn how to do it.

Chapters 13, 14 and 15 cover respectively signs, fences and crossings; accessories to track (buildings, engine terminals, water tanks and so forth); and bridges, trestles and culverts. The author's conservatism of opinion is shown in the section on engine houses, when he says they "may be either circular or rectangular," with no intimation that the one is the rule and the other the exception. He fails to bring out what constitutes an engine terminal in its entirety, and says nothing about yards, probably for the same reason he gives for omitting signals, because the subject is too big to be covered adequately here.

Chapter 17 sets forth the various classes of maintenance work necessary, and times and manner in which they should be done. This chapter is straightforward and free from fine-print rules, and is a useful one for students. The last chapter, chapter 21, which discusses the annual program and should perhaps come next, reverts to some extent to undigested fine print. Chapter 18, on machinery, tools and supplies, gives detail dimensions of everything from brooms to hand cars, and pictures and descriptions of larger work equipment.

Chapters 19 and 20 have to do with records and accounts, and in the former is a presentation of the requirements of the Interstate Commerce Commission regarding maps and profiles for the valuation work, and also of the requirements of the Board of Railway Commissioners of Canada.

One maintenance development that the author seems to have missed entirely is the unit system, developed on the Pittsburgh & Lake Erie, Baltimore & Ohio and other roads.

In conclusion the reviewer would merely repeat his opinion that the book will be heavy and uninspiring reading for the student, but that it is carefully prepared and technically accurate in the main, and should prove an excellent reference book. Even as a text it is far better than one which merely skims the surface and is inaccurate.

Letters to the Editor

Comment on matters of interest to engineers and contractors will be welcomed

Brooklyn's Fill-and-Draw Tank Not a Small One

SIR: I should like to call attention to a statement in your issue of the first instant, under the heading "Activated Sludge Sewage Treatment."

The statement that the fill-and-draw experiments on activated sludge conducted by the Brooklyn Bureau of Sewers were on a small scale tends to convey a somewhat misleading impression. Our fill-and-draw tank was second in size only to the Fowler tank at Milwaukee, being of 16,000-gal. capacity as against approximately 25,000 gal. in the latter case.

I think it must be granted that this is somewhat more than a small-scale experiment.

WILLIAM T. CARPENTER,
Bureau of Sewers.
Brooklyn, N. Y.

Decimals of the Degree and of the Full Circle

SIR: During the past half year or so your journal has contained considerable discussion of the decimal division of degrees, this subject having been revived by the publication of Professor Raymond's "Field Manual for Civil Engineers." Possibly you will tolerate further mention of this matter.

While none of us can expect to survive until the day of the general use of the decimal system, there should be unqualified encouragement of all moves in the right direction. The majority of our units of measure seem to have been chosen by guess to the great inconvenience of every one who must use them. Since so many tables are necessary in the uses of angular measure, the change from the established bad practice will be a slow one. The adoption of the decimals of a foot in steelwork and similar construction is a change which could be accomplished far more readily, yet we go merrily ahead surveying to thousandths of a foot and designing bridges to fractions of an inch. But since one desirable improvement has been inaugurated, there is some hope for final relief from the nerve-racking and unproductive work of reducing our major units of measure to their clumsy subdivisions.

Instrument manufacturers could improve their product and, at the same time, give substantial aid in simplifying surveying computations if they would equip their transits with one vernier plate which would give decimals of a degree. An engineer would be reluctant to buy an instrument which would not read to minutes, since his work would frequently require this division. But he could feel free to adopt the more reasonable division on new work if his instrument were so arranged. The focusing screw could be placed on the side of the telescope in order to be equally serviceable to the two directions of the instrument. Also, the manufacturers could offer to sell new vernier plates to fit old transits of their make. One such plate on an old transit would make the instrument available for the new system without robbing it of any of its present usefulness. While such a vernier plate would possibly be too long for the space allowed in the instruments as now constructed, such plates to be supplied for old transits could consist of a half vernier on each side of the zero in the manner common to the verniers of vertical circles.

Concerning the decimal division of the circle, little need be said. However, mention of two points should brand this idea as being superfluous. First, we seldom have occasion to consider any unit of measure in its relation to the whole circle. Besides, the substitution of a new main unit for the degree would lead to endless confusion during the process of the change while both units would necessarily be in common use. Second, no decimal part of a circle would be a convenient unit for transit use. The hundredth part, 3.6 deg., is too large and the thousandth part, 0.36 deg., is too small for the main division of the transit plate. This latter unit is too large for the smallest reading of the vernier, and one-tenth part of this, 0.216 min., is too small. On the other hand, the hundredth part of a degree is a very fitting subdivision for the vernier of a modern transit.

It might be added that with a vernier plate as suggested hundredths of a degree could be read as easily as minutes are read now. The vernier would be longer, the single scale being 24½ deg. in length as compared with the 14½ deg. of the present type, but the extra length would introduce no difficulty in the construction of the instrument.

LEONARD C. JORDAN,
Heffley School of Civil Engineering.
Brooklyn, N. Y.

Self-Dumping Scows

SIR: I note in your issue of Jan. 8, page 60, an article on "Filling Scows to Dump Them," and would state that during the First American Intervention in Cuba, as assistant superintendent for the department of street cleaning and parks in the City of Havana, I devised and built dump scows which were used from about 1901 until 1910 to take the garbage out of the city to sea and dump it. These scows may still be in use, but I am not sure. I obtained a patent for this scow and presented it to the City of Havana.

The scows used were about 100 ft. long, 30 ft. wide and 10 ft. in depth. They were decked scows, and the load was carried upon the deck. There was a longitudinal watertight bulkhead running through the middle of the scow with a shutter valve in one end. There was a 12-in. gate valve in the end of one of the compartments. The valve stems for both the valves were carried to the deck, so that the valves could be opened and closed from there. These scows were loaded with about 300 tons of garbage, towed to sea, and the sea valve opened to let in water enough to dump the load. The sea valve was then closed and the shutter valve opened to right the scow, which was then towed back to its place and pumped out, using fuel obtained from the garbage.

Before the use of these scows, from twenty to thirty men were sent out with each scow and the garbage dug off. This took about three-quarters of a day, and during stormy weather often could not be done at all. I have seen eight scows, some of them rented at $35 a day, lying loaded with garbage in the harbor of Havana. The self-dumping scow went out in all weather, took less than five minutes to dump, and there were no accidents.

T. WARREN ALLEN.

Washington, D. C.

To Trisect an Angle

SIR: It is with some astonishment that I see so gravely presented in the Engineering Record of Jan. 8, page 57, the solution of the trisection of an angle by compass and straightedge. I had thought the fact better known that this problem is in the same category as the squaring of the circle. The method shown is, of course, merely an approximation, whose degree of correctness is dependent on the given angle.

As the practical trisection of an angle can be readily effected in a few minutes by successive approximations with a pair of dividers, why this waste of time and space in the vain pursuit of the demonstrably impossible geometrical solution?

G. B. PILLSBURY.

New London, Conn.

SIR: The letter by Lieut. Natal Arnaud on the trisection of the angle which appeared in the Engineering Record of Jan. 8 greatly surprises me. Lieutenant Arnaud gives what he calls "another solution of the problem." It is a familiar fact that the trisection of the angle is (like the problems of the quadrature of the circle and the duplication of the cube) impossible by the use of ruler and compass alone.

The "solution" of Mr. Arnaud can therefore best be a rough approximation to the actual solution of the problem of trisection—an approximation which may, however, be of some practical value.

Looseness of statement in matters of this sort is to my mind inexcusable, and I think it is desirable to call attention to this case lest some of your readers be left under a false impression concerning the problem of angle trisection.

ALBERT LOUIS WECHSLER,
Columbia University.

New York City.

[Lieutenant Arnaud's method was published merely as another interesting attempt at the impossible.—EDITOR.]

Engineers' Technical File

SIR: The article by Louise B. Krause in your issue of Dec. 18, page 760, is interesting, but the system fails at the point where all the short cuts do; namely, in locating items of information not indicated by the general titles of articles in the technical periodicals. What I mean may best be indicated by a specific case, which is used for convenience because it is just at hand, though it is hardly typical of the kind of information that may appeal to engineers of experience.

In an article describing the Wallace plan for the elimination of grade crossings in Dallas, Tex., is the statement that crossing gates and bells cost $400 per crossing and that the cost of watchmen is $1,000 per annum. The only way that item of information could ever be found again would be by indexing it either in a card index under "Crossing Gates" or in a loose-leaf notebook under the same heading. In, say, two years from now, if one were looking for information on the costs, or costs of operation of crossing gates, one might run across it by looking up all the articles on grade crossings, but as these are almost innumerable this latter is practically buried if not indexed, and the argument applies whether the article be clipped and filed or whether the volume be filed and no matter what facilities exist for finding the article by the title.

The writer has found no short-cut system for filing that would enable detailed information of this character to be found more easily than by compiling one's own index (practically as some form of the Dewey decimal system) with sufficiently minute sub-divisions to cover the ground, and by doing the work necessary to keep it up to date. A small up-to-date file is better than none, but unless a file and index system is quite complete, it will generally be found to contain everything but the thing which is wanted *now*. My own experience has convinced me that even with the aid of a secretary, who must be a person of some intelligence, it means a certain definite amount of personal work on my own part at least to indicate that part of the vast volume of technical writing which it seems necessary to index in order to keep up to date. Most often when these things are needed there is no time for painstaking search, and it is quite as often that it is some minor detail that refuses to be found and causes trouble as the solution of a great problem.

F. LAVIS,
Consulting Engineer.

New York City.

[Miss Krause makes the following reply to the letter of Mr. Lavis.—EDITOR.]

SIR: The copy of the letter from Fred Lavis to the Engineering Record, commenting upon my article in your issue of Dec. 18, has been duly received. I appreciate the opportunity you have given me of making the following reply to Mr. Lavis' criticism:

To state the case briefly, Mr. Lavis thinks that the system of subject indexing technical data advocated in the writer's article fails, in that it does not provide a method of finding "items of information not indicated by the general titles of articles in the technical periodicals." This criticism is not justified, as careful reading of the article will show that it very plainly advocates making as many specific subject entries as is desired. To quote from the article in question: "Each piece of data should be indexed under its most specific subject heading and not under a broad term which includes several definite divisions of a general subject. It should be indexed not under one subject only, but under any other subjects on which it gives useful information." This statement not only was made in regard to subject indexing of manuscript data, but also was repeated in regard to printed and periodical information.

The writer of the article might possibly have elaborated the explanation in order to show the application of this principle in making just as many analytical subject entries to any article as the engineer desired, but did not think it necessary, as the inference seems entirely plain. It did not seem necessary to state the fact which should be well known, that *subject* indexing never takes into account the wording of the title of an article, but is concerned only with the exact subject content of the article, no matter by what title name it may be called.

Mr. Lavis states that in his judgment the best system for filing is "to compile one's own index (practically some form of the Dewey decimal system)." In making this statement Mr. Lavis is undoubtedly clear as to its meaning in his own mind, but his use of the word "index" in this sentence is apt seriously to mislead and confuse the general reader. The Dewey decimal classification is a numerical system for classifying and filing all material on the same specific subject under the same number.

What Mr. Lavis means is that he approves of copying on catalog cards the gist of certain data on particular subjects, giving the references as to where they can be found in full, and then classifying and filing these cards according to a decimal subject system. This arrangement of the cards makes what is called a *classified* subject index, and should not be confused with the *alphabetical* subject index advocated by the writer. The writer recommends a straight alphabetical index of subjects arranged like words in a dictionary and which serves to indicate where the desired information may be found without having assigned to it a subject classification number.

The gist of the matter under discussion is, therefore, that Mr. Lavis does not agree with the writer in advocating a simpler and less complicated system for filing and indexing, but this is only a matter of a difference of opinion and does not mean that the system which Mr. Lavis does not approve is a failure because it does not give satisfactory results. Readers of the article in the Engineering Record of Dec. 18 will note that the writer does not disapprove of the use of the Dewey decimal classification (in fact, is using it every day), but is only describing a simpler and entirely satisfactory way for an engineer to handle his personal material when he does not have the help of a library expert to guide him through the intricacies and difficulties attached to the use of any subject scheme based on the Dewey decimal classification.

The writer heartily agrees with Mr. Lavis that the indexing of engineering data should be minute, accurate and kept strictly up to date, and that it must be so administered that all information desired can be found immediately. A number of engineers have come to recognize that these results cannot be uniformly and continuously obtained without adding to their staffs trained library experts, who supply a knowledge and skill which the engineer does not have along these lines, unless he has qualified by having taken a course of study in library science.

LOUISE B. KRAUSE,
Librarian, H. M. Byllesby & Co.

Chicago.

THE ALTAI RAILWAY IN WESTERN SIBERIA is now completed, acording to the Russian Supplement in the London *Times* and will soon be opened to traffic. The line runs from Novonikolaievsk, on the Trans-Siberian Railway, through Barnaul to Semipalatinsk in the Steppes Provinces. It is 500 miles long and will serve the richest agricultural and mineral regions to be found in Siberia.

HINTS FOR THE CONTRACTOR

Details Which Save Time and Labor on Construction Work

Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

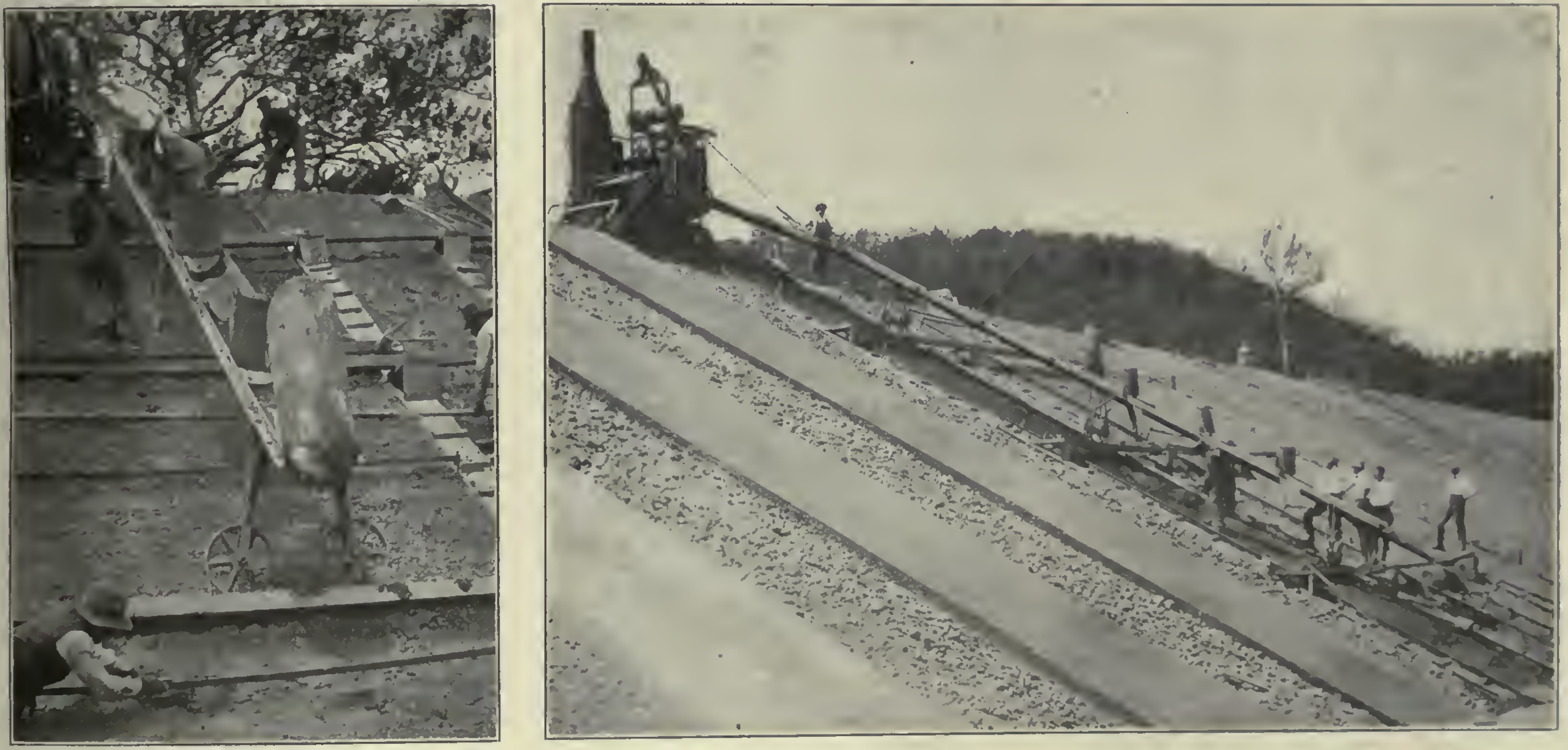
[*Contributions to this section are solicited, and if found available will be paid for. They must be* SHORT, *and should be accompanied, if possible, by photographs or sketches.*—EDITOR.]

Wheeled Spout Aids Concreting of Levee Slopes

CONCRETE protection for the river base of a 1600-ft. levee has recently been poured economically in alternate up-and-down strips by the light, sectional wheeled chute shown in the accompanying photographs, which delivered concrete from a mixer moved along the top of the embankment.

The dike will protect a thickly-settled section of Binghamton, N. Y., from floods on the Chenango River, which four times in recent years has inundated this part of the city. The entire levee is 2600 ft. long, the earth portion being built across the smaller, westerly channel of the river to Comming's Island. The east channel and part of the island was dredged out with a dragline and removed with a steam shovel and cars to provide material for the embankment. Most of the bank required a 20-ft. fill, the maximum being 35 ft. This brings the top of the levee to 26 ft. above low water and 6 ft. above the highest recorded flood. The remaining section of the dike consists of a steel-sheet-pile section 475 ft. long and a 500-ft. concrete wall.

The 6-in. reinforced-concrete slabs of the river face of the embankment were cast in alternate 10-ft. strips, using forms similar to sidewalk forms. They are carried down 4 ft. below low water mark. Although it was expected that a dry mixture would have to be used, it was found possible to hold a thoroughly wet mix on the 2-to-1 slope. The sectional chute, designed and furnished by the Foote Manufacturing Company, which supplied the mixer, was supported on wheels which rolled on scantlings laid at intervals across the top of the forms. The slabs for this section of the work were reinforced 2 in. from the bottom with No. 41-gage woven wire mesh to minimize damage from ice jams. The 1800 cu. yd. of 1:2:4 concrete laid on the levee slope cost $7.90 per cubic yard, according to John A. Giles, city engineer of Binghamton, who had charge of the project. Arthur L. LaRoch, engineer in charge, supervised the construction of both sections, while H. W. Fitzgerald was contractor for the embankment section described.



SECTIONAL CHUTE CONVENIENTLY MOUNTED ON WHEELS FOLLOWS MIXER ALONG LEVEE, PLACING CONCRETE WITHOUT NEED OF SHOVELING

Another Way to Keep Centrifugal Pump from Losing Prime

STILL another way of keeping the water in a cofferdam low with a centrifugal pump when the leakage is less than the capacity of the pump is reported by J. E. Thompson, with Larkin & Sangster, contractors, Seneca Falls, N. Y. Mr. Thompson's method differs from that described by William G. Broadhurst on page 611 of the Engineering Record for Nov. 13 in that the pump runs continuously at normal speed, and from the other method, described on page 802 of the Engineering Record for Dec. 25, in having only one regulating valve, and that on the discharge line just above the fan case. The 5-in. electrically-driven centrifugal pump replaced a 2-in. duplex pump, and the problem was to keep the hole dry without constantly priming the pump while the excavation progressed and the leakage increased, and then while the concrete was being placed and the flow of water gradually shut off. This was readily accomplished by putting a 5-in. gate valve in the discharge line just above the pump and throttling the discharge down until it just balanced the leakage. Another advantage of this arrangement was the ease with which the pump could be primed after shutting it down to shorten the suction. This was done by opening the valve and filling the fan chamber with water previously trapped in the discharge above the valve.

Freezing of Flood Water Under Swamp Buckles Falsework

By R. C. HARDMAN

Colorado Springs, Col.

IN CONSTRUCTION work hints of what not to do are just as important as those of an opposite nature. A short time ago, during the building of a concrete structure over swampy ground, a combination of circumstances occurred which might have had serious consequences if the concrete poured had not had time to set and the falsework had not been weakened by the removal of a part of the bracing. The site of the work was a low place which in wet weather was filled with "cat-tails." In making excavations, about a foot under the surface a layer of sand over coarse gravel and boulders, carrying a strong underflow of water, was found. Through the site ran an irrigation and power ditch about 20 ft. wide and 3 ft. deep, which apparently had no connection with the underflow, as it was possible to lower the water in excavations with a hand pump on the very bank of the ditch and water stood at different levels though only two or three feet apart.

The work was done in the winter when the ground was frozen and the power ditch had a thick covering of ice with a consequently restricted channel. The falsework for the superstructure was built directly on the soil, although the loads were distributed so that a sudden thaw would cause no appreciable settlement. The shores were of doubled 2 x 4-in. pieces tied together transversely and longitudinally by horizontal and diagonal braces 1 x 6-in. material.

One night after the superstructure had been poured and had set sufficiently for a part of the braces to be removed, the employees of the flour mill operated by the power ditch let down a flood of water much faster than the restricted channel could carry it. The apparent result was to force some of the ditch water into the underflow. At any rate, the ground under the structure was so heaved up that the shores buckled a foot out of the vertical in a height of about 25 ft. While the movement was not large, it would have caused difficulty had the flooding and freezing taken place while the concrete was green and before the removal of the braces, which allowed lateral movement in the shores. It was at first thought that the buckling was due to some unaccountable settlement of the structure, but an instrumental check soon disproved this. By coupling the circumstance of the unusually hard freeze with the flooding of the ditch and the underflow, the assumption was arrived at that additional water had gone under the ground and had frozen, thereby causing the upheaval.

Flume Bridges Break While Large Brick Sewer Is Repaired

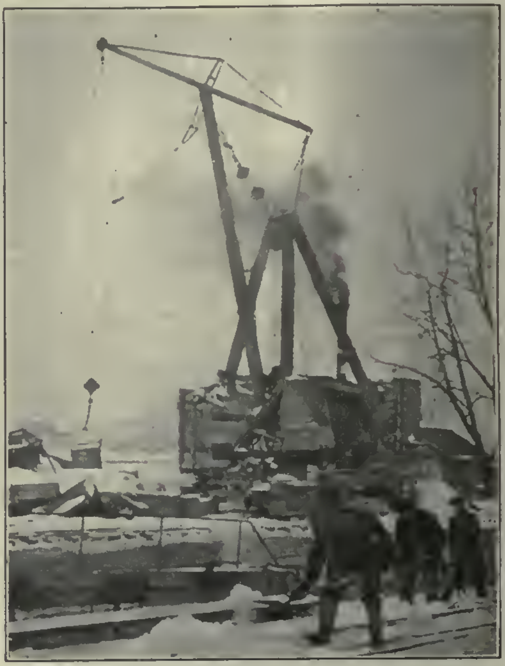
A STEEL-RIBBED semicircular wooden flume, assembled and sunk in place, was recently used to carry the flow of a damaged Chicago sewer and serve as invert form for repairing the break.

In building a subway underneath its tracks at Western Avenue and Bloomingdale Road the Chicago, Milwaukee & St. Paul Railway Company found it necessary to drive piles on either side of an 8-ft. brick sewer which rested in soft blue clay in order to prevent the load from a bent of column footings from coming directly on the sewer. The bottom of the footing excavation was at the center of the sewer. In driving the piles, the soil pressure raised the brick invert about 14 in. and the top part of the ring collapsed. Men were put to work immediately removing all brickwork and masonry proper, and the pile-driving work was completed as rapidly as possible. All brickwork was removed and a small portion of the lower excavation was made before an attempt was made to take care of the water and secure a dry bottom. The sewer normally ran from 2½ to 4 ft. deep, and frequently during the progress of the work light rains would cause it to run so full that at points along the line the water would rise in the manholes about a foot above the top of the sewer. When all the brickwork was removed and the soil excavated about to the bottom of the invert a semicircular flume was constructed of bent angle irons, lagged with 2 x 8-in. lumber, which is shown in the accompanying drawing. The ribs for this flume were placed in position above the water line and gradually lowered as lagging proceeded. When the necessary lagging had been placed the flume was lowered until the projecting ends of the lagging rested on the invert of the undisturbed sewer section at each end. The ends of the flume were made tight by calking them with burlap and clay. A 6-in. centrifugal pump had been set up on the site and within a very few minutes after the flume was sunk the hole had been pumped dry. The flume proved practically watertight. It was then a small detail to make the necessary excavation and pour concrete for the lower part of the sewer. After the concrete work had been finished it was only necessary to raise the upstream end of the flume a few inches and let the water get under it. This immediately loosened the entire flume and caused it to float at some distance above its original location, where it was easily taken apart. The top of the sewer was ordinary three-ring brick, which was placed in the usual manner. The centers supporting this work were removed and taken from the sewer at a manhole a short distance below the bridge.

Walking-Beam Traveler Reaches Over Lock Walls

A VERY handy traveler derrick for reaching over high walls without an abnormally long boom is shown in the accompanying photograph. Contractors who have built government locks and dams will appreciate the point of the walking-beam at once. It enables the traveler to rest on the lock floor and reach over the walls with an ordinary boom to handle forms and do other work. The rig shown in the photograph was one of two used in constructing the Government lock and dam on the Hudson River at Troy. It was designed by D. A. Watt, assistant engineer, and was built at the U. S. engineer yard at Troy.

The walking-beam consists of two light steel channels trussed on top and resting on the sheave pin in the outer end of the boom. From one end hangs the main fall, while the other end is tied to the pin at the heel of the boom by two 1-in. wire ropes. While the angle between the boom and the walking-beam is usually fixed it can be varied to suit conditions by adjusting these ropes. The outboard portion of the beam is 16 ft. long and the inboard portion 14 ft., the difference being made so that the beam will not tend to tip out of position. The wooden boom is 40 ft. long, and the derrick runs on a track of 10 ft. gage. All parts are designed so that the derrick, the framing, etc., can be quickly and easily taken apart and reassembled for use on other portions of the work. The derricks are very quick in handling. If a good load has to be lifted on a low boom, as a yard bucket of concrete, a movable guy line, adjusted by block and tackle, is run to the head of the mast.

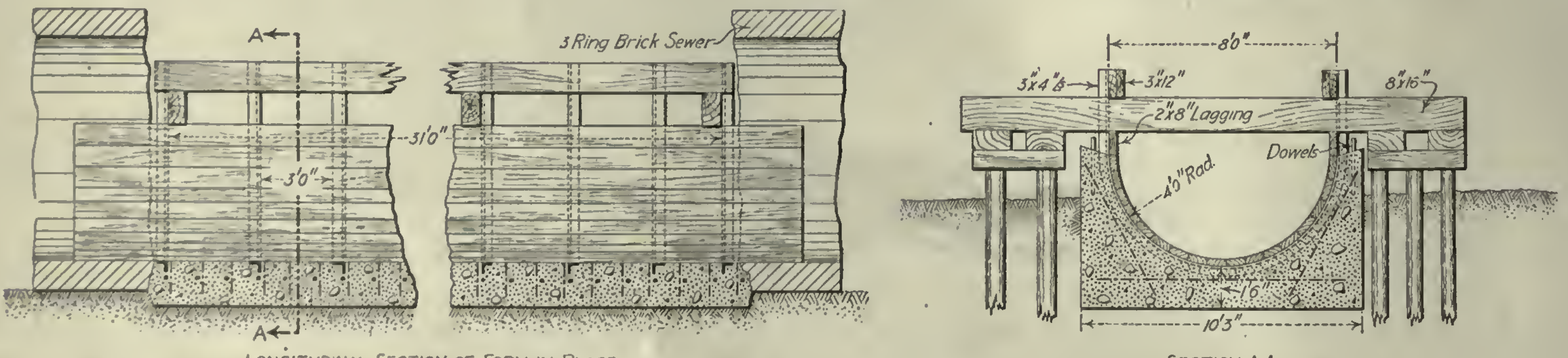


TRAVELER TO REACH OVER LOCK WALLS

The lock and dam at Troy, the completion of which was noted on page 61 of the Engineering Record for Jan. 8, 1916, was built by Government forces under the direction of the Corps of Engineers, U. S. Army, Col. William M. Black being in general charge of the district and Maj. M. J. McDonough in charge at Troy.

Dynamite to Loosen Stuck Machine Keys

A TEASPOONFUL of dynamite, judiciously applied to the end of a stuck machine key, mud-capped and fired, has often saved Mr. Mills, a Nebraska machinist, much trouble, according to a recent letter to the editors of the *Du Pont Magazine*. The dynamite used was 40 per cent strength, and the caution is added that unless the charge is placed very accurately the flywheel or the key may be broken. Machinists who have wrestled with stuck keys in large compressor or pump flywheels, where quarters were too close for swinging a hammer, will appreciate this suggestion, though considerable skill would doubtless be required in putting it to use.



LONGITUDINAL SECTION OF FORM IN PLACE

SECTION A-A

FLUME, BUILT AND SUNK IN PLACE, WAS LOOSENED AFTER CONCRETING INVERT BY FLOW IN SEWER AFTER RAISING ITS UPSTREAM END

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

American Society Elects Elmer L. Corthell President

Consulting Engineer of International Reputation Has Long List of Varied Works to His Credit

Elmer L. Corthell, Dr. Sc., consulting engineer, Civil War veteran, railway and bridge builder of international fame and eminent authority on harbor development, river control and shore protection, was elected president of the American Society of Civil Engineers at the annual meeting in New York this week. In his long and varied professional career in this country, Europe and South America, Dr. Corthell has given his services probably to a greater variety of large-scale engineering works than has any American engineer in consulting practice to-day.

He was born in South Abington, Mass., in 1840 and after spending two years at Brown University he enlisted as a private in the Union Army when the Civil War broke out, advancing in his four years of active service to the grade of captain. After the war he returned to Brown and received the degrees of B.A. and M.A.

From the time of his graduation until 1874 he was engaged in municipal engineering work in Providence, R. I., and railway and bridge work in Illinois and Missouri, at the end of this time being chief engineer of important levee building and construction of a bridge over the Mississippi River at Louisiana, Mo. This structure has a draw 444 ft. long, the longest in the world at that time.

Dr. Corthell's name is closely linked with the history of the control of the Mississippi River at its mouth. In 1875 he was engaged by the late James C. Eads to take charge of the engineering and construction of the jetties at the mouth of the Mississippi. On this work he was engaged for four years and when it was finished he wrote and published an illustrated "History of the Mississippi Jetties."

In 1880 he went to Mexico to make surveys for the ship railway project for crossing the Isthmus of Tehuantepec. The next four years he devoted to railroad and terminal construction in the United States, at the same time giving the benefit of his advice to the work in Mexico. From 1885 to 1887 he devoted nearly all of his attention to the ship railway project.

Entering into a partnership with George S. Morison in 1887 Dr. Corthell undertook the design and construction of railroads, bridges harbor works and waterworks. Many notable structures were built, among them being the Cairo bridge over the Ohio River for the Illinois Central Railroad, the Nebraska City bridge over the Missouri River for the Chicago, Burlington & Quincy Railway, the Sioux City bridge and others. Dr. Corthell served as chief engineer, from 1889 to 1890, of the St. Louis Merchants bridge over the Mississippi River and chief engineer of the improvements at the mouth of the Brazos River at Texas, consisting of jetties in the Gulf of Mexico. For the next three years he acted as consulting engineer of important railway construction in Chicago. He was in charge of extensive improvements at the harbor of Tampico, Mexico, and then went to Europe where he made a long tour of inspection of engineering projects of all kinds.

The Mexican Government retained him in 1882 to complete the important inter-oceanic route across the Mexican Isthmus. By this time he had achieved such professional dis-

(*Continued to page 129, second column*)

New President of the American Society of Civil Engineers

DR. ELMER L. CORTHELL

Unusually Spirited Discussion Characterizes Annual Meeting of American Society

Prof. C. R. Mann Raises Important Question, "What Is an Engineer?" —Meeting Votes in Favor of Military-Preparedness Resolutions

WHAT is an engineer? This question was raised by Prof. C. R. Mann of the Carnegie Foundation at the sixty-third annual meeting, Jan. 19, of the American Society of Civil Engineers, in a short talk explaining the work of the Foundation in the study of engineering education. Summarized replies from 1500 engineers to questions sent out last spring by the Foundation indicate that technical ability is worth but 13 per cent in a total of 100 per cent—non-technical attributes, such as character and executive ability, constituting the remaining 87 per cent. Before the Foundation accepts this ratio, however, another set of questions bearing directly on the matter will be sent out, and to a larger number of engineers. Military preparedness was brought into consideration by a set of resolutions offered by R. S. Buck. The spirit of the resolutions was accepted by the meeting, but their ponderousness was criticised, and the board of direction was instructed to edit them that afternoon for presentation at the congress of the American Security League in Washington the next day. Debate over whether or not the committee on materials for road construction was doing satisfactory work or could do it without enlargement or change of personnel ended in a vote to request the board of direction to consider the advisability of enlarging the committee and its scope. A plea for closer co-ordination of the national society with local societies on the one hand and engineers of other countries on the other was voiced by the incoming president, Dr. Corthell.

As is customary, the meeting was held at the society house in New York. An hour after its adjournment 712 registration cards had been given out, slightly less than last year.

Directors' Report

The annual report of the board of direction for 1915 showed a gain in membership of only 231, as compared with 406 for the previous year. The decrease is attributed mainly to general financial conditions. The total membership Jan. 1, 1916, was 7909.

The library now contains 25,872 bound volumes, 48,452 unbound volumes, 7859 specifications and 5236 maps, photographs and drawings—a total of 87,429 and a gain of 3965.

Twenty-three meetings, which about 5022 attended, were held during the year. Twenty-one formal papers and four lectures were presented. Five papers were also published but not discussed at any meeting. The number of members and others who took part in the preparation or discussion of these papers and lectures was 252.

During the year $10,000 was paid on the mortgage of the society, reducing the debt to $50,000. Increased expenditures for the work of the special committees, and for mileage to members of the board of direction and the nominating committee, due to a larger attendance, prevented any increase in the reserve fund, which remains at $90,000. Payment of the mortgage debt in full may be made soon, leaving $40,000 in the reserve fund.

Road Construction and Materials

The first special committee to report was that on materials for road construction. E. W. Stern expressed the view that the committee had not produced authoritative recommendations such as the society might reasonably expect, and moved that the board be requested to enlarge the committee. The chairman defended the committee's work, and considerable debate followed, which terminated in a compromise motion, which was adopted, that the board be requested, as stated in the first para-

Circuit Court Upholds Indiana Fire Marshal Law

The State Fire Marshal law of Indiana has been declared constitutional by the Circuit Court in a decision rendered by Judge Denney in the case of the Red Cross Lodge No. 88, Knights of Pythias, vs. W. E. Longley, State Fire Marshal, et al. The Lodge sought to enjoin the Fire Marshal from tearing down a livery stable in Portland, Ind., which the latter had ordered removed on June 18, 1913, for the reason that it constituted a fire menace.

After appeal by the Lodge to the Circuit Court, a change of venue and final appeal for an injunction, the trial on Dec. 24, 1915, was limited to the question of the constitutionality of the law on which the Fire Marshal's order was based. After holding the matter under advisement for some time, Judge Denney rendered judgment for the Fire Marshal and refused to grant the injunction.

graph, to consider the desirability of enlarging both the committee and its scope.

Speaking for the committee on a national water law in the absence of the chairman, Gardner S. Williams read part of the progress report printed in the December *Proceedings* of the society. The conclusion reached by the committee is that the uses of water are so diversified and important that a national water law is inadvisable until engineers have discussed the vital principles.

What Is an Engineer?

In connection with the report by Desmond Fitzgerald, chairman of the committee on engineering education, Prof. C. R. Mann of the Carnegie Foundation, which the society's committee is assisting in the investigation, made a short talk which aroused the interest of all. He pointed out that the fundamental problems were what constitute the essentials of a successful engineer, and how they are measured. Last spring, in response to questions on these points sent out to practising engineers, 1500 replies were received. These were carefully studied, and from them were compiled the following composite opinion of the relative values of attributes:

1. Character, including integrity, responsibility, resourcefulness, initiative	41.0	
2. Judgment, including common sense, scientific attitude, perspective	17.5	
3. Efficiency, including thoroughness, accuracy, industry	14.5	
4. Understanding of men, executive ability	14.0	
		87.0
5. Knowledge of the fundamentals of engineering science	7.0	
6. Technique of practice and of business	6.0	
		13.0

Professor Mann pointed out that if technical ability is worth only 13 per cent, technical education should evidently be radically changed. Before accepting this rating, however, another set of questions will be sent out, the answers to which will, he hopes, confirm or refute the figures. He holds that if the engineer will define the finished product desired from the technical school the school man will turn it out.

Other Committees

The committee on stresses in track reported that the various apparatus for measuring the stresses had only recently been brought to a satisfactory state, but that tests had already been instituted on a section of the Illinois Central Railroad near Champaign, Ill. The committee on flood prevention offered its report as final, and a motion was made to accept it and discharge the committee. Morris Knowles, author of the minority report, urged that the committee be continued, however, and his motion was carried. The committee on concrete and reinforced concrete announced that a final report would be submitted before July. Progress was reported by the committees on valuation and the bearing value of soils. No report was made by the committee on steel struts and columns, as its progress was reported in the December *Proceedings*, and none was made by the committee on compensation of engineers.

Military Preparedness

R. W. Buck introduced a long set of resolutions favoring military preparedness, for ratification in time to be presented at the congress of the American Security League in Washington the next day. The spirit of these resolutions was evidently generally approved, but their length and form was not. After considerable discussion it was voted that the board of direction be instructed to edit them that afternoon so they could be used for the purpose intended.

The incoming president, Dr. E. L. Corthell, mentioned various tasks that he readily perceived were confronting him. Briefly they involved the nationalization of all engineers, the revision of the society's constitution, the encouraging of local engineering societies, the furthering of military preparedness, co-operation with Pan-American activities and the internationalization of engineers.

Prizes and Officers

Prizes were awarded during the year as follows: Norman Medal, to Allen Hazen, for his paper on storage to be provided in impounding reservoirs; J. James R. Croes Medal, to R. R. Lyman, for the paper on improved forms of weirs; Thomas Fitch Rowland Prize, to C. R. Staniford, for that on pier construction in New York harbor; James Laurie Prize, to J. E. Greiner, for that on coal piers on the Atlantic seaboard; Collingwood Prize for juniors, George Schobinger, for that on the Colorado River siphon.

Officers for the coming year were elected as follows: President, Dr. E. L. Corthell; vice-presidents, Alfred Craven and P. C. Ricketts; treasurer, Lincoln Bush; directors—district 1, V. G. Bogue and Dr. A. C. Humphreys; district 2, O. F. Clapp; district 4, Richard Khuen; district 5, F. G. Jonah; district 7, Edwin Duryea, Jr.; members of nominating committee—district 1, E. J. Fort; district 2, S. E. Tinkham; district 3, F. W. Cappelen; district 4, H. H. Quimby; district 5, E. N. Layfield; district 6, W. B. Gregory; district 7, J. B. C. Lockwood.

The next annual convention will be held Jan. 27-30 at Pittsburgh.

Agreement Reached as to New York's West Side Improvement

Agreement has been reached between the city of New York and the New York Central Railroad relative to the removal of its West-Side freight tracks from grade in Eleventh and Tenth Avenues. The project, which involves the entire freight line of the New York Central from the junction with the main line at Spuyten Duyvil, at the upper end of Manhattan, to St. John's Park, the terminal in lower Manhattan, has been under discussion for many years. The details are yet to be worked out, but the salient features are as follows:

An elevated structure on private right-of-way east of West Street, from St. John's Park to Thirtieth Street.

An elevated structure from Twelfth Avenue and the marginal way from Thirtieth Street to Fifty-ninth Street.

Covered tracks under Riverside Park, and from 135th to 153rd Street.

Covered tracks on the present right-of-way through Fort Washington Park.

A viaduct over Dyckman Street.

A tunnel under Inwood Hill.

The cost of the improvement is estimated at $50,000,000. It is expected that the legal approval will be concluded in about two months, after which construction will proceed.

For the city the engineering studies have been handled by a board of engineers in the employ of the city, who served as consulting engineers to the committee on port and terminals of the Board of Estimate and Apportionment. These engineers are Ernest P. Goodrich, consulting engineer to the borough president of Manhattan; C. W. Staniford, chief engineer of the Department of Docks and Ferries, and John F. Sullivan, engineer of the Bureau of Contract Supervision of the board. For the railroad G. A. Harwood, chief engineer of electric zone improvements, and H. D. Jewett, designing engineer of West-Side improvements, handled the engineering end of the negotiations.

Report as to Licensing of Engineers in Pennsylvania Unverified

In the issue of the Engineering Record of Jan. 1 it was stated that the committee appointed to investigate the advisability of licensing engineers in Pennsylvania would probably report favorably to licensing.

Inquiry made by this journal fails to substantiate the report. The committee has not yet declared what its attitude will be.

Pan-American Congress Urges International Triangulation

Among other matters recommended in the resolutions of the Pan-American Scientific Congress, adopted at the final session in Washington, are several recommendations of engineering interest. Among them are that committees be appointed for the purpose of establishing an international triangulation, that a Pan-American committee be established to study and report upon the question of establishing a uniform railway gage, that the administrative practice of regulating the use of water be studied, that its use upon arid and irrigable land be investigated, and that the question of the reclamation of arid land is one that should receive the immediate and careful consideration of the several governments of the American states. It is suggested that the proper steps and measures be taken to bring about in the American Republics participating in the Congress a general use of the metric system and weights and measures.

Accurate geodetic measurements which may serve to contribute to the discovery of the true shape of our planets should be taken as soon as possible according to the resolutions adopted. It is proposed that the nations of the American continent establish by means of their offices of geodesy, or by committees appointed for that purpose, an international triangulation, and that the governments of American nations reach an agreement for the purpose of creating an office, or congress, of cartography and geography. The adoption of the metric system in this hemisphere is recommended, and, it was resolved, proper steps and measures should be taken to bring it about as soon as possible. The appointment of a Pan-American committee to study and report upon the questions of establishing such a uniform railway gage as will best serve the countries interested, their international communication and communication between all countries of America is suggested. It is also recommended that each of the American nations appoint a commission to investigate and study in their respective countries the existing laws and regulations effecting the administrative practice of regulating the use of water, the adjudicating of rights pertaining to the use of surface and underground water for irrigation purposes, the distribution, application and use of water upon arid and irrigable land, the method of conservation of surface and underground water for irrigation or industrial purposes, and to suggest laws or regulations in the interests of general industry, navigation and commerce.

General Dodge Leaves $300,000 to Norwich University

Norwich University, where the late Gen. Grenville M. Dodge received his professional education, was a beneficiary in his will, which was filed at Council Bluffs, Iowa, Jan. 10, to the extent of $300,000. Of this sum, $50 000 is immediately available for paying the salaries of professors of civil, military, electrical and mining engineers. The $250,000 remaining will be paid after a trust fund for the immediate family is dissolved in future years.

Consulting Engineers Selected for Barge Canal Improvements

Dr. Elmer L. Corthell, consulting engineer, of New York City; Henry C. Allen, consulting engineer, of Syracuse, N. Y.; Eugene E. Haskell, director of the College of Civil Engineering, Cornell University; Joseph Ripley of the board of consulting engineers of New York State canals, and E. C. Moore, formerly consulting engineer for the New York City Board of Estimate and Apportionment, have been selected as members of the board of consulting engineers on the improvements to be made on the New York State Barge Canal under the recently voted $27,000,000 bond issue.

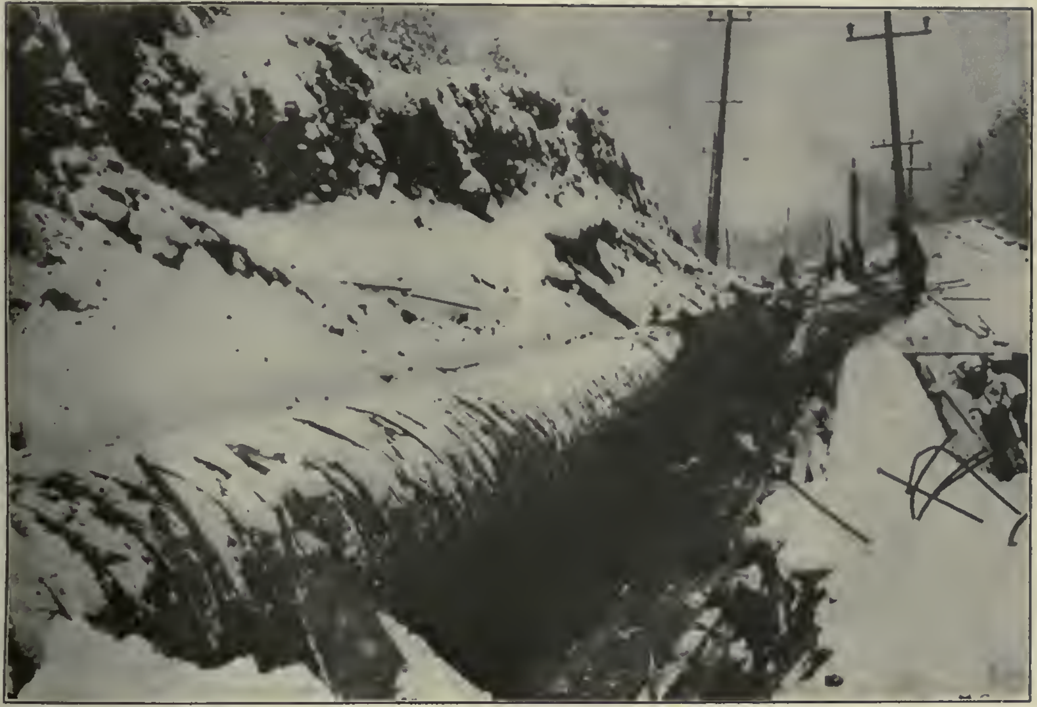
Seattle Water Main Collapse Preceded by Undermining

Covering Over Pipe Consisted Largely of Heavy Boulders—New Staves Cached at Convenient Points Facilitated Repairs

A force of 100 men worked for three days and three nights to clear the excavation preparatory to repairing the break in the wood-stave supply main, at Seattle, which was described on page 93 of last week's issue of this journal. New staves cached at convenient points along the line facilitated the work. At the point where the break occurred the escaping water washed away the support of the pipe, leaving a chasm into which the main settled and collapsed for a distance of about 100 ft.

Total Length of Mains, 66.61 Miles

The total length of the two large supply mains from the headworks on Cedar River, 28 miles from the city, is 62.61 miles, line 1 being 28.57 miles in length and line 2 being 34.04 miles, chiefly wood. The least diameter of the pipe in line 1 is 42 in., the greatest diameter 44¼ in. The least diameter of line 2 is 48 in. and the greatest 60 in. Both pipes pass over rough country. The static head varies from 10 or 12 ft. at the intake to about 530 ft. at the crossing of the Black River near Renton, the hydraulic head rising at that point to 485 ft. For the first 15 miles the hydraulic head is low, varying from a few feet to about 65 ft., except at one or two points where it rises to about 160 ft.



MAIN PIPE LINE REPAIRED AFTER BREAK—NEW STAVES CACHED AT NUMEROUS POINTS EXPEDITE WORK

There has been but little trouble with the line between Renton and Seattle, where the hydraulic head is sufficient to keep the staves thoroughly saturated, but, on the upper 15 miles, where the pressure is low and where the soil, for the most part, is gravelly, the staves, it is said, have shown evidence of decay. Leaks and breaks of more or less magnitude developed, from time to time, after the pipe had been in use six or seven years, and in a few cases small sections of main have collapsed.

Hydraulic Head Low Where Break Occurred

The break occurred where the hydraulic head is very low, the pressure at that point being only 10 or 12 lb. The soil is very gravelly and porous, permitting free entrance of the air through the covering, and there are considerable variations of temperature.

Across Black River Valley the high pressure required the use of heavy steel pipe. At this point there has been no trouble, except occasional areas of pitting in the pipe due to the action of electrolysis.

At the place where the pipe broke the backfilling and covering consisted very largely of heavy boulders, which did not form a compact arch over the pipe and left the whole superincumbent weight resting upon the pipe. When the break occurred the escaping water washed away the support of the pipe, leaving a chasm into which the pipe settled and collapsed, for a distance of about 100 ft. At the point of collapse the sides of the cut were very high, and much of the material that had to be removed in uncovering the pipe had to carried by hand some 30 or 40 yards lengthwise through the excavation. As some of these boulders were from 20 in. to 30 in. in diameter, the difficulty of uncovering it is apparent. It required the labor of about 100 men for three days and three nights to clear the excavation of rock and broken staves.

Cached Staves Facilitate Work

New staves are cached at convenient points along the line so that there was no delay in getting the necessary material to rebuild the section destroyed. After the water was turned on a new trouble developed about 9 miles from the intake, at a point where the pressure was low, which required two days and two nights to remedy. With the exception of the 24 hr. constituting the interval between the repairing of the first break, and the discovery of the second, the water was off about seven days.

The storage capacity in the city is 270,000,000 gal. About 200,000,000 gal. of this had been exhausted while water was off, leaving about 70,000,000 storage when the water was turned on the second time.

It is possible that much of the upper end of the line may have to be rebuilt within a year or two.

Highway Construction in Alaska to Be Requested of Congress

An appropriation to improve the highway from Fairbanks to the coast is to be asked of Congress by the people of Alaska, according to a recent report from the northwest. It is desired to make this road suitable for motor travel, which is estimated to require an expenditure of about $1,000 per mile, or $358,000. If these improvements were made it is thought that the traveling time between these two points could be reduced two or three days.

Lake Erie & Ohio River Canal Board Retains Engineers

At a recent conference of the Lake Erie & Ohio River Canal Board, it was decided to retain Isham Randolph, consulting engineer, of Chicago, to examine and check up the engineering and other data now in the possession of the board and to give his opinion on the canal project. George F. Stickney, consulting engineer, of Albany, N. Y., who prepared the estimates for the first canal board, was also engaged to assist the present board in certain engineering matters engaging its attention. George M. Lehman, chief engineer of the canal board, who was present at the conference, and who conducted surveys and estimates upon several previous occasions for the project, will act with the above named engineers in completing the report which it is intended to have in form by early spring.

Plan to Dredge New Inner Harbor Channel at Victoria, B. C.

Plans for a channel that will afford an entirely new passage into the inner harbor at Victoria, B. C., were discussed at the ninth annual meeting of the Victoria Inner Harbor Association, held in that city on Jan. 11. A. F. Mitchell, acting district engineer of the Dominion government, outlined plans which the government proposes to follow during the present year in opening up a new channel with a width of 300 ft. and a low water depth of 20 ft. by improving what is known as the Northwest passage. Borings have been made, it is reported, which show that in dredging for the new channel no rock would be encountered. This condition is expected to greatly reduce the cost of the work, as well as to expedite the construction.

Commissioner Hodge's Debut

The Public Service Commission's hearing upon the application of a taxpayers' association for an order directing increase of accommodations by a corporation without increase of fare gave a taste of Commissioner Hodge's quality. The usual argument of the convenience of a great many citizens was made, and Commissioner Hodge remarked:

"It isn't a question of how many people would like to have the transfers, but it's a question of whether it is reasonable to impose the order upon the company."

Whereupon Chairman Straus asked:

"You would not ask us to do anything that would make any less the income of a company which is already suffering a loss?"

The similarity of these views is no less striking than their similarity to those of Justice Hughes. That public service which wears best is the most truly popular, and there can be no manner of doubt that the regulation of public utilities in the Hughes manner is the most popular sort. Those who tried a different sort of regulation have been retired, while Justice Hughes is driving from his doors those who want to draft him for other duty.—*New York Times.*

Commission Engineer Declares Public Ownership Inefficient

That the poorest managed utilities in Indiana at the present time are those municipally owned was the declaration of H. O. Garman, chief engineer of the Public Service Commission of Indiana, in a recent address before the Saturday Lunch Club of Indianapolis. Partisan politics he blames for this. The complete changes in management of municipal plants now made with each change of administration work to the entire disadvantage of the enterprise. The municipal plant which furnishes a rendezvous for political workers cannot succeed, he said. No such shiftless management is tolerated in the privately owned plant, which is operated to show a return on the investment.

Institute of Consulting Engineers Holds Annual Meeting

President in Annual Address Points Out Opportunities for Public Service—Institute Urged to Join International Federation

The opportunity of the engineer to render public service was the keynote of the presidential address of Dr. E. L. Corthell at the annual meeting of the American Institute of Consulting Engineers at the Engineers' Club, New York, Jan. 17. He cited the instances during the year in which the institute as a body had undertaken work for the general good, and also indicated directions in which further work was possible. He emphasized the desirability of co-operation between the institute and the Chamber of Commerce of the United States of America, of which the institute is a member. The chamber is about to take up inland waterways and the merchant marine, in which there should be a large engineering interest, and in which the advice of the institute would be of material assistance to the chamber. Dr. Corthell urged, too, that the membership of the institute, now numbering eighty, be enlarged by the addition of those with a professional record and experience commensurate with the institute's requirements.

Valuation

Following the reading of committee reports there was a discussion on valuation, participated in by Gustav Lindenthal, Gardner S. Williams, Dr. A. C. Humphreys and F. A. Molitor. As a result of this discussion it was resolved that the council of the institute be asked to take under consideration the advisability of appointing a standing committee of the matter of valuation. It was pointed out that in this subject, now of exceedingly great interest and importance, because of the government's valuation of railroads, the institute might bear an important part in shaping the views of the public along sane lines.

A touching incident of the evening was a brief tribute to the memory of C. C. Schneider, by Mr. Lindenthal, and a brief suspense of the proceedings while the members stood silent as a mark of respect for the deceased member.

Reporting on the matter of the institute's part in the preparedness movement, Ralph Mershon told of the bill for an officers' reserve corps, which had been made part of the Administration's preparedness program. Mr. Mershon also called attention to a bill introduced in the Senate by Senator Pomerene of Ohio which makes possible, through additional instructional officers detailed from the army, the improvement of the courses of military instructions in the Land Grant Colleges. The meeting approved of Mr. Mershon's proposal to give the support of the institute to this measure.

International Federation

There was present as a guest of the president, Dr. Corthell, R. E. Mathot, president of the Chamber of Consulting Engineers of Belgium and chairman of the council of International Federation of Consulting Engineers. Mr. Mathot recounted briefly the progress of the international federation, pointing out that at the Ghent Convention, which was the first, there were eleven associations represented. In 1914, at the Berne Convention, there were fourteen associations, the new ones being the Swiss, Polish and Austrian societies. He stated that an association now in process of formation in Italy would come into the federation, and that only England and the United States would then be unrepresented in the international body. He urged strongly that the American institute come in, pointing out the advantages in standardizing codes of ethics and in making possible the recommendation by engineers in one conntry of thoroughly competent men in others. Among the proposed activities of the international federation is the publication of a year book, giving fully the qualifications of the members, so that their selection for work by their fellows in foreign countries will be made easy.

The election of the following members of the council was announced: S. Whinery, A. C. Humphreys, G. F. Swain, F. A. Molitor.

Rain Storms and Floods Isolate Southern California Towns

As we go to press a terrific rain storm is raging in Southern California, and although flood damage to railways, highways, bridges and public utility properties generally has been heavy, no final estimate can yet be made. Press reports place the damage thus far at about $2,000,000. At least six lives were lost. Up to midnight of Jan. 18, the rainfall for the storm was 5.79 in. in Los Angeles, with the downpour still continuing. Extreme flood conditions were due to a warm rain on deep Sierra snows, causing almost every stream in the Los Angeles district to overflow. The rainfall was unusually heavy in the mountains. At Upland it was 10.85 in.

Los Angeles was completely isolated on Jan. 19 by the impassable conditions of all highways and railways to the east, north and south. About fifteen through trains were stormbound in the mountains. Street car service was maintained on certain lines only, and many downtown streets were flooded.

Dynamite was used to clear debris jams in the Arroyo Seco, which threatened to cause overflows into adjacent sections. It is reported that the $30,000 bridge over the Santa Ana River has collapsed and that the Tippecanoe Avenue bridge is also a total loss. Near Bell Station the Los Angeles River was three miles wide with housetops showing in midstream. The Pomona region suffered heavily because a temporary stoppage of the San Gabriel River gave way suddenly, releasing a wall of water which caused excessive damage in the valley and endangered Pomona College buildings.

In the oil fields near Bakersfield several hundred oil derricks were blown over, and damage estimated to total several hundred thousand dollars is reported. Water was flowing over the spillways of the Sweetwater and Roosevelt dams, and workmen were attempting to avert a threatened break in the Salt River Levee near Phœnix.

Carnegie Steel Co. to Build $7,000,000 Plant at Youngstown

Announcement is made by Homer Williams, president of the Carnegie Steel Company (a subsidiary of the U. S. Steel Corporation), that construction of the new plant at Youngstown, so long contemplated, will be commenced at once. The plant will be located on a 500-acre site between Girard and Niles near Youngstown and will be known as the McDonald Mills, named for Thomas McDonald, who has been general superintendent of the Ohio Works for twenty-two years. At present ten merchant bar mills, of the total thirty contemplated in the future, will be built and will employ between 1500 and 3000 men. The annual capacity is estimated between 400,000 and 500,000 tons. Over 200 by-product coke ovens and an electric power plant will be built, the total amount appropriated being $7,000,000. Railroad connections to all the trunk lines in the Youngstown district will be made through the Youngstown & Northern, which passes through the site.

New York Assembly Passes Canal Bill

The New York State Assembly passed, Jan. 18, a bill making available for the completion of the Barge Canal the $27,000,000 provided in the bond issue referendum last November. A similar bill has been introduced in the Senate.

Enforcing the Red Flag on New York Subway Work

Flags Placed in Trolley Slots and Ropes Stretched Across Street Before Blasting—Caution Signs on Decked Streets

How to enforce traffic regulations in New York City over subway decking where blasting is being done has been a pressing problem with the Public Service Commission and the subway contractors since the violation of these regulations caused the loss of several lives in the Seventh Avenue collapse on Sept. 22, 1915. It was pointed out by the Engineering Record at that time, and subsequently, that little could be done without the help of the police. This help has been secured, to a considerable extent, and it is thought that, while individual carelessness is still a menace both to the public and the workmen, conditions are improved.

Two types of signs, put up and enforced with the help of the city authorities, are shown in the accompanying photographs. While from a safety standpoint it might be thought preferable to make these signs larger and fix them securely in the roadway itself at the end of decked streets, it was believed that the object of the signs could be attained without placing them so as to restrict traffic physically.

At the suggestion of the fire department, the Public Service Commission has instructed contractors to place red flags on sticks in the trolley slots to stop the cars when a blase is to be fired. The plan is now working well, although it is said that the first motorman on whom it was tried leaned out of his vestibule, threw the red flag into the gutter and went by so fast that the contractor's men failed to get his number.

The two sections of the Broadway-Seventh Avenue line on which the accompanying photo-

SIGNS MARK DECKED BLOCKS SUPPORTED ON FALSEWORK

SIGN ON CORNER POST WARNS TRAFFIC ON BOTH STREETS

graphs were taken are being built by the Litchfield Construction Company and the Holbrook, Cabot & Rollins Corporation. Both these contractors now stretch two ropes decorated with red flags entirely across the street and clear the space between them before firing a blast. Workmen engaged in stretching these ropes are said to have been run into, deliberately or otherwise, in a number of instances by cars or vehicles in a hurry to get by before the blast was fired. On the work of the first-mentioned contractor an automobilist ran through one line at full speed after it had been stretched. Fortunately a large number of the contractor's men were on the street at the time, having just come up for lunch. They surrounded the car and brought it to a stop. The police arrested the driver, and he was promptly fined on being brought into court. It is instructive to note that this man was fined for disorderly conduct. Running over a danger signal is not a legal offence in New York City.

Incidents of this kind show the difficulties with which the commission and contractors have to contend, as well as the sincere efforts now being made by the city authorities to protect both the public and the subway construction. They also suggest that one blue uniform is more potent than forty red flags when it comes to convincing traffic that a blast zone is an area to be respected.

U. S. Chamber of Commerce to Meet Early in February

The Chamber of Commerce of the United States of America will hold its fourth annual meeting in Washington, D. C., Feb. 8, 9 and 10. The greater part of the program will be taken up with foreign trade questions and with domestic questions which have been brought to the front by the foreign situation.

American Society Elects Elmer L. Corthell President

(*Continued from page 125, first column*)

tinction that Brown University, in 1884, conferred upon him the degree of Doctor of Science.

Dr. Corthell undertook another extensive European tour in 1897, this time devoting most of his attention to river and harbor work and the protection of sandy coasts against encroachments of the sea. For eleven years he served as consulting engineer on the Cape Cod Canal in Massachusetts, and was retained by the Argentine Government to act as its consulting engineer for two years on important problems connected with the great harbors of that country. In 1904 the Governor of New York State appointed Mr. Corthell upon the advisory board of consulting engineers to build the State Barge Canal from which position he resigned in order to give all of his time to Brazilian work.

Mr. Corthell is at present in consulting practice in New York City and is a member of numerous engineering and scientific societies in this country and abroad. He is also president of the American Institute of Consulting Engineers and has always taken an important part in international engineering congresses. He has been a prolific writer and has made important contributions to the technical press and the proceedings of engineering societies.

San Fernando Irrigation Project Under Way

The San Fernando irrigation project, which contemplates supplying Los Angeles aqueduct water to irrigable lands in the San Fernando Valley, is on a construction basis as a result of a meeting in San Fernando Dec. 27. At this time the legal firm employed by the city reported favorably upon the validity of the $2,650,000 bond issue of Los Angeles Water Works district No. 3.

At this meeting William Mulholland urged immediate action in order that part of the system at least could be built in time to supply water during the coming summer. The city, he said, may possibly sell at least $100,000 during 1916.

The work of constructing the pressure distribution system will be done under the supervision of William Mulholland, who has been appointed chief engineer of the district to serve without pay.

Railway Engineering Body Announces Nominees for Office

A. S. Baldwin, chief engineer of the Illinois Central Railroad, has been announced as the nominee for president of the American Railway Engineering Association for the coming year. C. A. Morse, chief engineer of the Rock Island lines, is nominated for vice-president. For treasurer and secretary the present incumbents, Geo. H. Bremner and E. H. Fritch, are renominated.

Three directors are to be chosen from the following nine nominees: R. N. Begien, Baltimore & Ohio Southwestern; W. M. Dawley, Erie; L. A. Downs, Illinois Central; John V. Hanna, Kansas City Terminal; A. J. Himes, New York, Chicago & St. Louis; C. E. Lindsay, New York Central; W. D. Pence, Engineering Board, Interstate Commerce Commission; F. E. Turneaure, University of Wisconsin, and J. E. Willoughby, Atlantic Coast Line.

Five members of the nominating committee are to be selected from these ten candidates: A. M. Burt, Northern Pacific; A. F. Dorley, Missouri Pacific; W. K. Hatt, Purdue University; V. K. Hendricks, St. Louis & San Francisco; M. A. Long, Baltimore & Ohio; A. Montzheimer, Elgin, Joliet & Eastern; A. R. Raymer, Pittsburgh & Lake Erie; O. E. Selby, Cleveland, Cincinnati, Chicago & St. Louis; A. F. Robinson, Atchison, Topeka & Santa Fé, and E. B. Temple, Pennsylvania.

President Asks Help of Engineers for National Defense

Five Societies Represented on Naval Consulting Board to Aid in Organizing Industries for Efficient Use in War

The plan of President Wilson, announced Jan. 16 by Secretary Daniels, will enlist the engineers of the country through the five national societies represented on the Naval Consulting Board for the purpose of organizing by states all the industrial plants of the country whose output would be of use to the nation in the event of war. A representative is to be appointed by each society for every state, and these five men are to list all industrial plants producing food, clothing, construction material, steel products and everything else that is classed as munitions in time of war. These lists will make the navy and war departments familiar with the resources at the disposal of the country. These departments will then scatter small orders from time to time among all the plants listed, so that each one will have government plans and specifications for its products always on hand and will also have a force that is experienced in producing government supplies.

Loss of Big Plants Would Not Stop Supplies

The plan would develop the small plant, and enlist manufacturers widely distributed over the country, so that the crippling of a few plants or the loss of a manufacturing section of the country would not curtail our supplies of important materials. Advice will also be given in selecting new equipment and making extensions, so that after a time each plant will be able to turn its entire capacity to government service on short notice in emergency. The active help of the 36,000 membership of the five societies is to be enlisted to develop the plan. The state of New Jersey has already been tentatively surveyed in this way by a committee of the Naval Consulting Board, disclosing 800 factories which could make war supplies in emergency. The membership of the five societies in New Jersey is 1200, or three men to every two plants.

Letter Announcing Plan

The first intimation of the proposed scheme was given to the public in a letter from President Wilson to W. L. Saunders, president of the American Institute of Mining Engineers, which was dated Jan. 13, and read as follows:

"The work which the American Institute of Mining Engineers has done through its members on the Naval Consulting Board is a patriotic service which is deeply appreciated.

"It has been so valuable that I am tempted to ask that you request the Institute to enlarge its usefulness to the government still further.

"This can be done by nominating for the approval of the Secretary of the Navy a representative from its membership for each state in the Union to act in conjunction with representatives from the following: American Society of Mechanical Engineers, the American Society of Civil Engineers, the American Institute of Electrical Engineers, and the American Chemical Society.

"The purpose is to assist the Naval Consulting Board in the work of collecting data for use in organizing the manufacturing resources of the country for the public service in case of emergency. I am sure that I may count upon your cordial co-operation."

Numerous Papers for Joint Meeting of Illinois Societies

Forty-four papers and reports are scheduled on the advance notice of the joint meetings of the Illinois Society of Engineers and Surveyors Jan. 26, 27 and 28, and the Illinois section of the American Waterworks Association Jan. 25, 26 and 27. The subjects are: Sewers and sewage, four papers; garbage, one; waterworks and related subjects on purification and supply, twelve; drainage and irrigation, seven; paving and roads, thirteen; surveys, five; concrete, one; general, two. Among those who have promised papers are Paul Hansen, E. S. Hanson, Edward Bartow, W. R. Gelston, F. C. Amsbary, C. B. Williams, C. A. Jennings, C. R. Knowles, C. G. Elliott, Benjamin Brooks, L. Kirschbaum, H. J. Fixmer, H. E. Bilger, B. H. Piepmeier, E. F. Motsinger, H. B. Bushnell, Duff A. Abrams, H. E. Babbitt and F. H. Newell.

Prof. Ira O. Baker is the chairman of local arrangements. Accommodations have been provided at the engineering hall of the University for exhibitors. E. E. R. Tratman, Wheaton, is secretary of the engineers society, and Edward Bartow, Urbana, is secretary of the waterworks section.

Steam Plants Replaced by Water Power in Drum Project

Two new power plants, now under construction by the Pacific Gas & Electric Company, will deliver 25,000 kw. additional load to the San Francisco territory, replacing the steam plants in Sacramento and Oakland, and making them available as reserve supplies of the system. The plants, known as plants 4 and 5, are situated near Auburn, and are supplied with water from a 22-mile canal which was built two years ago to convey water from Bear River to the irrigation district near that city.

The canal terminates near plant 4, a few miles above Auburn, and water is conveyed from the canal to the plant through a riveted steel pipe, varying from 8 ft. to 6 ft. in diameter, which delivers the water under a head of 342 ft. From the tailrace of plant 4 the water enters a 5½-mile canal leading to the forebay of plant 5, whence a steel pipe line, 6000 ft. long, conveys it to the power house, delivery being made under a head of 520 ft. From the tailrace of plant 5 the water is delivered into the irrigation system which the company maintains. There is a possibility of this water being still further used in a plant lower down which would be known as plant 6, provided that the irrigation requirements in later years warrant such development.

In providing the additional transmission-line capacity to convey energy from the new stations, a north and south line will be constructed which will tie into the Electra line just east of Stockton, from which point the existing lines would be used in connection with a short cut across the lower end of the bay at the Dumbarton bridge.

The additional 25,000 kw. which the new plant will deliver will be absorbed partly in San Francisco and partly in outlying cities. The energy which is now generated by steam in the Sacramento and Oakland substations will be replaced by energy from the new plants when these are in service. Thus the two new plants will take the load of the auxiliary steam stations, will increase the reserve supply of the system, and will materially increase its flexibility and dependability by virtue of the new route to San Francisco, as well as its connection, via the Drum line, with the main transmission arteries.

The steel work for the power house at plant 4 was erected and the crews were ready to begin pouring concrete Jan. 1. The plant will be equipped with two 9000-hp. Allis-Chalmers turbines, which will drive a single 12,500-kw., 6600-volt Wesintghouse generator. Plant 5 will be equipped with the 20,000-hp. Pelton-Doble waterwheel of the Francis type that was on exhibition in Machinery Palace at the Panama-Pacific International Exposition. It will have the same type of generating unit as plant 4.

A tower line will be run north from plant 4 to connect with the transmission line from Drum power house, while from plant 5 a transmission line will run south for a distance of about 63 miles and connect with the line from Electra just east of Stockton. The line construction will be practically the same as on the line from the Drum power house, having 70-ft. towers spaced 800 ft. apart.

At the present time the route of the transmission line from plant 4 north is being brushed out and the tower footings will probably be placed in the early spring. The towers for the entire length of the transmission line will have concrete footings. Most of the property rights on the line from plant 5 south have been acquired, but active construction on this section of the work will not be started until summer. It is estimated that the two plants will be put in service about November, 1916.

News of Engineering Societies

The Canadian Railway Club will hold its annual dinner at the Windsor Hotel, Montreal, Jan. 29.

The Idaho Society of Engineers will hold its annual meeting at Burley, Feb. 21-23. Ira F. Shaffner of Boise is secretary.

The Albany Society of Civil Engineers will hold its annual meeting and banquet at Keeler's Maiden Lane Hotel, Albany, Jan. 25, at 8.30 p. m.

The Minnesota Surveyors and Engineers' Society will hold its annual meeting in St. Paul, Feb. 10, 11 and 12. George H. Herrold, of St. Paul, is secretary.

The Manitoba Branch of the Canadian Society of Civil Engineers will hear E. Brydone-Jack speak on "Movable Bridges" at a meeting to be held at Winnipeg, Feb. 3.

The Engineers' Club of Baltimore will hear Col. John Biddle, Corps of Engineers, U. S. A., speak on "The Duties of Engineers in Warfare" at a meeting to be held in that city, Feb. 3.

The American Association of Engineers will shortly begin the publication, under the title of *The Monad*, of a monthly journal to be devoted to matters of direct interest to the engineering profession.

The Iowa Engineering Society will hold its annual convention in Des Moines, Feb. 16, 17 and 18. J. H. Dunlap, secretary, Iowa City, states that it is planned to spend one day at the Iowa State College, Ames.

The Minnesota Surveyors and Engineers Society will hold its annual meeting at St. Paul Feb. 10-12. Prof. F. H. Newell, head of the college of engineering, University of Illinois, will be the speaker of the evening at the annual dinner and smoker, on Feb. 11.

The Louisiana Engineering Society elected the following officers for the ensuing year at the annual meeting held in New Orleans, Jan. 8: President, Samuel Young; vice-president, A. T. Dusenbury; secretary, W. T. Hogg; treasurer, E. H. Coleman; director, Rufus S. Manley.

The Michigan Engineering Society, which met in Grand Rapids Jan. 18, 19 and 20, elected the following officers for the ensuing year: President, George W. Bissell, dean Michigan Agricultural College; vice-president, T. O. Williams; treasurer, A. J. Decker; secretary, S. J. Hoexter, Ann Arbor; directors, L. C. Smith, E. D. Rich and C. T. Johnston.

The Canadian Society of Civil Engineers held a sectional meeting at Montreal Jan. 13. Papers were presented by J. G. Sullivan, chief engineer of the Canadian Pacific Railway, and S. J. Fortin, of the Ottawa department of public works, on the construction of Rogers Pass Tunnel and "The Method Employed in Design ing the Foundations of the Federal Palace, Mexico," respectively.

The Engineers' Club of Cincinnati re-elected Frank L. Raschig, principal assistant engineer of the department of public service of that city, president at its annual meeting. Other officers elected were: Vice-president, A. M. Wilson, professor of electrical engineering, University of Cincinnati; secretary and treasurer, E. A. Gast, bridge engineer, Hamilton County; directors, E. H. Berry, Oscar F. Shepard, Jr., and A. E. Robinson.

The Springfield (Ill.) Engineers' Club entered upon its second year's work by electing Clifford Older, engineer for the Illinois State Highway Commission, president. The club meets on the second Monday night of each month. H. B. Lewis, of the Central Union Telephone Company, Springfield, is the recording secretary and J. R. Hughes, of the State Utilities Commission of Illinois, is corresponding secretary.

The Ohio Engineering Society will hold its annual meeting Feb. 9, 10 and 11 at the Ohio State University, Columbus. Among those who have promised papers are: Clinton Cowen, state highway commissioner; C. E. Sherman, Ohio State University; Thomas J. Smull, Ohio Northern University; Maurice B. Greenough, Case School Applied Science; E. G. Bradbury, W. A. Stinchcomb, H. P. Cumming, C. J. Knisely and F. W. Patterson.

The Association of Engineering Societies, consisting of the Engineers' Club of St. Louis, the Civil Engineers' Society of St. Paul and the Oregon Society of Engineers, has discontinued the publication of its monthly journal. Notice of the disbanding of the association was made in these columns Jan. 1, but the location of its headquarters was noted in a manner that tended to cause some uncertainty as to the constituent societies.

The Harvard Engineering Society of New York will hear Prof. J. B. Woodworth speak on "The First Shaler Memorial Expedition, Notes of a Geological Traveler in Brazil and Chili in 1908-09" at meeting to be held at the Harvard Club, New York City, Jan. 29. The members of the Princeton and Yale engineering associations have been invited to attend. Professor Woodworth went through the "cane country" in lower Brazil, and then across the continent over the Andes.

The Pacific Northwest Society of Engineers held its annual meeting in Seattle, Jan. 8. The following officers were elected for the ensuing year: President, A. S. Downey, consulting and constructing engineer; vice-president, S. B. Hill, consulting engineer; second vice-president, Charles C. More, professor of civil engineering, University of Washington; third vice-president, Jesse A. Jackson, chief computer, office of the city engineer, Seattle; secretary, Harrison A. Taft, contracting engineer; treasurer, W. N. Chase, assistant city engineer, Seattle; librarian, F. W. Allen.

The Indiana Crushed Stone Association elected the following officers for the ensuing year at its annual meeting held at the Claypool Hotel in Indianapolis, Jan. 12-13: President, E. D. Taylor; vice-president, E. T. Milligan; treasurer, V. C. Pogue; secretary, F. W. Connell; directors, O. H. Binns and L. H. Hoblitz. Edward Barrett, state geologist, Charles A. Carruth, of the New York State Highway Department, N. R. Noblet, secretary of the Hoosier Motor Club, and Fred. K. Irvine made addresses at the banquet. Standard specifications for use in improving public roads were adopted by the organization.

The San Francisco Wood Products Association is in the process of formation by A. B. Wastell, who had much to do with the lumber exhibits at the Panama-Pacific Exposition. Its main aim will be the promotion of every possible use of Pacific Coast woods. It will serve as a clearing house for lumbermen's problems, to investigate and counteract false and misleading statements published regarding lumber, to maintain a permanent exhibit of wood products in San Francisco, to advertise lumber throughout California by lectures, moving pictures and portable exhibits and to furnish information to the public regarding wood preservatives, paving blocks and the proper selection and treatment of West Coast timber.

Personal Notes

C. P. Rawson, office engineer of the Chicago, Milwaukee & St. Paul Railway, has been appointed senior architect in the division of valuation of the Interstate Commerce Commission at Chicago.

Simon Russek, Inc., general contractor, of New York City, has moved its offices from 261 Broadway to 25 Beaver Street.

R. D. Richardson, formerly of the firm of Williams & Richardson, engineers and contractors, of Scranton, Pa., which was dissolved Jan. 1, will continue to supervise the contracts that concern had in hand. He has also opened offices in the Connell Building, Scranton, to carry on a general engineering and contracting business under the name of the R. D. Richardson Construction Company. Mr. Richardson was graduated from the University of Michigan in 1905 and was, for a short period, with the American Bridge Company as a structural draftsman. Later he served with Westinghouse Church Kerr & Company, Post & McCord, the Trussed Concrete Steel Company, and with the bridge department of the Lake Shore & Michigan Southern Railroad. From 1907 to 1911 he was concrete engineer and master mason for the Delaware, Lackawanna & Western Railroad in charge of various works. He became a member of the firm of Williams & Richardson in the latter year. In his new connection, Mr. Richardson will specialize in the design and construction of reinforced-concrete structures.

Edward B. Cushing, formerly chief engineer of construction of the Sunset-Central Lines, has been appointed assistant general manager, with headquarters at Houston, Tex. He was graduated from the Agricultural and Mechanical College of Texas in 1880 and entered railway service as instrument man on the location of the Galveston, Harrisburg & San Antonio Railway. From 1881 to 1883 he assisted in locating and constructing the Mexican International Railroad to Palla, Mexico. From the latter year until 1885 he was again with the Galveston, Harrisburg & San Antonio, as division engineer, and later as contractor of masonry and bridge construction. In 1887 he entered the service of the Gulf, Colorado & Santa Fé as office engineer and chief clerk of construction, and in 1888, attained the grade of engineer of roadway. A year later he went to the Texas & New Orleans and the Galveston, Harrisburg & San Antonio, as resident engineer. In 1897 he became general superintendent of the Houston, East & West Texas and, later in addition to his other duties, was made chief engineer. He entered the service of the Sunset Lines as engineer maintenance-of-way in 1901 and attained the grade of chief engineer of construction in 1908.

Manton Hannah, formerly county engineer, on special work, of Lamar County, Tex., has been appointed assistant engineer to Rollen Windrow, county engineer and road superintendent of McLennon County, Tex. Mr. Hannah was graduated from the University of Texas in 1910 and served as superintendent on paving construction for the Shelby-Downard Rock Asphalt Company at Paris, Tex., for a short period, after which he was instrumentman for the Houston & Texas Central Railway until 1911, when he became assistant engineer to J. C. Field, on good roads construction in Grayson County, Tex. Later in the year he was appointed county engineer of Lamar County.

William B. Gray, engineer and contractor, of 2 Rector Street, New York City, has moved his offices to 17 Railroad Avenue, New Rochelle, N. Y., where he will continue his engineering and contracting business, and, in addition, will manage the New Rochelle autobus routes.

Robert C. Wheeler, formerly assistant engineer to George W. Fuller, consulting engineer, of New York City, has been appointed city engineer of Summit, N. J. Mr. Wheeler was connected with the staff of George W. Fuller for 5½ years, chiefly on the design, construction and operation of sewers, sewage disposal works and waterworks. His most recent work in that service was as engineer in charge of the construction of the Plainfield joint trunk sewer and sewage disposal works, and of the sewage collecting systems for the boroughs of North Plainfield and Dunellen. Previous to this work he had been assistant engineer on the construction of waterworks and sewers for the city of Clarksburg, W. Va., and resident engineer on the construction of the sanitary sewerage system and sewage disposal works of Vincennes, Ind.

George W. Gardner, civil engineer and surveyor, of Madison, N. J., has been appointed borough engineer of that borough. Mr. Gardner will also continue in the private engineering practice he established in Madison about eight years ago.

Joseph W. Foote, formerly trainmaster for the Erie Railroad at Susquehanna, Pa., has been appointed superintendent of the Delaware Division, with offices in the same city. Mr. Foote entered railway service on the Erie in 1901, and served as acting assistant engineer of the Wyoming division until 1906, when he was appointed assistant engineer on the New York division. In 1908 he became supervisor of the New York, Susquehanna & Western and, in 1910, division engineer of the Allegheny division. He was appointed trainmaster of the Delaware division in 1914.

Franklin B. Jamieson has been appointed transitman in the office of the engineer maintenance-of-way of the Pennsylvania Railroad. He received his professional education at the Carnegie Technical Schools.

R. W. E. Bowler, formerly assistant supervisor for the Pennsylvania Railroad at Harrisburg, Pa., has been promoted to the grade of supervisor, with headquarters at South Fork, Pa. He was graduated from Delaware College in 1905, and entered railway service on the Pennsylvania soon after. He was appointed assistant supervisor in 1909.

Frederic R. Harris, civil engineer, U. S. Navy, has been appointed chief of the Bureau of Yards and Docks, succeeding Homer R. Stanford, whose term expired Jan. 14. Mr. Harris was graduated from Stevens Institute of Technology in 1896, and worked with various contractors along the Atlantic Coast until 1901, when he was appointed assistant engineer for the Rapid Transit Commission of New York City on foundations for elevated structures and on tunnel work. He entered the service of the U. S. Navy in 1902 as chief draftsman of the yard at Charleston, S. C.

R. McC. Beanfield, superintendent of construction for the California State Department of Engineering, has been retained, as superintendent of construction, to complete the Fresno state normal school. The general contractors have abandoned the work and the state is completing it by force account. The structure will be the largest school building in California. The appropriation for it was $370,000.

J. E. McIntyre, formerly supervisor for the Pennsylvania Railroad at Watsontown, Pa., has been appointed supervisor of the Middle division, with headquarters at Mifflin, Pa.

Lawrence Connolly has been appointed city engineer to represent the commissions of Jersey City on all municipal construction work. Mr. Connolly is a graduate of Sheffield Scientific School, Yale University.

A. M. Williams, formerly supervisor for the Pennsylvania Railroad at Titusville, Pa., has been transferred, in the same capacity, to the office of the division engineer at Buffalo.

Earl C. Smith, formerly assistant supervisor on the Pennsylvania Railroad at Huntingdon, Pa., has been appointed acting supervisor at Titusville, Pa. He was graduated from Lafayette College in 1905, and has been with the Pennsylvania continuously since that time. He was appointed assistant supervisor in 1910.

R. W. Boyd, a New York engineer specializing in structural work, has been appointed secretary to Henry W. Hodge, who was recently made a member of the Public Service Commission for the First District, New York.

A. B. Fletcher, California State Highway engineer, recently made a reconnaissance of the proposed highway which is to be built by the state from San Bernardino to Needles, Cal. The proposed road will probably be built as far as Barstow under the next bond issue, it is reported, and be carried on to Needles whenever finances permit.

Clarence W. Marsh, formerly chief engineer and special investigator for the Hooker Electrochemical Company and the Development & Funding Company, of New York City, has opened offices in the Boston Safe Deposit & Trust Company Building, 201 Devonshire Street, Boston, to engage in practice as consulting and chemical engineer.

John Meigs, until recently, director of the Department of Wharves, Docks & Ferries of Philadelphia, has opened offices in the Pennsylvania Building, Fifteenth and Chestnut Streets, Philadelphia, to conduct a general consulting and constructing engineering practice. He will give special attention to investigation, valuation, construction and operation of public and private works and industrial plants, including general river, harbor, and port improvements, foundations, bridges, buildings, power plants, water supply, sewerage and pavements. Mr. Meigs was graduated from Columbian University, Washington, D. C., in 1894. Much of his engineering experience has been in the government service, his most recent work in that connection having been the direction of the dredging operations in the Delaware River at Philadelphia, which totaled about $1,000,000 in cost annually. As assistant engineer in the U. S. Engineer's Office at Washington, D. C., in 1904 and 1905, he was in local charge of the preparation of plans and specifications, and of the construction of the $1,200,000 Potomac highway bridge and approaches. His first engineering service was as draftsman for the Columbia Railway at Washington, from 1894 to 1895. Following this he was with the Capital Traction Company and the Union Bridge Company. He was appointed junior engineer in the U. S. Engineer's Office in 1897, and surveyor and inspector in the Bureau of Yards & Docks of the Navy Department in 1898. In the latter capacity, he was engaged on the construction of coal storage sheds and unloading piers, and on hydrographic surveys and dredging. He returned to the U. S. Engineer's Office in 1900, and continued in that service until 1906, when he was appointed engineer and superintendent for the Pennsylvania Bridge Company in charge of the construction of various bridges in Washington. From 1907 to 1908 he was engaged as contractor on earth moving and wharf building. In the latter year he returned to the government service as principal assistant engineer, U. S. Engineer's Office, in charge of the dredging work in the Delaware River. He resigned from this office to become assistant director of the Department of Wharves, Docks & Ferries of the city of Philadelphia. He was appointed director of the department in the early part of 1915, and went out of office with the change of local administration this year.

GEORGE R. CAMPBELL, formerly consulting engineer, of Spokane, Wash., and previous to that consulting engineer of bridges and public highways, of Wasco County, Oregon, has been appointed to a position in the office of the U. S. Department of the Interior, at Olympia, Wash., under E. P. Rand, assistant supervisor of surveys for district 8, and E. A. FitzHenry, surveyor general for Washington.

F. S. GATES, formerly assistant supervisor for the Pennsylvania Railroad at Jamesburg, N. J., has been transferred to Huntingdon, Pa., in a similar capacity.

J. V. GIBNEY, formerly transitman in the office of the engineer maintenance-of-way of the Pennsylvania Railroad at Philadelphia, has been promoted to the grade of assistant supervisor in the office of the valuation engineer. He received his professional education at Bucknell University, and entered the service as rodman in the construction department in 1910. He was appointed transitman in the early part of 1915.

F. W. BRUCE has resigned from the office of chief engineer for the Port Commission of Jacksonville, Fla. Mr. Bruce has been identified with the development of Florida since 1884, when he engaged in private practice in St. Augustine, and was appointed city engineer of that city. At the beginning of the late Henry M. Flagler's East Coast hotel construction, Mr. Bruce did all the local engineering and surveying for him. Later he located the St. Augustine & Palatka Railroad, now a part of the Florida East Coast Railroad. For many years he was with the U. S. Engineer Corps on river, harbor and fort repair and construction in the state. He entered the employ of the city of Jacksonville in 1913.

ANDREW R. SMILEY, JR., has been appointed transitman in the office of the engineer maintenance-of-way of the Pennsylvania Railroad. He was graduated from the University of Pennsylvania in 1910.

LOWELL G. KRIGBAUM, of the U. S. Engineer's office at San Francisco, has been sent to Sacramento in charge of the surveys ordered to determine what land will be required by the government in the plan for providing a 15-ft.-depth channel from Sacramento to San Francisco Bay. Mr. Krigbaum will report to Major Rand, in charge of U. S. War Department's investigations in the San Francisco district.

ZENO N. KENT has been promoted from the grade of transitman in the office of the engineer maintenance-of-way of the Pennsylvania Railroad to that of assistant supervisor at Millville, N. J. He was graduated from the Case School of Applied Science in 1910, and entered the service of the Pennsylvania in June of that year. He was appointed transitman in 1915.

H. C. EDDY, formerly engineer of the Public Utilities Commission of the District of Columbia, has been appointed an electrical engineer in the U. S. Navy Department.

CALDWELL & MARSHALL CONTRACTING COMPANY has moved its offices from Lafayette, Ind., where they have been located for nearly two years, to Evansville, Ind. The firm's name has been changed from Caldwell & Drake to the name given above, Clinton B. Marshall having purchased the interest of Mr. Drake. The company has the contract for constructing the new hotel at Evansville, of which H. Ziegler Dietz is architect.

JOHN J. BRACKEN, civil engineer of Newark, N. J., has been appointed town engineer of Harrison, N. J. Mr. Bracken has been engaged in private practice, mainly on municipal work, at Newark since 1902. For the six years previous to that he served on the engineering forces of the Essex County Park Commission.

MAYNARD D. CHURCH has been appointed chief engineer of the Terry Steam Turbine Company, builders of steam turbines for all purposes, of Hartford, Conn.

SYDNEY B. WILLIAMSON has resigned from the office of chief of construction of the U. S. Reclamation Service to become connected with the Guggenheim interests. For the next few months he will be in the New York offices of the firm at 120 Broadway, after which he will go to Chili to take charge of the construction of extensions to the plants at Breden and at Chuquicamata. Previous to his connection with the Reclamation Service, Mr. Williamson was construction engineer with J. G. White & Company, Ltd., of London, England, and, previous to that, was division engineer in charge of the Pacific division of the Panama Canal. He was graduated from Virginia Military Institute in 1884 and, after somewhat over a year as instructor of mathematics at Kings Mountain Military School, was engaged in railroad work until 1890, when he entered private practice at Montgomery, Ala. In 1892 he entered the service of the government on Tennessee River improvement work and remained in that service, with the exception of a short period in Porto Rico as captain of engineers during the Spanish-American War, until 1904, when he went to New York City as designing engineer for the Expanded Metal & Engineering Compay. In 1907 he went to the Panama Canal as engineer in charge of the Pacific locks, and, in 1908, was appointed division engineer of the Pacific division. He resigned from the Canal Commission in the latter part of 1912 and went with J. G. White & Company, Ltd. He was appointed chief of construction in the Reclamation Service in December, 1914.

A. F. FISCHER, formerly highway engineer of Jefferson County, Iowa, has been appointed highway engineer for Johnson County, Iowa, to have charge of all highway, bridge and road construction. Mr. Fischer was graduated from the State University of Iowa in 1911 and was in the service of the Delaware, Lackawanna & Western Railroad, in the Buffalo, N. Y., offices, until 1913, when he was appointed city engineer of Clinton, Iowa. He was appointed highway engineer of Jefferson County in 1915.

J. C. ELLIOTT, superintendent of construction of U. S. public buildings, Supervising Architect's Department, Treasury Department, has been relieved from further duty on the post office building at Corry, Pa., and the district adjacent thereto, and assigned to supervise construction of the new federal building at Salamanca, N. Y., and to take care of repairs of buildings at Buffalo and surrounding territory, owned by the Federal Government.

DON L. TEAL, formerly county engineer of Lucas County, Iowa, has been appointed highway engineer of Jefferson County, succeeding A. F. Fischer, whose appointment to another office is noted elsewhere in these columns. Mr. Teal was appointed county engineer of Lucas County in October of last year. Previous to that he was assistant county engineer of Jefferson County.

Obituary Notes

LOREN E. HUNT, principal assistant city engineer of San Francisco, died at his home Jan. 9 at the age of forty-six. Mr. Hunt was a native of Minnesota, from which state he came to California at an early age. He graduated from the University of California and was afterward instructor in civil engineering in the same institution. For some years he was in the engineering department of the United States Forest Service. He served as principal assistant engineer of San Francisco under M. M. O'Shaughnessy for four years.

GEORGE A. MORRIS, engineer for the Litchfield Construction Company on subway work in New York City, died in that city, Jan. 12. For a number of years he was division engineer, middle division, of New York State canals, with headquarters at Syracuse. Prior to that he was engaged on a number of large construction jobs in the South. During his early career he was connected with the Delaware, Lackawanna & Western Railroad on the building of the Buffalo and Cayuga divisions and, later, with Ryan & McDonald. While in these positions he designed, and had charge of the construction of the Susquehanna river bridge at Owego, N. Y. which it was said, was the first large bridge in this country to be built on a curve.

Business Notes

Charles Johnston, formerly sales engineer for the General Fireproofing Company of Youngstown, Ohio, at its Kansas City office, has been transferred in a similar capacity to the Philadelphia office. He is succeeded at the Kansas City office by Mr. J. R. Stolker.

The Association of American Portland Cement Manufacturers has opened offices in the Conway Building, Chicago, and in the Rialto Building, San Francisco. An office is also to be opened in New York. The headquarters of the association will shortly be moved from Philadelphia to Chicago.

The Burton-Townsend Company and the Trimble Paving Brick Company, the first of Zanesville, Ohio, and the second of Dayton, have been added to the Dunn Wire-Cut Lug Brick Company's list of licensees. The Burton-Townsend Company has two plants and a present daily capacity of 160,000 pavers. The Trimble Company has three plants, one at Dayton, one at Trimble, Ohio, and one at Gloucester, Ohio.

Lloyd Brown, who has been handling the Lakewood Engineering Company products at Baltimore, has also opened offices for the company in the Real Estate Trust Building, Philadelphia, and will take care of the trade in New Jersey, Eastern Pennsylvania, Maryland, Virginia and the District of Columbia for the company's entire line of contractors' equipment, concrete mixers, industrial railways, factory, mine and quarry cars and trucks.

E. C. Waldvogel has been appointed general manager of the Yale & Towne Manufacturing Company, manufacturer of chain blocks and electric hoists, locks, hardware, etc., of 9 East Fortieth Street, New York City. Mr. Waldvogel has been connected with the company for the past eleven years as traveling salesman, sales manager and assistant general manager. In addition to the regular duties pertaining to his new office, he will have charge of all sales, domestic, Canadian and export.

J. H. Williams & Company, manufacturer of wrenches and drop forgings, have placed with John W. Ferguson Company of New York and Paterson a contract for several additions to its Buffalo plant, consisting of a 64 ft. by 310 ft. addition to the drop hammer shop and an increase of 82 ft. by 80 ft. to the stock and finishing shop. An entirely new structure will be used as a repair shop. This will be one story, 98 ft. by 62 ft., with a mezzanine floor and a crane runway in the center.

The Virginia Portland Cement Company has announced the retirement of R. W. Kelley, president, Michael Gavin, vice-president, and F. W. White, treasurer, from their respective offices, and the election of Harry C. Trexler, president, E. M. Young, vice-president, and Alonzo F. Walter, treasurer. The main offices of the company will be in the Young Building, Allentown, Pa. The William G. Hartranft Company has discontinued the sale and distribution of Old Dominion portland cement, and the Virginia Portland Cement Company, itself, will hereafter sell and distribute its product direct to its customers, under the supervision of B. L. Swett, sales manager.

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John A. Hill

THE engineering profession, no less than the publishing world, suffered a severe loss in the death early this week of John A. Hill. Long known to the mechanical world through his ownership of the *American Machinist*, *Power*, and the *Engineering and Mining Journal*, he came to the attention of civil engineers and contractors through his purchase nearly four years ago of *Engineering News*. In the new field, as in the old, he won hosts of admirers for his steadfast upholding of the highest standards of technical journalism. No attack by advertisers on editorial policy could weaken his determination to place the interests of the reader first, and while those who could not break down this policy demurred at first, they admired the principle of the man and came to learn that only through the policies he adhered to could mediums be built up that could be of real service to reader and advertiser. With such standards his journals could not but have a great influence upon their respective fields. No one can measure what they have done for the advancement of engineering, for no human agency can follow ideas from their seed, an article or an editorial, to mature growth in an engineering structure or an industrial organization. That the influence was a very strong one, however, no one can doubt, for otherwise the large circulations his publications enjoyed could not have been maintained. Personally, he was the type of man it is a pleasure and an inspiration to watch. One had instinctively to give him the credit that the strong man—the strong man mentally and physically—exacts. He was a fighter—a dominant personality—but one that sought not the embittered conflict, but was prepared to last to the end if forced into it. And yet his forcefulness and dominant personality were happily tempered with kindness, and mellowed by the long and hard experiences of his rise from a mechanic to the presidency of one of the greatest of technical publishing organizations. He will be missed, sorely missed, by those who have observed carefully the development of technical journalism and particularly by those who have aided in that development.

Economists as Regulators

COMMENTING on the Newlands resolution for a joint congressional commission to investigate railroad regulation, *The Nation's Business*, published by the Chamber of Commerce of the United States of America, concludes as follows: "It will occur to most of us that there might well be several business men on such a commission; also that there is some good sound sense in the suggestion of the *Saturday Evening Post* that Congress could save much time and money by asking the assistance of the economic departments of some of our great universities." The Engineering Record regrets that the last part of this sentence, coming from the Chamber of Commerce, is so sweeping. Seemingly that body has not had enough experience with economists to realize that they need to be selected with care. The Engineering Record has full confidence in the wisdom of some of the economists, but warns against others who have had no contact with the actual raising, handling and spending of large sums of money, and who try to apply laboratory theories to great living industries. *The Nation's Business* ought to have pointed out the difference in the two types of economists.

The Alvord Honor Award

IT was a fine thing for the engineering profession and for those who have unbounded faith in the humanitarianism of engineers to witness the enthusiasm with which the $1,000 gift of John W. Alvord to the Western Society of Engineers for a fund for inconspicuous public service was received at the recent annual dinner. The medal can be made a splendid tribute to engineering service now little known if a great society can endow it with the proper honorary spirit. It is true that great benefits often accrue to the public at large through valuable improvements in the arts which are given without personal reward or gain. It is the duty of engineering societies to point out to their members and to the public such instances of engineering and administrative skill as seem to have unusual merit, in order that honor may be properly accorded where it is due. Recognition of the engineer's services to the public by his peers should be of the highest honor and value to him. The public will be served the better and engineers will feel a keener incentive to put forth a greater creative effort because of the Alvord honor award.

Engineers for Commissionerships

TO those engineers who have advocated that technically trained men should be represented in the membership of public service commissions there is much encouragement in the Engineering Record's interview, in the news section, with Oscar S. Straus, the new head of the Public Service Commission controlling New York's subways. To Commissioner Straus an engineer means more than a subordinate who can run a transit. He realizes that the profession numbers among its members broad-gage men of administrative capacity who are eminently qualified to perform the duties of a commissioner, and when such men can be found he is heartily in favor of their appointment. In the case of the New York Commission, to which Henry W. Hodge, an engineer, was recently appointed, fully half of the problems are construction problems, and if a man combine technical knowledge with the necessary executive qualifications, his services as a commissioner should be doubly valuable. In the average lay mind this conception of the engineer-commissioner is still somewhat hazy, and Commissioner Straus's views will be decidedly helpful in molding popular opinion into a proper form. Mere engineering experience, however, is no index of a man's fitness for a commissionership, even on a board controlling engineering work. Personality, business sense, broad vision, and a judicial temperament are all essential. If to these attributes engineering knowledge and experience are added an ideal combination is formed. State executives with appointive power will do well to weigh carefully Commissioner Straus' words when there are vacancies to fil on regulating boards.

A Coming International Obligation

LAST week the *New York Times* printed an interview between James O'Donnell Bennett and the Rector of the University of Leipsig, in which the latter argued that science and the universities should be the first, after peace is declared, to bind together again the peoples of the countries now at war. It should be their work, as the Rector expressed it, to "bring anew to their (the warring nations') consciousness the fact that in this world of self-interest and of strife there is also a bright world of spirit and of thought which counts no cannon in its equipment and demands no bleeding victims as the price of victory." Should not engineers, also, take to heart the Rector's words? With an eye single to the advancement of the interest of the human race are they not well fitted to brush aside the bitterness of discord and to bring together the peoples now at each other's throats? But further than that, should not the engineering profession in America prepare itself to take the initiative, after the war is over, in bringing about again close relations among the engineers of the European nations? International engineering congress after congress has been postponed—the International Road Congress, the International Congress on Testing Materials, the International Navigation Congress. What nation will be better fitted to bring together those that are now enemies than the United States? It would be a fitting and worthy thing for the engineering profession in this country to take the initiative, after the war, to re-establish these international congresses, and here, in the land of a neutral, to have the first meeting of each of these international bodies after the cannon's roar has subsided. It is a duty which the engineering profession and the engineering societies of this country should prepare for. They can render an inestimable service by re-establishing the international organizations. Not only the profession, but humanity at large, will be the gainer through the more rapid healing of the wounds of conflict thereby brought about.

An Extraordinary Contract

EFFICIENCY methods in handling construction are being more and more recognized as the contractor's biggest asset in securing work and in making money. An astonishing example of what planning and management can do is brought out in the description, on page 152, of the new methods and plant by which the Holbrook, Cabot & Rollins Corporation will be able to finish in twenty months a section of subway work for which forty months would ordinarily be required. Only two larger single sections of subway work, not counting river crossings, have been contracted for in New York City. Both were under little-traveled streets, four years was allowed for completing each and the average monthly value of work done on both was $82,000. For the completion of the other sections of the new Broadway subway, of which the one under discussion is the last let and the connecting link, an average time of 35.4 months was allowed, and the average monthly value of work required on them is only $56,000. The magnitude of the task confronting the contractors for the last link is, therefore, strikingly shown by the fact that they must spend an average of $187,000 a month to complete this section in the twenty months allowed. It includes thirteen of the most densely-traveled city blocks in the world, requires the construction of a crossing under the existing subway without interrupting four-track traffic, and is served only through narrow and congested cross-streets in which all material must be handled. At first sight the contract seems impossible. Nevertheless, by the application of efficient construction methods, made to order out of whole cloth where no precedents existed, it is being done. Needless to say, George Hallett Clark and his Broadway subway section are being watched with the keenest interest by everyone connected with this class of work.

A Model Construction Camp

IN this year of high cost of material labor will be none the less hard to obtain, and the contractor who must provision and house his force would do well to reduce to a minimum by all legitimate means the "going" gang so that the "working" and "coming" gang may be as large as possible. Good food, comfortable bunk houses and a well-ordered camp will help in keeping men on the job.

The builders of the hydroelectric plant on the Chippewa River at Wissota, Wis., realizing the necessity of caring well for its 1000 employees for the fourteen-month construction period in the wilderness have built a model camp and included a store, a moving picture theater, an electric light plant, waterworks, a sewer system, a laundry, a bath house and a hospital. Each bed is of the double-deck type and has a real mattress of good quality. The regulations require the bed linen to be changed once a week, and whenever there is a new occupant. No liquors are sold. Every man must bathe at least once each week and must send his washable clothing to the laundry each week. The minimum quality of the food supplied and its variety are all matters of exact contract and specification. No metal plates are permitted. The china is not Haviland or Limoges, but it is of good, honest American make.

Food specifications are of interest when, as the bulletin issued by the owners, the American Public Utilities Company, states, one has only to scratch an old woodsman to hear more interesting than appetizing stories of the "salt horse" diet of the olden days. No forequarters of beef are to be purchased and no shoulder beefsteak is to be served. Bread must be supplied fresh every day and none over thirty-six hours old is to be used. Kitchen refuse must be destroyed each day and all the quarters must be free from flies. Even details as to menus are specified and their rehearsal will make many a white-collar man restless. For instance, for breakfast the men must be supplied, in such quantity as each chooses to use, rolled oats, beefsteak, pork chops or bacon, boiled or fried potatoes, bread and real butter, doughnuts or cookies and tea or coffee. As to the cost of all this high living, board and lodging costs $5 per week and single meals 25 cents.

Contractors nearer civilization who have already begun to find difficulty in keeping their ranks filled with efficient men, will probably find before the coming season is over that similar "creature comfort" inducements will pay. Can the plan be carried out so successfully on more temporary work and within the confines of a city?

What Should Be the Education of the Engineer?

A MOST interesting subject for study and discussion was opened up at the annual meeting of the American Society of Civil Engineers last week by Prof. C. R. Mann, who is making the investigation for the Carnegie Foundation into engineering education. As shown in the report of the meeting in the Engineering Record, Jan. 22, pages 125 and 126, replies from 1500 practising engineers indicate that general qualifications, such as character, judgment, and executive ability, are rated as worth 87 per cent in the success of an engineer, while only the remaining 13 per cent is given as the weight of technical knowledge and practical engineering experience.

That the result of Professor Mann's canvass agreed with the views of the members of the society present was clearly evident by the applause which greeted his statement of the result. If the engineers who have reported their views have put the matter correctly it is apparent that we must write a new definition of what makes an engineer, and, after having written that new definition, must inquire into the type of instruction needed to produce the desired product. At the present time the conscious effort of the schools is being given almost entirely to the importing of that part of an engineer's equipment which is rated at only 13 per cent. Undoubtedly the colleges do something toward giving him the qualities which weigh 87 per cent, but they are by-products, not consciously sought for save as the individual instructor here and there may fashion his work.

A mere statement of the case is sufficient to open up vistas of what may happen in our engineering colleges when the full import of Professor Mann's findings are realized. There must come a recasting of courses and methods which will be most revolutionary. And between that revolution and a continuance of present methods lies only a more positive determination of the correctness of the views that Professor Mann has collected.

As to the correctness of his analysis this journal has no doubt. In fact, the views expressed in recent years by practising engineers have all tended to prepare one for these findings, radical as they are. Individual addresses have been made, too, which have clearly foreshadowed some such results. Professor Swain's address before the meeting of the American Institute of Electrical Engineers somewhat over a year ago is one of those addresses. The profession generally, however, and the engineering colleges will need to ponder the results quite carefully before they are willing to undertake the needed revision. That must come by a process of education, and through discussion in the technical press and the engineering societies.

Professor Mann was most conservative in his presentation of the matter. He might well have dogmatized, with the reviews of 1500 engineers in hand. Instead, he stated the problem as not yet solved, and appealed to the members not only of the American Society of Civil Engineers, but to all practising engineers to assist him in gathering fuller data, so that what results are given out as final may be correct beyond any chance for reasonable doubt.

The Engineering Record cannot urge too strongly upon the members of the profession throughout the United States the need for serious consideration of Professor Mann's work. It urges, too, that when he calls for further action, whether by the expression of individual views in answer to circulars and letters or by meetings of technical bodies across the country, the response will be most hearty. The work he is doing is of fundamental importance to the future of engineering in this country. He deserves hearty co-operation of everyone worthy to bear the name of engineer.

Committee Work Essential for National Engineering Society

In opposing a motion at last week's meeting of the American Society of Civil Engineers to increase the membership of a committee several speakers pointed out that the expense of committee work is becoming very heavy, and as one of them put it "is in danger of running away with the society." None of the speakers was opposed to committee work, but merely pointed out a fact that a considerable sum, over $10,000, is now devoted to the expenses of committees.

One is likely to demur at once from characterizing committee work as running away with the society when an expenditure of only $10,000 is made for the work. A study of the disbursements, shown in the secretary's report to the Board of Direction, would lead one to question at least whether it would not be best to curtail expenses in other directions and expand the committee work. This journal certainly feels emphatically that the committee work of the society needs to be broadened.

In professing its faith in committee work the Engineering Record does not necessarily indorse the appointment of some of the present and recent standing committees. In its judgment there are far more important matters neglected than are now covered by existing committees. While there will be disagreements, of course, there seems to be far greater need for committees to draw up specifications for paving work than for committees to investigate a national water law or the bearing power of soil. Without a doubt other important phases of engineering need to be covered by committee assignment, but some attention to the present situation in the making of specifications covering paving work will indicate that the society needs to expand its committee activities rather than to curtail them.

The society now most prominent in drawing up paving specifications is the American Society of Municipal Improvements. Its procedure is nothing short of a disgrace to the engineering profession. The method of handling committee work is exceedingly lax, and provision is not made for that long and careful consideration which should be demanded before any specification is labeled as a standard by a national body. Anyone knowing the procedure in the American Society of Municipal Improvements will take the specifications at their real value, but there are engineers throughout the country, not familiar with the procedure, who give them a standing not warranted by the method pursued.

If the American Society of Civil Engineers were writing paving specifications, it is safe to assume that the American Society of Municipal Improvements would give way to the more important body and confine its activities to an interchange of views among engineers engaged in municipal work. But until the larger organization does take its responsibility, one must look for a continuation of work by the municipal body.

While there may be other directions in which committee work is needed, the Engineering Record submits that in paving matters there is not only an immediate opportunity, but an immediate demand, for the attention of the American Society of Civil Engineers. This journal feels that the membership of the society at large will heartily favor expansion rather than contraction of committee work.

Course in Aeronautical Engineering

Until recently progress in the development of flying machines and dirigibles has been based largely upon rule-of-thumb methods, costly in life and money, and showing, in many cases, little engineering appreciation of the complex problems involved. It is not surprising that an art so new as aviation should have depended so much upon empirical methods, but even before the outbreak of the European war, in which the service of the aeroplane has been literally invaluable for scout duty, steps had been taken, both in this country and abroad, to establish aeronautics upon an engineering basis. Pioneer work of great value has been accomplished by the National Physical Laboratory in England during the last few years under the general direction of Dr. R. T. Glazebrook; research has been vigorously prosecuted at the laboratory of the University of Gottingen, in Germany; and the industrial testing of aircraft, corresponding to the work of the ship model tank in naval architecture, attained an advanced status at the Eiffel and St. Cyr laboratories in France prior to the opening of hostilities.

In the United States the Massachusetts Institute of Technology opened in 1914 the first course in aeronautical engineering to be offered on this side of the ocean, and as the second year of the Institute's work in this specialized realm began last fall, attention may properly be called to the purposes and methods of those responsible for this important branch of educational and research activity. Without depreciating the contributions of American scientists and aeroplane builders to the art of aviation, President Maclaurin emphasized some time ago the need of freeing air-craft from its more serious dangers, establishes aeroplane and dirigible design upon a scientific basis and, preparing to supply specially trained engineers to meet future demands for economical and safer construction in both military and civil flying equipment. Based on the broad relationships of the naval architect, the mechanical engineer, the physicist and the meteorologist, the course was planned for a very limited number of graduate students qualified by the Institute's bachelor degree in mechanical or electrical engineering or naval architecture or by graduation from other institutions affording adequate preparation.

The course is laid out to furnish training in the design and construction of aircraft of all kinds and is attached to the department of naval architecture, being in immediate charge of Jerome C. Hunsaker, assistant naval constructor, U. S. N., who is detailed for this duty by the Secretary of the Navy. No attempt is made to give instruction to pilots in the operation and control of such craft, but the endeavor is to train men who are already engineers to undertake the experimental development of air-craft, their manufacture and maintenance. Previous preparation in physics, advanced mathematics, the strength of materials and machine design is, therefore, absolutely necessary, and the year required as a minimum for the attainment of the master's degree is crowded with theoretical and experimental studies.

The Institute is fortunate in possessing an aerodynamic laboratory equipped along the lines of the celebrated English plant mentioned above, with a wind tunnel in which an air velocity of about 40 miles per hour can be maintained for the testing forces and couples produced on model aircraft and parts, offering extended facilities for industrial testing and scientific research leading toward the production of specified results at reduced cost, verification of laws and formulas, the determination of new constants, checking of details in design, study of lift, impact, stability and many other elements of the problem of air transportation. The curriculum includes extended studies of fluid dynamics and of the dynamics of rigid bodies, wireless telegraphy, meteorology, explosion motors, and aircraft design in extended ramifications, leading to a thesis embodying the results of an original research in aeronautics.

It is to be hoped that this work will be a potent factor in the progress of aeronautical engineering in America, and that greater encouragement to scientific research will result from such a recognition of the importance of adequate training in this complex technical specialty. Italy and Russia long since established either governmental or university laboratories for aeronautical investigation, and the United States has lagged too far behind European nations in making use of the fruits of its own pioneer development. The results of a number of investigations conducted at the Massachusetts Institute of Technology are now in the hands of the Smithsonian Institution for subsequent publication, and the possibilities of co-operation seem attractive. There is little question that the interest of the public in military preparedness will embrace aviation, and if anything like adequate appreciation of the value and importance of technical investigation and education along this line is secured, an impetus to the further development of the art will be given which will be worth its cost many times over.

Belt Conveyors a Success in Pneumatic Tunnel Construction at Boston

System Allows Muck to Be Handled Through All Other Work to Cars in Completed Tunnel—Full Crew Kept Busy at Each Operation at All Times

ALL THE WORK of mucking, lining with wood blocks, concreting the invert, waterproofing, concreting the main tunnel section and grouting is being carried on simultaneously and without interference in driving the twin Dorchester tunnels under Fort Point Channel in Boston. In sharp contrast to the well-known methods by which large pneumatic tunnels have heretofore been constructed, all the independent operations that go to make the finished tunnel are being carried on simultaneously without interference in one short stretch of heading just behind the shield. Concrete is supplied and muck is taken away with a novel layout, so successful in its working that monthly progress so far has easily averaged from 320 to 370 ft. in each heading. On many days more than 14 ft. has been driven, lined, waterproofed and concreted in each heading.

BELT CONVEYORS BIG FACTOR

The first factor in the layout which is making this progress possible is a belt conveyor in each heading. These conveyors carry muck back from the shields through all the other work, and occupy only a small space in the center of the tunnel. The muck cars are handled on a track at the side of the conveyor, and are loaded by it behind the end of all the finished concrete work except the concrete arch, which is turned in the rear of the conveyor. Outside of these tracks is a rail on either side, on which run the concreting platform and the form carriage. These rails are laid on the finished invert and one concreting carriage is always kept just ahead of the last side-wall arch form and the other just behind the belt conveyor.

Between the two concrete platforms is another platform, hung from eye-bolts in the wood-block lining of the roof, from which the waterproofing is done. The invert is waterproofed under the rear shield platform, from which the wood-block lining is handled. This last platform, at a level with the top of the belt conveyor, is attached to and bracketed out behind the shield, and supports the belt conveyor over the gap from the shield to a point from 20 to 30 ft. behind the shield where the invert is in place. The shield, lining platform and conveyor all travel forward together. The conveyor rides one of the two material tracks in the tunnel. The conveyor is so long that a few hours' or even a day's delay in driving would not hold up the other work.

UNDERGROUND RAILROADING

To take into each heading 70 cu. yd. of concrete, from 7000 to 8500 ft. b.m. of wood-block lining, waterproofing materials and cement for grouting, and to take out 190 to 230 cu. yd. of muck in 24 hr. would seem to be a task to tax the carrying capacity of even a double-track line. As a matter of fact, however, a large part of the time only one track is in service, and the limiting factor in the whole progress of the tubes is the amount of muck that can be excavated and shoveled upon the conveyor by as large a crew as can find room to work in the shield.

When the invert is being concreted each train is made up with a platform car of lining blocks in front, two 1-yd. concrete cars next, then four muck cars and last the storage-battery electric locomotive. A complete train can be handled through the long material lock at the shaft end of each tunnel. At the heading, the platform car is dropped down to the shield, the concrete cars stop at the concrete platform and the four 2-yd. muck cars are cut off and handled by the locomotive at the discharge chute of the conveyor. While the cars are there the crew at the face shovels as hard as possible to keep the conveyor full. By the time the concrete cars have been dumped, the 8 cu. yd. of muck is loaded, and the train is coupled up and taken back to the shaft.

As yet the haul in the west heading is so short that no empties have to be left at the conveyor. Empties are left at the conveyor in the advance tunnel, which is now 1400 ft. long. During the short time the belt is stopped the mucking gang has plenty to do to pick down enough of the stiff clay face to make the next load. Where sand pockets have been met, boulders have been encountered, and the work of shooting these up has consumed as much time as the pick work in clay.

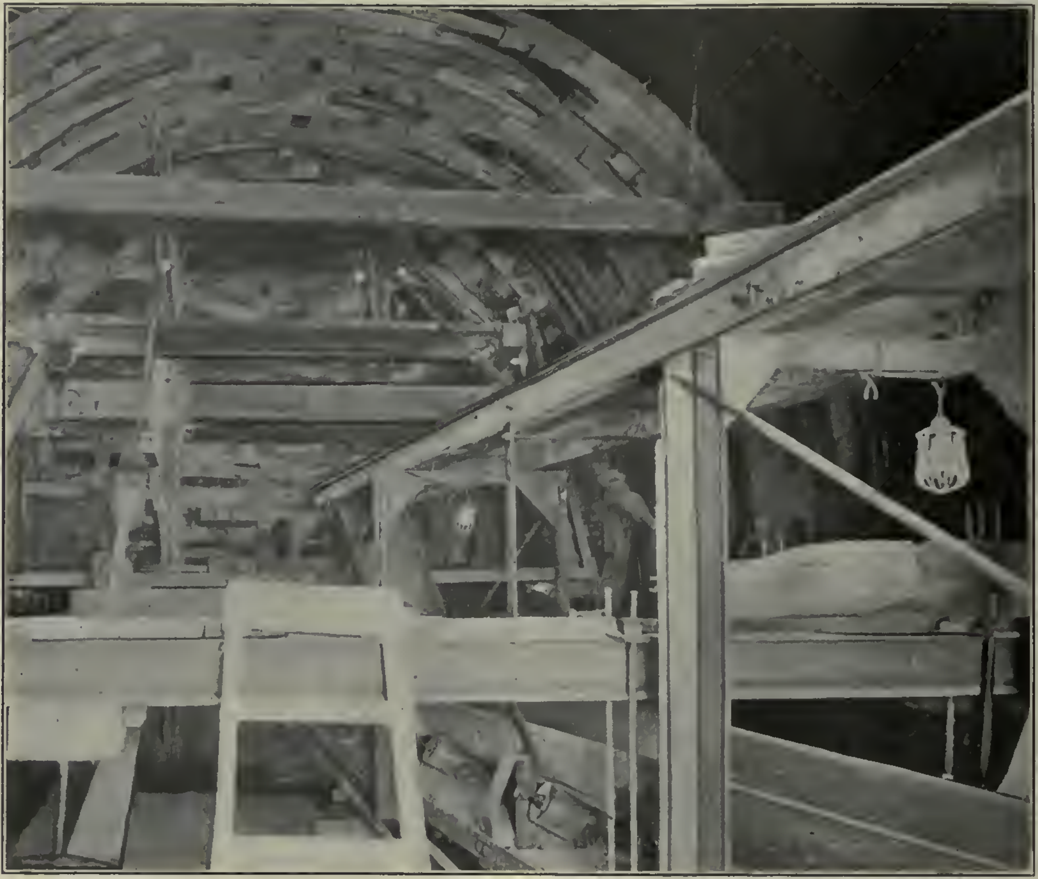
OPERATION OF SHIELDS

The shields used are shoved by hydraulic jacks, and were described in the Engineering Record of Aug. 21, 1915, page 218. They have two sliding tables, which have been used very successfully to help hold the face when sand pockets were encountered. In stiff clay, after the face below each table and the top of the shield has been picked out, the stiff shelf of material in line with each table is cut down by shoving forward the tables.

The men working in the bottom of the shield shovel directly upon the belt. A short hopper leads to the belt from the lower platform, and a chute leads from the upper platform. At the discharge end of the belt a perforated water pipe supplies a steady trickle which prevents the clay from sticking in the discharge chute. Two men with hoes rake the clay down into the cars or hold it back while the cars are shifted.

CONCRETING HANDLED FROM PLATFORMS

The inside invert form, being simple, is made of wood, and about two sections are carried in each heading. The forward concreting platforms carry a spout on each side and each has an elevator which, when down, fits into the material track. Each elevator is run by a two-drum hoisting engine, using air which is mounted on top of each platform at its rear. The side-dump concrete cars are hoisted and dumped one at a time, and the concrete is shoveled into the chutes for the invert and lower side walls, and directly into the forms for the rest of the section.


PLATFORM AND CONVEYOR HUNG FROM SHIELD OVER GAP AHEAD OF FINISHED INVERT

The Blaw forms being used for the side wall and arch section have ribs which make them self-supporting when the carriage used to telescope and move the sections is withdrawn. They are made with removable plates. Eight 15-ft. sections are used in each heading. The carriage on which they are collapsed and rolled forward leaves the lower part of the tunnel entirely clear for the material cars. The form installation was described in the Engineering Record of April 17, 1915, page 510.

MIXING PLANT UNDERGROUND

The concrete mixer is located in the main shaft on West First Street, and is fed entirely by gravity from bins under the street, the bins being loaded by bottom-dump wagons. Cement in bags is dropped to the charging platform down a spiral steel chute with a dished wood chute at the bottom. The pitch of the spiral and the vertical curve of the wood chute check the speed of the bags and prevent their sliding fast enough to tear the sacks. The 1-yd. mixer dumps directly into the concrete cars for either heading.

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BOTH DERRICK AND ELEVATORS EMPLOYED IN SHAFT WHICH SERVES ENTIRE TUNNEL

TUNNEL CARS DO NOT LEAVE SHAFT

As the muck cars come out of the tunnel, they are hoisted one at a time on one of the two elevators, run out on a short track and dumped into dirt hoppers large enough to hold about twelve car loads. From here the dirt runs into 4-yd. side-dump cars on tracks below the bins. These cars are hauled on a short elevated railroad to the dock on Fort Point Channel by narrow-gage dinkies, three of which are in use. At the dock the cars are dumped into scows, in which the muck is taken down the harbor for final disposal. Each of the three bottom-dump scows used will easily hold the dirt from a day's run in both headings.

Wood blocks, tools and supplies are not handled on the elevators, but are lowered down an open well in the shaft by a steel stiffleg derrick which was used in sinking the shaft.

Concrete materials are delivered to the job by trucks. The wood lining blocks are delivered, already milled, by lighter, stored at the waterfront and loaded in sixteen-block bundles by a derrick upon platform cars on the disposal trestle. A coal yard runs from the lower end of the dock to Dorchester Avenue, cutting this space off from the rest of the job. In the space between this yard and First Street is the material yard. A locomotive crane running on a track parallel to the trestle handles all cars, buckets and heavy loads.

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TUNNEL CARS DUMP IN THESE HOPPERS FROM WHICH OTHER CARS TAKE MUCK TO DOCK

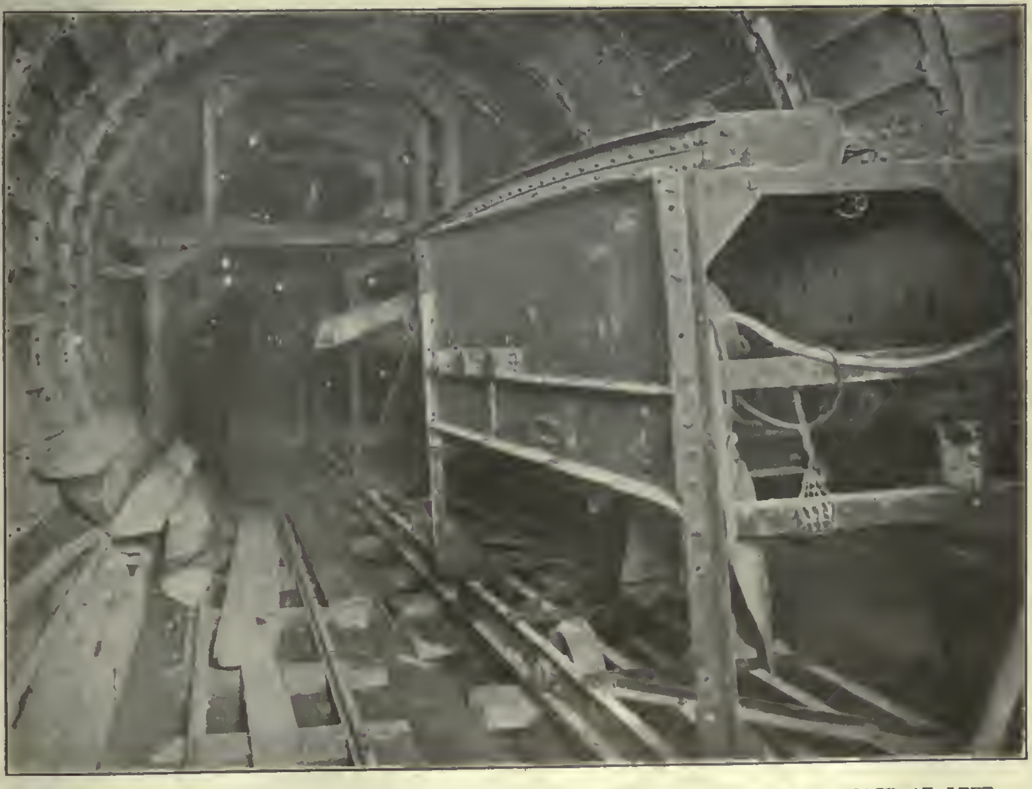
STATIONARY PLANT

On the opposite side of this track from the trestle are located the doctor's office, where a nurse is always in attendance, a two-story dry house with shower baths and lockers for 400 men, a carpenter shop, a machine shop and the compressor plant. The latter is operated by steam, and contains three Sullivan machines of about 2200 ft. capacity each, two small high-pressure air machines for grouting, etc., four high-pressure hydraulic pumps for the shield jacks and two generator outfits for lighting. The stiff clay through which the shields are being driven holds air well, and this air plant has operated much below capacity since the start.

In addition to the plant already mentioned below ground, an extra hoisting engine has been used at the shaft end of each tube to handle cars until the hauls became long enough to make electric locomotives preferable.

This section of the Dorchester tunnel work will be completed entirely from the First Street shaft, as facilities for disposal were poor at the Summer Street end of the section. A maximum haul of nearly 3000 ft. will result, which, however, is not expected to slow up the work.

The tunnel is being driven by Patrick McGovern & Company for the Boston Transit Commission, of which Prof. George F. Swain is chairman and Edmund S. Davis chief engineer. G. D. Emerson, assistant engineer, is in direct charge of this and the adjoining sections for the commission. Patrick McGovern and A. A. Cohill, his chief engineer, worked out the construction details and are taking personal charge of the work. Charles R. Gow is consulting engineer for the contractor. Patrick Porter is general foreman of the contractor's forces on the day shift, and James Brown has charge in the same capacity at night.



DISCHARGE END OF CONVEYOR IS ALWAYS IN FINISHED TUNNEL—FORM CARRIAGE AT LEFT

Swiss Automatic Gates Will Guard Wissota Dam

Gates in Largest Open-Flume Hydroelectric Middle West Plant Tip Only Enough to Pass Excess Flood Waters

AUTOMATIC spillway regulation gates are a feature of a dam 60 ft. high at Wissota, Wis., now being built across the Chippewa River 3 miles above Chippewa Falls to store 8,884,000,000 cu. ft. of water over 10,000 acres of land. Energy to the extent of 45,500 hp. will be developed by the six 8500-hp. single-runner turbines, according to the December bulletin issued by the owners, and from which these notes are taken.

At the point where the dam is to be located on the Chippewa, the river runs through a bed underlain with the pre-Cambrian granites. This granite river bed has been tested by the diamond drill to a depth of from 20 to 40 ft. below the water surface, and the adequacy of the foundation has been proved. From end to end the dam and spillway which will be imposed upon this base will be 6100 ft. long. That part which runs out from the slopes of the adjacent hills to the ends of the concrete spillway will be of earth, with a concrete core wall running continuously through it. The spillway will be 900 ft. long, rising from 60 to 80 ft. above the channel which will be cut into the rock bed of the river to receive it. The dam is to be built strong enough to withstand the failure of every dam either built or contemplated upstream from its location, and this, too, at full flood.

The spillway part will be equipped with thirteen Stauwerke automatic gates, each 64 ft. long and 10½ ft. high, which will operate as the control of the flood water. These gates are of comparatively recent use in the United States, their principle being a Swiss invention, and the right to use them being controlled in the United States by the parent Swiss company.

CONSTRUCTION AND OPERATION OF GATES

The gates are hinged at the bottom and placed so as to be inclined toward the downstream side. They are supported against the water pressure by a series of steel struts on the downstream side. Each strut is fastened to one end of a balance beam, to the other end of which is fastened a counterweight. The counterweight is arranged in such a way that it is in exact equilibrium with the water pressure on the gate. As soon as the pond level rises, the equilibrium is broken and the gate starts to open. The mechanism of the gate is so sensitive that a rise of ½ in. in the pond level is sufficient to start the gate downward. The strut, balance beam and counterweight are diminished in such a way that the gate will not open totally but gradually, proportionally to the rise of the pond level.

The gate is wide open—in other words, in a horizontal position—as soon as the pond level has risen 4 in. above its normal stage. If the pond level rises only 2 in. the gate will be only half open. If the flood is only of small excess the gates will not open wholly, but descend only partly until the pond rises no more, and will close again as the flood subsides. Even with the maximum flood the rise of the pond level will be no more than 4 in. at the gate, at which rise all gates will be totally open, and the combined openings of all thirteen gates has been calculated to be enough to control a flood larger than any on record.

EARTH DAM HAS CONCRETE CORE WALL

There will be 225 ft. of concrete power station built into and made part of the dam, and 300 ft. of concrete dam from the power station to the earth embankment on its side of the river. All the rest of the dam will be of earthwork with a concrete core wall anchored in the rock from the edges and being integrally continuous from the dam itself.

From the top of the embankment to its junction with the hillside the earth embankment will have a slope of 1:4. On the downstream side the slope will be 2½:1. To provide this slope will involve the placing of 650,000 cu. yd. of earth, nearly all of which will be placed in position by a sluicing process. Besides the earth the dam will be composed of 60,000 cu. yd. of reinforced concrete, to make which will entail the consumption of 85,000 bbl. of cement and 800 tons of reinforcing steel.

When completed next January the plant will stand alone as one of the largest open-flume developments in the Middle West.

Contracts have already been entered into for the sale of the major part of the electric power to the Consumers Power Company, of St. Paul, and the Minneapolis General Electric Company. A transmission line 74 miles long of three wires weighing 6500 lb. to the mile will be constructed.

In addition to the professional resources of its own engineering organization, the American Public Utilities Company, owner, has retained the services as consulting engineer of William G. Fargo, of Jackson, Mich. The work is being done in the name of a subsidiary, the Wisconsin-Minnesota Light & Power Company.

Tables Facilitate Accuracy in Timber Beam Design

Corrections and Actual Value for True Dimensions of Sized Timber Show Errors in Usual Practice Based on Nominal Sizes

By R. C. HARDMAN
Civil Engineer, Colorado Springs, Colorado

YEARS AGO commercial lumber was manufactured and sold in full-sized dimensions, but in recent years nearly all kinds of lumber have been cut and marketed under certain definite specifications as to size and quality. These commercial sizes are in all cases smaller than the nominal dimensions, and in the case of lumber surfaced on four sides, are a great deal smaller. These deficiencies in size vary usually from ¼ to ⅝ in., although it is still possible to get full-size timber. The scant dimensions are not important factors in the large timbers, as the ratios of actual sizes to nominal sizes are large, but in the case of the small-dimension material, such as 2-in. lumber, the depreciation in strength and the increase in deflections are serious enough to require consideration.

UNIVERSAL PRACTICE ERRONEOUS

If in the application of beam-and-column formulas the actual dimensions of the timber were used, no harm would result. But the almost universal practice of calling a 2 x 6 a 2 x 6, instead of a 1⅝ x 5⅝, as it actually is, results in too large a safe load or too small a unit stress. When formulas are not used, recourse is had to tables giving safe loads. These tables, which are in nearly every handbook for engineers and architects, are based upon nominal sizes of timbers instead of actual sizes. Therefore it is necessary to apply correction factors to the results given by the tables if the true values be desired.

As the strength of a beam varies directly as bd^2, the deflection varies inversely as bd^3 and in certain column formulas the strength varies as b^4, it is seen that a decrease in b or d will have an important bearing on these values. It is true that the difference between 7½ in. and 8 in. is not great—only 6.67 per cent; but when the second, third or fourth powers are used with the same figures the differences reach proportions which must be taken into account. Thus, for a 2 x 8-in. joist the moment of inertia is 85.33 if nominal sizes are used, and but 57.13 if actual sizes are used.

CORRECTION TABLE FOR SAFE LOADS

In using the tables of safe loads on beams mentioned above, the usual method is to give the safe load for a 1-in. width of beam. For a beam of the same depth, but of another width, the tabulated result is multiplied by the width of the beam. This can be done if nominal sizes are used, as the depths are uniform. However, if an attempt be made to construct a similar table using actual sizes it will be found that confusion will follow, as a 2 x 8, for instance, does not have the same depth as a 4 x 8, and a 4 x 8 has a different depth from a 6 x 8. Therefore a load for a beam 8 in. deep and 1 in. wide could not be used for a 2 x 8, 4 x 8 or 6 x 8. For this reason the simple expedient of constructing new tables for actual dimensions is not feasible. Instead, tables of corrections must be prepared giving factors for each size of timber.

TABLE 2—FACTORS TO BE APPLIED TO TABLES OF SAFE LOADS

Nominal depth	Nominal breadth 2	4	6	8	10	12
2......	....	0.598	0.619	0.619	0.627	0.633
4......	0.667	0.744	0.770	0.783	0.790	0.795
6......	0.714	0.796	0.824	0.889	0.895	0.899
8......	0.714	0.823	0.899	0.909	0.915	0.919
10......	0.733	0.839	0.911	0.921	0.927	0.931
12......	0.746	0.850	0.918	0.929	0.934	0.939

Table 1 gives the actual sizes, sectional areas and section moduli of nominal-size timber faced one side and one edge, the dimensions being those of the Southern Yellow Pine Manufacturers' Association. While these dimensions may not be exactly the same in all cases as those adopted for other kinds of lumber, they will be near enough so that no material error will arise from their use.

Table 2 gives correction factors to be applied to tables of safe loads on wooden beams. These factors, being based solely on bd^2, may be used regardless of allowable unit stress or factor of safety. As an illustration of the use of the table, take the case of a 2 x 8-in. beam with a 10-ft. span. From a table at hand the safe load

TABLE 1—ACTUAL SIZES, SECTIONAL AREAS AND SECTION MODULI FOR COMMERCIAL LUMBER SURFACED ONE SIDE AND ONE EDGE

Nominal depth		Nominal breadth 2	4	6	8	10	12
2	Sec. Mod...	......	1.60	2.48	3.30	4.18	5.06
4	Size	1⅝ x 3⅝	3⅝ x 3⅝	......	......	......	......
	Area	5.89	13.14	20.39	27.64	34.89	42.14
	Sec. Mod...	3.56	7.94	12.32	16.70	21.08	25.46
6	Size	1⅝ x 5⅝	3⅝ x 5⅝	5⅝ x 5⅝	......	......	......
	Area	9.14	20.39	31.64	44.56	56.06	67.56
	Sec. Mod...	8.57	19.12	29.66	42.70	53.72	64.74
8	Size	1⅝ x 7½	3⅝ x 7⅝	5¾ x 7¾	7¾ x 7¾	......	......
	Area	12.19	27.64	44.56	60.06	75.56	91.06
	Sec. Mod...	15.24	35.12	57.56	77.58	97.6	117.6
10	Size	1⅝ x 9½	3⅝ x 9⅝	5¾ x 9¾	7¾ x 9¾	9¾ x 9¾	......
	Area	15.44	34.89	56.06	75.56	95.06	114.6
	Sec. Mod...	24.44	55.97	91.10	121.8	154.5	186.2
12	Size	1⅝ x 11½	3⅝ x 11⅝	5¾ x 11¾	7¾ x 11¾	9¾ x 11¾	11¾ x 11¾
	Area	18.69	42.14	67.56	91.06	114.6	138.1
	Sec. Mod...	35.80	81.65	132.3	178.3	224.3	270.4

on this beam is shown to be 1706 lb. From Table 2 the correction factor to be applied for a 2 x 8 is 0.714. Applying this to 1706 gives 1218 lb.—nearly 500 lb. less than shown for the nominal size.

CHANGE IN DEFLECTION

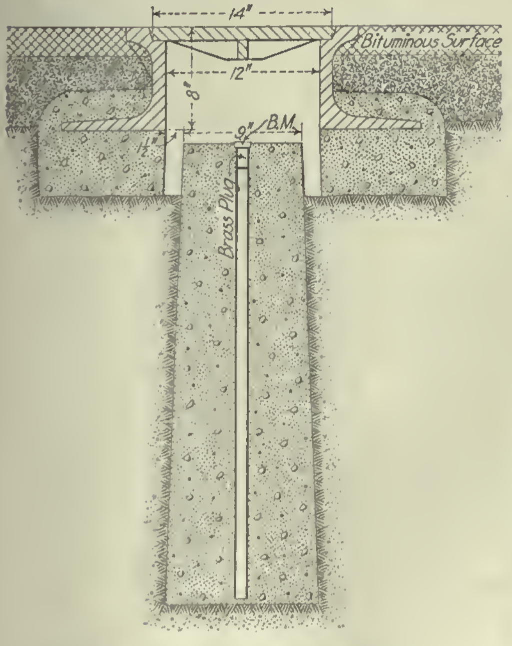
If the factors in Table 2 have been applied, the change in deflection from that computed for the nominal sizes will be almost negligible, except in cases where the depth of the beam is less than the breadth, which is seldom true. Moreover, as the modulus of elasticity, which enters into the computation for deflection, is very indefinite for wood, these corrections may be omitted.

From the above tables, which are based on material surfaced on one side and one edge only, it will be seen that the influence of the scant dimensions on safe loads varies from 59.8 per cent to 93.9 per cent. Similar variations will be found in the case of columns. For instance, a 4 x 4-in. column 10 ft. long, computed by Rankine's formula, gives but 70 per cent of the strength of a full-sized column of the same dimensions.

It may seem that the application of these factors is an unnecessary refinement. This is true, possibly, in the case of the larger sizes, where the correction factor is more than 0.9, but is certainly not true for the smaller sizes. Even though the strength of timber is variable, it seems reasonable in safe and economical designing to apply the factors given, especially when the loads for nominal-sized timbers are from 10 to 50 per cent in excess of the loads safely carried by actual-sized timbers.

Offset Street Monuments 10 Feet from Intersections

STREET MONUMENTS in El Paso, Tex., are placed 10 ft. north and east from the street intersection, thus making them accessible and still out of the way of street-car traffic. The monument consists of a concrete post 3 ft. deep, 12 in. in diameter at the base and 9 in. at the top, set in a hole dug with a post-hole auger. A 1-in. galvanized iron pipe set in the center of the concrete carries a brass plug at the upper end. The pipe also acts to reinforce the concrete. The center of the cross on the plug is accurately set and the elevation recorded, so that both line and grade are available.



FRAME AND COVER ARE INDEPENDENT OF MONUMENT

The method of building the cover into the pavement, so as to make it entirely independent of the monument, is shown in the accompanying drawing. The monuments cost about $35 each.

Competitive Examination Should Govern Highway Appointments

L. W. Page Would Eliminate Politics from Road Work and Save $50,000,000 Which Is Now Wasted Annually

ASSERTING that $50,000,000 is wasted annually in road-building and maintenance by incompetent officials, and that there are, in the whole United States today, only 150,000 miles of really first-class public highways, Logan Waller Page, director of the U. S. Office of Public Roads and Rural Engineering, in an address before the American Association for the Advancement of Science, forcefully denounced the practice of making political expediency the basis of appointment to positions, and urged control of state highway departments by non-partisan, non-paid commissions of laymen selecting technical officers only after their fitness has been demonstrated by competitive examinations.

$50,000,000 WASTED ANNUALLY

"The day for road administration under men holding office solely upon their merit has arrived," said Mr. Page. "We do not want men chosen because of their value as political workers, but men noted for their constructive gifts and proved engineering ability. What difference does it make to the farmer hauling his crops to market, or to the merchant transporting his merchandise home, or to the traveler journeying from place to place, whether the road was built and is maintained by a Democrat or a Republican or a Progressive? The road is the thing. Yet, speaking generally and of the country at large, road construction and road maintenance have been largely committed to more or less desirable political workers with the result that not less than $50,000,000 is wasted annually by the carelessness and incompetence of the men charged with the supervision and administration of the public highways of the country. It is not so much the fault of the road officials themselves—they want the money wasted upon them in the way of salary, and need it—but of the political system which makes their selection possible. Before there can be any substantial improvement in the character and efficiency of the men the system must be destroyed."

"There are in the United States 3000 counties and approximately 100,000 local road officials, supervisors who do not know how to supervise, overseers who lack both the technical knowledge and administrative ability to oversee, insufficiently paid for competent work but overpaid at any price for what they can do, and who are elected by the people because they are 'good fellows.' They are hard workers in party affairs, and they must have 'recognition,' bother the roads and the purposes for which they are opened. Time was not so very long ago when in some of the states superintendents of education, who signed their names with a cross mark, were not infrequently selected, because they had been 'good soldiers' and needed the salary. If the public roads of the country are to be accepted as proof of the fitness of the road officers they are condemned by their work."

CHANGES IN OFFICE CAUSED BY POLITICS

The whole business has been running at loose ends, according to Mr. Page. What should have been everybody's business has been nobody's business. There has been no continuity of effort, no organization of the working units, no general planning in the public interest, no seat of authority, no care in administration. Changes in the political control of states and counties and districts are followed by changes in the political complexion of road officials, without regard to the competency of the new men selected for this work or the efficiency and experience of the men displaced to make a political holiday. Within the last ten years arbitrary changes on political grounds have been made in the control of the engineering work in the state highway departments of Arizona, Connecticut, Delaware, Maine, Michigan, Maryland, Missouri, New Hampshire, New Jersey, New York, Pennsylvania, Washington and West Virginia. In the last fifteen years nine changes have been made in the control of the highway department of New York, and the most of these changes have been made on partisan political grounds. Doubtless some of the changes have been justified because of the inefficiency or other unfitness of the men holding office; but in the main the highway departments have been regarded as offering convenient refuges for "deserving" workers in whatever party happens to be on top.

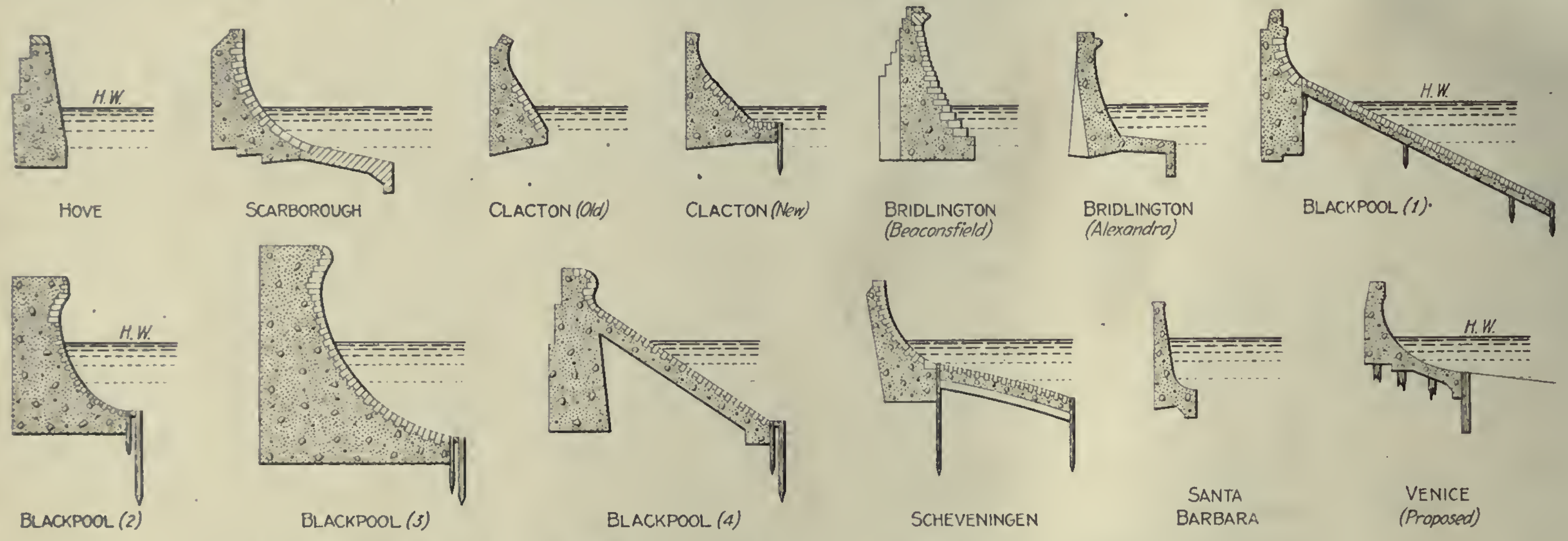
COMPETITIVE EXAMINATION URGED

The building of public roads ought to be a purely business enterprise, managed on strictly business principles. The men charged with the work should be selected solely on the ground of merit. As the most effective way of protecting the state highway departments from the destructive influence of partisan politics Mr. Page suggests that each department be placed under the control of a non-partisan, unpaid commission, partly ex-officio and partly appointed, and representative of the education and scientific institutions of the respective states, the appointed members of the commissions to be selected exclusively from laymen of approved fitness for the work in hand. He would entrust to these commissions the selection of the chief technical road officers, their selection to be made wholly on the ground of qualifications as proved by competitive examination, just as the officers of the Government at Washington are selected for their fitness. He would take the roads of the country out of politics, the bane of all well-directed and successful administration of the most important service. He would not interfere with the initiative and voice of the counties in the management of their local affairs further than to require that the men selected to direct the country road work should be chosen only after passing such examination as the state highway departments, acting in co-operation with the civil service department of the state, might require. The intelligent application of the merit system in securing skilled supervision in road work is the only promising method of eliminating politics from road administration.

Sea Walls of Various Designs Discussed and Compared

Success or Failure of Many Types Have Shown Curved Faces and Long Toes to Be Among the Essential Features

SEA WALLS and groins are in general mutually supplementary in the protection of sandy seashores, as was pointed out by Leeds & Barnard, engineers, of Los Angeles, in their report on the problem at Venice, Cal., which was abstracted in the Engineering Record of Jan. 8, page 51. Some of the latest developments in groin work along the coast of Holland were described in last week's issue, page 118. A discussion of various types of sea walls built at various times and places, mainly along the English coast, was included in the Leeds & Barnard report, and is here presented. The last drawing is that of the wall proposed at Venice, and the discussion by the authors as it appeared in the abstract published Jan. 8 is here repeated for convenience.



MANY TYPES OF SEA WALL HAVE BEEN TRIED, ESPECIALLY ALONG THE SOUTH AND EAST COASTS OF ENGLAND

Examples of Sea Walls

Of sea walls there are many different types, and the accompanying cross-sections show a number of the more important ones. A brief description of each follows. It is to be remembered that the costs as given represent work done under conditions very dissimilar to those prevailing in this locality at the present time. Such walls if constructed here would cost a very much greater amount.

Hove Sea Wall.—Built in 1884, of concrete, faced with 4-in. flints. Within a year after construction the sea scoured out the beach 7 or 8 ft., to within 10 in. of the bottom of the wall, necessitating the driving of sheet piling. This is a good illustration of the scour which usually occurs in front of a nearly vertical wall. Cost unknown. Groins were later constructed in this instance and have since maintained the beach in front of the wall.

Scarborough.—The section not cross-hatched was built in 1886-90. It was set 2 ft. in hard shale. It was subject to heavy wave action which soon after completion scoured out the beach and cut out the shale in places to a depth of 3 ft. The apron shown cross-hatched was added in 1891. This apron consists of pitched stones on a layer of concrete. The cost, including backfilling but not the added apron, was approximately $26 per linear foot.

Clacton (Old Wall).—This was built about 1880-2. It was founded in London clay. The cutting effect of the waves was largely due to three high concrete groins, so great that the groins had to be removed and an apron added to stop the scour and prevent overturning of the wall.

Clacton (New Wall).—As a result of the experience with the old wall this wall has an apron added, and a slightly flatter slope. Cost about $30.50 per linear foot.

Bridlington - Beaconsfield.—This was built in 1888. It is stone faced with concrete backing. Cost approximately $49 per linear foot.

Bridlington-Alexandra.—This was built in 1879 at a cost of approximately $27.75 per linear foot.

Blackpool (1).—This consists of a wall proper with an elaborately protected slope in front. The slope protection is at an inclination of 2:1, and has a tendency to encourage scour. It has had to be extended as the beach lowered. Three quarters of a mile of this protection, including a promenade, cost $575,000, or $145 per linear foot.

Blackpool (2) *and* (3).—These walls have been built very recently and represent probably the result of previous experience. The massive construction, curved face to receive and reflect the waves, protected surface in the rear of the wall and protective sheet piling at the toe are all to be noted.

Blackpool (4).—This wall is the last one constructed and shows the retaining-wall section with long sloping rock-faced apron. The total cost of 1200 ft. of the latter type, and 8352 ft. of types (2) and (3) was $1,850,000. This gives an apparent cost of approximately $190 per linear foot.

Scheveningen.—This is another combination of sea wall and slope protection. It was built about 1896-97. It is of concrete, faced with basalt blocks. Cost approximately $60.20 per linear foot.

Santa Barbara.—Built in 1915. This wall has not been in long enough use to have been subjected to any very severe test. This is a much lighter type of wall than the foreign walls described above, but is not exposed to such severe wave action. It is designed as a reinforced structure and not as one having a gravity section. The design embodies a number of correct principles, and presumably the size and weight of the wall are designed in accordance with the exposure, beach conditions, etc. Its cost was about $35 per linear foot.

Coronado.—This [not shown] is a sea wall of the random rock type used to protect the properties and driveway along the ocean front. It protects a light concrete wall in its rear, which in turn retains the roadway along the beach. It is a good example of a flexible, permanent and substantial type of protection, and occupies no great amount of beach space. If any settlement occurs due to an unusually hard storm, a little more stone can be added on top and the wall is stronger and better than before, and no labor or material will have been wasted. Concrete slab steps can be cast for access to the beach, and absolute protection to property is assured.

Wall Proposed at Venice, California

The proposed concrete wall at Venice embodies the best principles of sea-wall design. It has an elliptically curved face, which is the natural form of the wave, and is therefore best suited to changing the motion of the water from horizontal to vertical. At the bottom the curve is tangent to the slope of the beach. It therefore guides the wave from the beach to the wall and vice versa with the least possible disturbance.

Above the curve the wall slopes slightly backward, but has a slight coping at the top, just sufficient to prevent the wave being thrown upon the promenade back of the wall. This coping is carefully designed to turn the wave so that it shall fall on the apron, rather than on the beach in front of the wall. Scour of the beach at the toe of the wall will therefore be eliminated. To prevent undermining of the wall by a lowering of the beach in any exceptional storm, the sheet piling necessary during construction will be cut off at the toe and left in place.

The mass of the concrete is so distributed as to place the greatest resistance where the waves will strike with the greatest violence. It also offers the maximum resistance to the sand pressure from the back. Under present conditions such a wall should cost about $50 per linear foot.

MAINTENANCE OF A CONCRETE ROAD on Superior Boulevard carrying the heaviest traffic between Minneapolis and Lake Minnetonka cost $9.32 per mile last year. The original cost of the 4.8-mile stretch was $68,062. On the same road are 3.8 miles of macadam one year older than the concrete. It cost for maintenance $280 per mile per year, and $50,000 total to build.

Hydraulic Ejectors for Grit Removal Merit Trial in Sewer Maintenance

Tests Needed to Demonstrate Further Possibilities of Catch-Basin Cleaning by New Method Adopted in City of Seattle

By JOHN H. GREGORY
Consulting Engineer and Sanitary Expert, New York City

HYDRAULIC ejectors for cleaning sewer catch-basins at Seattle, Wash., described by A. W. Howard, of the city engineer's office, in the Engineering Record of Dec. 4, 1915, page 690, are well worth careful study by engineers in charge of the maintenance of sewer systems where grit must be removed from catch-basins or other devices serving the same purpose. The hydraulic ejector for raising and transporting sand has been used for a good many years, but Seattle is one of the first, if not the first, city to employ a hydraulic ejector for removing grit in connection with the maintenance of a sewerage system, although the idea of using an ejector for this purpose is not new. To the writer's personal knowledge it received serious consideration at least twice, once in Columbus, Ohio, in 1908, and again on the Passaic Valley sewerage project in New Jersey in 1909.

EJECTORS CONSIDERED AT COLUMBUS

In Columbus a large part of the city is sewered on the combined system, the dry weather flow being intercepted and discharged into an intercepting sewer which leads to a pumping station from which the sewage is pumped to the disposal works for treatment. The intercepting sewer, in a number of stretches, has quite flat grades with resulting low velocities, in several places the velocity being less than 2 ft. per second, while in one stretch the velocity is as low as 1.72 ft. per second. Trouble has been experienced a number of times from the deposit of grit in this sewer, and the removal of the grit has been expensive. This condition of affairs came to the attention of the writer while he was in charge of the design and construction of the sewage disposal works at Columbus, and he gave serious consideration to the construction of catch-basins and sand-catchers at the junction of certain of the lateral combined sewers with the intercepting sewer for the purpose of preventing a part, at least, of the grit from entering the intercepting sewer. The construction of these proposed sand-catchers was referred to by Julian Griggs, former city engineer of Columbus, and also by the writer, in the discussion of a paper descriptive of the Columbus sewage works. (*Transactions*, Am. Soc. C. E., Vol. 67, pages 206-437, "The Improved Water and Sewage Works of Columbus, Ohio," by John H. Gregory.)

Although no mention was made in the writer's discussion of any method of removing grit from these sand-catchers, he had in mind, from a wide experience with the handling of sand by hydraulic ejectors, the use of an ejector, the principle of which, if not the detail, was the same as that in use in Seattle. Unfortunately, funds were tied up until the completion of certain contracts, and it was not until the sewage disposal works were nearly completed that funds were in sight to make a start on the carrying out of this work. Realizing that this work should be done, and also that the writer's connection with the city would shortly come to an end, he made the recommendation that one of his assistants be retained to design these connections and supervise their construction, but no action was taken on this recommendation.

PASSAIC VALLEY PLANS

In the following year, 1909, while resident engineer of the Passaic Valley sewerage project, the writer again gave consideration to the use of the hydraulic ejector for removing grit from proposed sand-catchers or catch-basins which were to be so located as to prevent the heavier grit, which would come from certain lateral combined sewers, from entering the Passaic Valley sewer. The writer proceeded a little further with the idea this time, and he had made, before severing his connection with this work in 1910, quite a number of studies and detail designs of intercepting connections in which a sand-catcher for removing grit was included, the grit to be removed by a hydraulic ejector. And he even went so far, personally, as to make some rough tentative sketches of a specially designed motor-operated wagon or truck adapted for use with such an ejector.

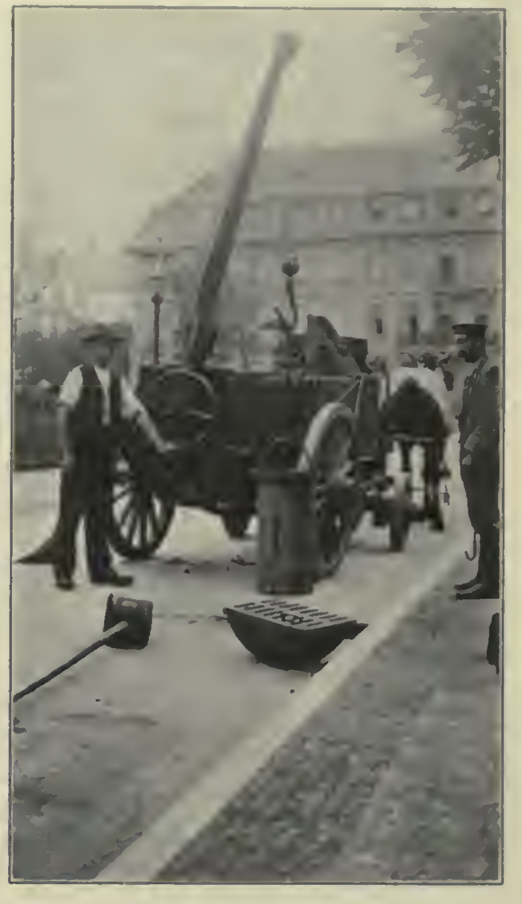


FIG. 2—CRANE RAISING CATCH-BASIN BUCKET FILLED WITH GRIT

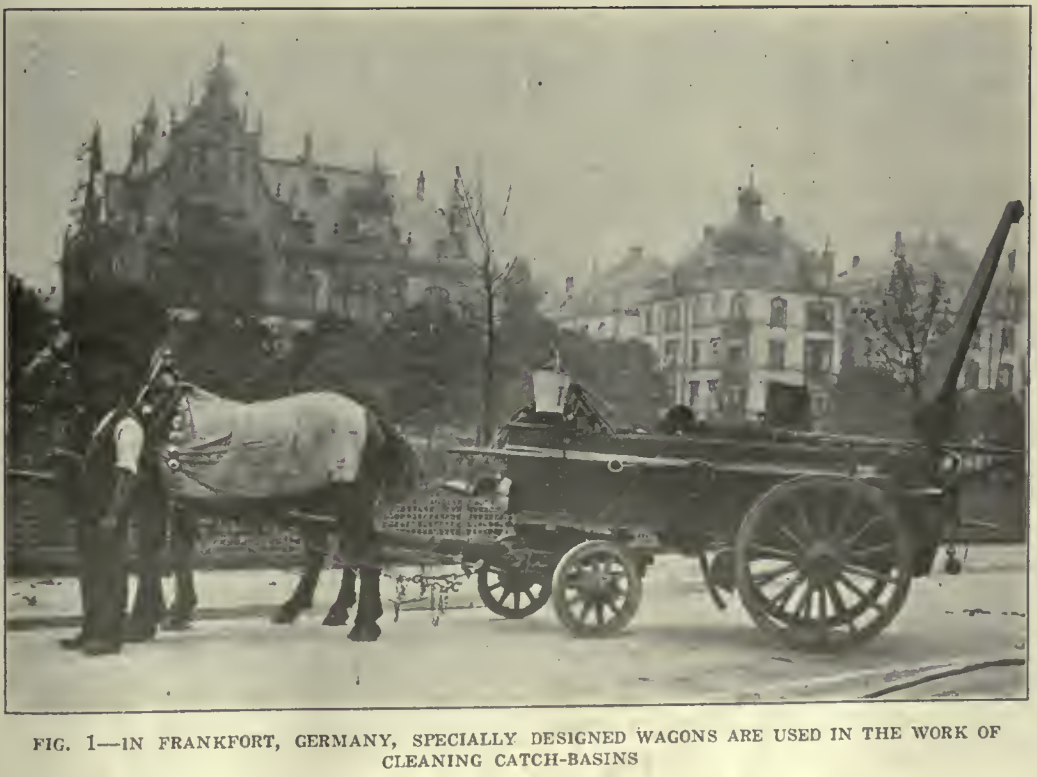


FIG. 1—IN FRANKFORT, GERMANY, SPECIALLY DESIGNED WAGONS ARE USED IN THE WORK OF CLEANING CATCH-BASINS

EJECTOR TESTS NEEDED

The writer does not wish, for a moment, to convey the idea that the hydraulic ejector will, by any means, solve all of the troubles and annoyances encountered in removing grit in the maintenance of a sewerage system, and he realizes full well that the ejector has its limitations, but in his opinion the idea of using such an ejector has enough merit to warrant, in large cities, the expenditure of sufficient funds to determine, on a practical scale, the relative advantages and disadvantages of the ejector for removing grit from sewer catch-basins.

Where grit is retained in what are now generally termed grit chambers, it is questionable how far the ejector could be used to advantage, especially in large grit chambers. But where it is desired to keep grit out of sewers which, perforce, have been or must be laid on relatively flat grades, the construction of sand-catchers at suitable points, and the removal of the grit therefrom by hydraulic ejectors, may be of material assistance in helping to keep the sewers free from objectionable deposits and thereby to reduce the cost of maintenance.

No hard and fast rules can be laid down as to whether the best results would be obtained with a stationary or portable ejector, as local conditions would generally be a controlling factor in deciding which type to use. The hydraulic ejector might be of much service in removing grit from catch-basins which are so commonly built for storm water to pass through before entering the sewers, and here again the feasibility of removing grit by this means is well worth trying out on a practical scale. Such an investigation should, however, be carried on under the direction of one who will appreciate in advance that troubles with the ejector are sure to be encountered sooner or later, and that much patience may be needed in order to overcome them.

Danger of Clogging

It is well known that nearly everything under the sun is either thrown, or in some other way gets, into the streets and that much of such matter is washed into the catch-basins, where a portion of it is retained. Not all of the material retained in the catch-basins can be handled by a hydraulic ejector, and it is fairly safe to predict that clogging of the ejector would, at times, take place. Whether the clogging would occur frequently enough to cause this method of removing grit to be more of a nuisance than a convenience can only be determined from actual experience. It is, however, possible that the ejector could be used to advantage in cleaning out a part of the material only from the catch-basins, as grit, sand, etc., thereby reducing the amount to be removed by other means.

The character of the pavements would have a direct bearing on the nature of the material retained in the catch-basins. Thus, in one locality, the streets may be well paved, in which case perhaps but relatively little grit would find its way into the catch-basins, while in another locality there may be many unimproved or macadam streets, in which case the catch-basins would be likely to receive a considerable amount of grit. Again, the material which had accumulated in the catch-basins in one locality might be so light that when removed by an ejector and brought into suspension in water it would not readily settle out in passing through either a movable or stationary tank especially built for the purpose of retaining such material.

The problem of cleaning catch-basins by means of a hydraulic ejector would not be fully solved with simply the removal of the material from the catch-basins. There still remains to be handled the mixture of water and material as discharged by the ejector. If the catch-basin material is heavy grit or sand, it would readily settle out in passing through a tank in which the velocity would be materially checked. Such a tank could, to advantage, be mounted on a specially designed motor truck, the truck to serve a double purpose, first, of providing means for the settling out of the material ejected from the catch-basins; and, second, of providing means for transporting this material to the point of disposal. The dirty overflow water from the tank, depending on local conditions, as on the grade of the gutter and on the order in which the catch-basins were cleaned, might be either discharged into the gutter, from which it would find its way to the sewer, or piped direct into the sewer.

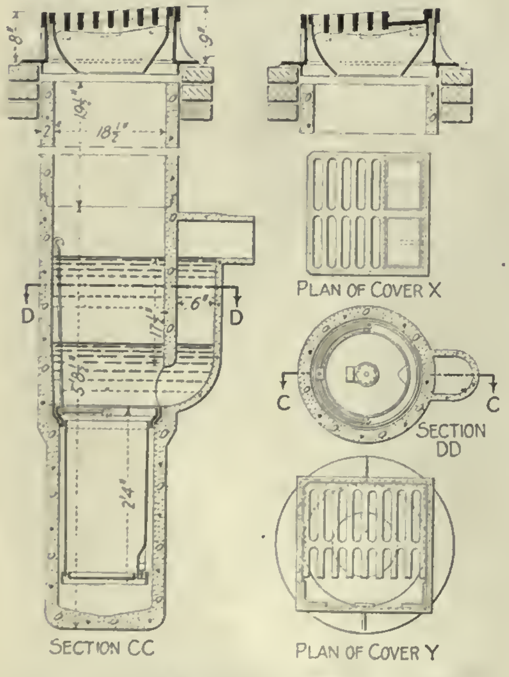


FIG. 3—TRAPPED CATCH-BASIN WITH DEEP HANGING BUCKET

Tank Truck an Accessory

The idea which the writer has had of a specially designed truck seems to coincide, in certain particulars at least, with the proposed wagon which Mr. Howard has planned to use in Seattle. For catch-basin service, however, the writer would go further than simply providing a truck with a tank for the settling out and transportation of the heavy material. The truck could, to advantage, be fitted up so as to carry an ejector which could be lowered, direct from the truck, down into the catch-basin, and also so as to carry the hose necessary to connect the ejector with the nearest hydrant and to carry away the dirty overflow water, if it was not found satisfactory or practicable to discharge it into the gutter. Means could also be provided for rolling up the hose and for carrying such tools as it would be found necessary to use.

It might, perhaps, be better to have one truck, an ejector truck, fitted up especially for handling the ejector operations, and other trucks, tank trucks, which could be provided at less expense, fitted up with tanks for the settling out and transportation of the material. One specially designed ejector truck could then, perhaps, keep several tank trucks busy with a minimum loss of time. That specially designed trucks or wagons fitted up for catch-basin cleaning can be used to advantage and that economy of operation will thereby result, has been shown by the experience in several cities, as for example in Pawtucket, R. I. (see Engineering Record Jan. 24, 1914, page 111), where a motor truck with an orange-peel bucket and boom is used not only for cleaning catch-basins but for transporting the material removed therefrom. It is obvious, of course, that the truck must be designed especially for the class of work which it is called on to perform.

Special Wagon Used in Germany

One of the best of these specially designed wagons is the one used in Frankfort, Germany, which the writer first saw there several years ago. Two views of one of these wagons are shown in Figs. 1 and 2. The construction and operation of the wagon will be readily understood from an examination of the photographs, especially of Fig. 2, which shows the crane raising a catch-basin bucket filled with grit. The bucket is raised to the top of the wagon where it is set upright in a pivoted tipping tray which may be seen on the right-hand side of the wagon. The tipping tray and the bucket are then turned over to the left, counter-clockwise, the bucket discharging its contents into the wagon.

Two Types of Catch-Basins

Two types of catch-basins are in use on the combined sewers and storm water drains in Frankfort. The first type, Fig. 3, is trapped and has a deep-hanging grit bucket; the other type, Fig. 4, is not trapped and the grit bucket is suspended at the top of the catch-basin. It will be noted that the Frankfort catch-basins are much smaller than those ordinarily built in American cities.

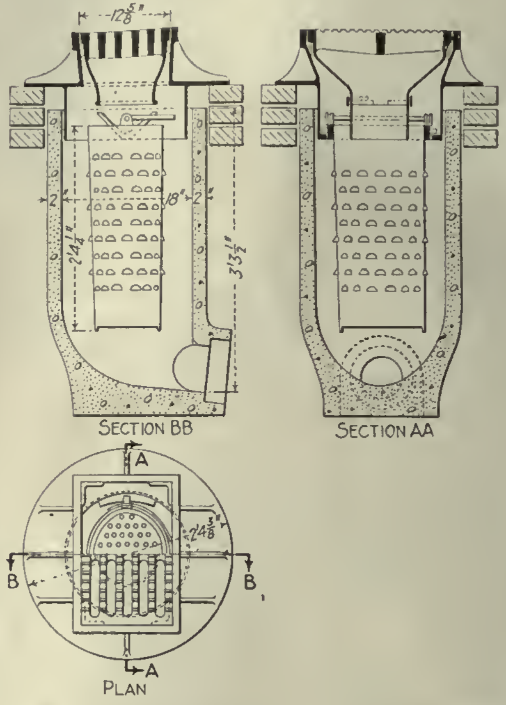
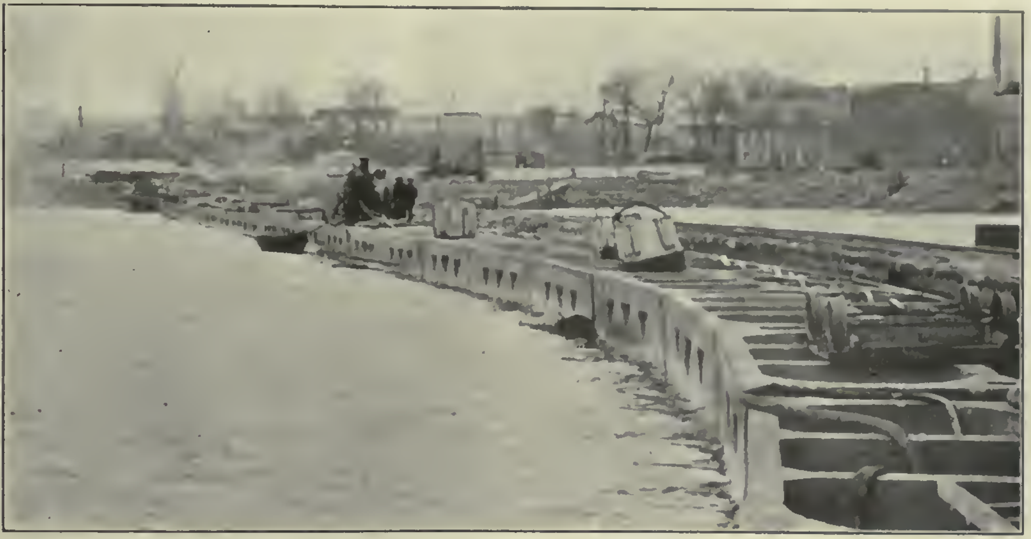


FIG. 4—UNTRAPPED CATCH-BASIN WITH BUCKET NEAR TOP

It should not be inferred that the use of a hydraulic ejector for catch-basin cleaning is necessarily the best method, or that it is applicable under all conditions. The method has sufficient merit, however, to warrant a fair trial on a practical scale, and only by so doing can its advantages and its shortcomings be determined. The writer has made no secret of his views on the use of the hydraulic ejector for cleaning catch-basins and sand-catchers, as he has discussed the subject with various engineers ever since he first proposed to use this method in Columbus, in 1908, and it is a source of much satisfaction that other engineers, acting entirely independently, have had sufficient faith in the method to install it on a practical scale and give it a fair trial. Too much credit cannot be given the engineers of Seattle for the work they have done in furthering the use of the ejector.

A **Bithulithic Pavement**, laid with soft stone, in Houston, Tex., was recently resurfaced. The soft material had begun to break out and some attention was necessary. The surface was thoroughly cleaned and cut back with Texaco asphalt cement (60 penetration) and naphtha. This was squeegeed on and left for about two hours until the naphtha had evaporated. The surface was then covered with a coat of asphalt cement and ¼-in. chats. This has, the city engineer of Houston, E. E. Sands, reports, proved a satisfactory method of treatment.



STACKS OF SHELLS BUILT UP WITH CLOSE ALIGNMENT ON CURVE AT BASIN 1

Large Volume of Concrete Handled in Small Batches at Halifax Ocean Terminals

Great Accuracy in Casting 62-Ton Blocks Laid Under Water on Foundations Prepared by Diving Bell—Unusual Drilling and Dredging Equipment

THAT submarine foundation walls for piers and quays can be built up in open water from solid rock with concrete blocks, securing first-class results in both grade and alignment, is being proved by the contractors for the first unit of the ocean terminals at Halifax, Nova Scotia. All the expense of cofferdams, or of rows of pneumatic caissons, is eliminated. The concrete is cast on shore in plain sight or is placed under water in most favorable circumstances by economical methods. The rock excavation is being done cheaply and at a rapid rate.

Unusual Conditions

But the foundation walls are no ordinary walls. Most of the blocks, or "shells," of which they are built weigh upward of 62 tons apiece. And the submarine excavation is no ordinary rock contract. More than 300,000 yd. of solid schist must be drilled, blasted and dredged to a depth of 45 ft. below low tide to make room for the land side of the pier, quay and basin now under construction. So also the plant assembled for the job does not consist altogether of the ordinary construction tools. It includes a central concrete plant capable of mixing more than 1000 yd. of concrete in twenty-four hours, and of mixing it in small batches that can be dumped into the accurately-adjusted shell forms without danger of displacing them. It includes a 310-ton tool resembling the giant shovels used for stripping in the western coal fields, but equipped with a steel boom and 5-yd. orange-peel, and mounted on a 180-ft. scow. It includes a 12½-yd. dipper dredge, two other smaller dredges and two drill scows capable of drilling simultaneously seventeen holes. These last are equipped to load holes, move back and fire the shot, and move up again and resume drilling, without assistance and in a very short time. The plant includes also a large diving bell in use for placing the concrete stools or pedestals under the corners of each stack of shells, which make it possible to lay them exactly level. A derrick barge which also mounts boiler, compressor and concrete plants, attends the diving bell. Besides, a floating concrete plant has been made ready for special work.

On shore the concrete buckets are handled by two locomotives and low, standard-gage flat cars, and dumped by an Industrial locomotive crane. Another crane of the same make, of 150 tons capacity, handles and places the huge shells at any radius up to 33 ft. In addition a granite quarry has been developed at Purcell's Cove, down the harbor, for rubble and face stone. A fleet of barges and three harbor tugs are used both to transport this material and to bring in sand and gravel from across the bay.

How Wall Is Placed

The principle on which the construction plan is based consists of building up a wall 31 ft. thick of the shells shown in the accompanying illustrations. The wall to be completed under the present contract will extend around the site of pier A, basin 1, and the passenger landing quay. The blocks are laid on top of each other by the locomotive crane running on the finished wall after the excavation has been completed and the foundation prepared with the diving bell. When a stack has been completed all the holes in the bottom shell and for half the height of the next-to-the-bottom shell are filled with concrete deposited under water. The rectangular holes down the center of the stack and across the outer face are then concreted solid, making a solid face on the water side with a counterfort at the center of every stack. The holes with round ends and the spaces between stacks are then backfilled with rubble and dirt. The small 10-in. holes are then grouted, all voids in the horizontal planes between shells being filled. In some of the latter holes old rails are hung from top to bottom to help bond the stack together. The V-shaped notches at each corner of the shells fit around square concrete posts, which are placed at the same time as the shells, and form a guide for setting them, as well as keying adjacent stacks together.

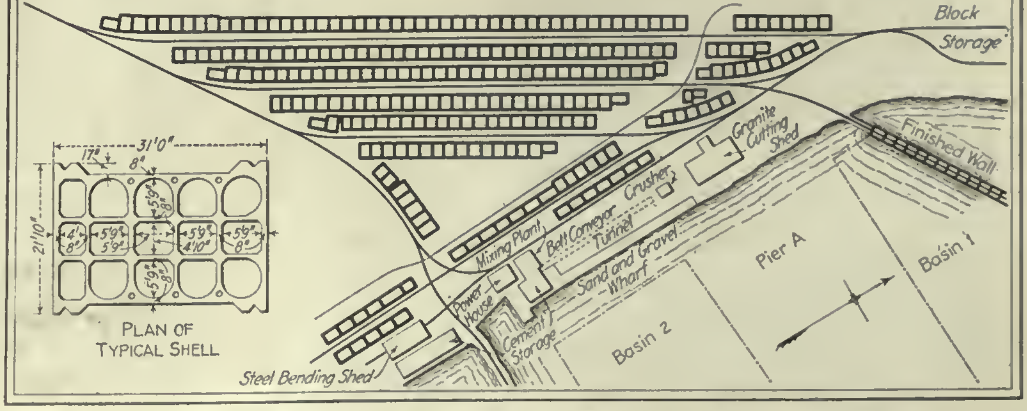
Part of the quay wall and the outer end of the pier lie in water 60 ft. deep. Of course no excavation for the basin was required at that depth, and rather than spend money to step off the bottom and build a wall of additional height and thickness, rubble mounds will be built up to 45 ft. below low water, allowed to settle for a year, leveled off and used in the same way as the rock bottom as a foundation for the wall.

Behind the quay and inside the pier a fill will be placed, of material dredged from the site or hauled from a heavy cut on the railroad being built to the terminal. This will give the wall a heavy backing of riprap.

On the shelf formed by stepping back the top two shells of each stack will be built a face wall of cut granite, backed with a heavy section of concrete. The wall will then be ready for final filling, which, as will be remembered from the article on page 102 of the Engineering Record of last week, will be of sand and gravel.

Block Casting a Critical Factor

How to build such a wall with economy and speed was the problem confronting the contractor. It has been found that a stack of these shells 44 ft. high, containing 322 cu. yd. of concrete, could be set in less than three hours. Granted that the drill boats and dredges could keep out of the way with the general excavation, the diving bell could prepare the foundation for a stack in about forty-eight hours. This speed, however, might be increased to the preparing of foundations for three stacks in the same or a shorter length of time, which, it is estimated, could be done with a new diving bell, the construction of which is now being considered. Should the proposed new and the existing bells both be used, a speed of three stacks a day could be reached by one crane. With the present and proposed diving bells and stacks of



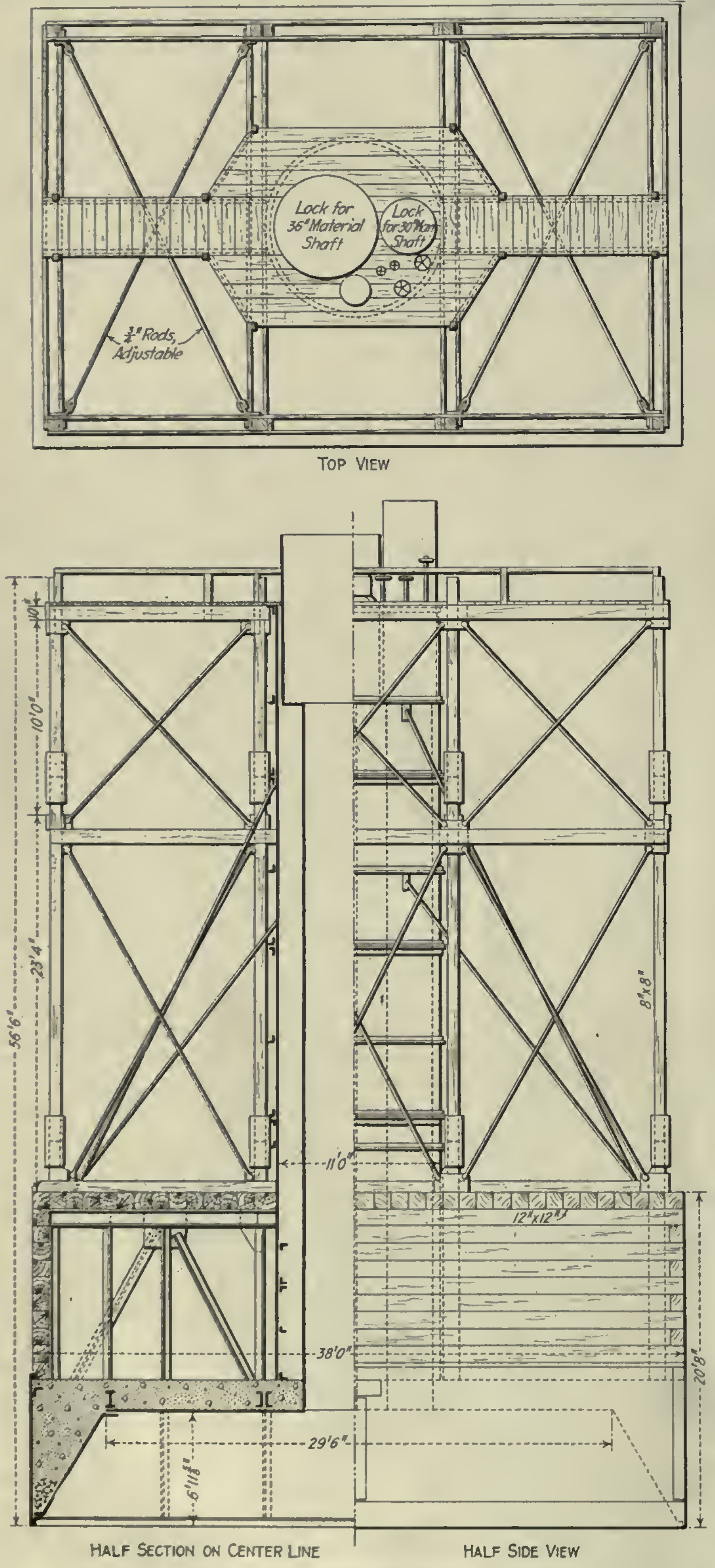
ENOUGH CASTING PLATFORMS PROVIDED FOR 7500-YARD RUN WITHOUT SHIFTING the height composing the bulk of the work, 1150 yd. of shells could be set per day, and 1050 yd. of additional concrete placed in the pockets. It was decided to build a concrete plant capable of at least maintaining the rate required to concrete the pockets, and in addition to cast as large a supply of blocks in advance as possible, to guard against delay from cold weather, shortage of material, or breakdowns.

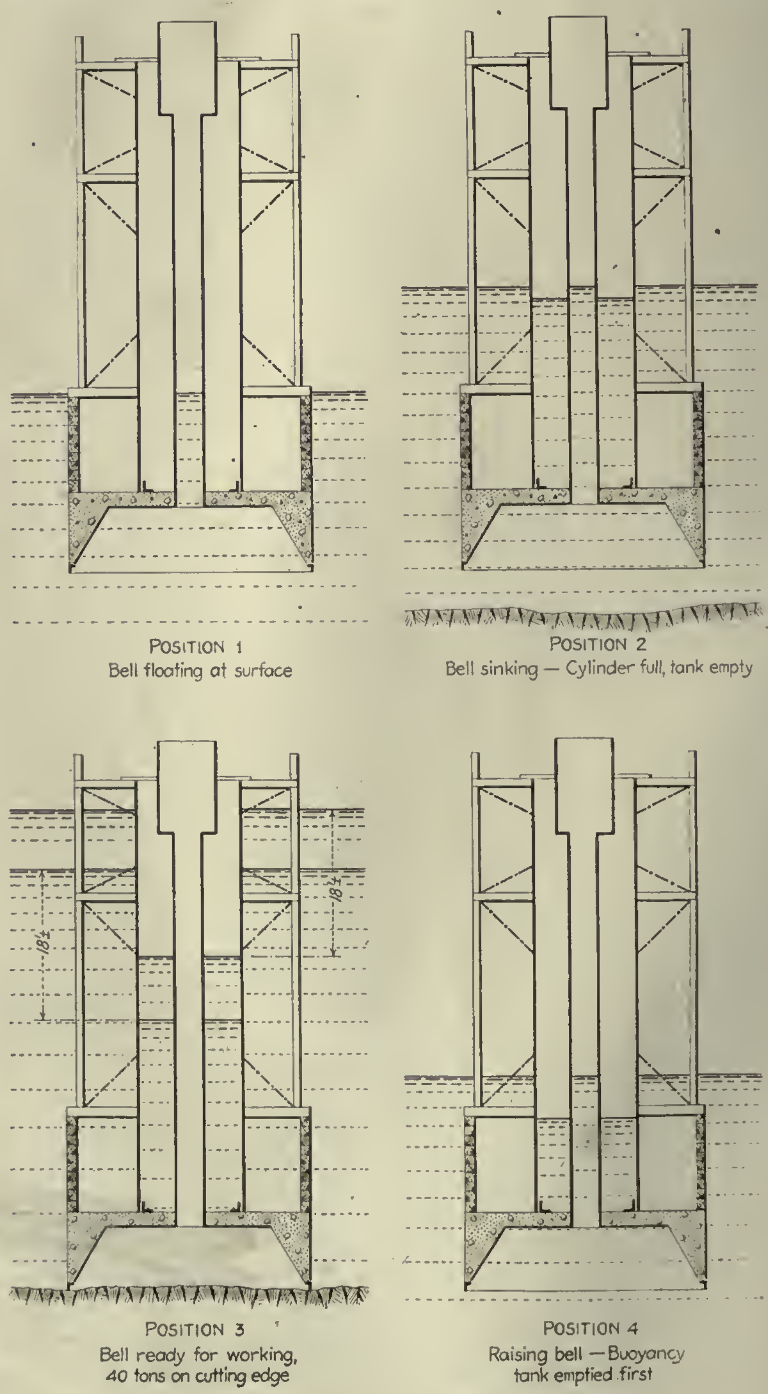
As it was necessary to let the blocks set 28 days before they could be handled, a yard containing upward of 260 form platforms, arranged along six tracks, was laid out. This made possible a continuous run of more than 7500 yd. without the necessity of moving any of the blocks. In order to keep up the work at this rate, thirty-four forms were provided for the shells S-1, of which 2453 are to be made. Forms for the shells S-4, of which there are 462, and for shells S-2 and S-3, of which there are 264 each, were ordered in proportion. The forms, shown in the accompanying photographs, were of Blaw design. The outside forms for special shells, of which there were few to be cast, were made of wood. It has never been necessary to cast any of the blocks on top of each other with building paper between, as was at first intended, to increase the capacity of the casting yard. This system would have made the handling of the forms much more expensive.

When possible the blocks are taken direct from the molding yard and placed in the wall. It is necessary, however, to store the surplus blocks for winter use before they are placed, for which two tracks northeast of the casting yard and in line with it are provided. Each block is stenciled as soon as the forms are removed with its date, its serial number in the order cast, and its pattern number. Shells of the same pattern and approximately the same age are stacked on top of each other three or four deep in the storage yard. Already about 1200 of the 3667 shells needed have been cast, which gives ample margin for the winter's setting and will leave something to work with when weather conditions permit the resumption of open-air casting.

Form-Setting Accurately Done

The platforms on which the blocks are cast must be carefully leveled each time the forms are set. The slightest irregularity in the principal dimensions or "square" of the blocks would make laying difficult. Holes are cut in the platforms under each pocket in the shells for which they were made to give access to the leveling wedges. The steel pocket-forms are assembled first and the reinforcing is placed, after which the outside form is set up, the platform is leveled and the forms are carefully adjusted. The reinforcing is all handled and bent in a special shop equipped with circle bending rolls and hook benders. Most of the bars are ⅞ in. square or less. About six men are kept busy in the shop continuously.





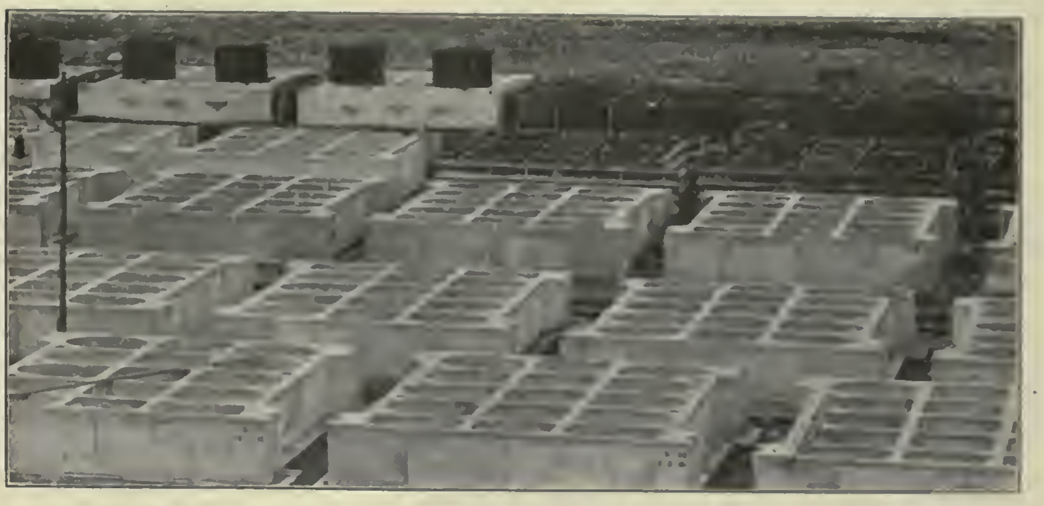
Position 1
Bell floating at surface

Position 2
Bell sinking — Cylinder full, tank empty

Position 3
Bell ready for working, 40 tons on cutting edge

Position 4
Raising bell — Buoyancy tank emptied first

DIVING BELL HAS BALLAST TANK DESIGNED TO FACILITATE RAPID MOVING FROM ONE PAIR OF FOUNDATION STOOLS TO NEXT

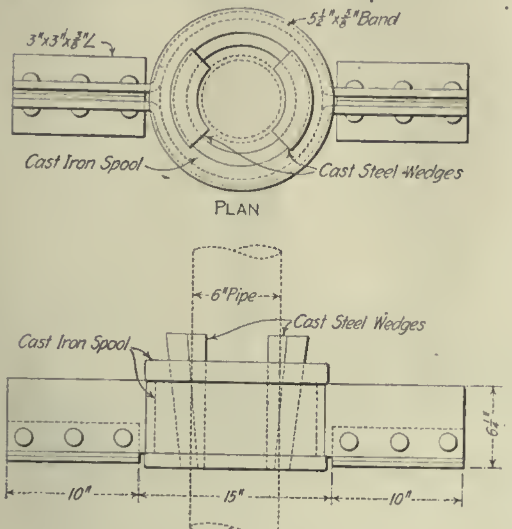


STEEL FORMS AND SOLID LEVEL PLATFORMS MAKE ACCURATE CASTING POSSIBLE

Small board platforms fitted over the top of each pocket or cell of the forms provide a platform for the men and for dumping the concrete. It is apparent that the impact of even a yard of concrete, unless carefully dumped, would throw the form out of level. Therefore ½-yd. batches were decided on. These were found to be unnecessarily small, and this winter longer drums are to be placed in the four Ransome mixers at the central plant to increase their capacity to ¾-yd. batches. This size batch, also, is nearly as large as the under-water concrete buckets used to fill the cells could be designed to hold without danger of tipping and wedging when being raised.

CENTRAL CONCRETE PLANT

The concrete plant, thus, instead of the 2 or 2½-yd. mixers usually associated with a 250,000-yd. contract, consists of four small units. These face the loading track and dump directly into buckets on the low flat cars used. Over them are the storage bins, loaded from the screening plant, which is fed by bucket conveyors. Sand and gravel are handled to this conveyor from barges or storage by a clamshell traveler derrick. The material received contains many large stones, which are returned to jaw crushers from the screens to be broken up. It was feared that too great an excess of sand would be found in the material, and an additional crusher plant was set up at the far end of the storage pile to provide crushed rock for adjusting the mix. In this plant the rock brought in on scows is dumped by derrick into the hoppers feeding the crushers. The crushed rock is elevated to the storage pile, and taken to the concrete plant by a belt conveyor boxed in under the storage pile. The roof of the tunnel through which this conveyor runs is provided at intervals with spouts drawing material from the bottom of the pile.



CLAMPS HOLD CASINGS PULLED BY RAISING DRILL BOAT ON ITS SPUDS

HOW CONCRETING IS DONE

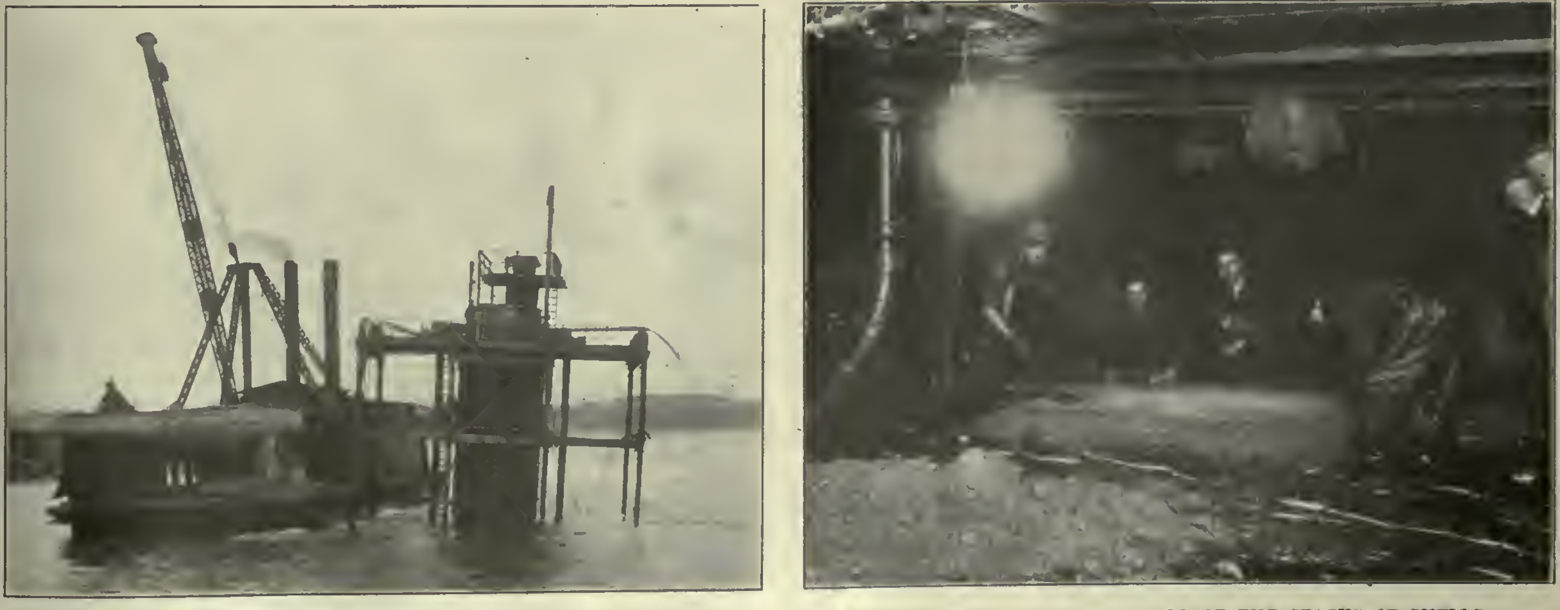
At present the plant is being run days on casting blocks and nights on filling pockets in the completed stacks. The latter work is done with two-bail, single-line buckets, which dump when picked by the lower bail. The double doors in the bottom of these buckets are held shut by the upper bail, which is used in lowering the load. When the bucket strikes bottom the hook attached to this bail drops loose, and the bucket is picked up by a chain at the end of the hoisting line attached to the lower bail. The buckets have vertical wood strips bolted to them outside to prevent catching on the concrete shells.

DIVING BELL PREPARES FOUNDATIONS

It has been brought out that the work of preparing the foundations for the shells is another important factor in the speed of the job. The diving bell now being used is illustrated in the accompanying drawing. As there is a 6-ft. tide, it carries from 20 to 25 lb. of air when in use. To float it the working chamber is covered, except for the cylindrical well in which the shafts are located, by a wood ballast tank. This is emptied by forcing the water out with compressed air, and by pumping. As originally planned the ballast tank was to be emptied by pumping, and the pump was supplied with only one suction. This made it impossible to empty the tank when the bell listed in the opposite direction from the side on which this suction was located. When air was applied an outlet was provided in each corner and each one was controlled with a valve so that the pipe at the highest point could be closed, forcing the water from the lowest point. The ballast tank for the new bell, if made, will be of steel plate, so that high-pressure air can be used to empty it. This is not possible with the present bell, as the high pressure causes the timbers of the ballast tank to give, and loosens the calking.

When the bell is in use the central well is also pumped full, sometimes above water level to help hold it down. As the bottom is rock, and the cutting edge of the bell can easily be mudded up, little air is needed. It is thought that the 400-ft. compressor now installed would easily take care of a larger bell. The main problem with the new one, which would cover six foundation stools or pedestals at one setting, would be to dispose of muck in cleaning up the bottom after the pedestals were concreted. It is thought that this could be solved by locking the muck out through the sides of the bell at several points in horizontal pipe locks.

For several points where the rock lies

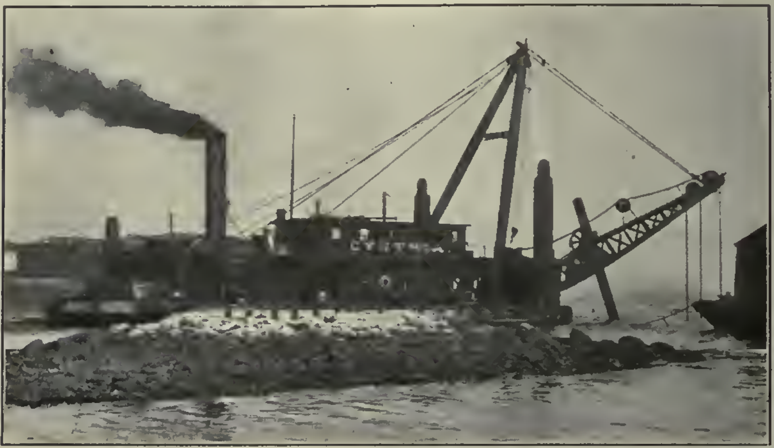


DIVING BELL AND TENDER AT WORK, AND ONE OF THE FOUNDATION PEDESTALS FOR THE INITIAL SUPPORT OF THE STACKS OF SHELLS too deep to build on directly, but not deep enough to require a rubble mound, mass concrete will be used up to 45 ft. below low water. This will be placed in an unusual way, as it is not expected that the diving bell will have to be used to go over the work and level it. It is for this work that the floating mixing plant will be used.

A cofferdam 120 ft. long of 64-ft. steel sheeting is set around a section including the foundations for five stacks. Concrete is then deposited under water to bring the bottom within 6 or 8 in. of the grade of the bottom shell. When this has set sufficiently to resist displacement, the laitance and slime will be cleaned off the rough surface and concrete pedestals will be placed at the front and back ends of each line between adjoining stacks of shells and leveled under water. Upon these pedestals the shells will be set in the usual way. After the stacks are set, the space beneath them over the mass concrete will be filled by the concrete deposited in the pockets. The steel piles will be withdrawn, of course, as soon as the foundations have been prepared.

OPERATION OF DRILL BOATS

The submarine blasting is being handled by two drill boats, one equipped with ten and the other with seven drills. Besides the boilers and engine for running the battery of churn drills, each boat has four spud engines, and also two double-headed steam winches. From each of the latter a wire rope is run out in each direction, either ashore or to anchors. This gives a pair of lines on each side. Also, one line on each end is provided, making six lines in all. Each of the six lines runs through a heavy cast-iron grip or clamp, bolted to the deck of the barge and operated with a lever. When the barge is to be moved back, the spuds are pulled, the lines put on the winch heads, the clamps loosened, and one pair of lines paid out while the other is taken in. The clamps can be set instantly and save tying the lines off each time to hold the boat.



BIG DIPPER DREDGE AND 310-TON SELF-HANDLING ORANGE-PEEL DREDGE TAKE CARE OF BULK OF SUBMARINE EXCAVATION AT HALIFAX OCEAN TERMINALS

The holes drilled by these boats average about 16 ft. deep and are loaded with 75 and 80-per cent gelatin dynamite. They are spaced 7 ft. apart along the line of the drills, and rows are drilled 10 ft. apart. Each boat can drill, load and fire one and one-half rounds per shift. The method of loading the shots, and of using the spuds to raise the boat and pull the casings, was described on page 395 of the Engineering Record of Sept. 25, 1915. The clamps used for the latter purpose are shown in an accompanying illustration.

Two dipper dredges, one clamshell and one orange-peel dredge have been used on the work. At present the larger dipper dredge and the 310-ton orange-peel are handling the submarine excavation, while the 5-yd. clamshell is used for miscellaneous work. The smaller dipper dredge was employed in digging a channel to the stone quarry, and has since been sent elsewhere.

The big orange-peel dredge is a remarkable tool because of its wide digging range. An area on either side of the hull 20 ft. across and more than 160 ft. long can be cleaned up at one setting of the scow. This tool, which can handle 100 tons at maximum radius, is also held in reserve for placing the concrete shells. It was assembled on shore and run upon the barge under its own power, and it would not require much time to run it back upon the completed wall for setting blocks. While this dredge cannot, of course, handle nearly the same quantity of material as is dug by the 12½-yd. dipper dredge, it is very economical of coal and can be run by a crew of seven men. It also has a set of engines for handling its 3-ft. square spuds. These are supplied by a steam line connected to the crane boiler by a hose. The dredge is moved in the same way as the drill scows.

The job has, of course, a completely equipped machine shop. One of the lathes in this shop is of unusual size for a construction job, because of the heavy machine parts that have to be worked. The shop is located in an old brick building, once a distillery, on Pleasant Street, opposite pier A. In the second floor of this building are the store rooms, and on its upper floor are sleeping rooms and a mess hall that accommodate 100 men, about a fifth of the force employed.

PROGRESS IN PAST SEASON

The first shell was set Sept. 25, 1915. Up to Dec. 22, 1915, thirty-eight stacks of shells had been set and concreted along the north side of basin 1, this section, 850 ft. long, being now ready for backfilling.

The Halifax Ocean Terminals are being constructed for the Dominion Government under the Department of Railways and Canals, of which the Hon. Frank Cochrane is minister. F. P. Gutelius, as general manager of the government railways, is in general charge of the project, while F. W. Cowie, chief engineer of the Montreal Harbor Commission, is consulting engineer for the dock construction. James McGregor is superintending engineer at Halifax of the entire project, while A. C. Brown is the resident engineer on the dock work. The general construction methods, the diving bell and the apparatus for lifting the concrete blocks were devised by the government engineers. Foley Bros., Welch, Stewart & Fauquier, contractors for the harbor work, have originated much of the construction plant and details. They are represented on the ground by J. P. Porter, a member of the firm. L. G. Fuller is superintendent and J. W. Roland chief engineer for the contractors.

Accurate Relief Map Embraces 10,000 Square Miles

Entire Los Angeles Aqueduct Drainage Basin Is Shown on Model Based on Government Topographical Sheets

IN ORDER to present an accurate bird's-eye view of the entire area drained by the Owens River and traversed by the Los Angeles aqueduct, there has been built up by the Los Angeles Bureau of Waterworks and Supply a relief map that shows the contour of every slope in an area of 10,000 sq. miles, or about one-fifteenth of the entire area of California. Before starting the construction of the map negotiations with the United States Coast and Geodetic Survey induced that department to cover in the usual way some unsurveyed parts of the area involved, so that the regulation topographical sheets were available for all the territory to be represented.

The map is built on a horizontal scale of 1 in. to the mile, which made it possible to include the entire area in a map 27 ft. long and 32 in. wide. The vertical scale is 1/16 in. to 100 ft. It is notable that the map includes Mt. Whitney, the highest point in the United States (el. 14,502 ft.), and ten other peaks more than 14,000 ft. in elevation, as well as a considerable area of desert land which is only slightly above sea level, and in fact includes a part of the county in which is located the point of lowest elevation in the United States.

HOW THE MAP WAS MADE

The map was built in several sections, each supported on a plane wood surface whose level was adopted as the lowest elevation shown on the topographical sheets for this section, and was used as a datum plane from which to build up the higher elevations. Sheets of red fiber 1/16 and 1/32 in. in thickness were used for building up the superstructure of the map, the 1/16-in. or 100-ft. sheets being used where the contours were close together and the 1/32-in. sheets for plain areas or wherever the 50-ft. contours showed the slopes to better advantage. Pantagraphs were used for transferring the contour lines from the topographical sheets to the red fiber. The fiber sheets were then sawed out in exact conformity with these lines, and after being carefully orientated on the map, each successive layer was fastened in place by brads. A sufficient number of brads was used to obviate the possibility of warping or buckling in the successive layers. Approximately 1000 lb. of the fiber was used in the construction of the map, about 25 per cent of this being necessarily wasted in cutting the irregular contours or discarding pieces too small for use.

When the apices of mountain peaks were being neared, where the area of the fiber sheet became so small as to interfere with accuracy, a plaster compound was substituted; this was moulded into place by hand and the contour of its surface checked up by dividers. By way of final finish an artist was employed to paint the map in colors conforming to the natural landscape of snow fields, forested slopes or yellow desert wastes. The aqueduct itself is shown by a heavy line, and the names of railroads, towns, etc., are delineated for identification.

FIVE MONTHS REQUIRED IN MAKING

The construction of the map required the entire time of four or five men from the drafting room and engineering staff for a period of about five months. Their instructions were to see that the model was as accurate as it was practicable to make it. One of the features of the finished work is that geological "faults" are brought out in a more striking manner than would be possible with any other method of representation. The map makes it possible to study the geological formation of the entire area in a general way and, on the whole, to get a very definite idea of just what relation each part of the water supply system bears to its neighbors.

As shown at the International Engineering Congress the map was supplemented by a background of forty transparencies depicting scenes along the aqueduct during and after construction. These views were 18 x 22 in. in size, arranged so as to be opposite the corresponding positions on the relief map. The transparencies were surmounted by a panorama 24 ft. long showing the higher part of the Sierra Nevada mountain range which the aqueduct traverses.

The map was constructed by the Water Department drafting-room force under the direction of William Mulholland, chief engineer, who conceived the idea of representing the drainage area on an accurate and adequate scale.

A MEMORIAL TO MAJOR JOHN WESLEY POWELL, the scientist who first explored the Grand Canyon, in Arizona, has been completed on the rim of the canyon, states a bulletin from the U. S. Department of the Interior. The memorial is an altar decorated in Indian imagery and supporting a bronze tablet, resting upon a pyramidal base of rough-hewn stone. Fifteen steps lead from the west up to the altar floor, from which one may gaze into the very heart of the glowing mile-deep canyon. The structure is considered worthy alike of the rugged, forceful personality of the man and of the titanic chasm which it overlooks.

BUILDING A CANAL ACROSS THE DESERT—THIS DRAGLINE DRAWS POWER FROM A STATION 75 MILES DISTANT

Electrically Driven Dragline Scrapers Dig 45-Mile Irrigation Canal

Unit Costs Given of Excavating 1,500,000 Cu. Yd. in Two Seasons with Two Machines on Sun River Reclamation Service Project

ELECTRICALLY-driven dragline scrapers have excavated economically a long canal at the Sun River project of the U. S. Reclamation Service, from 8 to 20 miles from the nearest railroad from which fuel for steam-driven units could have been obtained. The low unit costs, methods of handling the machines on sidehill work and continuity of electrical service make the records obtained of value to the engineer who has an excavation problem involving any fuel difficulties.

LOCATION AND CONSTRUCTION PLANS

The project is situated immediately west of the junction of the Sun River with the Missouri at Great Falls, Mont. The construction of the first unit of the north side development of the project involves the building of a 45-mile canal in heavy material. On account of the high cost of fuel for construction machinery it was determined by the engineers of the Reclamation Service to supplant coal with electricity from the nearby hydroelectric developments on the upper Missouri.

Early in the spring of 1913 arrangements were made with the Great Falls Power Company for the delivery of power from its plant at Rainbow Falls to three points on the canal line, from which it could be distributed along the work as required by the type of equipment used. The power company's transmission line from Rainbow Falls to the diversion dam at the upper end of the canal line is 75 miles long, and while its construction is simple and inexpensive, the engineers state that it has proved efficient for the service required of it. Power is transmitted at 48,600 volts over wires strung on 45-ft. cedar poles with a span length of about 350 ft. Each conductor is three-strand copper wire, carried by suspension insulators on wood cross arms. A fourth stranded steel cable is grounded at each pole to help keep the line clear of static disturbances.

MAKING A SIDE-HILL CUT

At canal miles 1, 20 and 36 power is delivered to substations of 700 to 1600 kva. capacity, where the voltage is reduced from 48,600 to 16,500 for distribution along the canal. The distribution line is on 30-ft. fir or cedar poles with span lengths of 150 ft. The circuit is three copper wires with pin-type insulators on single wood cross arms, and no ground wire is used.

MOTOR-DRIVEN DRAGLINES

A contract for the excavation of the canals, stipulating that electrical energy should be used wherever power was required, was let to MacArthur Brothers Company, of New York. The contractor decided to use dragline excavators for the major part of the work, subletting to team outfits such sections of the canal as could not be economically worked with dragline machines. The larger of the machines, a Bucyrus class 24, is equipped with a 100-ft. boom and a 3½-yd. extra heavy Page bucket. The motors are of the slip-ring induction type, designed for heavy intermittent reversing service, and are wound for 440 volts. The main motor is 200 hp. and the swinging motor 115 hp. The machine is operated through a remote-control, solenoid-operated Cutler-Hammer switchboard, set at the rear of the deck house and so arranged that it is impossible for the operator to overload the motors by improper handling of the levers. Brakes and frictions are air-controlled from a compressor run by a 2½-hp. motor in the rear of the house. The machinery is mounted on a heavily braced structural-steel frame, set on skids. The dragline is moved on rollers and timbers. The smaller machine is a class 20, similar in design to the larger one, but equipped with an 85-ft. boom and a 2½-yd. Bucyrus bucket.

TEAMS HAUL TRANSFORMERS

For transforming the 16,500-volt line current down to the voltage required by the motors, two sets of transformers are required. One set, stepping from 16,500 to 2200 volts, is mounted on heavy trucks and hauled along by teams as the work proceeds. Connection is made to the 16,500-volt line at some convenient point and current transmitted at 2200 volts through a triple-conductor, steel-armored cable to the second set of transformers. These are mounted under the floor on the frame of the machine, and step the current down to the 440 volts required by the motors. The steel cable is about 1000 ft. long and obviates the necessity of moving the high-tension connection when the line is alive, as the machine can move along 1500 ft. or more without moving the transformers.

The machines were hauled to the site of the work knocked down, and were erected in the field. Excavation was started in March, 1914, and has continued steadily ever since, with the exception of minor breakdowns and the shutting down of the class 20 machine for three months during the winter of 1914-15. At the time the work was started the construction of irrigation canals in heavy material by electrically driven draglines was more or less of an experiment, but the results have been far better than were expected. The power supply has had few interruptions, and only one of more than four hours' duration. This was caused by a heavy sleet storm breaking the wires on the 48,600-volt line.

ROADS FOR SIDEHILL WORK

It was expected that the handling of the machines on sidehill slopes as steep as 2½:1 would be slow and probably dangerous. Whenever sidehills were encountered the machines were used to excavate and level ahead of themselves a road from 30 to 35 ft. wide, on which the timber track was laid. This advance grading was at such elevation as would produce the most efficient work of the bucket and still keep the track excavation within the lines of the completed canal, thereby rendering unnecessary any non-productive excavation by the machines. At several points on the canal the upper cuts were as great as 90 ft. By excavating the grade of the track 50 ft. above canal grade, however, the upper part of the slope was excavated without double handling of the material. The engineers state that the machines far exceeded the expectations of the contractors in their ability to dig down on a 1½:1 slope and load the bucket to capacity.

HANDLE SANDSTONE WITHOUT EXPLOSIVES

The material excavated varied from a gravelly loam to cemented gravel, glacial drift and sandstone, and the topography from a level prairie to a steep, rocky hillside with transverse slopes of 2½:1. In the heaviest material blasting was resorted to, but in several instances the machines have dug 8 or 10 ft. of seamy sandstone without the use of explosives. About 1,500,000 cu. yd. of excavation has been handled by these two machines in two seasons, and costs are given here for some of the work, showing the nature of the material handled and the working conditions.

Power consumption has varied from 0.8 to 3.0 kw.-hr. per cubic yard of material moved, depending on the nature of the material. No attempt was made to obtain record-breaking outputs for the machines, as it was realized that with frequent moves, rough topography and the condition imposed of placing the material so as to produce a watertight bank, outputs would not be comparable with those of machines working in a large pit and wasting the material or loading it into cars. Outputs of 1450 cu. yd. per eight-hour shift and 32,000 cu. yd. per shift per month have, however, been obtained under the above conditions. The crew required to operate a machine for one shift has been one operator at from $175 to $200 a month, one oiler at $2.50 a day, four trackmen at from $2 to $2.50 a day and one team to move track timbers, etc. Electrical work for all shifts has been performed by an electrician or electrical foreman who received from $150 to $175 a month.

MACHINE DIGS A WORKING BENCH WITHIN THE CANAL PRISM

COSTS ANALYZED

Interest on investment includes all charges for insurance, bond premium and interest on cash capital required. Preparatory expense includes all charges for the delivery and installation of plant and accessories. Plant depreciation includes all charges for repairs and depreciation of tools and machinery. Under the classification adopted for excavation class 1 includes all material that can be plowed to a depth of 6 in. with six animals of 1400 lb. or over, and boulders of less than 2 cu. ft.; class 2 includes indurated material that cannot be plowed to a depth of 6 in. with six animals, but after being loosened can be excavated by teams and scrapers, and also boulders from 2 to 10 cu. ft. in size; class 3 is rock in place not included in classes 1 and 2.

TABLE 1—EXCAVATION COSTS IN CENTS PER YARD WITH CLASS 24 ELECTRIC DRAGLINE VALUED AT $36,326.63

Item	Class 1, 333,689 cu. yd.	Class 2, 23,319 cu. yd.	Class 3, 39,045 cu. yd.
Interest on investment....	0.81	1.21	2.25
Preparatory expense	1.33	1.99	3.[illegible]
Plant depreciation	3.63	5.41	10.12
Executive	0.89	1.24	3.09
Labor	5.98	7.85	21.03
Electric power	0.73	1.03	1.82
Supplies	1.13	1.67	6.72
Miscellaneous	0.16	0.15	0.29
Total	14.66	20.55	49.05

TABLE 2—EXCAVATION COSTS IN CENTS PER YARD WITH CLASS 20 ELECTRIC DRAGLINE VALUED AT $20,957.13

Item	Class 1, 410,747 cu. yd.	Class 2, 4,180 cu. yd.	Class 3, 9,546 cu. yd.
Interest on investment....	0.44	0.76	1.61
Preparatory expense	1.12	1.20	2.52
Plant depreciation	1.86	3.22	6.79
Executive	0.71	1.31	3.14
Labor	3.70	8.22	15.77
Electric power	0.78	1.78	2.80
Supplies	1.29	1.53	7.50
Total	9.90	18.02	40.13

Costs for the class 24 dragline are for the construction of 2 miles of canal on heavy sidehill and ½ mile of canal entirely in cut. The sections excavated were from 12 to 22 ft. in bottom width with side slopes of 1:1 and 1½:1. Costs include the hand trimming of 9000 ft. of the canal for placing concrete lining.

Costs for the class 20 dragline are for 5 miles of canal with 22-ft. bottom, and 4 miles of canal with 27-ft. bottom. Side slopes in both cases are 1½:1. The topography was rough, rolling foothill country, with the surface covered with large boulders. About 25 per cent of the canal was wet in the bottom from springs.

The work has been done by Buchanan & Company and Yale & Reagan, subcontractors under MacArthur Brothers Company. William Buchanan, Jr., is superintendent for Buchanan & Company, and A. W. Riney superintendent for Yale & Reagan. The general contractors are represented by Roderick McClure, superintendent. The work was under the immediate supervision of C. L. Bailey, A. F. Ross and V. W. Russell, resident engineers for the U. S. Reclamation Service. A. H. Ayers was construction engineer on about 75 per cent of the work, under R. M. Snell and Charles P. Williams, project managers for the Service.

SEWAGE TREATMENT IN SMALL COMMUNITIES when a sewerage system is not available, is described in detail by Paul Hansen in the *Illinois Health News*, the bulletin of the State Board of Health. Miniature Imhoff and septic tanks, subsurface irrigation systems and the methods of their maintenance are noted.

Greenheart, Used in Panama Canal, Is a Timber with Exceptional Qualities

Part I—Timber Imported from Demerara, British Guiana, Is Practically Unknown in This Country—Strength Is Great but Cost Is High

By A. K. ARMSTRONG
Engineer in Forest Products, Forest Products Laboratory, Madison, Wisconsin

IT IS an odd circumstance that greenheart (*Nectandra rodioei Schomb*) is a timber almost unknown to the engineers of the United States. Before its recent use in the construction of the lock gates and drydocks of the Panama Canal it was practically unknown in this country, even by name, although it has been in extensive use abroad for more than a hundred years. Its undoubted value to the engineering profession is exemplified by its numerous good qualities. Its strength as a post or beam and its stiffness are considerably higher than that of the strongest and stiffest of the 130 North American woods so far tested at the Forest Products Laboratory. It contains heartwood that is almost immune to decay, and which is probably more resistant to the teredo and other marine wood-borers than any of the hundreds of species of timber so far used as piling. In Europe it is generally considered of more value for lock-gate construction and piling than iron, or timber of other species, and finds extensive use in many places where a material of great durability and resistance to the marine wood-borers, coupled with other highly desirable physical and mechanical properties, is desired.

It is the purpose of this article, published in two parts, to aid in introducing this timber to the engineer through a full review of its properties and uses, and such other information upon it as the writer has been able to collect from numerous sources.

GREENHEART LOGGED ONLY IN DEMERARA

While growing in other portions of South America and in the West Indies, greenheart is now logged only in Demerara, British Guiana. There it is most plentiful, reaching its best development on a strip between 2 and 3 miles wide, just back of the deposit of alluvial soil along the coast and rivers. The workable area from which it is cut is about 14 per cent of the entire forested area of Demerara, and is confined to the more accessible parts of the country, extending from the sea coast to the rapids and falls of the larger rivers. In some parts of this area the stand has been materially reduced through overcutting; but the present government restriction, allowing no trees to be cut that squares less than 10 in., tends to provide for future crops in the old cutting areas.

Greenheart, in Demerara, is not under private ownership; the British government holds the entire stand. Private individuals, or companies, lease parts of the area, but they can sell standing timber only by permission from the Crown.

The tree attains a height of from 60 to 100 ft., the diameter ranging from 2 to 4 or more feet. The bole is generally clean and symmetrical for the first 50 or 60 ft. The tree, however, grows very slowly and one of the merchantable size (say 20-in. diameter) is about 250 years old.

SIZES AND FORMS OBTAINED IN WOODS

Since 1840 the average dimensions of export timbers seem to have remained fairly constant—from 12 to 18 in. square, and 25 to 50 ft. long. Timbers can be had up to 24 in. square and 70 ft. long. The timber is generally hewed, and is often shipped from Demerara with a great deal of wane left on the edges near the smaller end. No allowance is made for wane in calculating the cubic contents of the logs.

Since the logs have to be hauled by hand over corduroy roads to the nearest stream, the operation is facilitated by hewing the logs, and by "sledging," "snaping," or "sniping" their butts—that is, a bevel is cut, beginning from 2 to 5 ft. from the butt. Very often this end is not squared off before shipment abroad. The timber, however, does not taper as much as European oak, which adds to its favor among European contractors.

Carey sums up what seems to be the opinion of British engineers, that greenheart arriving in England is usually so misshapen and irregular in size that, as a material for piles, it cuts to great waste, thus increasing its cost.

CARE NECESSARY IN SEASONING

Care is necessary in seasoning the timber, owing to its tendency to check and split at the ends. The logs, however, do not check and split any more in seasoning than many other hardwoods in common use.

While awaiting shipment in Demerara, the timber is stored along the banks of tidal rivers, where it is submerged at every flood tide. The majority of the logs lie on these flats one year before shipment or sawing. This treatment is given the timber in order to prevent the forest borers from injuring it. It seems to be good practice to specify that the logs shall be felled and hewed at least one year before shipment. This is supposed to insure a proper preparation for use, provided the logs, after hewing, are stored as described. This seems to be a method developed through experience, since, although foreign users never specify that the timber shall be seasoned at all, it is probable that the timber they receive has gone through the treatment described, with entirely satisfactory results.

DIFFICULT TO SAW GREENHEART

Some greenheart is sawed before shipment from Demerara. Baterden states that the wood of greenheart possesses a poisonous character, rendering care necessary in working it, since splinters getting into the hands are known to have caused death. This property is not mentioned by any other writer and it is possible that Baterden had some other Demerara wood in mind. At least one other species from that region is reputed to yield a poisonous wood.

Greenheart is, however, a difficult timber to saw, owing to its tendency to splinter. Unless special saws are used in the mill, it may split from end to end in passing through them and when being converted into 2-in. plank may break short across the grain. These evils are prevented by cramping behind the saw. In cross-cutting, the timber should be hooped with iron on either side of the proposed saw-kerf. It is always necessary to support it under the kerf of the saw. If these precautions are not observed, flying splinters may seriously injure the men handling it. These remarks apply primarily to circular saws.

OVERCOMING DIFFICULTIES IN SAWING

These difficulties have in recent years been overcome by the introduction into Demerara of self-contained vertical saw frames, with a 24 to 30-in. stroke and a roller feed. No other type is now used. Even with these special saws the conversion of greenheart is a difficult and slow operation, so that the exporters prefer to ship hewed timber.

In sawing, it is estimated that only 1 cu. ft. of material can be obtained from 3 cu. ft. of hewed timber, if it is calculated that slabs, ends and occasional hollow logs cannot be sold locally. In Guiana, however, the refuse has a high market value, so that sawed timber, instead of selling for three times as much as the hewed, averages only from 70 to 115 per cent higher in price. In many cases the purchase of sawed timber is worth while, since sawing removes the larger part of the sapwood and exposes defects.

QUALITY OF TIMBER EXPORTED

The best quality timber is secured from trees more than 2 ft. in diameter. The timber is generally straight-grained and sound, and remarkably free from knots. The freedom from knots is due to its naturally clean bole, and to the fact that the part above the first branches is seldom logged. The soundness of the export timber may be attributed in part to the method of paying the woodsmen, who receive so much per tree for felling sound trees only, and are, therefore, careful to avoid any that show the least suspicion of decay. Although the logs often check into four segments, the latter usually do not continue separate for more than 2 or 3 ft. from the end. The split ends are generally cut off before shipment.

The sapwood of the logs is often attacked by a forest insect (presumably after felling), but the latter dies after the log is submerged, placed on shipboard or landed in a colder climate. Since worm holes are indications of defective wood, timber thus attacked, especially that which is to be exposed to fungi or marine borers, had best be rejected. Sometimes large and deep borings are found in the interior of a piece, no trace of which is observable from the outside. These are the burrows of tropical insects, and generally render a piece valueless.

It is a tradition in Demerara that the inherent qualities of the timber improve with its distance toward the west in that country. That from the Essequibo River is considered best, that from the Demerara intermediate, and that from the Berbice inferior. It seems that the largest trees (which contain the best quality timber) are found in the Essequibo River valley. The smallest come from the Berbice River valley, but that locality has been cut over several times. It seems to have yielded good quality timber in the early days of greenheart exploitation.

TO SECURE GOOD TIMBER

Owing to the great demand for the timber abroad, and the lack of legal restrictions upon cutting in the past, it has become increasingly difficult to secure good greenheart from the areas below the falls and rapids of the numerous streams. Beyond these obstructions, however, are valuable untouched forests, which transportation facilities might make available.

Before the timbers are loaded on the ship the checked or split ends are sawed off, and the fresh ends bound with metal hoops, in order to prevent further checking. The freshly cut surfaces are painted with red or white lead, over which 1-in. buffer pieces, covering the entire end of the log, are nailed. The removal of the split ends entails much waste, although there is a local market for the refuse.

Cost Is High

The price of greenheart always has been high, but it is generally lower to-day than seventy years ago. The quality does not seem to have deteriorated, although the quantity exported each year averages about 200,000 cu. ft. The price of greenheart in 1912 delivered alongside ship, British Guiana ports, was reported as approximately 32 to 34 cents per cubic foot for 12 x 12 in., short lengths; 50 to 55 cents for 20 x 20 in. under 45 ft. long, and 65 cents to $1.20 for timbers over 45 ft. long, depending on length and cross-section. The price, therefore, varies from about $27 to $100 per 1000 ft. b.m. These prices are for hewed timber, and are uniform over long periods; in the twenty-five years previous to 1908, the cost of greenheart did not materially fluctuate. Sawed timber on the average will cost from 170 to 215 per cent more.

Cause of High Price

The high price of the timber is due to a number of causes. The expenses of prospecting for new areas in a wild country are great, and the cost of surveying, rent and royalty must be borne by the operator. The trees are felled with the ax alone, since those felled with the saw are reported to be more liable to check and split. Since the wood near the ground is excessively hard and horny, the woodsmen cut to a high stump. It is, therefore, necessary to erect a scaffold at each tree, the latter being cut off 6 or 8 ft. above the ground. Great care is necessary in felling, so that the tree will not split or break, or fall where it is inaccessible for squaring and removing. This adds greatly to the cost of logging.

Transportation is difficult. Hauling to the water is done by hand. Since greenheart is heavier than water, the logs have to be slung on punts, from two to four logs per punt on the smaller streams and 1000 cu. ft. per punt on the larger watercourses. The logs also lie in storage for a year or more, thus tying up a great deal of the operator's capital.

The freight rates from Guiana in 1913 ran about as follows: To the United Kingdom by steamship, 24 to 30 cents per cubic foot, $6.72 to $8.40 per ton (of 28 cu. ft.), or $20 to $25 per 1000 ft. b.m.; to the United States via steamship, 20 cents per cubic foot, $5.60 per ton, or $16.15 per thousand; and to the West Indies, by sailing vessel, 16 to 20 cents per cubic foot, $4.50 per ton, or about $13.50 per thousand.

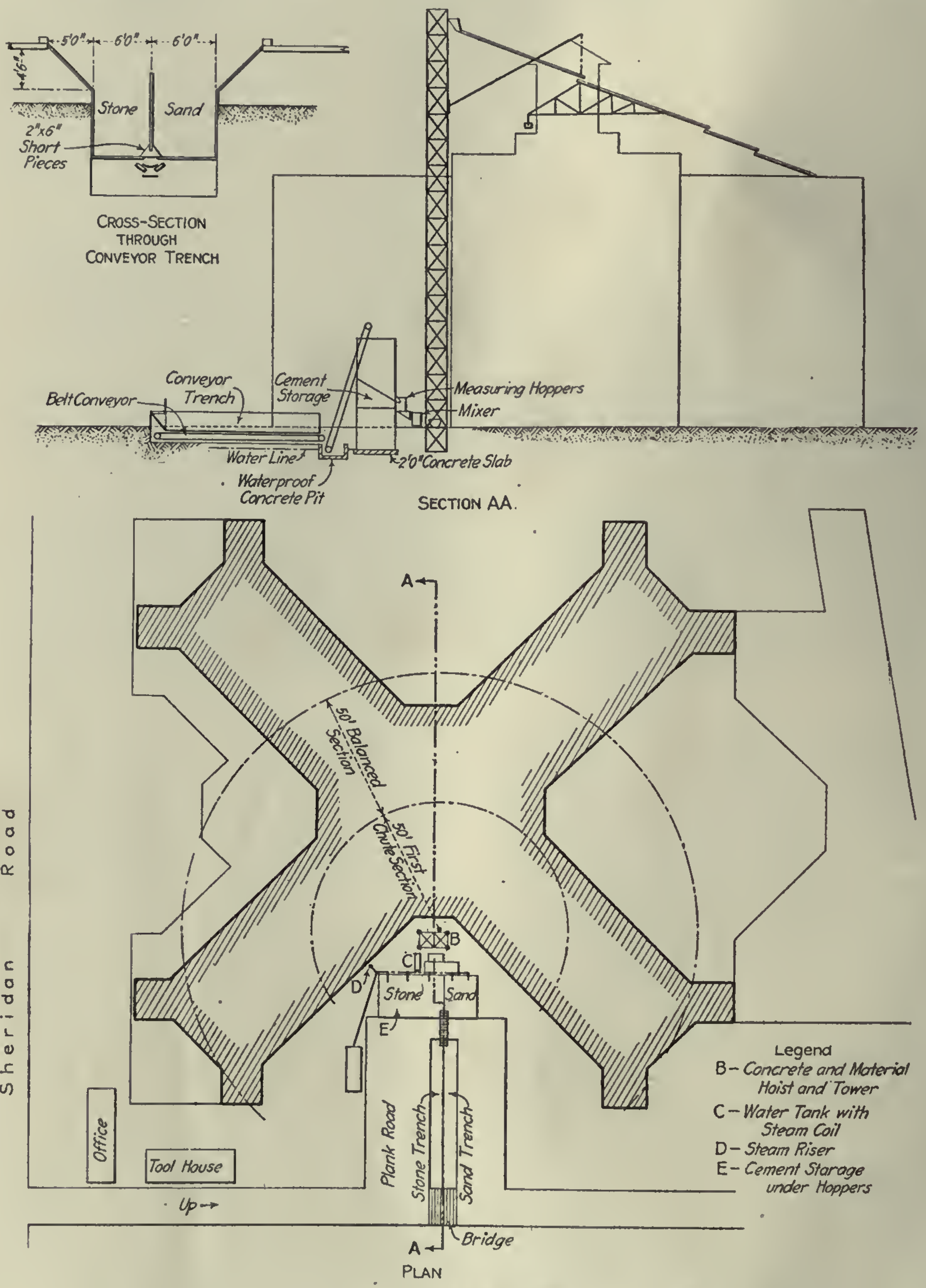
*[To be concluded in the next issue. In the second installment the author will discuss in detail the properties, examples of durability and the uses of greenheart.—*Editor.*]*

The Net Investment of the U. S. Reclamation Service to the beginning of the present fiscal year was approximately $100,000,000.

Contractor Handles Electrically Concrete Materials for Huge Chicago Hotel

Motor Trucks Dump Aggregate Directly Into Bin Over Belt Conveyor Feeding Bucket Elevator to Material Hoppers

Pouring 150 cu. yd. of concrete in floor slabs in five hours in the Edgewater Hotel, Chicago, is the usual procedure carried out by the contractor, who, in laying out his plant, had paid particular attention to the handling of the aggregates to the site by motor trucks.



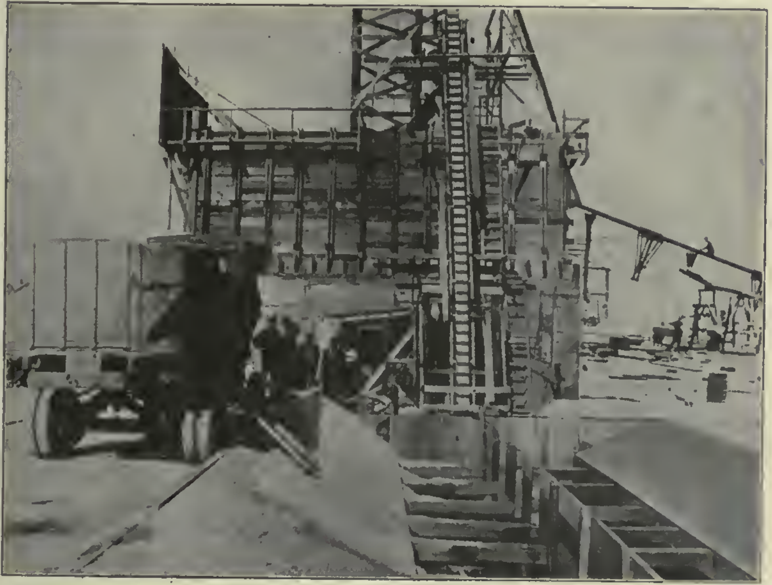
PLANT LAID OUT SO AS TO BRING CONCRETE TOWER NEAR CENTER OF BUILDING

The hotel is located on the lake front east of Sheridan Road and south of Balmoral Avenue. The plan of the building is a cross with arms 47 ft. wide and 260 ft. long, the axes of which are set at 45 deg. to the line of Sheridan Road. With the exception of steel trusses over the one-story part containing the dining rooms, in the angle between the two wings facing the lake, and the steel-frame tower, the building is of reinforced concrete. It is nine stories high, and the tower in the center runs up three more stories.

Advantage has been taken of the shape of the building to erect a double hoist for concrete and material near the center of the structure in the angle between the south wings. The bulk of the floor area thus comes within a 100-ft. radius which can be handled by a swinging counterbalanced Insley spouting system with extension spouts mounted on the floor. Where wheeling is necessary beyond easy reach of the spouting, concrete buggies are used. Back of the tower is set up a 2/3-yd. mixer at ground level. Above it, as shown in the drawing, are the cement and aggregate measuring hoppers. The 2500-bag cement-storage floor under the aggregate bins is at the level of the plank road noted in the drawing on each side of the stone and sand trench. A natural sand pile at this point is taken advantage of to get the material delivered at a somewhat higher elevation than that of the ground surface near the mixer.

MOTOR TRUCKS DUMP IN UNLOADING TRENCH

As the site is covered with fine beach sand a road made of 3 x 8-in. planks laid flat was built from Sheridan Road to gain access to both sides of the stone and sand trenches as shown in the layout sketch. These trenches are 80 ft. long and each holds 400 cu. yd. of material. A single 18-in. Weller belt conveyor under the central partition is fed with sand or stone as desired by removing successively the short 2 x 6-in. pieces laid at an angle over the opening directly above the belt. The belt delivers the material into a bucket elevator which raises it 60 ft. into the storage bins, where there is capacity for 250 cu. yd. of stone and half as much sand.



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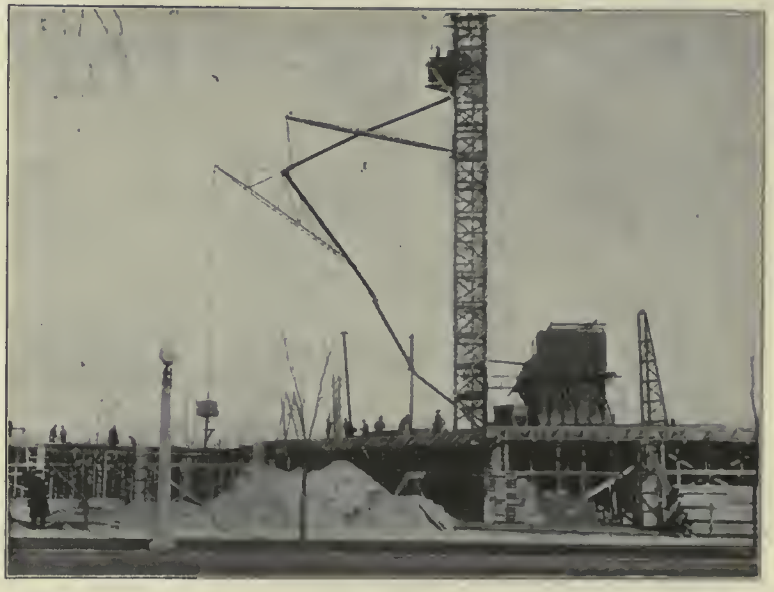
BELT CONVEYOR UNDER BINS CARRIES STONE AND SAND



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BALANCED CHUTE DELIVERS CONCRETE ON 100-FT. RADIUS

At the outer end of the dumping trench is a grating bridge for the convenience of dump wagons loaded with sand. The bottom of this area under the grating is sloped to the sand side of the trench. Most of the sand, however, comes in 5-yd. motor trucks. Under the aggregate bins and cement-storage structure there has been placed a 2-ft. slab of concrete to insure the exact alignment of the various shafts and machinery bearings. This slab is just covered by the ground water and has borne its load of 2½ tons per square foot without cracking or any apparent unequal settling. Concrete, waterproofed, was also used for the pit under the lower end of the bucket elevator, which is below the water line. This sand is not quicksand; it has been found to be quite firm when wet, trenches dug in it being unwatered without difficulty.

Electricity is used to run all the equipment, energy being furnished by the Thomas Electric Hoist Company, which also supplies the 50-hp. double drum hoist for the concrete tower. As two shifts have been maintained every part of the structure is wired temporarily for lighting as fast as the floors are brought up.

SCHEDULE CALLS FOR RAPID WORK

The order of concreting the floors, which has followed closely the schedule formulated in advance, required three days for placing forms, reinforcing steel, pipes and conduits. The pipes and conduits occupy one-quarter of the floor area, 6000 sq. ft. The concrete in one 7½-in. floor slab and in the columns below it is placed in five hours, an additional ten hours being required to place the cement finish. It was the idea to bring up all wings evenly, but on account of a delay in getting steelwork for the two east wings these fell behind for a time. By the tenth week, however, all of the fourth floor had been poured, bringing the wings even.

COLD WEATHER PRECAUTIONS ELABORATE

Forms for the floors are supported by 4 x 4-in. timbers spaced on 5-ft. centers. The forms are left in place two weeks, and after their removal extra form supports are placed at intervals under the floor slabs and left for some time. As cold weather came on a 75-hp. boiler was installed and steam pipes were run into the trench and aggregate hoppers. A special water tank 1½ ft. wide, 7 ft. deep and 9½ ft. long, with a steam coil through the center, was set up above the automatic supply tank to the mixer. The temperature of the water in this tank has been maintained at from 140 to 160 deg. Fahr.

To protect the poured concrete, forty salamanders fired with coke have been kept burning under the floor of each wing for several days after pouring. Tarpaulins have been hung around the sides to inclose the story below the green concrete, the temperature at no time being allowed to get below 40 deg. Fahr. Tarpaulins over the top of the floor are supported on a temporary framework about 6 ft. above the floor. A hose line supplies steam to keep this space heated for three days after the concrete is deposited. The 50,000 sq. ft. of canvas provided is sufficient to care for three wings.

Marshall & Fox are the architects for the building, and the Darling & Eitel Company is the contractor for the concrete work and part of the steel erection. Wilbur S. Sample is engineer and general superintendent for the contractor.

Slag Concrete Stronger than Broken Stone

Standard Cylinders of Slag Concrete Consistently 17 to 25 Per Cent Stronger in Compression than Trap-Rock Concrete

RESULTS of a series of compressive tests of standard cylinders at various ages from one month to one year show consistently higher strength for 1:2:4 concrete with slag for large aggregate than for a concrete with trap-rock aggregate graded for comparison to conform to the slag. The cement was a mixture of three standard brands—Atlas, Dragon and Kane. The sand was a typical "Cow Boy" sand from Long Island. Four specimens were tested for each case, and the averages are given in the accompanying table, including the percentage which the average strength of the slag concrete exceeded that of the ordinary trap-rock concrete.

ULTIMATE COMPRESSIVE STRENGTH OF 8 x 16-INCH STANDARD CYLINDERS

Each value, in pounds per square inch, is the average of four specimens.

	Age in months			
	1	3	6	12
National slag concrete	2465	3496	3567	4187
Palisade trap rock concrete	1975	2961	4053	3537
Percentage excess in strength	24.8	18.0	16.9	18.4

The average weight of the slag concrete was 140 lb. per cubic foot, and that of the trap-rock concrete 151 lb., while the average weight of the slag was 80 lb. and of the trap rock 100 lb. Tests of the modulus of elasticity were made on three cylinders of each kind, using average values below 650 lb. unit stress, the results were 4,126,000 for slag concrete and 4,036,000 for trap-rock concrete.

The tests were conducted at the laboratory of Columbia University and witnessed by representatives of the New York building bureaus, the Newark Building Department, the Erie Railroad, the New York Public Service Commission, First District, and the New Jersey Board of Public Utility Commissioners. The slag was furnished by the National Slag Company.

A MINIMUM HIGHWAY WIDTH OF 18 FEET will be established for future road work in Arizona, according to a recent announcement made by Lamar Cobb, state engineer. Heretofore the minimum width has been 16 ft.

Four Street Shaft Plants to Handle 300,000 Yards of Excavation in Twelve Months

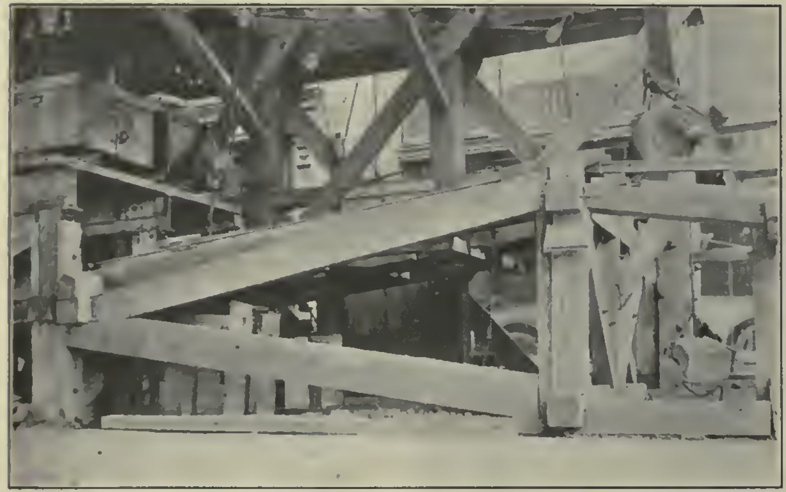
Large New York Subway Section in Crowded District Has Shafts Equipped with Double-Deck Changing Platforms Utilizing Wheeled Dirt Buckets

HOW TO TAKE 300,000 cu. yd. of rock and earth from beneath the most densely traveled parts of Broadway and Seventh Avenue, hoist it at four main shafts and dispose of it, within twelve months, was the problem confronting the Holbrook, Cabot & Rollins Corporation when the contract for the last link of the new Broadway subway in New York City was delivered to it on Sept. 8 last. The fleet of 15-ton trailer trucks carrying not two or three but six 1½-yd. skips, the dump buckets on wheels and the shaft loading platforms to change six empties for six loads in six minutes, which have been causing passers-by in the vicinity of Times Square during the past month to ask "What next?" are the answers to this problem.

EACH SHAFT HANDLES 250 YARDS A DAY

This contract, to be completed in twenty months, required three months to open up. After all the excavation is finished it will take five months more to complete and backfill the last of the subway structure. The place measurement of earth involved is 100,000 cu. yd., of rock 200,000 cu. yd. and of backfill 100,000 cu. yd. This means that even if all the material for backfill could be taken from the job itself, 200,000 cu. yd. place or 300,000 cu. yd. loose measurement of earth and rock will have to be removed from the work within twelve months if the contract is to be finished on time. There are five shafts on the work, but only four from which a continuous maximum output could be expected. Each of these, then, must handle 250 cu. yd. of material, loose measurement, every working day for the entire twelve months. No shaft plant of any of the types in use could be relied on for such an output. Such things as large dirt hoppers and a steady stream of trucks are out of the question on the crowded streets of this district, besides the fact that this type of plant does not work well with broken rock. Very large skips are slow and expensive to load underground, and to load a number of small skips on a large truck with any hoisting rig adapted to shaft work in a narrow street would cause a fatal loss of time at the shaft. Moreover, skips which would be as low as possible were necessary for more efficient loading below ground, if this yardage were to be handled. The ordinary "battleship," or double-leaf skip, stands well above a man's waist loaded on a platform car of the lowest kind, and much time is lost in loading large stones in them. A skip of this type was built with wheels, but the split bottom was not conducive to railroading. The rig could not be made rigid or strong enough to stand hard service. An ordinary dump bucket was then designed with four wheels, as shown in the accompanying drawing. It is possible to tip up this bucket, load a large stone and tip it back in less time than it takes to load stone with the hoisting line usually required below ground. A description of these buckets, built by Steubener Iron Works, and of the bail used to lift them will be found in the last pages of this issue.

→ LOADED BUCKET DESCENDING BRIDGE TO TRUCK



← LONG BRIDGE DOWN AS TRUCK IS BACKING IN

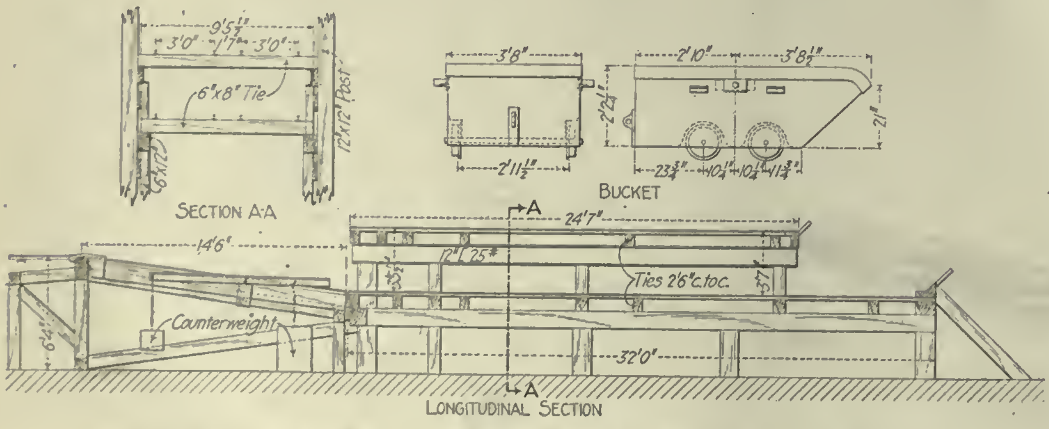
NEW SHAFT PLANT EVOLVED

Having wheeled buckets, it was possible to use this feature to cut the time of changing empty and loaded buckets on the trucks at the shaft, and also to keep the electric crane busy all the time at actual hoisting, raising a load and lowering an empty on each round trip. The loaded buckets are set on the upper tracks of the double-deck, four-track changing platform, and the empties are picked from the lower tracks. Six loaded buckets are set on the upper tracks while waiting for the next motor truck, and the six empties left by the last truck are lowered down the shaft at the same time. Connecting the two decks with the level of the truck platform is a movable bridge, lowered and raised by a small electric winch. Its outer end is hinged to a solid timber bent, and hinged timber legs on its inner end rest on the ground to support it level with the lower deck and on the latter to support the bridge in raised position. To connect this bridge and the tracks on the truck platform is a short, light bridge of four rails which is raised and lowered by a hand line. As the truck backs in, the rear end of the platform comes over a second bent which prevents deflection as the loaded buckets pass upon the truck. The truck is guided into exact line with the bridge tracks by channel-and-timber guides set in the pavement, and its rear wheels ride on a channel-iron track to prevent settlement due to tearing up of the asphalt pavement, which at first caused much trouble.

OPERATION IS RAPID

The truck is backed home and chocked, the long bridge being lowered. The short bridge then drops into angle-iron guides which line its rails up with the tracks on the trucks. The six empty buckets are then rolled off the truck to the lower deck of the platform. The bridge is then raised and the six loads rolled down on the truck. Strap-steel chocks, fastened to the two outer rails on the truck with pins similar to the familiar safety jointed shackle pin, are then set to hold the skips during their ride to the dock. The truck then pulls out and the long bridge is lowered in readiness for the next.

To check the speed of the buckets on the long bridge an ingenious brake is used. It



SHAFT PLANT CHANGES SIX LOADED SKIPS FOR SIX EMPTIES IN FEW MINUTES consists of a channel-iron and plank see-saw in the center of each track, pivoted near the center of the bridge and having a weight hung from each end. When the bridge is up the weights nearest the truck rest on the street, those nearest the changing platform also rest on the street, but with tight lines, and the ends of the plank nearest the truck stick up above the tracks. In descending the bridge each bucket has to ride over the plank and lift the counterweight next to the platform. In unloading the truck with the bridge down the brake automatically reverses itself. It is quite sufficient to check the empty buckets with the use of a light weight, but these are running onto a solid timber platform, while the loaded buckets are running onto the less secure truck. Consequently even with so heavy a weight as almost to lift the buckets from the rails a line is used to hold the loaded buckets in addition to the brake. This line has an 8-ft eye. spliced in one end, and is thrown over each bucket in turn and held by one man. The upper deck of the platform has a slight incline away from and the lower deck the same toward the shaft. Rail dogs made of round iron which slide in holes through the webs of the rails are used to hold the buckets on the upper deck when the bridge is down. The electric crane which handles the buckets in the shaft operates from a bridge over the street which has about 8 ft. clearance above the top platform. Three men are required to handle the entire work of the changing platform.

READY TO LEAVE WITH SIX LOADS

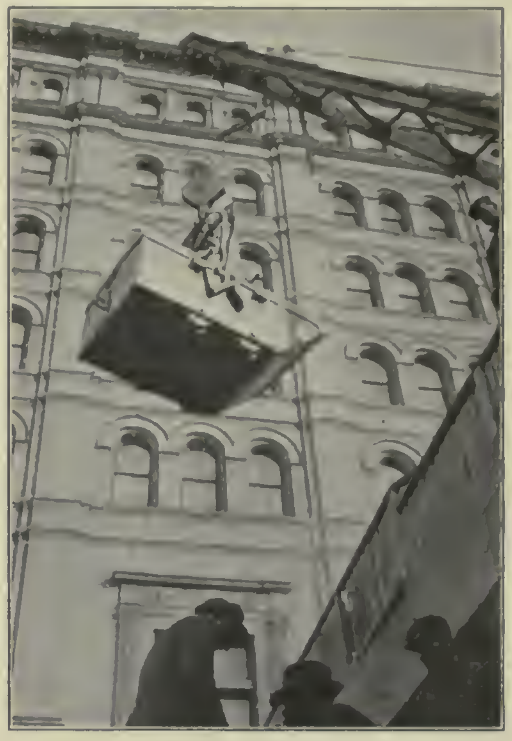
At the dock on the North River, which is more than two miles distant, two cranes unload each truck in from three to five minutes. The buckets are picked up by a latched bail, similar to that shown in the photographs, but without any braces on the back side, and are dumped directly into scows by a trip line attached to the lug at the back of each bucket. The fall of the tide, plus the difference in draft of empty and loaded scows, amounts to 12 ft. or more, making direct dumping a necessity with the heavy rock handled. The inability of the contractor to use a dumping board without risk of considerable damage to the scows was an important reason for preferring the buckets used to open-end skips.

OPERATING TIME

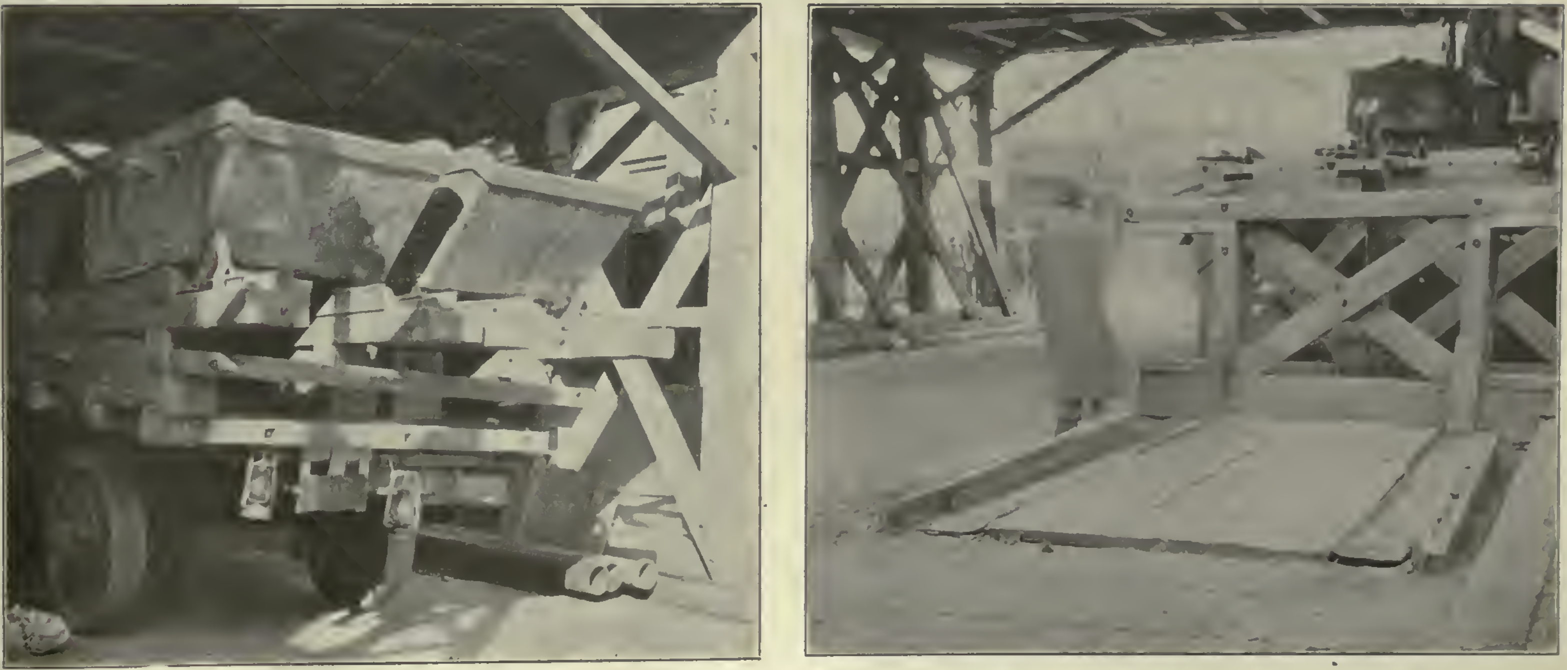
The round trip time of each truck will average forty minutes, fifteen minutes on the road and backing in each way, from three to five minutes at the dock and four to six minutes changing at the shaft. To change at the shaft by hoisting buckets on and off with the crane alone, which was done before the platforms were in service, averaged 25 min. per trip, and necessitated hoisting every bucket twice, once to get it out of the shaft and again to load it. With the platforms ten trips every eight hours can be made by each truck, handling 90 cu. yd., loose measurement, of muck, and each shaft can keep two trucks running, or take out 180 cu. yd. per shift.

The shaft crews are little or no larger than those used with other types of plant. It is evident that the investment and shaft payroll when spread over the large yardage handled per day will show a very low rate per cubic yard.

The entire scheme, including the wheeled buckets, was originated by George Hallett Clark, who is managing the work for the Holbrook, Cabot & Rollins Corporation. The contract, which is section 3 of routes 4 and 36, is being supervised by the New York State Public Service Commission for the First District, of which Robert Ridgway is engineer of subway construction. Jesse O. Shipman is engineer of the division including the work, and Howard D. Gates is engineer on the section.


LATCHED BAIL PICKS UP SKIPS

SMALL RETARDING DAMS OF DÉBRIS AND TIMBER constructed in mountain canyons, at an average cost of $25 each, as an experiment to control mountain torrents and prevent overflow on lands below, have given exceedingly encouraging results in Los Angeles County, California. At the mouth of one of the canyons the flow was approximately ½ sec.-ft., following a 5.7-in. rainfall in 25 hours, and a previous intermittent shower of about two weeks' duration which had thoroughly saturated the ground. With approximately the same amount of precipitation before the dams were constructed the flow is reported to have been about 65 sec.-ft. The experiment was carried out by Frank H. Olmsted, member of the Los Angeles County Board of Flood Control Engineers, assisted by J. E. Rockhold, deputy county surveyor.


REAR END OF TRUCK, SHOWING DOGS AND ANGLE GUIDES FOR RAILS OF SHORT BRIDGE, AND GUIDE TRACK FOR ALIGNING TRUCK

Committee Advocates Mortar Bed for Wood Blocks

Reports in Favor of 1:4 Mixture from ½ to 1 Inch Thick at Convention of American Wood Preservers' Association

A MORTAR BED for wood-block paving, instead of a sand cushion, is recommended by Clyde H. Teesdale, H. S. Loud and Frank Cherrington in their committee report submitted at the annual meeting in Chicago, Jan. 18 to 20, of the American Wood Preservers' Association. A 1:4 mixture, brought to a thickness of from ½ to 1 in. by templates, and containing just enough water to insure a proper setting of the cement, is advocated. The intention is to produce a granular mixture which may be raked to the desired grade.

Under certain conditions, especially where vibration may be expected, the committee report specifies that a mortar cushion may be omitted and a bituminous coating of one or two thicknesses, spread upon the smoothly finished and thoroughly dry concrete base, substituted therefor. A bituminous filler for the joints is recommended.

PRACTICES IN MANY CITIES SUMMARIZED

In another report to the same association Mr. Cherrington gave the results of a circular letter requesting information as to wood block paving practice in a number of cities. Of 155 cities circularized replies were received from seventy-nine. The majority called for a bituminous filler, with pitch having a slight advantage over asphalt. The favored cushion is shown to be about equally divided between sand and mortar. The heavy creosote is by far the most popular preservative oil.

The data show that very few cities install the blocks by ramming the rows or courses tightly together. Most of the pavements are laid with the blocks in slight contact or by leaving interstices of at least ⅛ in. between the ends of the individual blocks. A large majority advocate laying the blocks at an angle of 90 deg. with the curb line.

Slipperiness of wood block pavement is retarded, up to 6 per cent grades, with either lug blocks, creosoted lath strips or beveled blocks. Very few cities specify expansion joints transversely; most of them require a 1-in. joint parallel and adjacent to each curb. These expansion joints are filled with asphalt, pitch, fiber or sand, the preference being in the order named. In only two instances was a cement grout filler specified for wood blocks.

THE SUDDENNESS OF FLOODS in the Southwest is set forth by J. L. Campbell, engineer maintenance of way of the El Paso & Southwestern system, in discussing a recent bridge washout at Indiole, N. M., in the August *Bulletin* of the American Railway Engineering Association. At 5 p. m. an employee passed over the bridge, a timber trestle, and at that time no rain was falling in the vicinity. At 7 p. m. a freight train plunged into the flood through the 108-ft. washed-out section of the bridge. At 9 p. m. a flagman crossed the stream on foot near the wreck. Five men were drowned in the disaster, their bodies being found from 12 to 15 miles below the bridge, and several cars, including steel coal and coke cars of 100,000-lb. capacity, were washed from 500 to 1500 ft. downstream.

Literature

For the Civil Engineer and Contractor

New Publications

ANNUAL REPORT OF THE DIRECTOR OF THE BUREAU OF STANDARDS, 1915. Paper, 6 x 9 in., 148 pages. Washington, Government Printing Office.

GEOLOGY OF THE MISSISSIPPI EMBAYMENT. By T. G. Dabney. Paper, 6 x 9 in., 13 pages. Nashville, Tenn. Marshall & Bruce Company.

BRIDGE FOUNDATIONS. By W. Burnside. Cloth, 4½ x 7 in.; 139 pages; illustrated. London, Scott, Greenwood & Son; New York, D. Van Nostrand Company. $1.50 net.

ANNUAL REPORT OF THE SUPERINTENDENT, U. S. COAST AND GEODETIC SURVEY, 1915. Cloth, 6 x 9 in.; 156 pages; illustrated. Washington, Government Printing Office.

THE OHIO WATER PROBLEM. By C. E. Sherman. Bulletin 15, College of Engineering, Ohio State University. Paper, 6 x 9 in., 135 pages; illustrated. Columbus, Ohio, State University.

PETROLEUM AND ITS PRODUCTS—Properties, Specifications and Tables. Bulletin 9, Kansas City Testing Laboratory. Paper, 6 x 9 in.; 19 pages. Kansas City, Mo., Testing Laboratory, 1013 Grand Avenue. 25 cents.

BRITISH COLUMBIA HYDROGRAPHIC SURVEY, 1914. By R. G. Swan, chief engineer. Water Reservoirs Paper No. 14, Dominion Water Power Branch. Paper, 6 x 9 in.; 534 pages; illustrated. Ottawa, Canada, Government Printing Office.

SLIDES AT PANAMA. By Major General George W. Goethals, U. S. Army, Governor of the Panama Canal. Canal Record Supplement to edition of January 5. Paper, 9 x 12 in.; 17 pages; illustrated. Washington, Government Printing Office.

ENGINEERING AS A CAREER. A Series of Papers by Eminent Engineers. Edited by F. H. Newell, professor of civil engineering, University of Illinois, and C. E. Drayer, secretary, Cleveland Engineering Society. Cloth, 5 x 7½ in.; 214 pages. New York, D. Van Nostrand Company, $1 net.

SURFACE OILING OF EARTH ROADS. Bulletin 11 of the Illinois State Highway Department. By B. H. Piepmeier, maintenance engineer. Paper, 6 x 9 in.; 28 pages; illustrated. Copies for free distribution may be obtained from the State Highway Department, Springfield, Ill.

PROBLEMS PERTAINING TO STEEL TUBES. By O. G. Welton, M. E., formerly lecturer and assistant professor of mechanical engineering in the School of Mining, Queens University, Canada. Cloth, 5 x 7 in.; 172 pages; 34 illustrations and diagrams. New York, D. Van Nostrand Company. $2.50 net.

RESULTS OF OBSERVATIONS MADE AT THE U. S. COAST AND GEODETIC SURVEY MAGNETIC OBSERVATORY AT CHELTENHAM, MARYLAND, 1913 AND 1914. By Daniel L. Hazard, assistant chief, Division of Terrestrial Magnetism. Paper, 9 x 11½ in.; 98 pages; illustrated. Washington, Government Printing Office.

Books Reviewed

Scientific Management and Labor

Author, Robert F. Hoxie. Cloth, 5½ x 8 in., 302 pages, New York, D. Appleton & Company, $1.50.

The author of this book is associate professor of political economy at the University of Chicago and was special investigator on scientific management for the United States Commission on Industrial Relations. The book is based upon the investigation made for that commission. The study involved chiefly shops designated by H. L. Gantt and Harrington Emerson and the late Frederick W. Taylor, so that the plants studied are representative. In this study the investigator was assisted by Robert G. Valentine, appointed by the commission to represent the employers and John P. Frey, appointed similarly to represent labor.

The greater part of the volume sets forth in some detail the findings of the author, upon which his conclusions, reported to the Industrial Relations Commission, were based. One hundred and thirty-six pages of the volume are taken up with a presentation of what was found in various shops. The remainder of the volume is given up to appendices, detailing the claims of the various efficiency systems, a statement of the vital points at issue and the exhaustive questionnaire which employers were asked to answer.

Briefly, Professor Hoxie's conclusion is that scientific management has succeeded in creating an organic whole of the several departments of a plant, establishing a coordination previously impossible. In this respect, he declares, it has conferred a great benefit on industry.

The social problem created by scientific managements, however, does not lie in this field, but in its effect upon labor. In this respect there is now no control over the introducers of scientific-management methods, so that they are free to use them for good or ill as they and the employers see fit. Thus in some shops while labor has not been seriously affected through the introduction of efficiency system, in others it has been. Professor Hoxie also concludes that neither organized nor unorganized labor finds in scientific management any adequate protection to its standard of living, any progressive means for industrial education nor "any opportunity for industrial democracy by which labor may create for itself a progressively efficient share in efficient management." There is inevitably, therefore, conflict between organized labor and those who try to use the new systems to the detriment of the worker.

The character of the material supporting these conclusions can be pretty well sensed from the conclusions themselves. Professor Hoxie found a very great diversity in the methods of scientific management, in the thoroughness of its application and in the character of results. For this variation the introducers of the system are chiefly responsible, though special conditions in the various plants have a considerable effect. He has found what one might have predicted in advance—disparity just as wide as the personalities of those installing the systems. Consequently, since both good men and poor men, good employers and bad are concerned, one can find about anything he seeks. Reading the book, one's general impression is, however, that scientific-management shops are not inferior to the run of what one could properly characterize as a "good" shop.

A German Engineering Index

Jahrbuch der Technischen Zeitschriften—Literatur. Edited by Heinrich Rieser. Paper, 6 x 9 in.; 98 pages. Vienna and Berlin, Verlag fur Fachliteratur, 4 marks ($1) net.

REVIEWED BY A. G. HILLBERG
Civil and Hydraulic Engineer, New York City.

This engineering index classifies the articles published in 257 technical journals during 1914. Most of these journals are published in the German language, but about sixty of them are of American English, French, Swiss or Italian origin.

Comparing the work with the *Engineering Index*, published by the Engineering Magazine Company, of New York, which comprises about 250 publications representing seventeen nations and six languages, of which about three-fourths of the articles classified are printed in English, it is obvious that the sale of this German index in English-speaking countries will be very limited.

The different articles are referred to by title only and thus convey little about their contents and scope. This method, however, has enabled the editor to keep down the number of pages and to give the index a convenient size.

Engineering Geology

Authors, Heinrich Ries, Ph.D., professor of economic geology at Cornell University, and Thomas L. Watson, Ph.D., professor of economic geology at the University of Virginia, and state geologist of Virginia. Cloth, 6 x 9 in.; 722 pages, 249 illustrations. Second edition, enlarged. New York, John Wiley & Sons, Inc. $4 net.

REVIEWED BY FREDERICK K. MORRIS

Department of Geology, Columbia University, New York City.

This is a textbook of intermediate character. It can be used with profit by students who have had no previous training in geology, yet the matters in it are more fully treated than in any elementary textbook known to the reviewer.

The book may be divided into three general sections: Structural and dynamic geology and related engineering problems; applied geology, under which head are considered building stones, lines and cement, coal and oil and ore deposits, and historical geology.

The treatment is largely descriptive. Features of great geologic interest such as volcanoes and earthquakes receive almost no mention. Rocks are admirably described with ample illustrations in a long chapter so clearly subdivided and systematized that students find little difficulty in mastering its contents; but the theoretic and dynamic discussions are condensed to an extreme of brevity. In discussing rivers, on the other hand, the behavior of running water as a dynamic agent receives full consideration, for the engineer who attempts river improvement must know how to utilize or oppose the energies of the stream. This is especially true in the improvement of mature rivers where great lengths of river must be improved at low cost. The essays on landslides and on lakes, are quite the best in any textbook known to the reviewer, and form a unique feature of the work.

The second division might be called applied geology. More than 200 pages are given to the consideration of building stones, limes, cement and plaster, clay and clay products, coal, petroleum and gas and other hydrocarbons, road foundations and materials, and ore deposits. The discussion of building stones is exceptionally full on the theoretic side. Not merely to describe building stones, but rather to show students how to judge them, seems to be the author's aim. Methods of testing and the relative practical importance of tests; the structural qualities which characterize good building stone, and the peculiarities of composition and structure which make faulty building stone—these and similar matters of importance to both the architect and the engineer are well treated. The purely descriptive part is adequate for the purpose, and illustrated with maps and photographs. Much the same type of comment could be made on the other chapters of this section. An intensive and qualitative knowledge is aimed for rather than such a quantitative knowledge as only a full course in economic geology can impart.

The chapter on historical geology constitutes the chief addition to the first edition. The introduction to this subject points out the importance of fossils, conditions and methods of fossilization, and the inference that may be drawn from the fossil content of rocks. The presentation gives the engineer exactly what he needs —rock types, distribution, probable altitude of beds, economic possibilities and means of recognition. He is less concerned with the physical history of the earth or the evolution of life, yet these interesting matters are not wholly neglected.

On the whole, the new edition has lost none of its good points and is decidedly more complete as a geologic textbook and more valuable also as a guide to the man in the field by reason of the additions on the historical side appearing in it.

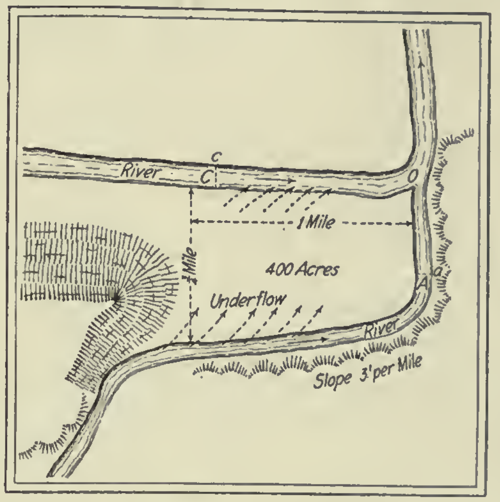
Letters to the Editor

Comment on matters of interest to engineers and contractors will be welcomed

Where Does the Water Go?

SIR:—Assume the elevation of the junction of two rivers to be 600 at the point marked *O* in the accompanying sketch. The elevation at *a*, ¼ mile from *O*, is 600.75. The elevation at *c*, ¾ mile from O, is 600.2.

With the two rivers at this stage, measurement of river A at *a* gave a discharge of 323 sec.-ft. A rise of 0.5 ft. in river C made the elevations at *c* and *a* 600.70 ft. and 600.75 ft. respectively, river A being unchanged, inasmuch as the drainage area was not in any way affected by rainfall in the drainage area of river C.



Now a measurement of the discharge at *a* gave 504 sec.-ft. The point between the two rivers consists of about 400 acres of bottomland about 20 ft. above normal river surface and underlain with a gravel bar from 10 to 15 ft. thick. My theory is that during the first measurement, because the river C was at a lower elevation of about 3 ft. than corresponding points across the bottom on river A by reason of the difference in slope of the rivers, a large part of the water flowed through the gravel underlying the land and emptied into river C above the junction, while during the second measurement, because the river C was flush, there was an elevation or head against which the assumed underflow would have been compelled to discharge. Now the coefficient of flow through the gravel might be such as to be balanced by this rise in river C, thus making the path of least resistance down the channel of river A, which would account for the larger discharge found under this condition.

River A traverses a valley approximately ½ mile wide, which is underlain with a gravel bar from 2 to 10 ft. thick from head to mouth. Measurements of the principal springs which give practically a constant discharge on the headwaters of the river aggregate 1200 sec.-ft., while at various points down the river the discharges do not increase nearly as much as the inflow from the springs, and at the mouth a discharge of from 300 to 500 sec.-ft. is all the water there is flowing in the channel above ground. While the drainage area is above that of adjacent basins an anticlinal prevents flow through the range of hills on the east side, and there are no large springs or other evidences of flow from this basin in the others.

Numerous measurements were taken and the mean computed. The method of rod floats was checked against meter measurements, and it is felt sure that the discrepancies noted are not due to errors of methods of measurement.

L. S. SCOTT.

Linn Creek, Mo.

Why Is Registration in Civil Engineering Decreasing?

SIR:—Referring to your editorial of Dec. 18, 1915, page 766, on the question of why registration in civil engineering is decreasing, and the numerous explanations which it has called forth, permit me to suggest another reason which may prove to be the principal reason why the engineering profession seems to be losing its charms for so many of our young men. I refer to the private practice of many of the engineering professors in active competition with their own alumni who have not the prestige of the university back of them nor free office rent, stationery and student labor.

Possibly the young graduate has found such competition extremely disheartening. The remedy for this growing evil is, we believe, in requiring the recipient of such professional fees to deposit them in the treasury of the university. This should discourage the practice and improve conditions in our profession.

W. J. SHERMAN,

The W. J. Sherman Company, Consulting Engineers.

Toledo, Ohio.

SIR: The writer has read with interest the discussion in the Engineering Record on the reasons for the decreasing number of engineering students in the colleges, and feels that the facts set forth should cause those who are interested in the welfare of the profession serious consideration—not perhaps so much because of the lesser number of students, as because of the reasons for this decrease. In considering the subject nothing will be gained unless it is done with an earnest desire to get at the naked truth regardless of unpleasant things we may discover about ourselves. Too often those who write on subjects related to the welfare of the engineer are prompted by selfish motives, or blinded by their own success to the actual conditions of the average man in engineering work. The conditions of the average engineer are never discussed, nor is his case presented fully.

The Engineering Record asks why, if the supply is not greater than the demand, are engineers' salaries so low? Supply and demand are not the only elements that go to fix salaries. There is fully as great an over-supply of young lawyers and doctors as there is of engineers, yet the average lawyer or doctor is able to own his own home, support his family comfortably and provide for his old age. Can this be said of the average man in engineering work? Again, is there not relatively more of a demand for engineers right out of college than for men of a few years' experience? A man with five years' experience can get nearly as good wages as a man with ten years' experience. This tends to prove that the fault is not poor training given in the schools. Is the trouble not here?

The engineers have had no organization to advance their interests. There is no helpful brotherly spirit among engineers of different stations in life. The chief or consulting engineer of fifty feels it is his duty to exploit and crush the spirit of the man of thirty in the name of his employer. This is often done by starting the young man on the work at a low salary with bright promises of a raise as soon as he has learned something of the business. What actually happens is that when he has had his experience and asks for the raise he is allowed to get another job and another cub is put through the extracting process.

This is not true of all firms, nor of all individuals, but there is enough of it to affect the salary of the average engineer and lower the general standards of the profession. There is no line to divide the engineer and the layman. Any one can set himself up as an engineer, and no one can say another is not an engineer for fear of being asked what is required to make a man an engineer. This lowers the general standard of the profession.

The Ohio Engineering Society has attempted for years to remedy this evil by having a license law passed, which would raise the standing of the profession in the eyes of the public, even if it had no other good effect. How the last bill proposed could hurt the best interests of the profession has never been explained, but the national society has stubbornly opposed all license laws. One cannot help but wonder whether this opposition is in the interest of the profession or of the employers.

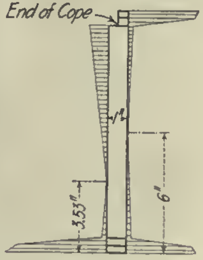
I do not believe there is an over-production of engineering graduates, but there is undoubtedly an under-consumption due to shortsighted policies of employers, which in turn is partly due to lack of general advertising and co-operation on the part of the profession, because of the lack of a strong and keen organization.

Had the national engineering societies seen their opportunity twenty years ago and started a constructive policy for advertising the profession and advancing its interests there would not be the complaint there is to-day of poor salaries; there would not be so many public bonds outstanding and maybe not so many railroads in the hands of receivers. It would seem that the stock arguments and explanations which are solemnly repeated to the average engineer every time he complains of his lot are about worn out, and that if the national societies cannot take a constructive stand of some kind in the interest of the whole profession they profess to lead they would do well to confine their discussions to strictly technical subjects. With conditions as they are what encouragement is offered to a young man to spend the four best years of his life and two or three thousand dollars on an engineering course? A few are able to make themselves comfortable homes, but there are more who are compelled to become mere floaters, kicked about the country and exploited by first one employer and then another until they take up another line of work. In closing let me remind the profession in the words of the poet—"They have rights who dare maintain them."

An Average Civil Engineer.
Cleveland.

Shear Cracks or Tension Failure?

Sir: With regard to the shear cracks in the 12-in. 31.5-lb. stringers, reported by F. H. Avery, in the article on page 14 of your issue of Jan. 1, and noticed in one of your editorials of Jan. 8, if we neglect the 12 x ⅜-in. plates riveted to the upper flanges, and if we assume that the upper flange only is cut off in coping and none of the web, the neutral axis is found to be only 3.53 in. above the lower face of the lower flange; the maximum shearing stress estimated by the simple theory of bending is about one-fourth larger in the coped part than it would be if the beam were of normal section, while the maximum fiber stress is increased more than three times by the coping. This is in agreement with your editorial.



However, it seems to me that this is not the whole story. The accompanying sketch shows a strip, 1 in. long, cut in imagination from this beam and so located as to include the end of the cope. On the right face of this strip we have a stress distribution somewhat like that of the normal beam, while on the left face we have a stress distribution characteristic of the coped beam, or a T-beam. In this sketch I have shown, not the stress distribution, but the distribution of forces on the two faces per unit of height, all to the same scale. These forces are those due to positive bending moment and do not include shear. For negative moment the magnitudes will be the same, but the signs will be interchanged.

It will be noticed that the whole force carried by the upper flange of the uncoped beam comes as a horizontal shear on the upper part of the web, and that we have no means of estimating over how long a horizontal section this shearing force is distributed. It seems fairly evident that the shearing stress will be extremely high on a horizontal section near the end of the cope, and it seems very probable that this may start a crack with many repetitions of even comparatively small moments, either positive or negative. After the crack has once started we may expect it to become longer with repeated loadings.

These considerations confirm Mr. Avery's suggestion that coped beams should be regarded with suspicion for live loads that are often repeated.

O. H. Basquin,
Professor of Applied Mechanics, College of Engineering, Northwestern University.
Evanston, Ill.

To Repair the Cistern and Yet Save the Tree

Sir: In your issue of Jan. 8, page 57, Stuart T. Smith inquires how to repair a cistern without injuring a near-by poplar tree. The Carolina poplar is one of our most vigorous and adaptable species. Mr. Smith is not likely to harm the growth of this tree by cutting off such roots as may be necessary in repairing the cistern. New roots will develop very rapidly and the only bad effect will be in weakening the root support of the tree, making it liable to be thrown by the wind. If the tree has a very large top, and the roots are cut to a considerable extent on one side, the branches should be cut back severely to lessen resistance to the wind. Otherwise the tree should be braced by an iron rod bolted through the trunk and firmly anchored by chains to a "dead-man."

Incidentally the Carolina poplar is notoriously a nuisance in cities or near dwellings because of the habit of its roots to penetrate and clog drains, crack and lift cement sidewalks, etc., and also because its leaves fall throughout the summer, causing unsightly litter. Owners of Carolina poplar trees would do well to plant species like the sycamore, Norway maple, oriental plane, ginkgo or red oak, and remove the poplars as soon as the more valuable trees are large enough to require the space.

In repairing the cistern Mr. Smith would probably get best results by lining it with a cement wall 4 to 6 in. thick. The poplar roots may penetrate even a wall of this character in time, owing to the disintegrating action of the acids formed during growth. For this reason some benefit may be derived by giving the earth walls of the cistern a thick coating of coal tar before the cement wall is placed. The coal tar would have a tendency to discourage the growth of near-by roots.

S. B. Detwiler,
Philadelphia. Forest Engineer.

Marine Borers Riddled Sheathed Timbers, although they did not touch similarly treated unsheathed specimens in the experiments of Dr. L. F. Shackell carried out last summer at the marine biological station of the U. S. Bureau of Fisheries, Beaufort, N. C., and reported at the recent convention of the American Wood Preservers' Association. The specimens were 3 in. square and 4 ft. long, covered by strips of ½-in. loblolly pine. It was explained that the borers enter the untreated sheath and grow to such size—several thousand times the dimensions of the embryonic stage—that any toxic property the preservative may have on the infant borer is lost on the full-grown individual. Dr. Shackell explained that the practical significance of the experiment lay in the absolute necessity of protecting by treatment every part of the stick which will be exposed.

HINTS FOR THE CONTRACTOR

Details Which Save Time and Labor on Construction Work

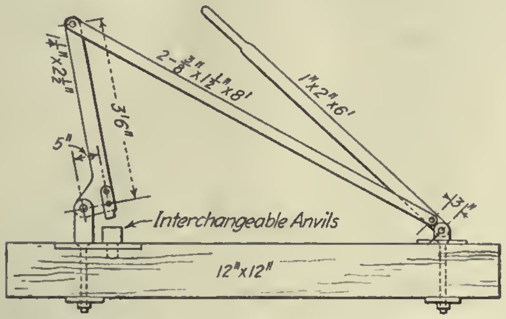
Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

[*Contributions to this section are solicited, and if found available will be paid for. They must be* SHORT, *and should be accompanied, if possible, by photographs or sketches.*—EDITOR.]

Simple Rod Cutter Made in Blacksmith's Shop

By L. A. FRANCISCO
New York City

A SHEAR for cutting steel bars made for a New Jersey dredging company by one of their blacksmiths, and which is used in their repair yard, is illustrated herewith. To a 12 x 12-in. timber is bolted a 1-in. thick steel plate having two holes over the center-line of the timber. Through one of these passes the eyebolt which forms the hinge of the jaw. Into the other fit several different sizes of anvil blocks, for cutting different sizes of steel bars. The movable blade of the shear was made from an old bridge eyebar fitted with a cutting edge of hardened tool steel. The leverage shown in the sketch makes it possible to exert a pressure of about 70,000 lb. on this edge.



LEVERAGE OF ROD CUTTER GIVES 70,000 POUNDS PRESSURE

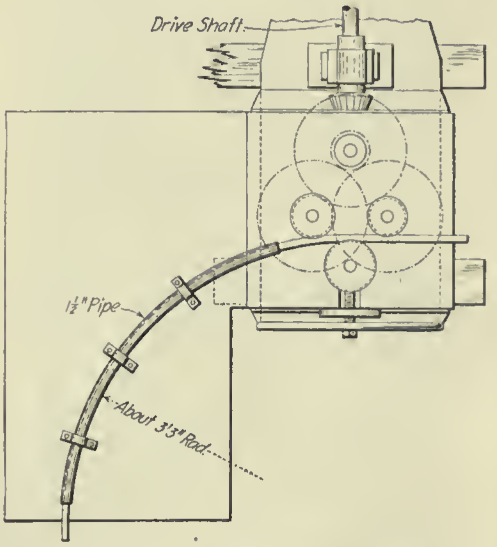
Grouting Simply Done Holds Running Sand Behind Sheeting

SHEET piling is often not absolutely tight, but lets through sand and water from behind in such quantities that it is impossible to do the required work. According to a reader, one solution of the problem thus presented is to work holes through the stiffer soil above the sand with an iron rod, withdraw the rod and replace it with a length of pipe through which grout is poured and worked down by churning. This stiffens the sand and effectually prevents it from flowing. If a long stretch of piling is troublesome it is desirable to have two lines in which the holes are staggered and about two feet apart, the first line being about three feet behind the sheet piling. This was successfully tried in building a retaining wall of reinforced concrete where the steel bars had to be anchored to the rock foundation, in connection with the construction of a surge tank, by forces of the Ontario Power Company at its plant at Niagara Falls, Ont.

After this retaining wall was built it was found necessary to strengthen it by placing more reinforced concrete behind it, which necessitated a second row of sheet piling behind the first and the excavation of the ground which had previously been grouted. This gave an admirable chance to observe what had happened in the first grouting. It was found that the grout had permeated the sand and stiffened it so that in most places it had to be broken up with hammers and picks.

Pipe "Tunnel" on Bender Keeps Curved Bars from Twisting

A LARGE number of bars bent to a three-quarter circle are required for reinforcing the shells used by Foley Bros., Welch, Stewart & Farquier, in building the pier walls at the Halifax ocean terminals. As the bars are light they would twist up in going through the rolls, and so acquire curves in several different planes. To overcome this and hold the bars flat on the table a pipe "tunnel" for the bent end of the bar to feed through was made of a piece of 1½-in. pipe. This was bent to a quarter circle and clamped down to the bending table on the circumference of a circle passing through the rolls. The bender is shown in the accompanying drawing. It was devised by C. D. McArthur, formerly chief engineer for Foley Bros., Welch, Stewart & Farquier.



PIPE "TUNNEL" PREVENTS TWISTING

Forms Wedged from Top of Shores with Superior Results

By G. W. SMITH
Engineer, Hodgin Construction Company, Omaha, Neb.

WEDGES are being placed at the top of the form shores instead of the bottom, as is the usual custom, in building the new Ford assembly plant at Omaha, Neb., for which the Hodgin Construction Company of St. Paul is contractor. When bottom wedging is used the form work must be leveled before the shores are braced, or else the bracers must be loosened for leveling. By using the system of top wedging the form work can be erected and braced and the steel reinforcing placed before any leveling is done.

On this job a flat-slab system of floor construction is being used. When a floor is ready to be leveled the level is set up at a convenient place and the target on the level rod is set for the proper grade. The column heads are leveled first by reading the rod on the four sides of the column and having two carpenters underneath to do the necessary wedging up. It is best to have the floor a little low rather than too high, as it is easier to drive the wedges up a little than to loosen them and lower the floor. After the column heads are leveled, the centers between columns are taken and given the proper crown. After this is done all the other wedges are gone over and brought to a solid bearing.

The claim for this method of wedging is that it facilitates the erection of centering. Its one disadvantage is that driving wedges while standing on a horizontal tie nailed to the shores at the proper height is a little more difficult than it would be standing on the finished floor. So far this method has been used on three floors of this building, and no cause has been found to abandon it for the usual procedure.

"Drydocking" a Tug with a Set of Chain Blocks

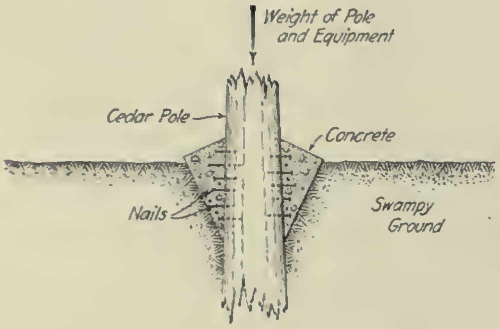
THE FACT that no great weight is lifted by tilting a floating hull to bring part of it above water for repairs has often been utilized by river contractors to make minor repairs, a derrick boat being usually employed to do the lifting. A good application of this principle, when avoided tying up a derrick boat for a day or more, is shown in the accompanying photograph. A large pair of chain blocks attached to a timber cantilevered over the edge of the lock wall was here used to raise the bow of the tug to repair holes made by running into ice, and to hold it up while the

CHAIN BLOCKS RAISE TUG FOR REPAIRS

entire bow was sheathed with metal. The tail of the timber was located over a well in the land wall which communicated with the operating culvert in the river wall, and was chained down suitably. This work was done at the Government lock and dam on the Hudson River at Troy, N. Y. The dam has just been completed by Government forces under the Corps of Engineers, U. S. Army, Col. William M. Black being in general charge of the district and Maj. M. J. McDonough having charge of the work at Troy.

Concrete Collars Economical Support for Poles in Swamp

THE BUILDERS of an Ohio transmission line which crossed swampy ground overcame troubles due to settlement of the poles by the expedient illustrated in the accompanying drawing. Poles of this sort carry loads much greater than their own weight, due to tension in the lines stretched on them and also to the pull of guy lines where it is necessary to use this means to prevent their leaning in soft ground.



CONCRETE SUPPORT EASILY PLACED

As indicated in the drawing, heavy nails were driven part way into each pole at and below the ground line. Around the pole and over these nails a circular, wedge-shaped section of concrete was molded. The nails took up the shear between the pole and the concrete, and the bearing area developed by the latter was made sufficient to prevent settlement.

Sheepskin Brush Solves Oiling Troubles in Narrow Forms

By B. M. MATHIAS

Circular Concrete Company, Minneapolis, Minn.

ANYONE who has had experience trying to apply oil to the surface of forms of the "release, raise as a unit and fill" type, extensively used in constructing concrete silos and tanks, knows that the task is not an easy one. Unless metal forms are oiled or given some kind of coating between fills the concrete adheres and a rough, unsightly surface results.

In building these thin walls (6 in. is a common thickness) the narrow space, obstructed by the horizontal reinforcing, which must be placed in at the top as the form is raised, does not permit the use of a common paint or whitewash brush for coating the mold surfaces. Oiling by spraying with a hand-pump we found objectionable, because the reinforcing steel, and also top of the previously poured wall, received too much of the shower of oil. A mop of cloth or burlap soon coats over and will not give up the oil, while on the other hand the oil readily leaks out at the bottom, making it almost as objectionable as spraying oil.

A brush that overcomes the difficulty, and one which experience on the work of this company has proved to be useful, is made by tacking a piece of unsheared sheepskin, wool side out, around the end of a thin board, of about ½ in. thickness, of convenient width and of sufficient length to reach the depth of form. The holding tacks are best put in the edge of the thin board handle. This should preferably be of hardwood to have the necessary strength and lightness. This cheap (even in these times of high-priced wool) sheep-brush makes a very efficient tool for spreading light mineral oil on metal forms. It is equally useful on wood forms if they are planed smooth and are free of splinters and so on. Of course, it is of no value when sticky oil is used.

In storing tools and machinery, a piece of sheep pelt makes a good wiper for applying a thin coating of oil to surfaces that should be protected against rust. For flexibility in getting into angles and over irregular surfaces, the wiper may be held limply in the hand, while for smooth surfaces, a brush that is easily held, and very effective in covering considerable surface quickly, is made by tacking the wiper on a block of wood.

Excavation to Backfill in One Handling via the Roof

IN the east portal of the Twin Peaks tunnel which the city of San Francisco is constructing as a municipal venture, description of which appeared in Engineering Record of Sept. 26, 1914, page 361, a considerable length of the concreting was done in open cut. It was found that the last of the excavation in this section could be expedited and that at the same time the work of backfilling on completed parts of the concrete arch could be cheapened by cutting through the arch and delivering muck direct to the backfill with one handling, using an inclined railway through the finished roof.

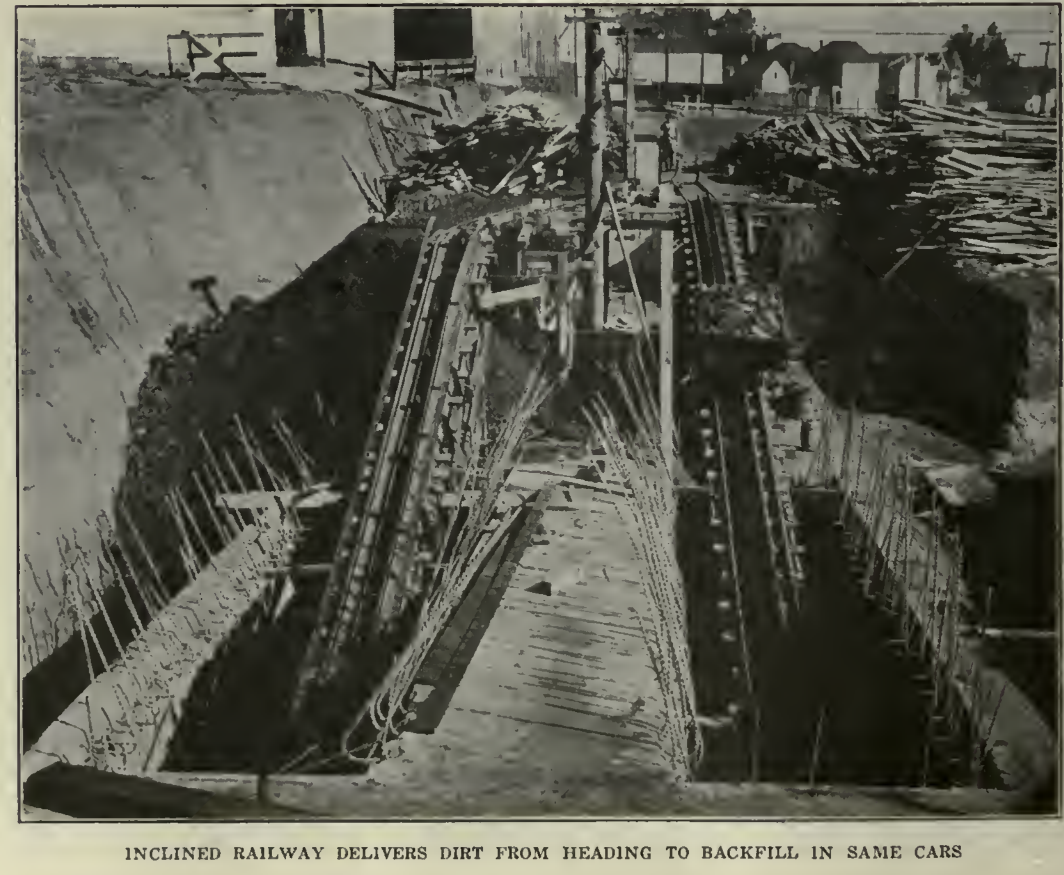
An accompanying illustration shows how this was accomplished. Loaded dump cars were delivered by gravity to the foot of the incline on the right, were drawn up by an electrically driven endless-chain belt, and after being dumped in fill were returned empty down the incline shown on the left. About 10,000 cu. yd. of material were handled over this incline improvised after the work was under way. In making the openings in the arch roof the reinforcing was left in place so that the sections could be readily restored to normal.

While mucking was in progress the electric motor ran continuously, cars being handled at about five-minute intervals. The link belt operated by this motor carried dogs which engaged steel brackets riveted to the running gear of the dump cars, so that the mechanism required no attention at either end of the incline. From the top a slight descending grade delivered the cars to the dump by gravity. On the return incline the link belt, which was not provided with power, was controlled by a hand-operated friction brake working on the shaft that carried the link belt sprocket at the head of the incline.

The most important problem that had to be solved in getting the scheme to work satisfactorily was the proper grades for the inclines. The grades first selected were too steep and a reconstruction of the track was required. As finally adopted the ascending grade was made 28 per cent and the descending grade 40 per cent. The cars handled had a capacity of 1½ cu. yd.

The work is being done under the direction of M. M. O'Shaughnessy, city engineer. The escalator was designed and built by the contractors, R. C. Storrie & Company, of San Francisco.

AN INTERSTATE BRIDGE is being constructed across the Colorado River at Topock, Ariz. The bridge will connect the highway systems of two states and is being built by joint action of California, Arizona and the federal government.



INCLINED RAILWAY DELIVERS DIRT FROM HEADING TO BACKFILL IN SAME CARS

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

Oscar S. Straus Strongly Approves of Engineer on Service Commissions

Chairman of New York City Board in Charge of Subway Work Tells Why Engineer Can Aid in Solving Commission Problems

Governor Whitman of New York openly professed his faith in the value of an engineer as a member of a service board when he appointed Henry W. Hodge to the Public Service Commission of the First District, which controls the New York City subway work. The public has not known, however, that the new chairman of the commission, Oscar S. Straus, is equally convinced of the need for a technical man on such a board. Mr. Straus' views are particularly important because of his business experience and his long and distinguished public service as Ambassador to Turkey and as Secretary of Commerce and Labor under President Roosevelt.

In calling on Mr. Straus to learn his opinion the representative of the Engineering Record was prepared to ask questions on the points usually argued—whether a subordinate engineering staff could not give the commission all the technical advice needed; whether the judicial mind was not all important, to the exclusion of the engineering; and what type of engineer is best fitted for the work. There was no need to ask the questions. Mr. Straus gave his views without pausing for questions, anticipating all of the queries it had been proposed to propound.

Advised Engineer's Appointment

"As chairman of this commission," said Mr. Straus, "I welcomed and advised the appointment of a high-class engineer as a member. The Governor, however, forestalled my ideas as he had, for some time past, before my appointment, come to the same conclusion that I subsequently reached. He carried out his views in a most excellent manner by inducing Mr. Hodge to accept the position. A man of Mr. Hodge's experience and standing is not a mere engineer. He has in the fullest sense of the word a constructive mind.

"The reason why an engineer of high standing is of such value to the commission is because fully half of our problems are construction problems. A man looking at them from the administrative point of view, and uniting with that attitude expert knowledge as an engineer, is of enormous help to our engineering force, which naturally looks at problems from the purely engineering aspect. Furthermore, an experienced engineer who has been connected with large works is in the very nature of things a broad-minded and a practical man. He possesses qualities that cannot but be helpful in the solution of such problems as the commission deals with.

"The reason why the engineering mind is so valuable in such work is that it unites what Carlyle characterizes as the articulate and the inarticulate qualities—the power of formulating proposals united with the power of construction—deeds together with words.

"We were particularly fortunate in securing on our board such an exceptional man, who in experience, character and ability is so well qualified to aid in the solution of the problems before us as Mr. Hodge. Our engineering staff is excellent and the fact that we have on the commission itself a member with full responsibility, who also understands the technical problems, will be an aid in solving the very important questions before us."

Colorado River at Thirty-Four-Foot Stage Inundates Yuma

On Jan. 22 the Colorado River reached the 34-ft. stage at Yuma, which is equivalent to a flood four feet deep on the ground floors of buildings along the main street, and is the highest level on record since 1891. Many old buildings in the lower portions of the town were destroyed, and the gas, electric and water services were put out of commission. The Government levees gave way, both above and below Yuma, flooding the Arizona side of the Yuma valley and completely inundating the town of Araz and the Indian Reservation. The Government levee had to be cut at one point to release water.

President of Technical Publishing Company Who Died Suddenly This Week

JOHN ALEXANDER HILL

Due to ample warning no fatalities occurred in Yuma, except for the death of Mayor Moore, caused by shock. A citizens' relief committee promptly undertook to feed and shelter the homeless, and on Jan. 23 electricity, light and water were being supplied by auxiliary plants brought by the Southern Pacific Railroad from Tucson. On Jan. 24 railroad traffic west of Yuma was still blocked by the washout at Araz station, and the flood waters at Yuma had lowered to the 22-ft. level. J. C. Allison, chief engineer, California Development Company, reported by telephone from Hanlon heading that the water was four feet below levee tops and the canal system intake was safe.

Conditions in the Volcano Lake Levee District were not considered serious, because the duration of the flood peak was short, and the overflow above this point served as storage.

A telegram to the Engineering Record from A. B. Fletcher, chief engineer California Highway Commission, stated that, although the recent Southern California floods had damaged many county highway bridges, damage to the state road system was comparatively slight, probably totaling less than $10,000.

John A. Hill, Publisher of Technical Journals, Dies Suddenly

Owner of "Engineering News" Stricken by Heart Disease—Arose from Locomotive Engineer to Presidency of Large Publishing Company

John Alexander Hill, president of the Hill Publishing Company, publisher of *Engineering News*, the *American Machinist*, *Power*, the *Engineering and Mining Journal*, and *Coal Age*, died suddenly of heart disease Jan. 24 while motoring from his house in East Orange, N. J., to his office in New York City. His death ends a career filled with dramatic interest—the rise of a farmer's boy, reared in the humblest surroundings, through the ranks of printer's "devil," machinist, locomotive engineer, and round-house foreman to a position in which he was one of the dominating influences in the field of technical journalism. Mr. Hill was essentially a self-made man, with a vigor of personality and a strength of determination which swept obstacles aside, but he had none of the objectionable egotism which is sometimes a characteristic of men who have risen to power through the sheer force of their own efforts.

He was born on a farm in Sandgate, near Bennington, Vt., Feb. 22, 1858, and while still a lad his parents moved to Wisconsin. His ambition for doing things asserted itself early in life, for he left the public schools when he was only fourteen years old to enter upon his first job in a country printing office. Here he remained until he had saved enough money from his meager earnings to buy a half interest in a small machine repair shop. Here it was that his inborn aptitude for mechanics developed and in 1878, when he had reached the age of twenty, he went to Colorado to run a locomotive on the Denver & Rio Grande Railroad. Mr. Hill's journalistic instincts soon began to crystallize. He was a keen observer of the things that passed before his eyes, and he commenced to translate his daily experiences on the railroad into "copy," sending his contributions to a small paper, *Locomotive Engineering*, published in New York by a company which also controlled the *American Machinist*. His forceful, breezy style and his evident grasp of the practical details of railroading made such a favorable impression that he was offered an editorship on the paper to which he had been sending his manuscripts. He left the railroad, came to New York and began work as an editor.

His First Paper

It is characteristic of the man's rugged power that in a short time he owned the paper which had offered him a job. He had not been writing for *Locomotive Engineering* long before he saw in the enterprise possibilities which had never been grasped by its owners. He promptly enlisted the support of Angus Sinclair, purchased the journal, and undertook to carry it on as a separate publication. In this venture Mr. Hill was both editor and publisher, and his genius was well proved by the phenomenal success of the publication. Its subscription list grew by leaps and bounds, and it rapidly assumed the leading position in its field.

It was evident to Mr. Hill's keen business sense, however, that a journal appealing largely to locomotive runners had not the elements for the largest financial success, and he perceived the opportunity of applying modern business and editorial methods to the *American*

Machinist, a journal of standing and reputation, which had been conducted for years along ultra conservative lines. In 1896 Mr. Hill sold his interest in *Locomotive Engineering* to his partner, Mr. Sinclair, purchased the *American Machinist* and laid the foundation for one of the largest enterprises in the field of technical publication ever established.

From the time of his acquisition of the *American Machinist* his activities in the publication field rapidly expanded. He purchased *Power*, and soon afterward the *Engineering and Mining Journal*. In 1912 *Engineering News* passed into his control from its founder and chief owner George H. Frost.

To carry on these various publications Mr. Hill organized the Hill Publishing Company, in which, while he held the largest interest, a number of those associated in the conduct of the various journals were also stockholders. A fifth journal, *Coal Age*, was established in 1911 to cover a field which it had become evident was too broad to be successfully reached by the *Engineering and Mining Journal*, chiefly devoted to metal mining interests.

In addition to his control of engineering periodicals Mr. Hill was a prominent factor in the technical book publishing business. In 1909 he became associated with James H. McGraw, publisher of the Engineering Record, and the McGraw-Hill Book Company was formed. This partnership involved only the book publishing interests of the McGraw and the Hill organizations, and involved no amalgamation in the production of the several technical journals controlled by Mr. McGraw and Mr. Hill.

An enterprise in which Mr. Hill took great pride and to which he devoted some of the best energy of the last years of his life was the construction on Tenth Avenue and Thirty-sixth Street, New York City, of the building to house his publications, which was completed in 1914. It was characteristic of Mr. Hill that the building was not only planned at every point to suit the convenience and economy of the printing and publishing business, but that unusual provision was made for the safety, comfort and health of the army of workers housed in the building.

Mr. Hill was married in Wisconsin in 1882 to Emma B. Carlisle, who, with one daughter survives him.

Mr. Hill was vice-president of the Machinery Club, a member of the Engineers' Club of New York City, Railroad Club, Campfire Club and of the American Society of Mechanical Engineers, to which he was elected in 1913, among his references being Thomas A. Edison and James Hartness.

Spend $4,623,880 in 1½ Years for Surfacing Lincoln Highway

Expenditures in hard-surfacing the Lincoln Highway in the past eighteen months have amounted to $4,623,880, all of the money being paid by the various communities along the route.

Water Main Break in Cleveland Damages Railway Tracks

Cleveland's West Side section was without water supply or fire protection for several hours Jan. 20, due to a break in a 42-in. water main under Spruce Street at the Sycamore Street slip. The rush of water was so great that over 200 ft. of railroad track were washed out. The break occurred at the lowest point of the water system leading to the West Side, and all house connections and mains were drained almost immediately.

For six hours, until a by-pass could be put in use, 175,000 persons were without a water supply or fire protection. The main which gave way was of cast iron, 1¼ in. thick, and has been in the ground twenty years. Water Commissioner Schulz stated the break, which occurred at a joint, was due to settlement of earth underneath the main.

Agree on Rivers and Harbors Bill

Claude Kitchin, chairman of the House Ways and Means Committee, announced Jan. 25, following a conference with President Wilson at the White House, that a rivers and harbors bill had been agreed on. It will carry an appropriation of $24,000,000 for the purpose of paying for projects already authorized. It is predicted that there will be no omnibus appropriation for public buildings at this session of Congress. Appropriations all along the line are being cut in anticipation of the needs for military preparedness.

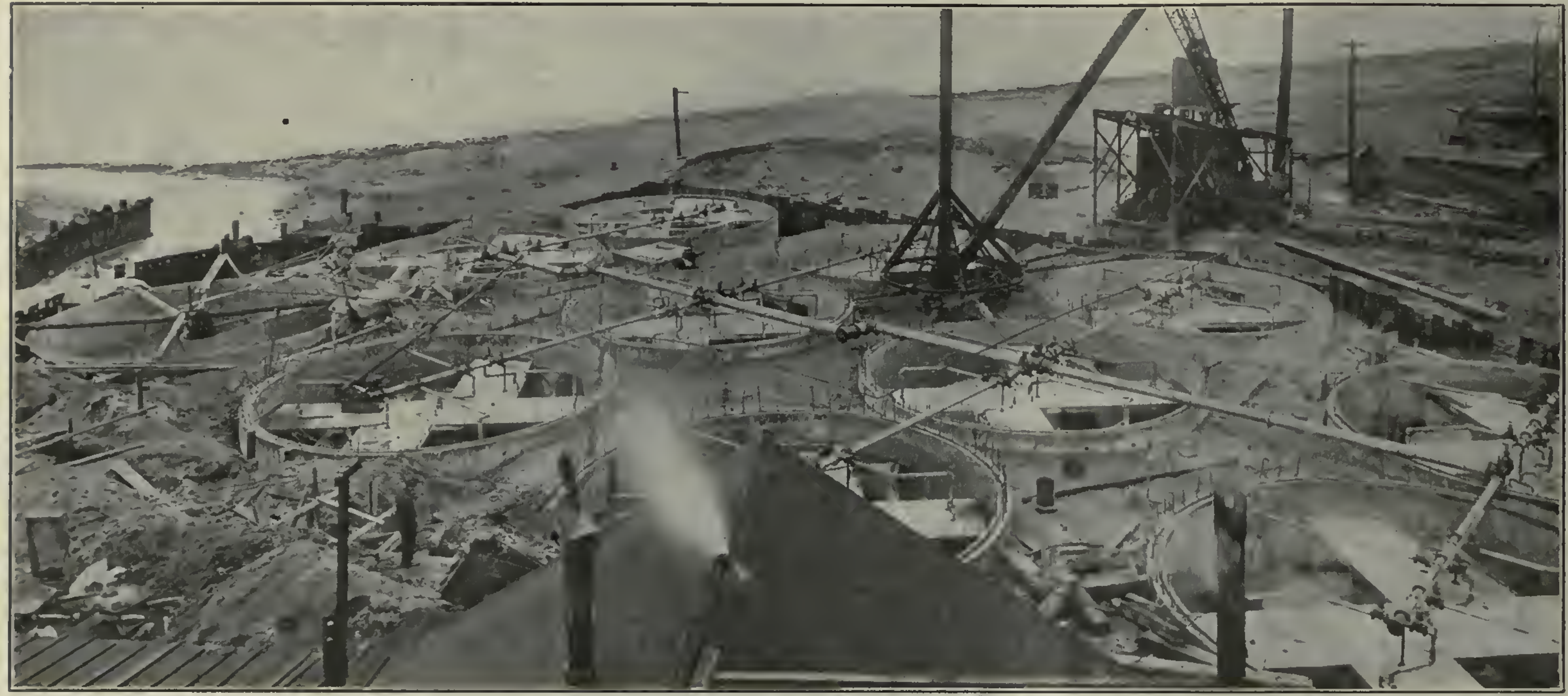
New Reinforced-Concrete Docks Planned for Asuncion, Paraguay

Plans for the construction at Asuncion, Paraguay, of approximately 1500 linear feet of new reinforced-concrete docks, with ample storage warehouse space and modern freight handling facilities and traveling cranes, have been submitted for approval. It is expected that active construction will begin within 90 days. The new docks will replace the five present totally inadequate, dilapidated wooden docks in front of the Custom House. Asuncion is a good natural port on the Paraguay River, which is navigable for large steamers all the way to the Atlantic Ocean. The construction and operation of the new works will be undertaken by MacArthur, Perks & Company, Ltd., and the contractors are the Construction & Engineering Finance Company, both allied with MacArthur Brothers Company of New York City.

Pioneer Activated Sludge Plant in Service

First Large-Scale Installation of New Process of Sewage Treatment Put Into Continuous Operation at Milwaukee

The 2,000,000-gal. activated sludge sewage treatment plant at Milwaukee is completed and has been put into operation. The accompanying photograph shows the sedimentation tank at the extreme left. It is to be covered later with a wooden roof. At the extreme right of the sedimentation tank are the two sludge aerating tanks. The other eight tanks are for aerating the sewage. The air pipes are seen on top of the tanks.



PIONEER ACTIVATED SLUDGE PLANT AT MILWAUKEE WHICH WAS RECENTLY PLACED IN REGULAR SERVICE

A complete description of the plant by T. Chalkley Hatton, chief engineer of the Milwaukee Sewerage Commission, appeared in the Engineering Record, Oct. 16, 1915, page 481. Up to the middle of January the plant was in partial operation on the fill-and-draw method for the purpose of building up sufficient activated sludge to warrant starting the continuous flow. When operating with 25 per cent of sludge in the aerating tanks and with a 4-hr. running-through period the capacity is 1,620,000 gal. per day. The sedimentation period is 27 min. and the velocity of the liquor through the eight aerating tanks over the 912-ft. direct travel is 3.8 ft. per minute. Decreasing the running-through period to 3 hr. increases the capacity to 2,160,000 gal. per day and the velocity to 5 ft. per minute.

Compressed air is furnished by a motor-driven Connersville positive blower having a capacity of 2400 cu. ft. of free air per minute compressed to 5 lb. The two complete units provided cost $2,986.69 erected, including the frame blower house.

The volume and rate of air supplied to the whole plant and to the sludge tanks is measured by General Electric indicating recording integrating meters costing $314.25 and $305.25 respectively.

The contract price for building the eleven tanks, including seventy-two 40-ft. piles for foundations under each tank and piping complete, was $55,000.

Sullivan Heads New England Waterworks Association

William F. Sullivan was elected president of the New England Waterworks Association at the annual meeting held in Boston, Jan. 12. He joined the organization in 1900 and is at present engineer and superintendent of the Pennichuck Waterworks, Nashua, N. H. Mr. Sullivan for a number of years past has taken an active part in the New England Association's work. He was a vice-president last year and has been identified with the organization's committee work. He was born at Lowell, Mass., in 1868, and began work as an assistant in the city engineer's office of that municipality. He advanced through the lower engineering grades until he was placed in general charge of the Lowell Waterworks. Later he went to Nashua, N. H., to enter upon his present duties.

Elected President of New England Waterworks Association at Annual Meeting

WILLIAM F. SULLIVAN

The other officers elected were: Vice-presidents, C. M. Saville, C. E. Davis, S. E. Killam, R. S. Lea, D. A. Heffernan and W. W. Brush; secretary, Willard Kent; treasurer, L. M. Bancroft; editor, R. K. Hale.

Northern Illinois Water Supplies Imperiled by Unusual Floods

"Boil the water" notices appeared last week in the Chicago papers following an unusually heavy 24-hour rainstorm on top of the frozen ground, a condition that backed water into the Sixty-eighth Street pumping station until it stood at a level 2 in. above the top of the open suction well extending up through the floor. The water department was prepared for a much higher level, having banked sand bags around the well. "We could not see and do not believe any seepage got into the supply," said one of the officials, "but we asked that the notices be printed so as to be on the safe side."

The supply to the station is sterilized at the crib and an extra amount of chlorine was added during the flood period, but of course it is not considered likely that it would act on a subsequent pollution if there was one.

Numerous basements throughout the city were flooded and practically all subways under elevated tracks on the South Side were filled with from 2 to 6 ft. of water. The antiquated sewer system of Chicago was taxed beyond its limits and the question of rebuilding it in the downtown district along with any subways now being agitated was forced home on the layman.

Reports from northern Illinois towns indicate that the sewer systems in many of them are entirely inadequate. West Hammond had 2½ ft. of water in its streets. The Fox River at South Aurora was dynamited to break an ice jam forcing the water into the Aurora pumping station. Joliet reported 2000 people driven out of their houses, and streets filled with ice left by the receding waters. At Peoria the Illinois River registered 24.1 ft. on Jan. 23, 0.1 ft. higher than the previous record made in 1882. The weather bureau predicted a further rise of 2 ft. A levee opposite the city protecting 4000 acres broke, forcing 100 families to abandon their homes. Water poured 3 ft. deep over some of the levees in this region. The 12,500-acre Spring Lake drainage district was flooded from breaks in the levees holding back the Mackinaw River.

Flood Damage Severe in Los Angeles County

Floods due to heavy rains descending upon California, Jan. 16 and 17, caused losses of not less than $3,000,000 and the lives of at least four people. In Los Angeles County, where the citizens will soon have a chance to vote on a $3,600,000 bond issue for flood control and conservation work, rich agricultural lands were overflowed and soil carried away, railroads washed out, streets and roads cut away, bridges destroyed and buildings wrecked.

The high water in and around the city of Los Angeles came near to being as disastrous as the flood two years ago, which was the direct cause of the agitation for flood prevention work. In 36 hours, more than 6 in. of rain fell. Cloudbursts, having their source in the mountains, swept down upon the fertile plain upon which are situated practically all the cities and towns of Los Angeles County, and, uniting there with swollen streams, cut new channels and spread out over wide areas on their way to the ocean. At the harbors, channels were filled with silt and dredging will be necessary to keep them navigable.

All of the railroads suffered. The San Pedro, Los Angeles & Salt Lake tracks were washed out at different points between Los Angeles and Riverside, and over a mile at Walnut, while the Southern Pacific lost several hundred feet of its line at Whitewater and some at Moorpark, Pacoima and Tejunga Pass. The Pacific Electric interurban service was almost completely suspended for a time, a number of towns being completely isolated. The Atchison, Topeka & Santa Fé lines also went out at points near Cajon, Upland, Glendora and San Diego.

A number of bridges were washed out, while others were undermined and threatened, including the Pacific Electric bridges at Rio Hondo and Rivera, the Southern Pacific bridge at Downey, the Los Angeles city bridges at Avenues 52 and 60, and all county bridges within five miles of Azusa, and also along the Foothill boulevard, on the Compton-Clearwater highway, and at other points.

Valuable industrial property bordering on the banks of the Arroyo Seco and Los Angeles Rivers, in Los Angeles, was cut away. In the residential districts streets and sewers caved in, and, it is said, houses were flooded and trees uprooted.

House Approves $25,000,000 Federal Aid Road Bill

The House of Representatives on Jan. 25 passed the Shackleford bill, which authorizes an appropriation of $25,000,000 to aid states in the building of public highways. The vote was 281 to 81. The measure was opposed by those who believe that all available money should be used for increased military preparedness.

Civil Engineer Becomes Vice-President of International Corporation

Philip W. Henry Elected an Officer in $50,000,000 Company Recently Organized for the Exploitation of Foreign Trade

Philip W. Henry, consulting civil engineer, of New York City, has been elected vice-president of the recently organized American International Corporation, the purpose and scope of which was briefly outlined on page 93 of the Jan. 15 issue of this journal.

Mr. Henry has for many years been prominently identified with developments in the West Indian and South American fields in which the corporation, among its other activities, will operate. Since 1909 he has been president of the Central Railroad of Haiti, which owns and operates 60 miles of railroad in that country, a modern reinforced-concrete wharf at Port-au-Prince, which represents the only real harbor improvement completed in that port since the founding of the republic over a century ago, and the tramways and electric light plant of the city.

In various official capacities with the Barber Asphalt Company he had much to do with the development of the Bermudez asphalt deposit in Venezuela, and that on the Island of Trinidad. From 1906 to 1909 he was president of the South American Construction Company, which built 125 miles of railroad in Bolivia. Other activities have taken him to Spain, Peru, Brazil, Mexico, Chili and the Argentine Republic.

Elected Vice-President of American International Corporation

PHILLIP W. HENRY

Started Career in Railroad Work

Mr. Henry was born at Scranton, Pa., and, after three years service in the engineering corps of the Delaware, Lackawanna & Western Railroad, on the location and construction of its extension from Binghamton to Buffalo, received his professional education at the Rensselaer Polytechnic Institute, from which he was graduated in 1887 with the degree of civil engineer. He then became foreman of the works of the Barber Asphalt Paving Company at Buffalo, and was made assistant superintendent the following year. In 1889 he became superintendent for the company at St. Joseph, Mo., and at Omaha, Neb. In 1897 he became general manager in New York, and, in 1900, attained the grade of vice-president and general manager. He left the company in 1902 to become vice-president of the Medina Quarry Company, and, in 1904, he opened an office in New York as consulting engineer. Since then he has been vice-president of the A. L. Barber Asphalt Company, operating the Bermudez asphalt deposits in Venezuela, and president of the South American Construction Company, which built 125 miles of railroad in Bolivia from Viacha to Oruro, all of which was built at an altitude of 12,000 ft. and over.

Since 1909 he has been president of the Central Railroad at Haiti, which owns sixty miles of railroad and the wharf, tramways and electric light plants at Port-au-Prince. He is also president and director of the Achotla Mines Company, which owns gold and silver mines in the state of Guerrero, Mexico.

Made 700-Mile Railroad Reconnoissance in Spain

In 1910 he made a railroad reconnoissance in Spain, traveling a distance of 700 miles, studying a proposed line from Bilbao to Madrid, and thence to Valencia.

In 1893 he made the only borings ever made in the pitch lake in the Island of Trinidad, which reached to a depth of 135 ft. in the center without reaching bottom, thereby demonstrating the inexhaustibility of the supply so far as the present generation, at least, is concerned. In 1904 and 1905 he spent some months in the state of Vera Cruz, Mexico, making an examination of the oil fields in that region, and making a survey of a railroad to develop the resources of that part of Mexico. This latter work was done for the Pan-American Company of Delaware, of which he was at the time vice-president. In 1911 he was appointed president of the Eddy-Peruvian Company, which in 1912 and 1913, made a railroad survey for the Peruvian Government, 200 miles in length, from Huancayo to Ayacucho, through a very difficult country.

Of recent years he has devoted considerable attention to the development of oil properties, and from 1911 to 1914 was consulting engineer for the Southern Pacific Railroad with special reference to the development of its oil properties in California, Texas and Mexico.

Recently he returned from an extended trip through Brazil, the Argentine, Chili and Bolivia, looking up the railway and public utility situation in those countries.

Wood Preservers Present Service Test Facts

Chicago Convention Program Replete with Results of Treated Paving Blocks, Bridge and Structural Timbers and Cross-Ties

Committee reports on treated timber for various uses were the feature of the convention of the American Wood Preservers' Association held in Chicago Jan. 18 to 20. When J. H. Waterman was elected president of the organization last year he began a campaign for the collection of facts, the information submitted to the annual meeting last week is the result of his effort to secure data upon which to base conclusions as to the best uses of wood and its preservatives.

So the program this year fairly bristled with facts on the longevity of wood block paving, on the significance of an innocent-looking fungus on the end of a cross-tie, on the suitability or undesirability of wood blocks for factory flooring, on the enormous waste of wood piling in water not infested with marine borers, and on results obtained under service with treated bridge and structural timbers.

Last year the West Coast representatives announced that they were on the eve of discovering a method of treating Douglas fir successfully. O. P. M. Goss, consulting engineer, of Seattle, presented a paper detailing the methods.

Service Test Results

A. E. Larkin, chairman of the committee on service tests of wood block paving, gave details of pavements in good condition, which had required an insignificant amount of maintenance in Minneapolis after thirteen years, in Seattle after seven years and in Newark after seven years.

On bridge and structural timbers the committee headed by H. M. Rollins added to the elaborate report of 1915, data from twenty-four different structures, mostly railroad trestles, piles and wharfs.

In the report on service tests on cross ties the chairman, C. P. Winslow, presented a mass of facts on the durability records of treated and untreated ties, involving more than 50 species, including 1200 individual records. The compilation was made by Messrs. Winslow and Teesdale, of the Forest Products Laboratory. Information of ties in the tracks of electric railways is desired by the committee, which was continued.

Mr. Winslow in a separate paper presented information on the composite strength value of thirty-five species, the factors being specific gravity, nail pull resistance, hardness, static bending, and compression, parallel and perpendicular to the grain.

Oil Specification Most Debated Question

The special report on a wood block preservative specification presented by S. R. Church furnished food for the most exciting discussion during the convention. Discussion on practically the same specification was looked for at Dayton at the meeting of the American Society of Municipal Improvements, but was held by that society in committee cold storage for another year. The proposed specification is confessedly a broad one and would let in nearly every kind of oil derived from coal gas tar or coke oven tar. Herman von Schrenck contended that practically all oils gave equally good protection against decay, "so why quibble over the oil specification when the real difficulty lies in getting the proper treatment." The water gas people felt that provision should be made for their oil, and presented a long brief in support of their contention. The committee members answered that as yet they had not become acquainted with sufficient service records to warrant advocating its use as standard. By a close vote the contenders for adoption of the specification as a standard of the society were defeated. The report was received as information and referred to the standing committee on preservatives.

The wood block paving report presented by C. H. Teesdale was very materially changed by the committee of which he was chariman from that printed as an advance paper. So many changes were suggested from the floor that it was referred back to the committee until another year.

E. A. Sterling, chairman of the committee on specifications for the purchase and preservation of treatable timber, presented specifications for structural timber, track ties and piling only. Wood blocks are under consideration by a special committee, and poles, mine timbers and other classes of material were left for future consideration.

Toxicity Test on Marine Borers

Dr. L. F. Shackell, St. Louis University, detailed tests on the toxicity of preservatives on the marine borer Limnora, based on 7000 observations. His findings bore out what he reported last year with reference to Xylotrya, namely, that the toxicity of creosote fractions diminished with rise of boiling point, the light oils are very toxic, naphthalene and anthracene are practically non-toxic and the tar acids are extremely toxic.

Herman von Schrenck had a tableful of treated and untreated specimens which showed bad decay, although apparently the timber was sound on the outside. He explained the factors contributing to these failures, some of which are treating timbers already decayed, failure to keep storage yards free from decaying sticks, and the impossibility of treating sap wood if it is already filled with water.

Society Affairs

The publication of a manual of suggested practice was urged. This was provided for last year, but it has not yet been carried out.

President Waterman suggested that a research committee be formed to investigate all new methods, patented or not.

A new constitution was adopted providing for probate membership instead of junior membership. The probate member should within five years be eligible for corporate membership. The time of meeting was changed to the fourth Tuesday in January to avoid conflict with the annual meeting of the American Society of Civil Engineers. A letter ballot for officers was adopted.

The secretary reported a membership of 276, a gain of 11 over the previous year.

A conference committee was authorized to work in co-operation with other organizations with the idea of cutting down the number of requests sent out each year to various companies and engineers. New York was chosen as the place for the next annual convention.

The officers elected for the ensuing year are as follows: President, Carl G. Crawford, general manager, American Creosoting Company; first vice-president, John Foley, chief forester, Pennsylvania Railroad Company; second vice-president, Morris K. Trumbull, vice-president, National Lumber & Creosoting Company; secretary-treasurer; F. J. Angier, superintendent of timber preservation, Baltimore & Ohio Railroad, Baltimore; members of executive committee, F. S. Pooler and A. R. Joyce.

Engineers Serving the Public to Receive Recognition

John W. Alvord Gives Western Society of Engineers $1,000 As Nucleus of Fund for Annual Honorary Medal or Tribute

An honorary award for inconspicuous engineering service to the public is to be made each year by the Western Society of Engineers from funds provided by the gift of $1,000 by John W. Alvord, consulting engineer of Chicago, which was noted on page 97 of the Jan. 15 issue of this journal. The purpose of the award and the extreme latitude given the society in making it are expressed best in Mr. Alvord's letter to the board of direction, printed below.

"It has long been my observation that there are numerous instances where the engineer serves the public amid many difficulties and often in inconspicuous ways, but with such ability that he accomplishes some particularly valuable results for the benefit of the community. Such achievements are often only known and not always properly acknowledged even by the profession to which he belongs, and they not infrequently entirely escape public notice.

"Further, it is well known that great benefits often accrue to the public at large through valuable improvements in the arts and their adaptation to the public use and need, and that these improvements are at times given by engineers to the public use without personal reward or gain.

"Finally, there is a class of engineers who, although substantially rewarded in a material way by the success of their work, nevertheless have accomplished so much for the world about them in vital, important and far-reaching ways, that they are deserving further of special honor for their accomplishments.

"It is not always clearly perceived that almost all engineers serve the public directly or indirectly. The field for useful public service is, therefore, about as wide as the profession, and it would appear that it is one of the important duties of engineering societies to point out to their membership and to the public such instances of engineering and administrative skill as seem to have unusual merit, in order that honor may be properly accorded where it is due.

"Being desirous of promoting a better appreciation by the public of able work accomplished by engineers for the public welfare, and further, of encouraging among engineers themselves a broader understanding of their opportunities for public usefulness, I desire to see established by the Western Society of Engineers an honor award—by medal or other tribute—to be annually presented to that engineer whose particular work in some special instance or whose services in general have been noteworthy for their merit in promoting the public good. I should be pleased if the recipient of such honor be not limited by Western Society membership, or, in fact, be restricted by any society or locality requirement. The only qualifications suggested are that he be an engineer of some reasonable degree of professional skill or administrative attainment. It would appear that the award will serve its purpose wisely if at times it is worthily bestowed upon comparatively little known instances of public and professional devotion, as well as at other times upon more conspicuous services.

"I trust, therefore, that the Western Society of Engineers, through its board of direction, may be willing and enable to administer some program of this kind in such manner and in such instances as from time to time seem to the board of direction best and most fitting; and for the purpose of enabling the society to have an income sufficient at least to make a beginning, I take pleasure in donating to it unreservedly the sum of $1,000 in securities."

Personal Notes

WILLIAM MCNAB, formerly principal assistant engineer of the Grand Trunk Railway at Montreal, has been appointed valuation engineer. Mr. McNab was born in Scotland, and entered railway service on the Grand Trunk in 1870, on work in connection with the International Bridge across Niagara River. Later he assisted on the location and construction of the Lewiston & Auburn. In 1878 he was appointed engineer of surveys and levels for projected revision work, and, in 1880, engineer of location and construction of the Montreal & Champlain Junction Railway. From 1883 to 1884 he was in charge of double tracking from Scarborough to Montreal, including the York Yard terminals and engine house. For 10 years, beginning in 1886, he had charge of the drafting office at Montreal, including part of the design and control of construction of the terminal passenger station in that city. From 1896 to 1907, as assistant engineer, he assisted the chief engineer on various work, including the extension of piers, and replacing the single-track Victoria Tubular Bridge across the St. Lawrence River with double-track steel trusses. He was appointed principal assistant engineer in 1907.

ELLMS & MILLER, consulting engineers, of Cincinnati, have been retained to supervise the construction, and to act as consulting engineers, of the extension of the approach to the Covington & Cincinnati Bridge, which is to be built this year. The approach will be of steel girder and concrete construction.

G. A. KNAPP has been appointed acting engineer of the Beaumont division of the Gulf Lines of the Atchison, Topeka & Santa Fé Railway.

C. R. SUMNER has been appointed city engineer of Hermosa Beach, Cal.

CHARLES FROMMER, formerly assistant engineer of sewer design of the Bureau of Surveys, Philadelphia, has been appointed principal assistant engineer of the bureau. Mr. Frommer received his professional education at Drexel Institute, and first engaged in engineering work in 1888 on the Lehigh Valley Railroad. From 1892 to 1894 he was structural draftsman with the Pencoyd Iron Company. He entered the service of the city of Philadelphia as sewer draftsman in 1894. In 1904 he was appointed assistant engineer of sewer design in full charge of all draftsmen and work necessary for the entire city, including the design of over 27 miles of main sewers, totaling more than $3,000,000 in cost, and of over 139 miles of branch sewers.

FRANK S. KRUG, city engineer of Cincinnati, was unanimously chosen administrative head of the proposed Cincinnati Rapid Transit & Interurban Railway project by the unanimous vote of the Rapid Transit Commission of that city at its meeting, Jan. 22. Mr. Krug is also to be chief engineer of the commission, and will have charge of the actual construction if the citizens approve the $6,000,000 bond issue for the improvement that is to be submitted to them in April. Mr. Krug's appointment to this post is in recognition of his past work in the public service. Following his graduation from Pennsylvania Military College, in 1884, with a degree in civil engineering, he obtained a position in the office of the county engineer of Hamilton County, Ohio, and rose to the rank of assistant county engineer. In 1891 he became county engineer, which office he held for 14 years. In recognition of his work his alma mater conferred the degree of master of engineering on him in 1904. Following his service with Hamilton County, Mr. Krug became associated with the Kirchner Construction Co., of Cincinnati, Ohio, as secretary and chief engineer. In January, 1914, he accepted the appointment of city engineer of Cincinnati, succeeding Henry M. Waite, who resigned to become city manager of Dayton. As city engineer Mr. Krug has been particularly successful in his method of handling the street repair department, which he has reduced to an economic and efficient basis by various technical innovations of his own origination.

City Engineer Appointed Head of Cincinnati Rapid Transit

FRANK S. KRUG

G. W. CUNARD has been appointed city engineer of Port Angeles, Wash.

JOHN H. HANNA, formerly chief engineer of the Capital Traction Company of Washington, D. C., has been elected vice-president of the company, and will have charge of operations. Mr. Hanna was graduated from Princeton University in 1892, and joined the engineering forces of the Louisville, St. Louis & Texas Railroad, as transitman on preliminary surveys and location, in August of that year. In 1894 he went to the Washington & Georgetown Railroad Company—now a part of the Capital Traction Company—as draftsman. He was appointed assistant engineer in this service in 1894, and assistant superintendent in 1895. In 1897 he attained the grade of assistant chief engineer and superintendent. He was appointed chief engineer about 7 years ago.

W. G. MASSENBURG, formerly division engineer for the Atchison, Topeka & Santa Fé Railway at Beaumont, Tex., has been appointed acting engineer of the Gulf Lines, with headquarters at Galveston.

FARLEY GANNETT AND THEODORE E. SEELYE of Harrisburg, Pa., have admitted Samuel W. Fleming, Jr., to the firm of Farley Gannett, consulting engineer, and have broadened their field of activity by including the design, construction, valuation and operation of electric properties. Mr. Fleming was graduated from Princeton University in 1906. He then studied engineering at Lehigh University, graduating from that institution in 1909. For three years after graduation he was identified with the Central Hudson Gas & Electric Company, acting as power engineer for a considerable part of the period, and devoting much attention to the revision of the rates of the company. For the last few years he has been largely employed in making reports on and investigations of electrical properties in the East and Middle West, including the White Rapids hydroelectric development in Michigan and Wisconsin, the Sturgeon River development in Michigan, and steam electric properties in the same territory. He has also been employed on reports upon electric railroads in New York and Maryland. Mr. Fleming will devote himself to the electrical work of the firm, giving especial attention to the design and construction of electric properties for corporations and municipalities, valuations for rate adjustments, and the operation of properties will also be undertaken for corporations and municipalities. The firm will continue to represent, as heretofore, public utilities, other corporations, municipalities and individuals before the State departments and commissions of Pennsylvania.

M. L. HUTTON, formerly connected with the Central States Engineering Company, of Muscatine, Iowa, has been appointed county highway engineer for Des Moines County, Iowa, succeeding Raymond Duer. Mr. Hutton was county highway engineer of Louisa County, Iowa, from 1912 to 1914, and, in 1915, was in the employ of the Central States Engineering Company of Muscatine, Iowa. Previous to 1912 he was employed in the engineering department of the Chicago, Milwaukee & St. Paul Railway on the Puget Sound extension, and in that of the Great Northern Railway on maintenance-of-way work. In 1911 he was engaged in drainage engineering in Humboldt County, Iowa.

ARTHUR CRUMPTON, formerly assistant engineer for the Grand Trunk Railway at Montreal, has been appointed assistant valuation engineer. He entered railway service in 1889 on the Grand Trunk, and was appointed assistant engineer in 1892. From 1893 to 1896 he was engaged in general maintenance work on the Great Western division, and, from 1897 to 1901, he was on field and office work in connection with the permanent renewal of 300 bridges, including the Victoria Bridge over the St. Lawrence River. From 1912 up to the present appointment he was engaged on surveys and construction in Ontario and New York State, and on bridge renewal work over the entire system.

Co-operative Russian-American Company Formed in Chicago

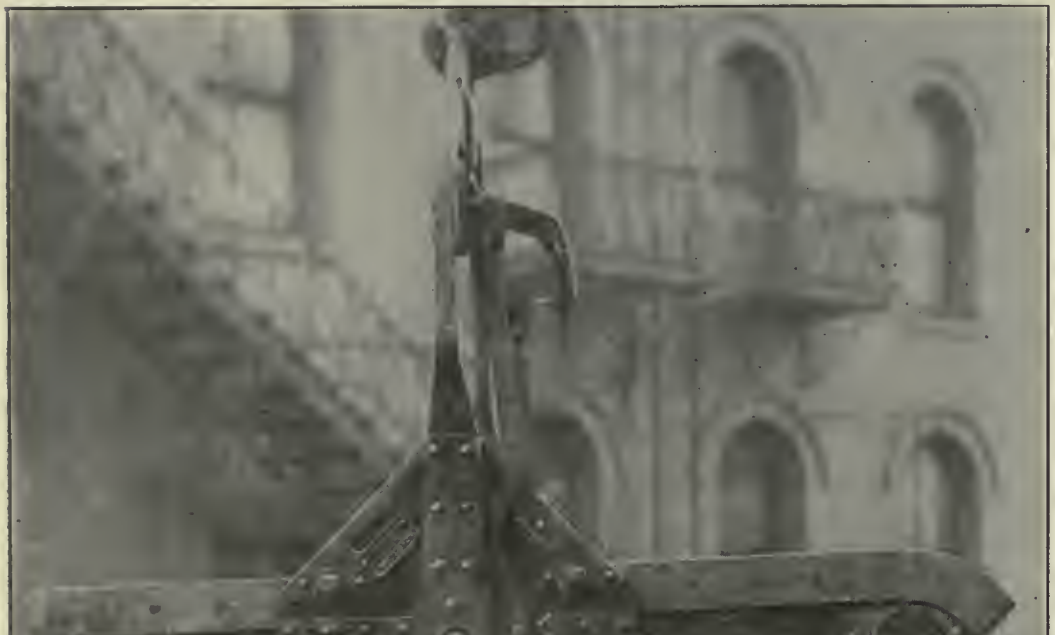
Twenty-five American non-competing firms have organized a co-operative organization with offices in the Rookery, Chicago, to push trade in Russia, to overcome the disabilities of different language, credit and business methods. It is called the International Manufacturers' Sales Company of America and has a capitalization of $100,000 to be subscribed by fifty non-competitors. A. S. Postnikoff was elected president at a meeting held last week of twenty-five representatives of firms having an aggregate capitalization of more than $200,000,000. A canvass is being made to obtain the remaining twenty-five firms provided for in the plan of organization.

Wheeled Skip for Subway Work Has Safety Latched Bail

The wheeled skips shown herewith were developed for use on the subway work described on page 152 of this issue. Not only are they low, being easy to load and requiring no cars for transporting them below ground, but they are handled by means of safety latched bails which can be put on and detached in a few seconds. Two of these are provided, one with wings on both sides of the bail engaging angle lugs on the skip, which insures the bucket against tipping from striking an obstruction at the shaft, and one with wings in front only. This allows the bucket to be dumped by tipping it with a trip line, but prevents it from turning turtle through the bail. The trip line is hooked to a lug at the back of the bucket.

Each of these bails has two latches, one on each side, which engage the trunnions on the bucket. They are connected by links and rods to a handle running across the bucket at the top of the bail. When this handle is raised, the latches are drawn aside by the links, leaving the slots in each side of the bail free so that it can be raised from the skip. In lowering the bail over the trunnions, its weight bearing on the latches forces them aside like a door latch until they have passed the trunnions, when the weight of the handle and links operates to throw the latches out and lock the bail to the skip. There is no way for the skip to slip out of this lock until the handle is raised, which cannot be done until the bucket is set down, because the weight of the skip exerts too great a friction on the latches through the trunnions, which bear directly on them. None of the moving parts can catch the men's fingers. The bail is strongly built and all parts are easily accessible. It is one of the inventions in this line of G. L. Stuebner, and patents on the rig have been applied for. The skips and bails are manufactured by the G. L. Stuebner Iron Works in Long Island City, N. Y.

BUCKETS ARE QUICKLY DUMPED AT DOCK



BAIL LATCHES ITSELF AUTOMATICALLY AND GRIPS BUCKET SO IT CANNOT DROP OR TIP

Business Notes

William A. Heartt, for the past five years in charge of the Western territory for the Sand Mixing Machine Company of New York, has been appointed assistant sales manager of the Chain Belt Company, manufacturer of chain belt and sprocket wheels, elevating and conveying machinery and concrete mixers, of Milwaukee.

The Apollo Electric Steel Company, which has just been organized, has acquired an 8-acre tract of land at Apollo, Pa., and has let contracts for buildings and equipment to start operations. The Snyder Electric Furnace Company of Chicago, will furnish two 12-ton single-phase furnaces, each of which will have a daily output capacity of 100 tons of steel. The concern plans to market high-grade steel in the shape of bars, billets and special products. The management of the affairs of the company will be in the hands of the following: Robert Lock, formerly of the Allegheny Steel Company and the American Sheet & Tin Plate Company, president and general manager; J. Arthur White, formerly with the American Sheet & Tin Plate Company; metallurgical engineer, W. E. Troutman, manager of the Vandergrift plant of the United Engineering & Foundry Company; J. E. Gallagher, real estate broker, Apollo, and Carl H. Booth, vice-president of the Snyder Electric Furnace Company, Chicago.

Trade Publications

The following companies have recently issued trade literature:

Milwaukee Concrete Mixer Company, Milwaukee, catalog, 78 pages, concrete mixing machines and pavers.

Carbic Corporation, Duluth, Minn., booklet, 12 pages, flare lights.

Owen Bucket Company, Cleveland, circular pamphlet, 16 pages, photographic, grab buckets.

Hydraulic Pressed Steel Company, Cleveland, catalog, 94 pages, pressed steel forms and appurtenances for concrete construction.

Municipal Engineering & Contracting Company, Railway Exchange, Chicago, catalog, 16 pages, Austin concrete mixers for concrete-road construction.

Kelley-Springfield Motor Truck Company, Springfield, Ohio, house organ, December, 1915, 16 pages, motor trucks, contract and military work.

Goheen Manufacturing Company, Canton, Ohio. Pamphlet, 4 x 9 in., 32 pages. Engineers and architects will be interested in this pamphlet for the reason that there is contained in its concise form useful information on protective paints and tables as to costs and spreading capacity of various paints in their application to structural, concrete and masonry work. The description covers Carbonizing, Coating, a chemically combined paint for steel and iron; Highway Red, for highway and railway steel structural bridges; Galvanum, for galvanized metals; Ornolack, for ornamental irons; Oxidized Carbon Cement, R No. 2, especially recommended for locomotives and trucks, R No. 1, for resisting brine and ammonia; Oxidized Carbon Cement, to prevent corrosion of steel or base of columns resting on masonry surfaces and for inaccessible parts of steel work and hulls of vessels; Concrewaltum paint, to finish concrete brick and masonry construction, and Flat Wall finish for plastered walls. Another valuable feature of the booklet is the inclusion of specifications covering each of these paints.

Engineering Record

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Shall the American Society of Civil Engineers Move Its Headquarters?

THIS week the Board of Direction of the American Society of Civil engineers sent out to its members a statement of a plan to transfer the headquarters of the society from its present home to the Engineering Societies' Building on West Thirty-ninth Street, New York City. The question, the board properly says, is one of the most momentous that has ever come before the society. The statement of the plan sent out does not take sides. It presents the subject dispassionately, leaving it to the members for discussion. The details will be found in the article on page 168 of this issue.

It is not possible in a single editorial to attempt a discussion of the question from every angle. The purpose here, therefore, will be to present the most important considerations, leaving for later issues such discussion of details and special phases of the question as may appear desirable.

First, let it be said that, in the opinion of this journal, it is scarcely possible to emphasize too strongly the importance of the subject. Thirteen years ago the same question was before the membership. The answer was in the negative. If the answer should now be the same, with the unsettled problems of thirteen years ago out of the way, it is morally certain that the proposal will never come again. If closer union in a physical way with the societies on Thirty-ninth Street is desirable, now is the time or never. Members of the society will need to appreciate the importance of the question and to give it the consideration it deserves.

The Engineering Record has for some years considered the advantages of a transfer of the society's headquarters. It is, therefore, and has been, prepared for such a discussion as has now been precipitated. First and foremost, it sees in the housing under one roof of all the great engineering societies, the external evidence of the final removal of the intangible, but nevertheless real, barrier which has existed between the American Society of Civil Engineers and its three sister societies. Gradually, year by year, that barrier has been yielding to the pressure of the need for closer co-operation. Many have been the steps toward better relations. Some of them are well known. First came the John Fritz Medal Board of Awards, then the organization of standing committees on inter-society co-operation, which considered, among other things, the standard bill for the licensing of engineers; then the establishment of the Engineering Foundation, and in turn the committees on the New York State Constitution and on a reserve corps of engineers. Each step has indicated the larger possibilities of a, still better understanding, while movements outside the headquarters of the various societies have shown that the memberships and engineers at large appreciate more and more the need of closer relations if the engineer is to take his proper place in the nation's life. In St. Louis, in Philadelphia, in Boston, in cities the country over, local clubs and societies, having in their membership engineers of every complexion, have been growing to power and have been bringing about an affiliation between the local branches of the national organizations. The movement has been irresistible. Papers read before many of the local bodies, in the last two years in particular, have pivoted about the status of the engineer and the means for its improvement. The renewed proposal of assembling the four great national bodies under one roof comes, therefore, as a climax of a great movement that has strength the country over; and those who have argued for closer co-operation, those who have discussed ways and means of improving the status of the profession, will be able to reach no other conclusion than that the movement under discussion is right, that the four bodies should be housed together just as soon as possible.

But while the logic of the growing activities of the past few years forces one to the conclusion that the suggested change is desirable, one naturally inquires as to the definite advantages in sight and also as to the offsetting disadvantages, if any.

The paramount advantage is the closer spiritual relationship between the four national bodies which will inevitably flow from the closer physical relationship of their headquarters. The secretaries of the societies, forming the managing committee of the building, get together daily and naturally interchange information as to the activities of their various organizations. Co-operation under such a plan is inevitable, as the history of the three bodies now on Thirty-ninth Street has shown. They have been called upon to advise the national government and congressional committees in cases where it is unlikely that any of them singly would have been drafted for such an important public duty. Moreover, committees with kindred interests and representing the various societies, meeting simultaneously under one roof, have been able very effectively to co-operate. The mere advantage of a broader inter-society acquaintanceship would alone almost warrant the change in headquarters, for that wider acquaintanceship, breeding confidence in sister societies, strengthens the individuals in their work for better recognition of the engineer and of his representative professional organizations. Without doubt, too, the relations at headquarters will be a stimulus for a very rapid spread of the affiliation idea between local branches, a movement which has already had a most favorable influence upon local public matters of an engineering character. The housing under one roof would be, as it were, the "outward sign of an inward grace" that would declare to the country at large that all engineers were standing together and that in any movement for the good of the profession and of the public, the virile support of 30,000 engineers could be relied upon. As long as one of the societies holds aloof in a physical way, this impression of solidarity cannot be carried to the public mind, and the profession is bound to be the loser.

Taking another phase of the movement, one finds in the possibilities of making a great engineering library an advantage in which the spiritual is mingled with the material. Here the consolidation of the books and manuscripts will be the means of strengthening the spiritual life of the organizations, enabling them to serve better their ever-increasing memberships.

From the physical standpoint the advantages, it seems to the Engineering Record, are distinctly on the side of the Thirty-ninth Street house. It has an adequate auditorium and meeting rooms of various sizes. Its location, midway between the Pennsylvania and the New York Central stations, in the midst of the hotel and club district, a section which is ever increasing in the advantages of its transportation facilities, cannot be excelled. The Fifty-seventh Street property, on the other hand, is in a neighborhood which is on the decline, at least from the standpoint of such a purpose as the headquarters of a national engineering society. Commercial interests which do not make for the peace and quiet desirable for a building such as the society's home have made large inroads in the neighborhood.

As to the disadvantages of the change, the Engineering Record sees few, if any. The chief argument it has heard advanced against the proposal is that the society would lose its identity. While the Engineering Record has the greatest respect for those who take such a position on account of their great pride in the standing of the American Society of Civil Engineers and their desire to see it maintain its present eminent place among engineering bodies, it does believe that their fears are groundless and that they do not consider correctly the status under which the society would make the change.

If the society continues its present good work and expands it, as it should and must do, there is little likelihood that it will be submerged and that its place will become less definite in the minds of engineers or of the country at large. This journal believes, on the contrary, that all of the societies will be strengthened by the closer union.

Moreover, the American Society of Civil Engineers would go into the Engineering Societies' Building to occupy physical headquarters, not changing its form of management, not giving up its publications, its committee system or anything it holds at present, except the building in which it is housed. True, there would be lost what sense of individuality comes from occupying a separate building, but that feature is minor compared to the society's technical prestige, and may well be sacrificed for the greater good that would come from the external evidence of professional solidarity.

As to the details of the proposal made by the United Engineering Society, both plans appear to this journal to be eminently fair. They would give the American Society of Civil Engineers an equity of about $500,000 for a consideration of $250,000 in cash, at the same time leaving the society in an exceedingly strong financial position, with approximately $100,000 of liquid funds in its treasury.

It is apparent from the trend of this discussion that the Engineering Record favors the removal to the United Societies' Building. The advantages in spiritual and material ways are so palpable, in its judgment, that an affirmative decision should result. The demand for the better recognition of the engineer, for fuller participation by him in the nation's life, is so insistent that it is difficult to see how a plan which will go far toward the consummation of all that it is desired can well be rejected. The issue at stake is a great one. At a single stroke the engineers of the country can stand before the public at large as a united army of 30,000. If the civil engineers refuse to accept the opportunity the present unfortunate division—for, whether we will it or no, the separation of headquarters has erected a barrier—will continue. This journal most earnestly hopes that its readers will favor the proposed plan. Realizing, however, that there are those who will dissent, it gladly opens its columns for a full discussion.

State Regulation from a New Angle

MANY who have turned a deaf ear to what they have deemed the hard-luck stories of the railroads concerning the burdens of dual regulation might get a new viewpoint from the address, abstracted on page 178, of Alfred P. Thom before the Second Pan-American Scientific Congress. Mr. Thom pointed out that every state reached by an interstate railroad is affected by regulation imposed on that road by one state, and that one state, by a selfish or narrow policy, may impose hardships on ten others reached by one trunk line. In his estimation, also, the European War has an important bearing on the matter, as it shows the imperative need for national and uniform industrial efficiency, not halted at state lines. Mr. Thom has presented his case so well, however, that to do more than call attention to his argument would be superfluous.

The "Touch of Elbow"

IN another column the significance of the recently organized plan of military training for New York engineers is discussed. Apart from the aspects of this movement which relate purely to adequate national defense one phase is bound to assume immense importance. There is nothing like a common object for bringing men of different types together. In any great concerted effort toward a single goal conceit and petty jealousies are soon forgotten, rough edges of personal differences of opinion are rounded by close contact, and conflicting ideas are cast into a melting pot. At the engineering training camp in Plattsburg next summer civil, electrical, mining and mechanical engineers of all degrees will rub elbows. It would be difficult to conceive of a project which could do more to weld the professional interests of these men into a closer bond than the life together out in the open. Flannel shirts and khaki are great levelers. In the ranks the members of the engineering profession will feel the "touch of elbow"—the contact of man against men which means team-work—and an esprit de corps will be developed which will continue after the men return to their professional work. That a desire for closer association of engineering interests exists was never more apparent than at present. Its latest manifestation, reported elsewhere in this issue, is the invitation of the United Engineering Society asking the American Society of Civil Engineers to become one of the founder members of the united organization and to move its quarters to the Engineering Societies' Building, thus bringing the four national engineering organizations into intimate relationship under one roof. Certainly the engineering camp is bound to foster the much-sought spirit of brotherhood among members of the battalion. The men who serve will return to New York with something more than a knowledge of an engineer officer's duties. The "touch of elbow" spirit cannot be left behind within the camp borders.

Future of Our Export Trade

THE foreign trade convention in New Orleans last week was widely heralded as one of the most important conferences of business interests the country has known. It deserved the characterization given it, and could its message be carried to the common people, to the voters of the country, the response would be such that foreign trade would overnight be given a new status in the thought of the country and Congress would be forced to remove the handicaps now embarrassing export business. Manifestly, it is impossible to bring that message to the people at large, for the relation between foreign trade and their personal interests is not self-evident. Relief must be sought, therefore, through the influence of the more enlightened citizens upon their representatives in Congress.

The basis for the strong movement for foreign trade expansion is its stabilizing influence on industry. The plant with a goodly share of its products sold abroad is the one that is likely to be kept running despite conditions here; in that lies the influence of foreign trade upon the welfare of each citizen.

A larger foreign trade then is desirable. But when ways and means of getting it are considered, one realizes that very grave obstacles confront manufacturers contemplating overseas business. To some extent the government helps in foreign trade extension—through its consular and commercial attache services. But that aid is more than negatived by the legal restrictions which Congress has seen fit to impose.

There are three principal agencies by which foreign trade expansion will be had—by increasing our investment in foreign lands and establishing our own banks there; by the co-operation of manufacturers, whether competing or not, in all matters affecting foreign trade; and by the development of a merchant marine. In each of these directions there is hampering legislation. The federal reserve act forbids banks which are members of the system combining with other banks, even if the combination be solely for the establishment of new institutions in foreign lands. The anti-trust laws prevent co-operation among competing manufacturers, though the object be merely to make their work in the foreign field more effective, while the seamen's bill, as is well known, is rapidly driving what little American shipping there is from the seas. The disappearance of our shipping in the Pacific, as a result of the La Follette bill, is bitter evidence of the lack of co-operation between the government and those who desire to develop export trade.

In some directions relief seems to be in sight. Joseph E. Davies, chairman of the Federal Trade Commission, stated emphatically at the dinner held in connection with the foreign trade convention that his commission stood ready to advocate the amendment of the anti-trust laws so that they will not apply to foreign trade, while a bill will shortly be introduced in Congress amending the federal reserve act so as to allow American banks which are members of the system to subscribe to the stock of banks organized for the foreign field. As to the merchant marine, however, there is no silver lining to the present black cloud. The administration is fighting for government-owned ships, confident that shipping interests will be glad to lease them. That seems to be a futile hope, for the decadence of American shipping is due primarily to high operating cost and not to high first cost, though the latter has always been a serious factor. The merchant-marine situation can be improved only by repealing the present seamen's act.

Apparently the subject is one in which all intelligent citizens should take a lively interest. The mass of the people are not likely to think correctly on the subject, being misled by agitators and occupied with interests which seem to them to affect their welfare more immediately. A practicable means of bringing about improvement is to force Congress to realize that the situation is serious and that the remedies lie solely in its hands.

Getting Down to Real Work in Preparedness

EVER since General Leonard Wood, in his memorable address before the Brooklyn Engineers' Club on Dec. 2, aroused engineers to a realization of their place in the general plan for national defense, the demand among the technical men of New York for further knowledge of the engineer officers' duties has been widespread. Up to the present time interest has manifested itself chiefly in individual efforts to get action. Several local engineering organizations appointed committees to report upon ways and means of enhancing the military value of their membership. As the movement expanded, however, it became evident that these commendable efforts would soon be working at cross purposes unless they were co-ordinated and directed by some central agency. There was power and enthusiasm, but no organization of a comprehensive character. The engineers were quick to appreciate this fact, and numerous conferences of all the interests involved have now welded the several plans into a single harmonious project for engineers in New York City and its vicinity, to be carried out under the auspices of the four national engineering organizations—civil, mechanical, electrical, and mining.

As the first definite move in the campaign a course of seven lectures has been arranged, as announced in the news section this week. They will be held in the auditorium of the Engineering Societies Building. General Wood will have general direction of the meetings and the speakers, in addition to him, are Captains Robins, Coiner and Ardery, all of the Corps of Engineers, U. S. Army. For the present there will be no military drill. The idea, apparently, is first to give the profession a bird's-eye view of the scope of the military engineer's duties in the field. Having this picture in mind the engineer can then undertake field work intelligently. The lectures are essentially a preliminary to service next summer at a camp in Plattsburg. Thus there will be an opportunity of putting theory into practice. Every military authority emphasizes the fact that the engineer officer must be a soldier first of all. Attendance at lectures is, of course, desirable, but it must be backed up by field service if the full value of the instruction is to be realized. Now is the time for engineers to enroll for the course and the camp to be held in Plattsburg next summer.

Following upon the heels of President Wilson's recent selection of the engineering profession to undertake an industrial census of the country's military resources, the organization of the New York training course and camp for technical men is highly significant. It indicates one thing clearly—that in the military preparedness program engineers can be relied upon for action, rather than talk. This is what counts. The country is already surfeited with plans and suggestions relating to military preparedness. It is now time to get down to real work. This is what the technical men of New York have done.

State Commissions' Views on Federal Valuation

HAD the state commissions at the valuation conference in Washington last week, an account of which appears in the "News of the Week," made Mr. Thelen of California their sole spokesman it seems to this journal they would have presented a much stronger case. With much that he said the Engineering Record agrees, and it believes that the discrepancy between his views on these points and those of the railroads is more apparent than real. Some of his theories the Engineering Record regards as unsound, but even these Mr. Thelen presented with a dexterity that almost made them plausible. Especially adroit was his summing up, in which he selected such of the views of his associates as he could indorse, and wove them into a well-rounded argument that seemed to be the unanimous view of all of the states.

On the other hand the comments and queries of some of the federal commissioners and attachés on theories expounded by the other state commissioners suggest that the latter overstepped themselves and really strengthened the railroad cause by clinging to untenable views. The Interstate Commerce Commission will hardly be impressed with Judge Helm's fear that because the state commissions are not competent to hold their own in argument with the railroad organization the national body must be on its guard. Having recognized and urged on the railroads the necessity for co-operation to make the valuations complete and reliable, the federal board will hardly applaud Judge Helm's plea that the railroads should withdraw and let the government do its best alone. Neither is it likely to see the fairness and desirability of dropping the work rather than let totals come to light far in excess of what the states approve. The national commission would hardly be satisfied with the state commissions' dictum that the state commissions interpret depreciation correctly, as so painstakingly set forth by Mr. Niles, even if the decisions cited were in absolute accord; much less as they were not. Director Prouty readily perceived the impracticability of attempting to allocate investment from earnings as argued for by Mr. Aitchison. The national commission will as readily perceive the absurdity of the Minnesota theory of instantaneous reproduction, even though it was set forth less baldly in the oral argument than in the Minnesota brief. And it will refuse to be beguiled by Judge Helm's failure to differentiate between land acquired by condemnation and that held in fee simple.

Reverting now to the main arguments—those of Mr. Thelen—this journal disagrees absolutely with Mr. Thelen's view on land. In the California commission's Mojave & Owenyo finding, quoted from at the conference and previously quoted from in the Engineering Record of Jan. 15, page 76, a reproduction figure for land but 66 per cent of the actual cost was found, and this in the face of an apparent general increase in surrounding land values. Surely there can be no charge of conjecture here in the figure rejected by the commission. The commission seems to be standing squarely on a technicality. The commission, which in most respects shows a disposition of fairness toward the utilities conspicuously lacking in some other state commissions, admits that railroad land could not be replaced at market value, but holds that the Minnesota rate decision bars anything else. This journal holds that as soon as the Supreme Court is shown clearly that market prices will not buy railroad land, it will upset these theories based on the Minnesota case.

Mr. Thelen refuses to take seriously the railroads' "other elements of value," save, of course, development expense. As pertinent to the main rate problem, whether rates in general are too high or too low, so does the Engineering Record. Nevertheless they exist, as all agree, hence the Valuation Act requires that they be found—if only for taxation purposes! And Mr. Thelen's own comments on the Ocean Shore Railway case suggest that perhaps he would give the intangibles more weight than the railroads themselves, so much weight that all cost figures would shrink to insignificance and the value of the service would become the sole criterion. Truly this question of intangibles, and whether the rate fixes the value or the value fixes the rate, is in a chaotic state.

The agitation about whether or not the Interstate Commerce Commission should make a finding of ultimate value seems like a tempest in a teapot. Does it matter whether the commission produces a total in which the items are all shown, so that they may be analyzed and modified as the particular case demands, or present the list of items and a comptometer, so that Congress or the courts can do the adding? A total would give all concerned some immediate conception of the value of the property. But none of those concerned would accept that total as the be-all-and-end-all for every purpose, especially as it would require constant revising, as will the items that would make it up.

In conclusion, the view of the states appears to be that, while they read into court decisions that reproduction cost is thoroughly discredited, they are not so sure of their ground but that they are determined to use their best efforts to keep that reproduction cost, which, when taken rationally, allows the so-called unearned increment, down to original cost, which does not. The trouble is that they follow different processes of reasoning in whittling down the real cost of reproduction, and some of those processes have collided squarely, with great damage to the cause. The Engineering Record has no fear that the Interstate Commerce Commission will be misled. Agreeing with Mr. Thelen that many of the legal questions of valuation are yet unsettled, it believes the commission will recognize the eligibility of reproduction cost as a basis of value to be one of them.

Shall Civil Engineers Move Their Headquarters?

Momentous Question of Relinquishing Society House and Moving to Engineering Societies' Building Is Submitted to Membership for Vote—Movement Springs from Desire for Broad Co-operation

MEMBERS of the American Society of Civil Engineers are on the eve of a decision characterized by the Board of Direction as the most momentous in the history of the organization. Through a letter ballot, distributed this week, and to be counted June 15, a vote will be taken upon the acceptance or rejection of a proposal to relinquish the $325,000 house and land at 220 West Fifty-seventh Street, New York City, and transfer the society's headquarters to the Engineering Societies' Building, erected in 1907 as a result of Andrew Carnegie's donation of $1,050,000 for an imposing structure to assemble under one roof the country's national engineering organizations. The Board of Direction's action in submitting the question to ballot is the outgrowth of an invitation in which the United Engineering Society, comprising the national electrical, mechanical and mining bodies, asks the civil engineers to consider joining the united organization as a founder society. It will be recalled that the electrical, mechanical and mining engineers entered into the project financed by Mr. Carnegie in 1903, but that the civil engineers decided at that time to remain in their present quarters on West Fifty-seventh Street, which they had built and owned. In sending out the letter ballot the Board of Direction of the American Society of Civil Engineers points out the present need of closer co-operation among all members of the engineering profession, stating also that one of the purposes of the projected movement is to strengthen the bonds of brotherhood which should exist among all engineers.

Board of Direction's Communication to Civil Engineers

The communication from the Board of Direction of the American Society of Civil Engineers to the membership is reproduced, in its more important parts, below:

An offer has been made to this society which your board considers to be one, the acceptance or rejection of which is perhaps the most important question which has ever come before the society. It will be remembered that 12 years ago by a letter ballot the corporate members of the society decided not to accept, in its behalf, a quarter interest in the gift of Andrew Carnegie of $1,050,000 to be expended on a home for the four national societies. Subsequent to this decision Mr. Carnegie gave the amount mentioned to the three other societies, and at No. 29 West Thirty-ninth Street there was erected a thirteen-story building for their occupancy. This money was expended entirely upon the building, the land on which it was built being furnished by the three societies.

VOTE WILL DETERMINE WHETHER OR NOT THIS HOUSE WILL BE RETAINED AS HEADQUARTERS OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS

In 1896 this society purchased two lots on West Fifty-seventh Street and erected its own home, and, subsequent to the decision not to accept Mr. Carnegie's offer, purchased an additional lot and erected an addition to the original building thereon, so that the present home of the society consists of a four-story and basement building of 75 ft. frontage, and an average depth of 110 ft. 7 in.

Need Greater Co-operation

The advisability, even the necessity, of greater co-operation among the various branches of the engineering profession for the general good has been a frequent topic of discussion for the last few years. One of these discussions resulted in an informal meeting of a number of gentlemen interested in this subject on June 9, 1915—the American Institute of Mining Engineers, the president-elect of the American Institute of Electrical Engineers, a past-president of the American Society of Mechanical Engineers, and the secretary of the American Society of Civil Engineers.

Following this conference, Gano Dunn, president of the United Engineering Society, extended to the American Society of Civil Engineers on June 24, 1915, an invitation to become one of the founder members of the united organization. He also announced the appointment of a conference committee consisting of Charles F. Rand, chairman, Dr. Alexander C. Humphreys and H. H. Barnes, Jr.

The United Engineering Society was incorporated for the purpose of acting for the three founder societies, viz.: the American Institute of Mining Engineers, the American Society of Mechanical Engineers, and the American Institute of Electrical Engineers, in all matters relating to their property holdings. Moreover, this original suggestion and the subsequent offer made by the United Engineering Society acting for these three founder societies have been referred to and confirmed by each of the societies separately.

Civil Engineers Appoint Committee

A conference committee for the American Society of Civil Engineers, consisting of Vice-President Clemens Herschel, Past-Director Robert Ridgway, and Secretary Charles Warren Hunt, was appointed by President Marx, and after careful investigation of the whole question, reported to the board Sept. 20, 1915. At a meeting of the board Nov. 9, 1915, the committee was enlarged by the addition of Vice-President Charles F. Loweth and Past-Presidents John A. Ockerson, George F. Swain, and Hunter McDonald. This committee has been going into the whole matter thoroughly, and has been furnished by the committee of the United Engineering Society with all available data upon which a judgment of the situation, so far as business arrangements are concerned, must be based. The present communication is based on the unanimous report of that committee.

Alternative Offers

There have been two offers made which may be briefly stated as follows:

(A) That a two and one-half story addition be made to the United Engineering Society Building at a cost estimated at $225,000, and not to exceed $250,000. That the American Society of Civil Engineers shall pay for this addition if the cost does not exceed the latter figure, and if said cost does exceed $250,000, the additional expense shall be borne by the United Engineering Society.

That the American Society of Civil Engineers shall then become an equal owner in the whole enlarged property on the same terms as each of the three present founder societies, and occupy as much space as it may need on the two floors to be added.

(B) That the American Society of Civil Engineers become one of the founder societies by the payment into the United Engineering Society treasury of a sum of money equal to that which each of the three founder societies has paid, the estimated amount being $240,000. This sum to be invested in interest-bearing bonds and held for the benefit of the United Engineering Society, of which the American Society of Civil Engineers would then become a part. That these bonds would be available in case it should later be found necessary to enlarge the building; otherwise, the income would be available for the activities of the United Engineering Society as the founders may determine. The American Society of Civil Engineers to occupy such part of the sixth and seventh floors as it needs. (See Appendix B.)

CONDITIONS OF ALTERNATIVES

The property of the United Engineering Society now stands free and clear of all debt, and there is a reserve fund of $70,160.89 for amortization of the building and for depreciation and repairs, and if the first offer is accepted this society will have an equal ownership in the entire enlarged property with the three other societies for practically the same amount of cash which each of them has expended up to the present time.

It will be observed that if offer A is accepted the present building will be enlarged so as to accommodate in a large and up-to-date stack-room the proposed great research library in addition to providing enough additional space for the use of our society on the two top floors, thus leaving plenty of room for the accommodation of other smaller scientific and technical organizations, many of which now occupy space in the building.

If offer B is accepted many of these present occupants will necessarily have to seek other quarters, and, as the work of the four societies grows, eventually there will be room only for the four founder societies. It is true that the proposed addition may be made when necessary, but in the meantime the building will have lost the character of a headquarters for all professional activities, and will be only the home of the four founder societies.

It is evident, therefore, that the acceptance of offer A will carry out more fully the broad fundamental idea which underlies the whole proposal.

There can be no question as to the ability of the four societies to handle the larger of the two propositions from the beginning.

VALUE OF PROPERTY

In order to ascertain from a reliable source what quick assets the society may have with which to operate, a valuation of the present property of the American Society of Civil Engineers was made by the Real Estate Board of New York, as follows: Value of land, $290,000; value of building, $35,000; total valuation, $325,000.

It will be noticed that in this report the present value of the ground on which the society house is built is given as $290,000. Its total cost to the society, including legal fees, etc., was $185,406.20. Attention is called to the fact that the cost of the building, including legal expenses, etc., has been $174,775.64, and that its estimated value by the Real Estate Board of New York is only $35,000. Adding the cost of the land to the cost of the building, the total cost of the society's real property at the present time has been $360,181.84, and it is only proper to say that the present house of the society is, in the opinion of many members, adequate for its present needs, and could not be duplicated at the present date at the figures given. In other words, that the society could not at the present date duplicate its plant for less than $475,000.

ENGINEERING SOCIETIES BUILDING IN NEW YORK —VOTE WILL DECIDE WHETHER OR NOT AMERICAN SOCIETY OF CIVIL ENGINEERS WILL MAKE PORTION OF THIS STRUCTURE THEIR NEW HOME

Assuming, however, that the property could not be sold quickly at more than the amount named by the Real Estate Board, and adding the amount which the society now has invested in bonds over and above the amount of the present mortgage, it would appear that a very conservative estimate of the available assets which could promptly be turned into cash is $365,000. ($90,000 is now invested in bonds and the present mortgage indebtedness is $50,000.) Should the society, therefore, accept offer A it could make full payment and have between $115,000 and $140,000 in the treasury, and would then own a one-quarter interest in the enlarged property of the United Engineering Society, the cost of which added to the accumulated reserve fund already mentioned will amount to $1,967,332, one-quarter of which is $491,833.

A careful investigation of the cost of operation and maintenance at the present home of the society, and for an equal accommodation in the Thirty-ninth Street building, shows that this item need not be considered, there being no material difference in the annual cost of operation.

Your board also wishes to suggest that, as there would be no great haste about selling the property of the society, a sum considerably more than that estimated by the New York Real Estate Board may be secured.

GREAT LIBRARY POSSIBLE

The libraries of the three founder societies, the American Institute of Mining Engineers, the American Society of Mechanical Engineers, and the American Institute of Electrical Engineers, are now combined, and are being operated by the United Engineering Society, and the addition of the library of the American Society of Civil Engineers would result in a collection of engineering books aggregating approximately 150,000 volumes. This would form the nucleus for one of the greatest technical libraries of the world, which, when properly housed, catalogued and maintained, would furnish an equipment for the carrying on of research work which could not be excelled. There is reason to believe that should such a combination be formed, funds to a large amount would be forthcoming for the endowment and maintenance of such a research library.

CLOSER CO-OPERATION NEEDED

For a number of years it has been quite evident to those who have been close to the activities of engineering societies that a closer co-operation is needed especially along the lines of the general welfare of the profession. Matters have come up from time to time which have resulted in the appointment of a joint committee (which is now in existence) to consider and to report back to the governing bodies of each of the societies on any question brought to its attention which affects the profession as a whole, and joint committees of all the societies have also done much work in matters relating to proposed legislation in various states on the licensing or registration of engineers, and in connection with the work of the recent constitutional convention of the State of New York. In addition to this all four of these national societies have been represented for more than nine years on the John Fritz Medal board of award, and they are now all equally represented on the Engineering Foundation Board, which was founded by the generous gift of Ambrose Swasey. It is largely through such joint committees made up of members of each society, clothed with the proper authority, that the general welfare of the engineering profession can be safeguarded and promoted.

It is the belief of your board, after repeated conferences with the officers and conference committee of the United Engineering Society, that such committees, which now must be more or less disjointed in their action, may be made more permanent, and therefore represent more authoritatively the engineering profession in matters relating to the status of the profession generally, and its individual members, both financially and socially, and in a manner which it is not possible for any one purely professional organization to accomplish. The need for such authoritative representation is clearly indicated by the attitude of many members of our society, as well as of the other national organizations.

Strengthen Bonds of Brotherhood

The engineering profession needs co-operation along these lines, there being no coherence between individuals, or groups of individuals, and it is one of the purposes of this movement to strengthen the bonds of brotherhood which should exist between all engineers.

It is fully recognized that to accomplish anything of magnitude sacrifices often must be made, and that to a certain extent, at least so far as property ownership is concerned, our society, if the offer is accepted, will give up a certain amount of independence. This does not, however, go any further than the property consideration, as it is not proposed in any way to change the methods of control of each individual society. Closer association with men of similar training, though working along the lines of different specialties, should tend to broaden the views of those who come within the sphere of such influence.

Our society now has a fine home, adequate, in the opinion of many members, for its present needs, and, as they think, capable of such enlargement as may be rendered necessary during the next 15 or 20 years. On the other hand, if the proposed enlargement of the Engineering Societies' Building is carried out, there will be plenty of room for the four founder societies, and for a large number of other organizations not strong enough to own their own headquarters, and thus there will be in the city of New York a representative American engineering headquarters where any engineer may go with the certainty of meeting his professional brothers.

In such a project as this there are many details to be considered, and while much study has been given to the whole question by your board, in its execution there will doubtless be many matters of adjustment which cannot be foreseen.

The main question, however, which must be decided by the membership of the society is whether the offer of the United Engineering Society shall be accepted. Members who are in favor of entering the united society are asked to indicate their preference for either plan A or plan B, or whether they prefer to leave the matter to the Board of Direction.

Am. Soc. C. E. House the First Engineering Society Building in America

Four-Story Structure in New York City Was Opened in 1897 and Subsequently Enlarged to Add 50 Per Cent to Its Capacity

THE house of the American Society of Civil Engineers at 220 West Fifty-seventh Street, New York City, which will be given up if the vote of the membership on the recently issued letter ballot is in favor of moving to the Engineering Societies' Building, 29 West Thirty-ninth Street, where the national organizations of electrical, mining and mechanical engineers are housed, was the first structure in the United States built solely for the use of a professional engineering society. As originally designed it was a four-story building with a 50-ft. frontage and a depth of about 111 ft. It was completed and formally opened Nov. 24, 1897. About eight years later, on account of the rapid growth of the society's membership, it became necessary to make an addition to the building, on the west side, which added about 50 per cent to its capacity and increased its frontage to 75 ft. In architectural treatment and general interior arrangement the addition was along the same lines as the original structure. The following notes, therefore, will deal with the society house before it was enlarged.

Project Inaugurated in 1895

The project for the building was inaugurated in 1895. Careful estimates of the resources of the society were made and the question was referred to the business meeting of the annual convention which was held in June of that year near Boston. This meeting approved the project unanimously and the whole matter was placed in the hands of the Board of Direction, with power. A building committee was appointed Jan. 15, 1896, and served continuously until the house was completed and final payment made to the architect and builder. This committee consisted of George A. Just, chairman; Charles Warren Hunt, Joseph M. Knap, Charles Sooysmith, Thomas C. Clarke, William R. Hutton, Bernard R. Green and George H. Browne.

The dedicatory exercises in 1897 were presided over by B. M. Harrod, president of the society. Addresses were delivered by President Harrod, Gen. William D. Craighill, past-president; J. G. Schurman, president of Cornell University, and the Hon. Joseph H. Choate. In the evening there was a housewarming at which about 700 were present.

Arrangement of Building

On entering the building one passes through the vestibule into a main hallway and foyer. On the left is a coat room and a reception room and on the right the secretary's offices. The hallway leads to a large lounging room underneath the auditorium. This room runs the full width of the building and serves as a gathering place for members after the regular meetings. It is connected with a serving room for the collations which are served after the regular meetings. This room also is the scene of the society's annual smoker. At the left of the main hallway is a stairway ending in a central hall on the second floor, which is given over to the reading room and the auditorium. The reading room occupies the second story front of the house, faces north and contains the latest files of all periodicals, publications of technical societies and in short all current engineering literature. There are also shelves where new books are placed for a short period after they are received. A section also is devoted permanently to such volumes as are often consulted—engineering hand-books, technical dictionaries, encyclopedias and the like. The reading room is open every day except Sundays and certain holidays from 9 a. m. to 10 p. m. and librarians are on duty to assist those consulting the general card index. Books are brought from the stack room on the fourth floor to the reader.

Contents of Library

The auditorium occupies the entire width of the house and its depth beyond the hallway leading to the library. In this room are held the regular meetings of the society at which technical papers are presented and other business transacted. The third floor is devoted entirely to executive and editorial work while the fourth floor is occupied by the stack room. The contents of the library, as given in Secretary Hunt's latest annual report was as follows: Bound volumes, 25,872; unbound volumes, 48,452; specifications, 7869; maps, photographs and drawings, 5236; total 87,429.

The work of the society makes it necessary to provide a large amount of storage room and this is secured in the basement, where quarters for the janitor also are provided. The boiler room, coal bin and engine room were located in a vault under the sidewalk entirely separate from the building. The engine room of the original building contained two gas engines of 25 hp. each with direct connected dynamos furnishing current for lighting of the building. Heat was supplied from a low pressure boiler. The entire house, with the exception of the board room and auditorium, was heated by direct radiation while in the two rooms mentioned the indirect method was used.

Since the enlargement of the society house was made in 1905, there has, of course, been a certain rearrangement of the interior. The auditorium has been enlarged and a board room provided on the second floor joining the library. The general meeting room on the ground floor also has been extended westward the full width of the building. The general appearance of the exterior of the house, including the addition is shown in the photograph on page 168.

The society's property has shown a steady appreciation in value from year to year. A recent appraisal by the Real Estate Board of New York gives the value of the enlarged building and plot as follows: Land, $290,000; building, $35,000; total valuation, $325,000.

Engineering Societies' Building the Home of Three National Organizations

Thirteen-Story Structure Made Possible by Andrew Carnegie's Contribution of $1,500,000 in 1903 to Unite Technical Bodies Under One Roof

THROUGH the generosity of Andrew Carnegie, who, in 1903 contributed $1,500,000, for the purpose, it was possible to erect the Engineering Societies' Building at 29 West Thirty-ninth Street, New York City, to which the American Society of

Civil Engineers may move its quarters if the membership decides to relinquish its present house on West Fifty-seventh Street. The Engineering Societies' Building is now the headquarters of the American Institute of Electrical Engineers, the American Institute of Mining Engineers, the American Society of Mechanical Engineers, known as the three founder societies, and a score of other kindred engineering and scientific organizations. When the project was considered the American Society of Civil Engineers was invited to join in the plan, but inasmuch as it had a house of its own and was then in a flourishing financial condition it decided not to accept this offer.

AN IMPOSING STRUCTURE

The Engineering Societies' Building was completed and opened in 1907. It is thirteen and one-half stories high and has a frontage of 115 ft. and a depth of 90 ft. The exterior is of limestone up to the auditorium floor and above is of gray mottled brick and terra cotta. The main entrance foyer is laid with Tennessee marble and the central court is marked by twelve large marble columns. The wood work is dark oak. On the ground floor is the office of the superintendent of the building, a committee room, telephone booths and a ladies' reception room. On the mezzanine floor below the first floor are several dressing booths and lavatories for the convenience of members. On the second floor is the coat room.

The main auditorium, one of the features of the structure, extends up through the third and fourth floors and seats about 1000. On the fifth floor are two large lecture halls; on the sixth floor a lecture hall and society offices; on the seventh and eighth floors the headquarters of the associated societies; on the ninth floor the headquarters of the American Institute of Mining Engineers; on the tenth floor the headquarters of the American Institute of Electrical Engineers; on the eleventh floor the headquarters of the American Society of Mechanical Engineers. The twelfth floor is used as a stack room for the library and also contains a small meeting room. The library proper occupies the thirteenth floor.

The main auditorium was arranged primarily for meetings of societies at which the speaking is from the floor as well as from the platform and where diagrams, illustrations and blackboard drawings are often employed. Particular attention was given to its seating arrangements and to its acoustic properties. On both the main floor and the gallery, at the sides, the auditorium is surrounded by corridors rendering easy access to every point and permitting ready withdrawal for conversation or conferences.

On the fifth floor are three assembly rooms seating respectively 500, 250 and 100 persons. On the sixth floor is an assembly room seating 150. The plans of all halls were submitted to and approved by Prof. W. C. Sabine, of Harvard University, an expert on acoustics. The principal feature in the plan of the building is the reservation of the twelfth and thirteenth floors for the libraries of the three founder societies. The founder societies entertain the ambition to create and maintain the finest collection of engineering literature in the world, supplemented by the current periodicals and patent literature relating to inventions in the arts and sciences.

The basement is occupied in part by the boiler room, 22 ft. below the curb and the engine room 16 ft. below. Steam is employed for heating and for tempering the air used for ventilating purposes. A thoroughly modern and effective ventilating system is provided for the lower floors of the building which contain the large assembly rooms. Special and unique features were adopted in the building construction so as to introduce the air into and exhaust it from rooms by a great number of openings at a low velocity, thus securing a perfect air distribution.

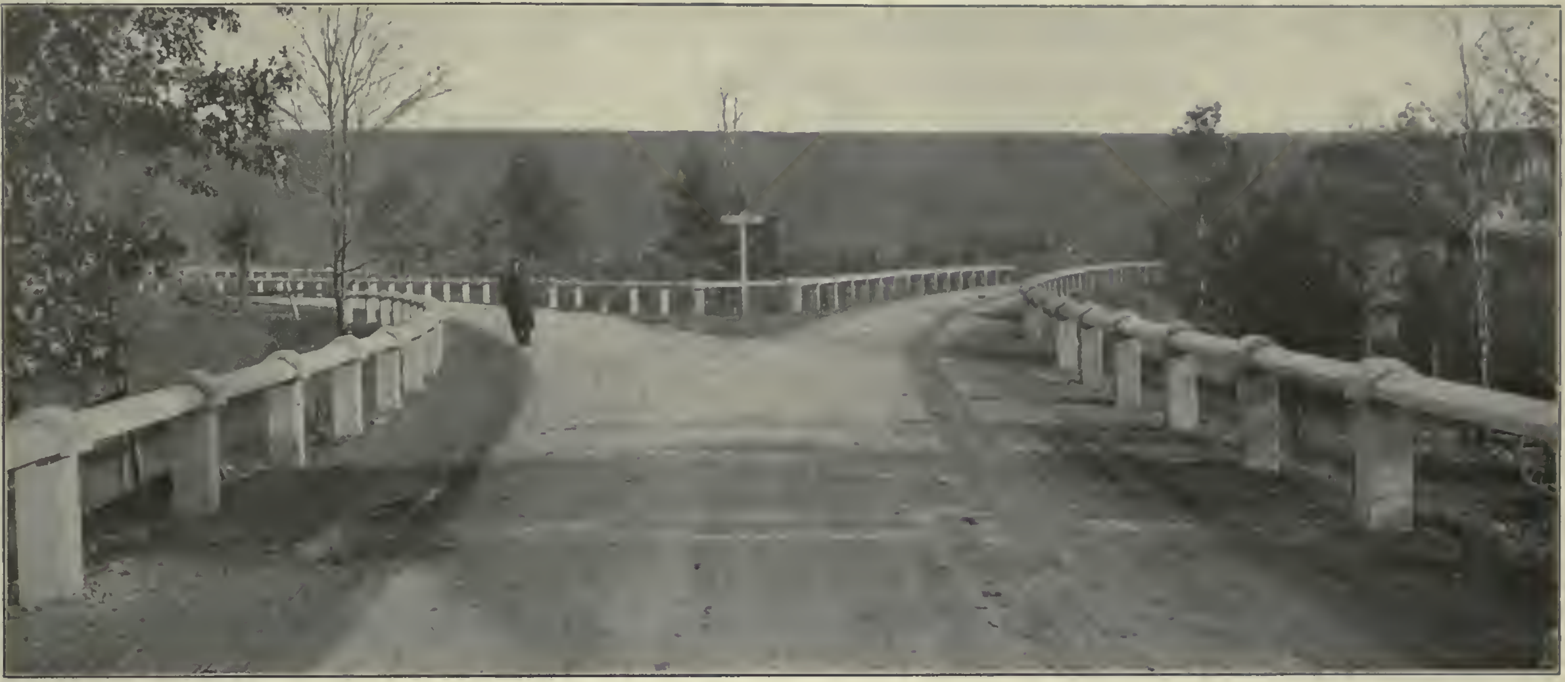
There is an exhibit room on the sixth floor containing original models made by Ericsson including steam engines, solar calorimeter, galvanometer, deep sea lead, caloric engines, rotary gun carriage, etc. Numerous other exhibits of tools, apparatus, photographs, etc., are to be seen in various parts of the building, while in the library there are many rare and valuable books and original manuscripts on exhibition.

LOCATION ADVANTAGEOUS

The Engineering Societies' Building is advantageously located midway between the Grand Central and Pennsylvania Railroad Terminals and is accessible from the principal transportation lines of the city. The building and land represent an expenditure of $1,717,000.

Concrete Guard Rails for New Roads in Catskill Watershed

SIXTY-FOUR miles of highways were discontinued and forty miles of new roads built to provide traffic routes in the vicinity of the new Ashokan reservoir of the Catskill aqueduct for New York City's additional water supply. In certain places where guard rails were needed it was decided to improve upon the familiar type of wooden fencing by substituting a construction of separately molded concrete posts and slabs. The accompanying photograph indicates the appearance of the guard rails adopted. Highway engineers may find it useful as a suggestion for treating similar structures required on their own work.



SEPARATELY MOLDED CONCRETE MEMBERS USED TO FORM GUARD RAILS ALONG RELOCATED CATSKILL ROADS

Gives Cost Analysis of Double-Course Pavement

A. F. Comstock at Meeting of Illinois Society of Engineers and Surveyors Details Construction Methods and Inspection

IN BUILDING 2½ miles of two-course pavement in Tonawanda, N. Y., extreme care was taken with every part of the construction and inspection. A. F. Comstock, associate in railway engineering, University of Illinois, outlined in detail the methods and the cost analysis in a paper presented Jan. 27, to the Illinois Society of Engineers and Surveyors. Some of these data are given below.

The method of measuring ingredients was not specified, although the bag of cement was specified to be taken as 1 cu. ft. Accordingly the following method was adopted: Three bags of cement were dumped in a box, the cement was shaken down and a mark was made around its upper limit. The cement was then removed and a number of tests were run with different men to determine the number of shovelfuls of sand and stone required to make 3 cu. ft. The men were instructed and observed to take a full shovelful each time. From these tests instructions were issued as to the number of shovelfuls of sand and stone to be placed in each wheelbarrow. These tests were repeated often enough to maintain a check on results, which were surprising in accuracy. The advantage of the method was that there was no way to increase the amount of aggregate without increasing the number of shovelfuls, and the inspector could stand some distance away, even as far as a block, perhaps, without being misled.

COST ANALYSIS—NOT DATA

The following detailed cost analysis is for a 1:1½:3 concrete slab 6 in. thick with a No. 29 American Steel & Wire wire reinforcement placed 2 in. from the top of the pavement. Transverse expansion joints were located at 33-ft. intervals, and a longitudinal joint was placed along the middle of the 48-ft. street between the 8-ft. parkings. A ⅜-in. felt strip was placed between the plates and in the joints without plates along the gutters.

TABLE 1—COST ANALYSIS 6-INCH PAVEMENT PER SQUARE YARD

Materials		
Cement, 0.32 bbl. at $1.20, f.o.b. cars	$0.384	
Sand, 0.080 cu. yd. at $1.10, delivered	0.088	
Stone, 0.14 cu. yd. at $1.21, f.o.b. cars	0.169	
Wire reinforcement at $0.76 per 100 sq. ft.	0.070	
Joint material at $0.15 per lin. ft.	0.050	
Total materials		$0.761
Labor		
Grading (12 in. of excavation on average)	$0.250	
Unloading and hauling materials 0.5 miles:		
Cement	0.032	
Stone	0.039	
Wire	0.005	
Joints	0.003	
Mixing and placing concrete	0.111	
Spreading and removing earth covering (2 in. thick)	0.008	
Sprinkling (for ten days)	0.005	
Total labor		0.453
Plant and Supplies		
Mixer rental at $10 per day	$0.020	
Fuel, oil and repairs	0.010	
Canvas, boots and other supplies and tools	0.020	
		0.050
Overhead		0.050
Total cost per square yard		$1.314

Weather conditions were, on the whole, favorable. The average rate of progress maintained while working was 720 sq. yd. per day of eight hours. Including delays by rain and repairs, the average rate for the entire period was only 500 sq. yd. per day. Deposition of 864 sq. yd. was the largest day's work.

TABLE 2—DETAILED LABOR COST

16 men shoveling and wheeling at 25 cents per hour	$32.00
2 men handling cement at 25 cents	4.00
2 men handling wire and joints at 25 cents.	4.00
4 men handling strike board at 25 cents	8.00
5 men shoveling concrete around chute at 25 cents	10.00
1 foreman at 50 cents	4.00
Engineer and fireman on mixer	6.00
2 finishers at 50 cents	8.00
Superintendent and timekeeper (½ time)	3.75
Total	$79.75

Labor cost per square yard = 79.75 ÷ 720 = $0.111. Plowing with steam roller in well compacted road cost 1 cent per square yard for each time over. Two or three times over was the rule. Rough grading cost 18 cents per square yard, exclusive of plowing. Fine grading cost 3 cents per square yard. Rolling with 10-ton roller cost 0.3 cent per square yard.

The work described was constructed under the direction of Mr. Comstock, acting for the firm of Ellsworth Brothers of Buffalo.

State Regulation of Interstate Utilities Viewed from a New Angle

Alfred P. Thom of Southern Railway Tells Pan-American Scientific Congress Local Control Encroaches on Rights of Other States

THAT the other states, as well as the utilities themselves, suffer by the local—that is, state—regulation of interstate public utilities, such as railroads, was the burden of the argument in a paper on the relation of central to local control, presented by Alfred P. Thom, general counsel of the Southern Railway, at the second Pan-American Scientific Congress. He held that the appropriation of special prerogatives and the imposing of special restrictions by one state necessarily threw an added burden on other states, even if they did not actually block needed development. To him also there was a great lesson in the European war. He pointed out that the nation at once the most militant and the most efficient in Europe was looking for other lands to colonize, and might seek certain parts of the American continent. While that would not necessarily force us to become a military nation, he held that it compels us now to put our industrial life on the most efficient basis—and to him this is impossible under local control of utilities.

In the first part of his address Mr. Thom went back into history and developed his contention that one of the very purposes of the Constitution of the United States was to protect the weaker states against the stronger in the control of trade. And if protection was needed then, Mr. Thom thinks it is needed far more now that great transportation systems spread over the entire land. On this point his remarks were in part as follows:

TRANSPORTATION CAPACITY LIMITS TRADE

The transportation capacity of the carriers marks the maximum limit of the trade, and hence of the producing capacity, of the people whom they serve. No more will be—no more can be—produced than can be carried to market. Therefore each state, being dependent for its prosperity upon the producing capacity of its people, is deeply concerned that the transportation capacity of the carriers which serve it shall be adequate and shall not be crippled or impaired.

A broad and wise policy in dealing with the instrumentalities of commerce is a matter of supreme interest to all localities and all states. A narrow, or niggardly, or selfish policy, if adopted by any one of the states through which a railroad passes, may seriously cripple and depress the commerce of every other state which the railroad serves.

No adequate conception of the railroad problem, as it affects the development of this country and the growth of its commerce, can ignore the necessity that transportation facilities must be all the time growing and improving to keep pace with the growth and expansion of commerce—otherwise there will be no growth and expansion of commerce.

Such an increase in railroad facilities involves the constant input of new capital, for no railroad is ever finished except in a dead country. It is a mere platitude to say that new capital can be attracted only by credit. While no one state through which a railroad passes can alone establish its credit, a single state can impair or destroy it.

ONE STATE MAY BLOCK DEVELOPMENT IN TEN OTHER STATES

If a railroad runs through and serves eleven states, ten of them may be guided by broad, liberal views, and controlled by the policy of encouraging the establishment and maintenance of adequate transportation facilities. The eleventh may, however, have no adequate commercial outlook, or may be temporarily under the domination of small and time-serving politicians. It may reduce rates on state traffic so as to barely escape the line of confiscation, and thus escape the condemnation of the Constitution. It may be unwilling that its state traffic shall contribute anything to the liberal program, favored by the other ten, which would build for the future and insure the present and continuing adequacy of the transportation facilities on which all are equally dependent.

In such a case, what shall be done? Shall the ten states bow to the will or caprice of the one and allow it to control? Shall they permit the narrow views of the one state to limit the standard or the character or the quality of facilities which their people shall enjoy?

If, on the other hand, the standard of facilities is not brought down to this low level and is to be made adequate to the needs of all, then the commerce of the other ten states, or interstate commerce, or foreign commerce, or all three, must bear the burden, which the dissenting state has refused to share, of building up adequate transportation facilities.

In either case, the dissenting state, in a very effective way, regulates the commerce and the business opportunities of all.

State rates have on occasion been greatly reduced for the avowed purpose of preserving state markets for state trade, and thus excluding and discriminating against the trade of other states. It is a right of each of these states, thus oppressed by the narrow and selfish policy of one, to have its commerce freed from these state restrictions and regulated by Congress, representing all the states, in accordance with the compact of the Constitution.

ISSUANCE OF SECURITIES

As exerting an important influence on the financial capacity of the carriers, it is appropriate to consider their capacity to issue and to dispose of their securities. It is manifest that, if such issue is to be regulated by the individual states, every state is at the mercy of the others. A bond, to be available in the market, must, as a rule—especially now, when most bonds are necessarily junior liens—be secured upon the whole railroad line; and this crosses many states. One of the states, therefore, if it possesses the power to regulate the issue of securities of an interstate carrier, may disappoint and defeat a financial plan approved by all the other states and necessary to the carrier's transportation efficiency.

Even if the state does not press its authority to the extent of absolutely declining to sanction the issue, it may selfishly, and as a political expedient—and in actual experience sometimes does—attach a condition that a designated portion of the proceeds shall be spent within its borders, where it may not in fact be needed.

The power of the state to consent, or to withhold its consent, is equivalent to a power to control the character and the location of additional transportation facilities against the views and the interests of all the other states.

Delays May Be Fatal

Even if the necessity for the new capital is universally recognized, and the approval of the states is not ultimately withheld, the time necessary to permit the investigation and to secure the approval of so many would, or might, constitute a fatal obstacle in the way of a successful financial operation. Promptness—ability to avail without unreasonable delay of a favorable market—is essential to success in placing large financial offerings.

And yet nineteen states have enacted statutes, each asserting for itself the individual right to control the issue of stocks and bonds of interstate carriers. And the end is not yet, for many other states are considering legislation which will give to them a power which they see is already being exercised by others.

The Furnishing of Cars

Another striking illustration of the exercise by one state of a power to discriminate against and to injure the commerce of other states and interstate and foreign commerce is found in the state laws which impose heavy penalties for failure to furnish cars or other instrumentalities for its internal commerce within a limited time.

One of the states now imposes a fine of $5 for each day of delay; an adjoining state fixes the fine at $1 per day; and the interstate commerce law fixes no per diem penalty at all. Suppose a carrier is reasonably supplied with equipment, but a large portion of it has moved in the regular channels of commerce to a point on or off its line and distant from the place where the demand for it is made. If, under these circumstances, there is a demand for a car by a shipper of interstate traffic in the state which imposes a heavy fine for delay, another is also made by a shipper in the state which imposes a light fine, and still another is made by a shipper in interstate commerce as to which no fine at all is imposed, and there is at the moment, by reason of special circumstances, only one car available to meet all three of these demands, the carrier in self-protection must deliver the one available car to the shipper in the state which imposes the largest fine, and the others must go without.

Is it not a right of the other states to have the question of a fair distribution of available car supply determined, not by one of the interested states, but by the authority which represents them all and can see that a rule of equity and fairness shall prevail?

Other Statutes

In addition a long and formidable list of state statutes, already in effect, might be given, which, without the consent of the other states, impose serious burdens of expense upon their commerce, and thus upon their people. All directly discriminate, or have the effect of discriminating against their commerce, state, interstate and foreign.

Thus, three states have passed laws making it illegal for a carrier having repair shops in the state to send any of its equipment, which it is possible to repair there, out of the state for repairs in another state; fifteen states have attempted to secure preferred treatment of their state traffic, either by heavy penalties for delays or by prescribing a minimum movement of freight cars, some of them requiring a minimum movement of 50 miles per day, whereas the average movement for the United States is not over 26 miles per day—one of these states imposing a fine of $10 per hour for the forbidden delay; twenty states have hours-of-service laws, varying from ten to sixteen hours; twenty states have extra-crew laws; twenty-eight states have headlight laws, with varying requirements as to the character of the lights, and fourteen states have safety-appliance acts.

It is apparent that these and similar statutes which impose burdens and create discriminations violate the principle of just and equal treatment as against the states which have a more liberal policy, and constitute serious invasions of the field of regulation by the states which adopt them to the substantial prejudice of those which have not sought to obtain special or preferential treatment.

In order to secure equality of burden and of privilege and the benefit of an adequate and efficient transportation system, the power to regulate commerce among the states and with foreign nations was, by their own action, withdrawn from the individual states and conferred upon Congress which represents them all. In fact, it may be truly said that the Constitution itself was the offspring of the insistent demand of the states for protection in trade against the other states. It is, therefore, peculiarly a right of the states to have this purpose fully and fairly carried into effect.

The Lesson of the European War

It seems not unprofitable to turn from the problem of commercial regulation, considered only as a problem of peace, to the lessons we must learn in regard to it from the great events now occurring on the continent of Europe. It will be merely fatuous in us to close our eyes to the fact that the organization of society will be revolutionized in consequence of the historic developments of the past eighteen months.

We have had it borne in upon us that the most militant and most efficient nation of Europe has outgrown its territorial limits and is looking for other lands to colonize, into which it will introduce its own national ideals, its own national efficiency and its own militant and aggressive spirit. If it should happen that her policies embrace the acquisition and colonization of certain parts of the American continent, we, in common with all the nations of the Western Hemisphere, will be confronted by greatly increased international complications, and will need both national power and national efficiency to deal with the conditions which will be certain to arise.

All this, I trust, will not involve us in the necessity of becoming a military nation, but it undoubtedly puts upon us the imperative obligation to organize our industrial life upon the most efficient basis. Not only must our resources exist, but they must be easily available. We must realize that the agitation must cease for a divided sovereignty in respect of functions which are in essence national. We must appreciate that efficient transportation is an essential condition of national efficiency, and if we are to halt or weaken our transportation systems at state lines, or subject them to local instead of central control, by permitting the imposition of burdens or the exercise of hurtful, inharmonious or unwise regulation, we will make national efficiency impossible.

Federal Regulation Inevitable

We must realize that inevitably commerce will eventually be regulated exclusively by our federal government. The existing system of private ownership cannot long endure if it is to be permanently subjected to the increased burdens and conflicting policies of a dual, or of a many-sided, regulation. It must be put under one master with a harmonious and constructive policy, or it will inevitably fail. When this failure comes and governmental ownership takes the place of the present system, the states will be deprived of all power, and Congress alone will necessarily regulate every detail of railroad management and all the instrumentalities of commerce.

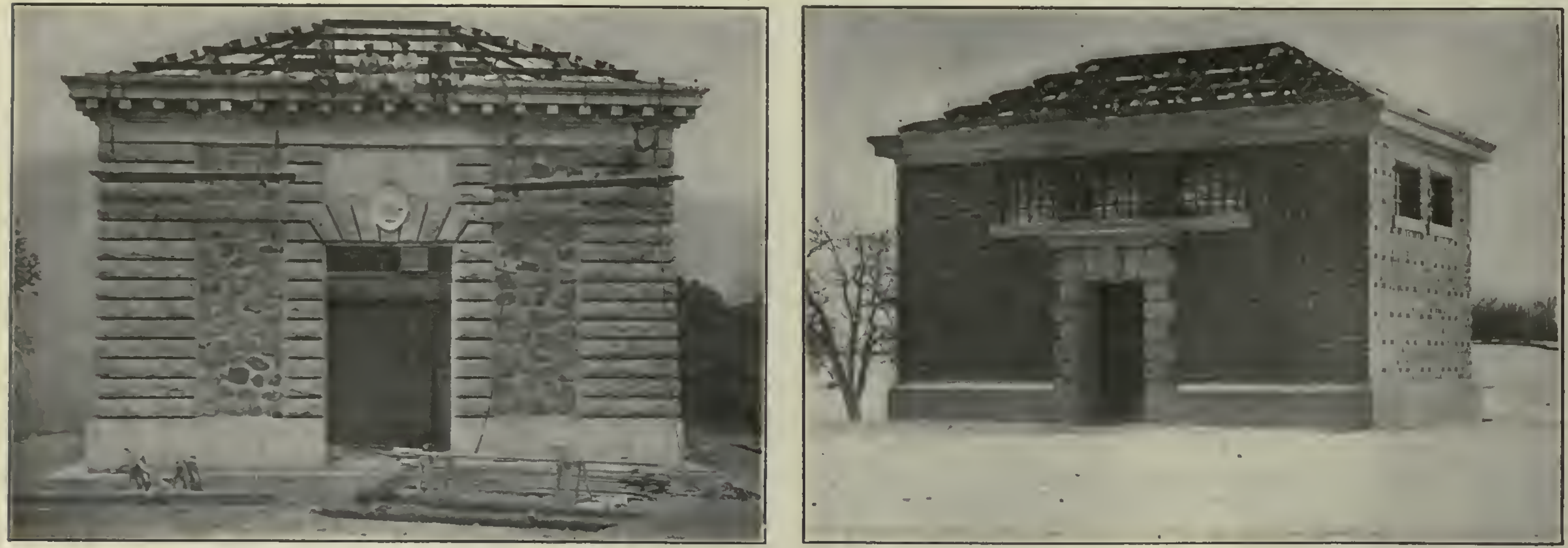
It must also be realized among us that the regulation of interstate commerce and its instrumentalities is no violation of the rights of the states, is no invasion of their prerogatives, is in no sense in derogation of their reserved sovereignty, but in reality is merely the specific performance of the contract which each state bargained for when it subscribed to the Constitution. It is their covenanted right, and the covenanted right of each of them, as well as their highest interest, that the commerce in which one in common with another state is interested shall be regulated by the fair and impartial judgment of the authority which alone springs from and is responsible to them all.

Predicts Federal Control of Stream Pollution

Prof. Earle B. Phelps Discusses Status of International Joint Commission's Work

THAT federal supervision over stream pollution will soon be in force was the prediction made by Earle B. Phelps, professor of chemistry of the U. S. Public Health Service, in a recent address before the Michigan Engineering Society. After pointing out the need for some plan of centralized stream control, instead of the piecemeal attempts at state regulation, Professor Phelps discussed the present status of the work of the International Joint Commission, which has been investigating measures for preventing the pollution of the boundary waters between the United States and Canada.

District offices were established by the commission at Detroit and at Buffalo early in 1915, he said, and a comprehensive study has been made of the general drainage and treatment problems of all sewered communities upon both sides of these rivers. These studies have not been carried to the point of complete engineering design, and the plans submitted will not obviate the necessity for further detailed engineering



EFFECTS SECURED BY THE USE OF FIELD STONE AND BRICK IN CATSKILL AQUEDUCT SIPHON CHAMBERS

studies in each local situation. They are, however, sufficiently comprehensive and detailed to justify estimates of upper cost limits with reasonable assurance, and furnish a satisfactory basis for a proper consideration of remedial policies. The results of this investigation are now being prepared for presentation.

Upon the basis of these results, together with the information the commission has already gathered, recommendations will be drawn up and submitted to the two governments. It would be premature to attempt at this time, Professor Phelps said, to forecast the exact nature of the commission's conclusions or the action that may be taken upon them by the governments. No effort has been spared to get at the facts, complex and inter-related as they are, and it is certain that whatever general policy may be recommended for the protection of the boundary waters will be the result of mature deliberation and a careful balancing of all the facts and interests involved.

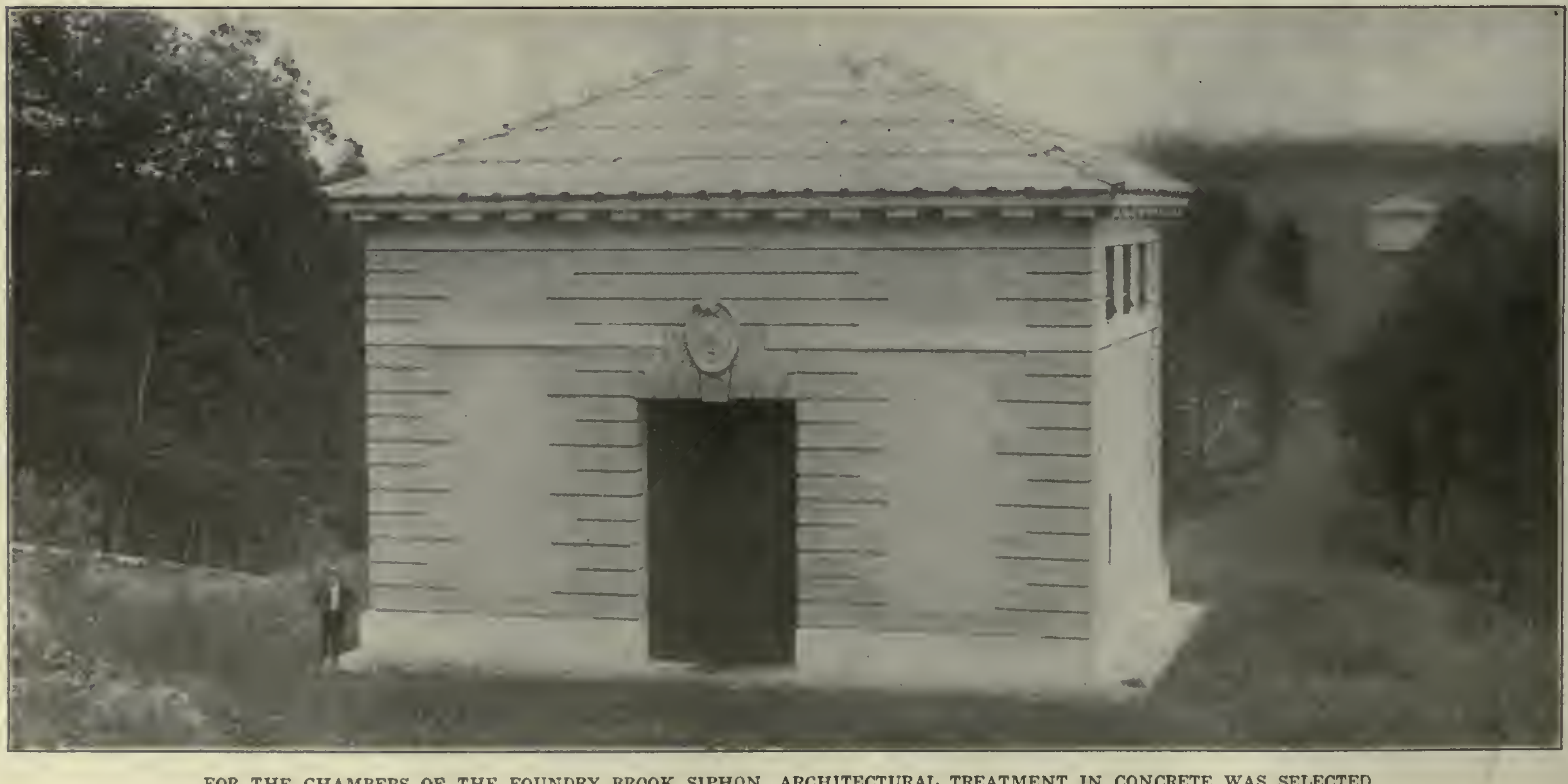
FEDERAL POLICY NEEDED

In addition to the direct interest that attaches to the final outcome of this question it is also of general interest in the matter of our interstate streams. Whatever action is taken to meet the particular case arising under our treaty obligations with a foreign neighbor ought at least to serve as a guiding principle in dealing with the more general case of our internal waters. That some form of federal supervision is going to be demanded in the near future is apparent from the present conditions. It will be fortunate, therefore, if the first step in this direction be made in connection with these boundary waters, and based upon a careful scientific study of stream conditions. It will be doubly fortunate if, out of the necessities of this situation, there shall be developed a suitable policy of federal supervision over stream pollution and the necessary administrative organization for putting it into effect. Even in the case of the boundary waters such a policy must recognize and harmonize with existing state policies in all cases where the latter are efficient. The gradual extension of these principles to the navigable and interstate streams and the development of a uniform body of state laws, supported and co-ordinated by the minimum of federal legislation and supervision, will be the logical and necessary development of the near future.

Chamber Structures on Catskill Aqueduct Artistically Treated

THE accompanying photographs indicate that the various siphon and gaging chambers on the Catskill aqueduct have been designed to present a pleasing exterior in addition to serving the purposes for which they were built. Cast concrete blocks, rough stone and brick have all been employed effectively. The views reproduced show the north chamber of the Elmsford siphon, the Wallkill gaging chamber and the south chamber of the Foundry Brook siphon. The structures were designed by the Board of Water Supply of New York City, of which J. Waldo Smith is chief engineer.

A CONCRETE AUTOMOBILE BODY, with graceful lines and devoid of seams or joints is the feature of a foreign-built 50-hp., 6-cyl. automobile that has been brought to New York City. The concrete is on a wire netting, or lath, similar to that used in concrete building construction. The dash and moldings are the only parts of the body constructed of wood.



FOR THE CHAMBERS OF THE FOUNDRY BROOK SIPHON, ARCHITECTURAL TREATMENT IN CONCRETE WAS SELECTED

Sand and Oil Road Construction Methods Improved by Massachusetts Commission

Developments in Highway Building for Light Traffic Announced in Col. William D. Sohier's Latest Annual Report—Vigilant Maintenance Necessary

SINCE it undertook its pioneer work in the construction of a road of sand mixed with bituminous material on Cape Cod, ten years ago, the Massachusetts Highway Commission has been constantly improving construction methods. Experience has proved the value of hardening the subgrade by mixing loam or clay with the sand, of applying the oil evenly to the surface, of selecting the proper asphaltic product and sand, and of machine-made mixtures. These and other features of the work, including a description of the methods employed in building roads of another type—gravel-asphalt—are discussed in the commission's report for the year ended Nov. 30, 1915. For the commission, Col. William D. Sohier, author of the report, is chairman, and Arthur W. Dean chief engineer. The report lays emphasis on the fact that the sand-oil road should be used only for light traffic, and that it is successful only when systematic maintenance is applied. Colonel Sohier comments also on the experience of Massachusetts with concrete roads, and gives figures indicating the wide range in costs of several types of construction. The total State construction last year covered 181.92 miles of roadway, divided as follows in mileage: Waterbound macadam, 23.26; gravel, 58.6; sand bound with oil and asphalt, 4.13; macadam with bituminous binder incorporated in the top course, 38.62; waterbound macadam with oil surface applied, 19.62; gravel with top surface bound with bituminous binder, 7.65; cement concrete, 5.34; gravel with oil surface applied, 16.61; Warrenite, 1.30; granite block on concrete foundation, 0.09; dirt roads, 6.7.

SAND AND ASPHALTIC OIL ROADS

The commission believes it was the first to construct a road of sand mixed with bituminous material. There are long stretches of road on Cape Cod and in southeastern Massachusetts where no stone or gravel exists. Broken stone has to be imported, often costing $2 per ton on the cars. A long and expensive haul over a sand road where a two-horse team can haul only about 1 ton per load is necessary. In many places the highway to be built was from 5 to 8 miles from the nearest railroad station.

Ten years ago the first sand and asphaltic oil road was built by the board at Eastham. At that time there were no machines available that would spread the oil evenly, even by gravity. The old sand road was graded, and about 0.75 gal. of hot asphaltic oil was spread on it and covered with all the sand the oil would absorb. Another 0.75 gal. was spread on top of this layer, and covered with sand, and on this layer 0.5 gal. of oil was spread and covered with sand. It was impossible, with the crude methods then employed, to spread the oil evenly; it ran into the ruts made by the carts and into the hoofprints of the horses that hauled the old watering cart containing the heated oil. Consequently that year and the next the surface had to be broken up, cut into as small pieces as possible with a disc harrow, harrowed and mixed with a toothed harrow, and then shaped back and rolled. After that certain places needed more oil and had to be patched. A reasonably passable road was secured in about two years at a cost of less than 25 cents a square yard for the surface, or not quite $2,250 per mile. This road is still in existence. It has required more oil from time to time, ruts have had to be filled and bunches on the sides cut off by hand or with a road machine. It has satisfactorily carried the traffic for ten years. The cost of maintenance since 1905 has averaged 2 cents per square yard per year, or about $175 per mile.

IMPROVEMENT IN CONSTRUCTION METHODS

Since this road was built the board has constructed about 25 miles of roads of sand and asphaltic oil by this layer method. The methods have been much improved. Perhaps the most important change is in the hardening of the subgrade before any oil is spread. After the road is graded the subgrade is prepared of the required width, now 18 ft., and this is hardened with clay or loam so that it is not much rutted by the wheels or pitted by hoops when the oil cart is hauled over it. The oil is immediately covered by the sand before any teams go over it and pick it up. This makes it possible to spread the oil evenly over the road surface before it is covered with sand.

There are now a number of specially equipped carts and trucks made with nozzles designed to spread the oil uniformly. The best of these spread it under pressure in several ways—by using a tight steel tank and steam from the tractor hauling the tank wagon; by steam obtained in the same way operating a pump on an oil-spreading device on the tank wagon; by a gasoline pump on the tank wagon, or by a pump driven by a sprocket and gear attached to the rear wheels of a tank wagon hauled by horses. The motor trucks have special machinery for spreading oil under pressure. The very heavy asphalts are usually spread under pressure secured by an air pump. Many of these tank wagons or trucks have burners or coil for heating and warming the oil; hence it is spread more evenly and mixed more readily. Also, a better quality of oil can be used, containing more asphalt.

LAYER METHOD

The surface of the 25.5 miles of sand and oil roads built by the layer method has cost from 21 to 33 cents per square yard, the average being 26 cents. For a road 18 ft. wide this would be $2,750 per mile, to which must be added the cost of grading, culverts, etc. On the roads in use at least five years the cost of maintenance per year has been 1 cent per square yard, or about $100 per mile per year. There are also about 25 miles of sand and oil roads on the Cape built by the towns.

In 1908 the board built its second section of sand and oil road. This was constructed by the layer method, and two years were needed to get it into reasonably good condition. Experiments were therefore made in mixing bituminous materials with hot sand. Eleven sections of road were built and a different bitumen used on each. Two qualities of tar were used and nine different oils or asphalt products. In each case the subgrade was carefully prepared of the required width and the mixture was spread as evenly as possible upon it and lightly rolled. The mixture was 4 in. thick in the middle and 3 in. thick on the sides. The sand and bituminous materials were first heated and then mixed by hand as thoroughly as possible before spreading. Eight of these experimental sections practically failed within the year. Another section was never very satisfactory, and only two remained in good condition and are still in use, having been patched from time to time. The only successful sections were those where a heavy oil with an asphalt base was used, or where this oil was used mixed with an equal quantity of "A" asphalt. This latter section was much better than the other two. These experiments clearly showed that it was possible to build a satisfactory road with sand mixed with oil asphalt if the proper asphalt product was used. From 18 to 20 gal. of bitumen was used per cubic yard of sand. The cost varied from 17 to 31 cents per square yard.

MIXING METHOD

In 1909 over a mile was built by the mixing method, using sand and asphaltic oil. This road was a success, although the oil used was rather light, and hence there was a tendency to rut. Also it was surfaced only 15 ft. in width, with the result that vehicles in passing often turned out into the soft sand shoulder and sheared off the sides of the hardened road surface. It was rapidly cut into and narrowed up, especially on curves. The second year it was all widened to 18 ft., which was increased on curves, the present standard being 21 ft. on the latter. The older roads are being widened as fast as possible.

IMPROVEMENTS IN METHODS, MACHINERY AND ASPHALTS

The commission is now using on mixed work an oil asphalt that tests 80 penetration on a Dow penetrometer. Mixing is by machinery. Until last year the sand was heated on sheets of iron with fire below, or over old boiler plates or pipes. The sand had to be constantly turned by hand, but even then frequent burning resulted, and some of the sand was not hot enough. Sand heaters in which the sand is kept in motion all the time are giving better results. It has been found advisable to spread a sealing coat of asphaltic oil of a little lighter quality over the road after rolling, covering this with sand. A sharp, strong sand well graded in the bank is used. These sands, local to Cape Cod, have been tested and found to correspond very closely with the sands used under the ordinary sheet asphalt specifications. The quality of oil asphalt used is varied according to the quantity of voids in the sand. From 18 to 21 gal. are used per cubic yard of sand. The roads are still built over a carefully prepared and hardened base, about 4 in. thick in the middle, 3 in. thick on the sides, 18 ft. wide and 21 ft. wide on curves. Better results are secured by a road scraper, keeping the mixture constantly shaped while rolling. The seal coat of lighter oil improves the surface, prevents occasional potholes and decreases the maintenance cost.

The commission has built over 23 miles of mixed sand and oil asphalt roads since 1908, and about 1.5 miles of sand mixed with tar. The cost has varied from 40 to 61 cents per square yard, averaging 52 cents. This cost would be somewhat less at the present price of asphalts.

The average yearly maintenance cost on the mixed roads that have been in use 5 years has been $0.016 per square yard; on roads in use over three years, 0.75 cents per square yard. If these roads require a seal coat every four or five years, as appears likely, the average yearly cost of maintenance will be about 2.5 cents per square yard.

Roads Which Have Failed

Some sections of sand and oil roads have failed, and one section of sand and tar was unsuccessful. These were built several years ago, and the failure was due to the poor quality of oil asphalt or tar used. While all the materials used were tested in the laboratory, there was little knowledge a few years ago as to what qualities were necessary either in asphaltic oils or tars. Now that Mexican and other asphaltic oils have come into use, it is easier to obtain better results. The manufacturers of both tars and asphalts have also learned what is needed and have greatly improved their processes, using greater care to secure a uniform product.

Quality of Sand Important

Roads of sand and oil asphalt construction can be used only where a sand of the right quality is available. As the commission is now building them they can be used only where the traffic is mostly light teams and automobiles, and will not stand up if traversed by many heavily loaded teams daily. The layer roads are more easily rutted by teams than the mixed roads; first, because as heavy a quality of asphaltic oil cannot be used, because it cannot be made to mix with the cold sand, and second, because by the layer method it is not possible to secure as even a mixture of the sand and oil on every part of the road. The commission and its engineers find that eight or nine motor trucks a day cause no appreciable injury on the Plymouth sand and oil asphalt road, although it is feared that a heavy motor truck traffic would not be successfully handled.

If traffic prove too heavy for such roads as above described the commission believes that they can be greatly improved and strengthened at a moderate increase in cost by using better and harder asphalts and more care in selecting and grading the sand, in heating and in mixing. By this method a standard sheet asphalt pavement can be made and laid 2 in. thick, using the old sand and asphaltic roads as a base. The same material can be used to resurface the old waterbound macadam roads where sand of the right quality is available. The traffic so far has not warranted this additional outlay.

A Word of Caution

A good road cannot be built without an oil asphalt of good quality—an oil which will bind and not lubricate. The quality of the oil and of the asphalt must be determined by standard tests, making sure that all the oil asphalt comes up to specifications. Many sands are too fine, too uniform in size, too rounded and not strong enough. Hard, strong and sharp sand, well graded in the banks, is essential. Before any contract is let or any large amount of work undertaken it is wise actually to build some experimental stretches of road, using the materials expected to be applied in practice. In warmer climates it is wise to use harder oil asphalts than in Massachusetts. When the traffic is heavy it will undoubtedly be economical to grade the sands, possibly add some stone, use a percentage of cement to make a denser mixture if the sand be not of good quality, use a portable asphalt mixer and construct a sheet asphalt road or a Topeka mixture. It is most important to build the roads so wide that they will not be rapidly destroyed by teams shearing off the sides in turning out.

Constant Maintenance Necessary

No class of road built will go to pieces faster than this type unless constantly maintained. A pothole in wet weather will soon become as large as a bushel basket, and with many holes of this kind not only is the road quickly destroyed by the traffic, but it becomes impassable. Thousands of dollars are lost yearly because of neglecting this maintenance. It means small expense. "Even when the greatest care is used in construction a few holes may develop, perhaps only three or four to the mile, the first year or two. Inspect the road, fill the holes, spend a few cents, and save hundreds of dollars," declares the report. "Maintenance begins when construction ends. Keep it up."

Gravel-Asphalt Mixed Surfaces

The commission has built some gravel-asphalt road 18 ft. wide, with 3-ft. shoulders, the curves being banked and widened to 21 ft. A gravel foundation was put in wherever the bottom was bad, and about 4 in. of local crushed stone was spread and well rolled. On this was spread, as evenly as possible, about 3 in. of bituminous mixture, made of gravel that had been run through the crusher and sand or stone dust, mixed with a heavy asphaltic product. The gravel and sand and asphalt were thoroughly heated and mixed in a hot mixer, and then carted upon the road and spread. The surface was rolled down to about 2 in. in thickness, when the mixture was sufficiently cool not to crawl under the roller. Great care was necessary to insure a uniform product, and only enough asphalt to bind the mixture properly was used.

The quantity of asphalt varied according to the amount of voids in the mineral aggregate. The variation was usually from 18 to 22 gal. of hot asphalt per cubic yard of gravel. The proper mixture has about the consistency of brown sugar, and compacts under the roller, although when it is first spread and rolled it sometimes has a few hair cracks which the traffic soon rolls out. The asphaltic product in this work had a penetration of 80 to 120.

In some cases where extra heavy traffic has to be handled the commission states that it would have preferred to rebuild of granite block on a concrete base, but it was impossible to secure enough money for this from the funds available for resurfacing, without letting many other roads severely suffer.

Salem-Lawrence Concrete Road

The commission has been building a cement-concrete road in North Andover on the Salem-Lawrence route, which was fully described in last year's report. Further observation of the longitudinal cracks therein described seems to indicate that they will not prove a serious defect in the use of the road if kept properly filled with some bituminous mixture. Over 3 miles of concrete road have been built, and observations of brass plugs set in the concrete on each edge of the roadway opposite the stone bounds show a maximum expansion of about 1 in. in 1000 ft. of road. The longitudinal cracks appeared due to settlements on new embankments and fills. The work was continued in 1915, about 1 mile more of cement-concrete road being built at a cost of $14,300, the width being 18 ft.

Cost of Construction and Maintenance

The commission is often asked for data regarding construction and maintenance cost, but such information cannot be given unless the conditions are known. Costs have been allocated on twenty different roads to show the impossibility of giving average figures. On these twenty highways, about 25 miles in length, the cost of drainage, culverts and bridges varied from $63 to $4,100 per mile. There was a small concrete bridge on the last road. On most of the roads the drainage and small culverts cost from $750 to $1,500 for each mile of road constructed. Grading and foundations varied from $1,200 to $8,700 per mile. The total cost of grading and foundation on 23.5 miles of road averaged $3,500 per mile. On the Mohawk Trail some of the excavation cost $40,000 a mile. These figures show the impossibility of giving any general data of value.

The cost of the hardened road surfaces alone may be of some value, though here again it depends on the availability of suitable local material, length of haul, cost of freight, price of labor, etc.

On four of the twenty roads a gravel surface was used. The cost of this surface varied from 15 to 27 cents per square yard, the depth being 6 to 7 in. On eleven of these roads the surface was bituminous macadam. All but one were built of local stone; some were grouted with tar and some with oil asphalt. The thickness of the broken stone varied from 3 to 6 in., less broken stone being used when there was a stone foundation. The top 2 in. on all these roads was grouted, and about 2 gal. of bituminous material was used per square yard of road. Four of these roads were 6 in. thick, and the cost, using local stone, ranged from $0.99 to $1.13 per square yard. Five were 4.5 in. thick, the cost ranging from $0.54 to $0.87 per square yard. One was 3 in. thick and cost $0.40 per square yard, and a resurfacing of an old macadam 2 in. thick cost $0.61 per square yard. One road in a country district was built of waterbound macadam 4 in. thick, on a stone foundation, and this cost $0.40 per square yard of surface. This road will be coated with light oil in the spring.

Four of these roads were built of Portland cement concrete, all averaging 7.25 in. in thickness, with a cost range of $1.10

to $1.60 per square yard. These roads were built on substantially identical specifications, and in each the cost of the concrete only is included. Such figures illustrate how misleading any general figures as to the cost of construction of maintenance of various types of roads would be. Some of the twenty-year-old water-bound macadam roads have been maintained at a cost of $100 to $150 per mile. Suddenly they have to be resurfaced and widened, at a cost of $5,000 to $10,000 a mile. This immediately jumps the average cost up to $350 to $650 per mile per year. Other sections of state highway built twenty years, where the traffic is heavy near the cities, have already been resurfaced three times, and the last time widened as well, with a bituminous macadam or other bituminous top put on. The cost of maintenance of such a road would easily be $1,000 or more per mile annually.

MAINTENANCE AND RESURFACING

With the increasing mileage of state highways, the tremendous increase in automobile traffic, and the growing use of long-distance motor-trucks, maintenance becomes of vital importance. Some state highways are now twenty-one years old, and the average age is over ten years. They are becoming worn out and are not strong enough to withstand the heavy modern traffic. Corners and curves, formerly safe for horse-drawn vehicles, are now dangerous when used daily by hundreds of motor-vehicles at high speed. Former country roads have become intercity and interstate trunk lines. The roads need widening, with improvement of curves and corners, and the surface, at least on main lines, must be reconstructed, using some permanent form of construction capable of withstanding modern traffic. This will cost probably from $8,000 to $10,000 a mile at least, but the work must be planned far ahead, done gradually, or in a few years many miles of state highway on the heavily traveled routes between the larger cities will go to pieces. The commission urges that the work be begun now, and that at least 100 miles a year should be widened and reconstructed, so that at the end of five years 500 miles of road will have been so improved. Nearly 500 miles of road have been built from ten to twenty years ago, and many miles of these roads have not as yet been resurfaced. They are thin, worn out, and beginning to be worn through by numerous heavy motor trucks.

RESURFACING AND WIDENING

In 1915 the commission had about $1,200,000 for maintenance. The first essential was to maintain as well as possible the state highways already built, over 1,026 miles in length. This was done by constant patching and by the use of bituminous covering. The drainage also had to be kept open, shoulders maintained, trees cut, and trees and shrubs obscuring the view removed. On practically all the state highways there were either section men or repair gangs in charge of the maintenance. Bituminous materials were used during the year on practically all the state highways that had not been constructed of concrete or paved, unless they had recently been resurfaced with bituminous materials. On many of these roads oil or tar has been used before, and a retreatment was necessary. Only a few years ago the authorities in charge of the roads were not in agreement as to the necessity of using some bitumen, on the top surface at least, to preserve the roads. To-day there is so much motor traffic that even in little country villages money is being appropriated to oil or tar the road surfaces. If the roads are not oiled great annoyance arises from the dust, with injury to crops. The commission is allotting all the money it can from motor-vehicle fees to help the poorer towns to oil and preserve their improved roads.

The commission easily could use twice as much money as it has available for preserving these improved highways. In 1915 about 65.2 miles of state highway were resurfaced at a cost of over $466,000, of these, 46 miles being widened at least 3 to 10 ft. The crown was reduced to 0.25 or 0.33 in. per foot, to spread the traffic over the entire roadway. About 18 miles were widened where no money was available for resurfacing. The widening cost over $130,000. While over 64 miles were widened, but 46 miles could be resurfaced. The total amount expended for widening and resurfacing was $597,200. The old standard width of 15 ft., adequate ten or twenty years ago, is insufficient to-day. The commission has, therefore, asked the 1916 Legislature to appropriate $200,000 to continue this essential work.

TRAFFIC INCREASE IN SIX YEARS

The report, when printed, will contain an appendix covering the latest traffic studies of the board. These show that in the past three years the number of runabouts passing per observation station per day has increased from 37.2 to 82; touring cars from 173.5 to 380; trucks, from 11.5 to 38, and total automobiles, from 222.2 to 500. Horse-drawn vehicles of all kinds have decreased from an average of 129.4 per station per day to 106. Observation in 1912 totaled 34,797 motor vehicles per day, with 156 total stations, and in 1915, 96,213 motor vehicles per day with 192.5 stations. The total horse-drawn vehicles in the day's test in 1912 was 20,264 and in 1915 20,328. Compared with 1909, when runabouts averaged 20.8 per station per day, the increase has been 300 per cent to 1915; touring cars in 1909 averaged 75.3 against a 405 per cent increase, and all motor vehicles showed a percentage increase per station of 420, while the horse-drawn vehicles decreased from 151 per station per day, or 30 per cent. There were practically no motor trucks on the highways in 1909, but in 1915 these constituted 6 per cent of the traffic. In the past three years day traffic at a few selected points increased 184 per cent and night traffic 68 per cent. Data are also given in the report to illustrate the increase in travel caused by good roads. On the Mohawk Trail the increase was from 30 to a maximum of 3,268 vehicles a day, and on other roads extraordinary increases are noted.

Mounted Motor-Driven Pump Tests Water Mains

Number of Tests Increased 150 Per Cent Over Old Method Using Team and Wagon to Haul Pump and Engine

TESTS of new water mains in Chicago are now made by means of a centrifugal pump driven by an automobile engine. Formerly the work was done by a triplex pump driven by a 2-hp. gasoline engine, all mounted on a wagon. As most of the pipe laying is in the outskirts of the city frequently a 25-mile drive with a team at $6 per day to cover one job was a day's work. Now it is possible to cover four or five jobs per day in different parts of the city. The number of tests has been increased 150 per cent and practically all jobs are tested.

THREE-STAGE PUMP IS DRIVEN BY THE AUTOMOBILE ENGINE

The outfit consists of a three-stage Fairbanks-Morse centrifugal pump mounted on the frame of the chassis of a ¾-ton White motor truck. The pump was specially designed for the purpose and rests in a horizontal position. It is driven by the truck through an extra sprocket and a silent chain without any reduction from the speed of the engine. A five-ply suction and discharge hose supplies 100 gal. of water per minute from hydrants at 350 ft. head.

The specifications for this equipment were prepared by the water pipe extension division, bureau of engineering, Chicago, under the direction of John Ericson, city engineer. R. S. Spaulding, engineer of the division, is responsible for the adoption of the outfit.

Engineer Reserve Outlined at Convention of National Security League

William Barclay Parsons Shows Washington Gathering Need of More Engineer Officers—How National Engineering Societies Will Supply Them

ALTHOUGH England had more than five times the number of army engineers now commissioned in this country, and far less complicated problems for them to solve than would arise if the United States were attacked, she was caught totally unprepared in this vital branch of the service by the outbreak of the European war. Plans for making available the services of every engineer in the country fit for army duty, so that this country may never be confronted with so grave a situation, have been formulated for legislation at the present Congress by the five great national engineering societies. They were outlined on Jan. 22 before the convention of the National Security League at Washington by William Barclay Parsons, chairman of a committee appointed by the American Society of Civil Engineers to co-operate with other societies and with the Government in matters of national defense. Mr. Parsons said, in part:

Reserve Corps of Engineers Needed

Last spring the five national engineering societies of the United States, realizing the great need for a very large increase in the numerical strength of the Engineer Corps of the army, should the unfortunate contingency arise, appointed separate committees to consider the problems involved. These committees, in order to avoid duplication of work, organized from their number a joint committee representing the whole profession in all its branches, whether mechanical, electrical, mining or civil, the last term covering all branches of engineering not otherwise especially described. The engineers enrolled in these societies and therefore represented by this joint committee number more than 26,000.

In the United States Army there are 210 officers in the Engineer Corps, some of whom serve with the very limited allowance of engineer troops, while the others are on special duty, usually engaged in the improvement of our rivers and harbors. These men stand in the front rank of the profession. For high character, for engineering skill and experience in their particular lines, they have no superiors; but in number they are wholly inadequate should a serious situation arise to demand their services.

Our Engineering Corps and England's

As an illustration of the deficiency in numerical strength, the Engineer Corps of the United States Army consists at present of one general officer, with rank of brigadier-general; 14 colonels, and 195 officers of rank less than that of colonel. In 1912, before the British army was affected by the war, the engineer corps of that army (known as the Royal Engineers) consisted of one field marshal, 11 general officers, 14 colonels-in-chief and 60 colonels; or 86 officers of rank of colonel and higher as compared with 15 in our army; and 1007 officers of rank less than that of colonel as compared with 195 here. These figures in the British army were exclusive of any engineer organization in the militia or territorial forces.

When the British army was called upon to take its part in a great war, although the part that the army took was but small as compared with the duties falling upon their allies, this engineer force, strong as it was compared with the American, was, like other departments of the army, wholly inadequate in strength to meet the demand that was put upon it.

But the difference between the engineer strength of the British army and of our own is even greater than what would appear by comparison of figures alone.

Our Frontiers Defenseless

In the British Isles the coast is amply protected by permanent fortifications or by Great Britain's mighty navy. Therefore, not only have no engineering works at home of magnitude been necessary, but not even works of minor or temporary character. The war in which the British forces are engaged has been for a large part in a country where railway and highway communications are of unsurpassed excellence and where only the comparatively lighter class of engineering works or of military field works have been required. In our own country, where our frontiers and our coast line are measured by tens of thousands of miles, there are defensive works located at the mouths of our principal harbors, and that is all. Along our great land frontiers to the north and south there is absolutely nothing. Likewise there is nothing along the actual coasts between harbors. In England, when the war broke out, nothing had to be done to protect her frontiers; with us, should war break out, there is nothing so far as land defenses are concerned to prohibit a foreign force from crossing the land frontiers, or from effecting a landing at any point on either the Atlantic or the Pacific or the Gulf coasts, except in the immediate neighborhood of the fortifications protecting our main harbor entrances.

What Engineers Can Do

If a war should arise or if we were put on the defensive against invasion, engineers would be needed at once to prepare, place and maintain mines in all our harbors; to construct emplacements for large guns and light earthworks and trenches along our many miles of coast; to construct the secondary lines of earthworks to be held by such an army as could be collected at the time to protect our cities in the event of a landing being effected at any point; to locate and build branch lines of railways to reach the points selected for defense in order to transport men and supplies of all kinds, because the places on the coast most inviting for a landing are those lacking in railway communication; to build thousands of miles of highways capable of standing up against heavy motor traffic, and to repair these roads as they break down; to string telegraph and telephone lines and construct wireless stations; to make military surveys and maps; to erect barracks and supervise the sanitary drainage and water supply of camps; to furnish inspectors to supervise the manufacture of war supplies; and to do a multitude of other duties.

If the war were one of offense, as for instance to maintain the Monroe Doctrine in some South American or Central American country, by dislodging a foreign force which had already obtained a foothold, there would be needed all the above works to resist a diverting home attack, and, in addition, the doing of the same things abroad, and also the construction of harbor works in order to permit the successful landing of our own men and supplies, and the development and proper operation of local transportation lines.

We Must Have More Military Engineers

It is but necessary to enumerate some of the needs of engineer service to appreciate how inadequate in number is the existing Engineer Corps of our army. Then it must be remembered that in case of war our regular Engineer Corps would be stripped, as in 1861 and 1898, of its ablest men to make army commanders of them; so at the very time when the increase of engineers would be most demanded they would probably be actually decreased.

For many years the army has maintained a Medical Reserve Corps, in which surgeons and doctors were regularly commissioned subject to immediate call in case of war, and with their consent at any time in peace. This Medical Reserve has been found exceedingly useful in cases of emergencies, such as floods, fires and other disasters, and at present along the Mexican frontier. With this as a model, the engineer committee has urged upon the War Department the formation of an engineer reserve. Engineers and doctors may be said to be always mobilized. They are doing in times of peace exactly what they will be called upon to do in times of war, but for the sake of an efficient organization in the army, the selection of these additional men cannot be left until the arrival of a crisis. The men for such a reserve should be selected in time of peace, when there is no excitement and no pressure, when care can be taken to investigate each candidate, to select him on account of his fitness, and then each year to call upon him to do a certain amount of work—not necessarily to teach him to build bridges or railways or highways, because that he will be doing anyway, but to teach him how these same bridges and railways and highways should be best adapted for military purposes; to instruct him in the details of large gun foundations and large gun mechanism, the size and shape of field earthworks; to call upon him to study the topography of his own district, its railways and highways, so that, being informed as to plans of defense, he could at once set out to put the construction of such works in execution. This instruction would also cover the duties of a soldier, subordination, obedience and the willingness to do what he is told, and the way in which engineering methods must be changed to meet the exigencies of war, where time and not economy is paramount. This regular annual work would not turn out highly trained military engineers as the term is understood in European armies, but it would bring together a force of men highly trained in their several specialties and with some military training, and who could be ordered out at once in any emergency and without waiting for either further legislation by Congress or the approval of their commissions by the Senate, and avoid the seriously hampering disadvantages of gathering a force of men together in a great hurry without any information as to their specific knowledge, experience or personal qualifications.

Plans for Engineer Reserve

In the legislation which has been tentatively drafted there is a provision for an officers' reserve, into which reserve the present Medical Reserve would be incorporated. This officers' reserve, as outlined, is so broad as to include all arms and staff corps. It is proposed that men should be commissioned for periods of five years, the commission renewable with the permission of the Secretary of War. The advantage of this renewal provision is that it would prevent the officers' reserve becoming loaded with men who, while capable at the time of their first appointment for rendering service, might in the course of time become incapable from any one of many reasons. If this renewal provision is effectively exercised it will free the corps of an accumulation of human deadwood. There would be no pay attached to the office, except at such times as the men are called upon for service. They would hold rank in the army and be subject to call for service in times of war exactly the same as any other officer of the army, and in times of peace in case of emergency, with their consent.

Confining my attention to the engineers in this reserve, the men could be selected as the President or Secretary of War would dictate. They would receive the amount of annual training as outlined above. They could be classified geographically and professionally, that is to say, in what particular line their experience lay, so that the War Department would know where to call for men especially versed in railway or highway construction, bridge building, sanitation, or any other line, so that when engineers were needed the department could at once have at hand not only men but the right kind of men, and men especially trained.

Army Men Favor Plan

It is highly gratifying and distinctly encouraging that this plan of an engineer reserve has, so far as our committee knows, met with the approval of the officers in the army from the Secretary of War down. The following extract from a letter from an officer of high standing and rank in the Corps of Engineers is but one illustration of such official support:

"I am strongly impressed with the importance of it, and it is good to know that men who likewise realize this importance are giving of their time and efforts to assist in putting our United States in a condition to meet any emergency which may arise. To those of us who know, it is very plain that one of our greatest lacks under present conditions will be a body of trained officers. The present war emphasizes the fact that such a body of men is a valuable asset and the lack of it a cause of disaster. I was told recently by one of the observers with the Austrian army that this was most noticeable there. He attributed the poor showing of the Austrians in the early stages of the war to the lack of proper training on the part of their officers and their subsequent successes in Galicia to the coming to their aid of the more highly trained Germans. England, too, has suffered severely, due to this same lack of trained officers and the consequent inability to fit her men for their services in the field."

The project for an engineer reserve, if enacted into law, will be the forging of one link in the chain of national preparedness and will be one step on the path marked out by that great patriot who preferred to die loving his country and beloved by his people for generations—a simple, American gentleman at Mount Vernon, and who left us, among other priceless heritages, those words: "If we desire to avoid insult, we must be prepared to repel it, and if we desire to secure peace, it must be known that we are at all times ready for war."

Home-Made Testing Machine Uses Water Barrel Weight

Wide Beams and Sewer Tile Tested by Simple Contrivance of Timber Frame and Lever, Costing Only $99

A COMPARATIVELY simple and inexpensive, but quite sensitive, testing apparatus was devised by F. W. Allen, deputy county engineer of King County, Seattle, Wash., for the purpose of breaking flat slabs wider than can be inserted in the usual laboratory testing machine. It was desired to break a brick and concrete slab 22 in. wide and about 6 ft. long, requiring a maximum load of about 10,000 lb.

TESTING SLAB BY HOME-MADE MACHINE

A timber-frame machine working on a simple lever principle, using water in a barrel for the applied weight, was constructed at a total cost of only $99. Its capacity is 40,000 lb., and it is sensitive to the nearest 5 lb., which is certainly remarkable for a machine of this character. The general nature of the construction is shown by the accompanying photograph. The weight of the water barrel is counterbalanced by a 10 ft. lever and adjustable weights as shown. The position of the bearing and hence the capacity and sensitiveness can be varied by using different holes in the bearing pin guide. The height is adjustable in the standards, as seen in the photograph. The main lever is 21 ft. long, tapered from 8 x 12 in. to 4 x 5 in. The main uprights are 4 x 6 in. timber, 7 ft. 6 in. long, braced by a 4 x 6 in. and bolted to the base consisting of three 8 x 12 in. timbers—two outside 13 ft. long and one inside 23 ft. 4 in. long. A 2-in. bearing pin and 2-in. main pin of steel with steel bearing plates, bearing pin guide, upright pin plates and stirrup for the beam are used.

Transportation of the slabs to the University of Washington was first contemplated, but this machine has proved to be exceptionally satisfactory and economical, taking widths of test specimens up to 24 in. with accurate results, and paying for its cost in a few tests through the saving in transportation costs.

Technical Students Should Receive Military Instruction

Intensive Training Under Regular Officers to Be Substituted for a Single Semester of Undergraduate Work

By WHARTON CLAY
Sales Engineer, United States Gypsum Company, Chicago

MODERN warfare has resolved itself into an engineering task. The problems of defense are engineering problems, and the civilian of engineering training will be the most useful recruit in the great volunteer army that the country must raise in case of national danger. No matter how brave or self-sacrificing the troops may be, or how brilliant the leaders, the machinery of war must be kept in smooth, running order at all times by the engineer. The engineer is needed in the scheme of national defense, but to place him face to face with problems of warfare without previous familiarity with the subject, obtained in times of peace when mistakes only add to experience instead of being contributions toward defeat, would result in disaster. If the engineering student is given a short intensive military training, so that he appreciates military needs, and during his professional career can think of engineering problems in terms of battalions, positions for mortars and sanitation for army corps, he will be invaluable to his country and may quickly rise to a position of prominence in a national emergency.

The following plan offers a simple and practical method of giving the technical college student an insight into these matters without any great expense to the government, and with no sacrifice of time or money to the student. All the machinery is now available and there are thousands of students who are in a position to take advantage of the opportunity.

Trade Semester of College Work for Real Army Life

The students at the various colleges who so elect should have the privilege during their sophomore or junior year of absenting themselves from the colleges at the beginning of a semester and joining a student regiment at one of our ample and unused army posts. This regiment would be officered by regular army officers of the same type as those now teaching at West Point, and a six months' intensive training extending over one vacation period would be undertaken, including military engineering, strategy, sanitation and communication, all under strict discipline and including an extended maneuver under full equipment. The course would be arranged with the co-operation and advice of the colleges, and cadets could specialize in the departments of army affairs already chosen for their civilian pursuits. Thus mechanical engineers would be sent for part of the time to a government arsenal shop, electrical engineers to a navy yard or battleship or coast defense, and railroad engineers would study transportation in the interests of mobilization and handling supplies. The cadet would return to college with a more serious outlook and this practical experience would help him in an understanding of the application of theory taught.

The various colleges would give the students one semester credit toward graduation when the course was completed, and would select such subjects to be omitted from requirements as would give the student in three and one-half years at college and one-half year in this student regiment a course fitting him as well, if not better, to practice his profession, than if he had spent the entire four years at college. It is without doubt possible for every engineer to select subjects out of his college course which have proved of little value and could very easily have been omitted.

EASY FOR THE GOVERNMENT

The government under this plan would merely maintain the student during his six months' training and give him regular army pay, relieving the student of the usual college expense during this term. Thus the process of securing such profitable material would entail no greater expense to the government than would the instruction of an equal number of ordinary recruits.

Much of real military value could be accomplished in this six months, for all the time of the training period would be devoted to military studies and drill, and the aptness of the pupil would be much above the average. It must be remembered in comparing this with West Point training that the regular collegiate mathematics, science and language, included in the four years at West Point, would be taken by these students in their college course.

OFFICERS URGENTLY NEEDED

It would not be expected that the graduates of this course would qualify as high officers, but when it is considered that England can transport her entire army to our shores in 14 days with her own tonnage, that Germany can transport 387,000 men in 16 days and 440,000 more in 31 days, Japan 96,000 in 23 days and 143,000 more in 41 days, and that each of these countries can continue with other trips, the required size of our army can be imagined, even by the layman. One million men would require 50,000 trained officers, and engineers with their special equipment should be in a position to serve their country as such. The training this course provides would be of vast importance to them and to the nation. It is practical because it is economical to the government and entails no sacrifice of time or money to the student.

The large percentage of engineers who attended the business and professional training camp at Plattsburg, and especially at Fort Sheridan this summer, proved that as a body they are patriotic and would volunteer in large numbers. Let us give them an opportunity to serve efficiently.

Looking at the product of such a course from a purely commercial viewpoint, would not such a student, with six months of strict discipline, be a more valuable employee than the usual college graduate? Would not his method of thought be more orderly? Would he not be more adaptable to circumstances of employment, with the habit of taking and properly executing orders thoroughly instilled? In short, outside of all considerations of national defense, would not such a graduate with six months of his college course under regular army officers and discipline be of more value to the engineering profession than the present college graduate?

HIGHWAY SIGN POSTS are to be erected in 1916 on California roads by the California Automobile Association under a comprehensive plan which involves a total expenditure in this work of $20,000.

Greenheart, Used in Panama Canal, Is a Timber with Exceptional Qualities

Part 2—Unusual Properties and Great Strength of This Timber Shown by Actual Tests—Durability Records Reported

By A. K. ARMSTRONG
Engineer in Forest Products, Forest Products Laboratory, Madison, Wis.

THE UNUSUAL properties of greenheart are manifested particularly in its structure, its great weight, its superlative strength and stiffness, its hardness and its great durability. In structure, the unmagnified cross-section has been described as resembling that of cane and palm, the pores appearing very distinct. According to Baterden, the growth rings, which are often regular near the heart, spread out on one or both sides, and, running into one another, become indistinct.

COLOR AND WEIGHT

The prevalent hue of the wood varies from a pale greenish-yellow to a deep brownish-purple. The freshly cut sapwood is pale yellow, turning upon exposure to dark-greenish or chestnut. From the sapwood to the heart the color gradually deepens, and, grading more or less into the latter, makes the distinction of sapwood from heartwood difficult to all but the trained eye. This is a matter of great importance, since the sapwood is often in excessive proportion. In trees 12 in. or less in diameter, 6 ft. from the ground, only a very small amount of heartwood is developed; in 18-in. trees the sapwood is 4 in. wide; in 24-in. trees, from 3 to 3½ in. wide; and in 30-in. trees from 2 to 3 in. wide.

The wood and bark contain at least four alkaloids, among which are bebeerine ($C_{18\ or\ 19}H_{21}O_3N$) and nectandrine ($C_{20}H_{23}O_4N$). The acid content of a sample of greenheart submitted to the Forest Products Laboratory based on the air-dry weight of the wood, and calculated as acetic acid, was 0.048 per cent. Teak, which is considered as corroding steel but little, contains 0.078 per cent of acid calculated in the same manner.

The specific gravity of the timber is given, by various authorities, as varying between 1.08 and 1.23, equivalent to from 67.5 to 75 lb. per cubic foot. A log tested at the Forest Products Laboratory had a specific gravity when green of 1.16, equivalent to 72.5 lb. per cubic foot. The air-dry weight (at 12 per cent moisture) was 62 lb. per cubic foot, and the oven-dry weight was 57.5 lb. On the whole it is heavier than osage orange, the heaviest of the 130 species of American woods tested at this laboratory.

SHRINKAGE AND STRENGTH

The claim has been made that greenheart has little or no moisture in its fibers, and far excels any other wood in its resistance to the absorption of moisture. Whatever may be the truth of the latter assertion, the green material tested at this laboratory contained at least 45 per cent moisture and shrank 13 per cent in volume from the green to the oven-dry condition, or about seven-eighths as much as white oak. This would lead to the belief that the above assertions are based on erroneous information. It is possible that the rate of shrinking and swelling is so low that the timber does not follow rapidly the changes in the moisture conditions surrounding it. This is true of oak.

Apparently an impression has been created abroad that the moisture content of the wood has no effect upon its strength. A small number of tests made at the Forest Products Laboratory upon small, clear specimens taken from one log of greenheart gave the average values shown in the table herewith. They show that in small, clear pieces drying does increase the strength.

VARIATION IN STRENGTH OF GREENHEART WITH PERCENTAGE OF MOISTURE

Seasoning	Moisture, per cent	Mod. of rupture, lb. per sq. in.	Max. crushing strength in component parallel to grain, lb. per sq. in.	Fiber stress at elastic limit in component perpendicular to grain, lb. per sq. in.	Shearing strength parallel to grain, lb. per sq. in.	Modulus of elasticity, lb. per sq. in.
Green	45.0	18,240	9,910	1,633	1,922	2,792,000
Air dry	9.5	26,420	13,570	2,638	1,864	3,446,000
Oven dry	2.8	22,380	16,430	2,249	1,962	3,367,000

These results indicate that greenheart, as a beam or post, is 25 per cent stronger and 50 per cent stiffer than black locust, the strongest and stiffest of the 130 species of North American woods so far tested. In resistance to shock it falls considerably below the hickories, and classes with beech, birch, ash and oak. It is a tough wood, however. The increase in its mechanical properties from the green to the dry condition will probably not take place in large-sized pieces, owing to defects, like knots, which develop in all species of timber during seasoning.

HARDNESS AND INFLAMMABILITY

Greenheart falls among the hickories in hardness. It is about as hard as dogwood and black locust. It is harder to work than oak, planing well, turning hard and badly, polishing indifferently and taking nails badly. In Demerara green timber is always preferred, owing to the extreme difficulty of working the material after it has seasoned.

Greenheart is neither more nor less inflammable than any other timber of the same dry weight per cubic foot. But since it is very heavy, it is remarkably fire-resistant. Its local name of torchwood, which seems to have arisen through special use, is, therefore, misleading.

DURABILITY

The durability of the heartwood is great. This is well proved not only by the actual experience of those who have used it, but also by tests at the Forest Products Laboratory. The results of work with twenty-three wood-destroying fungi led to the conclusion that:

"The heartwood of greenheart proved highly resistant, and, in most cases, practically immune to all of the fungi used, in spite of the fact that the organisms developed luxuriantly in the tubes. . . The sapwood proved far less resistant."

Records of durability show:

Scotland.—Piles at Glasgow and Leith are sound after from 60 to 80 yr. service, whereas longleaf pine of excellent quality is destroyed in from 15 to 40 yr.

England.—Gates of Canada Lock at Liverpool were in service 38 yr., were enlarged in 1894 and the same timber used, and still in service after 18 yr. additional use. Total service to last report is 56 yr. Some limnoria are reported at Liverpool.

RESISTANCE TO MARINE BORERS

The sapwood is not resistant to the marine wood-borers. This is a matter of great importance, since the detection of weathered sapwood is difficult, and the latter may be in large proportion. The shipworm and the crustacean borers (such as limnoria, chelura and sphæroma) undoubtedly attack greenheart.

In the Netherlands the attack in good-quality timber does not proceed deeper than ¾ in., and ordinarily less. This may possibly be the width of the sapwood on squared timber, since something in the heartwood, possibly one or more of the alkaloids, seems to deter or kill the shipworm. The Netherlands engineers advance the statement that the calcareous lining of the shipworm's burrow is softened by something in the wood.

RECORDS OF RESISTANCE

The following is a summary of records of resistance of greenheart to marine wood borers:

West Indies.—Piles sheathed with yellow metal at Barbados. Average life at Trinidad is 15 yr.

British Guiana.—Flooring in slipway of dockyard was sound after 20 yr., and piles after 25 yr. Log of bullet-wood was riddled in 1 yr. Teak and oak were destroyed in 2 yr.

Netherlands.—Bearing, revetment and fender piles and lock gates at ten places on the coast give average life of 12½ yr., with no shipworm attack deeper than ¾ in. Timbers in place from 2 to 29 yr. Surinam geelhart piles were riddled in 3 yr.

Belgium and France.—Piles and other under-water timbers, safety doors on lock gates, and bollards at four places average 13½ yr. against shipworm and remain in good condition. Timbers in place from 6 to 24 yr. European beech was riddled in 1 yr.

Scotland.—Staging, test pieces, piles and sill timbers, heel and miter posts at nine places on Scotch coast average 17 yr. against limnoria. Some were eaten throughout the entire surface after 3½ yr.; some were not fit for re-use 11 yr., and many were sound after 30 yr. Longleaf pine at the same points averages about 11 yr.

England.—Piles, paddles and bracing at six points on the English coast average 20 yr. All are reported in service after from 4 to 36 yr., against shipworm, limnoria and chelura. Longleaf pine of excellent quality was destroyed after an average life of 7½ yr., and janah after about 10 yr.

Mediterranean.—One place recorded piling destroyed in 20 yr.

Suez Canal.—An experimental piece of greenheart was sound after 2 yr. An oak pile driven at the same time was badly deteriorated, and a fir pile was completely eaten away.

South Africa.—At one port wharf timber and piling showed an average life of 10 yr. against shipworm, limnoria and sphæroma. All joints in the bracing were eaten out by limnoria in 8 yr. Piles averaged 12 yr. Longleaf pine has a maximum life of 1 yr.

India.—Dock gates and piling at two places showed an average life of 14 yr. and ranged from 10 to 20 yr. Teak was destroyed in an average of 12 yr. and longleaf pine in from 4 to 5 yr.

GENERAL USES

In Demerara the timber is used in the construction of houses, fences, wharves and board walks, and for paving blocks. It is the favorite wood for flooring, often lasting from 50 to 75 yr. without signs of wear. It is also the favorite wood with the wheelwright and shipbuilder. Large quantities of excellent charcoal are manufactured from it. In England it is used in bridge building, for carriage shafts, fishing rods, etc., and the "snaped" ends are worked up into motor-wagon spokes, belaying pins, etc.

In lock-gate construction greenheart, owing to its reliability, far outlasts iron and European oak, which are good for only about 25 yr. Moreover, it has been calculated that the amount of greenheart timber necessary for lockgates is only about three-fifths that of European oak of good quality. In England greenheart is preferred to iron, although gates of the former are heavier and harder to move.

EXAMPLES OF USE IN LOCK GATES

The lock gates at Buenos Ayres are of greenheart, and its use in ports of the lock gates of the Panama Canal is of more recent occurrence. The wood is largely used for lock-gate construction in Scotland. It is practically the only timber used at Liverpool and Birkenhead, England, for piling and lock gates. The Manchester Ship Canal is regulated by fifty-four pairs of gates composed entirely of greenheart. The lower gates for the 80-ft. lock at Eastham are built with triple panels. Each leaf weighs 265 tons complete in air. The chief engineer reported that from 1894 to 1902 the cost of maintenance averaged about $15 per pair of gates per year; and that the only elements in their construction limiting their life were the bolts and other fastenings, which could usually be renewed without serious difficulty. The Bridgewater Canal likewise has greenheart gates.

In the Netherlands greenheart is considered to be the best timber for lock gates as well as for piling. The engineers there recommend the following working stresses for lock-gate construction: Modulus of rupture, 2900 lb. per square inch; compression along the grain, 3200 lb. per square inch; horizontal shear, 255 lb. per square inch. Based upon the values for green material (which should always be used in the calculation of stresses in structural timber) given above under mechanical properties, the factors of safety are about 6, 3 and 7½ respectively. This is good practice, provided the material is of excellent quality.

The chief difficulty in its use for lock-gate construction is said to lie in its hardness, which tends to prevent the making of a watertight joint.

Greenheart has many properties which recommend it to the European pile user. It comes in good lengths and is of nearly the same square cross-section throughout its length. One objection to it is that it splits more easily in driving than European oak, but it can be rendered safe by tightly hooping the end under the hammer. In most cases the iron ring is allowed to remain after driving, owing to the tendency of the timber to check at the ends. However, instances have been recorded where piles not ringed showed almost perfect heads at the end of 12 yr.

Some doubt has been cast upon the advisability of allowing piles to season before driving. It has been noted in Scotland that air-seasoned and weathered timber proved much less resistant to the marine wood-borers than that used immediately upon receipt from Guiana. The former timber, however, may have contained a high proportion of sapwood.

MOST SATISFACTORY PILE TIMBER

From the evidence at hand it is apparent that greenheart is the most satisfactory pile timber used in the borer-infested waters of Northern Europe. In warmer climates its value is more doubtful, but even then it undoubtedly outlasts other species of commercial importance. It is necessary to consider that, in scanning data upon the life of piling, allowance must be made for the possible substitution of inferior species, or timber of poor quality. A shipment of sappy greenheart placed in a port would completely reverse the results that could be secured with heart timber.

Greenheart is in extensive use as piling in the British Isles, the Netherlands, France and, to a smaller degree, Germany. It is about the only piling timber in use in Demerara. It has been placed in service in the port works of La Guayra, Venezuela; Rosario, and Bahia Blanca, Argentina; and Coatzacaloos, Mexico. It has never been tried out for piling in the United States. The U. S. Forest Service has, however, installed several small pieces in the Gulf of Mexico, from which it is hoped to get indications of its value under the trying conditions in that region.

The Dutch engineers estimate that it costs from 7 to 10 per cent more to place greenheart piles than those of European oak, and from 12 to 15 per cent more than to place softwoods.

GROSS OPERATING REVENUES FOR NOVEMBER, 1915, on the large steam railroads of the United States, according to a bulletin issued by the Bureau of Railway Economics, were $1,303 per mile, showing an increase of $277 or 27.0 per cent, as compared with November, 1914. Operating expenses were $800, an increase of $66 or 9.0 per cent. Net operating revenue, therefore, was $503—an increase of $211 or 72.0 per cent, and operating income was $450—an increase of $207 or 84.9 per cent. The comparison is between the highest and lowest Novembers in six years, but the increase of operating income in November, 1915, over the average for the five previous Novembers was 45.8 per cent. The operating ratio was 61.4 per cent, as compared with 71.5 per cent in November, 1914, and the same in November, 1913. Considering the three main districts, the respective ratios for November, 1915, and November, 1914, were as follows: Eastern District, 63.9 and 76.1; Southern, 65.4 and 74.5; Western, 57.4 and 65.8.

Study Silt Problem in Imperial Valley System

Chief Engineer of Development Company Thinks Proper Distribution of Suspended Matter Can Make It an Asset

RECOGNIZING the fact that the disposal of silt brought down by the Colorado River is one of the great problems of irrigation in the Imperial Valley, the California Development Company has for the past two years examined samples of the water taken daily from the canal at Hanlon Heading by means of a device with a trapdoor which secures samples at various depths. In describing the study of silt movement, J. C. Allison, chief engineer for the company, stated recently that although most authorities measure the proportion of dry silt to water in terms of weight, it has been found more satisfactory for Imperial Valley purposes to deal with the proportion of semi-saturated silt to water by volume. On this latter basis the bulk is about six times as great as the dry material, but it is pointed out that all calculations of the accumulations in the canals and the calculations of yardage to be dredged deals with materials in its semi-saturated form.

AMOUNT OF SILT ENORMOUS

During 1914 there has passed through the Hanlon headgates the company's figures show, 30,024,000 cu. yd. of solid matter. This quantity represents a total for the year of 40,532,580 tons, or an amount sufficient to cover 18,610 acres of land with mud 1 ft. deep. Dredgers operated by the California Development Company during 1914 removed 1,511,000 cu. yd. of silt, and adding to this the yardage removed by the water companies and the individual farmers, the total amount of silt taken from the canals of the system by heroic methods represented only 13 per cent of the total solids passing through the headgate. This leaves a difference of more than 26,000,000 cu. yd. of material either deposited upon the lands, discharged into the Salton Sea through the waste ways, or left to accumulate in the canal systems.

The cost of removing material from the main canals with the company's dredgers was about 12½ cents per cubic yard. The cost of handling the material removed by the dredgers and by the smaller water companies brought the total expense for removing silt from mains and laterals during the year to $500,000. This does not, however, include the cost to the individual water consumer for cleaning out his own ditches, nor does it consider the loss in crops due to the clogging of local canals at critical periods during the season. The two latter considerations, Mr. Allison states, would bring the total amount to be charged directly to silt each year up to $1,000,000.

Experience in the Imperial Valley canals indicates that of the solids brought down by the water, about half are carried in suspension and half are rolled along the bottom. It has been noted that where particles of a single size are involved the movement is with less freedom than in the case of particles of mixed sizes. If fine material be added to coarse, not only is the total load increased, but a greater quantity of the coarse material is transported.

DEPTH-TO-WIDTH RATIO

For each combination of width, slope and kind of material conveyed there is a "competent discharge" or a discharge of water which will properly carry the material without deposition in the channel. The capacity of the stream is less sensitive to changes in fineness of material than to changes in discharge or slope. The ratio of depth to width of the channel is a most important factor, and Mr. Allison pointed out that it was a primary aim in the Imperial Valley study to determine the practical ratio of depth to width and the capacity for each of the canals which would enable them properly to carry the maximum load without clogging. A more extended study of the silt problem, he thought, would result in the decision to change the design of various canals to the end that each would deliver its load of solids upon the farming lands. The system could even be arranged, he believed, so that the materials would be so distributed that the land would always benefit rather than suffer damage. That is, it would be feasible to regulate the canals so as to discharge sandy materials on the hard soil and clayey silts on the soft soil.

An item which would considerably improve silt conditions, Mr. Allison pointed out, was the rearrangement of the method of diversion at Hanlon heading. Under the present method the water is taken by gravity virtually from the bottom of the stream and passed through the headgate with no facilities for holding back the silt, the floor of the headgate being lower than the bottom of the river. It would not be a great undertaking to make a change here which would eliminate the heavier particles of sand and silt which now go into the canal. It would be a physical impossibility to prevent entirely the diversion of silt into the system, but a certain amount, the maximum possibility being about 25 per cent of the total, could be rejected by the adoption of a skimming device along the lines of the scheme in use at Laguna dam.

ALL RECORDS FOR SURVEYS made by the U. S. General Land Office were broken during the last fiscal year. The total area of accepted and approved surveys aggregated 14,339,349 acres, which was nearly double the amount surveyed during the preceding year and 4,589,872 acres more than 1909.

Sewage Gas Tank Utilized for Light and Heat

Vents on Imhoff Units Capped to Yield By-Product for the Use of the Laboratory and for Domestic Needs

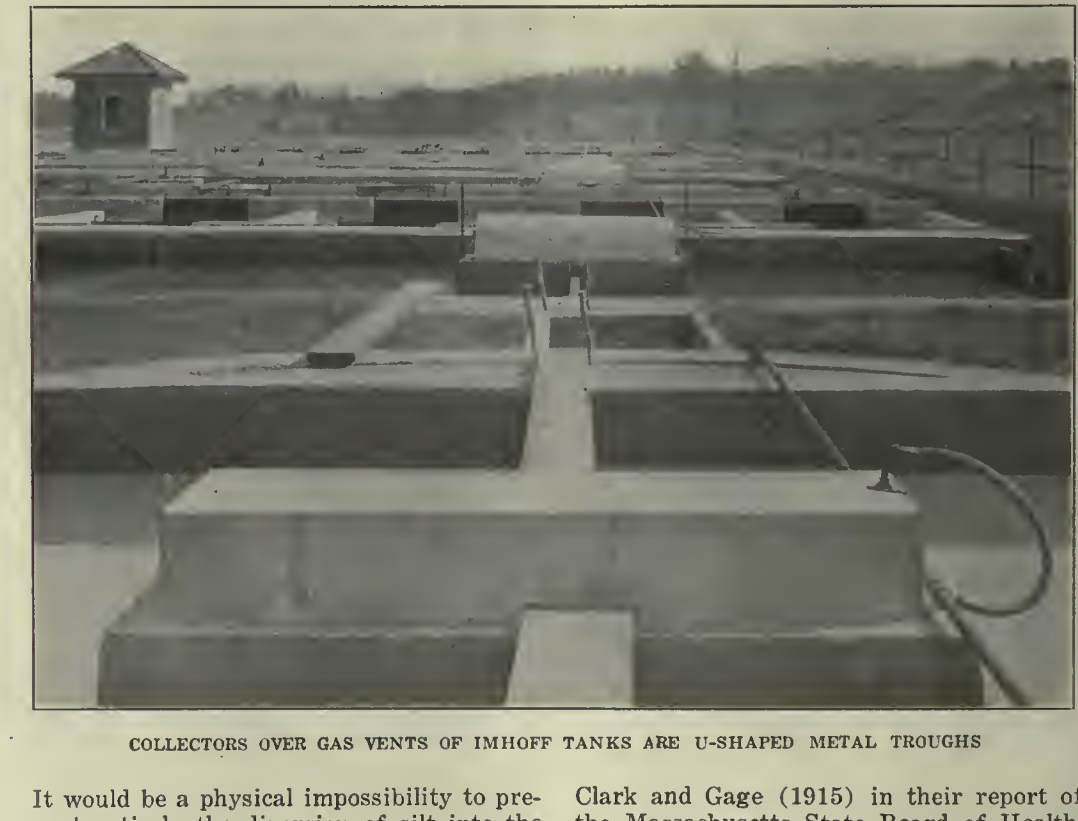
By CHARLES C. HOMMON

Chemist and Bacteriologist in Charge, Atlanta, Ga.

BY capping the vents of the Imhoff tanks at the Peachtree sewage treatment plant in Atlanta, Ga., it has been possible to collect an abundant supply of gas and utilize it for purposes of lighting and heating the laboratory and the home of the writer. The gas has a high calorific value and as a sewage plant by-product can probably be used advantageously in other ways to reduce the maintenance cost of the works.

PREVIOUS INVESTIGATIONS

Everyone familiar with the operation of sewage treatment plants knows that in the process of breaking down the organic matter by the bacteria, different kinds of gases are liberated. The composition and quantity of the gases that are liberated from treatment devices vary somewhat, due to the nature of the different sewages, types of tanks used, temperature, etc., but it has always been observed that the bubbles rising to the surface of the sewage in the tanks were inflammable. At several places in England and Germany, the gases of decomposition have been collected and measured, and in this country, George A. Johnson, in his report on the Columbus test, and Clark and Gage (1915) in their report of the Massachusetts State Board of Health, give data on gas production from septic tanks. The explosion in the covered septic tanks at Saratoga Springs, N. Y., where the roof was blown off the tanks, is evidence of the quantity and inflammability of the gas. The septic tanks at LaGrange, Ill., were provided with lamp posts and burners to consume the gases, but the scheme was never completed.



COLLECTORS OVER GAS VENTS OF IMHOFF TANKS ARE U-SHAPED METAL TROUGHS

METAL COLLECTORS DESIGNED

The problem of supplying gas for the laboratories at the sewage treatment plants at Atlanta came up for consideration when the laboratories were designed, but on account of the long distance necessary to pipe the gas from the city, the scheme was abandoned and it was decided to put in a gasoline gas plant. This was done at the Peachtree plant; it was quite successful, but expensive. As soon as the digestion in the Imhoff tanks became active, there seemed to be considerable gas escaping from the central gas vents. A metal collector was designed and built, as is shown in the accompanying photograph, with a view of collecting the gas and using it in the laboratory in place of the gasoline supply.

The collectors are U-shaped metal troughs, 6 ft. x 1 ft. 5 in. x 2 ft. 5 in., and made of No. 22 gage galvanized iron with a ¾-in. opening at one end. At first they were arranged with counterweights, so that when the quantity of gas collected in the hoods was equal to 4 in. of water, they lifted and broke the water seal, but since a gas holder has been installed all hoods are fastened in place and the excess gas escapes at the main holder.

AMOUNT OF GAS MEASURED

On measuring through a meter, it was found that the gas collected from three vents amounted to 125 cu. ft. per hour. As there are thirty vents available, and assuming that all of the vents are giving off gas at the same rate, there would be a total gas production of 1250 cu. ft. per hour, or 30,000 cu. ft. per day. Measurements of the quantity of gas were taken at two different intervals, each measurement covering one week. There is an uncertainty just what effect the temperature changes will have on the quantity of gas liberated, and whether or not all the vents are producing gas at the same rate as the three that were measured. It is a known fact that the lower the temperature, the lower the gas production, but just what the ratio is will have to be determined. However, after allowing a good substantial decrease, it would seem that there is a superabundance of gas for the laboratory.

GAS HOLDER INSTALLED

On finding there was sufficient gas produced to warrant its collection, a gas holder similar to that used to store artificial gas was built, as shown in the photograph. The holder has a capacity of 1400 cu. ft. and has a two-fold purpose. First, it holds a supply on hand, so that when the gas is cut off from the main supply, for any reason, the fires do not go out. Second, it maintains a constant pressure on the service pipes, which was not possible when the gas was used direct from the collectors.

At the present time ten gas vents are supplying sufficient gas to run all the Bunsen flames, incubators, lights, and a heating stove in the laboratory, in addition to two large heating stoves, a cooking stove, and a hot water heater in the writer's residence.

ANALYSIS, IN PERCENTAGES, OF GAS LIBERATED FROM IMHOFF TANKS AND OTHER SOURCES

	Imhoff Tanks	Natural Gas*	Water Gas*	Coal Gas*
Hydrogen	8.6	1.31	30.0	47.49
Methane	84.1	87.75	24.0	38.67
Carbon dioxide	4.6	6.60	...	1.04
Carbon monoxide	...	....	29.0	6.74
Nitrogen	3.1	4.34	2.5	0.85
Oxygen	0.4	....	0.2	....
Hydrogen sulphide	...	....	1.5	....
Ethylene	...	....	12.5	5.21
Illuminants	...	....	0.3	....

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*Note—These tables taken from Van Nostrand's Chemical Annual—Olsen.

The flow of sewage at present is 8,000,000 gal. per day, and the temperature is 55 deg.

GAS HOLDER OF 1400 CU. FT. CAPACITY EQUALIZES SUPPLY AND MAINTAINS CONSTANT PRESSURE ON SERVICE PIPES

As will be noted by comparing the tables, the gas from the Imhoff tanks compares very favorably with natural gas, and our experience in using it in the laboratory and heating with it demonstrates that it is a gas of high calorific value. The number of British thermal units produced from 1 cu. ft. of carbureted water gas is about 700, coal gas 600, and natural gas about 1000.

Since most sewage laboratories are located at the plant and, as a rule, are outside of the incorporated limits, which does not allow them access to the ordinary gas supply, it would seem that this sort of a gas supply would be very valuable. This has certainly been the case in Atlanta. The design of the Imhoff tanks as a rule makes the collection of the gas very simple, because of the fact that all of the gas from a large area has to escape through a small opening. The equipment for collecting the gas is simple, inexpensive, and there is practically no danger so long as ordinary precautions are observed.

ANALYSES, IN PERCENTAGES, SHOWING THE COMPOSITION OF GASES COLLECTED FROM SETTLING TANKS FROM DIFFERENT CITIES IN THE UNITED STATES AND EUROPE

Source	Methane	Nitrogen	Carbon dioxide	Oxygen	Hydrogen	Illuminants	Analyst
Atlanta	84.1	3.1	4.6	0.4	8.6	....	Chas. C. Hommon.
Chicago*	84.9	6.2	8.6	...	...	....	R. H. Jessie, Jr.
Urbana,* Ill.	81.0	6.1	12.3	0.13	...	....	R. H. Jessie, Jr.
Columbus*	83.5	9.3	8.1	...	...	....	R. H. Jessie, Jr.
Worcester*	57.7	32.5	8.2	1.2	...	....	Kinnicutt and Eddy.
Lawrence,* Mass.	78.9	16.3	3.4	0.5	...	....	Gill.
Manchester,* England	73.0	16.0	6.0	...	5.0	....	Fowler.

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*Report—R. H. Jessie, Jr., "The Composition of Insoluble Gases Formed by Decomposition of Organic Matter."

It is possible that this by-product can be used to a good advantage in a great many other ways around a sewage plant. It might be used to make steam, that in turn could be used to dry out the sludge more readily. This could be done by running a system of steam pipes through the sludge bed, and in this way dispose of it on a minimum area. The gas could also be used to run a gas engine, which in turn could be used to drive an electric generator, water pumps, etc.

The only odor that has been perceptible around the Peachtree plant was the odor of this escaping gas, and it is the writer's plan to put collectors over each gas vent next spring and burn the gas in order to get rid of the odor, even though we do not utilize the heat energy produced.

Pennsylvania Begins Large Coal Pier at Baltimore

Small Pier Cars on an Endless Cable, Together with Traveling Unloaders, Will Take Place of Ordinary Systems

WORK has been started by the Pennsylvania Railroad on the construction at Canton wharves, Baltimore, of a new coal pier of large capacity which is expected to prove one of the most efficient in the world. It is thought that the structure will be completed by early summer. It will provide facilities for loading 20,000 tons of coal per day into vessels.

The pier will be 940 ft. long and 66 ft. wide. It is to be built on creosoted piles with reinforced-concrete floor and concrete bulkhead. Space will be provided for loading four vessels at a time, utilizing both sides of the structure.

In order that the work of transferring coal from the cars to the ships may not be hampered in cold weather, a "thawing house," with a capacity of thirty cars, is to be provided. Coal frozen in the cars will be quickly thawed out by steam so that it can be easily dumped.

OPERATION

The pier will be operated as follows:

The cars will be pushed from the yard up on a "kick-back," whence they will descend by gravity to a dumper, where they will be picked up and turned over, emptying the coal into a hopper. Under this hopper small 4-ton cars will be run, by means of an endless cable, up an incline and out on a trestle along the center of the pier. On both sides of this trestle traveling unloaders are to be provided, which can be moved to any location desired. The small cars will be dumped automatically into hoppers constructed on these unloaders. The coal will then be elevated by a conveyor to telescopic chutes lowered into the holds of the vessels.

There will also be constructed storage bins at the end of the pier for different grades of coal for local harbor trade. These boats will be loaded by means of a small traveler.

The plans for the pier include the construction of a storage yard, for loaded and empty cars, having a capacity of 1000 cars.

The Maryland Dredging & Contracting Company, of Baltimore, has been awarded the contract for dredging at the dock and grading the new yard. The pier will be built by the Arthur McMullen Company, of New York, and the machinery will be furnished by the Mead-Morrison Manufacturing Company, of Chicago.

Throttling Gates Save 300,000 Gal. of Water Daily

Caleb M. Saville Describes Method Employed at Hartford to Conserve the Supply During a Period of Scant Supply

By throttling the gates on the three supply mains leading to the city so that the pressure during the period of least draft was but a few pounds higher than that at maximum draft, 300,000 gal. of water per day were saved at Hartford, Conn., according to a paper read before the New England Waterworks Association at Boston, Dec. 8, 1915, by Caleb Mills Saville, chief engineer, Board of Water Commissioners of Hartford. To provide for sudden drafts for fire protection service, experienced and reliable men were stationed at nearby points, during the period of throttling, to open the gates quickly if the necessity should arise. The pressure on sprinkler systems was from 4 to 6 lb. greater during the period than at the period of maximum draft.

RATES OF DRAFT

The water supply of the city is brought to the distribution system through three supply mains, one 30-in. line entering the southwest part through Park Street, and two 20-in. lines entering the central part through Farmington Avenue. Ordinarily the pressure at City Hall varies from a minimum of 58 to 60 lb. from 7 to 10 a. m., to maximum of about 72 lb. between midnight and 4 a. m., the respective rates of draft at these periods being 14,650,000 and 4,800,000 gal. per day.

Two years ago, during a scarcity of water, the method of reducing the pressure in Hartford by throttling and, by this means, conserving the supply, was tried. The test resulted in a saving of about 300,000 gal. per day, estimated from the Venturi meter record at the effluent gatehouse.

Because of the importance of the matter, and its relation to fire protection, four reliable employees, whose regular work was the maintenance and repair of the gates, were assigned to handle the gates. Fire engine houses, conveniently located, were chosen as stations for the men, two being assigned to each house, one located 1600 ft. and the other 900 ft. from the operated gates. From 4 p. m. to 5 a. m. the endeavor was made to hold the pressure in the city a few pounds above that registered during the period of maximum draft, it being assumed that any industry having sufficient pressure during the forenoon would not be seriously inconvenienced if the same pressure were maintained at night.

PRESSURES WATCHED CONSTANTLY

By careful comparison the difference in pressure at City Hall and at one of the engine houses was ascertained. A recording pressure gage was installed at the latter. By opening and closing a 20-in. gate in Farmington Avenue the pressure at this point was kept at a slightly higher point than that shown during the period from 7 to 10 a. m. In order to accomplish this result the man stationed at the engine house constantly watched the pressure gage from the time the main gate was closed until about midnight. During the evening, on account of gradually decreasing consumption, the pressure rose, and the gate was throttled down gradually. At about midnight, on account of the practically constant draft until 6 a. m., no additional attention was usually required. All three gates were opened at about 5.15 a. m.

The four men assigned to the work from midnight to 5 a. m. slept at the engine houses under the same conditions as the firemen, with similar arrangements for quick dressing and getaway. Close check could be kept on their conduct from inspection of the autographic chart records on gages located at City Hall and at the engine houses. It was found that it took from 1 to 2 min. for the men located at the stations to get to the gates, and from 2 to 3 min. to get full pressure. During the actual throttling period (about 12 hr.) it appeared that the actual reduction in draft was at a rate of about 600,000 gal. per day. Of the quantity passed 3,750,000 gal. per day went through the valve on Park Street, and the remainder through the throttled 20-in. gates on Farmington Avenue. It thus appeared that the entire city was getting a proper proportion of the supply, and that a sudden draft in any section could be quickly met.

PRESSURE FOR SPRINKLER SYSTEMS

For fire protection it is imperative that the supply for sprinkler systems be maintained. The pressure on these during the throttling period was from 4 to 6 lb. higher than that during the forenoon hours of each day. Under conditions of piping approved by the Associated Factory Mutual Fire Insurance Companies, fifty sprinkler heads on the top of a four-story building are satisfactorily served when there is available an average discharge for each equivalent to about 12.9 gal. per minute when all are discharging at once. This condition will occur with a street pressure of about 55 lb. per square inch and a pressure of 20 lb. per square inch at the top of the riser. Under this condition a floor space 100 x 50 ft. would be covered with a total discharge of about 645 gal. per minute.

As a part of the fire protection system, all factories maintain watchmen and the noise of running water from even one or two sprinkler heads should be quickly noticed and investigated. With any adequate system of control, before any large number of sprinkler heads could start action, an alarm would be rung in and the gates fully opened to provide for a large fire draft.

EFFECT OF SUDDEN INCREASE IN DRAFT

Before entering on the work several computations were made as to the effect of a sudden increase in consumption with the gates throttled. It appeared that a sudden draft of 550 gal. per minute would cause a drop of from 4 to 5 lb. The computations were checked roughly by observation of the conditions that obtained when a locomotive filled its tank at the railroad station, and, to a finer degree of accuracy, by a test run at a pipe yard. This rate of drop would seem to indicate that if a large number of sprinkler heads let go at once the drop in pressure would not be much in excess of 5 lb. before an alarm could be turned in and the gates on the supply lines opened.

Letters to the Editor

Comment on matters of interest to engineers and contractors will be welcomed

Is Crystallization of Steel Under Service Doubtful?

SIR: Your editorial on page 35 of the issue of Jan. 8 contained a statement to the effect that the theory of progressive crystallization in steel is no longer held to be sound, and that the so-called granulation of steel is due to a condition inherent in the metal when it is rolled. If this statement is intended as a general one I cannot agree with it, because I have found hundreds of cases where progressive crystallization has been manifest. On old boilers of steam locomotives it is a common occurrence to find the studs, which are screwed into the outside sheets for various purposes, so brittle that they may be knocked off by a single blow from a hand hammer. In fact, it is well understood by railroad machinists that the studs have become weakened and when the boilers come into the shop no attempts are made to unscrew them. Instead, they are knocked off and the remaining portion chipped out so that the new ones can be substituted. In all cases the breaks show a crystalline structure.

Admittedly, these conditions are special ones, as the metal in such cases is exposed to great variations in temperature and to extreme vibration. Nevertheless, the fact that progressive crystallization can take place under these circumstances prevents the general application of the theory supported in your editorial, and in view of numerous other examples, which may be less definite, but which are certainly good evidence, there seems to be logical reason for believing that under many other circumstances progressive crystallization can, and does, take place frequently.

F. KINGSLEY,
M. Am. Soc. M. E.

New York City.

Lug Angles and Stress Distribution

SIR:—In the Engineering Record of Oct. 23, 1915, page 512, the results of tests by Professor Batho on the effect of lug angles indicate that for double angle members with fixed connection plates the variation of stress throughout the cross-section is largely due to shear. As a simple, approximate method of determining the probable variation due to shear, consider Fig. 1. Upon the application of a load, assuming the center of the member to remain stationary, a moves to a', b to b' and c to c'. The stress at a will be zero, at the center section the stress S_m will be assumed to be distributed uniformly and at any point c the unit stress will be assumed to be proportional to the distance x from a toward the center section. Then at the section cd the stresses will vary as indicated in Fig. 2, and it will be assumed that the stress at all points of the riveted leg is equal to S_d.

By equating the total stress at cd to the total stress at the center section, there is found:

$$S_d = \frac{(1 - x/L)A_1 + A_2}{A_1/2 + A_2} S_m \qquad (1)$$

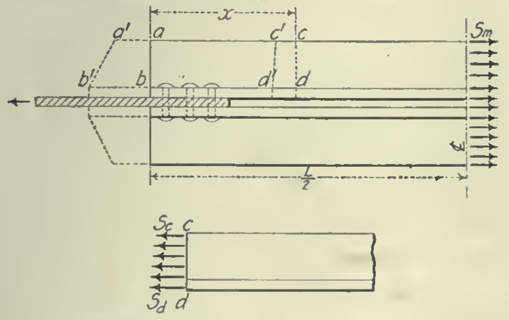
in which S_d is the maximum unit stress at section *cd*, S_m is the average unit stress at any cross-section, A_1 is the area of the outstanding leg and A_2 is the area of the riveted leg.

For equal angles, $A_1 = A_2$ and

$$S_d = \frac{4}{3}\left(1 - \frac{x}{2L} \right) S_m \qquad (2)$$

For Professor Batho's results on specimen 3, without lugs, the value of x for the end section was probably approximately 13 in., and L was a little less than 56 in., for which the value of S_d, computed by equation 2 is $1.18S_m$, and the corresponding observed value reported by Professor Batho for the average of the two angles is $S_d = 1.36S_m$. However, the stresses were not uniformly distributed at the center section, for which the average for the two angles for this case was $S_d = 1.17S_m$. The variation of 17 per cent at the center section may be attributed to flexure, or of the 1.36 for the end section, approximately 0.17 is due to flexure, and 1.36 — 0.17, or 1.19, should be the ratio of maximum to mean stress attributable to shear, which agrees very well with the value computed by equation 2.

In the case of connections with lug angles, if the shearing deformation in the lug angle is assumed to be the same as that in the outstanding leg to which it is attached, the lug may be considered to increase the effective length of both x and $L/2$ by an amount equal to its own length. For specimen 3 of Professor Batho's tests the value of S_d computed in this manner is $1.13S_m$ for angles with lug connections. For this case Professor Batho's observed values were $S_d = 1.23S_m$ for the end section, and $S_d = 1.12S_m$ for the center section. Deducting the value 0.12 from 1.23 leaves 1.11 as the ratio of maximum to average stress for the end section, attributable to shear, and this value also agrees very well with the value (1.13) which was computed by equation 2.



STRESS VARIATION DUE TO SHEAR

L. A. WATERBURY,
Professor of Civil Engineering, University of Arizona.
Tucson, Ariz.

Why Is Registration in Civil Engineering Decreasing?

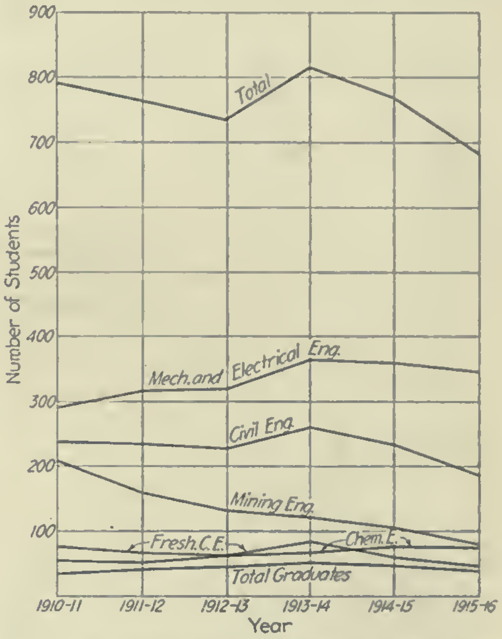
Sir: We have noted with interest in Engineering Record of Dec. 18, 1915, the editorial, page 746, and the article, page 766, upon the query, "Why Is Registration in Civil Engineering Decreasing?" and submit the accompanying classification of engineering students at the University of California. Total registration in civil engineering has been remarkably uniform from 1910 to 1914, with a slight rise in 1913. About the same statement may be made of the freshman enrollment for the same period. The decrease, therefore, is striking for 1915-16.

We consider the following possible causes as operating at California:

1. Financial depression;
2. The Exposition year;
3. The gradual development of what is termed the California six-year high school, which reduces university enrollment in the freshmen and sophomore years since such high school students are apt to find their way into business and the professions without attending the university.
4. The College of Agriculture at the University of California has been most generously endowed during the past decade. Many men who heretofore have studied engineering are enrolling in that college, not necessarily for the normal courses in agriculture, but for such specialties as agritural irrigation, forestry, farm mechanics, etc.
5. The University of California maintains a College of Commerce. Male students are enrolling there for courses which emphasize economics, statistics, accounting, etc. In earlier years students who did not desire to take the regulation letters and classical courses would instead enroll in the engineering departments.
6. Within the last five years courses in public health and home economics have been programmed. Such courses attract students who otherwise might study sanitary engineering subjects.
7. In late years our chemistry department is offering increasing opportunities for the study of chemical technology, while the growth of industrial plants in the San Francisco Bay region is producing new means for employment. In the last two years, particularly, it has been noticed that students who otherwise might have taken civil engineering have selected schedules emphasizing gas engineering, the petroleum industry, chemical and industrial problems.
8. We believe that civil engineering enrollment, at present, tends to be reduced not only by the above causes but also since the general public has the impression that there are more engineers being graduated than there are positions to be filled. Moreover, the parents and guardians, and intending matriculants have no clear ideas regarding the content of a civil engineering course. The word "civil" is not understood.
9. Again, in the San Francisco Bay region during the past ten years, there have been erected at least three technical schools and business colleges, two in Oakland and one in San Francisco, which give short courses, both day and night. Students who feel that they cannot afford the time and wish to work quickly on one subject are allured to these schools. Such local institutions are attracting larger numbers of students as the schools become better equipped and in proportion as the university increases the standard of its matriculation requirements.

We have observed your editorial comment on page 746: "Unless the curves soon change and tend upward again, faculty readjustments and idle educational plant are sure to follow." Such a conclusion can hardly be applied to the engineering departments at the University of California. It might perhaps be justified in an institution which restricts its instruction solely to engineering. Though registration in civil engineering at California has relatively decreased (particularly when we observe that the total enrollment in the whole university has vastly increased) nevertheless the civil engineering department gives more man-hours of instruction to-day than ever before and its equipment and laboratories are crowded. Why? Because though students register in architecture, agriculture, forestry, irrigation, commerce, public health and home economics, chemical technology, they yet need to elect fundamental courses offered by the civil engineering department.

We believe it may be generally stated that during the last decade many students have attended engineering courses in the various institutions of the United States, who not only have not been properly prepared for the work in high school, but in addition were not mentally fitted by talent or interest. Of any group of one hundred students in civil engineering, who have come under the writer's influence during the last twenty years, at least 20 per cent should never have attempted the study of civil engineering at all; and an additional 20 per cent will never greatly profit by their study. Such students would have done more wisely to enter trades or business immediately, or should have pursued a decidedly different curriculum of study either in another profession, like medicine, or in a general course in letters and sciences.



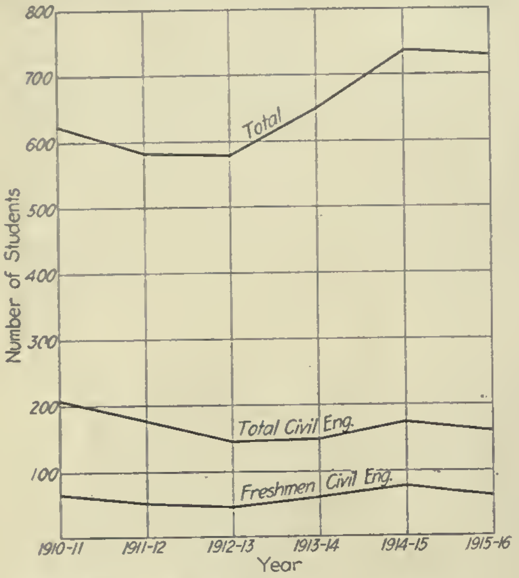
CLASSIFIED ENROLLMENT OF ENGINEERING STUDENTS AT UNIVERSITY OF CALIFORNIA

If the decrease in enrollment in civil engineering may be shown to include mainly those least adapted, there would be cause for satisfaction and congratulation, but if the decrease include a large percentage of the stronger individuals, then must the tendency be deplored, for there is always much room at the top of every profession.

C. DERLETH, JR.,
Dean, College of Civil Engineering, University of California.
Berkeley, Cal.

Sir: The accompanying diagram gives the statistics of engineering attendance at Iowa State College. I wish to offer one serious criticism on the statistics in engineering as published in your issue of Dec. 18 and discussions based on them. This criticism is that the statistics do not cover a period long enough to warrant correct conclusions. Engineering attendance curves should be extended back to 1890 to cover a complete cycle of growth. Statistics extending only from 1910 to the present are bound to be misleading.

The enormous increase in engineering attendance between the years 1896 and 1907 is one of the main causes of decrease in engineering attendance since that time. An important cause of the apparent decrease in civil engineering attendance, as compared with attendance in other engineering courses, is the constant tendency to differentiation and specialization. Civil engineering originally included mechanical egineering, electrical engineering, and in fact all other branches of engineering except military. Civil engineering now includes what is left after the separate branches have been established, and each new branch makes an apparent decrease in civil engineering, which is not due to a real decrease in the number of civil engineers.



ENROLLMENT OF ENGINEERING STUDENTS AT IOWA STATE COLLEGE SHOWS CHARACTERISTIC DECREASE IN PROPORTION OF CIVIL ENGINEERS

In recent years, for example, there has been a development of agricultural engineering which has drawn heavily from civil engineering attendance at the Iowa State College. A professional four year course in agricultural engineering is offered at this college, leading to an engineering degree, with a present enrollment of 101. This course was first offered in 1909. A four years' course in structure design is also offered at the Iowa State College, beginning in 1914, with a present enrollment of 38. There can be no doubt that the courses in agricultural engineering and structure design have drawn heavily from the attendance in civil engineering.

The sum of the enrollment in structure design, agricultural engineering and civil engineering this year will exceed 300, as compared with 285 in civil engineering alone in 1908. This view may be made clearer by comparing the statistics in civil engineering at the Iowa State College with those of the State University of Iowa, where there has been no corresponding differentiation of courses this period, and where there has been an actual increase in civil engineering attendance.

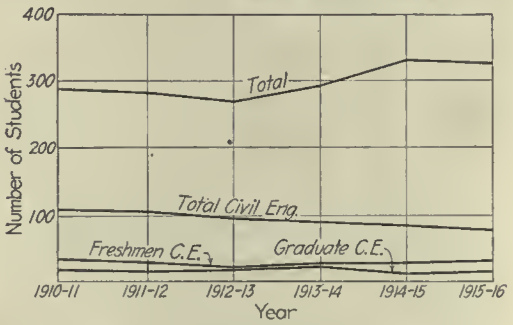
Even in the case of engineering schools where there has been no differentiation, engineering courses in recent years feel the effects of this specialization. They even feel seriously the recent and present popularity in instruction in agriculture. A very interesting phenomenon in the growth in agricultural attendance in recent years has been the large extent to which agricultural students have been attracted from the cities.

My personal forecast of the future in civil engineering attendance is for a marked increase, unless unusual conditions such as war or wide-spread business depression should interfere with the natural progress of the country. When the statistics of attendance since 1890 are considered and when differentiation of engineering courses is properly taken into account, it will be found that the general tendency is upward and that the curve of attendance is still concave upward, but the true facts cannot be brought out by such limited statistics and short time curves as were shown in the article of Dec. 18.

A. M. MARSTON,
Dean and Director, Division of Engineering, Iowa State College.
Ames, Iowa.

Sir: The accompanying diagram shows the total enrollment and the civil engineering enrollment at the University of Colorado for the years 1910 to 1915 inclusive.

It is very difficult to analyze the registration in civil engineering in the University of Colorado. A study of the registration in civil engineering before 1910-1911 shows a very rapid increase in civil engineering students just previous to the period mentioned. The largest graduating class in civil engineering we had had before 1910-1911 was ten men, with an average graduating class much below this number. The present graduating class will have forty-five men, of which fifteen will be civil engineers.



SMALL VARIATION IN ENROLLMENT AT UNIVERSITY OF COLORADO

The falling off in civil engineering registration in general is doubtless due to the slump in business conditions and, also, to the general interest in automobiles, wireless telegraphy and in the chemical industries. With the return to normal business conditions and with the increased demand for men in valuation work we might expect a picking up in the registration of civil engineering students.

M. S. KETCHUM,
Dean, College of Engineering, University of Colorado.
Boulder, Col.

Sir: The accompanying diagram indicates the classification of engineering students at the University of Washington. As I see them, there are many reasons to account for the decline in civil engineering registration. Some of them are local, others apparently general. Among the local ones are:

1. Establishment of a school of forestry in 1907 and courses in architecture and commerce in 1914. The first two of these have drawn more from the department of civil engineering than any of the engineering departments.

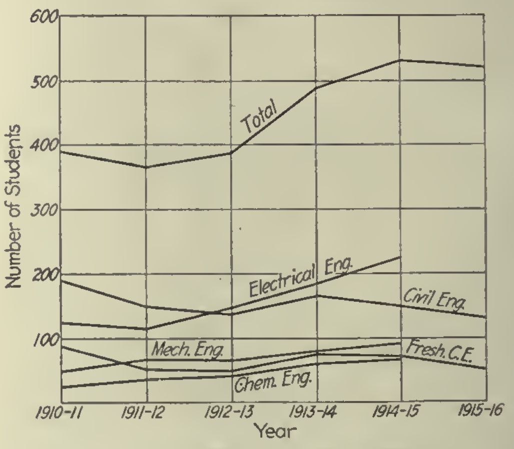
2. In the Pacific Northwest a great number of experienced railway men are working in subordinate positions, or are entirely without work.

3. Extensive hydroelectric development in this part of the country has been a factor in leading men toward the work in electrical engineering.

4. A couple of years ago a summer camp in surveying was announced for the department of civil engineering to begin in the summer of 1916. As a large proportion of our men depend upon remunerative work in the summers the move has not yet been considered a popular one.

5. Beginning with the present year, for the first time, a tuition fee has been charged for all departments.

As a general reason for the decline I would mention, but not emphasize, the over-supply of engineers in the country. I believe the question of over-supply is closely connected with the prescribed courses of study, and that in the decline is represented a protest against the present rigid requirements. I believe there is rightly a growing tendency to demand more flexibility in the education of the engineer, and that the work should include closer attention to the fundamental principles and an opportunity, through electives, of including a considerable amount of general training. If this should be provided, many of the engineering students would doubtless elect general courses in preference to the applied engineering work. The student body is sharp enough to see that much time is now being given to applied work in college, which could be picked up to much better advantage in practice. They are evidently noting the judgment of many of the leading engineers of the country, that the wrong things have been emphasized in college. They now seem ready to pay more attention to the fundamentals and to general training if the colleges make a revision of the curricula that will meet their views even half way. Personally I believe that this should and will be done.



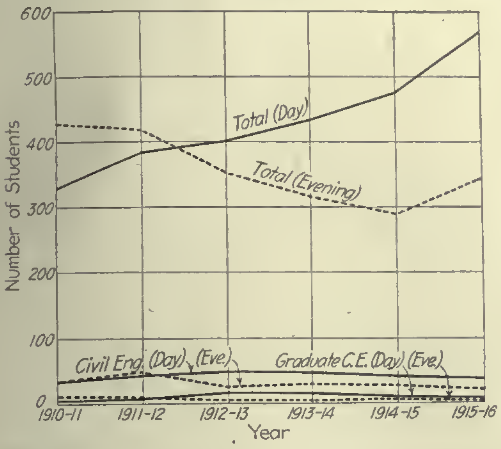
CLASSIFIED ENROLLMENT OF ENGINEERING STUDENTS AT UNIVERSITY OF WASHINGTON

I wish to call your attention to the fact that in your article on this subject of Dec. 18, two of the curves were labeled "University of Washington" and one of them "Washington State." They all followed up so closely the data which I am now sending that I believe they were all intended for the University of Washington rather than Washington State College, which is another institution.

I assure you of my appreciation of the interest your paper is taking in this subject.

ALMON H. FULLER,
Dean, College of Engineering, University of Washington.
Seattle.

Sir: I submit the accompanying figures showing the enrollment in the School of Applied Science of the Carnegie Institute of Technology, including the night school separately. Our students do not elect their professional courses until the end of the freshman year, so I cannot give the figures for freshmen civil engineers.



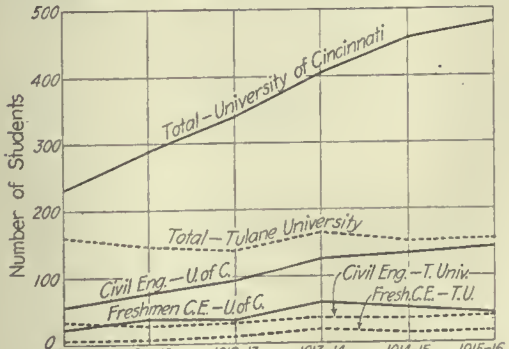
ENGINEERING ENROLLMENT IN BOTH DAY AND EVENING COURSES AT CARNEGIE INSTITUTE OF TECHNOLOGY

As regards reasons for changes in the number of students electing civil engineering, I venture the suggestion that while the total number of students in our engineering departments has been steadily increasing, the civil engineering department has not secured as large a proportion of the number as in the earlier years, because chemical engineering has been steadily becoming more and more important, particularly in the Pittsburgh district, and more students are now aware of the great field which this department of engineering has to offer.

Again, the establishment of a department of commercial engineering several years ago made an immediate impression upon the registration in the civil engineering department. I cannot see any reasons, other than the two mentioned, why our numbers in the civil engineering department should not increase proportionately.

WM. E. MOTT,
Professor of Civil Engineering, Carnegie Institute of Technology.
Pittsburgh.

Sir: The population of the State of Louisiana is small and we enroll relatively few students in the civil engineering course at Tulane University. Our enrollment has been increasing, as shown on the diagram herewith, although that in many institutions has shown a marked decrease.



ENGINEERING ENROLLMENT AT UNIVERSITY OF CINCINNATI AND TULANE UNIVERSITY OF LOUISIANA

The general decrease may be attributed to one or more of the following causes:

1. Higher entrance requirements.
2. Higher cost of education in many prominent institutions.
3. Increasing number of good small colleges.
4. Discouragement of prospective students by engineers who have not been successful on account of the ever increasing competition.
5. The higher educational requirements required for graduation in engineering, causing students to seek easier courses.
6. The subordination of mental training to highly specialized instruction confined to a limited field. Thus a student may be required to devote an excessive amount of time to drafting to the detriment of the time available for the study of the theory.

Our increase at Tulane is practically due to a reorganization of the department and making the civil engineering course as difficult as any other of the technical courses. The students feel that they are getting training that will be invaluable to them. One of the present seniors left a position paying $150 a month to return after an absence of two years in which he was accumulating money to pay his expenses and those of his family during this year.

We believe the success of our graduates to be one of the strongest influences in the maintenance of the number of our students.

W. H. P. CREIGHTON,
Dean, College of Technology, Tulane University of Louisiana.
New Orleans.

UNIVERSITY OF CINCINNATI enrollment in the co-operative courses in engineering is shown in the diagram herewith from figures furnished by Dean Schneider. The decrease in freshmen in civil engineering is due to the rejection of applications (which are always in excess of the number that can be accepted) in favor of chemical engineering students, in order to satisfy a largely increased demand from the co-operating firms for the latter class of students. The civil engineering enrollment is kept at about 25 per cent of the total.

Sir: I have read the article and editorial in the Engineering Record of Dec. 18 regarding the decline in registration of civil engineering students, and am sending a table showing the enrollment at the University of Minnesota. [The figures agree well with those already given in the original article, except for the three years, 1913 to 1915 inclusive. For these years the total engineering registration, not including the architects, is given as 390, 403 and 433, while the added figures for civil engineering students for those years are 149, 148 and 149.—EDITOR.]

The total registration of engineering students at Minnesota is on the increase since 1911-12. A falling off of the proportional registration of civil engineering students is barely perceptible. It will be found that the percentage which the latter bears to the total varies but slightly from 40 per cent in 1910 to 37 per cent in 1914. As to the reason for this, I would find it in the increased interest in electrical engineering. There is something so spectacular and in the nature of enchantment in electrical work that I find many young men coming into the college with the intent of becoming electrical engineers. The appeal to the imagination of youth is tremendous for this particular course.

Doubtless the rise of other courses such as forestry, architectural engineering, public health administration, and business administration will account for the lessened registration in engineering courses where the decline is present. I am not sure that the increase in the number of colleges which give engineering courses may not make the total registration of engineering students throughout the country equal to, if not in excess of, the registration of ten years ago.

As to the publicity given to engineers, it does appear to me that the successful completion of the Panama Canal has added a glamour to the civil engineering side of the profession, and that the newspapers, the magazines, fiction, the drama, and the movies are utilizing the engineer very fully as a hero. I believe never before has the engineer stood as high sociologically as to-day. I believe, moreover, that the compensation of engineers is on the increase, but I do believe the inducements of business into which so many mechanical and electrical engineers appear to go is sufficient to lure men from the early years of the practice of the profession. Large financial returns are for the maturer consulting and contracting engineers.

At Minnesota another element has entered to hold down the registration and that is our exceedingly high standard of scholarship. For instance, we eliminated last year sixty-one students out of a total student body of 475. High grade engineering schools care less now for numbers than formerly. A technical school's excellence is going to be determined by the really successful engineers which it graduates, and the accentuation of numbers is more of a play to the gallery than a real advantage. It is not improbable that some of our technical schools will follow the lead of our schools of medicine and surgery and limit the number of students whom they will accept.

FRANCIS C. SHENEHON,
Dean, College of Engineering, University of Minnesota.
Minneapolis.

Design of Turbine Draft Tubes

SIR:—I read the analytical discussion about the design of turbine draft tubes by A. G. Hillberg, which appeared in the Engineering Record of Nov. 13 and Nov. 20, 1915, pages 604 and 630 respectively, with special interest. In that treatment, however, there are some points which I cannot well understand.

In the first article, in the deductions of equation 7 he said:

$$v_{a+1} = y = \text{unknown velocity},$$

$$\frac{2g}{\left(\frac{A_{a+1}}{A_a}\right)^2 - 1} = k = \text{a constant}$$

and

$$h_{a+1} - h_a = x = \text{change in static head},$$

whence he derived an equation $y^2 = kx$, which represents a parabola.

In my opinion, however, the expression represented by k is not a constant, because A_{a+1}/A_a may not be a constant quantity. A_{a+1} is always inversely proportional to v_a, or to y under the given discharge; that is,

$$A_{a+1} = Q/v_{a+1}$$

Substituting this value into equation 7,

$$v_{a+1}^2 = \frac{2g}{\left(\frac{Q}{A_a v_{a+1}}\right)^2 - 1} (h_{a+1} - h_a)$$

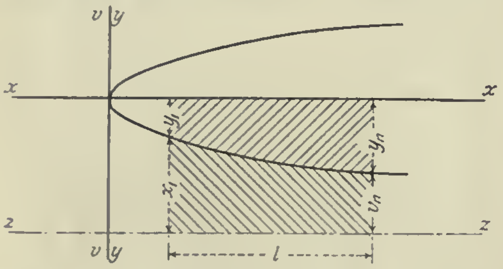
which can easily be changed into

$$v_{a+1}^2 = Q^2/A_a^2 - 2g\,(h_{a+1} - h_a)$$

Putting $v_{a+1} = y =$ unknown quantity, $(Q/A_a)^2 = a_o =$ a constant, $2g = b_o$ = a constant, and $h_{a+1} - h_a = x =$ change in static head, we have

$$y^2 = a_o - b_o x$$

This is the same equation which can be obtained in substituting Q/A_a for v_a in equation 6, and quite different from equation 7. Thus, I think, it is necessary to assume that the ratio A_{a+1}/A_a is a constant, providing the change of static head is very small, to make the equation 7 rational.



In the same article, by shifting the coordinate axes, the author obtained an equation $v = b - \sqrt{kz}$, the Z-axis representing the length of the center line of the draft tube; and considering the fact that $v_1 + v_n = y_1 + y_n$, he obtained the results $v_1 = y_n$, $v_n = y_1$ and $b = v_1 + v_n$. This is graphically represented by the accompanying figure. It shows that the variations of the static head is proportional to the change of the center-line length of the draft tube, and I think it cannot be true except in the case of a vertical draft tube.

T. KITAZAWA,
Professor of Civil Engineering, Nagoya Technological College.
Nagoya, Japan.

[The foregoing letter was referred to Mr. Hillberg, who replies as follows:—EDITOR.]

SIR:—Professor Kitazawa is correct in his observation that the term A_{a+1}/A_a is variable, thus making the term

$$\frac{2g}{(A_{a+1}/A_a)^2 - 1}$$

a variable also. But if the variation in the value of A_{a+1}/A_a is analyzed, it is found to be so slight as to be negligible, especially in the upper part of the draft tube.

If the reader looks at the table accompanying the second part of my article this statement is easily verified, but it must be borne in mind that the areas given in that table have been calculated on the principle of a parabolic retardation of the velocity in the draft tube, and that, therefore, the apparent variation of A_{a+1}/A_a is greater than it actually would be had the equation

$$v_{a+1}^2 = \frac{2g}{\left(\frac{A_{a+1}}{A_a}\right)^2 - 1} (h_{a+1} - h_a)$$

been used. The writer does not deny that it would have been more correct to use that equation instead of equation 7, but, unfortunately, certain complications found in establishing the relation between the areas made it easier to determine the change in velocity instead. This explains also why after having started with a definite assumption that

$$(v_a^2/2g) - (v_{a+1}^2/2g) = h_{a+1} - h_a$$

which, of course, is true for only one shape of the draft tube, it has been found necessary to analyze three different cases, viz.,

$$v_1 + v_n \overset{>}{\underset{<}{=}} y_1 + y_n$$

It has, furthermore, been shown that the case $v_1 + v_n = y_1 + y_n$ does not absolutely satisfy the condition that the change in velocity head should, for the maximum discharge, equal the change in static elevation, as it makes the change in the former somewhat smaller than that in the latter. This, however, is entirely on the safe side.

Professor Kitazawa shows how the equation

$$v_{a+1}^2 = (Q/A_a)^2 - 2g\,(h_{a+1} - h_a)$$

can be derived. He then states that $(Q/A_a)^2 = a_o =$ a constant, but this is incorrect. The size of the area A_a depends upon its location and the corresponding velocity at that point, and it is thus a variable, while Q is a constant. Consequently, the equation $y^2 = a_o - b_o x$ has three variables, y, a_o and x, which make it rather inconvenient to handle. In order to solve it analytically it is necessary to derive a second equation containing the same variables and to eliminate one of the three. It can, however, be solved by a few trials made under assumptions similar to cases 1, 2 and 3 used in solving the equation $y = b - \sqrt{kz}$ in my article.

As to the second part of Professor Kitazawa's letter, I beg to point out that the equation $v = b - \sqrt{kz}$, where $b = v_1 + v_n$ and $k = (v_1^2 - v_n^2)/l$, has nothing whatever to do with the *shape* of the center line of the draft tube. It merely states that the velocity at any point on the center line is a function of the distance of this point from a certain axis.

In the part of the article, published in the issue of Nov. 20, page 630, there are two apparent mistakes in the illustrations. The dimension 23 ft., as explained in the text, gives the difference in elevation, between the lowest tailwater level and the top of the runner band. On Figs. 6 and 7, however, the dimension lines have not been extended up to the line marked top of runner band, but have been terminated on a line located 5.3 ft. below it.

A. G. HILLBERG.
New York City.

The Economic Side of Sand Testing

SIR: The undersigned has recently had occasion to review in some detail the excellent articles on "The Economic Side of Sand Testing" by Cloyd M. Chapman and Nathan C. Johnson published in the Engineering Record in the issues of June 12, 19 and 26, 1915. These articles are now running in the Sibley *Journal of Engineering.*

In the first article of the series the authors gave a practical application of the use of a blended fine aggregate formed by adding stone screenings to a fine sand, resulting in a product cheaper and of much better quality than when the sand is used alone. By the use of this "blended material" a saving of $21,380 was effected on a certain work.

TESTS OF 2 x 2-IN. CUBES IN COMPRESSION AT AGE OF EIGHT DAYS

Aggregate used	Density of mortar	Compressive strength, lb. per. sq. in.	Per cent water
"B" sand	0.695	1162	14.0
Chapman and Johnson's blend.	0.798	3612	10.8
Writer's blend ...	0.828	4126	9.8

The proportion of fine sand and screenings was determined by using Fuller's maximum density curve as a model and approximating it as closely as possible with the curve of the blended mixture. The writer respectfully calls attention to the fact that inasmuch as Fuller's maximum density curve represents a mixture of *cement* and aggregate and not of aggregate alone, as used by the authors, it follows that some other combination of fine sand "B" (see their Fig. 2 on page 735 of the issue of June 12, 1915) and stone screenings would give, *when mixed with cement*, a closer approximation to the ideal curve.

The writer finds that this is accomplished by using 7 per cent of sand "B" and 93 per cent of stone screenings instead of 28 per cent and 72 per cent respectively as used by the authors. In the accompanying chart of sieve analysis curves, curve No. 1 is the curve of the cement alone, No. 2 is the "B" sand, No. 3 is the stone screenings, No. 7 is Fuller's maximum density curve as the authors used it, No. 6 is Fuller's curve as derived by the writer, using Fuller's constants for sand and crushed rock. Curve No. 5 is the mixture of *cement* and the authors' blend of "B" sand and stone screenings. Curve No. 4 is the mixture of *cement* and the blend of "B" sand and stone screenings which would give a closer approximation of mixture to Fuller's ideal curve.

Using the same reasoning as the authors, if Fuller's theory is right, curve No. 4 should give greater density and strength than curve No. 5. To ascertain if this be so the writer has made density and strength tests in which the "B" sand and stone screenings used were graded exactly as the same materials shown by the authors' curves. The results are given in the accompanying table, in which each value is the average of three tests.

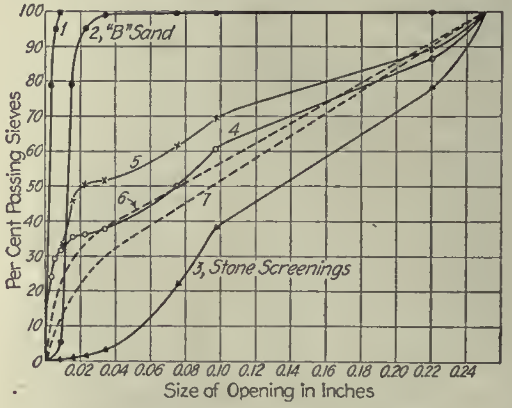


CHART OF SIEVE ANALYSIS CURVES

The methods used were similar to those used by Mr. Fuller in the original investigation. Mortar volume was read to 0.0001 cu. ft. The specific gravity of the sand was 2.645, of the screenings 2.63. The cement was a mixture of Alpha, Atlas, Lehigh, Universal and Wabash. The proportion of cement to total aggregate was the same in all cases—1 to 2.2 by weight.

Using the same assumptions that the authors did and the same method of computation, the saving amounts to $28,116. This is $6,736 more than that obtained by the authors.

H. H. SCOFIELD,
Instructor in Testing Materials, Purdue University.
West Lafayette, Ind.

HINTS FOR THE CONTRACTOR

Details Which Save Time and Labor on Construction Work

Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

[*Contributions to this section are solicited, and if found available will be paid for. They must be* SHORT, *and should be accompanied, if possible, by photographs or sketches.*—EDITOR.]

Plaster of Paris Holds Joint Mortar Exposed to Tidal Currents

IN BUILDING sea walls of coursed masonry laid in mortar and exposed to the action of tidal currents, where the bottom course is not more than a foot above mean low water, much difficulty is often encountered in holding the mortar in the joints long enough to give it time to set, as the action of the tides on the fresh mortar will pull it out of place. It does not matter how rich a mixture is used, whether 1:1 or neat cement, it is impossible to keep the mortar in place until it hardens.

On one piece of construction, under the supervision of John L. Howard, assistant engineer, Directors of the Port of Boston, this difficulty was successfully overcome by mixing plaster of Paris with the mortar in the proportion of one part of plaster of Paris to three parts of 1:1 mortar. This mixture hardened within five minutes, and no further trouble was experienced from the mortar in the joints failing to set in place. The pointing of the joints in which this mixture had been used was entirely satisfactory. The method is described by Mr. Howard in the current *Papers and Discussions* of the Boston Society of Civil Engineers.

Ceiling Hooks and Lockers Good Combination for Wash House

CEILING hooks on which working clothes can be hung and drawn up out of the way, combined with lockers at the floor level in which the men's street clothes can be kept, are recommended by Joseph H. White in a paper on miner's wash and change houses recently issued by the Bureau of Mines. The hooks are fastened to chains running over pulleys at the ceiling and in the top of the locker, in one arrangement, and unless the locker is opened the chain cannot be revolved. The scheme keeps the working clothes, which give off bad odors and soon make a locker offensive, next the roof, where a simple ventilating system can be installed to take the foul air out of the room. The clothes also dry much more quickly in this way.

Contractors who employ "sandhogs" on long jobs, and other workmen for whom wash and change facilities are needed, will find valuable suggestions in this pamphlet (known as technical paper 116), on the arrangement and construction of such houses. For instance, figures are quoted to show that less water and steam is needed if the combination of taps over a long trough for washing the face and hands and inclosed shower baths for washing the body is used. The experience of many mines has shown that it pays to have a first-class man as caretaker, and that, if soap and towels are furnished, and if a small charge is made for the use of the place, the men take better care of it, and maintenance in a sanitary condition is cheaper. A suggestion on this line is the installation of a wash tub or two, to prevent the men from washing out dirty clothes in the bathing places.

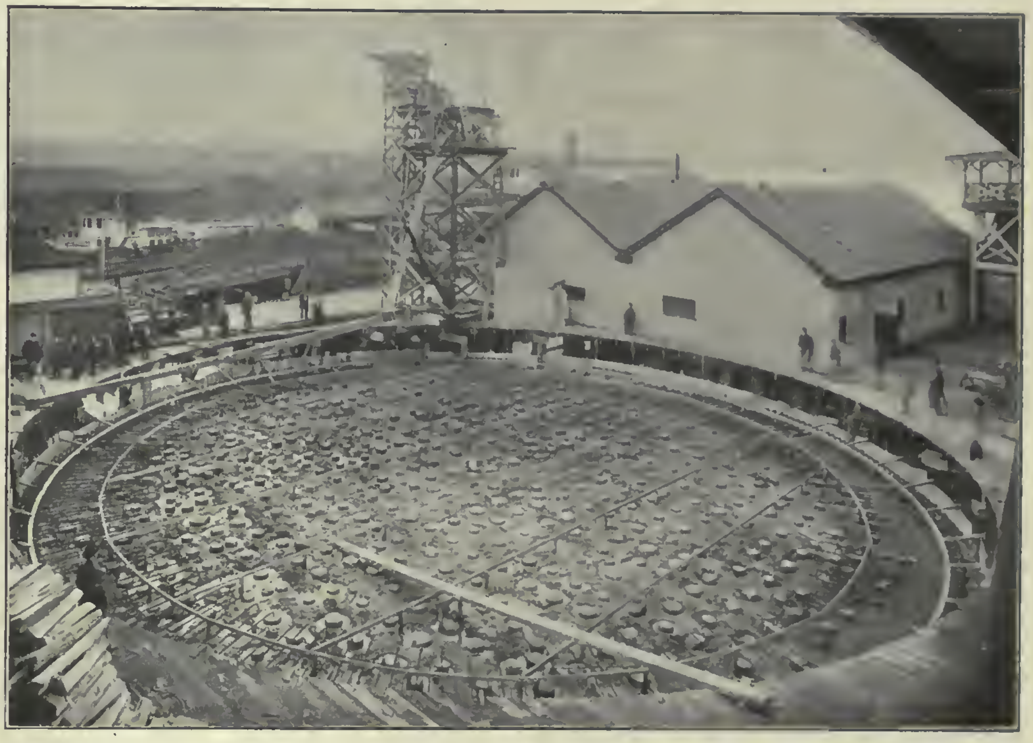
Mounting of Mixer Lowers the Cost on Tank Foundation and Wall

By CHARLES BENTALL
Vancouver, B. C.

ON THE oil-tank construction work shown in the accompanying photograph the mixer was mounted at the right height to dump into buggies on a runway at the top of the fire wall surrounding the tank, and at the same time was able to spout concrete directly into the tank foundation. The mixer was placed on a tower at the edge of the wharf so that the extension loading skip could be lowered to the deck of the barge at any stage of the 12-ft. tide. The sand and gravel were proportioned at the pit and delivered on barges carrying also the right quantity of cement, which saved time in handling.

The 30,000-bbl. oil tank, the work on which is described, was built at the Grand Trunk Pacific Railway wharf at Vancouver for the Imperial Oil Company, Ltd. After the piling was all in place the hoisting tower was erected and the hoist motor put in place. The beams supporting the sheaves at the top of the tower were made longer than usual, and temporarily placed at the extreme top, being allowed to project over the mixer platform. The mixer and its motor were then hoisted in a few minutes by the hoist motor. By making the height of the mixer platform such that it discharged directly into buggies at the top of the fire-wall form, and such that at the same time it was high enough to spout directly the concrete for the 2-ft. thick tank foundation, the entire concrete work was handled without requiring any derricks or other plant except the mixer installation.

The concrete materials were delivered by scow from the gravel pit. On this scow was placed the cement, which was delivered by water from the cement mills. The hoisting skip for charging the mixer was loaded by wheelbarrows with the correct amount of aggregate and two sacks of cement direct from the deck of the scow. The specifications for the concrete in the foundation slab called for a 1:3:5 mixture. It was found that 3 cu. ft. of the sand and 5 cu. ft. of the gravel used measured 7 cu. ft. when thoroughly mixed. By discharging the correct amount of sand and gravel from different hoppers at the gravel pit upon a belt which loaded the scows, it was possible to mix the sand and gravel dry as it was loaded. This saved time at the job, and also allowed the scows to be loaded more heavily, as the mixture occupied less space than the same quantity of materials loaded separately. The work was done by the Dominion Construction Company, Limited, of which the writer is engineer.



MIXER INSTALLATION WAS ONLY PLANT NEEDED TO COMPLETE 1000-YARD CONCRETE JOB

Making Asphalt Expansion Joints on a Plank Saves Time

By R. C. HARDMAN
Colorado Springs, Col.

EXPANSION joints in concrete are often made of asphalt or similar material applied to the concrete surface by means of a brush until a sufficient thickness is obtained. In other cases, especially in thin slabs, an open joint is formed by means of a wooden strip and later filled by pouring with hot asphalt. The writer has used two methods having many advantages over this practice, one of which consists in preparing sheets of the proper size and shape. The sheets are made on a plain surface of 1-in. lumber. Upon this is placed cheap building paper held in place by laths which also serve the purpose of determining the shape and thickness of the sheet. If the section to be covered is comparatively small the sheet may be made of the exact shape, while, if large, rectangular sheets are better. These may be cut to fit the exact section very easily, especially in cool weather. The sheets may be made of any desired thickness, although the thinner sheets are more easily handled. In placing these sheets they are merely nailed to the green concrete, or otherwise fastened if the concrete is too hard for nailing. This method is economical of asphalt compared with the cruder method of painting, and in addition secures a perfectly uniform thickness and a cleaner job. For thin floor sections a good device for forming open joints consists of a narrow trough formed from galvanized sheet metal. The bottom width is ¾ in. and the top width is made convenient for easy withdrawal. The sheet metal strips are made in sections about 8 ft. in length and furnished with three sets of handles. Wood wedges are placed close enough together inside the trough to prevent undue springing of the metal. This springing is also provided against by rolling the top edges. After the concrete is sufficiently set the wedges are knocked out and the metal strips withdrawn.

Steam Shovel, Crusher and Pumps Put Hydraulic Fill in Dam

INTEREST was directed to the San Fernando dam as a unit in the Los Angeles water supply system when it was announced that this structure was being built of material pumped into place at an overall cost of 7 cents per cubic yard. The process used, which was described in the Engineering Record of July 11, 1914, was continued until the increasing height of the dam and the lengthening of the pipe lines made it desirable to secure material from a higher level. Further study of the vicinity then developed the fact that a solidly packed material carrying 30 per cent of fine clay was available on the north side of the east end of the dam. This was, however, too firm to be handled effectively by the hydraulic giant methods previously employed and it was decided to excavate it from the bank by a steam shovel, which would load into dump wagons, these in turn delivering to a sump from which the material could be pumped to the desired location on the dam.

It was found, however, that in order to secure effective handling by means of the pumps, some means of crushing the material would be necessary, and rolls for this purpose were accordingly designed. These were installed so that their function could be performed after the time the material left the dump wagons and before it was picked up by the suction pipe.

Crushing and Pumping

In one of the accompanying illustrations the entire layout of the system is shown. The steam shovel in the background delivers to 1¼-cu. yd. dump wagons which have an average haul of 500 ft., and dump their loads on a hinged platform. To one edge of this platform are attached cables operated by electric motor and by which it is tilted so the material slides off into a hopper over the rolls. The average capacity of the steam shovel and the wagons which serve it is about 1500 1¼-cu.-yd. loads for each day of two 8-hr. shifts. On unusually favorable days, however, the output has been as high as 2294 loads for two shifts.

PLATFORM THAT WAGONS DUMP ON TILTS AFTER THEY LEAVE IT, SLIDING CLAY TO CRUISERS

The rolls are made of solid cast iron 36 in. in length and are hung on a 5-in. shaft. Each roll is equipped with 36 teeth arranged in six rows of six teeth each. These teeth are 2 in. square and 7 in. long. They are made of tempered tool steel and are fixed in the rolls so that about 2½ in. project. The rolls are so placed that the distance between the projecting ends of the teeth can be varied from 5 in. down to bare clearance. Each row of six teeth is held in place in its roll by means of a rod running parallel to the axle and fitting in the slot with which each tooth is provided. A single 75-hp. motor is connected so that direct drive is transmitted to each shaft. In order to provide for the shocks which would otherwise affect the motor a 1500-lb. fly wheel is mounted on the shaft of each roll.

From the rolls the material is dropped into a 10 x 10-ft. sump, into which water from the reservoir has free access so that the supply is continuous. A 12-in. suction pipe extending into this sump connects with a Byron Jackson sand and gravel pump, the rated capacity of which is about 450 cu. ft. per minute under a head of 50 ft., allowing for about 20 per cent of solid material.

At the present time the material is being lifted a total distance of 52 ft. in two stages, pumps of the same capacity being installed for each stage. The length of delivery ranges from 500 to 2000 ft., according to the point on the dam where the material is required.

The work is being done under the direction of William Mulholland, chief engineer, Bureau of Waterworks and Supply. Fred J. Fischer, chief mechanical engineer, is in charge of the design and construction of the crushing and pumping plant.

HYDRAULIC FILL AT TOP OF THIS DAM DUG BY STEAM SHOVEL, HAULED IN WAGONS, CRUSHED AND PUMPED TO PLACE

130,149,368 Cu. Yd. of rock and earth were excavated up to the beginning of the present fiscal year on the projects of the U. S. Reclamation Service.

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

Bridges Washed Out and Roads Damaged in Southern California

Serious damage was inflicted in all Southern California counties as a result of the heavy rainfall beginning Jan. 26. The $25,000 reinforced-concrete bridge across the San Diego River, completed about a year ago, was completely wrecked. The Santa Fé Railroad bridge across the same stream was also washed out. The reinforced-concrete highway bridge over Sycamore Creek in San Diego County and the steel girder bridge with three 40-ft. spans on San Juan Creek in Orange County went out.

Atogether the state highway damage was three times that suffered during the storm of the preceding week, according to highway officials, due to saturated soil conditions when the second storm began. County bridges and roads throughout all Southern California suffered even more heavily than state highways. A break occurred in the million dollar Los Angeles outfall sewer near Inglewood, and temporary repairs were hastily made. A dam above Vannuys failed, causing a small flood in that city.

Pennsylvania Railroad to Build Hotel in New York City

The Pennsylvania Railroad is making plans for the construction of a 12-story hotel on its site opposite the Pennsylvania Station on Seventh Avenue, between Thirty-second and Thirty-third Streets, in New York City. It is understood that a total of $9,000,000 will be invested in the project, the hotel to cost about $5,000,000, with the expectation of starting a building boom which will affect the entire Pennsylvania Station zone. The building will occupy most of the site of 198 ft. x 400 ft. already owned by the railroad. The details of size, height and capacity are not yet fully decided. Tentative plans for the structure are being prepared under the direction of McKim, Mead and White, architects, of New York City. It is hoped to complete the new building by the time the Seventh Avenue subway is in operation.

To Build Government Locomotive Plant at Petrograd, Russia

Alphonse I. Lipetz, chief of the locomotive division of the Imperial Russian Railway Administration, has been studying locomotive plants in this country, with a view to obtaining information to be used in the design of a plant at Petrograd, which he will have charge of. Work on the plant will be started as soon as he returns to that country.

Connecticut Utilities Companies Claim Earnings Tax Deductions

Attorney-General Hinman of the State of Connecticut has filed suits in the Superior Courts against the United Electric Light & Water Company, of Waterbury, and the Fountain Water Company, of Ansonia, for non-payment of State taxes under the terms of the miscellaneous corporations tax law. The cases will be taken at once to the Supreme Court of the state for final adjudication.

The tax which is being fought is one of 1½ per cent on the gross earnings from operations in the state, with no deductions to be made from the earnings before the tax is computed. The two defendant companies paid only a part of the tax, having deducted certain of their earnings.

The defendant companies claim that "deductions should be allowed from the amount of gross earnings for earnings derived from operations incidental to the main business of the company, for payments made from capital for the purchase of raw materials and for operating expenses.

The Supreme Court's decision will affect forty gas, electric light and water power companies in the state, in which a large portion of the stock is held by outside investors.

Subcontractors on Rogers Pass Tunnel Win Suit for Bonus

Damages for breach of contract in connection with construction work on the Canadian Pacific Railway tunnel at Rogers Pass were recently awarded McIlwee & Sons, of Denver, Col., in their claim against Foley Bros., Welch & Stewart, of Vancouver, B. C., by a judgment of the Privy Council, delivered in London, England. The exact amount of damages has not yet been decided, but it is reported that the council upheld the principle that McIlwee & Sons were entitled to full damages, including profits, just as if they had been allowed to complete the contract.

After Foley Bros., Welch & Stewart secured the contract for boring the five-mile tunnel at Rogers Pass, they sublet the contract for the pioneer and center headings to McIlwee & Sons, offering as a special inducement for rapid work a bonus of $1,000 a foot for every foot over a stipulated advance to be made each month. McIlwee & Sons began work and made such rapid progress that at the end of three months they had a claim for bonus amounting to over $200,000. Difficulties then arose between the engineers on the work and McIlwee & Sons were ordered to stop work and vacate the contract for alleged refusal to obey the orders of Foley Brothers' engineers. After a period of six weeks permission was given to McIlwee & Sons to resume work, but instead they quit work entirely and brought suit for $500,000 for breach of contract. This amount was later increased to $800,000.

Will Construct Double-Track System in Cincinnati Loop

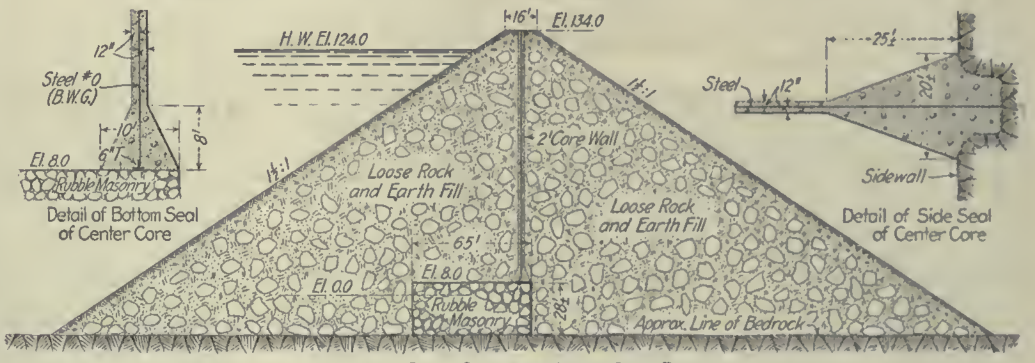
The Cincinnati Rapid Transit Commission, at a meeting held Jan. 22, decided to construct a double-track system for the proposed loop of the rapid transit and interurban railway project of that city.

Interurbans will be permitted to enter the loop and bring their cars to the heart of the city. Freight cars will also be moved over the loop. All passenger cars operated over the loop will be required to be of metal construction.

Otay Rock-Fill Dam Near San Diego Fails

Flood Devastates Valley and Sweeps Path Two Miles Wide When Structure with Steel Plate Core Goes Out

Late in the afternoon, Jan. 27, the lower Otay dam on Otay Creek, 22 miles southeast of San Diego, Cal., failed when, probably for the first time in its history, the water rose to its spillway 125 ft. above the stream bed level. The recent heavy rain storms in southern California, reported last week, followed by a storm which began on Jan. 26 and resulted in about 2.5 in. rainfall, filled the reservoir to the crest. Thirteen billion gallons of water suddenly released down the Otay Valley when the dam broke devastated a strip of rich farming land about two miles wide and fifteen miles long. It is estimated that forty lives were lost and $1,000,000 worth of property damaged.



CROSS-SECTION OF LOWER OTAY DAM

DIMENSIONS AND DETAILS OF CONSTRUCTION OF LOWER OTAY DAM WHICH FAILED

The lower Otay rock-fill dam was of unique type, containing a thin core wall of concrete 2 ft. thick, in the center of which was embedded a ¼-in. steel plate. It was the first of its kind ever constructed. Work started in 1887 and was completed in 1897, for the Southern California Mountain Water Company. The reservoir supplies water to San Diego and Coronado, and had been taken over by the city of San Diego. While this source of supply is cut off, the cities are being served by the Cuyamaca water system, whose lines connect with the city mains.

The dam was built on bed-rock foundation of seamy porphyry. The dimensions are shown in the accompanying drawing from the *Transactions* of the American Society of Civil Engineers, Vol. 75, page 30, in a paper by M. M. O'Shaughnessy on "Construction of the Morena Rock-Fill Dam, San Diego, Cal." The base of rubble masonry about 28 ft. high and 160 ft. long, was originally constructed with the intention of making a solid masonry dam throughout. The cost, however, appeared excessive to the owners who changed to a rock-fill type with the steel plate and concrete core wall. The top of the dam is about 600 ft. long, the total height being 150 ft. At previous stages in its history, when the water rose to high levels, the resulting saturation of the soft materials, mixed with the rock from nearby quarries used for the fill, caused a slight settlement of the upstream side. There has always been a slight leakage, varying with the head of water on the dam. The area of the watershed is only about 100 sq. miles, and usually the precipitation is light.

The steel plate in the core was riveted to a heavy 6-in. T, anchored to the top of the masonry foundation by 1-in. bolts. The lower sections were 5 ft. wide and 17 ft. 6 in. long, the three bottom courses being 0.33 in. thick.

From 28 to 50 ft. in height the thickness was ¼ in. and above 50 ft. the plates were 8 ft. wide and 20 ft. long, decreasing in thickness toward the top. After riveting, the plates were caulked on the upstream side and coated with hot asphalt, covered with burlap while still hot, and then encased by the 12-in. concrete layer on each side. The wooden forms used were not removed, so that the rock fill could settle independently of the core wall. When completed the top of the wall was in very irregular alignment. Further details of the construction will be found in the Engineering Record of Sept. 28, 1895, page 310, and June 27, 1896, page 64.

The spillway was a few hundred feet from the east end of the dam and had a channel 30 ft. wide with a maximum depth of 30 ft., being 10 ft. below the crest. No outlets or pipes were built through or under the dam proper, but an outlet tunnel was built about 1000 ft. west of the dam through a narrow part of the enclosing ridge. The failure is, therefore, not due to seepage.

The following rainfall data has been received from the U. S. Weather Bureau's Washington office:

Rain set in over southern California on the night of Jan. 26. On the morning of Jan. 27 the following-named amounts were reported: San Luis Obispo, 1.46 in.; Los Angeles, 0.96 in.; San Diego, 1.04 in. On the evening of Jan. 27 the amounts were: San Luis Obispo, 2.08 in.; Los Angeles, 1.62 in.

Communication by telegraph with San Diego was lost during Jan. 27 and was not restored until Jan. 31. It is clear, however, that the rain ended on Jan. 27; that the total fall of the storm was probably not greatly in excess of 2.50 in., since the amount recorded at Los Angeles was but 2.58 in.

700-Ft. Bridge in Arizona Left High and Dry by Floods

Further details in regard to the flood of Jan. 22 in Arizona indicate that the damages to the State road system were, as was indicated in the first reports published in these columns last week comparatively slight. The 700-ft. concrete bridge over the Gila River at Florence was left high and dry, the river having cut a new channel for itself. Works of the U. S. Reclammation Service were damaged to the extent of from $50,000 to $75,000.

In the Indian Reservation approximately 10,000 acres of land, of which about three-fourths was in cultivation, was flooded, and the Southern Pacific main line, which crosses the tract, was washed out in several places. In the Yuma Valley about 3000 acres of land were flooded, and the damage to the Reclamation Service works is probably between $50,000 and $75,000. The Southern Pacific, city of Yuma, and farmers' damage were each of greater amount. Reconstruction of the damaged levee and canals is being pushed rapidly with a view to having the minimum interruption to water service. The total damage done by the floods, according to conservative estimates amounted to over $1,500,000.

FLOOD WATERS COVERED 10,000 ACRES OF LAND IN THE INDIAN RESERVATION

The state highway concrete bridge across the Gila River at Florence, a 700-ft. structure completed in 1910, was left high and dry by the river, which cut a new channel 900 ft. wide through the south approach. While the damage has not yet been investigated by the state engineering department, it is believed from reports received that it may be necessary to extend the bridge for that distance in order to restore the crossing. Meanwhile travelers are being ferried across the river in boats. The state highway bridge over the Gila at Wellton, completed last year, was not damaged by the flood, save in the washing out of the north approach, which had not been completed.

RIVER REACHED HIGHEST LEVEL RECORDED SINCE 1891 AT RAILROAD BRIDGE AT YUMA

Bridges on the Roosevelt highway were washed out, and it is estimated that 4½ miles of the road will have to re-surfaced. It will be months before the highway can be opened for travel, except for light wagons, according to the report of Reclamation Service engineers.

During the floods, the overflow at the Roosevelt dam mounted to over 11 ft. of water over each of the 200-ft. spillways. Although 5 ft. over the spillways was the largest amount expected when the dam was designed, it is said that no effects from the recent heavy pressure were evident.

Subsidiary power plants in the Salt River Valley were forced to suspend operations during the flood owing to water backing up into canals, or to the fact that several canals were emptied in order to carry off flood waters.

Indiana Public Service Commission Fixes Rates for Hydrant Service

The Indiana Public Service Company of Aurora, Ind., has been ordered by the public service commission of that state to charge the following rates for private fire protection service from its water plant. Maintaining pressure for private fire sprinkling systems, connection 6 in. or over, $50 per annum; 4 in. connections, $45; private fire hydrants installed and maintained by the individual, 2 in. hose connection, $18 per year per hydrant; private fire hydrants installed and maintained by the individual, 2½ in. hose connection, $20 per hydrant.

Water System at Anchorage

The Alaskan Engineering Commission has completed the new water system at Anchorage, Alaska, and turned the water into the mains on Jan. 19, thereby ending a water shortage which began last November when freezing weather set in. Anchorage is the base of supplies for the government railroad now under construction.

Water Power Development Three Times as Fast as Steam

Secretary of Agriculture States That Eighteen Corporations Control More Than One-Half of Water Power in Public Service

In a special report submitted to the Senate, Jan. 20, by the Secretary of Agriculture it is stated that eighteen corporations control more than one-half of the total water power used in public service operations in this country. Eighty per cent of the total installed power in 1912 was steam power, but since then the per cent of increase in water power development has been three times as great as in steam power. The power developments which utilize national forest lands have 42 per cent of the total developed power of the Western states.

Tendency Towards Association of Interests

In his report, Secretary of Agriculture Houston presents, in far greater detail than has ever been attempted before, an exhaustive analysis of the general power situation, which shows that eighteen corporations control more than one-half of the total water power used in public-service operations in the United States, while six corporations control more than one-quarter. The data show, it is stated, a marked tendency toward association or community of interests, particularly between the principal holding companies.

Of all the primary power employed in the electrical industries and in manufactures in 1902, 11.2 per cent was installed in commercial central stations. The proportion had risen to 23.8 per cent in 1912, more than doubling in ten years. The movement toward concentration is found in all sections of the country. From 1902 to 1912, the rate of concentration was highest in the South Atlantic states, which had three times as great a proportion of primary power in commercial stations in 1912 as in 1902. The extent of concentration was greatest in the Western states. Fifty per cent of all primary power of all kinds in the Mountain states in 1912 was owned by public-service corporations; 54 per cent in the Pacific states. In California the proportion was three-fourths. To-day public-service corporations own 90 per cent of all the primary power in these two groups of states.

Water Power Resources of Country

Revised figures of the potential water-power resources of the country place them, the report states, at a minimum of 27,943,000 hp. and a maximum of 53,905,000 hp., the minimum representing the amount of power that could be developed from the use of the average annual minimum stream flow for the lowest two consecutive seven-day periods of each year, while the maximum represents the amount that could be developed from the use of the average maximum continuous stream flow available for six months during the year. The national forests are stated to contain 30.4 per cent of this minimum and 31.3 per cent of the maximum, while over 72 per cent of the country's total is found in the Mountain and Pacific states, and 42 per cent in the three Pacific Coast states. National forest water power amounts to 42 per cent of the minimum and 43 per cent of the maximum estimated power resources of the Western states.

While 80 per cent of the total installed power from all sources in 1912 was steam power, and while nearly three-fourths of the total primary power installed in commercial and municipal central stations, and in street and electric railway plants was steam power, the preponderance of steam power is found, according to the figures given, in the Eastern states; and the per cent of increase in water-power development for public service use, in the three years since 1912, has been three times as great as in steam power. Primary power installation from all sources and for all uses increased, in the eleven Western states, 240 per cent from 1902 to 1912, or more than two and one-half times as rapidly as in the remainder of the United States. This includes primary power used directly in manufactures, 94 per cent of which is found in the Central and Eastern states.

Primary electric power increased in the Western states between 1902 and 1912, 440 per cent, as against 226 per cent in the remainder of the country, while the development per capita in the Western states in 1912 was two and one-half times as great as in the remainder of the United States. In installed water power per capita the Western states had more than four times as much in 1912 as the remainder of the United States. There is at the present time a considerable over-development in nearly all the power centers of the Western states, California, Oregon, and Washington in particular showing installations far in excess of maximum demands.

Private power interests reported in 1912 a total investment, as represented by the item "Cost of Construction," of over $2,000,000,000, equivalent to $21.97 per capita, and to an average of $301 per horsepower of primary installation. Municipal stations reported an aggregate cost of $77,000,000 and a cost per horsepower installed of $138, or considerably less than one-half of the reported cost of commercial stations. This apparent discrepancy in favor of publicly-owned enterprises is explained as probably due in main to financial statements by the commercial stations in which "cost of construction, equipment, and real estate" represented not actual outlays, but the amount which will make assets balance liabilities. "In the majority of cases," says the report, "it would be more nearly correct to call this item 'assumed present value of properties,' than to call it 'investment in' or 'cost of' such properties."

The power developments which utilize Nation forest lands have 42 per cent of the total developed power of the Western states, 30 per cent through occupancy with some part of the immediate generating plant and 12 per cent through storage reservoirs. An additional 14 per cent either occupies public lands outside the forests or depends directly upon storage reservoirs upon such lands, making 56 per cent of the total developed water power of the Western states dependent upon the use of public lands, taking place under existing laws. Plants either now under construction or for which final permits have been taken out will provide a further increase equivalent to 20 per cent of the total present Western water power development.

Engineers Organize Preparedness Lectures Under Army Supervision

Captains in Corps of Engineers to Instruct Technical Men Preparatory to Organization of Training Camp at Plattsburg Next Summer

With the cooperation of Maj.-Gen. Leonard Wood, U. S. Army, a voluntary committee of representatives of the four national engineering societies have organized a series of seven military lectures to begin this month in the auditorium of the Engineering Societies Building, 29 West Thirty-ninth Street, New York City. These lectures are intended to serve as a preliminary to field instruction at an engineering camps to be held at Plattsburg, N. Y., next summer. The speakers are all captains in the U. S. Army Engineer Corps. The schedule of dates and subjects follows:

Feb. 14—Subject: Organization and duties of engineers in war, and what engineers in civil life will be called upon to do in the defense of the United States. Speaker, Capt. Thomas M. Robins, Corps of Engineers.

Recent Floods in California Damage Streets and Tear Up Valuable Lands in Pomona

SAN ANTONIO WASH BREAKS BANKS NEAR CLAREMONT AND TEARS UP ORANGE GROVES IN THE VICINITY OF POMONA

CITY RECREATION PARK AT POMONA SUFFERS SEVERELY FROM FLOOD WATERS, WHICH MAKE NEW COURSES THROUGH IT

NEW ASPHALT STREET AT POMONA UNDERMINED FOR AT LEAST A HALF MILE, DAMAGING PAVEMENT TO A VALUE OF $15,000

Feb. 21—Subject: The service of reconnaissance, including surveying, mapping and sketching, photography and map production. Speaker, Capt. Richard T. Coiner, Corps of Engineers.

Feb. 28—Subject: Field fortifications, sieges and demolitions. Speaker, Capt. Thomas M. Robins, Corps of Engineers.

March 6—Subject: Seacoast defenses and battle field illuminations. Speaker, Capt. Edward D. Ardery, Corps of Engineers.

March 13—Subject: The construction, maintenance and repair of roads, bridges and ferries; the selection and preparation of fords. Speaker, Capt. Thomas M. Robins, Corps of Engineers.

March 20—Subject: The selection, laying out and preparation of camps and cantonments; the service of general construction, and the special services, including all public work of an engineering nature which may be required in a territory under military control. Speaker, Capt. Richard T. Coiner, Corps of Engineers.

March 27—Subject: The construction, maintenance and operation of railways under military control, and the construction and operation of armored trains. Speaker, Capt. Thomas M. Robins, Corps of Engineers.

The organization committee in charge of this movement is composed of the following: J. Waldo Smith, chairman; Gano Dunn, chairman, Engineering Foundation; E. L. Corthell, president, and Charles Warren Hunt, secretary, American Society of Civil Engineers; W. L. Saunders, president, and Bradley Stoughton, secretary, American Institute of Mining Engineers; D. S. Jacobus, president, and Calvin W. Rice, secretary, American Society of Mechanical Engineers; J. J. Carty, president, and F. L. Hutchinson, secretary, American Institute of Electrical Engineers; Charles F. Rand, president, United Engineering Society. Other members of the committee are Richard S. Buck, J. Parke Channing, Alfred Craven, Thomas Crimmins, George Gibbs, Alexander C. Humphreys, John W. Lieb, William Barclay Parsons, George H. Pegram, Robert Ridgway, Merritt H. Smith, W. H. Wiley.

J. S. Langthorn, secretary of the committee, 250 West Fifty-fourth Street, New York City (telephone Circle 1676), will receive enrollments for the lectures.

The committee, in charge of the military lectures, is a purely voluntary organization and has no connection with the national societies' committee on the drafting of a bill for a proposed engineer officers' reserve corps. The latter body is headed by William Barclay Parsons and its other members are Henry S. Drinker, B. J. Arnold, W. H. Wiley and R. D. Mershon.

Patent Office Rules Revised

The revised general rules of practice before the U. S. Patent Office were approved by Secretary of the Interior Lane Dec. 22, and became effective Jan. 1. The revisions were made by a committee of which R. F. Whitehead, assistant commissioner of patents was chairman and Walter F. Rogers, former president of the Patent Bar Association was a member. The results of the committee's work were submitted to patents experts and attorneys throughout the country with the request that they give the Patent Office the benefit of their suggestions in respect to the proposed changes. Hundreds of suggestions were made, and many of them were incorporated in the new rules.

Record Sized Turbines Being Considered for New York Subways

Both the General Electric Company and the Westinghouse Electric & Manufacturing Company handed in bids and specifications on Wednesday of last week to Henry G. Stott of the Interborough Rapid Transit Company of New York City for two 60,000 kw. steam-turbine units. Each unit will be made up of three separate electric generators driven by one high-pressure and two low-pressure turbines, the latter being connected in multiple. These will be the largest steam turbines in the world, the next largest having been ordered from the General Electric Company recently by the Detroit Edison Company, and rated at 50,000 kva. No decision has been reached as yet on the choice of turbines, the Interborough Rapid Transit Company being undecided on single 60,000-kw. units or the equivalent in 30,000-kw. turbines.

Heaviest Snow in Thirty Years Descends on Cascade Mountains

The heaviest snow in thirty years was falling in the Cascade Mountains Feb. 2. Several buildings in Everett and Seattle, Wash., collapsed under the abnormal weight. Street railways and railroads were unable to cope with the storm and their services were badly crippled. The transcontinental lines abandoned the fight in the Cascades, where the snow was 19 ft. deep in places.

Three feet of snow fell within twenty-four hours in the blizzard that was at its height, Feb. 2, in Seattle and the Puget Sound District. Street railway and interurban service was paralyzed. All transcontinental lines had to give up the attempt to keep their lines open. Telegraphic communications were maintained under the greatest difficulties. St. James Cathedral in Seattle sustained damages to the extent of $150,000.

Montana Municipal Engineers Hold Annual Meeting

The Montana Institute of Municipal Engineers held its fourth annual meeting at Billings, Mont., Jan. 17, 18 and 19. Two and a half days were given to the reading of papers on street paving, improvement district laws, roads, water softening and purification, and sewage disposal and treatment. The afternoon of the third day was devoted to an inspection trip to the new filter plant at Billings.

The officers of the Institute elected for 1916 are as follows: President, Carl C. Widener, Bozeman; vice-president, C. W. Helmick, Helena; secretary-treasurer, John N. Edy, Billings; directors, M. L. Morris, and F. C. Snow.

Pennsylvania Proposes to Enlarge Baltimore Tunnel

A plan has been filed by the Pennsylvania Railroad with the city of Baltimore for the enlargement of the railroad's tunnel between the Union and Fulton stations in that city. No additional trackage is contemplated, but increased clearance for the existing tracks, together with better ventilation, is sought.

Seward Water System Sold

The water system at Seward, Alaska, was recently sold to Eastern capitalists, it is reported, for the sum of $200,000. The system was built by a Baltimore company at a cost of $75,000. Several water rights near Seward at a 200-ft. elevation above the town are included in the properties.

State Commissions Present Their Views on Federal Valuation of Railroads

Oppose Finding of Ultimate Value—Argue for Original Cost and Declare Reproduction Cost Discredited—Ridicule Railroads' Intangibles

Disagreement with the railroads was the common ground on which the various state public service commissions met at the valuation conference in Washington last week, called by the Interstate Commerce Commission to give the state commissions an opportunity to present their views on such fundamental questions as have arisen to date in the federal valuation of the carriers. The conference lasted two and one-half days, beginning Wednesday, Jan. 26. The discussion was based on the brief filed recently by the National Association of Railway Commissioners, those of four state commissions, California, Oregon, Kansas and Minnesota, and the answering brief of the carriers. Except for two hours on the second day, when the carriers, through their four counsel, Pierce Butler, George S. Patterson, W. G. Brantley and Sanford Robinson, replied briefly to some of the states' arguments, the states had the floor throughout the conference. The spokesmen for the states were Max Thelen of California, A. E. Helm of Kansas, E. C. Niles of New Hampshire, C. B. Aitchison of Oregon, W. A. Shaw of Illinois, J. L. Bristow of Kansas and C. E. Elmquist of Minnesota.

States' Main Contentions

As summarized by Mr. Thelen at the close of the conference, the main contentions of the states were: (1) That the Valuation Act does not require an ultimate finding of value, but merely classified statements of the evidences of value; (2) that original cost to date must be found, estimates being made where exact figures are not available; (3) that reproduction cost new must be found on a rational basis (the states disagreeing with each other as to the rational basis, but agreeing that the carriers' basis is irrational); (4) that accrued depreciation must show in reproduction cost less depreciation; (5) that the reproduction cost of land cannot exceed the normal market value, and (6) that intangibles should be discussed further when the carriers have stated how they shall be valued. Among the other theories contributed by various of the other commissioners, but not subscribed to unanimously, may be mentioned the Minnesota theory of instantaneous reproduction, the Kansas contention that the railroads do not own their land, and the Oregon view that each appropriation from earnings for additions and betterments shall be allocated to the bits of work it covered—"where feasible."

Where Shall the Valuation Stop?

Three topics were discussed by Mr. Thelen at the opening of the conference. The first was the interpretation of the requirements of the Valuation Act. He objected vigorously to the railroad view that the Interstate Commerce Commission must find the ultimate value of the property. He held that the framers of the act had not sought to have the report show more than the elements or evidences of value, that value depended upon the purpose for which it was to be used, that value for rate-making purposes depended on much that no inventory could show, such as the value of the service, past earnings and many other elements, and that with no rate before it and no standard, which the Supreme Court must set, to measure the relative weights of even the known evidences of value, no value could be found.

Aids, gifts, grants and donations, the second subject assigned to Mr. Thelen, were discussed very briefly. His main contention was that all of the facts obtainable should be ascertained.

His third topic was intangibles. He held that the claims of the railroads to date under this head were wild and absurd, and thought, also, that the carriers would probably produce more as time passed. He asserted that they did not agree among themselves as to the definitions of these elements, and pointed out that they had not suggested how they were to be determined. He thought, consequently, that full discussion of them should be deferred until a later date. He took occasion to point out, however, that most of the decisions cited by the carriers at previous conferences in support of their intangibles were in other than rate cases. He asserted that unity of use, and location with respect to both operation and traffic, had been rejected by the courts, and that franchise value had been rejected except in the Willcox case. Speaking for California alone, he approved a restricted allowance for going value, taking into account the value of the service, allowing only a reasonable development period, and demanding reasonable judgment during the period.

Original and Reproduction Cost

Original cost to date and reproduction cost were the subjects assigned to Judge Helm. He prefaced his remarks, however, by an endorsement of Mr. Thelen's views as to the interpretation of the Valuation Act. He also gave voice to his misgivings as to the ability of the state commissions to compete with the organization of the carriers in the valuation work, which organization he thought was unnecessary and undesirable. These remarks were in accord with the Kansas brief, which argued that the carriers should remain silent until the presentation of a tentative valuation.

Taking up the question of original cost, Judge Helm deplored the efforts he thought the railroads had made to evade and conceal original cost. He held that whatever could not be found exactly by the records should be estimated. He contended that reproduction cost had been definitely rejected by the U. S. Supreme Court in the Minnesota rate case, that capitalization could not be the basis of value, and that original cost, therefore, was the only thing left, and all that should be considered. Like some of his confreres he thought reproduction cost was a useless figure, which would not have been called for if the Valuation Act had been passed after the handing down of the Minnesota decision.

Who Owns Railroad Land?

His discussion of reproduction cost was confined mainly to the item of land, in which he set forth the theory he had promulgated at the Philadelphia conference last November, that the railroad does not own its land, and that, whether the land was donated, acquired by condemnation or bought in fee simple, it must revert to the original owner if abandoned for railroad purposes. Commissioner Harlan of the federal board, possibly having in mind the man whose attorney told him he could not be put in jail, mentioned the fact that two terminals had been abandoned in the city of Washington, and that the land had been sold. This did not, however, cause Judge Helm to recede from his position as to the law.

To prove that the state commissions are right in their contention that accrued depreciation must be taken into account in reproduction cost less depreciation, Mr. Niles quoted from numerous decisions of the state commissions themselves. There appeared, however, to be much division of opinion, even in the decisions cited. In fact, as Mr. Brantley later pointed out, seemingly the main deduction to be derived was that the question of depreciation in the minds of courts and commissions is in a chaotic state.

Expenditures from Earnings

Mr. Aitchison argued for the detailed segregation of all expenditures for additions and betterments out of earnings or depreciation reserves, and for complete allocation of all details to the different states. Director Prouty asked whether the Division of Valuation must analyze the expenditure on each item of plant, to determine which parts were chargeable to other than capital, and also whether it was fair to credit Oregon with the full amount of an expenditure wholly in Oregon made from earnings in many states. Mr. Aitchison thought the allocation should be made "where feasible."

Mr. Shaw spoke on appreciation. He thought that subsidence, solidification and adaptation should in general not be allowed.

Senator Bristow spoke briefly on the question of whether or not the federal commission should report ultimate value. He held that to report this would be unfair to the framers of the Act, who, though disagreeing as to this ultimate value, had agreed to the desirability of assembling all the evidences of value.

Mr. Elmquist elaborated on the Minnesota theory of instantaneous reproduction, which takes into account only the so-called engineering reproduction of materials and labor, ignoring contingencies, interest and the like on the ground that there is no actual construction. This theory was commented on in the Engineering Record of Jan. 8, page 36.

The Railroads Reply

For the railroads Mr. Patterson insisted that they were in agreement with the states on many of the issues raised. He held that the carriers desired the recording of expenditures for additions and betterments made from earnings, surplus or depreciation reserves, and that they had never opposed the ascertaining of original cost, or relying within reason upon estimates. The carriers, he said, also recognize the importance of attaching the proper weights to the elements of value, and think this can await the completion of the inventories. Disagreeing with the Kansas view that they should remain silent until a tentative valuation has been presented by the Interstate Commerce Commission, he held that cooperation was imperative to prevent the duplication of large amounts of work.

Mr. Robinson commented on the fact that the state commissions had in the last year changed their views regarding overhead expenses in reproduction cost. He insisted that the Minnesota rate decision did not condemn reproduction cost, but only that particular presentation of it.

Depreciation Again

Speaking on appreciation and depreciation, Mr. Brantley mentioned, as previously stated, the diversity of views on the depreciation question even among the state commissions themselves, as revealed by the decisions read from Mr. Niles. He devoted himself mainly to the difficulty of applying mortality tables or any sort of theoretical treatment to such items of plant as equipment, the annual maintenance expense of which completely overshadows any depreciation reserve based on the original cost and probable life. He pointed out that the railroads had found it cheaper to rebuild an old car into a new type than to build new the identical new type, so that oftentimes little ramained ultimately of the old car except the number. He cited the case of a locomotive which cost $3,350 new, and when retired after forty-seven years had cost $138,000 to maintain. In other words, the annual maintenance charge had averaged about $3,000, as against a theoretical depreciation reserve of $163. Obsolescence, he asserted, had usually been the cause of the ultimate retirement of equipment, but he held that no man could predict continued development and enlargement that would ever render present-day equipment obsolete.

Mr. Butler closed the railroad argument by disputing Judge Helm's assertion that the same restrictions applied to railroad land held in fee simple as to that acquired by condemnation, and by challenging the states to show any defect in the methods contended for by the railroads in their briefs for determining the reproduction cost of land.

California Theory of Land Reproduction

The main arguments made by Mr. Thelen in summing up the states' case were stated in the second paragraph. In addition he took up Mr. Butler's challenge regarding land. He held that the figures of recent actual costs to which the railroads invite attention include overhead, severance and improvement charges, together with an added item for continuity and suitability of shape, and that this makes the figure practically what the Supreme Court rejected in the Minnesota decision—far above the normal market value which, he holds, is definitely established by this decision to be the maximum allowable. He conceded that until fairly recently the California commission had tried to determine reproduction cost in the railroad manner, but that it had at last perceived the error of its ways, and was now proceeding according to its new definition of reproduction cost quoted in the Engineering Record of Jan. 15, page 76—the blending of *value* of land with *cost* of all other items.

Papers at Meeting of Illinois Engineers Run Whole Gamut of Engineering

Activated Sludge, Road Oiling, Rising Chemical Costs, Ethics for Engineers in Public Office, Drainage and Erosion Claim Attention

A multiplicity of papers and a paucity of discussion for lack of time marked the joint meeting of the Illinois Society of Engineers and Surveyors and the Illinois section of the American Waterworks Association, held at Urbana, Jan. 25 to 28.

Activated sludge elicited one of the most spirited discussions. The favorable cold weather findings at Milwaukee, as announced by T. Chalkley Hatton, seem to indicate that this new process has now been placed on a sound basis.

B. H. Piepmeier of the State Highway Department rather startled the more conservative engineers by his prediction that state aid for oiling 1000 miles of road, much of which has no metal surfacing, would be forthcoming this season. No earth road is oiled, however, with state assistance unless it has first been graded and rolled. To get this preliminary foundation for a surfaced road was his justification for the state paying for a dust preventive.

Waterworks operators were astonished and dismayed at the recent enormous jump in calcium hypochlorite quotations from 2½ to 13 cents per pound, pictured by W. F. Monfort on charts with curves brought up to the day previous to the meeting.

That soil erosion is an engineer's problem and one demanding early action was forcibly portrayed by Benjamin Brooks.

Much dissatisfaction has been expressed recently over the fact that many engineers holding public office are doing an undue amount of consulting work. A committee of the engineering society will look into the ethics of the situation and the fees charged.

Water Purification

Water softening in Illinois is coming more and more to the front, and four of the dozen papers scheduled dealt with this phase of water purification. The new plant at Hinsdale, a wealthy suburb of Chicago, was described and costs given by C. B. Williams, consulting engineer. It is the first municipal softening plant in the state.

F. C. Amsbary announced the successful use of an auxiliary wash-water grid above the sand surface in the iron removal filters of the Champaign & Urbana Water Company.

W. R. Gelston gave results of a year's operation of the new Quincy filters, reporting them according to the New England Waterworks Association recommendations. The lime and iron process, which made Quincy famous, will soon replace alum as a coagulant to keep costs within reason.

Water supplies on lake vessels have been examined during the past season by H. P. Letton of the U. S. Marine Hospital, Chicago. He analyzed 1000 samples from 74 passenger boats. About 22 per cent conformed to the standards set by the government for interstate carriers. So far only stills and heating apparatus have provided a safe water. Experiments on ultra-violet ray outfits are under way.

A typhoid outbreak at the Old Salem Chautauqua was described by H. F. Ferguson. The bad-example conditions are probably duplicated elsewhere and engineers were reminded that it is their duty to look more carefully into summer resorts. L. A. Fritze, of Moline, stated that 4-oz. bottles of hypochlorite with instructions as to use were furnished on demand to residents leaving the city for summer resorts.

Costs of producing alum by the process used at Columbus, Ohio, were given in a letter from George A. Johnson, general manager of the Hoover Chemical Company.

F. B. Seeley presented data on the flow of water through submerged short pipes having inlets and outlets of various angles of divergence. This information is of value to designers of short lengths like wall thimbles, intakes and suction pipes.

Sewage and Its Treatment

A. C. Stanfield described the new sewage treatment plant at Pana, Ill., which has cast-iron scalloped-edged distributing troughs 6 in. apart over the trickling filter.

Lake Forest has remodeled a fourteen-year-old septic tank into a double-compartment tank at small cost, according to N. N. Campbell.

Discussion of Mr. Hatton's paper on activated sludge and that of Prof. Bartow and F. Mohlman on the same subject brought out the fact that over treatment may reduce the sludge content to as much as 7 per cent.

W. D. Gerber in the report of the standing committee on sewerage and sewage disposal detailed the financial restrictions of the special assessment laws as applied to treatment works. In consequence, there is too little money spent for plants in the state. His report, with recommendation to support legislation enabling cities to get sufficient funds, was referred to the legislative committee.

Roads and Pavements

"Street Maintenance," a paper by J. E. Smith, contained a deserving plea for engineers to lend their aid to educate the public in the engineering of street maintenance, a problem being far out-shadowed, he held, by the call for the extension of country highways.

The committee on roads and pavements, of which B. H. Piepmeier is chairman, reported that thirty counties in the state were talking bond issues and that there was a good prospect of votes being taken in at least eight counties. A state-wide bond issue is also being agitated. About 100 miles of roads have now received state aid. Of these 98 per cent are of brick or concrete. Concrete with unarmored joints, 25 to 33 ft. apart, is becoming popular in small villages. Two-course work is dying out. Some hydrated lime is being used, but many investigations ought still to be made.

A description of the behavior of concrete pavement on Neil Street, in Champaign, by F. C. Lohman, gave a good idea of what will happen when things like frost, too rapid mixing, too much water and clay in the aggregate are not given proper attention.

Society Affairs

The newly elected officers of the waterworks section are as follows: Chairman, Paul Hansen; vice-chairman, E. MacDonald; trustee, W. E. Lautz; secretary, Edward Bartow, Urbana.

A one-day fall meeting will be held in Moline, arrangements to be perfected with the Iowa section, so that a combined evening session may be held, probably in Davenport.

The Illinois Society of Engineers is the new name the engineers adopted. A committee on structural engineering was added to the list of standing committees. The idea is to form a nucleus for a section for the structural men. An effort may be made to bring the state drainage association and a contemplated highway association into the society as sections.

Appointment of a representative on a national committee to draw up specifications for laying drain tile, suggested by the American Society for Testing Materials, was authorized.

The officers elected for the ensuing year are Paul Hansen, president; W. D. Gerber, vice-president; A. B. McDaniels and J. W. Dappert, trustees, and E. E. R. Tratman, secretary.

Next year's meeting will be held in Chicago, probably in the rooms of the Western Society of Engineers.

Ask Railroad Commission to Value Spring Valley Properties

A valuation of Spring Valley Water Company's properties, needed by the city of San Francisco for storage and distribution purposes in connection with the development of the Hetch Hetchy supply, will be undertaken by the California Railroad Commission, it is reported, under authority vested in the commission by a recent amendment to the public utilities act. The property considered necessary for city use will be examined by the commission, which will fix the valuation.

News of Engineering Societies

The New England Waterworks Association will hold a meeting at the Hotel Brunswick, Boston, Feb. 9.

The Engineers' Club of Atlantic City, which was organized recently, will be located temporarily in the Guarantee Trust Building. Willis Gale is secretary.

The North Dakota Society of Engineers will hold its annual convention at Grand Forks Feb. 24 and 25. E. F. Chandler of University, N. D., is secretary.

The Western Society of Engineers will be addressed Feb. 7 by Richard T. Fox, superintendent of the Chicago Citizens' Street Cleaning Bureau, on "Intensive Street Cleaning Methods."

The Arkansas Engineering Society will hold its annual convention at Helena Feb. 22-23. W. J. Parks of Pine Bluff, the secretary, is planning a trip through the "Sunk Land" district for the visitors.

The Boston Society of Civil Engineers, in conjunction with the American Society of Mechanical Engineers and the American Institute of Electrical Engineers, will hold its annual banquet at the Boston City Club Feb. 8.

The Engineers' Club of Memphis elected the following officers at its annual meeting, held Jan. 12: President, C. K. Chapin; vice-president, A. L. Dabney; secretary-treasurer, C. C. Pashby; directors, H. N. Howe and J. H. Haylow.

The Southern California Association of Members of the American Society of Civil Engineers, Los Angeles, has elected the following officers for the ensuing year: William Mulholland, president; H. Hawgood, first vice-president; Louis C. Hill, second vice-president; W. K. Barnard, secretary, and Charles H. Lee as treasurer.

The Engineers' Society of Western Pennsylvania at Pittsburgh discussed "The Status of the Civil Engineer in the World and His Relation to Human Progress" at a meeting held Jan. 19. The following officers were installed: Samuel E. Duff, president; W. E. Snyder, vice-president; Dr. A. E. Frost, treasurer; H. D. Jones and W. E. Mott, directors.

The Mississippi Valley Terminal League will hold its second annual convention Feb. 16 at the Planters' Hotel in St. Louis. Prof. Julius Bonn, University of Munich, Germany, will speak on "International Trade." In the report of the secretary, C. F. Perry, Quincy, Ill., will be a tabulated statement of terminal work by various cities in the Mississippi Valley.

The Albany Society of Civil Engineers elected the following officers at its annual meeting, held in that city Jan. 25: President, Rupert Sturtevant; first vice-president, John E. Byron; second vice-president, Stephen B. Vernon; third vice-president, Roy G. Finch; secretary, Ernest G. Raynor; treasurer, Hortatio S. Mattimore; librarian, Wilber E. Anderson.

The Engineers and Architects' Association of Los Angeles held its annual dinner on Jan. 25 and elected the following officers: President, A. H. Koebig; first vice-president, Arthur S. Bent; second vice-president, Ira J. Francis; directors, H. L. Smith, J. J. Backus, George P. Robinson and A. C. Martin. Short talks were given by Samuel Storrow and A. B. Benton. A new organization known as the Engineers and Architects' Glee Club provided entertainment.

The Engineering Society of Wisconsin will hold its annual meeting at Madison Feb. 25 and 26. Special discussion is solicited on two topics, "Relation of Contractor and Engineer" and a paper by the mayor of Beloit on "Open Specifications." Some of the speakers who have promised papers are: A. C. Larson, chief engineer, Railroad Commission; F. G. Simmons, director public works, Milwaukee; W. F. Reichert, consulting engineer, Watertown; Prof. D. W. Mead; T. Chalkley Hatton, chief engineer, Milwaukee Sewerage Commission. L. S. Smith, Madison, is secretary.

Personal Notes

Warren A. Lyon, formerly connected with the city engineer's office at Syracuse, N. Y., is now connected with the city engineer's office at Schenectady.

Frank D. Cooner has been appointed transitman in the office of the engineer maintenance-of-way of the Pennsylvania Railroad. He was graduated from Pennsylvania State College in 1909.

W. A. Cattell, consulting engineer, of San Francisco, who has been in Honolulu appraising the properties of the Honolulu Rapid Transit & Land Company, has finished that work, and has been retained by the Oahu Railway & Land Company of Honolulu to make a valuation of its physical properties.

C. Frank Allen, for the past 30 years a member of the faculty of Massachusetts Institute of Technology, will retire at the close of the present academic year. Professor Allen was graduated from the institute in 1872 and, for the next six years, was engaged in work connected with the water and sewerage systems of various cities, including Boston, Newton, Mass., and Providence, R. I. In 1878 he went West and, from that year until 1885, with the exception of a year spent as chief engineer of the Las Vegas, N. Mex., was assistant engineer of the Atchison, Topeka and Santa Fé Railway. In addition to his studies as an engineer he took up the study of the law and was admitted to the Bar in New Mexico in 1885, and in Massachusetts in 1901. He was appointed assistant professor of railway engineering at Massachusetts Institute of Technology in 1887. Two years later he became associate professor, and, since 1896, he has been professor, always in the department of civil engineering. He is the author of a number of technical writings, among them being: "Railway Curves and Embankments," "Tables for Earth Computations" and "Field and Office Tables," the first-named of which has passed through many editions.

Frank V. Sherburne, formerly with the American Bridge Company at its Gary (Ind.) plant, has been appointed to a position on the engineering forces of the Worden-Allen Company, manufacturer of steel structures, of Milwaukee.

David S. Carll has retired from the office of general manager of the Capital Traction Company of Washington, D. C. He retains his office as vice-president, however, and will continue to serve on the board of directors.

Benjamin F. Cresson, chief engineer of the New Jersey State Board of Commerce and Navigation, has notified Governor Fielder that the survey of the route of the proposed ship canal across the state from the Delaware, at Bordentown, to Morgan, on Raritan Bay, has been completed.

Robert Gaw has been appointed town engineer of North Bergen, N. J.

E. W. Sayles has been reappointed city engineer of Watertown, N. Y.

William H. North has been appointed city engineer of Bellingham, Wash.

G. W. Buchholz, formerly chief engineer of the Northeastern Construction Company, has joined the staff of the Snare & Triest Company, contracting engineers, 233 Broadway, New York City.

J. L. Richmond, general contractor, who recently completed his contracts on the New York State Barge Canal, has opened offices at Louisa, Ky., and will bid on work in the South and Middle West.

Raymond Duer, formerly county highway engineer of Des Moines County, Iowa, has been appointed highway engineer for Van Buren County, Iowa.

J. R. Graham, superintendent of construction for James Kennedy, contractor, has been assigned to have charge of the construction of 29 miles of sanitary sewer for El Centro and Imperial, Cal., ranging in size from 8 in. to 33 in. The main sewer is for the purpose of taking the sewage from the two cities to about 6 miles north of Imperial and emptying it into the New River after it has passed through Imhoff tanks. About 8000 ft. of the work is in a 30-ft. cut, which will be excavated by steam shovel. Olmsted & Gillelen, consulting sanitary and hydraulic engineers, of Los Angeles, are engineers for the cities.

Charles E. Barba, formerly assistant engineer in the office of the mechanical engineer of the Pennsylvania Railroad Company at Altoona, Pa., has accepted a position with the Midvale Steel Company.

H. W. Bittman has been appointed structural engineer for the school department of Seattle, Wash.

E. N. Layfield, acting secretary of the Western Society of Engineers, was elected secretary of the new board of directors at its first meeting, Jan. 21. Previous to his present engagement, which began last spring, he maintained a consulting engineer's office, doing railroad work, for the last four years mainly with grade crossings and terminals at Chicago Heights, Houston, Tex., Chicago and Grand Rapids. Mr. Layfield entered the railway service in 1892 at the age of 20, being engaged in maintenance-of-way work and in charge of construction for the Pennsylvania between Philadelphia and Washington. From 1899 to 1911 he was with the Chicago Terminal Transfer Company, for six years being its chief engineer. In addition to his secretarial duties, he is president of the Board of Examiners of Structural Engineers for Illinois.

R. H. Thomson, former city engineer of Seattle, has been named by the Aberdeen (Wash.) City Council as consulting engineer on the Wishkah water project, which is being considered by that city.

Charles S. Henning has been appointed county engineer by the El Paso (Tex.) county commissioners. Mr. Henning commenced immediately checking up the grades and other preliminary work on the new county roads in Ysleta district.

Frederic Robert Harris, whose appointment as chief of the Bureau of Yards & Docks of the Navy Department was noted in these columns in the Jan. 22 issue, has been in the navy corps of civil engineers since 1903. His appointment, which entitles him to the title and privileges of a rear-admiral, makes him the youngest officer of that rank in the navy. His most conspicuous work in the service was the completion of the large drydock in the New York Navy Yard, after the Navy Department had seriously considered the abandonment of the project, due to the difficulties involved. In December, 1909, he was entrusted with special duty in charge of the construction of the dock. A few weeks later, after investigation, he urged upon the Navy Department the abandonment of the original design, and the adoption of a design which he proposed consisting of a comparatively shallow reinforced-concrete bottom, supported upon reinforced columns, which, in turn, were to act as anchors to resist flotation. The design was passed upon and approved for the contractors, Holbrook, Cabot & Rollins, Inc., by the late Alfred Noble. The drydock was in use for the docking of the U. S. S. Utah in May, 1912, which established a record for rapidity in construction. Admiral Harris was commended for this work by the Bureau of Yards & Docks and the Navy Department for "initiative, foresight and professional ability, conspicuous because of ingenuity and ability in conception of details, and energy in their execution." In 1913, he was entrusted with special duty by the Secretary of the Navy, and with Admiral Stanford, then chief of the bureau, he visited Pearl Harbor, Hawaii, to examine into the causes of the failure of the Pearl Harbor Drydock, then under construction. As a result he recommended the adoption of the method of construction involving the building in sections by sinking the floating caissons. Shortly thereafter the late Alfred Noble was engaged to visit Pearl Harbor. He indorsed the plan of construction proposed, and submitted two suggested developments of it. The plan now being followed was based on this method of construction on which patents were granted to Admiral Harris, but which was designed in detail by the Bureau of Yards & Docks and contains many ingenious and novel features.

Engineer, Who Completed New York Drydock, Appointed Chief of Navy's Bureau of Yards & Docks

Photo-Crafters, Phila.

FREDERIC ROBERT HARRIS

W. H. Cunningham, consulting engineer, of Huntington, W. Va., has moved his offices to the First National Bank Building in that city.

Edward B. Raiguel, formerly engaged in survey work at Huntington, W. Va., has joined the forces of W. H. Cunningham, consulting engineer, of that city.

Ray S. Blinn has resigned from the office of city engineer of Mount Vernon, Ohio, to become village manager of Westerville, Ohio. Mr. Blinn became city engineer of Mount Vernon five years ago, having succeeded Walter S. Anderson.

Julius Adler, formerly engineer of tests of the city of Philadelphia, has been appointed engineer of tests for the Pennsylvania State Highway Department. A brief outline of Mr. Adler's professional history was published in these columns Jan. 8.

F. A. Dunham and David X. Clarin have become associated under the firm name of F. A. Dunham-Clarin Company, Inc., 109 Park Avenue, Plainfield, N. J., to continue the civil engineering and surveying practice that has been conducted by Mr. Dunham for the past forty-two years. Mr. Clarin has been connected with Mr. Dunham for the past seven years. The firm specializes in surveys, municipal engineering, topography and city and county developments.

Harry C. McClure, formerly chief engineer in charge of design and construction for the department of architecture of the Board of Education of Toledo, Ohio, has been appointed city engineer of that city. Mr. McClure received degrees in civil engineering from the universities of Kansas and Michigan, and first engaged in engineering work in 1907 in the city engineer's office at Kansas City. Later he served as draftsman and instrumentman in the maintenance-of-way department of the Frisco Railway at Monett, Mo. In the early part of 1909 he was with Prof. W. C. Hood, then state sanitary engineer of Kansas. In June of that year he became connected with the Riggs & Sherman Company, consulting engineers, of Toledo, and was later detailed as inspector on the Toledo Shipbuilding Company's 100 x 700-ft. concrete drydock. He joined the forces of the Board of Education of the city in 1910 as assistant engineer on design and rose through various grades to the position of chief engineer. During the period he had charge of the structural design of schools to a value of $1,125,000 and of construction to a value of about $2,250,000.

Robert W. Boyd, consulting engineer, of New York City, has moved his offices to the Singer Building, 149 Broadway, New York City.

John T. Gephart, Jr., has resigned as engineer of construction for the Pennsylvania State Highway Department to become consulting engineer of Fayette County, Pa. Mr. Gephart received his professional education at Western University of Pennsylvania and Pennsylvania State College. In 1901 he entered the construction department of the Pennsylvania Railroad in charge of surveys for the construction of the approaches to the Altoona gravity yard, one-half the low grade freight line over the Allegheny Mountains and the double track of the Petersburg Branch from Carlim to Petersburg. Later he was transferred to Lancaster in charge of the surveys and construction of the low grade freight line from Columbia to Shock's Mills, which position he was filling at the time he resigned to enter the State Highway Department as assistant engineer under Joseph W. Hunter, then state highway commissioner. In 1913 he was appointed construction engineer and was placed in charge of all construction work in the state. During the past summer, in the emergency created by a vacancy in district 5, Mr. Gephart assumed temporary charge of the district, meanwhile continuing his work as construction engineer. He continued in charge of the district until Jan. 1 of the present year.

Henry C. Vollmer, formerly city engineer of Burlington, Iowa, has been appointed city manager of Webster City, Iowa. Mr. Vollmer was graduated from the University of Iowa in 1908, and was engaged from then until 1910 in the office of the city engineer of Bozeman, Mont., and as county, bridge and drainage engineer of Grady County, Okla., at Chickasha. He was appointed city engineer of Burlington in April of the latter year.

B. L. Dorman has been reappointed city engineer of Vancouver, Wash.

C. L. Douthett, formerly assistant city engineer of Oelwein, Iowa, has been appointed assistant engineer for Vermilion County, Illinois, in connection with the bonded roads the county contemplates building. Mr. Douthett was graduated from Rose Polytechnic Institute in 1909.

Morse W. Rew has been appointed first assistant to Frank S. Krug, chief engineer of the Cincinnati Rapid Transit Commission. He will have charge of important branches of the construction work of the proposed new rapid transit loop for Cincinnati, particularly the building of the subway portion. Mr. Rew is a graduate of Massachusetts Institute of Technology, and was associated with Prof. George F. Swain in the construction of the Boston subway. Later he was connected with the building of the subways in New York City.

James W. Reagan, flood control engineer of Los Angeles County, California, has been appointed county engineer of that county. It will be his duty to carry out the preliminary work for the flood control project, for which a bond issue of approximately $3,600,000 will be submitted to the voters. Mr. Reagan has been serving the county under the title of flood control engineer, but, under the law creating the position, no provision was made for funds for office organizations and for preliminary work, although the position carried a salary. As flood control engineer he will receive a salary, and he will serve also as county engineer, but without salary. Under the new conditions funds are provided to carry on the necessary work preparatory to a bond election.

H. H. Barter, formerly director of works at the Panama-California Exposition, has been appointed head of the technical department of the Universal Film Manufacturing Company at Universal City, Cal. Mr. Barter received his professional education at the University of California, and was engaged for some time on railroad work in the State of Washington and in Alaska. Later he was connected with the Stone & Webster Engineering Corporation, of Boston, for a period of seven years, on the construction of steam and hydroelectric power plants. He left this service to go to the exposition work.

D. C. Sherman and L. J. Lichtenstetter have organized the firm of Lichtenstetter & Sherman, James Building, Chattanooga, Tenn., to engage in business as engineers and sales agents for structural steel, fireproofing, tanks, etc.

George Hogarth, formerly assistant engineer of the Department of Public Works of Ontario, Canada, has been appointed chief engineer of the Department of Highways of that province.

Otis F. Clapp resigned from the office of first assistant to the city engineer of Providence, R. I., Feb. 1, after fifty years in the city's service. As a member of the force of Shedd & Edson, consulting engineers, of Boston, Mr. Clapp went to Providence in 1866, in charge of a party on the preliminary surveys for the municipal waterworks then projected in that city. In 1872 he was placed in charge of the preparation of plans for the sewage disposal system, and in 1897, he succeeded the late J. Herbert Shedd as city engineer. He held this post until the spring of last year when he was replaced and appointed first assistant to the city engineer.

H. K. Barrows and C. B. Breed have dissolved the partnership heretofore existing under the name of Barrows & Breed, consulting engineers, of Boston. They will continue to occupy joint offices, however, at 6 Beacon Street, Boston. Mr. Barrows will continue in practice as consulting hydraulic engineer, giving special attention to water power, water supply and sewerage. Mr. Breed will continue practicing as consulting engineer, specializing in railroad, structural and municipal projects.

Charles E. Jenkins, formerly engineer maintenance-of-way of the Easton Transit Company, of Easton, Pa., has been appointed chief engineer of the Lehigh Valley Transit Company, succeeding W. W. Wysor. Mr. Jenkins first engaged in engineering work in 1896 as chainman for the town engineer of Franklin, N. J. From 1898 to 1903 he was with various consulting engineers. In the latter year he was appointed a transitman on the Long Island Railroad in which position he remained until 1904 when he became assistant city engineer of Easton, Pa. He later entered the service of the Easton Transit Company and, in 1908, was appointed engineer of ways and structures.

Joseph M. Tracy, formerly assistant city engineer of Ogden, Utah, has been appointed city engineer, succeeding Washington Jenkins. The position of assistant city engineer has been abolished.

Stacy S. Rumpleton, consulting engineer, of Binghamton, N. Y., has been appointed municipal engineer of Johnson City, N. Y.

H. S. Everhart, formerly junior partner of N. L. Everhart & Son, architects and contractors, of Greenfield, Ohio, is at present connected with the Kansas City Structural Steel Company.

Revoe C. Briggs has resigned from the U. S. Coast and Geodetic Survey to take up graduate work in the engineering department of Stanford University. He will also serve as field assistant in the department.

F. C. Clark has resigned from his position as superintendent of the Pacific Locks of the Panama Canal.

S. M. Morse has been appointed assistant engineer for the Commonwealth Mining & Milling Company at Pearce, Ariz.

H. B. Miller, consulting mining engineer and geologist, of Pittsburgh, is engaged in the prospecting of two tracts of coal near Grove City, Pa. The seam is 3 or 4 ft. in thickness, and has an overburden, or cover, of from 15 to 45 ft. If the investigation shows that such development is warranted, it is proposed to open up stripping operations and remove the overburden either with steam or electric shovels. It is believed that this is the only stripping territory in western Pennsylvania.

John Le Tourneux has resigned from the office of city engineer of Neenah, Wis.

Henry H. Quimby has been reappointed chief engineer of the Department of City Transit of Philadelphia.

Carl S. Donaldson has been reappointed city engineer of Beaver Falls, Pa.

J. M. Meade has been appointed special engineer for the Atchison, Topeka & Santa Fé Railway at Topeka, Kan.

Hugo Shaefer, formerly master mechanic of the Pecos division of the Atchison, Topeka & Santa Fé Railway, has been appointed pilot engineer in the valuation department.

N. B. Walkem, formerly resident engineer of the Canadian Pacific Railway at Nelson, B. C., has been appointed assistant engineer, and attached to the division engineer's office at Vancouver.

H. G. Barber, formerly assistant engineer on the construction of Rogers Pass tunnel, has been appointed resident engineer for the Canadian Pacific at Nelson, B. C.

S. M. Cotten, formerly connected with the office of the chief engineer of the Arizona Eastern Railroad on revaluation work at Tucson, Ariz., has been appointed to a position in the newly organized valuation department of the Texas & Pacific Railway at Dallas, Tex. Mr. Cotten received his professional education at the Agricultural and Mechanical College of Texas, and has been engaged in active practice since 1909, principally on railroad and reclamation work.

C. J. Callahan, formerly with the New York State Public Service Commission, First District, has been appointed construction engineer on the forces of John T. Scully, Inc., contractors, of Boston, Mass.

Obituary Notes

Matthew Gage, builder of the Gage canal and irrigation system which waters one of the choicest orange districts in California, near Arlington, died at Riverside, Jan. 22. He was born in 1844 and went to Southern California in 1881. The country where Riverside and Arlington now stand was then practically a desert. Foreseeing the possibilities of irrigation, Mr. Gage set out to develop water. With little money he bought up old water rights on the Santa Ana River, purchased a tract of land below his source of supply, sank artesian wells and began the construction of a canal system. Within one year he had completed the first 12 miles, and, eventually, all of it without the sale of stock or land. With the idea of interesting capitalists in further development he organized the Riverside Trust Company. This resulted in the laying out of Arlington Heights, and the planting of orange groves now valued in millions.

Frank D. Gould, senior partner of Gould & Sons, general contractors, of Omaha, Neb., died Jan. 24. He was sixty-two years old.

W. H. Davis, superintendent of repairs in the highway department of Jacksonville, Fla., died in that city, Jan. 26.

William B. Ruggles, head of the Ruggles-Coles Engineering Company, of New York City, died at Bergen Point, N. J., Jan. 23. Mr. Ruggles received his education at Cornell University, and was, for more than twenty years, engaged in engineering work in New York City. Recently he was engaged as engineering adviser to the Russian Government. He was fifty-four years old.

William W. Mills, retired civil engineer, who was identified with the building of the original New York City subways, died, at Pasadena, Cal., Jan. 25. He was seventy years old.

Frank M. Baker, formerly a member of the New York State Railroad Commission, died at Owego, N. Y., Jan. 22.

Griffith D. Walters, chief agricultural engineer of the Irrigation Branch, Canadian Department of the Interior, died in Calgary, Alberta, after a brief illness. Mr. Walters was born in Wales in 1884. He received the degree of B. S. in civil and irrigation engineering in the Colorado Agricultural College in 1911, and, during the following year, was assistant in irrigation investigations there, under V. M. Cone. In 1913 he was engaged to take charge of the duty of water investigations for the Canadian Government under F. H. Peters, commissioner of irrigation. He was, at the time of his death, chief agricultural engineer, Irrigation Branch, Department of the Interior.

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The Center of the Stage

NEXT week the concrete cohorts will meet in Chicago, drawn thither by the Second National Conference on Concrete Road Building, the Cement Show and the convention of the American Concrete Institute. It will be an extraordinary opportunity to get in touch with those whose thoughts and work deal with concrete, to learn of the latest ideas in organization, plant and methods. If the concrete road conference repeats the success of two years ago, it alone will be worth the expense and sacrifice of attendance, no matter how great they may be. The Cement Show has long since established itself with engineers and contractors alike and can be counted on to deliver full value. The concrete institute presents an extraordinarily good program, despite the vicissitudes it has passed through. While not generally known, the institute's fate—whether it will live or pass out of existence—will probably be decided at Chicago, or at least will be determined as a result of interest or lack of interest there displayed. The institute has been on the verge of extinction before, but the present crisis seems to be the most severe. It will be a serious loss if the organization must be abandoned—not indeed a loss if compared with recent performance, but a loss of a great opportunity that was and still may be made available. Altogether, then, the week is a most important one to the contractor and the engineer interested in concrete. Much good will come of it, even if no way is found to put the institute on a permanent basis.

A Cement Issue

AS NOTED in the preceding paragraph, the leading topic of interest in the engineering world next week will be concrete —the loadstone which will attract engineers and contractors to Chicago. Conforming with the spirit of the coming week, this issue is devoted to descriptions of some important concrete work. Mr. Breed's story on a very unusual concrete-road building plant, Mr. Poole's description of the largest Imhoff sewage plant in the United States, and the quay-wall design at Halifax will be found of special interest.

Condemnation of Water Power

LATE last month the Supreme Court of the United States handed down a decision relative to the condemnation, under state law, of water power in Alabama. The contention of those opposing the condemnation was that it contravened the fourteenth amendment of the Constitution. The Supreme Court holds that such is not the case. On the main question raised, that the purpose of the condemnation was not a public one, the court declares: "In the organic relations of modern society it may sometimes be hard to draw the line that is supposed to limit the authority of the legislature to exercise or delegate the power of eminent domain. But to gather the streams and rivers from waste and draw from them energy, and so to save mankind from toil that it can be spared, is to supply what, next to intellect, is the very foundation of all our achievements and all our welfare. If that purpose is not public we should be at a loss to say what is." The decision plainly ends any dispute as to the right of states to pass statutes permitting the condemnation of lands, water and water rights for the purposes of power development.

Minnesota Rate Decision—A Panacea

WHEREVER valuation is discussed, whatever the phase, whatever the side argued, it seems that the Minnesota rate decision proves the point. To the state commissions it proves that no more than the market value of land can be allowed as present value. To the railroads it proves only that pyramided multiples and percentages are taboo. To the state commissions it shows that reproduction cost is no longer to be seriously entertained. To the railroads it shows this to be the main basis of value. The most innocent expressions are made to mean as many things as there are views. For instance the word "assuming," as in the clause, "Assuming that the company is entitled to a reasonable share in the general prosperity of the communities which it serves," the railroads interpret to mean "assuming"—just what it says. The state commissions, however, find that it means "If it were, but it is not." Verily it is about time to concede that the Minnesota rate decision settled immutably the Minnesota rate case and little else, and take up the discussion of reproduction cost from the simple standpoint of right and wrong.

Halifax Quay Wall

AS A RESULT of thorough study of the local conditions at Halifax and of the works at other ports, the engineers responsible for the new ocean terminal at the Canadian city have developed something unique in quay-wall design. This could have been expected from the exhaustive comparative studies which were made. A description of them will be found on page 213 of this issue. The Halifax wall combines the advantages of the solid concrete-block with the rubble and mass-concrete types. This is evident from the stability of the completed structure and from the rapidity and success achieved in construction. The square reinforced-concrete guide columns; the use of open compartments and spaces between the blocks, to be filled after they are in position with either mass concrete or rubble; the grout holes to bond the blocks; and the use of a cut-stone retaining wall at the top between high and low-water levels, to prevent disintegration, are all evidences of the thoroughness of the work of the designers. The use of corner stools of carefully leveled concrete, prepared under a diving bell, to avoid the necessity of leveling the whole rock bottom, is one of the simple and effective features which resulted in great saving in time and cost. Engineers interested in the quay-wall design will find many suggestions both in the article in this issue and in the one on construction methods, published on page 143 of the issue of Jan. 29.

A Plea for an Open Mind

AS WAS to be expected, the plan to move the headquarters of the American Society of Civil Engineers to the Engineering Societies Building is already being widely discussed. It is to be hoped, for the good of the society and of the profession, that every phase of the question will be carefully reviewed. Yet there may be some who will close their minds and vote without giving the matter careful thought. One such was encountered by the Engineering Record early this week—an engineer of ability, who in this matter, has not displayed the fairness for which he is noted. Upon being asked his views on the advisability of the change in headquarters, he stated that he had opposed the removal thirteen years ago, was opposed to it now and had cast his ballot negatively immediately upon its receipt, lest someone might persuade him to vote in favor of the proposal. He went on to say that the American Society of Civil Engineers was sufficient unto itself—had all the money it needed and a good building where it could meet as it would. Upon protest that this was a selfish point of view and gave no thought to the possible advantages to the profession at large, he admitted without a quiver that such was the case. The Engineering Record trusts that there are not many who take the same attitude, and it submits that those who do are out of harmony with the spirit which induced the board of direction of the society to submit the proposal again to the membership. The resubmission necessarily implies that there is new evidence, that the situation is sufficiently different now from what it was thirteen years ago to warrant careful reconsideration by the members of the society. Certainly the least that any member can do is to consider the proposal carefully and with an open mind before casting his ballot.

Park Lands and Engineers

TWO Eastern cities are at present the scenes of controveries over the invasion of park lands by engineering structures. In Washington objection is being made to the location of a central heating and power plant near the Mall and in the neighborhood of the Washington Monument, while in New York there is strenuous protest against a pumping plant being erected by the Board of Water Supply in Morningside Park. In Washington not only architects but engineers as well have appealed to the authorities to change the site. At New York, so far, only taxpayers, real estate interests and the newspapers are advancing arguments against the use of the park property. Engineers generally, we have no doubt, are in hearty sympathy with the general principle prompting the present protests, namely, that park property—land set aside for the refreshment of the people and for recreation purposes—should not lightly be devoted to any other ends. The Washington case seems to be particularly flagrant. In the New York situation we have the assurance of the chairman of the Board of Water Supply that the engineers have considered and rejected alternative designs, but his statement is not convincing. A careful presentation of the situation by the engineers, with a full explanation of the alternatives considered and the reasons for their rejection, is a necessary step in settling the controversy to the satisfaction of the citizens. Both situations involve engineering structures, and it is but right that engineers should take an interest in securing a correct ultimate solution. If weighing of all factors shows that the Catskill structure can be placed nowhere else and cannot be put underground public necessity justifies the park site.

Port Development

TWO MAIN arguments concerning port development were put forth in the address of Fairfax Harrison, abstracted on page 209, at the recent Foreign Trade Convention in New Orleans. One is the fairly familiar one that ports should develop and administer their own facilities and collect from the traffic instead of from the railroads. The other is the rather new doctrine that we should concentrate on a few selected ports. The arguments for putting the responsibility for the terminal facilities on the port itself are many and strong. Their presentation by a railroad man seems to indicate a change of viewpoint since the day when each road felt it necessary to provide exclusive facilities better than those of any of its competitors. It is well that the railroads are coming to see the folly of this costly duplication of plant. As to the selecting of a few ports for development, while this would undoubtedly make for economy, it seems too Utopian to be realized. What ambitious port with a tolerable harbor and pier or two would forego its efforts to expand merely because a neighboring place was better equipped? Mr. Harrison implies, of course, that the railroads could force the situation if they were allowed to discriminate in favor of those ports best suited to their needs—or, from their point of view perhaps, to cease discriminating in favor of the weaker ports. If they were given more liberty here, however, the next logical step would be to extend the policy to the inland communities. The Engineering Record does not say that they should not be given more license in this respect. But the question is one involving the whole rate structure and the theory of rates; abuses are easily possible if a free rein is given, and it does not appear that public sentiment will allow it in this generation.

Part of Original Cost

SPEAKING for the state public service commissions at the recent valuation conference in Washington, W. A. Shaw of the Illinois commission—unintentionally, of course—gave an excellent argument against original cost as a basis for value. He stated that after a railroad is opened for traffic the work of putting the line into the best operating condition, widening ditches, trimming shoulders and the like has generally been done by the maintenance forces and charged to operating expenses. This is perfectly true—and it is equally true that the expense is part of original cost. Ergo, the original cost indicated by the books, which take no account of this item, is not original cost at all. The misgivings of the railroads on the subject of original cost are probably not so much on the score of the figures for the main items of construction, which either do or do not exist, as on account of the myriad of comparatively small items for finishing the original construction and making the gradual improvements that have been going on ever since. Probably the existence itself of many of these items will never be known. It does not meet the case at all to say that whatever these expenses were they were charged to operation, and that to add them to value would be to charge the consumer twice for the same thing. Naturally expenses must be paid somehow, if there is any money anywhere to pay them. The fact that in the old days, when accounting rules were loose, additions and betterments were paid for out of income, does not by any means prove that income could afford to pay for them and still yield a reasonable profit.

Concentration of Water-Power Control

THE BUGABOO of a water-power trust has been raised again by the publication of the report, submitted to the Senate by the Secretary of Agriculture, showing the relations of the companies owning water power in the United States. The report was briefly abstracted in the last issue of the Engineering Record, page 192. From various quarters have come expressions of fear that the people of the United States either now or later are to be at the mercy of the octopus. Granting that eighteen corporations control more than one-half of the total water power used in public-service operations in this country, and that six corporations control more than one-quarter, what need is there for alarm so long as the state utility commissions have control over the rates. In other words, no matter how extensive the monopoly, the return to it from the ownership of the water powers remains in control of the people. Such is not the case, of course, where the entire power produced at a particular point is used by a single corporation for industrial purposes. Yet it is not these powers that are discussed in the report in question.

That the report itself recognizes the advantage of monopoly is apparent from the following passage:

"Monopolization of the supply in any given territory makes possible, through interconnections of stations and through diversification of load, economies of operation that would not be possible for isolated independent stations. Interruptions to service may be lessened, the needs of the customer may be better served and rates may be lower with a single power system than with several. No better service is given and no lower rates charged than in California, where, notwithstanding the considerable municipal developments, 90 per cent of the total primary power is used by public-service corporations, or in Montana, where 89 per cent is owned by two affiliated corporations. Having the ability to give the better service and the lower rate, it only remains for the proper public agency to require it."

It is right here that the case of the agitators who hold up the water-power trust bugaboo falls to pieces, because the proper public agency to require reasonable rates is already provided in the various public-service commissions which now regulate electric utilities in all but fifteen states.

Centralized Control Over River Pollution

IN his recent address before the Michigan Engineering Society Prof. Earle B. Phelps, of the U. S. Public Health Service, speaking of the work of the International Joint Commission, decried the current practice of making the control of river pollution a state, rather than a federal, obligation. There has resulted from this condition, he said, many divergent, unrelated and even conflicting laws and court decisions, and a variety of practices in the various states, ranging from the most stringent laws and control to a complete disregard of the whole subject. Were single state jurisdictions coextensive with the principal river systems of the country each state would doubtless work out its problems to its own best interests. Unfortunately quite the reverse is true and all of the more important river systems, of the eastern half of the country at least, are either interstate or flow from one state into another. In addition we have as an international boundary on the north our greatest of inland water systems, the Great Lakes and their connecting rivers. This situation has been by far the most potent factor in our disregard of the problems of stream sanitation, leading to the present unsatisfactory conditions in many of our most valuable streams.

With the present system of regulation it is natural that there has grown up the feeling that, in case of interstate streams, local effort is of no avail. There being no medium of communication and agreement between states in such matters, a do-nothing policy has in most cases prevailed. The interstate character of its two principal streams has, in the case of Massachusetts, even been made the excuse for exempting those two rivers from the workings of an otherwise excellent system of stream control. Upon the plea that these rivers enter the state somewhat polluted, the state permits unlimited and harmful pollution within its borders to the detriment of its own people. In the central states the presence of the great interstate rivers has either discouraged legislation altogether or induced a tacit understanding that these rivers are exempted.

The question of our international waters might appear to be even more complicated, but fortunately in this case the treaty-making powers of the governments have provided a possible remedy and one which is not without significance. It is probable, therefore, that when the International Joint Commission finishes its work, there will be available concrete evidence of the desirability of centralized control which can be used to advantage to improve conditions as they now exist.

Fallacies Regarding the Crystallization of Steel

AMONG the Letters to the Editor in last week's issue is one which disagrees with the editorial on the subject of the crystallization of steel in The Engineering Record of Jan. 8, page 35. The alleged "evidence" adduced in the letter is of too general a nature for acceptance in support of the theory of the cold crystallization of steel under service conditions. That theory, which has so long served as a scapegoat for so-called mysterious failures of steel, flatly assumes that, because the fractures in such cases commonly exhibit a crystalline structure, the material has been reduced to that state under repetitive stress, with accompanying vibrations, the latter being usually designated more or less vaguely as the active agent in producing the alleged deterioration.

If this scapegoat theory is not in reality a mere bug-bear, it is high time that its validity should be established in a convincing way. From the present lack of affirmative evidence it may be fairly held that this so-called theory is purely chimerical, nor do the facts recited by our correspondent suffice to alter that position.

His observations and deductions, briefly summarized, are that certain steel studbolts which had been screwed into the outside sheets of steam locomotives could be knocked off, in the case of old boilers, by a single blow from a hand hammer. The fact that these bolts could be thus broken off is advanced as proof of their brittleness, and the circumstance that the fractures exhibited always a crystalline structure is offered inferentially as evidence of their having crystallized in service. Incidentally, the correspondent calls attention to the fact that these bolts had been subjected "to great variations in temperature and to extreme vibrations," this statement being obviously too indefinite to admit of critical deductions. Again, such pertinent matters as the character of the steel, the size of the bolts, the weight of the hammer and the height of the swing are not mentioned.

That the crystalline structure of steel and its ductile properties may be changed, within wide limits, by the familiar processes of tempering and annealing, and that such changes may be brought about under abnormal and very exceptional service conditions, wherein the material is exposed to peculiar heating and cooling influences, is, of course, not to be questioned. That consideration has, however, no bearing, direct or indirect, on the so-called theory of cold crystallization of steel, to which the editorial excepted to is addressed.

A steel bolt, ruptured in the screw threads under the blow of a hammer, will invariably show a crystalline structure, so that the latter is in no way indicative of deterioration. It is a well-known fact that if a V-shaped notch be cut in a steel bar, and the bar be broken in bending by means of a sledge hammer, with the notch on the tensile side of the beam, the fracture will be crystalline.

Again, if a sharp V-shaped notch be turned in a bar of soft steel, and, if the latter be broken in tension at this notch, under gradually applied loading, the structure will also be crystalline; whereas, if the same bar be broken, under like conditions, in the ungrooved parts, the structure will show the silk or finely granular texture characteristic of normal steel as ordinarily tested. The explanation lies in the fact that, in the former case, the stresses are localized by the groove, and no opportunity is given for the material to draw out gradually, as in the latter case.

It is to be confidently assumed that, unless the temperature conditions vaguely referred to by our correspondent were of such a pronounced character as to change the crystalline structure of the metal, the bolts in their original state would have shown the same behavior and given precisely the same indications as in their final state, as described in the letter. It may at least be said with entire safety that his contention remains *unproved.* His observations are, indeed, on a par with others that have frequently been reported, and to which the origin and persistency of the theory of cold crystallization of steel is directly attributable.

It is, perhaps, unnecessary to point out that this discussion has no bearing whatever on the question of the progressive fracture of steel under repetitive loading, commonly referred to as "fatigue," but attention may again be directed to the fact that investigations in that field do not give evidence of changes in the crystalline structure of the steel, save in the immediate vicinity of the fracture, due to the shear slips in the crystals.

To sum up, there exists, it is believed, no evidence that stresses, accompanied by vibrations of the members subjected to these stresses, but not by temperature influences, will affect the crystalline structure of steel, although it is doubtless true that, if the amplitude of the vibrations and their frequency are such as to induce conditions of stress similar to those which would eventually cause failure under repetitive loading, such failure may also be expected to occur under the former conditions, unaccompanied, however, in either case, by changes in the crystalline structure of the material, save in the region of fracture.

A Word of Thanks and a Pledge

THE ANNOUNCEMENT on the front cover of this issue of an increase in the subscription rate of the Engineering Record makes opportune a word of thanks from the editors to the engineering profession and to contractors for the generous support they have received. The contemplation of the Engineering Record's progress during the past thirteen years cannot but bring a feeling of satisfaction to those who have guided its policy, even as it daily elicits unstinted praise from readers. The improvement of the paper, in the last analysis, is attributable, first, to the ideals set up when the property was acquired thirteen years ago, and, second, to the confidence of the publishers that American engineers and contractors would warmly support a journal of the type planned. The publishers wanted a paper that should be broadly professional, and not merely technical; that would be vigorous and fearless editorially; that in virility, resourcefulness and energy would be typical of the clientele it was designed to serve. The plans, therefore, provided for a paper that should expand in any direction that promised better service to the field, that should be of as great value to the contractor as to the engineer, that should be accurate and timely in reporting engineering and contracting news, that should, in a word, set the pace and the standard of American engineering journalism. That the field has approved of this type of journal is clearly shown by the growth in circulation from 3000 in 1903 to 20,000 in 1916.

But while the development was going on, and during the past five years in particular, it has been appreciated that the subscription rate would have to be raised. It was merely a matter of time when the change should come, and the present year, with business on the upward grade, seems opportune. The publishers announce the increase with full confidence that its justification will be seen by engineers and contractors, and that the response will indicate that the publishers were right when they determined thirteen years ago to set new standards in engineering journalism.

To those who have watched the Engineering Record's progress, a word as to the future is entirely unnecessary. They know that it will continue in the forefront, that it can be counted on to lead in service to the engineer and contractor. The publishers, nevertheless, are glad to pledge themselves to a continuance of the policies that have brought the Engineering Record to its present high place. The leadership that has been won will be maintained.

FINISHED PAVEMENT SHOWING LINES MADE BY BROOMING

Concrete Road-Building Methods Yield Profits in Cash Instead of in Plant

Contractor Reduces Labor Costs by Mechanical Handling of Materials Used on New York State Highway Section

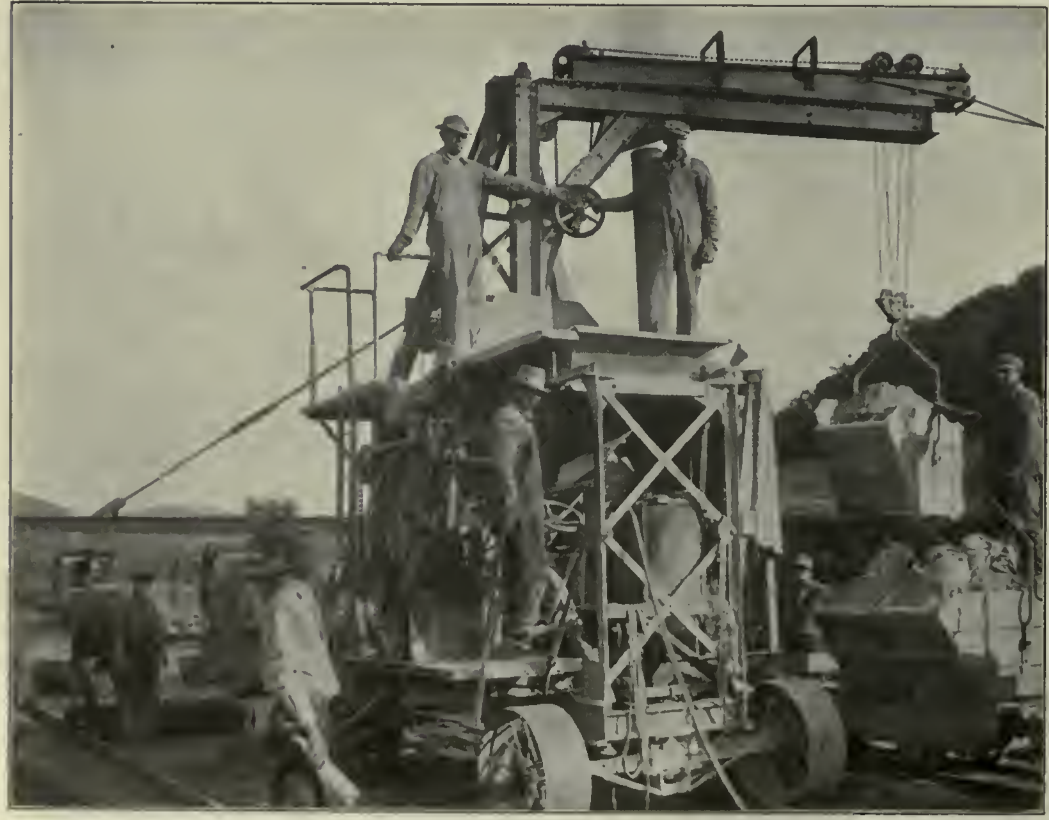
By H. E. BREED
First Deputy Commissioner, New York State Highway Department

PROFITS in cash, instead of in plant, were realized by the contractor on the Little Valley-Cattaraugus concrete road of the New York State highway system, where the problem of machinery versus labor was solved by economical methods of handling material. Three distinct advantages for the contractor can be summed up in this piece of work. His plant is the kind in common use and can be procured easily new or second-hand, or ofttimes rented. Being in general usage, it has higher salvage value than average plant and therefore larger margin for cash profits. And lastly it materially reduces man labor, strikes and other industrial troubles. The substitution of machinery for man labor progresses the work more rapidly, which is of distinct advantage both to contractor and public at large.

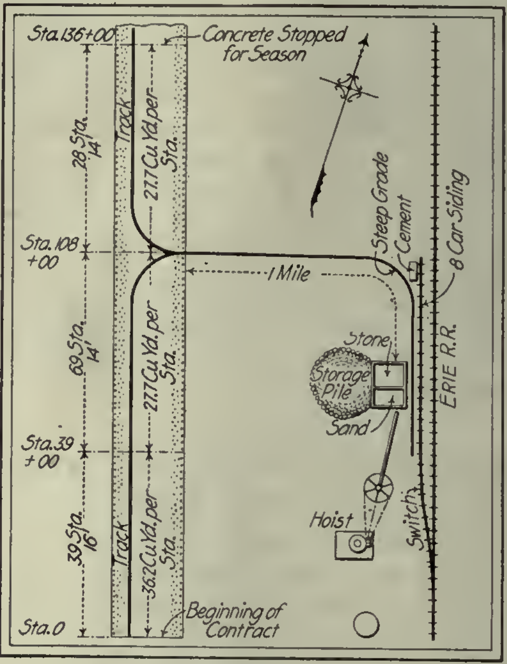
MACHINERY VERSUS MEN

During the past year the quality and quantity of labor has decreased for several reasons. The European war has checked immigration and withdrawn many of our laborers. The manufacture of munitions and the great output in the steel and mining industries have demanded large forces. With the adjustment of monetary conditions has come an increase of development and improvement work that has well-nigh exhausted the available supply of men. In order to cope with this scanty, risky and rising labor market, it has become necessary for those who, in competing for work, would allow themselves a reasonable margin of profit, to lessen the need of man power by substituting for it other methods of construction.

While the efficiency of labor has lessened, that of equipment has increased. Obviously the contractor must depend more and more upon machinery, but in this transition to a new form of construction he will consider several things. Can his ingenuity devise some means of cheapening the work that other competitors will overlook? How much will he save? Will his profits be real or plant profits? In other words, will he have actual cash or only increased plant to show for his work when it is done?



BOOM ON MIXING PLANT PICKING UP WOODEN BUCKET ON WHICH CEMENT HAS BEEN PLACED

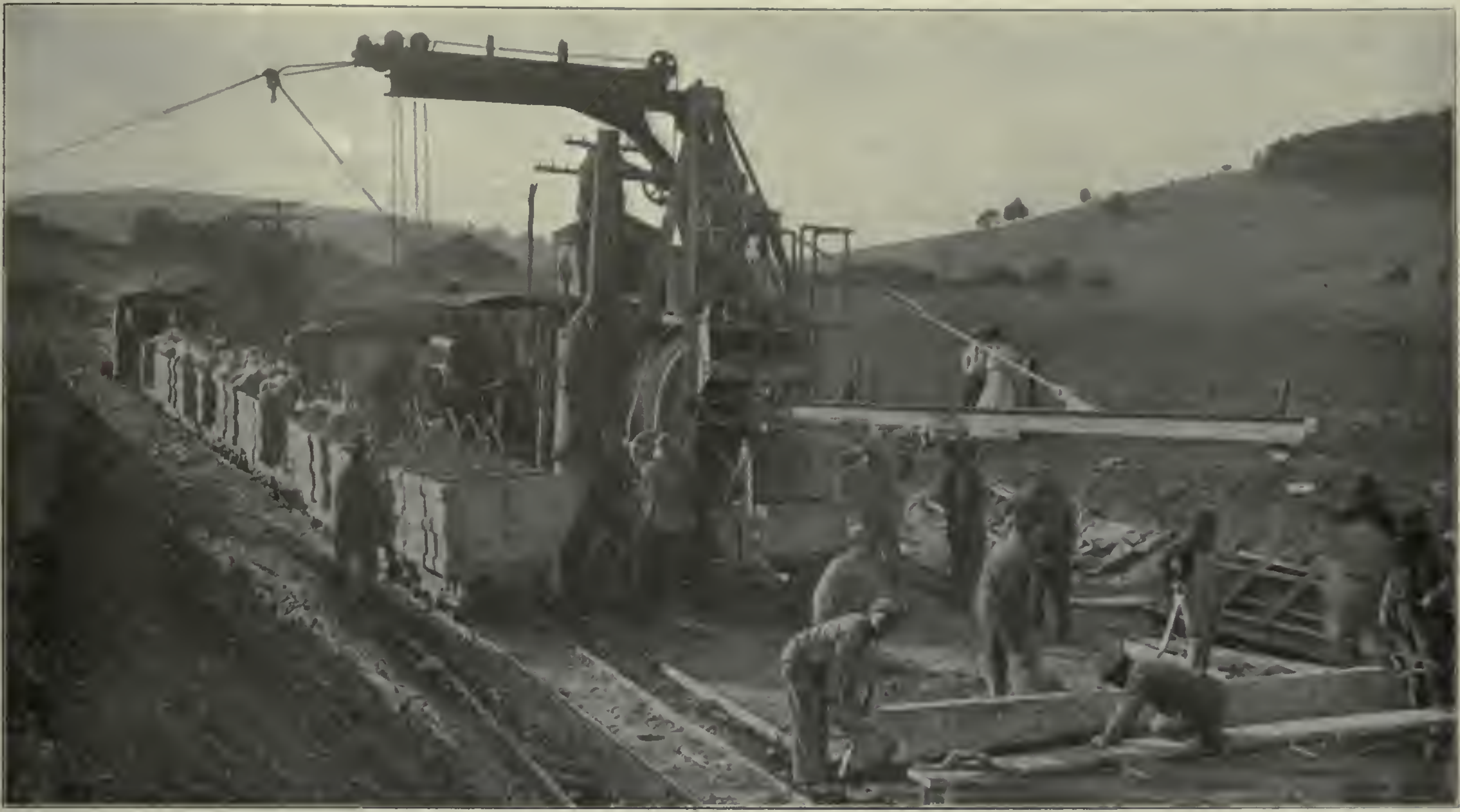


LAYOUT OF CONTRACTOR'S PLANT FOR CONCRETE ROAD CONSTRUCTION

Many contractors have gone to the wall because their profits were in plant instead of in cash. It is dangerous to equip any piece of work so that, on its completion, unsalable plant is left on the contractor's hands, unless he has included the entire cost of the plant in his bid cost of the work. If, on the other hand, the plant shall be readily salable, then only the excess of original cost over the salvage value, plus interest, repairs and depreciation, need be charged as a plant item against this particular piece of work.

PLANT LAYOUT

The plant layout used by the contractor on the Little Valley-Cattaraugus road is shown in the accompanying drawing. The location of the railroad, the siding, cement house, sand and stone bins, storage pile, water tank, and clam-shell hoist are indicated, together with the track, industrial railway and the line of improvement. This takes in about one-half of the work of the contract, and on this basis, from all indication, it looks as if the contractor would profit to a greater extent than if he had used labor. Labor, of course, was not entirely eliminated on this work, but it was lessened by about 15 men formerly used in shoveling material into barrows and wheeling it to the mixer, as well as by the number of men formerly necessary to do the



CONCRETE AGGREGATES WERE DELIVERED BY DINKEY TRAINS ON INDUSTRIAL TRACK PARALLELING ROADWAY

work of unloading the materials from the cars, such as cement, sand and stone.

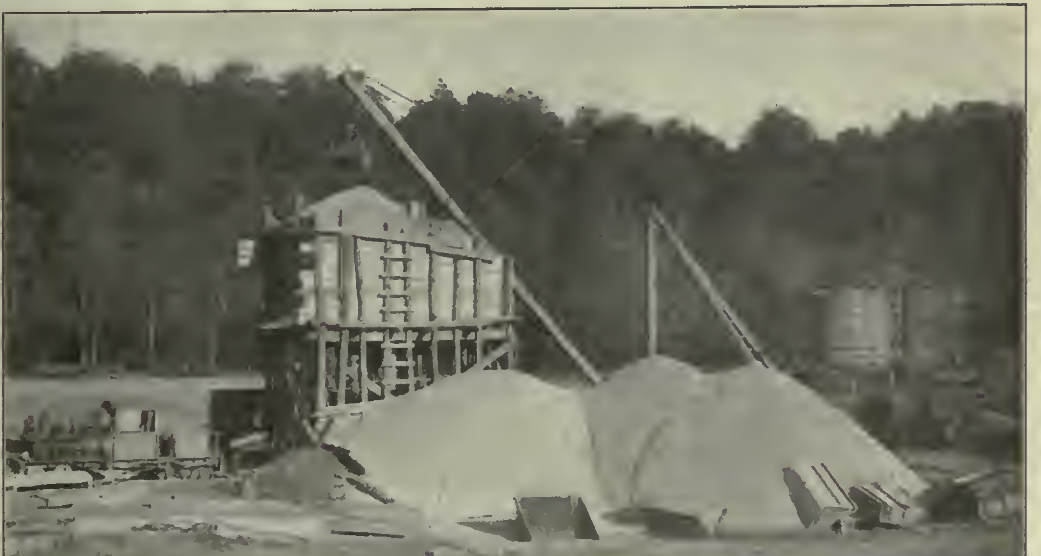
A general idea of the plant may be had from the photograph which shows the bins, stiff-legged derrick and hoist, with stock pile. Immediately back of the bins is noticed the dinkey engine at the head of a train made up for materials. Directly beyond is the standard freight car on the Erie Railroad siding.

Unloading Plant and Bins

The unloader kept the bins full at all times, handling material from the cars to the bins when possible, and to the stock piles if the bins were full, or from the stock piles to the bins if no cars were at hand. These stock piles almost eliminated the demurrage on cars. They also permitted the work to be continued if there happened to be such congestion as prevented material from arriving promptly. The extra cost of handling into the stock pile, and from stock pile into the bins, is more than recompensed by the continuity of the work at all times and the elimination of the idle or standing cost. The underside of the bin is equipped with two hoppers, one for stone and one for sand. They are provided with shut-off doors so that each may carry the desired amount of materials for a four-bag batch of concrete at the mixer. By opening the lower end of these hoppers simultaneously the stone and sand are mixed when entering wooden boxes which contain enough for one batch. These boxes were a part of the contractor's home-made equipment and were built for this work in particular.

Coal was also unloaded by the derrick and transported by the dinkey trains and Koppel cars. Sufficient cement for each train load was carried in two industrial steel cars.

The average number of men used at the unloader is five laborers and one hoist runner. In the old way from sixteen to twenty men would be required to do the same amount of work. The average haul for the portion completed last summer was 1.95 miles, as indicated in the drawing. About 1000 ft. of the track between the unloader and the road was over a swamp and up a fairly steep grade. This grade resulted in the stalling of some trains, and it was necessary to provide an extra dinkey engine to be sure of handling the trains properly. It would have been good economy to have reduced this grade in such a manner that the two engines could have handled this work without using the additional one.



MATERIAL HANDLING EQUIPMENT — BINS, STIFF-LEG DERRICK AND HOIST, AND DINKEY ENGINE WITH INDUSTRIAL CARS—STOCK PILES IN FOREGROUND

Special Boom on Mixer

The average train contained thirty wooden buckets for thirty batches with a sufficient amount of cement. This required about eight trainloads a day, the average force being three dinkey engineers, one foreman and two laborers. On the basis of the work done last summer the yard cost per mile haul was 5.65 cents, exclusive of coal and plant charges.

In one of the illustrations the boom is picking up a bucket on which the cement has been placed. The further operation of this bucket from the train to the hopper of the mixer is more clearly indicated in another, close-up view. These two pictures also show the location of the track with respect to the pavement and the construction details of the buckets used for carrying the material. The mixer is equipped with a boom for handling the buckets, which are dumped by a single trip on the iron handle. The man on the lower platform operates the hoisting mechanism. The boom at the present time is moved sideways to a position above the bucket by two men. It is the intention to operate it mechanically before next year's work begins. The views indicate the number of men required to place the concrete and something of the method of screeding and finishing the surface. The mixer used was a ½-cu. yd. Austin.

The sub-grade ahead of the machine, which is kept free from all material, can be carried so close that after rolling there is no chance for it to become cut up, nor is extra work necessary to shape it before the concrete is placed. This contributes largely to a better result in the pavement, as it is a well-known fact that with a smooth subgrade there is less chance for surface cracking. It also eliminates the cost of extra finishing of the sub-grade just before the concrete is placed.

In the view of the finished pavement the lines in the foreground are the results of brooming. In the manipulation gang there are, on an average, one foreman, one fireman, one mixer engineer and fifteen laborers, while on the fine grading and forms there are one foreman and an average of three laborers. The batch used was a four-bag one. The type of dumping bucket has the advantage of placing the concrete on the road in excellent shape. The water tank for the mixture is capable of fine adjustment and consequently gives a very uniform mix.

Grid Above Filter Surface Saves Wash Water

New System of Auxiliary Wash Shows Definite Economies and Eliminates Recourse to Fire Hose Stream

An auxiliary grid above the sand in the iron-removing filters of the Champaign & Urbana (Ill.) Water Company saves 10,000 gal. of wash water per filter daily. Considerable difficulty was experienced in the early period from fouling of the sand bed following the installation of the filters in 1913. A description of the plant and its operation appeared in the Engineering Record of April 11, 1914, page 419. F. C. Amsbary, manager of the company, presented at the meeting of the Illinois section of the American Waterworks Association, Jan. 26, the following information regarding his experience:

It had been the custom at the plant to use a fire hose on the surface of the filters whenever they became so clogged up that they would not last through a 15-hr. run with any degree of efficiency. This seemed to tear the floc loose and clean up the sand bed so that the filters could be used for several weeks again when the same operation had to be repeated.

The benefits resulting from the use of a fire hose upon the filter bed demonstrated the possible applicability of a high pressure wash regularly applied to the top of the bed. W. W. DeBerard, Western editor of the Engineering Record, suggested, during the meeting of the society in March, 1914, a high-pressure grid placed a few inches above the sand bed while the latter was at rest, but which would be submerged in sand when the wash water was applied to the underdrains. This method had been tried out at Oakland and found to work in a very efficient manner. Accordingly, during July, 1914, an experimental grid was placed in one of the Champaign & Urbana Company's filters. After six months' trial the effectiveness of this grid was so evident that similar grids were placed in all of the filters.

Details of System

The grid system, as installed for experimental purposes, consisted of two parallel manifolds made up of 4-in. nipples, 15 in. long, and 4 x ¾-in. crosses. Lengths of ordinary ¾-in. galvanized iron pipe, 2¾ ft. long, capped at the outer end, were screwed into the crosses, thus forming the laterals to the grid system. The laterals were perforated on their under surface at 12-in. intervals with 1/16-in. holes. Perforations were found to clog rapidly so the size of the holes was enlarged to ⅛ in. and finally to 3/16 in.

A fairly even distribution of the wash water is secured. There is approximately one perforation per square foot of filter area. The discharge through the grids is estimated at one-third the discharge through the underdrains.

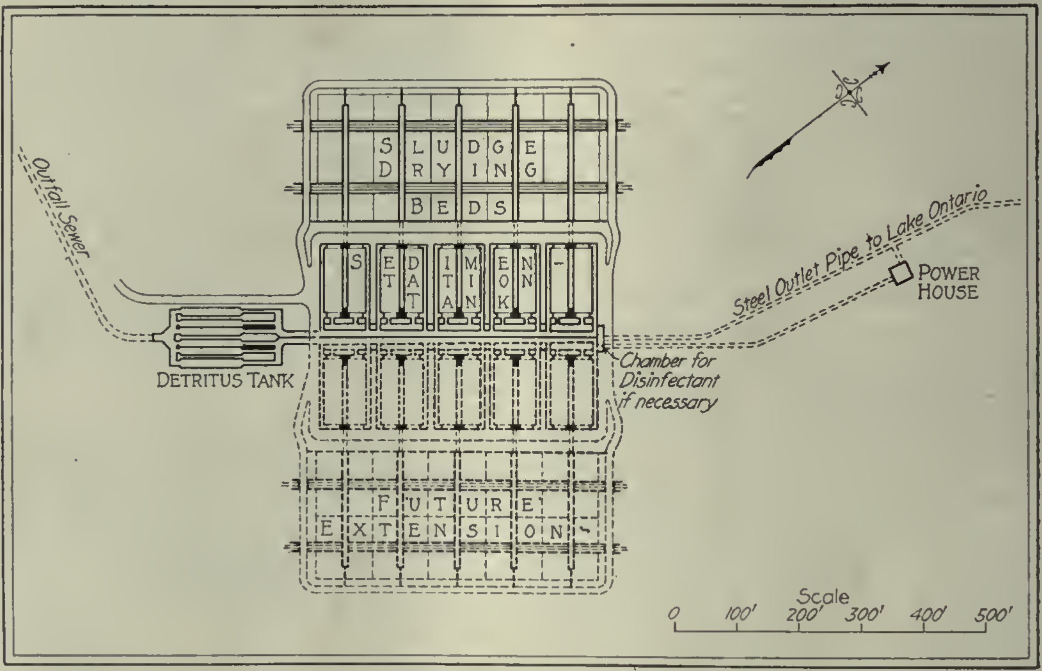
The quantity of water required to wash the filters has been reduced more than one-third. Approximately 25,000 gal. per filter per day are now required where formerly 35,000 gal. per filter per day were required. As to the frequency of washing, it has been found that when it is necessary the filters can be put through a 24-hr. run and still maintain a fair degree of efficiency. Formerly at the end of an 18-hr. run the sand bed would be almost impervious. Frequent analysis of the effluent shows an average iron removal of 95 per cent.

Largest Imhoff Tank Plant Nearly Ready to Treat Rochester's Sewage

Concrete Construction Finished on Six Detritus Tanks and Ten Sedimentation Units Having Exceptional Sludge-Storage Capacity

BY C. ARTHUR POOLE
General Assistant, Department of Engineering, Rochester, N. Y.

Except for the installation of the operating equipment, the sewerage and treatment works at Rochester, N. Y., the largest single Imhoff tank plant in the country, was completed at the beginning of this year. Involving an expenditure of about $2,000,000, the city's large-scale improvements, which have been under construction since 1911, include 7 miles of interceptors and conduits, 1 1/3 miles of submerged outlet, six detritus tanks, fine screens, and 10 Imhoff tanks, with provision for ten more when future needs require them. The work was undertaken to relieve the pollution of the Genesee River by crude sewage, and under the new plan of collection and disposal the effluent will be discharged into Lake Ontario. The design of the Imhoff tanks is rather unusual, in that it provides for unusually large sludge storage capacity and increased gas vent compartments, making the individual tanks of exceptional size. Another special feature is the installation of a power plant utilizing the head available in the effluent from the tanks to develop power sufficient to light and operate the plant. The entire work has been planned to provide for a future population of approximately 450,000 people living within the territory tributary to the sewage-treatment system.



TREATMENT WORKS ARE ON 290-ACRE PLOT AND CONSIST, AT PRESENT, OF SIX DETRITUS TANKS, REVOLVING SCREENS, TEN IMHOFF TANKS, AND SLUDGE-DRYING BEDS

History of Investigations

As early as the year 1889 the question of the future disposal of the sewage of the city was being considered, at which time the late Emil Kuichling, consulting engineer, made a study and report of the conditions. The flow in the Genesee River at that time, and for some years afterward, was adequate to dilute the sewage sufficiently to prevent any complaints of contamination. With the growth of the city and an increased volume of sewage the condition of the river continually grew worse, numerous complaints were made and several damage suits were begun, so that in 1904 Mr. Kuichling was again employed to investigate and report upon the question of sewage treatment for the entire city. These investigations continued until 1907, during the latter part of which period George H. Benzenberg and Rudolph Hering were associated with Mr. Kuichling and concurred in the report submitted by him early in that year. The system of disposal now under construction follows substantially the one recommended.

Plans were submitted to the State Department of Health for approval in 1910. Realizing the importance of the questions involved, not only to Rochester but to other municipalities near the Great Lakes, the Commissioner of Health held a public hearing upon the matter and before giving his approval submitted the plans to three of the leading sanitary engineers in this country, Allen Hazen, X. H. Goodnough and F. Herbert Snow. These men and Theodore Horton, consulting engineer to the Department of Health, all reported favorably upon the general principles, but recommended some modification of the details. As there was still some local criticism of the treatment proposed and the discharge of the effluent into the lake, Prof. George C. Whipple of Harvard University was retained in 1912 to investigate and report upon the project, more particularly as to the effect upon the quality of the lake water along the shore. Professor Whipple found that the sanitary quality of the water along the beaches would not be impaired.

SIX DETRITUS TANKS (IN FOREGROUND) ARE TO BE EQUIPPED WITH MECHANICALLY OPERATED BUCKET DREDGES FOR CLEANING—AT THE OUTLET END REVOLVING SCREENS WILL BE INSTALLED—CONCRETING PLANT FOR IMHOFF TANKS SHOWN IN BACKGROUND

ESTIMATE OF FUTURE POPULATION

The designs for the intercepting sewer and treatment plant have been based upon an estimated future population in each of the eight districts served by the principal outlet sewers, the estimates varying from 24 persons to the acre in the outlying districts, to 57 to the acre in sections nearer the center of the city. These districts have a total area of 13,100 acres and the future population is estimated at 390,000. This territory tributary to the existing outlet sewers includes all the area within the present boundaries of the city, except a small section in the northeastern part of the city which has a separate system of sewers and is treated independently, as described in the Engineering Record of May 29, 1915, page 679. This estimate of 390,000 does not represent the future population of the city itself, as it includes about 2600 acres to the west of the present limits tributary to the West Side trunk sewer, and about 500 acres to the east and north of the city tributary to the East Side trunk sewer and the Lake Avenue sewer. There are also large territories to the south and east which may in time be annexed to the city.

In addition, provision has been made for the sewage of a large territory north of the city, which is not now sewered, but where the natural drainage is toward the Genesee River. This section will include an area on the west side of the river of about 500 acres, with an estimated future population of 15,000 and about 1750 acres on the east side of the river with an estimated future population of 35,000. This will make approximately 440,000 people living within the district served by the sewage disposal system as at present planned. The present population of Rochester is about 250,000.

QUANTITY OF SEWAGE

For data on which to base the size of the intercepting sewer, and to make an estimate of the quantity of sewage at the treatment plant for present conditions, gagings with Cippoletti weirs were made in 1910 of the dry weather flow in each of the existing outlets. The mean daily flow for all of the sewers was found to be 91 gal. per capita, varying greatly for the different districts from 59 to 156 gal. per capita.

The intercepting sewer is designed to provide for a future dry weather flow of 120 gal. per capita, and a future storm-water flow of 420 gal. per capita, the latter being made up of 1 part of sewage and 2½ additional parts of storm water. This basis of estimate has been adopted for all sewers of the combined system, which is the condition in all the territory now tributary to the existing outlet sewers. In the territory north of the city, where the separate system will be used, it is planned to provide for the sewage only, and a future flow of 175 gal. per capita has been assumed here. On these bases the total estimated volume of the future dry-weather flow will be approximately 55,500,000 gal. and the storm-water flow will be 173,000,000 gal. daily.

The same quantities have been used for the design of the treatment plant, but only part of the Imhoff tanks, enough for present conditions, are constructed now.

INTERCEPTING SEWER

To divert the sewage from the river and deliver it at the treatment plant an intercepting sewer has been constructed to collect all of the sewage and 2½ additional equal volumes in time of storm. The storm water in the outlet sewer in excess of this quantity will pass on and discharge into the river, the existing sewers thus becoming overflows beyond the point of interception. The flow to be diverted into the interceptor will be controlled by regulating devices that will automatically maintain the required volume of discharge. These regulating devices are placed in a chamber, located, in most cases, over the intercepting sewer, and consist of a cast-iron float that operates a shutter over the inlet to the chamber. The flow will be diverted by a dam in the main sewer into the chamber, from which it will be discharged, at a lower level, into the interceptor.

The outlet for the discharge of the effluent from the plant is a steel pipe, 66 in. in diameter, made of plates ½ in. in thickness. The pipe terminates in a timber crib located 7000 ft. from the shore, discharging at a point where the water is 50 ft. deep. The methods employed in laying this pipe and the detail of the submarine joint used are described in the Engineering Record of July 3, 1915, page 20.

The location of the treatment plant is

CONTRACTOR'S TRAVELING DERRICK PLANT PLACING CONCRETE IN THE HOPPER-SHAPED BOTTOMS OF THE IMHOFF TANKS

STEEL FORMS FOR TRANSVERSE WALLS AND REINFORCEMENT IN MIDDLE WALL BETWEEN TWO TANKS

about 2 miles east of the Genessee River and about ½ mile south of the lake shore. The city has purchased 290 acres on which to build the works and dispose of the sludge.

Six Detritus Tanks

As all of the sewers tributary to the plant are on the combined system, ample provision has been made in the design for the removal of grit and floating matter by passing the sewage through detritus tanks and screens before entering the Imhoff tanks. There are six detritus tanks placed side by side, the flow being controlled by gates at the entrance to each tank. The settling chamber in a tank is 90 ft. long, 10 ft. wide and has an effective depth of 3 ft., giving a capacity for the accumulation of grit of about 100 cu. yd.

It is planned to operate the tanks so that the present dry weather flow will pass through one tank; as the flow increases in time of storm additional tanks will be put in operation, keeping approximately the same volume passing through each tank. As the water level will rise with the increased flow, the velocities will vary from 8 to 15 in. per second, the slower velocity prevailing during times of storm, since more grit is transported in the sewage.

Coarse racks with 2-in. openings are placed in the channel at the entrance to the tanks, and drainage is provided for by a system of underdrains, which, being controlled by valves, operate only during periods of cleaning.

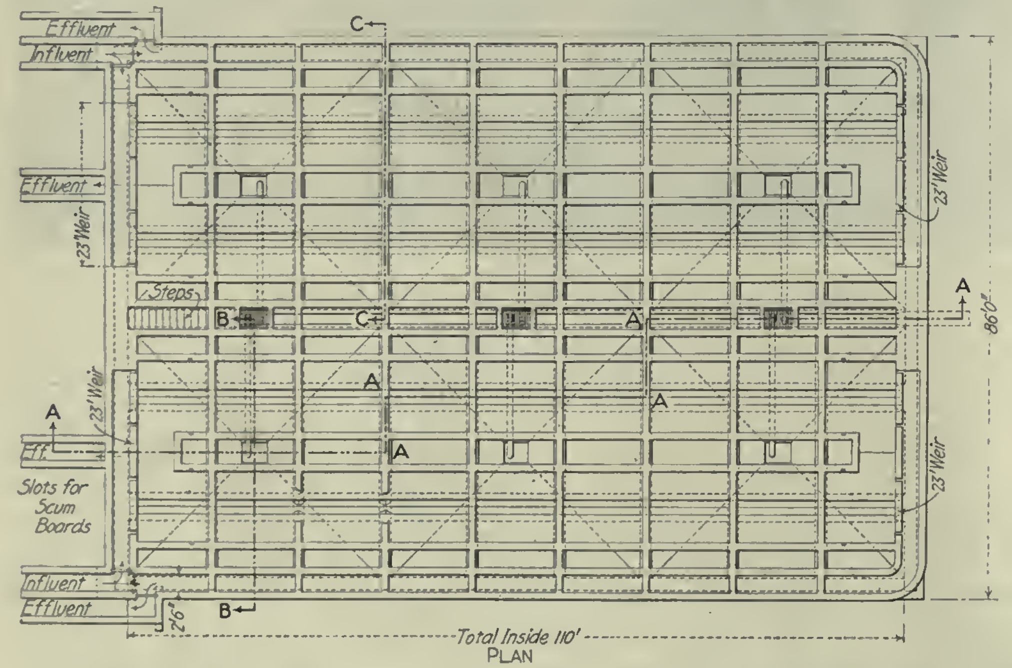
The tanks will be mechanically cleaned by an excavating machine, similar in operation to a bucket dredge. This machine will have three lines of buckets to elevate the material, which will be discharged on a belt conveyor delivering to dump cars. It will move longitudinally with the tanks on tracks placed on the walls and can be shifted under its own power on transfer tracks to any of the tanks. The excavated material placed in the dump cars will be transported by locomotives and deposited upon the adjacent city property.

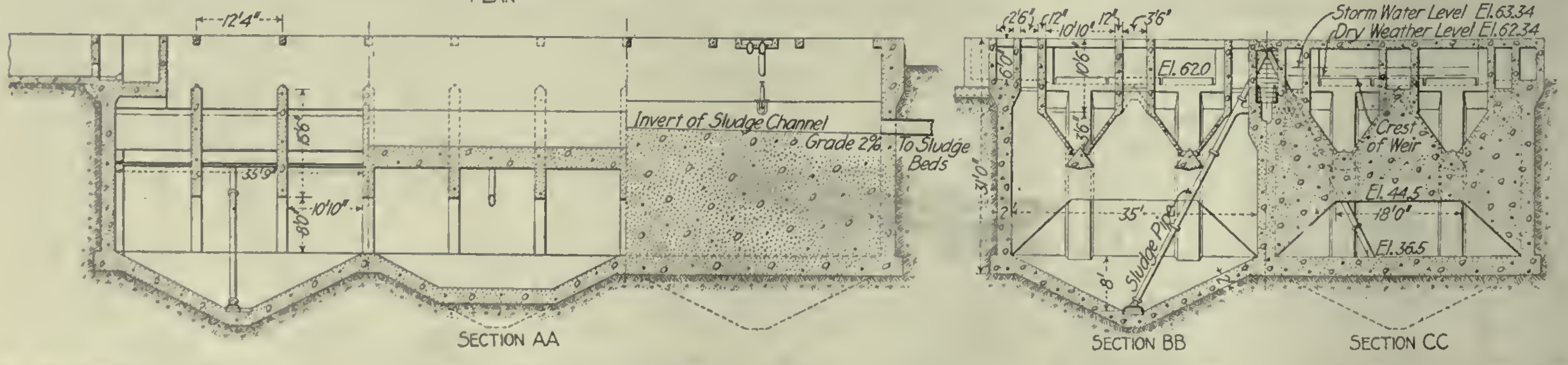
Mechanically cleaned, revolving screens, of the Riensch-Wurl pattern, with ¼-in. openings, will be placed at the outlet of each of the tanks. It is not intended to accomplish by these screens what is known as fine screening, but they are used only to remove floating matter from the sewage.

Automatic Control of Flow

From the detritus tanks the flow will pass to two main influent channels for distribution to the Imhoff tanks. These are arranged symmetrically, ten tanks being placed on each side of the influent channels. At present only the ten on the west side will be built; those on the east side are planned to provide for future enlargement as the population of the city increases.

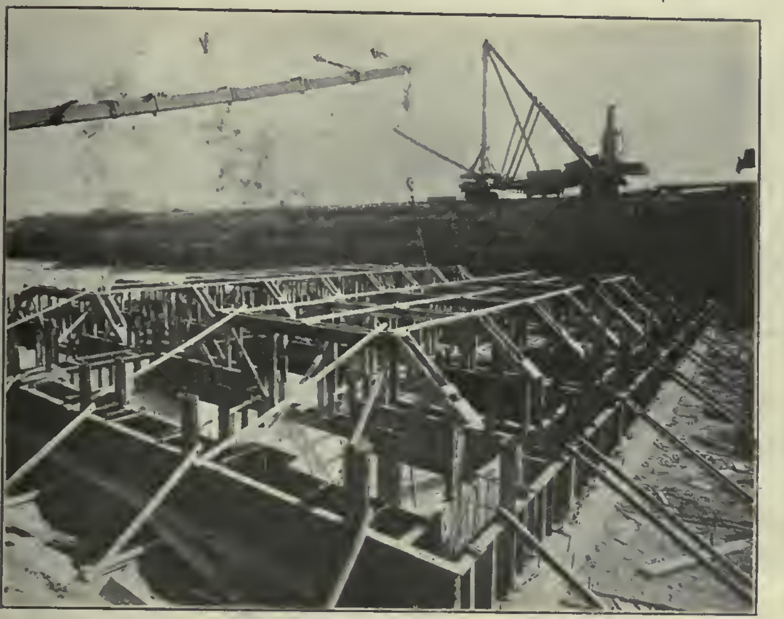
The two influent channels run the entire length of the plant, or about 485 ft. They have a level bottom and are 7 ft. wide opposite the first tank, decreasing in width, as each successive tank is passed, to a minimum width of 2 ft. opposite the last tank. This decrease in width is designed





IN ROCHESTER'S CASE RECTANGULAR IMHOFF TANKS WERE CHEAPER THAN CIRCULAR, ACCORDING TO ESTIMATES—SIDE WALLS ARE VERTICAL INSTEAD OF INCLINED—LARGE SLUDGE STORAGE CAPACITY PROVIDED so as to maintain a minimum velocity of 2 ft. per second in these channels. The desired flow for each tank will be diverted from these channels through an opening controlled by a gate. This gate will work automatically, being operated by a float in a chamber connected with the influent channel. As the water surface in the channel rises the gate will be opened, allowing an increased flow to enter each tank equal to the total increase in volume in the channel divided by the number of tanks in operation.

This regulating apparatus consists of an arm or walking-beam attached to the float with a counterweight on the other end. The gate is suspended from the arm on the same side of the pivot as the float. The ratio of the distances of the points of support from the pivot determines the relative movement of the float and gate. This ratio varies for the different tanks, being 1 to 6 opposite the first and 1 to 4 opposite the last tank. All parts of the apparatus have been made so that they can be easily adjusted to fit the varying conditions that will arise in the operation different from the theoretical assumptions.



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TRUSSES FOR FORMING ARCHES IN TRANSVERSE WALLS

The plans of the disposal plant approved by the State Department of Health in 1910 provided for plain sedimentation tanks 150 ft. long, 25 ft. wide and 12 ft. deep. This was about the time Dr. Karl Imhoff introduced in this country the type of tank bearing his name. In order to take advantage of any improvements in this line, the starting of construction work upon the plant was delayed until this proposed method of tank treatment could be examined. After extensive study and investigation it was decided to adopt the Imhoff tank in place of the sedimentation tanks first proposed. The main consideration entering into this decision was the question of the handling and disposal of the sludge. While the first cost would be considerably more, the inoffensive character and greatly reduced volume of sludge from the Imhoff tanks and the readiness with which the dried sludge could be handled, would more than offset the increased cost in reduced operating charges.

RECTANGULAR TANKS CHEAPEST

Another question requiring careful study was whether cylindrical or rectangular tanks would be the most economical. After preparing plans and estimates on both these designs and taking into consideration local conditions, it was found that the rectangular tanks were the cheaper. While the quantities in the cylindrical tank were less, the unit costs, due to the irregularities of the curved surfaces, would be very much greater. The cylindrical tank also would require more steel reinforcement than the rectangular.

In designing the tanks local conditions not common to other localities influenced the selection of a type of tank different in many features from other Imhoff tanks. In the first place the topography of the site and the character of the soil was such that it seemed best to excavate for all the tanks together by some cheap method of excavation, rather than the more costly method of excavating a pit for each tank as is done in most cases. The ground water being below the elevation of the foundation, all the excavation was dry. This made it advisable to construct the tanks with vertical side walls, avoiding the inclined surfaces that have been used to enlarge the tanks above the sludge compartment. Other controlling conditions were the shorter period of sedimentation required, as compared with other places, and the larger sludge-storage capacity adopted. These two conditions made the relative sizes of the flowing-through section and the sludge-digestion section unusual, and permitted carrying the outside walls up vertical as desired, and also allowed a greater area for the escape of gas, a feature that was also desired.

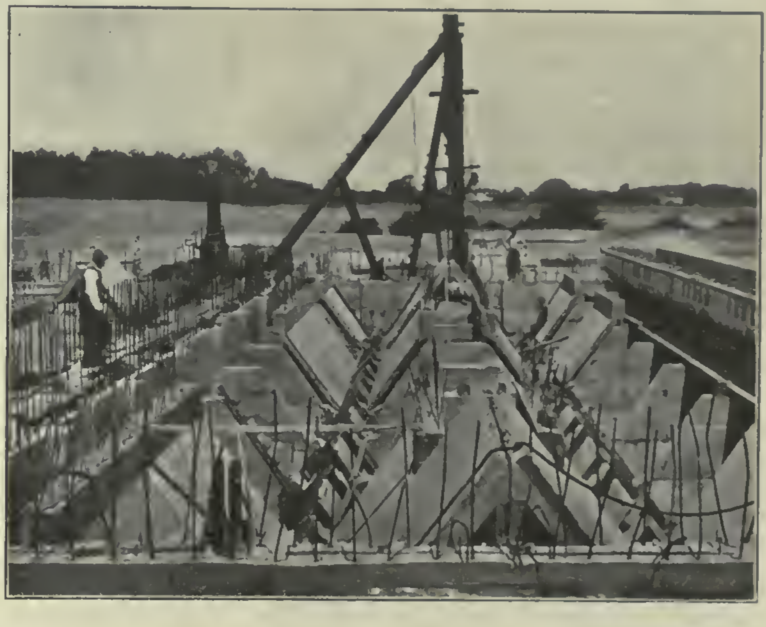
A tank is designed to handle the sewage from 21,500 persons. This will give a dry-weather flow of four cubic feet per second, and a storm flow of 14 cu. ft. per second in each tank, the storm flow passing through the same tanks as the dry weather flow, raising the water surface slightly and increasing the velocity. For these flows the velocities in the flowing-through chamber will be 0.023 ft. per second and 0.072 ft. per second, and the period of sedimentation will be 78 and 25 min., respectively. This comparatively short period of sedimentation is deemed sufficient as the final disposition of the effluent in the lake provides in itself adequate means of further treatment.

The sludge-digestion compartments are designed to provide for a storage period of 150 days, this being the probable maximum duration of cold weather during which the sludge cannot be removed.

The estimated quantity of sludge for this period is taken at 2 cu. ft. per person, making the required capacity of one tank 43,000 cu. ft. In fact, more space is provided for sludge than these figures indicate, as the three hopper bottoms are not included and the upper limit of the computed volume is taken three feet below the slot at the bottom of the sedimentation chamber.

IMHOFF TANK DETAILS

The inside dimensions of each tank are 110 ft. long, 35 ft. wide and a maximum depth of 40 ft. The flowing-through or settling compartment is made up of two longitudinal V-shaped troughs each 10 ft. wide and 12 ft. deep from the water surface to the 6-in. slot at bottom. The bottoms of these troughs are inclined slabs 5 in. thick, sloped at an angle of 1 horizontal to 1⅜ vertical. Between the troughs is a gas vent 3½ ft. wide and outside the troughs are two other gas vents each 2½ ft. wide, running the entire length of the tank, making the space for the escape of gas about 30 per cent of the total exposed water surface. The sludge-digestion compartment has three hopper-shaped bottoms, each 35 ft. square at the top and 8 ft. deep, and the distance from the hopper bottoms to the 6-in. slot in the bottom of the settling troughs is 15 ft.



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PLACING SLABS IN BOTTOM OF FLOWING CHANNEL

The tanks are arranged so that two tanks are built as one unit, using a middle longitudinal wall to divide the two tanks and also to carry the sludge channel. Between the units is a space 10 ft. wide to be used for a driveway. The outside dimensions of one unit are approximately 116 x 79 ft. The outside walls are 2 ft. in thickness and are designed to resist an outside earth pressure from backfill to the top of the wall with the tank empty and an inside water pressure, with a maximum head of 27 ft., with no backfill. The walls are divided longitudinally into panels with a transverse wall across the entire unit every 12 ft. 4 in. These transverse walls are 18 in. in thickness and act as beams supporting the settling troughs, also as buttresses for the earth pressure and ties for the water pressure. They are arched on the bottom to permit the free circulation of sludge between the hopper bottoms. In the side walls opposite each transverse wall are placed two 10-in. channels 24 ft. long, acting as pilasters, which are in turn connected with six 1¾-in. tie rods running through the transverse walls, thereby tying the sidewalls together. The end walls are similarly constructed with tie rods running through the triangular section which forms the key to the settling troughs. The horizontal reinforcement in the panels between the pilasters consists of ¾-in. bars spaced with increasing centers as they approach the top of the wall. The middle longitudinal wall between the two tanks is 30 in. in thickness and reinforced to resist a full head of water on either side with the other tank empty.

EFFLUENT RUNS POWER PLANT

In order to provide for a reversal of flow through the tanks, to equalize the deposit of sludge in the hopper bottoms, both ends of the tank are identical in design, with a channel running on top of the outside wall which alternately acts as an influent, or effluent channel as the flow is reversed. The direction of flow in the tanks will be controlled by hand-operated gates.

The flow from the Imhoff tanks passes to the main effluent channel, which runs parallel to the main influent channel, but at a lower level. Up to this point the channels and weirs of all the tanks are at the same elevation. The main effluent channel is divided into two smaller channels by a partition wall which acts as a weir. The flow drops into the smaller of these channels, which is designed to carry the normal dry-weather flow; if it exceeds this amount, it overflows into the larger channel. These channels have a grade and increase in width toward the outlet, being 2 ft. and 4 ft. wide, respectively, opposite the first tanks, and 3 ft. and 6 ft. wide opposite the last tank. The dry weather flow discharges into a 48-in. pipe leading to the power plant, and the storm flow directly into the outlet pipe to the lake.

The power plant is located some distance north of the Imhoff tanks, at an elevation that will give a head capable of producing 150 h.p. with a volume equal to the dry weather flow. The 48-in. pipe from the effluent channels acts as a penstock discharging through two turbines, each acting upon the unit principle. Each turbine is direct connected with the generators and the resulting power will be used to light and operate the plant.

SLUDGE-DRYING BEDS

The sludge is drawn from the Imhoff tanks through 8-in. cast-iron pipes which discharge into the channel between two tanks about 5 ft. lower than the water surface in the tanks. This channel conveys the sludge to the drying beds, located directly west of the tanks. The sludge beds are designed so as to provide 1 sq. ft. of area for every three persons of the population; the area for one tank therefore will be 7166 sq. ft, and the total area for ten tanks a little over 1½ acres. The beds are divided into sections about 43 ft. square by concrete partition walls and are lined with 19 in. of filtering material, made up of 2 in. of fine sand, 3 in. of coarse sand, 8 in. of coarse sand and gravel and 6 in. of broken stone. They are underdrained with 3-in. tile, spaced 8 ft. apart. Running lengthwise with the plant are two depressed channels which serve for the collection of the drainage from the 3-in. tile and also contain tracks on which the dried sludge will be removed in dump cars. For loading these dump cars conveying machines will be installed which will carry buckets from the beds to the cars.

The final disposition of the sludge will be in deep gulleys and low places on the city property adjacent to the plant, where it will be used as filling.

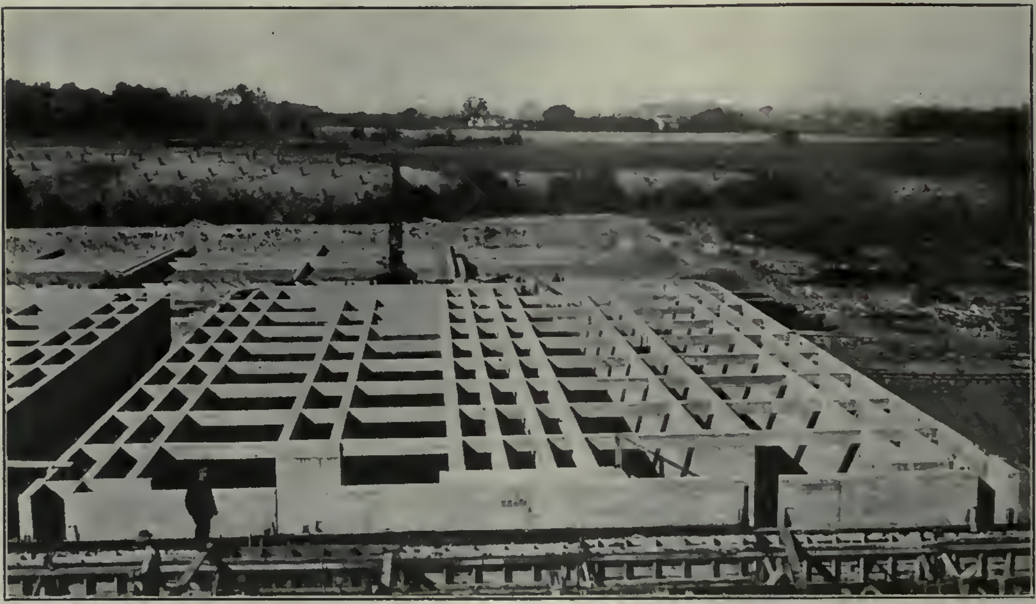
CONSTRUCTION WORK

Construction work upon the sewage-treatment system was started in April, 1911. The intercepting sewer with its connections, the conduit from the city to the plant and the outlet pipe in the lake were completed early in 1915. Work upon the plant was started in June, 1914, and on Jan. 1, 1916, all the work was completed except the installation of the equipment for operating the plant and the construction of the power plant.

The principal items in the contract for the construction of the plant were 110,000 cu. yd. of excavation, 25,000 cu. yd. of concrete and 750 tons of steel reinforcement. The total amount of the contract was $333,855. This did not include the power plant buildings or any of the operating equipment.

Most of the excavation work was done with the steam shovel. The hopper bottoms of the tanks were dug with a clamshell bucket, except the final grading and trimming of the slopes, which was by hand. Standard gage equipment was used by the contractor throughout the work and all supplies and material were delivered on the site in carload lots.

The accompanying photographs show the methods used for handling the concrete in the ten Imhoff tanks. From a central mixing plant, located about 500 ft. north of the tanks, the concrete was delivered in buckets on cars to either side of the tanks, where four traveling derricks with 80-ft. booms conveyed it to the place to be deposited. These four derricks covered the entire area of the ten tanks. The concrete in the hopper-shaped bottoms of all the tanks was placed first, then the side walls of two of the units were started. Forms for two units were provided so the concrete work could alternate between these units. The side walls were carried up in courses of about 3 ft. in a lift. The specifications provided that there should be no vertical joints in a unit, the outside walls, middle wall and transverse walls being carried up simultaneously. In a 3-ft. lift on one unit there are about 200 yd. of concrete which was run continuously and so distributed that it forms a monolithic section. By this method of construction the only joints are the horizontal ones between the 3-ft. courses, or a day's work. To prevent leakages at these joints horizontal keyways were placed in the tops of all sections and great care was taken to clean thoroughly the surface and remove all laitance before starting the next course. As an additional precaution against percolation and leakage it was deemed advisable to waterproof the entire structure. This was done by the integral method, 6 lb. of waterproofing being incorporated in every yard of concrete.



THE TANKS ARE ARRANGED SO THAT TWO ARE BUILT AS ONE UNIT, USING A MIDDLE LONGITUDINAL WALL TO DIVIDE THE TWO TANKS AND ALSO TO CARRY THE SLUDGE

Where the construction was uniform Blaw steel forms 3 ft. 4 in. in height were used on all the tanks. On the upper 10 ft., where the surfaces were irregular, wooden forms were used. The steel forms were made in panels, bolted together, and were raised and placed in position for the next lift by the derricks. No bracing was required, the forms being held up by bolts through the panels resting upon the last section, and were held in alignment by turnbuckles on top of the forms.

The plant was designed under the supervision of E. A. Fisher, consulting city engineer, with the late Emil Kuichling as consulting engineer. Myers & McWilliams, of Rochester, N. Y., are the contractors, and the work is being done under the supervision of the writer acting for the city engineer's department.

GRADES IN CITY STREETS in excess of 3 per cent are not desirable for the general use of horse-drawn vehicles, according to M. M. O'Shaughnessy, city engineer of San Francisco. He pointed out that 10 per cent is the maximum desirable for trolley service and stated that the San Francisco practice is to limit asphalt pavements to grades less than 8 per cent. Where asphalt pavement is desired on grades exceeding 8 per cent the center of the street is paved with basalt block for the heavier traffic.

Few Well Equipped Ports Held to Be Preferable to Many Poorly Equipped

Fairfax Harrison of Southern Railway Would Have Ports Provide Water Terminals and Collect Charges from Traffic Instead of from Railroads

PUBLIC ownership of and responsibility for interchange facilities between rail and water traffic at seaports have been advocated in recent years by a number of students of transportation. Less familiar is the doctrine that there should be a few well equipped ports rather than a large number with poor facilities. Both ideas were presented by Fairfax Harrison, president of the Southern Railway, at the third national foreign trade convention, held in New Orleans recently. Mr. Harrison contended not merely that it was uneconomical for each of several railroads to build and maintain separate water terminals at one port, or for one railroad to build and maintain separate water terminals at several ports, but that the traffic itself, and not the railroad, should pay the terminal charges. He held that the transshipment should be regarded as a separate element of the traffic movement, just as the water transportation is, and that inland transportation alone is the function of the railroad. To his mind, unless the ports are ready to provide the necessary terminal facilities they should attempt to rely on natural rights to traffic.

Extracts from Mr. Harrison's address follow:

TOO MANY TERMINALS

Generally speaking, in this country facilities at the ports for the interchange of export and import traffic have been provided by the railroads themselves. In numerous cases several railroads serving a single port have each provided independent waterfront terminals, and railroads serving more than one port have provided separate facilities for each port served, thus involving large investments of capital for which there has been no adequate return, because competition has to a considerable extent required the absorption of terminal costs as a practical deduction from the normal inland transportation charges, and, further, because the business is divided between too many ports and between too many separately owned and operated terminals.

Such conditions are economically unsound and must come to an end if economy of transportation is, in a national sense, to be a factor in the increase of the volume of our export and import traffic. A large number of insufficiently equipped ports is not as efficient a factor in the development of commerce at the stage we have now reached as would be a few sectionally representative ports, thoroughly well equipped. If this view shall obtain there is in prospect an increasingly fierce competition between individual ports for this position of sectional representation. On past experience we may expect the railroads to be in the vortex of this controversy. It may be settled by the biological law of the survival of the fittest, or it may be settled by the modern panacea for business ills, a statute; but in any event the best interests of our foreign trade will be in abeyance until it is settled. The nation which has in recent years made the largest deliberate increase of its foreign commerce has concentrated on two well equipped ports. It is probable that in this respect Germany's transportation costs must have been benefited from the operation of the economic law that concentration of volume, short of congestion, reduces cost units.

PAST DEVELOPMENT OF OUR PORTS

The development of the seaports of the United States, and especially that of the South Atlantic and Gulf ports, in relation to the railroads, has had its own peculiar history. To-day, when in the matter of rail transportation the political theory of "equal opportunity for all, special privileges to none" is having what is perhaps a too literal application, because it is often in the teeth of the natural laws of trade, the rational explanation of the partial and incomplete development of some of our seaports is forgotten and the attempt is made to explain it by diabolical design.

When the first railroads were built from the sea to the interior, they were comparatively small and always weak units. At the beginning they were economic monopolies and controlled all the traffic of a territory, insufficient though that may have been. As the railroad system was linked up and competition began between ports and between rival producing territories, the management of each local line which reached a port, actuated by the usual resource of the weak in dealing with a strong and impetuous force such as moves competitive commerce, exercised every effort of ingenuity to discriminate in transportation practices and charges in favor of its single port.

CHANGED CONDITIONS

When it came to pass that rail transportation swallowed all other forms of inland transportation, and the shipper, whatever his location, no longer depended upon any single railroad or any single seaport, the franchises of particular ports in respect of certain traffic were thus transmuted into competitive opportunities. It followed that discrimination in favor of the individual port has gradually been withdrawn by the railroad, not from any change of heart nor even from any lack of good will, but as a consequence of economic pressure. This consequence of the development of transportation in a national sense seems to have proved an apparent atrophy to the commercial enterprise of some of the seaboard communities affected. They had come to depend altogether upon the railroad for their commercial pabulum: they had looked to the railroad to supply not only the transportation and the terminals, but the traffic as well, and when in time the discrimination in their favor was removed, partly by the working of an economic law and partly by the fixed and inelastic methods which have, in the past, been nationally characteristic of our public regulation of railroad practices, it has resulted that some seaport communities have exercised more energy in asserting claims to assumed natural rights and in prosecuting charges that the railroad has discriminated against them, with evil intent, than in adjusting, as the railroads have done, their practice to new economic conditions.

PORTS SHOULD PROVIDE FACILITIES

Export commerce will always seek the line of least resistance. It will go to the point where the service is best, where storage facilities are most readily accessible, and most of all where there are ships. To bring the ships the successful port seeks above all to develop its import traffic and its banking facilities. Next in importance, the port itself should provide terminal facilities for the exchange of tonnage between rail and water carriers. My own view is that the demands on the railroads in the future in respect of inland transportation are going to be at least equal to the rates which the public will allow for rail service, and that the seaport must hereafter look elsewhere than to the railroads to provide, or even to pay for the use of, water terminals.

Seaport communities desiring to participate in the benefits of foreign commerce and to obtain a competitive advantage over other available ports should then provide the necessary terminal facilities either through municipal ownership or through local terminal companies supported by local interest, and thus undertake the responsibility of supplying facilities without discrimination for all ships and all railroads reaching the port; and further, they should impose charges upon the traffic, rather than upon the railroad, sufficient to make the terminal self-supporting. In competition with rival ports they may have to bear in the form of local taxes or otherwise locally so much of the terminal cost as may be necessary to attract and hold competitive traffic which is free to seek any one of several ports. New Orleans has taken a step in this direction through its public ownership of docks and through the wise policy of the Dock Board in undertaking to have uniform charges established for service performed at the city docks and at those provided by the railroad and the railroad-owned terminal companies.

RAILROADS WOULD CO-OPERATE

When this point has been made clear as a principle of sound growth, it may be added that, while the obligations of a railroad as a common carrier are not different with respect to foreign commerce than with respect to domestic commerce, the policies of a railroad need not necessarily be limited altogether by its obligations. They never have been in the past and will not be in the future. The railroad, so long as it is a function of private endeavor, properly may and always will consider its interests as a business enterprise. Because prosperous communities along its lines bring increased traffic to the railroad, the alert management is vitally interested in the development of the territory which it serves, and in helping the producers in that territory to find profitable markets either at home or abroad. As a large proportion of the products of the United States, either as raw materials or manufactured commodities, find, or, more strictly speaking, after domestic needs have been met, ought to find, markets in foreign countries, the carriage of these products to the seaports make up such a large part of the business of the railroads that they may properly so shape their policies as to encourage this business. This many railroads have done, and perhaps, as affects their own interest, have at times overdone.

Highest Arch Highway Viaduct of Striking Appearance Economically Constructed

High-Level Bridge Over Cuyahoga River Gorge Near Akron, Ohio, Erected on Steel Arch Centers Previously Used, with Slag for Aggregate

AN EXAMPLE of a satisfactory solution of the problem continually arising—how to construct with the available funds a structure of pleasing architectural appearance—is found in the design of the recently completed high-level bridge for highway traffic over the Cuyahoga River gorge near Akron, Ohio. The construction of a reinforced-concrete arch viaduct of striking appearance instead of the usual steel trestle was made possible through the utilization by the contractors of previously used steel centers, after modification of the arch outlines and span lengths; through the design of the high hollow piers without batter, allowing the continuous use of the same sectional forms, and through the use of sand from the approach cut for the fine aggregate and of blast furnace slag for the coarse aggregate.

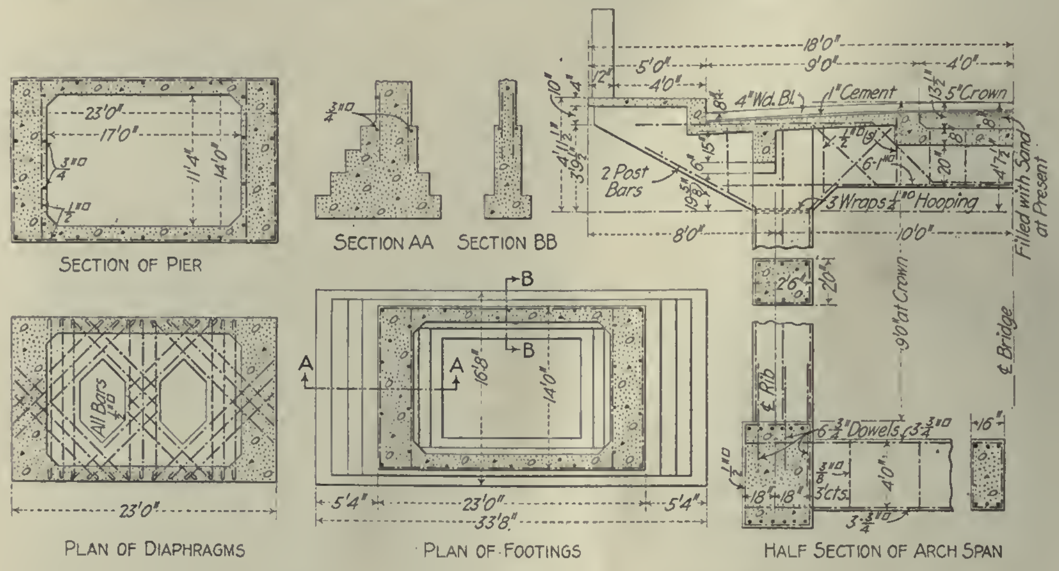
HIGHEST HIGHWAY STRUCTURE OF ITS KIND

This viaduct is the highest highway structure of its kind, 190 ft. from bed of stream to level of roadway. The Fontpedrouse masonry arch viaduct in France, described in the Engineering Record of Dec. 18, 1915, page 768, is 225 ft. high, but is a two-level structure. The recently completed Tunkhannock viaduct, a railway structure, is 240 ft. high.

The excessive height of the piers in the Akron bridge made the problems of construction more difficult than usual. Special care in erection was taken to avoid excessive unbalanced thrusts on these piers. The three-hinged steel arch centers with 2-in. tie rods to take the thrust are of course the most economical for such a location, the centers being placed by the construction cables.

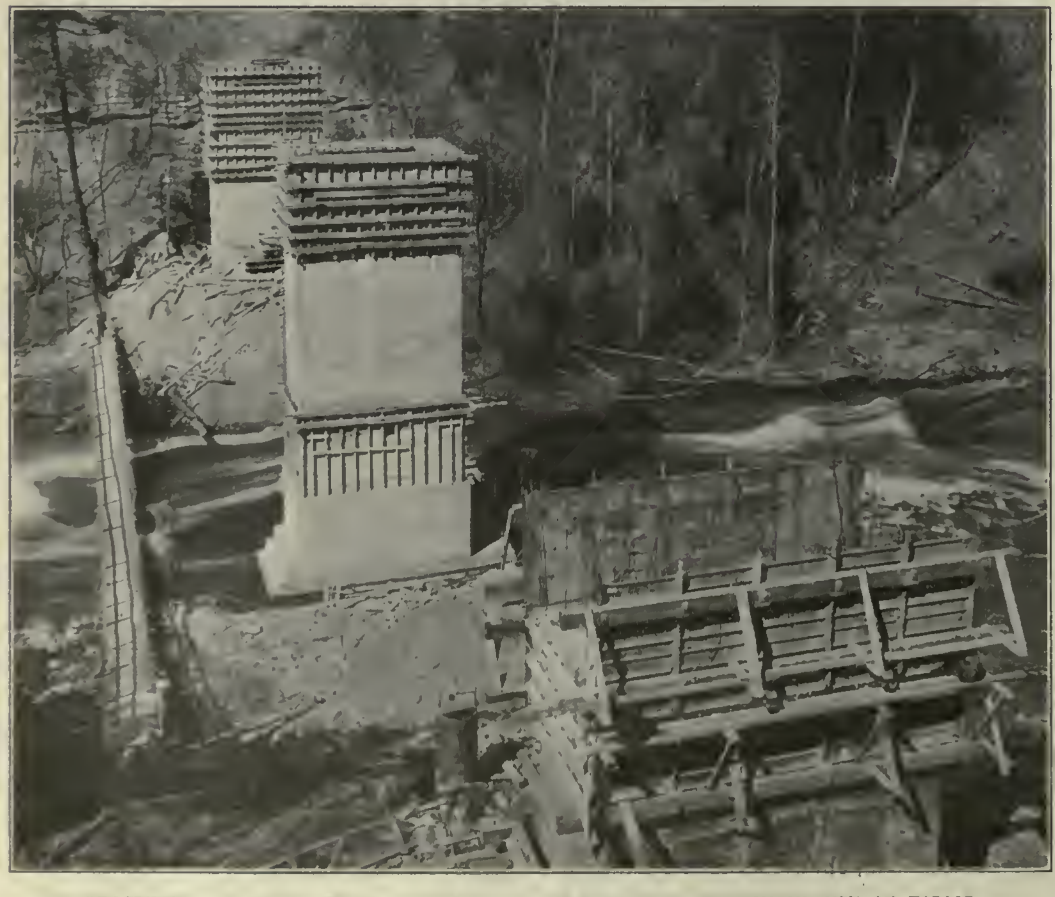
DESIRE FOR ORNAMENTAL BRIDGE AT LOW COST—PRELIMINARY DESIGNS

The original plans called for a steel bridge at a much lower level, carrying a roadway only and requiring steep approach grades. After considerable agitation additional bonds were voted to construct a high-level bridge with sidewalks and provision for electric-railway loads. Two sets of plans were then made, one for a steel trestle and one for an arch viaduct of reinforced concrete. When the bids were opened, those on the steel structure were well within the amount appropriated, but none were received on the concrete structure within that amount.



TYPICAL SECTIONS OF ARCH SPAN AND PIERS—REINFORCEMENT OF FLOOR

All floorbeams between columns on arch spans and on approaches are spaced 9 ft. 5 in. on centers.



PROGRESS IN CONSTRUCTION OF THE HIGH PIERS SHOWS CONTINUOUS USE OF FORMS

By this time, however, the people had made up their minds that only a concrete bridge would properly conform to the site, which is owned by the city of Akron, and is to be used in the future as a park. Opposition to the letting of a contract for a steel bridge was therefore so great that the county commissioners rejected all bids. At the next letting one bid was within the available fund. This was based upon a modified design, increasing the span of the arches and making them full centered to allow the use of steel arch centers previously applied in the construction of the arch bridge at Allentown, Pa. Economy was further attained by the rectangular hollow-pier design, permitting the use of 5-ft. sectional forms, made of both wood and steel, which could be used continuously.

GENERAL DIMENSIONS

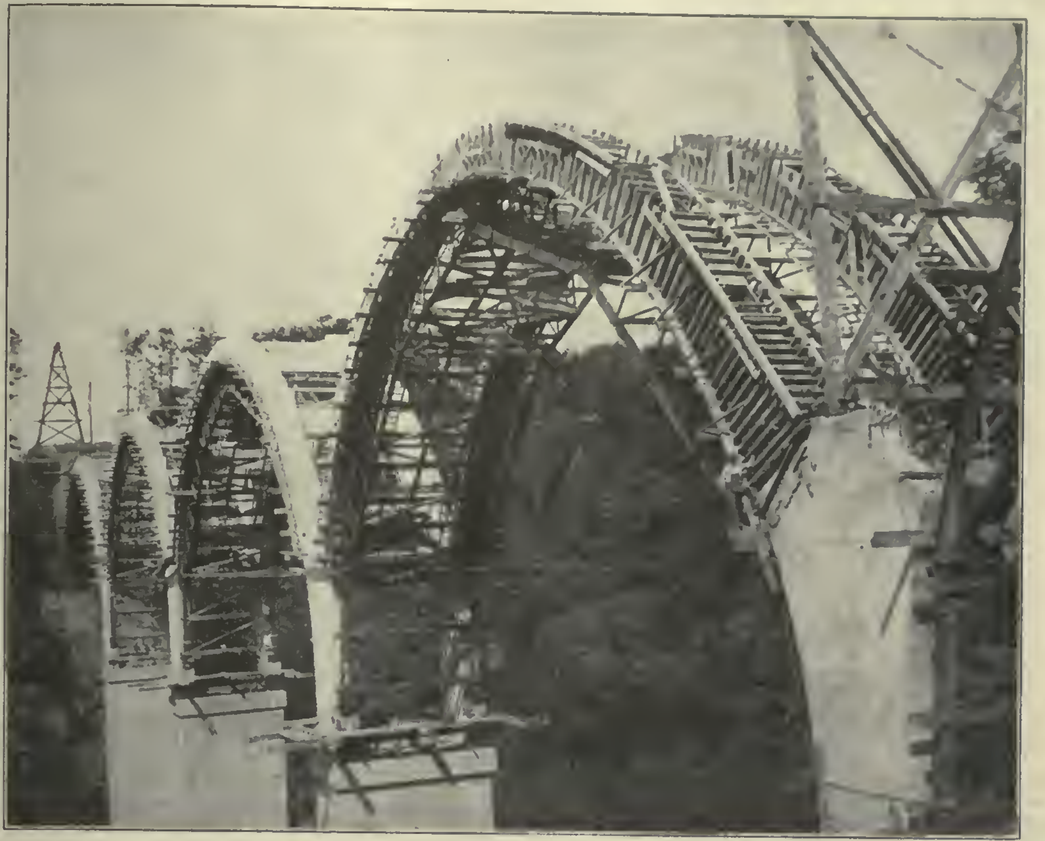
The total length of the viaduct is 781 ft. 9 in. The bridge has a 24-ft. roadway and two 4-ft. sidewalks, and provision for a single-track electric road in the future. It is located on the main road to Akron from the north, on an extension of North Howard Street, about one-half mile outside of the city line. The Cuyahoga River gorge at this point is a deep ravine with steep banks of shale and heavily wooded sides.

As finally built, the structure consists of five main arch spans 127 ft. long between centers of piers. Each arch has two main ribs, 20 ft. on centers, supporting spandrel columns. The three high piers are hollow, rectangular in section, reinforced with horizontal and vertical steel, and the walls strengthened by horizontal diaphragms about 40 ft. apart vertically. The highest pier is 110 ft. high and of the dimensions shown in the drawing.

The approaches are of exactly the same floor construction as the main-arch span, similar columns to the spandrel columns, spaced 9 ft. 5 in. on centers, being carried down to the rock foundation. On the south approach the columns, because of their great height, are braced by 12 x 12-in. longitudinal struts at about the mid-height, and transverse struts with knee braces are also used.

LIVE LOADS AND STRESS ANALYSIS

The bridge was designed for a uniform live load of 100 lb. per square foot on the roadway and 75 lb. on the sidewalks, for an



STEEL ARCH CENTERS SUPPORTING TIMBER FORMS FOR THE MAIN RIBS

18-ton truck on four wheels, 9000 lb. per wheel, 5-ft. gage and 10 ft. on centers, with 30 per cent impact, and for a 40-ton car with trucks 22 ft. on centers, wheels 10,000 lb. each, spaced 6 ft. apart, with 40 per cent impact. Wind pressure was considered at 30 lb. per square foot. The allowable unit stresses were 750 lb. per square inch compression in concrete and 16,000 tension in steel. On the foundation about 5 tons per square foot for dead load and 10 tons for the worst condition of unbalanced thrust were allowed. The maximum compression on the concrete of these piers under full live load and wind pressure is about 400 lb. per square inch.

The arch analysis was made in the usual manner, two street cars and two trucks being assumed. Stresses were computed to include the effects of a rise of temperature of 15 deg. and a fall of 60 deg., the rib-shortening effect being included as 16 deg. in the 60-deg. fall. It was found that ribs 3 x 3 ft. at the crown and 3 x 5 ft. at the springing line would carry the stresses. These sections were increased when the design was changed, so that the ribs as constructed are 4 ft. deep at the crown and 6 ft. deep at the springing line. Seven transverse struts 4 ft. deep with end knee braces connect the two main arch ribs. Each rib is reinforced with twelve ¾-in. square rods, with ½-in. square ties on 3-ft. centers.

In computing the stresses in the main ribs when the thrust line was outside of the middle third the stresses were found as for eccentrically loaded columns, including the steel in both tension and compression. When the thrust line was inside the middle third the effect of the steel was neglected. It will be noted that the percentage of steel at the crown is only 0.39 per cent. This is due to the excessive section used for the modified design.

The floor slabs are of two thicknesses, 8 in. and 6 in., as seen in the half section. Two-way reinforcement is used between the transverse floorbeams and the longitudinal stringers formed at the sidewalk curb and at the side of the central depressed 8-in. slab designed to carry the future electric-railway track.

CONSTRUCTION BY CABLES AND TOWERS

About 50 ft. back from the ends of the bridge 70-ft. towers were erected and a cableway which sagged about 50 ft. under the maximum load was swung, and operated from a powerhouse at the south end. The mixing plant, located just south of the south arch abutment, consisted of a large V-bottom bin of two compartments for the aggregate, with steam pipes for heating the material in cold weather. The coarse aggregate was brought to this bin by cars on a track which was extended about 1000 ft. to the site by the contractor.

The fine aggregate was stripped from the south approach cut by a mast and boom with an orange-peel bucket suspended from the boom, and loaded into small cars which ran out over the bin and dumped into a revolving cylinder screen to carry the larger particles over into the coarse aggregate compartment. The mixer, placed below the bin, discharged into bottom-dump buckets which rode on push cars operated by a cable from the mixer engine. When full they were pulled out under the cableway, where they were picked up and delivered where needed.

In concreting the superstructure it was necessary to consider carefully the se-

SATISFACTORY GENERAL APPEARANCE OF HIGH LEVEL BRIDGE AT SITE OF FUTURE PUBLIC PARK NEAR AKRON quence of pouring, so as to avoid excessive thrust at the top of the high slender piers. This sequence was as follows: (1) All steel centers were placed before any concrete was poured in the arch rings; (2) timber forms were completed in the two north spans and the concrete was poured in the arch rings for the north span, the timber forms being thereafter kept one span in advance of the pouring; (3) the columns were poured on the north span, followed by two and a half panels of the floor at each end of the north span, care being taken to keep the loads nearly balanced at all times; (4) the columns were poured on the next span, the piers being able to take up the unbalanced thrust produced by the weight of the columns and by two and a half panels of floor; (5) two more panels were poured at each end of the two north spans, and the columns in the third span; (6) the center panels were poured in the north span, completing this arch, two more panels in each end of the second and third spans, the columns in the fourth, etc., maintaining this system for the remaining arches.

The maximum settlement of the arch ribs under this unequal loading was about one-half inch, and a corresponding rise in the adjacent arches was noted.

The location survey was made by R. S. Ferguson, by direct measurements on the slope by tape and transit, checked by angles turned from a base line located approximately at right angles to the axis of the bridge. The entire work was in charge of Wilbur J. Watson & Company, consulting engineers for Summit County, which built the bridge. Stress sheets and designs were made by A. F. Blaser and R. S. Ferguson. George L. Ehrman was resident engineer. The contractor was the MacArthur Brothers Company of New York City, and the total cost was $114,000.

Good Progress Being Made on Victoria Breakwater

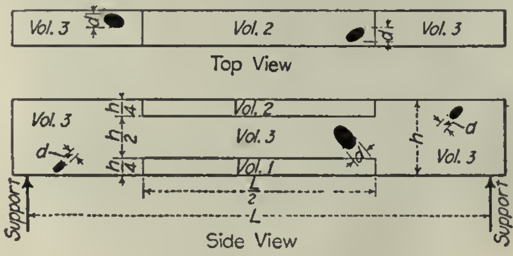
DURING 1915 work on the breakwater at Ogden Point, Victoria, B. C., has progressed so rapidly that the structure, which, at the beginning of the year, was not visible above the surface of the water is now two-thirds finished. The breakwater is composed of three arms, the first extending only 330 ft. from shore, the main arm having a total length of 1500 ft., and the outer arm which will be 700 ft. long. On Jan. 1 the work had been completed for a distance of 1630 ft. from shore. Over 1,000,000 tons of coarse and fine rubble have been used in the construction thus far, it is reported. J. S. Maclachan, Dominion government engineer, has given out the following figures referring to total quantities thus far handled on this contract: Coarse rubble dumped, 792,415 tons; core, or fine rubble dumped, 241,925 tons; granite blocks placed in position, 93,279 tons; concrete poured, 20,883 cu. yd. During 1915, 273,000 tons of rubble stone were deposited, 75,000 tons of granite blocks placed and 19,000 cu. yd. of concrete poured.

THE COST OF STREET CLEANING at Victoria, B. C., is now 13.4 cents per 1000 sq. yd. This does not include plant rental and overhead charges. All the work is done with hand brooms, pick-up carts and cans. No flushing water is used.

Forest Service Proposes Douglas Fir Grading Rule

Applies to Structural Timbers Only and Takes Account of Density as Well as Defects—Six Rings or More Per Inch Required

THE U. S. Forest Service, through the Forest Products Laboratory at Madison, Wis., has proposed a rule for grading Douglas fir timber used for structural purposes. Only one grade, No. 1, is provided for. The rule follows the recent trend in yellow pine rules, in placing in first position clauses that determine the density of the timber. In addition to the visual inspection for density—by a rings-per-inch clause—the weighing of dried borings is provided for when the sticks do not meet the rings-per-inch rule. The plan of restricting knots in beams, as developed for the yellow-pine rule, is also followed.



DIVISION OF BEAM INTO VOLUMES FOR LOCATION OF KNOTS

The rule proposed by the laboratory, with notes thereon, is as follows:

REQUIREMENTS FOR DENSITY AND RATE OF GROWTH

1. Shall contain only sound wood.

2. *Density Determinations by Borings.*—One inch holes will be bored into the end grain of the timbers with a clean cutting bit, each hole being 1¾ in. deep. All borings from a single timber shall be placed together and dried to a constant weight of 100 deg. C. They shall be weighed after being dried and without being allowed to cool and shall weigh not less than 10 grams per hole. All holes shall be bored into a representative portion of the cross-section free from checks or shakes. The holes should not be bored closer than 1 in. from the pith nor into knots or pitch streaks. The number and location of holes shall be as indicated below:

a. Beams or posts 35 sq. in. in cross-section or less. One hole will be bored into a representative portion of the cross-section.

b. Beams or posts with a cross-section of from 35 to 90 sq. in. Two holes will be bored.

- A. Beams, one in the lower quarter and one in the upper quarter, each representative of the quarter in which they are placed.
- B. Posts, one near each side or corner. opposite sides.

c. Beams and posts over 90 sq. in. cross-sectional areas. Four holes will be bored.

- A. Beams, two in the lower quarter, one in the middle half, and one in the upper quarter of the cross-section.
- B. Posts, one near each side or corner.

2*a. Density Determinations by Inspection.*—Any timbers fulfilling the following will be accepted without borings: Shall show on the cross-section an average of not less than one-third summerwood and six or more annual growth rings to the inch. The inspection for summerwood and rings shall be made on a radial line from the pith as follows:

a. When the pith is present or can be accurately located.

- A. Radial line of 5 in. present.
  - *a.* Apply inspection over third, fourth and fifth inches from the pith.
- B. Radial line of 5 in. not present.
  - *a.* Apply inspection to the second inch on 2 x 3, 2 x 4, 2 x 6, 3 x 3, 3 x 4, 4 x 4, or any other dimension material that has less than 16 sq. in. on the cross-section.
  - *b.* In larger material apply inspection to the three inches farthest from the pith.

b. When the pith is not present or can not be accurately located.

- A. When material is over 3 in. thick apply inspection to three inches nearest the pith.
- B. In dimension material 3 in. or less in thickness apply inspection to second inch from the edge nearest the pith.

c. The radial line chosen shall be representative with respect to rate of growth and percentage of summerwood. In case of disagreement between purchaser and seller the figures obtained by averaging the number of annual rings and percent of summerwood on the two chosen inspection lines shall be used.

3. It is sufficient if either end passes the inspection.

RESTRICTIONS ON KNOTS IN BEAMS

4. Shall not have in Volume 1 (see figure) sound knots with a diameter greater than 1½ in. or one-fourth the width of the face on which they appear—or knots over one-half inch in diameter which are insecurely attached to the surrounding wood. Shall not have in Volume 2 sound knots with a diameter greater than 3 in. or one-half the width of the face on which they appear—or insecurely attached knots with a diameter greater than 1½ in. or one-fourth the width of the face on which they appear.

The aggregate diameter of all knots within the center half of the length of any face shall not exceed the width of that face.

The diameter of a knot on the narrow or horizontal face of a beam is to be taken as its projection on a line perpendicular to the edge of the timber. On the wide or vertical face, the smallest dimension of a knot is to be taken as its diameter (see figure).

RESTRICTIONS ON KNOTS IN COLUMNS

5. Shall not have sound knots whose diameters are greater than 4 in. or one-third the least width of the column, or knots over one-half inch in diameter which are insecurely attached to the surrounding wood.

The diameter of a knot is to be taken as its projection on a line perpendicular to the edge of the column—as on the narrow edge of a beam (see figure).

RESTRICTIONS ON SHAKES AND CHECKS IN BEAMS

6. Ring-shakes shall not occupy, at either end of a timber, more than one-fourth the width of green material, nor more than one-third the width for seasoned material.

Any combination of checks and shakes which would reduce the strength to a greater extent than the allowable ring-shakes will not be permitted. Shakes shall not show on the faces of either green or seasoned timber.

RESTRICTION ON DIAGONAL GRAIN

7. Shall not have in Volume 1 diagonal grain with slope greater than one in twenty.

Notes on Proposed Rules

1. The greater part of Douglas fir structural timber is now sold under grade classifications adopted by associations of lumber manufacturers. These classifications differ somewhat and are described in rules published by the several associations. The rules here proposed embody the principles which should guide in the selection of high-grade structural timbers. Their use will result in securing timbers of higher average strength and greater uniformity than can be obtained by the use of any of the existing commercial rules. They are intended to apply to structural timbers only and not to material to be used where factors other than strength are of prime importance. In specifying material, the advantages connected with the use of commercial grades should be considered and the commercial grades adhered to as long as it is certain that material selected under such rules will meet the requirements.

2. The importance of shakes and checks in the middle half of the height of a beam is dependent upon the magnitude of the horizontal shearing stress. The specification given is for beams in which the allowable shearing stress is developed. In beams whose length is more than fifteen times their height, the allowable shearing stress is not usually developed, and as the ratio of length to height increases the importance of these shakes and checks decreases proportionately. Ring-shakes showing on an end should be considered as extending to the center. Checks and radial or star-shakes are not usually continuous in the direction of the length of the timber but should not be allowed if, in the judgment of the inspector, their weakening effect is greater than that of the allowable ring-shakes.

GREEN AND SEASONED MATERIAL

Allowable conditions for both green and seasoned material are given because checks are formed and shakes further developed during seasoning. The maximum amount of shakes and checks should not be allowed unless it is practically certain from the appearance of the timber, or from a knowledge of the seasoning conditions, or length of time elapsed since cutting, that it is thoroughly seasoned. For purposes of this rule, it will be considered that at least one and one-half months per inch of thickness is required for material to become thoroughly seasoned.

3. In dry interior construction a working stress of 1600 lb. per square inch may be used with beams which meet the requirements of the proposed rules.

AN 11-TON LOAD ON AN 18-PER CENT GRADE was one of the features of the transporting of a steel casting to the solar observatory on Mt. Wilson, near Pasadena, Cal. The casting, whose net weight was 8½ tons, was loaded on a motor truck and was hauled safely over the 9 1/3-mile grade in a little over six hours. The average grade for the entire distance is about 12 per cent.

Cellular Type of Quay Wall at Halifax Terminals Compared with Other Designs

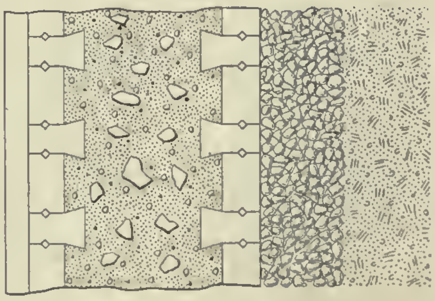
Large Precast Hollow Blocks of Reinforced Concrete Are Placed in Stacks About 50 Feet High and Compartments Filled with Rubble or Concrete

AFTER a thorough investigation of the relative costs and advantages of various types of quay walls and wharf construction, the engineers who designed the Halifax Ocean Terminals adopted a cellular type which contains many unique features. The work of European and American engineers was reviewed and all the available types were finally reduced to five. Designs and estimates of cost were made for each of these types, and their advantages and disadvantages carefully studied and compared, keeping clearly in mind the requirements for rapid and yet permanent construction, the nature of the foundation conditions, and the local aspects of the skilled labor problem.

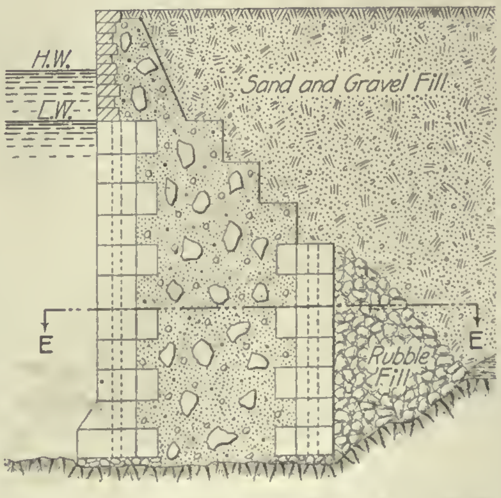
COMBINATION TYPE EVOLVED

As a result of this investigation a combination type of quay wall has been evolved. It contains many new design features and is proving to be economical and rapid in construction, because of the extensiveness of the work, the economies in the casting yard, and the effective use of mass concrete and rubble filling for the compartments. It combines the advantages of reinforced concrete with the cheaper mass concrete and eliminates most of the objectionable features of the other designs studied.

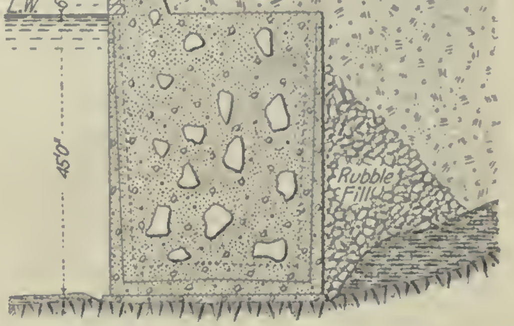
As explained in the previous articles in the Engineering Record of Jan. 22, page 102, and Jan. 29, page 143, the adopted design E consists of stacks of cellular reinforced-concrete shells, or blocks, securely bonded and bedded by mass concrete and grout, cast on shore and placed in position by economical methods already described. Thus the concrete shells are thoroughly cured before coming in contact with sea water and the mass concrete is deposited under ideal conditions in quiet water and in permanent forms. The adopted design provides for the effects of settlement and temperature changes by the vertical joints and short sections separated by rubble filling. It provides for unforeseen difficulties by possible alterations in the filling of the different compartments. It is most effective in its adaptability to the varying depths to rock bottom and in the elimination of expensive site-preparing operations.



SECTION EE



DESIGN A—CONCRETE BLOCKWORK WITH MASS CONCRETE HEART



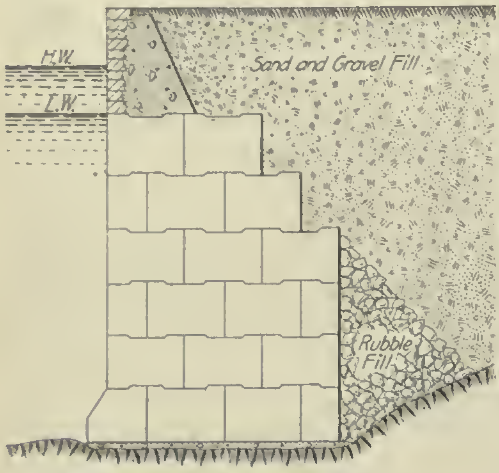
DESIGN B—REINFORCED-CONCRETE CAISSON FLOATED TO POSITION

The following detailed comparison of the five available designs, including the reasons for the adoption of the type used, a general statement of the theoretical analysis based upon given assumptions and a description of the design of the reinforced-concrete shells or blocks, is taken largely from a report to the Hon. Frank Cochrane, Minister of Railways and Canals, made by F. W. Cowie, consulting engineer, Montreal, Can.

DESIGNS CONSIDERED

Some of the determining conditions imposed by the site and the requirements of the problem were: The specified 45-ft. depth below low water, the entire elimination of timber except for fenders or where not exposed to sea water, the impossibility of the use of piles of either timber or reinforced concrete owing to the solid rock encountered, and the desire for rapidity of construction. Design A, a typical concrete blockwork wall with a mass concrete heart, would require the bottom of the harbor to be leveled carefully because of the increase in irregularity at the top courses resulting from uneven bedding of the bottom courses. To insure rapidity of construction elaborate temporary staging would be required, which would be expensive, as pile staging could not be used and the initial cost and cost of maintenance would be high, due to the exposed location.

Design B, a series of reinforced-concrete caissons 110 ft. long, filled with concrete, to be built in a floating dock, upon scows, or partly on launching ways and then launched and completed in the water, would present many difficulties. The great weight and draft of the caissons would require a heavy floating plant with tugs to assist in launching and placing in position. Winter construction would be impracticable. The preparation of the bottom would be a



DESIGN C—SOLID BLOCK WALL

serious expense, as in many places it would be necessary to dredge solid rock to depths up to 20 ft. The bed would be leveled by mass concrete or concrete in bags and would thus form a horizontal plane of weakness on which sliding might take place.

Design C, of precast solid blocks weighing 30 to 50 tons each, would require the use of heavy floating cranes or cranes on temporary staging and have the same objections as the first two in the preparation of the bottom and the loss of time in winter. The advantage of this design lies in the fact that no concrete is deposited under water until it is thoroughly cured.

REINFORCED-CONCRETE DECK

Design D is a reinforced-concrete deck of beam and slab type supported upon concrete piers or cylinders spaced about 22 ft. apart longitudinally. Transversely the spacing would be about 30 ft., to suit the shed columns. Great difficulty in this type would be encountered in places in preparing the bottom and setting the cylinders in a vertical position. Until the decking and bracing could be completed these cylinders would be in danger of injury from the floating plant or from ships. The rate of construction would be slow. The initial cost was estimated to be the same as the more solid type E adopted. The danger of serious consequences in case of accident and the difficulty in repairing this open type were strong considerations against it.

The adopted design E consists of vertical stacks of cellular reinforced-concrete shells or hollow blocks 22 ft. long, 31 ft. wide and about 4 ft. high, placed one directly above the other, and securely bonded and bedded by mass concrete deposited in the front and middle compartments and by grout in the 10-in. grout holes. All the bottom shells and half the height of the next shells above will be filled with concrete to form a solid full-width foundation and ballast floor.

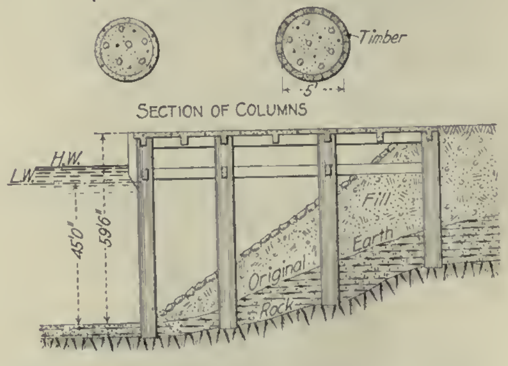
GUIDE POSTS FACILITATE SETTING

Each stack is keyed to the adjoining section by vertical reinforced-concrete guide posts of square section fitting into V-shaped recesses in the blocks. These posts facilitate the setting of the blocks under water, restrain lateral movement in case of settlement, and prevent the escape of the filling in and behind the wall. The spaces between the stacks of shells are filled with rubble or other filling, thus forming an expansion joint and allowing each stack to settle independently without affecting adjoining sections.

The estimated costs of the above-described five designs, including mooring blocks, hooks, ladders, stairs, fenders, etc., but excluding dredging and filling are, per linear foot: Design A, $550; design B, $540; design C, $550; design D, $490, and design E, $490.

ADVANTAGES OF ADOPTED DESIGN

The sectional type of wall adopted is proving itself to be rapid and economical in construction. It is exceptionally well adapted to the particular features of the bed of the harbor here encountered. Typical block sections, shown in the drawings, have been designed; one for the case where rock is either at the required depth or lower than the required depth of 45 ft. below low water, and the other where rock is above the required depth. In the first case the lower shell is placed upon small pillows or stools of concrete, laid on the solid rock or on a mass concrete or rubble fill at each of its four corners and exactly leveled by means of a large diving bell. Thus the necessity for leveling the whole site is avoided. The mass concrete filling on the bottom will bond with the rough rock and prevent sliding.



DESIGN D—REINFORCED-CONCRETE DECK ON CYLINDER PIERS

A great saving in rock excavation was to be accomplished by the use of the narrow hollow blocks shown in the drawing for the cases where rock level is above the required depth and the rock is in sound solid beds. This factor, combined with the saving in dredging operations due to the scheme for avoiding exact leveling of the site, would add a large element of economy not included in the figures above quoted.

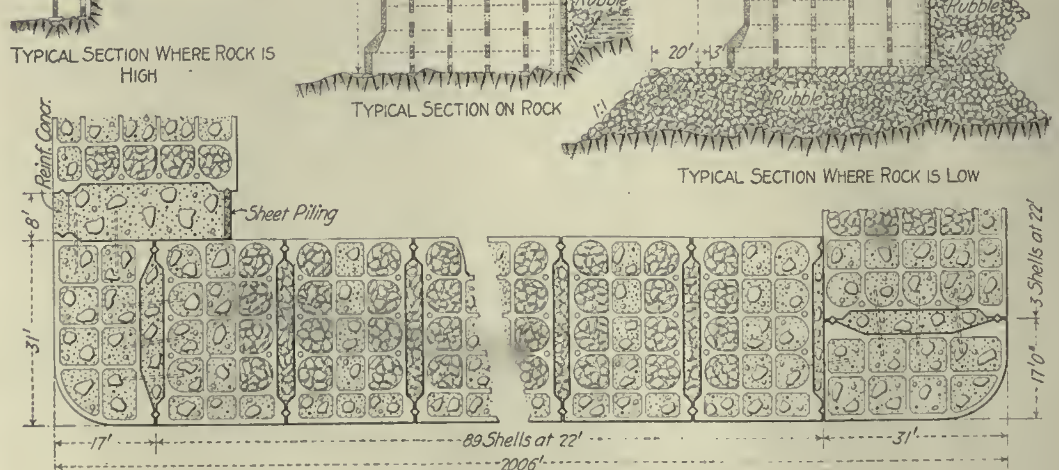
By the use of narrower blocks for the two upper rows, and a rubble concrete wall faced with cut granite masonry from the top down to 1 ft. below low water, the concrete is never exposed to the action of frost between high and low water, thus preventing disintegration.

Other obvious advantages of the adopted design are in the method of setting by a locomotive crane carried on the previously placed part of the wall, thus avoiding the necessity of expensive temporary staging or a floating crane, the advantages in precast units made under ideal manufacturing conditions, and the ease with which the mass concrete can be placed under water in the compartments under relatively good conditions.

ASSUMPTIONS

The governing case with reference to allowable toe pressure and horizontal thrust is the wall built on rubble foundation where rock is low, as shown in the drawing. For this case the whole submerged section is subjected to the full effect of buoyancy. This effect of buoyancy must also be considered for the material backing the wall, not only in modifying the weight, but also the angle of repose. The filling was assumed to be sand or gravel weighing when not submerged 115 lb. per cubic foot with an angle of repose of 38 deg. When submerged the angle of repose was taken at 32 deg.

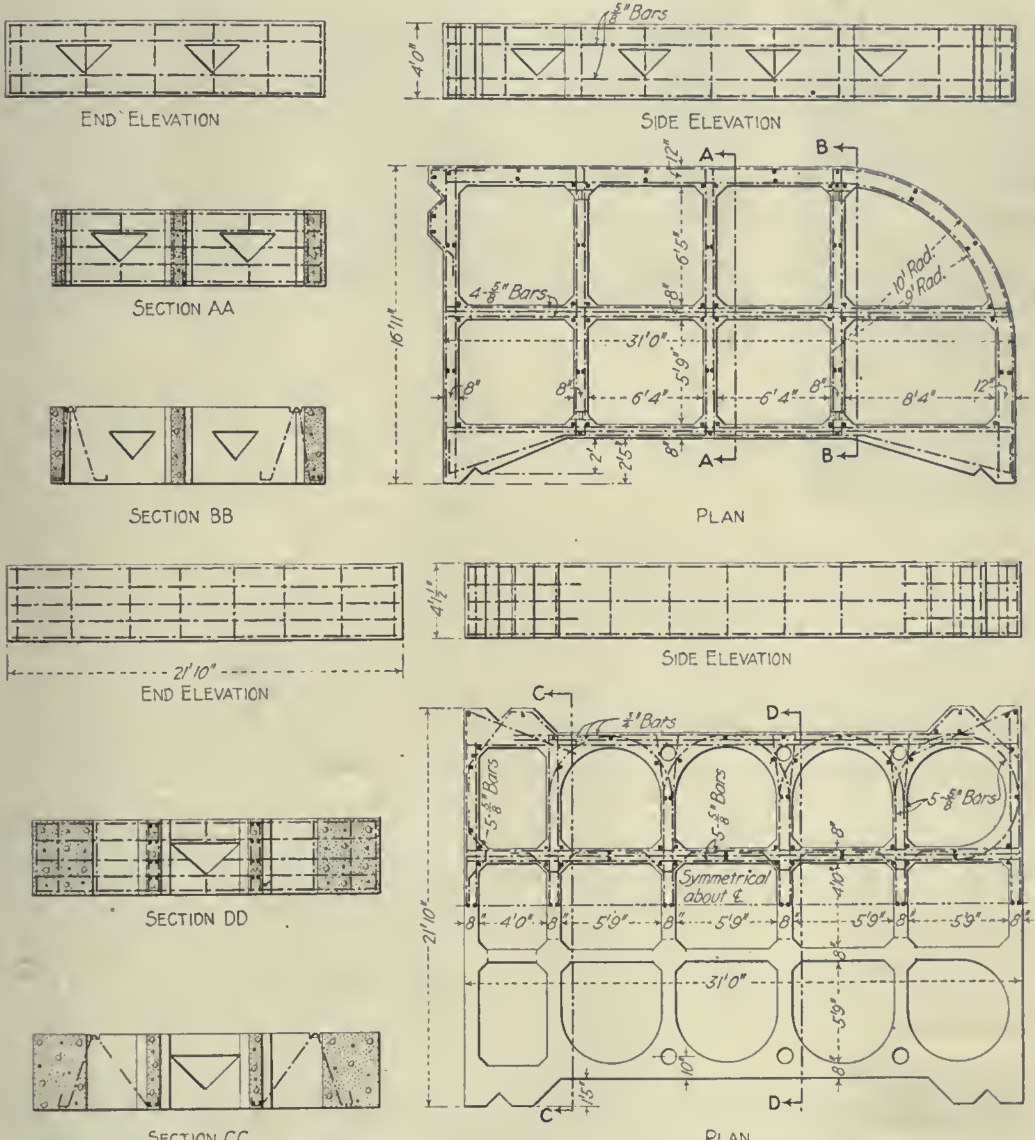
Two theoretical computations of the earth pressure were made, one based upon the Rankine theory of reciprocal pressure and the other upon the sliding wedge hypothesis taking into account the frictional forces on the back of the wall, using the formulas deduced by Poncelet. It was considered that these results gave the maximum and minimum possible values, and that the true pressures were between the two. A surcharge was considered, equal to the height of the backing above the coping plus the superimposed load, and the material was assumed divided into two strata of different



DESIGN E—PART PLAN AND THREE TYPICAL CROSS-SECTIONS OF QUAY WALL densities corresponding to the conditions above and below water level. The angle of friction between the filling and the back of the wall assumed in the second method was 38 deg. above water level and 16 deg. below water level.

RESULTS—RESISTANCE TO SLIDING

For the worst possible case, namely, where the blocks are supported by a carefully prepared rubble mound overlying solid rock, assuming full effect of buoyancy, the following results were obtained: By the Rankine method a maximum toe pressure of 5.7 tons per square foot and a horizontal thrust of 64,000 lb. per linear foot of wall; by the Poncelet method corresponding values of 4.8 tons and 54,000 lb. This maximum toe pressure of 5.7 tons per square foot does not appear excessive when compared with the dock walls at Southampton harbor, England, where experience has shown that a safe unit pressure in quay wall foundations on beds of more or less sandy clay may be taken as 5.4 tons per square foot.



TYPICAL DIMENSIONS AND REINFORCEMENT FOR CORNER AND INTERMEDIATE UNITS OF HOLLOW REINFORCED-CONCRETE BLOCK WALL

Considering the resistance to sliding for this worst case, the computed average weight of wall per linear foot without the superimposed load upon the foundations is 179,000 lb. Assuming a coefficient of friction of 1 at the base of the wall on the rubble foundation, i.e., an angle of repose of 45 deg., the factor of safety against sliding is 2.8 according to the first method, and 3.3 by the second. Since the bottom shell is to be filled with concrete deposited upon and penetrating the rubble bed, these values are amply safe. In all other cases, where the wall is founded directly upon the prepared rock bottom, the conditions will be even more favorable.

INTERNAL STABILITY—DESIGN OF SHELLS

The conditions of stress within the wall unit were investigated by considering the horizontal section immediately above the cantilever toe at the top of the second shell from the bottom. Computing the forces and moments acting on this section and applying equations of equilibrium, the position of the neutral axis was obtained and the stress intensities were calculated to be 120 lb. per square inch maximum compression on the concrete at the front and 115 lb. per square inch maximum tension in the old railway tie rails embedded in the rear compartments, there being practically no uplift.

The general dimensions of the wall and of the shells were fixed by the design of the transit sheds, since the foundations for the front row of shed columns rest on the rear of the quay wall. Thus the 22-ft. length of shells was determined by the column spacing so as to place the columns at the centers of the stacks of shells. The 31-ft. width was based on the requirements for a railway track and for handling freight in front of the shed.

The walls and diaphragms of the reinforced-concrete shells were designed to withstand the bursting pressure due to the rubble or gravel filling in the compartments, in combination with the stresses from all loads acting on the structure. The allowable unit stresses were 500 lb. compression in concrete and 16,000 lb. tension in steel for this case. Analyses for stresses due to a head of unset concrete in the front and middle compartments, for stresses due to dead load when the shells are stacked in the molding yard, and for erection stresses due to the weight of the lifting crane, to lifting, setting and all other causes were made. For erection stresses 25 per cent impact was added. Higher working unit stresses for this case were allowed—700 lb. compression in concrete and 20,000 lb. tension in steel where cracks in the concrete were not injurious.

On account of the important effect of the toe extensions of the two base shells, the unit stress in the steel was kept below 10,000 lb. tension, on the basis of the maximum theoretical toe pressure as a working load, to avoid danger of corrosion of the reinforcement due to salt water entering any tension hair cracks in the concrete. The bottom shell was also analyzed for stresses due to its own weight when resting on the prepared concrete foundation seats at the four corners.

The plans and specifications, designs and comparative estimates for this work were prepared under the supervision of F. W. Cowie, chief engineer of the Montreal Harbor Commission, and a staff of engineers of which James McGregor is superintending engineer at Halifax, A. C. Brown is resident engineer on the dock work and J. J. McDonald is office engineer. F. P. Gutelius, general manager of Canadian government railways, supervised and directed the project, which is being carried out by the Dominion government through the Department of Railways and Canals, of which the Hon. Frank Cochrane is minister.

Deflectometer Gives Direct-Readings of Building Settlements

A DIRECT-READING deflectometer was used in determining the cause of the usual initial settlement in buildings being underpinned along the New York subways. This deflectometer was never used in this country before, according to Maurice Deutsch, consulting engineer, New York City, who used it to make some original tests of piles on this work in September last year. It consists of a steel tape about ½ in. wide attached to the pile being tested and run vertically up and around a small wheel at the end of a horizontal shaft. At the other end of this shaft an index needle is set and revolves around a calibrated dial marked in millimeters, thus giving very exact indications of pile movement.

GOVERNMENT TIMBER AMOUNTING TO 42,578,000 ft. b. m., and valued at more than $93,000, has been cut from the national forests in California in the six months ended Dec. 31, 1915, according to a report recently made by the district forester. This is an increase of almost 43 per cent over the cut for the corresponding period of 1914, and is significant because of the fact that from the latter half of 1912, with a cut of 10,000,000 ft. b. m., valued at $65,000, to July 1, 1914, when a cut of 29,313,000 ft. b. m., valued at $63,669, was made, the government timber industry remained practically stationary.

Smooth Concrete Roads Produced by Accurate Headers

Study of Slight Irregularities in California Pavements Directs Attention to Need for Screeding Surface at True Grade

THAT the smooth-riding qualities of concrete roads are dependent more upon the use, during construction, of headers of true shape, set accurately to grade, than to screeding devices and floats, is the conclusion reached by Charles H. Wondries, resident engineer of the California Highway Commission, in a report submitted recently to Austin B. Fletcher, chief engineer. In the effort to get a smooth pavement the screeding device and float are limited, even under the most skillful handling, by the trueness to grade of the headers upon which the screed rides and from which the float works.

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SETTING RULES TO MEET STRAIGHT EDGE

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SCREEDING SURFACE OF CALIFORNIA CONCRETE ROAD

Header Board Abuses

In keeping with the rule requiring the maximum use of equipment, it has been the custom in road work to use header boards repeatedly. Ragged ends are occasionally sawed off, or strips which have been warped by alternate wetting and drying are partially sawed by way of correction, but headers are seldom rejected because the ends are partially broken and shattered, or because the body of the rule is slightly warped or splintered. These header boards perform a dual function, but the retaining of the concrete in the subgrade is a less delicate matter than marking the elevation to which the concrete should be finished. It has therefore been found worth while in California work to make special provision for checking and correcting inaccuracies which are likely to interfere with the latter function.

Numerous checks extending over various portions of 40 miles of pavement with 16 and 22-ft. straight edges in three Southern California counties showed that invariably, after the first day or two of pavement laying, during which the concrete crew accustoms itself to its working tools, the apparent rough-riding qualities of the finished concrete can be traced to warped strips and high or low header joints. The deflection from a straight line in these headers varies from unappreciable amounts to about 3/8 in. The results of this study have been the adoption of a 2 x 4-in. rule from 16 to 24 ft. in length for detecting minor warps in headers, and high and low joints. This check is applied in addition to the chalk-line and sighting tests ordinarily used.

This test with the 2 x 4-in. straight edge is not made, however, until a few hours before the concrete is actually placed between the headers. It has been found that under conditions on the California highways the concrete foreman, without neglecting his other work, can check up and correct enough rules during the day to keep ahead of his crew. Where headers are found to be warped the new practice requires driving additional outside stakes to which the headers are securely nailed after being raised or lowered to check with the straight edge. The old custom of sawing off part of the warped header, it is pointed out, simply decreases the length of the arc.

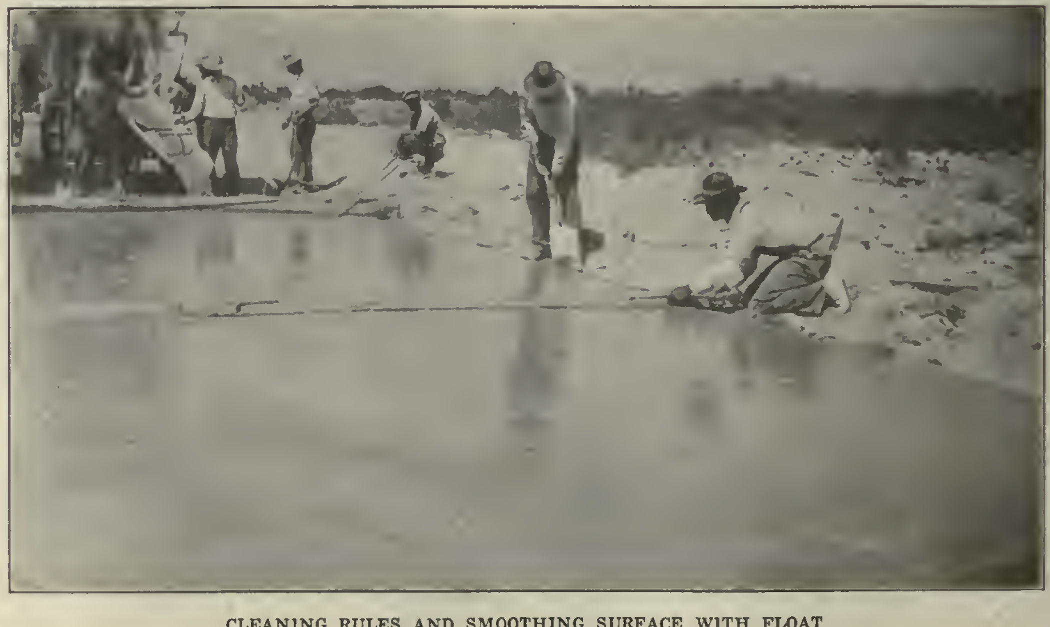
The morning after the concrete is placed, or the same day when possible, the straight edge is tried upon the finished concrete and any variation from a straight line is traced back to header, screed or float trouble. While this work of checking the finished pavement is going on, the men in charge of the crews are shown the possible causes of the variation from a true grade and remedies are suggested.

Checking with Straight Edge

This straight-edge method of checking does not show results in the close-range inspection of the completed work, but it results in a very appreciable improvement in the smoothness of the roadway surface and has made it possible to lay long stretches of concrete pavement with variations which were nowhere found to exceed 1/8 in. under a 20-ft. straight edge. This degree of smoothness adds much to the comfort and pleasure of driving over the road at 20 miles per hour or more.

It is not sufficient, the commission has found, to have the headers carefully set to grade and checked with a straight edge. Insistence must be placed on a gentle tamping of the concrete with the heavy wooden tamper which is now generally used, instead of vigorous blows which result, among other things, in deflecting the header from exact grade.

It has also been observed that where a very dry mix adjoins very wet concrete, even though practically perfect grade may be maintained over the entire surface, the surface will not be regular after the final set is attained, due to the difference in final volume of the two grades of material. Assuming uniformity of mix, if the concrete is spread out with shovels and screeds after it has left the mixer spout, and is first given a general tamping to close the inner voids and bring sufficient mortar to the surface to permit the float to close the surface voids, there was no trouble in going over the pavement finally with the long back and forward sweeps of the screed which would smooth off any local mortar inequalities and would permit of a very close checking with the rule on the finished pavement.



CLEANING RULES AND SMOOTHING SURFACE WITH FLOAT

Analysis and Tests Held to Show Advantages of New Flat-Slab Reinforcement

Part 1—Stress Conditions Discussed with Relation to Deflection Contours and Economical Placement of Steel in Smulski System

By EDWARD SMULSKI
Chief Engineer, S-M-I Flat Slab System Company, Boston

WITHOUT attempting to obtain or recommend coefficients for bending moments, the action under load of flat slabs with multiple reinforcement has been investigated by the author, both in the theoretical analysis presented herewith as Part 1, and by a series of tests on eight slabs in which the deformations and stress relations were carefully measured, the results of which will be presented in Part 2, to follow. This investigation shows the advantages of the new system of flat-slab reinforcement shown in Fig. 1 and described in the article on the Youth's Companion Building at Allston, Mass., in the Engineering Record of Oct. 9, 1915, page 450, and called the Smulski or S-M-I system.

CONTOUR LINES SHOW DEFLECTION

The action of the flat slab can be best understood by considering its deflection under load. For this purpose contour lines of a slab after deflection are shown in Fig. 2, based on results of tests made by A. R. Lord on the Deere & Webber Building and published in Bulletin 64 of the University of Illinois. The size of the test panel was 18 ft. 8 in. x 19 ft. 1 in. For a load of 350 lb. per square foot the deflection at the center, point C, was 0.32 in., while the average deflection at points C_1 and C_2 was 0.22 in.

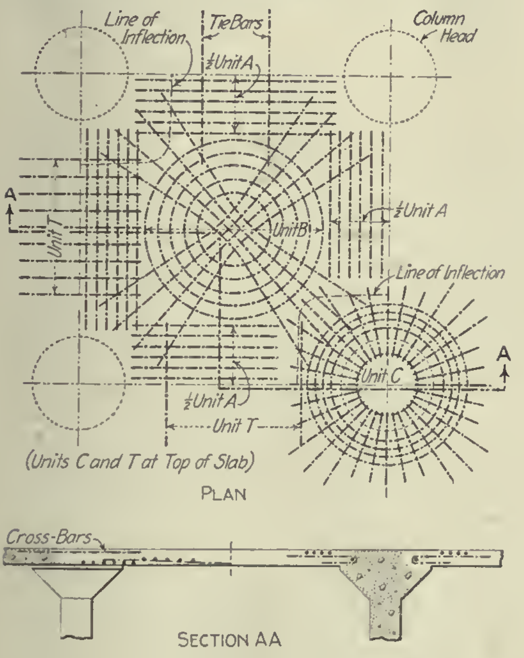


FIG. 1—NEW TYPE OF REINFORCEMENT

The contour lines were drawn by first plotting the deflections along the diagonal and rectangular lines as shown in the sections, Fig. 2, then using horizontal lines 0.04 in. apart to locate points of intersection with the neutral axis after deflection, transferring these points to the plan view and connecting the points of equal deflection by smooth curves showing the shape of the slab after deflection. The heavy dash lines around the columns give the location of the points of inflection from Mr. Lord's tests.

EFFECTS OF LOADING

The contour lines given are for the case of several spans loaded, which is the most unfavorable condition because then the maximum stresses are obtained at the column head. When one span only is loaded, the stresses in the center of the span are somewhat larger, but at the column head they are comparatively small, because the load not only is carried by the loaded panel but also is transferred to the unloaded panel. In other words, the negative bending moment is resisted by the column head and by the unloaded adjacent slabs.

The contour lines show that the slab can be divided into two parts, the circumferential cantilevers at the column head subjected to negative bending moment and the central portion of the slab subjected to positive bending moment. These two parts will be treated separately.

DEFLECTIONS AT THE COLUMN HEAD

From the shape of the contour line, it is evident that the circumferential cantilever at the column head assumes the shape of an umbrella. In Fig. 3, showing the circumferential cantilever to a larger scale, point *a* on the top of the slab, due to the deflection, changes its position to *a′*, consequently the radial distance from the center of the column is increased by *aa′*. Due to this increase of the radius, the circumference of the circle through *a* after the deflection is increased, as indicated by the dotted lines through *a′*. The particles above the neutral axis, therefore, are stretched in two directions perpendicular to each other, i.e., in a radial direction on account of the increase in radius and in a circumferential direction on account of the increase of circumference. The circle through *b* at the bottom of the slab assumes, after deflection, the position through the point *b′*, and therefore all particles here compress in two directions, i.e., in a radial direction and in a circumferential direction.

From the above discussion it is evident (1) that the stresses act in radial and circumferential directions, (2) that the radial component of the compressive stresses, which is the largest part of the compression, must finally be transferred to the columns.

As is evident from the shape of the contour lines and from the foregoing discussion, the slab may fail in compression by crushing of concrete around the column head. The width of beam resisting this crushing of concrete is equal to the circumference of the column head. Therefore, in determining the compressive stresses or the depth of slab for a bending moment around the total circumference, the circumference of the column head must be taken as the effective width of the slab.

REINFORCEMENT OF FLAT SLABS

It is a well-known principle that the best method of resisting stresses is by means of members placed in the direction of the stresses. The same applies to the design of flat-slab reinforcement. The direction of stresses can be seen from the contour lines, because the stresses act perpendicularly to them.

At the head of the column the stresses act radially and circumferentially; therefore, the logical method of reinforcing the slabs is by using radial and circumferential bars. The radial bars take the stresses acting in radial directions. The purpose of the rings is twofold: (1) to resist the circumferential bending moment, which acts in every point as a tangent to the ring and (2) to resist the radial stresses by its hooping effect. In such a combination the radial bars and the rings act co-ordinately, as will be seen from the tests of circumferential cantilevers to be described in the following Part 2.

The action of the rings in resisting radial stresses can be seen from Fig. 3. A section *ab* tends to assume the position of *a′b′* after deflection, and the distance *ma* on the top is increased in amount after deformation. The same would apply to any section around the circumference of the circumferential cantilever. Suppose that a ring is placed near *a*. In order to allow movement in a radial direction, it is necessary to stretch the ring by increasing its radius. The resistance of the ring to the increase of the diameter, therefore, resists the movement *aa′*.

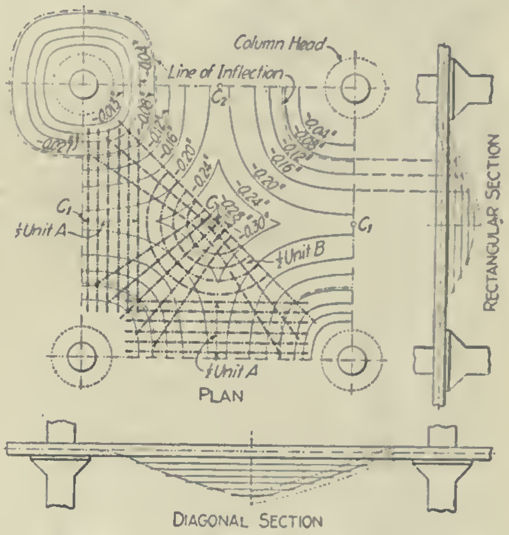


FIG. 2—RELATION BETWEEN DEFLECTIONS AND NEW SYSTEM OF REINFORCEMENT

DISTRIBUTION TO SEVERAL RINGS

If more than one ring is used, any radial movement within the portion of slab covered by the rings is resisted by all the rings placed outside of the point where the movement takes place, because before any movement can take place, it has to increase the radii and the circumferences of all the rings. Therefore all rings participate equally in resisting the stresses. This is shown in Table 1 and stress diagrams in Part 2, which give the results of the tests on circumferential cantilevers.

Compressive reinforcement at the column head is very often required. Tests indicate that the compressive stresses at the column head are larger than would correspond to the actual stresses in steel. This is partially due to arch action, which undoubtedly takes place in flat slabs. Therefore in many cases it is essential to provide compressive reinforcement at the column head. In the type of reinforcement discussed, this is provided by the compression prongs of the radial bars, which are carried near the bottom of the slab. (See cross-section in Fig. 1.)

In the portions of the slab covered by Units *A*, drawn on Fig. 2, the contour lines are practically parallel, which shows that the stresses act in one direction only. The reinforcement, therefore, is placed in one direction only, straight between the columns.

The reinforcement of the central portion of the slab consists of rings combined with diverging bars, because the stresses in the central portion of the slab act in four directions, as indicated by the contour lines. The rings in this Unit *B* not only take the stresses produced in the diagonal sections, Fig. 2, where they are nearly perpendicular to the contour lines, but also resist any tendency to deformation in the diagonal direction, thus helping the diverging bars, which are placed very nearly perpendicular to the contour lines, and in the direction of the stresses. The spacing of diagonal rods is close in the center of the slab where the deflection and the stresses are largest. The rods diverge at the ends to supply reinforcement in portions where the circles end and also to bind securely the central portion of the slab to the circumferential cantilevers.

SECONDARY REINFORCEMENT

If only one span is loaded, the shape of contour lines changes at the column head and across Units *A*, where negative bending moment develops. This is resisted by secondary reinforcement in Units *A*. In the central portion, however, the change is slight, so that the discussion given above applies equally to any condition of loading.

Secondary reinforcement consisting of straight bars is, as a rule, placed at the top of the slab across Units *A*. As is evident from inspection of the contour lines, Fig. 2, this reinforcement does not come fully into action when the load is distributed over all the spans, because there is no appreciable transverse deformation at Units *A*. This reinforcement is fully effective in resisting negative bending moment produced when only one span is loaded.

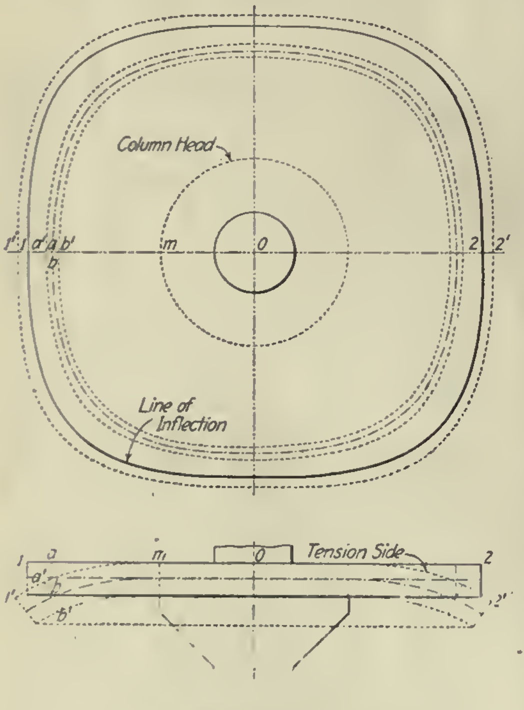


FIG. 3—CANTILEVER ACTION AT COLUMN

THEORETICAL COMPARISON

In comparing reinforcement placed in the direction of stress with reinforcement placed in bands as in the two-way or four-way systems, the statical bending moment, although it does not represent the actual conditions, furnishes a correct and convenient basis for determining the relative effectiveness of the two methods of reinforcing. In systems where bands of steel rods are used, it is necessary to resolve the actual bending moment acting in radial directions into components acting in the direction of the bands. The moment of resistance to be provided (equal to the sum of the components of the radial bending moment) is therefore larger than the actual bending moment. (See test specimens No. 7 and No. 8, Part 2.)

In the radial system, on the other hand, stresses acting in any direction are resisted directly by the circles and radials, as discussed above, and the moment of resistance to be provided equals the actual bending moment around the column head. The ratio of the required areas of steel for the two cases will now be found.

BAND REINFORCEMENT

In a paper before the American Society of Civil Engineers, printed in the *Proceedings* for April, 1913, J. R. Nichols develops the statical bending moment in a flat slab. On page 1735 the sum of components of positive and negative bending moments in one direction (equivalent to bending moment per quarter of circumference of the column head) is given as

$$M_x = \frac{wL}{8}\left(L - \frac{2}{3}D\right)^2$$

where *L* is the span in feet, *D* is the diameter of the column head and *w* is the load per square foot. Assuming $D = 0.24L$,

$$M_x = 0.71\frac{wL^3}{8}$$

As in continuous beams, the negative bending moment equals two-thirds M_x; therefore, in inch pounds per section

$$M = 0.71wL^3$$

and the required area of negative bending moment reinforcement per section is, in square inches,

$$A_s = \frac{0.71wL^3}{f_s jd}$$

It must be remembered that full negative reinforcement consists of four such effective sections (two per band). This will be compared with the amount of steel required by the radial system in one-quarter of a circumference.

The above figures giving the static bending moment are used for sake of comparison only, and are not recommended for use. The actual bending moment to be provided for is smaller, as it is reduced by Poisson's ratio, due to the fact that the stresses are acting in two directions. The ratio between the static bending moment and the actual bending moment, therefore, was selected so as to avoid comparing moments based on different assumptions.

RADIAL REINFORCEMENT

The best method of determining the statical bending moment in a flat slab is by dividing it into a number of simple statically determinate members. The practicability of this method follows from a consideration of continuous beams. Assume a continuous beam under uniform loading *w* per foot extending over numerous supports. The negative bending moment at the supports is $wl^2/12$ and the point of inflection is distant $0.21l$ from the support. By introducing hinges at the points of inflection, the center portion between the hinges, equal in length to $0.58l$ will be a simply supported beam producing reactions at the hinged point equal to $0.29wl$.

The remaining two portions of the beam will be simple cantilevers loaded with concentrated loads at the points of inflection and a uniformly distributed load *w* between the point of inflection and the support. It is evident that a continuous beam may be changed into statically determinate beams by inserting imaginary hinges at the points of inflection, because there is no bending moment at these points and the only force acting there is the shear, which is equal to the reaction $0.29wl$ of the imaginary center beam.

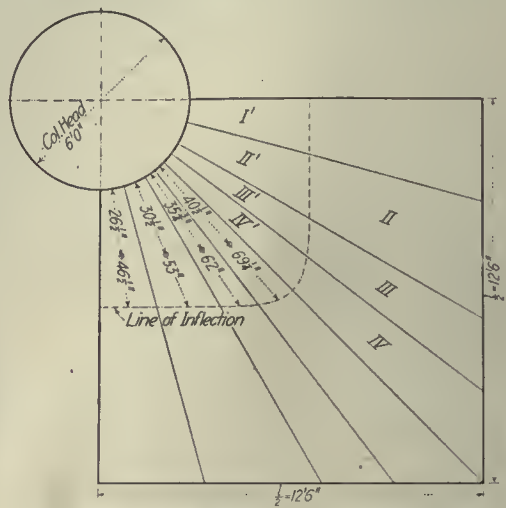


FIG. 4—TO DETERMINE STATICAL BENDING MOMENTS AROUND COLUMN HEAD

APPLICATION TO FLAT SLAB

Fig. 4 shows an outline of a 25-ft. span in which the column head (6 ft.) is assumed as 0.24 of the span, as before. The distance of the point of inflection from the edge of the column head is assumed at one-fifth of the clear span, which is equivalent to the assumption made for the distribution of the bending moments in the case with band reinforcement. There is no shear along the center lines of the panels nor along the lines between columns, under full loading on all panels, therefore the quarter of the panel can be treated separately. For partial loading the theory is modified by the shear acting of these lines.

As explained in connection with a continuous beam, the portion of the load in the span outside of the points of inflection can be considered as suspended at the points of inflection. To get the proper moment arms for the different loads in different portions of the panels, the slab is divided by imaginary radials into parts I, II, III, IV, etc. The division lines are not sections and are made only for the purpose of figuring the areas. Having found the areas and lever arms, the resulting coefficient is computed as in the table herewith, and the bend-

COMPUTATION OF MOMENT COEFFICIENT

No.	Area	Moment arm	Moment factor
I	14.8	46.5	688
II	16.8	53	890
III	10.3	62	639
IV	13.2	69.25	915
I'	5.1	26.25	134
II'	5.9	30.5	180
III'	3.9	35.75	140
IV'	4.7	40.5	190

Total moment factor per ⅛ circumference, 3776
Total moment factor per ¼ circumference, 7552
Coefficient = $7552/25^3 = 0.48$

ing moment is $M = 0.48wL^2$ in inch pounds, and the required area of steel is

$$A_s = \frac{0.48wL^2}{f_s jd}$$

The above bending moment will be resisted by radial bars and rings; therefore the area A_s, consists of the cross-section of radials within the quarter of circumference, and the cross-sections of rings. For the reasons explained in connection with moments for the band system, the above figures give higher results than required in practice and are intended for comparison only.

By comparing the areas of steel A_s required in the two cases (coefficients 0.71 and 0.48), it is found that the required cross-sectional area to be supplied by the new type of reinforcement resisting the direct stresses is 33 per cent smaller than required in the older systems placed in bands. In both cases, the areas of steel were figured on exactly the same basis.

[*To be concluded in the next issue. Results of tests and description of unique testing methods will be given in Part 2. Specimens of two-way and four-way slabs are tested for comparison with the tests of the new radial and circumferential reinforcement.*—EDITOR.]

Remodel Septic Tank Into Two-Story Tank

Pioneer Plant at Lake Forest, Ill., Built Fourteen Years Ago, Outgrown in Capacity, Changed to Modern Design at Small Cost

FOURTEEN years ago septic tanks were considered the last word in sewage treatment, and the 50,000-gal. tank at Lake Forest, Ill., built by Alvord & Shields, was the Mecca to which many sanitary engineers journeyed. Last year the old plant, neglected for several years, and outgrown as to size, became such a nuisance that the city officials had it remodeled into a two-story settling tank. N. N. Campbell, assistant city engineer, gave a history of the old plant and the reconstruction of the new one in a paper presented Jan. 27 to the Illinois Society of Engineers and Surveyors, from which the following notes are taken.

REPAIRS BADLY NEEDED

During the thirteen years the plant was in operation it had been cleaned only twice, once in 1907 and again in 1909. The average annual cost of operation and repair during this period was $534.79.

The physical condition of the plant gradually grew worse. The troughs and partitions in the filter beds had rotted and broken considerably, the tank walls about the surface of the ground were in need of repairs and a few slight leaks were noticed. The piping in the dosing chamber and the automatic operating device were badly rusted and likely to give away at any time. On the whole it became evident that something must be done at once to put the plant in such repair that it would take care of the sewage for at least a few years, or until such time as the proposed sanitary improvements along the North Shore were more fully developed.

In 1913 S. A. Greeley found that 30 per cent of the daily dry-weather flow was bypassed into the lake directly, 70 per cent was treated in the tank and only 24 per cent went through both tank and filters. Analyses indicated an effluent from the tank of poorer quality than the influent, and the effluent from the filters was little improved.

The work of remodeling the tank consisted of removing the old floor, underpinning the old walls and excavating to an additional depth of from 3 ft. 6 in. at the inlet end of the tank to 8 ft. 6 in. in the dosing chamber. A new reinforced-concrete floor 9 in. thick, making an angle of 30 deg. with the horizontal and sloping from each side toward the center of each chamber, was put in to replace the old floor. The water level in the tank was raised 1 ft., the total depth of the remodeled tank being 12 ft. 6 in.

THREE UNITS IN REMODELED TANK

The remodeled tank consists of three units, each of which is divided by a 9-in. concrete wall into two equal chambers. Each chamber is divided into three compartments by means of a false bottom constructed of 20-gage galvanized iron on a framework of No. 1 2 x 4-in. pine strips, heavily creosoted, making a slope of 60 deg. to the horizontal. The three units are in reality a series of three settling tanks. The liquid is drawn off from the top of each unit, as it passes on to the next, over a brick wall or partition separating the units and rising to within 12 in. of the surface. It finally emerges at a point 14 in. below the surface and discharges at the shore of Lake Michigan.

Three baffles or scum boards, 18 in. high, and extending down into the liquid 12 in., were placed across the tank at intervals so as to break up any surface currents that might develop.

The method devised to distribute the sewage to the several compartments is unique and very efficient in breaking up currents or vortex motion in the settling compartments. The sewage enters the tank from the remodeled grit chamber through a 3-ft. opening or trough in the center of the end wall, which leads into a reinforced-concrete distributor running parallel with the end wall and placed so as to leave a 9-in. space between the 18-in. square distributor and the wall. There are four rectangular openings in this channel, 6 x 15 in., which discharge the sewage into each of the four settling compartments against the end wall of the tank in the opposite direction to which it must flow through the settling compartments.

The collector is a rectangular trough or channel similar to the distributor and is placed 9 in. from the outlet end of the tank with the openings in the side next the end wall. The collector also serves as a scum board or trap and prevents any light floating sludge from being drawn off with the effluent.

The sludge drying bed is 90 ft. long and 20 ft. wide, and is parallel with the tank and 20 ft. from it. The bed is divided into three sections by concrete partitions. Each section receives the sludge from one of the three units of the settling tank and is underdrained with four lines of 6-in. drain tile leading into an 8-in. carrier which discharges into the pipe leading from the settling tank. The underdrains of the sludge drying beds are covered to a depth of 12 in. with common lake-shore sand and gravel.

ALTERATIONS COST $4,000

The cost of remodeling the Lake Forest plant and enlarging it so as to provide for the increased amount of sewage was about $4,000.

Some of the elements in the remodeled tank are the provision for 680,000 gal. daily dry-weather flow; settling capacity of 5670 cu. ft.; sludge space of 4000 cu. ft.; settling period, 1.4 hours; velocity through tank, 1 ft. per minute.

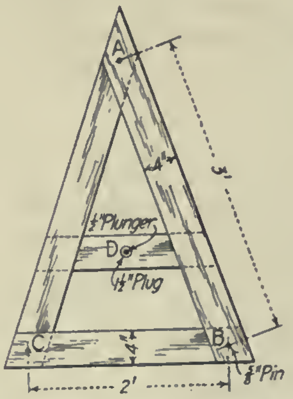
The tank was put into operation Dec. 6, 1915. On Jan. 21 one of the sludge drains leading from a unit nearest the inlet end of the tank was opened and about 10 bbl. of heavy sludge were drawn off before the sewage flowed freely from the pipe. The sludge was apparently well digested and had very little odor.

The plans were prepared by Mr. Campbell under the general direction of James Anderson, Jr., city engineer.

Replace Stakes by Monuments Without a Transit

Triangular Wooden Frame with Pointed Steel Legs Marked Auxiliary Stakes, Permitting Easy Recovery of Original Point

IN MAKING a re-survey of the city of Portage, Wis., it was desired to place at each block corner a permanent concrete monument upon which would be marked the point of intersection of the property lines. As the survey progressed, temporary wooden stakes were set at each corner, the exact point being marked by an ordinary cup tack driven into the stake. In order to replace the wooden stake with a concrete monument upon which would be permanently marked the point referred to, a triangular frame, as shown in the accompanying sketch, was devised.

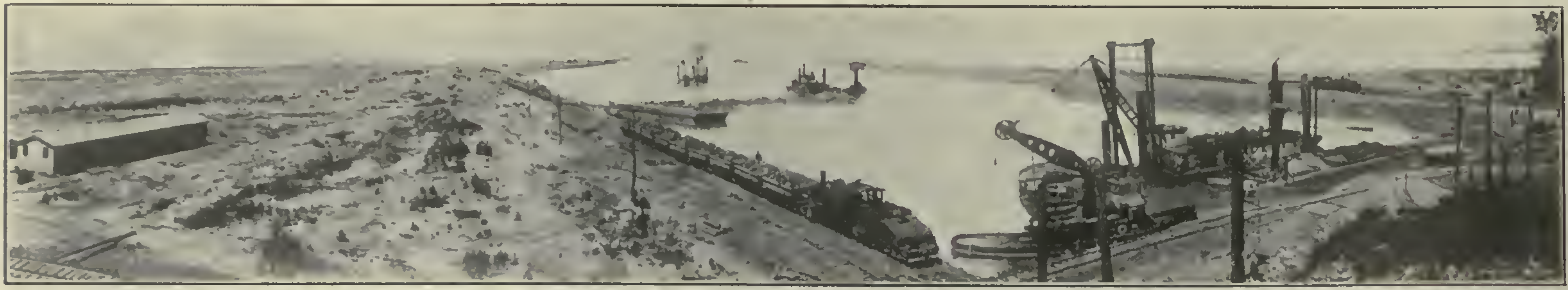


CENTER PUNCH PLUNGER ON TIMBER FRAME MARKS MONUMENT

The frame was made of well-seasoned yellow pine. The parts were glued and securely fastened together with wood screws, making the frame perfectly rigid. At the points *A*, *B* and *C*, ⅝-in. steel legs were inserted and clamped to the frame by means of locknuts. The lower ends of the legs were pointed bluntly to resemble an ordinary center punch. The frame was easily and quickly leveled by means of the locknuts. At *d* a hardwood plug 2 in. long and 1½ in. in diameter was fitted into the piece. In the center of the plug was a ½-in. hole through which a steel plunger 10 in. long worked. The plunger was also bluntly pointed.

HOW DEVICE WAS USED

The method of using the above device is obvious. The point of the plunger was placed on the tack in the stake, and three stakes were driven at the points *a*, *b* and *c*, a cup tack being driven into each stake under the point of each leg. If one or more of the legs fell upon the sidewalk, a light tap on the top of the leg bolt made a punch mark in the concrete, thus marking the point. The stake marking the corner of the block was then removed and the hole for the monument was dug and filled with concrete. After the concrete had been



PORT WELLER HARBOR, WELLAND SHIP CANAL, AS IT APPEARED IN AUGUST, 1915—CONCRETE CRIB BEING TOWED TO PLACE

brought to the required height a soft iron pin was placed directly beneath the plunger. After the concrete had hardened for several days the frame was again placed upon the reference points, and a punch mark was made upon the iron pin by tapping the plunger with a hammer, thus marking the desired point on the monument. Care was taken to have the frame practically level and to set the reference stakes so that there would be no danger of their being disturbed. The original distance between the points of the legs was kept constant by frequent comparisons with a set of standard tacks which were set with the frame at the beginning of the work.

H. V. Tennant, city engineer, under whose direction the survey was made, states that the method as it was here used proved very practical, an average of sixty monuments a day being attained.

Twelve 2000-Ton Cribs for Welland Canal Completed

Excavation Well Under Way at End of 1915—Embankments to Form New Harbor Entrance More Than 50 Per Cent Complete

TWELVE of the 2000-ton reinforced-concrete cribs for the Welland ship canal were completed at the end of 1915. More than 50 per cent of the material necessary to form the embankments for the Lake Ontario entrance had been deposited, and substantial progress had been made on the excavation of all sections. No new contracts were let during the year.

At the end of the year a total of 4,900,000 cu. yd. had been deposited in embankments forming the harbor entrance. The trestle on the west side, from which the material is dumped, has reached the outer extremity of the harbor, projecting 1½ miles into the lake, while the east trestle is out approximately 5500 ft. from the shore line.

Twelve of the large 2000-ton reinforced-concrete cribs to be used for the substructure of the entrance piers and inner harbor dockage have been built, and seven of them sunk in position on the work—five on the site of the outer entrance piers and two on that for the inside docking.

Excavation in Section 2

Section 2, about 4½ miles in length, includes the excavation of the canal prism involving the removal of about 6,500,000 cu. yd. of earth, the construction of locks 2 and 3, with entrance walls, weirs, etc., and the substructure for several bridges over the canal.

WEST WALL OF LOCK 1

Four large steam shovels and three dragline excavators have been engaged on prism excavation, and, to the end of the year, 4,300,000 cubic yards of earth were excavated, the greater part of it being disposed of in the harbor embankments.

Concreting in the breast wall at the head of lock 2 was completed during the summer, and work on the lock walls commenced about mid-season. The upper entrance walls, which are of mass concrete, are practically completed.

Section 3 involves the construction of the twin locks in flights 4, 5 and 6, single lock 7, the guard gates, the construction of the large dam at the head of lock 6 and the excavation of approximately 2,700,000 cu. yd. of rock and 3,400,000 cu. yd. of earth.

Operations on this section have consisted largely of earth and rock excavation. To Dec. 31, 850,000 cu. yd. of rock were excavated from the site of the flight locks, and approximately 1,850,000 cu. yd. of earth were removed. Rock suitable for concrete is taken to the large crushing plant at the lower end of the section and crushed for aggregate for sections 1 and 2.

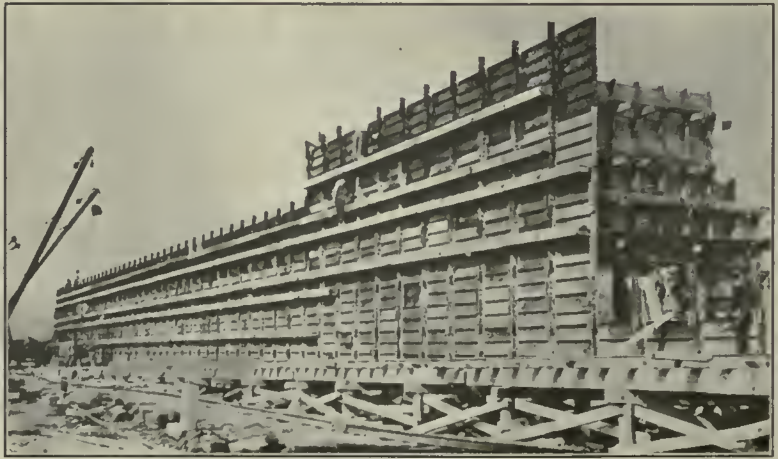
Present Canal Deepened

Section 5, consisting of the widening and deepening of the present canal between Allanburg and Port Robinson, a distance of 2½ miles, was worked by four steam shovels in the dry excavation and four dredges in the channel. The dry excavation removed totaled 2,900,000 cu. yd. of the 5,400,000 cu. yd. to be excavated. Four dredges have been at work in the channel, deepening the canal from the present 14-ft. to the new 25-ft. depth.

Colorado River Attains Highest Stage on Record

THE GREATEST known discharge of the Colorado River at Yuma, Ariz., was experienced Jan. 22, when the gage located at the Southern Pacific railroad bridge which crosses the river at that point registered 34 ft., and the approximate discharge was more than 200,000 sec.-ft. Previous high-gage readings occurred in February, 1891, when the gage read 33.2; in March, 1905, when 30.4 was registered; in November, 1905, when 31.4 was reached, and in June, 1909, when, with a gage of 30.75, there was a discharge of approximately 150,000 sec.-ft.

CONCRETE CRIB SUNK TO POSITION AT SITE OF OUTER ENTRANCE PIERS, PORT WELLER



STEEL FORMS BEING SET UP PREPARATORY TO CONCRETING EAST ENTRANCE WALL, LOCK 6

The latter discharge had represented the greatest measured discharge of the Colorado River since current-meter measurements have been made.

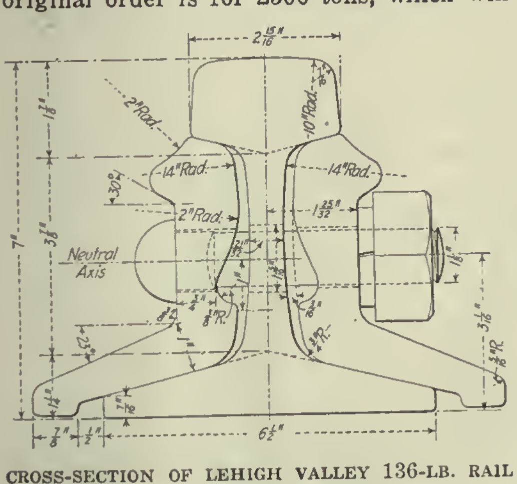
The unprecedented gage and discharge during the recent flood was caused by run-off from the upper Gila River. While the Colorado was slightly above normal for this time of year, due to local rains, the main body of the flood came from the Gila, which joins the Colorado two miles above Yuma. On Jan. 19 the gage at 2 p. m. was 18.2, with a discharge of 14,000 sec.-ft. On the following date the gage was 23, and the discharge approximately 52,000 sec.-ft. Beginning on the first-mentioned date, the gage rose steadily approximately 0.25 ft. per hour, reaching the crest given above on the evening of Jan. 22. The decline, which began early in the morning of Jan. 23, was at about the same rate as the increase. At noon of the day of highest level, when the gage read 32.9, the measured discharge was 109,000 sec.-ft.

The measured area of the river section on Jan. 21 was 12,075 sq. ft., with a mean velocity of 9 ft. per second. After the crest had been reached, on Jan. 24, the area was 12,700 sq. ft., with a mean velocity of 6½ ft. per second. The estimated area based on soundings before and after the flood, with the increased gage height, is estimated to have been approximately 19,000 sq. ft., which, with a mean velocity of 11 ft. per second, would give 208,000 sec.-ft.

Lehigh Valley to Try Out 136-Pound Rail

Experimental Rail, for Which Only a Small Order Has Been Placed, Is Heavier Than Any T-Rail Yet in Use

A RAIL weighing 136 lb. per yard—heavier than any T-rail previously laid, comparing with the 125-lb. rail newly adopted by the Pennsylvania Railroad and the special 135-lb. rail used for several years on sharp curves on one division of the Central Railroad of New Jersey—is about to be tried out by the Lehigh Valley Railroad. The dimensions of the new section are shown below. As the rail is experimental, only a small order has been placed. The original order is for 2500 tons, which will be placed on heavy-traffic track with heavy curvature.

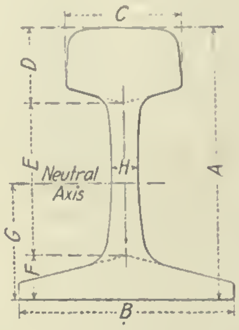


CROSS-SECTION OF LEHIGH VALLEY 136-LB. RAIL AND SPLICE

	Area Sq. In.	Area Per Cent
Head	4.72	35.4
Web	3.17	23.7
Base	5.46	40.9
Total	13.35	100.0

Moment of inertia	86.57
Section modulus, head	21.98
Section modulus, base	28.27

COMPARATIVE CROSS-SECTIONAL DIMENSIONS OF FIVE HEAVY RAILS



	136-lb. Lehigh Valley	135-lb. C. R. R. of N. J.	125-lb. Pennsylvania	130-lb. A. R. E. A.	140-lb. A. R. E. A.
A	7	6 1/2	6 1/2	6 3/4	7
B	6 1/2	6	5 1/2	6	6 1/4
C	2 15/16	3 5/32	*3	2 15/16	3
D	1 7/8	2	1 7/8	1 27/32	1 29/32
E	3 7/8	3 9/32	3 13/32	3 11/16	3 27/32
F	1 1/4	1 7/32	1 7/32	1 7/32	1 1/4
G	3 1/16	.....	3	3 1/32	3 9/64
H	21/32	3/4	23/32	21/32	11/16

*Faces of head are vertical.

It is natural to compare the new sections with the Pennsylvania and the Jersey Central sections above mentioned, and with the 130-lb. and 140-lb. sections offered last year by the rail committee of the American Railway Engineering Association. The above table of main dimensions has therefore been prepared, affording a ready comparison of the five sections. It will be seen that the Lehigh Valley section differs radically from that of the Jersey Central, which was admittedly designed for a very special purpose, and was in addition a pioneer among heavy rails. Whereas the extra weight of the Jersey Central rail is mostly in the head and web, that of the Lehigh Valley is to a considerable extent in the base. The upper part is more like that of the Pennsylvania 125-lb. rail, but the rail has a thinner web and a wider base. The head and web of the Lehigh Valley section is in fact almost identical with those of the 130-lb. A. R. E. A. section, but the base is wider than that of the 140-lb. A. R. E. A. section, while the height is the same as that of the 140-lb. section, and more than that of any of the others.

The new rail section was designed by G. L. Moore, engineer maintenance of way of the Lehigh Valley Railroad.

Letters to the Editor

Comment on matters of interest to engineers and contractors will be welcomed

Municipal and Public Contracting

SIR: An interesting example of competitive municipal and public bidding on county work has recently been evidenced at Los Angeles in connection with the erection of four steel and concrete bridges along the state highway in the northwestern section of the county, with contract awards resulting in favor of the public contractors. The county road commissioner surprised both the Board of Supervisors and general contractors by submitting bids for the work in the name of Los Angeles County, basing the estimates on the actual cost of the work, with the addition of a safe margin for any contingencies that might arise, or on the same conservative basis as the public contractor is presumed to figure.

The county's bids were among the high proposals for the work, standing third from the lowest in one instance, seventh in two others and ninth in the fourth case, for the four bridges, respectively. Owning a pile driver, the county was in position to estimate on this particular feature of the work to the best possible advantage, yet it could not approach the figures of the regular contractors. The bidding resulted in the awarding of contracts for the four structures to one contractor, Mesmer & Rice, at an aggregate price of $106,326.50.

For a municipality or county to enter into competition with general contractors on public work, figuring its proposals on exactly the same basis, presents a condition that consistently conforms to the policy of public welfare, yet such dual bidding occurrences are very infrequent. Contractors can hardly object to this action where the municipal bid is rightly and fairly figured under safe margin, and allows no pleas for further appropriations owing to unexpected difficulties in executing the work not foreseen.

With municipal bids accurately estimated, general contractors, while having greater competition, enjoy an equal if not better opportunity for receiving the contract award. And in addition, the tendering of bids by both municipal and regular contractors tends to alleviate from the public mind any suspicion of collusion between contractors and accordant seemingly excessive prices for public improvements.

The result in the Los Angeles incident tends to show that the experienced contractor with an efficient organization can estimate and build more cheaply than a city, county or state can expect to do.

L. R. W. ALLISON.

Newark, N. J.

Co-operation to Save Duplication of Field Surveys

SIR: A few words regarding co-operation of the several departments of our railroads which have engineering forces, such as the real-estate, maintenance and construction branches, may be of interest.

Many times a party is sent out from one of the three named departments to take some sections, get some topography or locate some fence lines, or other data, which information is already in the hands of one or both of the other departments. It means much time lost and expense incurred which could be eliminated by a systematic filing of notes, notebooks and plans, and by hearty co-operation, as soon as changes occur, between all concerned.

This valuation work has brought departments together and given one a glimpse of co-operation, but I fear that as soon as the work is completed little or no effort will be made to keep the plans up to date. A central office giving access to all departments needing engineering information which should be kept up to date by co-operation would do much to save time and expense.

Most railroads have complete surveys and a wealth of information concerning future line changes and improvements, but often have I witnessed maintenance engineers sent out to get a mile or so of profile, or half-mile or so of cross-sections, for a siding, perhaps, when all such information is in the construction engineer's office. If information were systematized all that would be necessary to get this information would be to request a profile between stations so and so, or cross-sections on the west side between such and such a station.

A four-man party usually costs between $8 and $11 a day without overhead charges, and very often when sent out to get a few levels, or a little topography, with time spent in travel, does not get time to do anything else, although the information secured may have taken only a few hours.

Perhaps great changes will result from the valuation work, and if so it will only be for the railroads' benefit, as economy is so much desired by all.

New Haven, Conn. Chas. A. Goelz.

[Mr. Goelz has undoubtedly made a good suggestion. It is customary on some railroads, at least, for one department, when it needs information from the field, to disregard entirely the possibility of some other department having exactly the data required. Mr. Goelz might have substituted "minutes" for "hours" in next to the last paragraph. Maintenance work is such that the engineering corps is called on for little bits of information from all over the division, and it is no unheard-of thing on a branch-line division with meager train service, for a member of the squad to be sent 200 miles and back on a local train to measure the length of plank at a crossing, or the size of a cattle pen. Many of these time-consuming trips are unavoidable, but such data as Mr. Goelz mentions could be kept in systematic fashion for the use of all concerned.—Editor.]

Fahrenheit or Centigrade

Sir: The Hon. Albert Johnson of Washington has introduced in Congress a bill to provide for the abandonment of the Fahrenheit thermometer and the use of the Centigrade thermometer by all departments of the U. S. Government. He asks that all scientific and technical men throughout the United States write their Representatives and Senators in Congress as soon as possible and urge that the change be made. He asks also that all the scientific and technical societies pass resolutions to the same effect and send them to the Thermometer Committee, A. A. A. S., Washington, D. C. It is necessary that the work be done promptly and the following history of thermometric scales is given for the information of those who will care to interest themselves in the change from a haphazard, empirical thermometric scale to a sensible and really scientific scale.

The letters and resolutions should ask that the change be accomplished as follows: Any department of the government may adopt the Centigrade scale in its work and publications at any time, but the change shall be compulsory in all departments after Jan. 1, 1920. Until Jan. 1, 1925, the Fahrenheit equivalent shall appear in parenthesis following the Centigrade temperature, but after that date the Centigrade temperature alone shall be used. The Centigrade temperatures are at present those used by scientific men in every country of the world, and are used in the physics and chemistry classes in all high schools and colleges. The change therefore will merely apply to common usage.

Beginning about the year 1680 the literature of science became international, and common measures and weights were seen to be desirable. In 1793 the French government adopted the metric system of weights and measures, this system now being that of scientific men used as the official system in practically every country except those where the English language is the language of the people. With the metric system of weights and measures the French adopted the scale of Celsius for thermometers, naming it the Centigrade, because of the decimal division of the scale.

Gabriel Daniel Fahrenheit, a native of Danzig, in Germany, long a resident of Holland and England, attempted to make a temperature recorder, and first sought for a zero point. He made a saturated solution of salt and placed it in a sealed glass tube containing alcohol. This he succeeded in freezing during the winter of 1709, on the day of the coldest recorded temperature in Holland. After marking the top of the alcohol in the tube the instrument was warmed in the hands of several persons and the highest average point reached by the liquid was taken as normal blood heat and marked 100, the scale being graduated uniformly between those points and continued considerably higher. It was discovered that at very low temperatures and at very high temperatures the expansion and contraction of alcohol was not uniform. It was discovered also that the specific gravity of the liquid was important, so that thermometers made by different men did not agree. Fahrenheit was an instrument-maker and a careful experimenter, so he went about the discovery of a better liquid in a careful, painstaking manner.

About 1714 he learned that mercury expanded uniformly at practically all temperatures, and constructed a bulb thermometer containing mercury. Setting it in a mixture cooled to the zero of his alcohol thermometer, he carefully measured the volume of the mercury and found it contained 11,124 units. Raising the temperature to that of melting ice the volume increased to 11,156 units, an increase of 32, which he marked as freezing point. Placing the tube in water which was brought to a boil the volume increased to 11,336 units, a further increase of 180, making a total of 212, which graduation was then representative of the temperature of boiling water. Being a prominent member of the Royal Society of Great Britain, that society in 1720 succeeded in securing the adoption of the Fahrenheit scale by the British government.

René Antoine Ferchault de Reaumur, a native of La Rochelle, in France, long resident in Paris, believed the arbitrary zero of Fahrenheit was clumsy and unscientific and difficult of restoration, so adopted as his zero the freezing point of water. He used spirits of wine of such a specific gravity that a volume of 1000 parts at the freezing point of water expanded to 1080 parts when the water boiled. His scale therefore was graduated into 80 parts between the freezing and boiling points of water. It is in fairly common use in parts of Russia, Germany and Spain to-day, although the scientific men and manufacturers in those countries use the Centigrade thermometer, and this latter is the official government scale. The Reaumur thermometer appeared in 1731, eleven years after the adoption of the Fahrenheit scale by England.

In 1742 Anders Celsius, professor of astronomy at Upsala University, Sweden, constructed a thermometer in which the freezing point of water, frost point, was zero, following the example of Reaumur. The boiling point of water, however, he fixed at 100, hence the name Centigrade later applied to his thermometer, which is yet called the Celsius thermometer in some countries. Any experimenter may determine the freezing point of pure water and also the boiling point. Any hollow tube with uniform bore may be used, and any liquid may be used which expands at a practically uniform rate. It is thus easily possible to reproduce thermometers in case standards are lost. The graduations are larger than those on the Fahrenheit scale, which is a convenience. To hold to the Fahrenheit thermometer based on unscientific empirical measurements is not creditable to an intelligent people, and as the Centigrade thermometer is in universal use it is time all English speaking countries fall in line with other countries and adopt a universal designation of temperature. Intercourse with other nations will be facilitated and conversion tables will be done away with. The present way of mentioning temperatures, with three thermometers in use, is prolific of mistakes.

Ernest McCullough,
Consulting Engineer.

Chicago.

Decimals of the Degree and of the Full Circle

Sir: Taking note of Professor Jordan's suggestion published in the Engineering Record of Jan. 22, page 121, about having one vernier of the regular engineer's and surveyor's transit to read to minutes and the opposite vernier to decimals of a degree, we desire to call attention to the fact that we have upon request graduated our verniers this way for many years.

Having a transit with two different verniers to the horizontal circle, the A vernier reading to minutes and the B vernier to decimals of a degree, necessitates the use of only one of these verniers at a time. If the engineer wishes to triangulate and use both verniers in reading angles, then both should be graduated alike. In a large engineering center it would be well to have an instrument having the one vernier reading to minutes and the other to decimals of a degree, but when the engineer desires to repeat the same angle on both verniers, this would be confusing. It is not for the instrument-maker to attempt to force the use of the instrument with different reading verniers upon the engineering profession, because the latter will buy what it wants, and it takes many years to introduce a matter of this kind. Moreover, it is of vital importance to the engineer whether he is to use the instrument for construction work or for triangulation.

Boston. C. L. Berger & Sons.

HINTS FOR THE CONTRACTOR

Details Which Save Time and Labor on Construction Work

Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

[*Contributions to this section are solicited, and if found available will be paid for. They must be* SHORT, *and should be accompanied, if possible, by photographs or sketches.*—EDITOR.]

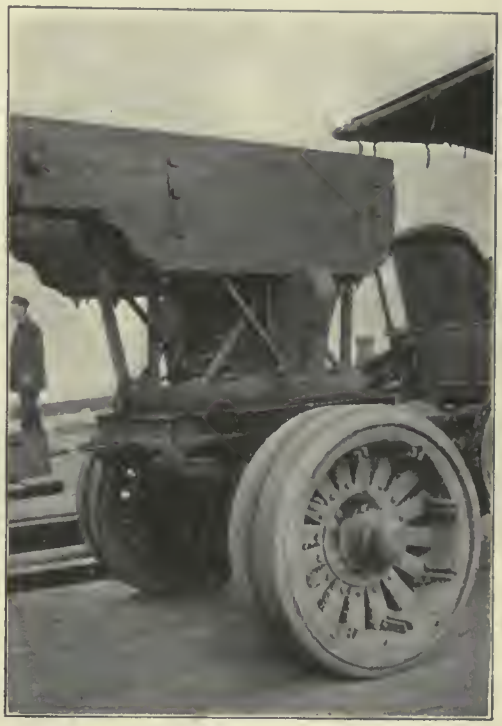
Swing Tractor Truck Developed for Hauling Steel

THE swing tractor truck shown in the accompanying photographs is more than earning its bread and butter in New York City for the Goodman Contracting Company in hauling building, elevated, and subway steel. A motor truck should be kept in a garage at night, while it can be seen that if the truck shown in the illustrations were taken into an ordinary garage there would be no room left for anything else. This consideration has delayed the application of motor haulage to long structural steel members, as the swing truck is much more economical for handling them than any other type, and as, to be effective, the truck must be nearly as long as the members handled.

The difficulty is overcome in this case by making the trailer so it can be released from the tractor in two or three minutes, and left in the yard while the tractor is taken into the garage. The rear of the latter and the front of the trailer are fitted with a rim-bearing center-pin turntable. A bolt engaging a slot in the center pin holds the trailer in place. It is withdrawn with a lever, which is locked in place, while the truck is running, by a pin. At night in the yard a jack is set under the front of the trailer, which is raised until the pin clears the tractor. The tractor is then driven off and a light horse placed under the front end of the trailer for the night. In the morning the process is reversed.

The swing truck is considered greatly superior to the platform truck for hauling heavy steel, as it does not have to wait at either end for a derrick to load and unload. It can take up and drop its own loads in a few minutes. Moreover. the large diameter of its wheels gives a distinct advantage in the reduction of impact and also of the traction required on rough streets.

The ordinary ratchet wheels and shafts, mounted on sliding carriages, are used with a timber lever to raise and lower the loads. This requires at least one man at each end to help the driver, who is the only man needed to travel with the truck. Plans are now being made to apply power to these shafts, so that fewer men will be required to handle the loads. The truck was made by Patrick Goodman, using a Knox tractor and the back parts of two horse-drawn swing trucks. One of these is 45 and the other 60 ft. long, and either is used with the tractor, depending on the length of load to be hauled. Loads up to 15 tons can be carried on either trailer. They are adjusted by sliding the shaft carriages so that about one-third of the load comes on the tractor and two-thirds on the rear truck of the trailer. The deepest girder that can be hauled is 6 ft. 6 in., laid flat. Mr. Goodman states that this truck makes a considerable saving over horse-drawn swing trucks, as it is much easier to handle and can make many more trips per day. Recently it has been climbing with ease the steep grade from the Ninety-sixth Street dock in New York City to West End Avenue with 8- and 10-ton loads of apartment-house steel.



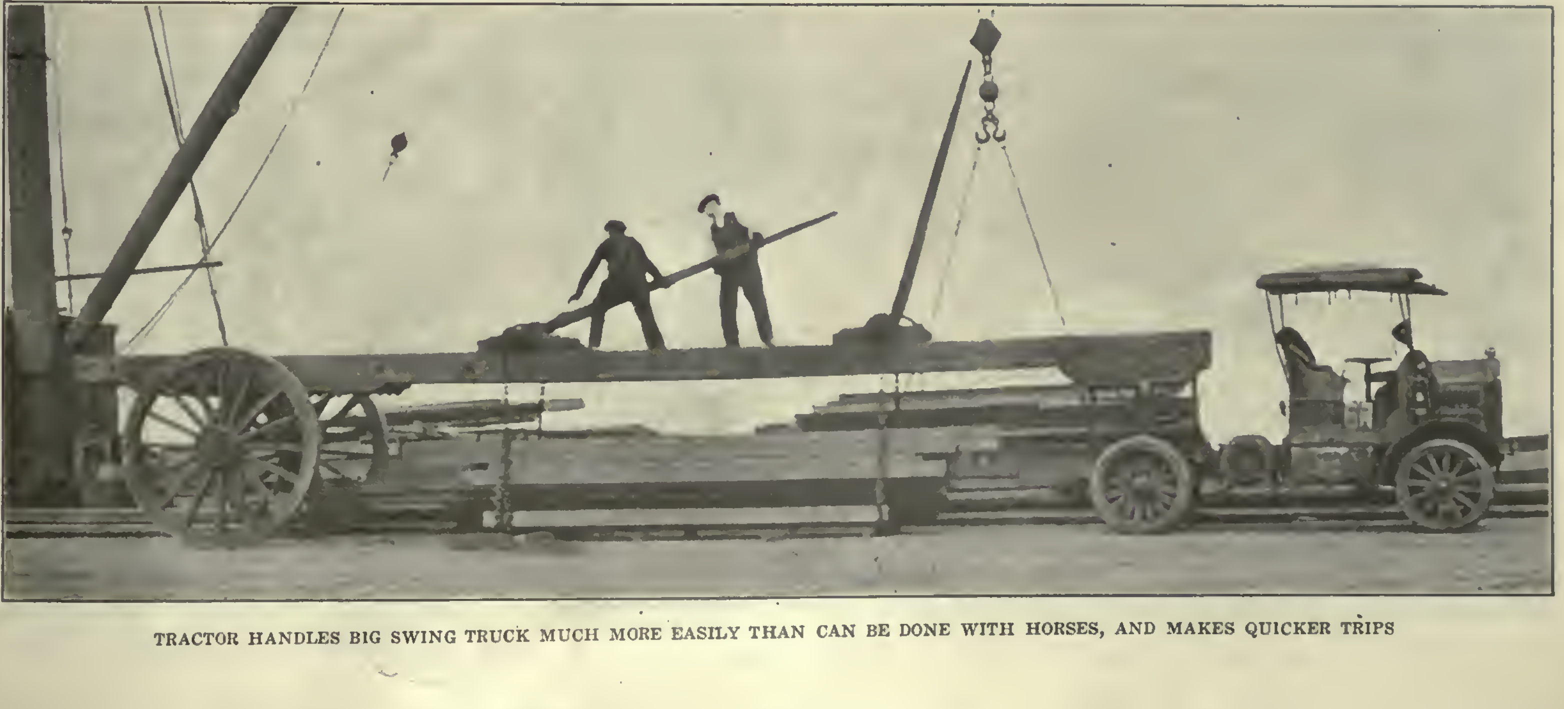
TRAILER IS TAKEN OFF AT NIGHT

Lever under tractor frame at left withdraws the key that locks the center pin of the turntable, when trailer is uncoupled and left in yard at night.

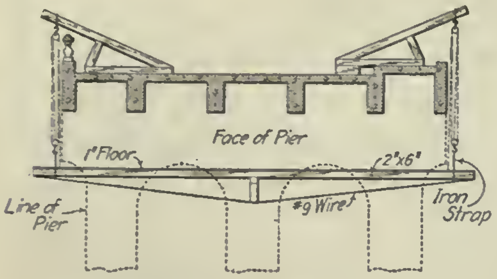
Light Swinging Scaffold Aids Finishing of Underside of Viaduct

By R. C. HARDMAN
Colorado Springs, Col.

THE specifications for a reinforced-concrete viaduct called for a brush finish on all exposed surfaces, except the roadway. Through a rigid interpretation on the part of an inexperienced inspector the washing of the underside of the superstructure was required, as well as of all surfaces visible in horizontal projections. Had the interpretation been made earlier the washing could have been done from scaffolds placed on the falsework before its removal, which was done in the case of the last four spans. However, for the most of the work some other means was necessary, and a swinging scaffold was devised from which practically the entire structure was washed. The scaffold consisted of a light platform suspended at each end from small booms which traveled along the roadway of the structure. Its important details are shown in the accompanying sketch. The swinging platform was built of 2 x 6-in. framework trussed by a king post and several strands of No. 9 wire. The booms were also of light construction so as to be easily moved. counterweights being used to give stability. In use the platform was swung at the bottom of a pier and raised vertically along its face



TRACTOR HANDLES BIG SWING TRUCK MUCH MORE EASILY THAN CAN BE DONE WITH HORSES, AND MAKES QUICKER TRIPS



TRAVELING SCAFFOLD USED ON VIADUCT

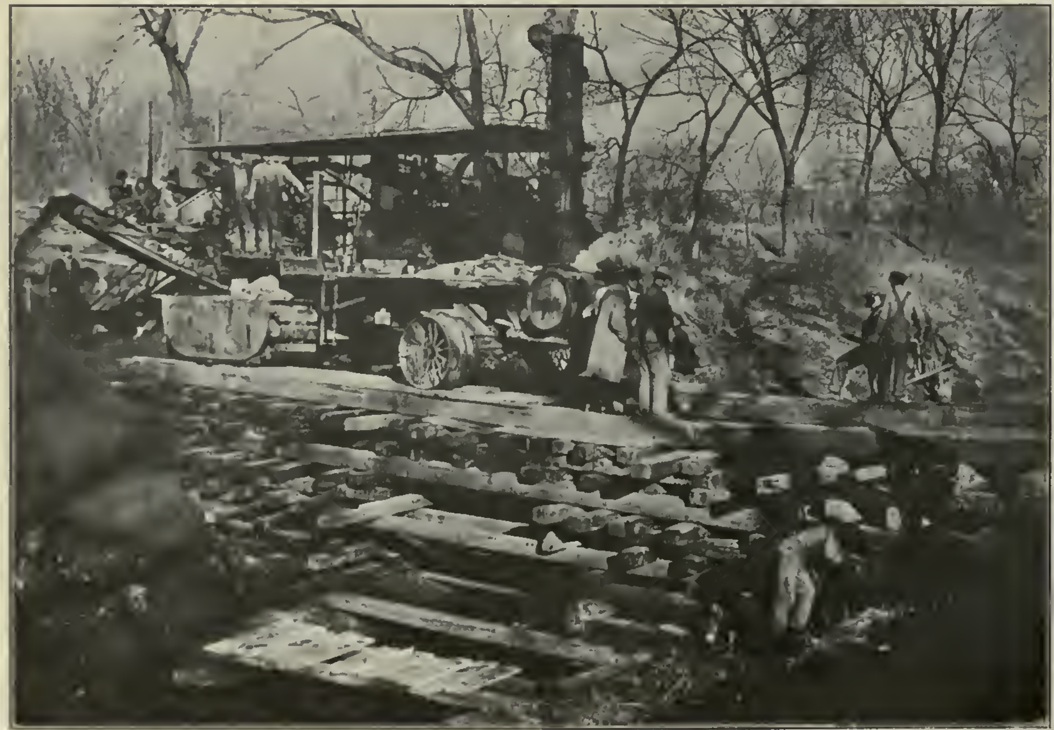
as the washing progressed. When the top of the pier was reached the lines were made fast and the booms moved along, carrying the platform under the span to the next pier, the under surfaces being washed during the movement. The platform was then lowered down the base of the next pier, unhooked, carried around the pier, and a start made on the next span. The ends of the piers were brushed from ladders and the rails from the roadway.

Camp Cooks' Salaries Dependent on Good Meals

GOOD camps and wholesome food were considered vital by O. Laurgaard, project engineer of the Tumalo development, and in order to secure them a sliding scale of wages for the cooks was adopted which raised their pay with the class of meals served and the cleanliness of their establishments. In the final report to the Desert Land Board of the state of Oregon on the construction of this project, it is brought out that great rivalry was developed between the fourteen camps maintained as to which should have the best name with the workmen. A limit of 25 cents a meal, the price charged the men, was set on the cooks, and when the final costs were compiled the camps showed a profit of about 10 per cent. The entire cost of food, transportation, help, utensils, buildings and depreciation was charged to the cost of meals. The profit was due to the premium put on thrift, and to economical management. One-fourth of it is directly accounted for by the practice of supplying young live pigs to each camp to consume the waste from the tables, and later using the pigs for food. With the sliding scale of wages used, making the cook's pay dependent on the quality of his meals, his cleanliness and his economy, it was found possible to secure and hold first-class camp help. This was considered a big factor in the good showing made. It is also stated that the influence of proper food and surroundings on the class of men secured and on their working efficiency constituted the chief profit derived by the state from these camps. The camps were also a large factor in advertising the development and giving it a good name with the public, as large numbers of visitors who might become or might influence settlers were entertained from time to time at the different mess halls.

Crossing an Unbridged Stream with a Trenching Machine

A SEWER contractor in Topeka, Kan., used the cribbing fully shown in the accompanying photograph to get his Austin trenching machine across a small stream. The trench met the stream at right angles, and the cribbing shown not only enabled the machine to cross the stream, but also made it possible to excavate the trench almost to the water's edge, leaving little hand work to be done.



TRENCHING MACHINE MOVES OVER STREAM TO DIG DITCH INTO IT, SAVING HAND WORK

Contractor's Camp on Stilts Made by Cutting Off Natural Trees

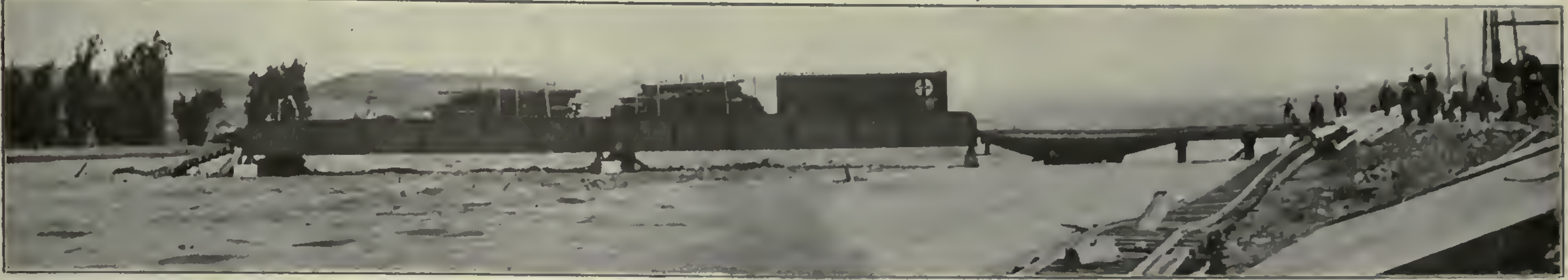
THE NATURAL growth of trees was cut off at high water, floored and used to mount the tent camp shown in the accompanying photograph by the contractor for a 9-mile section of levee in southeast Missouri. This section of levee, costing $300,000 and requiring 2,225,000 cu. yd. of fill, is part of a 27-mile dike to be built on the west bank of the Mississippi River for protecting bottom lands of considerable extent. The river had never been confined before at this point, and means had to be found for establishing a camp near the work and yet out of reach of floods. The density of the timber growth, which had mostly been cleared when this photograph was taken, can be appreciated when it is said that only a few piles had to be driven to support occasional corners of the tent floors that failed to fall at a standing tree. The river is shown at 5-ft. stage in the view. The contractor for the levee is the Oglesby Construction Company.

TREES FURNISHED ALL BUT A FEW POSTS FOR PUTTING THIS CAMP ABOVE RIVER'S REACH

THE PURITY OF WELL WATER at Sacramento, Cal., was recently made the subject of an investigation by the Commission of Health and Safety of that city. A bacteria count of more than 100 bacteria per cubic centimeter was reported in only nine wells out of a total of thirty-seven examined in the city and suburbs. Five of these nine showed a count of less than 200. The high counts were in each case from surface wells or from well water sampled after passing into a tank. The report is regarded as indicating the purity of the well supply in this district, where most of the wells tap underground streams fed from the snow-capped Sierra Nevada Mountains. Practically all of the large business houses and hotels in Sacramento are supplied from private wells, and it is asserted that a well system put in by the city would give much more satisfactory results than the present system, under which water is drawn from the Sacramento River, filtered and treated with chlorine to make it sterile.

California Floods Wreck Otay Rock-Fill Dam

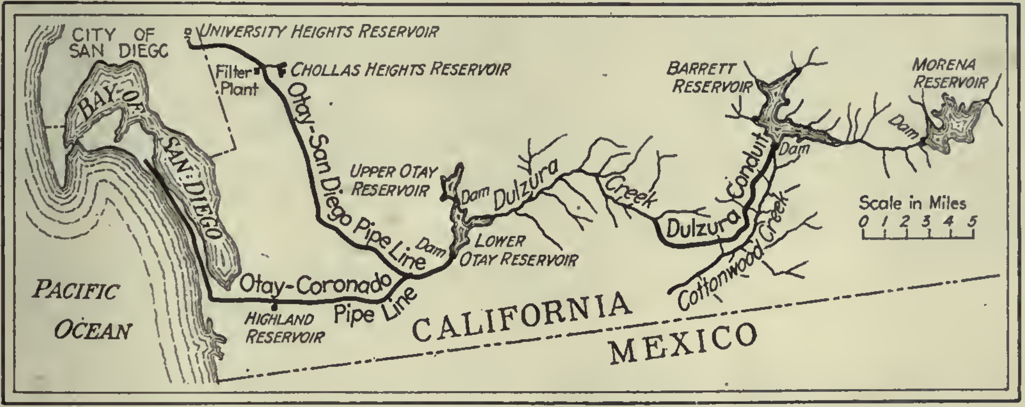
Four Other Dams Withstand Crest Floods—Sweetwater Structure Damaged—San Diego Bridge Washed Out—Water Supply Conduit Injured—Unprecedented Rainfall Deluges San Diego County



SAN DIEGO RIVER BRIDGE WAS PARTIALLY SAVED BY WEIGHTING GIRDER SPANS WITH HEAVILY LOADED CARS, ALTHOUGH FLOOD WATER RIPPED OUT TIMBER TRESTLE SECTIONS AT ENDS

CULMINATING in the complete destruction of the Lower Otay rock-fill dam, with its steel plate core-wall, partial breakage of the Sweetwater masonry dam, over which the water surged to a 3½-ft. depth, washouts of sections of the Dulzura conduit from the Morena dam, and demolition of a new reinforced-concrete highway bridge, unprecedented floods, caused by a record rainfall on saturated drainage areas, swept over San Diego County, California, late last month, leaving a wake of wreckage. A railroad bridge over the San Diego River was partially saved by weighting it down with loaded box cars.

The southern part of the state was visited generally by the storms, but the greatest damage was caused by the fall of rain which reached its maximum in the vicinity of San Diego on Jan. 26 and 27. Rain gage records show the precipitation at San Diego for the season up to Jan. 27 to have been 14.56 in., which is about 5½ in. greater than the usual annual rainfall at this point. It is believed, however, that the excess above normal in the upper part of the drainage areas was much heavier than this. At some points the excessive precipitation came as a warm rain on snow-covered areas, adding the melted snow to the runoff.



SAN DIEGO'S WATER SYSTEM, SHOWING LOCATIONS OF FLOOD-SWEPT DAMS

SAN DIEGO RIVER SWOLLEN

The flow of the San Diego River, as registered at its mouth, increased from 2000 sec.-ft. on Jan. 26 to 29,800 sec.-ft. 24 hr. later. The tributary drainage area is 434 sq. miles, and in this basin the average rainfall varies from 9 in. at sea level to a maximum of 62½ in. in the mountains near the divide. This extreme flow in the river entirely wrecked the $25,000 reinforced concrete bridge which was completed for the city of San Diego about a year ago.

The highway bridge was supported on concrete piers which, in turn, rested on 30-ft. wooden piles whose tops were about 3 ft. below mean low tide level. It is believed that the failure of the structure was caused by extremely deep scouring around the middle pier foundation. Two days before the failure it is reported that a settlement of the floor above the center pier was noted. The approaches to the bridge were solid fills, the entire flow of the stream being confined to the channel beneath the arches.

The railroad bridge across the San Diego River near the same point did not suffer serious loss, as the steel girder spans and the concrete piers on which they are supported remain intact, only the pile approaches being washed out. Foreseeing the flood, the railroad officials left on the structure the three loaded cars shown in the picture to provide additional stability.

SWEETWATER DAM OVERTOPPED 3 FEET

At the Sweetwater dam (details of the design and last height increase are given in an article on page 264 of the Engineering Record of Sept. 2, 1911, written by James B. Schuyler) the recent flood was six times as great as in the average winter flow, or more than twice the flood of 1895, which was the maximum on record up to that time. At the peak of the 1895 flood the flow was 17,000 sec.-ft. and in that season the total runoff from the 100-sq. mile drainage area was 73,000 acre-ft. The flow during the recent storm is calculated by engineers who were at the dam to have averaged about 33,000 sec.-ft. for 4 hr. during the peak of the flood.

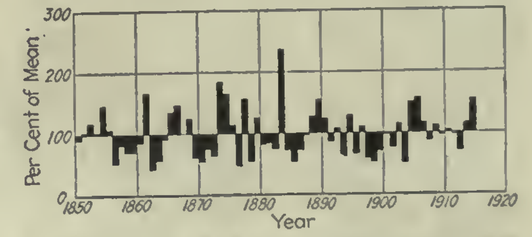
The storms which began on Jan. 15 and lasted about four days filled the Sweetwater reservoir up to the spillway level. Before the second storm commenced the two 24-in. and the two 30-in. blow-off valves through the dam were opened to lower the reservoir as much as possible before additional water could come in. These valves, owing to being slightly loose, were opened only half way, thus giving a total flow of about 750 sec.-ft.

On Jan. 27 the flow into the reservoir exceeded the combined capacity of spillway and blow-off valves, and the level behind the dam raised until the parapet was overtopped at 2.20 p. m. At 4.30 p. m. the flow over the parapet had increased to a depth of 3.5 ft., and the 50-ft. length of earth fill dike at the north end of the structure was overtopped. The water washed away this fill, broke the concrete core wall and cut a bypass around the dam through the bedrock foundation. As shown in the accompanying photograph, the break is about 75 ft. wide with a maximum depth of 30 ft. below the level of parapet.

This break was made by degrees, no water appearing below the dike until it was actually overtopped, and the cutting into the foundation was gradual. At 7 p. m. the reservoir level had lowered only 0.3 ft. Water flowed over the parapet about 7 hr. after the break occurred, it is believed, which would mean that the flood continued to overtop the dam for about 9 hr.

An earthen dike 650 ft. long stood some distance from the dam, where a low point in the ridge occurred. This dike had a puddled clay core and was 23 ft. high at its mid-point. At 3.50 p. m. on the day of the flood peak, the water level reached the top of this dike and began to spill over the downstream slope. This melted as the water continued to rise, and when the flood subsided the dike had been swept out cleanly except for about 10 ft. of its length. The material on which the dike stood was eroded by the outpouring water to such an extent that the reservoir rim at this point is now 15 ft. below the spillway level.

Reconstruction plans contemplate a hollow type reinforced concrete dam at the site of the earthen dike, and at the north end of the main dam where the break oc-



VARIATION IN SEASONAL PRECIPITATION FOR SAN DIEGO COUNTY EXPRESSED AS PERCENTAGE OF MEAN curred an additional spillway. Other than these two breaks and the section of pipe line washed out immediately below the dam, no further damage was suffered at this point. John F. Covert, consulting engineer for the Sweetwater Water Company, was at the dam during the peak of the flood and supplied the foregoing data.

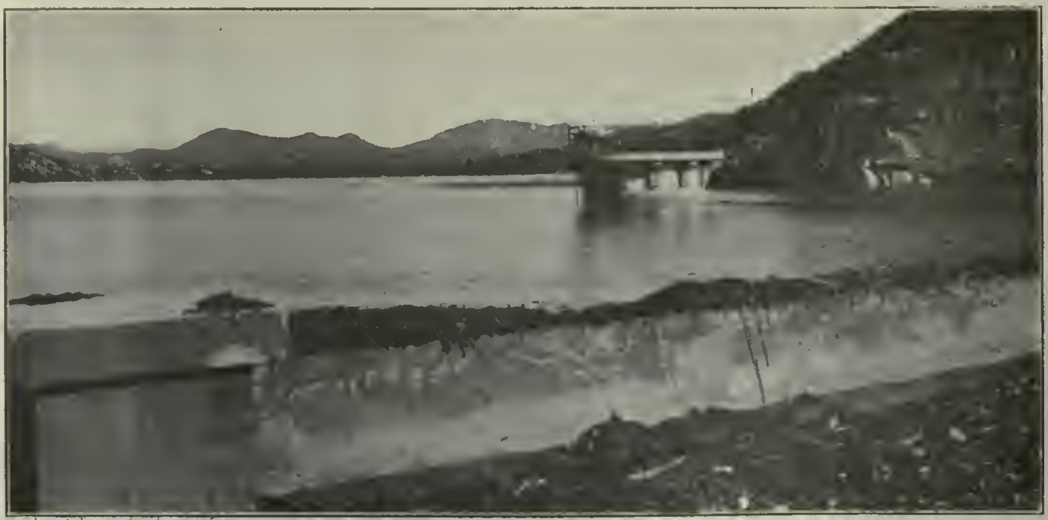
LOWER OTAY DAM SWEPT OUT

The Lower Otay dam was a rock filled structure 130 ft. high and 565 ft. long on top, which spanned the Otay Creek 22 miles southeast of San Diego. It was built by the Southern California Mountain Water Company to impound a water supply for San Diego and Coronado, and after a construction period of several years was completed in 1897.

The slopes were 1 to 1 on both up and down stream faces and no attempt was made to make the upstream face impervious, reliance being placed in the central core. As shown in the accompanying drawing, the steel core was founded in a block of concrete, and was protected from foundation to crest by 1 ft. of concrete on either side. The steel plates were 3/8 in. thick near the base and 5/8 in. near the top. The plates were 5 x 20 ft. in size. The joints were calked. The fill was, at least in part, blasted into place from the adjacent walls of the canyon.

The spillway is a concrete-lined conduit whose location can be traced high up on the right of one of the accompanying photographs, and has a throat section of 8 x 37.9 ft. The drainage area was 100 sq. miles, including the 20-sq. mile drainage supplying the Upper Otay dam, which is located on the same stream.

This structure was acquired by San Diego in 1913 as part of the water supply properties purchased by the city from the Spreckles interests, the price paid for the Lower Otay dam, conduits, water rights, and the Barrett dam site was $2,500,000, and a later bond issue of $1,500,000 was voted and used to purchase the Morena dam and reservoir.



WHILE MORENA DAM STOOD UP THE ROCK FILL SETTLED ABOUT 3 INCHES AS SHOWN BY DARK LINE AT RIGHT OF PICTURE

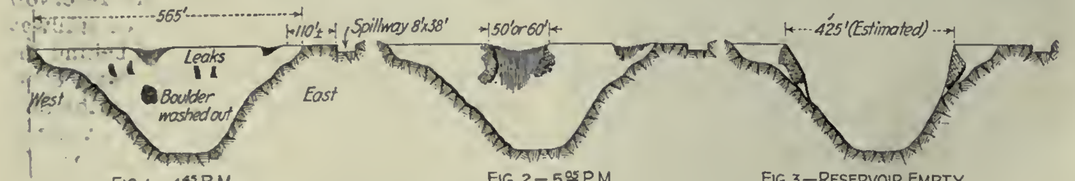
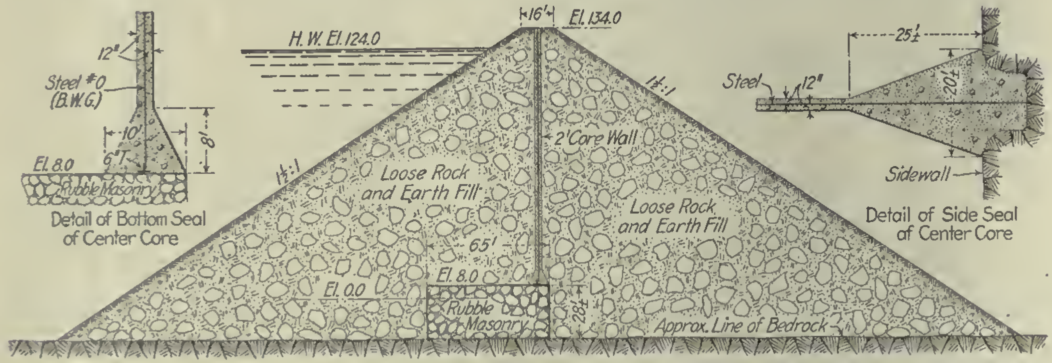


FIG. 1—4.45 P. M.   FIG. 2—5.05 P. M.   FIG. 3—RESERVOIR EMPTY

SUCCESSIVE STAGES IN FAILURE OF LOWER OTAY DAM, FROM EYE-WITNESS DESCRIPTION



CROSS-SECTION OF LOWER OTAY DAM

LOWER OTAY ROCK-FILL DAM, WHICH FAILED, HAD 1:1 SLOPES AND A COREWALL OF STEEL PLATE ENVELOPED IN CONCRETE

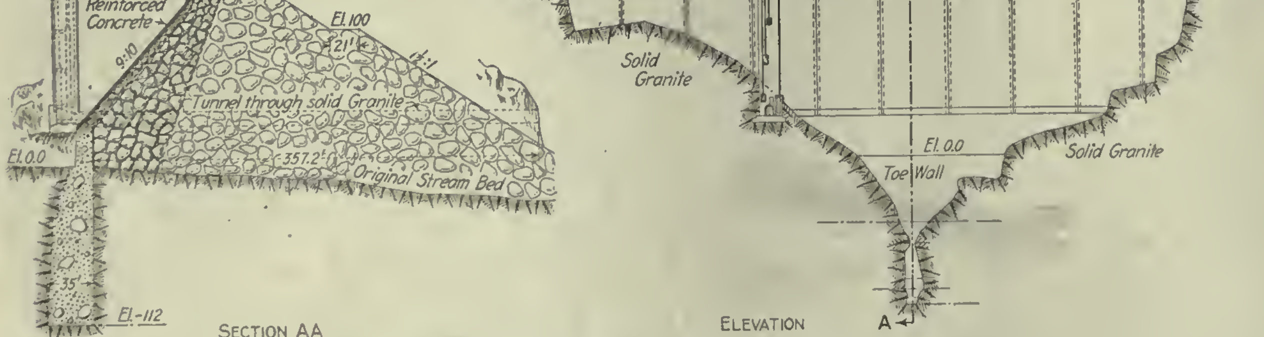
OTAY RESERVOIR FILLS QUICKLY

The excessive rain caused a sudden inflow into the Otay reservoir which filled it in less than a week, the rise continuing to be rapid even after the higher levels of the 13,000,000,000-gal. reservoir were reached. The first 17-ft. rise came in 48 hr., leaving the level on Jan. 17 at 101 ft. After that date the water level changed as follows: Jan. 18, 111 ft.; Jan. 19, 118.7 ft.; Jan. 21, 122.8 ft. (spillway level); Jan. 27, 7 a. m., 124.9 ft.; Jan. 27, 12 noon, 127.9 ft. (48-in. gate through dam opened); Jan. 27, 4.45 p. m., 130.8 ft., at which level failure occurred.

Failure did not commence until the water had overtopped the 5-ft. earth dike surmounting the core wall, but witnesses agree that the depth of the overflow before failure was very slight, probably between 4 and 6 in. The first failure occurred at the top near the center and at about the same time the water commenced to pour out of the downstream face in considerable volume, and one large boulder, an eye-witness asserts, was washed out near the middle of the structure. The accompanying sketches show how the failure progressed. There is no indication that the structure slipped along its foundation or that there were excessive leaks or blow-outs before overtopping occurred.

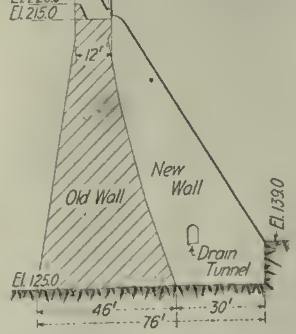
An examination of the steel core exposed after the failure showed that the metal was in perfect condition, although it had been in service 20 years. Investigation of the records, however, showed that it had been very carefully given a protective coating during construction. This consisted of a coat of hot asphalt, followed by a burlap covering, and over the burlap a second asphalt coating was applied. Numbers of rivets from the steel core which had been sheared in two were found below the dam.

While the reservoir level was still 4½ ft. below the crest, the city attorney of San Diego called a conference with the mayor,



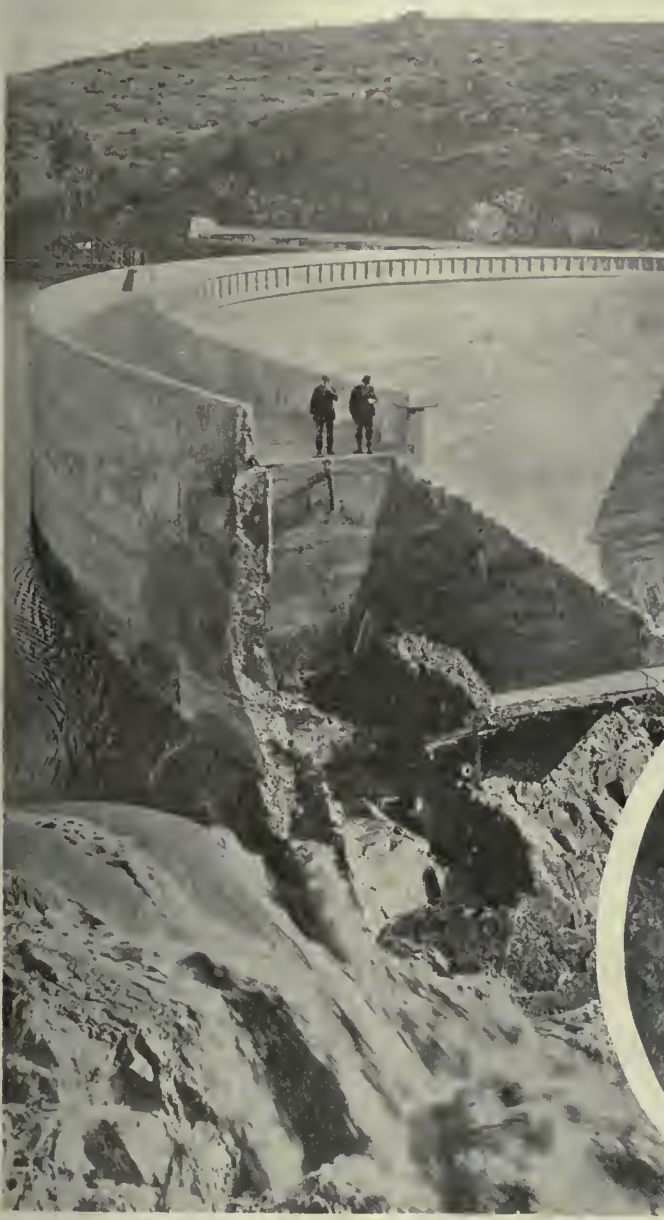
SECTION AA   ELEVATION

MORENA ROCK-FILL DAM, ALMOST OVERTOPPED, HELD DURING HIGH WATER STAGE



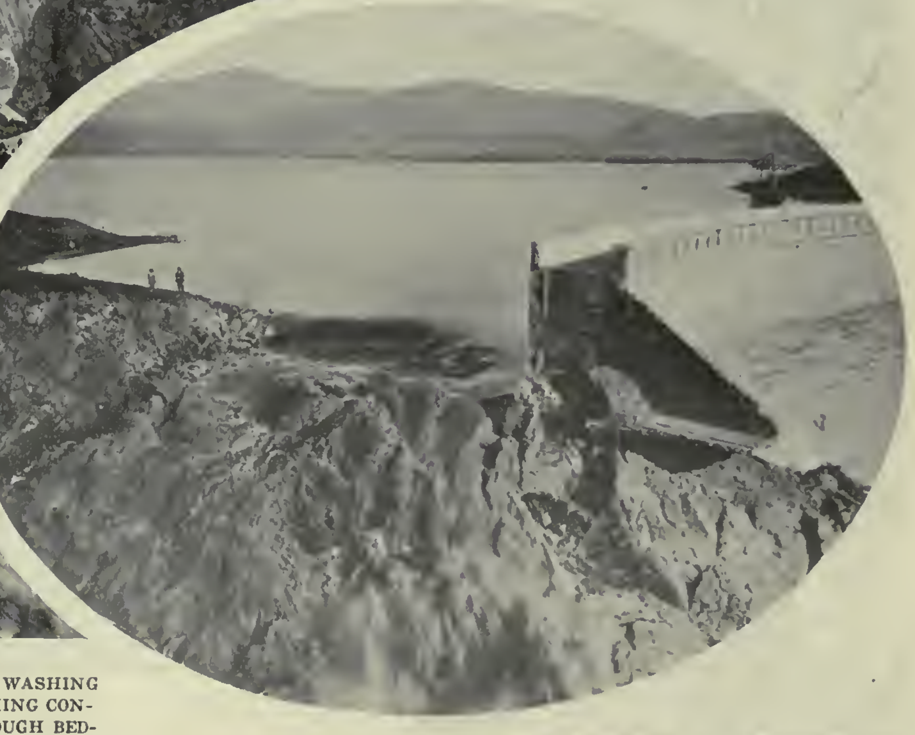
SWEETWATER DAM SECTION

Flood's Damage to Dams in San Diego County Section

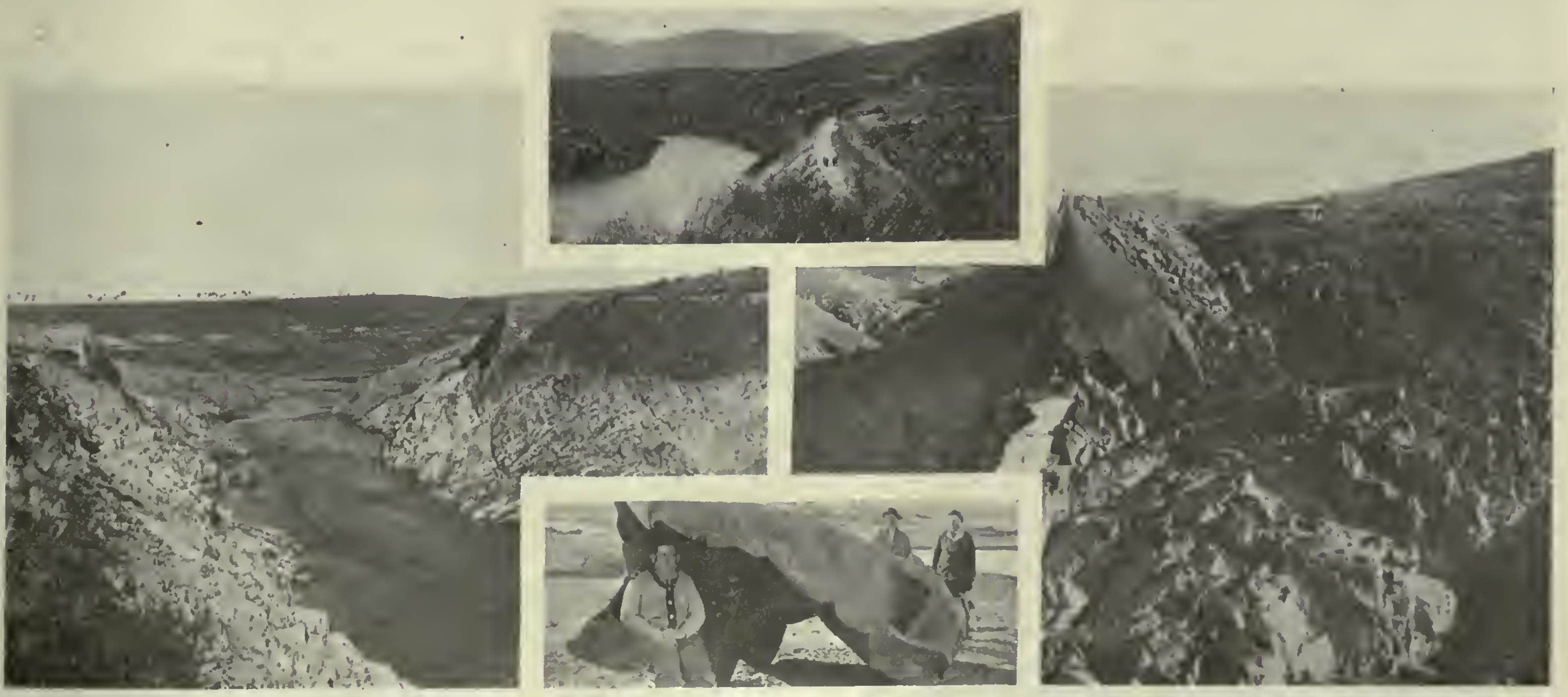


AT THE SWEETWATER DAM WATER OVERTOPPED THE CREST, WASHING AWAY A 50-FOOT LENGTH OF EARTH FILL AT NORTH END, BREAKING CONCRETE CORE WALL AND CUTTING A BY-PASS AROUND DAM THROUGH BEDROCK FOUNDATION

UPPER OTAY ARCHED REINFORCED-CONCRETE DAM WITHSTOOD FLOODS WHICH PASSED 3 FEET DEEP OVER ITS CREST. SAND BAGS RUSHED TO SITE PREVENTED OVERFLOW AT EARTH FILL NEAR END

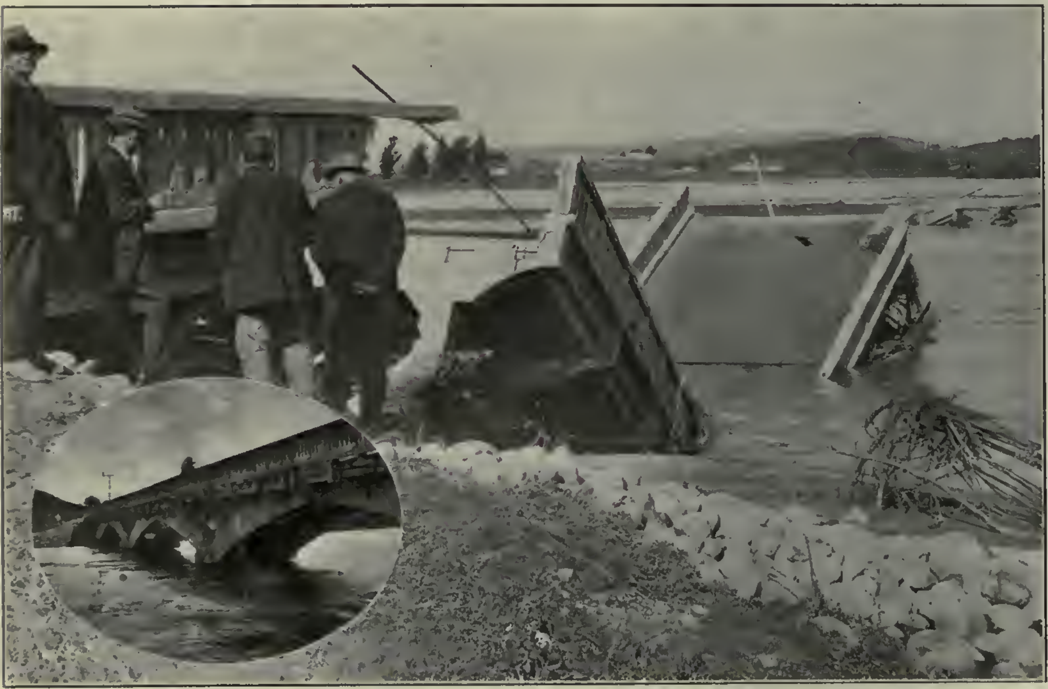


THE BREAK IS 75 FEET WIDE WITH MAXIMUM DEPTH OF 30 FEET BELOW LEVEL OF PARAPET



LOWER OTAY DAM, A ROCK-FILL STRUCTURE WITH STEEL PLATE CORE-WALL, WAS COMPLETELY DEMOLISHED. SMALL PICTURE, TOP CENTER, SHOWS STRUCTURE BEFORE FAILURE. LOWER INSERT SHOWS STEEL PLATE CORE WALL SECTION CARRIED 10 MILES DOWN STREAM. PICTURE AT LEFT INDICATES BREACH AFTER WASHOUT AND AT RIGHT A BENT SECTION OF CORE WALL STILL HANGING IN PLACE city manager, and the city engineer to discuss the danger of the situation. It was not believed that the dam would go out, but it was recognized that the danger point was reached. Accordingly the city dispatched four men to warn residents of the valley below the dam to go to higher ground. Two of these men went down the valley on either side, leaving the dam at 2 p. m. on the day of its failure, and warned all residents that the only safe procedure would be to leave the valley until the reservoir level was lowered. These men traversed the entire valley before the dam broke, and those who were drowned, in almost every case, had disregarded the warning.

The effective height of the tidal wave sweeping down the valley is shown by the denuded area on the canyon wall just below the dam. No authentic statement could be secured as to the height of this wave in the lower sections of the valley, but it may at least be said that its force was sufficient to sweep everything before it. All houses and other structures in the valley bottom were swept downstream and strewn along the bank or carried out into the bay. The loss of life as first reported was erroneous, and on Feb. 3 the coroner affirmed that the actual number of known dead was only 14.



REINFORCED-CONCRETE BRIDGE AT SAN DIEGO RIVER WAS UNDERMINED AT PIERS AND WASHED OUT

MORENA DAM ALMOST OVERTOPPED

The Morena dam, located on Cottonwood Creek 35 miles southeast of San Diego, is a rock fill structure 150 ft. high with a concrete face on the upstream side. The drainage area above this dam is 135 sq. miles and the reservoir capacity is 15,000,000,000 gal. The runoff from this basin was such that 15,000 acre-ft. was added to the storage in 24 hr. This addition took place while the 60-ft. spillway was running 5 ft. deep.

The flood brought into the reservoir a large quantity of debris which accumulated in front of the racks that protect the radial gates, and so choked the flow that when the reservoir level was 3 ft. above the spillway level the flow actually passing over the spillway beneath the open gates was only 3 in. deep. Under these conditions the water rose within 18 in. of the parapet crest and waves actually carried debris over the top.

Two effects of this pressure are apparent. A downstream movement of the upper face of the dam which showed in the alignment of the parapet as about 2 or 3 in. at the center of the structure, and a settlement of the top of the rock fill amounting to 2 or 3 in. The amount of leakage could not be observed, but George Cromwell, city engineer of San Diego, who was at the dam during the high water, affirmed that he believed such leakage as there was came through the face of the structure and not around the ends or from beneath. Leakage some time prior to recent storms amounted to 1,500,000 gal. per day.

After going down to the bottom of the intake tower during the height of the flood, Mr. Cromwell reported that structure was standing the pressure well, only slight seepage appearing. The intake gates were all in working order and all were left open to lower the reservoir level as much as possible. The debris was being removed by as large a force of men as could be readily assembled. Orders to lower the reservoir 3 ft. below the spillway level by means of the intake gates were left at the dam.

CONDUIT DAMAGED

Dulzura conduit, the 13.3-mile line which conveys the water stored behind the Morena dam into the Otay system, washed out in several places. The damage to this conduit line, Mr. Cromwell estimates at about $85,000, or about 12 per cent of its original cost. The rain gage at Dulzura Summit showed a precipitation for the storm of 9.9 in., but it is believed that in some districts traversed by this conduit the actual fall was near 12 in.

Certain portions of the conduit stood the storm much better than others; in some cases it bridged a span of 4 or 5 ft. over washouts. These more stable portions differed from the remainder in that the flume was built in 16-ft. lengths with "settlement joints" intervening. At each of these joints a yoke of concrete 4 x 8 in. in section and which had been cast and seasoned in a yard, was first placed in the trench as a support for the concrete flume proper, and a transverse steel tie rod was used which spanned the flume and bound yoke and flume walls together. The width of the conduit is 5 ft. at the top and 3 ft. 3 in. at the bottom; the depth is 3 ft., and the walls are 4 in. thick. Reinforcing was used only between floor and walls. The "settlement joints" were devised by H. A. Whitney, former hydraulic engineer of San Diego.

UPPER OTAY DAM HOLDS

The Upper Otay reservoir, which provides an auxiliary storage above the dam that failed, has a drainage area of 20 sq. miles and a storage capacity of 1,090,000,000 gal. This reservoir is formed by an arched, reinforced-concrete dam 84 ft. high, built on a radius of 358 ft. The section has a base thickness of 14 ft., reduced by steps to only 4 ft. at the top for 5 ft. below the crest. The reinforcing consists of 1-in. steel cables, two of which were imbedded in the concrete for every 18-in. rise. The cost of this dam, which was built in 1897-1901, was $28,000.

The rainfall on the Upper Otay basin is thought to have been among the heaviest in the district. The reservoir level rose very rapidly and at the peak of the flood the flow over the entire length of the dam crest was 3 ft. deep. No damage whatever was done at this point. Judicious use of sand bags, however, prevented overflowing near an earth fill at one end and, it is thought, prevented difficulty from a washout at this point.

CUYAMACA EARTH-FILL DAM HAS CLOSE CALL

The Cuyamaca earth-fill dam with a puddled core, built in 1886 for irrigation uses, is located 50 miles east of San Diego at an elevation of 4800 ft., and is on the headwaters of the San Diego River basin. Its crest is 635 ft. long and its height 41.5 ft. Two spillways are provided, 90 and 41 ft. long respectively, and each 6.5 ft. below the crest of the dam. The storage capacity is 10,800 acre-ft.

The impending danger of the recent flood was realized in time to draw down the Cuyamaca reservoir considerably. In fact the amount drawn off by the blow-off valve through the dam was about 1,000,000,000 gal. The peak of the flood brought the reservoir level up to within 14 in. of the crest of the dam with both spillways flowing over 4 ft. deep. A few washouts on the conduit constituted the only damage suffered by this system, which includes, in addition to the Cuyamaca dam, three smaller reservoirs on tributaries of the San Diego River. At the present time the San Diego water supply is being drawn from the Cuyamaca system.

SPEAKING ABILITY OF THE YOUNG ENGINEERS in the corps of the Milwaukee Sewerage Commission is being developed by staff meetings held every two weeks, at which engineering news of the week, commission problems, knotty designs and other matters of interest are discussed. At first, it is said, the rodmen and lower paid men were diffident about talking. Now they take an active part and are not afraid to present their views "before the chief." The effect on the staff in creating interest and loyalty, in addition to the development of latent ability, is beyond expectations, according to T. Chalkley Hatton, chief engineer, who is of the opinion that heads of departments owe it to young engineers under them to afford them some such opportunity.

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

First Train Crosses New Cumberland Valley Bridge

The first train to cross the new Cumberland Valley Railroad bridge over the Susquehanna River at Harrisburg, Pa., was passed Feb. 4. A few minutes later President Wilson's special from the West where he had just completed his speaking tour, passed over the viaduct.

The bridge is being built by the Cumberland Valley Railroad, as part of a general scheme of improvement in Harrisburg, approximating in cost about $3,000,000. The bridge itself will cost about $1,000,000.

The work on the concrete portions is being done by the Robert Grayce Company of Pittsburgh. The first half of the bridge from shore to shore was completed a short time ago, and on Feb. 3 the track work was completed. Work on the second half will start about April 1. It will be a 3-track structure when finished.

PART OF NEW RAILROAD BRIDGE AT HARRISBURG COMPLETED AND IN OPERATION FEB. 4

Urge House of Representatives to Provide Officer Reserve Corps

Representatives of five national engineering societies appeared before the House of Representatives military committee Feb. 8 to advocate the provision of an officers' reserve corps, with a view to utilizing the services of civil, electrical, mechanical and mining engineers, and others having technical knowledge.

Cleveland Freight Subway Likely to Be Started This Spring

Announcement is made by the promoters of the proposed 7-mile four-track subway under East Fifty-fifth Street, in Cleveland, from Lake Erie to the upper river valley that they will ask the city council for certain modifications in their franchise, and that if these are granted the work will be started this spring. The franchise amendments aim at better interchange facilities with the connecting railroads, and the avoidance of a vein of quicksand near Euclid Avenue.

The present franchise, which was approved by popular vote last election day, stipulates that 4 miles of double-track subway must be completed and in operation in five years from Nov. 3, 1915, and the remaining 3 miles within seven years. Work must begin by Nov. 3, 1917, on both the subway and the bulkheads along the lake.

The estimated cost is $10,000,000. The promoters are O. C. Barber, of Barberton, Ohio, and J. J. Breitinger. H. D. Goulder, Rockefeller Building, is attorney for the company.

Break in Sooke Lake Waterworks System Caused by Landslide

Twelve lengths of pipe were swept away and considerable water wasted owing to a break in the concrete flow line of the Sooke Lake waterworks system Jan. 22. This is the first accident which has occurred to the line. It was caused by a landslide. The damage is slight, it is reported, and until repairs can be made a temporary wooden trestle bearing a wooden flume will be used. The water stored in the Humpmack reservoir is reported to be more than sufficient to supply the city while repairs are being made.

Chicago Traction Experts Begin Work Feb. 14

The ordinance confirming the appointment of the Chicago traction commissioners has become a law, and the new commissioners, William Barclay Parsons, Robert Ridgway and Bion J. Arnold, have planned to take up the work of investigating Chicago's transportation problem Feb. 14, with a view to making early recommendations for improvements. Mr. Parsons was named chairman of the commission in the ordinance authorizing its appointment.

May Discard Tunnel Scheme in New Britain Water Project

Test drilling at Burlington, Conn., for the New Britain Water Department has thus far failed to find rock through which a tunnel for a new pipe line into the city could be built. At a depth of 80 ft. no rock has been found. Four more drills 110 ft. in depth will be made over a mile distance. If no rock is discovered the tunnel scheme will be abandoned.

Indiana Engineers and Sanitarians Celebrate Centennial of Endeavors

More Engineers for the State Board of Health, More Pay for County Surveyors and a Highway Commission Recommended

Indiana county surveyors can draw only $4 per day and expenses, yet many of them are called upon to handle work costing as much as $400,000. The Indiana Engineering Society, which met Feb. 3, 4 and 5 in conjunction with the Indiana Sanitary and Water Supply Association, urged the necessity of a concerted effort toward legislation whereby engineers holding such positions may be paid more nearly in proportion to the responsibilities involved.

The high lights at the convention, aside from a number of historical papers summing up sanitary and engineering progress in Indiana since that State entered the union 100 years ago, were as follows: a paper on activated sludge, by T. Chalkley Hatton, chief engineer Milwaukee Sewerage Commission; one on the reasons for forcing efficiency onto utility plants, by Charles Brossmann, consulting engineer; the phenomenal results obtained by the Logansport sanitary survey, described by H. E. Barnard, State food and drug commissioner; advertising as applied to public utilities, by Merle Sidener, and a plea for a readjustment of the standards for gravel to be used in concrete, by C. C. Brown.

Filter Experts Object to Throwing Out Air Wash

Philip Burgess, in his paper outlining the present status of rapid water purification, suggested as a future step the retention of excess chemical sludge in reaction chambers, and agitation with the incoming water. This is now practised successfully at Owensboro, Ky.

The discussion hinged on the washing methods. H. O. Garman, chief engineer of the Public Service Commission, stated that in his opinion an air wash was of no value, that he had therefore refused to allow any value for it in appraisals and that he had advised filter operators not to use the air. To this attitude several prominent sanitary engineers strenuously objected. Definite instances were cited of plants where only low vertical rises of wash water are possible and where the air keeps the sand clean which would otherwise fill up with mud balls.

Water superintendents will want to read carefully the results of tests on lead service pipes reported by Prof. R. B. Wiley, Purdue University.

Following a paper by John C. Diggs describing four new filter plants in Indiana—Logansport, Princeton, Paoli and Wolcott—came a discussion as to the reasons why a city the size of Logansport had to be treated to repeated epidemics of twenty to thirty deaths each before filter construction could be finally consummated. Compliments were also paid to city officials who put well designed plants into the hands of incompetent operators.

C. K. Calvert, chemist, Indianapolis Water Company, read a paper on the increase of oxygen content in reservoirs due to oscillaria. No remedies were proposed except in after-meeting discussions. W. F. Langelier was of the opinion that the incoming water might in some way be subjected to pressures less than atmospheric with beneficial results.

Activated Sludge Progress

Of the ten experimental plants working on activated sludge during the past ten months all but one or two report good results, according to Mr. Hatton, who stated also that the Milwaukee Sewerage Commission had just recently accepted tentative plans for a plant to treat 100,000,000 gal. daily. The cost will be $18,000 per 1,000,000 gal., a figure he considered high, because of the necessity of building a portion of the plant out in the lake.

The Phister & Vogel Company, leather manufacturers, have authorized the construction of a plant and, on the basis of an experimental tank, expect to recover values netting $30,000 annually.

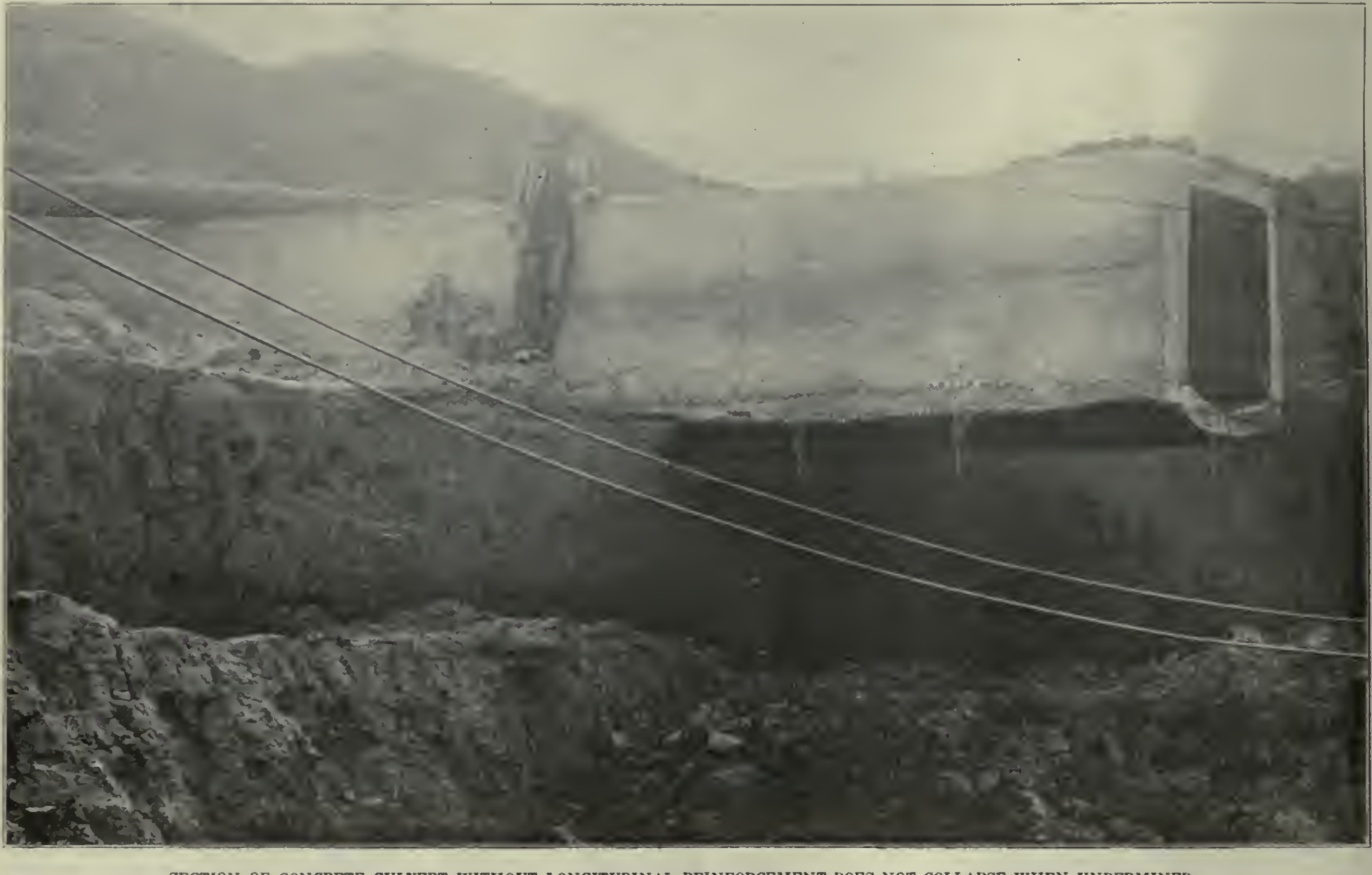
One of the largest meat-packing establishments in Chicago, said Mr. Hatton, is of the opinion that $1,300 per day can be recovered from wastes now being thrown away. Mr. Hatton was very careful, however, to be conservative and to point out that the extremely clear non putrescent effluent from this treatment was entirely unnecessary to obtain in many cases.

H. B. Hommon, chemist, U. S. Public Health Service, recited his experiences with strawboard wastes during the past year. Rapid filters were a failure, but Imhoff tanks followed by cinder filters for the sludge seemed to offer the most promising solution. Use of the dried sludge on farm land also appears to be fairly successful, but elaborate experiments on all kinds of crops are to be undertaken this year.

In discussing the subject Paul Hansen stated that sanitarians were waiting anxiously for the final results. If any fertilizing values are available which will help out the various companies, many stream pollution problems will be immediately simplified.

Efficiency Forced on Utilities

Competition, the price of material, the desire for lower rates and state regulation are all forcing utilities to be more efficient, according to a paper on the subject by Charles Brossmann. His paper was full of things about the inefficient pumping station equipment, such as feedwater heaters out of service, leaky boiler settings, clogged condensers, dampers connected backward and pipe changes.



SECTION OF CONCRETE CULVERT WITHOUT LONGITUDINAL REINFORCEMENT DOES NOT COLLAPSE WHEN UNDERMINED

Structure at Memphis, Tenn., 4 x 4 ft., without longitudinal reinforcement, had ground give away under it for a distance of 14 ft., and remained intact for two weeks, when it broke off near the band. The proportions of the concrete were 1:2½:5.

W. E. Graves, city engineer, South Bend, presented in his paper data on the behavior of concrete sewer pipes, some of which were laid in 1874.

Prof. U. S. Hanna gave detailed information on fine cracks in a two-course reinforced-concrete road 25 ft. wide laid eighteen months ago through the campus of Indiana University. The causes of the cracks were, in his opinion: Insufficient lap of the reinforcing, improper treatment of subgrade and lack of drainage.

C. C. Brown, in his paper on "Standardization of Gravel for Concrete," brought up the contentions of the Indiana Sand & Gravel Association, viz., that to specify sand as material passing a ¼-in. mesh was an unnecessary refinement. Analyses show that there is a preponderance of fine material in many of the bank and river gravels of the state, but tests indicate that good concrete can be made with the material. The gravel companies want the specification changed to define sand as that portion passing a ⅛-in. screen. Tests corroborating these contentions are to be made at Purdue University.

Society Affairs

The engineering society passed a resolution lending the influence of the organization toward obtaining state supervision of highways.

For the ensuing year the following officers were elected: President, Prof. L. W. Wallace; vice-president, J. W. Miller; trustees, J. C. Toyne and J. W. Moore.

The sanitary and waterworks association elected E. L. Loomis, president; W. S. Cramer, Dr. J. N. Hurty, R. B. Wiley, P. Burgess and J. B. Marvin, vice-presidents; W. F. King, secretary, and W. S. Ulrich, assistant secretary.

The association adopted a resolution urging legislation permitting full-time health offices and a force of sanitary engineers under the State Board of Health to pass on all plans for water supply and sewage-disposal plants.

District Court Decides Against Bone Cantilever Wall Patent

Regardless of the fact that several other courts decided in favor of the plaintiff in similar suits, Judge A. B. Anderson of the United States District Court of Indiana, found for the defendant in the suit brought by Frank A. Bone of Cincinnati, Ohio, against the Marion (Ind.) county commissioners for alleged infringement of patent in reinforced-concrete walls used in the construction of bridges. The amount involved was estimated at $30,000 and, had the case gone in favor of the plaintiff, the City of Indianapolis also would have been a defendant in a suit for half that amount. Judge Anderson's decision, which was verbal, was handed down on Jan. 26. He said:

"In reviewing the evidence in this case, I find no cause whatsoever to lead me to believe that there has been an infringement on patent; further, I do not believe the patents as claimed by the plaintiff are valid. This court finds for the defendant with all costs to be paid by the plaintiff."

Prominent architects and engineers of Indianapolis and Indiana, as well as D. B. Luten, F. A. Bone and E. B. Bone, testified for the plaintiff, but the testimony that apparently carried the greatest weight with the court was submitted by Prof. W. K. Hatt, of Purdue University. He stated that in view of the newly discovered evidence of prior use and patents, the Bone patent was not infringed in the construction of the retaining walls in Marion County, the witness citing the following five authorities: Stowell & Cunningham, United States Patents; Bauzeitung; Rehbein; Nolthenius in Tjidschrift, and Planat's Articles, Vols. 9 and 11, La Construction Moderne.

Testimony submitted by the plaintiff went to show that Bone claimed to have patents on all reinforced cantilever retaining walls, Bone adding to this claim by stating that he had won fifty similar suits in various counties in various states throughout the United States, that he had many similar suits pending in other courts and that five judges already had decided in his favor. Testimony was submitted to the effect that Bone's contention had been upheld by Judge Day, of Columbus, Ohio; the United States Circuit Court of Appeals, sixth district, Cincinnati, Ohio, and by Judge Trieber, of Denver, Col. It is understood that the case will be appealed.

Contractor Must Pay Workmen's Compensation on Percentage Contract

A contractor employed on a percentage basis to wreck and rebuild the plant of an owner coming under the Michigan workmen's compensation law sought to make the owner pay compensation for an injury to a workman engaged on the undertaking, claiming that he acted only as the owner's agent or superintendent, and that his workmen were in reality employees of the owner. The state industrial accident board refused to allow the claim, holding that the contractor was an employer within the meaning of the law as regarded that particular contract, and, as such, was required to stand his own workmen's compensation liabilities. The contractor carried liability insurance for the job, and the surety company was held liable for the damages.

White River Levee Breaks at Clarendon, Arkansas

The White River levee at Clarendon, Ark., broke on the evening of Feb. 5 and the water covered two-thirds of Lincoln, Desna and Chicot counties in southeast Arkansas. Water is also flowing through several breaks in the Arkansas River levees. Arkansas City and dozens of smaller towns are flooded. In the former water is running 8 ft. deep in the main streets, and the waterworks and electric light plants are out of commission. At last reports the Mississippi River levees were still holding, although at Arkansas City the flood stage was 55½ ft., the highest, it is said, ever known at this place.

Los Angeles County Sanitation Commission Named

The Los Angeles County Board of Supervisors on Jan. 24 announced the personnel of the commission of sanitary engineers who are to devise a comprehensive plan for sewage disposal throughout the county. The commission is composed of Prof. Charles Gilman Hyde, of the University of California, T. A. Gillespie, of the State Board of Health, A. H. Koebig, George R. Robinson and A. M. Brosius. The supervisors have appropriated $1,000 for the use of the commission.

Submit Report on Building Districts and Limits for New York

The commission on building districts and restrictions appointed by the Board of Estimate of New York City to consider and report on a districting plan for the puropes of regulating the height of buildings, the area of courts and yards, and the location of trades and industries has just issued a progress statement of its plans and filed detailed maps showing the suggested districts and proposed limitations. If the report of the commission is adopted by the Board of Estimate after public hearings, it will become law.

The commission desires thorough study of the proposed plans, and urges property owners and civic organizations to inspect the proposed district maps with reference to their particular localities, so that mistakes can be avoided and the proposed maps perfected before submitting them to the Board of Estimate. Edward M. Barrett is chairman of the commission and Robert H. Whitten is secretary. George B. Ford is consultant to the commission, which has in its membership representatives of the real estate and civic interests of the city.

Young Engineer to Head Big Traction Property

Philip J. Kealy, civil engineer, not quite 32 years old, has been selected to head the Kansas City Railways Company, a $30,000,000 corporation which on Feb. 14 will take over the ownership of the 263-mile electric railway system serving Kansas City. He will be, as the *Electric Railway Journal*, the leading paper in the traction field, states, the youngest president in the United States of so extensive a street-railway property.

Mr. Kealy's election comes as the logical sequence of traction events at Kansas City, where for the past three years he has been in the thick of the controversy over renewal of the traction franchise. As engineering adviser to the receivers of the present owners, the Metropolitan Street Railway Company, he bore a leading part in the negotiations which resulted in the drafting of the Kealy-Ash plan, under which the property is to be operated by a board of control consisting of two men, one representing the city and one the company. Under this plan, after making up certain amounts definitely specified, the city is to share in the company's net profits. A new ordinance embodying this plan was adopted, and since it went into effect Mr. Kealy has been the company's member of the board of control. It is understood that he will retain this position while discharging the duties of the presidency of the company.

Civil Engineer Becomes President of Large Electric Railway Property

PHILIP J. KEALY

Mr. Kealy was born in Bloomington, Ill., July 2, 1884, and spent two years in the civil engineering course at the University of Illinois. For six months he was engaged in railway work in Mexico, and then entered the electric railway field. His first employment in this line was with the Board of Supervising Engineers, Chicago Traction, on the rehabilitation of the city's electric railway system. This work brought him in touch with Bion J. Arnold, who, recognizing Mr. Kealy's ability, gave him a place on his (Mr. Arnold's) staff. As assistant to Mr. Arnold he had charge of electric-railway valuation work in Seattle, Buffalo, Chicago and Toronto. In 1912 this work took him to Kansas City, and after completing the valuation there for Mr. Arnold, he was temporarily "loaned" by the latter to the traction company. The work in hand was so arduous and complicated and required so much time that the company induced Mr. Arnold to release Mr. Kealy, so that he might devote himself entirely to the Kansas City work. His handling of that situation, with bitter opposition to the proposed plan from influential newspapers, his courage in taking the stump to put the proposition before the citizens, made him a marked man in Kansas City. The sheer merit of the plan, backed up by his forceful presentation of it, resulted in its adoption by a goodly majority.

In addition to his work at Kansas City, Mr. Kealy has during recent years acted as consulting engineer on various valuation work in Missouri and neighboring states.

Declare Removal of Boston Engineers Blow to Efficiency

Seven prominent civil engineers—Frederic P. Stearns, Desmond Fitzgerald, H. F. Bryant, Charles T. Main, Harrison P. Eddy, Frank A. Barbour and Edward C. Sherman—in a statement issued Feb. 4 in regard to the recent wholesale removal of engineers in important offices in the Boston public works department, characterized the mayor's action as striking a "disastrous blow," which not only affects most seriously the present efficiency of the department, but will, unless it is counteracted, lower the standard of efficiency to a still greater extent in the future.

In the opinion of the signers, the public should be made to realize the seriousness of the situation that has been created. "Hitherto," the statement continues, "civil engineers have entered the city's employ in the lower grades, knowing that as they developed in skill and efficiency, and rendered valuable service to the city they not only would be protected in their position but would have a chance to advance as opportunity offered.

"This practice has brought to the service of the city, and retained in it for many years, engineers who were both trustworthy and qualified for their work, but the recent action of Mayor Curley in removing, without just cause, men who have given loyal service for a long term of years, means not only that competent engineers will refuse to enter the service of the city in the future, but that those still in the service will be anxious to leave as soon as opportunity offers for other employment."

May Change Terms of Apportionment for Street Improvements

Alfred Bavis, president of the Board of Public Works of Richmond, Ind., is considering the adoption of a new rule for the payment of the city's share for permanent street improvements that may result in a change of the state's laws in regard to such payment. As explained by Mr. Bavis:

"For years the city has merely designated the amount of money it will contribute toward the cost of a permanent street improvement. In consequence, if the successful bid were lower than the estimated cost, the city did not benefit from the reduction in the expense, although the property owners did. We now are considering the advisability of merely designating what per cent of the cost of an improvement the city will be willing to assume. There is a question, however, as to whether this can be done under the laws of Indiana, as they now stand. A former city attorney ruled that the city had to designate the amount of money it would contribute."

Highway Official Must Have License to Operate Car in Pennsylvania

Deputy Attorney General Keller of Pennsylvania decided in an opinion recently rendered that a state highway engineer or superintendent must take out a driver's license to operate an automobile.

Not Ready to Predict Date for Re-Opening Panama Canal

No prediction can yet be made, according to Governor Goethals, as to the date for re-opening the Panama Canal. It is hoped, however, that information regarding two controlling features will soon be available, after which a prediction will be made. A recent statement from Governor Goethals reads as follows:

"It is not intended to re-open the canal until a safe and practicable permanent channel is reasonably assured. This cannot be assured at present, although the operations of the dredges during the past four months have shown that they are able, when not interrupted in the work by the passage of ships, or the clearing of the channel for navigation, to gain on the slides, and it is desired to have a reasonable assurance that they can maintain this gain even with the delay from the above causes.

"It is hoped that before long better information on the two main controlling features will be available. The large mass of rock at the base of Gold Hill, on the east bank, is being carefully observed. If the materials behind it move northwardly, as is not unlikely, one danger of interruption to navigation will be removed.

"The other feature is the rate of motion that will result in the west slide when the dredges attack its face, as will shortly be done. It is believed that the dredges can keep well ahead of any possible motion in this mass, provided the east bank is quiescent or nearly so.

CUTTING AWAY SLIDE-FORMED ISLAND IN PANAMA CANAL

"As soon as this office feels that sufficient information on these two points is at hand to justify it, a prediction will be made. In the meantime, it is recommended that the canal be not considered in the routing of shipping. The work of the restoration of the canal is, however, proceding most favorably. The office has in mind the desire of commerce to resume navigation through the canal, and as long notice as possible will be given to shippers in order that preparations for such routing may be adequate."

The last ship waiting at the canal was passed through Jan. 6, states the *Canal Record*. The ship was the "Newton." It had been waiting since Oct. 15, 1915.

The *Canal Record* also states that 232,292 cu. yd. of excavation were handled during the week ended Jan. 10.

Owner of Team Hired by Contractor Liable for Injury

The State Industrial Board of Indiana has decided that a driver, supplied by the owner of a team, is the employee of the owner of the team, and not of the person or company contracting for the team. This decision establishes a precedent for the industrial board. The driver of a wagon, whose owner held a contract with an asphalt company, was injured in a railroad accident. With the board holding that the asphalt company is not responsible, the widow must look to the owner of the team for compensation or sue the railroad.

Form New Sewage Works Association in Jersey

To advance the knowledge of design, construction, operation and management of sewage treatment works the New Jersey Sewage Works Association was organized at a meeting in Trenton, Jan. 28. Clyde Potts, consulting engineer and member of the State Department of Health, was the chief organizer of the movement. The constitution admits to membership in the new association superintendents, managers or other officers of municipal or private sewage works, civil, hydraulic or sanitary engineers, chemists, bacteriologists, or any persons engaged in the design, construction, operation or supervision of sewage works or engaged in the manufacturing or sale of sewage works equipment. The admission fee is $1 and the annual dues $1. Membership applications may be addressed to Frederick T. Parker, secretary, Atlantic City Sewerage Company, Atlantic City, N. J.

STEEL DREDGE CASCADE AT WORK IN CULEBRA CUT

A regular annual meeting of the association is to be held at the State House, Trenton, at the same time as the annual conference between the state department and local boards of health. Special meetings will be held at such times and places as arranged by the committee.

The following officers were elected: President, John R. Downes, Plainfield, N. J.; vice-presidents, Paul Molitor, Chatham, N. J., and I. D. Collings, Collingwood; secretary-treasurer, Frederick T. Parker, Atlantic City.

Will Begin Cheektowaga Grade Separation Near Buffalo Soon

The beginning of work on the Cheektowaga grade separation in Erie County, New York, this spring was made sure at a final hearing in the matter before the Public Service Commission at Albany, Jan. 29, when agreement among the parties to the elimination was reached on the important details, and some minor matters were submitted to Seymour Van Santvoord, chairman of the commission, for incorporation in an order to be drawn as soon as possible. Representative of the Delaware, Lackawanna & Western Railroad assured the commission that they would start work as soon as the order was made.

This is one of the most important single grade-crossing eliminations in the State. It will cost in the neighborhood of $400,000, and will take two years to complete. When completed the roadway will be carried on a 30-ft. viaduct over fifty-seven tracks of the Delaware, Lackawanna & Western, three of the Lehigh Valley and two of the Erie. The viaduct will be more than 3000 ft. long, and the plans include an elaborate system of drainage and of marginal streets and other adjacent improvements.

Overhead Transfer System to Be Built at Mobile Waterfront

The Terminal Transfer & Storage Warehouse Company, of Mobile, Ala., reorganized in December, proposes to construct a system of elevated railways or overhead conductors between its extensive warehouse properties there and the waterfront. The system is to include elevators at each end to permit the lifting of electrically-propelled tractors or trucks to the level of the overhead system at one end, and the lowering of the carriers to the ground level at the other end. There are also to be installed devices for distribution, where needed, to operate over a number of streets on which the warehouses are situated. The plant of this company covers approximately 22 acres in the northern part of the downtown section of Mobile.

The structural work is to be performed by the Stone & Webster Engineering Corporation, of Boston. Moores & Dunford, of Chicago, architects and promoters, designed the preliminary details. The first work will comprise the building of a large warehouse alongside the slip in the Hieronymus property, with dock and electric apparatus for hoisting cargoes from and into vessels, the contract for which has already been let.

As soon as the attorneys have passed upon the title of the lands recently purchased by the company, bonds to the amount of $1,000,000 will be issued. It is stated that work of building the plant will start within six weeks.

California Railroad Commission Sustained in Utility Valuation

The Supreme Court of California handed down a decision on Jan. 17 sustaining the ruling of the State Railroad Commission in the valuation of properties of the Marin Water & Power Company. This is the first case in which the Supreme Court has passed upon the validity of the act under which the commission has proceeded to fix the value of public utility properties in eminent domain proceedings. The court decision is of importance in that this case is parallel to numerous others which the commission is now or will be considering, namely, the valuation of the Southern California Edison Company properties and the water cases instituted by the cities of San Diego and Santa Monica.

The Marin municipal water district asked the commission to fix the just compensation to be paid to the Marin Water & Power Company for the latter's property. When the commission fixed this valuation at $1,200,000 the power company appealed to the court to overthrow the decision, first on the claim that the commission had no authority, and second that the valuation fixed was too low, depriving it of property without due process of law. The commission's order was upheld in every particular by the court.

Full Enrollment for Military Lectures Requires Overflow Meeting

The widespread response to the call for enrollment in the military lecture course to begin at the United Engineering Societies Building in New York next Monday evening has made it necessary for the committee to limit the attendance to 1600, which is the maximum number which can be provided for. Tickets, which the committee is now sending to those who signed for the course, will be required for admission to the auditorium. The overflow from the auditorium will be taken care of in a second lecture hall on the fifth floor where one of the regular lectures will be given by an army officer scheduled to speak at a later meeting in the main auditorium.

Thacher Patent on Concrete Bridges Upheld

The United States Circuit Court of Appeals for the fourth circuit, sitting at Richmond, Va., on Feb. 2 affirmed the decision of the lower court in favor of Edwin Thacher in the case of Thacher vs. the Mayor and City Council of Baltimore, an action brought on account of alleged infringement by the city of the Thacher patent on concrete bridges. The decree of the lower court is confirmed on the reasoning advanced by that court in its opinion.

Illinois Counties Agitate Bond Issue

The success of Cook County in getting the $2,000,000 road bond issue validated by the Illinois Legislature last week has spurred on each of the four counties adjoining Cook County to agitate the issue of $1,500,000 bonds. The supervisors of these counties have already voted to put the proposition up to the people at the next available election.

Excavation on the Rochester Sewer Tunnel Almost Complete

About 250 ft. remains to be excavated to complete the 4300-ft. sewer tunnel being built under Main Street, West, Front and Graves Streets in Rochester, N. Y. This tunnel has been driven in Niagara limestone under the center of the streets traversed, necessitating cross cuts from 30 to 50 ft. long to reach the shafts, which were located in cross streets to save interference with traffic. About 2420 ft. of the completed sewer will have an inside diameter of 8 ft., and 1317 ft. will be of 6 ft. diameter, the remaining length being made up by the cross cuts. Its depth below the street varies from 35 to 40 ft. The top of each section is a semi-circle of the diameter given; the bottom is a box section 3 ft. deep for each size. The floor in each case slopes 1 in. per foot toward a small, semi-circular drain at the center. Lateral tunnels 4 x 5 ft. in size are provided from the sewer to within the curb line at intervals on either side to drain the adjacent property. These are now being driven. The sewer will care for the storm water from a large central area in Rochester, and also for the leakage from the river at times of high water into the tailraces at Graves Street.

STARTING DOWN THE SHAFT

VERTICAL COLUMN DRILL IN HEADING OF SEWER TUNNEL BEING FINISHED AT ROCHESTER

A contract for the work was let on April 7 last to M. H. Ripton of Rochester, at $117,715. The work was opened up from six shafts, and is now entirely holed through except for the short section mentioned, which is between shafts 1 and 2. The main compressor plant for running the drills and shaft hoists is set up in Graves Street.

The work was designed and is being supervised by the engineering forces of the city of Rochester, of which Frederick T. Elwood is city engineer. Edwin A. Fisher is consulting engineer for the city and Charles L. Raymond is engineer in charge of the project.

American Association of Engineers Publishes Journal

The American Association of Engineers, established in Chicago last year, has begun the publication of a monthly magazine called "The Monad." A 5 x 8-in. page size has been adopted, and the first issue contains 60 pages. Chief position is given to a report of the proceedings of the first convention, and a statement of the work of the association. There are also local notes, which are sure to be followed with interest by the members.

The rather unusual name of "Monad" has been adopted because the Monad symbol was the first sign used by man to signify progress through co-operation.

News of Engineering Societies

The Iowa State Drainage Association will meet in Fort Dodge Feb. 24 and 25.

The Vermont Society of Engineers will hold its annual meeting at Hotel Vermont, Burlington, March 9.

The American Society of Civil Engineers will hold a meeting in New York City, Feb. 16. A. B. Lueder and W. J. R. Wilson will present a paper on "Secure Subway Supports."

The Engineers' Society of Western Pennsylvania will hear Dr. J. A. L. Waddell, consulting engineer, of Kansas City, on "What Can Best Be Done to Advance the Interests of the Engineering Profession in the United States," at a meeting to be held in Pittsburgh, Feb. 29.

The Florida Drainage Association will hold its annual meeting at Sanford, Feb. 28-29. The question of land reclamation for agricultural and other purposes will be discussed by public men, engineers, contractors, business men, lawyers and scientists. Benjamin Getzoff, secretary-treasurer, of Bartow, is in charge of arrangements.

The Society of Engineers of Eastern New York, at a meeting held in Schenectady, Feb. 2, heard John G. Brady, former Governor of that territory, speak on the "Mineral and Timber Resources of Alaska," and adopted resolutions favoring the immediate preparation of the national defenses with respect both to personnel and material.

The Engineers' Club of Philadelphia will hold a meeting in that city Feb. 15. George McAneny, president of the Board of Aldermen of New York City, will present a paper on "Municipal Problems." The proposed amendments to the by-laws, submitted at the regular meeting of the club, Jan. 18, may be discussed and amended, and then accepted for ballot or rejected.

The New York Section of the American Waterworks Association will hold a meeting at Hotel Manhattan, New York City, Feb. 16. Walter E. Spear will present a paper on "City Tunnel of the Catskill Aqueduct," Joseph Goodman, one on "The Determination of the Value of Fire Protection Afforded by the Queens County Water Company" and Francis F. Longley, one on "Improvements to the Water Supply of St. Johns, Newfoundland."

The Guild Scientific League of the University Settlement of New York City desires as members a number of young men who are interested in mechanics, surveying, engineering and similar subjects. The league has taken up the study and discussion of mechanical problems in a non-technical, informal way, under the leadership of a graduate engineer. The meetings are held in the University Settlement, 184 Eldridge Street, New York City, on Sunday afternoons.

The Western Society of Engineers was addressed Feb. 7 by Richard T. Fox, general manager, Citizens' Street Cleaning Bureau, on "Intensive Street Cleaning Methods." The hydraulic, sanitary and municipal section elected the following officers: Chairman, W. W. De-Berard; vice-chairman, W. T. Barnes; directors, H. E. Hudson and R. M. Yager.

The Connecticut Society of Civil Engineers will hold its annual meeting at New Haven, Feb. 15 and 16.

The Canadian Society of Civil Engineers has elected the following officers for the ensuing year: President, G. H. Duggan, vice-president and general manager, Dominion Bridge Company, Montreal; vice-president, T. H. White, chief engineer, Canadian Northern Railway, Vancouver; councillors, J. R. W. Ambrose, chief engineer, Toronto Terminals Railway Company, Toronto; H. Donkin, deputy minister, Department of Works and Mines, Halifax; A. E. Doucet, Quebec; W. J. Francis, consulting engineer, Montreal; E. D. Lafleur, chief engineer, Department of Public Works of Canada, Ottawa; D. O. Lewis, district engineer, Canadian Northern Railway, Victoria; D. A. Ross, consulting engineer, Winnipeg, and H. R. Safford, chief engineer, Grand Trunk Railway, Montreal.

The Detroit Engineering Society heard Frederic H. Fay, of the firm of Fay, Spofford & Thorndike, consulting engineers, of Boston, on the "Boston Metropolitan District" at a meeting held in that city, Jan. 21. Mr. Fay laid emphasis on the duty of engineers to give themselves to some extent to public service, because so many of the problems of a municipality are of an engineering character. He outlined the work of the committee on municipal and metropolitan affairs of the Boston Chamber of Commerce, of which he is chairman, as displayed in its constructive interest in the larger municipal problems of Boston, in keeping watch of legislation, reporting on public improvements, offering suggestions regarding the solution of important problems, and aiding, with the prestige of the chamber, in putting through measures which appear to be for the public good.

Personal Notes

MAJOR GEORGE B. PILLSBURY, Corps of Engineers, U. S. A., has been assigned to duty as district engineer officer at Los Angeles, Cal. Major Pillsbury received his professional education at Massachusetts Institute of Technology and the U. S. Military Academy, being commissioned in the engineer corps of the army in 1900. Since that year he has been engaged in the construction of fortifications in this country, road and bridge construction and surveys in the Philippine Islands, and, as engineer member of the Alaska Road Commission, on road and bridge construction in Alaska. From 1908 to 1912 he served as associate professor of mathematics at the U. S. Military Academy. Previous to his present assignment he served as district engineer officer at New London, Conn.

T. FILSKOV, formerly engineer maintenance of way and structures of the Raritan River Railroad, has been appointed acting superintendent, succeeding C. M. Himmelberger, resigned.

HENRY E. ELROD, consulting engineer, of Dallas, Tex., has been retained to investigate the waterworks and electric light plants of Sherman, Tex., for the purpose of increasing their capacities.

MAX J. WELCH, formerly consulting engineer, of Los Angeles, Cal., has joined the force of the Cerro De Pasco Mining Company in New York City. Mr. Welch has been located on the Pacific Coast for the past ten years, and has been connected with the designing departments of several of the most extensive new plants which have been built in recent years for the milling and smelting of copper ores.

I. A. COTTINGHAM, formerly assistant general manager and engineer maintenance-of-way of the Sunset-Central Lines, has been appointed special engineer in charge of valuation work.

ROY D. TYLER, formerly consulting engineer, of Caspar, Wyo., has been appointed engineer of erection and equipment for Montgomery, Ward & Company. Previous to engaging in consulting practice Mr. Tyler was a division engineer on the Lake Shore & Michigan Southern Railway.

HARRISON GUNNING, formerly engaged on sewer construction at Ravenna, Ohio, has been appointed to a position on the sanitary engineering forces of the Panama Canal. Mr. Gunning was graduated from Union College in 1914, and was, for a time, with the New York State Department of Health.

H. F. HARTWELL, formerly resident engineer for the Northern Contracting Company on work for the Georgia Railway & Power Company at Mathis, Ga., has been appointed resident engineer for the Grand Canyon Power Development Company at Peach Springs, Ariz.

C. E.-A. WINSLOW has resigned as director of the New York State Division of Public Health Education, to accept the Anna M. R. Lauder professorship in public health at Yale University.

DR. MATTHIAS NICOLL, JR., has been appointed director of the New York State Division of Public Health Education, succeeding C. E.-A. Winslow, whose resignation is noted elsewhere in these columns.

F. E. WEYMOUTH has been appointed engineer of construction of the U. S. Reclamation Service, succeeding S. B. Williamson, resigned. Mr. Weymouth has been in the Reclamation Service since its organization in 1902, and, before the reorganization last year, was supervising engineer of the central district. He has many achievements in the service to his credit, the largest of which is the construction of the Arrowrock Dam in Idaho, the highest dam in the world. He was graduated from the University of Maine in 1896, and worked from then until 1897 on sewer construction at Malden, Mass. In the latter year he joined the engineering forces of the Metropolitan Water Board of Massachusetts, remaining in that service until 1899, when he was appointed assistant city engineer of Winnipeg, Man. Later in the year he resigned to accept a position with the Isthmian Canal Commission on surveys and estimates for the proposed canal through Nicaragua. From 1901 to 1902 he was with the Guayaquil & Quito Railway of Ecuador as resident engineer on nine miles of railway construction in the Andes Mountains. He joined the U. S. Reclamation Service in 1902. In 1903, while in charge of investigations in North Dakota, he discovered the reclamation possibility that later materialized into the Lower Yellowstone project. From 1904 to 1908, as project engineer, he had charge of the construction of the canal system on that project, and the starting of work on the Lower Yellowstone Dam. In the latter year he was appointed assistant supervising engineer of the Idaho division, and, in 1910, supervising engineer of that division, in which capacity he had charge of the construction of the dam at Jackson Lake, the canal and drainage systems on the Minidoka project, the canal system on the Boise project and of Arrowrock Dam, which was completed last year.

THOMAS F. WILLIAMS, formerly chief mechanical engineer of the Aeromarine Plane & Motor Co., of Avondale, N. J., and a specialist in carburization of fuels, has accepted the position of chief consultant of the board of engineering research, mechanical applications, of the Powdered Coal Engineering & Equipment Company, of Chicago, and will direct the research work of that company in the carburization of comminuted fuel, and the application of automatic mechanical regulation and controls thereof.

ROBERT S. WESTON AND GEORGE A. SAMPSON have formed a partnership, under the firm name of Weston & Sampson, to engage in engineering practice, at 14 Beacon Street, Boston, where they have been associated for several years. The firm will specialize in water supply and purification, sewerage and sewage disposal, and the disposal of municipal and factory wastes, including the making of investigations and reports, the preparation of plans, contracts and specifications, the supervision of construction, the superintendence of the operation of municipal and private purification plants and the valuation of waterworks and water power. William Wheeler will co-operate with the firm, mainly in an advisory capacity.

THOMAS A. HAYDEN has been transferred from the field division of the U. S. General Land Office to office work in the office of the surveyor general at Phoenix, Ariz. Previous to his connection with the General Land Office, Mr. Hayden was city engineer of Santa Fé, N. M., in which city he had conducted a private engineering practice for ten years.

F. LAVIS, consulting engineer, of New York City, has become associated with the American International Corporation in an advisory capacity in regard to railway and general development projects in Central and South America. During the past two years Mr. Lavis has been an earnest advocate of the necessity of co-operation on proper lines of the United States in the development of South and Central America, and, particularly, of the necessity of an intelligent interest in, and financial aid for the development of transportation facilities as the basis of all other development. He was educated in England, but first engaged in engineering work in this country in 1889 as rodman on railroad work in the vicinity of Boston. In 1890 he went to Cuba on work near Santiago. From 1892 to 1894 he was with the Cartagena-Magdalena Railroad in Colombia, and, from 1895 to 1897, he served as transitman and assistant engineer for the New York, New Haven & Hartford Railroad. As locating and resident engineer for the Chihuahua & Pacific Railroad, from 1898 to 1899, he located about seventy miles of railway in Mexico, and had charge of the construction of about thirty miles. Later he engaged in mining work in that country and Arizona. After about two years of service on the Boston & Maine Railroad and the Exeter & Hampton Street Railway, following that work, he was appointed locating engineer of the Choctaw, Oklahoma & Gulf Railroad, in which capacity he had charge of preliminary and location surveys in Oklahoma and the Indian Territory. In 1903 he returned to the New York, New Haven & Hartford as assistant engineer. He left that service later in the year to accept a similar appointment with the New York Central. Later he was with Westinghouse Church Kerr & Company on the Pennsylvania Terminal work in New York City, and with the New York, Westchester & Boston as locating engineer. In 1905 he was appointed resident engineer in charge of the construction of the Bergen Hills tunnels in New Jersey for the Pennsylvania Railroad Company. Following this work he became a member of the engineering firm of Guerber, Lavis & Company, and, in 1910, general manager for the Dominion Construction Company, retaining his connection, however, with the first mentioned firm. In 1912, in addition to his consulting practice in New York City, he assumed the office of chief engineer of the Argentine Railway.

Luther Wagoner, consulting engineer, of San Francisco, has been appointed chief engineer of the Havana sewerage and paving contract by President Menocal of Cuba. Mr. Wagoner has been engaged in engineering since 1866, when he served for a short period as deputy county engineer of Johnson County, Missouri. In 1866 he entered the service of the Union Pacific Railway, in which he remained five years, leaving it to become engineer in the land department of the Texas Pacific. From 1874 to 1877 he was in Brazil on bridge construction, geodetic work and mine development, and, in 1879, he engaged in water supply work in Kansas. In 1884 he had charge of the construction of a section of the San Francisco sea wall. After four years spent in a general mining engineering practice, from 1896 to 1900, he was given charge of the investigations for a new water supply for San Francisco. During the period intervening since then he made the plans for the reclamation of Colusa Basin in California, and also for dams, canal systems, reservoirs and other irrigation works in California, Arizona, New Mexico, Washington and British Columbia, and was consulting engineer for the Modesto and Turlock irrigation districts.

R. D. Goodrich has resigned from the office of city engineer of Cheyenne, Wyo., to become manager of municipal public utilities under the Board of Public Works of Ypsilanti, Mich.

A. N. Johnson, formerly chief engineer of the Illinois Highway Commission and at present on the staff of the New York City Bureau of Municipal Research, will become consulting highway engineer of the Portland Cement Association with headquarters at 111 West Washington Street, Chicago, on or about April 1.

James Adams has been appointed assistant to the city engineer of Binghamton, N. Y.

E. W. Edwards, formerly a partner in the engineering firm of Edwards & Chamberlain, of Eldora, Iowa, has become connected with the force of S. B. Gardner, consulting and drainage engineer, of Benson, Minn.

Angus S. Hibbard, consulting engineer, Bell Telephone Building, Chicago, will hereafter act as consulting engineer for firms or corporations desiring advice in matters pertaining to commercial or technical business organizations in addition to his present work. Mr. Hibbard was general manager for the Chicago Telephone Company for eighteen years and was for eleven years connected with the American Telephone & Telegraph Company.

C. F. Schulz will retire from the office of water commissioner of Cleveland, March 1, when Thomas Farrell, city utilities director, will assume personal charge of the system. Charles P. Jaeger, present deputy commissioner, will remain as Mr. Farrell's chief assistant. Mr. Schulz has been connected with the waterworks department for 34 years, and was chief engineer until four years ago, when he became commissioner.

John Boldt and Albert S. Low, until recently superintendents for the Samuel Austin & Sons Company, have formed the Boldt-Low Construction Company, contractors, with offices in the Swetland Building, Cleveland.

Edward W. Cunningham, formerly assistant building commissioner of the city of Cleveland, has been appointed building commissioner of that city. Mr. Cunningham was graduated from Ohio State University in 1894, and was, for a time, connected with the Osborn Engineering Company, of Cleveland. He was appointed assistant building commissioner 4 years ago.

E. P. Roberts, formerly consulting engineer, of Cleveland, has entered business as a manufacturer's agent with offices in the Hippodrome Building, that city.

William S. Twining, formerly consulting engineer to the Department of City Transit of Philadelphia as the representative of Ford, Bacon & Davis, has been appointed director of that department, succeeding A. Merritt Taylor, by Mayor Smith. Since 1910, when he resigned as chief engineer of the Philadelphia Rapid Transit Company, Mr. Twining has been with Ford, Bacon & Davis, consulting engineers, of New York City; for the last 2½ years as consulting engineer to the department he has been appointed to direct. He was chief engineer of the Philadelphia Rapid Transit Company and of its predecessor, the Union Traction Company of Philadelphia, from the time of the organization of the latter company, in 1895, until 1910. Under his direction and supervision the Market Street subway and the elevated railway in Philadelphia was built. He was graduated from Allegheny College in 1887, and served 3 years there as instructor, then entered the employ of the Thomson-Houston Company, Boston, Mass., for which he had charge of electric railway construction in Indianapolis and Toledo. In the latter part of 1891 he assisted in equipping the Harlem Bridge, Morrisania & Fordham Railway, now a part of the Union Railway, New York City, with electricity, and, in the following year was one of the engineers in charge of the electrical equipment of the Atlantic Avenue Railway, now a part of the Brooklyn Rapid Transit System. In 1893 he was appointed assistant to the chief engineer of the People's Traction Company, Philadelphia.

Earl Meckley, assistant city engineer of Allentown, Pa., has resigned to enter the automobile business at Hanover, Pa. Mr. Meckley is a graduate of Pennsylvania State College, and has been in the service of the city of Allentown for the past four years.

De Witt V. Moore has resigned from the office of district engineer, central district, Division of Valuation, Interstate Commerce Commission, to engage in consulting practice with offices at the Lytton Building, Chicago. He will specialize in valuation work, and cost analysis will be given particular attention. Mr. Moore's experience covers 10 years in railroad engineering, 10 years in railroad and structural construction as engineer and contractor, and a connection with the Division of Valuation, in the position mentioned, since its organization in 1913.

Edmund F. Saxton, recently assistant director of the Department of Wharves, Docks & Ferries of Philadelphia, and formerly chief engineer of The United Railways of Yucatan, including the port of Progreso, and, for over fifteen years in charge of testing laboratories, railroad location and betterment, reports, reinforced-concrete and bridge construction, docks, piers and harbor work, has opened offices to engage in a general consulting engineering practice at the Pennsylvania Building, Philadelphia. Special attention will be given to municipal problems, valuations, railways, ocean and river piers and wharves, design, testing and supervision, and the construction of general works.

Rudolph P. Miller was reappointed on Feb. 1 by the new Board of Aldermen of New York City, as expert to assist the committee on buildings in completing the revision of the building code. In the last two years the committee has, under Mr. Miller's guidance, revised practically the entire code with the exception of the sections relating to theaters, now to be taken up by the committee. Mr. Miller, before his appointment as superintendent of buildings of New York City in January, 1910, had a large consulting practice in New York City, most of it with architects and builders. From 1895 to 1906 he was connected with the building department in various capacities, and, in 1907, was made a member of the first committee on the revision of the code. Mr. Miller was graduated from Columbia University in 1888 with the degree of civil engineer.

Dr. Gilbert J. Fowler, recently professor of chemistry in the Manchester University of England, and the discoverer of the activated sludge process of treating sewage, sailed Jan. 22 for India to assume the professorship of applied chemistry at the Indian Institute of Science at Bangalore, Mysore, India. In a letter to T. Chalkley Hatton, chief engineer, Milwaukee Sewerage Commission, he states that his research work in connection with activated sludge and other sanitary questions will be carried on at his laboratory in Manchester under the direction of Mrs. E. M. Mumford, M.Sc., research fellow of the Board of Agriculture, who is working in conjunction with Mr. Ardern.

William B. Bennet, consulting engineer, of Niagara Falls, N. Y., has accepted appointment to the office of city engineer of that city. He will continue his consulting practice in addition to his new duties.

Jay A. Craven, sanitary engineer for the U. S. Public Health Service, Cincinnati, has been made assistant manager of the Terre Haute (Ind.) Water Company. Following his graduation from Purdue University he was for one year assistant to C. A. Jennings at the Bubbly Creek filter plant, Chicago, one year as chemist with the Omaha Water Company, three years as sanitary engineer for the Indiana State Board of Health, and one year with Morris Knowles, consulting engineer, Pittsburgh. At the directors' meeting when Mr. Craven's position was created, Dow R. Gwinn was re-elected president and general manager, J. L. Crawford, vice-president, J. I. Mandeville, secretary, and M. H. McLeen, treasurer.

R. W. Sharp, superintendent of waterworks, Rock Island, Ill., has resigned to accept a position with the Illinois Oil Company.

Capt. J. McLean Jasper, formerly assistant engineer with Alvord & Burdick, Chicago, and at present with the British expeditionary force in the 172nd Brigade Royal Field Artillery, "somewhere in France," sends engineering friends in Chicago the regulation war postcard on which is checked off the phrases, "I am well," "Letter follows at the first opportunity," and "Your last letter received." He has been in the trenches since early in December.

Prof. William Hubert Burr has reached the age of retirement, after 22 years of continuous service as professor of civil engineering at Columbia University. The Board of Trustees announced on Feb. 7 that his active work at the university will cease at the end of the present academic year. Professor Burr is a graduate of the class of 1872, Rensselaer Polytechnic Institute. After a few years in practice he became instructor at Rensselaer in 1875, and the next year was made head of the department of applied mechanics. In 1884 he became assistant to the chief engineer of the Phoenix Bridge Company, and later was general manager of that company. In 1892 he was made professor of engineering at Harvard University, and, in 1894, he accepted his present position at Columbia University, where he has had charge of the civil engineering department. Professor Burr's work as an author of text books and technical papers is well known. He has been a member of various commissions, including the commission on additional water supply for New York City, of which he was made chairman in 1903, and of both Isthmian Canal Commissions. He was a member of the board of advisory engineers for the New York State Barge Canal construction, and was appointed by President Cleveland on the board of engineers to investigate the feasibility of bridging the North River. He has acted in a consulting capacity on many large projects and bridges, and as consulting engineer to various New York City departments. He was engaged by the City of New York to investigate and report on the strength of the Queensborough bridge.

Group of Consultants on Industrial Efficiency Organized

A number of engineers and specialists in sales and advertising methods have become associated under the title of "The Consultants," with the McCall & Clarke Company, of 101 Park Avenue, New York, as managers. Each of the consultants is a specialist of standing in his particular line and is prepared alone or in consultation with his associates to prosecute investigations for the increase of the efficiency of manufacturing and selling organizations.

The gentlemen associated in the group, and their specialties are as follows: E. D. Anderson, automatic machinery; W. H. Chappell, production contractor; Francis W. Collins, industrial and financial investigations; John F. Daniell, retail and department store economics; Albert A. Dowd, machine shop practice; C. E. Knoeppel & Company, organization and management; E. St. Elmo Lewis, sales and advertising, market investigations; F. M. Williams, industrial chemistry. The McCall & Clarke Company will take care of the installation of cost systems and will make financial audits.

A fifty-two page 5 x 8-in. pamphlet, giving the experiences of these gentlemen and also containing three chapters from Mr. Knoeppel's book on "Practical Application of Efficiency Methods," has been prepared for distribution.

Lumbermen Pushing Publicity

That lumber is second only to steel in magnitude of production and must have publicity worthy of it, was the point made in a recent address of E. A. Sterling, of Chicago, manager of the trade extension department, National Lumber Manufacturers Association, before Michigan lumber dealers. Mr. Sterling briefly outlined the trade extension idea and traced its rapid development from a mass meeting of lumbermen in Chicago about a year ago. The spirit of lumber trade promotion is now widespread and is being taken up by manufacturers' and dealers' associations, city groups of lumbermen and individuals everywhere. Probably not less than $1,000,000 will be spent by the lumbermen this year in advertising and promoting their product.

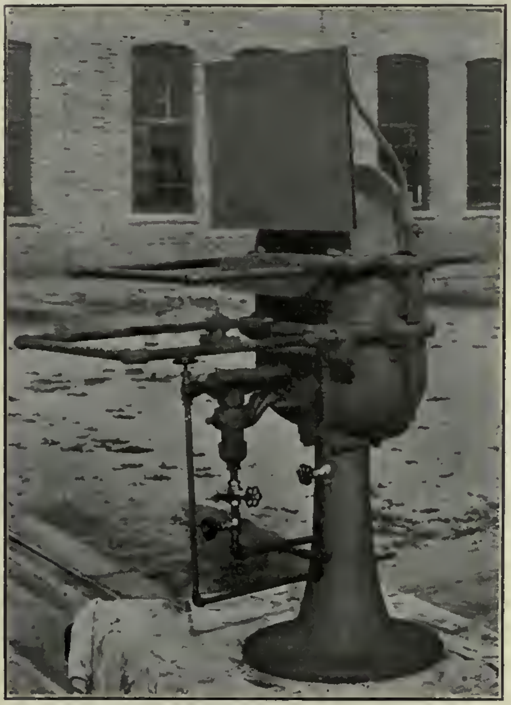
"Manufacturers of building materials which take the place of lumber have set the pace," said Mr. Sterling, "and the lumbermen must adopt similar selling methods or lose their market. We have only admiration for the progressive action of our competitors, yet, simply because the lumber industry is so big as to have lacked cohesion, is no reason why it should not now fight for its legitimate market." According to Mr. Sterling, "The lumbermen are now in the field, not in a spirit of crying down any other material, since all have their places, but to promote the use of lumber where lumber is best, and to secure safer and better wood construction in dwellings, commercial buildings and on the farms.

New Furnace for Heating Drill Steels Has Many Advantages

The new type of oil burning furnace illustrated herewith, used extensively for heating drill steel, is now made with a preheating chamber which greatly increases the capacity of the furnace. This preheater is a section which fits between the body and cover of the furnace of the former design. It is, therefore, a simple matter to attach this section to an old furnace by changing a few bolts. Referring to the illustration, it will be seen that the lower chamber is used for the final heating and the upper one for preheating. It is claimed that by the addition of the preheating feature, the space for heating is doubled, the heating capacity of the furnace is increased about 50 per cent and the efficiency of the furnace is increased correspondingly.

The type of burner now furnished with this furnace is suitable for either high or low pressure air. It has merely to be throttled for high pressures. When this is done it is said to be as efficient as burners designed especially for high pressures, while eliminating the noise common to such burners. The furnace burns petroleum or any of its oils, such as gasoline, kerosene, distillate, etc. Many advantages are claimed for oil heating. The steel cannot be injured by absorbing injurious elements such as sulphur, phosphorous and other impurities from the fuel, nor from unequal heating, as it is heated in a flame which imparts a uniform temperature. It is in full view of the operator at all times.

The floor space occupied by this new No. 3 Leyner furnace is 3 by 4 ft. No foundation is required, installation being complete when the air and oil supply pipes are connected. The absence of smoke, soot, dust, ashes and cinders is a convenience which is particularly appreciated in underground installations and in plants used in buildings. The manufacturers are the Ingersoll-Rand Company, of New York City.



OIL FURNACE PREHEATS DRILL STEELS

Business Notes

The Trussed Concrete Steel Company convention was held at the main plant at Youngstown, Ohio, Jan. 25-29.

The American Manganese Steel Company, of Chicago, Ill., has established a branch office in the Oliver Building, Pittsburgh.

The Waterworks Manufacturers' Association executive meeting that was scheduled for Feb. 8 was postponed and will be held at the Machinery Club, New York City, Feb. 16.

The Alliance Well Company, Turks Head Building, Providence, R. I., has succeeded to the business of the Roy S. Barker Company, well drillers, of that city. Roy S. Barker is president of the new company.

Walter B. Snow and Staff, advertising agents and publicity engineers, of Boston, have recently added to their organization Mr. Charles W. Burrage, formerly of the instructing staff of the Massachusetts Institute of Technology.

The Original Gas Engine Company, manufacturer of gasoline engines and contractors' equipment, of Lansing, Mich., will be known hereafter as the Ideal Engine Company. The change in name was decided upon at the annual meeting of the stockholders of the company.

Albert H. Scherzer, vice-president of the Scherzer Rolling Lift Bridge Company, died in Chicago, Jan. 28, at the age of 51 years. He was a graduate of the Technical School of Zurich, Switzerland, and of the Union College of Law, Chicago. He practised law until the death of his brother William, the inventor of the Scherzer rolling lift bridge.

W. L. Macatee & Sons, cement dealers, of Houston, Tex., were visited some time ago by a man who represented himself as being connected with a concern engaged on contracts for plain and decorative plastering, who stated he was contemplating figuring on some work in that city, and was desirous of obtaining prices. This done, he left the office, but later in the day returned and the firm cashed a check for him. The check was not honored by the bank upon which it was drawn, and inquiry in the cities at which the stranger's employers were said to have offices failed to locate any such concern.

The Veteran Employees' Association of the Westinghouse Electric & Manufacturing Company, at its annual banquet, held Jan. 29 in the Fort Pitt Hotel, Pittsburgh, Pa., presented to the company a bronze memorial tablet of the late George Westinghouse, founder of the numerous industries bearing his name. About 450 veterans were present. The memorial tablet is 4 by 3 ft., made of solid cast bronze, and weighs about 300 lb. It shows a bas-relief likeness of Mr. Westinghouse taken from one of his best photographic poses, seated in an armchair, and bears the inscription "GEORGE WESTINGHOUSE, Master Workman, Inventor, Founder, Organizer, 1846-1914." It will be placed in the reception room of the East Pittsburgh works of the electric company. The presentation was made on behalf of the veterans by Charles F. Scott, consulting engineer, and professor of electrical engineering at Sheffield Scientific School, Yale University, and was accepted on behalf of the company by Guy E. Tripp.

Trade Publications

The following companies have recently issued trade literature:

E. J. Whalen, Syracuse, N. Y., catalog, 20 pages, forms for concrete highway culverts.

Homestead Valve Manufacturing Company, Pittsburgh, catalog, 40 pages, straightway, three and four way, and angle valves from ⅛ to 6 in. in size.

New Way Motor Company, Lansing, Mich., catalog D-16, 40 pages, New Way horizontal, portable and pumping engines, single and double opposite cylinders, and special attachments transmission, gas generation, etc.

Barber Asphalt Paving Company, Philadelphia. Booklet, 6 x 8¼ in., 20 pages, illustrated. "The Asphalt Primer and Colloidal Catechism" represents, as the manufacturer says, an attempt to put a different chemical proposition into a form that will appeal to and be understood by the layman. The treatment is in the form of questions and answers on the history of road construction and on definitions relative to asphalt and its chemical nature. There is information in it that will interest everyone, because it is human. It includes accounts of the works of Egyptian and Roman road builders of past ages and theoretical explanations of stratum formation of asphalt.

Bausch & Lomb Optical Company, Rochester, N. Y. "Metro Manual," a handbook for engineers, 199 pages and appendix. This is a veritable treatise on surveying instruments and their use, including descriptions of instruments, adjustments, surveying methods, tables, formulas—far more useful information than can be even mentioned in the small space available here. The fact that detail information regarding the company's individual products is scattered through the pages does not detract from the merits of the book, especially as generous space has been given to instruments and devices with which the company seemingly has nothing to do.

Engineering Record

A Weekly Journal Devoted to Civil Engineering and Contracting

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Commissions and Maximum Rates

LAST SUMMER, in the issue of Aug. 7, page 154, this journal had occasion to comment on the decision of the New York Public Service Commission, Second District, in the Ulster & Delaware case. Although the carefully prepared report of W. J. Wilgus, consulting engineer, had convinced the commissioners that the existing passenger rates of this railroad were unremunerative, they ruled by a vote of three to two that the statutes did not empower them to raise the rates, the existing rates being the maxima fixed by the railroad law. The Engineering Record predicted that if the case was carried to the Court of Appeals the authority of the commission to set aside the maxima of the statutes would be upheld. And the prediction has just been made good by a finding of the Appellate Division of the state Supreme Court. Without going into the details, the ruling decision states in substance that the amendments of 1911, subsequent to the passage of the public-service and railroad laws, would be meaningless if the commission's interpretation were correct, and that the legislative maxima were intended to prevail only in the absence of action by the commission. The decision is an encouraging indication that a single official body may, after all, handle the whole rate question, and regulate rates either upward or downward as justice demands.

The Ultimate Court

IT is significant that in the great labor controversies which seem imminent—those on Western railroad systems and in the anthracite mining field—both sides to the controversies are making their efforts to get their case before the ultimate court—the public at large. The time was when the weaker party to such a controversy sulked in the background and contented himself with declaring that the other fellow was unreasonable and unjust. Now both sides are in the open, though, as is to be expected, each dresses up his argument in his own defense with all the ingenuity possible. If the public will read both sides with discrimination serious conflict in these fields may be avoided, for the mere fact that most employers and employees are endeavoring to get their views before the public is an admission that they do not expect to run counter to what the public will ultimately decide is the correct view of the matter. The anthracite mine operators have started this publicity campaign by using full-page advertisements in the newspapers, while the miners have distributed to the press a 250-page book giving their side of the case. In the West the newspapers have been plentifully supplied with the arguments of both the railroads and the engine and train men. If the controversy is thus fought out in the press, the more serious conflict—an actual stoppage of work, with all of the suffering and loss entailed—may be avoided. It is earnestly to be hoped that such will be the case. It is fairly easy to predict that, at the least, since both parties are endeavoring to argue with the public, that they will not be able to resist the demand which is sure to come from the public for arbitration.

Grasping the Fundamentals Correctly

NO progress can be made in the consideration of any question if the very fundamentals are misunderstood. Such seems to be the case in connection with the demands which the Western engine men and train men are making on the railroads. The controversy is briefly alluded to in the preceding note. The public generally, and the newspapers also, believe that the railroad employees are demanding an eight-hour working day. This is not the case. What they are demanding is an eight-hour day basis of payment. In a word, they ask for the same pay for eight hours as is now given them for ten hours, an increase of 25 per cent without increasing the amount of work delivered therefor. The demands do not require the reduction of the working time of the employees. Manifestly this is not necessarily the deciding point in that controversy, but immediately it puts the question squarely before the public whether or not the employees are entitled to a 25 per cent increase. Various angles need consideration and will not be taken up here. One thought, however, will come at once to the mind of every engineer who has followed rate regulation in recent years: Even if these demands, on the sole ground of economic consideration involving the employees alone, ought to be granted could the railroads in their present condition, without additional revenues from passenger and freight service, stand the increased strain?

Intensive Street Cleaning

DROP pieces of paper on the street in the shopping district in Chicago and they will be picked up, on the average, inside of 2.7 min.; every piece will be removed within 15 min. This is the yardstick in the new standard of street cleanliness, discussed on page 252. The sweeper cleans up his "block" or "patrol" during the first hour of the morning and thereafter transfers his daily burden from his arms to his legs, for he must walk rapidly from one end to the other, ever alert to make his pickups as fast as they fall. He must keep abreast of his work. Few shop-keepers in Chicago realize the high standard which has been set—one that requires the cleaner to pass their doors from sixty to ninety times every day. These remarks refer to the large refuse. The fine residual dust problem is not so easy to handle, particularly on cold days in winter when sprinkling is impracticable. The vacuum cleaner immediately comes to mind, but it will be necessary to make one small enough to dodge in and around traffic and over the sidewalks. Such a machine, operated by one man, would find instant consideration. Another possible solution is to sweep over the street an oiled sawdust or some material carrying an antiseptic chemical which would immediately fix the dust by contact. Both schemes appear to be too expensive, but experimental work with them may lead to a solution. Certain it is that the Citizens' Street Cleaning Bureau, now that its standards have been raised so high, will not hesitate to experiment fully and to put into effect any plan that promises to abate this dust nuisance on the few cold days in the year.

Bone Patent Declared Invalid

ALTHOUGH Judge Anderson, of the United States District Court of Indiana, in his decision against the validity of the Bone patent for reinforced cantilever retaining walls, frankly declared that he expected the plaintiff to appeal on the ground that "the defeated party usually thinks that the trial court knows nothing about it, and that he will go to a court that does understand it," the new evidence presented by Professor Hatt showing prior application of the fundamental idea is convincing. It is surprising, in view of the arguments of Judge Anderson, which are abstracted on page 243 of this issue, that courts have previously upheld the Bone patent. While engineers have assumed that the fundamental principle involved in placing steel rods to resist tension in such walls could not be patentable, the fact remains that the Bone patent for a steel frame reinforcement in cantilever walls was actually issued in 1902. Innumerable suits by Mr. Bone for alleged infringement have resulted. In spite of the fact that the evidence of prior art introduced by Professor Hatt has, of course, been in existence all the time, previous cases were decided in favor of the plaintiff, apparently ignoring these facts entirely. Assuming that the essential requirement for patentability is the proof that the device is new and based upon a new idea, the existence of prior designs or prior art based upon the same idea, as shown in the new evidence introduced in this case, certainly raises the question whether the lawyer-controlled system of judging the validity of engineering patents is not inherently weak, to say nothing of the apparent mistakes in the United States Patent Office itself in the issuance of patents, due to a lax system of investigation. Many engineers consider any new developments in engineering design which they may devise to be the rightful possession of the whole engineering profession. Take, for example, the New Halifax quay wall design described in last week's issue. This is undoubtedly patentable, yet the engineers have made no effort to reserve to their own private profit the benefits of the new idea.

Engineers Mobilize in Force for First Military Lecture

MORE than a thousand men filling the auditorium of the Engineering Societies Building, six hundred more in an overflow meeting on the fifth floor, and hundreds of others unable to gain admission to either hall because of Fire Department rules—this is the way the engineering profession of New York mobilized to greet Captains Thomas M. Robins and Richard T. Coiner of the United States Army Engineer Corps at the opening session on Monday of the military lecture course for New York engineers, organized by the four national engineering societies. If any concrete evidence were needed to prove that the technical man realizes his responsibility in National Defense, it was supplied in full measure at the meeting this week. From the enthusiastic response one inference seems clear—the War Department can count upon a plentiful supply of raw material from which to recruit its engineer troops if an enlargement of this branch of the service ever becomes necessary. This is worth knowing, for the progress of the war in Europe has demonstrated that engineers are needed as they were never needed before to insure the success of great offensive and defensive movements. The engineer's art is the backbone of war as it is waged to-day.

Captain Robins, in his initial address, which is reported in the news section of this issue, attempted to give nothing more than a birdseye view of the organization and duties of engineers in war, and to explain in a general way what engineers in civil life will be called upon to do in the defense of the United States, but he left in the minds of his engineer audience this vital thought: No matter how proficient the engineer may be in civil practice, he is of little use at the front unless he is thoroughly grounded in the duties of a soldier. Engineer troops must fight and defend themselves, as well as erect and demolish structures. There is no royal road to military training. It means hard work—not in a library armchair with a printed manual of instructions, but out in the open, in camp and on the march. Of course, reading and study are necessary, but it is time now to dispel any illusions which may lead an engineer to think that he can step from his office into command of engineer troops at the front and direct them successfully. It can't be done.

A man must know close and extended order drill, the manual of arms, the use of a rifle, and have inculcated in him by intensive training the fundamentals of military discipline and team-work before he is fit for active duty. This groundwork in first principles can be obtained only through service in the regular Army, the National Guard or at summer camps, such as the one at Plattsburg last year. The committee which organized the lectures realizes this need for supplementing the oral instruction by a tour of field service, and it is safe to assume that an engineer battalion will be formed at Plattsburg next summer. Every engineer who intends to make himself of real use, in a military sense, should plan to attend camp.

All of the engineer's work in war, however, is not with the advance troops. What has been said applies particularly to operations with the combatant forces, and is directed principally to the men not too old to stand vigorous work in the field. There are, in addition, the important services on lines of communication and defense. Here the older men can be used to advantage—in directing railway operation, the manufacture of munitions, coast defenses, etc. Their mature judgment will be invaluable to the War Department in doing the kind of work needed to support the fighting troops of younger men at the front, but their military training need not be so comprehensive as that of the man who will operate in the fighting zone.

It is clear from Captain Robins' remarks that there is a place for almost every man with technical training—young or old. After the lectures are finished on March 27, the next step is to carry the enthusiasm which characterized them into camp, so that the theories expounded indoors may be put into practice in the field.

Safety in Dam Design

THE recent destructive floods in southern California have taught the usual lessons. The disastrous failure of the Lower Otay dam, described fully in last week's issue, proved again, if proof were needed, the unwisdom of accumulating in a structure of such magnitude and importance so many elements of uncertainty. The question of how far it is proper to go in providing against unprecedented conditions is one of such complexity that anything like complete agreement among engineers is hardly to be expected. Yet this question presses for some kind of an answer. It is plain that the flood hazards to be guarded against in the semi-arid Southwest have been underestimated heretofore, and there is little doubt that in future much more generous provision will be made for securing safety. But it is also essential that the wisdom of solid and permanent construction be recognized by a marked avoidance of cheap or questionable design or construction materials. This does not mean a stupid prodigality, but a more thoughtful regard for recent developments in dam design, as well as a wholesome respect for the unexpected.

One of the most valuable lessons to be learned from the disasters and narrow escapes of the last flood period in California is the high value of the arch as an element in the design of masonry dams. The slender Upper Otay dam was overtopped by a flood pouring 3 ft. deep over its crest. Slender as are its proportions, and extreme as were the compressive stresses to which it was subjected, the dam was wholly uninjured. The old Bear Valley dam—a thin, arched structure that withstood the vicissitudes of flood and ice for many years without sign of weakness—can hardly be accused of representing conservative design, and the Sweetwater dam, handicapped by a central portion acting as a cantilever, stood without serious damage an overpour that would certainly have carried away the hollow shell recently added to its height had the structure been straight instead of arched. The flood of 1895 proved that the original spillway of the Sweetwater dam was wholly inadequate—a fact recognized in subsequent improvements by the provision of a spillway having an estimated capacity of 5500 sec.-ft. Yet it is estimated that during the peak of the recent flood six times this amount passed through the spillway, over the crest of the dam, and through the break in the earthern embankment at the north end of the main structure.

It may be said that if safety be granted as an essential in the design and construction of a dam, it must conform to one of two general types. The first is of such design and constructed of such materials as to sustain without danger a heavy overpour for a considerable period if the spillway capacity is exceeded. This is certainly the safest general type. The second, which may include all kinds of earth embankments, hydraulic-fill, and rock-fill dams—in short, dams constructed of any material subject to serious damage from overtopping—must have a spillway capacity in excess of the full peak of any flood that the most liberal estimates can indicate as remotely possible, and, what is still more important, the passage to this spillway must be kept absolutely unobstructed. It must be remembered that the peak of the flood may come on a full reservoir, as was the case with the recent flood when it reached the Sweetwater reservoir. It would appear, then, that if the requirements of safety are to be met by the provision of this extraordinary spillway capacity as a vital accessory to the second general type of dam, the first and generally preferable type in many cases may actually be lower in first cost.

The Lower Otay dam was a hybrid structure. Work was started with the intention of building a concrete dam, and after a ten-year construction period without adequate engineering supervision the finished product was not in accord with the rules of good practice. Well-known engineers criticised the manner of preparing the foundation, the design of the section, and the material used in the fill. However, the dam failed when overtopped, and after noting other features of this remarkable structure it is not surprising to find that, although the drainage area comprised 100 sq. miles the spillway provided was only 38 ft. wide with its lip but 3 ft. lower than the concrete core of the dam. The unfortunate feature is that the failure of such a structure creates in the public mind distrust of safe structures. In addition to the public supervision and inspection of dam construction which is usually demanded as a sequel to such disasters, the still greater need is for sound engineering practice in dam design.

What Is the New Evidence?

IN two previous editorial discussions of the proposal to move the headquarters of the American Society of Civil Engineers to the Engineering Societies Building, the Engineering Record has pointed out that the resubmission of the proposal of thirteen years ago is in itself evidence that there are new factors in the case, that the conditions have so changed that the plan of a unified headquarters deserves full consideration anew.

What is the new evidence? How have the conditions changed? What are the new elements that were not present thirteen years ago?

Brief reference to the earlier discussion of the question, when the proposal to join with the other societies was defeated by a vote of two to one, shows that the arguments against moving were, briefly, as follows:

1. That the three other national societies were weak financially and might be unable to carry their share of the financial responsibility of the undertaking.
2. That close relations with societies that had lower standards than the civil engineers would result in lowering the society in the estimation of the public and of the profession.
3. That a "merger" with the other societies was intended.
4. That the American Society of Civil Engineers would lose its identity and dignity.
5. That housing in a building adjacent to the Engineers' Club, a social organization, would work harm.

There is no reason for discussing now whether these contentions thirteen years ago were true as to fact and justifiable as to conjecture. On the contrary, for the sake of agreement at the inception of discussion, it may be admitted that the alleged facts were true and the fears reasonable. The important question now is: Do these facts hold to-day, and is there still reason to fear the undesirable results predicted thirteen years ago?

We stand to-day in a far better position to pass judgment on the proposal than did the membership thirteen years ago. Then there was no experience as to the joint operation by engineering societies of a $1,500,000 investment; then there had been no test of the ability of the other societies to shoulder and work off a heavy financial burden; then there were no data on the effect upon the societies themselves of close co-operation with bodies bearing different standards, and no way to judge of the effect which such close co-operation might have on the standing of the individual societies before the public and the profession. Now there is ten years of experience. What do the facts, as they are to-day, and the ten years of experience show?

In the first place, each of the three other societies—of mechanical, electrical and mining engineers—will soon have successfully worked off the debt, about $240,000, which it assumed when the new building was erected. The United Engineering Society, the body which holds and operates the building for the three founder societies, is out of debt and has a reserve fund of $70,000 toward amortization and for repairs. The fear, therefore, that the mechanical, electrical and mining engineers cannot carry the financial responsibility of the Engineering Societies Building can no longer be entertained. It is true that these societies are not as strong financially as is the American Society of Civil Engineers. They are, however, on a sound financial basis, and with their big obligation—that involving their respective shares of the property cost —practically wiped out, the growth in financial strength will be rapid.

The second objection listed above refers to the lower standards of the other societies. To learn whether that objection is still valid attention is directed to the article on page 245 of this issue, which shows the requirements for admission and the membership curves of the four national societies. It is evident that in the highest grade the requirements of the mechanical and electrical engineers are now on a par with, or higher than, those of the civil engineers. The mechanical engineers' age limit is two years higher than that of the civil engineers; the professional requirements are the same. The electrical engineers likewise require a higher age, but two years less in responsible charge of work. The mining engineers, admittedly, have not advanced their standards as have the other societies. The objection of lower standards, then, has been removed in large part—provided that the requirements are rigidly adhered to. Such, in fact, is the case, and both the mechanical and electrical engineers, with full appreciation that quality and not quantity gives a society its rank, are most jealous of the privilege of membership. Those unqualified are rigidly disbarred.

There is yet the possibility to be considered that the rank accorded all the societies will be that of the lowest. As to that, it may be asked, which of the three societies on Thirty-ninth Street gives the flavor to the standing of all? Each member of the profession will answer in accordance with his experience, but the Engineering Record feels certain that all but few of the replies will name either the American Society of Mechanical Engineers or the American Institute of Electrical Engineers—not the society with the lowest standards.

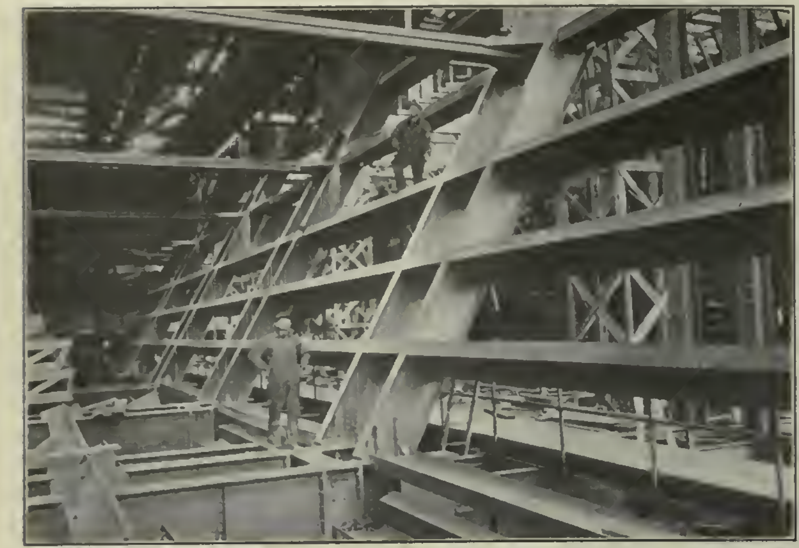
The third and fourth objections can be quickly dismissed. Ten years of co-operation under one roof have not brought the mechanical, electrical and mining engineers a whit nearer "merger" than they were at the start. Each is jealous of its record. Each would oppose most strenuously the loss of its identity.

Contemplation of the fifth objection forces one to exclaim: What a change in the past decade! Then fears were expressed that the "socializing" of the engineer would lower technical standards, that friendship and goodfellowship, while good in their way, must ruthlessly be separated from organizations where intellect must rule. Now, how different the sentiment! Engineering societies are emphasizing the social side of their organizations, appreciating that anything that brings their membership closer together is certain to redound to the advantage of the society, on its technical side, and of the profession as a whole. Far from being a disadvantage, the proximity of the Engineers' Club has been a decided benefit. Committees meeting in the Engineering Societies' Building have been able to adjourn to the club for luncheon or dinner with almost no break in their deliberations, while the good fellowship stimulated by the appointments of the club proves a welcome respite in the stress of a technical convention.

The Engineering Record is not unmindful that other practices of at least one of the societies in the union building have evoked the criticism of civil engineers—practices that did not obtain thirteen years ago, and therefore had no influence on the decision then reached. Objection has been made, for example, to the membership solicitation and the publication of advertisements in its journal by the American Society of Mechanical Engineers. The membership solicitation, however, has been judiciously handled; it has been directed only at well-qualified engineers and has not resulted in the lowering of the standards of the society. Despite its high plane, such solicitation will always earn the disfavor of those who believe that a society should not seek but should be sought. Provided the campaign for new members is properly conducted, the Engineering Record can see no reason for disapproving of it.

On the score of the admission of advertisements to the *Journal* of the American Society of Mechanical Engineers, the Engineering Record is in sympathy with the criticism of this practice. It believes, too, that it is allowing for the prejudice which a publisher would naturally feel toward such a plan.. The society has engaged in commercial work—a work grown great through skillful management. The Engineering Record believes that the standing of the society's proceedings has suffered in the estimation of engineers on account of the practice.

On the whole, however, the Engineering Record has believed that the objections raised against the plan thirteen years ago have been removed and that the board of direction of the American Society of Civil Engineers rightly resubmitted the proposal to the society. Those who were against the plan at its first presentation should carefully consider their former objections in the new light.



STEEL FRAMING OF BUNKER WITHOUT BENT CONNECTIONS

FORMS FOR CONCRETE STACK BASE—HOLES FOR ANCHOR RODS

Philadelphia Electric Company Power Station A-2 Has Four 12-Foot Steel Stacks 165 Feet High

160-Ton Crane Runway and Two 4000-Ton Coal Bunkers Are Other Features of New Steel-Frame Structure, Which Houses World's Largest Steam Turbo-Alternator

STEEL STACK ANCHORED BY LONG RODS

THE NEW Power Station A-2 of the Philadelphia Electric Company, located at Twenty-sixth and Christian Streets, Philadelphia, is a steel-frame and concrete structure containing many unusual features. Through the courtesy of Joseph B. McCall, president, and W. C. L. Elgin, second vice-president, of the Philadelphia Electric Company, the following detailed description of the main structural features of this building, on which J. T. Windrim was the architect, can be given.

SPECIAL FEATURES

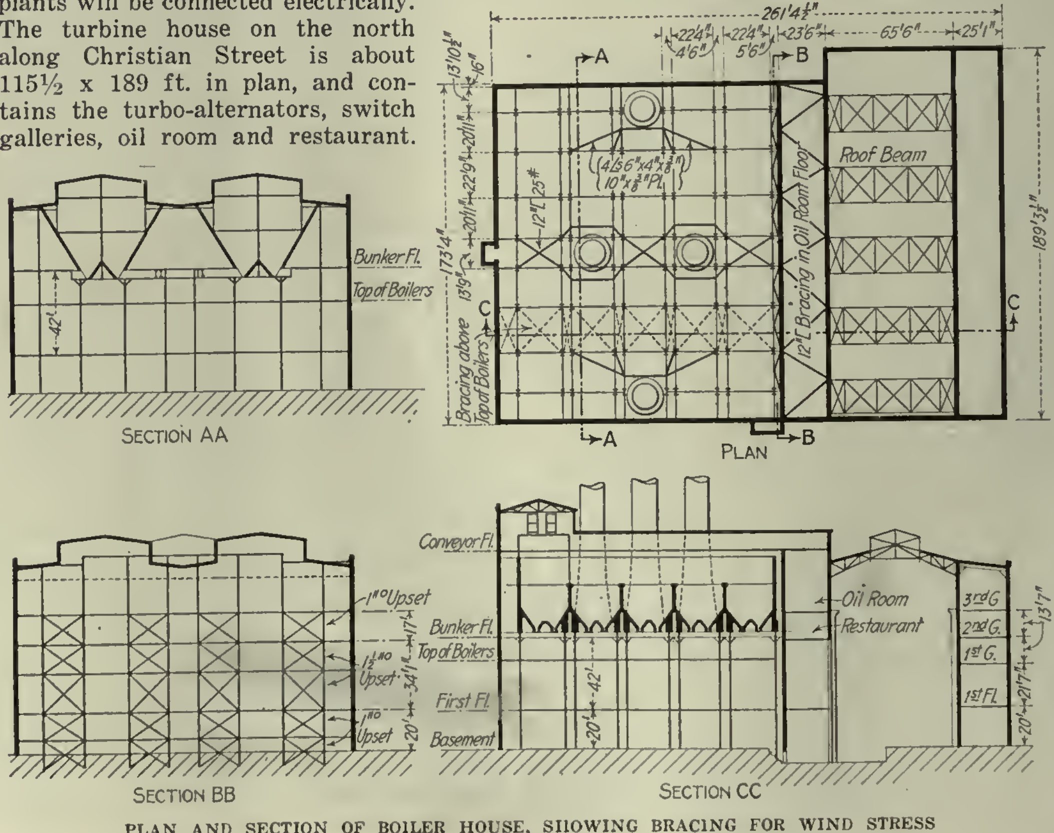
Four steel stacks, 12 ft. in diameter and 165 ft. high, are supported on the main bunker floor 62 ft. above the basement floor, with provision for resisting uplift and transferring the wind pressure to the foundations. Two 4000-ton coal bunkers have been designed in steel and reinforced concrete in such a way that all bent plate connections were avoided, the sloping bottoms and sides being formed of reinforced concrete. The 160-ton crane in the turbine room required double-beam crane girders braced for lateral forces by diaphragms to adjacent floors. The ceiling of this turbine room is also of special design, using flat tile between steel beams to give an arch effect.

This new power plant will contain the largest steam turbo-alternator in the world, and another almost as large. It will generate 65,000 kw. and control 104,000 kw. of alternating electric current, which would be sufficient to furnish a string of 50-watt lamps 8 ft. apart strung all the way from Philadelphia to the Pacific Coast, assuming a conducting wire without resistance.

The general dimensions of the building are given in the plan and sections in one of the accompanying drawings. The new structure is an extension of the present Station A-1. The east wall of the latter, after the window openings have been bricked up, will separate the two buildings, although the plants will be connected electrically. The turbine house on the north along Christian Street is about 115½ x 189 ft. in plan, and contains the turbo-alternators, switch galleries, oil room and restaurant. A 13-in. curtain wall divides the turbine house from the boiler house in the rear and acts as a fire wall. The building is fire resistant throughout, as brick walls, reinforced-concrete floors and protected steel framing have been used. The main turbine room is seen to be exceptionally spacious, 65 x 188 ft. in plan and about 90 ft. high.

STEEL STACKS AND SUPPORTS

The four steel stacks, with no guys whatever, are each 165 ft. high above the bunker floor, and 12 ft. in diameter, enlarged at the base to 18 ft. Their location is shown in the plan above mentioned and the bracing in the bunker floor indicated by heavy lines. Their total height above the basement floor is 227 ft. Double-web plate



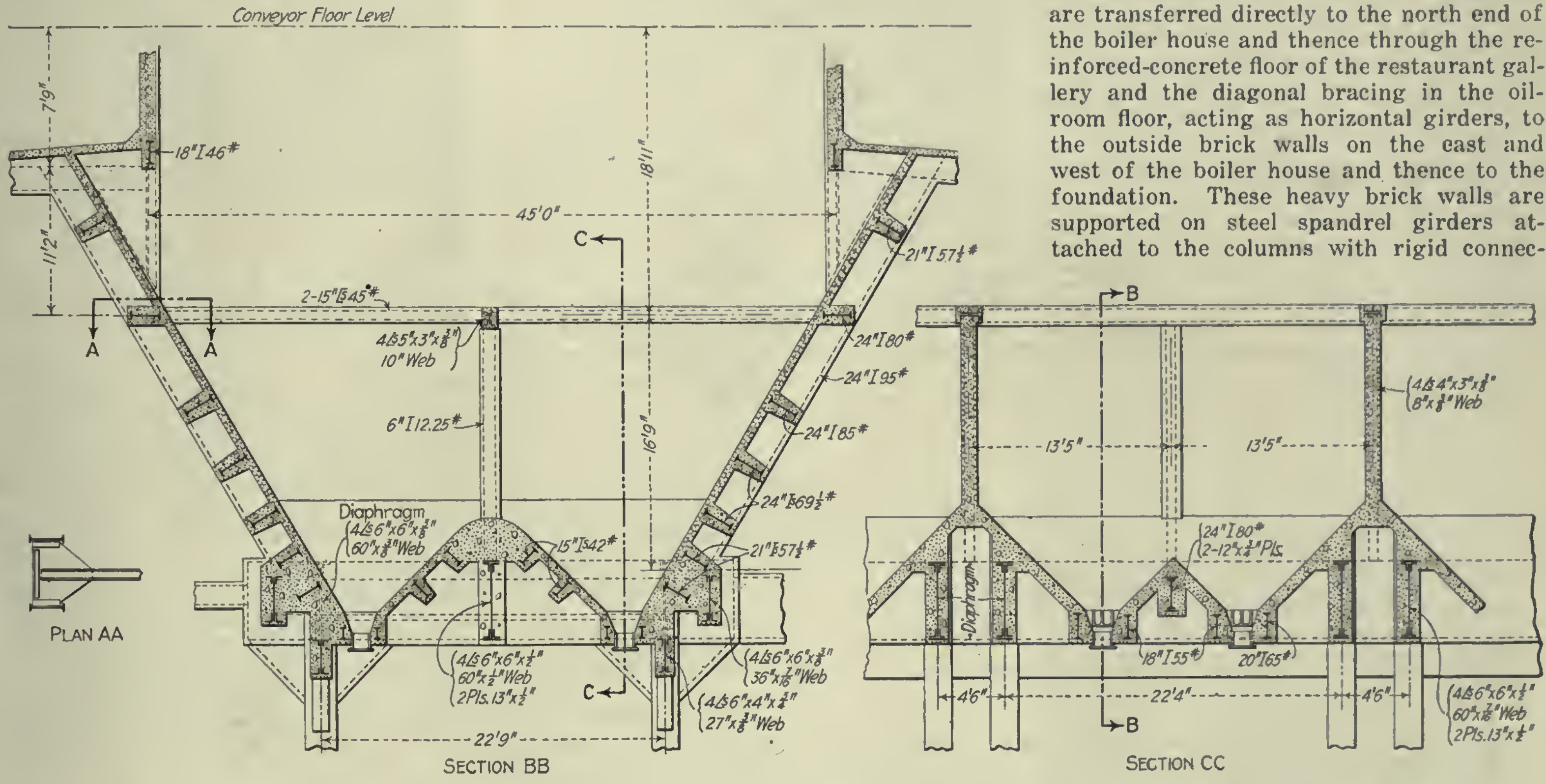
PLAN AND SECTION OF BOILER HOUSE, SHOWING BRACING FOR WIND STRESS girders 4 ft. deep and sixteen 2½-in. anchor bolts, as shown in one of the accompanying photographs, are provided for each stack base. The long bolts between vertical brackets on the lower section of the stack pass through the holes for which the cores are placed, as seen in one of the photographs, the girders being filled with concrete inserted through the open holes shown.

The total wind pressure on the exposed diametral area of one stack is 30,000 lb., and the overturning moment at its base is 3,000,000 ft.-lb. The approximate weight of the stack with its lining is 250,000 lb., and the weight of the concrete base to which the stack is anchored is at least as much again, giving a total of 500,000 lb. Assuming a distance of 10 ft. from this resultant at the center of the stack to a center of pressure at any side of the base, the resisting moment is more than 5,000,000 ft.-lb., without including the effect of dead load of floors and columns below. The overturning effect of the wind on the stack is thus amply resisted. The downward thrusts on the centers of pressure were provided for in the design of the girders and columns and their connections.

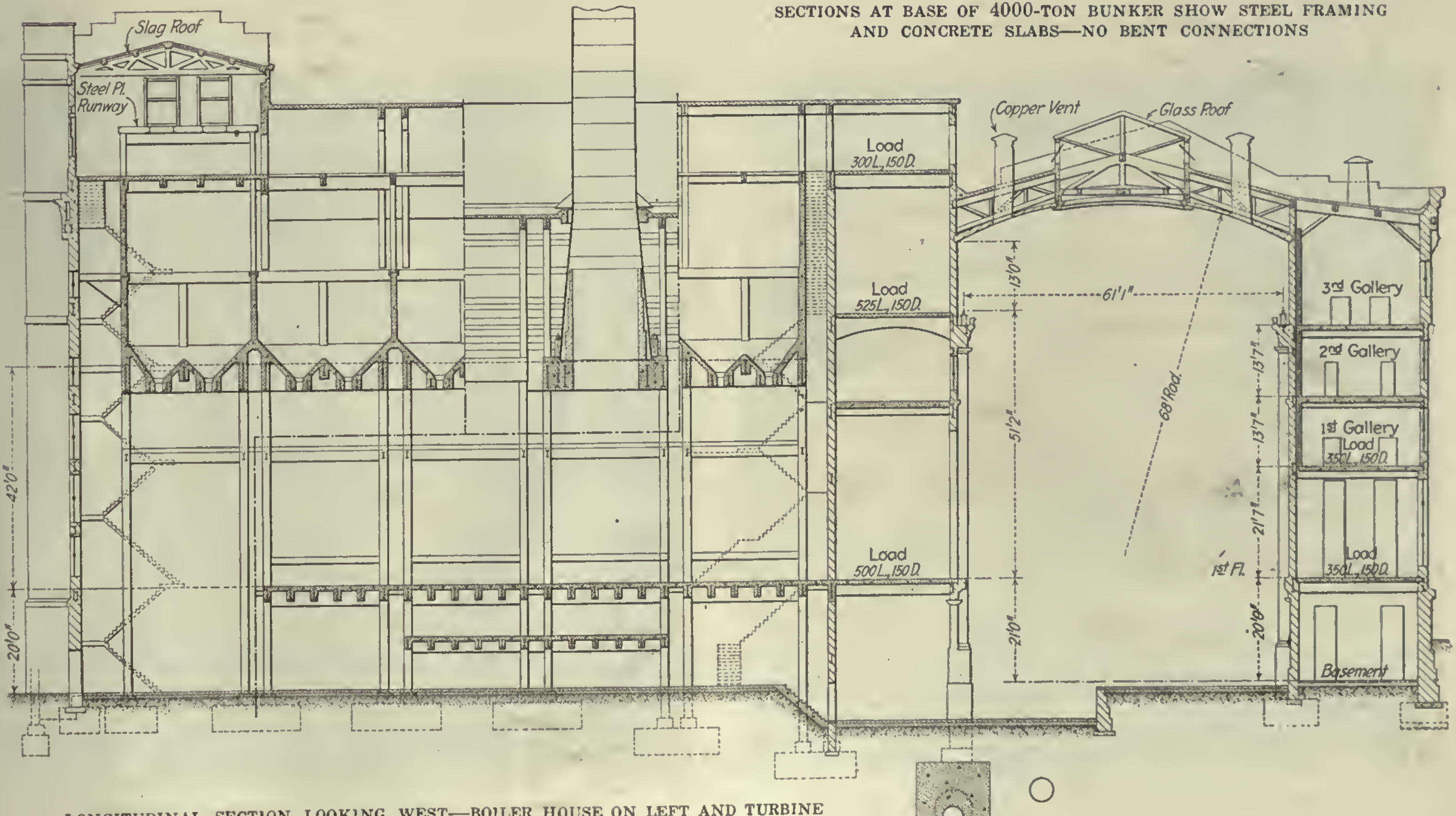
WIND BRACING FOR STACKS

In addition to the overturning effect of the wind, the horizontal pressure at the base of each stack had to be transferred to the foundation about 65 ft. below. As vertical diagonal bracing would interfere with the operation of the boilers, horizontal diagonal braces, as shown in the plan by heavy lines, were used from the corners of the square concrete stack bases. These braces from the two interior stacks distribute the east-and-west horizontal thrusts to the complete bracing system shown in the middle bays, and thence to the ends of this system, up the solid end walls of the bunkers to the horizontal girders at the end, shown by one of the photographs, and into the brick walls on the south end and the rod bracing in the partition wall on the north end of the boiler house. This rod bracing consists of 1¼, 1½ and 1¾-in. upset round diagonal rods, with clevises, in every other bay of the building and connected to brackets riveted to the columns and beams.

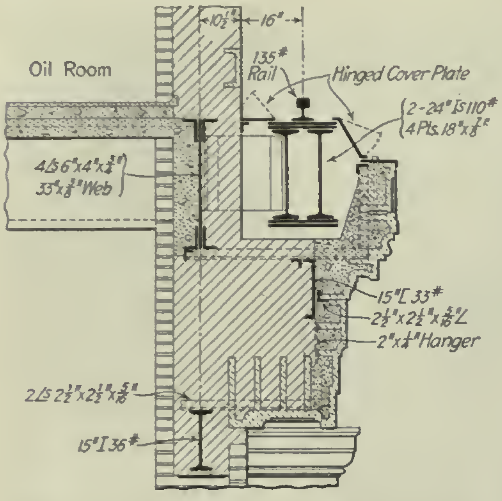
The north-and-south horizontal thrusts are transferred directly to the north end of the boiler house and thence through the reinforced-concrete floor of the restaurant gallery and the diagonal bracing in the oil-room floor, acting as horizontal girders, to the outside brick walls on the east and west of the boiler house and thence to the foundation. These heavy brick walls are supported on steel spandrel girders attached to the columns with rigid connec-



SECTIONS AT BASE OF 4000-TON BUNKER SHOW STEEL FRAMING AND CONCRETE SLABS—NO BENT CONNECTIONS



LONGITUDINAL SECTION LOOKING WEST—BOILER HOUSE ON LEFT AND TURBINE HOUSE ON RIGHT



SECTION THROUGH CRANE GIRDER, SHOWING CORNICE AND CONNECTIONS

tions, so that each side of the boiler house is assumed to be capable of transferring shear to the foundation.

4000-Ton Coal Bunkers

A general view of one partly completed bunker is shown, giving some idea of the size necessary for the 4000-ton required capacity. At the far end are transverse conveyors from which the coal will pass through the hopper-like chutes into the longitudinal conveyors shown on the sides and at the upper part of the picture, from which it drops into the bunkers. The hoppers can be seen below, and in one case the top of a feed pipe leading down to the automatic stokers. The steel framing and concrete walls are shown in detail in the accompanying cross-sections. The 24-in. I-beams frame into a 60-deg. sloping bent consisting of a pair of 24-in. I-beams 4 ft. 6 in. on centers. These bents are tied together at about two-thirds of their height by a pair of 15-in. channels, as seen. The longitudinal beams in the sides of the bunkers at these points are placed horizontally to simplify the details of the connections.

The design of the bunker frame was studied throughout to avoid any hip-and-valley connections, with the result that no bent plates are used. These connections are clearly shown in one of the photographs. The main horizontal girders supported in pairs by columns 4 ft. 6 in. apart are also shown, their sections being indicated on the detail drawing.

Design of Bunker Framing

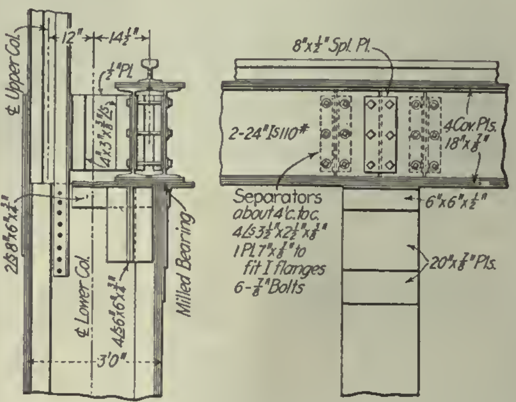
F. N. Kneas, the architect's consulting engineer, who designed the structural work and concrete throughout the buildings, proceeded as follows in designing the bunkers: The crushed coal was assumed to weigh 50 lb. per cubic foot, with an angle of repose of 30 deg. The ratio of horizontal to vertical pressure at any depth would then be 1/3, according to the usual Rankine formula. The resulting horizontal pressure on vertical walls of 16.7 lb. per foot of depth gave a normal pressure on the 60-deg. side walls of 25 lb., as found by the ellipse of stress. On the 45-deg. side of the bunker bottom the pressure was found to be 33 lb. per foot of depth. The bunkers were designed for the resulting normal total pressures, using the unit pressures and the known depths below the top level. Trimmed bunkers were assumed; that is, coal filled to a horizontal level at the underside of the conveyors.

The unit stresses used throughout the design are those allowed for buildings by the Philadelphia building code. The bunkers were designed with intermediate division walls, so that any section could be emptied if fire should start in the masses of coal. The concrete of the bunker slab is made practically watertight by the incorporation of hydrated lime in the mixture to prevent leaks and dripping when the coal is drenched with water. Such concrete was also found to flow more easily, and hence facilitate the pouring of the complicated parts of the bunker. A hard cement finish was applied on the interior bunker surfaces.

Special Condition Considered

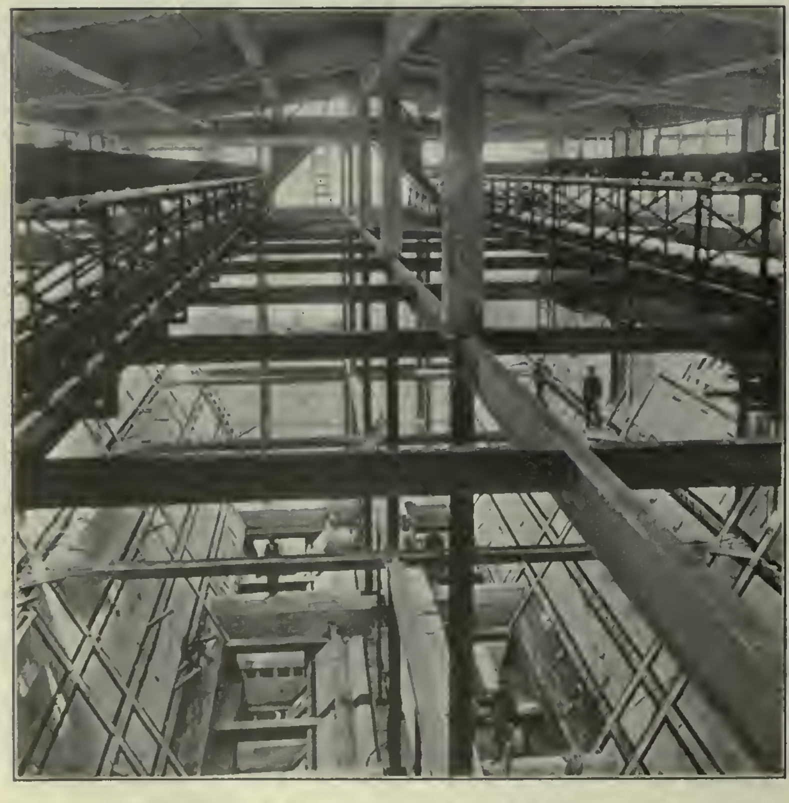
A special condition was further considered by the engineer. Any wetting down of the coal, in case of fire, would decrease the angle of repose and increase the normal pressure. While water would pass through and out the chutes at the bottom, it was assumed that 10 ft. of water above the outlet might be possible. Assuming crushed coal to have 40 per cent voids, 1 cu. ft. of coal weighing 50 lb. would displace 0.6 cu. ft. of water weighing 62.5 lb. or 37.5 lb. The net weight of a cubic foot of crushed coal in 1 ft. of water is therefore 12.5 lb.

By submerging a small test pile of coal under water it was found that the angle of repose was approximately 25 deg. Using the Rankine formula, the net horizontal component for 1-ft. depth of submerged coal is 5 lb., which with the 62.5 lb. water pressure, gives a total of 67.5 lb. fluid pressure on vertical surfaces. On the sloping 60-deg. and 45-deg. sides the total "fluid" pressures were found by the ellipse of stress to be 69.5 and 71.2 lb. respectively. In other words the pressures due to submerged crushed coal were found to be equivalent to those due to fluids weighing from 67.5 lb. per cubic foot when applied to vertical surfaces up to 71.2 lb. per cubic foot on 45-deg. slopes. For this special condition the allowable unit stress in the steel was increased from 16,000 lb. to 20,000 lb. on the extreme fiber.

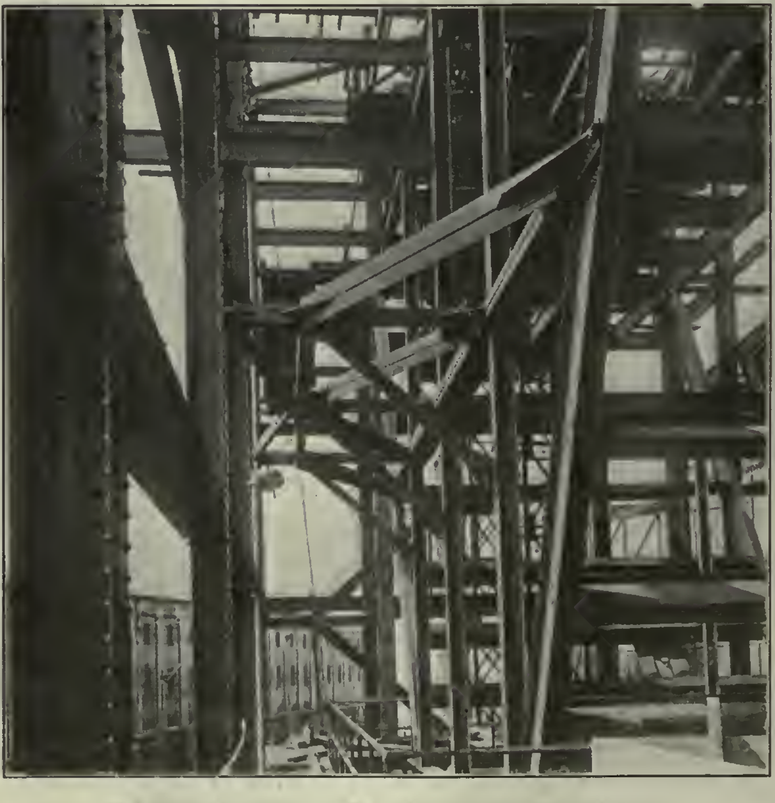


TYPICAL CONNECTION OF HEAVY CRANE GIRDER TO COLUMN

The horizontal girders supporting the end walls of the bunkers are connected by the



VIEW OF LARGE COAL BUNKER WITH FORMS IN PLACE



HORIZONTAL TRUSS AT END OF COAL BUNKER FRAMING tie which runs lengthwise with the bunkers, as shown in the detailed drawing, at the top of the division walls. This tie also acts as a strut between the tops of the division walls, and any surcharge on any division wall is carried by this longitudinal tie to the horizontal girders at the end shown in the photograph. The cumulative effect of the simultaneous surcharge on similar sides of the division walls and the end wall has been considered in the design of the girders and the ties.

160-Ton Crane Runway

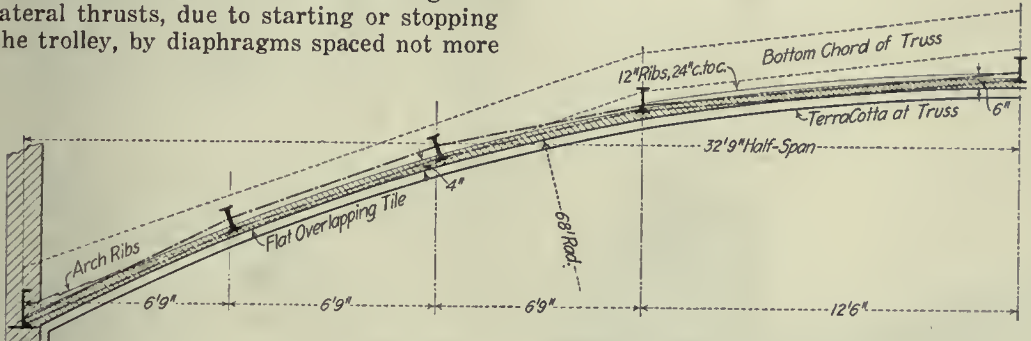
One of the governing features of the turbine-house design was the 160-ton electric traveling crane spanning 61 ft. between runway girders. The maximum load on each of the four wheels on each runway is 105,000 lb., and the wheel spacing is 6, 10 and 6 ft. The runway girder span is practically 18 ft. between columns. Two 24-in. 110-lb. beams with double top and bottom cover plates were used, the unit fiber stress being assumed at 12,500 lb. to allow for impact. To avoid inward buckling of the top flanges under the concentrated wheel load, steel diaphragms of ⅞-in. web and four angles 3½ x 2½ x ⅜ in., with webs machined to fit the top and bottom flanges, were spaced not more than 4 ft. apart. The details of these diaphragms and the crane girder seat on top of the offset columns are given on the accompanying sketch.

The runway girders are braced against lateral thrusts, due to starting or stopping the trolley, by diaphragms spaced not more than 6 ft. apart and connected to the main columns and to the gallery floor girders. The longitudinal thrusts on the runway due to starting or stopping the travel of the crane itself are carried to the ground by diagonal rod bracing in the vertical walls, three intermediate bays on the north side being braced. The thrust is carried to the division-wall bracing, on the south side by the horizontal diagonals in the oil room. The roof bracing, as shown in the plan, carries the wind pressure to the same vertical plane on the north side, and by diagonals in three vertical bays on the south side down to the oil-room level and thence to the foundations as described above.

Arched Ceiling and Tests

The arched ceiling for the turbine room is built up of overlapping flat tile 1 in. thick, 6 in. wide and 24 in. long to a thickness of from 4 to 6 in. The arch spans about 65 ft. with a radius of 68 ft. and a rise of about 8 ft., but is steadied and partly supported by longitudinal steel channels spaced 6 ft. 9 in. on centers near the springing line and 12 ft. 6 in. on centers at the crown. To take the thrusts ¾-in. tie rods 2 ft. on centers are carried from the approximate centers of pressure at the springing lines though the intermediate steel channels. In addition ¾-in. rods are built into the arch ring itself on alternate 2-ft. centers to supply ties for the reinforced-tile slab action. The latter rods had hooks on the ends and rested upon the bottom flanges of the steel beams. The accompanying detailed sketch shows this construction.

Two tests were made of this tile ceiling and loads approximating 60 lb. per square foot average intensity caused deflections of only 1/50 in. in the short panel near the spring line and 1/30 in. in the long panel near the crown. In one case the load was allowed to remain twenty-four hours and in the other about nine hours without any increase in deflection being observed, and in both cases about 75 per cent of the deflection was recovered upon removal of the load.



ARCH CEILING OF TURBINE HOUSE

Bone Wall Patent Invalid Because Anticipated

Because of Prior Use, Judge Anderson of U. S. District Court in Indiana Sustains Commissioners of Marion County in Suit

Basing his decision mainly on the evidence presented by Prof. W. K. Hatt of Purdue University, showing examples of the previous use of reinforced-concrete cantilever retaining walls, Judge Albert B. Anderson, of the U. S. District Court in Indiana, holds that the Bone patent No. 705,732, issued in 1902, is not infringed by retaining walls of this type as now built, and that the patent was invalid because of the existence of prior art. This decision, handed down Jan. 26 in the case of Frank A. Bone, of Cincinnati, against the Board of Commissioners of Marion County, Indiana, et al., is contrary to that of the district court of Cleveland, which upheld the patent and infringement thereof in the case of Bone against the city of Akron, which decision was affirmed on appeal to the Sixth Circuit Court of Appeals at Cincinnati, and by Judge Trieber in the U. S. District Court at Denver.

The decision of Judge Anderson was the outcome of the presentation by Professor Hatt of the following references showing prior use of the principal idea: (1) Stowell and Cunningham, U. S. Patent; (2) *Deutsche Bauzeitung*, 1894; (3) Rehbein in *Monier und Beton-Bauwerke*, 1894; (4) Nolthenius article in *Tydschrift* vanhet Koninklyk-Instituut, 1896, and (5) Planat's articles on page 610, Vol. 9, 1894, and page 621, Vol. 11, 1895, in *La Construction Moderne*. The principal arguments of this decision which, if upheld, will affect large sections of the country where similar cases are pending, have been abstracted in the following selections from the verbal opinion rendered by Judge Anderson:

Foundation of Previous Decision

It is perfectly evident to my mind that the very foundation of the decision of the Circuit Court of Appeals of the Sixth Circuit, as well as the foundation of the decision of the District Court from which that case was appealed, was wrong; the very foundation of it was wrong. I am firmly convinced either that the matter was not fully presented to the district judge in Cleveland, and that the record was not as fully made up in the Court of Appeals as it is here, or at least that they did not understand it—one or the other.

Judge Day in the previous decision says: "Considering the claims of the patent, and the testimony, I am of the opinion that Bone, the patentee, was the first to reinforce the retaining wall of concrete or masonry in such a manner that the weight of the retained material would be utilized to impart through the reinforcing members tensile resistance to the stem or vertical part of the wall, thereby fortifying this part of the wall against breaking strains."

New Evidence Produced

We now know in the light of the evidence in this case, that Bone was not the first to reinforce the retaining wall in such manner. He was not the first person to reinforce a retaining wall; he was not the first to conceive the idea of a reinforced retaining wall which was so shaped and constructed that the weight of the earth on the heel of the wall would withstand the pressure of the dirt or the earth on the wall. It may be that upon the record before Judge Day, Bone was the first person to do this. So far as the record in this case is concerned, the absolute converse of that proposition has been demonstrated.

Further, Judge Day says: "In the present more or less familiar state of the reinforced-concrete art, the impression is natural that there cannot be patentability in the structure of these claims, but the patent was issued upon an application filed in 1899, which was a renewal of an application filed in 1898, and Mr. Bone's idea is shown to have antedated his application. The said invention consists principally of introducing into masonry of concrete, stone or brick a framework of steel or iron in such a way that the whole wall is so much strengthened thereby that the volume of the masonry may be greatly reduced, and yet the height, base and strength against overturning, bulging or settling will still be ample." The record in this case shows a number of things to anticipate that substantial thought.

Judge Day continues: "If the prior art had shown a structure intended for a retaining wall, and having a heel such that the weight of the earth thereon would tend to keep the wall erect, it might be difficult to find invention in merely adding the form of reinforcement most suitable to create the desired tensile strength; but we find no such earlier structures." Now the evidence in this case shows a number of such earlier structures, and so the very foundation of this opinion is taken away by the evidence, assuming that the decision was based upon the record as here given.

Rehearing Evidence Also Defective

On the application for a rehearing, where the court declined to direct the court below to open the case to permit the defendant to put in a certain German patent after deciding that there was no satisfactory excuse for not producing the proof in due time, the court went on and said: "While the new reference (if it passed the limits of mere suggestion or unsuccessful experiment) would be distinctly pertinent upon the issue of invention, and if properly proved in another case should receive careful consideration, it is not so demonstrative of error in the result already reached as to require its reception."

So the court did not have before it the evidence either on the petition for a rehearing or on the original hearing that this court has on the state of the prior art. There is shown here beyond any question whatever retaining walls, anticipations of retaining walls, publications and descriptions of them which are of the cantilever type.

Now, I think it is going a long way to assert that what the defendants did is an infringement of this patent on either ground; and, inasmuch as I am a mere examining magistrate, and inasmuch as the defeated party usually thinks that the trial court knows nothing about it, and that he will go to a court that does understand it, I will dismiss this bill for want of equity.

A TYPOGRAPHICAL ERROR in the table on page 151 of the issue of Jan. 29, in the article on the relative strength of slag and broken-stone concrete, makes the strength of trap-rock concrete apparently higher at the age of six months than it is at twelve months. The value 4053 given for strength at six months should be 3053.

Heavily Loaded with Snow, Cathedral Dome Falls

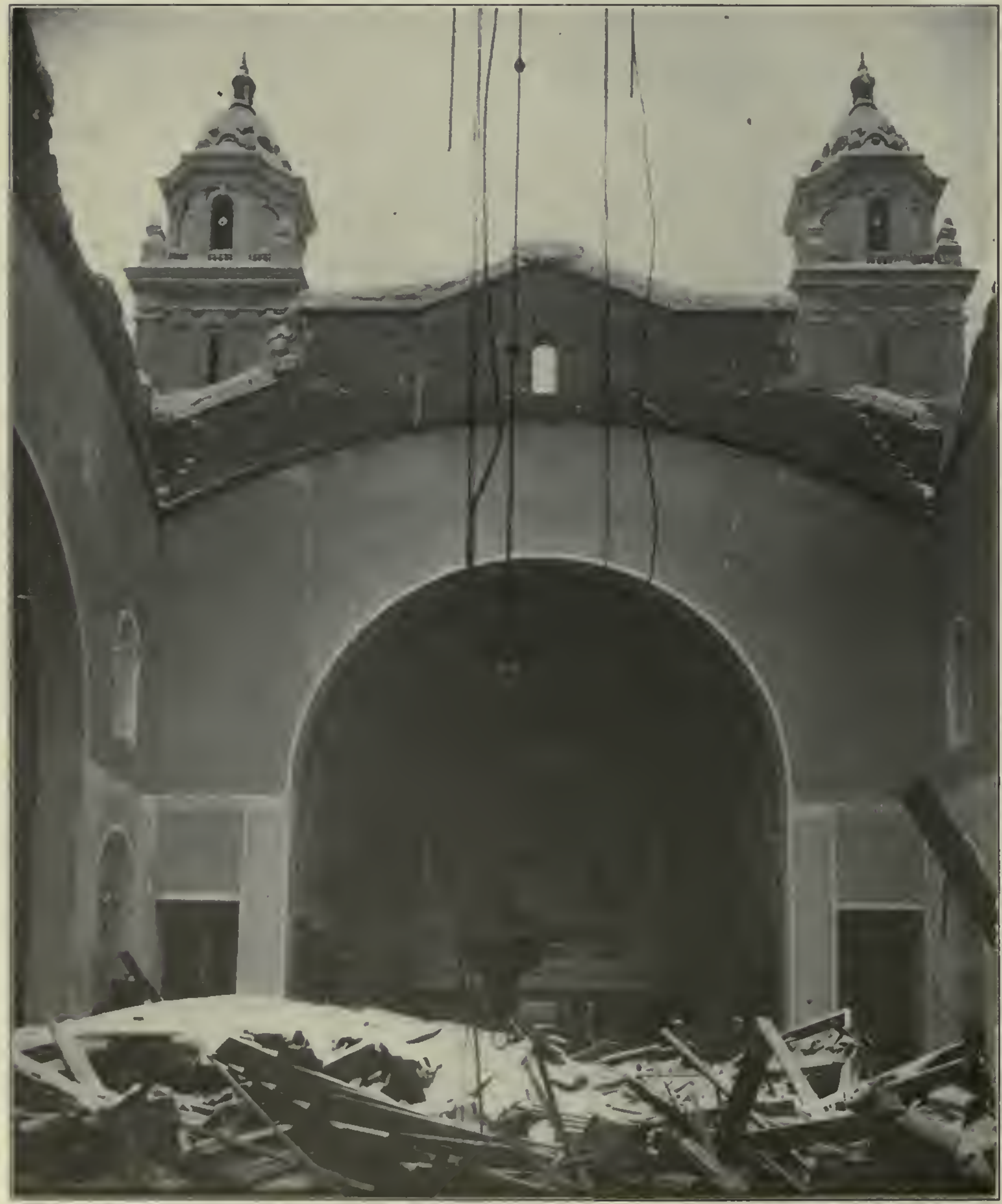
Unprecedented Snowstorm and Blizzard Piles Snow in Pockets on Roofs and Overloads Supports—Lower Chord of Truss Fractured

FOLLOWING an unprecedented snow fall for its locality, the supports of the 43-ft. dome of the St. James Cathedral in Seattle, Wash., collapsed on Feb. 2, under the weight of tons of water-soaked snow drifts which had collected in pockets on all sides of the dome, overloading the four steel latticed trusses upon which it rested. Fortunately, the main supporting piers and walls are practically undamaged, as seen in one of the photographs, so that the total loss is estimated as only about $75,000. The city building department is making a thorough investigation of the causes of the failure. The following general facts are based on information from W. M. Somervell, of Somervell & Putman, architects, of Seattle, who was originally in charge of the construction, and from C. G. La Farge, of the firm of Heins & La Farge, architects, New York City, who were the designers of the structure.

ST. JAMES CATHEDRAL IN SEATTLE

GENERAL DIMENSIONS

St. James Cathedral is located at the corner of Ninth Avenue and Marion Street, Seattle, and is shaped like a cross in plan, with a square crossing about 70 ft. clear opening near the center of the building, above which the 43-ft. tower is carried on four intersecting horizontal lattice steel trusses 73 ft. long in two pairs about 44 ft. apart. All of these trusses rested on piers of brick in cement mortar, the piers in one case being buttressed by the curving brick walls of the projecting alcove, and in the other case by steel framing to 12-in. Z-bar columns below.


STEEL TRUSSES FAIL UNDER HEAVY SNOW LOAD AND CATHEDRAL DOME FALLS

The zenith of the copper-covered dome, which can be seen in one of the photographs, was about 115 ft. above the cathedral floor, and about 40 ft. above the supporting trusses, its rise above the springing line being about 21 ft., the dome spring from the top of the octagonal brick wall containing the windows in a drum or tower about 14 ft. high. The dome was steel framed, of eight bent I-beam ribs, with a horizontal I-beam tie at the springing line. The opening of the dome is 70 ft. above the cathedral floor.

SKYLIGHT ADDED AFTER COMPLETION

Owing to difficulty with the acoustics of the cathedral, it was found necessary to seal the dome with a flat glass skylight, some five months after the completion of the building. This was done under the supervision of a local architect, and, of course, added a slight dead load weight to the steel trusses. These four steel trusses were designed to support the whole tower and dome, with wind and only light snow loads, because Seattle seldom experiences heavy snow storms.

One of the photographs shows the pockets outside the octagonal drum in which the snow accumulated. Owing to changes in the direction of the wind during the 36-hr. snowstorm and blizzard preceding the failure, all sides of the roof around the base of the drum was piled about 7 ft. high with drifted snow.

PROBABLE CAUSE OF COLLAPSE

In the opinion of Mr. Somervell, the probable cause of the collapse was defective steel in one of the trusses. The heavy water-soaked snow was found by test to vary from 28 to 35 lb. per cubic foot. This extraordinary load, which one engineer estimated at 30 tons total, seems to have caused the west end of the truss to fail, the lower chord being broken at that end and the diagonal end compression member badly buckled. The fractured steel showed practically no elongation, and the nature of the injury is such that it probably did not result from the fall.

As the four trusses intersected and were spliced at the points of intersection, the failure of one carried down the others, and the whole of the superstructure above collapsed with them. The supporting brick piers and walls are apparently intact. The fact that the side windows blew out under the sudden heavy air pressure caused by the falling dome undoubtedly saved the side walls from failure.

The steel trusses were fabricated by the Des Moines Bridge & Iron Company, of Des Moines, Iowa.

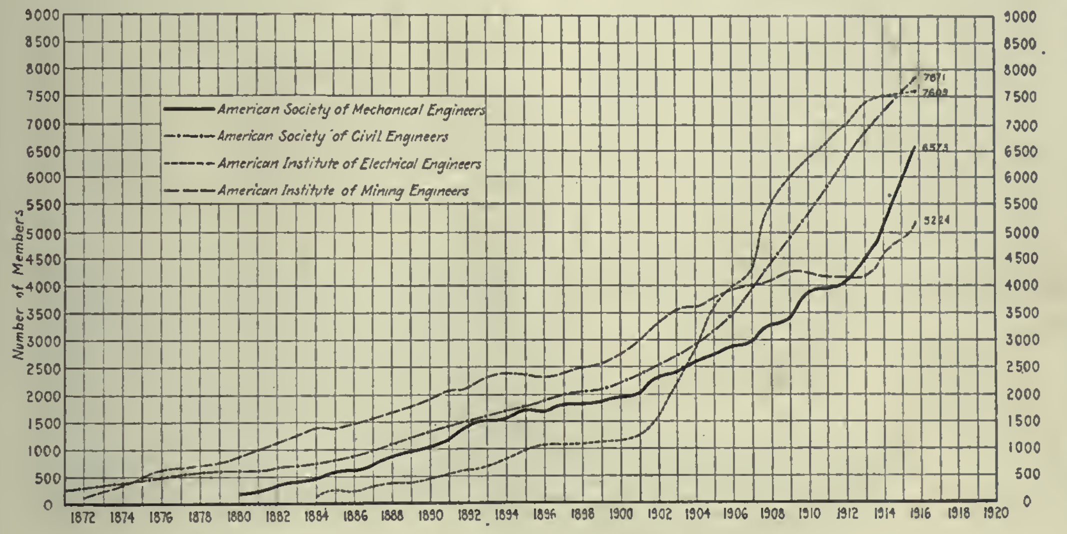
The cathedral was designed in 1905 by Heins & La Farge, of New York City, architects for the Cathedral of St. John the Divine, New York. It was completed in 1906, and dedicated in 1907. The structure cost about $400,000. The present bishop, Right Reverend E. J. O'Dea, has authorized a statement that the work of rebuilding will proceed at once.

TWO WEEKS' VACATION WITH PAY has been voted by the Boston Transit Commission to all its employees on the labor payroll, according to the annual report of the commission.

National Society Membership and Qualifications Compared

IN CONNECTION with the editorial in this week's issue, dealing with the proposal to move the headquarters of the American Society of Civil Engineers to the Engineering Societies Building, the accompanying curves of membership and table of admission qualifications to the various grades are pertinent. In the higher grades of membership it will be noted that the requirements are very similar for the civil, electrical and mechanical organizations. The minimum age for the former is thirty years as against thirty-two years for the others. Both the civil and mechanical bodies specify five years in responsible charge of work as against three years for the electrical society. The mining engineers, it will be noted, are not governed by the detailed admission requirements which obtain in the other organizations.

Other features of the comparison are discussed in detail in the editorial to which reference has been made.



GROWTH OF THE FOUR NATIONAL SOCIETIES FOR FORTY-FIVE YEARS

COMPARISON OF REQUIREMENTS FOR ADMISSION TO AMERICAN SOCIETY OF CIVIL ENGINEERS, AMERICAN SOCIETY OF MECHANICAL ENGINEERS, AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS AND AMERICAN INSTITUTE OF MINING ENGINEERS

	A.S.C.E.	A.S.M.E.	A.I.E.E.	A.I.M.E.
	Member	Member	Fellow	Member
Age	30 yr.	32 yr.	32 yr.	All professional mining engineers, geologists, metallurgists or chemists and all persons actively engaged in those branches of engineering.
Design and direction (as principal, important engineering work)	Yes	Yes	Yes	
Practice of profession	10 yr.	10 yr.	10 yr.	
Responsible charge	5 yr.	5 yr.	3 yr.	
Number of references	5	5	5	3
	Assoc. Member	Assoc. Member	Member	Associate
Age	25 yr.	27 yr.	27 yr.	All persons desirous of joining acceptable to the board of directors.
Design (charge of work under direction)	No	No	Yes	
Practice of profession	6 yr.	6 yr.	5 yr.	
In charge of work	1 yr.	1 yr.		
Number of references	5	5	4	3
	Junior	Junior	Associate	
Age	18-31 yr.	21-29 yr.	21 yr.	
Practice	2 yr.	2 yr.		
Graduation from engineering school equivalent to practice	2 yr.	2 yr.	1 yr.	
Number of references	5	3	3	

FIRE LOSSES IN 1915 DECREASED $52,755,000 as compared to the 1914 record for the United States and Canada, according to the records compiled by the *Journal of Commerce*. The total losses by fire last year were only $182,836,000, as compared with $235,591,000 the previous year. This presents the first sign that the educational efforts being put forth to reduce the appalling fire waste are beginning to bear fruit. It is the smallest loss the country has known since 1905.

Newark Commission Urges Importance of City Plan

Comprehensive Report Makes Variety of Recommendations for Both Undeveloped and Built-Up Sections—Studies Embrace Surrounding Towns

NOT ONLY the city of Newark, N. J., itself, but also the surrounding communities which have a collective population almost equal to that of Newark, are embraced in the report of the Newark City Plan Commission, presented recently as the result of three and one-half years of study of the problem. The study is divided into four parts: Streets and transportation of all kinds; recreation and civic beauty; housing and public control of private development; and planning the greater city, and a program for future work. The program assigns work in five-year periods up to 1956. The commission regards the plan presented as tentative; it hopes that criticisms and suggestions will be forthcoming, but that when finally revised the plan will be adopted through a referendum.

STREETS AND TRANSPORTATION

Regarding streets and transportation, the proposed plan includes both new streets for undeveloped sections, and extensive street changes in built-up districts. Five of the latter are proposed, as follows: (1) Extension of Central Avenue from Broad to Market Street—considered the improvement most needed in Newark; (2) straightening of Washington Street at Market Street; (3) extension of Frelinghuysen Avenue to Clinton Avenue; (4) widening of Lafayette Street from Broad to Mulberry Street, and (5) widening of Mulberry Street. Outside of the business district the suggested changes aim at the perfecting of the main rectangular and radial systems and at greater flexibility of the minor system.

In the matter of transportation the commission adheres to the recommendations made in a previous report for the rerouting of street cars. One-way vehicular traffic is recommended for a number of streets, and parking and other traffic regulations are proposed. Provision for adequate and suitable railroad stations, elimination of the remaining grade crossings and the construction of a connecting railroad along the meadow waterfront, with possibly another along Morris Avenue and the Morris Canal, are the steam railroad changes proposed. Expansion of the municipal water terminal now under construction (see the Engineering Record of Aug. 14, 1915, page 201) is suggested as something to be carried out only after years, but to be done according to a definite plan.

PARKS AND BUILDINGS

The second main head includes parks, recreation, public buildings, appearance of city streets, and lot and yard cultivation. The general plan shows numerous new parks, linked up with those in existence by broad parkways. Harmonious location of public buildings, rather than the creation, at considerable expense, of a civic center, is recommended. In the way of artistic public squares, a novel suggestion is the "Ironbound Plaza" proposed at the site of the Market Street Station of the Pennsylvania Railroad, the plan contemplating a large open circle, an octagonal station in the center and the elevated railroad passing diametrically across the circle and through the station. Aside from the recommended expenditures, the commission urges the cleaning up of the city and the substitution by the owner of private property of beauty for ugliness.

With reference to housing, changes are recommended in both the building code and the sanitary code in the light of the most advanced knowledge of the subject, and the need of a permanent housing association is pointed out. Regulation of the heights of buildings, and districting, are also recommended, and the lot-size question discussed.

Adjacent Municipalities

Because Newark itself is now largely restricted as to expansion of area by the numerous separate cities and towns surrounding it, and because these places, though likely to cling to their separate identities, geographically form with Newark one larger city, the Newark City Plan Commission, in co-operation with the Board of Street and Water Commissioners, formed some time ago an organization known as the "Conference on Interurban Improvement of Newark and Adjacent Municipalities" for the purpose of interesting and encouraging neighboring towns in making public improvements with an eye to future development. The Conference found three prime needs: (1) Extension of the major system of rectangular thoroughfares; (2) extension of the system of radial thoroughfares; (3) development of vacant land in conformity with the major and minor street systems. The report points out, however, that the study made by the Conference was brief, and that its conclusions are not final. It is recommended that the laying out of a comprehensive plan for the metropolitan area be undertaken either by the several communities or by a centralized authority.

Program to 1956

For the execution of the work in Newark eight five-year construction periods, extending to 1956, are outlined. These, for the first two periods, are in turn divided into non-financial and financial undertakings. During the first period the financial undertakings include the extension of Central Avenue, the straightening of Washington Street, the widening of Lafayette Street, the creation of the Ironbound Plaza, and a number of other improvements. The non-financial undertakings include the revision and adoption of the city plan itself, the revision of various codes, regulations and building lines, the establishment of trolley service on certain additional streets, the making of studies and the dissemination of knowledge on the subject.

The report is signed by Austen H. McGregor, president; Frederick J. Keer, vice-president; Joseph M. Byrne, treasurer, and Christian W. Feigenspan, David Grotta, Augustus V. Hamburg and Gustavus Staehlin, the seven members of the City Plan Commission. George B. Ford and E. P. Goodrich, consulting engineers, of New York City, were retained as expert advisers during part or all of the investigation.

Diagrams Similar to the Nomographic Chart described in this journal by G. S. Coleman in a letter to the editor, Oct. 16, 1915, page 489, on the determination of the coefficients in Kutter's formula, have been printed in the pamphlet, "Instructions for Measuring Discharge of Water by Current Meter," issued by the Hydrometric Service of Russia.

Is the Model Weir Unreliable?

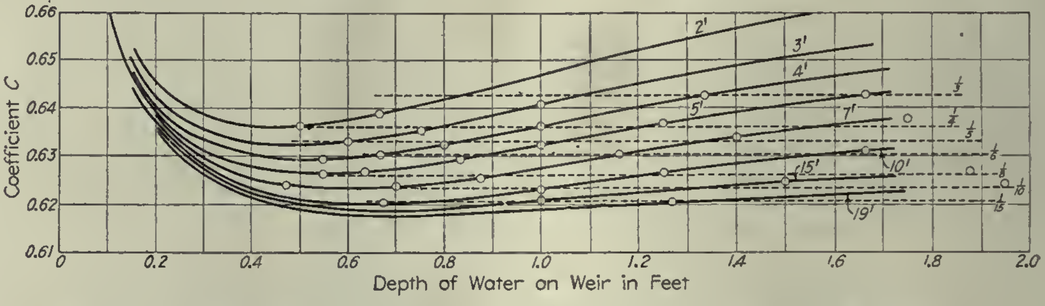
Assumption That Flow Over Similar Dams Is Proportional to 5/2 Power of Linear Dimensions Seems to Be Sound

By BEN D. MOSES
El Paso, Tex.

The ENGINEERING profession is today confronted most seriously by the problem of water measurement. Small quantities in closed conduits are handled to more or less satisfaction by different types of meters, but for streams and open channels rough approximations by the use of empirical formulas are the best that can be done. Frequently some one steps to the front with some plan, possibly of chemical measurement or velocity meters, all of which fall short of the mark for one reason or another. But there is one that presents us with a means that, if founded on sound principles, will enable us to cope satisfactorily with many hitherto impossible problems. It is the model weir.

Errors of Model Dam

In the Engineering Record of Aug. 16, 1913, page 193, there appeared an article on the use of a model dam for the determination of the flow on a rather large structure, and the article, aside from describing a unique device, presents us with the suggestion of using models for the obtaining of rating curves for streams too large for weirs or meters. The article closes with a summation of possible errors, as follows:



RATIOS OF LENGTH OF CREST TO HEAD ON IT POINT TO CONSTANCY OF COEFFICIENT *c*

"In summing up the probable sources of error in the above method we may consider them under the following heads: (1) Errors in hydraulic measurements of the flow over the model; (2) errors in drawing the rating curves; (3) errors in assuming the flow over similar dams to be proportional to the 5/2 power of their linear dimensions; (4) errors in the construction of the model."

Question of Proportional Flow

Errors 1, 2 and 4 have to do only with the personal side of the question and may be entirely waived in a consideration of the soundness of the principles underlying such a method. No. 3, then, may be considered the pillar supporting the entire structure.

This article is not intended as a conclusive proof of the accuracy of the assumption of No. 3, but as an investigation only. There are several methods of attack. One will be taken up at present, and is simply an application of a statement in the article mentioned above, to wit:

"If the curves of the coefficient, *G*, in terms of head, *h*, and for different breadths of notch up to 19 be examined in Hamilton Smith's 'Hydraulics,' it will be noted that the constancy of this coefficient holds within 2 per cent throughout the entire range of contracted and suppressed weirs, down to a breadth of 7 ft. and head of 3/10 ft."

Plate VII in "Hydraulics," by Hamilton Smith, Jr., is a plat of the coefficient *C*. These curves have been traced in the illustration herewith, and the points on the several curves, representing the same ratio h/l (l being the length of the crest and h the head over the crest) picked off. It is interesting to note that these points fall very closely on a straight horizontal line, pointing toward the constancy of the coefficient *C*. To be a little more clear, take the proportion $h/l = 1/8$. The points will be obtained for each case by simply dividing the length by 8. For $l = 15$ ft., the head must be $15/8 = 1.875$. Similarly on $l = 10$ ft., $h = 10/8 = 1.25$; on $l = 7$ ft., $h = 7/8 = 0.875$; on $l = 5$ ft., $h = 5/8 = 0.625$; on $l = 4$, $h = 4/8 = 0.5$, and so on.

It would seem, then, that *C* is the same for all suppressed weirs over 7 ft. long and for the special head, ml, where m = factor h/l. Or, broadly stated, C in $Q = 2/3\ cbh\sqrt{2gh}$ is constant for all similar weirs having the same ratio h/b. One value for m has been followed through, but other values produce the same result.

The curves for the suppressed weir have been used in preference to those of the fully contracted in the face of the fact that because the contractions are independent of the head, discordant effects of the factor h/l would enter into the relation to an exaggerated degree for small weirs. The straight-line tendency is, however, noticeable for the longer crests.

Application

A simple case will demonstrate the applicability of the above method. Assume that the weir in hand, with the approach-downstream channel and bottom, has been carefully reproduced in model, all linear dimensions of which are 1/20 of those corresponding on the actual. The model, too, is small enough to be calibrated correctly by the use of a standard weir.

Now the rating curve obtained by careful calibration can be converted into one for the actual by simply multiplying all "quantities" by $(20)^{5/2} = 1789$, and all "heads" by 20. Suppose, for instance, it is required to find the discharge over the weir when the water rises to a height of 10 ft. over the crest, and that the quantity over the model for 6 in. (10 ft. ÷ 20) is 15 sec.-ft. Then the quantity sought is $15 \times 1789 = 26,835$ sec.-ft.

Government Timber Purchases in California during the last fiscal year totaled 43,893,000 ft. b.m., of which 35,841,000 ft. b.m. was cut for commercial purposes, and the remainder was supplied to homesteaders or was removed from the forests by permission and without charge. When sold to homesteaders the price is 50 cents per thousand feet.

Analysis and Tests Held to Show Advantages of New Flat-Slab Reinforcement

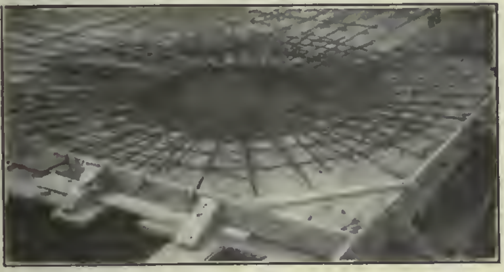
Part 2—Tests of Full-Size Flat Slab and of Circumferential Cantilevers Reported and Discussed—Steel Stresses Measured

By EDWARD SMULSKI
Chief Engineer, S-M-I Flat Slab System Company, Boston

FOLLOWING the theoretical discussion of the new system of combined radial and circumferential reinforcement for flat slabs presented in Part 1, in last week's issue, page 217, there will here be detailed the results of a series of practical field tests. These tests were made for the purpose of determining the carrying capacity of slabs built with the new type of reinforcement, and to find the relative effectiveness of steel placed in rings, as radials and in bands as in the older two-way and four-way systems.

TEST OF 20-FOOT FLAT SLAB

To determine the carrying capacity of a slab designed by the Smulski flat-slab system, two slabs were tested, one of which will be described. Deflection and extensometer readings were taken, but are not given, because the stresses in the steel at the maximum applied load were comparatively small, due to the fact that the test was in the stage where the tensile value of concrete was not yet destroyed. The test will serve, however, as a good comparison with a similar test in which the steel was arranged according to another system.


REINFORCEMENT OF 20-FOOT TEST SLAB

The test slab was 20 ft. square, and was supported by four columns spaced 12 ft. on centers in such a way that the slab projected on all sides 4 ft. beyond the centers of the columns. The purpose of the projections was to create a condition of continuity by causing negative bending moment at the supports. The thickness of slab was 4½ in. and the mild steel reinforcement is shown in one of the photographs. Unit *C* at the column head consisted of twenty ½-in. round radials, five ⅜-in. round outside rings and one 1-in. round center ring.

The positive bending moment reinforcement of the 12-ft. panel in each quarter consisted of four half-units *A* composed of three and a half ⅜-in. round straight bars, and one Unit *B* composed of five ⅜-in. round rings and five 5/16-in. round effective diagonal bars. The slab outside of the 12-ft. panel was reinforced at each side with six ⅜-in. round straight bars parallel to Unit *A*. The weight of steel within the 12-ft. panel was 2.1 lb. per square foot. The slab was poured Dec. 8 and 9, 1913, and the test was started the latter part of March, 1914. To prevent arching of the material, the broken stone loading was applied in boxes 6 ft. 4 in. square, leaving approximately 6 in. between the boxes.

The photograph herewith shows the total maximum applied loading of the slab, which consists of 6 ft. of loading material placed uniformly over the whole slab, equivalent to 600 lb. per square foot, and up to about 10 ft. 6 in. in the central part of the slab. The total test load was about 130 tons. The load, however, was left on the slab five months in order to determine the long-time effect. The stresses at the column head were very low, and only two faint hair cracks developed. The cracks at the bottom of the slab were more definitely developed, but the stresses did not reach the elastic limit.

Based on bending moments specified for flat slabs by the Chicago Building Department, the computed stresses in the steel for the test load within the 12-ft. panel would be, at the column head, about 60,000 lb. per square inch, and in the center of span, 50,000 lb. per square inch, or far above the elastic limit of mild steel.

It is of interest to compare the results of the above test with the results of the tests published by H. T. Eddy in his book on the "Theory of the Flexure and Strength of Rectangular Flat Plates," where a similar slab test is cited on page 92, in which bands of rods were used. The span of the slabs in both cases was the same, but the slab described by Professor Eddy was 6 in. thick instead of 4½ in. and the weight of steel within the area of the 12-ft. panel was 2.42 lb. per square foot instead of 2.1 lb. per square foot. It completely failed under a load of 120 tons, while the above test slab carried about 130 tons without sign of weakness.

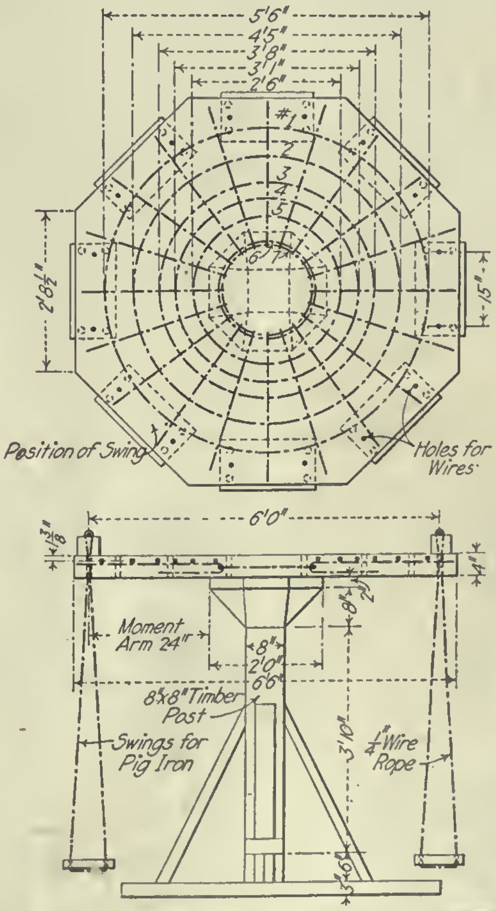


FIG. 5—OCTAGONAL TEST SPECIMENS AND TIMBER-TESTING PLATFORM

TESTS OF CIRCUMFERENTIAL CANTILEVERS

The general discussion of flat slabs given in Part 1 pointed out that the most important part of a flat slab is the circumferential cantilever at the column. The tests here described were designed to study the action of circumferential cantilevers with various arrangements of reinforcement. The results are applicable to flat slabs.

The purpose of these tests was (1) to determine the effectiveness of the rings, (2) to determine the most efficient combination of rings and radials, (3) to compare the effectiveness of the reinforcement placed in bands, as in the two-way and four-way systems, with the reinforcement placed in the direction of the stress.

MAXIMUM LOAD APPLIED TO SLAB

Concrete in the proportion 1:2:4 was used. The compressive strength of blocks, 6 x 6 in., made at the time of pouring the specimens, cured under the same conditions as the test specimens and tested at an age of 52 days, was 2100 lb. per square inch. The estimated strength of 8 x 16-in. cylinders at 28 days on the basis of the above test was 1385 lb. per square inch, or lower than first-class 1:2:4 concrete. Round bars of plain mild steel, with an average elastic limit of 35,000 lb. per square inch, were used. The age of specimens 1 to 6 ranged from 35 to 47 days. Specimens 7 and 8 were 51 and 50 days old respectively.

DIMENSIONS AND REINFORCEMENT OF SPECIMENS

Fig. 5 shows the dimensions of the specimens, which were octagonal in shape, 6 ft. 6 in. inside diameter. The column head, also octagonal and built monolithic with the slab, was 2 ft. in diameter. The reinforcement of specimens 1 to 4 is shown in the table and in Fig. 5. Specimens 5 and 6 were similar except that the number of radials was reduced from 20 to 10 and 5 respectively, combined with five ½-in. rings. The reinforcement of specimen 7 consisted of four layers of rods in each of the four directions, with nine 5/16-in. round rods per layer. Specimen 8 was reinforced with steel in top and bottom; the tensile reinforcement consisted of two layers placed at right angles, with twelve ⅜-in. round rods per layer, and the compressive reinforcement consisted of two layers with eight ⅜-in. round rods per layer.

The concrete was mixed by hand on the cement floor of the shed. Four laborers were used who had had experience on actual construction, and four specimens a day were poured. The specimens were stored in a shed at a temperature of between 50 and 60 deg., maintained by means of a salamander. The steel was wired by common laborers and the rings were less regular in shape and spacing than obtained in actual construction, where they are assembled to a template. Especially marked is the irregularity in specimen 3, in which the space between ring 1 and ring 2 was much larger than intended, which contributed in part to the failure of the specimen.

Preparatory to the test gage holes about 1/32 in. in diameter were drilled in the exposed steel. Particular care was required to space the holes in the steel rods as near 8 in. apart as possible, and to make them round and perpendicular to the body of the bar.

METHOD OF TESTING

The specimens weighed approximately 1 ton each. The testing platform was constructed in such a way as to prevent overturning, as shown in Fig. 5. The load was applied at sixteen points along the circumference, 2 ft. from the column head, each specimen being provided with sixteen holes spaced uniformly around its circumference. During testing, eight swings were suspended from the specimens by means of wire rope passing through the holes, and the swings were loaded with pig iron. It took from two to three days to test one specimen.

In specimen 4, which contained the strongest reinforcement, readings were taken after the application of sixteen pigs per swing, while in specimen 1, with the weakest reinforcement, only six pigs per swing constituted a load. In specimens 3 and 4 the capacities of the specimens were larger than the weight of pigs which could be placed in the swings, therefore it was necessary to place additional load on the top of these specimens. This was placed on two supports so that the resultant nearly coincided with the points of application of the swings.

The pigs were uniform in size, so that a pig could be accepted as a basis of figuring the load, the average weight per pig being 56 lb. In loading the pigs were applied indiscriminately, so that it is a fair assumption that the number of pigs multiplied by 56 lb. represented the actual loading on the swings. One of the photographs shows the maximum applied load on specimen 1.

DEFORMATION READINGS TAKEN

Deformation readings after each load were taken on 8-in. gage lines by means of a Berry extensometer loaned by the Massachusetts Institute of Technology. The position and number of gage lines are shown in Fig. 6. Fig. 7 shows the stress diagrams. In plotting the diagrams, all the individual readings for the same rings were averaged, as the difference between deformation readings on different gage lines on the same ring were, as a rule, small.

For the radials the averages plotted first are for the group of inside gage lines A_1 B_1 C_1 D_1, then for group A_2 B_2 C_2 D_2, etc. For specimens 7 and 8 curves for each of the bars were drawn separately, because their position in the specimen was different and the assumption of equal stresses not justified.

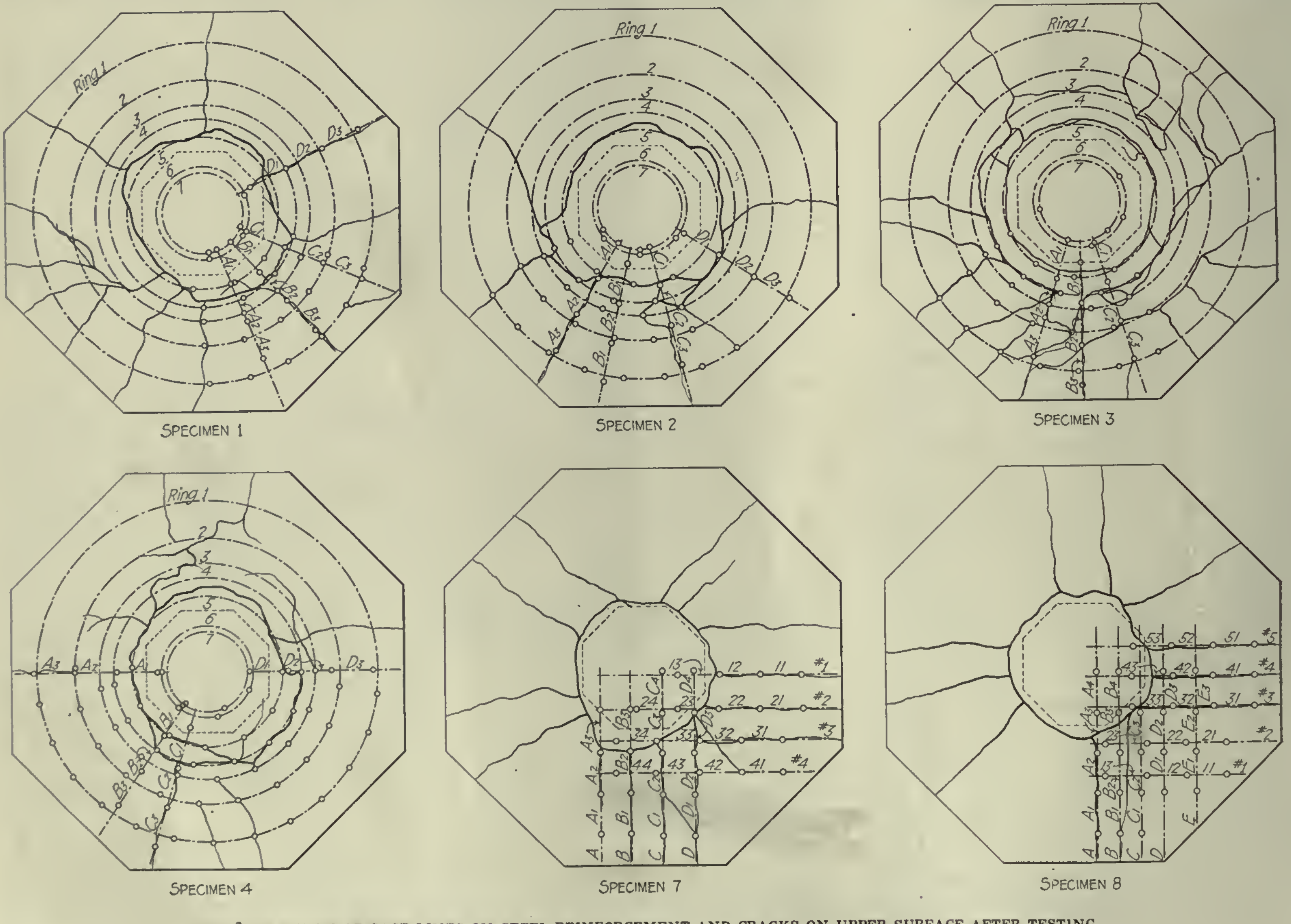
RESULTS OF TESTS

The accompanying table gives the results of the tests. Specimens 1, 2, 7 and 8 were loaded to the elastic limit of the steel. In specimen 3 at the load of 28,000 lb. the wires supporting two of the swings broke and the impact of the fallen pigs weakened the specimen so that after the load was replaced and reached 29,500 lb., one corner was broken off before the elastic limit of the specimen was reached. At the place of failure the rings were misplaced, so that the actual distance between rings 1 and 2 was 8 in. instead of 6 in. as contemplated, thereby putting more than its share of stress in ring 1 and thus contributing to the failure. The rest of the circumference of specimen 3 did not show any weakness at the time the corner broke off, and the stress diagrams show that the measured stresses at the time of failure were below the elastic limit.

In specimen 4 the maximum applied load consisted of 640 pigs (35,800 lb.), after which further loading was abandoned before the elastic limit was reached, on account of the difficulty of placing more material and the danger to the workmen. The loading of specimens 5 and 6 was abandoned before the elastic limit was reached.

FIRST VISIBLE CRACKS

The first visible cracks appeared at loads and stresses in steel given in the table, columns 19 and 20. Judging from the stress



SPECIMEN 1 SPECIMEN 2 SPECIMEN 3

SPECIMEN 4 SPECIMEN 7 SPECIMEN 8

FIG. 6—POSITION OF GAGE LINES ON STEEL REINFORCEMENT AND CRACKS ON UPPER SURFACE AFTER TESTING

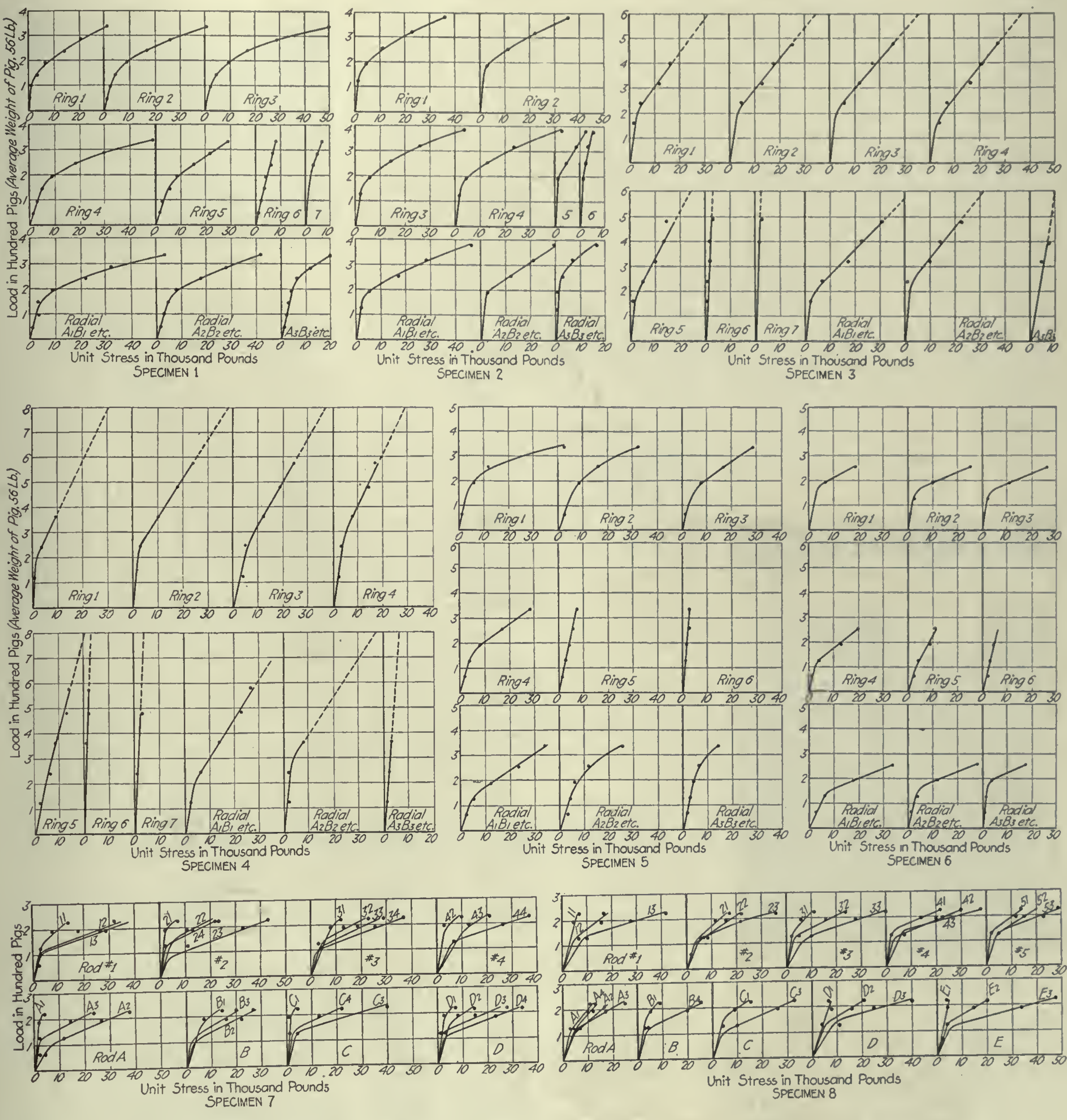


FIG. 7—STRESS DIAGRAMS SHOW RELATION BETWEEN TOTAL APPLIED LOAD AND UNIT STRESSES IN REINFORCEMENT

SUMMARY OF RESULTS OF TESTS OF CIRCUMFERENTIAL CANTILEVERS

Octagonal slab 6 ft. 6 in. inside diameter; column head 2 ft. diameter; 1:2:4 concrete; mild steel.

					NUMBER AND DIAMETER OF ROUND BARS IN INCHES						AT ELASTIC LIMIT f_s=35,000 LB. PER SQUARE INCH								
Specimen No.	System	Age, days	Total thickness of slab in.	Weight of tensile steel, lb.	Radial bars	Outside rings	Straight bars	Area of radial or straight bars around circumference sq. in.	Area of effective rings, sq. in.	Average effective depth, in.	Total load at elastic limit, lb.	Static bending moment, in.-lb.	Moment of resistance, in.-lb.	Difference between moments Col. 13 — Col. 14, in.-lb.	Moment of resistance of single cross-section of effective rings, in.-lb.	Effectiveness of rings Col. 15 ÷ Col. 16, ratio	Load per pound of tensile steel Col. 12 ÷ Col. 5 lb.	Load at first visible crack, lb.	Measured stress in steel at first visible crack, lb. per sq. in
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
1	S-M-I	47	4	42.6	20—⅜	5—5/16	......	2.2	0.368	2.56	18,800	450,000	172,000	278,000	28,800	9.65	442	12,400	14,000
2	S-M-I	44	4	50.2	20—⅜	5—⅜	......	2.2	0.484	2.62	22,500	540,000	177,000	363,000	39,000	9.30	448	15,000	15,000
3	S-M-I	42	4	71.7	20—⅜	5—½	......	2.2	0.901	2.60	32,000	*768,000	175,000	593,000	71,800	8.27	447	21,200	16,000
4	S-M-I	35	4	101.2	20—⅜	5—⅝	......	2.2	1.38	2.50	42,500	†1,020,000	169,000	851,000	105,000	8.10	421	26,600	15,000
7	4-Way	51	4	62.0	......	......	36—7/16	5.5	......	2.25	12,600	302,000	376,000	—74,000	......	......	203	8,950	15,000
8	2-Way	50	4	58.0	....	Tension Compression	24—½ 16—½	5.3	......	2.25	12,600	302,000	364,000	—62,000	......	......	217	8,900	15,000

Moment of resistance equals area of radials or straight bars multiplied by ⅞ effective depth times 35,000 lb.
Load times moment arm of 24 in. gives Col. 13.
*Estimated from stress diagram. Broken by accident at 29,500 lb., before elastic limit was reached.
†Estimated from stress diagram. Elastic limit not reached at maximum applied load.

diagrams, cracks invisible to the eye must have appeared at a smaller load corresponding to the break in the deformation curve. The first crack, at first hardly noticeable, extended all the way around the circumference of the column head about 2 in. from its edge. With additional loading this crack opened slowly and additional circumferential and radial cracks appeared. The extent of the cracking at final load is seen from Fig. 6. In all specimens the cracks were larger in number and size in the part where the tensile value of the concrete was destroyed by the gage holes, and where initial cracking was caused by the drilling of the holes in the concrete. It is especially noticeable above the radials and straight bars with gage lines. After the load was removed the cracks closed.

No cracks developed within the column head although the radials were stressed to the elastic limit and did not bear against the center ring.

Effectiveness of Reinforcement

The effectiveness of the rings was determined by computing the area of radials required to produce a moment of resistance equal to the difference between the bending moment and the moment of resistance of the radials. The ratio of the resulting area to the cross-section of the outside rings gives the effectiveness of the rings. In determining the cross-section of the rings, the outside rings 1 to 4 were considered as fully effective, because, as is evident from the stress diagrams, the stresses in the rings were equal. The stresses in ring 5 were much smaller than those in the remaining outside rings, which can be explained by the fact that it was placed too near the column head and was therefore only partly effective. The effectiveness of this ring was reduced in the ratio of the stresses resisted by it to the stresses in rings 1 to 4 at the same load, because if properly placed ring 5 would resist the same stresses as the other rings

MAXIMUM LOAD APPLIED TO SPECIMEN 1

In the table, column 17, is given the effectiveness of rings for specimens 1 to 4, which ranges from 8.1 for specimen 4 to 9.65 for specimen 1. The effectiveness of the rings in specimens 3 and 4 is much smaller than in specimens 1 and 2, which points to the fact that probably the estimated ultimate loads are smaller than the actual capacity of the specimens.

Comparison of specimen 3 with specimens 5 and 6, which differed only in the number of radial bars, shows that although the reduction in weight of steel by the omission of radial bars in the latter was small, specimen 3 showed much greater stiffness and larger ultimate load.

Comparison of the efficiency of the steel in specimens with radial bars and rings and specimens with bands is obtained by inspection of the table, column 18, giving the load per pound of tensile steel obtained by dividing the total ultimate load by the weight of tensile steel in the specimen. From comparison of specimens 7 and 8 with specimens 1 to 4, we find that specimens 1 to 4 carry more than double the load per pound of steel carried by the specimens with band reinforcement.

Conclusions

The following conclusions can be given:

1. Rings form a very effective reinforcement where stresses in two directions are to be resisted.

2. The effectiveness of a ring as circular cantilever reinforcement, the tests show, is equivalent to 9.65 times the area of a radial bar of equal cross-section where the rings resist 60 per cent of the total bending moment and 8.1 times the area of a radial bar of equal cross-section where the rings resist 82 per cent of the total bending moment.

3. The minimum distance of the first outside ring from the edge of the column head should be at least equal to the depth of the slab to develop the full tensile value.

4. The center ring takes very little stress. It is, however, necessary to keep the radial bars in alignment during construction.

5. The use of rings without proper proportion of radial bars is not desirable. This is evident by comparing specimens 5 and 6 with specimen 3. In practice this ratio is dependent upon other items; however, not less than 20 per cent of the total required area should be placed in radials, to give good stiffness.

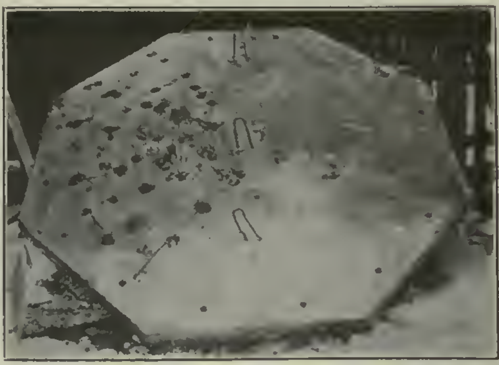
6. The circles must be proportioned in such a way that the diameter of the circle shall extend several inches beyond the points where the reinforcement is required.

7. The lap of 50 diameters of plain bar used in the tests proved to be sufficient to develop the elastic limit of the bar. In no case did failure occur at the splice.

8. Stresses are equally resisted by all the rings (except when the rings are not properly placed), and the elastic limit in radials and rings is reached at about the same time.

9. The effectiveness of the compressive reinforcement is evident from the fact that even for the large load carried by specimen 4 no compressive weakness was manifested.

10. Specimens reinforced with straight bars built on the two-way and four-way systems (specimens 7 and 8) failed under smaller actual bending moment (figured on the basis of load times the radial distance from the column head, which was used for all specimens) than the moment of resistance of the steel. This can be explained by the fact that the moment acts in all directions around the circumference radially and circumferentially, while the moment of resistance acts only in the direction of the bands. Therefore only the components of the moment of resistance were effective in resisting the bending moment.



TOP OF SPECIMEN 2 AFTER TESTING

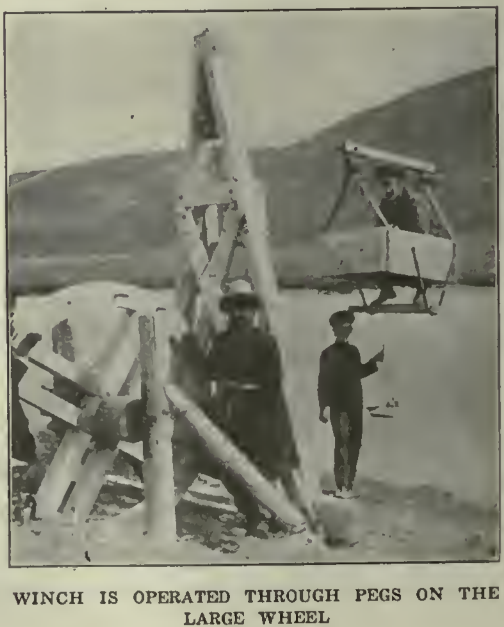
11. Radial and circumferential reinforcement is more effective than straight bars. By comparing the effectiveness of steel of equal weights from the table, it is evident that radial reinforcement is more than twice as effective as the reinforcement consisting of straight bands.

These tests were made by the writer under the supervision of Sanford E. Thompson, consulting engineer, Boston. The specimens were built under the direction of H. M. Davis, engineer, and readings were made by K. A. Funk and A. H. Haggart from Mr. Thompson's office, and T. A. Shea on behalf of the writer. The work was supervised by both Mr. Thompson and the writer.

Turkestan Gaging Station Has a Curious Winch

THE gaging station illustrated in the accompanying view represents a combination of primitive and modern equipment. The modern features are shown by the use of a Gurley current meter, Price pattern, while the winch is a relic of early days. Instead of being fitted with lever handles attached to the drum shaft, as is customary in this country, the winch is operated by means of pegs on a large wheel, as is clearly shown in the photographic view.

The station is operated by the hydrographic service of the Imperial Russian Government, and the photograph was supplied to the Engineering Record by W. & L. E. Gurley, of Troy, N. Y., manufacturers of the current meter referred to.



WINCH IS OPERATED THROUGH PEGS ON THE LARGE WHEEL

Convicts Build Mountain Highways in California

Two Camps of 61 Men Each Have Been at Work Since Last September—Four Attempted Escapes Were Frustrated by Fellow Convicts

THE California Highway Commission has recently established two road construction camps in the northern part of the state in which convict labor is employed exclusively. The camps are being operated under the supervision of men selected to direct the work, because they had the success of the plans at heart and desired to demonstrate to the public that when properly organized and directed convict labor offers a practicable and economical method of obtaining good results in the construction of roads.

TWO CAMPS ESTABLISHED

The first group of forty-seven convicts left the state prison at San Quentin on Sept. 20, 1915, and was followed later by fourteen men, thus bringing the total number in camp A to sixty-one. The second camp was established Nov. 8, 1915, starting with thirty-four men, which number was later increased by twenty-seven more, making a total of sixty-one at camp B. Up to the present time the men in these camps have been continuously employed on road construction, and while it may be too early to draw final conclusions, state authorities feel that the results thus far indicate that the plan will prove eminently successful.

The camps are located on the south fork of the Eel River in northern Mendocino County, camp B being about 13 miles from the Humboldt County line and camp A 5 miles farther south. Both camps are accessible by wagon roads from the coast, distant 24 miles, by which route all supplies and equipment have to come in. The camps were established about midway in the 33-mile section proposed to be built by convict labor, and which includes the roughest portion of the main trunk highway to be built between San Francisco and Eureka. This location was chosen as being the only point where conditions were favorable for advancing the work on either side of the camps. At the same time it would be possible to work on a part of the line where the rock formation offers greatest advantage for winter construction.

CAMP ORGANIZATION

The highway commission is represented in the camps by the superintendent, who is an engineer experienced in highway construction and who directs the organization. He is assisted at each camp by a foreman and a transitman with one or two rodmen. The prison authorities are represented by three guards at each camp, one of whom has direct charge of the conduct and discipline of the men and who also has, under the direction of the superintendent, charge of the commissary and messhouse. The other two guards act as sub-foremen, and when on the work are under the direction of the foreman. Cooks, blacksmiths, powder men and teamsters are all convicts, so that other than foremen there is no free labor regularly resident in the camp. Under the honor system the men are not guarded, and the term "guard" in connection with the camp organization is a misnomer.

The California convict labor bill provides that the state board of prison directors shall have full jurisdiction at all times over the discipline and control of the convicts employed on state roads. There are no firearms in evidence either in the camps or on the work, and the men are treated much the same as free labor. Punishment for any infringement of rules is only administered by returning the men to the prison and withdrawing the additional good-time allowance provided by law, which is one day for each two calendar days that the convict is employed on road work.

AN ESCAPE FOILED

No precautions are taken against escapes, and the men, outside of working hours and on holidays, enjoy almost absolute freedom. This privilege has resulted so far in four unsuccessful attempts to escape. The circumstances of a recent capture indicate the spirit in the camp. Two of the convicts got on the trail of two runaways and after a strenuous chase in the snow over a rugged country overtook them at a cattle ranch. After pleading with them without avail to return to the camp, and the rancher being at a loss to know whether or not all four had escaped from the camp, at the instigation of the trusties they were all held by the rancher at the point of a shotgun until the guards arrived.

At camp A the men are housed in 18 x 30-ft. tents provided with wood floors and each occupied by from 12 to 14 men. At camp B a frame building 18 x 21 ft. in plan covered with Malthoid roofing and lined with building paper is provided for each 8 men. All bunkhouses are provided with an iron cot, mattress, blankets and pillow and an iron camp chair. A camp reading room is kept equipped with books and magazines as well as checkers and dominoes, but no playing cards.

The commissary equipment is first class throughout, and an ample supply of good wholesome food is served in an airy and well-lighted messroom. The equipment at each camp includes a bathroom with hot and cold water, four showers, and a laundry. Each person washes and mends his own clothes, and one of the convicts is occasionally detailed for shoe repairing.

The work was purposely laid out with reference to weather conditions and geological formation so as to preclude the economical use of teams, limiting the work to hand implements. Only one team is employed at each camp, and this is detailed to the work of clearing, hauling firewood, and distributing culvert material. The convicts clear the right-of-way, install culverts, and build the road to completion.

EXPERIMENT CONSIDERED SUCCESSFUL

The convicts are of various nationalities, from all grades of society. Their sentences vary from a few months to life terms. Crimes range from petty larceny to murder, the average sentence being about 12 years; those serving life terms are men whom the prison directors are considering for parole.

The energetic spirit which highway engineers report as prevailing in the camps is taken as evidence that the effort to harmonize all of these different natures into an efficient force has proved successful. Extreme weather conditions characteristic of the locality were expected, and a decision was made in advance that the situation demanded a firm stand for six days' work in seven, rain or shine. Suitable clothing was provided, and this program has been successfully adhered to.

Since the installation of the camps 19 men have been returned to the prison, 5 were malcontents and agitators, 4 attempted to escape, 7 became sick, and 3 were paroled. As a result of experience in these camps, it is believed that the proper application of reward for good conduct and diligence, and punishment for misbehavior and indolence, bear a very important relation to the successful administration of the organization.

COSTS

The cost data obtained up to date are not considered a fair criterion of the efficiency of the system. Men accustomed to the inaction of prison life are more or less unused to manual labor, and in this case have not yet had time to become inured to the rigorous camp life. In addition to this, the cost of building the camps and transporting men to this remote locality makes a showing not comparable with that ultimately expected; however, including these additional costs, the camp records to date show the following apportionment:

COST PER CONVICT PER DAY

Subsistence	$0.69
Housing	.22
Transportation	.102
Clothes and other allowances (including hospital treatment)	.24
Guarding	.062
Total	$1.314

This total figure works out as the equivalent of 43 cents per cubic yard of earth and rock excavation involved in the work. This would include all clearing and grubbing incidental thereto.

The work at the convict camps has been under the supervision of F. A. Kittredge, who reported through F. G. Somner, division engineer, to A. B. Fletcher, chief engineer of the California Highway Commission.

Peak Flood Run-Off Figures Given for Southern California

DURING the storm which culminated in southern California on Jan. 27, and which came as a record rainfall on drainage areas already saturated, the maximum flow ever recorded was reported from the Sweetwater, San Diego and San Luis Rey Rivers. These streams have their sources in the hills between the Imperial valley and the coast, where considerable snow falls annually and therefore subjects the streams to the possibility of the heavy run-off that comes from warm rains on snow-covered areas. The rainfall ranges from about 9 in. on the coast to more than 60 in. in the mountains.

On Jan. 27 the run-off from the 100-sq. mile basin above Sweetwater dam was estimated to have averaged 33,000 sec.-ft. for four hours, or 330 sec.-ft. per square mile. On the San Luis Rey River a gaging taken near the mouth at 5.30 p. m., Jan. 27, showed the flow to be 55,000 sec.-ft. from the 578-sq. mile drainage area, or 95 sec.-ft. per square mile. However, at the peak of the flood the water was 2 ft. higher than when the last gaging was taken. On the San Diego River the flow at the peak of the flood was 29,800 sec.-ft. from a drainage area of 434 sq. miles, or 68.6 sec.-ft. per square mile. In the latter case the peak occurred less than twenty-four hours after the flow was only 2000 sec.-ft.

WEIGHT AND VOLUME OF REFUSE RECORDED FREQUENTLY

Cleanliness Standard for Street Cleaning for First Time

Richard T. Fox, General Manager, Chicago Citizens' Street Cleaning Bureau, Permits No Dirt to Lie on Streets More than 15 Minutes

THAT a standard of cleanliness for street cleaning by the intensive method may be expressed in definite terms was proved for the first time in a paper presented recently to the Western Society of Engineers by Richard T. Fox, general manager of the Citizens' Street Cleaning Bureau of Chicago. In the 120,000-sq. yd. area of streets in the shopping district, supervised by the bureau, the standard of cleanliness permits no dirt on the street beyond a maximum of 15 min. On a typical route, excluding the first hour of work when the force is cleaning up the night's accumulation and the noon hour, 48 per cent of the total pickups were made within 1 min., 72 per cent in 2 min., 94 per cent in 6 min. and 97 per cent in 10 min. Tests made on all the routes cleaned by the bureau show that it is easily possible to collect every deposit within the 15-min. limit. On the average, dirt dropped will be picked up within 2.7 min. The following abstract has been prepared from Mr. Fox's paper:

CLEANING PROBLEM ANALYZED

In order to make clear what is meant by our standard of cleanliness it is necessary to consider the character and distribution of street refuse and the method of removing it from the streets. The process of cleaning the streets is carried out in two operations—first, the collection of the refuse from the streets; second, the removal of the material to the points of disposal. The latter is a simple transportation problem, involving the hauling of certain quantities which vary somewhat from day to day from definite points, definite distances to the points of disposal. The factors affecting the amount of work a cart, wagon, motor vehicle or other unit can do per day can be measured and a definite standard of work set up. The quantity and quality of work can be readily checked. The collection of the refuse from the streets presents a different problem, the solution of which is more involved as to a determination of standards of work and the quantity and quality of work.

STREET REFUSE IS IN TWO FORMS

Refuse appears on the street in two forms; as fragments of various sizes and as fine dust. For convenience the former will be referred to hereafter as dirt or refuse and the latter as dust or residual dust. If a street is given anything like the daily attention it requires the dirt appearing on its surface through the day will lie in detached deposits here and there with clean spaces of pavement between them. It is not necessary then to clean the entire street, but simply to remove the individual deposits of dirt. The demands of a proper removal of this refuse from the street surface requires the observance of two principles: First, that the dirt be picked up at or as near as possible to its point of origin in the street; second, that the refuse be collected as near the time of origin as possible. If the dirt is thoroughly collected just where it lies and while it is still moist no dust will be raised during the operation.

FINE DUST AN ANNOYANCE

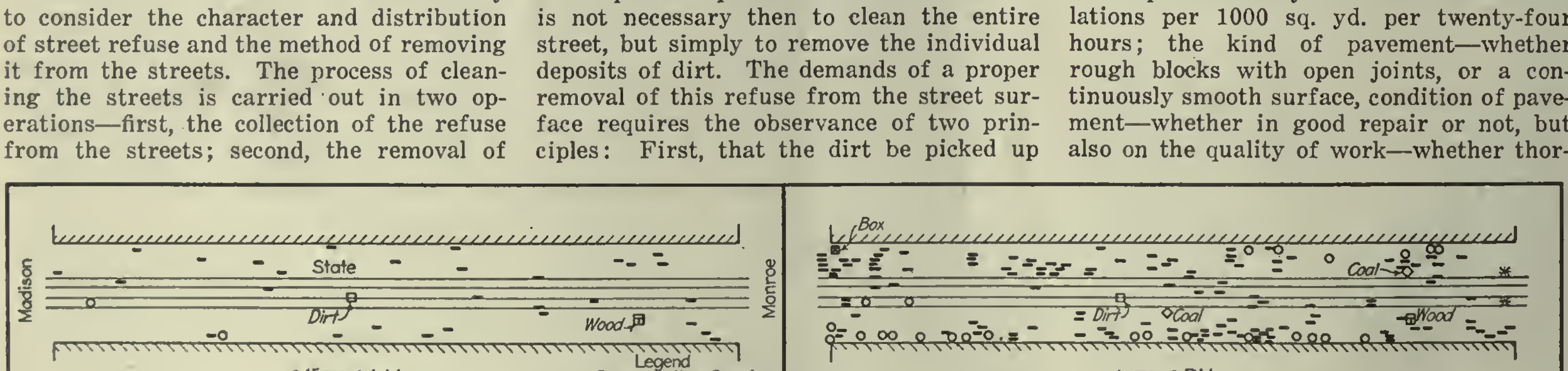
If these two principles are vigorously and intelligently applied through the day there will remain on the street after the day's work is complete a very fine dust, the quantity of which will depend on the fineness of the broom used in the day's work and the thoroughness of the cleaning. This residual dust is the greatest annoyance and nuisance with which the street-cleaning forces have to contend, and as a medium for disseminating disease germs it is a menace to health. It is very difficult to manage, because it is appearing every moment on the street from such sources as the thousands of chimneys, the roofs of buildings, the fine sand used by the street railway companies, the wear from pavements, sidewalks, wheels, street-car rails, etc., all of which are without the control of the street-cleaning officials.

HOW DUST IS REMOVED

Any system of street cleaning, to be effective, must provide every means possible, such as artificial sprinkling, flushing the streets and even scrubbing them, to combat the evil of fine dust. Mr. Fox finds the most effective method and means of routing the dust is to flush the streets at night with a motor-driven machine carrying a large tank from which the water is forced out under any desired pressure up to 70 lb. by a pump driven from the flywheel of the motor. Following this operation the sidewalks are flushed and hand-squeegeed to remove any dust from the roadway or sidewalk collected in low places there. When the weather does not permit of flushing the noticeable deposits of dust are collected by the men cleaning sidewalks. These men are provided with horsehair brooms, by careful use of which they can collect the dust without causing a nuisance by setting it astir.

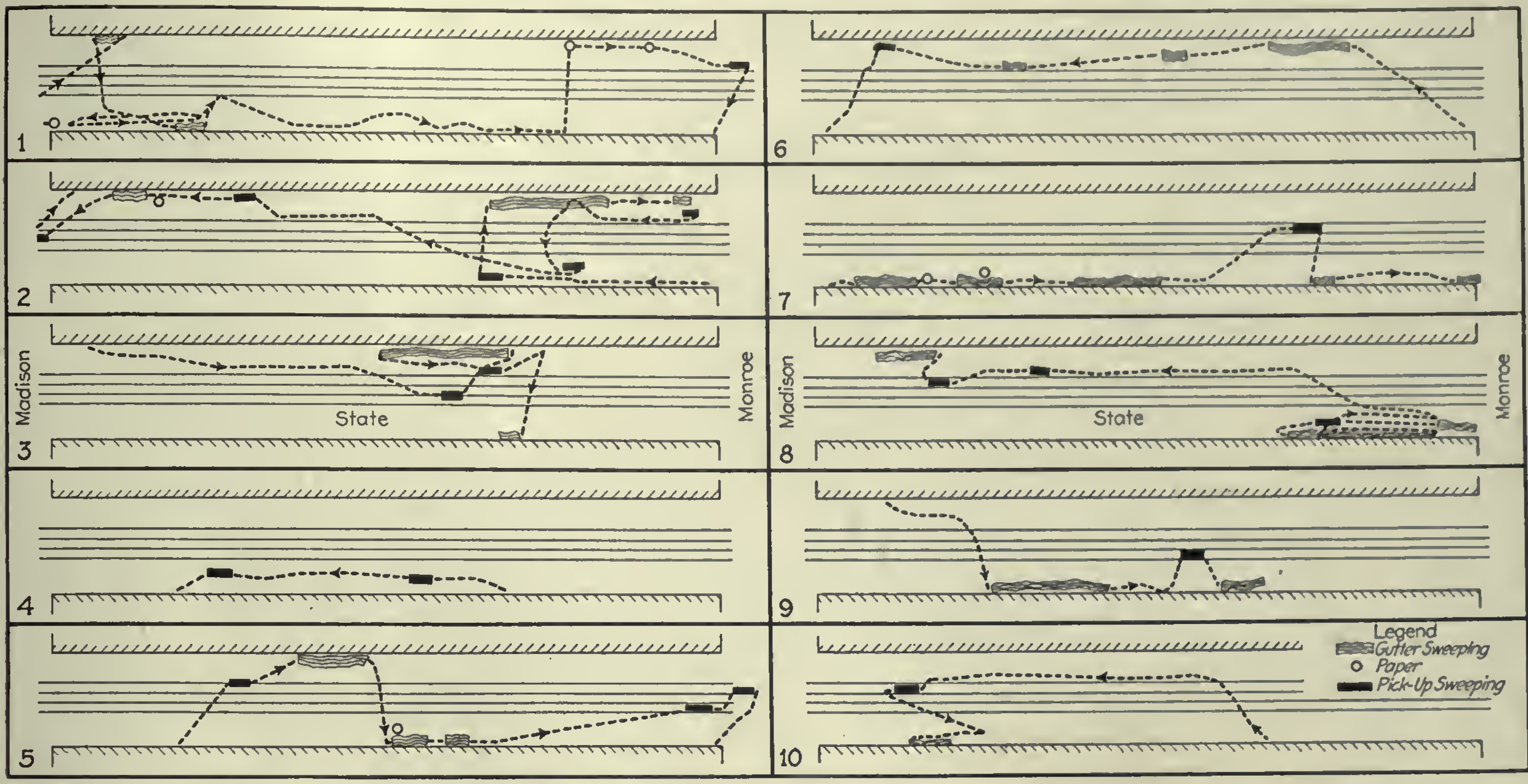
QUANTITY OF WORK

The quantity of work—the square yards of street pavement a man can clean daily—will depend not only on the refuse accumulations per 1000 sq. yd. per twenty-four hours; the kind of pavement—whether rough blocks with open joints, or a continuously smooth surface, condition of pavement—whether in good repair or not, but also on the quality of work—whether thor-



6⁴⁵ TO 8 A.M. 1 TO 2 P.M. 10 TO 11 A.M. 4 TO 5 P.M.

VISUALIZATION OF CUMULATIVE INCREASE OF REFUSE ON STATE STREET FROM HOUR TO HOUR IF STREET IS UNSWEPT



ROUTE OF SWEEPER IN COLLECTING REFUSE ON EACH OF TEN TRIPS ON STATE STREET, CHICAGO, FROM 1 TO 2 P. M.

Trip 1, 1.00-1.12; trip 2, 1.12-1.19; trip 3, 1.19-1.23; trip 4, 1.23-1.27; trip 5, 1.27-1.33; trip 6, 1.33-1.38; trip 7, 1.38-1.44; trip 8, 1.44-1.53; trip 9, 1.53-1.57; trip 10, 1.57-2.00.

ough or not—and on the standard of cleanliness. The first three factors are definite matters of fact. The remaining two have so far been considered questions of opinion, and have not to Mr. Fox's knowledge been defined.

The quality of work is a very important consideration, for a street surface not thoroughly cleaned cannot be called clean. If the horse droppings are carelessly picked up, if the dirt in the crevices and depressions of the pavements is not thoroughly removed; if, in fact, every bit of detachable refuse is not collected, the street has been merely brushed over, and the condition of the pavement falls far short of the aims of proper and sanitary street cleaning.

HOW QUALITY OF WORK IS MEASURED

Theoretically, the measure of the quality of work is the quantity of material remaining on the streets after the day's work is complete, less any accumulations after the beginning of the sweeper's last trip over the street. But, as pointed out, there is always on the street at the end of a day's work a certain quantity of fine dust which cannot be collected by the means at the sweeper's disposal. This quantity varies from day to day, which is due to a number of factors not under the control of the sweeper. Therefore, unless there is a very noticeable increase in the residual dust, it is difficult to determine whether or not the sweeper is at fault.

Furthermore, there might be enough undigested portions of hay, oats, and other feed, and bits of paper, together with matches, cigar or cigarette butts, and other noticeable odds and ends, scattered over the street to give it an untidy and an unsightly appearance; and yet the total quantity of these would affect but little the amount of residual dust on the street.

Practically, then, this test for quality is not as a rule feasible. The practical day-to-day determination of this element of the work is by the eye of trained and experienced inspectors, who are alert and observant.

WHAT IS A STANDARD OF CLEANLINESS?

When we say a street is clean, what do we mean? In other words, what is a clean street? Absolute cleanliness, the ideal condition, means that a street must be continuously free of dirt and dust. This condition can be maintained as far as the heavier fragments of street refuse are concerned, but the cost would be prohibitive. Moreover, it is not necessary, for this dirt is not objectionable if removed before it dries out or is scattered and ground into the pavement by traffic. The length of time it can be left on the street will depend upon the amount of the twenty-four-hour accumulation per 1000 sq. yd. of street surface; or, in other words, on the volume and kind of traffic. The residual dust from one or the other of many sources, although it may be hardly perceptible, will always lie on the street. Therefore, absolute cleanliness is an impossibility and will continue to be so until the sources of dust beyond the control of the street cleaner are eliminated. The length of time any refuse other than dust is permitted to remain on the street will determine the standard of cleanliness for that street.

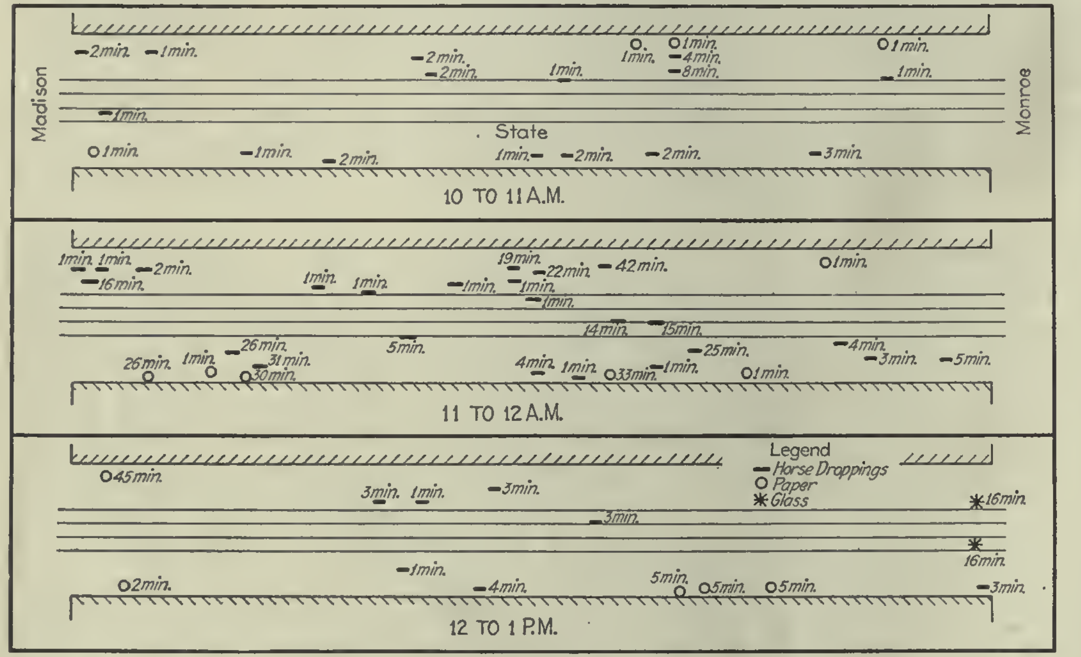
A standard of cleanliness, then, is an arbitrary matter, but it can be made definite for certain conditions of traffic, etc., by specifying the length of time any refuse other than fine dust can remain on the street. In order to make this point clear Mr. Fox referred to the conduct of the work of the Citizens' Street Cleaning Bureau, where he has developed, in following closely the hand-collection principles, what may be called the intensive method of street cleaning. The aim of this method is not only to clean a street thoroughly, but to keep it continuously clean throughout the working day.

PICKUPS AS FAST AS DIRT FALLS

The street sweepers are assigned a definite length of street, called a route, to care for as in the "patrol" or "block" system of street cleaning. The men are required to clean thoroughly their routes in the first hour of work in the morning, and thereafter to keep the refuse picked up practically as fast as it reaches the pavement. In other words, the work is not allowed to accumulate, but is taken care of as it presents itself. It is apparent that to do this the number of cleanings or trips over the route formerly given must be greatly increased. This increase is expressed in the statement that the standard of work under the "block" system is based on a certain number of cleanings per day, while the intensive method requires a certain number of cleanings per hour. The

WHERE DUST COLLECTED AT THE END OF THE DAY IS FOUND advantage gained in the latter method is that for the same street areas cleaned and the same amount of dirt collected the length of time the dirt lies in the street is greatly decreased by reason of the added number of cleanings, and therefore a much higher standard of cleanliness is obtained.

The explanation of the ability of the sweeper to increase so greatly the frequency of cleaning is apparent from a study of charts which Mr. Fox plotted from records of the location, time of deposit and time of collection of every bit of dirt appearing on a particular route. One of the charts was made up of ten diagrams, one for each hour of the day. Each successive diagram after 8 a. m. includes all the deposits of dirt for the preceding hours. The chart, therefore, is a visualization of the refuse accumulated on the route at the end of each hour, assuming that the street is not swept nor the dirt disturbed. Let us say that the route is swept once per day, the dirt to be collected is represented in the last diagram of the chart from 4 to 5 p. m. The actual condition of the refuse would not be as indicated; it would not be in individual deposits. The sweeper would find it spread over the entire street and adhered to the pavement by the action of hours of heavy traffic, and he would be compelled laboriously to sweep with a hand broom every square foot of the surface to clean it thoroughly. The distance walked by the sweeper in the course of the day's work would be at least 4.3 miles, which means that he must sweep a like distance, as this act is continuous through the day.



PLACE OF REFUSE ACCUMULATION AND TIME ELAPSING BEFORE COLLECTION FOR DIFFERENT HOURS OF THE DAY ON STATE STREET, CHICAGO

If it is assumed that the route is cleaned once each hour the accumulation per hour may be indicated on a chart representing the refuse actually collected from the route. The deposits of dirt would be shown with clean spaces of pavement between them, and this will be the actual condition, for the dirt will be scattered by traffic but little when the route is cleaned so frequently. The sweeper can now use, in addition to his broom, a pan scraper, which permits of more rapid and easier work than with a broom alone; and, as he can collect each deposit of dirt where it lies without cleaning the entire street, a trip over the route is rapidly made. The distance now walked is a minimum of 6 miles per day of ten hours. Therefore, the distance walked has increased and the labor of sweeping has been lessened.

WORK SHIFTED FROM ARMS TO LEGS

Now, if the route is swept seven times in an hour, as shown in one of the charts, which is an intensive study of the 1 to 2 p. m. condition, it will be seen that on that one trip no dirt was collected at all and that the greatest number of pickups per trip for the hour was six. Therefore the sweeper is able to clean the street about as fast as he can walk, and the work is accordingly much less laborious than in either of the other instances. The route in question was swept ninety times, the sweeper walking a minimum distance of 8 miles in ten hours. That is to say, the sweeper has shifted a considerable part of his daily burden from his arms to his legs. The total physical effort is no greater than in the other instances.

The streets cleaned by the Citizens' Street Cleaning Bureau produce from 5 to 8 cu. ft. of street refuse per 1000 sq. yd. per twenty-four hours. On streets of lighter traffic and therefore accumulating less dirt the street areas or routes allotted per man would naturally be increased. In such cases if the streets are the same width a sweeper would have a greater length of street to traverse, and would accordingly make less trips per day. The length of time elapsing before collection would be increased. In other words, another time standard must be established for the new conditions.

LONG CLEAN PERIODS

A study of one of the charts indicated that there are periods totaling twenty-one minutes in the hour from 1 to 2 p. m. in which the street in question was entirely free of dirt. These clean periods average three and one-half hours per day for the entire district cleaned.

While the standard of cleanliness of the bureau is defined and can be readily checked within close limits, and is checked from time to time, the day-to-day determination of this factor is by the eye of the foreman. The standard of cleanliness is so fixed in the minds of the foremen that they can tell at a glance whether or not a sweeper is abreast of his work.

W. B. Parsons Explains Engineer Reserve Bill

Proposal to Give Commissions as High as Rank of Major to Technical Men with Proper Military Training

"HAD the Spanish war really been serious there would have been no engineering troops for many months to do the things that would have been urgently and immediately demanded." Using this as the text of his address, William Barclay Parsons told the members of the Boston Society of Civil Engineers and the local sections of the national societies of electrical and mechanical engineers at their annual banquet at the Boston City Club last week, of the need for technically trained men in the plan for national defense and outlined the progress made by the joint committee of the five national engineering bodies, of which he is chairman, in securing legislation creating an engineer officers' reserve corps.

This legislation, with amendments already proposed by the General Staff of the Army, provides for the giving of commissions to men who, by examination or otherwise as determined by the President, have demonstrated their fitness. These commissions, Mr. Parsons explained, are to be for all grades up to and including the rank of major; they are for five years, renewable at the discretion of the Secretary of War, which permits the elimination without friction of human deadwood. At times of war these officers would be subject to call precisely the same as any other officer of the army, and in times of peace they would be required to serve for two weeks each year, or longer with the officer's consent. There will be no pay except for the short period of duty.

FRONTIERS NEED PROTECTION

Our land frontiers, Mr. Parsons pointed out, are unprotected, and our coasts are defended only at isolated spots. If war ever should be declared we would have to place mines in all our harbors; throw up earthworks along our coasts and secondary lines to provide for reserve defense in case a foothold on the shores should be forced; lay the foundations in concrete for heavy guns; build branch railways to isolated points on the coasts, for such points without transportation facilities would be the most inviting for attack; build highways capable of standing up against heavy motor traffic, and maintain and repair both the railways and the highways. It would also be necessary to string telegraph and telephone lines and install wireless stations; make camps for large armies, with water supply, sewers and lights. These things and many others would have to be done, not at one or two places but practically along our whole seaboards, for we could not tell where the enemy would strike.

Should the war be one of offense, as for instance to maintain the Monroe Doctrine, all these things would have to be done at home, to prevent a diverting home thrust, and in addition we would have to send an overseas expeditionary force to construct suitable landing places for our troops in some Central or South American country already held by an enemy, and build and maintain elaborate lines of transportation, besides carrying out military engineering works on a large scale.

We all know, said Mr. Parsons, the impossibility of selecting men during the initial excitement in the stress of war, but if they are chosen carefully in times of peace and then classified according to experience and given some training the War Department will have at hand a body of experienced engineers who could be at once assigned to special duties according to their ability and training, and thus reinforce and supplement the Corps of Engineers.

Air Diffusers Tested at Milwaukee Sewage Plant

T. Chalkley Hatton, Chief Engineer, Gives Results of Experiments on Activated Sludge Process Details

IN its experiments to determine the best method of securing a uniform diffusion of air for sewage treatment by the activated sludge process the Milwaukee Sewerage Commission has conducted exhaustive tests of various materials, as a result of which preference is given to a quartz sand plate baked until it is hard and strong. It is felt by the commission, however, that the best method of air diffusion has not yet been determined. The experiments have shown that there are three factors of special importance to be considered in choosing a diffuser agent. As set forth by T. Chalkley Hatton, the commission's chief engineer, in his paper presented Jan. 27 before the joint convention of the Illinois section of the American Waterworks Association and the Illinois Society of Engineers and Surveyors these three factors are: First, the smallest air bubbles produce the greatest efficiency. Second, greater density of the diffusing substance increases the frictional losses, and hence the cost. Third, the tendency to absorb and retain sludge, or to permit it to reach the underneath surface of the diffuser, tends to reduce the efficiency of the diffuser and allows sludge to precipitate on the top surface of the diffuser. Extracts from Mr. Hatton's paper are given below:

DIFFUSING AGENTS TESTED

The open air jet, Mr. Hatton states, reduces the loss of air pressure, but reduces its efficiency, owing to the size of the air bubbles produced. This objection may be overcome by reducing the size of the orifice. With an orifice 1/1000 in. bubbles 1/32 in. in diameter would be produced, which is below what is termed the critical size. It is problematical whether such small orifices would be kept free due to the small particles of solid matter carried along with the air. Another objection to the open jet is its tendency to clog the air feed pipes with sludge drawn into the pipe when the air is shut off for any reason.

Monel metal cloth has been tried out only for about a month, and proved quite satisfactory. Although much more porous than the filtros plate, it produced smaller bubbles, due probably to the fact that the surface of the cloth was smooth and the air, while building the bubble, could not adhere to the surface as it does to the rough granular surface of the filtros plate.

Kisselghur was tried. It gave the smallest bubbles of any other agent, but the initial frictional loss sustained in getting the air through a plate ½ in. thick was 20 lb., which made this diffuser impracticable, owing to cost.

The filtros plate, if furnished of uniform porosity, has given the most satisfactory results, according to Mr. Hatton, but it has a few characteristics which should be realized. This material is manufactured by the General Filtration Company, of Rochester, N. Y., and was designed to filter water rather than sewage. It is made in plates 12 in. square by 1½ in. thick, and is composed of quartz sand, supposed to be of a uniform coefficient according to the porosity of plate required, baked until it is quite hard and strong. It is produced in several different grades, which are classified in conformity with the volume of air which each plate will pass, when dry, per minute under a pressure due to 2 in. of water. These classes run from 0.5 to 12 cu. ft. of air per minute.

The accompanying table gives the comparison of results obtained by using filtros, air jet and monel metal cloth.

COMPARISON OF AIR-DIFFUSING MATERIALS

Diffuser	Period, 1915	Pressure of mercury in pounds	Vol. of air used in cu. ft. per gal.	Per cent of bacteria removed	Nitrate formed in P.P.M.	Stability of effluent in hours
Filtros plate	June 1 to Aug. 12	4.3	2.06	91	3.4	78
Air jet	June 1 to Aug. 12	3.5	1.94	91	2.2	52
Filtros plate	Nov. 18 to Dec. 7	4.6	1.71	90	0.3	113
Monel metal	Nov. 18 to Dec. 7	3.0	1.71	80	0.2	63

It is of the greatest importance that the agent used shall diffuse the air uniformly per cubic foot of liquor. Therefore great care should be taken in getting a diffuser of uniform porosity. So far this has not been possible with the filtros plate. Out of 780 plates tested for the new 2,000,000-gal. plant at Milwaukee, where the specifications called for a plate which would pass 2 cu. ft. of air per minute under a 2-in. water pressure and allow a 5-per cent variation either way, 35 per cent of the plates received were rejected, and only 27 per cent came within the strict terms of the specifications. The manufacturers, however, have recognized the necessity for exercising greater care, and are equipped to furnish more uniform plates, and to test them before shipment.

Tests made with the plates used showed that when wet the initial loss of pressure due to passing the air through the plate under 5-lb. pressure was ¾ lb., and for every cubic foot of air per minute per square foot of surface passing the plate there was an additional loss of ¼ lb.

REDUCING FRICTIONAL LOSS

There are two ways of overcoming this great frictional loss, and the factor is an important one to consider in large plants. One is by reducing the thickness of plate to about ½ in. and reinforcing it with wire similar to window glass reinforcement, and the other is by soaking the plate, before use, in a mixture of paraffin and benezine, blowing with air until the paraffin appears at the surface of the plate. This establishes fine pores through the plate, which are coated with a non-absorbent, permitting the air to pass with the least friction and the paraffin impels the water so that the plate does not become waterlogged.

At Milwaukee filtros plates have been operated for nine months under all sorts of conditions, and there has been no difficulty in keeping them from absorbing the solids in the sewage, or becoming clogged on the underneath surface. It may be possible for the pores to become filled in time with bacterial growths, which may be removed by forcing heated air through them. It is necessary, however, to filter the air before delivering it to the plate to prevent the dust and dirt from reaching it. This is done by passing the air through a filter composed of excelsior built into the feed line. The critical diameter for air bubbles is ⅛ in. Below this size the efficiency increases very rapidly, and the reverse is true for bubbles over this size.

FUNCTIONS OF ACTIVATED SLUDGE

Activated sludge accomplishes four principal functions: Clarification of the liquor; removal of the putrescible organic matter; reduction of bacteria; and, finally, if the process be continued for a sufficient period, the ammoniacal compounds are oxidized into nitrates. Therefore one of the first steps in designing a plant in which this process is to be employed is to determine the degree of purification required, following which the question arises as to efficiency, volume of air required, period of application and volume of activated sludge necessary to be kept in retention with the raw liquor.

MILWAUKEE'S PROBLEM

The problem in Milwaukee embraces the clarification of the liquor, securing an effluent stable for five days, the reduction of the suspended matters 90 per cent, and 95 per cent removal of bacteria at 20 deg. C. With the continuous flow tank Mr. Hatton has secured this average effluent for months by using 1.75 cu. ft. of air per gallon of sewage with 4-hr. aeration, 20 per cent activated sludge and from 10 to 15 min. sedimentation period. Basing these results upon the operation of a 50,000,000-gal. plant, the estimated cost will be $4.38 per 1,000,000 gal., including all overhead and boiler room charges, but excluding engine room and plant attendance, and the cost of disposing of the sludge.

The Milwaukee commission has found no difference in the results obtained by carrying out the process either by the fill-and-draw or continuous flow methods, considering volume of air applied per gallon, cost of aeration and volume of activated sludge required. But measured in terms of cost of construction and operation the "continuous flow" is the superior method. With a wide variation in strength of liquor and rate of flow a more uniform standard of effluent can be obtained from the fill-and-draw method, because it is susceptible of better control, which is true of all fill-and-draw processes.

SAND SPREADERS for sanding pavements to prevent skidding and slipping in damp weather are being used very successfully, it is reported, in San Francisco and Portland, Ore. The quantity of sand distributed can be easily kept below the quantity that would clog storm drains, at the same time that it is ample to make the pavement safe. The spreader, which is of the rotary, adjustable type, can make a round trip of fourteen blocks per hour when drawn by horses. In emergencies it is drawn as a trailer by an auto truck.

Plan for Lehigh Valley Station at Buffalo Places Train Shed Columns Between Tracks

Designs for a Nine-Track Shed Make Special Provisions for Future Addition of One More Track—Roof Lights Are of Unusual Type

A MODIFICATION has been made in the new train shed for the Lehigh Valley Railroad at Buffalo, N. Y., by locating the columns on the center line between tracks instead of placing them on the center line of the passenger platforms, as has been done in the other eleven Bush train sheds previously built in this country and Canada. This arrangement changes the relative position of smoke ducts and skylights to columns and modifies some details of the steel frame. The plans and specifications call for about 50,000 sq. ft. of the Keppler system of roof lights, adopted for greater permanence, minimum cost of maintenance and exceptional lighting value. The plans also provide for the future addition of one more track by increasing the width of the shed.

REASONS FOR MODIFIED DESIGN

The adoption of the design with columns between tracks resulted from the desire on the part of the railroad company to keep clear for pedestrians and trucking purposes the comparatively narrow passenger platforms, 14 ft. 2⅜ in. wide. The resulting modifications in the details of the structural design of this Bush train shed will be apparent by comparing the sections here shown with those in the Engineering Record of Jan. 4, 1913, page 6, describing the twenty-track Bush shed at Jersey City, N. J., and the seven-track Bush shed at Ottawa, Canada.

FIXING THE GENERAL LAYOUT

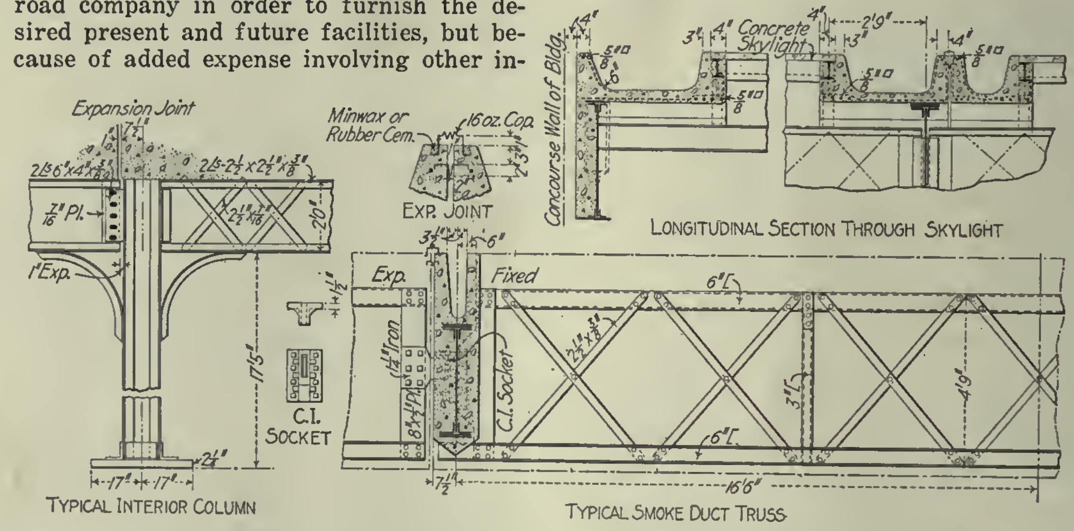
Owing to the fact that the existing facilities at the old Lehigh Valley Depot in Buffalo had become inadequate, the railroad recently began the construction of a new passenger station at the corner of Main and Scott Streets, designed by K. M. Murchison, architect, of New York City. It will be a four-story structure finished in classic style, using Indiana limestone with granite base and terra cotta trimmings. A ramp leads from this station to a tunnel under Washington Street, and a second short ramp leads up to the headhouse and concourse of the new train shed. This headhouse, 100 x 181 ft., is of gray brick with terra cotta trimmings, is two stories high, and includes the express, mail and baggage rooms and full-length concourse on the first floor, and the immigrant waiting rooms and employees quarters on the second floor.

The general layout for the steel-frame shed was determined by the total lot width of 195 ft. from Scott Street to the property line on the north, and the available length of about 843 ft. for straight tracks from the headhouse to the freight tracks connecting with the new freight station on the south side of Scott Street. Allowing for a width of 8 in. for the columns between tracks, the clearance requirements fixed the minimum track spacing at 14 ft. 8 in. Ten train shed tracks were planned by the railroad company in order to furnish the desired present and future facilities, but because of added expense involving other interests nine tracks only are now to be completed.

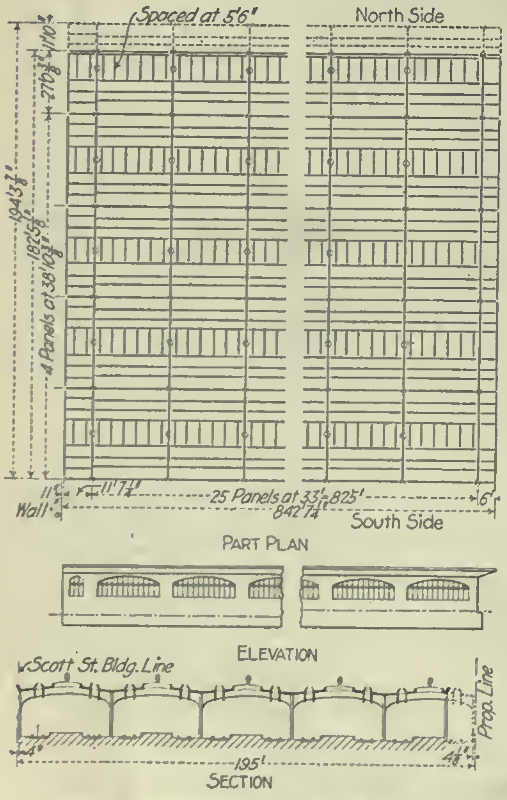
The north side columns and details are unusual, because the old Hamburg sewer, located along the northerly property line, interferes with the column foundations. The necessity for strengthening the sewer to carry the most northerly track and columns led to the decision to eliminate the tenth track in the shed for the present. The available width and required number of tracks and clearances thus fixed the width of platforms at 14 ft. 2⅜ in., allowing 5 ft. clearance from edge of platform to center of track. The panel length of 33 ft. between column centers was selected as the economical unit, considering cost of foundation piers of concrete, with piles in the northerly bays where filled ground is encountered at the former site of the old Hamburg Canal.

TYPICAL COLUMN AND GIRDER DETAILS

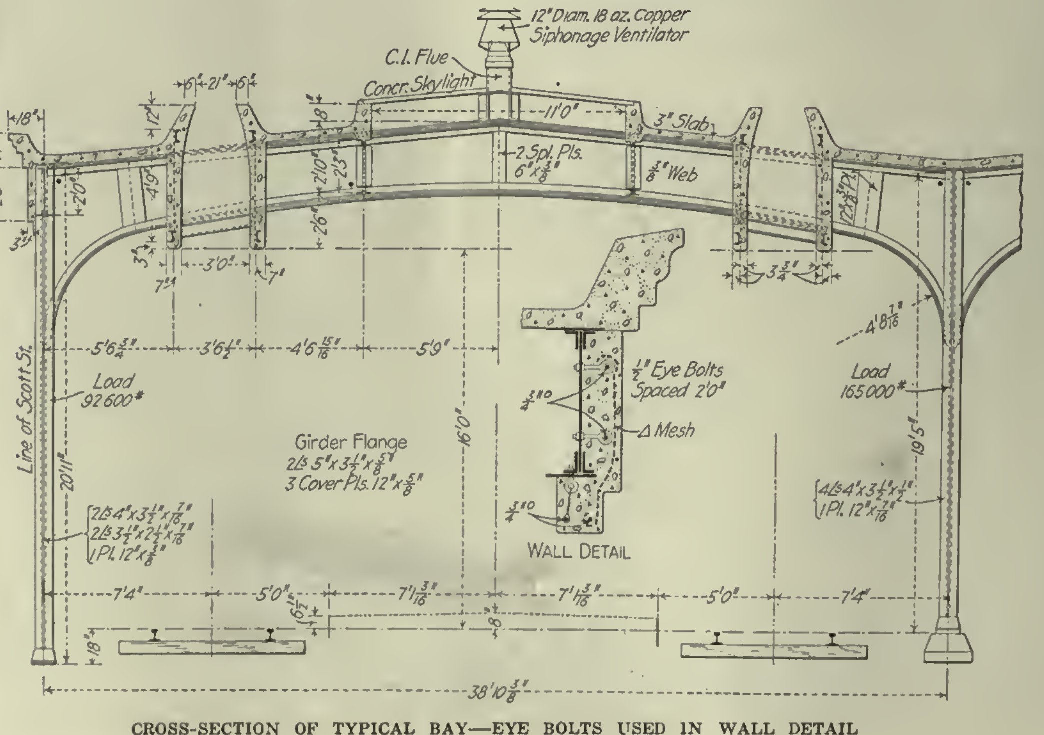
It will be seen by the accompanying cross-section that the columns are of built-up I-section with the webs parallel to the tracks to give maximum clearance. The curved girders are field-riveted to the columns, the flange material being bent and riveted up in the shop. The required 16-ft. clearance from top of rail to under side of smoke ducts, close to the low point of the shed, makes the total height for this de-



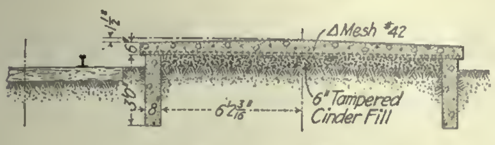
DETAILS OF TYPICAL COLUMN AND SMOKE DUCT TRUSS



PART PLAN AND OUTLINE ELEVATION



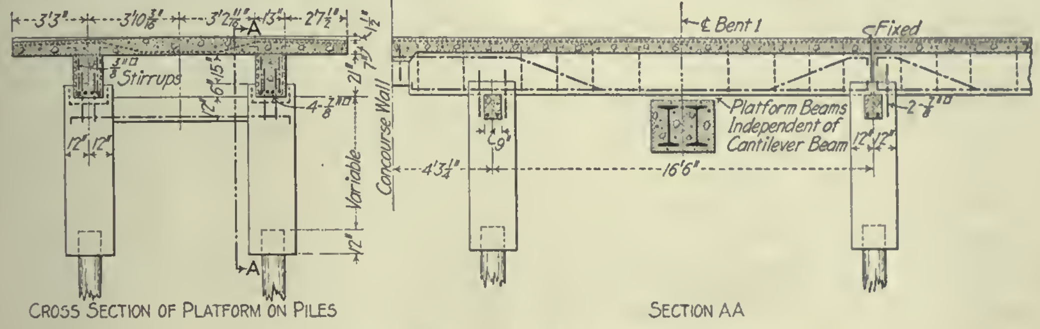
CROSS-SECTION OF TYPICAL BAY—EYE BOLTS USED IN WALL DETAIL



PLATFORM ON CINDER FILL

sign greater than for the design with columns on platforms.

The details of the longitudinal steel purlins supporting each side of the concrete-encased smoke ducts, the main rib rafters between columns, and the details of the columns are shown in the accompanying drawings. The clearance between the walls forming the smoke ducts and the form of the smoke ducts have been fixed by experiments which were made to determine the minimum clear width at top which could be used without producing back pressure from engine exhaust, or preventing the free escape of smoke, gas and cinders from locomotives. The inner curved surfaces deflect the cinders onto the roof of the train shed and prevent their return through the duct openings.



SLAB AND BEAM DESIGN OF PLATFORM FOR NORTH BAY

To make the tests, a curved adjustable wooden shield was placed on each inner side of a smoke duct above the smokestack of a locomotive in the Hoboken shed, the rails greased and brakes of the tender applied, and the action of the blast observed, using different widths of opening with the adjustable shield. It was found that free escape without back compression occurred down to a clear opening of about 16 in. between the tops of the curved shields. To avoid any possibility of back compression, the clear width between curved side walls at top of ducts has been made 21 in. in this structure and at Jersey City. The clear width of 3 ft. at the bottom of the smoke duct was determined by the possible swaying of engines, the sagging of engines to one side due to weak or broken springs, and the prevention of a driving storm from reaching the platforms by a proper relative height to width between duct walls. A diagonal line extending downward toward the platform and touching the inner edges of top and bottom of opposite smoke duct walls falls outside of the platform.

In order to deflect up through the duct openings the smoke and cinders which would strike the flat bottom flanges of the main rib rafters and also to protect the metal, cast-iron deflectors have been provided, as noted. These deflectors are shaped like a letter V, with sides forming an angle of about 45 deg. and bolted to the bottom flanges of the girders.

PROVISIONS FOR FUTURE TRACK

On the north side, the property boundary line follows the center line of the old Hamburg sewer. As already stated, the tenth track has been temporarily omitted and the special details shown in the accompanying cross-section have been adopted to allow for future extension when required. The height of the outside columns is kept the same as the interior columns, so that they can be shifted laterally with the side-wall framing. The connection of the girders is made by special connecting angles, the ends of the girders being milled for the future splice.

In order to support the outside row of columns, which come over the sewer wall, it was necessary to use cantilever beams on pile foundations as shown in the drawing. The platforms are all reinforced-concrete slabs on cinder fill, except in the northerly part of the shed, where a beam and floor slab construction is to be carried by piers. The probability of settlement of this filled-in ground at the old Hamburg Canal site was considered sufficient to warrant this extra expense, as well as the use of piles for supporting a part of the platform piers. Examination at the site when the excavating is done will determine the extent of work for which piles will be required.

EXPANSION AND DRAINAGE PROVISIONS

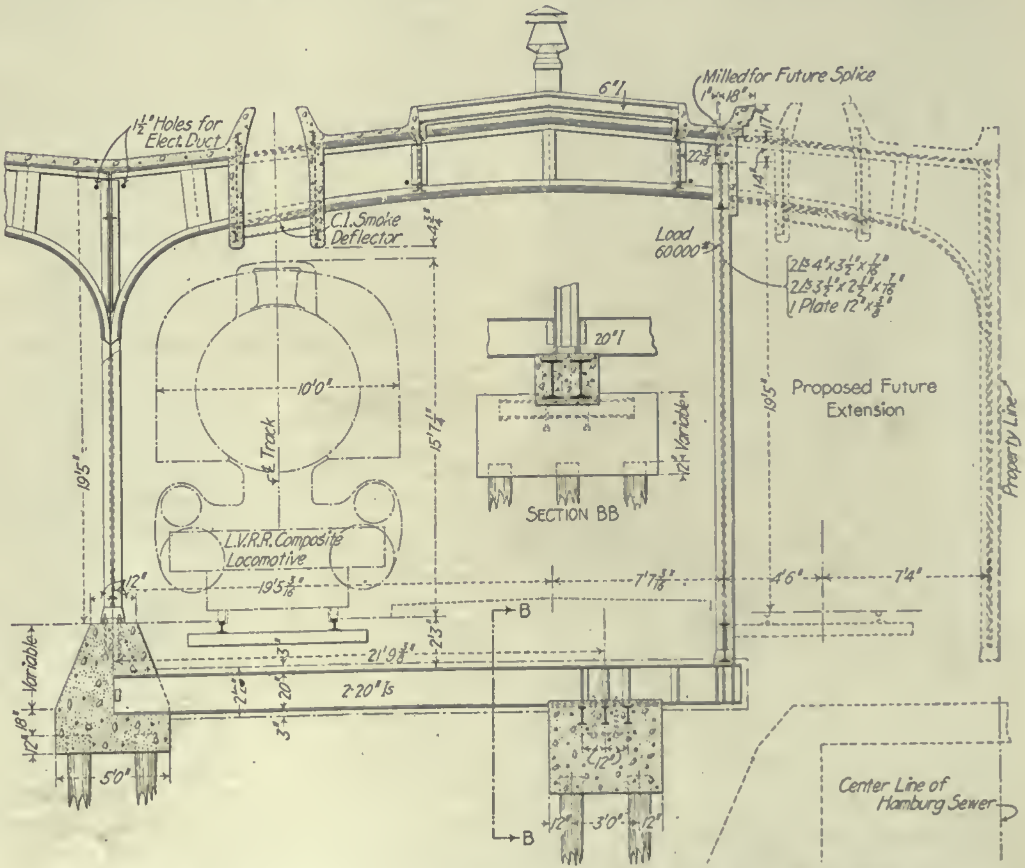
No lateral expansion joints have been provided, as it has been found in the other sheds of this type previously built that the main curved rib rafters have ample flexibility to take care of all lateral expansion. Longitudinal expansion joints are provided across the width of the structure and are spaced every fifth panel, or 165 ft., apart. Special care has been taken to insure watertight joints, as the details in the drawings clearly show.

All tracks and the column bases are on an ascending grade of 0.32 per cent toward the headhouse, and the drainage is thus easily carried away from this end and down the special cast-iron drains attached to the columns at the expansion joints. Lateral 6-in., 8-in. and 10-in. standard cast-iron drain pipes lead to the Hamburg sewer on the north. A 3 x 4 ft. conduit of reinforced concrete is carried transversely across and under the tracks near the track bumpers to provide for distribution of the several service pipe lines. The removable covers of this conduit are made of steel plates with large holes for attachment of steam, water or other connections for cars.

ROOF LIGHTS OF UNUSUAL TYPE

The roof lights are of unusual design, used for the first time in these train sheds. It was desired to make this part of the construction as nearly permanent as the rest of the structure if possible. It was, therefore, decided to adopt the Keppler system of roof lights having an all-glass under surface consisting essentially of a series of square glass units separated and supported by 1:2 concrete mortar ribs reinforced by steel rods.

The units used are 1¾ in. thick and 6 in. square, and the roof light panels are carried by 6-in. I-beam rafters 5½ ft. apart and bent as shown. The weight complete is 16 lb. per square foot. The top surface slopes about 1¼ in. per foot, and the bottom surface, on account of the shape of the glass units, forms an all-glass under surface of excellent appearance. An elastic light reflecting cushion of special material is provided between the glass units and the concrete ribs. The entire roof light con-



CROSS-SECTION OF NORTH BAY SHOWS SPECIAL DETAILS FOR FUTURE EXTENSION
Note the cantilever beam details for supporting columns, which cannot be carried on piers because of interference with the old Hamburg Sewer.

struction is to be insulated from the train shed supports by expansion joints filled with rubber cement or minwax and layers of asphalt paper attached by means of hot asphalt, to prevent the transmission of vibration from the substructure. Tests recently made on this 1¾-in. type of roof light showed an ultimate carrying capacity of 350 lb. per square foot on a 5 ft. span.

Ventilation is provided by means of the smoke ducts and additional ventilation at the ridge is supplied by 105 Kernchen siphonage ventilators to be furnished by the Kernchen Company, of Chicago, there being one of these ventilators located at the roof ridge line for each bay of the train shed.

As Scott Street extends along the southerly side of the train shed and other property ownerships along the north side, the 8-in. concrete side walls are to be made somewhat higher than is usual—7½ ft. above top of rail. Above this side-wall lighting is provided for by using ⅜-in. solid-rolled Pennsylvania wire glass, set in metal frames, with four sliding panels in each bay for ventilating purposes.

The side-wall lighting is to be installed by Mesker Brothers Iron Company, of St. Louis. The steel is being fabricated by the American Bridge Company. Lincoln Bush, consulting engineer, of New York City, prepared the plans and specifications and checked the bridge shop details, reporting to E. B. Ashby, chief engineer of the Lehigh Valley Railroad Company.

States Ten Difficulties of Public Service Regulation

Ten difficulties of state regulation of public utilities were named by H. O. Garman, chief engineer of the Indiana Public Service Commission at the joint meeting Feb. 4 of the Indiana Engineering Society and the Indiana Sanitary and Water Supply Association. They are as follows: Resentment on the part of the municipal governments toward state interference; change of personnel of commission after the members have been educated to their duties by experience at the expense of the public; lack of continuity of policy due to change in organization; attempts at political advertisement on the part of some city officials by starting trouble where no real trouble exists; lack of some form of civil-service restriction for the protection of the commission in obtaining its employees; lack of a co-operative spirit; political ambitions of commissioners; lack of publicity of the right sort concerning the activities of the commission; lack of confidence in the commission; lack of funds to carry on the work properly.

OLD FREIGHT CARS are no longer piled in a heap and burned on the Baltimore & Ohio Railroad. Some months ago the company began reclaiming the lumber and metal parts and utilizing the salvage. Lumber is resawed and planed until the outside defects are removed, after which it is made into smaller sizes and shipped from point to point over the road for repair work, or the erection of small buildings. A 90-ft. front platform at Keyser, W. Va., and a 300-ft. icing station 300 ft. long at Cumberland, Md., are among the structures built entirely from this reclaimed material. It is estimated that $50,000 per year can be saved by the new system.

War's Demands Cause Prices of Waterworks Chemicals to Soar

Hypochlorite Advances and Exports of Various Other Chemicals Have Reduced Supply Available for Filtration Work in United States

CHEMICALS commonly used in water purification have been affected in divers measures by the continuation of war conditions. Generally they are produced in large quantities for other purposes, while their application to water treatment is of minor importance to the manufacturer, although of first significance to the waterworks man. Some of the developments in the chemical industry which are of great significance to waterworks men were discussed by W. F. Monfort, consulting chemist, of St. Louis, in a paper before the Illinois section of the American Waterworks Association, Jan. 28, the source of the following:

PRICES ADVANCE

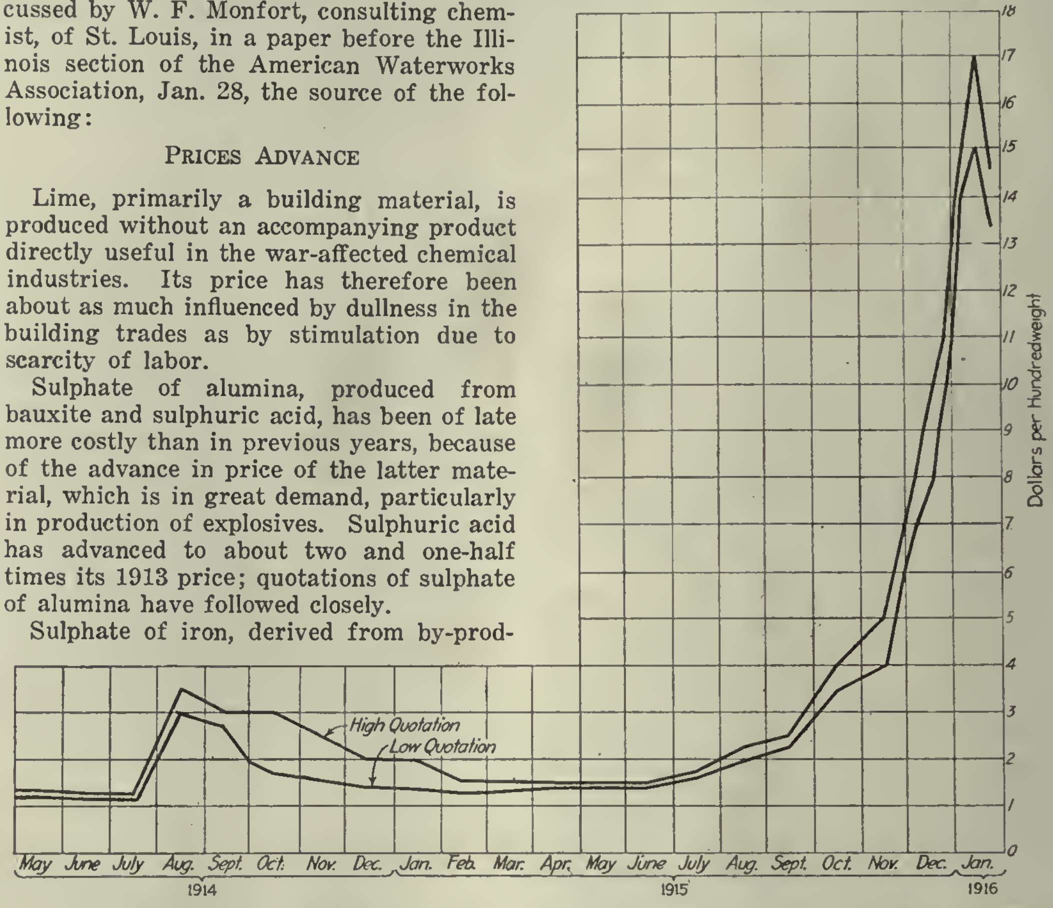
Lime, primarily a building material, is produced without an accompanying product directly useful in the war-affected chemical industries. Its price has therefore been about as much influenced by dullness in the building trades as by stimulation due to scarcity of labor.

Sulphate of alumina, produced from bauxite and sulphuric acid, has been of late more costly than in previous years, because of the advance in price of the latter material, which is in great demand, particularly in production of explosives. Sulphuric acid has advanced to about two and one-half times its 1913 price; quotations of sulphate of alumina have followed closely.

Sulphate of iron, derived from by-products of wire mills, has found no large new application on account of the war, and has suffered no marked change in price.

Soda ash is firm at prices almost threefold those of a year ago.

Sulphate of copper has advanced greatly. Its primary use is as a plant disinfectant or insecticide. In Bordeaux mixture it is extensively used as a spray for fruit trees. It forms the basis for manufacture of paris green. It is further used in metal plating and in dyeing textile materials. Its application to water purification is minor. Both sulphuric acid and copper (copper ores) have been greatly affected by war industries —sulphuric acid as above cited; copper as required for ammunition. Values are speculative. Before the war the market was on a basis of 4½ to 4¾ cents a pound, and was subject to no important changes until early last month, when a 10-cent level was reached. Foreign demand has been emphasized during the last three months as a result of the prohibition by the British Government of manufacture, for the purpose of assuring a greater supply of copper for war needs, as well as in anticipation of the important spring requirements. England had controlled the foreign trade, Germany participating to a minor extent; but with these sources cut off practically full reliance was shifted upon our producers. The export trade has grown to proportions beyond all possibility of fulfillment, but no plans are reported to enlarge producing facilities based upon the present exceptional outlet. Quotations on Jan. 22 were at 22 to 23 cents a pound. Immunity from infested orchards and potato fields and algae-burdened reservoirs is to be purchased at higher cost so far as it is secured through copper sulphate and its derivatives.



BLEACHING POWDER PRICE SOARS AS UNITED STATES ENTERS WORLD MARKET

HYPOCHLORITE IN DEMAND

Prices of calcium hypochlorite have likewise been seriously affected for several reasons. It is produced in this country as a by-product of caustic soda. Electrolysis of common salt (sodium chloride), either in solution or in a fused state, yields sodium (sodium hydroxide) and chlorine. Shipment of chlorine in liquid form in steel cylinders has been practised to a considerable extent in this country, but until very recently this procedure was not permissible in some countries. For safety and convenience in shipping it has long been the practice in all countries to combine chlorine, however produced, with lime. Treatment of this product with acid—even with carbonic acid—releases the full amount of chlorine from bleach. In this form it is primarily in greatest demand by manufacturers of textiles, in bleaching paper, cloth, etc. Minor uses are in some forms of chemical manufacture, disinfection and water treatment.

The latter use in America has been wide and successful, so that hypochlorite of lime has afforded a standard of cheapness and efficiency with which other sterilizing agents were compared. Its general use in water sterilization has raised the standard of purity demanded by water consumers and by sanitarians, for it was the agent which first gave practically perfect elimination of organisms of the colon group at costs which were not prohibitive.

Immediately after war was declared the market stiffened, and bleach rose in price through September, 1914, falling to normal, or nearly so, in the early part of 1915. During the past seven months the stringency has increased. The diversion of large quantities of chlorine to chemical manufacture was one potent factor; one former producer of bleach is now using all his chlorine output in manufacture of chlorinated organic products. Others have diverted at least a large part of their output, and instead of making bleach in large quantities are selling much of their chlorine in liquid form.

Last summer quite a stir was made in the daily press by reports that liquid chlorine was being shipped in large quantities to the seat of war. Statements were given out by three producers that they had not been approached by foreign representatives. However, exports of chlorine have been made from New York in later months; for example, there are reports of shipments valued at $14,526 to France, Mexico, Cuba and Argentine in December, as well as one shipment of 4000 lb. (value $1,000) to France last month. Speculation as to the uses of this exported chlorine is idle. The fact remains that not only in this country is its use in general ways greatly increased, but the world market is drawing upon the available supply of the United States and is thus limiting the production of the older secondary product (bleach), which has held its own for a long time as a convenient form for the shipment of chlorine.

DECLINE IN IMPORTATION OF BLEACH

Dates	Pounds	Valuation, Cents Per Lb.
1912—Jan. to Dec. 31	72,706,732	0.82
1913—Jan. to Oct. 31	52,115,552	0.82
1914—Jan. to Oct. 31	31,172,596	0.96
1915—Jan. to Oct. 31	7,079,076	1.26

For the purpose of comparing prices New York wholesale quotations are used. Prior to 1914 the normal price was about $1.25 per 100 lb. The production in this country was supplemented by importations from England and Germany. In August, 1914, when the German supply was cut off, prices averaged $3 to $3.50, dropping within the next four months to $1.50 or less. This condition prevailed from February to June. Since then there has been a rising tendency which has not yet passed; quotations Jan. 14 were at 15 to 17 cents per pound, and on Jan. 22 13½ to 14½ cents.

FOREIGN SHIPMENTS

For several months the domestic supply has been practically valued by second hands, and for immediate delivery or on forward orders it has been difficult to find sellers. One Western city which last year had a contract for a supply at 1⅞ cents per pound, received as the low bid for 1916 an offer of 9½ cents. An Eastern city recently had an offer at 16½ cents on the year's supply.

Importations slackened in 1914 and have fallen to practically nothing at the present time.

While importation of bleach has not entirely ceased, for shipments are still received at New York from Liverpool, our exports are largely increased. From Dec. 1, 1915, to Jan. 22, 1916, the imports reported at New York aggregate 289,445 lb.; the record of exports to Sweden, Argentine, Brazil and Chile for the first week of this period shows a total of 228,970 lb. The first week of January had a total of 666,965 lb. to France and Sweden, valued at $23,350. In the reports from week to week the weights are not always given; the values appear. The total value given for exported bleach in the seven weeks' period since Dec. 1, 1915, is $51,497.

Reports on foreign market for several weeks past are to the effect that bleaching powder is very scarce in Holland, and nominal in London, and that any business passing in Liverpool is at special terms that are not reported.

Altogether the outlook for cheap hypo during 1916 or during the high tide of chemical production is discouraging. In considering offerings it must be borne in mind that only the chlorine content is of value; that the lime shipped and applied in connection with this chlorine adds no increment of value. If bleach containing 25 per cent of chlorine is purchased at 7 cents per pound, this is equivalent to 28 cents a pound available chlorine; 35 per cent bleach at 9½ cents corresponds to 27.17 cents per pound of available chlorine.

The market résumé for the week ending Jan. 22 is as follows: The general quotation for spot bleach is 14 to 15 cents per pound. Demand has assumed more quiet proportions and occasional sales have been made as low as 13½ cents per pound. Contract shipments are reported heavy, and it is believed that no great amount of stock is offered for immediate shipment.

The condition may be summed up as follows: Imports have practically ceased. Exports are still increasing. Production has been greatly diminished on account of diversion of chlorine to extraordinary uses and the increased demand in chemical manufacture. The output of the limited number of factories in the United States where cheap electric power is available has become utterly inadequate for the world market in which we as minor users of bleach are now buying. There is great difficulty in securing a dependable supply, even at prohibitive cost, of this standard material which has stood between many a small community and an unsafe water supply.

Letters to the Editor

Comment on matters of interest to engineers and contractors will be welcomed

What Is an Engineer?

SIR: Permit me to express my interest in the subject recently mentioned in your bright pages, under the caption "What Is an Engineer?" The questions, or rather set of questions, I understand was given to a great number of engineers, widely spread and of all complexions. And the typical engineer slowly evolved through the strata of innumerable replies is, without doubt, the man we hail to-day as master of the big job. But there seems to be dissatisfaction with "Frankenstein" as he stands before us. The extremely low percentage allowed for technical qualifications, as compared with that for a kind of equipment that would be equally essential in running a first-class grocery business, is not the working equation that has heretofore obtained with those preparing for the profession.

I believe, however, that a straw man, a Frankenstein, indeed, has been erected from the accumulated data, through failure on the part of some persons to co-ordinate the figures of expression. For instance, consider mathematics, and in a psychological sense, the mental faculty which intuitively knows that twice two is four, and moreover feels that the right angle is the main prop of geometrical form and can think in its terms; which also knows how once was found the resultant of two unequal, unlike parallel forces, and can find it again because it is bred in the bone—and now, therefore, has initiative and resourcefulness, which are but structures and superstructures on a foundation laid deep and wide upon a rock bottom; and so on through all the broad domain of technical knowledge; then we have the well-rounded, finely equipped man, the engineer supreme.

The whole matter passes through my mind in dissolving views in which I see engineers, and so-called engineers, of my acquaintance of years. The thing that has thrown a haze over the whole situation and has caused a great deal of misconception is that disease called "push." If it were the right kind of push—the momentum of a moving body, slowly and surely coming to the front, no complaint could be made. But it is another kind, a masquerade. I need say no more. Howbeit, a better day is dawning, and of this I am convinced. In that day true worth will be measured upon a scale of all-round fitness, where integrity, initiative, resourcefulness and many other admirable attributes will be only the outgrowth of a well-trained and technical mind.

P. G. MELBOURNE.

Hyattsville, Md.

Elimination of Wet Spots in Railroad Cuts

SIR: Referring to the discussion between E. L. Sinclair and J. T. Bowser in your journal concerning the methods of eliminating wet spots in railroad cuts (see the Engineering Record of Oct. 23, 1915, page 506, and that of Jan. 15, 1916, page 72), it seems to me that they are both taking more trouble than necessary to overcome the difficulty. The water in railway cuts usually comes from the banks on each side of the track, and the logical place to deal with it is in the side ditches before it gets to the track. If the soil is impervious the water will run off through the side ditches if they are properly graded and kept clear. If the ground is not impervious, then the water will soak down below the ditch and be collected in a drain pipe underneath.

In order to remove what little water gets to the roadbed itself side drains can be run from the ballast to the main drain under the ditch. These should not be separated from the ballast, as the gentlemen suggest, but should connect directly with it so there will be no difficulty about a through connection from the ballast to the main drain. Ground which is properly and adequately drained in this way will soon become hard enough so that the ballast and the subsoil will not churn up together.

There is a possibility that while the drains are ridding the soil of the excess water and trains are running, if the ground is very soft, the drain tile will become so displaced as to fill with mud and cease to operate. The cure for this, however, is not to go to a lot of expense for sheet piling and concrete walls, but simply to use No. 2 bell-and-spigot sewer pipe, placing the lengths together in the usual way, but without any jointing material in the bells. This gives ample opportunity for the water to get into the pipe, once it has reached it; and the bells prevent the pipe from getting out of line and filling with mud.

It seems to me that with the other types of construction suggested there might be many places where the continuous impervious walls would have a tendency to retain water under the track rather than to keep it out, and would make matters worse instead of better. At all events the No. 2 sewer pipe has come to be a standard means of draining wet cuts by some very extensive railway systems.

BENJAMIN BROOKS.

Kansas City, Mo.

Why Is Registration in Civil Engineering Decreasing?

SIR: In the article on the decrease in registration of civil engineering students, published in your issue of Dec. 18, 1915, page 766, the figures given for the Massachusetts Institute of Technology are too low, evidently because plotted from the data in the annual report of the president. These figures refer to the number of students on the first of November of each year. At that period of the year the freshmen have not elected their various courses, so that they are not included. The freshmen do not elect the different courses until the second half of the year, so that it is not practicable to give accurate statistics for the current year. The numbers of students pursuing the course in civil engineering in each of the five years preceding this, beginning with the year 1910-11, were as follows: 267, 276, 264, 263 and 251. You will see from this that the number has been practically stationary within the period.

The falling off in the last year is more apparent than real, because in that year we instituted a new course called "Engineering Administration." In the year 1914-15 eleven students took the civil-engineering option of this course. This civil-engineering option is very closely allied to the older and more regular course of civil engineering, and doubtless these eleven students should be added to the 251, making the total 262 for the year 1914-15.

Within the same period the enrollment of freshmen in civil engineering was as follows: 56, 70, 60, 54 and 60. The enrollment of all engineering students in the latter half of each of the years (the latter half, as I have explained, being the period when the elections have been made) was 1216, 1232, 1260, 1336 and 1386.

Although the number of students in civil engineering has remained practically stationary, there has been a decline in the proportion of engineering students pursuing this particular course. Such a decline might be expected in view of the greater variety of opportunities that are now presented.

RICHARD C. MACLAURIN,
President, Massachusetts Institute of Technology.
Boston.

The Economic Side of Sand Testing

SIR: I was interested in reading H. H. Scofield's criticism in the Engineering Record of Feb. 5, page 188, of Chapman and Johnson's article on the economic side of sand testing, and to note the application there made of Fuller's ideal curve.

As a matter of fact all these gentlemen are in error in attempting to apply Fuller's ideal curve for concrete to any mixture of cement and sand alone. This curve (see the *Transactions* of the American Society of Civil Engineers, Vol. 59, page 67) was only put forward as a suggestion toward the obtaining of greater strength and density in concrete; that is, toward the better proportioning of the cement, fine aggregate and coarse aggregate. No experiments were made on, nor was the curve intended for use with, mixtures of cement and sand alone.

I have lately, however, been carrying on a series of experiments toward developing a curve to fit maximum densities of mortar, and have reached the conclusion that the same general form of ideal curve is applicable as to concrete with the exception of a change of constants for the values of a and b, depending on the proportion of cement in the mortar, the constant increasing materially as the percentage of cement increases.

My experiments indicate that for a sand having maximum grains of 0.25 in. diameter, and a mortar of 31 per cent cement as used in Professor Scofield's experiments, the value of a in the ideal curve should be 0.0379, and of b 32.2, which is, as nearly as I can judge from the small-scale diagram, about the value which Professor Scofield adopted.

It has thus accidentally happened that the coefficients adopted applied to the mixture used, but I wished to call attention to this fact so that the ideal curve for concrete will not be assumed to apply at all times to mortars without a careful selection of constants.

I cannot resist calling attention most forcibly to the great improvement of strength by grading sands to approximate an ideal curve, as shown by these tests of Professor Scofield. Assuming that mortar from the quoted sand "B" gave perfectly acceptable strength in the completed work, the relation of strengths shown make it possible to have cut out 25 per cent of the cement in use with the blended sands and still obtain the same strength as would have been obtained with the sand "B."

Assuming the case cited by Messrs. Chapman and Johnson, the amount of cement thus saved would approximate 23,600 bbl., which, at say $1.50 per barrel for cement in a Western state, would amount to $35,400, a total saving on the cement and sand of $57,680, or nearly $1 per cubic yard of concrete.

Where large masses of concrete are to be used, as in masonry dams, attention to grading not only produces stronger and more watertight concrete, but also pays a handsome interest on the investment of the trifling extra labor involved.

W. B. FULLER,
Consulting Civil Engineer.
New York City.

Writing Land Descriptions

SIR: Lawmakers have devoted much time to regulating the practice of engineers, architects and surveyors, but no attention seems to have been given to the important function of writing descriptions for the transfer of real property. A surveyor may possess enough licenses to paper his office walls, and be a paragon of perfection in his line of work, but as long as he has to deal with faulty descriptions, just that long will his condition be retarded in its upward trend toward the ideal.

In this state any one may write a description, take it to the county recorder and have it put on record in the form of a deed; thus it stands, whether right or wrong, as the grantee's protection against encroachment. This laxity has resulted in many cloudy titles, useless litigation and much hard unappreciated work for the surveyor. In many transfers there can be no doubt that the intention was honest, but the ability to state clearly what was intended was entirely lacking. On the other hand, the intent to defraud is quite evident in some cases, the opportunity to do so being made possible by the ability to draw a deed with an ambiguous description.

R. W. Cautley in his "Descriptions of Land" says in Section 1: "Since the ownership of land is the most universal and, at the same time, the most permanent form of property, it follows that conveyancing of land constitutes the most common and important class of transactions in the everyday business of the world."

In view of the importance of this class of work, it seems to me that appropriate restrictions placed upon indiscriminate description writing would correct this evil. If, for instance, before a deed be accepted for record the description be examined by a licensed surveyor or other person qualified to test its accuracy, and if found to be incorrect, rejected, future records will be better than those of to-day. If the courses given were obtained astronomically—not from needle courses with the variation set off—the same line would not be given two or more bearings, as is quite often the case with division lines where adjoining property has been described separately. If the description be based on actual survey, the survey executed by a responsible party, and well monumented, the uncertainty of identifying the property described would be eliminated.

To be able to write descriptions one should have some knowledge of plane trigonometry, be familiar with the kinds of trees and objects used for ties, be able to state in a clear, concise manner the meanings intended, and have a fair knowledge of the law of conveyancing. I should like to see the above qualifications in our law books.

L. L. MILLS,
Licensed Surveyor.
Santa Rosa, Cal.

HINTS FOR THE CONTRACTOR

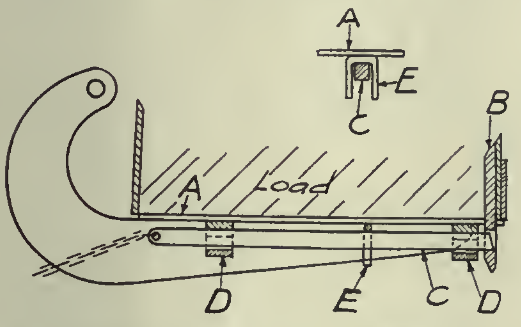
Details Which Save Time and Labor on Construction Work

Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

[Contributions to this section are solicited, and if found available will be paid for. They must be SHORT, *and should be accompanied, if possible, by photographs or sketches.*—EDITOR.]

Roller Makes Dipper-Latch on Steam Shovel Work Easily

A BENT piece of round iron placed between the latch bar and the door of a steam shovel dipper makes it easy to draw the latch and stops it from sticking, according to F. A. Crabb, of Vandalia, N. Y. The device, which was described in the January number of the *Excavating Engineer*, is illustrated by the accompanying sketch, in which A represents the dipper door, B the latch bar keeper, C the latch bar, D the guides, or brackets, and E the roller. It will be seen from the sketch that the weight of the load on the dipper door bears upon the underside of the latch keeper, upon the upper side of the outside bracket and the upper side of the inside bracket. A very simple and inexpensive way to prevent the latch bar from sticking is to take a piece of round iron either ¾ in. or ⅞ in. in diameter, whichever fits best, bend it to a three-sided piece as shown by *E* on the top sketch, and slip this in between the latch bar guides as shown in the lower sketch. It will be seen that this piece of round iron acts as a roller. Mr. Crabb says that it makes the dipper dump much more easily.



ROLLER REDUCES FRICTION ON DIPPER LATCH

Types of Dredging Equipment Best Adapted to Land Drainage

POWER MACHINERY is now available which will construct outlet drainage ditches of all sizes, and under all conditions of soil and water, more cheaply than can be accomplished by any other method, according to D. L. Yarnell, drainage engineer of the Office of Public Roads and Rural Engineering. In a special bulletin issued recently by the Department of Agriculture, the uses and limitations of the different machines that have been employed in such work are summarized by Mr. Yarnell, whose conclusions follow.

The floating dipper dredge is more widely used in drainage work than is any other type of excavating machine. For work through wet land no other excavator will equal it in cheapness of construction of ditches having a cross-section of from 100 sq. ft. to 1200 sq. ft. It is by far the most efficient machine to use where many stumps will be encountered. Owing to its limited reach it is not generally applicable to levee construction. Dipper dredges as constructed for drainage work range in capacity from ½ cu. yd. to 4 or 5 cu. yd. The sizes most commonly used vary from 1 to 2 cu. yd. The smallest dredge costs about $5,000; the cost increases rapidly with the capacity of the dipper. The floating dipper dredge should be operated downstream, where practicable, to insure sufficient water at all times.

In general, the clamshell or orange-peel dredge is not well adapted to ditch construction, especially if there be stumps to handle. Certain types of soil, such as the muck of southern Louisiana, can, however, be handled to advantage with this machine. It is also suited to levee building when a long boom is used.

The dragline scraper excavator is constantly increasing in favor for drainage work. It is especially suited to the construction of ditches and levees of large cross-section, where the ground is sufficiently stable to support the machine. The scraper excavator is also suitable for ditch cleaning.

The various forms of so-called dry-land machines find quite extensive use in drainage. The dipper and orange-peel dredges of the dry-land type are suitable for use where sufficient water cannot be had to float a dredge. The templet and the wheel types of excavators are applicable to open land, where the soil is neither too hard nor too wet. The ditches cut by these latter machines are superior in hydraulic efficiency to those of similar section cut by any other type of excavator. The dry-land machines should be operated upstream.

The hydraulic dredge is not suited to ordinary drainage ditch construction. It has been used to some extent in cleaning ditches, and, with the use of slope boards, has in at least one instance made a satisfactory record in levee construction.

Wheeled Mixing Plant and Travelers Build Sewer Rapidly

By E. NOVAK
Cincinnati, Ohio

FOUR traveler derricks and a concrete plant on wheels, all spanning the sewer trench and running on the same track, were used recently to complete a large concrete sewer in Cincinnati at a rapid rate. The sewer, which will intercept the sanitary flow previously carried by Mill Creek, is 6600 ft. long and has an egg-shaped section 6 x 6 ft. except for a distance of 200 ft. where it crosses the creek, and where a twin section is employed. The bottom of the sewer trench was 10 ft. or more below the creek and only 10 to 50 ft. from it, and in addition the work was but 250 ft. from and nearly 50 ft. below the Miami and Erie Canal. For this reason special care was taken to have the wood sheeting tight. It was driven in two sets, and averaged 18 ft. in depth. For the same reason plenty of clearance was provided for by making the top set 12 ft. wide and the bottom set 10 ft. wide, giving 18 in. on each side of the sewer.

On account of the proximity of the work to the creek some trouble was experienced with keeping the trench dry, and the work was flooded no less than five times. In spite of this, however, no damage was done and no serious accidents occurred. Three small centrifugal pumps and two pulsometers were used.

The plant was arranged so that each unit had to do a certain amount of work each day. Nevertheless the units were spaced so that any accident to one would not result in holding up the rest. One traveler derrick with a 1-yd. clamshell bucket on a 50-ft. boom, facing the direction in which the work was progressing, took out the first 10 ft. of excavation as the upper set of sheeting, with two sets of braces and rangers, was placed. Back to back with this traveler was a second which took out about 5 ft. more, while the lower set of sheeting

TRAVELING DERRICKS AND MIXER COMPLETED SEWER AT RATE OF 60 FEET A DAY was being placed. Following this was a third derrick facing the same way as the second, which finished the excavation and left the trench ready for the concrete work. Behind this came the mixer, which discharged through a hopper in the platform on which it was mounted into chutes leading to the forms. Owing to the irregularity of the water supply, the mixer carried its own water in barrels mounted on the platform. Two days were required between pouring the invert and the arch, and the mixer was pulled back and forth by a line to a winch head of the nearest derrick. The work was drained to a pump and a portable boiler stationed behind the mixer. The sumps for this pump were spaced about 300 ft. apart and water was carried to them from the excavation ahead by an 8-in. underdrain. The fourth traveler followed the concrete mixer, removing the bracing and backfilling the trench.

As the arch forms had to be left in place three days after pouring concrete, 240 lin. ft. of them were supplied. Steel forms of Blaw design were used. They were without interior bracing and ran on a track laid on the completed invert. The concreting was the limiting factor in the speed of the work. It was found advantageous to pour 120 ft. of invert one day and 120 ft. of arch the next, always keeping one completed invert section between the new arch and the advance section of invert. While this made it necessary to keep open a large amount of trench it allowed rapid construction at a reasonable cost. The maximum amount of sewer completed in any one week was 420 ft., but the open trench part of the work was carried on at a rate which nearly averaged 60 ft. for every full working day.

The railroad siding at which materials for the job were delivered was on the other side of the creek from the work. A 2-ft.-gage track was built from this siding, carried across the creek on an I-beam bridge supported by small concrete piers, and extended to and along the line of the trench for delivering materials to the concrete mixer. A locomotive was used to haul the small cars. Material cars were unloaded at the siding onto a platform over the narrow-gage track, from which the small cars were charged by gravity. In both the sand and gravel piles was built a brick furnace fired with coke, from which large pipes radiated. The sand and gravel were heated without trouble in this way, so that the work was never held up by cold weather. A portable telephone line was carried along the work, keeping it in touch at all times with the yard and the office.

TOWER DID WORK OF DERRICK IN DISPOSING OF TUNNEL EXCAVATION

TRAVELERS AND MIXER SPANNED TRENCH—NARROW GAGE TRACK AT RIGHT

A short tunnel 120 ft. in length was built at one point under the track of the Baltimore & Ohio Railroad. The excavation from this tunnel was disposed of by hoisting it in a tower and dumping it down a wooden chute from the head of the tower to the creek. The skip in the tower dropped below the floor of the excavation and was operated by a 10-hp. electric motor. The tower was built in place out of second-hand lumber, required only a laborer to run it, and did the work of a derrick and hoisting engineer.

The work was done by the Thurber & Browning Company for the city of Cincinnati, of which Frank S. Krug is city engineer and Walter E. Sullivan sewer engineer. C. L. Harrison was engineer in charge of the work for the city. The plant layout was designed by H. Thurber, of the contracting firm, who gave the work his personal attention. N. E. Morrow was in charge of the work as superintendent for the contractor.

Working Air Out of Pipe Line Tested in Long Sections

By R. C. HARDMAN
Colorado Springs, Col.

BY USING a hand force pump to raise the test pressure to the required 250 lb. where necessary, loosening the high joints to permit the escape of air, and providing heavy end bracing and clamps to take the thrust of $\frac{1}{2}$-mile sections under test pressure, an 8-in. steel pipe line about $8\frac{1}{2}$ miles long was quite recently tested satisfactorily.

The specifications provided for testing the line to a pressure of 250 lb. per square inch before backfilling the trench. Part of the line received normally more than this pressure when the discharge end of the line was closed, but, as no valve was provided at the reservoir, static pressure could not be obtained in operation. Where the pressure exceeded the required amount the pipe was simply capped and the line examined. Where the pressure was less than 250 lb. it was raised to that figure.

The tests were made about every half mile immediately upon the completion of that amount of pipe-laying. A small hand-operated boiler testing pump was used for the purpose, although some doubt was had as to whether it would be feasible for increasing the pressure in such a long length of line—about $2\frac{1}{2}$ miles being the longest section tested. In preparing for the test a cast-iron cap fitted to the end of the pipe and tapped to receive the discharge of the test pump was securely fastened to the last section of pipe. This was accomplished by means of a steel bar over the casting, through which bolts were passed, the bolts in turn being fastened at their opposite ends to a steel clamp which bolted around the pipe. Water-tightness was secured by means of a rubber gasket between casting and pipe end. As the pressure tending to force the casting off the pipe and to disjoint the line was about 12,500 lb., a system of timber bracing was employed. At the first test, which was at a creek crossing, the pipe was braced against the opposite bank so effectively that the line was buckled completely out of the trench, the last joint being broken.

As the line followed the contour of the ground there were many high points in which air collected. The procedure in making the tests was to cap and brace the lower end, loosen all high joints to allow escape of all air and close the valve in line at the intake. Water was then hauled in barrels for the operation of the pump. The time consumed in reaching the desired pressure was not uniform throughout the series, varying from two to six or seven hours for four laborers working in $\frac{1}{2}$-hr. shifts of two men each. The variation in time was due to the amount of additional pressure necessary and to the care with which the accumulated air had been released. At times when it was thought that the air had been carefully attended to no headway would be made by the pump, a more careful inspection always revealing the fact that some air still remained in the line. In fact, to increase pressure in this way it is absolutely essential that all air be removed.

PUBLIC-UTILITY-COMMISSION COSTS IN INDIANA were given as $1\frac{1}{2}$ per cent of the cost of reproduction new by H. O. Garman, chief engineer of the Indiana commission, before the joint meeting, Feb. 4, of the Indiana Engineering Society and the Indiana Sanitary and Water Supply Association. They were made up as follows: The combined cost of the appraisals, audits and hearings amounts approximately to 1 per cent by the utility, $\frac{1}{4}$ per cent expended by the commission and charged against the utility, and $\frac{1}{4}$ per cent expended by the city. Since May, 1913, the commission staff has evaluated fifty-one public utilities having a total physical value of approximately $33,300,000.

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

Court of Appeals Upholds Thacher Patent in Baltimore Case

Deciding for the Thacher concrete bridge patent, in the appeal from the decision in its favor made by the Maryland District Court on Feb. 25, 1915, the U. S. Circuit Court of Appeals for the fourth circuit on Feb. 2 affirmed the decree of the lower court "on the reasoning in the opinion of that court." The original suit was brought by Edwin Thacher against the City of Baltimore for infringement of his patent in the construction of the Fallsway viaduct.

The original decree, which is affirmed by Judges Pritchard, Knapp and Woods of the Court of Appeals, stated that claims one and three of Thacher's patent 617,615, granted Jan. 10, 1899, for reinforced-concrete arch construction, are valid and original, that the defendant, the Mayor and City Council of Baltimore, violated and infringed the rights of the plaintiff in the Fallsway viaduct, that an injunction issue perpetually restraining the defendant from further infringement, and that the plaintiff is entitled to $5,000 damages, with costs.

The opinion of Judge Rose, upon which the decree is based, upholds the priority of the fundamental claim in Thacher's patent for an improved concrete arch structure in which iron or steel bars are imbedded in the concrete near the outer and inner surfaces in pairs, each independent of the other and one or both extending well into the abutments. Evidence of royalties already paid for licenses to build according to the patent was cited. Some previous patents, such as the Monier and the Von Emperger, were discussed, and held not to show priority in the details of the Thacher patent.

Discuss Proposed American Society Move at Regular Meeting

No opposition whatever was voiced to the proposed move of the American Society of Civil Engineers to the Engineering Societies' Building, when the matter was put up for discussion at the regular meeting of the society in New York Feb. 16. The four men who spoke—Clemens Herschel, chairman of the committee that handled the negotiations for the society; Dr. Alexander C. Humphreys, of the United Engineering Society, as well as a member of the American Society of Civil Engineers; Dr. E. L. Corthell, president of the civil engineering body, and Henry G. Stott, past president of the American Institute of Electrical Engineers, and a former director of the American Society of Civil Engineers—were all emphatically in favor of the proposed move. Their keynote seemed to be solidarity of the whole engineering profession in public questions.

Materials Standards to Be Published in Foreign Languages

The executive committee of the American Society for Testing Materials has made arrangements with the Department of Commerce by which the standards of the society, insofar as they affect the requirements of export trade, will be translated into foreign languages. The department will bear the expense and the translated standards will be distributed among the U. S. Consular Offices and made available at moderate prices to American manufacturers interested in foreign trade. It is planned that each specification in a foreign language will be accompanied by the original English version and that all numerical quantities will be both British and metric.

Government to Make Soil Pressure Tests at Arlington

Experiments on the distribution of pressures through soils are to be conducted at the government's Arlington farm, near Washington, by the U. S. Office of Public Roads and Rural Engineering. A specially designed apparatus will be installed which will permit of earth pressure measurements being taken in a large number of positions during a single application of the load. This feature is regarded as an important one, and it is hoped that an unnatural rearrangement of the soil from previous load applications in various positions will be thus avoided. Earth fills up to 10 ft. thick may be accommodated by this apparatus, and it will have lateral dimensions sufficiently large to permit of obtaining the full distribution of the load in all directions.

Bone Sues City of Cincinnati

Ewald & Shadman, attorneys, in behalf of Frank A. Bone, have lodged a claim against the City of Cincinnati for the usual royalties of 10 per cent of cost for alleged violation of the Bone patent in the construction of the retaining walls in its grade crossing work. The claim refers to sums previously collected from the Chicago, Burlington & Quincy Railroad, the City of Binghamton, and others, and addresses a number of queries to the grade-crossing commission. An article and editorial discussion on the recent decision against the Bone patent will be found in this issue of the Engineering Record.

May Submit $50,000,000 Highway Bond Issue in Pennsylvania in 1917

In a recent address before the Harrisburg Chamber of Commerce, State Highway Commissioner Cunningham announced that a $50,000,000 bond issue for highway improvement will likely be submitted to the voters of Pennsylvania in 1917. The highway commissioner declared that the greatest need in Pennsylvania is a definite system whereby stretches of good roads can be made continuous from one end of the state to the other.

Ohio Will Need Highway Inspectors

A large number of highway inspectors will be needed in Ohio for road work during the coming season. With a view to obtaining men to fill the vacancies the State Civil Service Commission, Columbus, will hold examinations within the next week or two.

Sixteen Hundred Engineers Hear First Military Lecture Under Army Supervision

Captains Robins and Coiner Explain Organization and Duties of Engineers in War and Opportunities for Technical Men in National Defense

LIMITED in numbers only by the capacity of the main auditorium of the Engineering Societies Building and a second hall, pressed into service for an overflow meeting, 1600 engineers of New York City listened on Monday evening to the first of the series of seven lectures on military engineering and national defense, organized under General Leonard Wood's direction by the national societies of civil, mechanical, mining and electrical engineers. While Captains Thomas M. Robins and Richard T. Coiner, Corps of Engineers, U. S. A., were explaining to two enthusiastic audiences the organization and duties of engineers in war, and what engineers in civil life will be called upon to do in the defense of the United States, the representatives of the New York Fire Department, following orders regarding dangerous over-crowding of buildings, stood guard at the doorways and turned away hundreds of technical men who sought entrance to the packed lecture halls.

"This wonderful spontaneous response," said J. Waldo Smith, chairman of the meeting, "has far exceeded our wildest dreams. Where this interest will lead we cannot tell. But, speaking as chairman of the committee, if it leads or tends to bring about some compulsory requirement, whereby every able-bodied young man is required to put in at least one continuous year of hard military service under the direction of the United States Army, we feel it will be a great thing for the country, and it will be a far greater thing for the young men."

Engineers Must Be Soldiers

In beginning his address, Captain Robins emphasized the fact that warfare, as it is conducted to-day, is making greater demands upon engineering skill than ever before. But engineering work, he said, is only one of the manifold duties of engineer troops. They must be soldiers, first of all, and must know how to fight. Upon a foundation of military knowledge must be built up the training in the services of reconnaissance, demolitions, fortifications, sieges, battlefield illumination, communication, lay-out of camp, sewerage and water supply systems, general construction work and special services of an engineering nature which are beyond the technical training of combatant troops, or which require tools, implements and material, which are not issued to the combatant forces.

The engineer's work in war is not all at the front. Of course, the pioneer and ponton battalions operate in the fighting zone, but other engineer forces must be assigned to lines of communication, to the preparation of defensive lines, to sea coast fortification and in the interior of the country at manufacturing and munition works.

In European armies that are fighting to-day, Captain Robins pointed out, it is considered that about 6 per cent should be the ratio of engineers to infantry. If it is assumed that this country needs 500,000 men in the first line troops, there will be needed for their support about 1200 engineer officers and 36,000 engineering enlisted men.

Speedy Work Necessary

In military engineering time is the all-important factor. Labor is plentiful and costs nothing. "For material to work with," Captain Robins said, "you have everything that you do not want, and nothing that you do want. But you have this one great advantage—you can take whatever you want, wherever you find it, and use it, no matter what shape it is in. You do not have to worry about paying damages. If you need timber and a house is nearby you tear down the house and use it."

Captain Robins laid particular stress upon the necessity of supplementing engineering knowledge with actual military service. "The only way to get military training is by actual service," he said, "combined with study and reading on the subject. You can study and read and profit by it, to a certain extent, but you cannot expect to qualify for service, unless you have been in camp, or performed actual field duty. You men ought to know that most of the work, at first, will have to be straight military training, as it is taught in the Army. Every man must learn by actual experience the duties of a soldier. Then we can concentrate on the engineering phases of the work, and round out the course of instruction in its technical features."

An idea of the many things an engineer is called upon to do in service was portrayed by a series of lantern slides, showing various stages of a practice march undertaken by a force of Regulars. The bulk of the work consisted in spanning rivers with ponton bridges, opening up roads, laying out camps and preparing defensive works such as trenches, and barbed wire entanglements. Motor trucks were used effectively in transporting the bridge building equipment. Most of the ponton structures which were shown were completed a couple of hours after work on them had been begun. Another feature of the practice march was the demolition of a steel bridge with dummy cartridges.

Field for Older Men

All of the engineer's work, however, is not with the advance troops. Important service is rendered on lines of communication, such as railways, and roads. The line of communication, Captain Robins pointed out, is a field open to the older men of the profession, whose physical strength is not equal to the strenuous duties at the front, and who have not time to receive intensive military training by going to summer camps or joining organizations like the National Guard. The senior members of the profession also could be used to good advantage on the defensive lines, at munitions plants, and in the coast artillery service. These duties, together with the making of military maps and the laying out of trenches, will require a large force of engineers. This service, in the rear of the combatant troops, will not be strenuous work, but will require a good knowledge of field fortification in all its branches, not only the construction of trenches, but the preparation of the foreground, the clearing away of trees, the construction of entanglements, the placing of searchlights, and field ordnance emplacements.

"If the troops in the field are not backed up by all the resources of the country," said Captain Robins, "they will not get far, and there is nobody that will have any more to do with the development and utilization of their resources than the engineers. There will be many manufacturing plants making munitions and other supplies; thousands of engineers may be called into service to look after these plants, and to inspect materials. If the time ever comes there will be plenty for every member of the engineering profession, old or young, to do. It is only organized and united effort that will count."

Ohio Act Relating to Continuous Service Held Unconstitutional

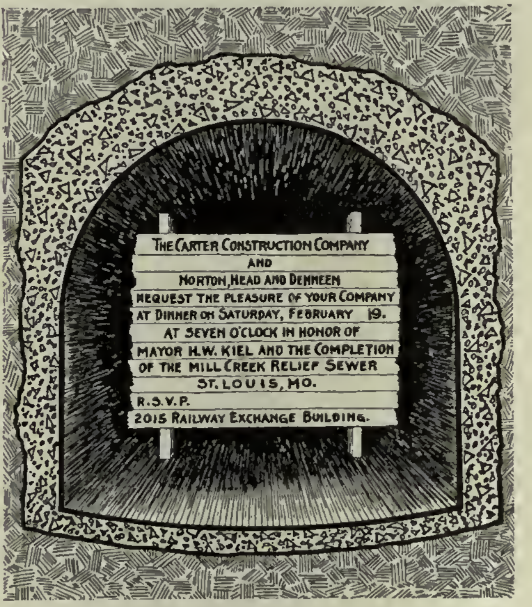
In the case of Henry M. Redd, who claimed the office of city engineer of Chillicothe, Ohio, under the clause of the state civil service act that reads "that all persons who have served the state or any political subdivision thereof continuously and satisfactorily for a period of not less than seven years . . . . shall be deemed appointees, within the provisions of this act." Judge J. W. Goldsberry, of the Court of Common Pleas, sitting at Chillicothe, held that the act was unconstitutional.

Mr. Redd had been acting city engineer of Chillicothe for twenty-one years. At the beginning of the present year the mayor appointed Morgan W. Shuitt to the office. Mr. Redd appealed to the court for aid, holding that he was entitled to the office of city engineer by reason of the clause of the civil service act, as quoted above.

Hold Dinner in Mill Creek Sewer to Commemorate Completion

The Carter Construction Company and Norton, Head & Denneen will be the hosts at a dinner to be held this evening in St. Louis, in honor of Mayor Kiel, of that city, and the completion of the 38-mile Mill Creek relief sewer, which drains 5030 acres of land. The notice to begin work was given Oct. 23, 1914, 24 months being allowed for completion. The actual time taken was 16 months.

The dinner will be prepared and served 100 ft. underground at Montrose Avenue and Rutger Street, and will be the chief feature of novel ceremonies that have been arranged for the celebration of the completion of the new sewer. The sewer will be formally turned over to that city by R. T. Norton, chief engineer for the Carter Construction Company, the general contractors, at the banquet, and will be accepted on behalf of the city by Mayor Kiel. A part of the section of the sewer, walled in for the banqut, will be outfitted as a kitchen and the dinner will be prepared there.


THE CARTER CONSTRUCTION COMPANY
AND
NORTON, HEAD AND DENNEEN
REQUEST THE PLEASURE OF YOUR COMPANY
AT DINNER ON SATURDAY, FEBRUARY 19.
AT SEVEN O'CLOCK IN HONOR OF
MAYOR H.W. KIEL AND THE COMPLETION
OF THE MILL CREEK RELIEF SEWER
ST. LOUIS, MO.
R.S.V.P.
2015 RAILWAY EXCHANGE BUILDING.

INVITATION TO DINNER IN COMPLETED SEWER

Preparedness Discussed at Boston Engineering Banquet

The part to be played by the engineer in national defence was the principal theme of discussion at the seventh annual banquet of the engineering profession, held at the Boston City Club, Feb. 8. Charles L. Edgar, president of the Boston Edison Company, was toastmaster, and nearly 500 engineers were present, including delegations from Providence, R. I., and Worcester and Lynn, Mass. Governor McCall, of Massachusetts, pointed out the opportunity for expanding engineering along social and economic lines, with particular reference to reducing waste in government. He touched upon the overlapping of functions among the 107 different departments and commissions of the state and said that there is a wide field for engineers in increasing the efficiency of governmental administration.

Col. W. E. Craighill, Corps of Engineers, U. S. A., spoke of the advantages of the proposed reserve corps of engineers in national defence. He stated that the general staff has prepared plans for the defence of Boston in case of hostilities, and that would require 100 miles of outer and 80 miles of inner trenches, to be built within ten days, which would require 25,000 men, and the expenditure of $2,000,000. William Barclay Parsons, chairman of the joint engineering societies committee on preparedness, described the plans leading toward the formation of the national engineer reserve, and John R. Freeman, of the government commission on the recent slides in the Panama Canal, commended universal military training, and urged at least one year of it for every young man in the country as a part of his education. Mr. Freeman stated that navigation through the Panama Canal will soon be resumed, and apprehended no further trouble from slides. Other speakers were Calvin W. Rice, secretary American Society of Mechanical Engineers, and Dr. John A. Brashear, Pittsburgh.

Military Lectures Enlarged to Meet Applications for Enrollment

So many engineers have enrolled for the military lecture course, organized under Gen. Leonard Wood's direction by the four national engineering societies, that it has been found impossible to care for them all in the auditorium of the Engineering Societies Building in New York, as originally planned. The committee accordingly has completed plans for three lecture courses, all covering the same ground and to be given by the same speakers as originally announced, Captains Thomas M. Robins, Richard T. Coiner and Edward D. Ardery of the Corps of Engineers, U. S. A. The following schedule will take effect immediately:

Course 1—Every Monday, 8 p. m., to March 27 in the Engineering Societies Building; orange tickets (blue tickets for stage).

Course 2—Every Monday, 8 p. m., to March 27 in American Society of Civil Engineers Building, 220 West Fifty-seventh Street; pink ticket (these tickets read 29 West Thirty-ninth Street, but a change was necessary to secure a larger hall).

Course 3—Every Monday, 5.30 p. m., to April 3 in the Engineering Societies Building (white tickets).

Captain Dorey, U. S. A., will speak next week at each of the meetings. He will tell of the camp at Plattsburg, N. Y., of which he was in charge.

Many Attend Concrete and Road Building Conventions in Chicago

Attendance at the National Conference on Concrete Road Building in Chicago Feb. 15 to 18 passed previous records, reaching 530 on Wednesday. Engineers from the Pacific Coast, supervisors from counties with million-dollar bond issues, federal, state and municipal road officials and contractors taxed the presiding officer's parliamentary ability in their eagerness to take part in the numerous discussions.

Major Amos A. Fries' paper on permanent highways for national defense brought the latent feelings of engineers and their co-workers to the surface in no uncertain manner.

Meetings of the American Concrete Institute were well attended, 350 registering. Nathan C. Johnson's moving pictures of concrete mixing conditions crowded the hall to capacity. The officers elected by the institute are: L. C. Wason, president; H. C. Turner, vice-president; Charles R. Gow, E. D. Boyer, and J. G. Treanor, directors.

The office of the institute is to be removed to Boston and the journal is to be discontinued.

Appraisers Appointed for Chattanooga Waterworks

A board of appraisers was appointed Feb. 9 to investigate the purchase of the plant of the city water company of Chattanooga, Tenn., for which Chattanooga has authorized a bond issue of $2,000,000. James N. Hazlehurst, consulting municipal engineer, of Atlanta, Ga., will represent the city of Chattanooga, and William Wheeler, consulting engineer, of Boston, will represent the water company. John W. Alvord, consulting engineer, of Chicago, will be the third member of the board.

The property was offered for sale several years ago, when it was valued by the company at $1,700,000.

Engineers Begin Study of Chicago's Traction Problem

William Barclay Parsons, consulting engineer, of New York City, and Robert Ridgway, engineer of subway construction for the New York State Public Service Commission, First District, whose appointment to the traction commission to investigate the Chicago transportation problem and recommend improvements was noted in these columns last week, commenced their study, Feb. 14, in conjunction with Bion J. Arnold. Both Mr. Parsons and Mr. Ridgway have had wide experience in traction matters, and have been closely identified with the transportation development of New York City for many years.

William Barclay Parsons

William Barclay Parsons was born in New York City in 1859, and graduated from Columbia University in 1879. His first work was in the maintenance-of-way department of the Erie Railroad, where he attained the position of division engineer previous to his resignation in 1885. He then began a general engineering practice, engaging chiefly in the preparation of plans for underground railroads projected in New York, and in railroad and hydraulic work in different parts of the United States.

In 1891 he was appointed deputy chief engineer of the New York Rapid Transit Commission, and, in 1894, became chief engineer of the reorganized commission. In the latter capacity he prepared plans for the original New York subway, but, owing to complications in financing the work, construction was postponed. In 1898 he went to China, where he made surveys for the location of the Canton-Hankow Railroad, up to that time the longest survey made in that country. In 1899 he returned to New York City and assumed charge of the construction of the subway, continuing as chief engineer of the Rapid Transit Commission until the work was completed and opened to traffic in 1904.

Civil Engineers, Closely Identified with the New York City Rapid Transit Developments, Investigate Chicago's Transportation Problem

WILLIAM BARCLAY PARSONS

ROBERT RIDGWAY

During his incumbency as chief engineer such matters as the franchise providing for the construction of the Hudson & Manhattan tunnels, the Pennsylvania tunnels and terminals and the construction of the New York Connecting Railway were referred to the commission for approval. In 1903 he rendered a report on additional routes for the Manhattan traction lines and lines in the Bronx, as well as additional routes for Brooklyn and Queens, New York City, that was the basis of the comprehensive scheme of subway and elevated railroad extensions contracted for in 1913, and known as the dual system of subways now under construction. In 1902 he designed a large dam for the Hudson River Water Power Company at Spiers Falls, N. Y., and, in 1904, he served with Sir John Wolfe Barry and Sir Benjamin Baker as advisory engineers to the Royal Commission on London traffic. During the same year he was appointed by President Roosevelt a member of the Isthmian Canal Commission. In 1905 he was appointed a member of the International Advisory Board of Consulting Engineers for the Panama Canal. It was this board which decided between the different types, and adopted the plans upon which the canal was built.

He has served as consulting engineer for the Interborough Rapid Transit Company of New York City, the Hudson Companies, builders of the Hudson & Manhattan tubes, the New York, Westchester & Boston Railroad and the Susquehanna Water Power Company among other clients. At present, as consulting engineer, he represents the Interborough Rapid Transit Company in negotiations between that company and the Public Service Commission, First District. As chief engineer he had charge of the construction of the Cape Cod ship canal, which was recently completed. During the Spanish-American War he served as chief engineer of the National Guard of New York with the rank of Brigadier General.

Recently he directed the preparation of an elaborate report, just completed, on the consolidation of the public utilities, including street railroads, electric lighting, telephone and gas systems of one of the largest cities in South America.

Robert Ridgway

Robert Ridgway was born in New York City in 1862. He began engineering work in 1882 on the staff of the Northern Pacific Railroad, where he remained until 1884. In the latter year he became leveler with the Aqueduct Commission of New York City, which was created to construct new aqueducts and additional reservoirs in the Croton watershed. He attained the grade of division engineer in charge of the construction of the Jerome Park Reservoir previous to leaving that service, in 1900, to become senior assistant engineer on the construction of the present interborough subway system in New York City. In 1905 he resigned from that position to join the Board of Water Supply of New York City, on the construction of the Catskill Aqueduct, where he remained until the latter part of 1911, when he was appointed engineer of subway construction on the new dual system of subways in New York City, in which capacity he has charge of all construction work, under the chief engineer on that system.

Subsurface Land Slip Causes Building Collapse at Baltimore

A subsurface earth movement, Feb. 2, in connection with nearby dredging brought about the settlement of a large area of ground and the collapse of a stock shed of the American Agricultural Chemical Company in the Canton pier district, Baltimore. Dredging was in progress at the time in preparation for the erection of a new coal pier for the Pennsylvania Railroad.

The stock shed faces on Clinton Street, and runs back about 300 ft. to a bulkhead near the pier head line of the harbor. It is one of a group of light timber sheds, consisting of a series of open bays with about 30 ft. between rows of timber columns, which rest on concrete pedestals. The shed floor is paved with a bituminous concrete.

The level of the shed floor was about 11 ft. above mean tide. On the side where the settlement occurred, there was originally a plot of open land, several hundred feet wide, and extending from the bulkhead to the street; that is, covering the inshore end of the new coal pier site. The specifications required that the site be excavated to a 35-ft. depth in the slip at the side of the pier, it being planned to leave the excavated bank on a slope of about 1½ to 1 without bulkheading, since adjacent cuts in the local strata of sandy clay, hard sand and iron ore stood almost vertically, and other slopes within 500 ft. had stood up for years. The shoulder of the slope was fixed about 15 ft. outside the line of the chemical stock shed, which brought its toe about 75 ft. away.

The dredges had been working in the pier slip prior to the settlement, principally beyond the toe of the slope, but, shortly beforehand, one of them had been trimming the slope at a depth of about 16 ft. About three or four weeks before the collapse of the building a crack was noticed in the floor of the shed. No special significance was attached to this, since it was from 30 to 60 ft. back from the shoulder line of the dredging, and nearly 300 ft. from the harbor bulkhead. The crack widened somewhat as the work progressed, and some settlement occurred. Several shed columns were shimmed up, but it was taken to be only a small local settlement which could be adjusted after the dredging was completed.

On Feb. 2 an area of the shed floor, 60 ft. wide by about 200 ft. long, dropped to a maximum depth of 8 ft., taking the building with it. The greatest depth was on a sheer perpendicular cleavage along the line most remote from the water. The slope was thence upward to the original ground level near the outer line of the shed. A tongue of land at the original level, tapering from 15 ft. wide at its inshore end to nothing at its outshore end, remained undisturbed between the sunken area and the pier site, leaving the shoulder of the excavation practically intact except for a distance of about 50 ft. from the harbor bulkhead, where it had also sunk under water. The sunken area was thus landlocked for a distance of 150 ft. There was apparently a movement from beneath the area of the shed diagonally out toward the harbor. It is thought this was due to the gradual bleeding of a large pocket of sand, though most of the material taken out by the dredges had been noted to be clayey, with no undue amount of loose sand.

The situation will be met by driving sheet piling along the inland line of the break to check any further tendency toward movement, then bulkheading the slip after dredging, and finally filling back of the bulkhead.

News of Engineering Societies

The Chicago Engineers' Club was addressed Feb. 17 by E. J. Mehren, editor of the Engineering Record, on "Closer co-operation between national engineering societies."

The Albany Society of Civil Engineers will hear Major Edward P. O'Hearn, Ordnance Department, U. S. A., on "Modern Guns and Ammunition," at a meeting to be held at Keeler's Maiden Lane Hotel, that city, Feb. 22.

The American Institute of Consulting Engineers elected the following officers at a meeting held in New York City, Feb. 2: President, Dr. Elmer L. Corthell; vice-president, George Gibbs; secretary and treasurer, F. A. Molitor.

The Seattle Association of the American Society of Civil Engineers elected the following officers at a meeting held in that city, Jan. 31: President, A. O. Powell; vice-president, Joseph Jacobs; secretary-treasurer, Carl H. Reeves.

The Connecticut Society of Civil Engineers elected the following officers at the annual meeting held in New Haven, Feb. 8 and 9: President, Clarence Blakeslee; first vice-president, Henry R. Buck; second vice-president, P. T. Scott; secretary and treasurer, J. Frederick Jackson.

The Engineers' and Architects' Association of Southern California held a meeting at Los Angeles, Feb. 1. Major Amos R. Fries, Corps of Engineers, U. S. A., formerly in charge of work on the Los Angeles harbor, gave a talk advocating two years of compulsory military service, and the organization of the nation's resources along lines of preparedness.

The Western Society of Engineers, bridge and structural section, elected Feb. 14 the following officers for the coming year: Chairman, W. S. Lacher; vice-chairman, N. M. Stineman; directors, O. F. Dalstrom and F. G. Vent. Herbert Fisher Moore, professor of engineering materials, University of Illinois, presented a paper on "Stresses in Webs and I-Beams." Feb. 21 will be ladies' night and Judge Cutting will speak on "Washington."

The Municipal Engineers of the City of New York elected the following officers at a meeting held Jan. 26: President, Daniel L. Turner; first vice-president, William W. Brush; second vice-president, Charles E. Gregory; secretary, George A. Taber; treasurer, Herman K. Endemann. The next meeting of the society will be held Feb. 23. Francis B. Marsh, J. D. Groves and Charles E. Price will present a paper on "The New Roads Around Ashokan Reservoir."

The Engineering Society of Wisconsin will hold its annual meeting at Madison, Feb. 25-26. Papers will be read on the relation of engineers and contractors, state inspection of public utilities, flood protection, asphalt concrete pavements, surface treatment of old macadam, the water softener and its function in the treatment of boiler feed water, and sewage treatment. Among the speakers will be: T. Chalkley Hatton, A. C. Larsen, chief engineer of state railroad commission; Prof. D. W. Mead; F. G. Summons, director of public works, Milwaukee; W. F. Reichardt and James R. Valk.

The Idaho Society of Engineers, at its annual convention to be held at Burley, Feb. 21-23, will hear, among other papers: J. S. Longwell, assistant engineer U. S. Reclamation Service, on "Hydrometric Data and Practice on the Minidoka Project"; W. T. Wallace, on "Irrigation Pumping and Power Rates Therefor," and A. N. Kimmell, U. S. surveyor, on "Surveys of Overflowed Lands in Arkansas." Speakers at the banquet, to be held Feb. 22, will be Barry Dibble on "The Engineer's Opportunity to Serve His Country," E. B. Darlington on "The Success of Irrigation Projects," and J. C. Porterfield, W. H. Gibson and C. H. Mull.

Personal Notes

George W. Bacon, of the engineering firm of Ford, Bacon & Davis, New York City, has joined the export department of J. P. Morgan & Company. Although retaining his connection with the engineering firm, Mr. Bacon will devote all his time to the Morgan interests, the export department of which is engaged largely in buying supplies for the Allies.

H. A. Bayfield, who has been in charge of the Dominion government harbor work at Port Nelson, Hudson Bay, has resigned to accept a position as engineer in charge of construction for Norton Griffiths & Company, Ltd., on the harbor work at Saint John, N. B.

H. C. Brown, formerly assistant engineer in the construction department of the Illinois Central Railroad Company, has accepted a position with the Chicago Bridge & Iron Works as sales engineer, with headquarters in Chicago.

Frank P. Trott, who served as court water commissioner of Arizona for 16 years and later became a member and chairman of the state board of pardons and paroles of Arizona, was recently appointed surveyor general of Arizona by President Wilson. Mr. Trott succeeds Frank E. Ingalls, who was appointed to the office 12 years ago.

John P. Maguire, formerly superintendent of the subway department of the city of New Britain, Conn., has opened offices at 580 Arch Street, that city, to engage in business as a general engineering contractor.

L. S. Hulburd, resident engineer in charge of construction on the New York State Barge Canal at Seneca Falls, has been transferred to a similar position in Rochester, where he will have charge of some contracts for the completion of the canal which are about to be let. He will be succeeded at Seneca Falls by H. C. Smith.

D. J. Dougherty, formerly of the construction department of the maintenance-of-way department of the Pennsylvania Railroad, has been appointed a member of a party of engineers formed to work up an improved system of underground conduits to take care of all wires on a portion of the New York division. He was graduated from Pennsylvania State College in 1911.

D. A. Graham has been appointed resident engineer for the Canadian Northern Pacific Railway at Vancouver, B. C.

G. B. Swingley has been appointed supervisor of bridges and buildings for the San Antonio & Aransas Pass Railway at Yoakum, Tex.

A. C. Shields, formerly division engineer for the Chicago, Rock Island & Pacific Railway at Little Rock, Ark., has been appointed division engineer of the Missouri division, with office at Trenton, Mo.

E. H. Raquet, engineer of tests of the New York, New Haven & Hartford Railroad, has resigned to become manager of the American Wood Encysting Company, Inc., of New York City.

E. W. Davis has been appointed a division engineer in the Ohio State Highway Department.

Paul P. Whitman and L. Evans have organized the Industrial Engineering Company to engage in consulting practice, with offices in the New York Building, Seattle, Wash., and at 725 Commerce Street, Tacoma. Mr. Whitman was formerly chief engineer of the port of Seattle. Mr. Evans is an electrical engineer. The firm will give special attention to matters relating to railway and marine terminals, industrial plants, power development, and electrical and mechanical applications.

Ward Baldwin, consulting engineer, of Cincinnati, has been retained as consulting expert for the Cincinnati Rapid Transit Commission to continue the physical valuation of the properties of the Cincinnati Traction Company. The valuation is to be used by the city as a basis for readjustment of fares in the revision of the terms of the company's franchise in April.

A. C. King, deputy light commissioner of Chicago, has been retained by the city of Cincinnati to continue his survey of the properties of the Union Gas & Electric Company, of Cincinnati, preparatory to entering into a new 10-year contract for natural gas rates.

H. L. Bowman, until recently with the American Bridge Company, is now assistant to C. E. Smith, consulting engineer, Railway Exchange Building, St. Louis. Mr. Bowman is a graduate of Pennsylvania State College, class of 1911, and was with the American Bridge Company from June, 1911, until his recent change, excepting one year spent in graduate work at the Massachusetts Institute of Technology, and a half year spent as instructor in structural engineering at Purdue University.

J. G. Grossman, efficiency engineer for the Aberthaw Construction Company of Boston, is now located at Hartford, Conn., where the company is engaged on work for the Colt Patent Fire Arms Company.

Solomon-Norcross Company, consulting engineers, of Atlanta, Ga., has been retained to prepare plans and supervise the construction of a sewer system at Owensboro, Ky. It is estimated that it will require 3 months to get the plans ready and about 16 months to do the work. A bond issue of $225,000 was voted by the citizens of Owensboro last November to defray the cost of the work.

Straiton Hard, engineer and constructor, of Atlanta, Ga., will be manager of the new office the Ceresit Waterproofing Company has opened in that city. Mr. Hard is a graduate of Columbia University.

Charles E. Huber, formerly connected with the Alliance Structural Company, of Alliance Ohio, has been appointed engineering draftsman and checker for the Wellman-Seaver-Morgan Company, of Cleveland, Ohio.

Francis W. Collins, consulting engineer, of New York City, has been appointed consulting engineer of the Roanoke (Va.) Waterworks Company.

Norris E. Parratt, formerly engaged in private practice at Munising, Mich., and city engineer of that city, has been appointed engineer for the Charcoal Iron Company of America, of Detroit, at its Manistique, Mich., plant.

Charles Harding, erecting engineer of the New York Continental Jewell Filtration Company, of 15 Broad Street, New York City, has completed the construction of the filtration plant at Columbus, Ga., on which he has been engaged for the past eight months, and is located temporarily at 154 Academy Street, Jersey City, N. J.

O. F. Sieder, for the past 3 years assistant structural engineer for the Levering & Garrigues Company, engineers and contractors on iron and steel construction, of 552 West Twenty-third Street, New York City, has been appointed chief structural engineer of that company. Mr. Sieder was graduated from Lafayette College as a civil engineer in 1902, and entered the employ of Purdy & Henderson, where he assisted in the design of such buildings as the New York Times and the Bellevue-Stratford Hotel. He then went with Westinghouse, Church, Kerr & Company, assisting in the design of the Pennsylvania Terminal Station in New York City, and many large power houses. After this service he became designing engineer in the bridge department of Milliken Brothers and represented the company in South America for several years, being located in Buenos Aires, where he built some of the first "skyscrapers" which were erected in that city. For several years after his return to this country he was assistant engineer in the bridge department of the Eastern Steel Company. He left that company to accept an offer from the Levering & Garrigues Company. One of his chief interests has been an original and practical course in structural engineering, which he has conducted for many years in the Fawcett School of Industrial Arts in Newark, N. J. This is an evening school for engineers and draftsmen. Mr. Sieder is in charge of the technical department of the institution.

C. G. Elliott, consulting drainage engineer of Washington, D. C., and for ten years chief drainage engineer of the U. S. Department of Agriculture, has become affiliated with the Harman Engineering Company, of 144 Fedonia Avenue, Peoria, Ill., and the firm name has been changed to the Elliott & Harman Engineering Company. Mr. Elliott will act as consulting drainage engineer of the corporation and will have charge of the Eastern branch office in the McLachlen Building, Washington, D. C. Mr. Elliott was graduated from the University of Illinois in 1877 and has been engaged in drainage work and sanitary practice almost continuously since that time. In 1866 he was chief engineer of the Red River Valley Drainage Commission in charge of surveys and design for the drainage of almost a million acres in Minesota. From 1887 to 1889 he was in charge of drainage work in Illinois. He was appointed chief drainage engineer of the U. S. Department of Agriculture in 1903 and served in that capacity until 1913, when he resigned to engage in consulting practice in Washington, D. C. Of recent years he has had an important part in drainage developments in the State of Florida.

L. W. Coiner, formerly connected with the U. S. Reclamation Service, and R. A. See, who was also connected with the Reclamation Service, have formed a partnership and have opened offices at Fort Collins, Col., to engage in practice as civil and irrigation engineers. Mr. Coiner is a graduate of the Colorado State Agricultural College and Mr. See is a graduate of the University of Missouri and Cornell University.

Obituary Notes

Stevenson Towle, consulting engineer, of New York City, and formerly chief engineer of the Department of Sewers, Borough of Manhattan, New York City, died at Mamaroneck, N. Y., Feb. 14. He was graduated from Columbia University and was, for 18 years, chief engineer of the Department of Sewers. He also was, at various times, park commissioner in New York City, a member of the first Rapid Transit Commission, a member of the commission that laid out Long Island City and consulting engineer of the health and highway departments of New York City and of the Consolidated Gas Company. He was 78 years old.

Daniel O'Brien, of the O'Brien Construction Company, Syracuse, N. Y., died Feb. 6. He was formerly the head of the contracting firm of O'Brien & Hoolihan, which constructed numerous buildings at the Brooklyn and Portsmouth, N. H., navy yards, and later had contracts on the New York State Barge Canal.

David Brower, who retired June 1, 1915, after 54 years of continuous service on the engineering force of the sewer department of the Borough of Brooklyn, New York City, died Feb. 14. An outline of Mr. Brower's professional activities was published on page 788 of the June 19, 1915, issue of this journal.

Charles Beck, a civil engineer, of Ashland, Pa., died recently. He was forty-seven years old.

Michael J. Mack, civil engineer and surveyor, of New York City, died Jan. 23. In 1872 he was on the first survey of the West Shore Railroad, as transmitman and chief of corps, in the Mohawk Valley, from Utica to Fink's Basin, and from Victor to the Genesee River. From 1873 to 1875 he was U. S. assistant engineer on the surveys and plans for the improvement of the Chattahoochee and Apalachicola rivers from Alabama to Florida, a distance of 350 miles. Also he was on the survey for the improvement of the Ouachita River for a distance of 300 miles, and for the improvement of the Cahaba River for a distance of 100 miles. From the latter year until 1878 he was engaged in private practice in New York City and vicinity. In 1878 he was appointed U. S. assistant engineer in charge of surveys and plans for improving the mouth of the Red River in Louisiana. He went from this work to become assistant engineer and chief engineer of the Belleville & Eldorado Railroad. Following this work he prepared the first sewerage plan for Topeka, Kan., and was, for a time, in the office of the Atchison, Topeka & Sante Fé Railroad, and U. S. deputy mineral surveyor for New Mexico. From 1890 he was in Costa Rica on railroad work. From 1891 to 1892 he was engaged in the construction of waterworks in Southern cities, and, from 1893 to 1909, he was engaged in municipal work in New York City.

Thomas J. Moore, general manager of the Philadelphia branch of the Holcomb Steel Company, died recently at Atlantic City, N. J.

Sir Charles R. Wilson, a former president of the Grand Trunk Railway of Canada, died in England, Feb. 9.

George W. Swinburne, civil and mining engineer, died in East Orange, N. J., Feb. 3. He was graduated from Lafayette College in 1883 and, during his engineering career, was connected with the New York City Croton Aqueduct, with George E. Waring on sewage and water supply work among other works, previous to entering private practice in New York City as a member of the firm of Swinburne & Clarké, civil engineers. At the time of his death he was connected with the Sterilization Company of Newark.

Jonathan B. Harris, a railroad contractor of international reputation, died at his home in Monrovia, Cal., Feb. 9, at the age of 81. In California Mr. Harris built the Central Pacific and the Southern Pacific lines, from Bakersfield south to the Colorado River, including the Tehachepi Pass, with its 17 tunnels and 14 miles of track. In the Northwest he built lines for the Northern Pacific and the California & Oregon and on the island of Cuba he constructed an important railroad for which he received a substantial reward from the government. One of his most picturesque exploits as a contractor was the construction of a line in Guatemala for the Southern Pacific. Here he used native labor exclusively, and was handicapped by governmental regulations, but completed the job 7 months ahead of the time set by a lapsing franchise, and with a saving of approximately $300,000 for the company out of its appropriation.

Edgar M. Jessup, engineer maintenance-of-way of the San Pedro, Los Angeles & Salt Lake Railway, at Los Angeles, Cal., died Feb. 9 at the age of 57. Mr. Jessup spent almost his entire life in the service of the San Pedro, Los Angeles & Salt Lake and its predecessor, the Los Angeles Terminal Railway. Entering the employ of the latter 30 years ago, he assisted in surveying and constructing its main line between Los Angeles and Pasadena. When the road was absorbed in 1901 by the newly organized San Pedro, Los Angeles & Salt Lake, he was made engineer maintenance-of-way, which position he held until his death. He was born in Iowa and spent his early life as a surveyor there.

Frederick W. Clark, a retired builder and contractor, died in Chicago, Feb. 5 at the age of fifty-nine. He was graduated from the Massachusetts Institute of Technology in 1880, and for ten years followed the profession of mining engineer. Then, for six years, he was assistant professor of mining engineering and metallurgy at his alma mater. In 1889 he entered the building and contracting business in Chicago, and, from 1902 to 1909 was president of the Clark Construction Company.

George A. Hancock, a well known railroad constructor, died Feb. 9 in Los Angeles. Mr. Hancock was perhaps best known among railroad men as the builder of the Atchison, Topeka & Santa Fé shops at Topeka, Kan., and the St. Louis & San Francisco shops at Springfield, Mo. He was formerly general superintendent of motive power of the St. Louis & San Francisco Railway, and also assistant superintendent of machinery of the Atchison, Topeka & Santa Fé. He was born in 1856 in Toronto, Can., and as a young man worked for the Grand Trunk in various capacities. In 1881 he went to Albuquerque, N. M., and worked as a machinist for the Atchison, Topeka & Santa Fé, and in a few months was made shop foreman at El Paso, Tex., where he remained four years, rising to the position of master mechanic. It is said that while he was in El Paso Mr. Hancock coupled up the first engine for service on the Mexican Central and also was on the first engine that ran under steam from the United States into Mexico. He had been connected for about a year with the Southern California Railroad at San Diego, Cal., when, in 1885, he was made assistant superintendent of machinery of the Atchison, Topeka & Santa Fé, with headquarters at Topeka, a position he resigned two years later to become general master mechanic of the Atlantic & Pacific with headquarters at Albuquerque. He remained with this road and its successor, the Atchison, Topeka & Santa Fé, or its subsidiary, the Gulf, Colorado & Santa Fé, until March, 1901, when he was made superintendent of motive power of the St. Louis & San Francisco, and a few years later, general superintendent of motive power. Failing health forced him to resign in 1914, and he traveled a year before taking up his residence in Los Angeles.

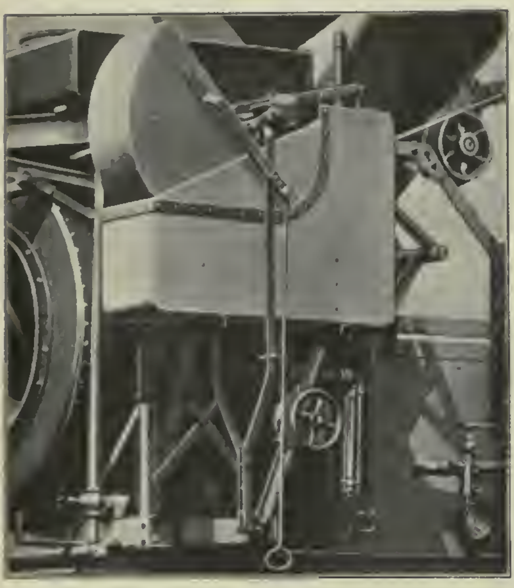
Civil Service Examination

United States.—An open competitive examination for an aid, qualified in engineering, is to be held March 8 at the usual cities throughout the country where service boards are located. The position is in connection with the Bureau of Standards in Pittsburgh at a salary of $840 a year, or with other branches of the bureau at a salary of from $600 to $840. Those who take the examination must have a thorough understanding of mathematics, through trigonometry and physics and mechanics. Experience in laboratory work or one or more years of an engineering course in a university or a college will be given special consideration. Application form 1312, specifying the title of the examination, may be obtained from the Civil Service Commission, at Washington, D. C., or from any of the civil service boards.

High Drum Setting and Water Weigher Improve Paver

By setting the mixer drum, on the upper part of the frame work of the machine, 9 ft. above the ground, the swivel spout on the latest type of Smith-Chicago paver exhibited for the first time at the Cement Show, Chicago, makes an angle not less than 20 deg. with the horizontal.

In spite of the high position of the drum the designers have kept the center of gravity within a few inches of the position in the older charging types. This is done by bunching the traction and hoisting machinery over the rear axle on a one-piece casting supported by a heavy cast-steel bolster independent of the truck sills.



AUTOMATIC WATER WEIGHER DISCHARGING

In the new machines it is claimed that added power has been put into the engine so that the skip may be unloaded in eight seconds. Discharge takes place in twelve seconds. The skip on the large machine is sufficiently wide to permit three men to empty their barrows simultaneously.

A positive and automatic water feed easily changed becomes essential on this machine since the height above ground precludes a personal inspection without difficulty. The photograph shows this device in the tipping position. The semi-cylindrical tank is supported on a pivot and balanced by a weight adjusted to the weight of water desired. When the tank is empty the weight sinks and raises the tank about 3 in. A lug inside the tank engages a spindle of the valve controlling the water supply from the storage tank holding water for five batches. When sufficient water has passed into the measuring tank the weight is overcome and the tank settles down, closing off the supply automatically. When the skip is hoisted the tank is tilted through a train of levers which are engaged by the front roller. The water then flows into the tank surrounding the measuring tank, passing in through the feed pipes to the mixer drum at the same time that the dry materials enter and mingling with them before the batch reaches the bottom of the drum. The amount of water can be accurately adjusted by moving the weight along the graduated lever on which there is a rack to hold it in any fixed position.

The high drum type of paver is made in 4, 7, 10 and 16-cu. ft. sizes, wet measure, by the T. L. Smith Company, Milwaukee.

Steel and Iron Plants on the Pacific Coast Add Extensions

The Pacific Coast Steel Company on Jan. 25 awarded contracts for two new 60-ton open hearth furnaces which will be installed immediately as additions to the South San Francisco plant of this company. This addition to the equipment will raise the capacity of this plant from 200 tons to 500 tons of finished product per day. With the new furnace a 36-in. blooming mill will be installed and the limiting size of structural shapes which can be handled will be increased to 15-in. I-beams.

Simultaneously with the San Francisco plant increase, the Seattle mills will receive an additional 60-ton furnace which will increase the capacity at that point to 11,000 tons per month. The raw product which this company uses is brought from red hematite mines in China under long term contracts. The fuel used in the mills is California petroleum.

The plant of the United Engineering Works of Alameda, Cal., was purchased on Jan. 26 by the Union Iron Works of San Francisco, which company plans, it is announced, to remodel the plant and equip it for shipbuilding work. The transfer involved about $1,000,000, it is reported, and the remodeling is to cost $250,000.

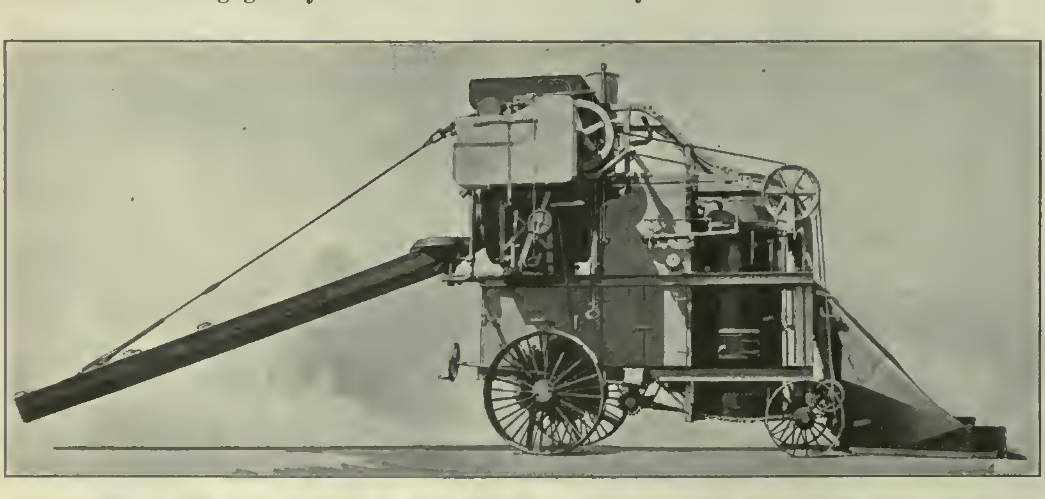
Oil Pressure Pump Designed for Electrical Machinery

A motor-drive pump designed especially for forcing oil under the bearings of electrical machinery has recently been placed on the market by the Goulds Manufacturing Company, pump builders, Seneca Falls, N. Y.

This pump, which is known as Goulds Fig. 1673 is of the single-acting, quadruplex, horizontal type with ⅞-in. cylinders and stroke of 4 in. It is designed for a capacity of 2 gal. per minute against a pressure of 1200 lb. The base of the pump is built with a self contained reservoir of 10-gal. capacity, to which the oil returns from the bearings.

Business Notes

The Lenher Engineering Company, sales agents for the S. Flory Manufacturing Company, manufacturer of hoists and cableways, has moved its offices to 95 Liberty Street, New York City.



HIGH DRUM MIXER MAKES MINIMUM CHUTE SLOPE NOT LESS THAN 20 DEGREES

The Pacific Coast Steel Company has moved its Seattle sales office to 915 Alaska Building in the same city.

National Paving Brick Manufacturers' Association will hold a meeting at Hotel Statler, Cleveland, Feb. 21-22. Will P. Blair, Brotherhood of Locomotive Engineering Building, Cleveland, is secretary of the association.

S. E. Elmore, formerly Central sales manager of the Bucyrus Company, manufacturer of steam, oil and electric shovels, hydraulic machinery, drag line excavators and railway cranes, of South Milwaukee, Wis., has been appointed superintendent of the company's Evansville plant. E. C. Hingston will succeed him at Chicago as Central sales manager, and G. H. Hutchinson will be Western sales manager, having his office at the Merchants' National Bank Building, San Francisco.

Trade Publications

The following companies have recently issued trade literature:

Rogers Brothers Company, Albion, Pa., catalog A, 16 pages, steel two-wheeled auto trailers.

Pioneer Asphalt Company, Lawrenceville, Ill., circular, 8 pages, road asphalt and surface asphalt.

M. Smolensky Manufacturing Company, 932 Garfield Building, Cleveland, Ohio, catalog, 16 pages, suction and check valves, price list.

Trussed Concrete Steel Company, Youngstown, Ohio, catalog, 32 pages, Kahn portable steel houses; garages, contractors' offices, etc.

McClintic-Marshall Company, Pittsburgh, portfolio, 48 pages, photographic reproductions of steel building, bridges, etc., furnished and erected by this company.

American Cement Machine Company, Inc., Keokuk, Iowa, circular, 16 pages, Boss concrete mixers, road pavers and mortar mixers of 5-ft., 7½-ft., 10-ft. and 15-ft. capacities.

Expanded Metal Engineering Company, 101 Park Ave., New York, booklet, 12 pages, new building ordinance of New York City, and use of steelcrete mesh for floor and wall construction.

Warren Brothers Company, 142 Berkeley Street, Boston, Mass. Catalog, 11 x 8½ in., 30 pages, illustrated. Narrates the history of Warren's portable asphalt plant, its experimental stages and their results, and describes the particular fitness of this machine for asphalt paving mixing, as to its construction, operation and maintenance expenses. It is typographically well compiled and is logically arranged in the way it treats the evolution of the Warren plant.

E. I. du Pont de Nemours Powder Company, Wilmington, Del. Booklet, 6 x 9 in., 128 pages, illustrated; entitled, "Road Construction and Maintenance." While the object of this publication is doubtless to promote the use of explosives in road building it does not restrict itself to this phase of the subject only, but rather goes in great detail into the general subject of road construction and maintenance. The way in which the text is classified is sufficient to indicate the general nature of the book. For instance, it commences with location and construction of roads, goes on to clearing of rights-of-way, then, discusses road drainage and deprecates the practice of making heavy grades, instructing in the means for their reduction. From here the book takes up the subject of subgrades and surfaces, explaining in detail the various practices of road construction and enumerates various methods of upkeep of country roads. Closing it describes equipment, such as scrapers, drags, rollers, graders, etc., and finally comes into its own by a general description of explosives and blasting supplies. Appended is a glossary of road building terms, as well as some valuable advice on handling of explosives. The book, which is in reality a text book, will be sent to whosoever applies for it, provided this journal is mentioned.

Engineering Record

A Weekly Journal Devoted to Civil Engineering and Contracting

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Volume 73 NEW YORK, SATURDAY, FEBRUARY 26, 1916 Number 9

Engineer for Maryland Commission

THERE is now before the Legislature of Maryland a bill providing for the appointment of an engineer on the Public Service Commission of that state. The Engineers' Club of Baltimore is using its influence in the passage of this measure and it was largely through its effort that such a bill was introduced. The bill proposes to amend the public service law by adding the clause "and one of said commission shall be an engineer." Engineers have long realized the desirability of having their profession represented on public service commissions, but until recently they have made no real effort to influence such appointments or to secure the passage of legislation requiring them. It is good news, therefore, that Baltimore's engineers have not been content with the plea that "something should be done," but are actually doing it. Their efforts deserve the solid support of all citizens of Maryland. In this connection it might be well for the Engineers' Club of Baltimore to impress upon the legislators of the state the fact that Governor Whitman of New York has recently named Henry W. Hodge, an engineer, as a member of the New York State Public Service Commission, which is in direct charge of the new subway work. This appointment received the hearty indorsement of the chairman of the commission, Oscar S. Straus, who, in an interview published in the Engineering Record of Jan. 29, page 159, summed up in convincing manner the desirability of having a technically trained man a member of a commission such as the one which operates in New York. It would seem that the Engineers' Club might make effective use of the Straus interview in influencing public opinion, for it comes from a man of broad vision and international prominence. If the Maryland Legislature has the interests of the state at heart it will enact into law the amendment suggested by the Baltimore engineers.

Editorial Announcement

REALIZING the intense interest of the profession in the engineer's part in military preparedness, the Engineeering Record will publish next week the first of a series of illustrated articles on

National Defense—For Engineer and Contractor

By MAJOR P. S. BOND
Corps of Engineers, U. S. Army

MAJOR BOND'S articles have the official sanction of the Secretary of War.

THIS series, continued through a number of issues, will be the most complete treatment of the subject in the annals of American technical journalism. It will give to engineer and contractor a detailed survey, by an Army authority, of the military engineer's training and manifold duties. A few of the topics discussed are:

Bridges and Stream Crossings; Plant and Tools; Map-Making and Reconnaissance; Roads; Demolitions; Sanitation; Field Fortification; and Mobilization of Industrial Resources.

Refinements in Highway Construction

THE relation between inspector and contractor in construction work of any sort is an important factor in determining the quality of the finished product, but it has remained for California highway engineers to say that co-operation between inspector and contractor in concrete paving is necessary and sufficient to secure a certain continuity of grade which is noticeable to the motorist, but is hardly to be detected by ordinary inspection methods applied during construction. After all, the proof of the pudding is in the eating, and if certain conditions imposed during construction, such as those outlined on page 216 of the Feb. 12 issue, can bring about marked improvement in the finished product, then such conditions should become a part of the specifications in first-class construction. The checking of header board grades for concrete pavement is recognized as part of the inspector's duty, but ordinarily he gives the matter no thought beyond seeing that the grade is right. An example of what can be done by co-operation on this point between inspector and contractor has been demonstrated on certain road work in California. Where such co-operation exists successive sections of the pavement can be brought to a grade alignment so smooth that in riding over the finished surface the motorist at once notices its superior quality. The perfect continuity of grade is indicated by the entire absence of vibration, even in a machine traveling at high speed. The refinements in checking used on the work described are not at all unreasonable to require on any concrete highway work if the right spirit exists between inspector and contractor. Speaking generally it may be said that the good results of such a spirit of co-operation may not always be traced to their real cause, any more than the bad effects of antagonism can always be analyzed, but certain it is that friendly relations of the right sort never interfere and often help mightily in securing desired results. It is to the interest of both engineer and contractor to study carefully this phase of his work.

Newark's City-Planning Pioneers

SPACE was not available last week to comment editorially on the admirable report recently filed by the City Plan Commission of Newark, N. J., some of whose recommendations were set forth briefly on page 245 of last week's issue. The commission, after three and a half years of study, has presented what it modestly designates a tentative plan which, it thinks, should be discussed, revised and then adopted by a referendum. The plan, however, is perhaps the most comprehensive ever put forth in this country, and the highest praise is due these pioneers in a line of endeavor that is only beginning to come into its own. The Engineering Record does not wish to belittle in any way the admirable work being done by another group of pioneers in Philadelphia, whose work in the undeveloped South Philadelphia tract will be described in an early issue. Execution of the Newark city plan will require thorough intensive study such as is being done at Philadelphia; but in Newark the broad general study had to come first, if the plan was to include, as it does, the rectification of mistakes of long standing in the heart of the city, as well as the avoidance of such mistakes in the laying out of the undeveloped sections—and if it was to embrace the surrounding communities, as it does. As evidence of the broadgage way in which the problem has been attacked, note the "non-financial undertakings" proposed for the first of the eight five-year periods: Revision of plan and submission to referendum, establishment of building lines on various streets, establishment of trolley service on various streets, rerouting of cars, creation of parks and a recreation department, making of districting study, changes in building codes and in tenement-house law, obtaining of new city-planning law, assisting of city planning in neighboring municipalities. Certainly the commission has gone whole-heartedly into its task, and Newark is to be congratulated for the example it has set.

Croton Watershed Menace

THE Merchants' Association of New York City is renewing its fight to prevent the use of the Croton watershed, from which the bulk of the city's supply is attained, as a site for state institutions housing from 5000 to 8000 people, mainly defectives. The opposition is based upon the menace to public health involved in the sewage discharges from these buildings. The association has been instrumental in introducing into the State Legislature bills which, if enacted, would insure the protection of the water supply from such dangers as now seem imminent, and in calling upon its members to protest against the construction of the institutional buildings. With this movement the Engineering Record is in hearty accord. Its views on the subject have been expressed in former editorials and are reinforced by the opinions of sanitary engineers. It all gets down to the matter of whether or not a sewage treatment plant will be operated so as to produce a safe effluent *continuously*. When appointing officials recognize the urgent need of placing qualified sanitary engineers, chemists and bacteriologists in charge of the operation of sewage works this result—a satisfactory effluent at *all* times—may be within the realm of achievement. As many plants are now operated it is still a long way off. It is certainly anything but reassuring to those who would have the Croton water uncontaminated to know that the State officials who planned the buildings now under arraignment are the same ones who provided for sewage treatment, in recent contracts on other work of a similar character, by the electrolytic method, a process which, to say the least, has by no means established its claim to recognition as an efficient means of treatment.

Improvement in Patent Procedure

PROMISE of future improvement in the thoroughness with which the U. S. Patent Office will investigate patents is offered by the bill for a reorganization of the working force signed by President Wilson on Feb. 15. Last week, in the editorial on the Bone patent, it was stated that the lawyer-controlled system of conducting patent litigation and the lax investigation before issuance often led to mistakes and injustice, particularly in patents relating to engineering construction. The probability of better investigation before issuance is therefore encouraging, in view of the present chaotic state of patent litigation in this country evidenced by the federal court decisions against the Bone patent for cantilever reinforced-concrete retaining walls, discussed last week on page 243, and upholding the Thacher patent for arch reinforcement, discussed on page 274 of this issue.

Engineers will certainly welcome a clearer and more consistent policy in the granting of patents affecting their work. The contemplated reorganization and improvement in the patent office force should involve clear definitions of the fundamental elements in a patentable idea, and, more important still, a new basis for decision on the matter of details and the possibility of making slight modifications in a fundamental idea and obtaining a new patent. Undoubtedly, the procedure in patent issuance in the past has often resulted in injustice to the original inventor, not only in errors through incomplete evidence on the subject of prior use, but through the granting of later patents for inventions differing from the original only in details of a very minor nature.

It cannot be too strongly urged that competent engineers should be consulted before passing upon the original application for a patent relating to engineering construction. Furthermore, in all suits concerning the infringements of such patents, it should be perfectly evident from the history of the patent litigation above cited that the well-qualified experienced engineer is the only reliable witness.

The Catskill Aqueduct Association

EVIDENCES of a desire on the part of engineers for something more than a mere association of professional interests are cropping out with increased frequency. In the past, the personal side of this relationship has been very largely subordinated to the technical. The tendency now is to digress, somewhat, from the narrow path which formerly has been followed. It has just been announced that a permanent organization, known as the Catskill Aqueduct Association, has been formed to perpetuate the friendships formed during the construction of New York's additional water supply system, which is now practically completed.

The object of the association is to bring together once a year all those who have been, or who are, connected in any way with the Catskill aqueduct work. Thus the new organization will be, in effect, an alumni association with annual reunions of its members. Many of the Catskill graduates, whom these reunions will bring back into the fold for a brief interchange of greetings, are now performing important work elsewhere. Robert Ridgway, for many years at the head of the Northern Aqueduct Department, resigned to assume the huge responsibility of directing New York City's vast program of new subway construction. Col. Merritt H. Smith, at one time deputy to Chief Engineer J. Waldo Smith, is now chief engineer of the New York Department of Water Supply, Gas and Electricity, and he has with him, as his first lieutenant, W. W. Brush, a Catskill aqueduct alumnus. Carleton E. Davis, at one time in charge of the great Ashokan reservoir work, is now directing the destinies of Philadelphia's Bureau of Water, and L. White, who was identified with some of the most important tunneling work on the aqueduct, left the city service to become managing engineer for Smith, Hauser & MacIsaac, one of New York's big subway and underpining contractors. Frank E. Winsor is capitalizing the experience he gained on the Kensico dam in planning a new waterworks system for Providence, R. I.; in fact, the new Providence organization is made up very largely of former Catskill aqueduct men. While most of the engineers leaving the Catskill project have entered upon work along similar lines, B. H. Waite became division engineer of the New York State highway department.

These are only a few of the Catskill alumni. Now that the work for the first installment of 250,000,000 gal. daily is practically finished, others will be leaving to take up new duties, and old ties must be broken. The Catskill Aqueduct Association, however, will perform a useful service in bringing these men together occasionally and allowing them to renew the friendship of former years.

The Concrete Road Conference a Remarkable Gathering

LAST week witnessed the gathering in Chicago of a conference the like of which does not exist in the engineering field. An ephemeral organization, in a way, it nevertheless brought together for the second time a record-breaking attendance of technical men and produced discussions on a single general subject which, for volume and quality, are unique in American technical affairs.

The National Conference on Concrete Road Building, if standards of other bodies are used as a basis for judgment, should be productive of very little good. It has no permanent organization. It is not richly endowed with funds. It does not meet at frequent intervals. Yet the fact remains that it produced material of exceptionally high value, secured the participation of the very best men in the special field of concrete road construction and rendered an incalculable service to the profession and to the public. There were 698 persons registered —from as far away as California and Nova Scotia—while the average attendance at the six sessions was 400.

Such a showing leads one naturally to seek the reason. First, without doubt, is the intrinsic merit of the product itself—the concrete road. A form of construction with less to recommend it to engineers and to public officials could not bring such a group of men together a second time, even though skillful promotion had forced a first conference. Then, too, the rapidity of progress in concrete road construction has developed improvements and difficulties which formed excellent topics for discussion—topics on which many men were seeking the advice and experiences of others. Furthermore, the program was well planned. The subject of concrete road construction was split up into seventeen subdivisions and each was made the subject of a committee report. In this way the detailed problems were thrown into relief and naturally elicited the intimate experiences of the practical men present. Finally, the management was most skillful—in the selection of members of the committees, in advertising the meeting, in securing the attendance and participation of men of the very highest rank, in the handling of the program and in arranging the many small details which make for the comfort of those in attendance.

AFTER attending the road conference one cannot help contrasting it with other engineering meetings. It can be said without fear of contradiction that no meetings or conventions in the civil engineering field are more valuable than last week's conference except those of the American Society for Testing Materials and the American Railway Engineering Association. The two latter organizations are, of course, broader in scope than the concrete road conference, and go far beyond its mission in that they formulate and adopt specifications which the other gathering does not. Meetings, therefore, that are not really comparable are here compared; yet it is significant that no other gatherings than these can be cited to convey an adequate idea of the character of the Chicago conference. The meeting of the American Concrete Institute, held in Chicago at the same time, and in the same hotel, was pitiable by comparison. The American Road Congresses, with their small attendance at the technical meetings, their papers on a great diversity of subjects, and their total lack of committee work, cannot be mentioned in the same breath with the Chicago gathering. The American Society of Civil Engineers, leader in prestige, has never been noted for the usefulness of its meetings, and can take only a qualified pride in its thorough, but plodding and conservative, committee work.

The secret of the success of the Chicago meeting of concrete road builders, and of the conventions of the American Society for Testing Materials and the American Railway Engineering Association, is that they are founded on the idea of "service." They exist not for show, not for pleasure, not for the prestige they can acquire by gathering unto themselves a distinguished membership (though they want that, too) but to afford a means for engineers to work out problems that press for solution and are too big for the individual to handle alone. In other words, they have no other object than to serve their members by producing material usable in their every-day work.

There is possibility of "service," of course, in many directions, and not merely in producing technical data—but no prominent organization in the civil engineering field to-day has formulated that ideal of "service" except as it applies to the technical work mentioned. Further and much desired progress of other organizations is not to be expected until there is a keen appreciation by the managements that the crying demand to-day is for service—service without loss of prestige. That appreciation would quickly result in the formulation of policies which would remove the criticisms now so commonly heard.

ONE other comment prompted by the committee work of the concrete road conference and of the testing materials and railway engineering organizations is apropos, because of the discussion of committee work at the annual meeting of the American Society of Civil Engineers. The support which bodies doing strong committee work are receiving is clear evidence that such work is meeting a demand and that engineers are quick to recognize organizations which can thus serve them. There is need for more, far more, committee work than is now being done, but that committee work must be vigorous and effective. A committee which lags, year after year disappointing the central organization, should be discontinued or given a new membership. No other course can save the committee and the society—and the reference here, of course, is general—from well-merited criticism.

The conference should not be dismissed without brief reference to its financing. The funds were provided by the Cement Products Exhibition Company, formed of manufacturers, chiefly of cement. Yet nowhere was there evidence of the manufacturer save in open discussion and when the affiliation of the speaker was well understood. In fact, the tendency of the committees and of the speakers in the general sessions was to subject manufactured products to an especially strong scrutiny. Were the attitude of the manufacturers other than that taken—of hands off, so that the engineers could decide themselves—there would not have been participation a second time by the deans and professors of engineering of the very first rank. The presence of these distinguished gentlemen was a striking evidence of their confidence in the manufacturers who bore the financial burden.

American Specifications and Foreign Trade

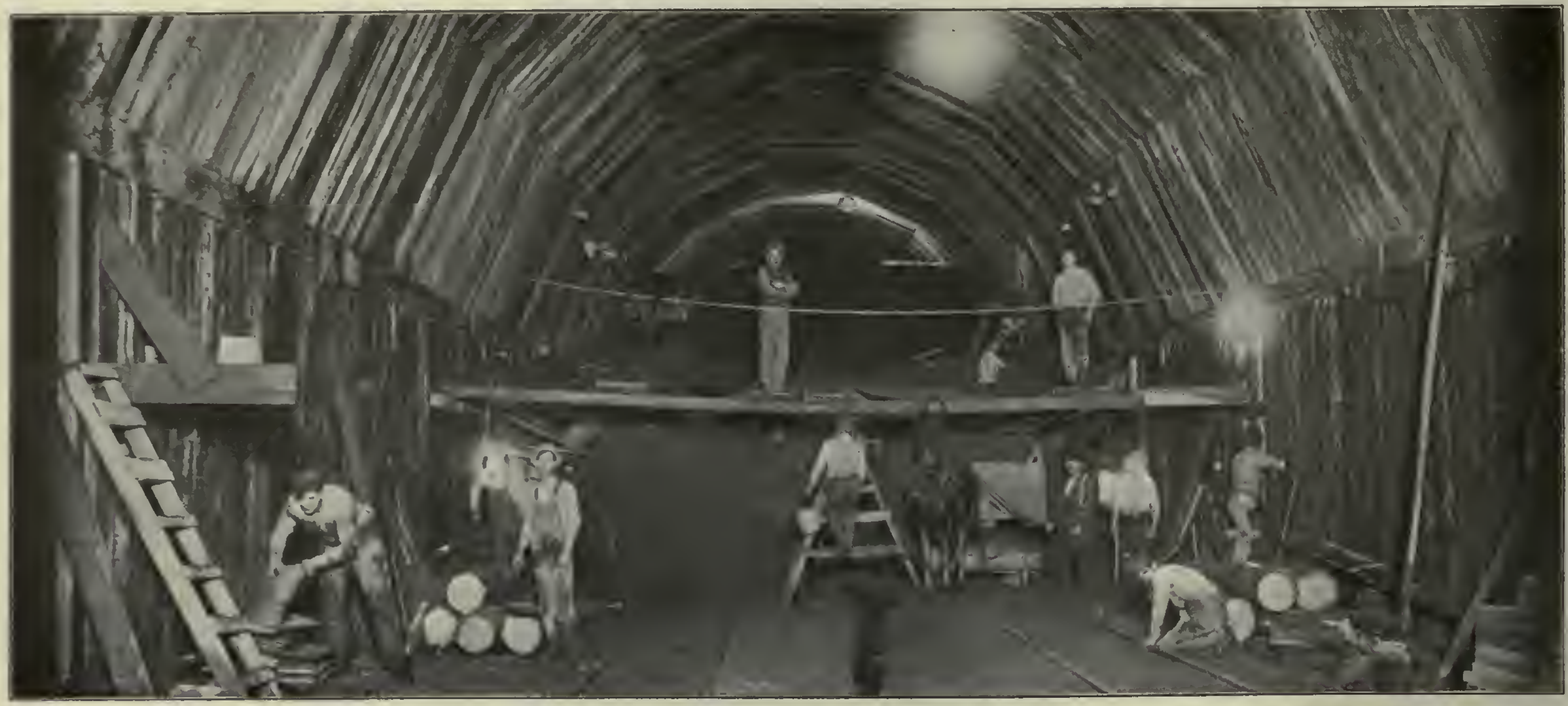
THE executive committee of the American Society for Testing Materials has just made an announcement of unusual interest, not only to its own members, but to American industrial circles at large, in calling attention to an arrangement by which the Department of Commerce has undertaken the translation into foreign languages of such of the standard specifications of that society as have an important bearing on the requirements of American export trade. As explained in the news section of the Engineering Record last week, each specification in a foreign language will be accompanied by the original version in English as a criterion, and all numeric quantities will be expressed in both the British and the metric systems. It is intended to distribute these specifications among the United States consular offices throughout the world, and to make them available at moderate prices to American manufacturers and others interested in commerce with foreign nations.

The Department of Commerce and the American Society for Testing Materials are to be congratulated on the extraordinary opportunity that has thus been opened for rendering a service of momentous importance in the field of industrial preparedness. Industrial preparedness for prospective conditions of peace is second in importance only to such preparedness for the direful possibility of war. When the present European conflict comes to an end, there will surely follow immediately a fierce struggle for industrial and commercial rehabilitation on the part of the exhausted European nations. It is well known that the present commercial prosperity of this country had its origin in the pressing needs of the belligerent nations for the implements of warfare. Its ephemeral growth will be arrested, on the restoration of peace, just as suddenly as it sprang into existence shortly after the declaration of hostilities.

The question of vital moment to this nation, second only to that of military preparedness, is that of its preparedness for commanding its proper sphere in the prospective contest for the future control of world markets—a contest in which this nation has, in the past, fallen far short of realizing its rightful possibilities. There can be no more opportune time than the present for this country to enter upon wisely and broadly conceived policies by which its present and future commercial relations with foreign nations, especially those on the American continent, may be placed upon a sound and enduring foundation. The recent Pan-American Scientific Congress has served in no unimportant measure to pave the way toward a better mutual understanding with our Central and South American brethren, and a clearer recognition of the solidarity of our interests. The American International Corporation, capitalized at $50,000,000, and under the guidance of some of the ablest engineers, financiers, and men of large affairs, may be looked to with confidence, among other agencies, to shape and give practical effect to broad measures for the expansion and strengthening of the outer commercial relations of this country. Logically, the United States should become the chief purveyor of a long line of manufactured articles for which the Latin-American countries have to depend almost wholly on the outer world, such as structural steel, rails, bridges, locomotives and other rolling stock, automobiles, electric equipment, machinery and machine tools, cement and innumerable other products. Commerce in such products is, however, necessarily predicated on specifications.

American manufacturers have long labored under an unfair and unnecessary handicap in international competition by being required to base their prices for such articles on specifications of exotic, and usually European, origin, which are not infrequently framed designedly to meet the peculiar manufacturing requirements of a given country, to the embarrassment and disadvantage of American producers. It is high time that an end should be made of this unfair handicap, and that American manufacturers should be permitted to bid on specifications best suited to American conditions, and acceptable to the largest consumers in their own country. That international competition should be thus broadened would be obviously also to the direct advantage of foreign purchasers.

The importance of standard specifications in relation to international trade has long received recognition in Great Britain to a degree hitherto unknown in this country. The British Engineering Standards Committee, whose position in Great Britain relative to specifications is analogous to that of the American Society for Testing Materials in this country, has had, from its inception, the direct co-operative and financial support of the leading British engineering societies, in addition to substantial financial aid from the government. Although the American society has enjoyed neither of these advantages, its accomplishments in the field of standardization will bear favorable comparison with those of the British committee. It is peculiarly gratifying, therefore, that, through the enlightened co-operation of the Department of Commerce, the fruits of the admirable work of that society are about to be given added value in directions so promising to American commercial interests.



THE TUNNEL TIMBERS CONSTITUTE THE OUTER FORMS FOR THE CONCRETE LINING OF TWIN PEAKS TUNNEL

Wall-Plate Drift Method Used for the Most Part in Twin Peaks Tunnel, San Francisco

Double-Track Tube 12,000 Feet Long Being Built by Graduated Assessment Plan—Tunnel Lining Being Placed in Four Sections, with Special Two-Hinged Collapsible Steel Forms

THE WALL-PLATE drift method, with certain adaptations, is being used for the most part in advancing the headings of the 12,000-ft. Twin Peaks tunnel in San Francisco. Although the bulk of the concrete lining will be placed pneumatically, a concrete mixer and dump cars are being used for 1800 ft., and here a specially designed two-hinged collapsible form plays a part. The improvement is being paid for by a graduated assessment plan.

The tunnel, which the city is constructing under the contract system, will afford a much needed rapid-transit connection between the business district of the city and a desirable residence section which has not developed heretofore because of its inaccessibility. The tunnel will be ready for service in about two years, when a branch of the municipal railway will be operated through it. Funds to the amount of $4,000,000 for the acquisition of the necessary lands and the construction of the tunnel were raised by means of a graduated assessment plan. Of the total amount, 85 per cent was raised by ten annual assessments from the undeveloped land near the southwest portal, which will be brought within eight minutes of the settled section of the city; while the remaining 15 per cent was assessed on the property on that part of Market Street adjacent to the northeast end of the tunnel.

Materials Encountered.

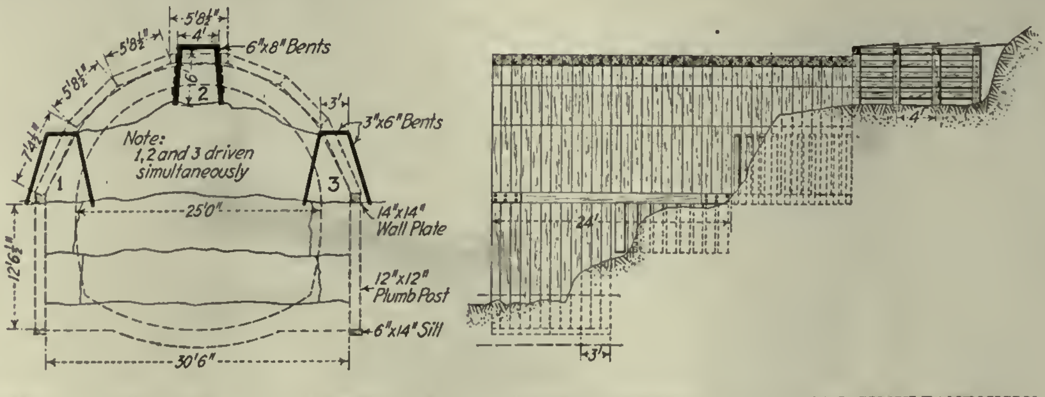
The standard tunnel section for soft material measures 30½ ft. in width on the outside of the concrete lining, and 28 ft. in height from bottom of invert to top of arch. In some of the station sections the inside width increases to as much as 44 ft. to allow for platforms on either side of the tracks, and in this case the over-all width of the concrete section is as much as 62 ft. The tunnel section varies somewhat according to material encountered, the thickness of the lining being less, of course, in the rock sections, but a minimum clearance width of 25 ft. is maintained, and the standard height throughout from rail head to ceiling slab is 15 ft. This ceiling slab cuts off a segmental space 4 ft. 6 in. high in the center and just below the arch of the tunnel, which will be used as a ventilating duct.

In the preparation of designs and the compilation of the preliminary report by the city engineer a large number of test holes were sunk along the center line of the tunnel. These showed a predominance of sandy clay with occasional sand, about 5000 ft. of rock beneath the highest part of the hill, and at a few points some broken and disintegrated rock. In the 1800 ft. which have already been completed at the west portal the material has been clean sand and sandy clay, which has been fairly easy to work and to hold in place. At the west portal sand and hard clay have been encountered as far as the heading has been advanced, while at the Laguna Honda station, where the tunnel was built in open cut for some distance, the same favorable soil conditions prevail. After going over the tunnel line carefully some of the experienced tunnel men on the work find indications of water-bearing sand between the Laguna Honda station and the eastern portal that may prove difficult to handle.

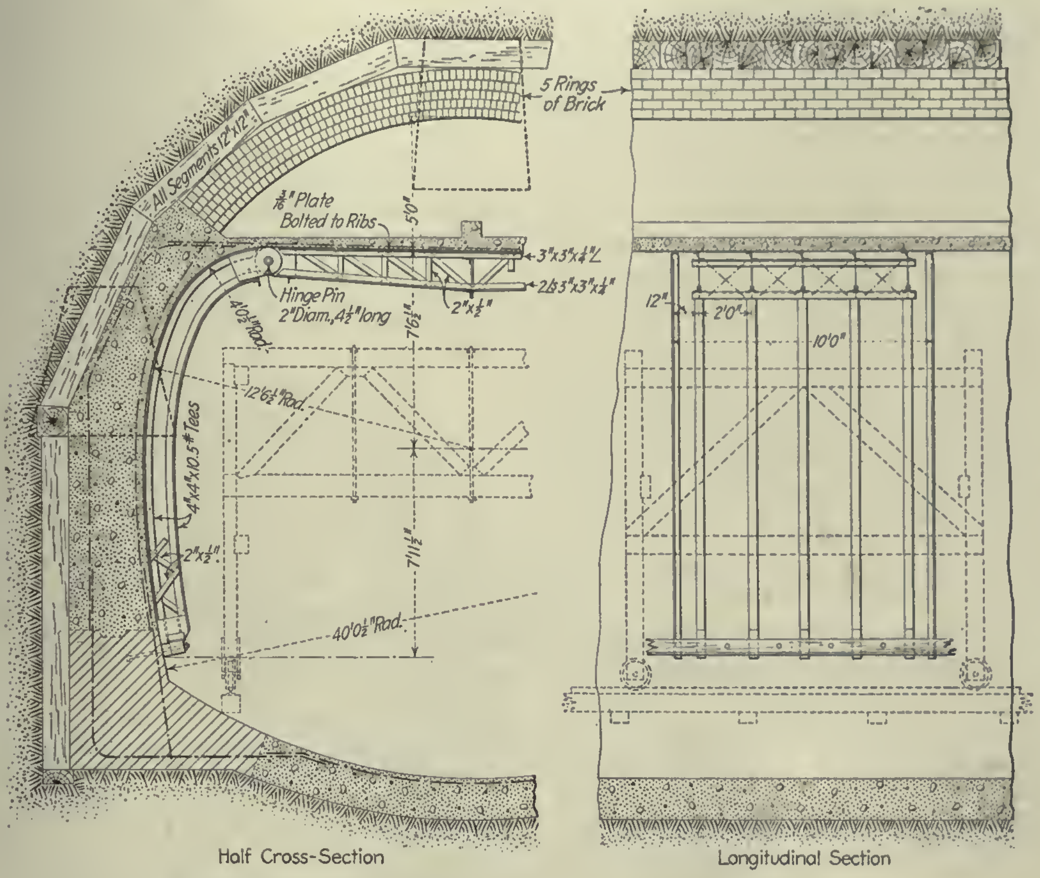
On Jan. 1 90 per cent of the excavation at Laguna Honda station was completed and 70 per cent of the concrete was in place. Excavation in open cut has been finished at both portals and at Laguna Honda station, a total of about 195,000 cu. yd. having been taken out by open-cut methods. At the east end of the tunnel the work has been finished for a distance of about 2000 ft. from the portal, including the Eureka Valley station, 300 ft. in length.

Wall-Plate Drift Method

As previously stated, the wall-plate drift method has been used for the most part in advancing the headings, certain adaptations being made to suit the conditions met at various points. The two wall-plate drifts were driven with incline posts practically paralleling the lower segments of the arch so that a minimum of space would be left



METHOD OF DRIFTING AND TIMBERING—WALL-PLATE AND CROWN DRIFTS DRIVEN SIMULTANEOUSLY



DETAILS OF 10-FOOT SECTION OF SPECIAL COLLAPSIBLE STEEL FORM

between these posts and the arch segments. One of the accompanying drawings shows the wall-plate and crown drifts, all of which were driven simultaneously. The wall plates, which are 24 ft. long, are first supported temporarily on 5-ft. posts which are later removed to make way for the full-length plumb posts that rest on 6 x 14-in. sills below the invert level.

The method of procedure is usually as follows: After the wall-plate and crown drifts have advanced far enough to permit the placing of a 24-ft. wall plate, this timber and its temporary supports are put in place and a few feet of the arch between wall-plate and crown drifts are opened up so that the arch segments can be placed. Each wall-plate drift is followed by two bench excavations carried from wall to wall. From the first of these the temporary posts are placed, and from the second the footing and plumb posts are set.

The usual scheme of mining and mucking employed is to keep three eight-hour shifts of miners at work and to use only two eight-hour shifts of muckers. The muck is loaded into 1½-yd. dump cars and taken in trains to the mouth of the tunnel by mule power. On the west end enough water was encountered to make it worth while to lay a drain in the invert. An 8-in. tile drain was accordingly laid and is advanced in a center heading at invert level ahead of the main excavation.

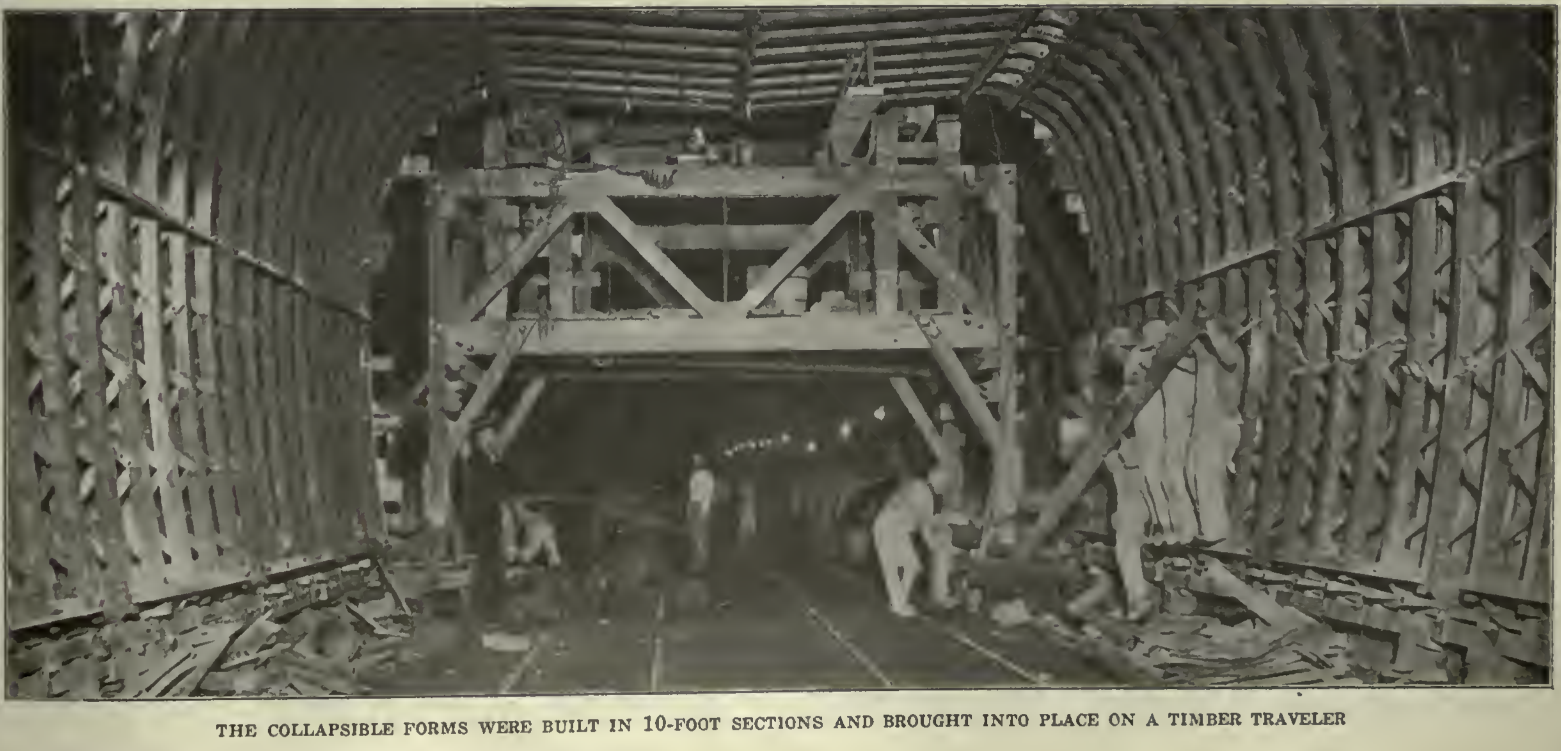
CONCRETE LINING

In most of the tunnel the pneumatic method of mixing and placing is to be employed, but 1800 ft. at the west end has been lined by the use of a concrete mixer and dump cars. Here the concrete is being placed in four sections. The first, which is shown shaded in the accompanying sectional drawing, is poured and allowed to set before the walls and ceiling slab are poured. The arch comes next and the invert is the last section to be placed. As shown in the drawing, the tunnel timbers are used as the outer forms for the concrete lining, while the inner faces of wall and slab forms are provided by a two-hinged collapsible steel device designed and specially built for this work.

In order to permit of gravity flow in depositing the concrete, the mixer was mounted on the ceiling slab after temporary timber supports had been placed to take the extra load thus imposed. Materials were delivered to the mixer by gravity through a shaft from bins on the surface. For the lower section of the walls the concrete from the mixer was delivered through chutes into "high cars" on construction tracks in the tunnel, these cars being so built that the concrete was held at a height sufficient to allow it to flow by gravity into the lower parts of the walls. The ceiling slab and the upper sections of the walls were poured from dump cars traveling over completed sections of the ceiling slab. A temporary timber support was provided under the ceiling slab as soon as the forms were removed, so that industrial tracks could safely be placed upon it.

The collapsible steel forms were built in 10-ft. sections and were brought into place in the tunnel on a timber traveler moving on rails laid on stringers 18 ft. apart. These forms were fastened in place by fitting the lower part of the vertical wings over 1½-in. bolts embedded in the concrete at intervals of 2 ft. Exact alignment of the upper parts of the forms was obtained by turnbuckles on the aligning rods. The forms were allowed to remain in place seven days after the concrete was poured, and enough forms were used so that when a set was removed from the cured concrete it could be carried ahead on the traveler and jacked up into place ready for concrete in the next 10-ft. section.

The contract for driving and lining the tunnel was awarded Nov. 2, 1914, to R. C. Storrie & Company at a contract price of $3,372,000. Under the terms of the con-



THE COLLAPSIBLE FORMS WERE BUILT IN 10-FOOT SECTIONS AND BROUGHT INTO PLACE ON A TIMBER TRAVELER tract 1000 calendar days were allowed for the completion of the work. The construction is under the supervision of M. M. O'Shaughnessy, city engineer of San Francisco, for whom L. T. McAfee is resident engineer in charge of construction.

Patent for Arch Reinforcement Declared Valid

Short Historical Sketch of the Patent Situation—Reasoning of Lower Court Upon Which Court of Appeals Acted Favorably

THE RECENT affirmation of the decree of the Maryland District Court by the U. S. Circuit Court of Appeals for the fourth circuit in the case of Edwin Thacher against the city of Baltimore, practically fixes the validity of the Thacher patent. In view of the importance of this decision and its direct influence in the broad field of reinforced-concrete arch bridge design, there is given here a short history of this patent, its essential principles and an abstract of the reasoning of Judge Rose in the Maryland District Court which was affirmed by the Court of Appeals, as noted in last week's issue, page 263.

ESSENTIALS OF PATENT

In the specification forming part of the patent No. 617,615, dated Jan. 10, 1899, issued to Edwin Thacher, it is stated that the invention relates to concrete arches for bridges or vault covering, or for spanning openings in building construction. It has for its object an improved arch structure in which iron or steel bars are imbedded in concrete near the outer and inner surfaces of the arch in such a manner as to assist the concrete in resisting the thrusts and bending moments to which the arch is subjected.

The invention provides, first, for an effective connection between the bars and the concrete, employing lugs, dowels, bolts, or rivets; second, for bars of such form that they can be readily and cheaply spliced if a greater length of bar is required than that which can be conveniently rolled or shipped; third, for bars that can be manufactured at a small cost and as a standard or stock article and can be readily bent when used to the curve of the arch into which they are to enter. Ordinarily, the bars are in pairs, one vertically above the other, although it is not considered that this manner of disposing the bars is essential in all cases.

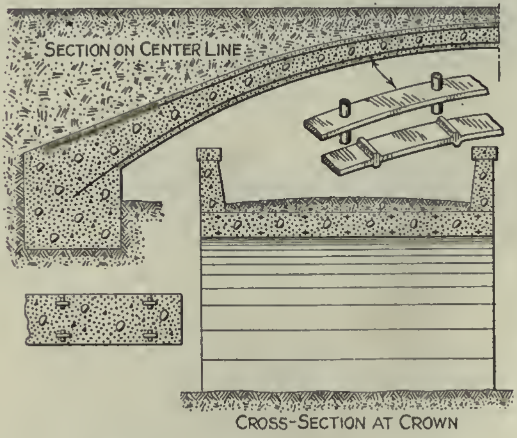
The bars act as the flanges of beams to resist bending moments, whereas the shearing stresses, which are small, are taken by the concrete alone. Normally, the bars and concrete act together, but if the concrete is defective and has a tendency to crack, the bars will greatly aid in resisting such tendency and if a crack should take place the relation of the parts will be changed, and the bars will do the work of the concrete and prevent the falling of the structure.

PRINCIPAL CLAIMS

Three separate claims are made in the patent. The first claim is as follows: "The combination with abutments, and the concrete arch spanning the intervening space, of a series of metal bars, in pairs, one bar of each pair above the other, near the intrados and extrados of the arch and extending well into the abutment, each bar of a pair being independent of the other"—substantially as shown in the drawing. The second claim is similar except that one bar of each pair is to be placed vertically above the other, and each bar is to be flat and provided with projections. The third claim is the same as the first except that one bar of each pair extends into the abutment.

HISTORICAL RECORD

This patent was applied for Oct. 16, 1896. Its history in the patent office shows a very thorough search on the part of the examiner, extending over a period of more than two years, during which time 18 United States and foreign patents were referred to. Of the 17 patents, only one had any bearing on these claims, and sworn testimony was produced showing conclusively that a bridge was under construction on the Thacher system before this one was applied for. The exact date of the Thacher invention is unknown, but it was some time early in 1895. An estimate for a small bridge was made July 6, 1895, and the first bridge completed under this system was in August, 1896.



PART OF ORIGINAL SKETCH ACCOMPANYING PATENT SHOWS ESSENTIAL FEATURES

The earliest record of concrete reinforced with metal is some experiments made by Malet in France in 1845. At the World's Exposition in Paris in 1855, he exhibited a reinforced-concrete ship. The idea was to replace wood in ships by reinforced-concrete plates, but this never came into practical use. Joseph Monier of France is generally given the credit of being the original inventor of reinforced concrete. The main idea in the Monier invention, shown in his basic patent of 1867 and in all of his subsequent patents, is a flexible net work of wires, wired together at all intersections. The Monier patent was first used for tree pots, using imbedded wire nets; next for water and gas tanks; next for tubes and sewers; next for vaults and bridges, and finally for flat floors. The genuine Monier system had only one wire netting at the intrados of the arch, and no sample has been found of two complete wire nettings used in the Monier bridges.

THREE EARLY SYSTEMS

In 1896, only three systems of concrete-steel arches were in use, the Melan system, the Wunsch system, and the Monier system. The Melan system consists of beams imbedded in concrete at regular intervals, usually from 2 to 3 ft. apart. The beams at first used and shown in the patent were I-beams of uniform depth, usually the depth of the arch; later, and first used by Mr. Thacher, rolled I-beams were replaced by riveted beams, composed of two angles near the intrados and two angles near the extrados, the four angles being rigidly connected by tie plates and diagonal lacing bars, which transmit stresses from one flange to the other. It is clear that the Melan system has no similarity to the Thacher system.

The Wunsch system is used only for shallow arches horizontal on top to form the floor of the bridge, and curved at the bottom only. All Monier bridges have been built with mortar composed of one part cement and three parts sand, as the fineness of the netting prevented the use of concrete.

JUDGE ROSE'S OPINION

In deciding the suit brought by Mr. Thacher against the city of Baltimore for an infringement of the first and third claims of patent No. 617,615, Judge Rose, after reviewing the history given above, called attention to the advantages of the arrangement of bars in the patent, as explained by the plaintiff's expert, who showed that the metallic reinforcement is the more valuable the further it is away from the neutral axis of the arch and the nearer it is to the upper and lower surfaces thereof. In recognizing this principle and turning it into practical use, stated Judge Rose, the plaintiff did something which most of the patents cited against him did not.

There is one, No. 583,464, granted to Von Emperger on June 1, 1897, which embodied this idea. This patent was issued before that of the plaintiff upon an application which antedated his by five months. The patent office cited it against the plaintiff, who thereupon filed affidavits carrying back his invention to a period prior to the date of Von Emperger's application. Under the patent office rules the patent was then issued to the plaintiff.

It is quite possible to argue that there were so many forms of reinforced-concrete arch construction before the plaintiff devised his, that no invention was required to do what he did. On the other hand, the grant of the patent raises a presumption of invention. In this case, the presumption is supported by evidence that the invention went largely into use and that until 1910 there was no serious attempt to infringe upon the exclusive rights of the patentee.

There is testimony that others paid handsome royalties for licenses to build their bridges in the manner shown in the patents in suit. There was absolutely no testimony to the contrary, although the city examined an expert witness of large experience in concrete arch construction, as well as the very eminent chief engineer of its sewerage system. The latter frankly admitted that he could not recollect having seen or heard of any bridge or arch constructed in accordance with the plaintiff's designed before the issue of the patent in suit.

In conclusion Judge Rose said:

"Under the circumstances I am not prepared to hold that the claims in suit are void, either because of direct anticipation or because, in view of the state of the prior art, they do not disclose the invention.

CITY'S CONTENTIONS INVALID

"The city points out three respects in which its structure, the Fallsway viaduct, is unlike that shown in the patent. These are, that upon its arches rests no spandrel filling, that the upper of each pair of its bars is not in precisely the same vertical plane as the lower, and that its construction consists of a series of arches one end of each of which in all cases, and both ends in most, are supported by piers rather than by abutments. Of these differences in their order:

"There is not a word about spandrel filling in the patent claims, although one drawing indicates such filling. It is utterly immaterial for any purpose connected with the construction in suit whether there shall be any or not. The patent would be infringed the moment the arch was constructed although neither spandrel filling nor any other covering was ever placed upon it.

"That in the city's arches the upper bar of each pair is not vertically directly over the lower is true. In some cases it is 1½ in. out of the vertical line. The city's engineers says that there was no purpose in so arranging the bars. It was a mere accident in the design of construction. It is not suggested that such a slight departure from the form shown in the patent makes any real difference.

"It is perfectly obvious that the word abutments as used by the patentee was intended to include both abutments and piers. If the structure only calls for one span there will be only one arch supported by two abutments. If there be more than one arch the ends of some of them will be supported by piers.

"No question has been raised but that an arch is a manufacture within the meaning of the patent law. The plaintiff is therefore entitled to a decree for an injunction and an accounting."

Concrete Road Conference Adopts Code of Recommended Practice

Covers Briefly Main Features in Every Branch of the Work, from Drainage and Grading to Finishing and Curing

IN the final session the Second National Conference on Concrete Road Building, meeting in Chicago last week, adopted a code of practice recommended for the construction of concrete roads and pavements. Each division of the work is taken up, and the views as to best practice, as presented in committee reports and developed in the discussion, are set forth briefly; as is natural most of the code is devoted to aggregates, methods of mixing and placing, and such other details as are most likely to affect for better or worse the concrete pavement. Controversial matters are avoided.

The code adopted is as follows:

1—SPECIFICATIONS

Since no specifications were considered by the Conference the Standard Specifications for Pavements and Roadways of the American Concrete Institute are recommended.

2—DRAINAGE

The drainage of the roadbed is of vital importance. If the subgrade is not well drained, there is danger of unequal settlement or frost action, which will cause cracks. The method of drainage to be used will depend on local conditions. For roads proper drainage may be secured through lateral ditches. For streets, as well as roads, tile drains may be used which should be laid on each side of the roadway, or on one side only, with cross drains leading thereto at a suitable depth, depending on the width of the pavement. Drainage trenches, if placed under the subgrade, should be completed before final rolling.

3—GRADING

When roadways are constructed over fills extreme care should be observed to insure the use of proper materials in layers of such thickness that they may be thoroughly compacted so that when the fill is completed there will be a minimum of settlement. In general, fills shall be made in thin layers, the depth depending on the character of material to be used in making the fill. The fill should be allowed to stand for as long a time as possible, giving it an opportunity to settle thoroughly before the pavement is placed thereon. Deep fills should be allowed to settle through one winter wherever such precedure is possible. Puddling will be found advantageous in compacting deep fills. Wetting and rolling shall be performed when making a fill in order to secure thorough compactness. Fills should never be made with frozen materials nor with lumps greater than 6 in. in their greatest dimension.

4—SUBGRADE

The fundamental requirement of the subgrade is that it should be of uniform density so that it will not settle unevenly and cause cracks in the surface of the pavement. No part of the work is more worthy of intelligent care and painstaking labor than the preparation of the subgrade. The slight additional cost necessary to insure good results is abundantly justifiable. When the pavement is constructed on virgin soil, care should be taken to remove all soft spots so as to insure a uniform density; and if constructed on an old roadbed, even greater care must be taken to secure uniform density, as the subgrade is likely to be more compact in the center than at the sides. An old roadbed should be scarified, reshaped and rolled. The subgrade adjacent to curbs should be hand tamped.

5—MATERIALS

Portland Cement—Portland cement shall meet the requirements of the standard specifications for Portland cement of the American Society for Testing Materials and tests should be made in accordance with the methods of tests outlined by the American Society of Civil Engineers.

Aggregates—The selection of proper aggregates for concrete road construction is of utmost importance. Clean, hard, well-graded materials are absolutely essential to success. For this reason samples of the materials proposed for use should be submitted to the engineer for approval before orders are placed. These samples should be carefully inspected; and, if possible, laboratory tests made to determine their suitability. If laboratory tests on shipments cannot be made, field tests can be used to furnish a general indication of quality.

The different aggregates should be kept clean and separate.

Aggregates to be used in the wearing course of two-course pavements should never be placed on the subgrade but on planks or some other means provided to keep them free from dirt. When aggregates are placed directly on the subgrade care should be used by the shovelers to avoid getting clay or earth shoveled from the subgrade into the mix. Aggregates should not only be clean when they are delivered on the job, but clean when placed in the mixer.

Water—Water supply is a most important factor and is frequently overlooked by the engineer and contractor. A large supply of water is necessary for (a) sprinkling the subgrade; (b) mixing the concrete; and (c) keeping the concrete moist during early stages of hardening. For this latter purpose 25 to 30 gal. per square yard of pavement will be required during the summer months. Insufficient sprinkling is detrimental to the wearing qualities of the pavement.

Reinforcement—The use of reinforcement in concrete pavements is increasing.

A coating of light rust will not be detrimental to satisfactory results but care should be exercised that no excessive rust, paint or other coatings are present to interfere with proper bond. Care should also be exercised to see that the reinforcement is so stored, prior to use, that it is not covered with mud or clay when placed in the pavement. Reinforcement left on a job when contract is not completed at the end of the season should be collected and stored so that it is protected from the elements. Occasional tensile and bending tests should be made to see that the requirements of the specifications are fulfilled.

Joint Filler—Joint filler should preferably be of a single thickness. Transverse joint filler should be cut to the crown of the pavement by the manufacturer when metal plates are used. A type of joint filler which will iron out readily under traffic is preferable for use in unprotected joints. A joint filler which will not bend easily when concrete is deposited against it is to be preferred.

Joint-Protection Plates—Metal joint-protection plates should be properly bundled and wired by the manufacturer so that they will arrive on the work in good condition, free from warp. Protection plates up to 20 ft. shall be shipped in single lengths. The exact length should be provided so that the contractor will not find it necessary to cut plates. In cutting plates for length, spacing between eccentrics on the installation bar should be considered to avoid interference with anchorage lugs on plates. Particular care should be used by the manufacturer in crowning the installing bar, to avoid the necessity of duplication of work by the contractor.

6—FORMS

Metal forms of sufficient strength to withstand the necessary hard usage are preferred. When wooden forms are used they should be of at least 2-in. stock and capped with a 2-in. angle iron, so constructed that adjacent sections can be lapped. Forms should have a width not less than the thickness of the pavement at the sides. Particular care should be exercised to see that the top edge of forms are clean so as to avoid unevenness in the finished pavement. If forms are warped or stakes not properly placed, a poor alignment of the edge of the concrete slab will result.

7—PAVEMENT SECTION

Thickness—The thickness of a concrete road or pavement is controlled by many factors, each of which should be given consideration. In view of the increasing use of the heavy motor truck and bus, it seems unwise to build pavements with a thickness of less than 6 in. at any point. In general, pavements shall be thicker at the center than at the sides. Alleys with an inverted crown and narrow one-slope roads should have a uniform thickness. Wherever the thickness can be increased without excessive cost, to secure a flat or nearly flat subgrade, such increase is advisable.

Width—The desirable width for single-track road is 10 ft. The desirable width of double-track roads is 18 ft. The total width of the roadway should not be less than 20 ft. for single-track roads and not less than 26 ft. for double-track roads.

Crown—The crown of roads and pavements should be not less than one one-hundredth nor more than one-fiftieth of the total width. Except in unusual cases, one one-hundredth will be sufficient for country roads and one-fiftieth will be considered satfactory for alley pavements. For city streets an average crown of one-seventy-fifth will generally be found sufficient and should not be reduced, except on grades.

8—JOINTS

Transverse Joints—Joints should be placed across the pavement perpendicular to the center line about 50 ft. apart.

There seems to be a tendency to widen the distance between joints.

Joints should extend entirely through the pavement as well as through the curb if integral curbs are used. Joints should be constructed perpendicular to the surface of the pavement to avoid the possibility of one slab rising above the other.

Longitudinal Joints—Longitudinal joint filler should be staked or otherwise securely held against the curb. Joint material should also be placed around manholes, catch-basins, etc.

Protected Joints—The tendency of present practice is toward the omission of metal protection plates for joints. It is possible that the value of metal protection plates is dependable somewhat on the character of aggregate used, and it is considered that they are more essential in street pavements than in country highways.

Plates—Plates for protected joints should be wired together with the joint filler in place and securely held in the installing bars. When short sections of joint filler are used they should likewise be wired together. Supports for the joint should be used when the pavement is of such width that the installing bar deflects. On wide streets every joint should be checked as to crown with sighting T's. When necessary to have joint plates in two sections, the contractor should arrange with the manufacturer to have holes drilled in the abutting ends of the plates so that the plates may be securely wired or strapped together. As the joint plates usually do not fit tight to the installing bar, a ¼-in. shim is placed under each end of the installing bar, to insure that the plates are not covered by the concrete.

9—MIXING AND PLACING CONCRETE

Measuring—The method of measuring materials for the concrete, including water, should be one which will insure accurate proportions of each of the ingredients at all times. It is recommended that a sack of Portland cement, containing 94 lb. net, be considered the equivalent to 1 cu. ft.

Proportioning—The proportions should not exceed five parts of fine and coarse aggregate measured separately to one part of Portland cement, and the fine aggregate should not exceed 40 per cent of the mixture of fine and coarse aggregates.

Aggregates—Bank run material should not be used. Proportioning based on sieve analysis or by relative density tests is not practicable for concrete roads, except where laboratory direction is available; but where proper facilities are available the above proportions should be varied as the tests warrant.

Mixing—The ingredients should be mixed in a batch mixer of approved style, and the size of the batch should not exceed the rated capacity of the mixer. The mixing should be continued for at least 1 min. after all the materials are in the mixer and before any of the concrete is discharged. The speed of the mixer should not exceed 16 revolutions per minute; however the time and not number of revolutions should be the gage of proper mixing.

Consistency—The practice is to mix concrete entirely too wet. The consistency should be such as not to require tamping, but not so wet as to cause the separation of the mortar from the aggregate in handling and placing. The strength and wearing qualities of the concrete are vitally lessened by an excess of water in mixing.

Placing—If the subgrade has been disturbed by teaming or other causes, it should be brought to its former surface, and thoroughly saturated with water. The concrete should be deposited rapidly to the required depth and width. The section should be completed to a transverse joint, without the use of intermediate forms or bulkheads, or a transverse joint may be placed at the point of stopping of the work. In case the mixer breaks down the concrete should be mixed by hand to complete the section. Where reinforcement is used it should be embedded in the concrete before the concrete has begun to set; the concrete above the reinforcement should be placed within 20 min. after the placing of the concrete below.

In two-course pavements the top should be placed within 20 min. after the placing of the bottom.

Finishing—The surface of the concrete should be struck off by means of a template moved with a combined longitudinal and transverse motion. The excess material accumulated in front of the template should be uniformly distributed over the surface of the pavement except near the transverse joint, where the excess material should be removed.

The concrete adjoining the transverse joint should be dense and any depressions in the surface should be filled with concrete of the same composition as the body of the work. After being brought to the established grade with a template, the concrete should be finished, from a suitable bridge, with a wood float to true surface. A metal float should not be used.

Brooming of the surface is not necessary and grooves are objectionable even on grades.

10—RETEMPERING

Retempering of mortar or concrete which has partially hardened, that is, mixing with additional materials or water, is strongly condemned and should not be permitted.

11—PROTECTION AND CURING

Even the best concrete may be seriously damaged by too rapid drying out, early exposure to low temperature, or by being opened to traffic at too early a period. Hot sun and drying winds are most liable to dry out the concrete too rapidly, thus causing shrinkage cracks or causing a surface which will not wear well under traffic. The use of a canvas covering will be found effective in overcoming this condition.

Sprinkling should also be employed as soon as the concrete is hard enough to prevent the surface being pitted. An earth covering or protection by ponding should be employed after the first day. Under most favorable conditions such protection should be given the pavement for at least two weeks. Water should be added during this period to keep the concrete wet.

In cool weather it is often advisable to omit the earth covering, thus allowing the concrete to harden more rapidly. Sprinkling should not be omitted during the day in case the surface shows a tendency to dry out. When there is danger of frost, sprinkling should be omitted and a covering of canvas or straw and canvas used.

Placing concrete in roads and pavements in temperatures at or near freezing is not advisable, and if in special cases, such work is unavoidable, the water and aggregate should be heated and precautions taken to protect the concrete from freezing for at least 10 days. Chemicals to lower the freezing temperature of the mixture should not be used.

Concrete should not be deposited on a frozen subgrade.

12—OPENING TO TRAFFIC

Under most favorable conditions a concrete pavement should not be opened to traffic in less than two weeks and when conditions permit this interval should be at least four weeks.

13—ONE-COURSE PAVEMENT

Where the materials most readily available are such as to give good construction in one-course pavement, this convention recommends that the one course be used.

14—INTEGRAL CURB

The integral curb for concrete street pavements is recommended in preference to straight curb or combined curb and gutter. Such construction eliminates the longitudinal joint along curb, maintains a permanent grade and alignment. Precaution should be taken to insure that the curb is thoroughly bonded to the pavement proper. The integral curb can be used on wide as well as narrow streets.

FOUR CONCRETE PONTOONS for landings for small boats at Balboa are being built on the floor of the new drydock at that point, states the *Canal Record*. They will support gangways at the heads of the slips alongside pier 18. Each will be 120 ft. long, 28 ft. wide and 8 ft. deep, and as the pontoons are designed to support heavy weights and withstand severe knocking, the system of reinforcement is elaborate. The truss bridges gangways have been completed.

Present Practice in Concrete Design and Construction Summed Up at Convention Last Week

Abstracts of Some of the Papers Presented at the Twelfth Annual Meeting of the American Concrete Institute held in Chicago, February 14 to 17

Spiral vs. Vertical Steel in Concrete Columns

Column Tests Reported Last Year Are Cited in Claim That Most Building Ordinances Are Incorrect for Hooped Columns

By PIERCE P. FURBER
Resident Engineer for C. A. P. Turner, Chicago

REINFORCED-CONCRETE COLUMN tests reported last year to the Institute show by comparison that most of the building ordinances now in effect are far from correct in the specifications for unit stresses on hooped columns. (See the *Journal*, American Concrete Institute, February, 1915, page 47, or the abstract in the Engineering Record of April 24, 1915, page 527.) Being published nearly simultaneously with accounts of the Edison fire, this report brought the subject of concrete columns vividly to the attention of those in the building business, regarding questions of both safe loads and fire resistance.

It seems to the writer that there is no lesson in the Edison fire for the experienced engineer, for the reason that it could have been expected that such columns as those, without hooping of any kind, should have acted very badly in a hot fire. Supposedly, it is well known to structural engineers that columns vertically reinforced and hooped with sufficient spiral reinforcement of close pitch, are much to be preferred to columns with vertical rods only, even in case ties are used, although they were not in the Edison buildings.

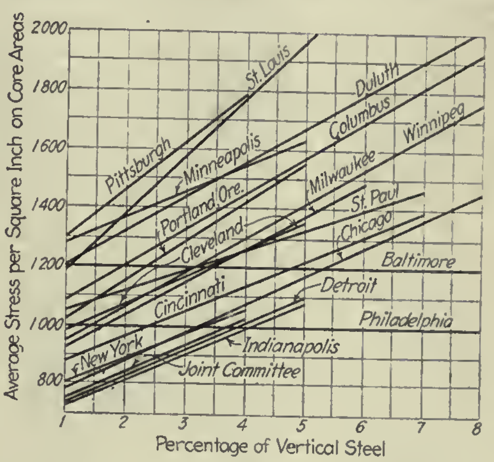
In spite of this knowledge, columns without hooping are being built extensively throughout the country, although it is common practice to use ties or stays of small-diameter rods or wire for lateral reinforcement, spaced about 1 ft. apart. The reason for the use of this inferior construction is found in the lower cost of that type as compared to the hooped column when designed according to most building ordinances.

BAD BUILDING ORDINANCES

Many building ordinances place a premium on this dangerous construction by allowing higher relative stresses on the concrete of such columns than on spirally reinforced columns, when we consider the increase in ultimate strength of the latter. Some even permit as great unit pressure on the concrete of a column without hooping as on a well-designed hooped column. In other words, the concrete of tied columns is stressed beyond what should be permissible values, and the hooped column, instead of being given the benefit of its increased toughness and reliability, is actually put at a disadvantage, because the allowed stresses are lower than tests have shown to be safe.

The results of such building laws are obvious. Designers will use the cheaper type, except in some cases where it may be possible to control the design of the work with regard to actual strength secured in the structure rather than with a view to meet the requirements of some building department. It may be said that a conscientious engineer will always work on this principle, but this is not so, and will hardly be possible where there is an ordinance limitation. The engineer has no opportunity to use his best judgment.

Most of the failures of concrete structures have occurred in buildings designed so that the figured unit stresses were not too high when judged by ordinance requirements, and the failures have been due to failures of the type of member rather than of the material. A large number can be blamed on the use of columns without hooping. On the other hand, the writer at least has never heard of the failure of a hooped column in a building. The continued service of hooped columns under pressures which, according to some building laws, would be considered dangerous leads one to believe that something is wrong with the building codes.



ALLOWABLE UNIT STRESSES FOR HOOPED COLUMNS VARY WIDELY

Lines show values in the various building ordinances for 1 per cent hooping. Seattle is the same as Chicago. Toronto and Syracuse are the same as Detroit.

UNIT STRESSES FOR HOOPED COLUMNS

The writer believes that the tests have proved that most of the building ordinances are too conservative in the unit stresses permitted for hooped columns and a number of them too liberal in the allowances for columns without hoopings. Consequently, the cities represented in the accompanying diagram which appear to have radical ordinances are nearer to agreement with the test data than those at the other end of the scale. Some building departments have been progressive enough to recognize fully the advantage of hooped columns and have incorporated in their ordinances values in keeping with the strength disclosed by tests.

The tests of the American Concrete Institute have proved the contention that hooped columns are to be preferred and will be cheaper than rodded columns, if properly designed. The proof lies in the comparative strength exhibited by the tested columns. It is to be regretted that the tests did not cover a wider range of spiral percentages, and also that the concrete mix was 1:1½:3 instead of the standard 1:2:4 mixture usually employed in building construction.

Need Accurate Estimates Based on Unit Costs

Contractors in Concrete Construction Can Reduce Costs by Thorough Analysis and Systematizing of Labor Operations

By SANFORD E. THOMPSON
Consulting Engineer, Boston

THE aim of this paper is to call attention to the necessity for more accurate estimates by architects, engineers and contractors, and to the possibility of reducing construction costs by a more thorough analysis and systematizing of the labor operations. Open any technical paper giving construction items and notice the enormous variation in bids received from contractors for the same job. At random, I find four bids in a current engineering periodical on a certain job, as follows: $117,000, $126,000, $143,000 and $171,000. This does not represent an exceptional case, but is the general rule on work in which the cost of labor is relatively large.

Unquestionably, the methods of management, especially on construction jobs, affect the cost to a very large extent, but it is hardly conceivable that differences of, say, 50 per cent in cost can be accounted for in this way. Assuming, as is generally the case, that the bidders really try for the job, there is evidently gross error in the estimating. The variations must be due to one of three causes: (1) inaccurate estimates of volume or cost of materials; (2) inaccurate estimates of labor costs, or (3) inaccurate estimates of overhead costs and profits. The items of overhead costs and profits are combined because they are practically interdependent. The contractor, for example, who handles a job personally has small overhead expenses but requires a larger profit to make up for the value of his own time than does a large contractor whose overhead costs in salaries and plant are large, but whose percentage in profit may be small and yet yield a large total income.

ESTIMATED LABOR COST ERRORS

Material costs usually are figured without trouble. The variation in overhead costs by two different estimators may be large, because many contractors do not properly charge or divide their overhead items, but this difference on any one job can hardly account for more than 10 per cent. The big variation, then, must be in the estimated labor cost. As a matter of fact, this is the item on which money is made or lost in contracting.

A contractor was asked recently why he did not bid on a certain reinforced-concrete bridge. The reply was, "I have built mine." Construction companies handling reinforced concrete will tell you that a contractor does not begin to make money until he gets his third job, provided he stays in the game as long as this. The first job costs him more than his estimate; he bids low on the second job because he thinks he sees where he has lost money on the first, and on the third job he knows he has been a fool and adjusts his bid accordingly.

Follow-Up System Required

It must be the aim not simply to know how to do the work cheaply, but to figure estimates more accurately, and at the same time take care to keep the cost of estimating as low as possible. It is evident, further, that, having made the bid with care, the construction must be handled in such a way as to come within the limits set. This requires not simply a fair comparison with the monthly estimates, but the follow-up from day to day of quantities and wages, so as to have a running check on the work. It takes but little more time in figuring an estimate where material costs are estimated in detail also to obtain unit costs of labor.

In reinforced-concrete construction, the greatest discrepancy lies in the cost of forms. It is here that the contractor, and also the engineer, are apt to be fooled, unless either they are well provided with unit costs, or have handled work previously of an identical nature. [Mr. Thompson then cites examples showing danger in using previous costs on work of a different kind, and the uncertainty in the use of units, comparing the cubic yard with the square foot. He refers to tables in "Concrete Costs," by Taylor and Thompson.]

Inaccuracy of Cost Data

Much has been written of the inaccuracy of cost data, and with perfect truth. On the other hand, if the unit costs are taken from personal experience or from records in which all the local conditions are fully stated and the average values compiled, they are of immense value in estimating and in following up the work. Care must be taken, of course, to provide for indirect charges such as foremen, sharpening tools, miscellaneous work, and contingencies.

Reducing Construction Costs

Up to this point there has been considered the substitution of accurate methods for guess work in estimating. The more important question is how far the knowledge referred to can be utilized in reducing costs. Accurate cost keeping is of value in following up construction costs from day to day by showing waste labor and in providing a mark for attainment of superintendents and foremen. Unless cost knowledge is in the form of small units, such comparisons cannot be made satisfactorily.

To get the full benefit of a knowledge of unit costs it must be utilized in the planning of the work in advance, and in distributing materials and jobs; in selecting materials and methods which will result in lowest labor costs; in adapting the construction plant to the special conditions; and, carried to its ultimate end, in laying out jobs for the workmen and giving them a reward for accomplishment.

Such management involves the adoption of factory methods in construction. Already the need of this is being recognized, but only to a limited degree. The president of one of our large construction companies states that on one job he made $10,000 by the adoption of methods involving systematic planning and routing. Full economy in construction can only be attained as the builder discards the haphazard rule-of-thumb method and considers his job with a view to thorough analysis, planning functional methods, and a complete study of details. By such methods as these will the labor of construction be brought to a more scientific basis and more nearly on a par with the material end of the work.

Designing Concrete Form Work Reduces Costs

Contractors Should Design and Plan the Form Construction—Experiments on Equivalent Hydraulic Pressure Cited

By R. A. SHERWIN
With the Aberthaw Construction Company, Boston, Mass.

SOME of the points mentioned by H. S. Taft in the paper on "Strength of Concrete Forms," presented to the Institute last year, are worthy of further discussion, and I propose to describe the methods used by the Aberthaw Construction Company in handling form work, to show the relation between the important features of form work, and show how we have successfully reduced the cost of forms by a careful study of their design, buying material and field work.

Numerous cost analysis diagrams prepared in our office from the actual cost of average reinforced-concrete buildings of the industrial type, not taking into account the cost of any equipment, show that the labor on forms averages about one-third the labor cost, which is about 35 per cent of the total cost of the building, and the lumber about one-tenth of the total material cost, including subcontracts. The design and erection of forms is therefore the most important single item in concrete building construction, and one upon which much thought and study can be well spent.

Contractor Should Design Forms

In the March, 1915, issue of *Concrete Cement Age*, Jerome Cochrane in an article on forms, says "Plans and details for forms, if required to be furnished by the contractor, should be submitted to the engineer for his approval before starting the work, but such approval should not release the contractor from any responsibility." I do not believe that this is the correct position to take in this matter. The engineer should be interested in results only. The finished building must be as he specifies. Since he holds the contractor responsible for results, the methods of doing the work should be left to the contractor entirely. The engineer has his work in designing the structure. The contractor ought to know more about designing forms. It is his business to know how to build.

Economical forms must be designed as light and with as few pieces as possible to give the necessary strength and stiffness. Remember, on the one hand, that human lives and the cost of failure, in both money and reputation, are dependent upon the design, and, on the other hand, that form work is a temporary structure fully loaded for a short time only and a lower factor of safety is therefore allowable. The main question, then, is one of strength with enough stiffness to prevent any appreciable sags in the finished concrete.

One place where deflection should be carefully guarded against is at the window head, where a slight deflection will cause much trouble and expense in setting the sash. The principal cause of settlement of form work is crushing of the soft spruce or pine lumber perpendicular to the grain in the girt over the post and also in the adjustment of the wedges under the posts as the full load is applied. An average safe value to use in form design for crushing across the grain, as determined by numerous tests, is 400 lb. per square inch for spruce. I believe that limiting the floor timbers to very small deflections and at the same time using high loads on the posts is not consistent, and surely not economical.

Equivalent Hydraulic Pressure

The proper value for the equivalent hydraulic pressure of concrete to use in form design has been variously estimated all the way from 75 lb. per square foot per foot of depth to twice that amount. The value of 140 lb. will give safe results and is based on actual experiments under job conditions. We have recently made three tests of concrete pressure on wall forms. Two of these were in a 20-in. wall, cast at the same time as the floor slab. The third was in a 6-in. partition wall, cast after the slab had been stripped.

The results of the first two tests seemed to indicate that the maximum pressure came when the head was about 3 ft. and diminished or remained constant thereafter. This was due to the fact that the wall could not be poured faster than 3 ft. in height in 30 min. and the concrete rapidly lost some of its hydraulic effect after this time had elapsed. Up to the time the mercury column began to fall, the pressure was 130 lb. The test on the partition wall gave an average of 125 lb. per square foot. This wall was built in about 25 min. In this test also the gages showed a decrease in pressure after about 30 min. The rate of filling the form should be considered in selecting the design head.

It should be noted that as a rule the head of concrete in a wall is limited by the height that can be cast by the placing outfit in one hour. Ordinary concrete begins to set up in this space of time so as to lose much of its hydraulic effect. It is economical when high heads occur to limit the height to which the concrete can be cast in order to use lighter forms. A system which requires a large number of rod or wire ties is decidedly uneconomical.

Points in Original Design

Stock sizes of lumber should be kept in mind when dimensioning the concrete members. For example, projections should be made 1¼ and 1¾ in. instead of 1 and 2 in., since the dressed stock comes nearer the former sizes. Beams can be made 11¾ in. wide instead of 12 in. Thus one 12-in. plank can be used without needing a ¼-in. strip tacked to the edge. Points such as these, thought out in the designing room, mean a cheaper building.

It is the writer's opinion that more accidents can be prevented, and money saved by contractors and for owners by showing the same interest in the study of form work as in the reinforced-concrete design. The greatest proportion of the small number of failures in concrete structures is due to either faulty form design or too early stripping.

The unit cost of making a thorough study of forms for a job is difficult to determine, but it is small compared to the time saved in the field by using the more efficient methods. In spite of the fact that carpenters' wages have steadily increased, while the quality of labor has decreased, and a poorer grade of lumber costs more than a few years ago, unit costs on form work now are much lower than when the job was left to itself. The overhead cost for this office work is a very small part of the total unit cost of the fórm work.

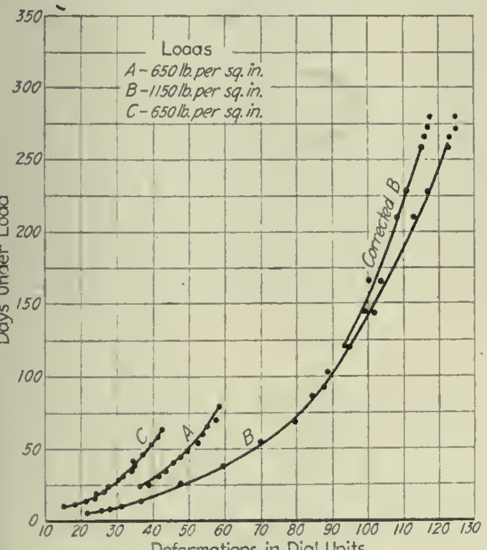
Concrete Deformations Increase with Time

Result of Long Time Tests of Three Compression Specimens Shows Importance of Time in Measuring Stresses in Buildings

By ALMOND H. FULLER,
Dean of the College of Engineering,
and CHARLES C. MORE,
Professor of Civil Engineering, University of Washington

IN MAKING a recent test (April, 1915) of a reinforced-concrete building, the writers found concrete deformations in the building which greatly exceeded those in the laboratory tests under, presumably, approximately the same unit stresses. It was found, further, that the deformations in the building increased during the few days that the maximum test load was allowed to remain. It seemed probable, therefore, that the time element should be considered in interpreting the stresses, but a search in available literature failed to disclose any data on the subject.

[Since this time the results obtained by F. R. McMillan have been published in "Studies in Engineering, No. 3," University of Minnesota, abstracts of which will be found in the Engineering Record of April 17, 1915, page 489, and Aug. 28, 1915, page 251.]



DEFORMATIONS INCREASE WITH TIME

Use was made of three available compression specimens in applying increments of load at intervals of twenty-four hours at approximately the same rate as in the building above referred to. The accompanying diagram shows the relation between days under load and deformation during the periods that the three specimens, *A*, *B* and *C*, were under constant load.

It seems apparent that the modulus of elasticity as a measure of the relation of stress to deformation while the load is being applied or released is of doubtful value in determining the stresses that are represented by observed deformation in concrete that has been under load for a considerable period of time. However, the modulus of elasticity as a measure of the relation of stress to deformation as determined from time tests in which the rate of application is the same would furnish means for making a fairly satisfactory determination of the existing stresses.

The standard to which the readings have been referred is a steel bar bedded in concrete, therefóre the results show the total deformation in the concrete, including shrinkage, effect of humidity, etc. In presenting these few results at this time it is realized that they are entirely inadequate for use other than on the building in question. It is believed, however, that they indicate that the elasticity of concrete must be recognized and that the distribution of stress between steel and concrete in reinforced-concrete structures may be quite different from that usually assumed. It is hoped that the discussion may bring out the results of other work done along this line.

Reinforced-Concrete Tower Tank 172 Feet High

Middleboro (Mass.) 500,000-Gallon Water Tank Built with Hemispherical Bottom and Supported on Cylindrical Tower

By G. A. SAMPSON
Of Weston & Sampson, Consulting Engineers, Boston, Mass.

THE aim of this paper is to present the main features of the design and construction of the Middleboro (Mass.) tower tank, the largest elevated water tank in the United States and the first to be built with a hemispherical bottom.

A hollow cylindrical tower was adopted in preference to a number of columns because, structurally, it seemed a safer type of support, would probably be more economical to construct, and could be designed to present a more pleasing appearance. The simple cylinder is relieved by twelve 4 x 24-in. pilasters. The thickness of the tower wall between pilasters is 10 in. and the greatest compression due to the dead load is 483 lb. per square inch, increased by wind pressure to 631 lb.

TANK HAS HEMISPHERICAL BOTTOM

The 500,000-gal. tank is 41 ft. in inside diameter and has a depth of water at the center of 59 ft. The bottom is a hemispherical bowl hung at its rim from the wall of the tower. The bowl itself has a capacity of 125,000 gal. The advantages of this type of bottom over the flat beam and slab construction often employed for small tanks, and the dome type used in a few structures of considerable size, are great enough to warrant careful consideration in the design of elevated concrete tanks. As compared with the dome bottom, there is a saving of 34 per cent in the height of the vertical wall of the tank for the same capacity, or a 47 per cent increase in capacity for the same height of wall. It has a practically self-cleaning bottom. There is a better distribution of stresses because the enormous thrust in the dome bottom, which is concentrated at the most critical point of the tank, is replaced by a uniform tensile stress.

The vertical wall of the tank varies in thickness from 10 in. at the top to 16 in. at the bottom, and the hemispherical bottom from 18 in. at its connection with the tank walls to 14 in. at its center. Without any assistance from the steel reinforcement, the tensile stress in the concrete is about 250 lb. per square inch. The tensile stress in the steel acting independently is approximately 14,000 lb. per square inch. With both materials acting in conjunction, the computed stresses are 215 and 2150 lb. respectively. The tank is covered to guard against the growth of algae and to prevent freezing. The roof is a concrete dome 4 in. thick, with a rise of 4 ft. in the center.

HEMISPHERICAL BOTTOM WELL REINFORCED

SPECIAL JOINTS IN TANK

To insure watertight construction joints in the tank, there was cast in the old concrete a continuous triangular groove, about 1½ in. deep, running around the wall near its center subsequently filled with grout and concrete; to still further minimize the chance of leakage at each horizontal joint, an uncoated steel plate or dam of No. 14 gage metal 10 in. wide, turned over 1 in. at each edge to form a channel and bolted together to form a continuous watertight stop, was imbedded 4 in. into the old work, thus leaving 4 in. extending up for a bond with the new concrete. The cost of twelve channel rings in place was about $400.

Water was let into the tank on Oct. 24, 1915, and the depth gradually increased to 26 ft., when three hair-cracks developed radiating from the central 16-in. inlet main and extending 6 to 9 ft. therefrom. The water was drawn off, and a circular reinforced-concrete ring 9 in. thick, bonded to the old bottom by roughening, grouting and dowelling, was cast on the inside of the tank around the pipe. The structure was put into service on Jan. 1, 1916, and although the present depth of water is only about 30 ft., no weakness or leakage has developed. The sole reason for the cracks was undoubtedly the insufficient reinforcement in the design, and does not reflect on the type of bottom or the workmanship of the contractors.

The vertical wall of the tank, with the exception of three or four small damp spots in one horizontal joint where an excessively hot day caused shrinkage cracks in the top of the ring poured on the previous day, has been absolutely tight, as well as the hemispherical bottom, except for the above-mentioned cracks.

The total cost of the completed structure, including engineering, was $27,500. The average cost of concrete per cubic yard, excluding reinforcement, was $18.09; the average cost including reinforcement was $21.60. The contractor was the Hennebique Construction Company, of New York. Thomas M. Dorsey was resident engineer for the writer, under whose direction the work was designed and constructed.

Construction Methods Tested in DuPont Concrete Road

Experiments Made to Determine Effects of Reinforcement and Hydrated Lime in Preventing Transverse Cracks

By CHARLES UPHAM
Chief Engineer, Coleman-DuPont Road, Delaware

EXPERIMENTS to determine the most suitable methods and materials to use in preventing transverse cracks by means of steel reinforcement and by the addition of hydrated lime, have been a feature in the construction of a 20-mile section of the Coleman-DuPont road in Delaware. No standard length of concrete slab was adopted, as it was decided, in order to learn what the maximum length of slab could be, to place joints only when the concrete mixer stopped for more than 15 min. This has resulted in some very long slabs, the longest being 460 ft. The concrete pavement is 14 ft. wide, 7 in. thick at the center and 5 in. thick at the sides, on a flat subgrade.

Three Kinds of Reinforcement

Three different kinds of steel reinforcement have been used. It was the intention to keep the cost and weight of reinforcement per square yard practically the same for all types of construction.

One section of the road is reinforced for the entire width with No. 29 American Steel & Wire mesh reinforcement. This gives the weight of reinforcement per square yard of pavement as 2.52 lb. Wherever the slab was less than 178 ft. long, no cracks have yet appeared.

Another section of the road is reinforced for the entire width with No. 25 Kahn expanded metal. This gives the weight of reinforcement per square yard of pavement as 2.25 lb. Wherever the slab was less than 164 ft. long, no cracks have yet appeared.

The third section of the road was reinforced with No. 25 Kahn reinforcement for a distance of 4 ft. on each side of the center line. More cracks appeared in this section than where the reinforcement extended the entire width of the pavement.

A fourth section was reinforced with the same material as noted in the preceding paragraph for a distance of 3 ft. on each side of the center line. With the exception of one slab, more cracks have appeared in this section than in either of the other reinforced sections.

The sections where no reinforcement was used have developed cracks, but up to the present time not as many as the sections that were reinforced with the 6 and 8-ft. reinforcement. One reason to account for this may be that the unreinforced section has not been laid as long as the others. With one exception it appears that as the percentage of reinforcement increases the transverse cracks become fewer. The increased cost due to reinforcement was 9 cents per square yard.

Tests with Hydrated Lime

A number of experiments using different amounts of hydrated lime up to 10 per cent by volume were performed. While sufficient time has not elapsed to warrant any definite conclusions, the results promise to be interesting. The only conclusion that can be drawn now as to whether or not the lime is of benefit is from the number of transverse cracks that have developed.

On one section where no lime was used the longest reinforced slab that has not developed a crack is 191 ft. When 10 per cent of lime by volume was used the longest slab to develop no crack was 210 ft. In another instance a slab without reinforcement and using no lime, has developed two cracks, breaking the slab up into three sections, 299, 118 and 126 ft. long, respectively. In two slabs where 10 per cent lime was used no cracks have yet developed; the length of these slabs is 336 and 210 ft.

On another section the longest slab without lime, showing no cracks, was 187 ft. When 5 per cent of lime was used the longest slab without a crack was 245 ft. When 10 per cent of lime was used the longest slab showing no crack was 294 ft. While the data are not sufficient to warrant definite conclusions, they do advocate the use of lime.

Diverse Methods Feature New York Subway Concreting

Both Central and Portable Mixing Plants Used on $330,000,000 Dual Transit System Contracts

By ROBERT RIDGWAY
Engineer of Subway Construction, Public Service Commission, New York

IN the construction of New York City's new $330,000,000 dual system of subways, which will increase the single-track mileage from 296 to 620, approximately 3,000,000,000 cu. yd. of concrete, involving 5,500,000 bbl. of cement, are being placed by a variety of methods, involving both central and portable mixing plants. Of the total estimated concrete yardage 1,600,000 cu. yd. were placed prior to Jan. 1, 1916. On account of the magnitude of the work it has been necessary to establish in New York City a laboratory where all concrete materials are passed upon by a specially organized division of the Public Service Commission known as the Division of Materials Inspection.

The plans for the new subways involve many types of structure, such as subways in open cut and in excavation under decking, soft ground and rock tunnel, subaqueous tunnels driven with and without the use of the shields and compressed air, subaqueous tunnels of the Detroit River type, and elevated railway construction of steel and reinforced concrete. The work also involves the underpinning of buildings from one to twenty stories in height.

The methods of mixing and placing concrete are left largely to the discretion of the several contractors. On most of the Lexington Avenue work the contractors preferred to use central mixing plants, which were generally located along the East River where the materials could be brought to them by water, the concrete being hauled, after mixing, ½ mile or so to the work. Where motor trucks were used the time consumed in transporting the mixture was not a cause for concern. Some of these trucks had a capacity of 4 cu. yd. On one of the sections air jets were used instead of water jets to loosen the concrete from the trucks when being dumped. On several of the contracts the concrete was hauled in horse-drawn trucks from the mixing plant, and the time required was long enough to raise a question as to whether initial set was taking place before the concrete could be placed in the forms. Some of the concrete delayed in transit was rejected. Because of the trouble from this source the contractors adopted a plan of mixing the ingredients dry at the central plant and delivering the dry mixture on the street at the work, when water was added and the mixture turned over twice by hand before being placed in the forms.

In spite of the advantages of central mixing plants the author prefers to have concrete mixed as close to the work as possible, for he believes that a better quality of concrete is insured when it can be delivered to the forms immediately after mixing. As most of the streets are decked over the subway openings, the concrete is delivered to the forms through chutes leading from holes cut through the decking. Mixing and placing concrete by a pneumatic method has been tried experimentally on several of the subway contracts.

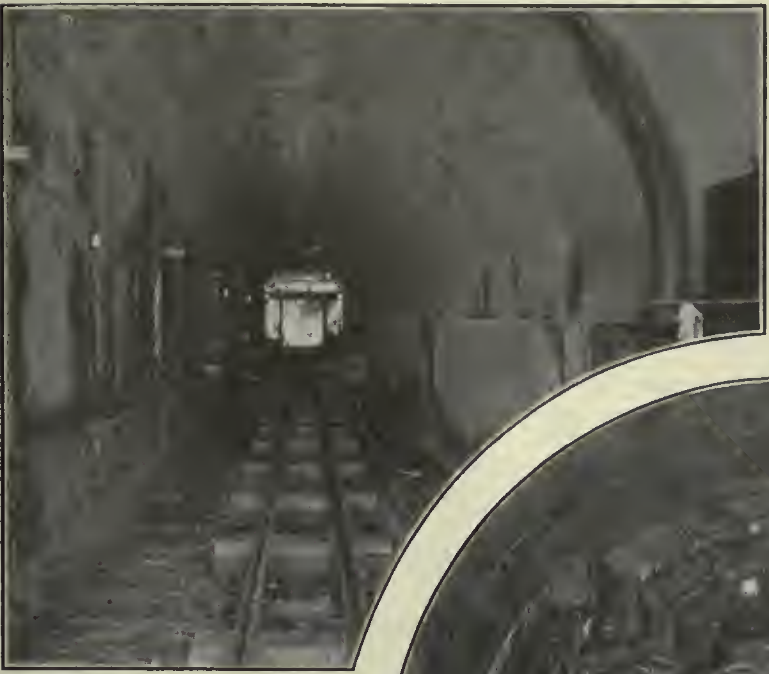
The Harlem River section of the Lexington Avenue subway was built by sinking steel tubes in sections in a trench previously dredged in the bottom of the river. The steel shells were surrounded with concrete placed under water through tremies and work was carried on in a manner generally similar to that employed in the construction of the Detroit River tunnel. (This work has been previously described in the Engineering Record.)

Old Concrete Well Preserved

The original Interborough subways which are now in operation were constructed between the years of 1900 and 1906. It has been necessary, from time to time, to lengthen the platforms of the stations to provide for longer trains, to construct ventilating chambers, emergency exits and to make other alterations for various purposes. All of this work involves the cutting out of the original concrete in many places and there has been no evidence of any disintegration of the old concrete from electrolysis or other causes. Two pieces of concrete, thirteen years old, were cut from the lining of the Park Avenue tunnel, sawed into 6 x 6 x 12-in. prisms and tested for compression. One sample failed at 3960 lb. per square inch and the other did not fail under the capacity of the machine, about 4000 lb. per square inch.

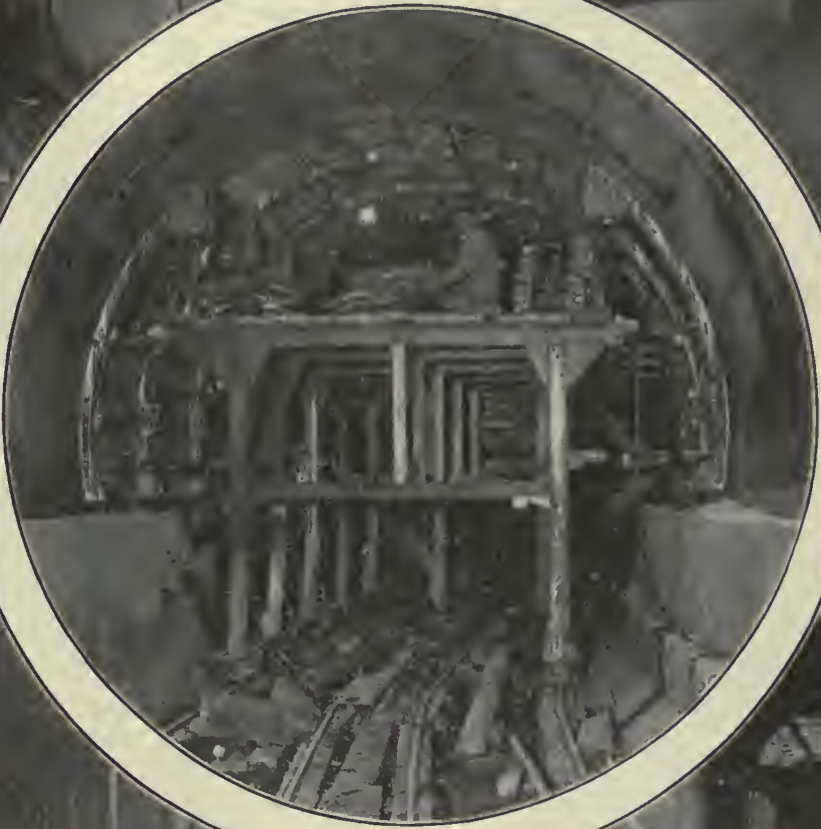
In driving the shields for the tunnel which passes under the East River the Manhattan shield encountered the concrete foundation of a bulkhead wall constructed by the Department of Docks and Ferries in 1905. This foundation was in the form of concrete deposited in the salt water in

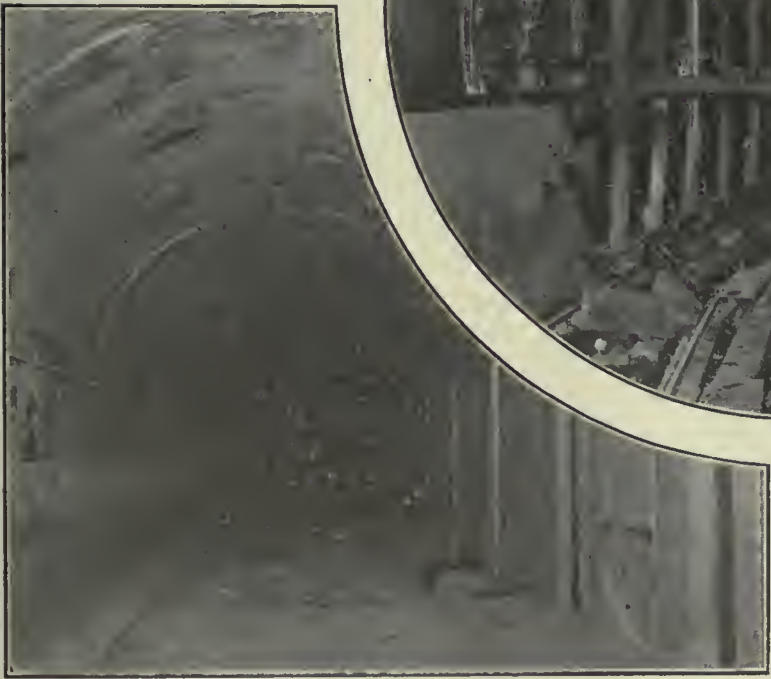
How New York's Subway Work Is Progressing



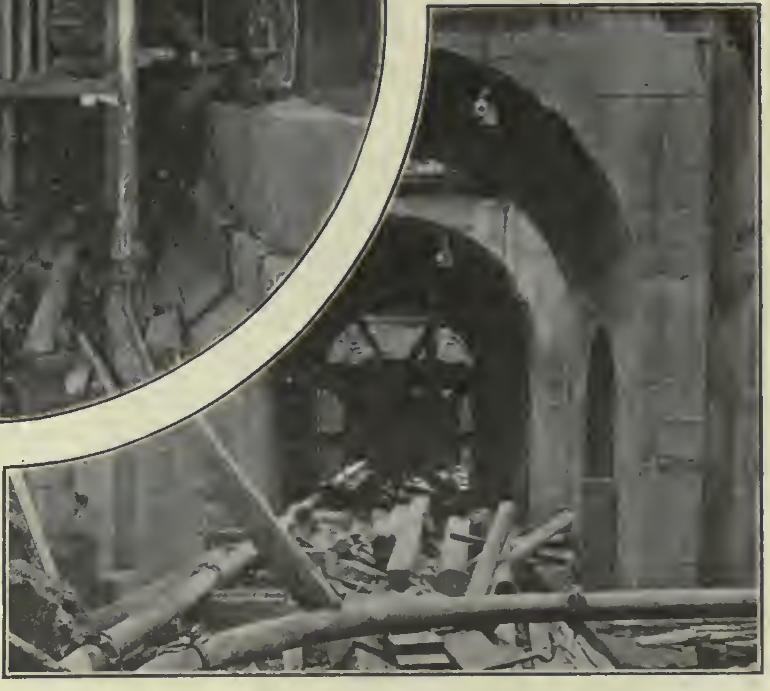
HARLEM RIVER TUNNEL SECTION READY FOR TRACK-LAYING

PLATFORM OF LOCAL STATION ON LEXINGTON AVENUE LINE





COMPLETED PORTION OF LEXINGTON AVENUE ROUTE



THIS SUBWAY CONCRETE PLACED BY PNEUMATIC METHOD

ORNAMENTAL REINFORCED CONCRETE STRUCTURE FOR ELEVATED LINES ALONG QUEENS BOULEVARD—(IN CIRCLE ABOVE) FORM-HANDLING PLANT FOR CONCRETE LINING OF VESEY STREET CAST-IRON TUBE burlap bags and was found to be in excellent condition. The burlap of the bags was intact in places, and the general appearance of the material was that of mass concrete placed in the dry.

Three-Level Concrete Conduit Design Outlined

Special Conditions Encountered in Location of Conduits Complicate the Unusual Design—Expansion Provisions Ample

By FREDERIC H. FAY
Of Fay, Spofford & Thorndike, Consulting Engineers, Boston

THIS PAPER on the Fall River concrete conduits is the very brief statement of a complicated municipal problem in which are involved many questions of sanitation, stream control, mill engineering and city planning, and to which a concrete conduit of peculiar design furnishes the key.

[As this project has already been described in an article in the Engineering Record of Oct. 23, 1915, page 501, only the details of the design of three-level conduit are here abstracted from Mr. Fay's paper.]

THREE-LEVEL CONDUIT DESIGN

So far as is consistent with stability the main three-level conduit has been designed as a reinforced-concrete structure. For a considerable part of its length, however, this conduit is to be built in gravel and other porous material in which the level of ground water will stand nearly at the top of the conduit. In view of the fact that the several conduit channels may all be empty at the same time, the lower section of the structure was designed of massive concrete to give it sufficient weight against possible flotation.

Further, it will be possible, if found desirable, to deposit this mass concrete in water within the walls of a temporary cofferdam, thus sealing the bottom and rendering the unwatering of the cofferdam by pumping a simple and easy matter. Under the program of construction proposed, however, it is planned to dike off that part of the river in which the conduit is to be built, and to carry out practically all the construction in the dry.

Above the mass concrete of the cold-water channel, the side walls and the floor, both of the surface-water and of the hot-water channels, are of thin reinforced-concrete construction. To avoid the objections to an open channel, the hot-water channel is covered by thin reinforced-concrete roof slabs supported on reinforced-concrete cross beams, the roof slabs being removable so that access to the hot-water conduit from the surface may be had at any point.

EXPANSION AND WATERTIGHT JOINTS

The usual provisions for expansion are to be made, care being taken to secure watertight joints. The hot-water channel is exposed at the surface of the ground and, because of this fact and also because it carries an intermittent flow of hot water, is subjected to greater variations of temperature than other parts of the three-level conduit; consequently, provision has been made for the expansion and contraction of the hot-water channel independently of the remainder of the structure. In effect, the hot-water channel with its cross floor is simply supported on the vertical walls of the surface-water channel, horizontal expansion joints being provided at the top of these walls.

The provision for longitudinal expansion of the surface-water portion of the three-level conduit consists of vertical expansion joints in its vertical walls at intervals of approximately 60 ft. No provision for expansion has been made in the mass-concrete section of the cold-water channel, as this is buried to a depth of 9 ft. below the surface of the ground, the water in it is drawn from a level below the surface of the lake, and no considerable variation of temperature is expected in this mass concrete.

Reinforced-Concrete Slab Tests Show Time Effects

Investigation for Effective Widths of Slabs Carrying Concentrated Loads Also Indicates Increased Deformations with Time

By A. T. GOLDBECK,
Engineer of Tests,
and E. B. SMITH,
Associate Mechanical Engineer, U. S. Office of Public Roads, Washington

IN JUNE, 1912, an investigation was started at the U. S. Office of Public Roads to determine the distribution of stress in reinforced-concrete slabs subjected to concentrated loads. A report on the first six slabs tested was made in June, 1913, before the American Society of Testing Materials. (See the Engineering Record of Aug. 9, 1913, page 154.) During the past two years there have been tested three large-size reinforced bridge slabs to secure data concerning the distribution of stresses to serve as a basis for a reasonable assumption in design formulas. (One of these tests, slab 835, has already been reported in the Engineering Record of Jan. 2, 1915, page 26.)

DESCRIPTION OF SLABS

Each of the slabs herein described was made of 1:2:4 gravel concrete, machine mixed, and was reinforced 0.75 per cent of plain square steel bars, with no transverse reinforcing. These slabs were 32 ft. wide, of 16 ft. clear span with a 10-in. bearing width on each support. The accompanying Table 1 gives the dimensions and the breaking loads.

TABLE 1—DIMENSIONAL DATA AND BREAKING LOADS

Serial No.	Thickness, in inches		Reinforcing		Modulus of elasticity	Breaking load, lb.	Age, mos.
	Total	Effective	Size, in.	Spacing, in.			
835	12	10½	¾	10.5	2,900,000	119,000	6
930	10	8½	¾	8.87	4,000,000	80,000	5
934	7	6	½	5.56	3,000,000	40,000	3

The forms were removed at the end of two weeks, and each slab was cured in air and sprinkled once each day until the forms were removed. Tests were begun at the age of about twenty-eight days and were continued periodically until the time of breaking, at the age given in the table.

TIME ELEMENT IMPORTANT FACTOR

One of the important facts which these tests have brought out and which this paper seeks to impress upon concrete engineers, is that the time element is a very large and important factor in determining stress values and their distribution from the fiber deformation. Nearly all other materials of construction will show an approximately constant relation, independent of the time, between the load and its accompanying deformation within the limit of elasticity. This is not true in the case of concrete, which exhibits a marked flow or molecular adjustment under working stresses extending over time periods of several weeks.

TABLE 2—EFFECTIVE WIDTHS OF SLABS

Center load, lb.	12-in. slab 835		10-in. slab 930		7-in. slab 934	
	Ft.	Per cent of span	Ft.	Per cent of span	Ft.	Per cent of span
15,000....	...	...	11.4	71.6	12.7	79.5
20,000....	11.6	72.3	13.0	81.2	17.5	109.3
25,000....	11.5	71.9	12.9	81.1	...	...
32,500....	12.1	75.7	...	...	...	...
35,000....	...	...	14.5	90.7	...	...
Safe load	12.1	75.7	12.9	81.1	17.5	109.3

When concrete is subjected to compressive fiber stress of 700 lb. per square inch, the immediate fiber deformation is only about 50 per cent of what it will be if the stress is maintained for three weeks. Within twenty-four hours after the application of the load the deformation has increased an additional 20 per cent; during the first hour the deformation may show a change of 5 per cent or more. Furthermore, the recovery of the deformation after the removal of the load is slow and not complete.

This fact is mentioned here to show the importance of taking all the deformation readings at approximately the same time after the load is applied, and in each case a new set of deformation readings under zero load must be taken just before each load application. The *immediate* fiber deformation is the value which should be used, and not the value obtained after a long-time suspension of the load, nor that which contains the effect of several applications and removals of loads.

RESULTS FOR EFFECTIVE WIDTH

The determination of the effective width is attended by so many variables that, from the information at hand, a final and definite formula cannot be given. Its value, however, is affected by the span, the total width, the thickness, the load on the slabs, the distribution of the loads, and probably by special forms of reinforcing. The thickness and the load with its distribution are the only variables that have been considered in tests so far, and the values for the effective widths for single concentrated loads are collected in Table 2.

From these values it may be noted that there is a general tendency for the effective width to slightly increase with the increase of load. Also, the effective width seems to vary inversely as the thickness of the slab. In the light of the information available at the present time, we should be safe in using a value for the effective width equal to 0.7 of the span.

This series of experiments has not been completed, but is being continued with the hope of arriving at a definite formula for determining the value of the effective width as influenced by all of the important variables.

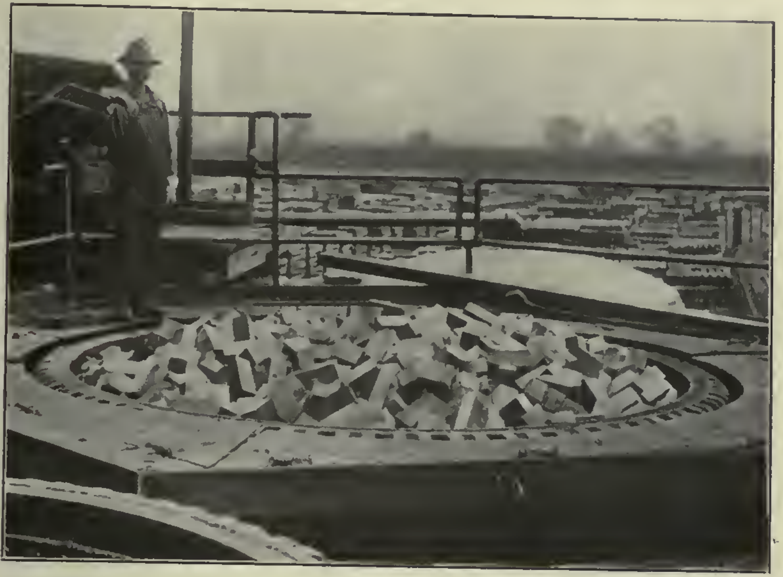
[*The paper by E. B. Smith, entitled "The Flow of Concrete Under Sustained Load," giving the results of additional tests supplementing the above will be published in a succeeding issue.*—EDITOR.]

Creosoting Plant at Orrville, Ohio, Has Vertical Cylinders for Wood Blocks

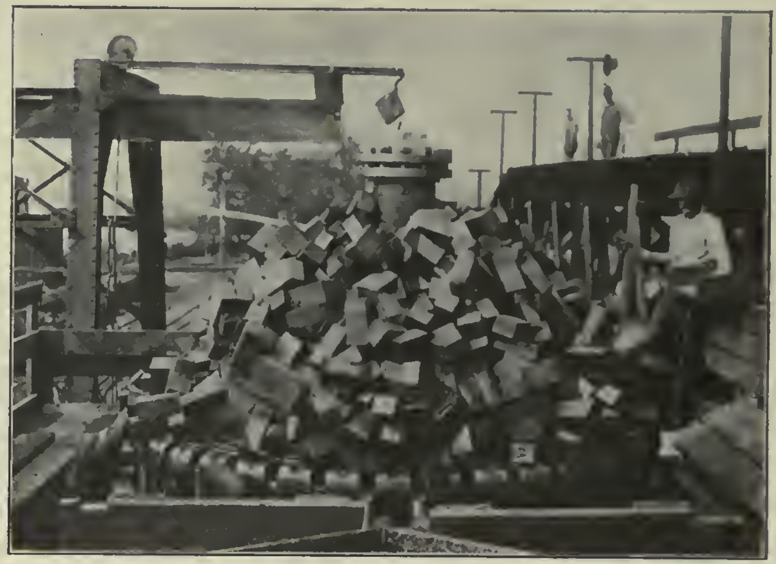
Comparatively New Idea Is Believed to Have Many Points in Its Favor, Economizing in First Cost, Labor and Space

By E. A. STERLING
Manager, National Lumber Manufacturers' Association, Chicago

A COMPARATIVELY new idea in the process of creosoted wood block has been developed which is of great importance, because it promises to reduce materially the cost of wood block. The new idea is mainly one of economy in operation, which is certainly a practical measure when properly applied, and worthy of consideration, because it does not involve any new or untried methods of impregnation, nor of preservative material. It is, in short, the vertical cylinder. Two engineers, working independently, have evolved practically the same fundamental idea in the matter of vertical treating cylinders. The first to design and build a plant of this character was J. B. Card, of Chicago. He was followed by G. B. Shipley, of Pittsburgh, who is more recently in the field with a new plant embodying all the improvements and advantages which present experience makes it possible to apply to the vertical-cylinder idea. Since the designs are patented, both of the gentlemen concerned have expressed their willingness to have descriptions published and the information made available to the lumber-trade, wood-preserving and engineering interests. The following describes more specifically Mr. Shipley's vertical plant at Orrville, Ohio:



CYLINDER FILLED WITH BLOCKS, READY TO BE CLOSED



PLUNGER PUSHING TREATED BLOCKS OUT OF CYLINDER

THE ORRVILLE PLANT

The vertical wood-block cylinders at Orrville have been installed by the Ohio Wood Preserving Company, in conjunction with their horizontal cylinder, which is of the usual type for the treatment of ties and other classes of material. Each type of cylinder is equipped for the use of any standard process, using either creosote or zinc chloride, but, because of the greater economy through the elimination of the wood-block cages necessary in the horizontal cylinder, and the mechanical handling of the blocks from the planing mill to the cars, the vertical cylinders are so far devoted entirely to wood-block treatment. The boiler house, horizontal cylinder building, vertical cylinder equipment, planing mill and shop are all housed in separate buildings. Steam is generated in two boilers of 150 hp. each, with steam at from 100 to 150 lb. working pressure, and so fitted that either coal, wood, refuse or gas may be put in as fuel at any time. The electric current is furnished by a local power plant, and all the woodworking machinery is driven by direct-connected alternating-current motors, while the crane is driven by direct current.

The plant contains a number of special machines which have been designed and developed to effect the highest efficiency in operation. These improvements have proved entirely satisfactory, and have eliminated many of the operating labor problems of the old type of wood-preserving plant.

The vertical cylinders for treating paving blocks are of two sizes, one holding 300 yd. and the other 200 yd. Each cylinder is fitted on the inside with a hydraulic plunger and platform, so that when empty and about to be charged with wood blocks the platform is at the top, and as the blocks are delivered into the cylinder the platform lowers gradually, thus preventing breakage. When the cylinder is full the top cover or door is put on and the blocks are treated in the usual manner. After treatment, when the cover is taken off and the plunger started, the treated blocks are forced up and discharged into a chute and direct into cars for shipment.

APPARENT ADVANTAGES OF SYSTEM

Without going into further details the apparent advantages of treating wood blocks in a vertical type of cylinder may be summarized as follows:

1. There is a reduction in the amount of labor, owing to the mechanical handling of the blocks from the saws to the outbound cars.
2. Lost space is reduced to a minimum, permitting in each charge more cubic yards of blocks per unit of cylinder displacement than is possible in a horizontal cylinder, where block baskets or cages are necessary.
3. The vertical cylinders require only one-tenth of the ground space used for the horizontal type of plant.
4. The first cost of the entire equipment is very materially less than that of a treating plant with horizontal cylinders.

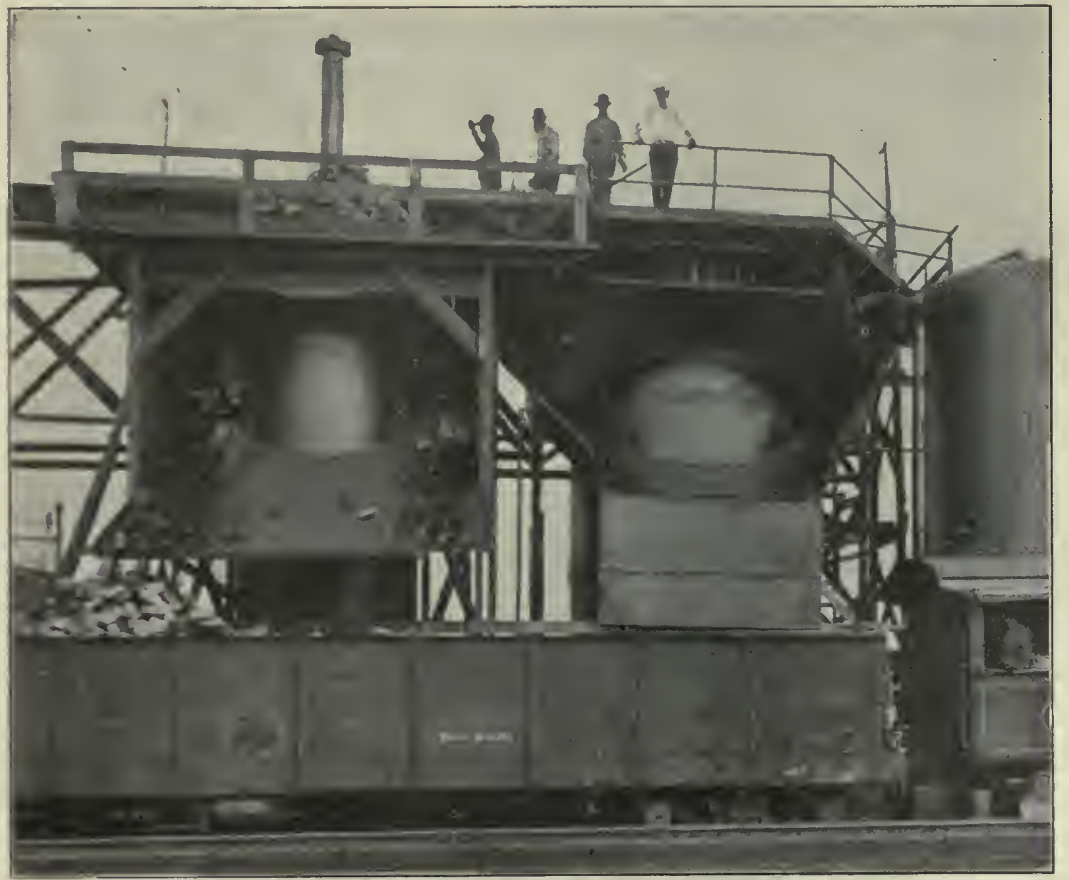
LOW FIRST COST

Perhaps the chief advantage of the vertical block plant from the standpoint of the lumber industry is its simplicity of operation and its low first cost. Only two machines are required, and much smaller tanks and cylinders, thus permitting the construction of paving-block plants in connection with sawmills, or near consuming points. Freight rates on shipments of blocks to remote territory may thus be eliminated, making it easier to meet the competition of other paving materials. In many localities the cost of wood block has been almost prohibitive on account of the long haul, a factor which can be largely eliminated if inexpensive vertical block plants can be erected in regions which it is now possible to serve only from distant plants. Another consideration is that the capacity of the plant may be more readily adjusted to the needs of the locality, the size and number of cylinders being readily adjusted or changed.

If the point has actually been reached where a vertical type of plant will materially reduce the cost of treatment, and the equipment is so simple in character and so low in cost that it can be installed in connection with existing treating plants or sawmills, where power is already available, it should greatly help to develop the wood-block industry in all parts of the country. This development in turn would create a demand for Southern pine in the South, tamarack in the North and fir on the Pacific Coast, or any other wood suitable for wood-block pavement. At the same time it would permit the use of this superior paving in cities and towns where previously its cost had prevented its use.

The vertical type of plant is also adapted to treat material other than blocks, so that local requirements may be taken care of, or material treated for retail trade. The smaller dimensions of timbers, silo stock and bridge material can be rapidly treated by loading them on the movable platform which can be pushed up to take the load and lowered so as to immerse it in the cylinder.

The cylinders are operated by combined air compressor and vacuum pump, thus reducing all piping to a minimum. All measuring tanks are also vertical and mounted on weighing scales, so that the exact amount of preservative absorbed by the wood is determined directly on the basis of weight, instead of by the old volumetric measurements which required temperature adjustment.



TREATED BLOCKS BEING EJECTED AND DROPPED DOWN CHUTE INTO CAR

The blocks are cut with an automatic band saw running on ball bearings, and driven by a direct-connected motor. The machine can be adjusted for different capacities, although it is generally used with eight saws, which easily cut 70 yd. of blocks an hour.

TO PROTECT BOTTOM FLANGES of girders over railroad tracks from the rapid deterioration due to the chemical action of smoke and gas, together with the erosive effects of engine blasts, it was found, after trying several other devices, that ⅞-in. plain oak sheathing held firmly in place by iron clamps, the sheathing being first covered on its upper side by a paste composed of red lead and Portland cement, was very satisfactory. As stated by L. M. Hastings, city engineer of Cambridge, Mass., in the February *Journal* of the Boston Society of Civil Engineers, the oak sheathing showed surprising resistance to the destructive action of the blast. Some pieces of oak taken from the bridge after 10 or 12 yr. exposure showed a loss of thickness of not more than ¼ in.

Building Districts and Restrictions to Be Based Upon Definite Principles

New York City Commission Working on Plans for Regulating Height of Buildings, Area of Courts and Location of Trades

THE COMMISSION on building districts and restrictions appointed by the Board of Estimate and Apportionment of New York City to report on a districting plan regulating the height of buildings, the area of courts and yards, and the locations of trades and industries has recently issued a progress statement of the plans under consideration. It contains the definite principles on which the work is to be done. The following is an abstract of the more important of these principles relating to the justification for districts and to the basis for the limitations:

DISTRICTING FOR USE

Generally speaking, a building is appropriately located when it is in a section surrounded by buildings of similar type and use. Strong social and economic forces work toward a natural segregation of buildings. In general, the maximum land values and the maximum rentals are obtained where the segregation and uniformity are most complete. The chief purpose of districting regulations is to strengthen and supplement the natural trend toward segregation.

In spite of this natural trend, building development in many parts of a big city is haphazard. The natural trend is not strong enough to prevent sporadic invasion of a district by harmful or inappropriate buildings. Once a district has been thus invaded, rents and property values decline, and it is difficult ever to reclaim the district to its more appropriate use. Individual property owners are helpless to prevent the depreciation of their property. One purpose of districting regulations is to do for the individual owners what they cannot do for themselves—set up uniform restrictions that will protect each against his neighbor and thus redound to the benefit of all.

HEIGHT AND AREA DISTRICTING

Rentable values in any given block or area are largely dependent on a certain measure of uniformity in its development as regards height, yards and open spaces. There can be no security or stability of values if each individual owner is at liberty to build to any height and over any proportion of his lot without regard to his appropriate and reasonable contribution to the light and air of the block.

This has been conclusively demonstrated by costly experience in the recent history of the office and loft-building sections of Manhattan. Whole areas have been built up piecemeal with towering buildings having inadequate courts and yards without much thought of ultimate consequences. Such areas are in process of being smothered by their own growth. The streets are inadequate to handle the traffic induced by the multiplication of floor area to be served, and the buildings, constructed without reference to the width of the streets, yards and courts on which they abut, shut out light and air essential to rental on a basis that will permit of a fair return on the investment.

BASIS IN INTENSITY OF DEMAND

A proper districting plan would insure that wherever probable intensity of demand will permit, a certain measure of the improved light and air conditions that have attracted tenants to the new locations shall be permanently retained. In establishing air and light provisions the district plan will not usually go as far as, and will in no case go farther than, the purely economic standard indicated by the mutual advantage of the property owners and tenants and the conservation of the property values.

A districting plan should look to the future and take into consideration the types of development appropriate for the increasing intensity of use required by a growing city. To avoid the continuous reconstruction of existing buildings and the evils and misfits often resulting from the conversion of old buildings to new uses, it is undesirable to base a districting plan on the type of construction appropriate to the present-moment intensity of use. As the city is growing, that fact should be taken into consideration and types of construction authorized appropriate for any intensity of use that will probably be demanded and be socially justifiable within twenty-five or fifty years. A city that is not built with reference to probable future growth must be rebuilt time and again at enormous expense.

USE DISTRICTS

In a residential district only buildings with their usual accessories designed for the following specified uses may be constructured: Residential, hotels, private clubs, religious, educational, curative and philanthropic buildings and institutions. In a business district a list of justified industries and uses of a clearly objectionable character are excluded, as are also all other uses that are not noxious or offensive by reason of the emission of noise, odor, dust or gas.

The larger type of factory is excluded from the business districts by the limiting of the floor space that may be occupied for factory uses in any one building in a business district to 25 per cent of the total floor space of the building, but floor space equal to twice the ground floor area of the building may in any case be so used.

The proposed regulations apply only to future buildings and uses, and do not interfere with any existing structure or occupancy. The parts of the city not included in the residential or business districts are left unrestricted as to use. In residential neighborhoods the plan has been to preserve the side streets, wherever feasible, for strictly residential use. The avenues along the ends of the block and the main thoroughfares have usually been included in the business districts.

HEIGHT DISTRICTS

Five classes of height districts are provided, limiting the height of the building at the street line to a varying multiple of the street width. These multiples vary from 2½ in the office and financial section of Manhattan to 1 in the more undeveloped sections of Brooklyn, the Bronx, Queens and Richmond. Back of the street wall, the height of which is limited by a multiple of the street width, the building may go higher, but not beyond the line formed by the extension of the line drawn from the center of the street to the limiting height of street wall. This will permit the construction of mansards or of vertical walls, provided they are set back in a prescribed ratio so as to keep within the set-back provisions.

In limiting the height of all buildings in relation to width of streets the commission has adopted a principle which has been applied to tenement-house construction in New York City since 1885. It has also been extensively applied in European cities. It has evident advantages over a flat limitation that operates without regard to the street. The commission has, however, modified the strict application of this principle by providing that for the purpose of computing the limiting height a street less than 50 ft. wide shall be considered to be 50 ft. wide, and a street more than 100 ft. wide shall be considered to be but 100 ft. wide.

The only district in which the height of 2½ times the street width is proposed is in the section of lower Manhattan, south of Leonard Street and Brooklyn Bridge Plaza between Church and Pearl Streets. A width of two times the street width is allowed for the remaining parts of the more intensely developed commercial and industrial section in a broad belt through the center of the island from Leonard Street to Fifty-ninth Street between West Broadway, Seventh or Eighth Avenue and Third Avenue or Lexington Avenue. An exception is made for part of the Fifth Avenue section where limits of 1¼ and 1½ times the street width are proposed. A width of two times the street width is also allowed for a narrow belt along part of the North River waterfront of Manhattan and along the East River waterfront of Brooklyn, Queens and the Bronx.

YARD AND COURT REQUIREMENTS

In establishing districts limiting the percentage of the area of the lot that may be covered by the building, and prescribing minimum yards and courts, the commission has attempted to insure that each owner shall make a reasonable contribution to the light and air of the block. The plan has been based, first, on the partial segregation of buildings according to use districts, and second, by the gradation of court and yard provisions, particularly as affecting residential buildings, in accordance with the present and prospective intensity of use in various sections of the city.

Five classes of area districts are proposed, fixing varying percentage of lots that may be covered and corresponding regulations as to courts and yards. These are called the 100, 90, 80, 50 and 30-per cent classes. In each case the court and yard requirements and the limitation of area covered is more stringent for residential buildings than for non-residential buildings.

Edward M. Bassett is chairman and Dr. Robert H. Whitten, secretary of the commission. George B. Ford is consultant. The tentative maps for each of the boroughs of the greater city can be inspected at the office of the commission in the Municipal Building, New York City.

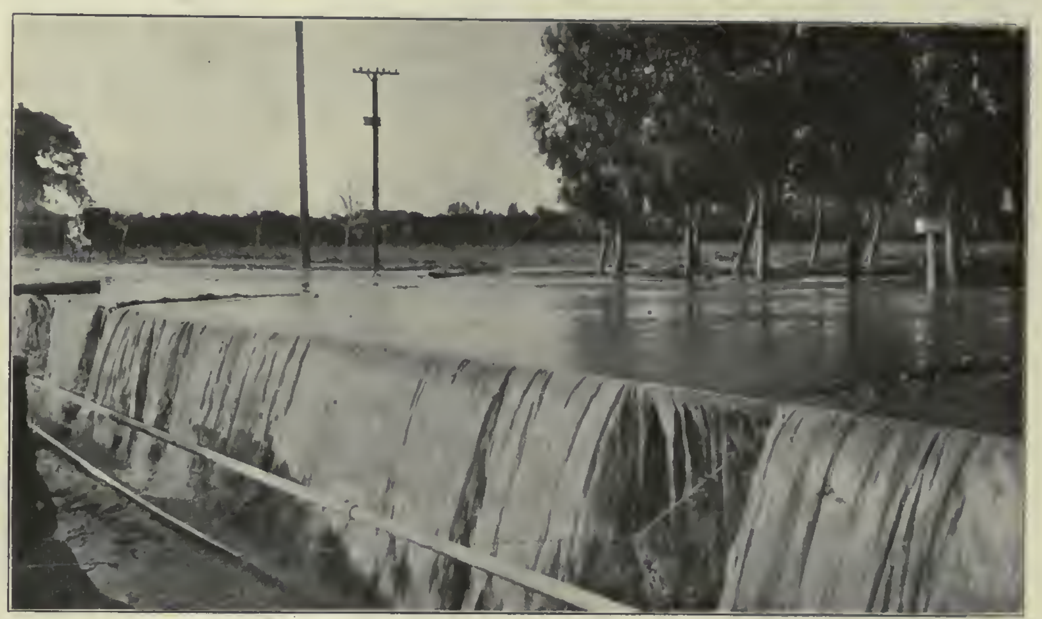
Public Works Scholarship Fund Helps City

THROOP College of Technology, Pasadena, Cal., has a scholarship fund which enables it to help the city with technical students without any expense to the city. A "public works scholarship fund" has been provided by a resident of Pasadena and is administered by Prof. R. W. Sorensen. For purposes for which no appropriations are made by the city a city official can obtain students from the college, approve their time slips and know that they will be paid from the interest or principal, part of which becomes available annually. The present city engineer, R. V. Orbison, has been making use of the opportunity to get good observers for storm-water flows and for his sewerage investigations. Previous to his incumbency the city light and power plant was almost the only department to use the students under this scheme.

Undermined Asphalt Pavement Withstands Unusual Stresses

IN southern California the State Highway Commission has laid the concrete pavement in many districts with shoulders 3 ft. wide and 3 in. thick, composed of crushed-rock aggregate up to ½ in. in size mixed with hot asphalt. The concrete base of the road is laid only under the central part, so that these shoulders overlie only a crushed-rock base.

When the unprecedented January floods swept down from the mountains, natural channels were overflowed and the highways suffered their share of the damage. The accompanying photograph shows a section of the boulevard east of Pomona over which the waters poured for the greater part of two days. At this particular point the overflow cut a deep ditch along the road and undermined the pavement for a distance of about 3 ft. back from its outer edge.



WATER FLOWED OVER THIS UNDERMINED PAVEMENT FOR THIRTY-SIX HOURS

The asphalt compound withstood a flood ranging up to 10 or 12 in. deep for a period of thirty-six hours, showing no signs of failure after the waters had subsided to normal. Unfortunately, highway officials could not obtain workmen in the flooded district during and immediately after the storm, as all available men had been drafted into service by the various properties threatened, and only the regular highway force could be depended upon for repair work. With the available forces an attempt was made to shore up the overhanging pavement, but before this could be properly done the sun came out and softened the asphalt to such a degree that the unsupported sections collapsed.

SCRAP MATERIAL sold by the Pennsylvania Railroad during 1914 brought $2,157,241.24, which is $1,000,000 less than was obtained by the same means in 1913. Some of the items and amounts were as follows: Old wheels, metals and wrought iron, $780,000; locomotives and wooden passenger cars, $114,326; waste paper, $19,211; oil barrels, $22,439; old rubber, $15,222.

Nation-Wide Canvass by Experts Sifts Out Best Methods of Concrete Road Building

Abstracts of Some of the Committee Reports Presented at the National Conference on Concrete Road Building Held in Chicago, February 15 to 18

Proportions of Materials and Consistency of Concrete

Committee—W. S. Gearhart, chairman, Kansas State Engineer; A. N. Talbot, professor of municipal and sanitary engineering, University of Illinois; W. M. Acheson, division engineer, New York State Highway Commission, Syracuse, N. Y.; H. S. Van Scoyoc, chief engineer, Toronto-Hamilton Highway Commission; F. L. Rice, F. L. Rice & Sons, Shelby, Ohio.

IT is the common practice at the present time to proportion materials for concrete roads and streets by the method of "arbitrary selection"; that is, by specifying the number of parts of different ingredients.

The general adoption of a more scientific method of proportioning the materials is very much to be desired. The committee appreciates the practical objections to such a change, but with the hope that the present method may be improved wishes to call attention to the sieve-analysis method of studying the character of aggregates and the proportioning of materials devised by W. B. Fuller. By this method, the densest mixture of the aggregates to be used can be accurately and readily determined; and often considerable economy may be effected by varying the proportions without injuring the quality of the concrete.

Your committee's recommendations for the proportions of the several classes of concrete for roads and streets represent the best practice at the present time. However, they should not be used without a thorough appreciation of the defects in the method of arbitrary selection.

For a one-course concrete pavement the materials should be mixed in the proportions of 1 sack of Portland cement, 2 cu. ft. of fine aggregate, and 3 cu. ft. of coarse aggregate. A cubic yard of the resulting concrete in place should contain not fewer than 6.8 sacks of cement.

For the base of a two-course pavement the materials should be mixed in the proportions of 1 sack of Portland cement, 2½ cu. ft. of fine aggregate, and 5 cu. ft. of coarse aggregate. A cubic yard of the resulting concrete in place should contain not fewer than 5.6 sacks of cement.

If the base is to consist of cement and fine aggregate the materials should be mixed in the proportions of 1 sack of Portland cement to not more than 4 cu. ft. of fine aggregate. A cubic yard of the resulting concrete in place should contain not fewer than 8.2 sacks of cement.

For the wearing course of a two-course pavement the materials should be mixed in the proportion of 1 sack of Portland cement to not more than 2 cu. ft. of fine aggregate. A cubic yard of the resulting concrete in place should contain not fewer than 11.8 sacks of cement.

Whenever it is economical to do so the materials in the wearing course should be mixed in the proportions of 1 sack of Portland cement, 1½ cu. ft. of fine aggregate, and 2½ cu. ft. of coarse aggregate which would be retained on a ¼-in. mesh sieve and which would pass a ¾-in. mesh screen, in order to reduce the difference between the expansion and contraction in the base and wearing courses to a minimum.

Many experiments in concrete road construction have been made recently with hydrated lime added to the concrete in amounts ranging from 5 to 10 per cent by weight of the cement. Information available at the present time seems to indicate that the addition of a small percentage of some inert material such as hydrated lime may be of value in concrete road construction, for it decreases the percentage of voids and produces a more impervious concrete, and reduces the expansion and contraction under moisture changes; but at this time the committee does not feel warranted in making any definite recommendations.

Wet, slushy concrete has many disadvantages. The consistency of concrete for road or street work should be such that when deposited from a chute or bucket it will settle in a flat mass, but will not flow on the subgrade. No tamping should be required and no separation of the mortar from the coarse aggregate should occur in handling the concrete or in finishing the surface.

The hauling of concrete in carts from the mixer a distance of from 300 to 500 ft. is not considered advisable and in accord with good practice.

Drainage and Preparation of Subgrade

Committee—Hector J. Hughes, chairman, professor of civil engineering, Harvard University and Massachusetts Institute of Technology; Clinton Cowen, state highway commissioner, Columbus, Ohio; George W. Cooley, state engineer, Minnesota State Highway Commission, St. Paul, Minn.; George A. Quinlan, county superintendent of highways, Chicago; Edward T. Beck, Edward T. Beck & Co., contractors, Cuba, N. Y.

EXPENDITURES on preliminary investigations of road drainage are, in the end, a real economy. Neglect of this factor means increased cost of construction, permanently poor roads and large maintenance charges. Excavations for drainage should be definitely and carefully arranged for in the specifications, and executed with as much care as any other part of the work.

Road drainage in general involves the disposal of, (1) surface water flowing to the road from outside areas; (2) rain falling on the road itself; and (3) underground water from outside areas. Problems of road drainage should be approached with the fundamental idea that to be effective in protecting the road surface a drainage system must be capable of acting quickly. Underdrainage is of necessity slow drainage as compared with surface drainage; every reasonable provision should be made to dispose of surface water coming to the roadway by surface drainage, and to keep it out of the foundation. The conditions imposed by the location often make it necessary that surface water shall be handled by underground channels or even underdrains; but in such cases the underdrains should be proportioned for storm-water capacity and not as for underdrainage alone.

The most obvious and effective way to dispose of surface water coming from outside the road is by means of surface ditches dug outside the top of cuts or along the toes of fills, on one or both sides. Ditches and gutters should be of liberal capacity. Gutters immediately adjacent to the traveled surface should be broad and shallow, rather than narrow and deep.

The kind of soil, the lay of the land, the amount of water, and other local conditions, such as the availability of suitable materials, will determine the method of underdrainage to be employed. The choice would in general be from among the following: (a) Pipes of vitrified clay or cement concrete laid in trenches, backfilled with the material excavated from the trenches, that is, "farm drains." (b) Pipes laid in trenches backfilled with broken stone, gravel, cinders, or similar open material. (c) Trenches filled with stone or gravel, without pipes, "blind drains." (d) Layers of cinders, gravel, broken stone or similar material varying in thickness from a few inches to 12 or 15 in., under the entire road surface. (e) A layer of similar material laid in a shallow longitudinal trench with the cross-section of a flat letter V, and known as "V" drains. (f) Two or more of these methods used in combination.

Of the three types of trench drains, a pipe covered with coarse gravel or similar filling, for the whole depth of the trench, is the most effective. It will act more quickly than the farm drain, or the blind drain; has more capacity, other things equal; and it serves quickly to take care of that part of the surface water that in most cases eventually gets into the ground.

Pipe drains smaller than 4 in. in diameter should not be used. Drains should be laid at least 2½ to 3 ft. below the subgrade, and 4 ft. is often better. Unless the drain is laid to sufficient depth it will not lower the water sufficiently under the entire roadway; but rather than increase the depth much over 4 ft. it is usually better to lay additional underdrains.

Drains in trenches should be laid parallel to the center line of the road on the side from which the underflow comes, or one line on each side; or a succession of transverse lines may be laid at a sloping angle across the road. Cross trenches are likely to form weak spots under the concrete, owing to the difficulty of getting them properly backfilled, and they should if possible be placed outside. It is desirable to lay underdrains as long as possible before building the road surface, especially if the concrete is to be laid late in the autumn. In many instances a layer of sand, gravel, stone, or cinders has been found to work more satisfactorily than drains in trenches. The committee believes that in very wet foundations the most effective method is a combination of two of the above types, such as pipe laid in trenches 3 ft. deep, more or less, at each side of the road and draining into catch basins or culverts in city streets at or under the curb, otherwise in the shoulder, just outside the ends of the concrete, the trench to be backfilled with coarse gravel, cinders or broken stone. In addition the whole subgrade under the concrete should be covered with a layer of similar material or sand, which makes with the trench filling a continuous drain as well as an insulation for the concrete. Where such loose material is not available, lateral drains laid at depths of 12 to 18 in. at intervals of 20 to 40 ft. across the roadbed from the side drains and draining into them, may serve the same end. The problem is to keep the subgrade dry by the use of such resources and material as are available.

Handling and Hauling Materials and Water Supply

Committee—T. R. Agg, chairman, professor in charge of highway engineering, Iowa State College; H. G. Shirley, chief engineer, Maryland State Roads Commission; Edward N. Hines, chairman, Board of County Road Commissioners, Wayne County, Detroit, Mich.; R. N. Waid, division engineer, Ohio State Highway Department; E. H. Cowan, vice-president, Farrell Engineering & Construction Co., Cleveland, Ohio.

FOR hauling concrete road materials, the following equipment is employed and each type has a distinct field of usefulness:

For hauling in congested districts and for city paving work, the team-drawn truck and the motor truck are available. Neither has an advantage over the other as regards keeping the aggregates clean. The motor truck will prove more economical if the haul exceeds about 2 miles.

The tractor train can be used economically for hauls exceeding about 1 mile, but usually cannot be operated over paved streets, and is not economical unless the hauling is over fairly good roads. Its capacity is relatively small, and it is hampered by unfavorable weather conditions more than any other type of hauling equipment. It is not suitable for paving work except under unusual conditions. It has no advantage over the other types of hauling equipment as regards keeping the aggregates clean.

The industrial railroad is adapted to conditions where loading facilities are ample and where the haul exceeds about 2 miles. It is quite flexible as to capacity, is not hampered greatly by weather conditions and is probably the most economical method of hauling. Under suitable conditions it has the advantage of enabling the materials to be handled without danger of becoming dirty.

Aggregates are most economically handled by unloading from railroad cars by means of the locomotive crane, the bucket elevator or the belt conveyor. Hauling is greatly facilitated when ample storage is provided of such a nature that the hauling equipment can be loaded quickly.

The water supply system for the concrete road should be such as to insure an abundance of water, and a pipe line along the road is the most convenient means of distribution. If the water is piped for more than a mile the pipe should be not less than 2 in. in diameter; but in any case hydraulic computations can be made to determine the proper size. For all ordinary purposes a 2-in. pipe seems adequate. The pump may be any suitable type designed to furnish not less than 250 gal. per minute. The power requirements will vary with the head, but the 5 or 6-hp. gas engine is commonly employed and is adequate except where the static head is excessive.

Economical Widths of Pavements and Shoulders

Committee—J. J. Cox, chairman, instructor in civil engineering, University of Michigan; W. W. Marr, chief state highway engineer, Springfield, Ill.; A. J. Rockwood, consulting engineer and contractor, Rochester, N. Y.; W. A. Stinchcomb, county surveyor, Cuyahoga County, Cleveland, Ohio.

A SINGLE-TRACK concrete road is generally uneconomical. Where traffic demands a hard-surfaced highway, like that obtained with Portland cement concrete, this traffic also demands a double-track road. The minimum width of concrete roads should be 15 ft.

Economy can be practised by building all shoulders to concrete roads from the native soil. As to widths of shoulders, 5 ft. should be the minimum; no width less than 4 ft. is satisfactory under any conditions. The minimum width of any road grade, even when provided with a single-track concrete road, should be 20 ft.

The use of such materials as crushed stone and high-grade gravel to surface the shoulders of a concrete road are uneconomical. They do not readily consolidate under the light traffic to which they are subjected. They form in ruts and prohibit perfect surface drainage, and do not accomplish the purpose desired. Greater economy will be obtained by putting the extra expense of constructing metal shoulders into extra widths of concrete. The only exception to this statement is where the road happens to be so located that a good consolidating gravel can be obtained at low cost.

Problems of Design, Thickness, Crown and Grade

Committee—Ira O. Baker, chairman, professor of civil engineering, University of Illinois; Thomas H. MacDonald, highway engineer, Iowa State Highway Commission; H. L. Bowlby, executive officer, Pacific Highway Association, Portland, Ore.; Eugene W. Stern, chief engineer, highways of Manhattan, New York, N. Y.; R. C. Hunt, contractor, Washington Court House, Ohio.

IN California, part of which is semi-arid and part arid, the State Highway Commission has laid many miles of concrete roads 16 and 18 ft. wide and only 4 in. thick, which have given entire satisfaction. In Oregon, chiefly semi-arid, many miles have been built 16 ft. wide with a thickness of 5½ in. at the sides and 6½ in. at the crown, which competent authority pronounces as being satisfactory. In 1914 3 mi. of 16-ft. roadway were built in which the thickness at the sides was only 4 in. and that at the crown only 5 in., and after 15 months' use this road is in excellent condition. In the Mississippi Valley, the general practice seems to be to make the thickness 6 in. at the side and 7 or 8 in. at the crown. Practice is so variable in the different elements affecting the thickness of the slab, that it is impossible to discover any definite relationship between thickness and width.

The crown used in practice for concrete roads without curbs, varies from 1/24 to 1/200 of the width, without much tendency to group within any smaller limits. For concrete pavements with curbs, the crown employed in practice varies from about 1/50 to 1/150 of the width, the intermediate values being used about equally.

The standard specifications for concrete roads adopted by the 1914 session of this conference call for a crown of 1/100 of the width, and this committee sees no reason to change this recommendation. However, one member of the committee believes that in the Mississippi Valley a crown of 1/150 is not too flat, and another member believes that in a warm and arid region a crown of 1/200 is justifiable.

The surface of concrete roads or pavements is sometimes grooved, scored, or corrugated to make it less slippery; but the practice is believed to be unwise, since the corrugations weaken the slab.

In the arid regions, a few concrete roads have been built with 10 per cent grades, and grades of 5 and 6 per cent are common and entirely satisfactory. In a humid climate, a grade of 5 or 6 per cent is about the limit for a concrete surface finished with a wood float. However, one member of the committee claims that a 7 per cent grade is not slippery in Iowa, and cites the case of a 12 per cent grade on a main street in Platteville, Wis., which teamsters prefer to any other pavement in the town.

Joint Location and Construction

Committee—George A. Ricker, chairman, ex-first deputy commissioner, New York State Highway Commission; H. J. Kuelling, county highway commissioner, Milwaukee, Wis.; Fred C. Smith, consulting engineer, Philip Carey Company, Cincinnati, Ohio; E. D. Boyer, engineer, Atlas Portland Cement Co., New York; Austin W. Summers, contractor, Buffalo, N. Y.

IN the present state of the art of building concrete pavements, joints seem to be necessary and unavoidable. Transverse joints should be located in concrete road pavements not less than 25 ft. nor more than 50 ft. apart. Under favorable conditions, particularly where reinforced with embedded metal, longer sections of pavement have been successfully used. In suburban single-track pavements joints should not be placed more than 33 ft. apart; for double-track roads, 50 ft. apart.

Results of practice seem to indicate that structural stability of road concrete is secured when the slab in length is approximately three times its width. Where concrete is laid 50 ft. or more in width, as street pavement in villages or cities, transverse joints not more than 25 ft. apart are recommended.

Transverse joints should be not less than ¼ in. nor more than ⅜ in. in width and should be placed across the pavement at right angles to the center line. Where curbs are used, a longitudinal joint not less than ¼ in. wide should be placed between the curb and the pavement. All joints should extend through the entire thickness of the pavement, and it is most important that they be constructed in a plane perpendicular to the surface in order to prevent lifting or slipping of one side or the other, especially on grades.

Careful spading of the mixture, in placing, next to the joints is urged, and the use of a suitably designed edging tool is recommended. Protection of transverse joints in concrete by the use of metal plates is not recommended. The committee recognizes that the practice regarding protection of joints is not uniform and competent engineers and road builders differ upon the question of the necessity for the use of metal plates.

A suitable pre-formed joint filler should be used and should be made of some plastic material that will remain soft in cold weather and will not run in warm weather.

Expansion and Contraction

Committee—F. E. Turneaure, chairman, dean, college of engineering, University of Wisconsin; Paul D. Sargent, chief engineer, State Highway Commission, Augusta, Me.; Gaylord C. Cummin, city manager, Jackson, Mich.; W. A. McIntyre, chief road engineer, Association of American Portland Cement Manufacturers.

THE following conclusions may reasonably be drawn:

Contraction and expansion are caused both by temperature changes and by changes in moisture conditions, and that under climatic conditions similar to those at Washington, D. C., the effects from these two factors in concrete road surfaces are approximately of the same magnitude.

In concrete roads, contraction and expansion are sufficient to cause frequent transverse cracks unless joints are provided.

The actual movement in any particular case depends upon the character of the concrete and of the subgrade. A sloppy concrete shows greater movement than a concrete mixed only moderately wet. No more water should be used than necessary to permit of convenient placing and forming.

Shoulders and Curbs

Committee—A. N. Johnson, chairman, until recently highway engineer, Bureau of Municipal Research, New York; A. W. Dean, chief engineer, Massachusetts Highway Commission; A. B. Fletcher, highway engineer, California Highway Commission; Charles E. Russell, county superintendent of highways, Lake County, Waukegan, Ill.; Edward M. Laing, president, Edward M. Laing Company, contractors, Highland Park, Ill.

WHERE traffic conditions are such as to make it expedient to build one-track roads only, not exceeding 10 ft. wide, shoulders 4 ft. wide should be constructed of gravel or macadam, where these materials can be obtained cheaply. Where a two-track concrete road has been constructed, that is, one not less than 16 ft. wide, it will not be necessary to provide shoulders for traffic purposes, but rather for occasional turning out. In this case the shoulders may be constructed of earth materials, excluding all vegetable or other matter likely to decay. The slope of the shoulders to the gutter should be continuous. Deep open ditches should not be constructed. The slope of the shoulders for 2 or 3 ft. out from the concrete should be but slightly greater than that of the concrete, and then should increase gradually as the gutter is approached.

It is recommended that where practicable the shoulders be sown with grass and thereafter kept mowed. This will effectually protect them from any cross wash and add much to the roadside appearance. The shoulder slopes and the gutter slopes should be made gradual so that a mowing machine may be utilized to cut the grass.

Where the grade of a one-track road is 5 per cent or more the expense of maintaining macadam shoulders is found to be the greatest maintenance expense. The construction which the committee recommends is practically to do away with the shoulders and gutters, and increase the width of the concrete to 15 or 16 ft., and to use curbs, allowing the water in excessive rainfalls to use the entire road as a gutter. Under favorable conditions the cost of constructing the extra 6 ft. of concrete and curbs would not be more than 25 per cent greater than the other method. The cost of maintenance is greatly reduced. Experience has shown that the maintenance of macadam shoulders and gutters on grades constructed in connection with a concrete road has been excessive.

The width of concrete for a two-track road should be not less than 16 ft. and preferably 18 ft. In cuts an arrangement similar to that described for single-track roads for cuts on steep grades is to be recommended, that is, doing away with gutters and shoulders entirely, supplying a curb and allowing the whole road surface to take extra storm water.

The construction here recommended, to do away with shoulders and gutters on heavy grades in cuts and allow the whole roadway to take care of the storm water, suggests a type of construction to be used on hills where the remainder of the road may be of macadam or gravel, but where this form of construction on the hill would have excessive cost of maintenance and comparative high first cost in construction as well.

Finishing and Curing

Committee — Charles Whiting Baker, chairman, editor Engineering News, New York; W. A. McLean, engineer of highways, Department of Public Works of Ontario, Toronto, Ont.; H. M. Sharp, deputy state highway commissioner, State Highway Department, Columbus, Ohio; William M. Kinney, inspecting engineer, Universal Portland Cement Company, Chicago; Howard W. Underwood, Field, Barker & Underwood, Philadelphia, Pa.

CONCRETE roads should be brought to shape with a strikeboard resting upon the side forms and moved forward with a combined forward and side motion like a saw. This motion fills all pockets with concrete and does not have the tendency to pull out the coarse aggregate as a straight forward motion would. Except near joints the striking off is usually done in the direction in which the work is progressing. When the strikeboard approaches to within about 1 ft. of a joint, it is lifted, placed alongside of the joint and then worked away from the joint. This avoids the danger of piling up material around the joint, or pushing the joint out of place.

Wooden side forms should be shod with 2-in. steel angles secured to the top side of the forms. This not only makes the strikeboard work easier but insures a true road surface of proper thickness. Where a considerable amount of street paving 20 ft. and more wide is to be laid, a strikeboard which can roll on the curbs is preferable.

The pavement is best finished with a wooden hand float, the finisher working from a bridge. The steel trowel tends to slipperiness, and while good results are not impossible with a long-handled wood float, it invites careless finishing, and good work is not generally done with this tool. Early floating or floating immediately behind the strikeboard is to be condemned. Any saving which the contractor may make by this means is at the expense of the wearing qualities and appearance of the pavement.

During hot and windy weather it will usually be found necessary to cover the surface of the finished pavement with canvas as soon after floating as possible, and to keep this canvas sprinkled for several hours. This will help to prevent the formation of shrinkage cracks. When the concrete has had sufficient time to harden the canvas should be removed and the pavement covered with earth or other water-retaining material. This covering should be at least 2 in. thick and should be kept thoroughly wet for a period of from ten to fourteen days. Another method of curing which has been used successfully and at a cost considerably less than that of earth covering and sprinkling, is that known as "ponding." The pavement is flooded so that the water stands about 2 in. deep over the crown of the pavement at the shallowest point.

During warm weather the pavement should be kept closed to traffic for at least fourteen days and preferably for three weeks after construction has been finished.

Cost of Construction

Committee.—C. J. Bennett, chairman, state highway commissioner of Connecticut; H. Eltinge Breed, first deputy commissioner, New York State Highway Commission; E. J. Mehren, editor, Engineering Record, New York; C. U. Boley, city engineer, Sheboygan, Wis.; Frank A. Windes, Windes & Marsh, Winnetka, Ill.

THE committee on cost of construction has divided its report into two parts: First, cost data on certain road jobs; second, proposed headings for a uniform cost-reporting system for the construction of concrete roads.

There was such disparity in methods of reporting that comparisons were impossible; in other words, there were few, if any, sets of figures that included the same cost items under the same heads. Extended comparison of costs and conclusions as to percentages chargeable to various features are therefore impossible. There is presented in the latter part of the report a uniform cost-reporting system.

The Association of American Portland Cement Manufacturers has furnished summaries of figures gathered by its concrete road inspection forces during the season of

TABLE 1—AVERAGE COST PER SQUARE YARD OF CONSTRUCTING CONCRETE ROADS, REPORTED TO THE ASSOCIATION OF AMERICAN PORTLAND CEMENT MANUFACTURERS, 1913 AND 1915

Figures for 1915 Gathered by Association's Inspectors

	1913	1915
Conecticut	$1.32	$1.13
Illinois	1.01	1.03
Indiana	1.23	0.98
Iowa	1.11	1.19
Kansas	1.08	1.28
Maryland	1.21	1.08
Massachusetts	1.29	0.95
Michigan	1.27	1.10
Minnesota	1.05	1.11
Missouri	1.17	1.09
New Jersey	1.12	1.23
New York	...	0.98
Ohio	1.22	1.02
Pennsylvania	1.16	1.01
Texas	...	1.15
West Virginia	1.32	1.03
Wisconsin	1.06	1.02

1914. Unfortunately, they are on a square-yard basis. Since the pavement thickness was not shown, the cubic-yard price could not be derived. In order to compare the data, however, with state averages collected by the same association and presented by the committee on cost of construction to the First National Conference on Concrete Road Building, Table 1 is given. It shows in parallel columns the average cost of construction per square yard in various states in 1913 and 1915. These figures, like those of the other tables, are for the concrete pavement only; that is, they do not include charges for grading, drainage, or the other incidental work.

Methods and Cost of Maintenance

Committee—A. H. Hinkle, chairman, deputy highway commissioner, Ohio State Highway Department; L. C. Herrick, county engineer, Huron County, Norwalk, Ohio; John W. Mueller, civil engineer, New Castle, Ind.; Maurice Hoeffken, Hoeffken Bros. Supply & Construction Company, contractors, Belleville, Ill.

JOINTS and cracks can be successfully treated by thoroughly cleaning them and filling them when dry, and preferably during warm weather, with hot tar, then covering with dry sand or screenings. The tar should be permitted to lap over the spalled edges of the crack, but not to exceed 1 in. The most desirable covering is clean, coarse sand or clean screenings of stone, slag or gravel, that will pass a ½-in. circular opening, and be retained on a 3/16-in. mesh screen.

The use of a mastic consisting of a mixture of hot tar and sand, in place of pure tar, for filling the cracks and joints, gives promise of excellent results; but perhaps it is too soon to give definite specifications for this mixture. The filling of the larger and more open cracks or joints with the mastic, and the use of the pure tar for filling the minor openings in the pavement and such as are made necessary by settlement after the joints have been originally filled with the mastic, may be found to be most satisfactory.

Small holes and shallow depressions can be successfully treated as follows: Clean surface thoroughly. Where the surface is disintegrated it should first be thoroughly swept with a steel broom; afterward, the dust must be removed by sweeping with a rattan or house broom. The hot tar is then applied to the dry concrete and rubbed well with a squeegee or stiff broom to secure a good bond to the surface of the concrete. The tar is then covered with coarse sand or screenings (½ to 3/16 in.) of stone, slag or gravel.

The amount of tar to be used will vary from ½ to 1 gal. per square yard, depending upon the depth of the depression to be filled. Where more than ½ gal. per square yard is used, it should be applied in two coats and the excess screenings swept off before the second coat is applied. The more tar that is applied to the surface, the more desirable it is to have the coarser material for a covering. In filling small holes the application of the tar in two layers would, of course, be unnecessary.

To repair larger holes and deeper depressions than those just discussed, thoroughly clean and paint the surface with tar. Fill the hole or depression with broken stone, preferably of such size that they will not exceed in diameter one-half the depth of the depression to be filled nor exceed in size stone suitable for an ordinary tar macadam. The stone should be levelled off and compacted as well as may be by tamping or rolling so as to conform to the true surface of the road. The voids are then filled with the hot tar and screenings applied to the surface, which is again compacted and treated as in building a tar macadam by the penetration method.

The use of a cold mix consisting of clean, hard stone chips coated with a coal tar cutback, for filling such holes and depressions, as described under the above paragraph, has been followed to some extent with very promising results. The stone chips are first thoroughly coated with the coal tar preparation by turning with shovels after the tar has been sprayed upon them, as in mixing ordinary cement concrete. The mixture is then permitted to stand a few days until the lighter oils vaporize from the tar, which leaves the stone coated with the heavy tar. The coated chips are then well tamped into the hole or depression to be filled, the shallower depressions being first painted with the pure tar. Coarse sand or fine screenings are then spread over the surface. If the voids appear quite open after the coated chips have been thoroughly tamped, a light application of the tar is made to seal up the voids before the surface screenings are applied.

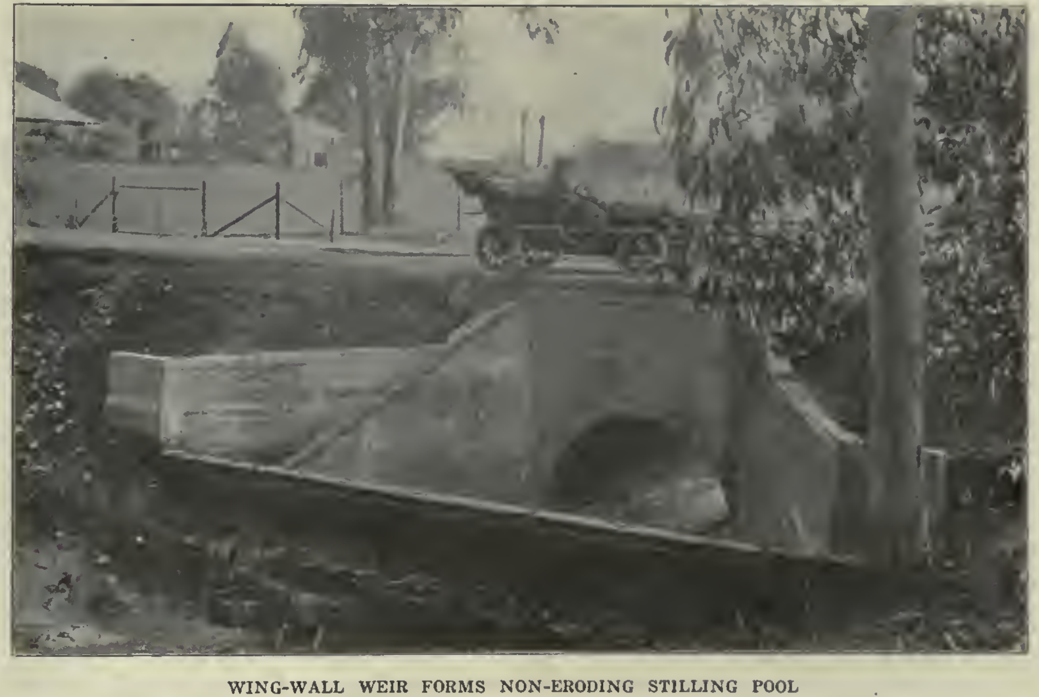
Where the pavement is disintegrated badly or broken clear through so as to require rebuilding, it should be cut away with vertical edges and replaced with new concrete conforming in quality as nearly as possible to the concrete of the surrounding pavement. The new concrete should be kept well dampened for about seven days.

The use of a tar top over the entire surface to protect and maintain a *good* concrete road is not necessary and of doubtful economy. It may be desirable and economical to maintain such a top on a concrete road not made of first-class concrete. While such a tar top has in the majority of cases proved a failure, many instances exist where it has stuck well, which seems to indicate that if the right grade of material is applied to a suitable surface in the proper way, good results will be secured.

Reasonably accurate cost data for maintenance have not been kept over long enough periods to predict the average maintenance cost of the concrete roads until they are worn out. The best available data seem to indicate, as a conservative estimate for roads that have been down from one to five years, a maintenance cost of less than ½ cent per square yard per year.

Wing-Wall Weir Stops Erosion

SOIL EROSION was stopped and a gully practically reclaimed on a ranch on Rose Road, near Pasadena, Cal., by means of a weir between the outer ends of extra-high wing walls. The velocity of approach has been checked sufficiently to build up the eroded portion from the settled material in an impounded pool nearly to the top of the weir crest. The fruit crates in front of the weir indicate the fertility and high value of the land being reclaimed.



WING-WALL WEIR FORMS NON-ERODING STILLING POOL

TYPHOID-FEVER CASES IN CHICAGO during 1915 numbered 915, as against 1181 for 1914. This is the lowest number of cases reported in nine year, according to the annual report of Dr. J. D. Robertson, commissioner of health. The 133 deaths give a rate of 55 per cent below the average for the last decade. Typhoid vaccination of the survivors of the Eastland disaster who were immersed in water at a point where a sewer entered the Chicago River prevented any cases from developing. Only one survivor contracted the disease, and she refused the treatment.

Literature

For the Civil Engineer and Contractor

New Publications

Farm Drainage in North Carolina. By H. M. Lynde, senior drainage engineer, U. S. Department of Agriculture. Bulletin 234, North Carolina Agricultural Experiment Station. Paper, 6 x 9 in.; 31 pages; illustrated. Raleigh, Va., State Department of Agriculture.

Legal Rights of Civil Servants in the City of New York. Bulletin 66, Bureau of Municipal Research. Paper, 6 x 9 in.; 202 pages. New York, Bureau of Municipal Research, 261 Broadway. $1.

Irrigation Practice and Engineering Vol. 3—Irrigation Structures and Distribution Systems. By B. A. Etcheverry, head of the Department of Irrigation, University of California. Cloth, 6 x 9 in.; 438 pages; illustrated. New York, McGraw-Hill Book Company, Inc. $4 net.

Summary of Railway Returns for the year ending June 30, 1915. Consecutive No. 88, Miscellaneous Series 22, Bureau of Railway Economics. Paper, 6 x 9 in.; 23 pages. Washington, D. C., Bureau of Railway Economics.

This is the first of a series of proposed annual publications which aims to present as soon as possible after the close of the fiscal year the significant statistics of the more important railway systems, compiled from their annual reports to the Interstate Commerce Commission.

Twenty-First Annual Report of the Boston Transit Commission, 1915. Cloth, 6 x 9 in.; 102 pages; illustrated. Boston, Boston Transit Commission.

Thirty-sixth Annual Report of the Director of the U. S. Geological Survey, 1915. Paper, 6 x 9 in.; 186 pages; illustrated. Washington, Government Printing Office.

Water Resources of Hawaii, 1913. By C. K. Larrison. Water-Supply Paper 373, U. S. Geological Survey. Paper, 6 x 9 in.; 190 pages. Washington, Government Printing Office.

The Operation and Care of Sewage Disposal Plants. By D. C. Faber, industrial engineer. Bulletin 16, Engineering Extension, Department Technical Service, Iowa State College. Paper, 6 x 9 in.; 23 pages; illustrated. Ames, Iowa, Iowa State College of Agriculture and Mechanic Arts.

Stream Pollution and Sewage Disposal in Illinois with Reference to Public Policy and Legislation. By LeRoy K. Sherman, C. E. Bulletin 16, Rivers and Lakes Commission, State of Illinois. Paper, 6 x 9 in.; 32 pages. Chicago, Rivers and Lakes Commission of Illinois, Charles Christman, Secretary.

Water Supplies of Kansas, Part 1—Ground Water Supplies. By C. A. Haskins, associate professor of civil engineering, engineer, State Board of Health, and C. C. Young, director, water and sewage laboratory, State Board of Health. Bulletin 10, University of Kansas. Paper, 5¾ x 8¾ in.; 187 pages; illustrated. Lawrence, Kan., University Engineering Experiment Station.

Comprehensive Plan of Newark. By the City Plan Commission of Newark, N. J. Paper, 6 x 9 in.; 180 pages; illustrated. Newark, N. J. The City Plan Commission.

Live Load Stresses in Railway Bridges with Formulas and Tables. By George E. Beggs, A. B., C. E., assistant professor of civil engineering in Princeton University. Cloth, 6 x 9 in.; 123 pages; illustrated. New York, John Wiley & Sons, Inc. $2 net.

Dams and Weirs. An Analytical and Practical Treatise on Gravity Dams and Weirs, Arch and Buttress Dams, Submerged Weirs and Barrages. By W. A. Bligh, inspecting engineer of irrigation works, Department of Interior, Canada. Cloth, 5½ x 8¼ in.; 206 pages; illustrated. Chicago, American Technical Society.

Pole and Tower Lines for Electric Power Transmission. By R. D. Coombs, C. E., consulting engineer. Cloth, 6 x 9 in.; 272 pages; illustrated. New York, McGraw-Hill Book Company, Inc. $2.50 net.

Manufacture and Uses of Alloy Steels. By Henry D. Hibbard. Bulletin 100, U. S. Bureau of Mines. Paper, 6 x 9 in.; 77 pages. Washington, Government Printing Office.

Report of Board of Engineers on Flood Control to the Board of Supervisors of Los Angeles County, California. Paper, 8 x 11 in.; 400 pages; illustrated.

Copies of this report may be obtained by addressing the Board of Supervisors of Los Angeles County, Los Angeles, Cal.

The Disposal of Human Excreta and Sewage of the Country Home. By Theodore Horton, director, Division of Sanitary Engineering, New York State Department of Health. Paper, 5½ x 8½ in.; 18 pages; illustrated. Albany, N. Y., Division of Publicity and Public Health, New York State Department of Health.

Final Report of the Construction of the Tumalo Irrigation Project to the Desert Land Board, State of Oregon. By O. Laurgaard, project engineer. Paper, 6 x 9 in.; 90 pages; illustrated. Laidlaw, Oregon, Desert Land Board, State of Oregon.

Co-operative Centralized Purchasing in the City of New York. Results of a year's practical test of central purchasing in the Mayor's departments, conducted by the Mayor's Central Purchasing Committee, 1915. Paper, 6¾ x 10 in.; 49 pages; illustrated. New York City, Mayor's Central Purchasing Committee.

Annual Report of the Library Board, United Engineering Society, 1915. Paper, 8 x 10 in.; 28 pages; illustrated. New York City, United Engineering Society.

Proceedings of the Twenty-third Annual Meeting of the Society for the Promotion of Engineering Education, 1915. Cloth, 6 x 9 in.; 374 pages; illustrated. Pittsburgh, Pa., Secretary, F. L. Bishop, University of Pittsburgh.

Books Reviewed

Applied Mechanics

Author, Ewart S. Andrews, B. Sc. Eng. (London), lecturer in the Engineering Department of the Goldsmith's College, New Cross, and of the Westminster Technical Institute. Cloth, 6 x 9 in.; 316 pages; 184 illustrations. Cambridge, England, Cambridge University Press; New York, G. P. Putnam's Sons. $1.10.

This book discusses the basic principles of mechanics in the most elementary form with the idea that too much attention is usually paid to mathematical treatment of the subject and not enough to the driving home of the important fundamentals.

There are seventeen chapters discussing the usual subjects, under the following heads: Statics, Dynamics, Kinematics, Strength of Materials, and Mechanisms. The arrangement is not logical and the treatment is very superficial.

As a text book for engineering students it is far too elementary, and it would be of little use as a reference book.

Kidder's Architects' and Builders' Pocket Book

Author, the late Frank E. Kidder; compiled by a staff of specialists; Thomas Nolan, professor of architectural construction, University of Pennsylvania, editor-in-chief. Sixteenth edition, rewritten. Flexible leather, 4½ x 7 in.; 1816 pages; illustrated. New York, John Wiley & Sons, Inc. $5 net.

In the seven years which have elapsed since the previous edition of Kidder's well-known pocket book for architects and builders was issued, in 1908, many new developments in the field of building construction have taken place. The new sixteenth edition has therefore been entirely rewritten and reset by Professor Nolan and an able corps of thirteen associate editors, of whom nine are engineers. The fact that so many engineers are the authors of much of the matter on materials of construction and on strength and stability of structures will insure an even wider field of usefulness among structural designers than the older editions enjoyed.

The original arrangement in three main divisions has been retained: Part 1 on practical arithmetic, geometry and trigonometry; Part 2 on materials of construction, and strength and stability of structures, and Part 3 giving miscellaneous useful information. Part 1 has been checked and rearranged, the twenty-eight chapters of Part 2 have been entirely rewritten and one new chapter on reinforced-concrete mill and factory construction has been added by the associate editors, each chapter being signed by its author. Part 3 has been largely rewritten, and new matter has been added in the form of tables.

As an indication of the scope of the matter in Part 2, which is given in most satisfying form, the following more important chapters, with the names of the authors, can be mentioned: Foundations, by Daniel E. Moran, consulting engineer, of New York City; Masonry Walls, Footings, Cement and Concrete, Strength of Brick, Stone, Mass Concrete and Masonry, by Professor Nolan, editor-in-chief; Forces and Moments, Types of Roof Trusses and Stresses in Roof Trusses, by M. A. Howe, professor of civil engineering, Rose Polytechnic Institute; Stability of Masonry Arches, by G. T. Snelling, architect; Reactions and Bending Moments for Beams, Properties of Structural Shapes, Strength of Columns, Posts, Struts, Beams, Girders, Stiffness and Deflection of Beams, Continuous Beams and Riveted Girders, by Charles P. Warren, assistant professor of architecture, Columbia University; Resistance to Tension, Properties of Iron and Steel, Resistance to Shear, and Bearing Plates, by H. C. Berry, professor of materials of construction, University of Pennsylvania; Fireproofing of Buildings and Reinforced-Concrete Construction, by Rudolf P. Miller, former superintendent of buildings, New York City, and Reinforced-Concrete Factory and Mill Construction, by E. G. Perrot, of Ballinger & Perot, architects and engineers, Philadelphia.

Some of the values for unit stresses allowable in timber have been reduced to conform to more conservative practice, and the tables and examples revised accordingly. Additional notes or new matter explain the derivation of many formulas more fully, and practical problems with their solution have been added. The tables giving the properties of structural shapes and safe allowable loads on beams and columns for usual unit stresses used in practice are very complete and useful.

The text is reset in much improved form, so that it can be read more easily. Each paragraph has a black-face caption, greatly facilitating use of the book for reference, and many cross references are added for the same purpose. In its new form the book should prove most helpful to all engineers whose work is along lines of building construction.

Problems Pertaining to Steel Tubes

Author, O. G. Welton, M. E., formerly lecturer and assistant professor of mechanical engineering in the School of Mining, Queens University, Canada. Cloth; 5 x 7 in.; 172 pages; 34 illustrations and diagrams. New York, D. Van Nostrand Company. $2.50 net.

REVIEWED BY A. G. HILLBERG

Civil and Hydraulic Engineer, New York City.

Steel tubes of circular cross-section have found a variety of uses in modern engineering, but little is known about the stresses such tubes are called upon to withstand. Special cases have been treated scientifically, but the assumptions constituting the foundation on which the theories have been constructed limit the application of the formulas.

In dealing with the subject the author has endeavored to establish formulas of such form that they can be applied to a number of practical cases. He has also considered the question of the frictional resistance to sliding, a factor that seemingly has been neglected. The book requires a thorough knowledge of higher mathematics.

The present volume, which is apparently the first of a series, deals with circular tubes resting in a trough. The maximum errors due to approximations are discussed, and the deformations of the shell under different conditions considered, with the conclusion that, "In order to support a tube so that the vertical and horizontal deflections are equal and of the same size, the points of support should be two and located from 90 to 118 deg. apart."

The second chapter treats of lined tubes, as the first is applicable only to very thin tubes. In designing a lined tube it is necessary to add the values found in corresponding equations of these chapters, while in chapter 3 these two separate problems have been discussed as one, and in addition it has been assumed that the tube carries a liquid under pressure. The author presents a number of new facts in respect to the distribution of tension and compression and has clearly shown the location of the plane of greatest stress.

At the end of the volume the author compares the greatest stress in a tube, when supported on two points spaced 90 deg. apart and when supported on a horizontal surface, and finds that in the latter case the stress is 230 per cent greater than in the former. The book is well written and the mathematical treatment of the subject excellent.

The Ohio Water Problem

Author, C. E. Sherman, professor of civil engineering, Ohio State University. Bulletin 15, College of Engineering. Paper, 6 x 9 in.; 135 pages; illustrated. Columbus, Ohio State University.

REVIEWED BY MORRIS KNOWLES

Consulting Engineer, Pittsburgh.

In "The Ohio Water Problem" the author presents a plea for a far-sighted policy of stream regulation in Ohio—for a program that not only will aim at the negative good to be derived from guarding against flood damage, but also and to an even greater extent will strive to attain the positive benefits that will accrue from comprehensive stream regulation in the years intervening between floods.

A novel and interesting method has been used in making this plea to the people of Ohio in that it is presented not as propaganda by argument, but rather as a treatise instructing the reader first in the general principles of stream regulation, and finally giving him a telling object lesson taken from an important Ohio problem of to-day, from all of which the reader himself can draw the obvious inference.

After devoting several chapters to floods and plans for flood protection, in which it is wisely concluded that each and every stream presents a highly individual problem which no general prescription is at all likely to fit, the author passes to a consideration of the other advantages to be gained from stream regulation. A wealth of figures and facts are presented to prove the relative economic value of water transportation upon canalized rivers, as compared with artificial canals. In a chapter devoted to the relation of the federal government to stream regulation and to the necessity for a wise and comprehensive plan for the ultimate development of each stream, the author takes occasion to illustrate some of the evils arising from the existing policy (or lack of policy) in haphazard legislation based on local selfishness and pork barrel politics. Concerning water power, it is concluded that the opportunities for development in Ohio are few, though well worth while in the exceptional instances in which they relate to large-scale projects. Other and subsidiary benefits of stream regulation accruing to agriculture, public and industrial water supplies, sanitary drainage and pleasure are briefly reviewed.

There follows the proposal of a remarkable plan for the canalization of the Scioto and Sandusky rivers, and the diversion in this manner of a portion of this Ohio River flood drainage into the Lake Erie drainage. According to the author, this plan would effectually secure not only the prevention of floods, but also the benefits of water transportation, water power, water supply and subsidiary uses, all of which is strongly contrasted, from the standpoint of both cost and benefits, with past and present "piecemeal" plans for flood protection alone, thus strikingly illustrating the advantage of comprehensiveness in planning for stream control. Whether the proposed plan would accomplish all that the author claims could be determined only by a study far more extensive than a review of this interesting paper. But this question is of relatively small importance, since the illustration is carried far enough to demonstrate that this plan, or another resembling it in comprehensiveness, may be made entirely practical and economical. The book closes with thirteen appendices containing many interesting and valuable data on the waters of Ohio.

In the past Ohio, in company with most other states, has been backward in giving thought to its water problem and in attacking that problem in a scientific manner. Even the recent flood-control legislation in that state, admirable as it is in many respects, cannot be considered a final step in this direction. Professor Sherman's work is therefore timely, and it is to be hoped that so able a presentation of his plea will not go unanswered by Ohio's legislators.

Letters to the Editor

Comment on matters of interest to engineers and contractors will be welcomed

Data Sought on Brick Faces for Concrete Bridge Piers

SIR: The writer is interested to know if any one has used brick for an outside face for concrete bridge piers so as to make the brick serve the purpose of a form for the concrete. The idea would be to lay a sufficient proportion of brick "header" fashion to make bond with the concrete filling, the face course of brick being only 4 in. thick except for occasional headers.

If so, has it proved satisfactory in use, that is, in service? And how many days should the brick shell set before filling with concrete? And about what would be the limiting amount of concrete that could be placed at a run before the shell would be damaged by pressure from the fresh-mixed concrete, assuming a rather wet mix? Some cost data also would be interesting.

GEORGE C. LOVE,
Civil Engineer.

Pineola, N. C.

Why Is Registration in Civil Engineering Decreasing?

SIR: Replying to your request for an expression of my views on the decrease in registration of engineering students at our colleges, indicated by the article on page 766 of your issue of Dec. 18, 1915, I am glad to do so briefly.

I do not think that such a decrease is an unfavorable symptom, but, on the contrary, I think it quite the reverse, provided the decrease does not take place in too large proportion from the class of young men who could best profit from the instruction—or, in other words, provided the standard of ability of the students is maintained. I am convinced, by many years of teaching and practice, that a large proportion—very likely more than one-half—of the students in our colleges and engineering schools do not gain from their courses enough to pay them for taking them. This, of course, may not be due to the colleges, although they have serious faults, but is primarily due to the students themselves, and to the fact that the collegiate standard of accuracy, of thoroughness, of achievement, is lower than that of the commercial and business world.

In other words, a man can go through almost any college with a standard which in business would cost him his job; and no academic degree has much value, because it does not guarantee any good quality. The constitution of the American Society of Civil Engineers is perfectly right in its admission requirements, in making an engineering degree the equivalent of only two years of actual practice. In my opinion, therefore, it would be a benefit, both to the community and to the students themselves, if a large proportion of those who go or are sent to college were set to work in business and obliged to earn their own living instead. This is especially true of the sons of rich men.

My observation has convinced me that the average college graduate knows nothing accurately or thoroughly, cannot think logically or observe correctly, has not gained habits of accuracy, and does not know how to obey orders. He has a half knowledge of many interesting facts, but he does not see them in the right proportion, or know how to use them. Not infrequently, too, a college or engineering education educates nearly all the common sense out of a man. Consequently, when he goes to work he has to learn all over again, besides unlearning a good deal, and he has to experience some hard knocks before he can be of much use. Probably the greatest benefit which most men derive from college comes from the acquaintances which they form, and the discipline they get from athletics, but these are possible of attainment in other ways.

These statements may be considered exaggerated, but they are deliberate, and based upon experience. Many teachers are apt to think that, because they are teaching a thing, the students are learning it. They do not distinguish between getting a thing into the curriculum and getting it into the student. Those who have really investigated the matter, however, know that the young men who go to work instead of going to college, and who take correspondence courses, or night courses, attending such schools as the Pratt Institute, the Mechanics Institute, Cooper Union, Franklin Union, the Wentworth Institute, and the Lowell School for Industrial Foremen, acquire more real knowledge than the average college graduate, and without the conceit and unwarranted self-assurance that the latter so often possesses in marked degree.

Let it be understood that this is not a criticism of our colleges and engineering schools. They offer great opportunities *for those who are able to take advantage of them.* But, unfortunately, higher education, like the symphony concert, has become fashionable, instead of being reserved for the comparatively few. In some of our colleges, the failure of a student is looked upon by some of the faculty. or even by the authorities, as the fault of the teacher. Every effort is made to increase the number of students, more importance being placed upon quantity than upon quality. As a consequence, our colleges and engineering schools are turning out large numbers of routine, rule-of-thumb men.

In my opinion, we need *more moral training,* and more *discipline of the entire body of boys and girls, and less higher education.*

GEO. F. SWAIN,
Professor of Civil Engineering, Harvard University and Massachusetts Institute of Technology.
Cambridge, Mass.

What Is an Engineer?

SIR: A most important step forward in the investigation of the necessary requirements of engineering education has been taken by the Carnegie Foundation, working in co-operation with the Committee on Engineering Education of the American Society of Civil Engineers, as noted in detail in the Engineering Record of Jan. 22, page 125. The investigation to date, based on replies to a circular letter received from 1500 practising engineers, discloses the fact that these latter believe that the qualifications of an engineer are 13 per cent technical and 87 per cent human.

We all like to believe this, but the question arises, whether these are the proportions which should apply to the student just graduating from a technical school or college? Should not the qualifications of such a young man be just about reversed; that is, 87 per cent technical and 13 per cent human? Can a young graduate have understanding of men, executive ability, efficiency, judgment, perspective, responsibility, resourcefulness, initiative, etc.? I think not. These can only be attained and obtained by practice and experience, and are the attributes only of the engineer who has had practice and experience.

The student, and especially the senior, should have the necessity of acquiring all these attributes fully impressed upon him, and he should know not only that they must be acquired if he is to become really and truly an engineer, but also how, in a general way, he may best acquire them.

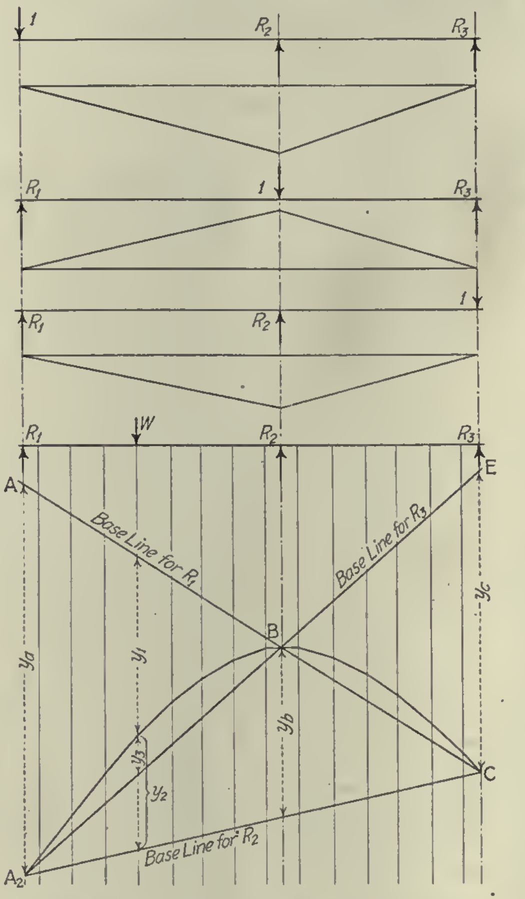
Before sending out the further inquiry, which it is understood is to be made before the Foundation finally decides this important question, it would be well to consider the advisability and necessity of differentiating between the requisite attainments of the student who at graduation is just beginning his career as an engineer, and the necessary qualifications of the engineer "who is competent to design as well as direct engineering work."

ENGINEER.

Elastic Curves and Influence Lines

SIR:—In your issue of Dec. 18, 1915, I read with interest the article on page 762 by your associate editor, J. P. J. Williams, containing a treatment of statically indeterminate girders by influence lines. I arrived at practically the same graphical constructions about two years ago, while figuring shafts for machinery. To the excellent treatment given by Mr. Williams I may add the following:

The influence line for the reaction R_1 of a continuous girder of two spans was given in the above-mentioned article by an elastic curve obtained by considering a load unity applied at the support R_1 while the support is supposed to be removed. The accompanying figure shows this influence line, and also illustrates the fact that, by changing the base from which ordinates are measured, the influence lines for reactions R_2 and R_3 are easily obtained.



INFLUENCE LINE FOR ALL REACTIONS GIVEN BY ELASTIC CURVE

In the figure I have drawn the base lines A_2C and A_2E for the reactions R_2 and R_3. For any given load W the reactions would then be:

$$R_1 = Wy_1/y_a \qquad R_2 = Wy_2/y_b \qquad R_3 = Wy_3/y_c$$

The principle upon which this construction is based becomes evident by considering the fact that no matter at which support a load unity is applied, considering that support removed, the shape of the bending-moment diagram is always a triangle with its vertex at the middle support, as indicated in the figure. The scale of the bending-moment triangles is immaterial for the purpose of the constructions in question, since it enters as a factor both in the numerator and denominator of the expressions for the reactions and eventually vanishes.

For the case shown y_3 is negative, and therefore R_3 is negative. As a check:

$$R_1 + R_2 + R_3 = W, \text{ or } \frac{y_1}{y_a} + \frac{y_2}{y_b} + \frac{y_3}{y_c} = 1$$

In case of many loads, it is well to apply this check to the construction and test this remarkable property of the curve before using it. The above principle can be utilized for finding reactions for girders of more than two spans.

I. DUBERSTEIN, C.E.,
Public Service Commission of the First District.
New York City.

Decimals of the Degree and of the Full Circle

SIR: I wish to reply to the comment of C. L. Berger & Sons on my letter on the subject of providing one vernier of the transit to read the decimal divisions of degrees, which letter was published in Engineering Record of Jan. 22, page 121.

The only objection to the unlike verniers seems to arise from the desire to check angular measurements by reading both verniers. The custom of taking simultaneous readings on the two verniers is in vogue or a very small proportion of transit work. Ask a dealer about his single-vernier instrument. When both verniers are used there are two possible advantages, catching up errors in readings and eliminating errors due to irregularity in the graduations of the transit limb. The latter possibility may be ignored entirely if all transits are as trustworthy as are the Berger and other good instruments that I have had the pleasure of using. And on ordinary work errors in the readings are as unlikely to occur when full attention is given to one vernier as when the two verniers are read and both speed and accuracy are desired.

While the vernier reading to hundredths of degrees is an extremely simple matter, it has very probably been overlooked by the great majority of transitmen. And engineers would not likely think to ask for this contrivance when purchasing a new instrument. My contention in this respect is that manufacturers could make more favorable the chances of a change from minutes to decimals if they would give a choice of verniers with new instruments and would offer to supply decimal verniers for old ones, calling attention to these facts in their catalogues.

LEONARD C. JORDAN,
Heffley School of Civil Engineering.
Brooklyn, N. Y.

UNRELIABILITY OF SAMPLE TESTS OF CONCRETE, found by tests made of 6-in. cubes cast on the work at the Twenty-ninth Street Pier, Brooklyn, has led the Department of Docks and Ferries of New York City to the decision to test floor slabs themselves in the future by applying a load equivalent to twice the live load for which the slab was designed. As given in the November *Bulletin of Tests* of the Bureau of Standards, Supply Division, Board of Estimate of New York City, the sample cubes showed great variations in compressive strength at 30 to 37 days—from 1220 to 3020 lb. per square inch. Eleven of the twenty-four specimens were below 2000 lb. and averaged only 1545 lb. per square inch.

HINTS FOR THE CONTRACTOR

Details Which Save Time and Labor on Construction Work

Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

[*Contributions to this section are solicited, and if found available will be paid for. They must be* SHORT, *and should be accompanied, if possible, by photographs or sketches.*—EDITOR.]

Concrete Tower Erected Within Armory Drill Hall

SPOUTING PLANT INSIDE ARMORY WAS SUPPLIED BY MOTOR TRUCKS AND RUN AS IF IN OPEN

SO LARGE is the Second Infantry Armory of the National Guard in Chicago that a concrete tower was erected under the steel arches. From it the concrete was conveyed in chutes hung from the arches to a discharge hopper over the balcony forms. Runways were provided over the forms to the point of deposit. The building has a front 236 ft. long on West Madison Street and extends through to Monroe Street, a distance of 266 ft. The West Madison frontage is three stories and basement, with a large central tower five stories high and a rear arched drill hall 200 ft. wide, 126 ft. long and 90 ft. high. The building is of fire-resistant construction throughout, with reinforced-concrete foundation, basement walls and floors, including a balcony which extends around three sides of the drill hall.

All of the concrete was furnished by two portable 1/3-yd. Standard mixers to which materials were delivered by motor trucks around the building and inside the drill hall near the point of deposition. Much of the concrete was spouted directly into the forms. In the drill hall the mixers were picked up and moved about bodily several times by the travelers erecting the steel work.

Another feature of interest in the construction of the armory was the erection of the large three-hinge arches by a double-boom steel traveler. The arches which carry the concrete balcony have a span of 198 ft. and a rise of 89 ft. measured between the pins. They are spaced 37 ft. apart and are connected by deep latticed struts on which are carried the curved purlins supporting the roof. The arches were assembled on the ground and completely riveted to make two complete segments, each about 120 ft. long. They were erected by a steel traveler 38 ft. square and 38 ft. high, on which was mounted two 90-ft. booms. The heels of the segments were first lifted into the cast supporting shoes and the heel pins driven. Each boom was then attached to a segment near the crown pin and the two segments lifted simultaneously by rocking them back on the heel pins until the crown pin holes registered, permitting the crown pin to be driven. By this method the booms were required to lift only about one-fourth of the weight of the arch, the total weight of which was about 36 tons.

The armory was designed by James B. Dibelka, state architect. The general contractor was the C. E. Carson Company, for which the Morava Construction Company, as sub-contractor, erected the steel work.

Concrete Pavement Struck Crosswise at Steel Expansion Joints

IN BUILDING a concrete road at Tonawanda, N. Y., some of the construction methods on which were described on page 171 of the Engineering Record for Feb. 5, a novel method was used to bring the Baker steel expansion joints at the exact level of the surface of the concrete, or slightly below it. The men operating the strike board were instructed not to work closer to the joint than 2 ft., but to be sure to leave the concrete around the joint a little high. The clamps holding the several parts of the joint together were left in place for more than half an hour. The finishers were then required to wade in the unsurfaced strip of concrete next the joint, and, by the use of a 3-ft. straightedge, cut the concrete down to the level of the finished pavement adjoining, using the top of the steel joint as a template to support one end of the straightedge. In this way no abrupt changes in level were possible at the joints, and the concrete was made to meet exactly the top of the steel.

Gasoline Locomotives Safe in Tunnel Work if Properly Run

GASOLINE locomotives used in mine and tunnel work may develop a quantity of carbon monoxide as great as 5¾ per cent of the piston displacement, which makes them dangerous to health if operated in headings where a good ventilating system is lacking. This occurs, according to O. P. Hood and R. H. Kudlitch, who have just completed a careful series of experiments announced in Bulletin 74 of the Bureau of Mines, only when the locomotive is running at full speed and full load on an excess of gasoline. The maximum efficiency for the weight of gasoline consumed, and also the least amount of carbon monoxide, was reached when the locomotives tested were running at 85 per cent of capacity on a mixture just rich enough to avoid backfiring. Consequently it appears that if locomotives of excess capacity be operated so as to obtain the greatest fuel economy, there is no danger, in using them in tunnel headings, from the highly poisonous gas, carbon monoxide. The quantity of this gas given off under these conditions amounts to one-third of 1 per cent of the piston displacement. To reach this condition for any given load and position of throttle the operator should close the needle valve until occasional backfiring occurs and then open it just enough to prevent further backfiring. If a first-class ventilating system exists there is little danger from carbon monoxide poisoning in any case, but the locomotives should be operated in the manner outlined because of other considerations. When running as described the cylinders stay cleaner. When the cylinders become coated with carbon it interferes with the cooling system, causes trouble with the spark plugs, and induces overheating. This in turn results in disagreeable "smoke" from burning lubricating oil. In addition to fuel economy the life of the locomotive is increased by careful operation.

According to these men, American gasoline locomotives are not entirely safe in headings where gas or dust is present in sufficient quantities to form an explosive mixture with the tunnel air. American manufacturers have not yet appreciated the demand for a locomotive that is entirely proof against the emission of flames from the muffler or carbureter, and against sparking outside the cylinders. Such locomotives, having closed ignition circuits and other devices, are in use in Europe, and are considered perfectly safe under any conditions in which men are able to work.

Gasoline for locomotive use should not be stored underground in pump chambers or other places where the ventilation is poor. These experiments show, however, that where there is a good current of air the gasoline, even if spilled in quantities, will not evaporate fast enough to produce an explosive mixture.

Improvised Blow Torch Heats Concrete Inside the Mixer

An IMPROVISED kerosene glow torch with its flame directed into the mixer barrel employed for heating the concrete aggregates on New York subway work during cold weather was described by Robert Ridgway, engineer of subway construction for the Public Service Commission, in a paper read before the twelfth annual convention at Chicago (Feb. 14-17) of the American Concrete Institute. The paper quoted a report by Andrew Veitch, assistant division engineer of the commission, on this device.

The U. S. Realty & Improvement Company and the Rapid Transit Subway Construction Company, contractors on Seventh Avenue for routes 4 and 38, sections 5 and 6, are using, as described in this report, an attachment placed on the mixer which forces a flame or hot blast directly into the mixer, thus raising the concrete to the desired temperature while it is being made. Almost any degree of heat may be obtained by leaving the materials in the mixer different lengths of time. If the heat tends to dry out the mix, sufficient water may be added to maintain the right consistency for use.

The apparatus itself consists of the ordinary kerosene blow torch inserted in a large pipe placed at the hopper through which the heat is forced and directed into the mixer. A 30-gal. kerosene tank is placed on top of the mixer, from which the oil feeds into the burner. Here it is vaporized and burns, the flame being forced into the mixer by a blast of compressed air. This air is supplied by a direct connection to the contractors' air lines feeding the rock drills. It is evident that in using this method the contractors are able to make a considerable labor saving in eliminating rehandling of the materials to heat them. Also it is possible to save much space formerly required on the street for this purpose, as with this arrangement materials can be mixed and placed as fast as they are delivered from the docks or store yards.

Heavy Concrete Footings Suspended in Underpinning Columns

A CONCRETE mat footing 6 ft. thick supporting four heavy columns, the total load being about 900 tons, was hung one side at a time on suspender rods from the main needles in underpinning the Seventh Avenue side of the steel and brick building at Fourteenth Street and Seventh Avenue, New York City. This was found cheaper than removing the old concrete footing and underpinning the columns directly. On account of subway construction along Seventh Avenue, it was necessary to carry the foundations of this twelve-story building to rock. The bottom of these foundations along Seventh Avenue was from 12 to 15 ft. above the subgrade of the new subway and consisted of spread concrete footings and I-beam grillages resting on sand and gravel, just a few feet above the ground water level. On account of the comparatively small depth to which these footings were carried, about 12 ft. below curb level, it was necessary to underpin both westerly lines of columns along Seventh Avenue.

In underpinning the northwest corner of the building, the most interesting section of the work, as the other columns rested on much smaller footings, the two north columns along Fourteenth Street were first needled. Brackets, riveted to the columns, transferred the load to 24-in. 140-lb. I-beams, which in turn rested on the main needlebeams running parallel to Seventh Avenue. Four of these latter, which were 30-in. 180-lb. I-beams, were required per column. The south ends had a bearing on the south end of the concrete mat, and the north ends were set on timber cribwork. Not only did these beams carry the weight on the columns, but they also held the dead load of half of the concrete mat, which it was decided not to remove. As soon as the load on the columns was transferred to the beams, by the usual method of jacking, 3-in. sheet piling was driven around the corner column and the one next it on the Fourteenth Street side and the excavation carried to the bottom of the mat. Seven short 9-in. I-beams, 6 ft. long, were then placed under the mat at three different points, with one end of each butting against the sheet piling, the other ends catching under the mat with a bearing of about 2 ft. These 9-in. I-beams were then made into inverted cantilevers by running posts up from the ends nearest sheet piling to the bottom of the 30-in. needles, and by carrying the middle of each beam in a saddle which transferred the load by two 3-in. diameter rods to the short 24-in. beams. Thus the entire load on the columns and the weight of half of the mat was transferred to the main needlebeams.

The excavation under one-half of this mat was next made to about four feet above the subgrade of the subway excavation, wood and steel sheeting being used. Five 16-in. steel pipes were then driven under each column to rock, about 16 ft. below subgrade, and excavated with post-hole augers. These pipes and the excavation above were then filled with concrete up to within 3 ft. of the bottom of the concrete mat. Two granite wedging stones were then placed to transfer the load to the new foundation. Thus the north end of the mat rested on a new concrete footing, which at the east and west ends was carried on pile clusters.

NORTH EDGE OF OLD CONCRETE MAT AND NORTH COLUMNS SUSPENDED ON NEEDLEBEAMS
Sheeting around top of pit dug to reach bottom of mat shows at lower left-hand corner.

The southern half of the concrete mat was underpinned next by sliding the main needlebeams south, with their north ends bearing on the new foundation and their south ends on the footings of the next two columns southward. The new concrete footing was placed as on the north end, except that three additional piles were driven between the columns. The work was then continued from north to south in the same manner until all the columns in the two rows on the Seventh Avenue side had been underpinned.

The work at this point is part of section 4, routes 4 and 38, of the Seventh Avenue-Lexington Avenue subway. F. W. Carpenter is division engineer and J. F. Fouhy section engineer for the Public Service Commission, of which Robert Ridgway is engineer of subway construction. For the contractors, the Engineering and Construction Department of the United States Realty & Improvement Company, C. H. Stengel is chief engineer and E. A. Little general superintendent.

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

Concrete Institute Makes Sand Leading Topic of Convention

Necessity of Long-Time Mixing and Detailed Attention to Sand with Modulus of Fineness Defined Features of Program

Moving pictures indicating the necessity of long-time mixing of concrete and better handling methods made the Wednesday evening meeting of the nine-session convention of the American Concrete Institute in Chicago, Feb. 14 to 17, the best attended. The topic of sand analyses, sand specifications, sand quality and sand in relation to other aggregates was discussed as never before by the institute. As more than forty papers and eleven reports were presented, many of them being read in full, the interest lagged considerably at times, although the average attendance at each session was about fifty. The final registration was 435.

Pavement Specification Changes

The report of the committee on concrete roads and pavements, presented by A. N. Johnson, chairman, had been awaited with such interest that the hall was crowded to hear of the changes. Only four alterations in last year's proposed specifications were made: First, provision is made for a field test of the fine aggregate. Second, mixing in the drum is to be continued for a full minute, irrespective of the size of batch and rate of speed used, although that rate must be not less than 12 r.p.m. Third, reinforcement shall have a weight not less than 28 lb. per 100 sq. ft. Fourth, an additional specification has been prepared for concrete pavement between streetcar tracks whereby the traffic is to be excluded for two weeks. A motion to adopt the specification was carried unanimously after Mr. Johnson stated that no changes had been made without definite evidence before the committee.

Long-Time Mixes Already Used

Nathan C. Johnson told the convention that there is a growing tendency to insist upon longer mixing periods for concrete.

His moving pictures indicated the speed with which many mixers have been working and later he showed views indicating the change during a year's time, even in general advertising, from the idea, "speed of mix" to "quality of mix."

In constructing the tall, hemispherical-bottom water tower at Middleboro, Mass. (see page 279), George Sampson, consulting engineer, stated in his paper on the subject that the concrete was retained in the mixer for 1½ min. for the foundation concrete and 2 min. for the tank and tower concrete.

John T. Gephart, in constructing the Easton-Allentown concrete road in Pennsylvania, insisted on concrete being mixed for 1½ min., according to a paper presented on the subject. He added that tests indicated that the additional time was well spent.

S. F. Butler, in reviewing a paper on the DuPont Boulevard, by Charles Upham, chief engineer (see page 280), stated that the test indicated long-time mixing.

H. S. Scoyoc, chief engineer of the Toronto-Hamilton Highway Commission, described, by the aid of moving pictures, a 36-mile stretch of Canadian concrete road now in the course of construction. This highway is said to be the longest concrete road of its width. Of special interest was the operation of two mixers, side by side, on a 50-ft. pavement and

(*Continued to page 96, column 3.*)

Concrete Road Conference Evokes Large Volume of Practical Information

Largely Attended Sessions in Chicago Consider Details Summarized in Seventeen Committee Reports—Code of Practice Adopted

CONFIDENCE in concrete roads was the most marked characteristic of the second National Conference on Concrete Road Building, held in Chicago Feb. 15 to Feb. 18. While many men at the first conference, held in the winter of 1914, had not then been convinced of the value of this comparatively new type of highway, this attitude of doubt was conspicuously absent at last week's meeting. It was evident from the discussions in the conference, and from the corridor talk, that the art was more in a formative stage two years ago, but that now the principal problems had been solved. For that reason there was little debate on the more important questions. Refinement and details received the more attention. The sentiment in favor of the highest class of workmanship was very apparent, as was also a clear appreciation of the necessity for efficient maintenance. Of the particular technical features the most noticeable, probably, was the sentiment in favor of increasing the distance between expansion joints.

At its final session the conference adopted a resolution authorizing the continuance of the advisory committee and investing the latter with full power to arrange for another conference, to set the date and make any changes in its organization it deemed necessary. The conclusions of the conference are published on page 275, and the committee reports on page 286.

The total registration at the conference was 698, with an average attendance at sessions of about 400. Dr. W. F. M. Goss, chairman of the conference, presided at the first and last sessions. The other meetings were presided over by Dean F. E. Turneaure, of the college of engineering, University of Wisconsin; Richard L. Humphrey, Philadelphia; Hector J. Hughes, professor of civil engineering, Harvard University; H. E. Breed, first deputy commissioner, New York State Highway Commission.

General Papers

The plan of the convention was to take up the details of concrete road construction with the committee reports, of which there were seventeen, as the basis. The first session, however, was given up to general papers. W. G. Edens, president of the Illinois Highway Improvement Association, and Henry B. Joy, president of the Lincoln Highway, discussed the general problems of road improvement, pointing out that appreciation by the general public is necessary in order that the highway movement may continue to grow.

Major Amos A. Fries, Corps of Engineers, U. S. A., discussed the value of permanent highways for national defense and brought out considerable discussion. There was keen interest among the highway engineers present as to the strength of bridges needed to provide for the passage of an army. Major Fries assurred those present that bridges that will carry a 16-ton tractor will provide adequately for army needs. He laid very great stress on the need for an adequate number of well-trained men, saying that highways for defense, forts, warships and all other military equipment are useless without an adequate army to man and operate them.

Edward Hoopes, of the Fidelity & Deposit Company of Maryland, discussed maintenance funds for concrete roads, taking the position that five-year maintenance clauses, not only on concrete roads but on all types, should be abolished. He maintained, and in this he was heartily supported by those who participated in the discussion, that experimentation should not be made at the expense of the contractor or through the agency of maintenance funds, but should be assumed by the municipality or state on their own initiative. He did advo-

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Military Map Data Collected Quickly by Approximate Methods

Exigencies of War Demand Speed Rather Than Extreme Accuracy, According to Capt. Richard T. Coiner, Corps of Engineers, United States Army

While the basic principles of map-making for military purposes are the same as those for topographic surveying in civil practice, the soldier's work is radically different in its objects, methods of procedure and apparatus employed. These differences were explained by Capt. Richard T. Coiner, Corps of Engineers, U. S. Army, in the second military lecture of the series organized by the four national engineering societies and delivered Feb. 21 in the auditorium of the Engineering Societies Building, New York City. As a supplement to Captain Coiner's address, Capt. Halstead Dorey, aide-de-camp to General Leonard Wood, outlined the object of the military training camps held last summer at Plattsburg, N. Y., and to be repeated this year.

Immense Battlefronts Now

The fact that battlefronts have increased from a length of a few miles during the Civil War to hundreds of miles in the present war in Europe was cited by Captain Coiner as evidence of the tremendously increased importance of military maps. A commanding officer, to-day, cannot hope to see all of his troops in action. He must remain at some central point and base the plans for his campaign upon reports from his subordinates. In this work maps are of the utmost value, and it is the duty of engineer troops to supply them regularly each night as a guide for the next morning's orders governing troop movements.

While existing maps, such as those furnished by the United States Geological Survey, are of considerable value, they do not give all information of a military nature which is desired. A military map, Captain Coiner pointed out, should show the character of all roads, with the existing grades, especially the steepest; all trails; railroads, with the number of tracks, siding, stations, cuts and fills, etc.; telegraph and telephone lines; lakes; canals with locations of locks and dams; streams, with the width, depth, strength and direction of current and character of banks; fords and ferries, and bridges, with the type and ma-

(*Continued to page 303, column 1.*)

cate, however, a one-year maintenance fund, feeling that this was a sufficient guarantee that the work had been properly performed. Sentiment in the conference, if those who spoke were representative, was clearly in favor of the abolition of the maintenance fund.

Among the other miscellaneous addresses was one on "Motor Haulage and Good Roads," by S. M. Williams, of the Garford Motor Truck Company. He pointed out that the truck manufacturers, and also the builders of pleasure automobiles, are vitally interested in the good road problem, for their equipment is almost useless if roads are impassable. This is especially true of motor trucking, and he cited many instances where trucks could not be used at all because of road conditions. He explained in detail the character of the highway campaign that has been conducted by his company. A booklet has been distributed among highway improvement associations, sent to individuals in counties where bond issues were to be voted on, supplied to universities which requested them, and in general furnished to anybody who could make use of them in connection with highway campaign work.

Subgrade and Design

In discussing the report on "Organization of Concreting Crew," presented by H. P. Gillette, editor of *Engineering and Contracting*, H. J. Kuelling, of Milwaukee, advanced an objection to advertising work early in the winter. While this method was satisfactory, he stated, for local contractors, those from other sections could see so little in the winter months that there was no advantage. Discussing the matter of force account versus contract work, Charles Whiting Baker, editor of *Engineering News*, maintained that force account was just as satisfactory as contract work, provided a competent engineer who knew construction methods was employed and provided also his hands were not tied by politcal considerations. As opposed to Mr. Baker's view, another speaker called attention to the fact that governments and municipalities, as a rule, do not keep their forces from one year to another, taking chances upon being able to pick them up again in the spring. The good contractor, however, keeps a nucleus of his best men from season to season.

Under the head of width of pavement there was a spirited discussion as to the advisability of building single-track roads as narrow as 8 or 9 ft. In general the sentiment was in favor of a 10-ft. width, but instances were cited where the narrower pavements had given satisfaction. W. M. Acheson, of the New York State Highway Department, cited a case of a 6-mile road only 8 ft. wide, in which the pavement was placed to one side of the center line, so as to carry the loaded traffic. The light traffic took the earth or macadam road alongside. If this design proves satisfactory, he stated, more mileage of that type would be built. The advantage of placing the road to one side is that if later the traffic gets to be very heavy, the other portion can be paved, making a 16 or 18-ft. roadway.

Under the heading of design, objection was made to brooming the surface. George A. Ricker, consulting engineer, Albany, N. Y., and formerly first deputy commissioner of the New York Highway Department, pointed out that brooming helped the situation with the horse and the farmer at the start. The horses have a rougher pavement and become used to it by the time it wears smooth. There is further advantage in the fact that during curing the corrugations hold the moisture. Automobilists, of course, do not like the broomed pavement, because it is hard on the tires. The brooming is therefore done lightly.

Aggregates and Mixing

The discussion of the report of the committee on aggregates, which was presented by D. A. Abrams of the materials research laboratory, Lewis Institute, Chicago, showed that there was a remarkable interest even in so technical a subject as this. Between 350 and 400 men stayed through a long, and sometimes tedious, discussion, showing that there was keen appreciation of the importance of the subject and a sincere desire to learn. Among the important points brought out in this discussion was Rudolph J. Wig's statement that an exhaustive study of test results obtained during the last ten years shows that the sand should be tested with the aggregate with which it is to be used in practice. Tests of the sand separately are unsatisfactory because the samples giving the highest results may give the lowest when combined with the coarser material.

The report of the committee on reinforcement aroused a great deal of discussion. The committee had recommended that all concrete roads be reinforced. It was very apparent, however, that those present did not indorse this point of view. On going into the details of the discussion it became apparent that the reinforcement could not be considered as assisting in carrying loads, but was used merely to spread the cracks and keep them small. The experience of those, however, who have laid both reinforced and unreinforced roads was to the effect that the maintenance cost on the reinforced roads was considerably lower than upon the plain roads. A number of speakers stated that they believed it merely a matter of cost, saying that analysis should be made to see whether the cost of reinforcing might not be saved, and whether an amount equivalent to or less than the interest charge on the saved amount would not maintain satisfactorily an unreinforced road.

Chute Distribution Indorsed

The committee on mixing and placing concrete, whose chairman was Ernest McCullough, of Chicago, reported at length the results of tests made by the committee upon a chute type of concrete mixer. Despite conclusions reached and published two years ago condemning the chute type of machine, this committee found that the chute was as satisfactory as the boom-and-bucket type. The committee also made tests of the effect of hydrated lime upon the material. While it did not find that the concrete with the addition of hydrate flowed more readily, as has been claimed, the committee found that there was a distinct advantage in preventing segregation. It was noted, too, that the water was quickly squeezed out of samples using hydrated lime, and in which an excess amount of water had been used in order to secure good flow in the chutes. The committee strongly recommended the weighing type for measuring water, which has been introduced recently on a new mixer.

Joints and Maintenance

After the presentation of the report of the committee on joints, vigorous discussion indicated that the tendency is to increase the distance between them. Some even advocated the entire omission of the joints, in these cases using a reinforced-concrete pavement. In general, too, those who favor a considerable spacing distance, prefer to reinforce their slabs.

Much interest was displayed in the report of the committee on maintenance, and a spirited discussion ensued. It was apparent that there is now keen appreciation of the need for close attention to incipient holes and to cracks as soon as they appear. The chairman of the committee, A. H. Hinkle, deputy highway commissioner of Ohio, showed by lantern slides the maintenance outfits used in various states. He also gave cost of maintenance on roads in Ohio. The brick and concrete roads last year averaged $29 per mile. Other types ran up into the hundreds. Mr. Hinkle placed strong emphasis on the need of segregating the cost of maintaining the surface from the other maintenance items, such as the expenditures on ditches, brush cutting, guard rails, etc. After the presentation of his paper he called attention to the danger of placing too much tar on cracks and in holes, thus, by successive applications, building up a mound around the depression which will eventually result in shattering the pavement as vehicles drop from the mound onto the concrete. It was suggested that it might be possible to scrape off this excess tar before a re-application. Mr. Hinkle pointed out, however, that this was difficult and that the very best method was to exercise care in placing the material in the first instance.

Recommended Practice

At the final session the conference adopted, after an intelligent discussion in which good points were made, the report of the resolutions committee. This carried with it a code of recommended practice, summarizing the main points agreed upon by the conference. The code will be found on page 275 of this issue.

The resolutions also expressed the appreciation of the conference to the Cement Products Exhibition Company, which financed the meeting.

Concrete Institute Makes Sand Leading Topic of Convention

(*Continued from page* 295, *column* 1.)

their subsequent finishing from a special I-beam bridge.

Sand Modulus of Fineness Defined

Add up the percentages of sand passing six sand sieves ranging from 4 to 100 meshes per inch and the sum is the arbitrary modulus of fineness of sand, described by Duff A. Abrams in his paper on "Tests of 885 Sand Samples at the Structural Materials Research Laboratory at Lewis Institute." Numerous other tests have been made during the past four years on these sands to determine their efficiency for making concrete. Both briquettes and compression cylinders were made. These relations were plotted by Mr. Abrams with the idea that so great a number would eliminate the effect of freak sands and give general laws. In general, a high modulus, meaning a fine sand, gives a low strength. A modulus of 325 corresponds approximately to a standard sand mixture.

C. C. Brown, in a paper on "How Shall a Rational Specification for Gravel Concrete Be Developed?" outlined the problems in Indiana and detailed an ambitious program proposed at Purdue University for testing all the gravels of the state to determine the line of demarcation between sand and gravel.

Cloyd M. Chapman illustrated the use of the Universal sand tests and stated that tests could be made in the field in 10 min. time and that the results checks closely with dry-sieve methods.

The committee on concrete aggregate, of which Sanford E. Thompson is chairman, presented a progress report only. Some striking reductions in strength of specimens stored in the dry, as compared with those stored in damp sand, were outlined.

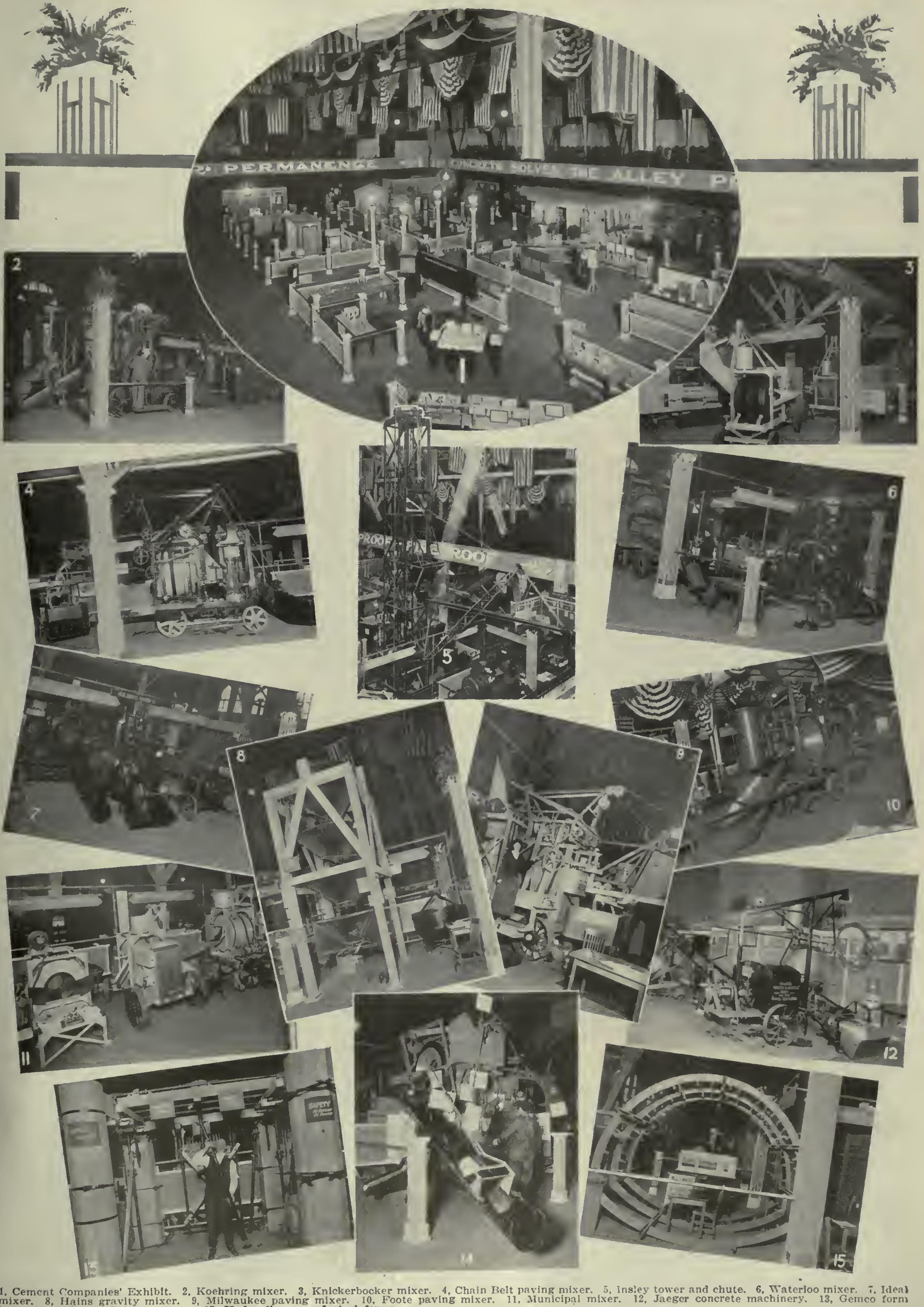
E. J. Moore, chairman of the committee on reinforced concrete and building laws, presented a suggestion for the anchorage of stirrups to the slab which was criticised by Prof. A. N. Talbot as not having a sufficiently good connection with the steel in the top of the beam and in the slab. The report was received, but as there were numerous objections the specifications were held in abeyance with the suggestion that as many clauses as possible be made to conform to those issued by the Joint Committee.

A cement drain-tile specification was submitted by R. F. Havlik, chairman of the committee on building blocks and cement products. It was accepted, but cannot be adopted until another year, as the rules require submission at least thirty days prior to the convention.

The committee on nomenclature, F. C. Wight chairman, was instructed to get in touch with a proposed joint committee of other organizations. No changes were made in the definitions presented last year.

C. B. McCullough's report of the committee on reinforced-concrete highway bridges and

With the Equipment Manufacturers at the Cement Show



1, Cement Companies' Exhibit. 2, Koehring mixer. 3, Knickerbocker mixer. 4, Chain Belt paving mixer. 5, Insley tower and chute. 6, Waterloo mixer. 7, Ideal mixer. 8, Hains gravity mixer. 9, Milwaukee paving mixer. 10, Foote paving mixer. 11, Municipal mixer. 12, Jaeger concrete machinery. 13, Gemco form braces. 14, Smith-Chicago paver. 15, Hydraulic pressed steel forms.

culverts was received as information. It contained valuable data on the preliminary investigation, selection of type, loading and determination of the design of highway spans. A plea was made for more definiteness in the outside investigations.

In view of the recent interest in patent litigation, Prof. W. K. Hatt's paper on "Genesis of Reinforced Concrete Construction," going back sixty-four years; and A. E. Lindau's paper on "Construction of Flat-Slab Floors" will be of particular value to engineers.

The board of direction announced at the final session that H. D. Hynds, 30 Broadway, New York, had been elected secretary. Other officials were announced in the News of Engineering Societies column on page 266 of last week's issue.

Chicago Cement Show Most Elaborate Ever Held

Coliseum Not Affording Sufficient Space, First Regiment Armory is Also Used—Exhibits Indicate Tendency Toward Sturdier Plant and Equipment to Meet New Conditions

IF the amount of space needed to accommodate the exhibits is an index of the interest in concrete the Ninth Annual Cement Show held in Chicago last week was a mark of great progress. Space demands exceeded the accommodations of the Coliseum, and about 40 per cent additional room was secured by using the First Regiment Armory, nearby. Of radical departures there were few, though the whole line of exhibits again displayed the tendency shown in recent years to build sturdier plant and to meet the new conditions which engineering investigation has imposed on construction equipment. For example, to secure more desirable slopes on chute types of paving mixers there were two high-drum machines shown, while a water-measuring device on the weight, instead of the volume, principle was exhibited. There was comparatively large participation, too, of manufacturers of what might be termed auxiliary equipment, in the sense that its use is not confined to concrete jobs. Such, for example, were the motor trucks, pumps and hoists. Mixer exhibits led the list in numbers. The show, as usual, was well arranged, skillfully managed, and staged in a very satisfactory decorative style.

Cement Companies' Exhibit

By far the largest space allotted to any exhibitor was that of the cement companies, which had all pooled their interests in an effort to present material of high educational value. Chief among the items in the large space occupied in the Armory was a testing demonstration, which compared the results of, say, 1:6 mix with graded and with bank-run materials. Comparative cylinders had been made up in advance and were tested at advertised periods each day. The results chalked up on a blackboard showed strikingly the inferiority of the back-run specimens. Crowds gathered always during the demonstrations, and even during periods between the tests interested and intelligent groups gathered in the booth to quiz the demonstrator in charge.

Near by were other features that preached silently but eloquently the danger of bank-run mixes. Side by side were the ingredients of batch mixes of the same nominal proportions —one set of separated, the other of bank-run aggregates.

Other features in the cement companies' exhibit were pavement slabs showing methods of tarring cracks and incipient holes, and panels showing the artistic possibilities of various methods of finishing concrete surfaces. Colored aggregates in some of the panels gave very striking effects.

With the Mixer Manufacturers

A new grouting outfit and a complete mixing and spouting plant were shown by the Jaeger Machine Company, of Columbus, Ohio. A feature of the grouting outfit was a grout cart equipped with plows so mounted on the axles as to revolve in the grout as the cart is wheeled from the mixer, thus keeping the grout agitated and preventing segregation. It is said that a Jaeger Big-an-Litle mixer with special grouting equipment and the Turner grout cart described, form a highly economical outfit for grouting brick pavements. The Jaeger spouting plant shown included a mixer and an inclined track from mixer to center of form. The concrete is discharged from the mixer to a skip car, carried to the top of the track and here discharged into double-jointed spouts which can be made to reach all points on the form.

A new 10-ft.-capacity paving mixer, referred to as the Lincoln Highway type, was featured in the space of the American Cement Machine Company, Inc., Keokuk, Iowa. Features of this machine include all-steel construction and Hyatt roller bearings, the latter materially cutting down power consumption and lubricating cost. Other new models of this company's line on view were a 10-ft. low-charging mixer; a "Boss" mixer, of the same capacity, with power loader; and a 5-ft. Packard mixer.

New types of drum machines in 5 and 10-ft. sizes, batch or side loader, occupied the booth of the Northwestern Steel & Iron Works, Eau Claire, Wis. Chilled-steel roller track, dust-proof bearing boxes and other new features met with favorable comment.

In addition to a Hains mixer the Automatic Concrete Mixer Company, Providence, R. I., exhibited a controllable discharge bottom-dump bucket which the company is now marketing in sizes from 1 to 7 cu. yd. Features claimed for these buckets, aside from their great capacity, include means for permitting the contents to be spread out without the need for shovelers and for keeping the bucket stationary while the contents are discharging. It is said that the discharge is so thoroughly controlled that the largest sizes can be used without danger to the lightest forms. Any portion of the load may be dumped at any point. The sloping bottom of the bucket gives the contents another mixing as it is dumped, the principle being the same as that of the Hains mixer. This type of bucket has been used on some large jobs.

The new 1916 line of drum mixers and pavers put out by the Municipal Engineering & Contracting Company, Chicago, were on exhibition. The low-chargers and side loaders are made in 4½ ft. and 6 ft. wet capacity. The paver is also of 6-ft. capacity. These are low-priced mixers of good appearance and fit in well with the "Cube" line.

Other New Mixer Ideas

In addition to the standard line of pavers and mixers usually shown, the Koehring Machine Company, Milwaukee, Wis., had a new group called the "Dandie." This includes two sizes of small batch mixers and two sizes of high-drum pavers with a chute delivery.

Automatic stops on the charging skip together with reduction in width to a clearance of 87 in. for close quarter operation are the new features on the No. 12 paver found in the booth of the Chain Belt Company, Milwaukee, Wis. The low-charging Rex mixers, 6 and 10-ft. wet capacity were also shown, together with a rack from which hung a complete set of samples of Chabelco all-steel chain belt.

Three sizes of Foote pavers, 27-E, 13-E and 10-E, 2/3 yd., 1/3 yd. and 1/4 yd. respectively, were shown by the Foote Concrete Machinery Company, Chicago. Three systems of distribution were represented, boom and bucket, chute delivery, and cart-guide and bumper. The new feature of the exhibit was the 1/3-yd. mixer equipped with boom and bucket delivery. This new machine is the latest addition to the Foote line.

A new model low-charging mixer, 7 ft. wet capacity was on exhibit for the first time in the space of the Marsh-Capron Manufacturing Company, Chicago. This mixer is equipped with loading platform and large charging hopper. The paver is now equipped with two speeds forward and reverse, and is ready for delivery in 7, 10, 17 and 27 cu. ft. wet capacity.

Pavers with boom and bucket or chute delivery, side loaders, low-charging Wisconsin mixers, and a working model of a Wylie tower and chute made up the collection of contractors' machinery shown by the Milwaukee Concrete Machinery Company, Milwaukee, Wis. The Wisconsin No. 9 is now equipped with a low-loading platform or side loader.

The new high-drum Smith-Chicago paver was the feature of the T. L. Smith Company's exhibit, which included new models of low-charging and side-loading mixers. The new paver is made in four sizes, equipped with chute delivery with a minimum slope of 20 deg. This outfit was described at length in the Engineering Record last week, page 268. A small model Smith Duo-Cone mixer, a Mixerette and the new Smith-Chicago low charger with 16-in. loading platform completed an interesting exhibit.

The Eureka Machine Company, Lansing, Mich., displayed its new line of batch mixers in addition to its mortar mixers and continuous machines. One of each type of machine included in the company's product was shown as was also a portable contractor's pumping outfit.

The new 8-ft. batch mixer which the Knickerbocker Company, Jackson, Mich., has just placed upon the market was in evidence. The 5 ft. machine was also shown as was one of the road pavers and Coltrin continuous mixers. The new 8 ft. machine has a catch which holds the charging hopper when elevated and thus relieves the brake.

Additional Mixer Exhibits

Among the other mixer exhibits were the following:

W. E. Dunn Manufacturing Company, Holland, Mich.—Small mixers, cement-tile machines, and a semi-Diesel oil engine (new) in 2, 3, 4½ and 6-hp. sizes.

Waterloo Cement Machinery Corporation, Waterloo, Iowa—"Wonder" mixers, of which the 10-ft. paver was new.

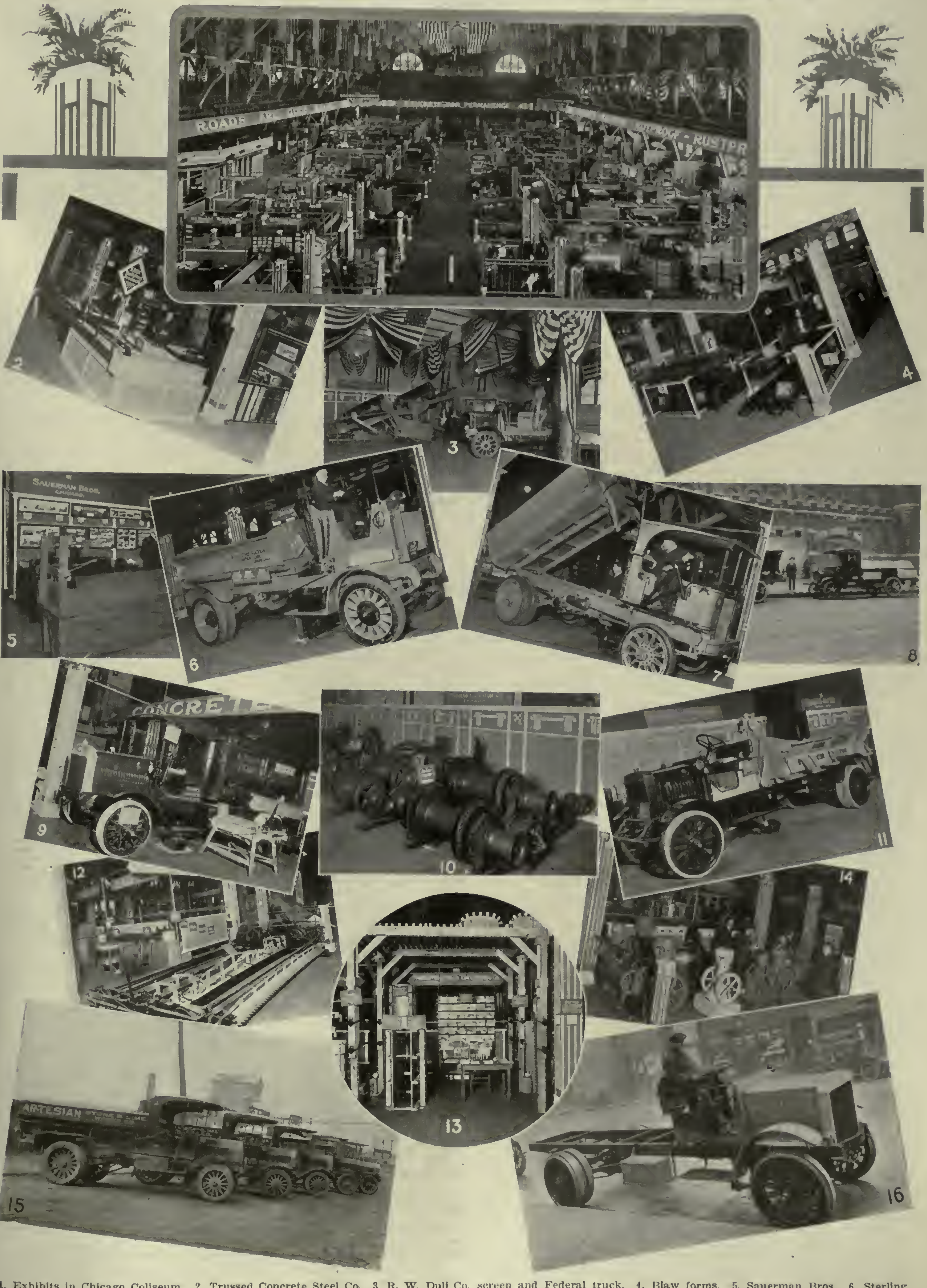
Standard Scale & Supply Company, Chicago —The "low charging line" in ten sizes, from 4 to 40 cu. ft. dry capacity, represented by six models.

Oshkosh Manufacturing Company, Oshkosh, Wis.—Mixers, pavers and low loaders, saw rigs, trench pumps and back-fillers. The back-filler and the low-loading mixers of 5 and 7½-ft. wet capacity are new machines.

Schaefer Manufacturing Company, Berlin, Wis.—A low charger and an improved saw rig with bandsaw and several new attachments.

Atlas Engineering Company, Milwaukee, Wis.—Two models of batch mixers of 5 and 7-ft. dry capacity.

Cement Show Exhibits Covered Wide Range of Products



1, Exhibits in Chicago Coliseum. 2, Trussed Concrete Steel Co. 3, R. W. Dull Co. screen and Federal truck. 4, Blaw forms. 5, Sauerman Bros. 6, Sterling truck. 7, Garford truck. 8, Harvey truck. 9, Gramm truck. 10, **Thomas hoists.** 11, Service truck. 12, R. D. Baker finishing machine for concrete roads. 13, Keator and American forms. 14, Sultan pumps. 15, Mack trucks. 16, Locomobile truck.

Republic Iron Works, Tecumseh, Mich.—The "Republic Light Ten," a new batch mixer of 10-ft. capacity of dry materials with low charging platform and automatic loader.

Blystone Manufacturing Company, Cambridge Springs, Pa.—Concrete mortar and plaster mixers and demonstrations of the process of concrete block making.

Ideal Concrete Machinery Company, Cincinnati, Ohio.—Batch mixers of sizes up to 14 ft. of loose material, a complete concrete block making plant in operation, and various types of the company's automatic conveyors and feeders.

Kent Machine Company, Kent, Ohio.—A three-hopper portable continuous mixer in operation, with sand-weighing device.

What the Form Makers Were Showing

The Blaw Steel Construction Company, Pittsburgh, found a clear way to show visitors how its products were being used on big work by exhibiting half-size models of the steel forms used in constructing the New York subways, the Wilson Avenue tunnel, Chicago, and the retaining walls on the Chicago, Rock Island & Pacific track elevation, also in Chicago. Two new specialities were exhibited, a full-round telescopic sewer form and an adjustable rectangular culvert mold. The latter provides for the insertion of side plates, so that culverts from 2 ft. high up to any other size can be formed. The office occupied by the Blaw representatives was built entirely of Blaw light-wall forms. A section of the space formed a good-roads exhibit, showing steel forms for curb and gutter, sidewalk and all types of concrete-road construction. Other forms shown included types for sewers, columns and walls. Special steel plates used for lining soft-ground tunnels were also exhibited.

The Hydraulic Pressed Steel Company, of Cleveland, showed a full-size section of the Calumet sewer forms furnished by the company to Byrne Brothers Dredging & Engineering Company, Chicago. Another portion of the exhibit presented a model of a house poured into Hydraulic house forms at Euclid Beach, Cleveland. Also on view were a number of full-size standard Hydraulic wall forms designed to form walls of any desired thickness, height and batter.

The exhibit of Edward O. Keator & Company, Cincinnati, Ohio, consisted of a booth built up with the Hodges adjustable shores as the support and the Hodges adjustable floor forms as the roof. The exhibit told its story in a clear and interesting manner.

An instructive booth consisting of actual beam, column and floor panel forms, supported and held by the Gemco adjustable shores and clamps made by the Gemco Manufacturing Company, Milwaukee, Wis., offered a lesson in economical form erection and support. Continuous demonstration of the application and use of these appliances held an interested group of spectators.

A new form clamp for use with wire, together with adjustable metal forms for round columns made up the exhibit of the American Metal Form Company, Chicago. The wire clamps eliminate the twisting of the wire in tying these forms and may be applied and locked in a "jiffy." They are particularly applicable for straight wall, column forms, etc.

Additional Form Exhibits

Among the other form exhibits were the following:

Schulz & Hodgson, Chicago.—Small models and full-size sections of the Hall interlocking culvert.

Reichert Manufacturing Company, Milwaukee, Wis.—Metal forms for straight wall and circular work were shown.

Security Culvert Company, of Minneapolis, Minn.—Models and a full-sized section of the Security concrete sectional culvert.

Hetzel Steel Form & Iron Company, Warren, Ohio.—A new steel manhole form, a new style of wall form held together without special clamps, and a new car unloader chute.

H. D. Cornelius Company, Indianapolis, Ind.—Curb forms and an adjustable cement step form.

D. & A. Post Mold Company, Three Rivers, Mich.—Concrete fence post molds.

Materials Exhibited

One of the largest single exhibits in the Coliseum was that of the Trussed Concrete Steel Company, Detroit. The display covered every item of the company's wide line, including Kahn pressed steel construction for light fireproof construction, United steel sash, semistock sash, sliding and casement sash, reinforcing steel of all types, Floretyle, Kahn trussed bars, rib bars, Hy-Rib and metal lath. An important part of the exhibit was a solid slab depicting what was described as "the permanent concrete road of the future. The concrete was reinforced with Kahn road mesh. Expansion joints were protected by the new Kahn armor plate, a feature of which is a beveled joint which produces a flush surface, protects the edges of the concrete slab against chipping and is firmly anchored in the slab.

A special device was installed by the Standard Paint Company, New York, to impress upon visitors the upward pressure on floors due to static heads of water at various heights. A plunger exactly 1 ft. square was placed in a tank connected by hose to a bucket of water so suspended that it could be raised and lowered to increase or decrease the head. The upward push on the plunger was measured on a heavy spring scale. The object of the exhibit was to show builders that floors are frequently made so thin that no amount of waterproofing can keep them dry. As manufacturers of "Impervite," a waterproofing compound, the Standard Paint Company recognizes the wisdom of carrying on educational work of this character.

L. Sonneborn Sons, Inc., New York, evolved a novel way to demonstrate the effect of treating concrete with "Lapidolith," the company's liquid hardener. An abrasion machine held a treated and an untreated specimen of concrete of equal size with equal pressure against a carborundrum disc revolving about a vertical axis at about 50 r.p.m. Worn specimens exhibited were said to show that a 2-in. cube "lapidized" wore 1/32 in. on a side, while the untreated specimen wore 1⅝ in.

Additional Materials Exhibits

Among the other exhibits of materials were the following:

American Steel & Wire Company, Chicago.—Reinforcing steel mesh in rolls, with large photographs of actual uses.

Universal Concrete Bar Company, Chicago.—Miniature models of concrete roads, curbs and intersections with steel bars and plates for the protection of curbs and joints and steel nosing for stair treads.

Carnegie Steel Company and Illinois Steel Company.—Joint exhibit showing various sizes of twisted squares for reinforcing concrete.

Smooth-On Manufacturing Company, Jersey City.—Iron cements for dust-proofing, waterproofing, oil-proofing compound, and floor hardener.

Philip Carey Company, Cincinnati, Ohio.—"Elastite," for use in expansion joints on concrete construction.

Ceresit Waterproofing Company, Chicago.—Products for the protection and "permanentizing" of concrete and allied materials.

Pioneer Asphalt Company, of Lawrenceville, Ill.—Asphaltic products for waterproofing, paint and road surfaces, expansion joints and sheet waterproofing.

Trucks and Hauling Equipment

The contracting field has proved an interesting one for the Sterling Motor Truck Company, of Milwaukee, and in addition to their 3½, 5 and 7-ton dump trucks, it is now placing on its chassis street flushers and sprinklers, as well as pressure road oilers. The chassis is made in two types with the engine either under the foot board or hood. The latter design shortens the wheel base, making a compact truck with short turning radius.

A 7½-ton Mack truck with Mack power dump body was displayed by the International Motor Company, New York. The company also distributed an interesting pamphlet describing how their 6½-ton Saurer trucks recently solved the problem of transporting loads as high as 13 tons for the Carnegie solar observatory over a hazardous trail up Mount Wilson, Cal , 6000 ft. above sea-level.

A dump wagon with a new closing method, eliminating the use of winding chain and ratchet was shown by the America Dump Wagon Company, Cedar Rapids, Iowa. The pivoted 1¾-in. steel carrier rods run the full length under each bottom. A single chain connects a carrier rod with the closing lever and one movement shuts the bottom. A foot trip drops either side independently. Capacity, 2 yd. This wagon was designed by Mr. Murray of Murray Brothers, railroad contractors, Cedar Rapids, Iowa.

Two trucks loaded with cement stationed outside of Coliseum formed the exhibit of the Harvey Motor Truck Co., Harvey, Ill. The larger truck is equipped with a Lee two-way side-dump body.

A massive 6-ton truck of new design was the feature of the exhibit of the Gramm-Bernstein Company, Lima, Ohio. It is especially built for hauling cement, asphalt, stone, sand and gravel. The great steel hopper body is elevated vertically by a hydraulic hoist, instead of being tipped at an angle as is the usual custom. Considerable interest was also evinced in the Gramm transmission which obviates the stripping of gears, because the latter are always in mesh, the shifting being done by large square hardened steel dogs.

A power dump, steel body 5-ton truck, responding readily to the operation of levers, all within easy reach of the driver, and a 2-ton delivery truck were shown by the Garford Motor Truck Company.

A 3½-ton contractor's truck with power dump and steel body was on display at the booth of the Federal Motor Truck Company, Detroit, Mich. This is a worm-drive truck, concerning which cost data figures were given in a series of leaflets.

Additional Transportation Exhibits

Among the other transportation and truck exhibits were the following:

Baker Manufacturing Company, Springfield, Ill.—The Maney four-wheel 1-cu. yd. scraper for earth-moving contractors.

Austin-Western Road Machinery Company, Chicago.—A two-speed forward and reverse gasoline tandem road roller, crushers, wagons, oilers and graders.

Galion Iron & Manufacturing Company, Galion, Ohio.—Working models of the Eclipse unloader, graders, scrapers, road drags and other road machinery.

Equipment of a Miscellaneous Character

The Berg rotary concrete surfacer, a new device exhibited by the Elevator Supply & Repair Company, New York, was shown in operation. The machine is designed to supplant hand rubbing in removing board marks and projections from concrete surfaces. One man with this machine can, it is said, cover 1000 sq. ft. per day. The machine, which weighs about 30 pounds, is slung over the operator's shoulder. A flexible shaft from the electric motor revolves 16 self-sharpening steel cutters at 2500 r.p.m. By substituting a carborundum disc for the steel cutters, it is possible to give concrete surfaces a smooth finish, presenting the appearance of a plastered surface, which can be painted.

Devices for reinforcing steel bending, both power and hand operated made up the exhibit of Kardong Brothers, Minneapolis, Minn. The power bender operated by gas engine or electric motor offers the contractor a machine which, it is claimed, will do four times the work of a hand bender, with attendant decrease in cost. The power machine will handle four ½-in., three ⅝-in., two 1-in. and up to one 1½-in. square rods.

A new line of gasoline engines for contractors' machinery was represented by five sizes, 1¾ to 10 hp., in the space of the Brownwall Engine & Pulley Company, Holland, Mich. The display covered both air and water-cooled horizontal enclosed crank case types with jump-spark ignition.

The application of steam as driving power for two-speed hoists was demonstrated by the Thomas Elevator Company, Chicago, in the new 8 x 10-in. double-drum steam hoist which has been designed for exceptionally heavy duty on dragline or cableway operation. There were also shown an electric-driven hoist and a single-speed builder's hoist.

Pressure, trench and centrifugal pumps, saw rigs, band saws, material elevators and mortar mixers were on exhibit by the C. H. & E. Manufacturing Company, Milwaukee, Wis. One of the most interesting machines was a new design of trench pump, with capacity of 3000 gal. per hour. This is claimed to be the most compact unit on the market, weighing but 475 lb. The engine is direct-connected to a worm-drive which lends itself to the compact design.

The booth of the Whitman A. Company, St. Louis, Mo., was occupied with 1916 models of pressure, trench and centrifugal pumps with saw rigs, hoists and engines. Special stress was laid of the high efficiency of the company's centrifugal pumps.

The Sasgen Derrick Company, of Chicago, showed light hand derricks of almost every conceivable type. A 1-ton power tower-boom, with steel fittings, for use on concrete hoist towers was a new feature. In addition a single shaft change gear winch, 5 to 1 ratio, designed to be mounted on the company's 2-ton derrick was exhibited.

A self-contained portable crushing plant including engine, bins, elevators, 7 x 10-in. jaw crusher and screen, particularly adapted for small jobs and highway work, according to the Smith Engineering Works, Milwaukee, Wis., was shown for the first time. A No. 3 Tel-Smith gyratory crusher for heavy work and larger capacity for both portable or stationary plants was also shown. The gyratory crushers are manufactured in seven sizes.

Road builders who attended the Second National Conference on Concrete Boad Building were interested in the exhibit of the R. D. Baker Company, Detroit, Mich. A finishing machine for concrete roads was shown in operation. It stamps the concrete and eliminates screeding by hand.

Towering over all the machinery exhibited at the show was a new 40-ft. steel quick-shift boom gravity plant for concrete distribution shown by the Insley Manufacturing Company, Indianapolis, Ind. The new feature of this outfit consists of pivoting the top dumping guides to the sliding frame which carries the receiving hopper. Consequently, in shifting the point of spill, the top dumping guides go along up and down the tower with the shifting of the hopper. The Insley automatic concrete roller hoist bucket was also shown as was the controllable center dump from bucket and the center dump utility bucket. Concrete chutes of the swivel head and continuous line types of the Insley egg shape cross-section were exhibited. A new section of chute of the vertical drop line was shown having a series of baffle plates to check the fall of the concrete and a controllable line gate.

Additional Miscellaneous Exhibits

Among the additional miscellaneous exhibits were the following:

Universal Crusher Company, Cedar Rapids, Iowa.—Crushing equipment, elevators and bins for highway work.

Alexander Milburn Company, Baltimore.—Three new types of acetylene lamps for contractors, including a 100-rated-candlepower hand lamp burning eight hours per charge.

Crerar Adams & Company, Chicago.—Carbic flare lights, Yale & Towne chain falls, shovels, pumps, rope, waste, belting, Wallace bar benders and a dozen other lines of contractors' equipment.

Raymond W. Dull Company, Chicago.—Equipment for gravel plants, screens and cableway buckets.

Sauerman Brothers, Chicago.—Cableway excavators for use in gravel pits, stripping or levee building.

Mays & Talley Company, Chicago.—Pulsometer pumps and American metal hose.

C. A. Londelius & Sons Company, Chicago. —Portable combination salamander and water heater for use in winter weather.

John F. Byers Machine Company, Ravenna, Ohio.—Hoisting engines, excavators and derricks.

The Conneaut Shovel Company, Conneaut, Ohio.—Demonstration of the strength of shovels.

Ideal Engine Company, Lansing, Mich.—A 4-hp. engine direct-connected to a water pumping outfit and another connected to a 5 x 5 in. bulldozer type pump mounted on trucks; the latter is a special outfit developed for road contractors.

Novo Engine Company, Lansing, Mich.—Hoisting engine, pumping outfit and air compressor.

New Way Motor Company, Lansing, Mich.—A new high-speed four-cycle engine claimed to be the first high-speed machine put out for general purpose work.

Joint Board Formed to Unify Engineers on Matters of Public Policy

In order to exercise a fitting influence in public affairs of engineering character the Minnesota Joint Engineering Board has been organized. Represented on it are the Minnesota Branch of the American Institute of Electrical Engineers, the Minnesota Section of the American Society of Mechanical Engineers, the Northwestern Association of Members of the American Society of Civil Engineers, the Civil Engineers Society of St. Paul, the Minnesota Society of Surveyors and Engineers and the engineering college of the University of Minnesota.

The plan is the outgrowth of an effort to unify the engineers of the state on matters of public policy and have some agency through which co-operation on such matters could be quickly secured. The constitution calls for one meeting a year. Others may be called as necessary on the motion of constituent bodies.

Board Established to Effect Improvements at La Libertad, Salvador

By a recent executive decree a Board of Sanitation and Adornment has been created for the port of La Libertad, Salvador, to effect, if possible, various improvements, according to the January *Bulletin* of the Pan-American Union. The works to be undertaken include the drainage of swamps in and near the town, a potable water supply, the paving of the city streets and the construction of a pier.

To Hold Snow Removal Conference in New York City

A snow removal conference will be held at the Automobile Club of America, 247 West Fifty-fourth Street, New York City, March 8, under the joint auspices of various divisions of the National Highways Association.

Tunnel Blow-Out Carries Man Safely Through River Bed

Blanket 26 Feet Thick Failed to Confine 5 Pounds Unbalanced Pressure Where Theoretically 18 Feet of Cover Was Enough

A blow-out at the top of the shield in the Manhattan-bound, or north, heading of the Whitehall-Montague Street tunnels occurred at 4.05 p. m. Feb. 19 in New York City, carrying one of the men up through the river bottom alive, and resulting in the death of two others. The shield at the time was about 300 ft. beyond the bulkhead line in the old Montague Street ferry slip, and was some 26 ft. below the bottom. The entire area over the tubes had been dredged out and backfilled with clay weighted down with sand. It was supposed that all the soft harbor mud not removed by the dredging must have been squeezed aside by this fill, whose weight was sufficient to carry it to solid bottom. The top 5 ft. of the face at the shield was fine sand at this point, and the remainder of the face sand, gravel and boulders. The 260th cast-iron ring, counting from the shaft, was about to be placed, as the shield had just been advanced 2 ft. by the jacks. Four men had taken out the top board at the face, which was being held with breasting boards over most of its area, and were raking out the sand to reset the board 2 ft. ahead when the upper part of the face gave way. One of the men succeeded in getting down from the shield, but the other three were carried up through the river bed, only one of them being able to swim to safety on reaching the surface. The unbalanced pressure at the top of the shield amounted to only 5 lb., 24½ lb. being carried at the time. This pressure theoretically required only an 18-ft. blanket for safety, whereas 26 ft. had been provided. Trouble had been experienced with small blows in the tail of the shield, but none of consequence had occurred before on the Brooklyn side of the river at the face. The breasting boards were used primarily to hold the face.

The tunnel heading is 540 ft. long and on a 3 per cent down grade, and as the water could rise only till it sealed the air at the top of the shield, all the men working in the heading except the three at the face were gotten out in safety by the foreman. The heading is still carrying 19 lb. of air. An irregular hole 14 ft. deep and 40 ft. across which was left in the clay and sand blanket is being filled with clay, and it is expected that the heading will be in operation again within a week.

These tunnels are being driven for the Public Service Commission, Alfred Craven, Chief Engineer, Robert Ridgway, engineer of subway construction, George Rice, engineer of the division including the work, and Clifford Holland, engineer in charge of the East River tunnels, by the Flinn-O'Rourke Company, Inc. George H. Flinn is president and Major John F. O'Rourke vice-president and chief engineer of the contracting company, for which Michael J. Quinn is general superintendent, and LeRoy Tallman is in direct charge of the Brooklyn ends of the tunnels.

Board of Engineers Recommends Arches for Galveston Causeway

The board of engineers, composed of one engineer to represent each railroad using the causeway, has just recommended to the railroad managers that the damaged fill approaches of the Galveston causeway be reconstructed by using reinforced-concrete arches. The damage to the causeway was described in the Engineering Record of Aug. 28, 1915, page 272, where drawings showing the original construction and the details of the 70-ft. arches which withstood the flood are shown. The board recommends that there shall be used for the new approaches twenty-eight 70-ft. arch spans similar to the old design and 3600 ft. of 50-ft. arch spans constructed between the undamaged concrete sheet piling designed to support the original earth fill.

As will be seen in the drawings above referred to, the two rows of piling are about 154 ft. apart. The new structure will be 62 ft. wide, probably supported by piers founded on piles, and a clay fill will be placed between the existing rows of sheet piling, substantially as proposed by William Mueser, of the Concrete Steel Engineering Company, of New York City, who represented Galveston county in the conference. This company designed the undamaged concrete arches in the main part of the causeway. The total cost is estimated at $1,500,000, and it is reported that the railroad managers will probably act favorably on this recommendation within two weeks.

Would Make Contractor's Profits Increase with Saving to Owner

A method of letting percentage contracts, whereby the contractor can make more money by reducing the cost of a job than by increasing it, is illustrated by a clear example in a recent monthly letter of the Master Builders' Association of Boston. The contract is drawn so that the cost of the work is not to exceed a certain sum, which includes a percentage of profit to the contractor on the actual cost, and if the contractor produces the work at a less cost than the maximum, he is allowed a bonus percentage on the amount saved such that the result will be an increased profit to the contractor. As an illustration, suppose that a maximum cost of $10,000 is agreed upon, with a 10 per cent profit on the actual cost and a 20 per cent bonus on any saving. If the contractor makes the total cost exactly $10,000, the actual cost would then be approximately $9,091, and the 10 per cent profit $909. If, however, the contractor succeeds in keeping the actual cost down to $8,000, the accounting at the end of the job will stand thus:

Actual cost of work	$8,000
10 per cent profit	800
Cost to owner	$8,800
Saving under maximum cost	1,200
20 per cent of saving paid contractor	240
Total profit to contractor	1,040

It will be observed that this leaves the contractor $131 better off than if he had made the job cost the maximum allowed. Meanwhile, including the bonus, the owner has paid $9,040 for the work, which leaves him a saving of $960 on the guaranteed cost. It is best to make the bonus percentage 20 per cent, as, if it is lower, the increase in the contractor's profit for keeping the cost down will be nominal. For instance, if only 10 per cent had been allowed, the contractor's profit in the above example would have been only $11 greater if he had done the job for $8,000 than if he had done it for $10,000. Extra work ordered or savings on price are added to or deducted from the contract price, giving a new maximum.

Los Angeles County Engineer Reports on Flood Control Needs

A report recently submitted to the Los Angeles Board of Supervisors by J. W. Reagan, engineer for the Los Angeles county flood control district, recommends that protective measures be taken immediately at the Mission bridge and at the mouth of the San Gabriel canyon, and that this work be carried out under the supervision of the highway department.

Mr. Reagan advises that span bridges be erected instead of rebuilding the pile trestles. He points out that "flimsy" structures of the latter type are too frequently built, and that nearly every year some of them collect debris awhile and then go out, causing the destruction of property lower down in the valley, and incalculable inconvenience in highway connections and business loss.

The report states that a map and details showing the official channel of the San Gabriel River from Mission bridge to the Stewart bridge will be prepared immediately. Owners of property abutting on the Rio Honda, or old San Gabriel River, between the Montebello and the Foster bridges, the report states, have offered to the county free of cost the land necessary for the official channel.

Building Officials Conference Advocates Enclosed Fire Escapes

Two important resolutions, advocating that discretionary power be vested in building officials and that inclosed stairways should be provided for every building were passed at the second annual meeting of the Building Officials Conference held Feb. 14 at the Auditorium Hotel, Chicago. About thirty representatives of building departments and bureaus throughout the country were present. The morning and part of the afternoon sessions were devoted to discussing the recent changes and improvements in building codes and the desirability of giving building officials discretionary power, a large part of that discussion being devoted to the question of the certificate of occupancy. Other topics that occupied some of the time were the use of terra cotta blocks and gypsum products, metal lath and wood shingles. The discussion on these various matters proved so interesting that an evening session had to be arranged for in addition to those scheduled.

The following resolutions were adopted by the conference:

Resolved: That discretionary power should be vested in building officials to vary or modify the law, where practical difficulties arise in its literal enforcement, so that the intent of the law is secured; and that in case the building official declines to exercise such discretionary power an appeal should lie to a board of technical experts.

Resolved: That proper means of egress from every building should be provided in the form of inclosed stairways; that outside metal fire escapes should not be considered as a required means of egress from new buildings, and that their use should be confined to existing buildings where other means of egress are impractical; and that wherever such fire escapes are used the opening thereon should be protected by metal sash and wire glass or by fire-resisting doors with proper fusible links.

Rudolph P. Miller, of New York City, was elected to serve as chairman of the conference for the next year and James G. Houghton, building inspector of Minneapolis, was elected vice-chairman. Sidney J. Williams, state building inspector of Wisconsin, was elected secretary.

California Waterways Association Holds Annual Meeting

On Feb. 21-22 the Inland Waterways Association of California held the regular annual meeting at San Francisco, Cal. The program for the first morning's session included addresses by Isidor Jacobs, president of the association, and Hiram W. Johnson, governor of California. Two papers were presented at this session, "Uses of Streams" by Stephen I. Miller, assistant professor of economics, Stanford University, and "California's Water Problems Outlined" by A. W. Frye.

At the afternoon session of the first day papers were presented on "Governmental Agencies Dealing with Various Phases of our Water Problems" by J. B. Lippincott and D. L. Board, and "The Department Plan in Public Work," by C. E. Grunsky.

On the second day the papers presented were "The Co-ordination of Federal Agencies Proposed by the Newlands-Broussard River Regulation Bill," by George H. Maxwell, and "Coordination of Voluntary Organizations," by Capt. Wilson I. Davenny, field secretary National Rivers and Harbors Congress, Washington, D. C.

Iowa Engineers Give Approval to License Law

Collaboration with Architects Sought—Free Engineering by Technical Service Bureau and Manufacturers Discussed

At the twenty-eighth meeting of the Iowa Engineering Society, held in Des Moines, Feb. 16, 17 and 18, approval was given a licensing law for engineers. It was suggested, however, that the engineers and the architects should collaborate in drafting the proposed law.

The society found it unnecessary to take official action in regard to free engineering advice as proposed by the Technical Service Bureau since the matter has not been pressed following several conferences between a committee of the society and the authorities of the Iowa State College.

The committee on professional ethics and standard fees reported in two parts; first, a set of standard fees which the society was not ready to adopt, but, instead, referred back to the committee for further consideration; second, the report on professional ethics. The committee proposed no set of ethics but discussed at considerable length the habit which certain manufacturers have of advertising and furnishing free engineering advice in connection with their selling methods. The society realizes that this arises from a spirit of competition among the manufacturers, but feels that since it does work harm to the engineering profession, that something should be done to minimize the difficulty. The committee was given authority to investigate and to make proposals for its alleviation at the next meeting.

It was the sense of the society that there should be a uniform method of assessing paving costs in all the cities of Iowa. To this end the matter of drawing up a bill to accomplish it was referred to the committee on legislation for their action.

Prof. F. H. Newell of the University of Illinois delivered a short address on "Co-operation" making special reference to the American Association of Engineers.

At the annual banquet Major Cheney, U. S. Corps of Engineers, U. S. A., gave a short talk on "The Engineer in Modern Warfare."

The following officers were elected for the ensuing year: President, S. Hall, consulting engineer, of Centerville; vice-president, C. H. Young; secretary-treasurer, J. H. Dunlap, Iowa City; directors, T. S. Delay and F. S. Alden.

Indianapolis Sewer Construction in 1915 Cost Almost $1,000,000

In a summary of results of public improvement projects completed in Indianapolis during 1915, the board of public works has announced that the year's work included the construction of sewers at a cost of $906,794, exclusive of the Pogues Run drain, which will be finished at a cost of $943,000.

The sewer construction program for 1915 included 77 contracts, and totaled 45 miles in length. The largest of the four principal improvements was the College Avenue Sewer District, just being completed now, with a length of 7.27 miles, extending from Thirty-eighth Street and College Avenue to Fiftieth Street, and embracing surrounding territory. This work will cost $199,332.48. The second big sewer was on Central Avenue, from Thirty-eighth Street to Fiftieth Street, 5.43 miles in length, and costing $143,732.10.

A large sewer, extending from Fall Creek to Thirty-eighth Street, to take care of the overflow from the College and Central Avenue sewers, also was constructed. The sewer is 8½ ft. in diameter throughout and cost $78,210. The fourth was on Warman Avenue, in West Indianapolis, extending from Eagle Creek and Morris Street north to Michigan Street, and thence west to Tibbs Avenue. This covered a distance of approximately 3 miles and cost $114,504.

Military Map Data Collected Quickly by Approximate Methods

(*Continued from page* 295, *column* 2.)

terial of which constructed, together with length, width and height of the water.

The map also should show the character and configuration of the ground, contours indicating all hills and relative elevations, height, shape and character of their slopes; all ravines and undulations which afford protection to a firing line or for the movement of troops. It should locate objects forming obstacles or giving cover, wooded areas, swamps, cultivation, building, fences, hedges and walls. The street plans of towns and villages should be plotted, as well as available camp sites, water supplies, grazing facilities and the like.

Military maps are made according to a uniform system of scales and contour intervals. These schedules are, 1 in. to the mile, vertical interval 60 ft.; 3 in. to the mile, vertical interval 20 ft.; 6 in. to the mile, vertical interval 10 ft.; 10 in. to the mile, vertical interval 5 ft.

CONSTRUCTION VIEW OF THE NEW SEDIMENTATION BASIN WHICH WILL IMPROVE PHILADELPHIA'S WATER SUPPLY

Quick Work Necessary

The maps which the Engineer Corps makes are of two general types, road sketches and area sketches. Of the area sketches there are three subdivisions—position sketches, for camp sites, etc.; outpost sketches, made within friendly lines; and place sketches, made from a single point of observation. As speed is so essential in the military sketcher's work, more or less primitive methods are employed in collecting information. Distances ordinarily are measured by pacing, either on foot or horseback. Another method is by counting the revolutions of the wheel of a wagon. In pacing on foot the error generally is less than 3 per cent in 500 yd. In road sketches the distance for side shots is usually estimated in yards, the same unit that is employed in estimating range for rifle fire, so that a man can soon become very skillful in approximating distances and ranges.

The general principles of plane-table surveys are employed extensively in Army practice. The plane table is known as a sketching board and sometimes an alidade is used. Ordinarily, however, rougher methods are employed and shots are located by sighting along a ruler and pacing or estimating the distance to a given point. The vertical angles are obtained by the use of a clinometer or slope board. The matter involves sighting along one edge of the board and measuring the vertical angle by means of a scale across which a plumb-bob line hangs. Hand levels also are of value.

Photography is used to some extent in military map-making and sketching and each engineer company is provided with a camera.

As to the speed of work Captain Coiner said that a good sketcher, on foot, will cover about 10 miles a day, and a mounted map-maker will cover 15 miles a day on road sketching work. Owing to the extent of present-day battlefronts large map-making forces must be used and their sketches turned in to an engineer officer every night for consolidation and use in planning the orders for the next day. Each engineer company also is fitted with equipment for making blue and brown prints and lithographs. A portable mimeographing outfit also has proved of service.

The main consideration in this branch of the Army service, however, is the getting of results quickly, and the engineer officer often must improvise methods and equipment to secure the data desired.

The meeting was attended by about 1000 engineers and was presided over by John W. Lieb, Jr., vice-president of the Consolidated Gas Company, New York, and past-president of the American Institute of Electrical Engineers.

Engineers to Bring Civic Societies of Chicago Together

The engineering societies in Chicago have plans under way to give a banquet in the near future to the newly appointed engineers of the Traction and Subway Commission, William Barclay Parsons, Bion J. Arnold and Robert Ridgway. Various civic organizations and societies are being interested by the engineers to make it an occasion at which the public may learn of the confidence of engineers in their fellows as well as to identify engineers with the movement for the development of a greater Chicago.

New York Assembly Passes Bill Appropriating $10,000,000 for Roads

Despite the protests of the New York City administration, the State Assembly passed the Maier bill, appropriating $10,000,000 for highway work in upstate counties, Feb. 21. The money will come out of the second $50,000,000 highway bond issue, which has been apportioned among all the counties of the State except the five counties in New York City.

Constitutional Amendments Proposed to American Society

Several radical changes in the constitution of the American Society of Civil Engineers are proposed by the committee appointed by the board of direction to prepare a draft for a revision to simplify the constitution by making it more general and fundamental. In order to ascertain the feeling of the members, the committee, which consists of M. T. Endicott, J. A. Ockerson, G. F. Swain, Hunter McDonald, J. V. Davies, H. S. Crocker and C. W. Hunt, secretary, submits the following six questions for careful consideration, a brief statement of the reasons for the submission of each being appended:

1. Shall membership in the society be open to women as well as men?

(This is a question on which there is known to be difference of opinion, and on which there has been much controversy. There is nothing specific about it in the present constitution, and it is doubtful if the framers of the original constitution ever thought of the possibility of a woman desiring to become a member.)

2. The board of direction now elects members in all grades. Shall it also have power to expel and discipline?

(The present Constitution provides for no disciplinary measures, but does provide for expulsion, which must originate with ten members, and the subsequent procedure is prescribed in great detail, and finally provides that after full investigation the board may expel, but, if the member under trial so elects, must, in order to make such expulsion valid, be upheld by a letter-ballot of the corporate membership. A careful examination of the process which must be followed (see Art. III. Sec. 6,) is convincing that the present constitution is in this respect practically impossible of application.)

3. Shall the duties of a professor of engineering in a technical school be considered as equivalent to responsible charge of engineering work?

(The present constitution states that "The performance of the duties of a professor of engineering in a technical school of a high grade shall be taken as an equivalent to an equal number of years of actual practice." This has always been interpreted to mean that the performance of such duties cannot be construed as "responsible charge" of engineering work, and therefore that no professor may be made a corporate member unless he has had "responsible charge" in addition to his practice as a teacher.)

4. Is it desirable that the society should adopt some form of district organization along lines advocated by the meeting of the presidents of the local associations at the time of the annual meeting of 1915?

(An amendment to the constitution has been adopted by which the society is in future to be divided into 13 districts instead of 7 as now exist, each of these districts to be represented upon the board of direction. The recommendations of the meeting of the presidents of local associations are briefly, that in each of these districts there shall be a district organization reporting to the parent society whenever necessary, and that every member of the society in any grade residing in that district shall become a member of the district organization without the payment of additional dues. Local associations as now existing or as formed in the future will have their own local government as at the present time.)

5. Shall persons who are engaged in the promotion, manufacture, or sale of proprietary or patented articles used in engineering work (a) be admitted to the society? (b) If so, shall they be placed in a class by themselves?

(The only class in which salesmen may possibly be placed under the present constitution is that of associate, and it is frequently difficult for the board of direction to tell whether a person engaged in commercial engineering is, strictly speaking, eligible for this grade.)

6. Shall the present requirements for admission to the highest grade of corporate membership be increased?

Three Minnesota Engineering Organizations Participate in State Society's Convention

Co-operation with two local and another state organization in holding participatory meetings was the feature of the meeting last week of the Minnesota Surveyors' and Engineers' Society. The furnishing of free engineering services was condemned by a resolution adopted as being misleading to the public and demoralizing to the engineering profession.

The enthusiasm with which Prof. F. H. Newell's address on "Public Duties of an Engineering Society" was received at a joint session of the state organization, Engineers' Club of Minneapolis and the Civil Engineers' Society of St. Paul, indicates the fast-growing interest in this topic.

One whole session was given up to a paper on highway work of the state, in which the following topics were discussed: "Contract Road Work," by R. W. Acton; "Handling Surfacing Materials by Tractor and by Team and Comparison of Cost," by Orrin J. Kipp; "Earth Road Construction by County Outfits," by P. L. Minder; "Work of the Commission," by George W. Wooley, state engineer.

Two railroad papers were presented: "Railroad Construction in Muskeg Swamps," by P. L. Pickles, chief engineer Duluth, Winnipeg & Pacific; "Ore Dock No. 5," by F. C. Baluss, bridge engineer of the same company. W. C. Armstrong, chief engineer Union Depot Company, St. Paul, spoke on "The Relation Between the Architect and the Engineer."

Drainage occupied the attention of the society for three papers, and municipal problems for five papers.

It was stated that several companies had offered free services of their engineering forces to furnish detail plans of reinforced concrete and steel structures, of tile drainage systems and other engineering works. The practice was denominated "Misleading to the public, not conducive to fair and impartial commercial consideration, and demoralizing to the engineering profession in general." The society protested and will use every honorable means to discourage the practice.

Other resolutions passed by the society were as follows: Betterment of drainage laws; increased the dues; the appointment of a committee to urge the State Board of Health to define more adequately the laws controlling water supply and sewage disposal; approval of the St. Croix valley highway improvement, and one advocating the removal of restrictions as to compensation of county surveyors so that the work may be paid for on its merits.

The society was the guest of the Minnesota section of the American Society of Mechanical Engineers at the University of Minnesota to hear a talk on cement by George P. Dieckmann.

George H. Herrold, secretary for several years past, declined the renomination, as he has been chosen president of the Civil Engineers' Society of St. Paul. The following officers of the state society were elected: President, F. W. McKellip, city engineer, Faribault; vice-president, B. J. Reynolds, drainage engineer, Redwood Falls; secretary-treasurer, W. F. Rosenwald, State Highway Commission, St. Paul.

Recommend Flood Control Bond Issue of at Least $3,600,000

The Los Angeles Flood Control Association, which was recently organized at Los Angeles, Cal., on Feb. 13 passed by practically unanimous vote a recommendation, addressed to the county board of supervisors and carrying the following program for flood control; (1) That the bond issue now being considered for flood control shall not be less than $3,600,000, and as large as the supervisors decide is necessary for adequate protection. (2) That the bond question shall not be segregated on the ballot as to amounts for different purposes, but placed before the voters as one proposition. (3) That a comprehensive plan of flood control, embracing all the various features of (a) conservation through the construction of a series of check dams in the mountain districts and spreading of streams at the mouths of canyons; (b) reclamation in the lowlands by defining and straightening the channels of streams and rivers, and the reinforcing of banks in dangerous and low place, and (c) the protection of the harbor from silt, should be worked out by the flood control engineer as soon as possible. (4) That the voters shall be given full information as to what the plan is before the election and the proposition as placed before them shall state how much money is to be expended for each kind of control work.

Urge Compulsory Appointment of Engineer on Maryland Commission

As a means of furthering the passage of a bill that would amend the public service law of Maryland to the extent that would specify that one member of the Public Service Commission should be an engineer, the Engineers' Club of Baltimore has sent a letter to members of the State Legislature, which says, in substance:

"It is universally recognized that mathematics, science and engineering subjects are the greatest factors in the education of human intellect and the development of the power of differentiating substance from elusive matter. An engineer is the best prepared person to grasp intricate and complex problems in any line involving public utilities.

"Any commissioner, before he is of much service as such, must be educated along the above lines either by pre-education, or by statements of experts, more or less biased, produced before him and in the latter case only after several years, and much experience, is he on equal footing with the engineer to grasp the large problems of the kind he has to deal with.

"The problems of the Public Service Commission are legal, financial and engineering. The greater part of those thus far presented have been principally engineering questions, i. e., the Gas Rate Case, the Telephone Case, the orders issued to the United Railways & Electric Co. in re: physical valuation, etc. The cost of transportation, in fact, the cost of anything in the public service line is an engineering problem. The handling or operation of a public service utility is also an engineering problem.

"Therefore, it is advisable that at least one commissioner have the training and education that will enable him to pass on engineering problems without being entirely dependent upon the statements of interested experts.

"This bill, if passed, will not become a law until June, so it does not affect the appointment of the commissioner whose term begins May 1. As the next term does not expire until May 1, 1918, it can be seen that this bill is being presented from a motive of public welfare, and not to further the interests of anyone in particular."

Institute of Consulting Engineers Opposes Power Station on Potomac

At a special meeting held in New York City for the purpose of hearing the report of its special committee on the proposed central power station site on the shores of the Potomac River in the city of Washington, D. C., the council of the American Institute of Consulting Engineers adopted resolutions opposing the erection of the plant on such a site and declaring that it will be a "hideous object in the forefront of the beauties in Washington upon which the nation is spending many millions of dollars." The resolution adopted reads as follows:

> Whereas, A site in the city of Washington has been purchased for, and the work actually started upon, a Government light, heat and power station on the waters of the Potomac River, near the foot of Fourteenth Street, in plain view from Potomac and Island Parks, including the new Lincoln Memorial and the proposed new memorial bridge across the Potomac River, and also indirectly visible from other Government grounds and buildings; and
>
> Whereas, The construction of a power station with its towering chimneys, upon this site will be a hideous object in the forefront of the beauties of Washington upon which the nation is spending many millions of dollars.
>
> Now Therefore, Be It Resolved, That the American Institute of Consulting Engineers hereby enters its earnest protest in the interest of the American people against the erection of a power station upon the proposed site on the waters of the Potomac River in the City of Washington, and recommends that work thereon be suspended pending a thorough and disinterested inquiry into the subject by the National Art Commission, aided by competent engineering advice, with a view to a selection of a site that will not be offensive to the artistic sense of the nation and that will conform to economic principles; and
>
> Be It Further Resolved, That copies of these resolutions be sent to the chairmen of the various legislative committees at Washington now considering this subject, and to the press, and also to the members of the Institute, with a request that they bring the facts to the attention of those within their circle, who will endeavor to convince their representatives in Congress that this matter is of national importance and should have the attention recommended herein.

The resolution was signed by the following: William J. Wilgus, chairman; Reginald Pelham Bolton, Colin M. Ingersoll, Charles W. Leavitt, Ralph D. Mershon.

To Hold Drainage Conference at University of Illinois

A conference on drainage and related subjects will be held at the University of Illinois under the auspices of the department of civil engineering, March 8-11. Land reclamation, flood protection, levee construction, and their importance to the agricultural interests of the state will be discussed by engineers and contractors who have specialized in such work. The program includes the names of George Parsons, president of the National Drainage Congress; Edmund T. Perkins and Isham Randolph, consulting engineers; S. H. McCrory, chief of drainage investigations, U. S. Department of Agriculture, and W. L. Park, of the Illinois Central Railroad. The practicability of an annual short course in drainage engineering under the direction of Prof. F. H. Newell, head of the department of civil engineering, and formerly director of the U. S. Reclamation Service, will be considered.

International Engineering Congress Issues Mechanical Engineering Volume

The committee of management of the 1915 International Engineering Congress has announced that the volume on mechanical engineering is ready for distribution and that the members who have subscribed for it will soon receive it. The other volumes will be issued as rapidly as possible. Owing to the large amount of material to be reprinted, and the thousands of copies to be bound, the work cannot be carried on with greater speed. It is hoped that within two months the entire set will be completed.

Members who did not send in their final selections may not be able to secure all the volumes they might have had in mind, and the committee has decided to close the lists for certain volumes which have been sent to the press. It may be possible to supply members who apply with copies of volumes which have not gone to press.

Bethlehem Steel Corporation Buys Pennsylvania Steel Company

For the sum of $31,900,000, which is at the rate of par for the preferred stock and about $27 per share for the common stock, the Bethlehem Steel Corporation has purchased the Pennsylvania Steel Company. Formal announcement was made on Feb. 18, following a meeting of the board of directors of the corporation. At this meeting Chas. M. Schwab was elected chairman and E. G. Grace was elected president of the board of directors of the merged companies.

Omaha, Neb., Changes Paving and Curbing Specifications

The City of Omaha, Neb., has changed its specifications for paving and curbing in many details. The city's power to revoke contracts and complete the work itself is enlarged, and the concrete proportions for paving base are changed from 1:3:6 to 1:2½:5. Concrete curbing is to be of monolithic construction instead of base and finish as hitherto. Three grades of artificial stone pavement are established: one reinforced by steel and having protecting plates; one without reinforcement, but having protecting plates, and one without either reinforcement or plates.

Estimates Prepared on New Water System for Albuquerque, N. M.

A new water system for Albuquerque, N. M., could be built for approximately $413,000, according to a report by James N. Gladding, city engineer of El Paso, who made the estimate at the request of the Albuquerque city council. The estimate includes the following items:

Reservoir	$41,762
Well system	4,124
Main pumping station	15,114
Sub-pumping station	6,384
Pumping plant	42,650
Meters, hydrants, valves and specials	19,485
Distribution system	133,449
House connections	80,907
Engineering and overhead	68,775
Total	$412,650

The last item includes besides engineering costs, incidentals, taxes, interest, office expenses, legal advice, equipment, liability insurance and contractors' profit. A sub-contractor's profit is also included in construction and materials estimates.

A well system of water supply is the best that could be obtained, the report states, owing to the geological formation in the vicinity of the city, which consists of a layer of coarse sand and gravel saturated with water and extending from depths of 4 or 5 ft. to about 45 or 50 ft. below the surface. This furnishes an almost inexhaustible supply and the gravel forms a large natural filter. Wells sunk into, but not through, this gravel give large flows and 8-in. wells have yielded, it is reported, as much as 1000 gal. per minute. It is recommended that three pumping stations be installed, each with enough wells to produce 1,000,000 gal. every 24 hr. Two concrete-lined reservoirs, each having a capacity of 3,500,000 gal., to furnish ample storage, are also recommended. The proposition is to be voted on at the next municipal election.

Spokane to Consider Bond Issue for New Bridges

Four bridges within the city of Spokane will probaby be replaced by heavy steel or concrete structures, if the action which is now contemplated is approved. The cost of the new structures would be about $500,000, and repairs on other bridges would cost about $200,000, according to press reports. The question is now the subject of an investigation by the city's engineering staff, and it is expected that the report to the city council will be presented in the near future.

To Establish Large Research Laboratory

Following a personal study of industrial conditions in Germany and other foreign countries by Dean Frederick A. Goetze and several members of the faculty of the graduate engineering school of Columbia University, he elaborates in his annual report, which has just been issued, the proposed plans for the foundation of a large industrial engineering research laboratory under the auspices of the university. Such a move, he sets forth, would be a boon to the industries of this country, bringing to their aid, as is done in Germany, keen university research study to solve the many engineering problems which confront them.

The plan outlined by Dean Goetze and his colleagues calls for the immediate erection of a building easily accessible to the university, with water and railroad facilities, which with the equipment necessary would cost $500,000. This would be an initial step, however, as it is ultimately proposed that a research foundation of from $2,000,000 to $5,000,000 be secured, the income to be used exclusively for engineering research.

Form Catskill Aqueduct Association

To keep alive friendships started on the Catskill Aqueduct work, a permanent organization known as the Catskill Aqueduct Association has been formed, with the object of bringing together each year all those who have been or are connected in any way with that work.

A committee consisting of the following men has been designated to arrange for the 1916 reunion: H. C. Buncke, J. F. Sanborn, W. E. Spear, S. F. Thomson, Beverly R. Value and W. J. Buhrendorf, secretary. The committee has made arrangements for a dance at the Biltmore Hotel, New York City, March 7. Tickets may be obtained from the secretary, or any member of the committee. The office of the secretary is in Room 2224, Municipal Building, New York City.

News of Engineering Societies

The Engineers Club of Philadelphia will hold a special meeting March 4 to hear a paper on "Hydrated Lime in Concrete Mortars," by Prof. James S. Macgregor of Columbia University.

The Civil Engineers Society of St. Paul heard E. J. Mehren, editor of the Engineering Record on "The Proposed Removal of the Headquarters of the American Society of Civil Engineers" at a meeting held in that city, Feb. 21.

The American Society of Civil Engineers will hold a meeting in New York City, March 1. Joseph W. Ellms and John S. Gettrust will present a paper on "A Study of the Behavior of Rapid Sand Filters Subjected to the High-Velocity Method of Washing," and Henry S. Prichard will present one on "The Effects of Straining Structural Steel and Wrought Iron."

The American Chemical Society will meet in Urbana, Ill., April 18 to 21. An exhibition of chemical industries is to be held in conjunction with the meeting and the dedication of the new chemistry building of the University of Illinois. No charge is to be made to exhibitors and necessary gas, water, electricity and drayage will be furnished free. Correspondence should be addressed to the chairman of the exhibits committee, H. L. Olin, Urbana.

The Oregon Society of Engineers held its fifth annual banquet in Portland on Feb. 7. Newly elected officers were announced as follows: Philip H. Dater, vice-president; Orrin E. Stanley, secretary, and Henry M. Morse, treasurer. The first issue of the "Journal" which will hereafter be issued by the society, appeared at the meeting. It is intended to publish in the "Journal" not only the papers read before the society but others which may be contributed for this purpose by members.

The San Francisco Association of Members of the American Society of Civil Engineers held the regular bimonthly meeting on Feb. 18. After an address by H. L. Haehl, the new president of the organization, the secretary read a communication from J. A. Ockerson presenting an argument against the proposed move of society headquarters into the Engineering Societies' Building in New York. Discussion developed the fact that many of those present disagreed with Mr. Ockerson, and it was decided to write to Secretary Hunt for additional information on certain points involved; the question to be considered again at the April meeting. A. B. Foote, superintendent of the North Star Mining Company, Marysville, Cal., presented an illustrated paper on the pumping, ore hoisting and conveying equipment installed at the company's properties.

Personal Notes

H. L. Fishel, division engineer for the Santa Fé, Prescott & Phoenix Railway, has been promoted to the position of pilot to federal engineers engaged in the appraisal of structures for the Atchison, Topeka & Santa Fé system, and will have his headquarters at Topeka, Kan.

Glen P. Beach has resigned his position as assistant engineer to the Minnesota State Railroad and Warehouse Commission, to take effect April 1.

G. M. Derr has resigned his position with the Riter Conley Manufacturing Company of Pittsburgh to become connected with the engineering department of the Trussed Concrete Steel Company of Youngstown, Ohio.

T. J. Dean, formerly of Flint, Mich., has become connected with the county surveyor's office at Hillsdale, Mich., on drainage work.

Morris W. Loving, formerly with the Baltimore Sewerage Commission, has been appointed assistant engineer in the extension division of the Universal Portland Cement Company, 208 South La Salle Street, Chicago.

George O. Plamondon, formerly with the Trussed Concrete Steel Company of Youngstown, Ohio, has accepted a position as engineer in the Valuation Division of Interstate Commerce Commission, with headquarters at Chattanooga, Tenn.

Capt. Thomas M. Robins' subject for the next military lecture at the Engineering Societies' Building, New York, Feb. 28, will be field fortifications, sieges and demolitions.

P. C. Clemens has been appointed fourth assistant city engineer of Indianapolis by the Board of Public Works of that city, acting on the recommendation of City Engineer Jeup.

Charles A. Brown has resigned from the position of assistant city engineer of Indianapolis.

Howard Howie, formerly in charge of the development of new iron mines for the Roane Iron Company of Chamberlain, Tenn., has become connected with the Oriskany Ore & Iron Corporation of Lynchburg, Va.

C. Petersen, formerly in the main office of the Trussed Concrete Steel Company, has been appointed sales engineer in the company's branch office in the Munsey Building, Baltimore.

D. W. Cole, of the U. S. Reclamation Service, has been designated senior engineer and resident manager of the Boise Project, succeeding F. E. Weymouth, whose appointment as chief of construction for the Service was noted in these columns Feb. 12. As senior engineer for the Western district, with headquarters at Boise, Idaho, he will have general oversight of all projects in the States of Washington, Oregon, Idaho, Nevada and Northern California for the purpose of advising the chief of construction upon all Reclamation affairs in that territory. Mr. Cole has been in the Reclamation Service nearly 12 years, first upon the construction of the Shoshone Dam in Wyoming, and, latterly, in charge of the Truckee-Carson Project and the construction of Lahontan Dam in Nevada. Previous to the national irrigation era Mr. Cole's engineering practice comprised a number of years in railroad surveys, construction and maintenance, following which he was engaged for 10 years in municipal water works for the City of Waterbury, Conn., the Metropolitan Water Board of Massachusetts, the Commission on Additional Water Supply for New York City and in various hydraulic investigations for the States of Connecticut and New Jersey.

A. E. Miller and H. W. Wendelken have formed a partnership under the firm name of A. E. Miller Construction Company, Turley Building, Portsmouth, Ohio, to engage in a general engineering and contracting business. Mr. Miller has been engaged in contracting work in that vicinity for the past year. Previous to that he was for 3 years erecting engineer for the New York Continental Jewel Company. Mr. Wendelken has had a wide experience in municipal, railroad and highway work, and has been for the past few years, connected with the Ohio State Highway Department.

J. P. Wells, consulting engineer, of Rochester, N. Y., specializing particularly in hydraulic and sanitary practice, has moved his offices from the Exchange Place Building to the Cutler Building.

P. D. Fitzpatrick has been appointed valuation engineer of the Central Vermont Railway, with headquarters at St. Albans, Vt.

T. D. Sedwick, formerly chief chemist of the Chicago, Rock Island and Pacific Railway, has been appointed acting engineer of tests, succeeding F. O. Bunnell, resigned.

Henry E. Elrod, consulting engineer, of Dallas, Tex., has been retained to design a waterworks and sewer system for the City of Cooper, Tex.

George J. Eyreck, Jr., has been appointed engineer for F. W. Long & Company, general contractors, 434 East Bay Street, Jacksonville, Fla.

D. W. Townsend, formerly connected with the Lehigh Valley Railroad, has been appointed to a position on the engineering forces of the Department of Public Works of the Territory of Hawaii, at Wailuku, Maui, T. H. Mr. Townsend is a graduate of Cornell University.

J. W. Bartholow, of the Bartholow-Willits Engineering Company, civil engineers, of Galveston, Tex., has accepted a temporary appointment as assistant to the valuation engineer of the Eastern lines of the Atchison, Topeka & Santa Fé Railway at Topeka, Kan. At the conclusion of his work, which is of a special nature, he will return to Galveston and resume his work with the Bartholow-Willits Company.

W. T. Price has been appointed superintendent of the waterworks system of Hood River, Ore., succeeding P. M. Morse, resigned. Mr. Price was formerly engaged in business as a builder and general contractor at Scranton, Pa.

S. Q. Cannon was reappointed city engineer of Salt Lake City, Feb. 10.

Harry H. Blee, of Santa Ana, Cal., who has been connected with the state engineering department of California, has been appointed assistant state engineer. The law provides for two assistant state engineers. Mr. Blee is the second to be named, Major P. N. Norboe having been appointed to a similar position some time ago.

Stephen W. Jones, Henry E. Cass and Robert L. Cobb have formed the Finance & Construction Company, engineers and contractors, Phoenix Building, Minneapolis, Minn., to conduct a financing and general contracting business within the United States. Mr. Jones has had interests in the contracting business for the past thirty years, and Mr. Cobb has been engaged in the writing of contractors' bonds and liability insurance. Mr. Cass is at present vice-president of the Werdenhoff-Cass Company, railroad contractors.

Nathan C. Johnson, consulting engineer, of New York City, delivered a lecture on "Concrete" at the college of engineering of the University of Minnesota, Feb. 19.

E. J. Mehren, editor of the Engineering Record, delivered an address on "The Relation of College Life to Professional Success" at the college of engineering of the University of Minnesota, Feb. 21.

Dayton Corson, Jr., has resigned from the office of borough engineer of Woodbury, N. J.

Owen Carter has been appointed borough engineer of Woodbury, N. J., succeeding Dayton Corson, whose resignation is noted elsewhere in these columns.

H. M. Brinckerhoff, a member of the engineering firm of Barclay Parsons & Klapp, New York City, has been oppointed chief engineer of the Chicago Traction and Subway Commission, with offices in the Home Insurance Building. He will direct the investigations of traffic conditions and other factors to determine a plan for consolidated operation of the elevated, surface and future subway systems. After Mr. Brinckerhoff was graduated from Stevens Institute of Technology in 1890 he was engaged in the original electrification of the horse-car lines of Boston. In 1892, in Chicago, as assistant engineer of the Intramural Railway, he devised and installed for the first time the third-rail system. In 1898 he became general manager of the West Side Elevated, a position he held until 1906, when he joined the firm of Barclay Parsons & Klapp. His most recent work in this connection was the supervision and direction of the preparation of a report on the traffic conditions in Detroit for the street railway commission of that city.

Obituary Notes

W. I. Baumeister, a well-known building contractor of the Northwest, died Feb. 13 in Bellingham, Wash.

James B. Robinson, consulting engineer, who was connected with the Southern Pacific Company for many years and later with the Northern Pacific Company, died at Portland, Ore., Feb. 12. Mr. Robinson built the Butte County Railroad between Chico, Cal., and Stirling City, and also the present street railway in Chico.

Thomas F. McCrickett, engineer for the Russell Wheel & Foundry Company of Detroit, Mich., died in that city Jan. 26, at the age of 47. He was graduated from the University of Michigan in 1897 and was with the Russell Wheel & Foundry Company from that year until his death.

Joseph S. Ward, resident engineer of the Philadelphia & Reading Railway at Williamsport, Pa., died Feb. 16. He was born in Philadelphia, and, after graduating from the Polytechnic College of Pennsylvania, started in active work as a draftsman in the Pennsylvania Railroad shops at Meadows, N. J. Later he served as draftsman, transitman, levelman and topographer on the Maderia-Mamori Railroad in Brazil. From 1879 to 1881 he was in the assistant engineer's office of the Pennsylvania Railroad's New York division at Jersey City. From 1881 to 1884 he was with the Mexican National Construction Company in Texas and Mexico. In 1884 he entered the service of the Philadelphia & Reading as assistant in the Philadelphia and New York division.

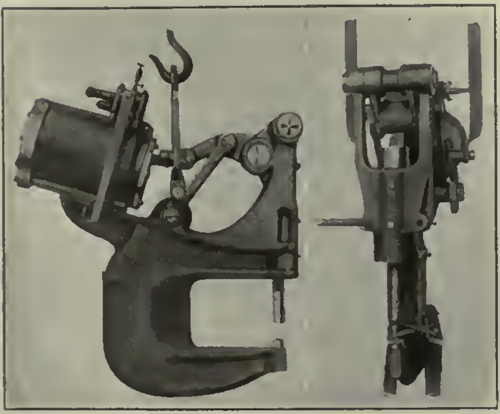
Charles Mills, a civil engineer in the Department of City Transit of Philadelphia, died in that city, Feb. 15.

William J. Nicholls, consulting engineer, of Philadelphia, and a former chief engineer of the Long Island Railroad, died in Philadelphia, Feb. 14. He was 62 years old. Mr. Nicholls, during his professional career, served as chief engineer of the Long Island Railroad, as assistant engineer of the Reading and as chief engineer of the Pennsylvania Steel Company. He also did considerable mining work, and was the author of various works on mining and railroad subjects, as well as several books of fiction. He became a member of the American Society of Civil Engineers in 1878.

Stevenson Towle, for many years chief engineer of New York city sewers, and builder of the first cable railway in that city, whose death was noted in these columns last week, was born in New York City in 1837. He received his professional education at the Free Academy—now the College of the City of New York—and was appointed city surveyor of the city in 1857. In 1860 the mayor designated him to examine the sewer systems of European cities, for the purpose of obtaining the information on which the present sewer laws of the city are based. He was chief engineer of New York sewers from 1870 to 1886. In 1871 he served with Generals McClellan and Franklin on a commission appointed to lay out Long Island City, and, in 1883, he planned and built the first cable road in New York City—the Tenth Avenue line. In 1886 he became consulting engineer of the Broadway Arcade Rapid Transit Railroad, and in the following year was appointed by Mayor Hewitt a member of the Rapid Transit Commission. In the same year the Mayor selected him to visit Europe and personally investigate the question of improved pavement throughout the cities on that continent. He was appointed a park commissioner in 1888, and, in 1889, he became consulting engineer for the department of public works, in special charge of improved street pavements. He held that position until 1897, when he was appointed consulting engineer of sewerage, in connection with the city rapid transit tunnel. He was one of the original members of the American Society of Civil Engineers, being elected in 1868, and served as director from 1887 to 1888. He was married in New York City in 1863 to Mary Stewart Brevoort, and is survived by three sons and five daughters.

Pneumatic Riveter Can Work on Small Latticed Columns

The accompanying photographs illustrate a specially designed Hanna type of pneumatic riveter for lattice column work. A good idea of the limited space in which this machine will operate may be gained from the photographs. The frame, main lever, guide links, toggles, plunger and piston rod head are of cast steel, the main frame bushing and cylinder parts of cast iron and the lower toggle, die screw, lower die holder, dies and piston rod of a specially selected high-carbon steel. The usual Hanna mechanism, described on page 775 of the Engineering Record for Dec. 18, 1915, is applied, in which there is combined, in a simple form, toggles, levers and guide links to give the large opening of the toggle joint movement with its gradually increasing pressure, until the desired pressure is reached, then a simple lever movement throughout a considerable space under approximately maximum pressure. The machines are made by the Hanna Engineering Works, for which the Vulcan Engineering Sales Company is general agent.


PNEUMATIC MACHINE RIVETS LATTICED COLUMNS

Bent Weir Measures Water Proportional to Head

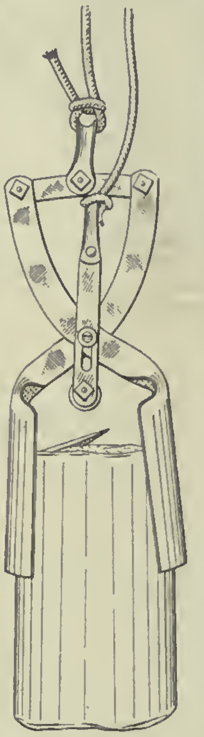
By casting a sloping weir slot on the curve of a right cycloid as shown in the accompanying photograph, the new cycloid weir meter measures quantity of water discharged directly proportional to the head. The weir has recently been placed on the market by the Kennicott Company, Chicago Heights, Ill., which has secured basic patents on the device. The company has been experimenting with the device for more than a year in connection with the numerous calls it has in its water softening and purification installations for a weir meter in which the registering device would not be complicated by the necessity of compensating for the values which are introduced in registering the measurement.

DISCHARGE IS PROPORTIONAL TO HEAD

One of the weirs has been installed in a water softening plant for the Minneapolis General Electric Company having a capacity of 1200 gal. per minute.

Deep Holes Loaded with Safety

The contractor is following the lead of the quarry man in adopting "well-drilled" holes in deep rock cuts because of the economy of deep blasting. These holes are usually loaded by dropping the charge down them from the top. This is a proceeding attended with some danger, which the Chambers loader, illustrated herewith, is designed to obviate. The loader grips the charge until the trip line is pulled. The load can thus be lowered carefully to the bottom of the hole in sections if the charge be heavy, and the loader can be easily released and withdrawn. All metal parts are protected by a heavy coating, which is said to make the production of sparks, from striking the rock sides of the hole very unlikely. The device is manufactured by George T. Chambers, Le Grange, Ill.

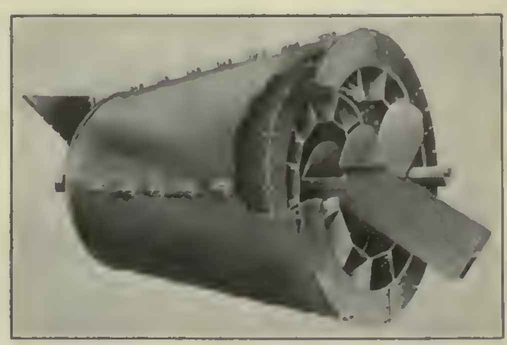


Air Compressors Use Fuel Oil

To obtain an air compressor that would operate cheaply and have a low first cost, the Chicago Pneumatic Tool Company has begun building oil-engine compressors that run on heavy mineral oils costing 3 cents a gallon. These compressors, known as type N-SO, are of the straight line, single stage type with the air cylinder mounted on the main frame between and in tandem with the flywheels and oil cylinder. The two-cycle engine operates at low pressure, using a patented hot-plate system to produce ignition. Air only is compressed, combustion taking place at the end of the compression stroke when an oil pump injects a mixture of oil and water into the cylinder against the hot plate. This mixture is controlled by a fly-ball governor. By using this system it is said that greater fuel economy and practically perfect combustion are attained. The smaller sizes of these compressors are portable. The very low cost at which they compress air, the fuel cost for each 100 cu. ft. per min. warranted by the manufacturer being 56 cents per 9-hr. day, is expected to bring about great extension of the use of compressed air, especially in the way of new uses for this source of power on construction work.

Double-Screen, Self-Contained Unit Washes and Screens Gravel

A new self-contained portable or stationary sand and gravel screening outfit has a washer feature with it in which the clean water strikes the cleanest material. The material is charged through a hopper, shown at the back of the picture, and is dropped directly onto the inner coarse screen. As the screens revolve the finest material goes through the outer screen to a sand hopper, not shown, below the screen. The gravel travels to the outlet between the two screens, and that on the inner coarse screen is finally picked up by pockets at the bottom of the screen, and pumped at the top into the respective chutes which carry the different sizes to separate storage bins.


TWO SIZES OF GRAVEL ARE HANDLED

The washer is set in a box in which the water submerges it about one-third of its depth. Fresh water is applied through two nozzles, not shown, placed midway of the center line on the drum, each nozzle directing a stream against a single set of buckets.

The screen shown is for a plant having a daily capacity of 300 cu. yd. The large and small ends are 66 and 48 in. in diameter respectively, and the length is 6 ft. A 500-cu. yd, outfit is also made by the Raymond W. Dull Company, Chicago, designer and builder of the outfit.

Repair Steam Hammer on Job with Oxy-Acetylene Apparatus

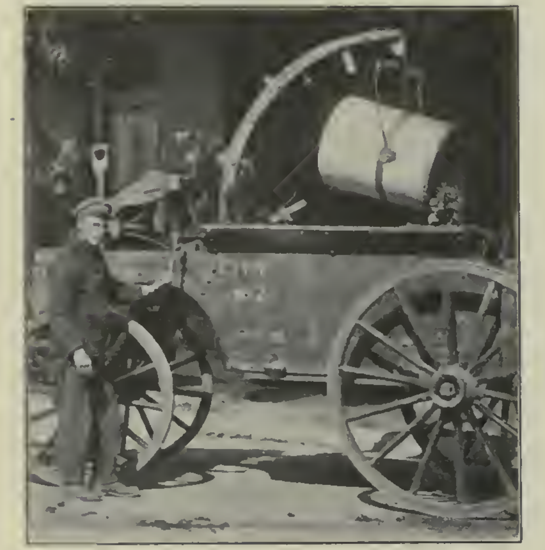
By use of oxy-acetylene apparatus, a steam hammer that was broken on the Hanover Street Bridge construction in Baltimore was repaired on the job in two days time, thus effecting a considerable saving in loss of time.

In the course of the work the pile driver, driving piles for the pier cofferdams was disabled through the breaking off of a heavy corner from the bottom of the hammer, where it fits around the driving cap. The crippled hammer was laid up on one of the partly finished piers and a Milburn Portable Oxy-Acetylene plant was taken out to the work on a boat. The broken portions were chipped away to allow for the new filling material and the end of the hammer welded back in place. The entire work was completed within two days, saving a considerable loss of time on the job.

BROKEN STEAM HAMMER REPAIRED ON JOB

Simple Device Facilitates Waste Removal in Grand Rapids, Mich.

To solve the rubbish removal problem in the schools of Grand Rapids, Mich., William Walsh, highway commissioner of that city, devised a scheme of wells located in the rear of each building and a handling device by which the deposited rubbish can be readily lifted and loaded onto dump wagons.



CRANE LIFTS AND DUMPS CANS

The wagons carry galvanized iron cans, which are lowered into the wells, into which the rubbish has been swept, by means of a crank, controlling a wire rope which moves through pulleys attached to a crane. But one man is required to load the refuse, which is drawn up and dumped into the cart. The dumping is done by a rope, terminating in a catch, which is hooked on the base of the can, as shown in the illustration. But little time is required to clean the wells, and one wagon takes care of the needs of all the schools.

Pressure for Road Oiler with Heater Comes from Rear Wheel

A new pressure road oiler with a heater of 600-gal. capacity has recently been put on the market in which the power pumps are driven by a chain from the rear wheel. It will handle any amount up to ½ gal. per square yard on an 8-ft. strip.

The oil heater as shown in the photograph is in the form of a jacket surrounding the tank and is operated by a kerosene oil improved burner giving a combustion in which the smoke and soot are eliminated.

All levers can be operated from the driver's seat, so that the outfit can be operated by one man.

The machine, which is built by the Austin-Western Road Machinery Company, will handle, it is claimed, oils containing 40 per cent asphalt unheated and oil up to 90 per cent asphalt and all Tarvia products heated.

PRESSURE OIL DISTRIBUTER HAS HEATER

Declare Timber Supply Abundant

That the timber supply of the nation is sufficient for years to come, and that all that is needed is proper co-ordination in its manufacture, scientific distribution of the manufactured product and co-operation among the various groups of manufacturers and between manufacturers and retailers was the declaration of E. A. Sterling, forest engineer and head of the trade extension department of the National Lumber Manufacturers' Association, before the annual meeting of the Southern Pine Association in New Orleans, February 23.

"That ample lumber resources still remain is indicated," he said, "by the more recent Government estimates, and by careful study of the situation by those most familiar with conditions. Undue publicity has been given in statements that our forest resources are practically exhausted. In fact the enormous reserve supply on the Pacific Coast, now readily available, with large timbered areas still standing in the North, South and East, and with an estimated total of 200,000,000 acres of farm woodlands which still contribute to local needs, the fallacy of a timber famine becomes evident. With this comes the practical certainty that if a reasonable consumption of lumber can be maintained, the gradual adoption of forest management, the reduction of loss by fire, and the longer service to be obtained from lumber by proper selection and preservative treatment, will give us adequate supply for all time."

Business Notes

J. R. Nichols, formerly assistant sales manager at the Pittsburgh office for the Asbestos Protected Metal Company, is opening an office for that company in the Hart Building, Atlanta, Ga.

The Coffin Valve Company, manufacturer of sluice and gate valves, of Boston, has entered into an agreement with C. W. Bergen, 30 Church Street, New York City, to become its New York representative.

J. A. & W. Bird & Company, distributor for North America of Repolin Enamel Paint, of 88 Pearl Street, Boston, has moved its New York City offices from 66 Beaver Street to the Equitable Building, 120 Broadway.

W. B. Knickerbocker, president Knickerbocker Company of Jackson, Mich., manufacturing cyclone heads and concrete mixers, died suddenly Feb. 10, presumably as the result of two serious falls sustained during the past year.

Peter James Cunneen, manager of the Lassig Plant, American Bridge Company, at Chicago, died Feb. 13. Mr. Cunneen was born in 1859 and entered the employ of the old American Bridge Company in 1878. He remained in the employ of that company and its various successors until the formation of the present American Bridge Company.

A. C. Cameron of the Municipal Engineering & Contracting Company, Chicago, was chosen president of the National Association of Mixer Manufacturers at the meeting in Chicago, Feb. 15. The other officials elected were F. C. Wilcox, of the Foot Concrete Machinery Company, treasurer, and H. E. Smith, of the T. L. Smith Company, secretary. Active work toward establishment of the "wet mixed" batch as the basis for rating mixers will be pushed.

The Scherzer Rolling Lift Bridge Company has announced, that, following the death of Albert H. Scherzer, president, the entire stock of the company has been purchased by a syndicate of officials of the company, who have been connected with the business from its inception, and that there will be no change in the personnel of the organization, Mr. Scherzer having taken no active part in the affairs of the company for several years. The company has general offices in the Monadnock Block, Chicago, and an Eastern office at 220 Broadway, New York, with sales connections in various cities of this country and Europe.

The American Coal Products Company and the **Barrett Manufacturing Company** have decided to unite the good-will and reputation of both concerns under the name of The Barrett Company. The American Coal Products Company is known in connection with the sale of sulphate of ammonia, and heretofore owned the stock of The Barrett Manufacturing Company. The fact that all the coal tar chemicals, disinfectants, roofing, waterproofing, road-making and wood preserving materials have been made and widely advertised in the name of the Barrett Manufacturing Company has added to the good-will attached to it. This increase, however, has not been connected in the minds of the general public with the securities of the American Coal Products Company. The new company will have the same amount of stock as the American Coal Products Company, and the change in the name will be accomplished by exchanging the outstanding certificates share for share.

Trade Publications

The following companies have recently issued trade literature:

Foster & Creighton Company, Nashville, Tenn., booklet, 8 pages, comparative tests, Rockwood, Alabama, limestone.

Sterling Motor Truck Company, Milwaukee, Wis., leaflet, 8 pages, Sterling-Kindling motor "squeegee" street washer.

Studebaker, South Bend, Ind., leaflet 1023, 8 pages, oil heater and pressure distributor for road construction and maintenance.

Whiting Foundry Equipment Company, Harvey, Ill., catalog 119, 20 pages, air hoists of from 350 to 40,000 lb. lifting capacity.

Evinrude Motor Company, Milwaukee, catalog 32 pages, small detachable motor for boats and canoes—a suggestion for surveying trips.

Hayward Company, 50 Church Street, New York City, pamphlet 608, 24 pages, Hayward clamshell and orange-peel buckets put to a variety of uses.

Vanadium-Alloys Steel Company, Pittsburgh, booklet, an article on Tungsten mining in Colorado written by Roy C. McKenna, president of the company.

Stephens Adamson Manufacturing Company, Aurora, Ill., booklet 76, February, 1916, 24 pages, The Labor Saver, semi-portable screening and crushing plants for road work.

Texas Company, New York, booklet, 10 pages, February, 1916. Lubrication, oil behavior in Diesel-type engine, temperature considerations in oil-testing and sundry items about Texaco crater compound.

Chain Belt Company, Milwaukee, supplement to general catalog 56, 32 pages, revised price lists on Standard detachable chain belt and various changes in Chabelco steel chain belt, as well as listing of the new H-type riveted chain belt.

Austin-Western Road Machinery Company, Chicago, catalog, 80 pages, road machines, scrapers, graders, rippers, and planers and finishers. Rock-crushing machinery, portable storage bins, screens and conveyors. Road rollers and road-maintenance machinery.

Allis-Chalmers Manufacturing Company, Milwaukee. Bulletin 1439-A, 36 pages, entitled "Timber Preserving Machinery." Describes briefly various treatment processes, and gives useful condensed information about them, in addition to data regarding the company's make of machinery.

Link Belt Company, Chicago. Eighty-page booklet profusely illustrated with installations of elevators, conveyors and machinery for handling, preparing and storing gravel, stone, sand and other materials. Many dimension tables and layout drawing make the volume particularly valuable. A new scheme of using wagon loaders to handle road materials to wheelbarrows and a new type of high-speed grab-bucket for hard digging are illustrated.

Engineering Record

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Good Roads Saved Paris

ENGINEERS in this country have known, in a general way, that good roads are a military asset, but very few, outside of Army circles, have realized the momentous part which the highway system around Paris has played in the destinies of France. Good roads were the big factor in stopping the great German drive at the beginning of the war, and prevented the investment of Paris by the Teutonic forces. This, in effect, is the significant statement made recently by Major Amos A. Fries, Corp of Engineers, U. S. Army, in an address at the National Conference on Concrete Road Building in Chicago. By the quickness of their mobilization and movements, said Major Fries, the Germans all but took Paris, which was saved only by General Joffre's skillful use of automobiles and the fine roads around Paris. By commandeering all sorts of motor vehicles he was able to carry from Paris to the front for several days prior to and during the battle of the Marne a steady stream of soldiers, night and day. This turned the tide of invasion. The use which General Joffre made of good roads and motors at Paris in August, 1914, furnishes a lesson that this country should never forget.

Paving Factors of Safety

RECOGNITION of the added wear on pavement by motor buses was made in Chicago recently by a company seeking a franchise to operate over the boulevard system of the Lincoln Park Board. The offer to finance a $300,000 bond issue to repave the North Side system along Lake Michigan in exchange for a 25-year franchise to operate on the roads meets the most serious objection that the park officials heretofore have interposed against granting the right. The present paving, it has been contended, will not stand the heavy bus traffic. Agreements of this kind or monetary considerations will have to come sooner or later if the increasingly heavy traffic of special interests, as differentiated from that of the general public, is to be taken care of. Many of our paved streets now have little more than a factor of safety of one. Probably in no other class of engineering structure has the unity factor been approached with such rapidity, but ultimate rupture does not cause an accident and little attention is paid to a study of yield points. Yearly inspections of railroad bridges are made to ascertain the factor of safety which the members have under increased weight of the newest and heaviest rolling stock. The same practice is carried out in a more or less perfunctory way in highway bridges, but no one ever heard of a road inspection to see how heavy trucks it would carry, assuming a definite factor of safety. Trucks of 15 tons capacity, not at all unusual at present, cannot continue to operate over many suburban pavements without inflicting permanent injury. Is it not time now to determine what factor of safety different standard pavements have?

Plain Contracts for Philadelphia

MAYOR SMITH, of Philadelphia, in speaking recently before the Contractors' Association of that city, is reported to have said, in part: "I do not know of the past, whether there has been a favoring of certain contractors by means of changes in specifications or otherwise, but I do know that during the next four years the contracts and specifications will be so prepared that the veriest novice cannot fail to understand them." The Engineering Record hopes, for the sake of Philadelphia contractors, that the mayor's words will prove prophetic. What the owner, the engineer and the contractor need most today are specifications and contracts that "the veriest novice cannot fail to understand." Such documents should be so plain that they will tell all bidders at once the full and final object of the contract, the exact methods and standards by which that object is to be secured, and the precise business relations that will govern the co-operative efforts of the parties to the contract. If this be Mayor Smith's meaning, may his words come true, not only in Philadelphia, but on all municipal construction work.

"Fall In!"

ENGINEERS of New York who are planning to attend one of the military training camps at Plattsburg next summer will have an opportunity of receiving preliminary armory instruction in the rudiments of a soldier's duties during the next three months. This announcement was made Monday night at the military lecture in the Engineering Societies Building, given under the auspices of the four national engineering organizations. Further details are reported in the news section of this issue. The announcement means that the men who avail themselves of this indoor instruction in fundamentals will have time at Plattsburg to devote to much more interesting problems than close order drills and the manual of arms—which must be mastered thoroughly before any field progress is possible. The commanding officer of the proposed armory battalion is Capt. George Perrine, himself an engineed and a Spanish War veteran, well-known to Engineering Record readers for his article on national defense published in this journal Nov. 13. The value of the indoor work, as a preliminary to field service, cannot be overestimated. It will serve as a foundation upon which to erect a superstructure of advanced knowledge in military matters. The important thing to keep in mind is that the superstructure is impossible without a stable base. When Captain Perrine gives the command "Fall In!" next Thursday, he should face a large and enthusiastic company of engineers.

Society Progress in Minnesota

ENGINEERS generally are familiar with the co-operative work which has been done by engineering societies nationally and in certain of the large cities. It has remained for Minnesota, however, to establish co-operation among societies through a state organization. As noted briefly in the news section of this journal last week, the Minnesota sections of the American Institute of Electrical Engineers and of the American Society of Mechanical Engineers, the Northwestern Association of Members of the American Society of Civil Engineers, the Minnesota Surveyors & Engineers' Society, the Minneapolis Engineers' Club, the Civil Engineers' Society of St. Paul, and the Engineering College of the University of Minnesota have formed the Minnesota Joint Engineering Board, whose purpose is to secure co-operation on public matters of an engineering character. The matter needs only to be mentioned to bring forth hearty commendation. The organizations mentioned are to be congratulated on their step. May the Minnesota Joint Engineering Board soon have to its credit substantial achievements in the interest both of the public and of the engineering profession.

Engineer Commissioners

PERSONALITY, business sense, broad vision and a judicial temperament—all of these attributes were mentioned recently by this journal as essential for the success of the engineer as a public service commissioner. Because the engineering profession has had to fight so hard for any recognition in the selection of commissioners, there has been a tendency to regard the appointment of any engineer a great triumph. The fallacy of this view was illustrated recently by the dismal effort of a certain engineer commissioner at an important hearing. His lame and halting delivery, contrasting so sharply with the fluency of the lawyers who preceded and followed him; his substitution of personal opinions for facts from which the experienced tribunal could draw its own conclusions; his failure to differentiate between actual investment and investment indicated by inadequate accounting systems; and, above all, his lending of his technical knowledge to the support of doctrines unscientific but popular—all of these things seemed to stamp him as sadly deficient in all of the attributes mentioned above—a man to be employed by a commission for the benefit of his technical knowledge, but not to sit in judgment on the larger questions. It may be he did not do himself full justice. He was in a peculiar position, speaking as perhaps the only engineer on his side of the case in the presence of numerous engineers on the other side, and attempting to argue a technical matter before a non-technical tribunal. This may have made it seem necessary for him to appall his fellow commissioners and the court by his engineering learning, and at the same time show that learning to the critical engineers in a surer way by the abundant use of terms that none but the engineer would understand. The exhibition could hardly have been taken as a convincing argument for the appointment of engineers on commissions, and the Engineering Record hopes that those who see great advantage to both the profession and the public in the selection of engineers of the right type will support only those who possess qualifications for a commissioner's duties.

Major Bond's Military Articles

THE series of articles on "National Defense—For Engineer and Contractor," by Major P. S. Bond, Corps of Engineers, U. S. Army, which begins in this issue, states the great problem of military preparedness in engineering terms. The manuscript has been written by a regular Army officer and approved by the War Department at Washington. The facts and figures, therefore, bear the weight of authority. It is well to emphasize, at the outset, that the mere reading of these articles will not make a military engineer, but the series will form a valuable preliminary to instruction in the field. It will give a man a broad view of the country's present military status and future needs, and will show how engineers can make their specialized technical training a national asset of vast importance. With these facts in mind, the engineer may begin actual training at Plattsburg and other military camps next summer with a clear understanding of the ultimate aim of the work. To the man of narrow vision military drill appears only as irksome routine—a mere change of direction in marching when the command "Column Right" is given. To the man who can see farther there is more in it than this. It accomplishes definite disciplinary objects and is the very essence of an efficient fighting force. This is the ultimate goal—not merely precise execution of close order movements, but success in battle. No able-bodied man can consistently favor measures of adequate national defense and elect to have someone else do his fighting for him. If Major Bond's articles aid in impressing upon engineers their obligation to prepare for any eventuality that this country may face, they will have served their purpose.

Spanish for the Engineer

WITHIN the past year, this journal has urged upon its readers—especially the younger men—the advantages that would accrue to them through a knowledge of Spanish. The possibilities in the process of development in the Latin-Americas are so attractive that it does not seem amiss to refer to them again. The future of many of the men just starting their professional careers, doubtless, lies southward. While it is possible that many who do not know Spanish will find openings in the new fields, the man who has acquired a speaking knowledge of the language will be doubly prepared to realize the full value of the opportunities that are presented. Spanish is an exceedingly easy language to learn. By devoting one hour a day to a study of it the man of average intelligence should, in three to four months, be able to acquire a sufficient knowledge to enable him to carry on an every-day conversation with ease and facility, and to read newspapers and similar matter in that language without difficulty. From this point it is merely a matter of practice until Spanish is almost as familiar to him as is English. It is desirable that the studies should be made under the direction of a competent instructor, but so simple and so regular are the accents and sounds that it is possible to attain a sufficient knowledge of the subject to make oneself understood in conversation, and to acquire ease in reading, without even this advantage. The American engineer should, without delay, take up the study of Spanish. To procrastinate, or to neglect to do so, is likely to handicap him greatly if his future work is to be done in South America.

Flow of Concrete

THAT the subject of continued deformation of concrete under sustained loads is claiming increased attention is evidenced by the fact that at least three papers presented before the American Concrete Institute at its recent annual meeting contain test results demonstrating that concrete flows under sustained load. As the tests so far made are by no means exhaustive, usually being limited to but few specimens, the need for more complete investigation has already been emphasized in an editorial on page 246 of the Engineering Record of Aug. 28, 1915. On page 251 of the same issue the Minnesota test results by F. R. McMillan are given, while in last week's issue the subject was discussed in papers abstracted on pages 279 and 282. On page 329 of this issue still further evidence is offered in the paper by E. B. Smith. On of the most important deductions from these tests is the fact that field measurements of strains in reinforced-concrete structures cannot be used as indications of internal stress conditions in the manner usually adopted in applying the coefficient of elasticity to the unit strains. The effects of shrinkage and moisture contions, the unknown value of the coefficient for the various stress conditions and the direct influence of the time element all must be considered in translating strain into stress. While the magnitude of the continuing deformations under sustained load is not large, and the tendency to reach a constant limiting deformation within a given time is reassuring, these tests raise problems in design for deflection and permanence of structure which engineers should keep in mind for the future investigations which will doubtless follow.

Why State Engineering Societies?

HAS the state engineering society passed its field of usefulness? Has the diversity of civil engineering progressed so far that the engineer interested individually only in different branches such as drainage, highways and waterworks, cannot afford to spend the time to attend meetings where a few papers only are given on his particular subject? Have the associations devoted entirely to a single line of work, such as roads and pavements, usurped entirely the field of the general society? These and other questions of like nature were in the minds of engineers attending the joint meeting of the Illinois Society of Engineers and Surveyors and the Illinois section of the American Waterworks Association. Few highway officials were in attendance, presumably because many of them had spent the preceding week at the university road school. When the road papers were being read the sewage enthusiasts strolled out, and when the waterworks papers were presented the highway men became restless.

To the consulting engineer who does general work and to the city engineers who handle a multiplicity of lines the general organization appeals strongly. There seems to be a need, however, for a careful restatement of the bonds and principles which all these engineers have in common. The constitution states that the objects of practically all engineering organizations shall be the advancement of engineering knowledge and practice and the maintenance of a high professional standard. That statement, however, is too general and a small organization, to succeed, must have more closely defined common causes.

The Illinois Society of Engineers has an enviable record, has served its members well and is on a firm financial basis, having more than $1,000 in its treasury, but it is not growing materially in membership. The incoming officers can, therefore, with profit not only to the Illinois society, but to all state organizations, make examination of itself and its field. Some of the things worth while considering were voiced on the floor of the convention—greater opportunity for individual expression by the younger men and participation in civic affairs looking toward the education of the public in engineering matters. To this list might be added co-operation of existing societies to avoid duplication of effort, a study of the newer relations among existing organizations, and the tendency toward the democratization of the national societies with the spread of the section idea and what bearing this will have on the state societies. Most careful consideration should be taken of new organizations—those of the specialized type, such as drainage and highway associations, and those of the all-inclusive type, which feature the business side of engineers and engineering rather than the technical side.

Low Standards in Engineering Education

WHEN so eminent an educator as Professor Swain, of Harvard University, can make the deliberate assertion, as the result of his many years of experience, that the average college graduate knows nothing accurately, cannot think logically or observe correctly, has not gained habits of accuracy, and does not know how to obey orders, that men go through college with standards that in business would cost them their jobs, and further, that college or engineering education educates nearly all the common sense out of a man, it is surely time for those who are responsible for our educational institutions to give careful thought to their administration as well as to the courses themselves. Professor Swain's letter on page 291 of the last issue, in which he discusses the decreasing enrollment of civil engineering students, is a strong presentment in favor of the view that such a decrease may not be undesirable.

Two constructive suggestions directly affecting both teachers and administrators in the field of engineering education follow logically from Professor Swain's letter. First, low academic standards should be raised. This can be accomplished by deliberate efforts to develop those habits of logical and accurate thinking which are so conspicuous by their absence in the average college graduate through that severe discipline which Professor Swain advocates. Second, only teachers who themselves possess common sense and can develop it in others, should be allowed to teach engineering. Furthermore, teachers must be able to inspire their students to give their very best efforts to the college work, to stimulate each one to independent self-expression, and to develop in them a strong and life-long ambition to obtain the highest possible goal for which they are qualified.

It is difficult to select the favored few who can profit by the opportunities offered in higher education. Who can predict with certainty what any man may become? His will may be strongly awakened in a stimulating and helpful atmosphere, and great service to the profession be given by one who, seemingly, would never rise above mediocrity. This journal, therefore, believes that the opportunity for engineering education of the right kind should be freely offered to many candidates, but that high standards of student accomplishment, vigorously and severely enforced, should result in early elimination of that undesirable half which Professor Swain states are taking the course at a loss to themselves. Moreover, were it understood that the high standards would be maintained regardless of the mortality, poorly prepared and unadaptable candidates would soon be a small minority. The better class of students who remain can accomplish more real work and the teacher's efforts bear far greater fruit. The much-to-be desired goal of engineering degrees which guarantee quality would thus be attained.

Expensive Temporizing

SOME contractors are possessed of an incurable reluctance to pay small bills. When the job is costing more from month to month than the estimates bring in, even though a profit is in sight when the retained percentage is paid, the temptation to let such bills slide is very great. The big bills must be paid or the job may be crippled. A sudden stoppage in shipment of structural steel, for instance, would be very disastrous. But a few bags of cement, an occasional barrel of kerosene, or a few tons of coal at a delivery can be obtained from any number of dealers at any time. In other words the big bills have to be paid or the consequences may be serious. The little bills can wait—there are no consequences. The little creditor will not even sue. He would have to pay more for collection than he would receive from it.

One contractor evidently used such reasoning when, a few years ago, he purchased some materials amounting to less than $100 from a firm with which, in the preceding decade, he had done business amounting to almost a million dollars. The bill has not been paid yet, and, beyond sending out monthly reminders, which the contractor completely ignores, the manufacturer has taken no action. But, because of the magnitude of his previous purchases, the contractor is somewhat of a marked man with that firm. Even the higher officials of the company have taken cognizance of his lapse. They are beginning to doubt his honesty. In the due course of events, when construction is on the boom again, the contractor will probably send an order or ask for a quotation. It is very likely that he will be asked to establish a credit, make a cash deposit, or furnish a bond. Of course, he will have the alternative of going elsewhere for his materials, but it may be that at that particular time the manufacturer in whose bad graces he happens to be will be in a position to quote the lowest price. In any event, slowness in paying a very small bill is quite likely to prove very expensive to him in the long run.

Another case is that of a contractor who had a dispute over a small difference in a $500 account. The upshot of it was that he refused to pay any part of the bill until it was corrected to suit his opinion. The manufacturer sued and obtained a judgment against him, but the contractor had arranged his affairs so that it was not collectible. A year or so passed and the matter was almost forgotten. Then the contractor was lowest bidder on a $200,000 job at a good price in a distant city. Before awarding a contract to him the authorities looked up his antecedents. They unearthed the matter of that unsatisfied judgment. There was considerable hesitancy about awarding the contract to him, and he only got it after he had almost given up hope himself, by going to considerable expense in traveling and bringing witnesses to speak for him to the city in question. Then, too, the judgment was eventually paid.

These instances do not take into account the general class of small creditors—the coal and oil dealers, the small-town lumber dealer, owners of one or two teams and the like. They seldom get the satisfaction of future squaring-up and very seldom sue, but they talk, and scandal travels far. A contractor's reputation is a very valuable asset to him, and such talk is injurious.

This discussion is not intended for the dishonest contractor, but for the indifferent one, not the one who never pays his bills, but the one who merely procrastinates. It would be wiser, and easier, to pay the small bills as promptly as the large ones.

The Return of Bidder's Checks

CRITICISM has been aroused on two occasions recently in the West because certified checks were returned to low bidders who failed to enter into contracts. The reason given in each case was that errors had been made in preparing the bids. That such criticism is justified this journal feels sure the great majority of responsible contractors will agree. Individual cases are apt to arouse one's sympathy, and it is unquestionable that even the best contractors make mistakes in their computations sometimes. As against these there are a very large number of irresponsible or actually dishonorable individuals who place bids merely as a feeler, to find out from others better informed what a job is worth, or how prices are going, figuring on getting their checks back on some technicality or other, even if they have to go to court to do it. Then, too, there is the ignoramus who prepares his bid from the tabulations of previous lettings of somewhat similar work, only to discover that he is all wrong on the particular job for which he is bidding.

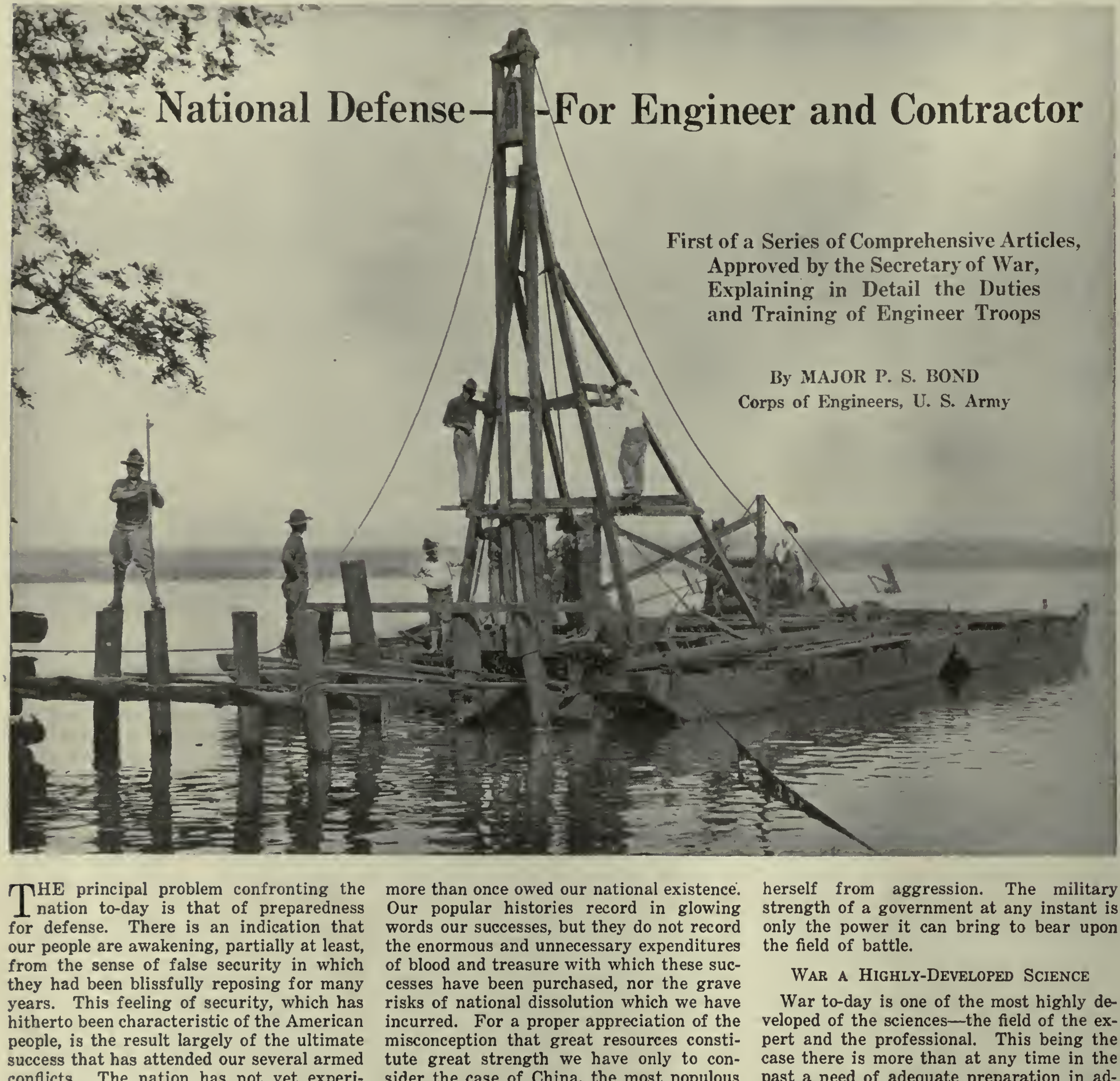
It costs a responsible contractor an appreciable sum of money to prepare a bid for a work of average magnitude. To be sure of what he is bidding on he must make a trip over the site of the proposed work and do some very careful figuring. If an irresponsible bidder happens to confuse the whole thing, his expense has been for nothing. Also, he is placed at a disadvantage at the second letting. In preparing his first bid he figured the job would cost so much and he allowed himself a certain profit. In preparing his second bid he knows his competitors are aware of what he thinks the job is worth. To throw them off the track he must either cut into his profits or do some skillful unbalancing. The latter subterfuge being prohibited in most work nowadays, the only course left open is to be satisfied with a lower profit and a smaller allowance for contingencies. The job was spoiled for him at the first letting.

If there were no penalty attached to a failure to enter into a contract by the lowest bidder or if, in general, such a penalty should become merely a figure of speech and not be exacted, the profits of contracting would soon be a matter of history. Lettings would become mere auctioneering and no contractor could expect to survive.

National Defense—For Engineer and Contractor

First of a Series of Comprehensive Articles, Approved by the Secretary of War, Explaining in Detail the Duties and Training of Engineer Troops

By MAJOR P. S. BOND
Corps of Engineers, U. S. Army



To the engineers of New York City an opportunity of learning something regarding the need of technically trained men for National Defense has been offered by the military lecture course, organized recently by the four national engineering societies under the general direction of Major-Gen. Leonard Wood. The response to the call for enrollment exceeded all expectations. Three thousand engineers registered, and the lectures are now being given in three separate sessions each week.

Realizing that these New York meetings could be attended by only a comparatively small number of this country's engineers and that members of the profession in other states were eager for information on the subject of military engineering, the Engineering Record engaged Major P. S. Bond, Corps of Engineers, U. S. Army, and member of the American Society of Civil Engineers, to prepare the series of articles which begins in this issue.

The articles are written primarily for the engineer and the contractor—by one of the best informed officers in the army service. Their approval by the Secretary of War attests their high value.

The initial installment this week deals with the general subject of modern warfare and the relation of the engineer thereto. In succeeding issues Major Bond will discuss specific problems—stream crossings, map-making, field fortifications, road-building, sanitation, and mobilization of industrial resources.—EDITOR.

THE principal problem confronting the nation to-day is that of preparedness for defense. There is an indication that our people are awakening, partially at least, from the sense of false security in which they had been blissfully reposing for many years. This feeling of security, which has hitherto been characteristic of the American people, is the result largely of the ultimate success that has attended our several armed conflicts. The nation has not yet experienced the chastening discipline of defeat. There is also prevalent an idea that great resources in men and materials of themselves constitute great military strength.

As to the first of these popular ideas, it is to be remarked that our successes have been unearned. We have triumphed, not because of our efficiency, but in spite of our inefficiency. The systematic and intelligent progress that has marked our industrial growth has been conspicuously lacking in our military affairs. We have never entered the lists with a powerful nation trained for the conflict and able to turn its strength against us. To this fact we have more than once owed our national existence. Our popular histories record in glowing words our successes, but they do not record the enormous and unnecessary expenditures of blood and treasure with which these successes have been purchased, nor the grave risks of national dissolution which we have incurred. For a proper appreciation of the misconception that great resources constitute great strength we have only to consider the case of China, the most populous nation on earth and possessor of vast unorganized resources, yet utterly lacking in military strength and powerless to protect herself from aggression. The military strength of a government at any instant is only the power it can bring to bear upon the field of battle.

WAR A HIGHLY-DEVELOPED SCIENCE

War to-day is one of the most highly developed of the sciences—the field of the expert and the professional. This being the case there is more than at any time in the past a need of adequate preparation in advance of the outbreak of hostilities. Preparation for defense is merely a form of national life or accident insurance. When the conflagration has broken forth it is too late to organize the fire insurance company or the fire department. Fire is an unreasoning element which strikes alike the insured and uninsured. War is destruction endowed with judgment and perception—it prefers deliberately to select the uninsured.

The preparation for war is of two kinds: One of material things—the construction of battleships, submarines and coast defenses, the fabrication of weapons, munitions and supplies; the other, the organization and training of the people. While both are necessary, the latter is the more important as well as the more difficult to provide.

The modern theory of war, as exemplified in the practice of the so-called military nations, is that all the resources of the state—moral, physical and intellectual—should be at the disposal of the government. War is the most critical condition of the modern state with its highly developed and peculiarly sensitive and vulnerable industrial and commercial systems. For the successful prosecution of a conflict on which the very fate of the nation may depend every ounce of its strength should be available. The aim is to strike quickly with all the force at the nation's command. That state is best prepared which can most rapidly bring to bear its resources in men and materials. In this modern theory is involved the principle that every able-bodied male citizen owes to the state the obligation of service. This principle is not incompatible with democratic ideals and is recognized in theory by our own constitution. The greater the benefits conferred by the government, the greater the resulting obligation of the citizen.

The nearest approach to perfection in the application of this theory of war is exhibited by the German Empire. Whatever may be our personal sympathies, we cannot withhold our admiration for the splendid efficiency of the German military machine and the complete mobilization of the material resources of the Empire. The history of this state shows that the military system is the mother of the German Empire. Bismarck, the statesman, planned the greater Germany, but Von Moltke, the soldier, created it when he destroyed in two short campaigns the military power of Austria and France.

Significant Statements Made by Major Bond

War is destruction, endowed with judgment and perception; it prefers deliberately to select the uninsured.

To repel possible attacks the general staff recommends 500,000 men at the outbreak of war, 500,000 men ninety days thereafter, and 500,000 men to replace casualties.

In all, we might muster for a field army, in case of invasion, 125,000 men, many of whom would be only partially trained.

It is safe to say that no army has ever had an excess of engineer troops.

The officer of engineers must be not only a trained and disciplined soldier, but, in addition, a competent and experienced engineer.

Of the peaceful arts that contribute the results of their research and practice to the successful prosecution of war, none is of more vital importance than engineering.

Military engineering, in contrast to civil practice, is characterized by makeshifts and temporary expedients.

GERMANY'S SYSTEM EFFECTIVE

The German system, then, may be regarded as the most effective policy of national preparation for war, and it will be of interest to consider its principal features. In the first place the training of the personnel is what is known as universal, which is to say that it is applied to a very large proportion of the male inhabitants. In the second place, it is compulsory. In the third place, it is regular. The standing army constitutes a school in which all men receive in their youth the regular training necessary to qualify them for field service, after which they are passed to the reserves and allowed to pursue the vocations of civil life, being occasionally called out for short periods of training. They thus constitute a military asset until they reach the age of physical disability, but are not withdrawn from the pursuits of civil life.

This excellent system of general training is supplemented and made effective by governmental control of the material resources of the country, including the transportation, agricultural and industrial systems, to the end that they may be instantly brought into efficient service in case of war. This mobilization of the resources of the country is controlled by a large corps of highly-trained officers known as the Great General Staff. Such, in brief, is the German system, which exemplifies the modern theory hereinbefore referred to, that all the resources of the state, moral, physical and intellectual, should be at the immediate disposal of the government for use in case of war. Such a system is most effectual under a highly centralized, indeed a despotic, form of government. But it is not limited to such, inasmuch as France, a republic, has adopted and carried out practically the same system as Germany. On the other hand, China, hitherto and possibly again to be one of the most despotic of governments, has no military policy whatever, unless peace at any price may be so called.

In contrast with the efficient systems of the continental powers of Europe the defects of our own military policy are most glaring. "Whether we may be willing to admit it or not," says General Upton, "in the conduct of war, we have rejected the practice of European nations and, with little variation, have thus far pursued the policy of China." It is not the purpose of the writer to dwell at length upon the defects of our system, nor to detail the mistakes that have characterized the conduct of our past wars, but to look hopefully to the future. In recent years there has been

—*Photo, Press Illus. Co.*

"MILITARY ENGINEERING IS, IN A GENERAL SENSE, THE ADAPTATION OF CIVIL ENGINEERING TO THE CONDUCT OF WAR" a marked improvement in our national defense. The regular army has been enlarged, a general staff has been established, and the system of instruction for both officers and men has been greatly extended and improved. The militia of the several states has been brought into closer relation with the federal government, and better methods of instruction have been inaugurated. We are still, however, very far below European standards. Our military policy has not kept pace with the growth of our population, the advances in the science of war, and the constantly augmented strength of other nations.

There is promise that the present agitation for national defense may result in the further strengthening and improvement of our organized forces, but the outcome is still uncertain and our discussion is based, therefore, on the policy as it exists to-day. This policy is, perhaps, the logical outcome of a firmly rooted national prejudice against large standing armies. Our form of government and the spirit of our people at present preclude that efficient form of preparation adopted by the Europeans and characterized by large standing armies and reserves and compulsory regular training. It is doubtful if anything short of a great national calamity will cause a radical change in this policy. We can and should, however, do everything possible under the restrictions imposed by the temper of our people to make the national defense effective, or rather to decrease its inefficiency, to plan for the future and avoid some of the mistakes of the past.

OUR PRESENT FORCES

Our organized land forces at present consist of a well-trained standing army of about 100,000 men, and a partially trained national guard having an enrolled strength of about 130,000 and an effective strength less than this figure. Neither organization is provided with a reserve. The demands of our oversea possessions considerably reduce the number of regular troops available for home defense. In all, we might muster for the field army in case of invasion 125,000 men, many of whom would be only partially trained—not first line troops as that term would be understood in Europe. This is not an imposing array certainly, for the greatest of nations, having some 18,000,000 men capable of bearing arms. For the rest, we should have to depend upon volunteers or conscripts, men with little or no training, who would require months to fit them even for defensive warfare against the highly trained troops of a foreign foe. In this connection it will be of interest to note that the British government has recently resorted to compulsory service and has announced the policy that hereafter no troops not having at least one year of constant training will be sent to the front. Such is the result of the bitter experience derived from opposing imperfectly trained volunteers to the highly trained German regulars. At present our chief reliance for defense is in these same imperfectly trained volunteers. The prospect is not a cheerful one nor calculated to arouse our pride and fill us with confidence.

What would be required in the event of war? This, of course, is problematical. The nations of Europe assume in advance that their entire strength may be required, and this is actually the case of several of them in the present war. A protracted struggle with a combination of foreign powers might call for several millions of men. The following table, prepared by the General Staff of the Army, shows the expeditionary forces which, in the event that our navy were defeated or bottled up, could be landed on our shores:

State	Strength of regular force	First expedition	Time, days	Second expedition	Time, days
Austria ..	4,320,000	72,000	20.7	108,000	40.4
France ..	5,000,000	161,000	15.8	243,000	30
Germany..	5,000,000	387,000	15.8	440,000	30.8
Great Britain.	695,000	170,000	14	......	27
Italy	2,600,000	91,000	18.3	136,000	35
Japan ...	2,212,000	96,000	22.5	143,000	41
Russia ...	5,000,000	38,000	20.5	66,000	40

To repel possible attacks of this nature the General Staff recommends the following:

500,000 men at the outbreak of war.
500,000 men in 90 days thereafter.
500,000 men to replace casualties.

For the purposes of our discussion then, we will assume that a volunteer army of 1,250,000 men will be required. This is a modest figure. It is to be noted that it contemplates strategical defensive measures in particular. Such a force would be totally inadequate to a foreign invasion except of a weak neighbor, such as Mexico. It would not serve to maintain the "Monroe Doctrine" in the face of determined aggression by a great foreign power, especially when the inadequacy of our water transport facilities is considered. Preparedness for defense of our own territory does not of course preclude the possibility of offensive tactical operations, and it is the blows which we strike and not those which we fend that win the victory. But it does condemn us in advance to suffer all the ruin and agony of war on our own soil in case of aggression by a great foreign power. And we should not overlook the fact that our Atlantic seaboard, the most populous, wealthy and highly developed, and hence the most vulnerable portion of our domain, might be the theater of the early stages of war. Whatever the final outcome of the conflict, the ruin and suffering in our own fair land would be very great. Germany, the greatest of the military nations, does not entertain the defensive policy of preparedness. Her theory is that an active offensive is the best defense, and her thorough preparation enabled her at the outset to carry the war into the enemies' territory and, thus far, to keep it there. Thus is Germany spared the ravages of war on her own soil.

ENGINEER TROOPS REQUIRED

Without entering into the intricacies of army organizations suffice it to assume that this force would consist of sixty-two divisions of about 20,000 men each. These would be further organized into field armies consisting of two or more divisions, say twenty in all. And finally, they would constitute four main armies, each including five field armies.

Now let us consider the engineer troops that would be required for service with this force. The proportion of engineer troops with an army in the field which experience indicates to be correct is from 1/40 to 1/16. Considering the vast extent of our territory, the generally poor condition of our roads and the inexperience of our volunteer troops, it is certain that the services of engineer troops will be urgently needed. It is safe to say that no army has ever had an excess of engineer troops. The demands upon them have invariably been greater than their capacity. Our organization contemplates one battalion of engineers with each division, and an additional battalion as auxiliary to each field army. Each of the four main armies would require as a minimum two additional battalions. Besides this there would be required engineers on the lines of communication and at the main supply depots. The number and efficiency of our railroads would operate to reduce the number of engineers required on the lines of communication, unless these were subject to attack by the enemy—a not unlikely contingency. Let us assume then the following force:

Attached to divisions................	62 battalions
Attached to field armies.............	20 battalions
Attached to armies...................	8 battalions
On lines of communication and at depots	10 battalions
Total	100 battalions

These battalions would include, on the average, 500 men and fourteen officers each. Total, 50,000 men and 1400 officers. This gives a proportion of approximately 1/25 for the assumed force of 1,250,000 men, which is none too large. In addition to this, a considerable number of engineer officers would be required for service in the War Department and on the staffs of the generals commanding divisions and armies. In many of the divisions the senior engineer officer with the troops would act also on the staff of the commanding general. The following engineer personnel (officers) is assumed as necessary for staff duty:

On division staffs..............................	24
On field army staffs...........................	32
On army staffs.................................	12
On lines of communication and at depots.......	12
At the War Department (General Staff and Office of Chief of Engineers).................	20
Total	100

To recapitulate, say:
50,000 men.
1500 officers.

The regular army at present includes twelve companies of engineers and 248 officers. There are very few organized engineer units in the national guard. New York has two battalions of four companies each and Ohio a battalion of four companies. Certain other states have companies or detachments. In all, the guard might muster not to exceed six battalions at war strength, with eighty-four officers. The regular engineers might, with some delay and loss of efficiency, be expanded into six battalions. Thus the total available personnel of the regular army and national guard would be 6000 men and 332 officers. A very considerable number of the regular officers would be required in the training of the volunteer engineers, in the control of civilian contractors and laborers in the land defense works of our important cities and arsenals and works on the lines of communication, the direction of civilian surveyors in the preparation of military maps of the theaters of war, and many other special duties. But assuming that all were available for the tactical duties hereinbefore outlined, there remains a deficiency of 1200 officers and 44,000 men.

History has demonstrated again and again that efficient trained officers are the most important part of an army. In the hands of competent officers green troops have been known to give a good account of themselves, whereas the best troops have been uselessly sacrificed by incompetent leaders. Napoleon is credited with the statement that he would rather have an army of lambs commanded by lions than an army of lions commanded by lambs. These truths will be almost self-evident and they are especially applicable to engineer troops on account of the variety of their duties. To obtain trained officers is more difficult than to obtain trained troops, since the time and effort required to fit officers for the performance of their duties is greater than in the case of enlisted men. The officers for this engineer force are accordingly our chief concern.

An officer to command engineer troops should have the following qualifications:

It is essential that he have a good constitution, able to withstand the hardships of a campaign. He should be a man of high professional qualifications, both as a soldier and as an engineer. Without such qualifications an engineer officer cannot properly plan nor execute the varied works that will be assigned to him, nor properly subordinate his work to the needs of the combatant forces; he cannot command the respect and confidence of his own men and cannot, consequently, maintain discipline. He should be zealous in the performance of his duty—which ordinarily implies an interest in his work—resourceful, and last but not least, a student of human nature, knowing how to handle men so as to produce the best results under trying circumstances. Whence and how, under present conditions, are 1200 trained engineer officers to be obtained in the event of war?

LARGE RESERVE NEEDED

It is essential under our present policy that we provide for a large reserve of at least partially trained men. The object of this partial training is, of course, to reduce as much as possible the time required for the final training of the volunteer army that would be assembled at the outbreak of war. The time required to train the officers will be greater than in the case of the men and accordingly special attention must be devoted to the peace training of the men on whom we must rely to furnish officers for this vast force of volunteers. The officer of engineers must be not only a trained and disciplined soldier but in addition a competent and experienced engineer. In other words, he must have training along two lines to fit him for the discharge of his duties. It is not sufficient that he be instructed merely in the technical details of his work. He must have his tactical sense so developed as to be able to grasp the situation of the moment and intelligently bend his energies to meet it with suitable works. This means that the volunteer engineer officer could not be brought to the same state of efficiency in his own lines as quickly as the volunteer infantry officer, unless he had previous training and experience in civil engineering. The volunteers taking the field should all be trained to a certain minimum standard of efficiency. Otherwise, efficient infantry would be severely handicapped by being forced to depend upon inefficient engineers. If this necessary condition is to be realized it is evident that we must obtain our volunteer engineer officers from a class of men having previous training along engineering and construction lines. The nation then, depends upon the engineering and contracting professions to furnish these men.

—*Photo, Press Illus. Co.*

DYNAMITE'S DAMAGE REPLACED BY PONTON ACROSS VISTULA RIVER—TYPICAL MILITARY ENGINEERING PROBLEM WHICH THE EUROPEAN WAR PRESENTS

If our volunteer engineer officers are to be fitted to take the field on a plane of equality with volunteer officers of the other arms, special effort in the way of preliminary training will be necessary. Military engineering in a general sense is the adaptation of civil engineering to the conduct of war It is a special application of the engineering art, and its methods and economics are essentially different from those which characterize good civil practice. It is our purpose to inquire into the relation of engineering to the conduct of war and the methods characteristic of military engineering, to the end that the civil engineers and contractors of the United States may partially prepare themselves in advance for the patriotic duty which they may be called upon to perform.

There is no science known to mankind, from astronomy to bacteriology, which does not find its application in the conduct of war. There is scarcely a practitioner or artisan who may not contribute his share to the national defense. Even the clergyman and the musician, the exponents of peace on earth and the gentlest of the arts, are called upon. Thus do we obtain a practical conception of the theory that all the intellectual resources of the nation should be at the command of the government in the prosecution of a war on which the fate of the nation may depend. Of the peaceful arts that contribute the results of their research and practice to the successful prosecution of war, none is of more vital importance than engineering.

MILITARY ENGINEER'S DUTIES

The duty of the military engineer in time of war is to plan and execute all works of an engineering nature which are required in connection with the operations of the army. It will be apparent that this is a wide field of endeavor. The engineering requirements of an army include most of those of the average large community, and in addition many others not called for by the gentle vocations of peace. The military engineer must have, therefore, a thorough working knowledge of the more important branches of civil, mechanical and electrical engineering as applied to military needs. This might appear to be more than an average man could be expected to know, and so it would be did we demand of the military engineer all the precision and nicety characteristic of civil practice. Military engineering, in rather sharp contrast to good civil practice, is characterized by makeshifts and temporary expedients. "Build for posterity," says the civil engineer. He places the foundations of his bridge at great expense of time and labor on the solid rock and he has a just pride in the enduring nature of the structure he erects. In his brain is the accumulated knowledge of centuries of painstaking construction. Long after his death the great bridge remains, a monument to his skill and devotion. How different is the case of the military engineer. Not for posterity builds he, but for the exigency of the moment. Not on the solid rock does he place his foundation, but often on the heaving bosom of the stream itself. The army arrives at the impassable stream and the engineer rapidly scans the situation. In his brain also is the accumulated knowledge of centuries of scientific warfare. Aladdin's lamp is rubbed. And lo! in the twinkling of an eye the wonderful bridge is there and the army with all its animals and heavy vehicles proceeds across. To the frail but still adequate structure are committed not only the lives of the troops, but the destinies of the nation perhaps.

The military engineer must possess not only a thorough knowledge of construction, but also a thorough knowledge of the art of warfare. He must foresee the needs of the army and build to meet those needs, and on his sagacity, energy, foresight and resourcefulness the issue of the campaign may indeed depend.

[*Next week Major Bond will explain the special duties of engineer troops and how the methods employed by the military engineer differ from those employed in civil practice.*—EDITOR.]

Does Alkali Disintegrate Concrete?

Reclamation Service Engineers Draw Preliminary Conclusions from Elaborate Experiments on Different Projects

PRELIMINARY conclusions of the disintegrating effect of alkali waters and soils on concrete obtained by the U. S. Reclamation Service engineers, are given in the February issue of the *Reclamation Record*. The general question was divided into several narrower questions, the answers to which follow.

SULPHATES MOST HARMFUL

Investigation has shown that the principal salts acting to produce disintegration are the sulphates, especially magnesium and sodium sulphates. It is thought that of these the former is the more active, but this has not been definitely established. Different localities have shown different results for the same materials.

Two extreme cases may be cited in the Sunnyside and Belle Fourche projects. Of a number of test specimens exposed on the former no disintegration was observed at the end of about eleven months with the exception of a specimen containing a soap and alum solution in the mix. The specimens were all of a 1:3:5 gravel mixture. Furthermore, none of the concrete structures on this project have been affected. On the other hand, various mixtures exposed on the Belle Fourche project were all found to be disintegrated at the end of eight months, with the exception of a 1:2 mortar specimen which was not affected. Concrete structures on this project have also been disintegrated by alkali. Other projects showed intermediate results.

Analyses of samples from the Belle Fourche project show magnesium and sodium sulphates present in strong solution, with the former predominating, and from the Sunnyside project show sodium sulphate only, and in much lighter solution. As a general proposition, it must for the present be concluded that in locations where alkali is present containing these salts, special precautions must be taken to prevent its possible action, unless experience with structures previously built has shown no deleterious effect, as in the case of the Sunnyside project above cited.

LEANER MIXTURES MORE EASILY DISINTEGRATED

It has been quite clearly demonstrated that the leaner mixtures of concrete are more easily disintegrated than the richer; also, that the more scientifically proportioned mixtures—that is, those having least voids for given proportions of cement and aggregate—give better results. This is a natural result, as the action results from seepage of water into or through the concrete, which is retarded by the richer and more scientifically proportioned concrete.

Experiments have shown that the more nearly impervious the concrete the less it is disintegrated by alkali. It is a natural deduction, therefore, that waterproof concrete will resist alkali action. Such concrete under certain conditions may be difficult to produce. Laboratory experiments have shown that it is possible to produce concrete that is practically impervious to water up to 50 to 75 lb. pressure, and satisfactory results have been obtained in the production of an impervious concrete in the field on structures where special pains were taken toward that end.

ALKALI PROOF CEMENTS

There are numerous patented waterproofing compounds on the market; there are also being manufactured several so-called alkali-proof cements. A number of these have been tested, but the results have not been any better than those obtained with straight Portland cement. Sand cements also have so far shown no superior alkali-resisting qualities. J. Y. Jewett, cement expert, gives his tentative opinion "that with good cement, with care in the selection of suitable aggregates, with proportioning to produce a rich dense mixture, and with proper methods of mixing and placing, it is possible to produce a dense impervious concrete that will withstand the alkali action under ordinary conditions without the use of any special materials for waterproofing purposes." With fairly rich concrete an impervious skin of neat cement or rich mortar, such as is produced by working a flat spade between the concrete and steel or surfaced wood forms, will no doubt also have a decided effect in resisting the action of alkali.

Unusual Methods Simplify Topographic Survey of Rough Wooded Area

Mine LaMotte Tract in Missouri Mapped on 50-Foot Scale with 2-Foot Contours for Mill and Town Site at Total Cost of $3.34 per Acre

By R. E. DAVIS and W. H. RAYNER
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THE Mine LaMotte Company, operating lead mines at Mine LaMotte, Missouri, recently had completed a large-scale topographic survey for a proposed mill and town site, the methods of which survey were somewhat at variance with those usually employed. The tract over which the survey extended was rough and the topographic features were irregular, the maximum slope being about 35 in 100 and the maximum difference in elevation being 200 ft. in a third of a mile. The purpose of the map made it necessary that the scale should be 50 ft. = 1 in., and that contours should be shown at 2-ft. intervals, and attempt was made to maintain a precision in field work consistent with the scale.

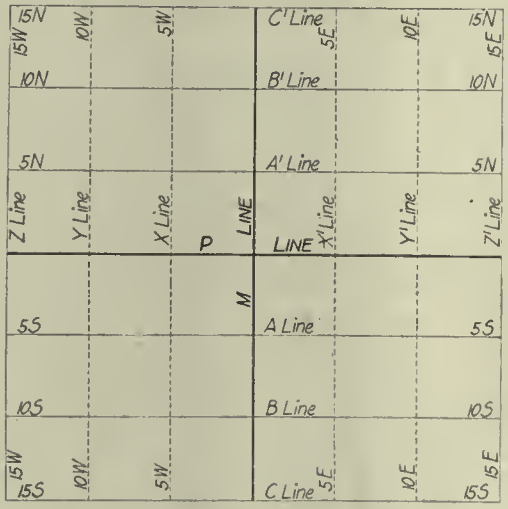


FIG. 1—HORIZONTAL CONTROL OF TRACT

USUAL METHODS

Perhaps the two more common methods on large-scale topographic surveys are (1) the "square" method, in which the tract is subdivided by lines established with transit and tape into small squares (usually 100 ft. or less on a side), the contours crossing the sides of the squares being directly located with the engineers' level, and (2) the plane-table method, in which horizontal control is provided by a large number of plane-table stations established by transit and tape traverses, the contours being directly located either by using the plane-table alidade as a level or (more commonly if the ground is uneven) by using an engineers' level in conjunction with the plane-table.

In the present case the irregularities of the land and the density of the forest growth combined to make either of the above methods impracticable on account of the excessive amount of clearing that would have been necessary; and the following method was devised:

HORIZONTAL AND VERTICAL CONTROL

Through the middle of the tract a base line *M* (Fig. 1) was run with transit and tape, stations being established every 100 ft., and hubs every 500 ft. Through the hubs, in a similar manner, laterals *P*, *A*, *B*, *C*, *A'*, *B'* and *C'* were run at right angles with the base line. Through the extremities of these laterals and at right angles with them, the lines *Z* and *Z'* were run, thus forming a series of rectangular closed traverses, the errors of closure of which could be ascertained without computations. In this way all angular and linear measurements connected with the establishing of base line and laterals were checked, the allowable error being fixed at 1/1000.

The lines *X*, *Y*, *X'* and *Y'* were run in increments of 500 ft. and made to close (errors being distributed along the lines under consideration) on the 500-ft. stations of the laterals, the maximum allowable error in distance or alignment being 1/250. Here it was unnecessary to use the transit for lining purposes except at each 500-ft. station, direction, after having once been given, being carried through to the station on the next lateral by the chainmen with flagpoles. In this way considerable less clearing was required and the transitman was able to have the transit in position for giving line along the next 500-ft. increment by the time the axemen had cleared the preceding increment. Thus the speed of the party was considerably increased.

In this way the tract was divided into 500-ft. squares, the sides of which were stationed each 100 ft. Vertical control was obtained by running profile levels over these lines in such manner as to form closed circuits, thereby checking all turning points.

LOCATION OF CONTOURS

Horizontal control was plotted at the required scale on sketch sheets of thin tracing paper, a single 500-ft. square to a sheet, and elevations of stations were recorded close to corresponding points.

The topographic party consisted of a topographer, two hand-level operators, two rodmen, two chainmen and two axemen.

The procedure of filling in the topographic details within each of the 500-ft. squares or, in other words, on each of the sketch sheets was as follows: Let Fig. 2 represent a typical sketch sheet and also a corresponding area on the ground, the numbers around the large square being station numbers and elevations. The interior lines, shown dotted, were established by chainmen with flagpoles for lining, thus subdividing each of the 500-ft. squares into twenty-five 100-ft. squares, and long blazed stakes cut from saplings as the work progressed were placed at the corners as guides for the hand-level parties. The work of clearing for these lines was light, it being necessary only to cut the thick underbrush so that a glimpse of each stake could be obtained from adjacent stakes, as will be seen later.

The order of setting the stakes was 1, 2, 3, 4, etc., referring to the numbers on Fig. 2. A trial perpendicular *A*-1 having been cleared by one axeman and chained and a stake having been set at 1, the other axeman cleared the line *B*-1. The stake at 1 was then moved to make the distance *B*-1 equal 100 ft., thus establishing a line parallel to the *A* line. One axman and the chaining party then prolonged the line *A*-1 toward *C*, setting stakes 2, 3 and 4, while the other axeman cleared the lines *D*-2, *E*-3, etc. In general the chainmen were able to run 500 ft. without being off line more than 1 or 2 ft., a negligible amount.

HAND-LEVEL WORK

Quite in parallel with the method of progression utilized by the chaining party was that employed by the hand-level parties. One party, starting from the known elevation of *A*, directly located each contour crossing the line *A*-1; while in a similar manner the other party located the contours crossing *B*-1. The elevation of 1 was thus determined by hand-level lines run in two directions. The allowable discrepancy in elevation was fixed at 0.5 ft. (on the average it did not exceed 0.2 ft.), and a mean value was chosen.

The topographer, stationed within the square *a*, plotted the contour crossings as they were obtained by the hand-level parties, and having already on the sheet the position of contours crossing the lines *A-G* and *B-G*, he sketched the contours and other details within the square.

In place of the small drawing board usually used for sketching, a shallow box mounted on a plane-table tripod was devised. The box had a hinged end so that sheets not in use might be conveniently stored flat; its size (only large enough to hold sheets) made it much more convenient in the brush than a plane-table would have been, while its being mounted like a plane-table made orientation possible and thereby greatly aided the topographer in his work of sketching the deviations of contours between located points. Owing to the roughness of the ground the topographer's position permitted much to be sketched with veracity that could not have been truly portrayed otherwise.

The topographer then moved to the square *b*, and the first hand-level party worked from 1 to 2 while the second party worked from *D* to 2; and so on, for the squares *c*, *d*, *e*, *f*, etc.

MAP

In the preparation of the map the horizontal control was first plotted on mounted paper 6 ft. square; then one at a time the sketch sheets, the backs of which had been smeared with powdered graphite, were placed in position, and the topography was traced through to the map. Since the sketch sheets were of tracing paper it was a very simple matter to place the horizontal control lines of the sheets exactly over corresponding lines on the map.

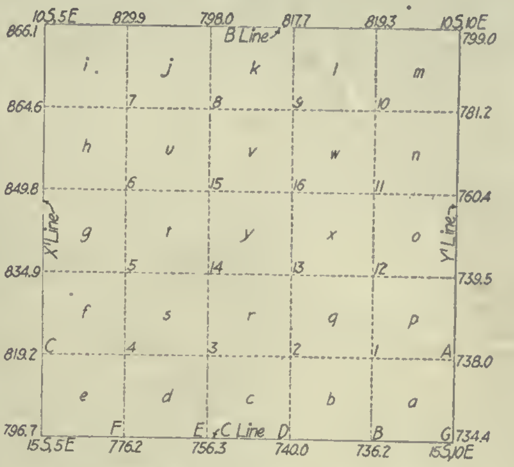


FIG. 2—SKELETON FOR 500-FOOT SQUARE

There were within the tract 8 miles of transit lines and 27¼ miles of hand-level lines. In the former case the speed of the transit party was limited by the axemen, although as many axemen were employed as could work to advantage; and owing to the rough country the speed of the level party was even less than that of the transit party. In the latter case two axemen were sufficient to clear line over which hand-levels could be operated with facility, the speed of the topographic party being governed by the hand-level parties. But while the transit party progressed on the average over only a little more than 1 mile of line per day, the topographic party was able to cover 2 miles. In an average day of 7½ hr. actual field work, approximately 650 contour points were located and plotted. The maximum area (light slope) covered during any day was 16 acres; the maximum number of contour points located (steep slope) was 810.

It is interesting to note the dependence of cost on scale or contour interval. The cost of the field work here considered was $3.14 per acre; the office work, 20 cents per acre. Later the same party made a similar survey of an adjoining tract with a scale of 400 ft. = 1 in. and 5-ft. contour intervals. The percentage of open country was slightly greater and the relief was considerably less marked and less irregular. The cost of the field work of the later survey was 33 cents per acre.

LOANS TO SETTLERS on irrigation prospects in New South Wales for the year ended June 2, 1915, aggregated $170,000.

No Cracks in Sioux City's Concrete Pavements

City Engineer Johnson Tells National Road Conference That Dense Mixture Is the All-Important Factor

NOT a single cracked section has developed in Sioux City's 1,000,000 sq. yd. of concrete pavement, some of which has been in service five years. With this statement T. H. Johnson, city engineer of the Iowa municipality, prefaced his discussion of several of the committee reports submitted Feb. 15 to 18 at the Second National Conference on Concrete Road-Building in Chicago, and published in the Engineering Record of Feb. 26, page 286. The pavement, ranging in width from 24 to 52 ft. was laid under trying climatic conditions. The foundations included all kinds of soil, and no particular attention was paid to drainage. The grades are as steep as 16 per cent, and a leaner mixture than any authority recommends was used in one course 6 in. thick, without a pound of reinforcing steel or a single metal-protected joint. Sioux City, according to Mr. Johnson, is laying practically a crackless pavement, and one that remains crackless under average conditions prevailing throughout the country.

One committee states in its report, said Mr. Johnson, that the thickness of a concrete pavement depends on nine things. What this means is that there are nine things that cause concrete pavement to crack unless it is made thick enough to prevent this occurrence. The experience at Sioux City, according to Mr. Johnson, indicates that this list includes some things that it should not, and further that there is a better way to prevent cracking than by increasing the thickness.

CLIMATIC CONDITIONS SEVERE

The climate at Sioux City is very trying upon the pavement slab. The range of temperature is from 115 deg. above (in the sun) to 35 deg. below zero. During the heat of summer there are frequent heavy rains, and very sudden extreme variations in temperature. Last July, for instance, the rainfall was 7½ in.; three storms averaged 1½ in., with a maximum difference in temperatures of 42 deg. In January of this year there occurred a precipitation of only 1¾ in. and a range of temperatures from 44 above to 28 deg. below zero. If climate affects pavements, Mr. Johnson pointed out, his should have suffered heavy damage.

As to the width of the slab affecting the thickness, Sioux City has one block of pavement 52 ft. wide. It is on a street intersecting a viaduct approach and is on a fill of 4½ ft. at one end of the block and 18 ft. at the other. The longitudinal grade is about 5½ per cent, and at one end the transverse grade is 5½ per cent, so that the surface is badly warped. Immediately before laying the pavement a fill of about 3 ft. was made at the lower corner of the block, running to nothing at the opposite and high side, and at about 100 ft. along the side from the low corner. This fill was made in one layer, and over the heaviest part two or three sections have cracked. The balance of the block is free from cracks. This pavement is only 5 in. thick; part of it was laid with gravel concrete and part with broken stone. The proportions were 1:3:5. It is four years old and is subject to heavy traffic. It is one of the approaches to the Illinois Central freight depot, and on it are located the International Harvester Company's warehouse and a six-story cracker and candy factory. Under such extraordinary conditions, with the exceptionally lean mixture and thin slab, if the thickness were a function of the width this block should be a veritable checkerboard of cracks.

There is another street 36 ft. wide, and more than ¾ mile long, without a single cracked section. This pavement is 6 in. thick and proportioned 1:2½:4.

With reference to the character of the soil on which the pavement rests, a couple of miles were laid on a low, flat creek bottom, about 15 ft. above the water. The district is poorly provided with storm sewers, and the soil is a heavy, black, retentive soil, almost a gumbo. No subdrainage is provided.

None of this pavement has cracked. The grades on many of these blocks are not over 1½ of 1 per cent.

DENSE MIX IMPORTANT

The factors that affect the cracking of concrete pavements Mr. Johnson would rearrange in the following order of importance: Workmanship, materials and proportions, subgrade, and traffic. The first two of these, workmanship and materials and proportions, might be replaced with the one word, "density." In that one word is the solution of the concrete pavement problem—density of the foundation and density of the pavement slab.

The problems of crown and grade take care of themselves very largely. Up to 4 or 5 per cent grades it is the practice in Sioux City to lay highway pavement in a flat subgrade, making the slab 8 in. thick at the center and 6 in. at the sides. When the grade exceeds the above limits, the crown is reversed, dishing the slab, making it 7 in. thick the full width. The 8-ft. earth shoulders are then crowned, throwing half the drainage into the side ditch and the other half into the center of the pavement. The soil washes very badly and it is hoped in this way to prevent gulleys forming at the edges of the pavement. Transverse joints are spaced 25 ft. apart on these roadways.

The crown of the city street with curbs is another proposition. A crown of 1/50 to 1/70 of the width is more pleasing to the eye than a flat surface, and it also helps materially in keeping the street clean, as the wind blows most of the litter into the gutters.

CONCRETE THE LEAST SLIPPERY PAVEMENT IN SIOUX CITY

Concrete, Mr. Johnson stated, is the least slippery pavement of any in his city. There are 5½ miles on 6 to 9 per cent grades, ¼ mile on 12 to 15 per cent, and ¼ mile on a 16 per cent slope. Even these steeper grades are not corrugated. These pavements are all in daily use and all kinds of traffic are said to seek the concrete streets during slippery times. The grade of a concrete pavement, in Mr. Johnson's opinion, depends no more upon climate or the character of the traffic than the grade of any other kind of pavement. Frost and ice make any kind of pavement, or even dirt roads, slippery. Concrete is smooth and offers slight tractive resistance, but it is not slick. Under wear it retains its characteristic "sandpaper" finish, giving a firm foothold to all kinds of traffic.

Warehouse to Raise Freight Within and Without

Service to and from Six Floors of Los Angeles Municipal Structure Facilitated by Hoists on Roof

CONSTRUCTION is now under way on a six-story concrete warehouse being built at Los Angeles harbor by the municipality. The structure will be 152 x 482 ft. in plan and will be served by two railroad tracks extending the full length of the interior with a loading platform between, 27 ft. wide. From this platform four elevators with capacities of 6000 lb. each, which will be spaced 120 ft. apart, will afford direct service to each of the six floors, one of these elevators being large enough to handle automobiles. Goods are to be conveyed between the warehouse and the wharves by storage battery trucks, to accommodate which ramps will be provided at each end of the loading platform so that those trucks can run directly into the building and take an elevator to any floor desired.

On the roof of the building along each side will be constructed a track on which electrically operated whip hoists can be moved along to serve any one of the eight tiers of doors which afford entry to the several floors from the outside of the building. It is planned to have three of these hoists on each side of the structure so that freight could be moved between the street and any desired floor at three points simultaneously on each side of the building. These hoists, which will have a capacity of 2500 lb., will be operated by remote control connections, connections being provided at each door on each floor. It is thought that this arrangement will afford ample capacity with the minimum of equipment, but as the traffic increases, if an additional number of hoists should be required, these could be added as desired without involving outlay other than for the hoists themselves.

Access to each floor is also afforded by stairways from the streets which run along either side of the building. Stairways to the second floor are inclosed within the structure and above the second floor are built outside the walls with entrances to the different floors through doors. To expedite the quick handling of miscellaneous freight two platform automatic dial scales are to be provided on the central loading platform. The structure is designed to be fire-resistant throughout and will have an automatic sprinkler system and complete electric light and power service.

Both the design and the construction of the structure are under the direction of S. A. Jubb, assistant harbor engineer.

Build Rapid Filters Over Pipe Gallery at Alton

Design Further Simplified at Plant of Illinois City by Operation as One of Two Filters Opposite Each Other

LIMITED space at Alton, Ill., forced the waterworks officials to place the front ends of the ten filters of their newly constructed 6,000,000-gal. plant close together over the pipe gallery, said Paul Hansen, engineer, Illinois State Water Survey, in a paper presented recently to the Illinois section of the American Waterworks Association. Between the ends of the two rows of filters for wash-water overflow sumps, and also for manholes, a small space is left whereby the pipe gallery may be reached, and through which pressure water pipes controlling the operation of the hydraulic cylinders of the filter operating valves may pass.

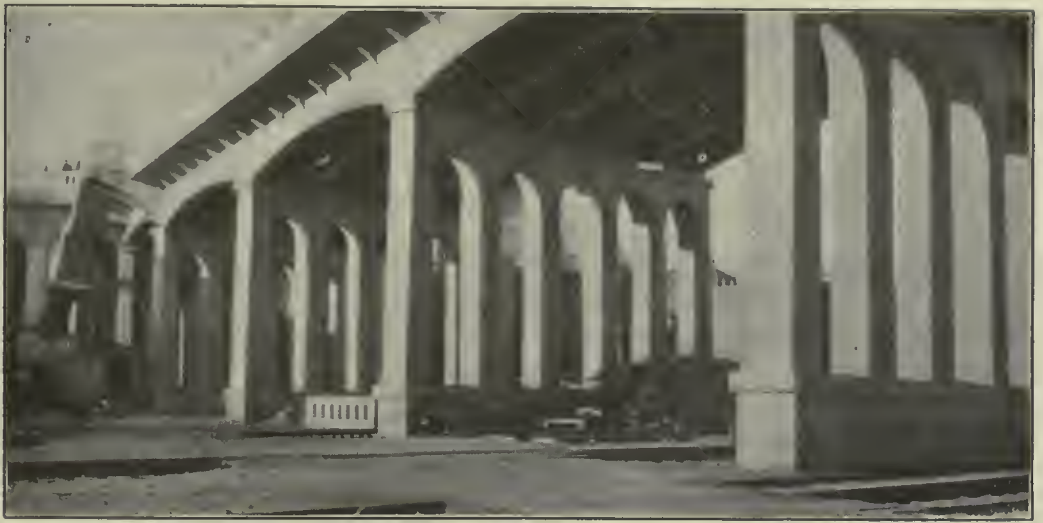
The design is further simplified by the operation of two filters opposite each other as one, yet the piping connections are such that either one may be left out of service while the other is retained in service. The arrangement is analogous to, though somewhat more flexible than, a type of mechanical filter now commonly used in the larger plants, as, for example, at Cincinnati, Columbus, Minneapolis and St. Louis, where the filter is divided into two beds by a longitudinal central gutter. In this case, however, instead of having a central gutter extending horizontally along the filter there is a sump placed between the ends of the filters.

The pipe gallery is rendered accessible for inspection and repairs by having both ends open. The peculiar design used locally somewhat crowds the cross-section of the pipe gallery, but this is a matter, said Mr. Hansen, that can be readily modified so as to leave a clear central passageway. Under ordinary conditions but one main sewer pipe would be necessary, and this could be placed at one side of the pipe gallery. The main filtered water pipe, together with its connections to the filters, may be located on the opposite side of the gallery. Under conditions locally obtaining, these modifications were deemed inadvisable on account of the arrangement of existing piping serving adjoining filters.

At the Alton plant the coagulated water is admitted for convenience at the rear end of the group of filters to one side of the pipe gallery, and arrangements are made whereby it can flow through these filters to the group of filters on the other side of the gallery. Normally, however, single or duplicate coagulated water conduits would be placed at the top of the filters and overhanging their front ends. These could be built of concrete and would not interfere with the operation of the filters.

The details are not recommended by Mr. Hansen for universal application, but they have certain advantages of economy and simplicity for plants of moderate size, especially where space must be economized. The designs and the construction were carried out under the direction of Charles T. Parker, chief engineer of the Alton Water Company.

A FILL APPARENTLY 18 FEET DEEP and actually 63 ft. deep was found on the Boston & Albany Railroad at Richmond, Mass., where the road had been built across a large swamp, in connection with the federal valuation work. The condition was described by J. C. Irwin, assistant valuation engineer of that road, in discussing before the Boston Society of Civil Engineers the paper by F. C. Shepherd, valuation engineer of the Boston & Maine Railroad, on the valuation of the Boston & Maine. This paper was abstracted in the Engineering Record of Oct. 30, 1915, page 538, and an account of the use of wash borings to determine the amount of settlement of fills in soft ground was published in the issue of June 19, 1915, page 776. In the fill at Richmond, as the bed of the swamp was peat, the limits of the sand and gravel fill could readily be determined. The settlement has continued to the present time, stated Mr. Irwin, although the road was built in 1840.

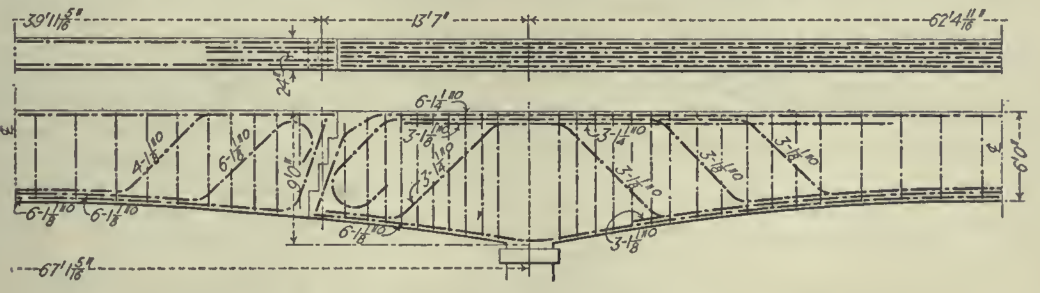


ARCHED PIERS SUPPORT SIX ROWS OF REINFORCED-CONCRETE CANTILEVER BEAMS
View of Main viaduct, showing intersection with Clark Street viaduct. Note railing and curved sidewalk brackets, both cast as separate units.

Great Variety in Design Reduces Cost of New Portland Harbor Bridge

Reinforced-Concrete and Steel Cantilever Spans Have Suspended Links and Special Details—Arched Outlines Improve Appearance

ECONOMY in design and construction, preserving at the same time an effective architectural treatment by arched outlines, is believed to have been attained by the engineers of the new Portland-South Portland viaduct across the harbor of Portland, Me., nearing completion. The total cost had to be kept within $1,000,000, and to accomplish this object unusual variety and ingenuity in detail has resulted; reinforced-concrete girders, steel girders, steel trusses and rolling lift trusses are used in the main viaduct and the various parts of the several approaches. The distinctive type adopted in both steel and reinforced concrete for the main viaduct is an arching cantilever span supporting suspended spans or links. A similar type of viaduct with cantilever construction is the Colfax-Larimer Street structure in Denver, described in the Engineering Record of Oct. 17, 1914, page 428. Marked economy resulted in each case by the adoption of this design.



REINFORCEMENT OF CANTILEVER GIRDERS AND SUSPENDED BEAMS OR LINKS

Other features which reduced the cost are the precast sidewalk brackets and railing, cast in Boston and shipped to the site, the special manhole boxes, cast on the ground and hoisted as units into place under the sidewalk, the economical design of the sidehill construction of the State Street approach, the method of casting the sidewalk slabs and the floating into position of the specially designed caissons for the harbor piers with timber framing easily removable for continuous use.

GENERAL LAYOUT AND DIMENSIONS

The new Portland bridge and viaduct replaces the old Cape Elizabeth bridge and Clark Street viaduct connecting Portland with South Portland, Me., and is being built by Cumberland County, aided by assessments on the street railway company crossing the bridge and the Portland Terminal Company below it. The viaduct is 60 ft. wide and accommodates two electric tracks with roadway and sidewalk on each side. The main part runs nearly north and south across Portland harbor and the freight yards on the Portland side. At the north end the Clark Street viaduct approach, about 40 ft. wide and 300 ft. long, on a 3 per cent grade, joins the main viaduct at right angles, and the State Street viaduct, about 700 ft. long, follows the Boston & Maine Railroad on a curving sidehill structure, joining the main viaduct nearly at right angles. Brackett Street connects with the viaduct at a slight angle.

The main viaduct is about 3000 ft. long. From Brackett Street to the water line, about 750 ft., there are thirteen reinforced-concrete alternating cantilever and suspended or link spans. The general appearance is indicated by one of the accompanying photographs. Arched outlines are used throughout, but not a single true arch occurs in the structure. Crossing the harbor on eight river piers and two piers on the south shore are seven steel cantilever and link spans of curved girder construction, with a Scherzer rolling lift span of two leaves, flanked on each side by deck trusses. The piers of the main viaduct are all skewed. On account of the skew, the lift span could not roll wholly on the piers, but when lifted the leaves are carried partly on the adjacent truss spans, which were designed to carry the added load. The south side approach consists of about 300 ft. of simple reinforced-concrete girders of small spans carried on reinforced-concrete columns on piers, and a gravel fill about 800 ft. long.

The total cost of the bridge, including land damages, engineers' and attorneys' commissions and all other expenses, will fall slightly below $1,000,000.

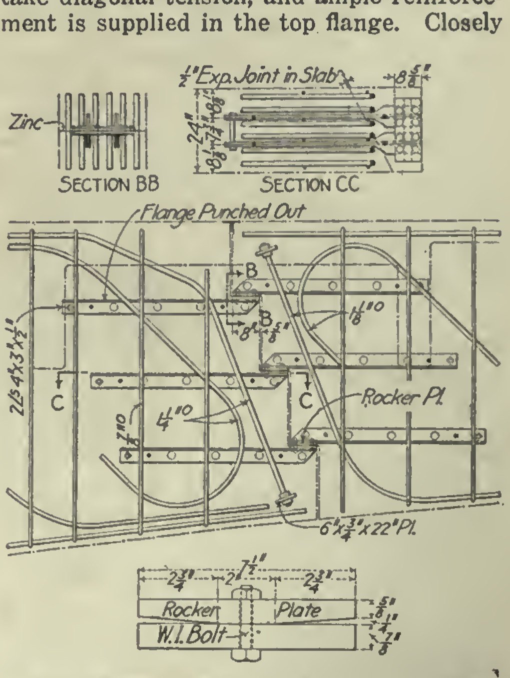
ECONOMICAL CANTILEVER DESIGN

It is estimated that a considerable saving was attained through the adoption of the cantilever and suspended span type of girder construction. The seven steel girder spans are uniformly 98 ft. long on centers, with cantilever arms of 16 ft. 4 in. on each end of the intermediate or anchor span. The thirteen concrete girder spans vary in length from about 58 to 67 ft., with the cantilever ends about 14 ft. long. It is seen, therefore, that the suspended spans are between 0.55 and 0.65 of the total span, being 65 ft. 4 in. for the steel girders, and between about 32 ft. and 40 ft. for the concrete girders.

The number of steel girders used in the width of 60 ft., as shown in the cross-section, is five, while six reinforced-concrete girders were necessary. On the steel spans two X-braces are placed near the center and one near each end between the steel girders. These are designed to distribute the loading so that all girders could be made alike. The reinforced-concrete girders rest on skew pier bents with reinforced-concrete columns immediately below the girders, but connected by arched beams giving a pleasing effect from below, as can be seen in the photograph. The steel spans are supported on steel bents resting on masonry piers. This was done for two reasons: To keep the tops of all piers at the same elevation for the sake of appearance, and as a matter of economy. An unusual detail of the floor design is the use of an 8-in. depression in the concrete floor to provide for the two tracks, carried on ties embedded in cinder concrete.

REINFORCED-CONCRETE CANTILEVERS

The details of the reinforcement in a typical cantilever beam and suspended span are shown in one of the drawings. Over the piers the reinforcing rods are bent to take diagonal tension, and ample reinforcement is supplied in the top flange. Closely

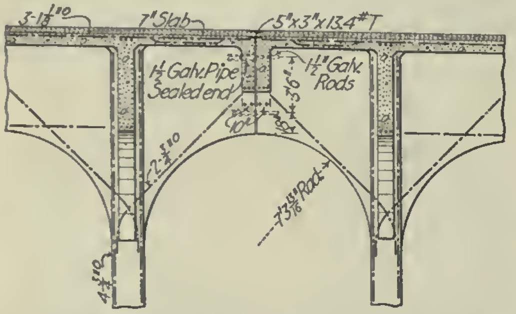


TRIPLE-SEATED JOINTS AT END OF CONCRETE CANTILEVER ARMS spaced stirrups are also used to take care of shear. These beams are seen to be 20 or 24 in. wide and 9 ft. deep at the piers, making them exceptionally large examples of this type of structure.

The connecting diaphragms are spaced about 8 or 9 ft. apart, where the cantilever brackets occur, and distribute any locally concentrated loads to the adjacent girders. The separately cast sidewalk brackets are set normal to the girders, while the connecting diaphragms follow the skew. A very unusual type of three-tier joint between the cantilever arm and the suspended link is shown in one of the detail drawings.

Special Expansion Joints

Between the main reinforced-concrete cantilever girders and the suspension girders an expansion joint is provided. The link spans are supported on three tiers of steps with rocker plates resting on bearing plates carried by four angles embedded in the concrete of each step, as shown in one of the drawings. The value of the reinforcement was developed by curving the ends of the rods or by using a washer plate and nuts, and vertical stirrups were provided. To avoid interference with the reinforcing steel, the angles have their horizontal legs punched out and the edges left rough for greater bond with the concrete.



GALVANIZED PIPE AND RODS USED IN CURVED BEAMS AT EXPANSION JOINTS

The ⅜-in. wrought-iron bolts noted between the rocker and the bearing plates were inserted for erection purposes only, and it is assumed that the first expansion movement will shear these bolts and insure free motion thereafter. A space of ½ in. was left between the vertical faces of joints to provide for expansion.

The expansion joint between the cantilever and suspended spans of the steel girder construction consists of a single seat with planed plates 1 in. thick and slotted holes for anchor bolts. Top and bottom plates are also provided, using slotted holes, as shown in the accompanying drawing. Vertical guide angles insure the alignment of the girders, and are field drilled to match the end stiffeners of the girders.

The six lines of concrete girders are carried by six-column bents or piers of reinforced concrete, with arched beam above. The reinforcement of these columns is shown in the accompanying half elevation, indicating the manner in which the column rods are curved at the top to reinforce the beams. Piles were used for the support of several bents north of the harbor line, after which a good hard gravel was encountered close enough to the surface to avoid the necessity for piling.

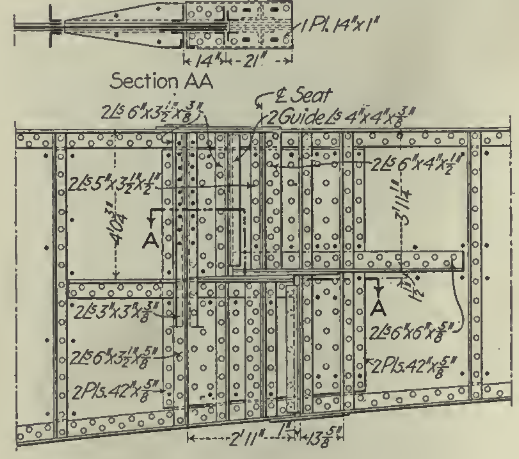
Special Joints and Slab Floor

The Clark Street viaduct, which is 40 ft. wide, consists of three rows of reinforced-concrete arched beams of about 16½ ft. span, carried by three-column bents on concrete piers, with arched beams transversely between them and, for the higher columns, with concrete struts at midheight. The floor, which carries no trolley rails, is a 9-in. reinforced-concrete rectangular slab about 16 x 16½ ft. between beams, reinforced in both directions. The longitudinal rods are ¾-in. round rods, placed on 9-in. centers and run straight through the bottom of the slab, with short 8-ft. rods at the top of the slab over the supporting beam. The transverse rods are also ¾-in. round ones, bent up over the center beam and spaced from 8 to 10 in. on centers. The sidewalk slabs are carried by longitudinal beams on short cantilever brackets, projecting 4 ft. beyond the center of the outside columns.

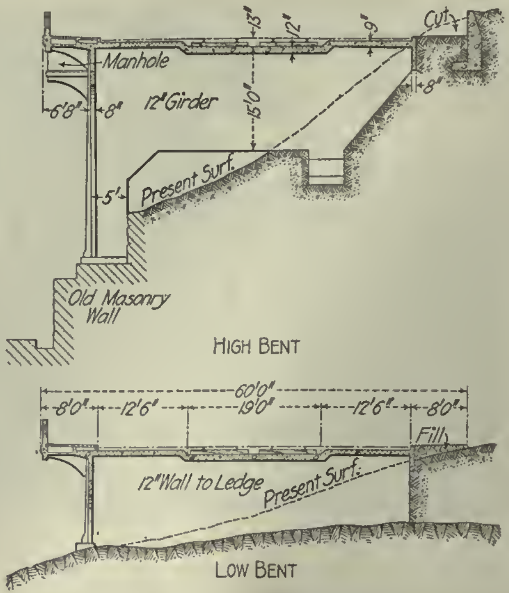
The expansion joint in the curved or arch beams is placed in the center of the panel, and contains the embedded galvanized pipe and rods for keeping the structure in line, as shown in one of the accompanying drawings.

Precast Units Used

The sidewalk brackets and the rather plain type of concrete railing were cast in sand molds in Boston and shipped to the site. The reinforcement of the brackets was cast in place and protruded on the inside so that the poured concrete of the structure would furnish sufficient bond. As shown in the half-section, there are, in addition to the ¾-in. rods cast in the brackets, 1-in. rods which are cast with the sidewalk and bent down over the ends of the brackets to resist further the top flange tension. The outline of these brackets is shown by a heavy dotted line, indicating the manner in which they were incorporated in the structure.



DETAILS OF STEEL EXPANSION JOINT



ECONOMY SOUGHT BY SPECIAL SIDEHILL CONSTRUCTION—STATE STREET VIADUCT

In the placing of the sidewalk railing, which was cast in sections from 8 to 12 ft. long, projecting 1¼-in. dowel rods were cast in the outside sidewalk beam, and 2-in. holes in the sidewalk railings were cored out in casting to correspond with the location of the dowels. Grout was poured through the holes from the outside until flush with the surface. The posts were cast in place between the sections. The cost of this railing was only about $2 per linear foot, instead of probably $5 for the usual cast-in-place construction.

The sand molds were made by templates in ordinary molder's sand, and the railing and brackets mixed of 1:2:4 concrete with coarse aggregate not exceeding ¾ in. in size. The manhole boxes, which can be seen in one of the photographs, were cast as separate units in special forms, and were hoisted into place under the sidewalk.

Economy in Sidehill Construction

The State Street viaduct is sidehill construction on a curve, and follows the old retaining wall on the downhill side, as shown in the photograph and drawing. It

STATE STREET VIADUCT ON CURVE ABOVE OLD MASONRY RETAINING WALL
Note special sidehill construction, and, in foreground, locomotive crane used at Portland end of bridge. Special manholes below sidewalk were precast and hoisted into place.

was planned to use the stone retaining wall as a support for the new columns on the downhill side, but when construction was started it was found necessary to tear out the masonry and use concrete in many instances.

Another source of economy in this part of the work was the special form of girder or cross-wall design used for the supporting bents, as indicated in the accompanying drawing. The uphill side of the bent rests on a footing carried only deep enough to reach good bearing, and the downhill side is extended to the requisite depth either on or in the old retaining wall. The inside sidewalk is either cut out of the sidehill, in which case a retaining wall is necessary, or rests upon a fill, as shown.

River Pier Bases Floated to Place

The contractors for the river piers decided that it would be economical to place seven of them by the use of floating caissons, although the engineers had agreed to allow the placing of the concrete through the 20 to 50 ft. of water, provided this was done inside of sheathing and by a method which would insure concrete of good quality. Timber piles were specified, and were driven on the dredged pier sites on about 2½ to 3-ft. centers to specified resistance, and accurately cut to length by means of a circular saw between pile-driver leads. The erection on ways, the launching, and the floating of the caissons to a bearing on the tops of these piles are some of the most unique features of the construction.

TRUSS CENTERING USED FOR GIRDERS

The accompanying photograph shows the concrete base of the pier or caisson on the ways, where it was cast on a 3-in. timber platform in position for launching. This base is 4 ft. 6 in. high, with division walls 12 in. thick. In the projecting sill at the bottom are cast 1-in. hook bolts, to which long rods are attached when the timber form is built up around this base to a height of about 18 ft. The form is tightly sheathed on the outside, and calked to prevent leakage while floating.

Launching the Caisson

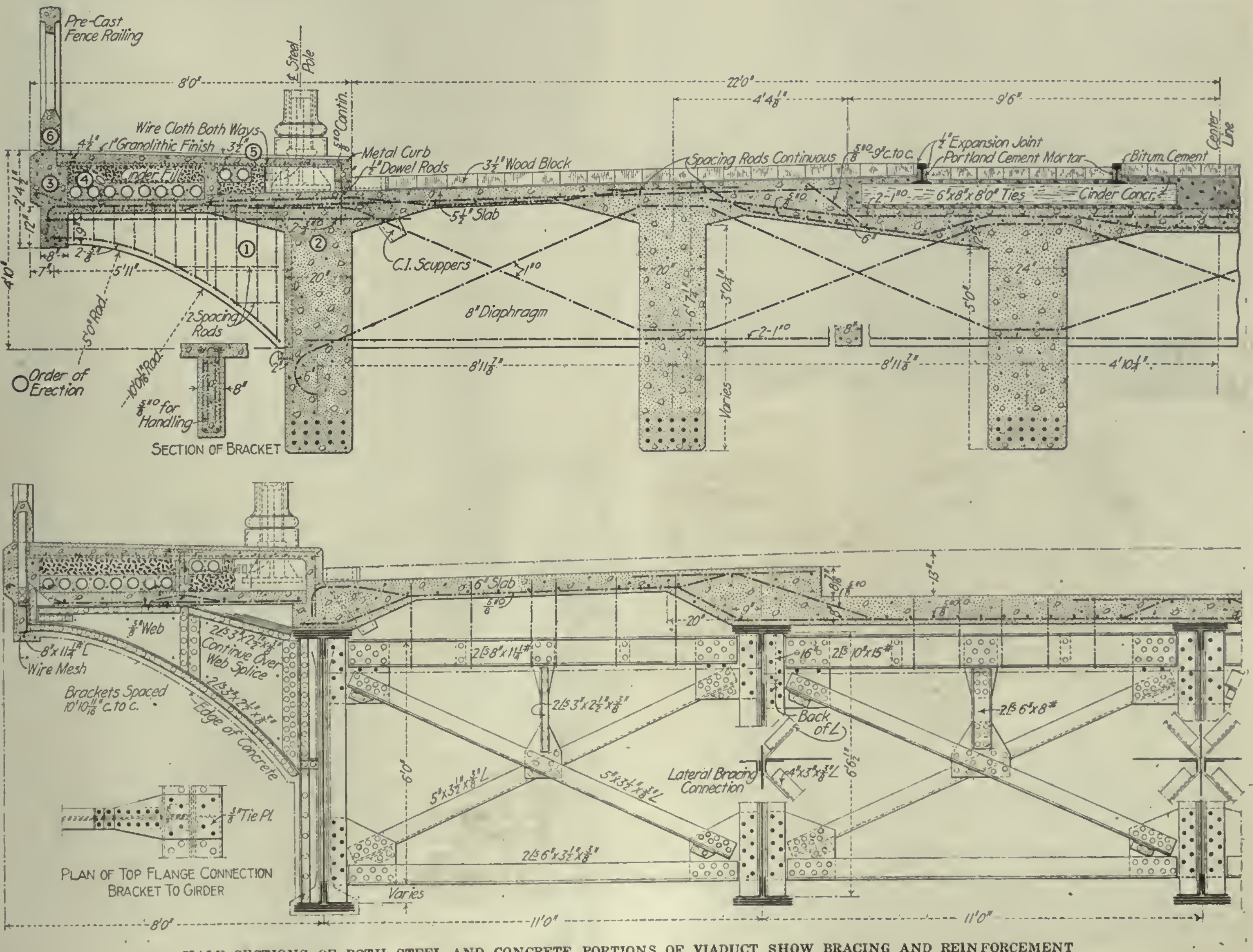
After the caisson was completed on the ways, the wedges were struck and it was launched. It was then towed to its position over the pile bed. After being secured in position, the pouring of the concrete was begun and continued until such time as the caisson rested on the piles at low tide. Additional siding for the caisson was set in place as it was sunk by the weight of concrete, the maximum depth of these sides being 53 ft. As soon as the caisson rested on the piles water was admitted in order to settle it on a firm bearing, this water entering through openings provided in the sides, and filling the space between the sides of the pier and the sides of the caisson.

Pouring of the concrete in the pier was continued in the dry, protected by the sheathing, up to a level 2 ft. below low water. Ashlar masonry was then laid around the pier, behind which the concrete was poured. As soon as the construction advanced above the water level, the outside frame and sheathing were removed by loosening the long bolts at the top and the frame was towed to the ways for use on the next pier.

The masonry facing was made 25½ ft. high and was used to prevent disintegration due to the action of sea water on concrete, especially at levels between tides in freezing climate. An attempt was made to refill the dredged part under the bottom of the piers by pouring sand around the outside, with the expectation that it would drift in beneath the pier. Finally, riprap was placed on the refilled area around the outside of all the piers for a distance of about 15 ft.

Progress in Construction

It was necessary to construct the new viaduct without interrupting the heavy traffic on the old bridge, which occupies practically the same site for much of the distance across the harbor. A temporary



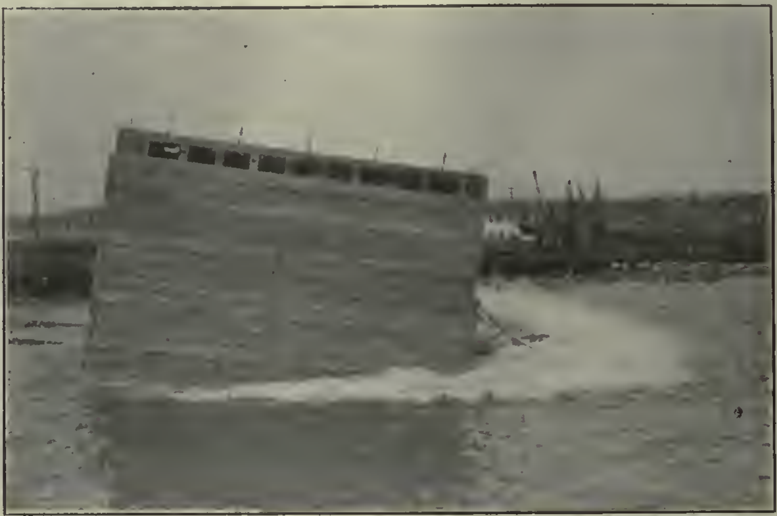
HALF SECTIONS OF BOTH STEEL AND CONCRETE PORTIONS OF VIADUCT SHOW BRACING AND REINFORCEMENT bridge in the shape of a V was constructed, of a length sufficient to divert traffic from the interfering portion of the old viaduct, and this was carried to the east far enough to clear the swing bridge. A temporary draw span was provided, carried on a pile pier at the center.

The construction was begun about Dec. 1, 1914, and it is estimated that it will be completed about June 1, 1916. Up to Dec. 1, 1915, 28,400 yd. of concrete, 1930 tons of structural steel, and 700 tons of reinforcing steel had been placed. The work progressed rapidly from two main concreting towers on the Portland side, using chutes, and by the use of the derrick-and-bucket method on the South Portland side. A locomotive crane of standard gage was very useful on the freight-yard tracks in handling forms, falsework and reinforcing steel. The wooden trussed type of centering used for the concrete girders can be seen in one of the photographs.

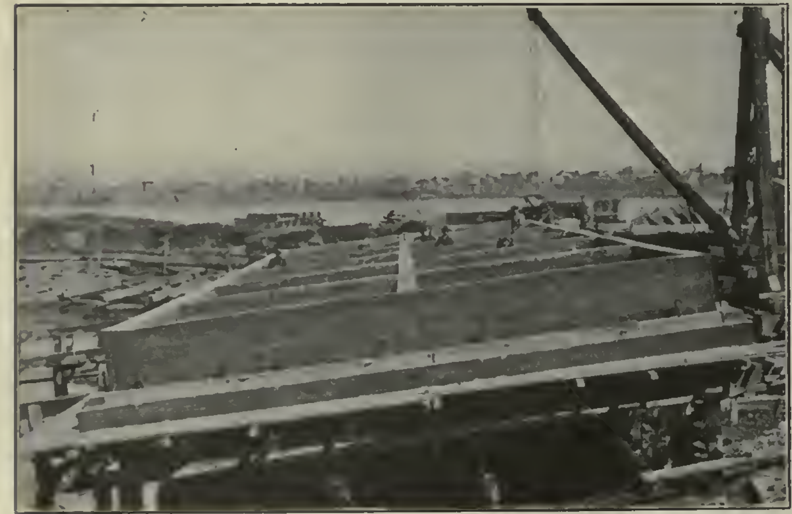
The method of pouring the sidewalk slabs and curbs was unique in the use of a double slab, with the conduits covered with cinder fill as a form for the upper slab, while wooden forms were used along the curb against which the concrete could be poured. The work has progressed so satisfactorily, mainly by reason of the complete equipment of the contractors, together with favorable weather conditions, that it is estimated to be about three months ahead of contract time.

The bridge was designed by J. R. Worcester & Company, consulting engineers, of Boston, under the direction of J. R. Worcester and G. H. Brazer, and the construction was under the supervision of E. E. Pettee, also a member of the above firm. The work was divided into three contracts. Contract A comprises the building of the temporary bridge, the filled portion at the southerly end of the structure, the substructure for the reinforced-concrete structure immediately south of the South Portland Harbor Commissioners' line, the piers in the harbor and the substructure of section 4, which is the part lying between the Portland shore and Commercial Street. This contract was awarded to the Holbrook, Cabot & Rollins Corporation, of Boston, who in turn sublet the substructure for the reinforced-concrete portion on the southerly end and the substructure on the Portland shore to T. Stuart & Sons, of Newton, Mass.

Contract B included the furnishing of all steel spans across the harbor, including the double-leaf Scherzer draw and operating machinery. This contract was carried out by the Phoenix Bridge Company, of Phoenixville, Pa. Contract C included the superstructure across the Portland Terminal tracks, the State Street and Clark Street viaducts, the reinforced-concrete floor slab on all steel spans, the reinforced-concrete superstructure at the southerly end of the bridge, and the paving of the entire length of the roadway. This contract was awarded to T. Stuart & Sons.



→ LAUNCHING TIMBER CAISSONS BUILT UPON CONCRETE BASE, PORTLAND, MAINE



← CONCRETE BASE OF RIVER PIER CAST ON WAYS FOR PORTLAND HARBOR BRIDGE

To Increase the Usefulness of Local Societies

Plans to Enlarge Membership and Extend Influence of San Francisco Branch of American Society Proposed by H. L. Haehl

PLANS for promoting the growth and increasing the usefulness of a branch association of the American Society of Civil Engineers were recently presented to the San Francisco association by H. L. Haehl in such a form that it was at once voted to have the address printed and copies sent to all members of the parent organization residing within the thirteenth district. Extracts from the address follow:

Means of Increasing Membership

In order to secure for the local association a membership truly representative of the district, and at the same time distribute the dues fairly, members living more than 50 miles from San Francisco, and all juniors, should be subject to a lower rate of dues than resident members. There should be advantages to offer non-resident members, and three means of accomplishing are suggested. First, authorize the secretary to employ a shorthand reporter for the meetings, and from his notes prepare and send out for each meeting a brief of proceedings sufficiently comprehensive to give a good idea of the papers presented, the discussion thereon and the business transacted. Second, arrange more often to secure papers from non-resident members. They are very often engaged on work of great interest which is different in nature from the problems confronting those closer home, and their active interest in association affairs helps materially in unifying the organization. Third, an election of officers of the local association by letter ballot would do much to interest non-residents and promote the feeling that the organization is truly representative and that all have an equal voice in affairs.

The close association of the young engineer with older members of the society makes for his broader appreciation of the elements of high professional standing and tends to bring him to the enthusiasm that comes from being one of a body of engineers working with a purpose and toward an ideal, rather than merely an individual striving for his bread. It is highly desirable, therefore, that the junior be brought into the branch association. The objections that the tone of the organization might be lowered are groundless, particularly because of the disproportionately small number of juniors.

Larger membership is merely an end to greater usefulness, and although attention to this element comes first, other considerations are of equal importance. The engineer is not an advertiser; he takes the task that is given him and seldom fails to accomplish it, but he does not rise up in his community to announce the fact, or even subtly direct public attention to his performances. We are mostly a modest lot and we believe most kinds of advertising to be unprofessional. But there are permissible kinds of advertising which will stimulate our growth as a profession—things which we can do as a body which we would hesitate to do as individuals. Such things our association should undertake, being careful always of the dignity and standing of our profession, but mindful of our duty as citizens. Some examples come to mind. The President of the United States has only recently asked the engineering profession to assist the government in bringing about economic preparedness. We will be able, as an association, to be of great assistance. Our efforts will be strictly patriotic and not in any sense selfish, yet they will at the same time help to let the world know what an engineer is capable of doing and give him entirely proper and legitimate advertising.

Opportunities are constantly arising for engineers to take part in affairs of the city, state or nation, to the advantage of all concerned, but a permanent committee charged with securing the maximum of such useful work is a necessity. Unless organized effort is made to place the direction of these matters in definite hands, no really material results can be expected.

The engineer must be mindful that professional jealousy is common to all professions, and one of the benefits of an association is that as we increase the number of our friends in the profession our tendencies toward criticism decrease proportionately. It is to be remembered that denunciations and unkind criticisms, which are all too frequent, often prove groundless and ultimately sources of regret.

We would prosper more and would more quickly reach the point where the importance and dignity of our work would be better understood and appreciated if we were more careful in this regard. Engineers are almost invariably honest—the American engineer particularly is so esteemed by the whole world. Let us not be the first to question it. Differences of opinion and differences in method are natural, and our mistakes are usually honest ones, if we would only recognize these facts and bear them constantly in mind. A common cause promotes acquaintance and respect and tolerance. If we can make common cause in this association not only for the advancement of engineering knowledge but also for the promotion of good fellowship, we shall do much to attain the objects which are set down in our constitution as "the maintenance of high professional standing and the furtherance of the general welfare of the American Society of Civil Engineers."

Panel Testing Furnace Is of Exceptional Size

J. E. Latta Describes Design and Operation of Large Furnace Recently Completed for Underwriters' Laboratory

THE LARGEST UNIT of its kind yet completed, embodying some special features believed to be new and distinctive, is described by J. E. Latta in the January *Quarterly* of the National Fire Protection Association. The furnace has been installed at the Chicago plant of the Underwriters' Laboratory.

DIMENSIONS OF FURNACE

The furnace proper consists of a shallow combustion chamber approximately 16 in. deep, 12 ft. wide and 14 ft. 9 in. high. Communicating with it at the bottom is a pit 19 in. wide and 36 in. deep. The combustion chamber, wherein the fire is maintained against one side of the sample under test, is inclosed at the back and one end by substantial stationary brick walls. Movable walls in steel frames make up the front and other end of the inclosure. The front movable wall is suspended from an overhead steel beam by trolleys, and the movable end wall is carried by flanged wheels which run upon rails within the floor.

The products to be tested may be such that the necessary testing sample will form the entire front wall of the furnace, filling completely the steel frame for this wall and subjecting the frame and the supporting trolley to great weight; or, the appliance under test may be light and may require but a comparatively small space in the combustion chamber, as is the case with wired-glass windows and the smaller fire shutters.

Four panel frames are supplied with the new furnace, the largest and strongest of which will accommodate test samples weighing as much as 24,000 lb. The frame itself for this particular panel weighs about 14,000 lb. The top of the furnace consists of heavy fire-clay blocks, and has six vents which lead to a stack. Dampers made of suitable fire-resisting materials are installed in the vents.

OBSERVATION WINDOWS

Each end wall of the furnace has three observation windows glazed with mica, and so arranged that all parts of the combustion chamber and the exposed side of the test sample may be readily observed. An observation gallery affords access to the upper windows and the valves at the top of the rear of the furnace.

The heat supply is provided by means of six 4-in. blast burners installed in the base of the back wall of the combustion chamber, the arrangement being such that the discharge is upward at a small angle, and each of these six burners carries a screen of special design to prevent flashing back. Fuel consisting of a mixture of gas and air is conveyed to the burners through mixing tubes of suitable design. The secondary air supply consists of fifty air inlets spaced uniformly over the back wall of the furnace. Gas is supplied to the furnace through a 6-in. pipe connected directly to the street main. The air supply is from a blower system capable of furnishing something over 2000 cu. ft. per minute at a pressure corresponding to a head of 13.8 in. of water.

TEMPERATURE MEASUREMENTS

Thermo-couples are employed for measuring the high temperatures within the gas furnace and on the exposed side of the material under test, the number and position of these depending largely upon the size and nature of the test sample. On the unexposed side of the test sample the temperatures are taken by means of thermocouples, and by mercury thermometers hung in various positions. Fire pressures within the furnace are indicated by means of a draft gage connected to the combustion chamber by piping. The equipment also includes provision for the measurement and control of the pressure in the air supply.

FIRE STREAM APPARATUS

The apparatus employed in the fire stream test consists of special hydrants located at convenient points, flexible nozzles attached to the hydrants, gate valves for controlling the stream, and pressure gages at the bases of the nozzles. The tip of the nozzle is held 20 ft. from the sample when the wall is pulled from the test furnace. The hydrants are connected to the water mains under the floor, the source of water supply in which may either be three 4500-gal. presure tanks, or an electrically driven fire pump having a capacity of 500 gal. per minute. The tanks and pumps are located in an adjacent building.

AN UNUSUALLY LARGE FLOATING DRY-DOCK is being built by the Union Iron Works at Hunter's Point on San Francisco Bay, as a necessary adjunct to the work entailed by the large shipbuilding contracts undertaken during the past few months. The capacity of the dock will be 7500 tons, its function being to accommodate vessels of less than this tonnage without interfering with the work on the larger dock and marine ways. The new dock, which will be equipped with electrically driven centrifugal pumps, will be 450 ft. long, 100 ft. wide and 30 ft. deep, sheathed outside with copper.

Propose to Improve the Sacramento River

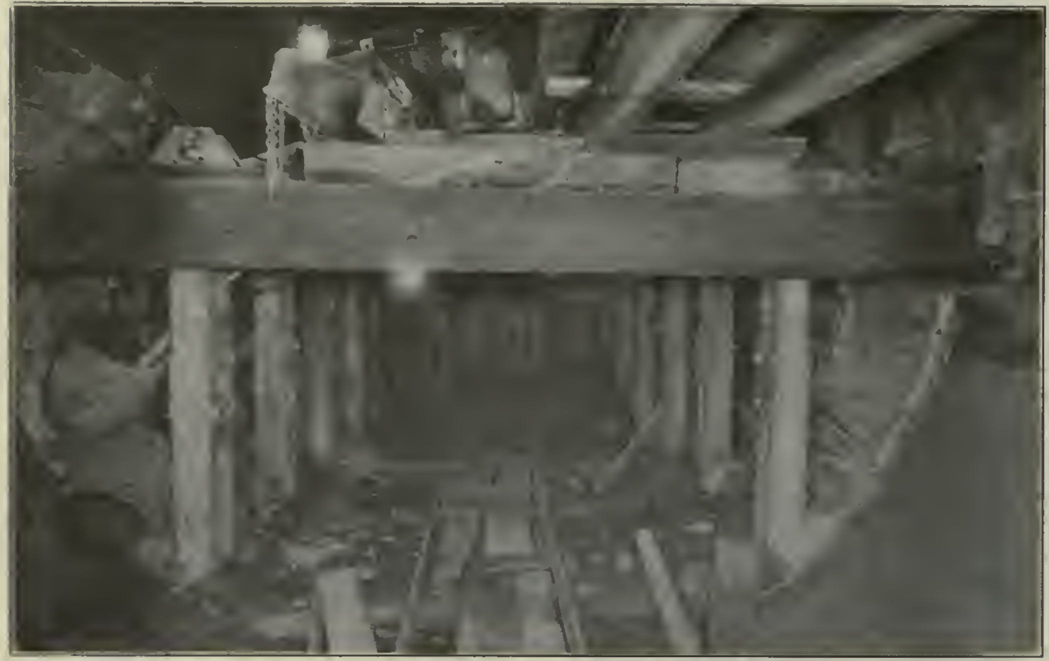
Overflow Weirs and By-Pass Channel Contemplated to Facilitate Navigation on River of Heaviest Run-Off in Country

FLOOD-CONTROL, irrigation and navigation problems of the Sacramento River in California, which have been the subject of study for many years, were reviewed by V. S. McClatchey, president of the State Reclamation Board of California, in a paper presented at the recent annual meeting of the National Drainage Congress. In referring to the plan of development now contemplated Mr. McClatchey pointed out that the Sacramento River in flood volume is the fourth greatest river in the United States, and in flood volume, compared to drainage area, is more than five times as great as that of any other river in this country. The project involves an estimated cost of about $42,000,000, of which sum the nation will pay $6,250,000, the State of California will pay a similar sum and the balance will be paid by the landowners benefited.

The work contemplated consists of the construction of strong river-bank levees which will confine in the river channel all the water it can safely carry. The excess will be taken out by means of four weirs and conducted through by-passes which empty into the river again 15 miles above its mouth, at which point the channel will be enlarged and all of the flood waters will be carried into the upper arm of San Francisco Bay. The enlarging of the channel and the construction of weirs will be under the direction of federal engineers, the expense to be equally divided between state and nation. The State Reclamation Board, working in co-operation with federal and state engineers, will have control of the remaining part, which consists of 502 miles of river levees, 180 miles of by-pass levees and the securing of by-pass rights-of-way through 85,000 acres.

The completion of this project means, Mr. McClatchey affirms, the restoration of navigability on the Sacramento River, and the preservation thereof in 263 miles of waterway; the protection of navigation on the San Joaquin River (the two rivers having a common delta); the protection of lives and property in the two valleys, including the cities of Sacramento and Stockton; the protection of reclamation, complete or in progress, on 750,000 acres of river lands whose annual production exceeds $30,000,000 in value; and the reclamation of 750,000 acres of waste lands which would add $120,000,000 to the wealth of the state, and whose annual production would be approximately $30,000,000. The growth of the state in commerce, wealth and population depends, it is asserted, to a great extent on the development of the extensive agricultural areas in the Sacramento and San Joaquin valleys, as well as upon a system of inland waterways to joint these rivers.

A PLAN FOR SYSTEMATICALLY PATROLLING HIGHWAYS has recently been put into effect in southern California by the State Highway Commission, whereby minor repair work is constantly under way during the storm season on hundreds of miles of roads. The methods adopted consist of dividing the roads into districts with a foreman in charge of each, and using light trucks to carry men and tools to and from their work.



RIBS OF FORMS CARRY LOAD AS NEEDLE BEAM IS ADVANCED TILL CONCRETE SETS

Needle-Beam Heading Method Applied to Sewer Tunnel in Dry Ground

Increased Pressure in Open Tunnel Causes Important Modifications on Brooklyn Sewer Work of Methods Used for Passaic Sewer in Newark

THE NEEDLE-BEAM heading method, using pressed-steel lining plates and radial shoring jacks to support the earth, is being applied successfully to a section of large open sewer tunnel under Tompkins Avenue in Brooklyn, N. Y. Except for the fact that the absence of water makes the use of compressed air unnecessary, and the resulting increase in soil pressure has caused the adoption of important modifications, the method is similar to that used on the Newark (N. J.) section of the Passaic sewer tunnel, and described in the Engineering Record of Jan. 30, 1915, page 130. In addition to a monthly progress of 100 ft. in each heading, the Litchfield Construction Company, contractor for this section, has lowered the cost of the work still further by equipping a screening plant at each of the two constructing shafts and using for the lining concrete the sand and gravel taken from the headings. This concrete lining is being placed rapidly by the pneumatic process.

NATURE OF CONSTRUCTION

This section of the Tompkins Avenue relief sewer, designed by the Sewer Department for carrying the increasing stormwater flow from the downtown section of Brooklyn, extends from Greene Avenue to Fulton Street and under Fulton Street a short block from Tompkins Avenue to Brooklyn Avenue. One shaft is located at Macon Street, two blocks from Fulton Street, and another at Monroe Street, three blocks from the upper end of the work. For 800 ft. the sewer has an inside diameter of 10 ft. 6 in., and for the remaining 2700 ft. is 13 ft. 6 in. inside and 16 ft. 4 in. outside diameter. It is being driven with from 30 to 35 ft. of cover, and its roof for quite a distance is but 10 ft. below an old brick sewer. Some safe method of holding the sand and gravel soil which would at the same time allow rapid progress was necessary.

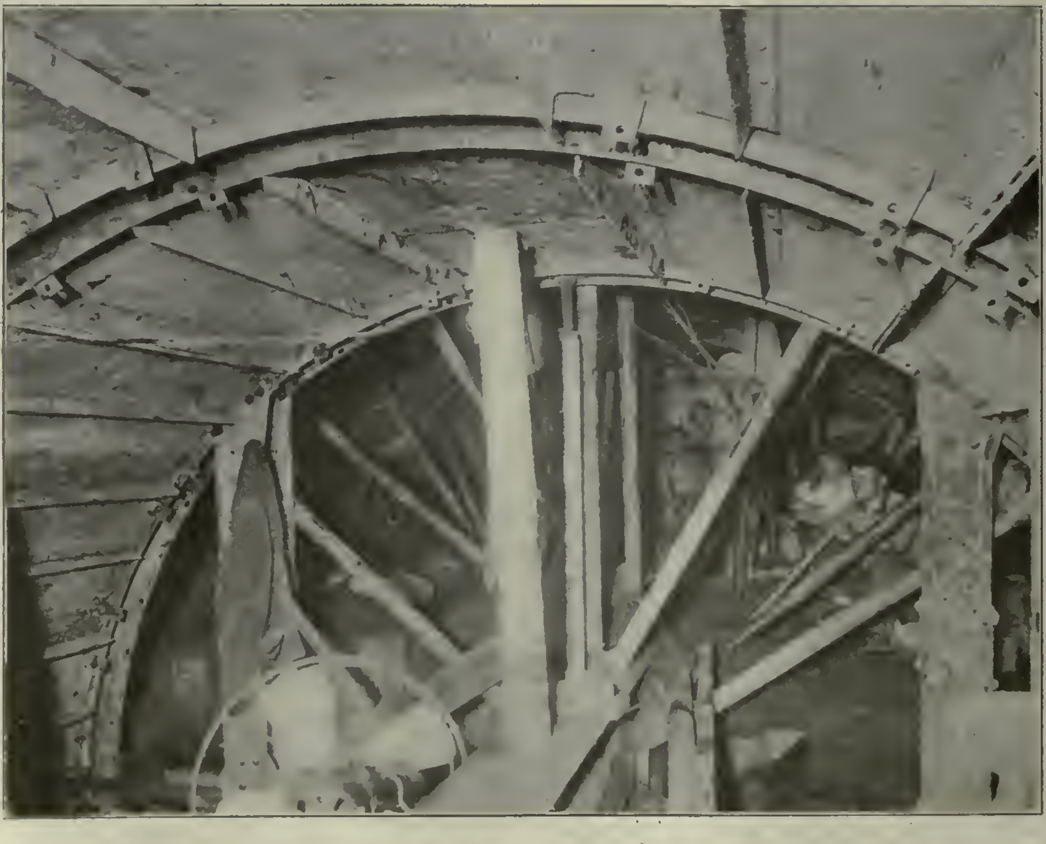
The needle-beam heading method, as developed for this tunnel, is well shown in the accompanying photographs. The needle beam is made of two 15-in. I-beams bolted together with timber separators. Instead of carrying it below the center of the tunnel and taking out most of the dirt in the top heading, as was done in the Passaic sewer, the Tompkins Avenue headings are driven with the needle beams above the center. This balances the work better, as the top heading requires more time to brace, it alone being lined with plates, and a greater pressure existing on the breasting boards at the face than on those at the end of the bench. More dirt can be taken out of a given length of bench in the same time for this reason than from the same length of heading. The plan of throwing the bulk of the excavation in the bench also reduces the length of the shoring jacks needed under the roof, where the greatest load is carried.

As in the Passaic sewer, the front end of the needle beam is carried on blocking on top of the bench, and its rear end on a 12 x 12-in. post to the concrete invert. In addition, however, two horizontal braces from the rear end of the beam to notches in the sides of the sewer and a jack from the rear end of the beam to the roof are needed. But for these, the earth pressure on the breasting boards at the face, which is carried jointly by the edge of the lining plates and the needle beam, would force the latter back, unseat the shoring jacks and let down the headings.

PILOT PLATES DEVELOPED

Another feature of the construction necessary without compressed-air support is three structural-steel pilot plates, a little wider than a lining ring, which are carried over the lining at the crown of the arch and pried forward with bars. Beneath them the top of the heading is dug out and the first lining plates are inserted. The rest of the heading is handled with breasting boards of 2-in. plank.

Nine feet of heading is excavated and lined with plates, carrying the shoring jacks on blocking in the heading. Meanwhile forms are set and the 9-ft. ring at the back end of the needle beam is concreted. Through the forms is then taken out the muck from the next 9-ft. section of bench, after which the needle beam is advanced and the jacks are transferred to it. The needle beams thus usually support 9 ft. and never more than 18 ft. of roof at once. They are about 25 ft. long. In excavating below the center of the sewer, wood lagging laid horizontally is sufficient to hold the sides, and the invert stands without support for the short time until the section can be concreted. It is necessary, how-



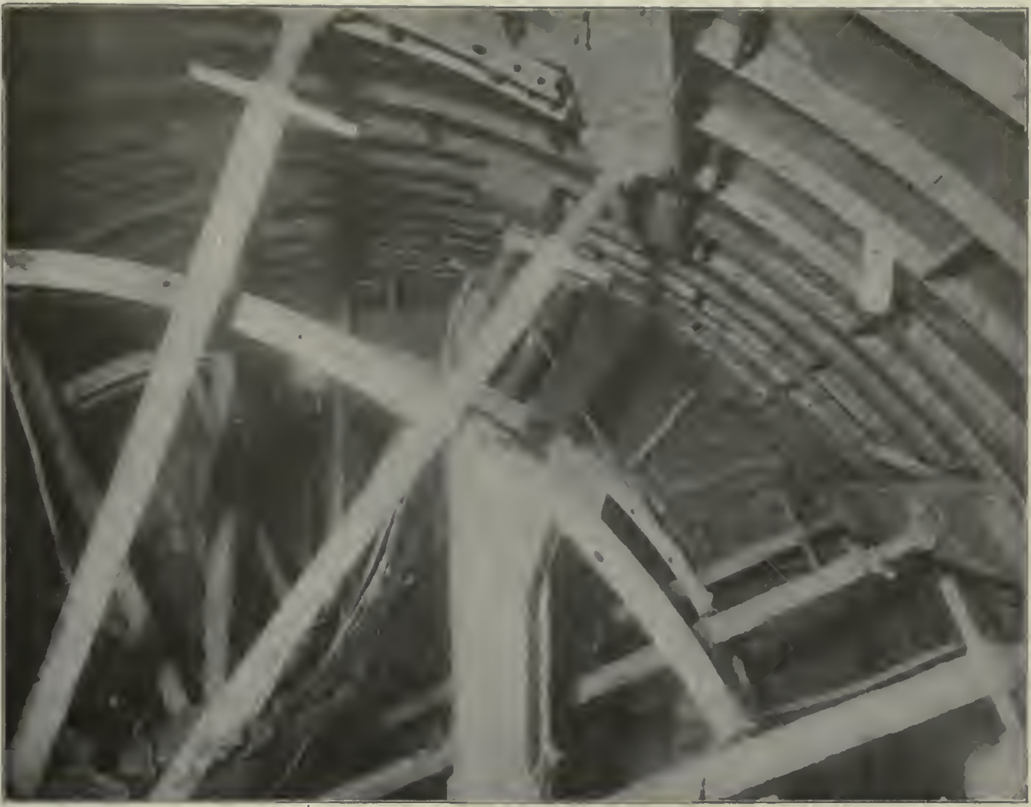
HEAVY SOIL PRESSURE REQUIRES FOREST OF JACKS AND LARGE NEEDLE BEAMS ever, to bulkhead the back end of the bench to retain a solid bearing for the forward end of the needle beam.

PIPE SEPARATORS BETWEEN FORMS AND LINING PLATES

The support of the lining plates during concreting is more difficult than on the Passaic sewer, as the green concrete cannot be depended on without air support to take the full load. Also, the strain on the form ribs is much heavier. Instead of the shoring jacks being taken out and the form plates being placed as the concrete rises, therefore, pipe separators bearing on the form ribs are used at frequent intervals to brace the lining plates. This allows all the removable form plates to be set at once. The separators remain in place, and are plugged with mortar after removing the forms. The form ribs have to be made of extra heavy channels with very deep flanges. The forms are supported by H-frames, the crossbar of which is under the needle beam and the vertical legs of which are unbolted and re-assembled at each move.

PNEUMATIC PLACING METHOD RAPID

The entire volume of concrete is mixed in regular mixers at the two shafts, dropped down a pipe to the pneumatic placing machine and "shot" 600 ft. or more directly into the forms. The 8-in. delivery pipe runs through and ahead of the section being concreted, rises, returns and ends in an elbow and nipple. These feed into steel drop chutes for concreting the invert and side walls, and are taken entirely off in concreting the roof. For the latter work, the end bulkhead of the form is made of bags of sand, fitted together and around the delivery pipe. It is difficult to tell always when the key is full, as back pressure occurs before all the air is out of the forms. With the care exercised on this contract, however, very good results have been secured. This method allows the concrete to be placed considerably faster than the heading can be advanced, and without interfering with the mucking operations.

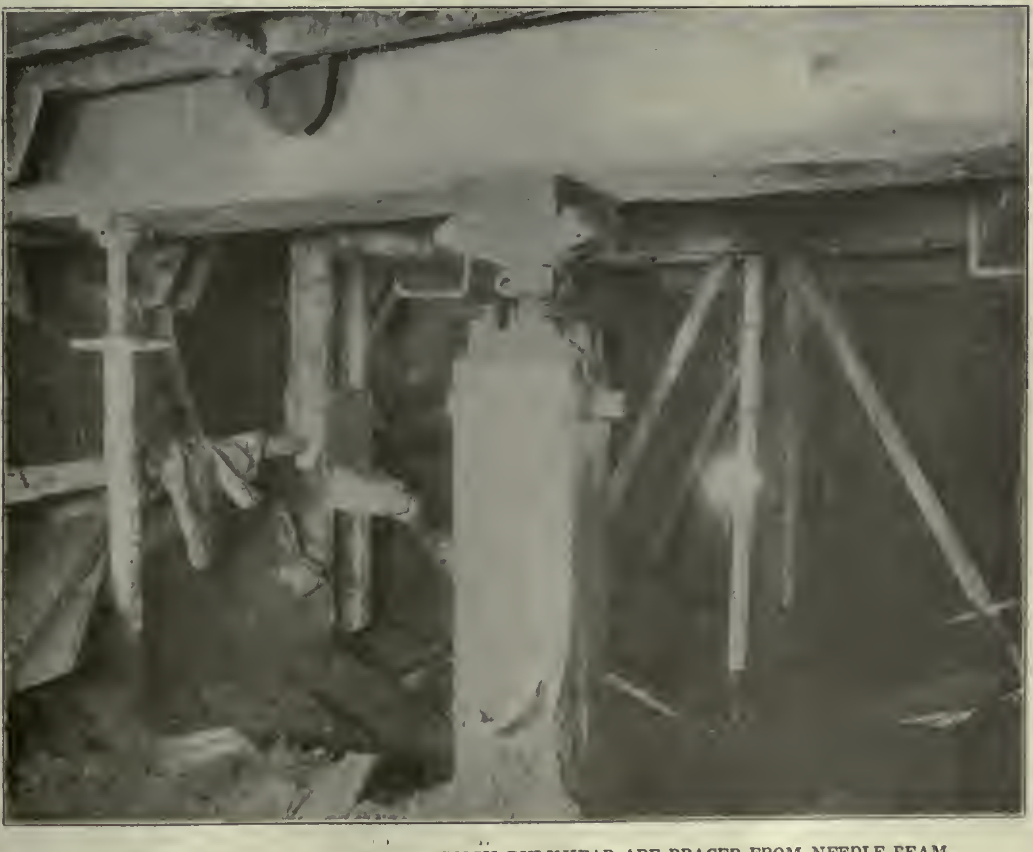


FORM FRAMEWORK SET UP BETWEEN JACKS WHICH SUPPORT LINING PLATES

The bottom half of the sewer is lined with one ring of vitrified brick. This and the comparatively short length of headings led to the adoption of sand-ballasted industrial track and mule haulage for the muck cars. Beginning midway between shafts and at the ends of the section, the lining can be placed as the track is torn up and the ballast removed. Some of the sand can be used directly in laying the bricks. A single track takes muck from each heading as fast as it can be dug. The two mules that have been lowered down each shaft are stabled under ground.

On being hoisted from the shaft, the sand and gravel pass through a screening plant, and much of it is used over again for concrete. Such as will not pass the specifications of the Sewer Department is removed by teams and dump wagons. As the run of the headings is uneven, and as little storage space is available in a plant built on city streets, some concrete materials have to be purchased. The compressor plant for placing the concrete at both shafts is located at Monroe Street, and includes one 1050-ft. and one 600-ft. electrically driven machine. The hoisting plant at each shaft consists of a derrick mounted on the overhead structure within reach of the shaft and the bins. Cement storage at both shafts is provided for under the bins and directly behind the mixer, which is set up at the edge of the shaft.

The contractor for this section is the Litchfield Construction Company, for whom the work is under the direction of J. W. Goodridge, vice-president. For the Brooklyn Sewer Department E. J. Fort is chief engineer and George T. Hammond designing engineer. Arthur J. Griffin is engineer of construction for this and other work, and I. H. Kirby is assistant engineer in charge of the section described.



INVERT FORMS IN PLACE BEHIND BENCH BULKHEAD ARE BRACED FROM NEEDLE BEAM

Check Dams Approved by Investigating Committee

THAT check dams would prove to be a potential agency in the general scheme of water conservation and flood control is the substance of the report made by a committee appointed by the city of Glendora, Cal., to inspect the experimental dams in Haines Canyon. Following the report of the committee, the Glendora Flood Control Association, organized since the January floods in southern California, has decided to construct check dams in the Big and Little Dalton Canyons, which carry the runoff from the watershed upon which the ranchers of this valley depend for their supply of water during the irrigating season. To finance this work a levy of $2.50 per acre will be made on land liable to damage from flood waters in this vicinity.

Cracks in 16 of 300 Concrete Road Slabs Analyzed

Very Little Wear Observed on Baltimore Highway After Sixteen Months' Service

By P. A. BEATTY
Loch Raven, Md.

IN connection with the Gunpowder water supply improvement for the city of Baltimore the Water Board constructed several miles of new highway, about 1½ miles of which were surfaced with plain concrete slabs, 14 ft. in width, 7¼ in. thick at the center and 6 in. thick at the sides. Joints were spaced 25 ft. apart. The sub-grade was well rolled and sprinkled before placing the concrete, which was carefully inspected. The screeded surface was broomed to show well-defined transverse lines, and was well protected, first with canvas, and later with earth; it was frequently wetted down to prevent too rapid drying out. Two weeks after completion it was put in service.

A careful inspection made on Feb. 8, after the road had been in service about 16 months, under a fairly heavy country traffic, showed that very little wear had taken place, the brush marks still being plainly discernible everywhere, and at most places looking as fresh as ever.

Sixteen Slabs Cracked

Of approximately 300 slabs, sixteen showed cracks. Six cracked slabs were on fills, and evidently due to settlement. Four were cracked approximately along the center, from end to end, although the cracks were not continuous. In six slabs the cracks started approximately at the middle at one end, but ran out to the side about two-thirds of the way up with a sweeping curve. One had an 18-in. crack in one corner, which did not reach the edge. One had a transverse crack about the middle. All, except the six classified as settlement cracks, were in cuts, where the original soil had not been disturbed, the sub-grade being clay.

In no case, except in the settlement cracks, were the cracks continuous; they consisted of short fractures with the ends approaching, and often lapping, but an inch or two apart. No spalling had occurred at the edges of these, and only a few were of sufficient width to receive the end of a small pin. Many of the cracks would have remained unnoticed except that the moisture which they contained made them visible. It is not known whether they extended through the slab, or were superficial. In the latter case the moisture must have come from above, or that which the slab contained must have concentrated at or been made apparent by the cracks, as the slabs did not look damp.

There seems reason to expect that these cracks will widen, owing to repeated freezing of this moisture, but two winters' exposure so far have caused little apparent damage. The writer does not believe that these cracks were caused originally by external causes, although they may have been rendered apparent by frost action. Their appearance suggests the idea of internal stressing of the concrete. One would not expect insufficient hydration to produce these results. There seems to be some significance in the fact that all of the cracks occurred in cuts, where the moisture might be expected to be greater than on fills. That, combined, perhaps, with temperature changes, might have some bearing. The writer would be glad if some of your readers would give their experience and express their views.

Half of Long Steel Viaduct at Cleveland Wrecked in Seven Days

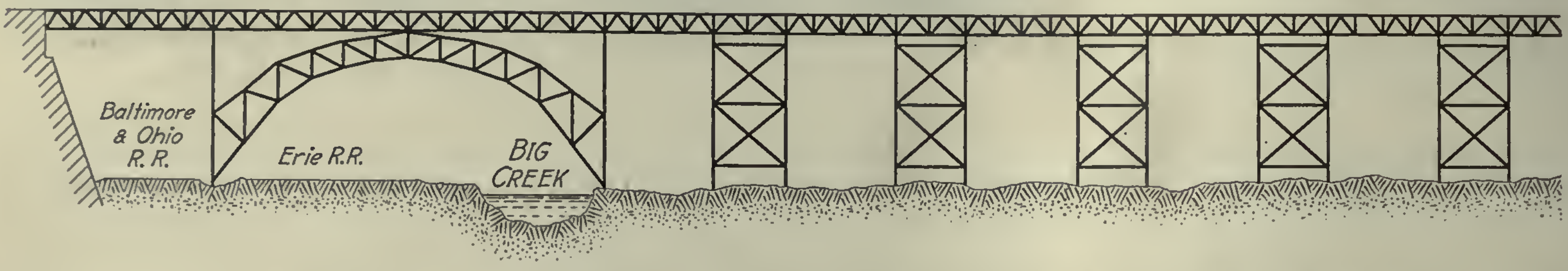
Arch Ribs at Brooklyn-Brighton Structure Thrown Down Bodily After Being Stripped—Cutting Torches and Single Traveler Used

ONE-HALF of the old Brooklyn-Brighton viaduct in Cleveland was wrecked in the week ended Sept. 2 last, with the help of the oxyacetylene torch and a single traveler, to make way for a new concrete structure. This rapid progress, which was three days faster than required by the construction program, was not necessary with the south half of the old viaduct, as the center lines of the old and new structures diverged so that the former cleared the latter for this distance.

From the north end the old viaduct, which was built in 1892, consisted of 1322 ft. of alternate 57-ft. and 28-ft. Warren truss spans, the latter directly over steel towers 26 x 28 ft. in top plan and from 25 to 85 ft. in height. Next was a 168-ft. arch span over Big Creek and the Wheeling & Lake Erie Railroad, which was wrecked by dismantling everything but the two arch ribs and throwing these sidewise to the ground. A 72-ft. truss span carrying the roadway over the Baltimore & Ohio Railroad tracks completed the old structure.

New Viaduct Built in Halves

The new viaduct was built in longitudinal halves, the west half being built first and the east half after a large part of the old structure had been taken down. All of the west half of the new bridge could be built without disturbing the old bridge except for a small section at the north end. Timber falsework which did not interfere with the new construction was built to support the roadway at this point, and the old steel was cut up with a blow torch and removed by hand. The quantity taken out in this operation was small, and the work was at no great height from the ground. The old bridge remained in this state until the west half of the new bridge was paved and ready for use on Aug. 25, 1915. As soon as the wires of the street car company had been removed, on Aug. 27, the workmen started tearing up the wooden street decking and erecting a stiffleg traveler derrick of 14 x 14-in. timbers with a 60-ft. boom. This derrick was in operation by 2.30 p. m. of the same day, when actual removal of the old steel was begun. The derrick, which was mounted on skids, rolled back as the bridge was torn down in front of it.



THE RIGHT-HAND HALF OF THIS 1562-FOOT VIADUCT IN CLEVELAND WAS WRECKED BY A SINGLE TRAVELER DERRICK IN SEVEN

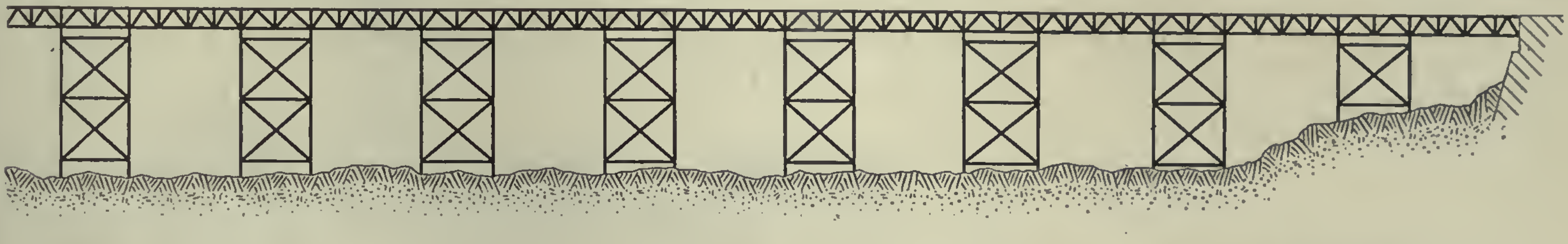
Floor System Cut Out First

In removing the old spans the derrick was set over a tower and from this position took down the spans and the tower behind it as they were cut up. The floor system was made up of longitudinal stringers riveted to floorbeams. Each end of these latter rested on a bracket at a bottom-chord panel point of the truss, and had its top flange riveted to the under side of the top chord of the truss. As the stringers were taken out, the rivets in the bottom flange of the floorbeams were burned off, and the top chord on each end was cut through on each side of the floorbeam, leaving a piece of it attached to the top flange of the floorbeam at each end. This allowed the floorbeams to be lifted and lowered to the ground without time being taken to back out any rivets. The center floorbeam was first removed, and next those on either side of it, to reduce the stress on what was left standing of the trusses. This procedure left the bottom chord of the truss intact and all the diagonals in place, each pair supporting a section of top chord at the panel points. The trusses were next taken down by burning off the diagonals at their lower ends and lowering two diagonals and a section of top chord still fastened together for each pair of cuts made. The two lower chords were then cut at each tower and lowered to the ground full length, where they were cut in two to facilitate shipping.

Removal of Towers

After the truss between two towers was removed in this manner, the tower behind that on which the traveler stood was taken down by cutting out the top set of bracing and burning off the posts at the lower end of this top panel. This left about half of the tower still standing. This lower part was cut up and allowed to fall to the ground, where it was further cut into lengths suitable for loading on cars.

These operations were carried on from one end of the bridge to the other, leaving only the main trusses of the 168-ft. arch span standing after the traveler had passed over it. The arch trusses were wrecked by first removing the top lateral braces, and then taking down the top-chord members, verticals and diagonals simultaneously for both trusses. This work was begun at the center by taking out two panel lengths of top chord and the center post, and removing thereafter one diagonal, one vertical post and one panel length of top chord at a time on each truss, first on one side and then on the other of the center, until nothing remained standing but the two main arch ribs connected by the bottom system of lateral bracing. The way in which this was done is described in detail on page 333 of this issue. The arch ribs were then guyed with six lines each and the bottom laterals cut out. As the east rib was thrown down first, its guys were passed under the west rib and the guys of the west rib passed over it. The ribs were thrown over bodily, one at a time, by pulling on a set of falls hitched to the center of each rib after the anchor bolts had been burned off. The arch ribs fell without breaking up, and were cut up on the ground into car lengths. Blocking was placed over the railroad tracks, and they were not damaged. It was possible with each rib to make two cuts and drag the center piece off the tracks quickly enough to avoid delaying any trains.



DAYS BETWEEN THE COMPLETION OF THE FIRST LONGITUDINAL HALF OF THE NEW VIADUCT AND THE BEGINNING OF THE SECOND HALF

TIME IMPORTANT IN REMOVING FIRST HALF

In order to take care of the erection schedule for the new bridge it was necessary to have the north half of the old bridge entirely removed within ten days after starting work on Aug. 27. This meant that the section had to be removed by Sept. 5, which was known to be a difficult matter and was thought by some to be impossible, even working night and day. However, one-half of the whole bridge was down on Sept. 2, three days ahead of time. The remainder of the bridge was not removed until the middle of November, there being no necessity for haste, as it did not interfere with the new structure. No accidents or unforeseen delays were met with in the entire work of removal.

Two Oxweld burners were used steadily, a third being kept in reserve. All of the steel was sold in car-load lots, and was cut up only enough to make loading convenient. It was all sold for scrap, not being fit for any other purpose.

The new Brooklyn-Brighton viaduct was built and the old one was removed by the Bates & Rogers Construction Company, of Chicago, for whom C. S. Smith was superintendent in charge of the viaduct. The work was done for the Bridge Department of Cuyahoga County, Ohio, of which A. W. Zesiger is engineer. W. H. Baker was resident engineer on the work.

THE STREET-CLEANING DEPARTMENT of Springfield, Ohio, has been completely "motorized," as has its fire department.

Where Possible Would Avoid Muskeg Swamps

J. L. Pickles Discusses Various Expedients to Carry Railroads Over Them, but Thinks It Much Better to Go Around Them

MUSKEG swamps should be avoided in railroad location as far as possible, in the estimation of J. L. Pickles, chief engineer of the Duluth, Winnipeg & Pacific Railway. While he outlined various expedients in use to carry railroads over these bogs peculiar to the glacial regions of the north, in discussing the subject at the recent convention of the Minnesota Surveyors and Engineers, Mr. Pickles made it clear that he regarded entire avoidance of the deeper bogs as the safest preventive of trouble. To this end he would eye with suspicion stunted tree growth and luxuriant moss, and would take plenty of soundings during location. To avoid the deep moraines he would even risk criticism by locating reverse curves on apparently level ground. He would also try to keep his subgrade as near the original ground surface as possible to eliminate high and heavy embankments. His paper, slightly condensed, was as follows:

ORIGIN OF MUSKEG SWAMPS

When the continental ice cap receded it left vast quantities of glacial drift composed of all sorts of material varying in size from huge boulders weighing several hundred tons down to an impalpable powder-forming clay. It is owing to this glacial invasion that the surface differs from the normal type in the minor topography and drainage. The whole plateau is deeply covered with glacial deposits, which have disarranged the drainage so that there are abundant lakes, swamps and muskegs. Overlying the glacial drift and under the swamp is usually found a stratum of impervious blue clay.

As the ice melted, the materials were deposited as a mantle of glacial drift. These were deposited in moraines and in a very irregular manner, so that the topography of the country did not conform to the usual regularity presented by country formed by the erosive action of water. Huge quantities of ice were left embedded, afterward melting, which formed large circular depressions or kettles. These became filled with water in the form of lakes. The muskeg is of recent formation and is composed of decayed moss and various vegetable growth, which, by constant decay and renewal, gradually filled the depressions, until we have what is known to-day as muskeg swamps.

AMPLE SOUNDINGS SHOULD BE TAKEN

As the added formation does not bear the regular contours usually found, it is very necessary in determining locations over these swamps that a thorough investigation should be made to determine the contours of the hard bottom. We are too apt to take it for granted that the muskeg is but a shallow formation, and trust our road to be supported by the decayed vegetation, rather than to accept the country surrounding these swamps, which is invariably covered with very thick vegetation. There is a great temptation to run our lines through the open country in order to avoid a more difficult location on higher ground. In locations over such swamps it would be well for the engineer to proceed in the same manner as he would in locating over frozen lakes, and not trust the moss covering to support his line until he has thoroughly tested the same and ascertained what the bearing value of the soil is. In testing it will quite often be found that the surface is floating and the lake is not yet filled to the bottom. In such cases disaster is sure to follow unless adequate measures are taken to support the track. It would be much better to introduce curvature in the alignment, in order to keep the location over shallow swamps, than to produce long tangents crossing over deep pockets. It would, of course, take a great deal of stamina on the part of any engineer to introduce apparent reverse curves on what appears to be level ground; but while this would undoubtedly cause a great deal of criticism of his location, it would in some instances be a very great economy.

VEGETATION AS AN INDEX

Generally speaking it will be found that the smaller the tree growth and the more luxuriant the growth of the moss, the deeper will be the muskeg, but I have not as yet been able to ascertain anything more than a very approximate depth by such observations. The areas found void of tree growth should be regarded with suspicion, as this usually indicates deep and recent formation, and quite often indicates floating bog.

It has been found in some of the lines already constructed that, had adequate soundings been made previous to final locations, a great deal of money could have been saved over what was necessarily spent to bring the road up to the required standard after operation was begun. As a concrete example, I would like to draw your attention to a line, heavily corduroyed, which broke through before traffic was started. Soundings taken on the center line after the failure showed a depth of about 60 ft. to apparently hard bottom. About 83,000 yd. of material were required to bring the track above water. A great deal of time and money was lost, due to the failure of the surface. All of this would have been avoided had adequate soundings been taken during the location, and money and time lost in this one instance would have been much more than required for the entire line.

In railroad construction over muskeg swamps, the methods in general use are:

1. To follow out the usual form of construction, laying the track directly on the surface and afterward ballasting up to grade.
2. To corduroy or crossway the surface, using long timbers, laying them in alternative layers parallel and transverse to the line, afterward bringing the track to grade with ballast.
3. To excavate ditches along the side of the line, using the material excavated to form embankment.
4. To use sawdust, cinders or other light material, floating the line over and depending on the buoyancy of the muskeg for support.
5. To fill to the bottom with logs and timber.
6. To fill with excavated material.
7. To use a bridge.
8. Where considerable embankment is to be carried over the swamp, to drive piles on about 4-ft. centers, cap them with timber grillage and construct the fill on the same.

Drainage

Drainage is often resorted to with very beneficial results. However, in many instances where deep muskeg is encountered, it is not practical to drain, due to large lakes in the vicinity and exceptionally heavy expense required due to great length of ditches which it would be necessary to construct. Ditches cut in muskeg are prone to close, and it is a constant source of expense to keep them open. Again, it will usually be found that there is no place to stop the ditch without carrying it to an unreasonable distance. And while such ditches are always of more benefit to the surrounding country than to the roads constructing them, they invariably bring on a system of suits in which the company is usually the loser. It is for this reason alone that many of the swamps in the northern part of the state [Minnesota] are not drained.

Whatever the construction decided upon, it must be borne in mind that a good foundation must be obtained, otherwise there will be a constant source of expense and trouble from rail running, causing broken rails, derailments and a constant settlement, which will result in very heavy maintenance charges.

In locations over this country, it is well to keep the grade as near the surface as good drainage will permit, in order not to overload the surface by the weight of heavy embankments, which are apt to break through the surface and in some instances will cause rupture through the underlying strata into the substrata, which are of an older formation but not yet solidified sufficiently to carry the increased load.

Swamps are like wrecks, there are no two of them alike, and they are very good things to avoid if at all possible.

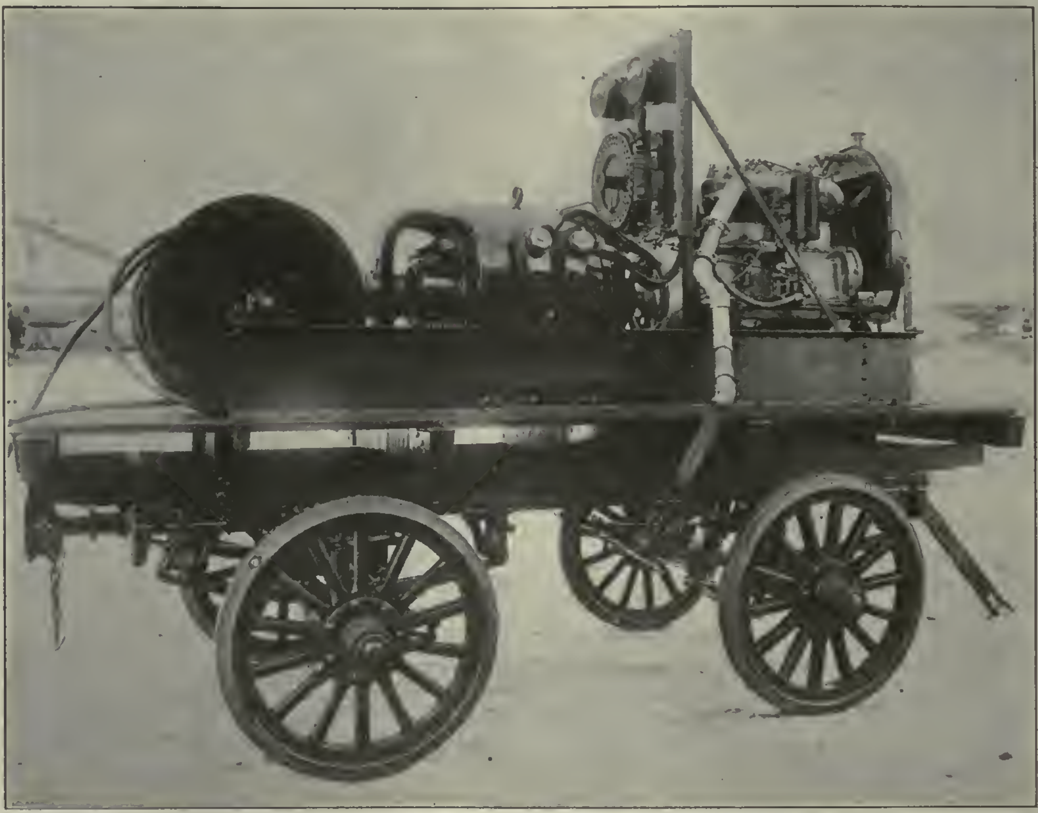
California Bridge Fails When Wreckage Lodges Against Pier

THE HIGHWAY bridge across the San Luis Rey River, San Diego County, California, was 690 ft. long and consisted of six 100-ft. arches and the two approaches. The structure was supported on concrete piers, which in turn were founded on piles with tops cut off below low-water level. It is reported that when the flood of Jan. 27 was at its crest, a piece of wreckage resembling the floor of a small highway bridge drifted down and lodged against the center pier of the structure. The current held it in place and other drift swept against it so that it was forced into a vertical position. In this position it deflected a strong current downward which seemed to produce serious scouring effects, as not long afterward the center pier was moved downstream and disappeared beneath the flood. After the collapse of the central arches the others soon followed, and the bridge was completely carried away from shore to shore.

St. Paul Builds Equipment for Thawing Frozen Pipes

Apparatus Mounted on Truck, Which Is Used for General Service in Summer, Clears Ice-Clogged Mains in 15 Minutes

A THAWING outfit, put into service within the past month, has enabled the St. Paul, Minn., Waterworks Department to thaw out any frozen water service on which it has been tried within a maximum of 15 min. In one case a temporary main, thawed out in this time several weeks ago, had also been frozen the previous winter, but on that occasion the residences served were without water for four days. The apparatus consists of a gasoline engine direct-connected to a generator, a switchboard and a reel of cable, the whole mounted on a structural steel frame, so that it can be handled as a unit.



THIS APPARATUS THAWS FROZEN WATER SERVICES IN FROM 5 TO 15 MINUTES

Details of Thawing Unit

The arrangement of the equipment is clearly shown in the accompanying illustration. The four-cycle, four-cylinder gasoline engine, built by the Capitol Engine Works, St. Paul, is direct-connected by a leather-link flexible coupling to a Roth Brothers 20-kw. 40-volt direct-current generator. A voltmeter, an ammeter, a rheostat and a single-pole knife switch of 500-amp. capacity are mounted on the switchboard. The reel holds 500 ft. of extra-flexible copper cable of 300,000 circ. mils cross-section, in 100-ft. lengths. Each length is fitted with terminal lugs. The various parts of the equipment are securely attached to the steel frame, making the equipment easily portable. For service the equipment is mounted on a Troy trailer of 1½-ton capacity, which is hauled about by a motor truck. The mounting is not permanent, and after the winter season the thawing unit will be removed and the trailer used for other purposes.

Method of Using

To thaw out a service one pole of the generator is connected, in the premises, to the pipe between the meter and the street main. The other pole is connected with the nearest fire hydrant. Thawing is effected in from 5 to 15 min. after the current is turned on.

When the construction of the thawing unit was originally determined on by G. O. House, general superintendent of the department, a design was considered whereby the generator would be driven through the medium of a belt from the engine of a motor truck. The mechanism would have been so complicated that this design was abandoned in favor of the scheme carried out.

The apparatus was developed under the direction of Mr. House, and was assembled by E. L. Sudheimer of St. Paul.

THE CROSS-SECTIONING AND TRACK INVENTORY WORK in the federal valuation of the Boston & Albany Railroad has been done mainly by men in the employ of the railroad, the government merely having a recorder with each party, stated J. C. Irwin, assistant valuation engineer of that road, before the Boston Society of Civil Engineers, in discussing the paper by F. C. Shepherd, valuation engineer of the Boston & Maine Railroad, on the valuation of the Boston & Maine. (See the Engineering Record of Oct. 30, 1915, page 538.) Usually, on other roads, the government has been providing the party and the railroad has furnished a pilot only.

What Is an Engineer?

Carnegie Foundation Sends Out Second Letter to Get Views as to Relative Value of Technical and Other Attributes

AS ANNOUNCED by Prof. C. R. Mann of the Carnegie Foundation at the recent annual meeting of the American Society of Civil Engineers (see the Engineering Record of Jan. 22, page 125), the Foundation is sending out a second circular letter and mailing card to the members of the engineering societies to get further light on the question, "What is an engineer?" The letter is as follows:

DEAR SIR: Last spring we consulted you on the subject of engineering education, concerning the qualities that you look for in young engineers and the general effectiveness of the engineering schools in producing such men as you want.

The replies that have been received mention many factors that are essential to the successful engineer. These essential factors fall naturally into the following six groups, which are named in the order of their importance as determined by their frequency of occurrence in the replies.

1. **Character, integrity, responsibility, resourcefulness, initiative.**
2. **Judgment, common sense, scientific attitude, perspective.**
3. **Efficiency, thoroughness, accuracy, industry.**
4. **Understanding of men, executive ability.**
5. **Knowledge of the fundamentals of engineering science.**
6. **Technique of practice and of business.**

If this is a correct definition of the essential characteristics of an engineer, it furnishes the necessary basis for a rational discussion of the effectiveness of the schools. It can also be used as a standard in developing staff organizations and curricula, and in selecting efficient methods of instruction.

The best way in which engineers can aid the schools in solving problems in connection with engineering education is by defining the product which they desire. We therefore urge you to contribute to this important cause by numbering the six groups on the inclosed card in the order of importance which you give them in judging the reasons for engineering success and in sizing up young men for employment or for promotion.

Yours very truly,
C. R. MANN.

P. S.—We shall be glad to keep you informed of the progress of this study if you are interested.

The mailing card gives the same six groups, in the same order, but omits the numbers and asks the voter to indicate the order of importance he gives them at the beginning of each line. The voter is also asked to give his name and address, and the number of years he has been in practice.

Readers of the Engineering Record are invited to vote on the matter, sending their replies to the Carnegie Foundation for the Advancement of Teaching, 576 Fifth Avenue, New York City.

A TOTAL OF 24,000 TONS OF EXHIBITS, constituting practically all of the displays at the Panama-Pacific Exposition, have been shipped from the exposition. Of this total about two-thirds has been handled by outgoing railroads and the remainder by steamship lines.

Concrete Flows Under Sustained Load

Earl C. Smith Cites Results of Tests of Concrete Beam and Cylinders Showing Continued Increase in Deformation with Constant Load

THAT CONCRETE subjected to long-continued sustained loads exhibits a continually increasing deformation or "flow" is shown by Earl B. Smith, associate mechanical engineer, U. S. Office of Public Roads, Washington, D. C., in a paper presented at the annual meeting of the American Concrete Institute. The paper is here reproduced practically in full:

HOOKE'S LAW ONLY APPROXIMATE

The ordinary conception of the behavior of materials under stress is that it follows Hooke's law for both increasing and decreasing loads within the limit of elasticity. As a matter of fact, this straight-line relation between stress and deformation is only approximately true for any material. There is an elastic-hysteresis phenomenon (see the article by the author on "Elastic Hysteresis" in the Engineering Record of May 17, 1913, page 561) in all cases of loading and unloading a material which makes the relation between stress and deformation only approximately constant.

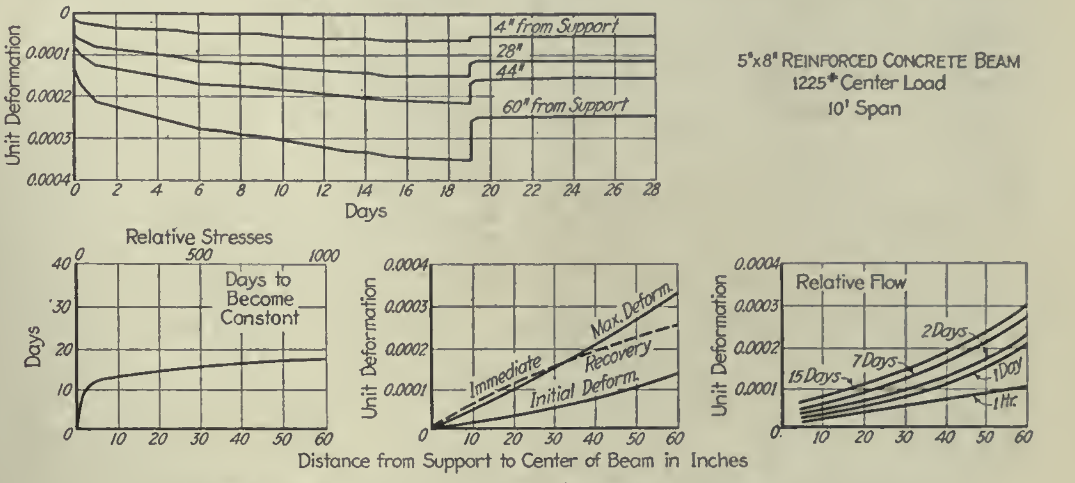


FIG. 1—CONCRETE BEAM SHOWS CONTINUED DEFORMATION UNDER CONSTANT LOAD

Although structural metals do not exactly follow this straight-line law, they so nearly do that stress computations based upon their deformations are approximately constant and independent of any time factor. It has long been realized that the deformations of stressed concrete are not even an approximately constant function of the stresses, but the effect of any time factor or of continually sustained loads has been almost entirely overlooked.

While making some tests on large reinforced-concrete slabs, in August, 1914, the writer noticed the large variation in the concrete deformations under a constant stress, and was unable to make any check readings after an elapsed time of one hour or more, even when the temperature and moisture conditions were constant. After considerable search for the cause of these variations there was discovered an apparently definite relation between them and the elapsed time. Several experiments were made with the object of determining the amount of "flow" in the concrete, with respect to the time factor, under sustained loads.

DESCRIPTION OF TEST BEAM

A 5 x 8-in. reinforced-concrete beam was cast, and at the age of about two weeks was placed on two supports of 10 ft. clear span and loaded at the center with a single concentrated load of 1225 lb. The effective depth was 7 in. and the reinforcing amounted to approximately 0.75 per cent, and consisted of five ¼-in. Havemeyer rods. The concrete was 1:2:4 gravel.

The strain-gage points were placed 8 in. apart on the top of the beam, which permitted readings to be made along its whole length and thus give the concrete deformations for different fiber-stress values. The beam when loaded had a computed fiber stress of approximately 1000 lb. at the center section, 60 in. from the support; the fiber stress at the 30-in. section would then be about 500 lb., and at other sections in proportion to their position.

RESULTS OF TEST

The results of this test are shown graphically in Fig. 1. The flow of the concrete for four fiber-stress values (which are indicated by the position of the strain-gage points in inches from the support) is shown in the upper curves. The load was sustained at the constant value of 1225 lb. for 19 days and then released, deformations being read once each day. The first day the deformation readings were taken every two to four hours. These curves contain in their results the effect of the natural contraction of the concrete while hardening.

When the deformations become constant, the flow has attained its maximum value and has ceased. The time necessary for this to occur under the different stress values is shown by the curve in the lower left-hand corner. It should be noted that it has required about two weeks for concrete to attain its maximum deformation with a fiber stress of 500 lb. under the conditions of this test.

The group of curves shown in the lower center indicates the initial deformation, the maximum deformation and the initial or immediate recovery of the beam for the different stress values. The relative flow for the different stress conditions at different elapsed times from the application of the load is shown in the group of curves in the lower right-hand corner of Fig. 1. These curves indicate the large increase of deformation which may be expected for short-time lapses.

The flow of concrete under a simple compressive load was obtained by testing a cylinder loaded to 700 lb. per square inch. The cylinder was 6 in. in diameter and 24 in. long, of 1:2:4 gravel concrete. The strain-gage points were 20 in. apart, and readings were made once each day. A companion cylinder exactly like the first and prepared in the same manner was used, without being loaded, to obtain contraction data for correcting the deformations of the loaded cylinders, thus giving the net flow due to the load. These cylinders were cured for 29 days in wet sand, and then allowed to dry out for 7 days before beginning the test.

The results on these dry cylinders are shown by the curve *A* in Fig. 2, which gives the values of the net flow. The curve is corrected for contraction effect. A second set of companion cylinders of the same size were tested in exactly the same manner, except that they were kept saturated. The flow results on these wet cylinders are shown by curve *B*, Fig. 2, the net flow only being shown.

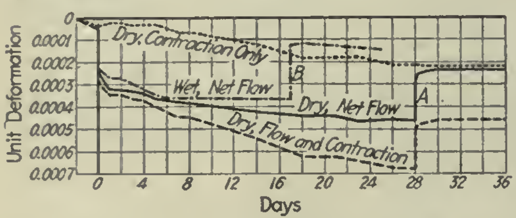


FIG. 2—CONCRETE CYLINDERS FLOW UNDER CONSTANT 700-POUND UNIT STRESS

Two Factors in Deformation

The deformation of concrete due to stress contains two factors, one of which is probably somewhat elastic, and the other a molecular displacement or flow; the magnitude of the flow factor is dependent upon the time.

The determination of stress values in concrete structures from the deformations of the concrete is rather questionable, and entirely dependent upon the time factor. Stress values obtained from initial deformations, within only a few minutes after the application of the load, are probably more nearly true than later determinations. The value of the modulus of elasticity to be used in this connection should be determined on a specimen loaded at the same rate and with the deformations read after the same time lapse.

Effects of Flow

The effect of flow in most cases is to change or relieve the stress value; where this is impossible there is a gradual change in the length of the member, continuing possibly for several weeks.

In the case of a concrete beam with anchored or confined ends, the temperature stresses are supposed to be very large; but since the temperature expansion is slow, there is time for flow to occur and thus relieve the stress. The amount of relief may be from 25 to 80 per cent of the computed temperature stress, depending on the relative magnitude of the stress and the time factor.

This phenomenon of the flow of concrete may explain the abnormal stress conditions which apparently exist in some structures. Concrete roads and pavements, constantly subject to expansion and contraction, due to moisture and temperature, in many cases do not crack where they apparently should. Concrete arches may also be largely protected from excessive temperature stresses by the flow of the material.

This subject needs much investigation to establish its exact effect and magnitude before it should be considered as a factor in design. At present it should be used only as a possible explanation of certain deformation and stress phenomena.

Letters to the Editor

Comment on matters of interest to engineers and contractors will be welcomed

Greenheart Timber for Canal and Harbor Works

SIR: In your issues of Jan. 29 and Feb. 6, pages 149 and 180 respectively, A. K. Armstrong points out the exceptional merits of greenheart timber and gives a valuable summary of its properties.

The writer has never been able to understand why this remarkable material has remained almost completely unknown in the United States. In Great Britain and the Continent it has long been the standard timber for high-grade harbor works, and has also been extensively employed in South America, India and elsewhere. It has great strength and stiffness, and its durability even in very moist and hot climates is remarkable, while its resistance to the attacks of marine borers is greater than that of any other timber suitable for engineering works. In some English lockgates greenheart has remained in excellent condition after more than 100 years of use. It would, therefore, appear to be exactly the material needed, in the teredo-infested waters of our Atlantic Gulf and Pacific coasts, and for trestles in hot and humid parts of the country.

Nor need the question of cost stand in the way. In heavy and medium sizes it can be delivered in the United States at prices not exceeding $60 per 1000 ft.b.m., or about the cost of creosoted yellow pine of the same dimension.

Mr. Armstrong refers to the use of greenheart on the Panama Canal. It must be confessed that the amount used there was not very great, less than 150,000 ft.b.m. in all. It was employed only for the sills and fender timbers of the mitering lockgates, and the quoin and miter posts of the drydock gates. For these parts it was recommended by the writer after a personal inspection of greenheart gates at Cardiff and other British ports. The Panama gates were too large to be built entirely of timber, though greenheart gates are probably more desirable as a whole than those of steel.

The timber used at Panama came from Georgetown, British Guiana, only a few hundred miles from the Isthmus, but, strange to say, was shipped via New York, owing to lack of direct steamer lines. It was inspected by a local engineer who had inspected all the greenheart for the Manchester Canal, and the cost of the inspection was moderate.

The separate pieces came to the Isthmus smoothly planed. The ends were painted and, in some cases, banded with hoop iron to prevent checking in the hot sun. It was also deemed wise to store them under water in the lock sumps until required by the erectors. No difficulty was met with in obtaining a watertight closure at the sills.

Greenheart is handled by few American firms, but may be obtained through brokers in New York, Philadelphia or London, or by direct correspondence with the mills through the American consul at Georgetown, Demarara.

It is to be hoped that Mr. Armstrong's interesting article may lead to greenheart being tried on a fairly extensive scale on some large work in the United States.

HENRY GOLDMARK,
Consulting Engineer.
New York City.

The Economic Side of Sand Testing

SIR: I have read W. B. Fuller's notes on the criticism of Chapman and Johnson's article on the economic side of sand testing, which I recently offered (see the Engineering Record of Feb. 5, page 188, and that of Feb. 19, page 260) and am pleased to note that the "blended mixture" adopted by me proved to agree so closely with the "ideal" as brought out by Mr. Fuller's later investigations.

I wish to correct, however, Mr. Fuller's impression as to my "error in attempting to apply Fuller's ideal curve for concrete, to any mixture of cement and sand alone." If Mr. Fuller will read my criticism again, he will perceive that I assumed no responsibility as to the advisability of applying his methods and curves to a mortar, neither did I make any criticism upon that point. I simply pointed out an error in the method used by Chapman and Johnson in the mechanical application of Fuller's theory to an actual problem and proved my contention by actual tests.

With regard to the larger subject, the proper grading of sands for mortars for use in concrete, I have always contended that an ideal curve for cement, sand and stone would not necessarily be correct for cement and sand alone and could not be so used except by reasoning by analogy, which is generally an unwise thing to do.

In the writer's opinion, based upon the results of a considerable number of tests of Indiana sands, the "uniformly" graded or straight-line curve is very nearly the best grading for any given sand for mixtures within the commercial ranges of proportions of cement. However, the writer is inclined to agree with the authors of Technologic Paper 58, Bureau of Standards, in their statement that the so-called "maximum density curve," which is a combination of the straight line and ellipse, does not represent the curve for maximum density except for the particular materials in the tests from which it was derived or very similar materials.

Since there are few natural sands which approximate a straight-line grading, and the sands artificially so graded are in many cases a commercial impracticability, it has been the writer's aim in some recent tests to determine how far above the straight line the curve of the sand may fall without a too great loss of strength and density in the resulting mortar. The investigation also will attempt to determine the equally important question as to whether the relative value of several fine aggregates can be determined by testing them in mortar mixtures. A sand which is so graded as to give maximum density and strength when used in a mortar may or may not give the best results when tested in the combined state with any given coarse aggregate.

H. H. SCOFIELD,
Assistant Professor, Materials Testing,
Purdue University.
Lafayette, Ind.

How to Become an Effective Public Speaker

SIR: Technical journals have repeatedly of late brought to the attention of engineers the value of facility in public speaking. As a rule, however, no attempt has been made to indicate the course to be pursued in developing the desired facility. Possibly, then, some personal experiences and some rules adopted by the writer may be of value to your readers.

Since early manhood the writer has had a very wide experience in addressing both small and large assemblages. While his ability as a speaker may be to some extent a natural gift, it has been developed by arduous work.

For years the practice has been cultivated of making up imaginary speeches, as a pastime, in walking about on business errands or for pleasure. A situation would be imagined and a speech formed to fit the occasion. In this way versatility and readiness have been developed. The plan is recommended to those who are sincerely desirous of developing facility in public discourse.

As a result of experience—of successes and failures—the writer has formulated rules which a speaker will do well to observe.

1. Always prepare well for an address. Short speeches—remarks, they might be better called—need not be written. It is necessary, however, to determine carefully in advance the line of thought to be developed. It is well to make brief notes so that the logical sequence will be observed and none of the important points missed. These notes, written on a small card, may be carried in the pocket or held in the hand when speaking.

2. The important parts of longer addresses had best be written, so that their strong features may be well developed and emphasized. Very important addresses may be written in full. Under no circumstances, however, should the written portions of the address be within the speaker's reach while on the platform. If they are at hand, there is strong temptation to follow the wording slavishly, thus putting a double burden on the mind—the necessity of remembering both the line of thought and the actual words. Vigorous expression, under such circumstances, is impossible. It is best to talk from notes, intent only on presenting the idea, letting the words come as they will.

3. Never *read* a paper. An address from notes is far more effective. If the character of the occasion demands a very scholarly address, the manuscript may be carried to the platform, but the line of thought should be so well in mind that the paper is used only for reference. In no other way can a telling address be delivered.

4. Never speak on a subject unless thoroughly familiar with it. Of course, one is not always forewarned, and extempore remarks are sometimes necessary. However, refuse absolutely to be tempted to talk extempore unless the subject is well in hand. Only then will the words come easily.

5. Unless the subject is unusually important, and there is to be but one speaker, do not speak longer than twenty minutes.

6. If the address is to be short—not over ten minutes—it is well to develop only one idea. That is the best way to grip the audience. They must catch things quickly. Two or three lines of thought confuse or tire them, and at the end of the address no salient point stands out clearly in their memories. To make a lasting impression, develop only one idea, presented, if you will, from various angles.

These rules relate to the preparation of an address. The four following suggest specific means of holding the attention of the audience:

1. Talk straight at the audience.

2. Mean everything you say and put your whole personality back of your words. Let your voice and your facial expression be in harmony with the seriousness, the determination, the enthusiasm, the horror, the graciousness of your words.

3. Be in a fine physical condition. Forceful public speaking is a hard physical strain. When one is nervous or weak, strong expression is impossible.

4. Use gestures if you can, but only if they come naturally.

The writer would add that but comparatively little time is needed to develop effectiveness. Odd moments and idle time when walking to business engagements can be profitably improved by picturing situations and framing a few remarks to fit the occasion. In the writer's case, the time that he has devoted to developing effectiveness on the platform has been repaid a hundredfold.

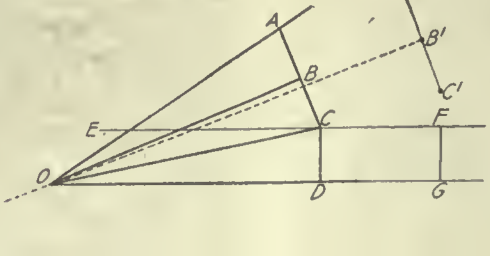
ENGINEER.
New York.

To Trisect an Angle

SIR: Your "impossible" "ruler and compass" man cannot trisect an angle, for he needs a scale and a couple of triangles. People who have occasion to trisect angles usually have tools enough to do their work. Particularly do I want to show my appreciation for the efforts of the two gentlemen who had the ambition to try the "impossible."

Here is a drafting-room method that you will find quite accurate and theoretically true.

Take any angle *AOG* and parallel to one side, as *OG*, draw a line *EF*, whose point *F* is visibly below the point of trisection of the angle. Then with two triangles back to back, or with a piece of transparent material with the line *OB'* marked on it aud *A'* and *C'* located at right angles to *OB'* and at a distance each of *FG* from the point *B'*, slide along with the line *OB'*, always passing through *O* until *A'* and *C'* rest on the lines *OA* and *EF*, respectively. Mark the point *B'*, now *B*; *A'* becomes *A* and *C'* becomes *C*.



Draw radial lines from *O* through *B* and *C*. These trisect the angle.

Proof: $FG = CD$; $BC = AB = CD$ by hypothesis.

It will be noted that the three right-angled triangles are similar and equal, having two sides evidently equal to the same triangle, hence equal to each other. This will work even on an angle of 180 deg.

JNO. E. WALKER,
Office Engineer, El Paso & Southwestern System.
El Paso, Tex.

SIR: In the letter published in the Engineering Record of Jan. 8, 1916, page 57, a construction was proposed for the trisection of any angle. It has of course been well known for many generations that (as was remarked in the consequent letters in the issue of Jan. 22, page 122), with the exception of a few special cases, such as angles of 90 deg., the trisection of an angle by direct work with straightedge and compass is not possible, but that some of the attempted constructions are fairly close approximations. Accordingly, being curious to ascertain the amount of the error resulting from this proposed construction, during a leisure afternoon I carried out the rather lengthy series of trigonometric computations necessary to determine the error for each of a series of angles increasing by 5 or 10 deg. differences from 0 to 180 deg.

If the angle is very small, near zero, the error of this construction is an infinitesimal percentage of the angle; if the angle is acute, the middle "third" as determined by the construction is greater than the portions on each side; the error is greater for larger angles up to angles of about 50 deg., when the middle one of the alleged thirds is about 10 min. greater than each of the remaining angles or arcs; the error is less for larger acute angles up to 90 deg., which is correctly divided, but 90 deg. can be exactly trisected by other very simple methods. If the angle is obtuse, the middle portion is smaller than the other two, the maximum difference being about 11 min. and occurring with angles of about 120 deg.; an angle of 180 deg. is precisely trisected, but simpler constructions will also do that.

In other words, if an angle is divided according to this proposed construction, and if absolutely perfect mechanical work can be done, no one of the parts will be as much as 8' greater or less than a correct third of the whole angle; this is an unusually close approximation that has been happened upon. But when it is considered how many steps there are in the construction, each of which necessarily introduces a slight inaccuracy in the mechanical work in addition to the original theoretical error of the construction, it is seen at once that by successive approximations with a pair of dividers an arc or angle can be trisected much more accurately in a quarter of the time that this construction would require.

The same remark will apply to the construction for trisecting an angle described by a letter in the Engineering Record of July 31, 1915. That construction like many others proposed for the same purpose, gave theoretically correct results, but required in the process the construction of one of the curves of higher than second degree, which if a draftsman is equipped merely with straightedge and compasses or dividers can be obtained only by marking out a series of points on the curve and drawing the curve through them freehand; this is more laborious and less accurate mechanically than the method of trisection by successive trial with dividers, which will quickly give results so close that the error is inappreciable or invisible, although it is mathematically not a method but mere guesswork.

E. F. Chandler,
Professor of Civil Engineering, University of North Dakota.
University, N. D.

[The Engineering Record has received other interesting approximate solutions of this problem, but believes it will be necessary to terminate the discussion at this point.—Editor.]

Writing Land Descriptions

Sir: I am very much interested in Mr. L. L. Mills' letter entitled "Writing Land Descriptions," which appeared in your issue of Feb. 19, page 260. Mr. Mills is discussing this matter along the right line, but he does not go far enough.

For a number of years I have been actively engaged in land surveys in the Virginias where the rectangular system of land surveys is not in vogue. During the last two years I have been surveying mountain lands for the U. S. Forest Service and have adopted their methods. In our work it is, of course, necessary for us to get our data from which to work from the county records, and these descriptions have, in the majority of cases, been quite inadequate to locate properly the tracts on the ground. In fact, in a number of cases, the old descriptions do not in the slightest degree describe the tracts as they actually exist on the ground, and it thus taxes to the utmost the ingenuity of the surveyor when he attempts to retrace the old lines on the ground, and in some cases after he has finally located the tract he can not feel certain that he has it located as it originally existed.

This state of affairs is caused almost exclusively by the incompetence of the surveyor before him, who in most cases was one who should not have been allowed to make land surveys. In this state there are no licensed surveyors, consequently, any layman who can peep through the sights of a compass and can read a compass needle, buys or inherits an old compass that might have been a good one in its time, takes it to a blacksmith shop, repairs it with steel screws or bands, sticks out his shingle and is a finished land surveyor. When he writes his description, the important things in his mind are the bearings and distances, which in a large measure are incorrect, and he pays very little, if any, attention to the local description and seldom mentions such a thing as a permanent monument. The fact is, he does not want to leave any marks so that a competent surveyor can check him up. Even when he does leave a mark on the ground, it is very difficult to locate because of the inaccuracy of his actual work of surveying and keeping notes.

The county surveyors oftentimes are just such surveyors, who are hale-fellows-well-met with the political party in power, and they are elected to fill these important positions. Their incompetency causes more litigation and strife over property lines and titles to real estate than all other causes combined.

Laws should be enacted taking these positions out of politics entirely and making it necessary for a surveyor of real estate to pass a state examination before he is qualified to do such work, then issue him a license allowing him to do land surveying as a profession. This examination should be a rigid one and only those who certify that they have had at least two full years' actual experience in land surveying as a subordinate should be allowed to take such an examination. At the same time a fixed standard or book of instructions should be issued covering the requirements of a description before it could be admitted to record, and all licensed surveyors should be required to follow these instructions so far as possible.

Then the licensed surveyor or other person qualified to test the accuracy of the description and survey could pass upon and accept or reject the description for recordation as his judgment and experience directed him.

It is hoped that other land surveyors will discuss this matter from its many sides so that the lawmakers may get the experiences of those who have had these problems to deal with as well as their suggestions for remedies.

A Forest Service Surveyor.

Sir: The condition described by Mr. Mills in his letter in the Engineering Record of Feb. 19, page 260, with reference to the descriptions contained in deeds is undoubtedly quite generally true in all parts of the country.

What constitutes a proper description in a deed is perhaps a mooted question, and except in states where title may be acquired by Land Court registration, the requirements for a description in a deed are, generally speaking, that it describe the land sufficiently to identify it. The variety of descriptions that one encounters in examining deeds, and especially those of country districts, indicates very plainly that the provisions of law which require the description to be sufficiently accurate to identify the property are used in a very elastic manner. Identification ought not to presuppose a historical knowledge of the premises, and yet in many deeds, and perhaps the average country deed, the description is so loosely drawn that it is very difficult and sometimes impossible to identify the premises except with the aid of persons who have an intimate knowledge of the same. The same descriptions are handed down generation after generation, referring to walls and fences which have ceased to exist, and to stakes and trees which, because of the intervening years, have decayed. Present abutting owners are seldom referred to, and oftentimes the present name of streets, railroads, streams and other boundaries are omitted as well. Except by visiting the premises no idea is gained as to the extent of the boundaries, owing to a lack of measurements.

In Massachusetts the provisions of law with reference to the registration of land titles by decree of the Land Court offers, perhaps, an ideal solution of the situation. Briefly stated, some of its important features are as follows:

1. The title is examined by expert examiners appointed by the court.
2. The applicant shall file with the application a plan of the land.
3. The plan is prepared in accordance with the explicit requirements of the court and it is required that:

(a) The title state the location, scale, date, name and address of the surveyor.

(b) There be shown the north point, area, town or county lines, name of adjoining owners, passageways, railroads, official street lines, fences, walls, buildings, boundary monuments and any other natural monuments pertinent to the purpose.

(c) In addition to buildings on locus, there be shown such part of all buildings and other physical features on adjoining land as are within ten feet of the boundary line.

(d) The plan have plainly indicated upon it the manner in which each corner, property line and reference point is marked upon the ground.

(e) In addition to the above, there be indicated the measurements and direction of the boundaries—and the precision with which the plan must be executed is carefully laid down by a set of rules issued by the court in which the degree of precision is adjusted by the value of the property, varying from city surveys to timber and isolated properties. The court also orders a sufficient number of permanent monuments to be erected to reproduce all the boundaries.

After the title has been examined, the plan prepared, all interested parties heard, and all other formalities observed, the court issues a decree, in which is included a description of the property in accordance with the plan.

While registration of land by decree of the Land Court is optional with the parties in this state, and requires some stipulations which might be inequitable to owners of isolated and low value properties, it nevertheless offers some fundamental features which ought to be mandatory upon all parties desiring to convey property. Undoubtedly some statute could be indicated which would standardize the preparation of descriptions contained in deeds having due regard to the value of the property involved.

In Mr. Mills' concluding paragraph he indicates in a general way what requirements are necessary to write a description. In this connection it may be said that too many surveyors are ignorant of the many legal features involved in the preparation of plans for conveying property. Many properties abutting on highways, streams and railroads are affected by state, county, city and town authorities which have the right to acquire land by the right of eminent domain. It is also to be assumed that the conveyancer must have in addition to the above some knowledge of surveying principles in order that a correct interpretation may be put upon the plan.

J. Henry Duffy.
Cambridge, Mass.

To Protect 7-Foot Steel Girders on the outside and avoid the great increase in dead load for such deep girders which would result if cast concrete thick enough to be practicable were used, a cement-gun covering 2 in. thick has been applied. As described by L. M. Hastings in the February *Journal* of the Boston Society of Civil Engineers, this coating was applied to the girders at the shop, which were then transported to the site and erected without starting a discoverable crack. The cost was thus successfully reduced below the price for applying the "gunite" after erection.

HINTS FOR THE CONTRACTOR

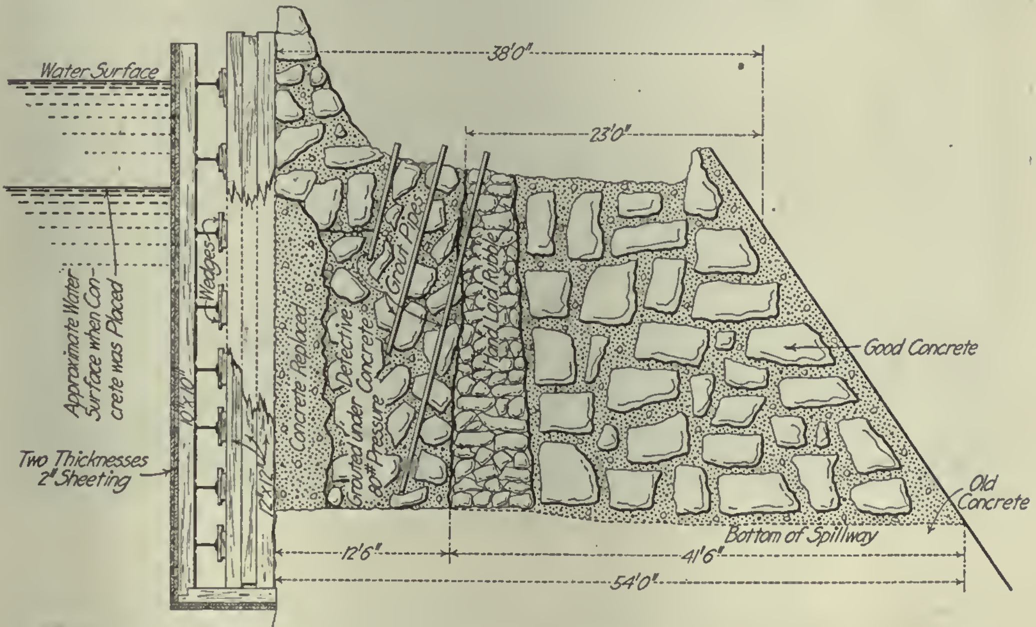
Details Which Save Time and Labor on Construction Work

Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

[*Contributions to this section are solicited, and if found available will be paid for. They must be* SHORT, *and should be accompanied, if possible, by photographs or sketches.*—EDITOR.]

Wood Coffer Against Back of Dam Used in Replacing Masonry

TWO temporary spillways left in constructing the La Boquilla dam of the Northern Mexican Power Company, Ltd., were closed under a considerable head of water by constructing timber shutters across the upstream openings, building a rubble masonry wall across them and filling the space between wall and shutter with concrete in which large stones were bedded. The masonry placed in this space was laid under water, as the shutters could not well be made tight. The east spillway was deeper than the west, and the masonry proved so porous that it was not practicable to grout it. G. G. Underhill, chief engineer, and Edwin Duryea, Jr., consulting engineer for the power company, then decided to replace the back face of this masonry, doing the work in a timber cofferdam seated against the back of the dam. The method is described by them in a recent issue of the *Cornell Civil Engineer*.



COFFER SEATED AGAINST BACK OF HIGH MASONRY DAM WAS BRACED WITH VERTICAL TIMBERS

The construction of the dam, which is in the State of Chihuahua, Mexico, had been delayed by the difficulty of securing cement. Meanwhile the reservoir filled so that at the time the 33-ft.-wide east spillway was closed it was passing water at a depth of 20 ft. The volume of water descending into the gorge below at high velocity menaced the foundations of the powerhouse, 140 ft. below the spillway floor. By the time it was decided to remove the porous masonry from the back of this spillway section cement had been secured, the dam had been carried considerably higher and the reservoir had filled to about 33 ft. above the bottom of the section to be repaired.

A cofferdam 46 ft. high and braced with horizontal I-beam stringers inside vertical studding was used. Over the latter were nailed two layers of 2-in. plank covered with canvas. Because there was no site convenient for a launchway, the studding, floor and lower part of the sheeting were assembled on shore and handled to place by the two cableways spanning the dam. The cofferdam was completed in place and lowered a few feet at a time as it was built up. On reaching the required depth, the sides and floor of the cofferdam were calked against the back face of the dam with bags, etc., by a diver. Several vertical cross walls of three 12 x 12-in. 50-ft. timbers each were then set and wedged against the I-beams by the diver. These were found far easier to place than crossbraces, and were considered much superior. During the building of the cofferdam it was hung on two 1-in. wire ropes fastened to the floor near the upstream edge and clamped off around blocks hung from eyebolts in the masonry above. These lines pulled the bottom of the cofferdam against the masonry, while the top was held in by short side lines fastened to eyebolts on either side of the section. The lowering was done by two stiffleg derricks, set one on each side of the old spillway, helped when necessary by the cableways. The floor of the cofferdam was weighted with stone to help sink it.

When the cofferdam was in place and braced it was unwatered with three 8-in. centrifugal pumps. As the water was lowered, inclined timber struts were placed from notches in the masonry to blocks bolted to the studs. They were required in addition to the friction of the cofferdam against the masonry to overcome the uplift.

The coffer once pumped out, the work of removing the defective masonry to an average depth of a yard and replacing it with good concrete was readily accomplished, working from the bottom up. This wall provided a solid backing, enabling the interior part of the porous section of concrete to be grouted without difficulty.

Hot Water Aids in Unloading Frozen Sand

By G. W. SMITH

Hodgin Construction Company, Omaha, Neb.

SERIOUS difficulty experienced by the contractor on the Ford Assembly Plant at Omaha, Neb., in unloading sand in freezing weather has been overcome by the use of hot water. Platte River sand is being used, and when it arrives at the site it is frozen solid in the cars. The plant for unloading sand and stone consists of a 1¾-yd. clamshell bucket operated by a stiffleg derrick with a 100-ft. boom which swings between the cars and the sand and stone bins. When the sand is frozen, the clam will not penetrate the frost. Three methods for overcoming this difficulty have been tried, the last being distinctly more efficient than the other two. First, an attempt was made to thaw the sand out by the use of steam, which did not prove very successful. Next, picking was tried, but this method proved too expensive in time and labor. The third and successful scheme is to use hot water obtained from an auxiliary boiler used for heating material. The water is allowed to flow through the boiler under city pressure and through a pipe line to the cars. The water penetrates to the bottom of the cars and thaws the sand so thoroughly that it can easily be unloaded with the clam.

Traveler Derrick Converted Into Cableway Removes Steel Arch

A THREE-DRUM hoist provided an extra fall line which was used as an improvised cableway to extend the reach of a traveler derrick in removing the upper members of the 168-ft. steel arch of the old Brooklyn-Brighton viaduct in Cleveland. The work of wrecking the entire structure was carried out by C. S. Smith, superintendent for the Bates & Rogers Construction Company, and is described on page 326 of this issue. This rig differed from the usual "telegraph," or outhall, in important respects which made for more rapid work. After the traveler had backed over the arch, removing the roadway steel, it was stopped for the time on the end of the 72-ft. span beyond. One of the fall lines was run out to a deadman. On it was mounted a sheave with a hook and frame to which the second fall line was attached for a pulling line. In removing the members of the steel arch the pulling line was slacked till the sheave on the track line reached the desired point. The track line was then slacked and the hook on the sheave frame made fast with a short hitch to the member to be raised. As soon as this member was cut free it was hoisted by tightening the track line and hauled in to the traveler with the pulling line. Here the steel was lowered by the pulling line, the track line, of course, being slacked at the same time, to wagons on the railroad right-of-way below. All of the arch members except the main ribs were burned off and removed in this way.

More Devices for Keeping Centrifugal Pumps Running Steadily

By R. E. POST
Superintendent of Construction, United States Reclamation Service, Meadow Creek, Wash.

IN RECENT issues of the Engineering Record various methods have been suggested for keeping the water in a sump low when using centrifugal pumps. The two devices described below have been used successfully at Keechelus dam, under construction by the U. S. Reclamation Service at Meadow Creek, Wash., on which work the writer is superintendent of construction.

The device first used consisted of a bypass with control valve leading from the discharge just above the pump back to the sump. A 3-in. bypass proved large enough to allow the pumps with 6 and 7-in. discharges to run continuously at less than half capacity. By adjusting the bypass valve the level of the water in the sump could be kept constant at any desired point permitted by the suction. When this method is used it is usually necessary to have the sump sheeted on all sides and the bottom floored, as otherwise the discharge from the bypass is likely to cause erosion.

The second device consisted of a gate valve placed in the suction near the pump and adjusted until the water was held at the desired level. This method is very simple, is less trouble to install than the bypass and is better in that there is no danger of damaging the sump. In addition to keeping the water in the sump constant at a low level it is always a great advantage to keep a centrifugal pump running continuously, as by doing so the principal pump troubles—losing of prime and settling of mud in the suction—are eliminated. If alternating-current motors are used for power, as was the case at Keechelus dam, it is still more advantageous to keep the pump running continuously, as frequent starting and stopping causes the starting-box contacts to give out. Whenever this happens their repair causes an annoying and expensive delay in addition to the direct cost of repairs, which is considerable.

The power losses due to the use of either of the schemes proposed are small as the power decreases with the discharge, although not in the same ratio. In this respect the bypass or valve on the suction is thought to have the advantage of a valve on the discharge, although any scheme is worth while which will allow a centrifugal used on construction work to run continuously.

Pneumatic Mixer Moved as Lining Progressed in Long Tunnel

IN THE San Francisquito Canyon the Los Angeles aqueduct is entirely in tunnel from the Clearwater power plant to plant No. 2, with the exception of an 11½-ft. steel siphon, 1000 ft. long, across Bee Canyon. The total length of the tunnel is about 30,000 ft., about three-quarters of which was lined by hand previous to 1915. It was decided to complete the lining by the pneumatic method, and this work was commenced Jan. 1, 1915, on the day-labor plan. From that date the work progressed satisfactorily to completion, the mixer being located inside the tunnel and moved every 1000 ft.

The cost per yard using the machine was somewhat less than with the hand method of placing, but, on the other hand, a greater quantity of concrete was used. Spaces in the arch and around the timbers that would not be filled by the hand method were tightly packed with concrete by the pneumatic method, engineers in charge of the work affirm, due to the velocity with which the mix was driven from the end of the pipe. This was said to be particularly noticeable in the top of the arch where overbreakage occurred when the tunnel was being driven.

It was decided to use a lining thickness varying from 8 in. to about 18 in. The tunneling in this canyon was almost continuous, the average length between adits being 3500 ft., and it was deemed best to put the pneumatic mixer and connections in the tunnel. It was found feasible to do this and still allow sufficient clearance for the electrically-operated tram cars for hauling material from the portals by enlarging the section somewhat at the points where the pneumatic apparatus was to be installed.

The mixer was supplied with compressed air through a 3-in. pipe line running to a compressor plant consisting of two 550-cu. ft. compressor units. The compressor plant was situated in the bottom of the canyon at a point which averaged about 2 miles from the mixer. From the mixer the concrete was conveyed to the forms through a 6-in. pipe which had a maximum length of about 1000 ft. This length of delivery pipe was used with each new set-up of the mixer, and as the lining progressed the pipe was shortened until the work reached a point within 50 or 100 ft. of the mixer, when the plant was moved on and the full length of the delivery pipe was again used.

The gravel for the mix came from a nearby creek bed whence it was hoisted up an incline into bunkers near the mouth of an adit. Here it passed through a crusher and was loaded into cars. Cement was delivered by the same hoist, and all materials were hauled into the tunnel on tram cars and delivered alongside the mixing plant. At the mixing plant a loading skip operated by an air piston elevated the material for a one-bag batch. Water reached the mixer through a 2½-in. pipe.

The forms used were designed for easy handling, the frame consisting of steel bents on 4-ft. centers supported on timber sills. The bents were made from channel irons joined at the top in the center. The forms themselves were of wood, built in panels and covered with galvanized iron. These were inserted behind the steel bents as the concreting progressed. Ordinarily a section of forms about 75 ft. long was set up and filled each day. Lengths of the 6-in. discharge pipe were removed from the top of the forms when the face of the concrete approached within 2 or 3 ft. of the end of the pipe. In this way, it was affirmed, the concrete was densely packed in the arch.

During the month of May, 1915, a total length of 2356 ft. of tunnel was lined from three setups of the mixing plant. The section of the tunnel was such as to require about 1½ cu. yd. of concrete per linear foot.

SEVENTY-FIVE FEET A DAY WERE LINED BY PNEUMATIC MIXER LOCATED INSIDE THE TUNNEL

The entire crew on one mixing plant consisted of sixteen men, whose assigned duties were as follows: Two scraper drivers, one hoisting man, one motorman, one brakeman, one mix operator, one cement man, two gravel loaders, five men on forms and two handy men.

The machine is being used at the present time to line a section of the pressure tunnel about 4 miles above that referred to in the foregoing, and which contains a large amount of reinforcement. The pneumatic method was chosen for this work because of its advantage in completely filling in around the reinforcing bars.

The work of lining the tunnel was carried out by the city of Los Angeles on the day-labor plan. Part of the work has been done under the general supervision of William Mulholland, chief engineer of the water department, with H. A. Van Norman in immediate charge of the work. The present tunnel lining is being done under the direction of E. F. Scattergood, chief electrical engineer. The pneumatic concrete apparatus is furnished by the Pacific Concrete Placing Company, of San Francisco.

BUILDING CONSTRUCTION IN LOS ANGELES for 1915 totaled $11,888,662 on 7845 permits covering all classes of structures.

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

Imperial Valley Irrigation System Transfer Effected

On Feb. 24, W. H. Holabird, receiver for the California Development Company, telegraphed the chief engineer at Calexico to turn the irrigation system over to the agents of the Southern Pacific Company. This action was taken after the final cash settlement, approved by judges of the Superior Court, in which agents of the railroad handed over to Receiver Holabird approximately $445,000. In addition there was delivered satisfaction of judgment in the case of the New Liverpool Salt Company and the claim of the Southern Pacific Company.

The total consideration for which the railroad company received the property amounted to $3,875,000. The railroad turned the property over to the Imperial Irrigation District and received in return bonds of the latter.

The purchase of the property of the California Development Company ends many years of litigation, which was started following the breaking into the Salton Sea of the Colorado River.

Oregon County to Spend $750,000 on Roads During Year

Following the voting of a bond issue of $1,813,000, for the hard surfacing of 130 miles of main roads, by a decisive majority, the Board of County Commissioners of Snohomish County, Washington, has authorized the sale of $750,000 in bonds to defray the cost of this year's work.

There are, in all, about 700 miles of road in the county, mostly gravel, but the maintenance, under present day traffic conditions, has been excessive. The roads to be paved will cover the main trunk highways, thus eliminating most expensive ones in maintenance cost.

The proposed improvements are expected to be completed in about three years. The preliminary field work for this year's construction is now under way. It is probable that the greater portion of the roads will be improved by one course concrete paving. In most cases it will be 16 ft. wide, except in one or two cases, where for a short distance it will be only 9 ft. wide. The sub-grade will be flat, with a crown of 2 in. in the 16-ft. roads. The thickness will be 7 in. at the center and 5 in. at the sides, except where the nature of the sub-grade may require particular attention. The work will be done under the direct supervision of W. C. Bickford, county engineer. A. B. Dean is chief deputy engineer.

Change in Philadelphia Subway Plans

Work on the City Hall section of the new Broadway subway in Philadelphia has been temporarily suspended pending the consideration by Mayor Smith of proposed changes in the plans which may be to the benefit of the city. This information was contained in a statement issued by William S. Twining, director of city transit, which indicated that the changes proposed would effect a saving both in time and in cost.

May Create City Planning Commission in Cincinnati

The City Council of Cincinnati has under consideration an ordinance to create a City Planning Commission. The various civic organizations of the city have indorsed the measure and are urging its passage.

The ordinance contemplates giving the commission authority to determine the location of new streets, parks and boulevards, and the enhancing of existing ones, the location of all public buildings, and jurisdiction over the architecture of all bridges, buildings and other structures so as to bring them into harmony with their respective surroundings.

The provision giving the commission authority to designate the height of buildings in various sections of the city has caused a hitch, as it was believed to conflict with the official powers of the building commissioner. The city solicitor and a special committee from the various civic organizations are now at work on a new draft of the ordnance which will eliminate this difficulty.

Railroad Adopts Scheme for St. Paul Union Station

For some years the construction of a union station has been an important issue at St. Paul, Minn. The first proposal seriously considered contemplated a station on the present site. The plan was agreed to by the railroads, and was authorized by the city. The design, however, called for some encroachment on the Mississippi River and on this account the consent of the War Department could not be secured.

The Directors of the Union Depot Company have now agreed upon a new plan, and work is under way to secure from the respective railroads the property they must assign in order to allow the scheme to be carried out. Consent of the city will also have to be secured, but since it assented to the original plan, little doubt is entertained that it will agree to the new proposal.

The present station site lies between the river and the alley south of Third Street. This area, as well as that between the alley and Third Street, will be used for trackage under the new plan, while the station house itself will be placed on the block to the north, now occupied by business buildings. The entire square bounded by Third and Fourth Streets on the south and north respectively, and by Sibley and Wabouba Streets on the west and east will be occupied by the main structure, halving the waiting rooms, ticket office, restaurant, etc. Third Street will be bridged over to connect the waiting room with the Concourse above the tracks. Twenty tracks are provided for, 7 stub-ended, and 13 through.

The cost of the earlier plan was estimated at about $15,000,000, and the new scheme will probably approximate the same figure. W. C. Armstrong is chief engineer of the Union Depot Company.

Connecticut Utilities Must Mark Poles

The Public Utilities Commission of Connecticut has issued an order by which utility companies owning, or having custody and maintenance of, a pole or other structure used for supporting electrical conductors are required, before Oct. 1, to mark such a structure with an identifying symbol. On trunk lines in rural districts every fifth pole needs to be so marked.

Alumni Records Indicate Demand for Engineers in Latin America

A scrutiny of the lists of graduates of Massachusetts Institute of Technology, native to Latin-American countries, especially as refers to Brazil, the Argentine and Chili, indicates that the men return home after graduation and engage in their professions in their own lands; that, in fact, the demand for engineers is such that many men from the United States locate in those countries.

Explains How Army Engineers Build Field Fortifications

Following Address by General Leonard Wood, Captain Robins Tells Large Audience of Construction Methods Used for Defensive Works

Cheers greeted Major-Gen. Leonard Wood when he addressed the members of the engineers' military lecture course at the Engineering Societies Building in New York City Monday night. His facts and figures regarding the army's past experiences and future needs served as an introduction to the third regular lecture by Capt. Thomas M. Robins, Corps of Engineers, U. S. Army, who explained the construction features of field fortifications and the methods of procedure followed in sieges and demolitions.

Fortifications of Three Kinds

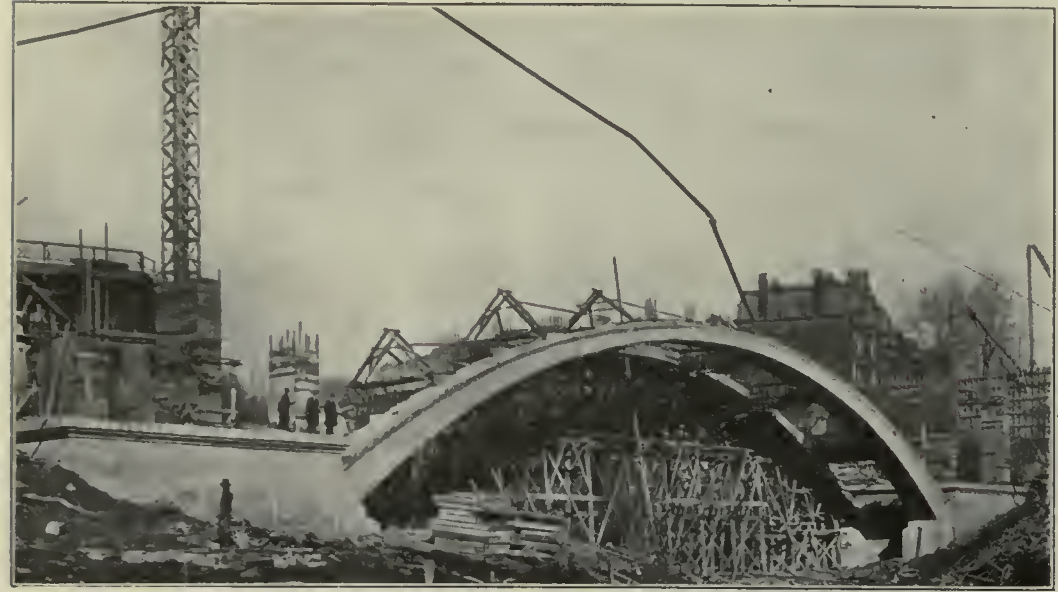
Fortifications were classified by Captain Robins as permanent, semi-permanent and field fortifications. The permanent fortifications, he said, are built in time of peace by civilian labor for the protection of strategic points. Semi-permanent fortifications are less elaborate, and are generally built after the outbreak of war. Works hastily constructed in the field by the troops themselves to increase their fighting power are designated as field fortifications. Hastily built intrenchments are examples of the latter type of construction. Certain terms applicable to trench work were explained by Captain Robins. The "parapet" is the earth thrown up in front of the trench for protection. The "command" of the parapet over any point of the foreground is the difference in elevation between its top and that point. The "relief" of the parapet is its elevation above the ditch in front, although the same term is often used to express its elevation above the bottom of the fire trench. Trenches should not necessarily be located at the crest of the hill, as this leaves a so-called dead space not covered by the fire of the troops. The best location is along what is known as the "military crest," generally a break in the slope in front of the actual crest.

Captain Robins explained in detail the points to be observed in the selection of cover and illustrated with diagrams sections of typical trench work. In choosing a position the principal requirements, it was pointed out, are a wide and clear field of fire to the front; concealment; freedom of movement along and in rear of the position, and security of the flanks.

In discussing some of the accessory features of defensive work Captain Robins emphasized the fact that trenches should not be made continuous, but should be broken at regular intervals by traverses, thus preventing the enemy from enfilading the position. Dummy trenches, in which no troops are stationed, are often used to deceive the enemy and its fire.

Hints on Trench Building

In the construction of rifle trenches the company forms the normal working unit. The company commander, assisted by his lieutenants and non-commissioned officers, marks out the line of the trench, determines the height of parapet and the location of traverses. The men are then deployed along the line, posted at the proper intervals, and begin work. If an attack is likely during the progress of operations, first efforts should be directed toward securing a parapet of sufficient height



VIADUCT BEING BUILT AT CINCINNATI TO REPLACE 52-YEAR-OLD IRON STRUCTURE

Reinforced-concrete bridge, 360 ft. in length including approaches, designed by Frank L. Raschig, assistant city engineer, has 3-ribbed arch span of 180 ft. Portion of old structure used by D. P. Foley, the contractor, to deliver material by gravity to mixer.

to afford cover for the head and a support for the rifle in a prone position, after which the trench is gradually deepened to a standing trench. With the portable tools which engineering troops carry a simple standing rifle trench can be constructed in two hours or less. Captain Robins pointed out that a hot fire from the opposing force can always be counted upon to speed up this work.

Sieges and Demolitions

Captain Robins struck a responsive note when he explained the methods of conducting sieges. The large delegation of subway engineers present from the Public Service Commission exhibited particular interest in his discussion of tunneling work for saps and mines. Mining is the final operation of a siege, resorted to in order to reach the enemy's works and make an assault practicable. The enemy promptly starts counter-mines and a prolonged underground warfare results, each side trying to blow in the other's galleries before a mine can be planted under their own works. The methods of mining generally used are similar to ordinary earth tunnel practice, except, of course, that they are on a much smaller scale. Galleries approximating 7 ft. in width by 6 ft. in height are generally used. They constitute the trunk lines from which smaller galleries branch out.

Demolitions, Captain Robins explained, may be carried out either with or without explosives. Representing work done without explosives are the burning of bridges and brush entanglements, cutting down barbed wire obstructions, disabling locomotives by removal of valves, and tearing up railroad tracks. For the work with explosives the methods used in civil practice are very largely employed. Blocks of trinitrotoluol, measuring 1¾ x 1¾ x 3 in. and weighing ½ lb. are the standards for this work, although sticks also are used, measuring 1¼ in. in diameter and 3 in. long. The caps used are manufactured by a secret process. To demolish ordinary walls the charge per running foot varies with the square of the thickness or $C = 0.85\, T^2$ where C is the charge in pounds and T the thickness in feet. The charge should be placed along the foot of the wall. If the charge is well tamped or placed in a groove and tamped it can be reduced from one-third to one-half.

Masonry arch bridges are best attacked by charging across the extrados at the haunches and crown. The charge should be one-half more than for a wall of the same thickness. Wood trusses are cut near the middle of the lower chord. Steel trusses and girders should have every member cut on the same cross section, preferably near the abutment. A cantilever bridge should be cut over the towers, with regard to rupturing the top chords.

To Aid in Promoting Closer Associations Throughout Americas

The board of direction of the American Society of Civil Engineers on Jan. 17, 1916, authorized the appointment of representatives of the society to act jointly with similar committees of the three other national engineering societies, for the purpose of promoting a closer political, social, scientific, commercial, and industrial association throughout the Americas, and to be known as the Pan-American Engineering Committee.

The following members were appointed as representatives: Fred Lavis, chairman; Chandler Davis, B. F. Cresson, Jr., P. W. Henry, and Edgar Marburg.

Five Miles of Roosevelt Road Washed Out by January Floods

Five miles of Roosevelt Road on the Salt River project, U. S. Reclamation Service, was made impassable, except for pedestrians, by the January floods in Arizona, according to an article by William S. Cone, project manager, in the March issue of the *Reclamation Record.*

Roosevelt Road, which winds down the canyon, just above the water's edge when the river is in its normal stage, was, during the flood, in some places 12 ft. under water. All of the surfacing was washed off, and about 5 miles of it made practically impassable.

The flood water ran over the spillways of Roosevelt Dam to a depth of 11.3 ft.

Plan Outlined for Rehabilitation of San Diego's Waterworks

According to the monthly report of F. M. Lockwood, manager of the operating department of the San Diego Waterworks, water will be purchased from the Cuyamaca Water Company to supply the deficiency in the city's supply pending the completion of the work of piping water from the Upper Otay reservoir. The storm during the latter part of January, and the resulting failure of Otay Dam, described in the Engineering Record, page 191, issue of Feb. 5, and page 225, issue of Feb. 12, as well as that of all the pipe lines leading into the city entail a large amount of work which will have to be done during the balance of the year.

To rehabilitate the water system it is planned to repair the conduit from Morena to Dulzura Summit, allowing the water to flow in its natural channel from the latter point to a point on Dulzura creek, about 5½ miles above the Upper Otay. Thence it will be diverted into a pipe or flume to the upper Otay reservoir. From that point a pipe line will be constructed to the outlet tower at the Lower Otay. The water will be passed through the filter plant, and from there on into the city. The two pipe lines across the Sweetwater River will have to be rebuilt.

It is also planned to install an air lift plant in Mission Valley to bring the water from the wells in the river bottom to the sumps, and from thence into the University Heights reservoir.

Another Engineering Society Is Formed in Chicago

Passage of the structural engineers' license law in Illinois is directly responsible for the new Structural Engineers' Association of Illinois, in the process of formation in Chicago, to maintain the welfare, promote the best interests and safeguard the legal rights and privileges of the structural engineers of the state of Illinois. At a meeting in the rooms of the Western Society of Engineers, Feb. 23, a constitution was adopted. Only licensed engineers are eligible for membership. The initiation fee is $5 and annual dues $10. No initiation fee will be asked of those who join before July 1, 1916.

The government is to be vested in a board of fifteen directors, five of whom are to be elected each year to serve for three years. A full board is to be elected this year, five to serve three years, five two years and five one year.

From a list of eighteen names submitted by Charles B. Burdick, I. F. Stern, E. E. Barrett and H. J. Burt, committee on nominations, the following were elected as directors: Andrews Allen, J. G. Giaver, R. M. Gerety, H. E. Van-

FIVE MILES OF ROOSEVELT ROAD MADE IMPASSABLE BY JANUARY FLOODS derlip, F. H. Hamilton, J. N. Hatch, J. P. Cowing, George Jobst, D. H. Maury, John Brunner, I. F. Stern, C. B. Burdick, H. C. Lotholz, O. A. Bailey and C. C. Brooks. All officers are to be named by the board of directors when they have been elected.

A secretary, not necessarily a member, is to be chosen and the board will fix the conditions of his employment and salary.

Cleveland Holds First Complete Building Show

What was claimed to be the first complete building show in the United States was held in Cleveland last week. Its purpose was to present ideas regarding residence and factory construction to prospective builders and to contractors.

Most of the space was devoted to the exhibit of manufacturers of materials, though house furnishings, such as sanitary fixtures, heaters, etc., occupied considerable space. The Lumber Manufacturers' Associations were there in force, as were also the brick-makers. These two interests, occupying more space than any other, vied with each other in the attractiveness of their display. The brick-makers showed excellent examples of district brick work while the lumber dealers had a model park with nine small dwellings, showing the possibilities of frame construction. The hollow building tile manufacturers, not to be outdone, showed how their materials could be used both for exterior work and as a basis for stucco.

← SNOW PLOWS ATTACHED TO MOTOR TRUCKS ARE USED TO CLEAR NEW YORK'S STREETS AFTER STORMS

→ FIFTH AVENUE, NEW YORK, AFTER PASSAGE OF MOTOR TRUCK SNOW PLOWS

With the purpose of appealing to the contractors quite a number of manufacturers of construction equipment had booths. Among them were the Thew Automatic Shovel Company, the Chain Belt Company, and the Clinton Wire Cloth Company.

Simultaneously with the show were held meetings of the National Paving Brick Manufacturers' Association, the American Ceramic Society, the National Brick Manufacturers' Association and the National Clay Machinery Association.

The admissions to the show totaled about $150,000.

Storm Waters Bring Silt to Los Angeles Harbor

A complete report on the flood damage to Los Angeles harbor during the recent severe storms has been made to the harbor commission by S. A. Jubb, assistant harbor engineer. The report, which was later forwarded to the Rivers and Harbor Committee of Congress, showed that approximately 2,030,000 cu. yd. of silt were deposited in the various basins and channels in the harbor. Of this amount 1,400,000 cu. yd. was deposited in territory where the dredging is done by the federal government, and the harbor commission, in forwarding the report, asks Congress to make an emergency appropriation of $1,080,000 for the diversion dam, so that construction can be started immediately. It is pointed out that the recent storm damage, repetition of which would be obviated by a diversion dam, amounts to 13 per cent of the cost of such a structure. The harbor commission estimates that on a basis of ten cents per yard, the cost to the government will be $140,000 for removing this season's silt deposits. In addition to this sum, it is estimated that it will cost the city and property owners approximately $63,000 to restore their channels.

Military Drill for Engineers

For the benefit of those engineers who plan to attend the military training camp at Plattsburg, N. Y., and others who wish to take up some form of military training, arrangements have been made for a preliminary course of drills during March, April and May. Col. W. G. Bates of the 71st Regiment, N. G. N. Y., and Lieut.-Col. Eugene W. Van C. Lucas, of the 22d Corps of Engineers, N. G. N. Y., have offered the use of their armories with competent instructors

The drills at the 71st Regiment armory, Thirty-third Street and Park Avenue, New York City, will be given every Thursday afternoon, from 5.30 to 7.00 o'clock, under the direction of Capt. George Perrine, assisted by other officers of the regiment. If a sufficient number apply, drills will be held in the 22d Corps of Engineers armory, 168th Street near Broadway, every Tuesday evening at 8.15 o'clock.

These drills will include work similar to that done during the first two weeks at the Plattsburg camp—the school of the soldier, squad and company, in close and extended order; guard duty; use and care of the rifle with sub-target and small arms practice. The armory work will include pitching and packing tents and making blanket rolls and packs. The indoor work will be followed, when weather permits, by week-end encampments and rifle shooting on the Peekskill range. Such preliminary training is especially recommended by the regular army officers.

Those who wish to attend these drills should notify Capt. George Perrine, 820 West End Avenue, New York City.

Ordered to Install Treatment Works

More than 200 manufacturing plants of Pennsylvania have been directed to install treatment plants to prevent stream pollution. The works must be completed by July 1.

News of Engineering Societies

The California Development Board will hold a quarterly session at Fresno, March 10 and 11.

The American Society of Civil Engineers will hear George Henry Ellis on "The Flow of Water in Irrigation Channels" at a meeting to be held in New York City, March 15.

The Canadian Society of Civil Engineers held a meeting at Montreal, March 2, at which a paper on "The Design of Passenger Terminals" was presented by J. L. Busfield.

The Engineers' Society of Western Pennsylvania will hear Harrison P. Eddy, consulting engineer, of Boston, Mass., on "The Extent to Which Sewage Can Be Purified by Practical Methods Now in Use" at a meeting to be held in Pittsburgh, March 7.

The Maine Society of Civil Engineers elected the following officers for the ensuing year at the annual meeting held at Augusta, Feb. 2: Paul D. Sargent, president; Harry E. Green, vice-president; Frank E. Pressey, secretary and treasurer; I. W. Barbour, John Calvin Stevens, T. W. Clark, S. A. Moulton and E. C. Jordan, directors.

The New England Waterworks Association will hold a meeting in Boston, March 8. The report of the committee on meter rates will be discussed and Robert Weston, consulting engineer, of Boston, will present a paper on "The Proposed Auxiliary Water Supply for the City of Brockton." The preliminary report of the committee on service pipe will also be received.

The Arkansas Engineering Society held its annual meeting at Helena, Feb. 22-23. Owing to the geographical location of Helena and the flooded condition of the Mississippi River, the papers and discussions were devoted almost entirely to river protection, levees and drainage. A considerable portion of the time was devoted to visiting and inspecting works of such nature. The officers elected were: James R. Rhyne, president; Louis R. Parmelee, vice-president; William J. Parkes, secretary-treasurer; Perry T. Simons and Hugh H. Humphreys, directors for two years. The next annual meeting of the Society will be held in Little Rock in the early part of 1917, the exact date to be fixed by the board of direction.

Personal Notes

F. G. Hoskins, formerly division engineer for the Baltimore & Ohio Railroad at Philadelphia, has been appointed superintendent at Parkersburg, W. Va. Mr. Hoskins entered the service of the Baltimore & Ohio in 1907 as a bridge draftsman, being advanced to bridge inspector on the Pittsburgh division in 1908. He was made assistant division engineer at Pittsburgh in 1911, and division engineer at Connellsville in 1914, later being transferred to Philadelphia with this title.

F. Willis, of the engineering department of the Pennsylvania Steel Company, of Steelton, Pa., has been appointed superintendent of the new number 2 forge department of the plant of that company.

C. P. Ballinger, formerly city engineer, of Greenville, S. C., has been appointed consulting engineer for Greenwood, S. C. The latter city is engaged in municipal improvements to a value of $225,000.

W. F. B. Haynsworth, formerly with the U. S. Government on the construction of the Panama Canal, has been appointed city engineer of Greenville, S. C.

E. A. Taylor, formerly engineer and construction superintendent for the J. B. McCrary Company, of Atlanta, Ga., has been appointed to a similar position on the forces of the Florida Industrial Corporation at Gainesville, Fla.

T. V. Stephens, for the past two years city engineer of Cadillac, Mich., has recently been appointed by the city commission to serve as city manager of that city the coming year. He succeeds O. E. Carr, who is now city manager of Niagara Falls. He was graduated from Pennsylvania State College in civil and sanitary engineering in 1912. Previous to going to Cadillac he was connected with the division of sewerage investigation, designs and plans of the city of Cincinnati.

M. W. Parrish has resigned from the office of head of the department of manual arts at the State School at Tontsawa, Okla., to become connected with the Illinois State Highway Department.

Paul J. Merrill, formerly chief civil engineer on the erection of the experimental station for Henry Ford & Son at Dearborn, Mich., has been appointed assistant chief inspector for the Dayton Metal Products Company, of Dayton, Ohio.

Joseph C. Allison has resigned from the office of chief engineer and assistant general manager of the California Development Company, upon the transfer of that company's properties in the Imperial Valley, California, to the Southern Pacific Company, which is noted elsewhere in these pages, and will engage in private practice as consulting engineer at Calexico, Cal., specializing on flood, silt and conservation of supply problems in that section of the country. Mr. Allison was for 14 years connected with the California Development Company and the Imperial Valley development, and handled the big floods of recent years, including those of last January. He received his professional education at Stanford University in California, and served on the forces of the California Development Company in minor capacities from 1902 to 1910. In the latter year he was appointed assistant chief engineer and had direct charge of all engineering work, both design and construction, in Imperial Valley. He attained the office of assistant general manager and chief engineer in 1911.

Frederic Bass and Lee E. Rollins have opened a consulting office in the Plymouth Building, Minneapolis, for the general practices of civil and mechanical engineering, having to do with municipal works and the engineering and mechanical equipment for buildings as their specialties. Following Mr. Bass' graduation from the Massachusetts Institute of Technology in 1901 he spent three years with the Metropolitan Waterworks of Boston, one year in the U. S. Engineer Corps and fifteen years at the University of Minnesota, where he is now professor of municipal and sanitary engineering. For eight years he was in charge of the engineering for the Minnesota State Board of Health. For two years he was in private practice in municipal engineering.

Robert Lloyd, formerly with the U. S. Reclamation Service, has been appointed to a position in the valuation department of the Pennsylvania Railroad.

J. B. Weddell has been appointed city engineer of Olympia, Wash., and Ray F. Wood, assistant city engineer.

E. H. Fitzhugh and Charles J. Crowley have organized the Fitzhugh-Crowley Corporation to engage in business as engineers, constructors and railway specialists, at 60 Broadway, New York City. Mr. Fitzhugh, who will serve as president of the new corporation, entered railway service in 1873 on the St. Louis, Kansas City & Northern. After serving with various railways, including the Wabash, he went to the Grand Trunk Railway as assistant to Charles M. Hays, and aided him in putting into effect the vast physical improvements undertaken under his charge by that system. Later Mr. Fitzhugh became president and general manager of the Central Vermont Railway, in which office he remained until about a year ago. Mr. Crowley served as division engineer with Mr. Fitzhugh on the Grand Trunk Railway, during the reorganization and rehabilitation of that system, and has had a varied experience in railway location, construction and maintenance, as well as the revision of terminal and grade, and grade separation. He retired from railway service several years ago, and, after some experience as engineer with various contracting concerns on hydroelectric developments and other work, he entered the employ of Jacobs & Davies, consulting engineers, of New York City, and served as resident engineer on the Pennsylvania tunnels, as engineer and manager of construction of the McAdoo tunnels and on the subway connecting the Fourth Avenue subway, Brooklyn, with the Coney Island tracks of the Brooklyn Rapid Transit at Thirty-eighth Street, Brooklyn. Later he was superintendent and engineer of the construction of Hale's Bar dam in the Tennessee River near Chattanooga.

Earle A. Waterman, formerly professor of sanitary engineering at Pennsylvania State College, has joined the staff of E. D. Rich, state sanitary engineer, Michigan State Board of Health.

R. L. Pearson, formerly track supervisor for the New York, New Haven & Hartford Railroad at Providence, R. I., has been appointed division engineer of the New London division, with headquarters at New London.

H. M. Curtis, formerly track supervisor for the New York, New Haven & Hartford Railroad at Boston, has been appointed division engineer at that city.

R. H. Nelson has resigned from the office of assistant city engineer of Hoquiam, Wash., and will go to Chehalis, Wash., where he will assume the management of a part of a $1,000,000 logging and lumber mill project.

Samuel A. Greeley has opened an office for practice as hydraulic and sanitary engineer, at 64 W. Randolph Street, Chicago. He was graduated from Harvard University in 1903 and later took a degree in sanitary engineering at the Massachusetts Institute of Technology. For 5 years, until 1910, he was employed as assistant engineer with Rudolph Hering and George W. Fuller, working on the design and construction of works for sewerage, sewage disposal, water purification and refuse disposal, and on waterworks valuations. For three years previous to 1911 he was engaged on the construction and operation of the refuse incinerator at Milwaukee, which has a rated capacity of 300 tons per day. Mr. Greeley had charge of the operation for a year and a quarter. From 1911 to 1915 he was assistant engineer with the Sanitary District of Chicago, on investigations, designs and construction of sewers and sewage treatment plants. Mr. Greeley has made two trips to Europe, investigating and reporting upon the practice of sanitary engineering abroad, and made a trip to Caracas, Venezuela, to investigate sanitary conditions. In a private capacity, he has made many reports and plans for work for water supply, sewerage, sewage disposal and refuse disposal.

Thomas Muir and Joseph McClelland have formed a contracting firm to be known as the Muir & McClelland Construction Company, with offices in the Chamber of Commerce Building, Portland, Ore.

C. R. Rockwood, formerly in charge of the Volcano Lake works in connection with the recent flood prevention construction in Imperial Valley, has been appointed chief engineer of the development, succeeding J. C. Allison, whose resignation to engage in private practice is noted elsewhere in these columns. Mr. Rockwood has been engaged in engineering work since 1881. For 9 years he was on railroad location and construction. He was then, for a short period, deputy city engineer of San Francisco, leaving that post to enter the service of the U. S. Geological Survey on irrigation work. He was placed in charge of the Volcano Lake works in March, 1915.

Clark & Appelman, builders and general contractors, of 419 East Sixteenth Street, New York City, will move their offices to the Foster Building, Fortieth Street and Madison Avenue, as soon as that structure is ready for occupancy.

H. W. Shimer and A. J. Cleary, of the engineering department, city of San Francisco, have recently been advanced in rank by M. M. O'Shaughnessy, city engineer. Mr. Shimer becomes first assistant, succeeding Loren E. Hunt, who died recently, and Mr. Cleary will be second assistant.

Leonard Metcalf, of Boston, who has been engaged in valuation work on the Pacific Coast for some time, gave a lecture on "Engineering Valuation" in the Mining Building of the University of California on Feb. 23.

W. C. Hood and A. R. Decker, consulting engineers of Ann Arbor, Mich., have been retained by Gaylord Cummin, city manager of Jackson, Mich., to make a sewerage survey which will involve a topographic map of the city, a general resurvey of the sewers, an investigation of storm water and dry-weather flows, the design of relief storm sewers, a general consideration of sewage treatment and the necessary intercepting and trunk sewers which adequate treatment will necessitate. The work will be done in the office of H. S. McGee, city sanitary engineer, under the general direction of the consulting engineers and the city manager.

Hurlburt S. Jacoby, assistant chief engineer of the Samuel Austin & Son Company, building constructors, of Cleveland, is located temporarily at Niagara Falls, N. Y., where he is in charge of the design of an extensive addition to the Hocker Electro Chemical Company.

Bertrand D. Barker, formerly superintendent of construction for George A. Quinlan, contracting engineer, of Chicago, has been appointed assistant chief highway engineer of Cook County, Illinois. He was graduated from Norwich University, Vermont, in 1903, and served from then until 1907 as aid in the U. S. Coast and Geodetic Survey. From the latter year until 1912 he was with George Jackson, Inc., of New York City and Chicago, as engineer, general foreman and superintendent of construction and tunnel work. He became connected with George A. Quinlan in 1912.

Waddell & Son will be the consulting engineers on the design and supervision of the rebuilding of the Ohio Avenue Bridge over the Kaw River for the Kansas City Southern Railway, of which C. S. Johnston is chief engineer. The bridge will be a steel structure, costing $200,000 and consisting of 3 spans, two 300-ft. skew spans and one 215-ft. spread skew span. The American Bridge Company has been awarded the contract on the superstructure.

H. E. Astley, formerly division engineer for the New York, New Haven & Hartford Railroad at Waterbury, Conn., has been appointed trainmaster of the Midland division.

J. R. PENLAND has been re-elected city engineer of Albany, Ore.

LOUIS MITCHELL, associate professor of civil engineering at Syracuse University, has been retained by the council of Tippecanoe City, Ohio, to review the flood plans of the Miami Conservancy District, with special reference to their effect upon that city.

DR. F. W. CUNNINGHAM, of Orange, N. J., has resigned his connection with the research and development work of the Newark plant of the General Electric Company to join the engineering research staff of the Powdered Coal Engineering & Equipment Company, of Chicago.

ROBERT H. ANDERSON, formerly hydraulic engineer for the Tennessee Power Company, has been appointed chief engineer in charge of the construction of the Great Falls development for that company. He was graduated from Cornell University in 1898. From then until 1899 he served on the U. S. Deep Waterway Survey in New York, and, later, he was with James H. Fuertes, consulting engineer, of New York City, on the investigation of the New York Water Supply, and from 1900 to 1901 he served on the Nicaragua Canal surveys. He was transitman for George S. Morison on water power investigations on the Susquehanna River for the two years following, and with the U. S. Geological Survey from then until 1904, when he was appointed assistant engineer for the Isthmian Canal Commission. Previous to his connection with the Tennessee Power Company he was with the McCall Ferry Power Company.

E. A. WEST, formerly efficiency engineer of the Portland Light & Power Company, of Portland, Ore., has been appointed chief engineer of the Denver Tramway Company, succeeding Roger W. Toll, whose resignation is noted elsewhere in these columns.

JOHN A. BENSEL, formerly state engineer of New York, and past-president of the American Society Engineers, has been retained by the Water Service Commission of Bernardsville, N. J., to prepare preliminary plans for the water power development of dam 6 in that city.

CALEB BERRY has been appointed city engineer of Centralia, Wash.

F. M. ERWIN has resigned from his position with the U. S. Engineer's Office at Louisville, Ky., to accept an appointment on the forces of the Aluminium Company of America at Pittsburgh.

O. E. WELLER has resigned from the office of chairman of the Maryland State Roads Commission.

CURTIS A. MEES has resigned from the office of designing engineer of the Southern Power Company at Charlotte, N. C.

DR. HENRY K. BENSON, professor of industrial chemistry at the University of Washington, has been appointed director of the newly established Bureau of Industrial Research, at the university.

R. B. VAN SICKLE, formerly construction engineer for J. A. Zimmerman & Son on the new cotton warehouses being constructed at New Orleans, and, previous to that, for several years manager for the Casper Ranger Construction Company, of New York, has formed a partnership with C. H. Wilmot to carry on a sales business in building material and equipment.

FRED R. HESSER has resigned his position as assistant engineer of the Kansas State Board of Health to become associated with the Universal Concrete Construction Company, of Kansas City. He will be supervising engineer for the company and will manage the plant for the manufacture of reinforced-concrete fence posts, telegraph poles, silo staves and other concrete units at Armourdale, Kan. Mr. Hesser became assistant engineer of the Kansas State Board of Health in 1912. Previous to that he was city engineer of Beloit, Kan.

DR. KARL IMHOFF wrote a letter to S. Fischer Miller, president of the Pacific Flush-Tank Company, dated at Essen, Germany, Jan. 27, on business matters. There had been reports circulated that Dr. Imhoff had been killed in action in the European War.

JOHN M. BANDEL, for the past three years assistant engineer in charge of construction for the Baltimore Sewerage Commission, has been appointed engineer for the Davison Chemical Company of that city. Mr. Bandel was graduated from Johns Hopkins University in 1901, and was engaged in quarry and railroad work until 1909, when he became connected with the U. S. Engineer's Office at Memphis. From 1910 to 1912 he was with the State Roads Commission of Maryland. He joined the forces of the Baltimore Sewerage Commission in the latter year.

W. W. HARMON, formerly city engineer of Grants Pass, Ore., during the construction period of the municipal railroad there, has been retained by the Oregon-Utah Sugar Company as chief engineer on the construction of its large sugar factory in that city.

ROGER W. TOLL has resigned from the office of chief engineer of the Denver City Tramway Company. Mr. Toll was graduated from Columbia University in 1906 and had been connected with the Denver company for the past 7 years. Previous to that he was with the U. S. Coast and Geodetic Survey.

C. E. WRIGHT, formerly municipal and consulting engineer in private practice, has been appointed county engineer of Carrol County, Iowa, in charge of road and bridge construction.

RAY D. ARMSTRONG, U. S. surveyor, has been transferred from the office at Spokane, Wash., to the office at Yucca, Ariz.

ALBERT WOLSTENHOLME, formerly superintendent of streets of Fall River, Mass., has been named by the Mayor of that city as city engineer. Mr. Wolstenholme was appointed superintendent of streets of Fall River 3 years ago. Previous to that he had been, for 20 years, a member of the engineering firm of Wolstenholme & Buffinton. He first engaged in engineering work in 1885.

Obituary Notes

CHARLES E. LAWSON, a retired contractor, of New York City, died at Allentown, Pa., Feb. 20. He was 66 years old.

CHARLES W. MILHOLLAND, resident engineer for the Baltimore & Ohio Railroad at Cincinnati, died in that city, Feb. 23. He was in the service of the Baltimore & Ohio for 20 years, and supervised the construction of many of its important structures.

JACOB C. JAMERSON, formerly a contractor, of Seattle, Wash., died in Tacoma, Feb. 21. He was 77 years old. Mr. Jamerson came to Seattle from St. Louis in 1887.

J. W. WHITE, a retired contractor and builder of Spokane, Wash., was recently killed while alighting from a Great Northern train at Loon Lake, Wash.

JOHN M. ESHLEMAN, from 1911 to 1914 president of the California Railroad Commission, died at Indio, Cal., Feb. 28.

Civil Service Examinations

United States.—An open-competitive examination for junior civil engineers, Grades 1 and 2, salaries from $1,200 to $1,680 and $720 to $1,080 respectively, will be held March 22 and 23 at the usual places. These positions are in connection with the Interstate Commerce Commission on the valuation of the property of railroads. Applicants for the examination for civil engineers of grade 1 will be obliged to show that they have had either five years' experience in civil engineering, two of which must have been railway civil engineering, or a civil engineering education in a recognized school and two years' experience, one of which must have been railway civil engineering, while those of grade 2 must prove that they have had either two years' experience in engineering as civil engineers, structural engineers or supervisors of building construction, or an education equal to three years of a recognized technical school. The age limits are between twenty-one and thirty-six years. The application form for both examinations may be secured from the United States Civil Service Commission at Washington, D. C., or anyone of the civil service boards throughout the country, by specifying form 2039 and the title of the examination.

Another open-competitive examination is announced for laboratory assistant, Bureau of Standards, salary from $900 to $1,200 a year, to be held on April 12-13. The requirements for participating in this examination include a thorough knowledge of physics and civil, mechanical or electrical engineering. The age limit is between twenty and thirty-five years. It is suggested that applicants desiring to take the examination should apply for a copy of the Manual of Examinations for the spring of 1916, and form 1312, giving the title of the examination. Application may be made through the same sources given above.

Philadelphia.—The Civil Service Commission announces examinations, open to residents of the city, for positions enumerated below, to be held on the dates given. Applications must be secured and filed with the commission four days before the date of examination. Forms may be obtained from the commission at room 976, City Hall. The examinations are for:

ASSISTANT ENGINEER in charge of testing laboratory, Bureau of Surveys, salary $3,000 a year, to be held March 10 and 11. The duties of this position include the directing of physical and chemical testing of cement, concrete, steel, paints, oils, waterproofing compounds, asphalt, coal, building stone, paving brick, and other materials, and the making of investigations required in connection with the testing laboratory work. Applicants must be at least thirty years of age, and have had eight years' active laboratory experience.

ARCHITECTURAL DRAFTSMAN, salary from $900 to $1,200 a year, to be held April 3 and 4. Applicants shall have had six months' experience and a definite knowledge of the principles of architectural drafting. The work is making details and drawings, and elevations and perspectives of building construction.

ARCHITECTURAL DRAFTSMAN, salary from $1,200 to $1,500 a year, to be held April 5 and 6. The qualifications for this position are similar to that noted above. The duties, of course, will be of a more responsible nature commensurate with the difference in salary.

ASSISTANT ENGINEERS, Highway Department, salaries $2,100 and $2,500 a year, to be held April 7 and 8. The duties for the lesser position include general supervision of the construction, inspection and maintenance of highways, bridges and sewers, so far as they are a part of highway work, and also the work of employees in this department. The applicant must be a civil engineer and have had two years' experience in road work. The better position, on the other hand, includes, as duties, besides this general supervision, that of office work and correspondence. The applicant for this examination must also have a civil engineering training and three years' experience in highway work.

RODMAN, City Transit Department, salary from $840 to $960 a year, to be held April 4. To assist in making surveys and giving lines for the construction of subway and elevated structures. Candidate must have the necessary mathematical knowledge to understand the use and adjustment of the transit, the reading of rods, chaining, and keeping notes, and to compute and plot surveys or quantities of materials entering into construction. This will necessitate a year's experience at least in surveying work.

Consider Building Chain of Automobile Plants in Russia

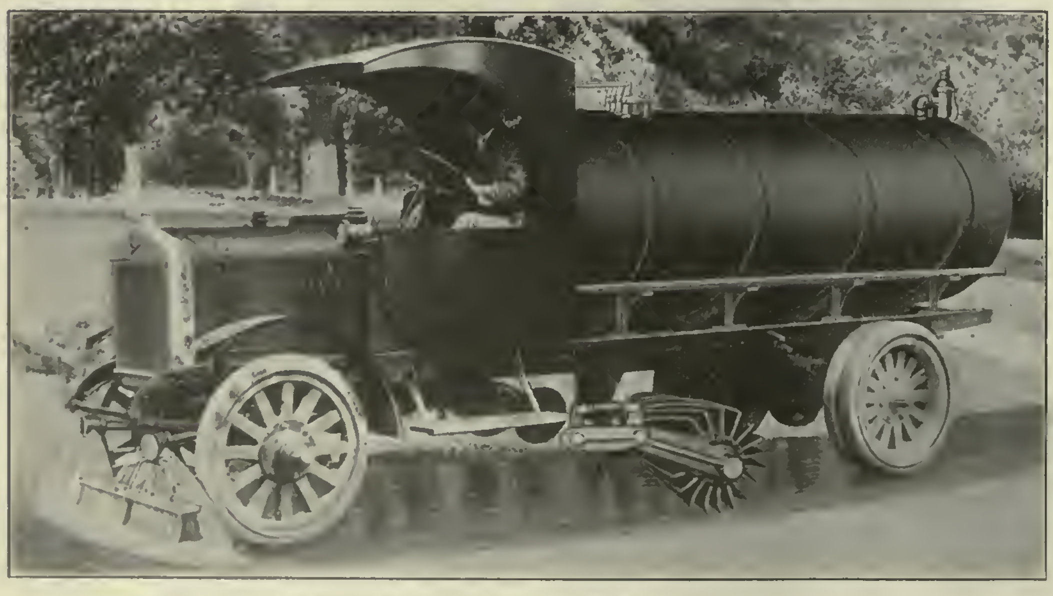
Benton Hopkins, representing Samuel Austin & Son Company, engineers and builders of Cleveland, and the Morgan Engineering Company of Alliance, Ohio, sailed for Russia, Feb. 22, to open the way for the construction of a string of automobile plants. The plant, immediately under consideration, is the first one of a group of 27 large self-contained plants of various kinds, which are to be erected in Russia as a part of a movement for placing that country on the map industrially. A group of influential Russian people are back of the project, and are very much in earnest in making the country as independent as possible from outside countries in the procuring of the manufactured articles which are needed. The first plant will be used for the manufacture of automobiles and motor-trucks.

Motor Squeegee Street Washer Removes Impacted Filth

A motor driven street washer that is said to clean a street as a rubber squeegee cleans a window, and which, it is claimed, will remove impacted dirt and filth in a manner impossible by ordinary methods has been put on the market by the Sterling Motor Truck Company, of West Allis, Milwaukee, Wis., under the name of the Sterling-Kindling motor squeegee street washer.

The machine consists of a special Sterling worm-driven chassis upon which is mounted a 1000-gal. steel tank. Immediately in front of the front fenders are two flusher nozzles controlled by the driver by means of a lever. The nozzles by sprinkling the surface of the street prevent the agitation of dust, and also dampen the attached matter so that the squeegee roller can force it loose from the pavement, and wash the surface clean. Supplementing the function of the nozzles in loosening the attached matter, and to prevent the squeegee from being compelled to handle too large a mass of material, a pair of heavy pavement sweeping brooms are fitted behind the front nozzles, the purpose of which are to force aside the large refuse so that it will be suspended in the water, leaving the squeegee to wash up the tightly adhered material by frictional action. Mounted near the center of the chassis frame, and underneath it, is a squeegee 19 in. in diameter, and 8 ft. long. Each rubber spiral is easily detachable, and is mounted in a special kiln-dried wood holder of large wearing surface. The squeegee attachment is flexibly mounted and counterbalanced in such a way that when adjusted to a certain pressure, it is impossible for the roller to work loose, and the pressure against the surface of the street is uniform, the rubber strips being 6 in. deep and affording large wearing surface. A toggle joint linkage terminating in a lever in the driver's cab, enables him to easily and quickly place the squeegee attachment in and out of engagement with the street and, when returning from washing a section of street, to lift the roller out of contact with the pavement.

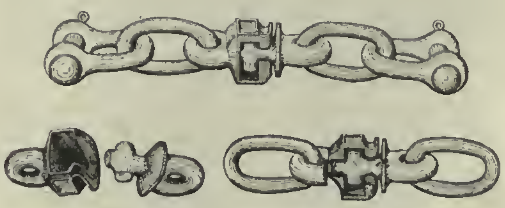
The tank is fitted with a water meter which indicates the amount of water flowing through it. It contains four valves near the front end for distributing water to the front and to the side nozzles near the squeegee roller.



BROOMS FORCE ASIDE LARGE REFUSE AND SQUEEGEE LOOSENS ATTACHED MATTER

Car Coupling Breaks Sidewise

A mine car coupling designed to come undone in a second when broken sidewise, but to stay locked all day unless released on purpose, has been put on the market by the Macomber & Whyte Rope Company, of Chicago. It is made in two styles, fitting either horizontal or vertical drawbars. That for the latter kind is shown in the illustration, which makes the method of operating the coupling apparent. It is claimed for these couplings that they are rugged and simple to use, and are not affected by much ice or other conditions which often make the switching of contractors' rolling stock one continual delay.

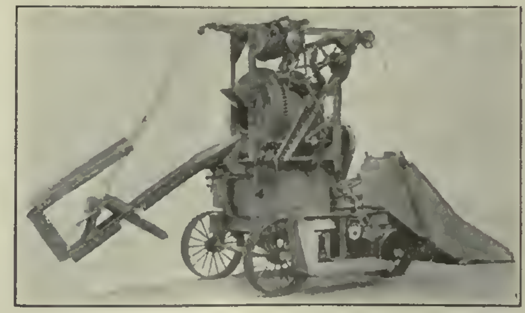


COUPLING HAS NO LOOSE PARTS

High-Drum Mixer Has Sectional Chute

A raised drum, 6½ ft. from the ground to the discharge chute, is a feature of the new line of paving mixers brought out by the Koehring Machine Company, Milwaukee, shown for the first time at the Chicago Cement Show. The delivery chute is in sections, as shown in the photograph. By turning the crank operating a compensating gear at the cable-supported end of the chute, the sections may be lowered to deliver concrete from each of them at the same level. As a section is taken or added to the end of the spout the chute is lowered or raised respectively.

Other features of the new line, called the "Dandie," are the universal type of bearing to insure automatic alignment and the slots in the reversible front wheels into which a driving gear meshes, thus eliminating an extra cast gear. All operations of these pavers, which are made in 10 and 20-cu. ft. dry capacity, are controlled by one man from levers at the side.



DELIVERY CHUTE FITTED IN SECTIONS

Batch mixers of 5 and 10-cu. ft. capacity with low charging platform or side loader complete the "Dandie" line.

Business Note

The Concrete Steel Company, 42 Broadway, New York City, has opened a district sales office at Birmingham, Ala. The office will be under the personal direction of William Piez, who has had a long experience in handling reinforcing bars and concrete specialties.

Trade Publications

The following companies have recently issued trade literature:

Smith Engineering Works, Milwaukee, Wis., booklet, 24 pages, portable crushing plants, a plain talk to Bill Jones.

Alexander Milburn Company, Baltimore, Md., catalog, 52 pages, portable acetylene lights for outdoor illumination; oxy-acetylene generator.

National Tube Company, Pittsburgh, catalog, 72 pages, the whole Kewanee line of specialties; unions, couplings, joints, valves, etc.

Pneumatic Placing Company, 2 Rector Street, New York, circular, 4 pages, pneumatic-concrete-mixer installation on self-propelled material railway car.

Link-Belt Company, Chicago, book 249, 24 pages, reprint, "Insuring the Coal Supply," by H. J. Edsall, describing apparatus for handling and storing coal.

Thew Automatic Shovel Company, Lorain, Ohio, circulars 22, 24 and 26; 12 pages, 6 pages and folder respectively, full-circle shovels and combination boom shovel.

Blaw Steel Construction Company, Pittsburgh, bulletin 68, 12 pages, reprint of an article on concrete construction and design of water tower-tank at Middleboro, Mass.

Brown Hoisting Machinery Company, Cleveland, Ohio. Catalog D, 1916, 6 x 9 in., 64 pages, illustrated. Describes the Brownhoist tramrail system, trolleys and electric hoists in their application to power plants, factories and warehouses.

E. I. du Pont de Nemours & Company, Wilmington, Del. Booklet, 6 x 9 in., 128 pages, illustrated; a handbook on high explosives, first section. Instructions as to the best and safest methods of handling, thawing, priming, and firing explosives are contained in this booklet. The opening paragraphs describe the du Pont plant and organization, the balance of the text dealing entirely with the problems of explosives. In the chapter on thawing, besides the suggestions on how this operation should be and should not be performed, there are contained numerous drawings, illustrating houses and systems best adapted for this work. Likewise, on priming and firing there are included illustrations, showing the right practice; in connection with the latter, the various uses to which dynamite is put are enumerated and described in detail. The latter part of the book is devoted to "don't" advices and a glossary. The entire set, first and second sections, which may be secured from the du Pont company, is without doubt a valuable adjunct to every contractor's library, no less for the simple advice they contain than for the innumerable hints for handling explosives.

Engineering Record

A Weekly Journal Devoted to Civil Engineering and Contracting

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The New Chief of Engineers

IN the light of the present movement to bring into closer relationship and mutual interchange of knowledge the engineers of the two Americas, it seems a happy coincidence that a moving up in rank in the U. S. Army Engineer Corps, due to the retirement on account of age of Brig.-Gen. D. C. Kingman, should bring to its head such a man as Brig.-Gen. William M. Black, whose appointment as chief of engineers is noted in the news section of this issue. General Black knows the Latin-American peoples, and proved by his actions in Cuba that he appreciates the worth of their engineers. In addition he has had broad experience in dealing with problems vital to many of the Latin-American countries. In any gathering of engineers during his term of office such as occurred during the recent Pan-American Scientific Congress in Washington, the International Engineering Congress at the Panama-Pacific Exposition in San Francisco, or minor conventions in which the engineers of the two Americas come into contact, it cannot but have a good effect upon the engineers of the countries to the south to encounter as the official head of our military engineers a man so familiar with their problems, so well versed in their ways and so appreciative of their worth.

Would Highway Engineers Respond?

AN ARMY officer of high rank told a gathering of engineers recently that the War Department lacks information on the strength of highway bridges and on the grades, surfacing and conditions of roads throughout the country. Although an army could hardly move to repel invasion or execute maneuvers without such knowledge, repeated efforts have failed to have it added to the excellent maps of the United States Geological Survey. The obstacle has been, so it is stated, the impossibility of securing an appropriation for the work. There is a way, the Engineering Record believes, of getting part of the desired information promptly and at the nominal expense of postage and the time of draftsmen required to transfer it to existing maps. Judging from the courtesy of engineers in official positions to the Engineering Record in forwarding information requested by letters—and for less vital reasons—state and county engineers everywhere would respond promptly to a request from the War Department for all the data in their possession. After all of the information which can be secured in this way is in hand, missing and evidently inaccurate data can be secured and corrected by field survey. In many sections of the country, probably, the data are not in hand and such survey work will be needed before any but the most meager information can be secured. Eventually the whole country will need to be covered by field work, for obviously the data gathered by highway engineers are not always as complete as needed for army purposes. At present, however, quick action is needed. Probably most of the information in reference to the North Atlantic and the Pacific coast roads is in fairly good shape and could be quickly assembled. In the Southern and the Gulf states the data may not be so readily available. Taking the country as a whole, however, much data can be quickly collected. The cost would be trifling.

Short Courses vs. Conventions

THIS journal has in the past argued for a single national highway convention each year, supplemented by state and district conventions, giving special attention to the local conditions. The rapid spread during recent years of short courses in highway work leads one to believe that this desideratum, at least so far as district meetings are concerned, has possibility of accomplishment. Within the last two months there have been not less than ten of these short courses, in as many universities. Registrations have run as high as 500. Such short courses, when the theoretical lectures given by the instructional force are reinforced by talks from practical men, serve every function of the state or district convention. Moreover, men go to the short courses with a more serious purpose, the idea of a junket being entirely absent. Instead, therefore, of encouraging state and district conventions, fashioned along old-style lines, highway officials should throw their influence in favor of the short courses, endeavoring to get their subordinates who have any authority and responsibility in the construction and maintenance of roads to attend. Provided the instructors will see that the practical features and details are given adequate attention and that sufficient time is allowed for questions and discussion, the further development of the short-course movement is destined to have a great influence for good upon highway building and maintenance.

Forestall Typhoid Epidemics

TYPHOID epidemics are prevalent at this season of the year in localities using untreated surface water supplies. Rains and melting snow wash foul matter into streams. This condition leads the New York State Department of Health to say, in its monthly *Almanac*, that "water-borne epidemics of typhoid fever in towns with unprotected water supplies may be safely set down as an *Almanac* prediction for March, 1916." In the light of recent advances in the art of water sterilization, however, there is not, to-day, the same ground for alarm which existed a decade ago. Although sterilization cannot generally be considered as a substitute for filtration, but rather as a supplement, much good will result from the installation of chlorinating apparatus in towns not provided with a filter plant. The State Department of Health estimates that about 6,750,000 people in New York State are now receiving a public supply of pure water; 900,000 receive water from questionable, and 250,000 from distinctly dangerous public sources, while about 2,000,000 people depend on private sources of supply. For the 1,150,000 people in municipalities with dangerous or doubtful public water supplies this is a good time of year to consider whether it is not poor economy to run the risk involved in drinking unpurified water from unprotected ponds and streams. All such waters may be rendered safe for drinking by simple and inexpensive processes of filtration or disinfection. The installation of a plant for disinfecting water by means of liquid chlorine, the Health Department points out, will insure the protection of most supplies at an altogether negligible cost—between one and two cents per person per year.

City Planning in Philadelphia

TWO WEEKS AGO, in commenting on the pioneer work of the Newark City Plan Commission, the Engineering Record mentioned the pioneer city-planning work of another sort being done in Philadelphia in the undeveloped South Philadelphia tract. Newark's problem is one of conception; Philadelphia's is one of execution. How the Philadelphia Bureau of Surveys, through its General Plans Division, is doing the work—providing deeper building lots, making street widths fit the needs, introducing open places and other irregularities to break up the monotony that characterizes the older streets of most American cities—is set forth at length on page 344. An attempt has been made to go deeper into the reasons for certain details than this journal has ever done before, and the Engineering Record hopes the article will be valuable to all city planners. As pointed out in the beginning of the article, the large South Philadelphia tract affords an exceptional field for the city planner in that it is now almost wholly undeveloped, is adjacent to the developed sections and can be rather definitely assigned to certain uses. Aside from that, the planners are most fortunate in that the authority of the Board of Surveyors is broad, and the board is able to put its plans through without interference from other municipal authorities. This was not always so, however, and the General Plans Division was obliged to do much missionary work before it could get a favorable attitude toward its efforts. The whole subject is one that is rapidly coming to the front, and the Engineering Record welcomes this double opportunity of commending the excellent work of Philadelphia's engineers, and setting forth ideas that may be of service to others who have not advanced so far in the new combination of science and art.

The Road Builders' Convention

LAST week the American Road Builders' Association held a convention and a manufacturers' exhibition in Pittsburgh. This was the meeting scheduled, so this journal holds, in violation of the spirit of the agreement under which the Pan-American Road Congress was held in Oakland, Cal., last September. The prejudice against the convention on account of this violation, and the efforts made to dissuade manufacturers from exhibiting, had a very noticeable effect. The attendance was only fair and composed very largely of local people—from Pennsylvania and West Virginia. State highway officials were noticeable by their absence. The machinery and materials show was only a shadow of its former self. It was a distinct disappointment to those ignorant of the efforts made to quash the exhibit entirely, and who consequently had set their standards by the great exhibit in Chicago in December, 1914.

Contrasted with the Second National Conference on Concrete Road Building, held two weeks previously in Chicago, the Pittsburgh meeting made a poor showing, both in attendance and in caliber of men. Compared with other road meetings, however, the showing was favorable, at least in the number of interested attendants at the sessions. This is true whether the meeting be contrasted with previous conventions of the same association or with the American Road Congresses, held under the auspices of the American Highway Association. In fact, it is difficult to recall any sessions of the road congresses where discussion has been so keen as in the sessions on concrete and on brick roads at Pittsburgh.

One naturally inquires whether the Pittsburgh meeting gave any indication as to what might be expected in reference to the possibility of holding only one national highway convention in the future. Some expected that the showing would be so poor as to force the American Road Builders' Association into seeking for some arrangement with the American Highway Association by which simultaneous sessions would be insured. The result did not bear out the expectation. While, broadly, last week's convention was a second-rate affair, it indicated that the association has enough virility to force recognition and to be a real factor in the future of highway promotion. It will not be lightly pushed aside. Whereas the American Highway Association is a continuing organization that not only holds a convention annually but, by its highway publicity work and the publication of the Good Roads Year Book, renders a service throughout the year, the Road Builders' Association exists solely for the purpose of holding a convention and a show. Nevertheless, it has demonstrated its ability to hold a meeting under adverse circumstances, even though it failed badly on the machinery and materials exhibit.

The conclusion that must be reached, therefore, is that the American Road Builders' Association is still a factor to be reckoned with in the highway field. If, in the face of all of the opposition it met in connection with the Pittsburgh convention, it was able to do anything at all—which it did—it should receive recognition, even though it renders a smaller service to the highway field than its younger and more energetic rival.

Shall We Save New York?

THE title of this note was used as the heading for a full-page advertisement run in the New York City newspapers this week, introducing a remarkable campaign to safeguard a certain section of the city against factory invasion. Some years ago, after the completion of the Interborough subway, the wholesale clothing dealers and manufacturers began to desert the section along Broadway from City Hall to Thirteenth Street and spread northward as far as about Twenty-third Street. This section built up very rapidly with loft buildings devoted exclusively to the housing of these interests, but such was the movement that long since Twenty-third Street ceased to be the northern limit of the new district. Now clothing factories can be found as far north as Thirty-seventh Street. Even Fifth Avenue, the city's finest retail business street (reference is made to the section south of Fifty-ninth Street), has been invaded.

The result is that loft buildings without any character architecturally, covered in every window and at every floor level with flaring gold-letter signs proclaiming the names of the wares and their makers, are destroying the character of a district heretofore devoted exclusively to residences, handsome hotels and clubs, theaters, restaurants and high-class retail establishments. Obviously the district would lose its characteristics were the increase in the number of factories to continue at the present rate.

The high-class retail mercantile establishments, therefore, have banded together and have decided to use the dollar argument in their campaign. One can prophesy that it will prove effective. Twelve prominent companies—including such establishments as B. Altman & Company, Lord & Taylor and James McCreery & Company—have announced in full-page advertisements that they will give preference in their purchases of cloaks, suits, furs, clothing, etc., to firms whose manufacturing plants are located outside of a zone bounded by Thirty-third and Fifty-ninth Streets, Third and Seventh Avenues. They promise, further, that they will not show this preference until Feb. 1, 1917, thus enabling manufacturers now located in this zone to secure other quarters. They promise, too, that consideration will be given those firms that remove their plants. It is stated that as soon as the seriousness of the situation was put to the clothing manufacturers they assented to the plan and agreed to help.

In this campaign the retail merchants are receiving the hearty support of hotels, clubs, banks and other mercantile establishments in the specified zone. Without a doubt the city of New York will benefit by the segregation—or rather the exclusion campaign. It is significant, though, that accomplishment of the desired end is not allowed to wait upon securing suitable legislation. In fact, it may be questioned whether the legislation would be legal, since the factories in themselves are not a nuisance.

While those unfamiliar with the situation will feel that the action taken is rather drastic, it needs only an examination on the ground to convince one that quick and forceful steps are needed. Much that attracts visitors to the city is concentrated in the exclusion zone. If allowed to deteriorate the impression made by the city on visitors will be decidedly unfavorable. One can wish, therefore, that the efforts of the manufacturers will prove successful.

Qualifications for Engineering Work

IN accordance with the announcement made some time ago, the Carnegie Foundation for the Advancement of Teaching has sent a second letter to the members of engineering societies asking them to indicate the qualifications which make for success in professional work. Unlike the first letter, however, which made no suggestions as to the needed qualifications, the second circular in giving a summary of the results of the first inquiry presents certain qualities for consideration.

The readers of the Engineering Record know, from the account given in the report of the annual meeting of the American Society of Civil Engineers, in the issue of Jan. 22, and the editorial on the subject the following week, what the first returns were. The essential factors, summarized from the first letter, fall naturally into six groups, and these are named here in the order of their importance, as determined by the frequency of their occurrence in the replies:

1. *Character*, integrity, responsibility, resourcefulness, initiative.
2. *Judgment*, common sense, scientific attitude, perspective.
3. *Efficiency*, thoroughness, accuracy, industry.
4. *Understanding of men*, executive ability.
5. *Knowledge* of the fundamentals of engineering science.
6. *Technique* of practice and of business.

With this tabulation before them the members of the society are now asked to indicate their views as to the relative importance of these qualifications.

Naturally, what is desired is a single arrangement of these six groups which will most nearly indicate the views of the country's engineers. Manifestly, however, the individual in picking a new employee or in determining upon promotion will arrange these groups in accordance with the requirements of the position in mind. For a given position, requiring a certain type of mentality, some one group will stand out as much more important than the others, while that group may be far down the scale when another position is in question.

If, for example, a designer is to be selected, the rearrangement of the groups (using the catch word only) might be as follows: Knowledge, judgment, technique, character, efficiency, understanding of men. In other words, such a man, devoting himself entirely to the drafting room, where his characteristics and peculiarities do not affect those outside the organization, with little work of an executive character, might do very well even with low grading on the understanding-of-men group.

On the other hand, if candidates are hired for construction work, the understanding-of-men group might be placed first in importance, with the other groups in the following order: Judgment, character, technique, efficiency, knowledge.

Again, should the position be one in which the young man will quickly find it necessary to do executive work and to bear considerable responsibility in the absence of his chief, the order of importance would probably be that summarized from the replies to the foundation's first letter.

Without a doubt, too, the qualifications making for the largest success in professional work should be grouped about as indicated in the first reply. This standard —the largest success—was probably in the minds of the members of the professions in sending in their first answers. Instead of thinking of the different kinds of positions likely to occur in an engineering organization, and indicating the qualifications needed for them, they took the larger view and indicated the characteristics needed for the commanding positions. The replies to the second letter will undoubtedly be based upon the same view.

It is well known that the information Professor Mann, who is conducting the investigation for the Carnegie Foundation, is gathering is to be used in connection with a determination of the proper method of engineering education. The question then occurs whether there should be only one type of education for the various types of positions in the engineering world. Undoubtedly there are those who feel that engineering fundamentals can be so taught and combined with liberal studies as to develop simultaneously the qualifications in the first three groups. If that can be done one is willing to admit that a single type of education may suffice. Native talent will, of course, pay a large part in the degree to which any group of qualifications is developed in the individual.

It would be interesting, indeed, if Professor Mann's conclusion should lead to a single type of engineering course. It would be an indication of a return to earlier views, when education was one and individual characteristics were given little consideration. The differentiation in education for the main branches of engineering—civil, electrical, mechanical, mining and chemical—will still persist. The general type is here referred to, rather than the differentiation determined by the fields of engineering.

One Highway Convention—The Manufacturer's Opportunity

FRUITLESS attempts have been made for several years to bring the American Highway Association and the American Road Builders' Association to some understanding which would result in the holding of only one national highway convention annually. The meeting of the road builders at Pittsburgh last week showed clearly, from the temper of those present, that the two associations are not any closer to-day than they were three years ago. If anything, the breach has been widened. It is useless to hope for a single convention as the result of initiative on the part of either of the associations concerned.

Various suggestions for a solution have been made. In one case the formation of a new organization into which the others might be merged has been proposed. The road builders, the older of the two associations, will not listen to any such proposal, and are determined to maintain their separate existence. On the other hand, the American Highway Association has much to give up—in publicity work and in the publication of the Good Roads' Year Book —and if the new association would not continue this work, the loss would be a serious one to the highway field. Unless there is assurance that its broader plans will be accepted it is hardly to be expected that the highway association, with a large bona fide membership, will give up its work. In the opinion of this journal, therefore, it is useless to expect that a single highway convention can be brought about by amalgamation of the existing organizations.

Another suggestion has been that the Association of State Highway Officials invite the other two organizations to meet simultaneously with it. In fact, that association has taken steps in this direction, and will invite the other bodies to meet at one place on the same dates unless they agree, previous to Aug. 1, 1916, on a joint meeting place. This arrangement would allow the two highway associations to maintain their separate identities. It fails, however, to make provision for the road shows, and on this point the two associations would likely split. Both of them depend for a considerable part on revenue from the shows—for enough, at least, to defray the convention expenses. This gives an opportunity for squabbling and is a fatal defect in the state highway officials' plan.

In the judgment of the Engineering Record neither the amalgamation, the third organization nor the state highway officials' plan has any likelihood of success. There is, however, a way out.

The manufacturers can decide the issue without any shadow of doubt. If they will get together and form a manufacturers' exhibition company, taking the management of the show out of the hands of the association officials, the matter is settled. The exhibition company would notify both the American Road Builders' Association and the American Highway Association that it would exhibit at only one show, and would invite the officials of the two organizations to get together and to agree upon a time and place of meeting at which the exhibition company in turn would pledge itself to hold an exhibition. If the two associations failed to agree, the exhibition company would then exhibit with each in alternate years.

The Engineering Record believes that this is the only feasible solution. The conventions cannot afford to do without the shows, which have become a very valuable feature of the meetings. If the manufacturers will stand by their exhibition company and will refuse to yield to the pressure that will be brought upon them, there is no doubt that the organization which would make a first attempt, if it dared, to meet without the show would quickly be convinced of the folly of its procedure.

Without a doubt, too, the exhibition company would be willing to appropriate a certain sum to each association, in order to assist it in defraying the expense of publishing the proceedings, and would see that the proper meeting places were provided.

This journal realizes that some years ago there was an association of exhibitors, and that this association could not be held together. Nevertheless, so disgruntled are manufacturers with the present situation that there is greater likelihood of success now than then. Moreover, the exhibitors, besides saving the cost of the extra display each year, would probably get their space for less, since the exhibition company would operate at cost, plus whatever appropriations were made to the highway organizations.

This proposal of an exhibit company or association is not by any means new in the exhibit field. The machinery and materials exhibits which are held jointly with the conventions of the American Electric Railway Association, the Master Car Builders' Association, the American Waterworks Association, the American Railway Engineering Association, and the American Concrete Institute are financed in every case by exhibition associations or companies. The technical bodies have no hand in arranging for the shows. In fact, the holding of a manufacturers' exhibit is not, and should never have been, part of the work of the highway organizations. It is essentially a commercial matter.

What has been done sucessfully in other fields is possible in the highway field—if only the manufacturers have the backbone to hang together.

It is time that a stop be put to the dual conventions. The manufacturers have the whip hand. If they will get together and stand solidly against the pressure that will be brought to bear against them, two national conventions a year in the highway field will be a thing of the past.

The influential and energetic manufacturers of road machinery and materials must take the initiative. Highway engineers and contractors, as well as their brother manufacturers, will be their debtors.

City Planning on an Exceptionally Large Scale Is Meeting with Public Approval at Philadelphia

Radical Departures Have Been Made from Old Ideas as to Street Arrangement and Sizes of Lots in Territory to Be Opened Up by $24,000,000 South Philadelphia Improvement

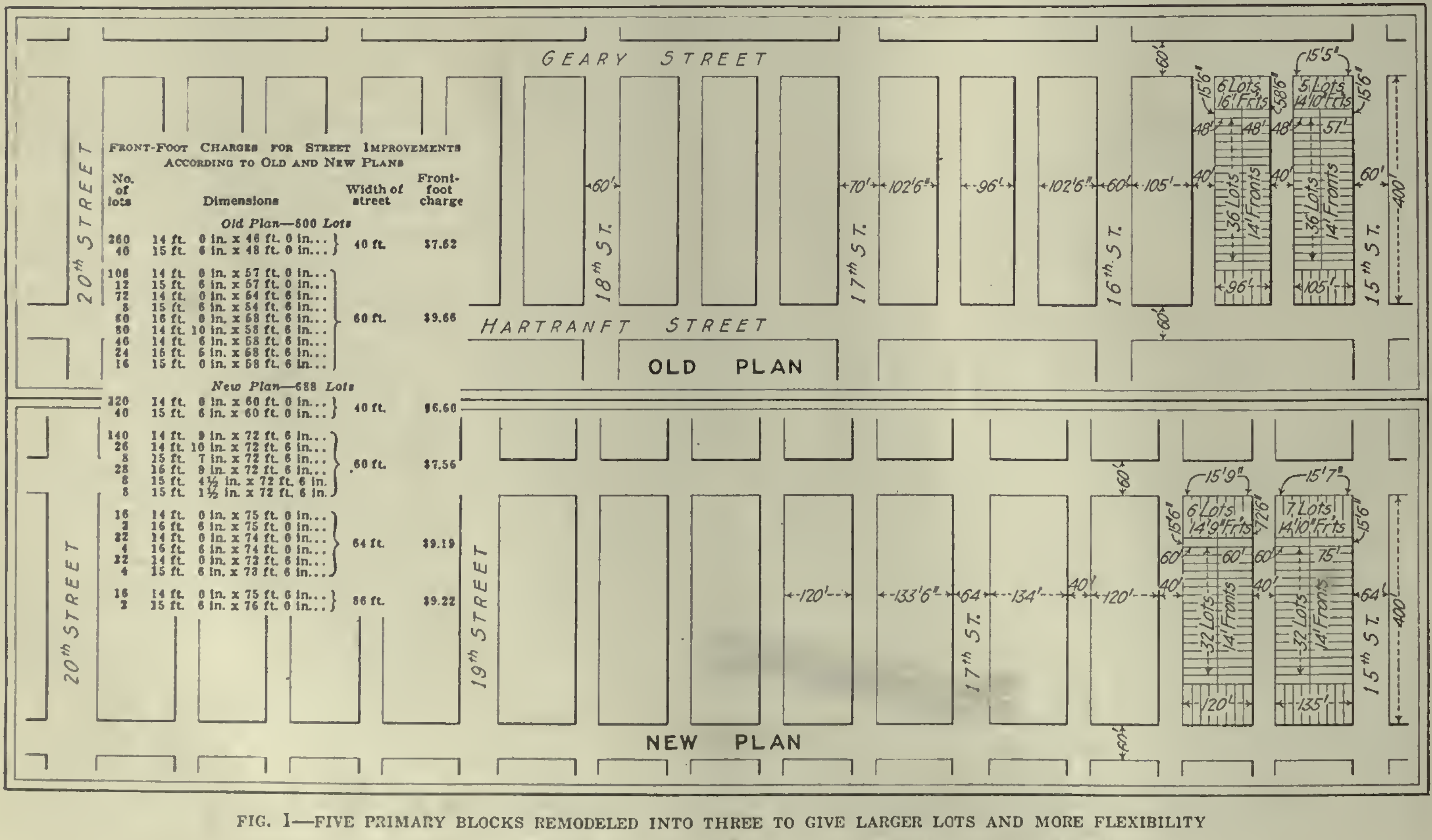
PROBABLY the largest project of comprehensive city planning, as applied to an undeveloped district, ever undertaken in the United States is now being carried out in Philadelphia. This has been made possible by the fact that the $24,000,000 South Philadelphia improvement, described in the Engineering Record of Sept. 11, 1915, page 327, is expected, by the removal of railroad barriers, to open up about 5000 acres of undeveloped city land. In addition to the extensive projects of railroad and pier construction referred to in that article, the ordinance of Feb. 14, 1914, under which the general improvement is being carried out, authorizes "such general revision of the lines and grades of streets as may be necessary to provide for the better service and development of the waterfronts, and more direct and convenient approaches thereto; to provide for proper and adequate facilities for circulation and transportation, and for commercial, industrial and residential development; and to complete the city plan."

SUGGESTED TREATMENT OF OPEN SPACE AT THIRTY-FOURTH STREET AND SNYDER AVENUE

Long ago a street plan was made for this section, following the same arrangement of uniform rectangular blocks as prevails in the present built-up areas, with nothing to break the monotony except a few diagonal streets. For some years the Bureau of Surveys, Department of Public Works, through its General Plans Division, has been working on a radical remodeling of this plan, with these three principal objectives: A better subdivision of land for industrial purposes and the Philadelphia type of house; the classification of streets by widths and arrangement into main thoroughfares and business streets, secondary streets, minor residential streets, and parkways; and the creation of parks, squares and other open spaces to relieve the monotony of the streets and invite artistic treatment. At first the efforts along these lines met with considerable local opposition but at length the real-estate owners and others saw the desirability of the changes, and they are now actively supporting the movement. The revised plans for 2000 acres have been officially established, and the plans for the remaining area are about completed.

Deeper Building Lots

The most fundamental aim of the General Plans Division was to increase the depth of building lots and to encourage more informal schemes of land subdivision. Philadelphia, as is well known, is built up very largely with one-family dwellings in solid rows. This type of development is generally approved and there is no intent to interfere with it. As the built-up part of the city is laid out, however, and as the original city plan was continued into the undeveloped South Philadelphia region, the block distances between main or through streets range from 381 to 400 ft. Dividing one of these blocks with two intermediate streets of a minimum width of 40 ft. gave lot depths often not more than 45 ft., and it is the opinion of the Board of Surveyors that this depth is not sufficient to insure proper housing conditions. On the other hand, with only one intermediate street the lots became too deep, so that the owners found the property difficult to market. Furthermore, lots more than 75 ft. deep are deemed undesirable as they encourage the erection of small buildings behind the houses and lead to the creation of nuisances.



FRONT-FOOT CHARGES FOR STREET IMPROVEMENTS ACCORDING TO OLD AND NEW PLANS

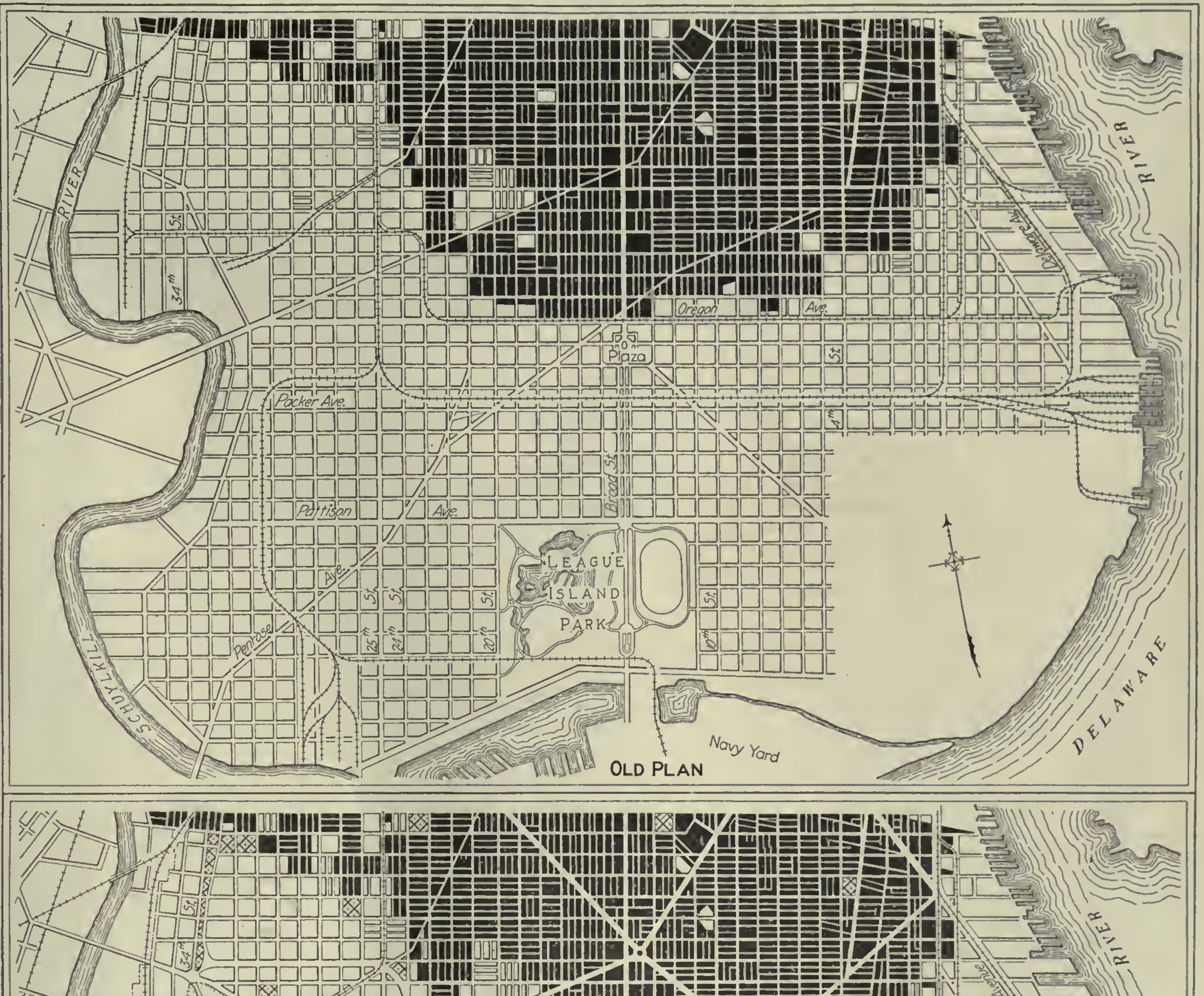
No. of lots	Dimensions	Width of street	Front-foot charge
	Old Plan—800 Lots		
260	14 ft. 0 in. x 46 ft. 0 in. . .	40 ft.	$7.62
40	15 ft. 6 in. x 48 ft. 0 in. . .		
106	14 ft. 0 in. x 57 ft. 0 in. . .	60 ft.	$9.66
12	15 ft. 6 in. x 57 ft. 0 in. . .		
72	14 ft. 0 in. x 64 ft. 6 in. . .		
8	15 ft. 6 in. x 54 ft. 6 in. . .		
60	16 ft. 0 in. x 68 ft. 6 in. . .		
80	14 ft. 10 in. x 58 ft. 6 in. . .		
46	14 ft. 6 in. x 58 ft. 6 in. . .		
24	16 ft. 6 in. x 68 ft. 6 in. . .		
16	15 ft. 0 in. x 58 ft. 6 in. . .		
	New Plan—688 Lots		
320	14 ft. 0 in. x 60 ft. 0 in. . .	40 ft.	$6.60
40	15 ft. 6 in. x 60 ft. 0 in. . .		
140	14 ft. 9 in. x 72 ft. 6 in. . .	60 ft.	$7.56
26	14 ft. 10 in. x 72 ft. 6 in. . .		
8	15 ft. 7 in. x 72 ft. 6 in. . .		
28	16 ft. 9 in. x 72 ft. 6 in. . .		
8	15 ft. 4½ in. x 72 ft. 6 in.		
8	15 ft. 1½ in. x 72 ft. 6 in.		
16	14 ft. 0 in. x 75 ft. 0 in. . .	64 ft.	$9.19
2	16 ft. 6 in. x 75 ft. 0 in. . .		
22	14 ft. 0 in. x 74 ft. 0 in. . .		
4	16 ft. 6 in. x 74 ft. 0 in. . .		
22	14 ft. 0 in. x 73 ft. 6 in. . .		
4	15 ft. 6 in. x 73 ft. 6 in. . .		
16	14 ft. 0 in. x 75 ft. 6 in. . .	66 ft.	$9.22
2	15 ft. 6 in. x 76 ft. 0 in. . .		

FIG. 1—FIVE PRIMARY BLOCKS REMODELED INTO THREE TO GIVE LARGER LOTS AND MORE FLEXIBILITY

Even on the old plan the desirability of deeper lots on the more important streets was recognized.

The only remedy, therefore, seemed to be a change in the size of the main blocks to permit greater variety and elasticity of subdivision.

Fig. 1 shows how the streets have been relocated in the area bounded by Geary, Fifteenth, Hartranft and Twentieth Streets, as well as the detail dimensions of some of the building lots in the old and new plans. The changes, it will be noted, are all in the north-and-south streets. The table shows the number and sizes of the



FIGS. 2 AND 3—THE OLD STREET PLAN AND THE NEW—THE OLD, RIGID AND MONOTONOUS; THE NEW, FLEXIBLE AND INTERESTING

lots in detail in the two plans, together with the charges per front foot for the street improvements. These charges are materially less for the new plan, and this fact has proved a potent argument with the real-estate owners.

It may be said that in time to come a different arrangement of the narrow intermediate streets may be made in unimproved areas, and Mr. Haldeman, the head of the General Plans Division, has stated that he would like to see this done, so as to give the property owners an opportunity for adopting informal plans of the garden city or other type not in conflict with the general city-planning laws. The Board of Surveyors concluded, however, that for the time being it would be better to exercise a more rigid control over the situation.

CLASSIFYING THE STREETS

Tied up with the question of lot subdivision is that of street widths. Business and traffic usually seek the same street, and as only a few streets can become business streets there is always a tendency toward congestion if the street is narrow; even the proximity of other streets of equal width and availability do not attract travel from the business street. The aim, therefore, has been to select a few streets as main thoroughfares and business streets and fix their widths so that traffic and business will instinctively follow them and have ample freedom of movement. Secondary streets will take a less amount of traffic, while the narrow residential streets will be used for local purposes only. In Fig. 1 Twentieth Street is designed as a main thoroughfare and business street, while Fifteenth, Seventeenth and Nineteenth as well as Geary and Hartranft, the secondary streets.

More diagonal streets are provided in the new plan than in the old. These diagonal streets are expected to carry heavy traffic. With industries ultimately segregated along the waterfront and the belt line it becomes doubly important that they may be reached by direct routes without the necessity of going around two sides of a square for long distances. The diagonal streets are equally important, also, in providing direct routes for trunk sewers, principal water mains and other underground facilities.

These diagonals are not laid out perfectly straight for long distance. Minor deviations such as appear in Fig. 3 add little to their length, but give them character and add to the interest of their perspectives.

SUGGESTED TREATMENT OF PENROSE PLACE, LOOKING NORTHEAST

OPEN PLACES

To afford variety and give opportunity for the centralization of public buildings for local neighborhood uses, such as churches, schools, libraries and other similar institutions necessary to the civic activities of the community, a number of open places have been introduced in the new plan. An important feature of some of these open places is the intercepting of the north-and-south and east-and-west streets by a sort of loop street, this being done to eliminate sharp angles of intersecting streets and of streets abutting on the open places, and to increase the economic value and usefulness of the frontages of the wider and more important streets. This, of course, means that in general these open places must be located between and not on the main thoroughfares of the rectangular system, so that these thoroughfares will not be cut off.

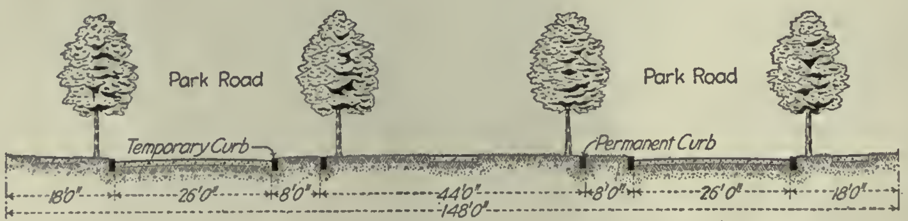
Figs. 2 and 3 show in comparison the old plan and the new for the whole South Philadelphia district. The areas not built up are blackened in. The purely minor streets in the undeveloped section are not shown. Attention is called to the warping of the streets around the open places.

It will be noted that the blocks along the waterfront and the belt line are much larger than those elsewhere. This is to give large industries a chance to locate their plants and expand them as necessity arises without crossing streets, an opportunity they do not enjoy with the present small blocks.

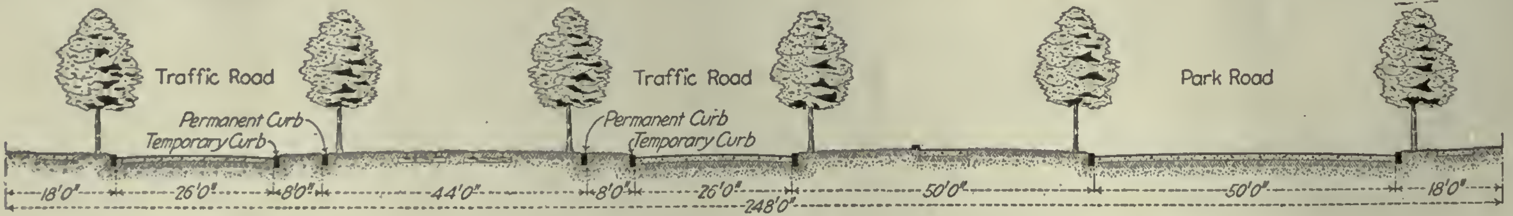
Attention is also called to the large number of small parks scattered through both the built-up and the undeveloped sections in the new plan. Those in the built-up area are already established and the system is being extended through the undeveloped area as the revision of the street plans progresses.

ECONOMICAL STREET WIDTHS

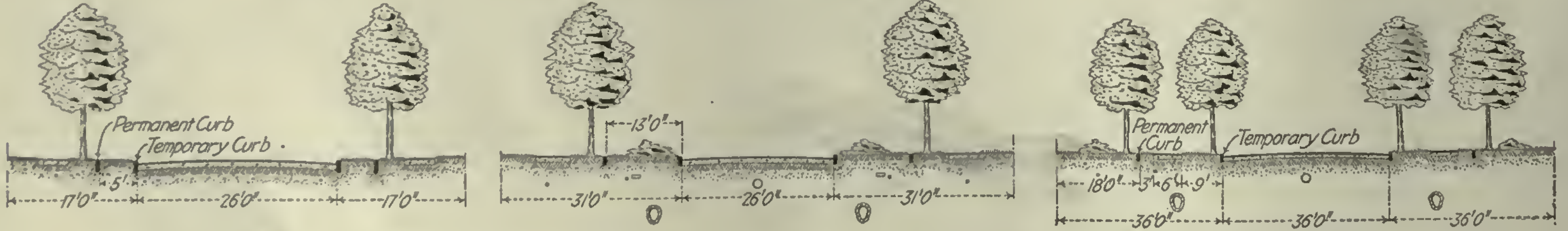
Considerable study has been given to the question of economical street widths, with the result that a number of unusual widths have been adopted. A standard of 18 ft. is used as the width of a roadway for two lines of vehicles, and this width is increased by a unit of 8 ft. for each additional line, except in streets to be occupied with a double-track street railway, for which an 18-ft. unit is allowed. This gives roadways of 18, 26, 36 and 52 ft. for streets of the vari-



148-FOOT PARKWAY



248-FOOT AVENUE—PENROSE SOUTH OF PATTISON



60-FOOT STREET 88-FOOT STREET 108-FOOT STREET

FIG. 4—APPLICATION OF FLEXIBLE PRINCIPLE TO ROADWAY WIDTHS OF VARIOUS CLASSES OF STREETS

Note that both the temporary and the permanent roadways conform in width to the standards adopted by the General Plans Division—18, 26, 36 and 52 ft.

ous commonly used widths up to 88 ft.

For minor residential streets 40 ft. is prescribed by law as the minimum. This is made up by an 18-ft. roadway and two 11-ft. sidewalks. For the 50-ft. streets the roadway is 26 ft. and the sidewalks are 12 ft. each. Sixty-foot streets are in favor, this width allowing 36 ft. for roadway (18 of this being given to car tracks), together with 12-ft. sidewalks. Streets 64 ft. wide are also used, the roadways being the same and the sidewalks 2 ft. wider. Seventy-foot streets are not in favor, as they give an odd number of traffic lines or unnecessarily wide sidewalks.

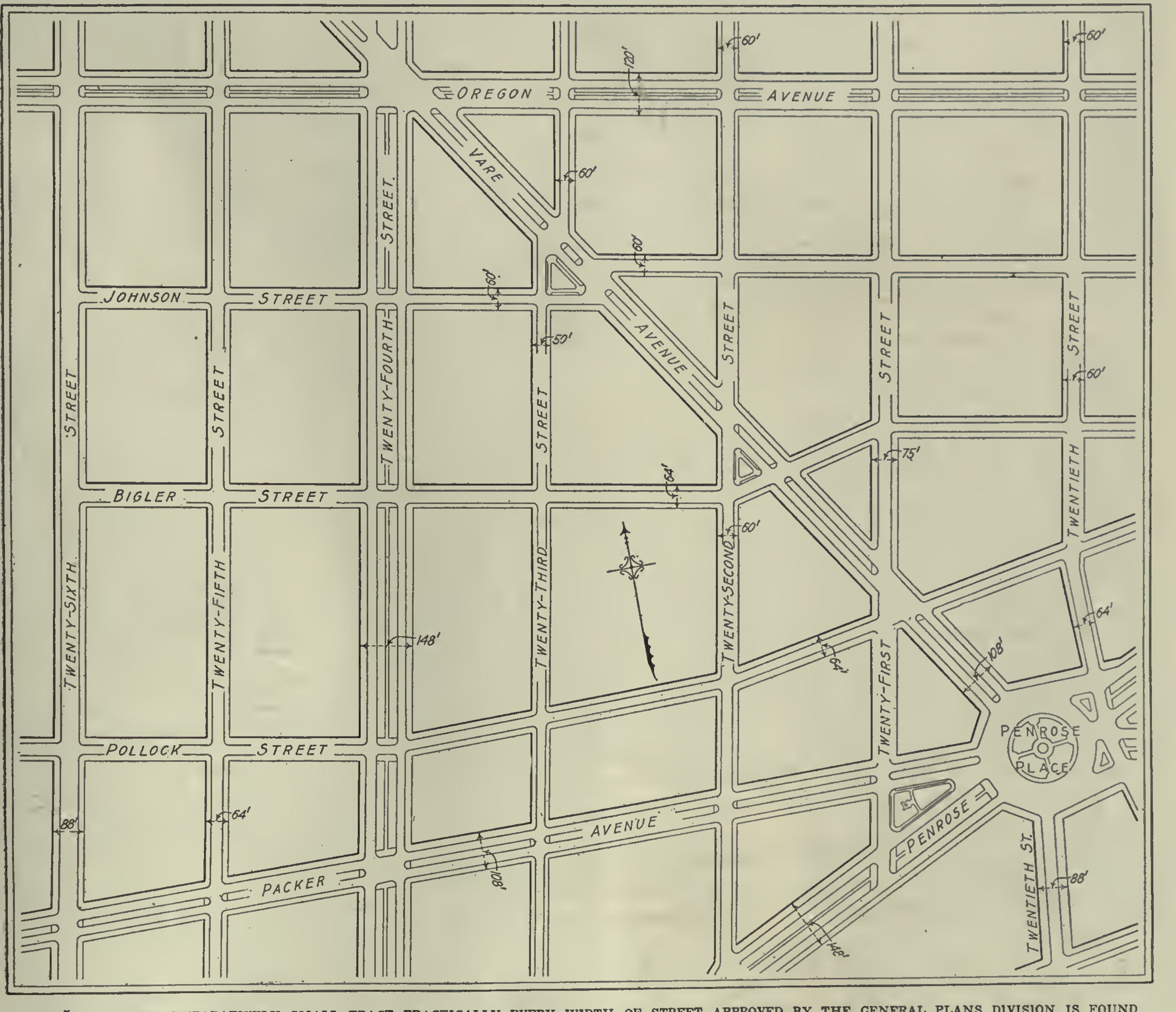


FIG. 5—IN THIS COMPARATIVELY SMALL TRACT PRACTICALLY EVERY WIDTH OF STREET APPROVED BY THE GENERAL PLANS DIVISION IS FOUND

The Division considers 88 ft. an ideal width for business streets, this allowing a 52-ft. roadway (two car tracks and two lines of traffic in each direction) with 18-ft. sidewalks. For some of the diagonal streets expected to carry very heavy through traffic, 108 ft. is the width selected, this giving a 72-ft. roadway, which will accommodate eight lines of traffic or six lines and a double-track trolley line. This is considered about the maximum width for a business street, as business shuns wider streets. Some of the parkways are much wider. Penrose Avenue south of Pattison Avenue being 248 ft. wide, divided up as shown in the middle drawing of Fig. 4.

The elastic principle is being applied to a considerable extent in the street cross-sections by temporarily making some of the roadways narrower than the ultimate plan calls for, this narrowing being based upon the unit widths adopted for lines of traffic. Fig. 4 shows the application of this flexible principle on streets of various widths.

ONE SMALL TRACT WITH ALL CLASSES OF STREETS

Fig. 5 shows the street widths adopted for the section south of Oregon Avenue between Twenty-sixth and Twentieth Streets. This illustrates practically every width used by the Division. Twenty-sixth Street is designed as a business street and main thoroughfare, as shown further on Fig. 3, and is the width believed to be ideal for such streets, 88 ft. South of Penrose Place Twentieth Street is to be a business street and has the same width. At Penrose Place, however, it forks into Vare and Penrose Avenues, leading to the northwest and northeast respectively. Consequently north of this junction Twentieth Street becomes a secondary street, 64 and then 60 ft. wide. Next in importance of the north-and-south-streets is Twenty-first, which is made 75 ft. wide, with a 36-ft. roadway south of Oregon Avenue and a 45-ft. roadway north; this street is a survival of the former plan. Twenty-second and Twenty-fifth Streets, both secondary streets, are 60 ft. wide, and Twenty-third, of still less importance, and offset at Vare Avenue, is only 50 ft. wide. Twenty-fourth Street is designed as a parkway and is made 148 ft. wide, with two 26-ft. roadways and a 60-ft. park space between them.

Penrose Avenue is laid out in a similar way. This avenue is expected ultimately to become a very important thoroughfare paralleling the Delaware River from Philadelphia to Chester, and will probably be occupied by a high-speed rapid-transit line; hence it is likely that the park space will be largely cut down in the future by widening the roadways. South of Pattison Avenue, where the greatest amount of traffic will be concentrated, Penrose Avenue is to be 248 ft. wide. Packer, Vare and Oregon Avenues are intended to be business arteries, and as they are expected to carry very heavy traffic they are made 108 ft. and 120 ft. wide instead of the 88 ft. generally adopted for business streets. Oregon Avenue is also a survival of the former plan. The remaining east-and-west streets are secondary streets 60 and 64 ft. wide. The narrower residential streets dividing up the territory still further are not shown.

ANGLES AND OFFSETS IN SECONDARY STREETS

Attention is called to the numerous angles and offsets in the streets. This is due largely but not wholly to the warping of the street system around the open spaces and to the effort to make the frontage of the main streets more available. The General Plans Division considers it necessary to make only the primary streets direct, deeming it desirable, rather than otherwise, to introduce deviations in the secondary system to give variety and afford the opportunity for small open places and triangles.

A view is shown of the suggested treatment of Penrose Place. It may be mentioned in passing that Penrose Place is not typical of all the open squares, as it is on, instead of between, main north-and-south and east-and-west thoroughfares, and is designed to accommodate the gyratory movement of traffic. The elimination of sharp intersection angles between the streets coming to the square is, therefore, not quite as complete as at the other open places, but this is remedied by making the square larger and utilizing some of the triangles for parking purposes.

It will be noted that there are no curved streets in the city plan. From the city-planning point of view curves are felt to suggest irregular topography and winding ascents of hillsides; hence it is thought that they would be out of keeping with the absolute flatness of the South Philadelphia territory. Furthermore, they would not be acceptable in the development of this territory, which will be commercial and industrial in character, with the one-family row houses in residential sections.

This city-planning work in Philadelphia is being done by the General Plans Division of the Bureau of Surveys, Department of Public Works. B. Antrim Haldeman, assistant engineer, is in charge of the Division, and is assisted by a staff of seven men. The Board of Surveyors has final authority in establishing the plans, and when the street system is confirmed by that body all improvements must be made in accordance therewith.

THE STREAMS OF THE PACIFIC COAST STATES furnish about 40 per cent of the total estimated available water power of the United States, according to a bulletin issued by the U. S. Geological Survey.

Miami Conservancy Plans Are Completed

Project for Protection of Dayton and Adjacent Cities Ready to Be Discussed at Public Hearings

PLANS for the engineering works of the Miami Conservancy District, which includes Dayton, Ohio, have been completed and filed with the directors of the district. They follow in the main the scheme proposed two years ago and described in The Engineering Record of March 28, 1914, page 356. The plan includes the building of five retarding basins, supplemented by channel improvements through the cities. The preliminary plans had called for seven of these basins. The basins, with the channel improvements, will take care of a flood 40 per cent greater than that of 1913.

GENERAL FEATURES OF DAMS

The retarding reservoirs will be formed by dams built across the valleys of the Miami, Mad and Stillwater rivers, and on Twin and Loramie creeks. The total capacity of the retarding basins to the spillway level is 840,000 acre-ft., or 60 per cent of the total rainfall of the 1913 flood.

In general, the greatest rate of flow through the cities below the retarding basins in case of a storm like that of 1913 would be approximately half as great as in 1913. The channel at Dayton when improved and enlarged will have sufficient capacity to carry somewhat less than half as much water as the maximum 1913 flow, and that at Hamilton to carry somewhat more than half; the remainder in each case being cared for by retarding basin control.

The principal dimensions of the dams are given in Table 1.

TABLE 1—DIMENSIONS OF DAMS AND APPURTENANCES

	German-town dam	Engle-wood dam	Locking-ton dam	Taylors-ville dam	Huff-man dam
Average elevation bed of river	723	768	876	759	777
Average elevation valley floor	730	782	885	770	785
Elevation of spillway crest	815	876	938	818	835
Elevation of top of dam	830	892.5	954	837	850
Maximum elevation of water surface for a flood like 1913	805	862	936	815	830
Area submerged in a flood like 1913, acres	2,950	6,350	3,600	9,650	7,300
Maximum amount of water stored in a flood like 1913, acre feet	73,000	209,000	63,000	152,000	124,000
Maximum average depth of water in reservoir in a flood like 1913, feet	24.8	32.9	17.4	15.7	17.1
Length of crest of dam, feet	1,210	4,660	*6,400	*2,980	*3,340
Thickness of dam at average elevation of valley floor, feet	650	740	410	390	380
Length of outlet conduit, feet	520	725	45	40	40
Number of conduits	2	2	2	4	3
Total sectional area of outlet conduits, square feet	182	214	158	1,116	705
Maximum discharge of conduits in 1913 flood, second-feet	9,340	11,000	8,630	51,300	32,600
Length of spillway crest, feet	55	100	72	132	100
Vertical diameter of conduits, feet	12.3	13.5	10.0	20.5	17.6
Yardage of earth in dams	865,000	4,000,000	1,135,000	1,235,000	1,655,000
Yardage of concrete in dams and appurtenances	20,000	38,000	38,000	47,000	40,000

*Including spillway crest.

The highest dam is that at Englewood, 120 ft. above the valley and the lowest is the Huffman Dam, 65 ft. high. For the construction of all the dams, a total of about 9,500,000 cu. yd. of earth and about 190,000 cu. yd. of concrete will be necessary.

The local flood control works at the various cities will consist of widening and deepening channels, correcting sharp bends, raising and lengthening bridges, protecting the sides and bottoms of channels with concrete at critical points, and building levees.

COST

Table 2 gives the estimate of the total cost of each dam, and of each local channel improvement, including the cost of real estate and other damages.

TABLE 2—ESTIMATED COST OF COMPLETION OF ENTIRE PROJECT

Retarding Basins—	
Germantown	$640,235
Englewood	1,959,632
Lockington	865,218
Taylorsville	1,508,674
Huffman	1,299,125
	$6,272,884
Local Flood Protection—	
Piqua	$128,801
Troy	157,574
Dayton	1,383,619
West Carrollton	22,416
Miamisburg	167,267
Chautauqua	4,283
Franklin	115,076
Middletown	81,305
Hamilton	1,274,962
	$3,335,303
Estimated cost of construction of the works included in the plan	$9,608,187
Public service relocations and damages	2,309,315
Real estate purchases and easements	5,664,200
Administration and general expense	1,758,170
Taxes and special assessments, during construction period, on lands acquired	200,000
Estimated cost without contingencies	$19,539,872
Contingencies	4,000,000
Estimated maximum cost	$23,539,872

Construction can proceed on all of the channel improvements and on nearly all of the dam construction at one time. Three years of active construction work should be sufficient for the substantial completion of the project.

DETAILS

The dams will be earthen structures constructed on the highest standards, with liberal sections. Discharge conduits will be constructed on rock. Concrete spillways have a capacity to discharge safely all excess water in case of a flood twice as great as that of 1913.

A short distance upstream from the entrance to the conduits, rows of concrete piers will prevent large masses of timber from floating to the conduit entrances. Booms, anchored to massive concrete piers, also will be constructed, to catch material drifting on the surface of the water and prevent it from being carried into the conduits. The stream beds and the toes and slopes of the embankments of the dams will be paved at and near the entrance to the conduits in such manner as to provide ample protection against all erosive action.

Below the conduits broad channels with concrete floors and side walls, and wide enough to allow the water to spread out very quickly as it issues from the outlets, will extend down stream for several hundred feet, finally connecting, either directly or through an artificial channel, with the river channels below. The bottoms of these channels will be below the water level in the stream. As a result the water leaving the conduits at high velocities will meet comparatively still water in the larger channel below, a stilling pool being formed by the section of increased depth.

LANDS WITHIN THE BASINS

A flood 40 per cent greater than that of 1913 would cover about 35,600 acres of land in the five retarding basins. Of this area about 20,500 acres were actually flooded in 1913, and a larger area would, of course, have been flooded by a flood 40 per cent greater; so that less than 15,000 acres additional would be flooded by the construction of the dams in case a greater storm should ever occur.

The right to flood this land will be acquired by the purchase of the land or by obtaining easements. The construction of the dams will not result in removing from agricultural use more than a few hundred acres of land at and near the dam sites.

Angle for Concrete Chute Suggested by Committee

Recommendation Made After Tests with Mixes of Different Consistencies—Limit Proposed also for Amount of Water

AFTER studying the effect of different chute angles and different consistencies of mix, the committee on mixing and placing reported to the Second National Conference on Concrete Road Building at Chicago two weeks ago that the least angle for chutes should be 20 deg. and that the maximum amount of water should be 6 lb. per cubic foot of loose materials.

In beginning its work the committee looked into the matter of chute paving mixers, against which objection had been made. Opportunity then being afforded through the courtesy of the T. L. Smith Company, investigations of a machine of this type were made, at Milwaukee, by the committee. The machine used was the new Smith-Chicago Paver, No. 507, the capacity being 7 cu. ft. per batch, wet rating. (For description of this machine, see the Engineering Record of Feb. 19, 1916, page 268.) A 12-ft. chute was used, the full length being in service practically throughout the tests.

COMMITTEE'S CONCLUSIONS

As a result of its studies the committee reported that the chuting method when properly used is good. The pitch of the chute should be steep enough to deliver concrete of a proper consistency readily. In the attempt to cover considerable area contractors are likely to set the chute at a flat angle and use too much water in order to make the concrete flow readily. The committee believes, as a result of the tests, that the least angle should be approximately 20 deg. and the maximum amount of water should be 6 lb. per cubic foot of loose materials. With this quantity of water the concrete ordinarily will not flow fast enough for the average contractor on the slope recommended, but after a little time the material flows faster, owing to the smoothing of the chute by the grinding and cleansing action of the wet concrete. It is better to increase the pitch of the chute than to increase the amount of water.

The committee expressed the hope that before the next conference all of the leading mixer manufacturers will have arranged for a test of a battery of mixers of the principal types. Such a test should be arranged so that loose materials can be fed from one bin in certain predetermined quantities and be mixed for the same length of time. It should also consider the size and shape of mixer drums, the form of mixer blades in the drums, the speed of the drum for the best results and all the prominent features which now enable salesmen to put forward selling arguments in favor of a particular mixer. Until such a comprehensive battery test can be made the committee believes that the following points should be observed in mixing concrete for road work:

1. The mixer drum should revolve at a speed not exceeding sixteen revolutions per minute.
2. The minimum number of revolutions for each batch to be ten.
3. The minimum length of time for mixing each batch to be one minute.

TIME OF MIXING

The reason for fixing one minute as a minimum is that in the tests referred to it was found that the water was not worked through the mass as it should be in less than one minute. This is a point which has never been mentioned to our knowledge but it is of importance. A much smaller quantity of water can be used with long-time mixing than with short-time mixing, and the same degree of fluidity obtained. It is necessary therefore to have each batch mixed not less than one minute if the amount of water mentioned as a maximum is to be used.

When the batches mixed for less than one minute were discharged, there was a marked difference between the first and last concrete discharged. In ordinary work, owing to the very large quantity of water used per batch, this has not been marked enough to cause comment. Rapid mixing requires considerable water to secure uniformity in appearance of the mixed concrete and as the quality of concrete is usually judged by the eye too much water is used.

PERSONNEL

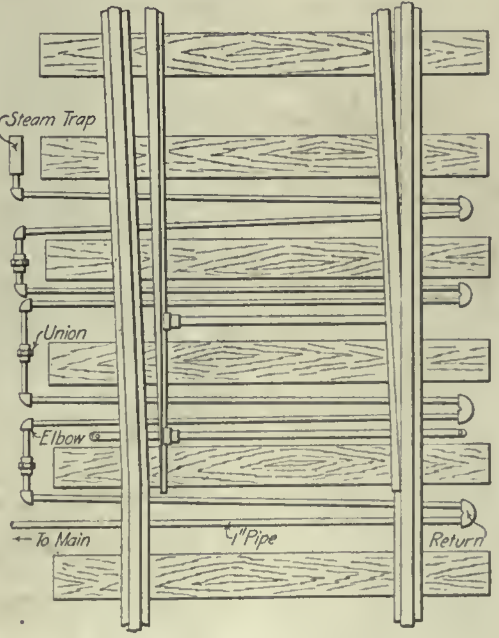
The personnel of the committee was as follows: Ernest McCullough, consulting engineer, Chicago, chairman; John Wilson, consulting engineer, Duluth; Ernest Ashton, chemical engineer, Lehigh Portland Cement Company, Allentown, Pa.; G. E. Scott, contracting engineer, Norwalk, Ohio; A. D. Williams, chief engineer, West Virginia State Road Bureau, Morgantown, W. Va.

Steam Piping Protects Erie Switches from Snow and Ice

By L. A. FRANCISCO
New York City

JUST WEST of Grove Street on the Erie Railroad is an installation of steam piping to heat switches. Two 9-ft. lengths of 1-in. pipe connected at one end by a standard return form one section or hairpin. Four of these sections connected by elbows, nipples and unions form the protection for one switch. The elbows, nipples and union connect the hairpins around the ends of the ties, giving a spread of about 15 in., as shown by the accompanying sketch.

The units are passed between the tees under the rails and on top of the ballast, which is scooped out a little to accommodate them; on the end of the last section is placed a Sarco or Hines steam trap to take care of the condensation. The first section is connected to the main by a 1-in. pipe. The mains run along one side of the yard for some two blocks, as shown by the accompanying photograph, and are supported on ¾-in. saddle irons, which are stuck into vertical sockets of 1-in. pipe. The mains are 2-in. pipe covered with insulating material and having a sheet-metal covering, the whole clearing the ground about 6 in.



ARRANGEMENT OF STEAM PIPING

MAINS RUN ALONG YARD FOR ABOUT TWO BLOCKS

The steam is furnished by a locomotive which is coupled on when the weather warrants it. The coil sections are removed in the summer.

Recommends $2,500,000 Garbage Plant for New York

Works on Rikers Island, Having Capacity of 2800 Tons Daily, Will Revert to City After Five Years' Private Operation

IF the recommendations of John T. Fetherston, commissioner of the Department of Street Cleaning of New York City, are adopted, the garbage of the boroughs of Manhattan, the Bronx and Brooklyn will be disposed of at a new $2,500,000 plant to be constructed by Gaffney, Gahagan & Van Etten on a city-owned site at Rikers Island and operated by these contractors under a five-year agreement, the plant reverting to the city at a sale price of $1,500,000. The contractor is to finance the construction of the proposed works, for it is stated that the city, at the present time, is not in a position to provide the necessary funds. The contractor's net operating profits, it is estimated, will exceed $575,000 per annum. When the city takes over the operation of the works at the end of five years it will realize, for a further period of ten years, an average annual net profit of $527,500. The proposed plant is to have a daily capacity of 2800 tons and will utilize the Cobwell system of garbage treatment, which is employed at New Bedford, Mass. Before making his recommendations for New York, Commissioner Fetherston inspected the New Bedford works and his findings were made public recently in a report to Mayor Mitchel, the source of the following notes.

NEW BEDFORD PLANT OPERATION

In addition to the power plant for the production of steam, there are only three types of apparatus used in the Cobwell method: (1) The so-called reducer, which is essentially a closed, steam-jacketed kettle, with a revolving arm or agitator, used for stirring the garbage. (2) Condensers for liquefying water and gasoline vapors. (3) Vaporizing tanks or stills, consisting of closed vessels, steam heated, for the purpose of separating grease from gasoline or naphtha. Other parts of the process consist of the usual conveying machinery for transporting raw garbage from the reception point to the reducers; grinders with screens and conveyors to grade the tankage or fibrous residue.

At the New Bedford plant 30 tons of garbage are delivered daily in wagons. When a charge of about 8 tons of green garbage is placed in the reducer the opening to the reducer is closed and the process started in operation by flooding the garbage with low-grade gasoline or naphtha-petroleum. Steam is then turned into the jacket, which encloses the lower portion of the reducer or kettle, and the agitator is likewise started in operation. The steam enters the kettle at about 60 lb. pressure, and the temperature within the chamber occupied by the garbage and gasoline is maintained below 200 deg. Fahr. The application of steam heat causes moisture in the garbage and vaporized gasoline to pass off from the kettle into a so-called vapor line, and thence to the surface condensers, where cold water reduces the temperature of the mixed vapor (water and gasoline)and liquefies water and gasoline, which pass into a settling tank, the gasoline occupying the upper portion of the tank, while the water is retained in the lower portion of the tank up to a certain level; the excess water passes from the tank to the sewer. Commissioner Fetherston examined this effluent water from the garbage and found it to be practically odorless, and with only a very slight tinge of color. The effluent, in his opinion, would not constitute a nuisance, and would in reality carry less odor than ordinary household sewage.

Gasoline Acts as Solvent

After the moisture is driven from the garbage the temperature in the reducer rises, thus indicating that the process of abstracting the moisture is complete, and the material is in suitable condition for the abstraction of grease. There are three general products resulting from the treatment of garbage: (1) moisture, amounting to approximately 70 per cent by weight of the original garbage; (2) about 4 per cent by weight of grease; and (3) about 26 per cent by weight of solid material, consisting mainly of vegetable and animal fibre, but containing about 5 per cent of bones, glass, rags and crockery. The valve leading to the vapor line is closed after moisture is evaporated and gasoline is pumped through the fibrous or solid residue until the material receives three or four washings with liquid gasoline, which acts as a solvent and carries off the grease to the vaporizing tanks or stills, where heat is applied to the mixture of grease and gasoline, the gasoline being driven off, condensed and returned to the storage tank therefor, the grease remaining in the still until it is pumped to the grease storage tank for shipment to market. This portion of the process, involving the extraction of grease, is entirely enclosed and the grease at no time is exposed to the atmosphere. No nuisance, it is believed, can result from this portion of the process.

After the solid material in the reducer has had the moisture and grease abstracted live steam is injected into the mass of "tankage" (solid or fibrous residue) for a short time, and the door on the side of the reducer is opened, the agitator or paddle started in operation and the tankage for the first time appears exposed to the atmosphere of the room. The odor in the immediate vicinity of the pile of tankage, the report states, was not objectionable, and 10 ft. away from the mass no odor was perceptible. Any odor which might arise from the tankage discharged from the reducer did not reach the outside atmosphere, though the mass of tankage was within a few feet of two open doorways. The process of eliminating the moisture and abstracting the grease from the garbage, as well as drying the tankage, was all performed in one piece of apparatus which remained closed during the entire time the process was in operation. Only the moisture from the garbage and the tankage were exposed to the atmosphere at the conclusion of the process, and neither the garbage water nor the tankage was at a temperature sufficiently high above that of the surrounding atmosphere to drive off vapors containing odorous gases.

In the new Cobwell system, according to Commissioner Fetherston, inefficient operation will result in the loss of profits, which reverses the conditions obtaining under other methods, so that simplicity in design in this case will force efficient operation and corresponding elimination of odors.

Commissioner Fetherston concludes his report with this statement: "I have compared all the details of the proposed Cobwell system with those of other methods of garbage disposal, both by the so-called cooking process (Barren Island, Columbus, Cleveland, etc.) and the direct heat drying method with percolation by gasoline and no cooking (Chicago), and I believe that in sanitary effect, as well as commercial return from the treatment of by-products, the Cobwell system commands the greatest advantages, more especially from the sanitary standpoint, and that a plant using this system can be operated within the limits of New York City without creating any nuisance due to the escape of odors, fumes, noxious gases or odorous liquids."

Strong opposition to the plant location on Rikers Island has been voiced by real estate interests and taxpayers.

Concrete Slabs Used at Railroad Crossings

Grade Intersections at Cedar Rapids, Iowa, Made Smooth by Premolded Slabs 8 Feet Long and 24½ Inches Wide

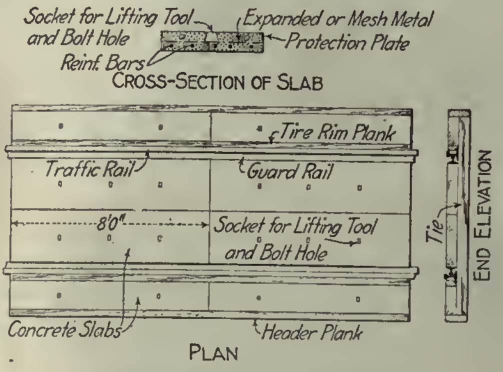
SLABS of premolded reinforced concrete are used in Cedar Rapids, Iowa, for making smooth grade crossings. The slabs are used in pairs, each slab being 24½ in. in width by 8 ft. in length. With proper expansion joints they exactly fill the space between the rails. The thickness is made the same as the height of the rails so that vehicles pass over without a jar. Lewisohn sockets cast in the slabs permit removal by a tripod or by carrying bars usually found in the tool box of a section gang, in case the supporting ties need replacing or electrical connections are in need of repairs.

A letter from T. F. McCauley, city engineer, states that the first crossing was installed on the interurban railway that passes by the city barn and is in as good condition practically as when installed. The second one was placed last September on the Chicago, Milwaukee & St. Paul Railway tracks on a street that carries a heavy storage-house traffic. This one was installed by the section crew. They used a guard rail that was too deep, and as a result they had to force the slabs into place by using an oak tie as a battering ram, with the result that they crushed the edges of the slabs. However, they have gone through the winter without any apparent further damage.

Nothing Needed to Hold Slabs in Place

In installing the slabs no device was used for holding them in place. They were merely laid on top of the ties and at the ends stakes were driven or an end piece was spiked to the ties to keep the slabs from being disturbed. Their weight seems to be sufficient to keep them in place. If necessary, however, it is pointed out that a screw bolt could be placed through the sockets into the ties.

The slabs were made in the city barn of 1 part cement to 2 parts sand, of a rather wet mixture, in an ordinary wood form. They were allowed to harden for thirty days before being hauled to place. It seems to be impossible, says Mr. McCauley, to find a satisfactory pavement for the space between rails, or rather for the entire space over the ties where the track foundation is a resilient one, and it is hoped that this slab construction will turn out to be an improvement over ordinary methods of paving.



DETAILS OF CROSSING SLABS

[Concrete slabs for city pavements that must be removed at intervals were suggested in an editorial in the Engineering Record of April 18, 1914, page 434. Perhaps there are other instances of the use of premolded slabs on such pavements. A discussion of them in these pages is invited.—Editor.]

Gross Operating Revenues for December, 1915, on the large steam railroads of the United States, according to a bulletin issued by the Bureau of Railway Economics, were $1,253 per mile, showing an increase of $260, or 26.2 per cent as compared with December, 1914. Operating expenses were $802, an increase of $72, or 9.9 per cent. Net operating revenue, therefore, was $451—an increase of $188, or 71.7 per cent, and operating income was $398—an increase of $180, or 82.3 per cent. Like the November figures, the above figures compare the highest and lowest Decembers in six years; the increase of operating income in December, 1915, over the average for the five previous Decembers was 49.6 per cent. The operating ratio was 64.0 per cent, as compared with 73.5 per cent in December, 1914, and 73.4 in December, 1913. Considering the three main districts, the representative ratios for December, 1915, and December, 1914, were as follows: Eastern district, 67.4 and 79.3; Southern, 63.3 and 71.1; Western, 60.5 and 68.5.

National Defense—For Engineer and Contractor

Second Article of Series Describing the Pioneer Troop's Duties, Methods for Speedy Work, Assignment of Tasks and the Tools and Equipment Which Least Impede Mobility

By MAJOR P. S. BOND
Corps of Engineers, U. S. Army

THE duties of engineer troops in the United States Army in time of war may, with respect to location, be classified as follows:

1. At bases, mobilization camps and advance supply depots.
2. On the line of communications.
3. In the attack and defense of fortified places (siege operations).
4. With the mobile army in the field.

Each of these is further capable of subdivision, and may include a great variety of works. Duty with the mobile army is the prime function of engineer troops, and is the one on which their organization, training and equipment should primarily be based. All other engineering duties, except, possibly, siege operations, must be regarded as special. They will, when necessary, be performed by engineer troops, either regular or volunteer, with such changes or additions in personnel or equipment, civilian assistance, etc., as the special situation or exigency may demand.

Photo. Am. Press Ass'n.

"THE INTRENCHMENTS OF THE FIELD ARMY ARE OFTEN QUITE ELABORATE, BUT THEY ARE IN GENERAL LOCATED AND PREPARED IN HASTE AND ARE LATER ELABORATED AND DEVELOPED TO MEET THE TACTICAL NEEDS OF THE SITUATION"

Engineer Operations Classified

The engineer troops for field service should be with the combatant forces at the front, at all times subject to the immediate orders of the commanders of the divisions or armies to which they may be attached. Their duties will be intimately connected with the movements and tactical operations of the fighting forces and should be characterized by extreme rapidity, full use of local resources and a thoroughness all sufficient unto the immediate needs, but *no more* than sufficient. Subject to these conditions, the operations of the field engineers may be roughly classified as follows:

1. Operations to facilitate the rapid movement of the combatant forces.
2. Operations to increase the offensive or defensive powers of the combatant forces and to limit or decrease those of the enemy.
3. Operations to maintain the health and promote the comfort of the troops.

In brief, these duties may be classed as, (1) transportation; (2) fortification; (3) sanitation—in short, conserving and promoting the operating efficiency of the troops.

It is of the utmost importance in every case to draw the line of demarcation between the duties of the field engineers at the front and those which properly pertain to the engineer or other personnel on the lines of communication. This is necessary in order to insure smooth co-operation and the presence in every tactical emergency of the mobile engineer troops with the combatant forces. The supreme commander in the field will in each case prescribe and limit the functions of the two organizations. Those of the field engineers should include no work which might have been performed by others. There will be enough which they alone can execute, and their energies should not be frittered away on work for which other troops or civilians are or might be made available.

The more important special duties of engineer troops in the mobile army may include:

1. Reconnaissance of the natural and cultural features of the terrain, preliminary to tactical operations, or for other purposes, and reconnaissance of hostile works and dispositions.
2. Collection of maps and other data from local sources.
3. Correction and amplification of existing charts.
4. Mapping of limited portions of the terrain within the sphere of tactical operations and other minor survey duties.
5. Map reproduction, field methods.
6. Collection and utilization of local engineering resources in personnel and material.
7. Laying out of defensive positions and points of support.
8. Planning and superintendence of offensive or defensive field fortifications, including obstacles, sapping and mining, etc., and the execution of the more difficult tasks in connection therewith.
9. Laying out and improving camps.
10. Sanitation, including water supply and sewage disposal.
11. Construction and repair of roads, railroads and bridges.
12. Construction of temporary buildings and repair of permanent buildings and other structures.
13. Military demolitions.

The ideal engineer troops are those prepared to execute all tasks which may be assigned them, and the engineers of the United States Army are trained with this end in view. In the field they must not only meet but anticipate the needs of the army. To this end the chief engineer should be at all times in close touch with the commander-in-chief and with the engineer troops, and each battalion and company commander of the engineers must be at all times in close touch and hearty co-operation with the troops of the line with whom he is serving.

SPECIALIZATION UNDESIRABLE

On account of the variety of duties exacted of an army in war, we find a strong tendency in many countries to specialize the work of the technical troops. By this is meant that certain organizations are trained to perform a certain kind of work and are not supposed to be employed in anything outside of their specialty. Thus we find in the European armies sapper companies, railroad companies, aero companies, telegraph companies, etc. One foreign engineer has even recommended the organization of water-supply companies.

In our own service the duties of the foreign, aero and telegraph companies fall to the Signal Corps. All the remaining technical field operations demanded by the modern army are to be performed by the engineers—an entirely feasible arrangement. If we were to have special troops for each technical duty there would be no limit to their numbers. Moreover, many of these duties are sporadic in their nature and the troops trained to perform them would necessarily be idle a large part of their time, or else, which is more probable, they would be assigned to other duty, for which they should have been trained. So far as our own service is concerned, a multitude of special troops would be a useless expense, and our engineer companies can and should be trained to perform satisfactorily all the engineering operations required by the mobile army, including the mapping of limited portions of the terrain, the construction of temporary buildings, water supply, the hasty repair of railroads, etc. A single organization large enough to have representatives with every command, from a brigade up, is thus always available and qualified to perform any task that may be assigned. Extensive work of a special nature, excepting siege operations, will generally be executed in the rear of the army, and special provisions therefor can be made as the occasions arise.

QUICK RESULTS ESSENTIAL

Military engineering, as we have seen, is an adaptation of civil engineering to military needs. The fundamental difference between the two arts is in their economic aspects. In civil engineering the element of first cost is of prime importance. The matter of time consumed in construction is of importance as a rule only as affecting the first cost and the financial returns on the investment. A considerable time spent in design and other preliminaries to construction will usually be amply justified by a material saving in first cost.

Such are the economics of civil engineering. Those of military field engineering are very different. The cost of a modern war between two great nations is enormous—estimated at about $100,000,000 per day, not including incidental losses to industry and commerce, for all the European belligerents. The price of success is great enough—that of failure is usually much greater. A few days—even a few hours—have decided the issue of a battle and the fate of a nation. Accordingly, the march of events is rapid in modern warfare. Everything must move with the utmost celerity. Time is the controlling element. The commanding general does not ask his engineer, "How much will it cost?" but "How soon will it be ready?" The rough and ready makeshifts which serve their purpose are the triumphs of the military engineer's art. They have the beauty of utilitarianism.

USE ANY MATERIAL AT HAND

Suppose that it is war time and an army approaches a stream. Its mission is to cross the stream and seize an important position on the other side before the enemy can reach and hold it. The engineer with this force is called upon for a bridge to replace the one that has been unexpectedly destroyed. "It must be ready by day after to-morrow," the Commanding General informs him, "or my opportunity will be lost." Unlike the civil community, the army cannot wait for its bridge. The engineer finds that no suitable lumber is at hand, but he perceives a number of costly buildings whose demolition will furnish what he needs. The owners protest their destruction. The engineer is well aware that they will place claims for many thousands of dollars against the government, but he realizes the vital need for the bridge and rightly considers the cost as insignificant by comparison. He is not restricted to the available funds of a small community, but has at his back the vast resources of a great and wealthy nation which demands results. The buildings are demolished, in spite of protest, and the bridge is built on time. The army accomplishes its mission, which proves to be a contributing cause of ultimate victory.

The two chief essentials of military field engineering, then, are: (1) The adaptation of engineering work to tactical needs; (2) appreciation of the economics of warfare, which ordinarily demand high speed in construction, even at a sacrifice of money and life.

Only the simplest works can be successfully executed in the haste and excitement attendant upon field operations. In the forefront of operations, often actually under fire, construction can and must be carried on under conditions which would be exceedingly discouraging to the average civilian engineer or contractor. It is the simplest works, comparatively few in number, which will most frequently be demanded. It is for the execution of these simple works that engineer officers and troops should primarily be trained.

AIDS TO SPEED

The methods by which speed in construction may be attained constitute a study which no engineers, military or civilian, can afford to neglect. Formal plans are rarely used. Ordinarily nothing more than simple sketches is required. These consist of an instantaneous adaptation of military type plans to the materials, tools and labor available. All details which increase the time required for construction without being absolutely essential to the completed structure are eliminated and the remaining details reduced to the simplest form. Unless construction plant is available, which will seldom be the case, very large pieces should not be used. All pieces should be of such size that they can be readily obtained and easily handled by the men with the assistance of animals and simple tackle.

It is not to be supposed indeed that all military field engineering is in the nature of sudden emergencies. Frequently the need of certain structures can be foreseen days or weeks in advance, and when this is the case careful and elaborate preliminary arrangements may be possible.

In starting work the necessary tools are laid out and steps taken in advance to have all necessary material on hand as soon as it may be required. The work should then be divided into a number of definite tasks under the officers and senior non-commissioned officers, and these again subdivided into smaller tasks, under the junior non-commissioned officers. The cost of superintendence, which might be prohibitive on civil work, is justified in military construction if it results in a saving of time. If several of the tasks can be made similar in nature and equal in amount, so much the better. This will create competition, always a stimulus to endeavor.

It should never be necessary to have any men idle, except when they are actually resting. There always will be tasks in connection with any piece of work, the performance of which will not tire the men as much as standing around, which is very fatiguing. Extra non-commissioned officers should be put to work, on the more dignified tasks, of course. They should not be allowed to get the idea that their sole function is to superintend. The foreman of any particular task should, when practicable, be given a specific time in which to complete it, usually the least time in which the task can possibly be accomplished. While he may fail to complete it on time, he will naturally be anxious to avoid the explanations that will then be demanded of him. If no time is set for completion dawdling is very apt to result. Two gangs mutually dependent upon each other, as where one furnishes the material which another incorporates in the structure, should be so organized that each will be hard pushed to keep up with the other. This is in the nature of competition. If the number of tools is limited, care should be taken that all tools are doing useful work all the time.

NO USE FOR HEAVY PLANT

It has frequently been remarked that military engineers make very little use of construction plant in their field operations and they have been criticised for not availing themselves of it to a greater extent. Plant is utilized in military construction whenever practicable, but in operations with the mobile troops at the front the opportunities for its useful employment are decidedly limited in number. Such plant is, of course, less useful on the light, hasty military structures than on the heavier and more formal works of peace. The work of the military engineers is spread over a considerable area, they move rapidly from place to place, and they must at all times keep up with the mobile fighting forces. Heavy construction plant is not sufficiently mobile to meet such requirements. Often it would not be on hand when needed. One of the chief purposes of such plant is to save manual labor, and of this there is seldom a dearth in military operations. The military pioneer is greatly concerned in preserving his mobility, and accordingly must not be unduly hampered in his movements by the necessity for transporting heavy machines. This is especially true in America on account of the deficiency in good roads. Therefore, he places his chief reliance on the most mobile and adaptable of all machines—man himself.

In the occupation of a defensive position, each soldier intrenches his own section of the line. It is quite apparent that the troops can be disposed in the position and can complete the excavation, each man using his own portable tool, in a few hours of time. In such a situation, trenching machines could not compete with manual labor. If concrete be employed in such intrenchments, it would be distributed in small masses over a considerable distance. Neither large nor small machine mixers would be as rapid and efficient as hand mixing.

For the more formal work in rear of the fighting forces, however, conditions will be different and plant may be more frequently employed. Such works would include roads, railroads and bridges on the lines of communication, buildings at supply depots, the preparation of secondary lines of defense, the rather deliberate fortification of important cities, arsenals, supply depots, etc. Here labor will be less plentiful than at the front, more time will be available, and structures of a somewhat more permanent nature will be appropriate. The intrenchments of the field army are often quite elaborate, but they are in general located and prepared in haste and are later elaborated and developed to meet the tactical needs of the situation.

The foregoing considerations will also make evident the economic necessity for utilizing to the greatest possible extent the construction materials which are available at the site. The necessity of bringing materials from a great distance would often cause most injurious delays. Accordingly, earth, timber, brush, gravel, etc., will be the favorite materials, and works should be designed to utilize these so far as possible. Accessory materials of construction which must be transported to the site should be of a portable nature. Chief among these will be cordage, nails, spikes, wire, barbed wire, etc.

MOBILITY A PRIME FACTOR

The principal construction work of the combatant troops will be intrenching. For this work the troops are supplied with special miniature shovels, picks, mattocks, saws and hatchets, which are carried on their persons. More efficient work could, of course, be performed with the commercial types of tools, but these must be carried in wagons or motor trucks and often would be missing when most needed. "The soldier," said Napoleon, "should never be separated from his rifle or his intrenching tool." What was true in Napoleon's day is more true in this day of trench warfare. The operations of the engineers being more varied, they require a more elaborate equipment. But it must never be forgotten that mobility is a prime requisite, and neither the infantry nor engineers should be hampered in their movements by the transportation requirements of an unnecessarily elaborate equipment.

"THE ROUGH AND READY MAKESHIFTS WHICH SERVE THEIR PURPOSE ARE THE TRIUMPHS OF THE MILITARY ENGINEER'S ART"

The tools and equipment of the engineers may be divided into two classes: (a) Commercial types of tools and materials. (b) Special tools, apparatus and equipment used only by the army. Under (a) would be included the great bulk of engineer equipment, not including the ponton material. Under (b) would be included such equipment as cannot be readily obtained on short notice in the commercial markets—ponton material, the miniature intrenching tools issued to the infantry, tools for military mining and other siege material, wagon and pack equipment (army standard), portable map reproduction outfits, etc. An ample reserve of the second class (b) should be kept on hand at all times, as there would be a considerable delay in obtaining this in sufficient quantity on short notice, in the event of war, on account of its "special" nature. An additional source of supply, besides arsenals and home markets, is the immediate theater of war, whose resources should be utilized to the fullest possible extent.

Tools for pioneer work, like the structures built therewith, should be of the simplest character. A man trained to their use can do excellent work with the simplest tools. The standard pioneer tools and supplies of the engineers should include picks, mattocks, crow-bars, axes, adzes, shovels (mostly D hdl., r.p.), hammers (asstd.), machetes, hatchets, saws, two-man saws, wire cutters and pliers, a few light jacks, augers (large sizes), a few short rock drills, canthooks or peavies, pulley blocks (up to four sheaves), a couple of small chain blocks, lanterns, marline, rope for lashing and tackle (3/8-in. is a good size for lashing, 3/4 to 1-in. good for tackle, nothing larger), wire (10 to 14 AWG—a copious supply), spikes and nails, various sizes. There should be flat and round iron for straps, bolts, driftbolts, dogs, etc., a little tool steel, some tapped nuts of same sizes as round iron, and washers (wrought), machine and black oil and oil for lanterns, one or two light portable forges and anvils with a little coal, a couple of grindstones, leather, etc., etc.

In addition to these general tools and supplies, there should be several small and compact carpenter outfits, a simple blacksmith's, machinist's and horse-shoeing outfit, a farrier's kit, saddler's and shoemaker's equipments, sketching instruments (to be carried on persons of sketchers), a couple of light transits (to be used also as levels), stadia rods (used also as level rods), a number of metallic tapes, 50 and 100 ft.; a simple plumbing kit, twine, tracing tape (for laying out intrenchments), a demolition outfit (40 per cent dynamite is the handiest explosive), a camera and simple photographic supplies, a simple drafting and map reproduction outfit, a field desk and portable typewriter for the company office, etc.

TRANSPORTATION OF EQUIPMENT

The entire equipment is ordinarily carried in wagons divided into compartments to permit ready accessibility. It should, however, be such that it can be carried on pack mules, in which case survey instruments, photo equipment and the smaller and more delicate tools, such as carpenter's outfits, are packed in boxes of a suitable size. Each company of engineers ordinarily includes a section of mounted men and a small pack train carrying their equipment. In very rough country, where wagon transportation is impracticable, the entire equipment would be carried on pack mules. There should be an ample supply of the more common tools (especially picks, axes, mattocks and shovels) so that when occasion arises the labor of other troops or of civilians can be utilized. Most of the tools and materials listed above should be carried by each company of engineers, but some of them will be needed only with battalion headquarters.

With this simple equipment the engineers can perform all the operations which will ordinarily be required of them, utilizing such materials as may be found at hand. Beyond this it does not seem advisable to recommend any standard equipment, except the regular ponton bridge equipage. There is a large number of special tasks for which special equipment may be used to advantage. Such equipment should be obtained locally or sent forward from the base as it is needed. Plows and scrapers are most useful for road work, intrenching, and many other tasks. In a civilized country they can be obtained in almost any locality. For simple railroad repairs a few claw and tamping bars, track jacks, spiking hammers, wrenches, hack-saws, track drills and a "jim-crow" rail bender will be sufficient. Traction and hoisting engines and the commercial types of trenching machines may be used to advantage in fortification work and almost any heavy construction. They can not, of course, accompany the engineers in their more rapid movements, but for big jobs in one locality they may be sent forward when needed.

The battalion headquarters may carry some equipment in addition to that of the companies. Extensive survey work and map reproduction should preferably be under the immediate charge of the battalion commander; the equipment therefor, especially lithographic (zincographic) outfits being with battalion headquarters, operated by special skilled men.

For rapid communication between the separated portions of an engineer command, engaged at section work at various localities, a small micro-telephone outfit and a few bicycles should form part of the company equipment. All engineer officers should be mounted. The development of the motor truck will greatly increase the efficiency of engineer troops, making possible the more rapid transportation of tools and materials. It has also made possible the transportation of small, compact gasoline power plants, which may have a wide field of usefulness. Up to the present time few such plants have been developed, inasmuch as the present war is the first in which the automobile has been extensively employed. Among the possible gasoline power plants for military purposes are the following: Portable searchlights, winches, hoists, drills and boring machines, saws, trenching and mining apparatus, concrete mixers, stone crushers, etc. Very little has been done along these lines and there is room for great improvement.

[*The next installment of Major Bond's articles will deal with stream crossings by means of ponton and truss bridges—one of the most important phases of the military engineer's work.*—Editor.]

Check Dams Subjected to Extreme Flood Test in Southern California

RESIDENTS in the district below Haines Canyon in southern California, where check dams were built to prevent the rapid run-off during heavy rains, affirm that the plan is eminently successful. For thirty years there have been floods from the canyon as often as the rains came, it is stated, but this year, with the check dams in service.

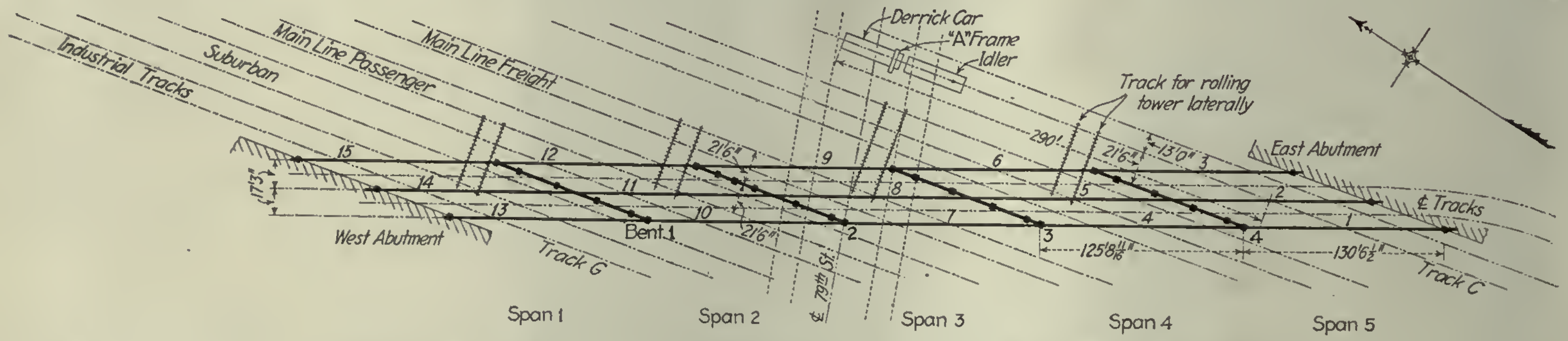
Haines Canyon now has 427 small dams, a complete account of which appeared in the Engineering Record of Aug. 14, 1915, page 204, and although these represent the completion of the work in the upper half of the canyon only, they sufficed to prevent serious effects from the heavy storms of the present season, during which more than 16 in. of rain have already fallen in that section. During the rains the stream from the mouth of the canyon was never so large that school children were unable to cross it easily. When the check dams are finished throughout the entire length of the canyon it is expected that the storm run-off will be entirely absorbed by the cone at the canyon's mouth.

Since the work in Haines Canyon was undertaken, more than a thousand other check dams have been built on private lands in the vicinity. One estate in this district has more than 100 dams, each of which is now retaining its pool of water where preceding seasons left simply the eroded gorge.

Special Steel and Timber Erection Tower Places Heavy Plate Girders

Longest Girders in World Erected for Nickel Plate Railroad Bridge Over Illinois Central in Chicago by Specially Designed Rigging

UNUSUALLY GOOD RECORDS were made in the erection of the long heavy plate girders in the New York, Chicago & St. Louis (Nickel Plate) Railroad over the Illinois Central Railroad tracks at Seventy-ninth Street, Chicago. Special erection rigging was designed to handle the 113-ton girders, which exceeded the capacity of any wrecking crane or derrick car with sufficient length of boom to handle them. Some of these girders are of record-breaking length, the end span being 130 ft. 6½ in. long, the longest ever built. The center girders are nearly 126 ft. long and 10 ft. 10 in. deep; their weight of 113 tons is less than the previous record-holding girders at Worcester, Mass., on the Boston & Albany Railroad, which weigh 170 tons, though only 122 ft. long.



PLAN OF NICKEL PLATE RAILROAD BRIDGE SHOWS ORDER OF PROCEDURE IN ERECTION OF GIRDERS

THREE-LEVEL CROSSING

Near the center of the bridge both railroads cross Seventy-ninth Street, forming a three-level crossing. The Nickel Plate bridge is of the through plate-girder type with solid ballasted floor, three girders spaced 17 ft. 3 in. on centers being used in each of the five skew spans, making fifteen girders in all to be erected. The span lengths were all the same, 125 ft. 8 11-16 in. on centers, except the record span of 130 ft. 6½ in. at the east end.

The problem of safely and rapidly erecting these girders from cars on the tracks of the Illinois Central Railroad without unnecessary interruption of traffic was solved by the use of a special heavy timber and steel tower illustrated in the photographs. This tower was so constructed that by taking out the connection bolts a 15-ft. "gate" section in the west leg could be removed in order to clear the girders when sliding the tower laterally to its next position. Removable transverse braces were placed below this "gate" just before it was taken out, thus stiffening the tower and making a solid base for the cantilever above.

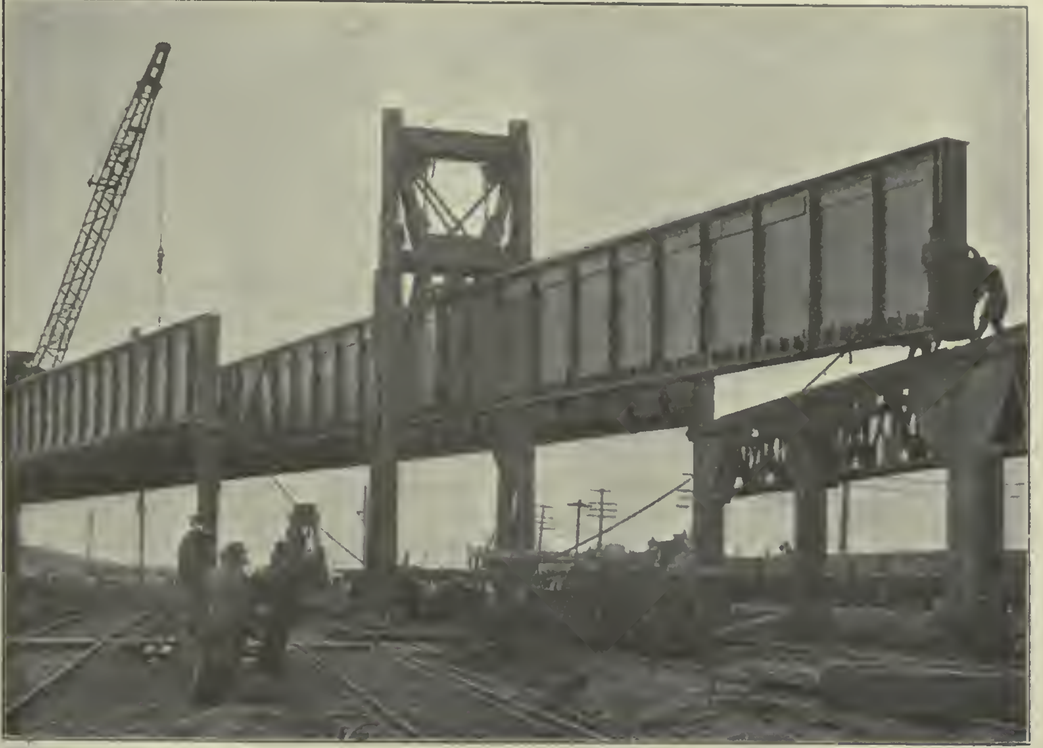
The tower was first erected by a derrick car on the Illinois Central Railroad track *C* to clear the tracks, and was skidded along parallel to the track to its position 1 to erect the south girder of span 5, as noted on the accompanying plan. The tower was then blocked up in this position and the temporary bracing in the lower part removed. The girder was run in on track *C* under the tower, picked up and turned about 20 deg. and placed in its final position. Power was furnished by a derrick car anchored to the track about 300 ft. north of the tower.

The temporary lower bracing was then replaced, the gate section removed and the tower skidded along until it reached position 2 for erecting the middle girder of span 5. The gate section was then replaced, the temporary bracing removed and the second girder placed in position as before. After the erection of the three girders of span 5, the tower was moved clear of bent 4, both the gate section and the temporary bracing were bolted in place, and the tower was skidded over the temporary track under span 4, and the erection carried out as before. The erection then followed in the order given by the number on each girder.

RAPID PROGRESS MADE

After about ten days' delay, which was experienced on reaching span 3, because the lower level bridge over Seventy-ninth Street was not sufficiently complete to proceed, the tower erection continued at the rate of a girder a day, an extra day being required in each case to move the tower laterally across the tracks.

The tower was designed to permit traffic on immediately adjacent tracks, and only when steel was actually being raised or the tower was being moved was more than one track blocked to traffic. A 30-ton crane working upon the new bridge followed up the tower and placed the I-beam floor and other light parts. Just two months after the first steel was unloaded at the site the



SPECIAL TOWER PLACING HEAVY CENTRAL GIRDER IN NICKEL PLATE BRIDGE, CHICAGO

erection tackle was unloaded and shipped away from the site.

A total of 2488 tons was placed in the bridge, the girders varying in weight from 86 to 113 tons. Each long girder was shipped from the shops on four flat cars, two middle spacing cars, and two end cars of 150,000-lb. capacity carrying the weight of the girder.

Unusual Design Features

The design of this bridge is unusual in the use of steel columns in the end abutments, surrounded and braced by the concrete and carrying the end girders. In this way the length of the girders could be made less than would be required for a full bridge-seat bearing on top of the concrete abutment. As every inch increases in span length caused a large increase in the bending moment and cost of such record-breaking girders, this device was found to be economical.

Expansion was provided by fixing the central girder span 3 and the adjacent girders at bents 2 and 3, allowing expansion both ways on top of the other bents and the abutments. Owing to railway clearance requirements, no longitudinal bracing or brackets could be used. The expansion bearings, instead of being the usual roller and rocker type, are made of special steel castings, with oil grooves, sliding on the cap plates of the columns. The castings contain cylindrical projections which engage the hollow cylindrical casting fixed to the girder.

The erection was planned and the special tower designed by the erection department of the Pennsylvania Steel Company, of Steelton, Pa., contractors for the steelwork of the bridge, under the supervision of E. E. Hart, chief engineer, and G. H. Tinker, bridge engineer, of the New York, Chicago & St. Louis Railroad.

The Supply of Flint Pebbles for the sand-cement plant at the Elephant Butte dam of the United States Reclamation Service has been cut off since the war began, according to the March *Reclamation Record*. Canadian pebbles were purchased, with decreased efficiency, and in the latter days of the operation basalt pebbles were used, but proved very unsatisfactory.

Settle Waterworks Valuation Without Litigation

Engineers in Maine Case Make Notable Savings in Time and Money as Compared with Usual Protracted Court Appeal and Appraisal

At a Conference at Brunswick, Me., Feb. 10, between Frederick H. Fay, of the engineering firm of Fay, Spofford & Thorndike, Boston, representing the Bath (Me.) Water District, and W. B. Getchell, engineer of the Maine Water Company, of Augusta, it was agreed that the plants, property, rights and franchises of the water company in the county of Sagadahoc and the town of Brunswick should be taken over by the Bath Water District at a price of $539,500, with interest on this sum from Jan. 1, 1916, at 6 per cent. The agreement is the first in Maine, and so far as known in New England, in which the award is less than the total reproduction cost of the physical plant, and it exemplifies a method of settling waterworks valuation disputes which has never before been utilized in any major water case in the state. By engineering arbitration the price of the system has been agreed upon within about four months of the passage of a referendum authorizing the taking of the works by the Bath Water District. Protracted legal proceedings and a court appraisal have been avoided, and a satisfactory settlement attained without the necessity of a third arbitrator. It is estimated that the actual saving to the Water District in interest charges, legal expenses, experts' fees and other outlays exceeds $40,000.

By chapter 197 of the private and special laws of Maine, of 1915, the Bath Water District was created and authorized to purchase and administer the supply system of the water company. During negotiations the two interests agreed that the question of reproduction cost of physical plant, depreciation and water rights should be left to the engineers on both sides. After examination and appraisal of the waterworks system by the engineers it was determined that the cost of reproduction, new, as of Jan. 1, 1916, of the physical plant, excluding (a) real estate, rights of way, tools and supplies on hand, (b) depreciation, (c) water rights and (d) going concern value, was $544,491. The value of water rights was agreed upon as $5,000, and rights of

GATE IN TOWER REMOVED WHILE SKIDDING LATERALLY PAST GIRDER

MOVING TOWER FROM SPAN 3 TO SPAN 2—GIRDER ON CARS AT LEFT way, tools and supplies totaled $14,516, making a total of $564,007, subject to modification in taking account of depreciation and going value.

ENGINEER ARBITRATORS

These conferences ended in a disagreement between the two sets of engineers who took part as to the depreciation allowance, and accordingly the trustees of the water district and the water company agreed to arbitrate the final price through Messrs. Fay, and Getchell, provision being made for the selection by them of a third arbitrator in the event of a disagreement. It was agreed that the two arbitrators should appoint a time and place for private meeting outside of Bath, Portland or Augusta; that prior to this meeting both parties should have the right to furnish any evidence deemed apropos to Messrs. Fay and Getchell; that each party should pay the fees and expenses of its representative and share those of a third arbitrator, if such should be named. Both parties recognized the advantages of avoiding litigation and a court appraisal in placing the settlement of the case in the hands of their engineers. The result of the arbitration was the above-named price of $539,500, with interest, or $19,507 less than the total reproduction cost.

In previous cases, where the parties have been unable to agree and have been obliged to resort to a court appraisal, the final price awarded has averaged about 1.5 times the amount of reproduction cost. In the case of eighteen water districts in Maine and Massachusetts in the past few years the average award has been 54 per cent in excess of the reproduction cost. The accompanying table gives the reproduction costs and prices awarded in several New England water district cases:

REPRODUCTION COSTS AND PRICES AWARDED IN SEVERAL NEW ENGLAND CASES

Place	Reproduction cost	Award	Ratio, award to reproduction cost
Gardiner, Me.	$132,000	$245,000	1.85
Waterville, Me.	368,546	503,475	1.37
Augusta, Me.	287,279	427,135	1.48
Kittery, Me.	102,510	163,869	1.60
Livermore Falls, Me.	85,394	117,698	1.38
Portland, Me.	2,853,696	3,963,034	1.38
Gardner, Mass.	165,000	274,000	1.66
Athol, Mass.	206,386	316,500	1.53

The cost of arriving at the valuation in the Portland case was $152,000 for the municipality and $130,000 for the proprietary water company; in the Gardner, Mass., case the total cost was $72,390; in the Waterville case, $80,600; in the Augusta case, $78,000; and in the Gardiner (Me.) case, $27,317. In the case of Brunswick, Me., the reproduction cost was $130,455, the award $196,162, and the total expense, $41,500.

BASIS OF AGREEMENT

The price at which the Bath supply system is acquired, based on the average operating expenses for the past ten years, indicates that the district, under proper management, should be able from the first to pay all operating charges, interest on bonded debt, yearly sinking fund of 1 per cent and have an annual surplus of about $5,000. The district will receive all water rates collected by the company since Jan. 1, less the actual expenses during the period.

To save the cost of employing an expert accountant it has been agreed that this accounting shall be done by the superintendent of the water company and by the clerk of the district, referring any disputed questions to Walter S. Glidden, counsel for the district. This accounting will take but two or three days. The trustees of the district were desirous of making immediate arrangements for marketing a bond issue to finance the purchase, a step which could not have been taken satisfactorily at this time had a court appraisal been resorted to instead of the engineering arbitration. The trustees feel entirely satisfied with the result, and the water company has expressed itself as thoroughly gratified with the method and solution of the problem adopted. It is expected that early in the present month the district will be in full possession of the property.

Shall the American Society of Civil Engineers Move Its Headquarters?

Views of Prominent Members on the Important Question Now Awaiting the Decision of the Society

[In its issue of Feb. 5 the Engineering Record presented a summary of the proposal to have the American Society of Civil Engineers move its headquarters in New York to the Engineering Societies' Building. In the editorial discussion in the same issue it invited engineers to send their views for publication. An invitation was also extended by letter to present and former officers to express their opinions.

A number of the replies are presented below. Those of William Barclay Parsons, William J. Wilgus and Palmer C. Ricketts oppose the removal. On the other hand, John R. Freeman, Henry G. Stott, Gardner S. Williams, Hunter McDonald, John A. Bensel and James H. Edwards favor the proposal.

Additional replies will be published in later issues.—EDITOR.]

Gardner S. Williams, Formerly Vice-President and Director of the Society, Favors the Proposal, Seeing in It Great Good for the Profession.

The invitation extended to the American Society of Civil Engineers by the three other great national engineering societies, to join with them in the occupancy of an enlarged Engineering Societies' Building on Thirty-ninth Street, New York City, brings the former face to face with a situation of large and far-reaching possibilities. In submitting to the membership the question whether to accept or to decline the invitation, the board of directors has placed upon every engineer in the society a personal and serious responsibility.

The question as submitted now, based on the invitation of the other societies extended of their own free will, is materially different from that voted upon and rejected 12 years ago, when the proposal was the outcome of the conditions of a gift.

Whatever doubts there may have been as to the possibility of the societies living in harmony under one roof, or of the financial success of the plan, are now reasonably well cleared up by the fact that three of the societies have so lived for over a decade, and have accumulated a "Repair and Depreciation Fund" of $70,000.

That the decision of the American Society of Civil Engineers to remain in its own quarters on Fifty-seventh Street was wise, the writer firmly believes, for in the solution of the problems confronting them the character and strength of the other societies have been more firmly developed than would have been the case had they been able to lean upon the civil engineers, while the latter, by their assertion of independence of the munificent gift of a generous patron, attracted to their membership many of the influential men in the sister societies.

But times and conditions have changed. The separate organizations, at one time extremely jealous each of the other, have come to realize that each has its field and that outside of, and over, and above all is a demand for a spirit of unity and co-operation that was only a dream 12 years ago. This is an age of combination and organization. The medical fraternity of the country through its co-ordination of national, state and county medical societies, exerts a power both socially and politically which enables it to secure any reasonable legislation that may be demanded, either state or national. It is unnecessary to more than refer to the bulwarks a united legal profession has built around its functions and practices. The engineers must take these lessons to heart and profit by them if the profession is to receive in the future that recognition to which the importance of its work in the past entitles it. In other words, the engineers must get together, stay together and work together. To such an end the occupancy of quarters by the civil engineers in the same building that houses three other great national engineering societies, as well as a dozen more or less of allied technical organizations will unquestionably conduce.

This does not contemplate any amalgamation of the American Society of Civil Engineers with the other societies so far as the functions it has hitherto exercised are concerned, but in the writer's mind it is a step and a long one toward the creation of some form of organization, in which, through society representation or otherwise, the interests of upward of fifty thousand engineers and allied craftsmen in the United States, scattered from Maine to California, from Florida to Alaska, may be intelligently guarded, and their influence brought to bear upon the great social and economic problems which this twentieth century is presenting for solution.

William J. Wilgus, Formerly Director of the Society, Favors a Change of Headquarters, but Not as Proposed.

It is with pleasure that I give to you my views on the society house matter of the American Society of Civil Engineers, as I am decidedly of the opinion that a change should be made, although not in the direction that is proposed.

Beyond question the society house is too small, poorly located and so ill-lighted as to have a most inhospitable and depressing effect upon the visitor.

I am not in favor of the use of the Engineering Societies' Building, because I feel that the American Society of Civil Engineers is in such a strong position financially that there is no need for the acceptance, indirectly or otherwise, of a gift from any one outside of its own circle. This, of course, is a purely personal view on my part, as the idea of the society not providing for its own home is repugnant to my sense of independence.

Therefore, because of the need for a change of quarters and also because of the strong financial condition of the society, I am in favor of the purchase of a suitable location in or near the business center of the city, and the erection thereon of a commodious and attractive structure, with adequate provision not only for the present needs of the society, but also for a reasonable time in the future, the spare space not needed at first to be rentable for office or other remunerative purposes.

Without having gone into the matter in detail, it seems to me that, possibly with the aid of many of the members of the society, among whom I would be glad to be numbered, a fund of sufficient size could be raised to finance this project, thereby retaining for the society its independent position, which I hope that it will not sacrifice.

Wm. Barclay Parsons, Formerly Director of the Society, Suggests Single Engineering Organization and Opposes Proposed Plan.

My view is that the American Society of Civil Engineers should retain its own house and its entire separate identity, unless it would be possible to merge all the societies into one American Institution of Engineers. The profession should stop dividing itself up, as it has done, into a multitude of small units. The law and medicine do not make that mistake.

Until a concrete proposition of this sort can be brought forward to merge the societies, I am opposed to the civil engineers moving from Fifty-seventh Street.

John R. Freeman, Formerly Vice-President and Director of the Society, Heartily Approves of Plan.

As one who has enjoyed membership in the American Society of Civil Engineers for thirty-three years past and who has also been active in other engineering societies and a great believer in their usefulness, I am earnestly in favor of the American Society of Civil Engineers joining with the other national engineering societies in the use of the Engineering Societies' Building in New York. There are many good reasons why we should "get together". Among those which appeal to me personally are the following:

1. That the closer contact thus gained with members of allied professions will help in advancing the appreciation of the engineering profession in this country. In several trips abroad, and particularly when attending the annual meeting of the Verein Deutscher Ingenieure in Leipsic, two and one-half years ago, I have been impressed with the better appreciation of the profession by the public abroad, and in the case of the verein this has seemed to me in no small part due to the presence of engineers, from all branches, in one great body.

2. In the Engineering Societies' Building I believe we have the opportunity to build up the best engineering library in the world and one in which the availability of a collection of books pertaining to all branches can be brought to the distant member by a system of research and prompt service, with abstracts and photographic copies of texts, more efficiently if organized on a large scale on behalf of all the engineering societies.

3. I believe the advancement of the profession, the helpfulness of older members to younger members, and the helpfulness of specialists in one branch to those in another branch can be best effected by means of a strong central organization, in which the civil engineers should have their fair share; and that in course of time affiliated with this central organization, the local societies at each of twenty, or perhaps fifty, engineering and industrial centers throughout the North American continent should be encouraged to carry on the work that can best be accomplished by a local society, but all in harmony.

4. The facts appeal strongly to me, after years of interest and activity in these matters, that in the United Engineering Society and its building and in the Engineering Foundation and in the great central library, we have a machine admirably adapted to promoting the interests of the profession in the broadest possible way, and that it is best at the present time to get together on the fundamental principles involved and trust to the application of common sense with engineering experience in course of time to smooth out or mend petty obstacles and loose joints.

In any great movement one must trust more to the spirit which animates than to the precise and elaborate verbiage of articles of association.

Already the matter has been shaped up on broad lines which appear fair and liberal to all concerned, and I believe it better to get together at once and to trust something to the future intelligence of those whom we elect to represent us in carrying on this closer union.

Hunter McDonald, Past-President of the Society, Adduces Arguments in Favor of Removal.

To my mind the proposition admits of little room for argument on the negative side, unless the material interests of the American Society of Civil Engineers are to be given consideration to the exclusion of the professional interests of this society and the profession at large.

In the annual address which I delivered at Baltimore in June, 1914, I gave my views upon the importance of co-operation among all engineers for the good of themselves, the profession and our country. In the same address I also gave my views as to the wisdom of remaining in the present quarters of the society.

At that time I did not know that the doors of the United Engineering Building would ever be again opened to us, and it was not until January, 1915, at the time of the annual meeting that I was advised by Clemens Herschel that there was a probability of its accomplishment. I at once expressed to him my entire approval of the project.

The building which we now own has served a useful purpose, and the society has grown and prospered under the wise management which conceived and carried out the plan, but many changes have taken place since this building was completed. Other societies have grown in importance and numbers. The number of engineers not connected with any of the national societies has vastly increased. Engineers are at last beginning to realize that they, more than any other profession, have it in their power to shape the destiny of our country.

A thorough co-operation of the engineering forces of Germany has made possible her remarkable exhibition of prowess and resistance.

I believe the time has come for the American Society of Civil Engineers to put aside all material considerations in the effort to bring about unanimity of thought and action among all the engineers of this country, and I regard the removal to the Engineering Societies' Building as the first and most important step in this direction.

It will be unfortunate if the matter is defeated or is decided by a close vote. I sincerely hope it may be carried by an overwhelming majority. There is no doubt but that there will be opposition, but I believe it will arise largely through misunderstanding. There may also be discussion of the material interests involved, and if such develops it may become bitter and acrimonious. The announcement by the board of direction of the suggested plan shows that the material interests are about balanced between moving and remaining where we are, but if the proposition is defeated, I shall continue to advocate a building, which will bring in an income commensurate with the value of the location we now occupy.

John A. Bensel, Past-President of the Society, Approves of Plan.

Permit me in the first place to state that in my opinion the Engineering Record is performing valuable service to the engineering profession by opening its columns to the discussion of the arguments for and against the proposal to have the American Society of Civil Engineers join with the other national engineering bodies in the use of the Engineering Societies' Building in New York.

I believe the subject one of grave importance not only to the society, but to the profession as a whole and therefore welcome the opportunity offered by you for an expression of my views.

I am strongly of the opinion that it would be to the advantage of the American Society of Civil Engineers as a body, as well as to the profession as a whole, for it to join the other societies in Engineering Societies' Building, but I do not propose to enter into any discussion as to the saving that would ensue by such a course, as I think the question should be decided along lines of what is best for the profession, with but little reference to the gain or loss in a financial way in continuing our separate existence or joining the other bodies as proposed.

Whatever may be the satisfaction derived from the practice of a profession that comes entirely from its performance, the question of the position of the profession in the minds of the public is one that cannot profitably be neglected. There now is presented an opportunity for civil engineers to join with others whose education, tradition and professional aspirations are those possessed by all engineers irrespective of the particular branch of engineering under which they may be enrolled. It is certainly a fact, so far as the public is concerned, that the home of the profession is in the Engineering Societies' Building, and if the civil engineers were to join the present amalgamation they would thereby not only add to the public estimate of the engineering profession as a whole, which is desirable as a stimulant to professional effort, but also be the gainer as a separate body in the larger recognition that would follow. Personally I have long been of the opinion that engineers have gone too far on both educational and society lines of separation, and that we should get some form of amalgamation of all engineers into one organization and that this would be to the benefit of the profession as a whole. Probably at this time the movement could be begun, if all branches of the profession were identified as one by the public by being housed at one location.

The above reasons seem to me ample to justify my point of view, but, in addition, I think it will be conceded that, so far as convenience is concerned, the location of the Engineering Societies' Building is more convenient as to general access from downtown and for out-of-town members than the house in Fifty-seventh Street. It is conceivable, too, that financially a scheme could be worked out in the change that would show greatly to the advantage of the American Society of Civil Engineers.

Palmer C. Ricketts, Director of the Society, Opposes the Plan.

It seems to me that it would be difficult to induce the American Society of Civil Engineers to give up its Fifty-seventh Street property, and probably to some extent sacrifice it, in order to move to another building in New York City. If it had had no house and little property at the time the union under one roof was contemplated, the proposition would have been different. The same reasons hold now which were pertinent then regarding the change. It can, of course, act now with the other societies in any undertaking where unity of action is desirable, practically as well as if it were on Thirty-ninth Street.

James H. Edwards, Formerly Director of the Society, Believes the Plan Should Be Adopted.

I am heartily in favor of this proposition. The main reason why I am in sympathy with the move is that I feel that engineers of all branches of the profession should come more closely in touch with each other, and exert all the influence possible (which can best be done by co-operation) to place the engineering profession on a proper basis. The work of the engineer, no matter whether looked at from the practical or the theoretical standpoint, is becoming so general that no particular branch can lay any claim to superiority. I hope the time is not far off when engineering will be recognized as one great profession and the different independent divisions as they exist to-day will be considered as sub-divisions of the general profession.

Henry G. Stott, Formerly Director of the Society and Past-President of the American Institute of Electrical Engineers, Favors Removal.

Inasmuch as the actual cost of operating the present building and the proposed quarters will be practically equal, and the investment of the society will be substantially less under the new plan, the discussion seems to be narrowed down to the question: Will the new home improve the status of the society?

I believe the answer to this should be in the affirmative, for the following reasons:

1. The present home of the society is quite inaccessible from a transportation point of view, when compared to the Engineering Societies' Building on West Thirty-ninth Street.
2. Many of our members are also members of the Engineers' Club, which adjoins the Engineering Societies Building.
3. The close proximity of the New York Public Library on Fifth Avenue tends to establish the character of the neighborhood.
4. The fact that the society will be under the same roof as the American Society of Mechanical Engineers, the American Institute of Mining Engineers and the American Institute of Electrical Engineers will strengthen the bond between these societies, and tend to united action when occasion demands co-operation.
5. Have we not the best of precedents for this action in our own government? In any question affecting any of the forty-eight states of the union, such as an attack by an enemy, does any one believe for a moment that the forty-eight states could defend their common interests as efficiently as the United States could?
6. The consolidation of the society's library with that of the United Engineering Society (which now contains over 55,000 volumes) will create the greatest technical library in the world.
7. In joining with the other societies in the ownership of this very excellent modern building, the society preserves its own individuality, prestige and seniority, whilst securing the above advantages.

Standardization of Buildings to Insure Economy and Quick Delivery

H. S. Jacoby Describes Method of Firm of Industrial Engineers Who Claim to Be Able to Make 30-Day Deliveries of Standard Buildings

STANDARD SIZES and standardized details for factory buildings were claimed to make possible not only decreased cost and increased profit, but rapid fabrication and 30-day delivery of the completed structures, in an address made by H. S. Jacoby of the Samuel Austin & Son Company before the students at Cornell University on Feb. 25. How this standardization is accomplished and the reasons for the selected standard dimensions are described in the following abstracts of Mr. Jacoby's address:

STANDARD 1—FULL PANEL OF STEEL SASH GIVES MAXIMUM LIGHT

DETERMINING REQUIREMENTS

In devising a method to get a larger margin between the actual cost and the selling price, or, in other words, a larger profit, the Samuel Austin & Son Company, industrial engineers, of Cleveland, decided to standardize building construction. This company believes that the time is coming, and coming soon, when a prospective owner will sacrifice some of his "pet" ideas if he knows that he can get a building which will answer his purpose and get it within 30 days after the signing of the contract. To this end designs and complete details for seven standard buildings have been drawn up. Furthermore, the fabricated steelwork and other items which are not under direct control are even put into stock. It requires faith, coupled with an optimistic and powerful sales manager, Mr. Jacoby asserted, to have on hand three buildings 100 x 400 ft., two buildings 90 x 300 ft., and one building 200 ft. square before any actual contracts are in sight.

It has taken years of study to arrive at the general dimensions and outlines of buildings which will meet the requirements of a large proportion of manufacturers, engineers and prospective owners. Often the width of the building is determined by the room permitted by adjacent structures or the size of lot available. But, having adopted a certain unit width, say 100 ft., consisting of two 50-ft. aisles, there is a great advantage in being able to increase the width by further additions of 50-ft. aisles.

SEVEN STANDARD BUILDINGS

Standard 1 is a simple steel I-beam structure of one story, with 14 ft. clear height and 60 ft. width out to out, and one intermediate row of columns. Standard 2 is a heavy machine shop or foundry building 90 ft. wide, with three 30-ft. aisles and a traveling crane in the center aisle, with 22 ft. 6 in. clear height to the I-beam rafters. Standard 3 is a 100-ft. one-story factory building, with central monitor and a steel roof truss of the Warren type supporting the flat-slope composition or tar gravel roofing. This is a popular type and contains but one row of intermediate columns. The clear height of 13 ft. under trusses is ample to allow for most requirements. Hundreds of these 50-ft. roof trusses are carried in stock; the columns are not cut to exact length, but are kept in stock ready to cut on very short notice.

Standard 4 is a saw-tooth-roof factory building. The columns are spaced 20 ft. apart in both directions, making all trusses exactly alike, and the vertical faces are used for the roof sash to give rigidity, and because less expensive side-wall sash can be used. Standard 5 is a typical forge shop or structural warehouse for use where a heated building is not required. It has sloping corrugated-iron roofing and is 100 ft. wide, with central aisle 40 ft. wide and 34 ft. high for the crane runway.

← STANDARD 3 — NEW CASTLE CONSTRUCTION COMPANY FACTORY BUILDING

→ STANDARD 6 — FRANTZ - PREMIER BUILDING IN CLEVELAND

Standard 6 is a multi-story mill building with upper tier similar to standard 1, steel frame and brick walls below the steel sash windows. For this type 16-ft. bays are specified. Since the same load is carried by the floorbeam of this type on a 20-ft. span as by the roof beams of types 1 and 2 on a 30-ft. span, standard 18-in., 55-lb. I-beams are kept in stock and cut into three parts for the floorbeams in type 6, or two parts for the rafters in type 1 or 2. Standard 7 is a strictly fire-resistive type of multi-story reinforced-concrete building with round columns, flat-slab floors and the regular brick and steel sash walls.

The height of a building is determined by a combination of requirements. Viewed from the outside, a certain sill height is necessary, and above this sill sufficient glass to insure good illumination. The sill height may be determined by the height of work benches, the storage of materials or the height of pipe coils for heating purposes. An over-abundance of sash means unnecessary expense for heating. Viewed from the inside, the clear headroom varies with the depth of the supporting steelwork, the height of the machinery in the building, the presence of traveling cranes or other special apparatus.

Standard Sizes—20-Foot Bays

In the design of standard buildings capable of being erected in thirty working days, commercial and standard sizes of materials must be strictly adhered to. The structural steel man passing through the drafting rooms of our colleges and noting the sample drawings on the walls will almost invariably detect timber or steel sections which are uneconomical or not in general use, and consequently hard to obtain. For instance, a 2½ x 2½ x ½-in. angle may be designated in a roof truss. A 4 x 3 x 5/16-in. angle is stronger, weighs less, costs less per pound and is kept in stock by every steel company.

Why did we adopt the bay length of 20 ft.? First of all, there is a great advantage in the use of whole numbers rather than fractions. Why choose 20 ft. when 20-ft. lumber costs more per thousand than 16 or 18-ft. lumber? Simply because a 6 x 12-in. roof purlin, far cheaper than a steel beam with a nailing strip bolted to the top flange, is stressed to its maximum capacity when supporting a panel roof load 8 ft. wide and 20 ft. long. Eight feet is the maximum spacing of roof purlins for 2-in. roof sheathing. These yellow-pine boards are dressed and matched from 2 x 6-in. lumber. To prevent deflection a continuous 2 x 6-in. flat is nailed to the under side of the roof sheathing midway between the purlins.

One more factor, the steel sash, entered into the 20-ft. spacing of roof trusses. We examined the catalogs of various sash manufacturers to get a combination of units which total exactly 16, 18 or 20 ft. The two sizes of glass in most general use are 12 x 18 in. and 14 x 20 in. Of these two the 14 x 20-in. size is the more economical. Four units of four lights each are placed from column to column, and the ends measure exactly 20 ft.

There are many advantages in having the steel sash line up at the columns with the structural steelwork. During erection sash has a tendency to creep. In a 400-ft. building the actual out-to-out dimension of sash may exceed the computed dimension by 6 in. When the units line up with some definite mark, as they now do with the columns every 20 ft., the variation of actual from theoretical dimensions is reduced to a minimum.

Standard Structural Details

The principal feature of our standard truss is that the details are arranged to permit all trusses to be exactly alike. The wind load is taken by a system of bracing in the plane of the upper chord. Open holes in the rafter angles engage the lateral plates for the connection of diagonal rods. The equal spacing of these plates means equal length of rods. The cost of shop work is reduced, likewise the cost of drawing. Erection is simplified, as the erector can pick up any truss and place it between any two columns.

All clip angles which engage the wood purlins are identical. On the main truss there is no evidence of the presence of a monitor truss. In reality the vertical members of the 34-ft. monitor are connected to angles similar to those used for purlin clips. This arrangement permits the use of the standard truss with or without the center monitor. A star strut composed of two steel angles extends continuously between the tops of all center columns.

Steel Sash Economical

When any considerable area of windows is required, wood sash is seldom considered in mill-building construction. Steel sash costs less, is non-combustible, lasts longer and offers a greater unobstructed lighting surface on account of the thin muntin bars. The present tendency is to give the factory plenty of light, the direct rays of the sun being subdued by ribbed glass, which also keeps the attention of the employees directed to the inside of the building. To-day it is cheaper to erect steel sash than to fill the same area with a brick wall. By a special arrangement with manufacturers, steel sash may be shipped to the job ten days after the order is taken.

Excessive Shipping Sizes

Needless delay and expense are often caused on account of excessive height and length of completed trusses. Even if a member more than 10 ft. high is accepted by a railroad at the shipping point, it is necessary to route the cars to avoid tunnels or bridges where the head room is not ample. For members more than 40 ft. long an idler is necessary, and it is almost impossible to load economically. To ship too much material loose for field riveting is of course more expensive than shop work.

In conclusion, said Mr. Jacoby, the near future offers a good opportunity to the young graduate who is thoroughly in touch with the building problem. At the present time many owners have tucked away in their office desks blueprints showing plans of proposed extensions to their plant. Europe is looking to this country to supply her demand, which cannot be supplied by the normal capacity of the American factories. With this demand will come the necessity of engineers with sound working knowledge and an unusual amount of common sense.

BEAR TRAP WEIRS CONTAIN ALMOST HALF OF CONCRETE YARDAGE, EXCLUSIVE OF THE LOCK

Two Ohio River Dams Built in Two Seasons

Locomotive Cranes on Trestles Handle Lock Work, While Floating Mixing Plants Were Large Factors in Progress on Dams and Guide Walls

THE UNUSUAL feat of completing a Government lock and dam on the Ohio River in two working seasons has been accomplished by one contractor with two dams, Nos. 16 and 17, which are 5 and 25 miles, respectively, above Marietta, Ohio. The contracts for these dams were let in the fall of 1913, and all work on both of them, including the removal of the contractor's plant, was completed by Jan. 1, 1916. Out of the twenty-six dams on which the concrete work has been finished, it is believed that only one other—dam 10, at Steubenville, Ohio—has been finished in less than three full seasons. The treacherous nature of the Ohio and its extraordinary range of 60 ft. or more between high and low water cause frequent flooding of the cofferdams and make imperative a construction layout that can cover a whole coffer so as to develop the work at maximum speed from the moment the water is pumped out. It also puts on the timing of the work and the advance construction of the several cofferdams a cash premium far in excess of that placed on these factors in other river work.

On these dams, locomotive cranes and traveler derricks on trestles were selected to do most of the hoisting work. The tracks were built while the cofferdams were being unwatered and the pump-boat foundations prepared. They were constructed, for the locks, out of piles and stringers used in the second season for the foundations of the guide walls. The concrete plants were designed so that the bulk of the yardage was spouted without tying up or hampering the excavating and hoisting equipment. For the locks, all but the gate foundations and a relatively small yardage in the upper part of the walls was spouted direct from side dump cars. For the rest of the work mixer boats, one of which was described in the Engineering Record of Oct. 30, 1915, page 552, were used. Plenty of floating plant and ample pumping capacity were provided. Sub-cofferdams were used, greatly reducing the quantity of general excavation needed for the rock foundations for the main sections of the work.

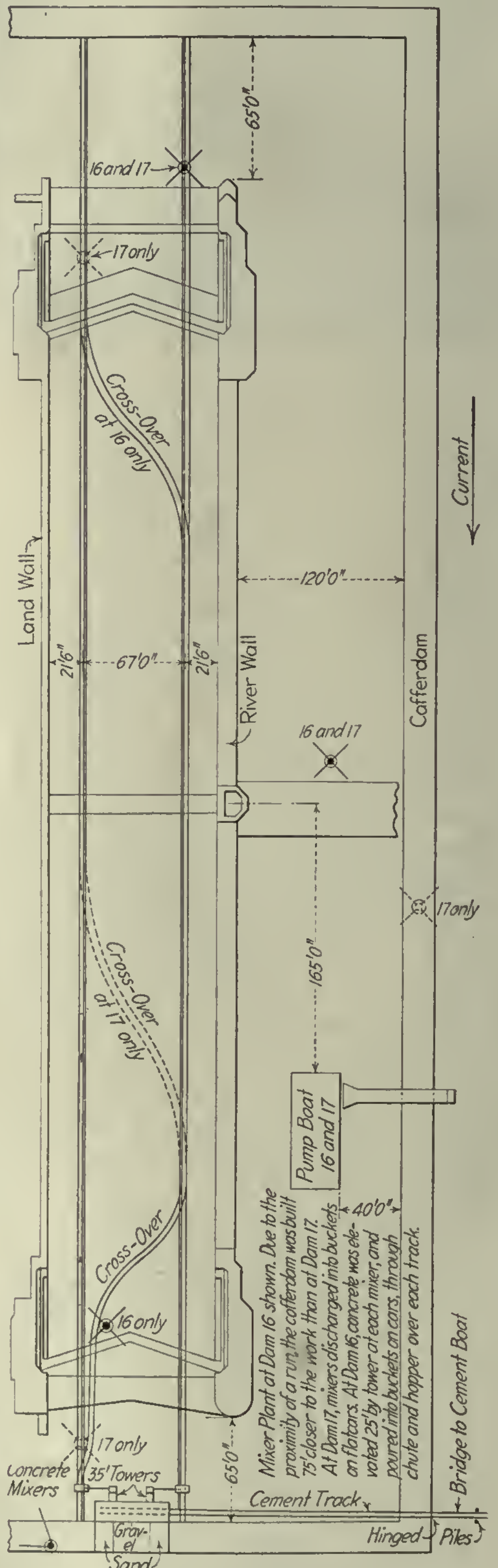
Status of Ohio River Development

The purpose of the fifty-four locks and dams being constructed from Pittsburgh to Cairo under the Pittsburgh, Wheeling, Cincinnati and Louisville district offices of the Corps of Engineers, U. S. A., is to maintain a navigable stage in the river during the nine months from April to January, when the river is normally below a 9-ft. stage. The design and operation of these dams, and some of the construction methods employed in building them, have been described in the issues of the Engineering Record of March 11, 1905, page 299; Dec. 26, 1908, page 712, and Jan. 2, 9, 16 and 23, 1909, pages 13, 41, 69 and 97; April 12, 1913, page 412, and Feb. 7, 1914, page 164. Twenty of these dams are in operation; the first contract, which includes everything except lock gates, wickets and operating machinery, has been completed on six others, and eight more are now under construction, while the remaining twenty have not yet been authorized by Congress. All but two of those completed and four of those under construction were let to contractors. These six were undertaken by Government forces under the day-labor plan. When the dams now being built are in operation the river will be navigable during the summer from dam 20, about 30 miles below Parkersburg, W. Va., to Pittsburgh.

Floods Make Work Difficult

The average period during which work can be carried on in the river extends from the middle of spring until Thanksgiving, and generally the work is flooded from one to four times in this period. In several cases within the last ten years the cofferdams have been flooded as often as once a month, and only two of these years have been free of floods in the working season. The loss of time caused by a flood varies from about ten days, when the cofferdam and permanent work escape damage, to a month or more when damage is sustained.

Contracts for these dams were let in August, 1913, four years being allowed for their completion. Camps had to be built, as there were no large towns near either dam, and all labor had to be brought in. Work on them and on the construction yards was begun as soon as possible and practically completed that fall. The layout of the yard at dam 16 is shown in the accompanying drawing. That at dam 17 was similar, but had to be located a mile upstream from the work because of the contour of the ground. The main yard sidings at each dam extended out into the river about 100 ft. on pile trestles. From these all materials and supplies except coal were handled by a locomotive crane direct from cars and storage to flats. Coal was dumped



Mixer Plant at Dam 16 shown. Due to the proximity of a run, the cofferdam was built 75' closer to the work than at Dam 17. At Dam 17, mixers discharged into buckets on flatcars. At Dam 16, concrete was elevated 25' by tower at each mixer, and poured into buckets on cars, through chute and hopper over each track.

Plant Layout, Ohio Side

RAPID INSTALLATION AND

from cars into bins built in the trestles, and from the bins into flats. Practically all of the coal was brought in by rail, as very little could be transported by river on account of low water, which continued during most of the construction period.

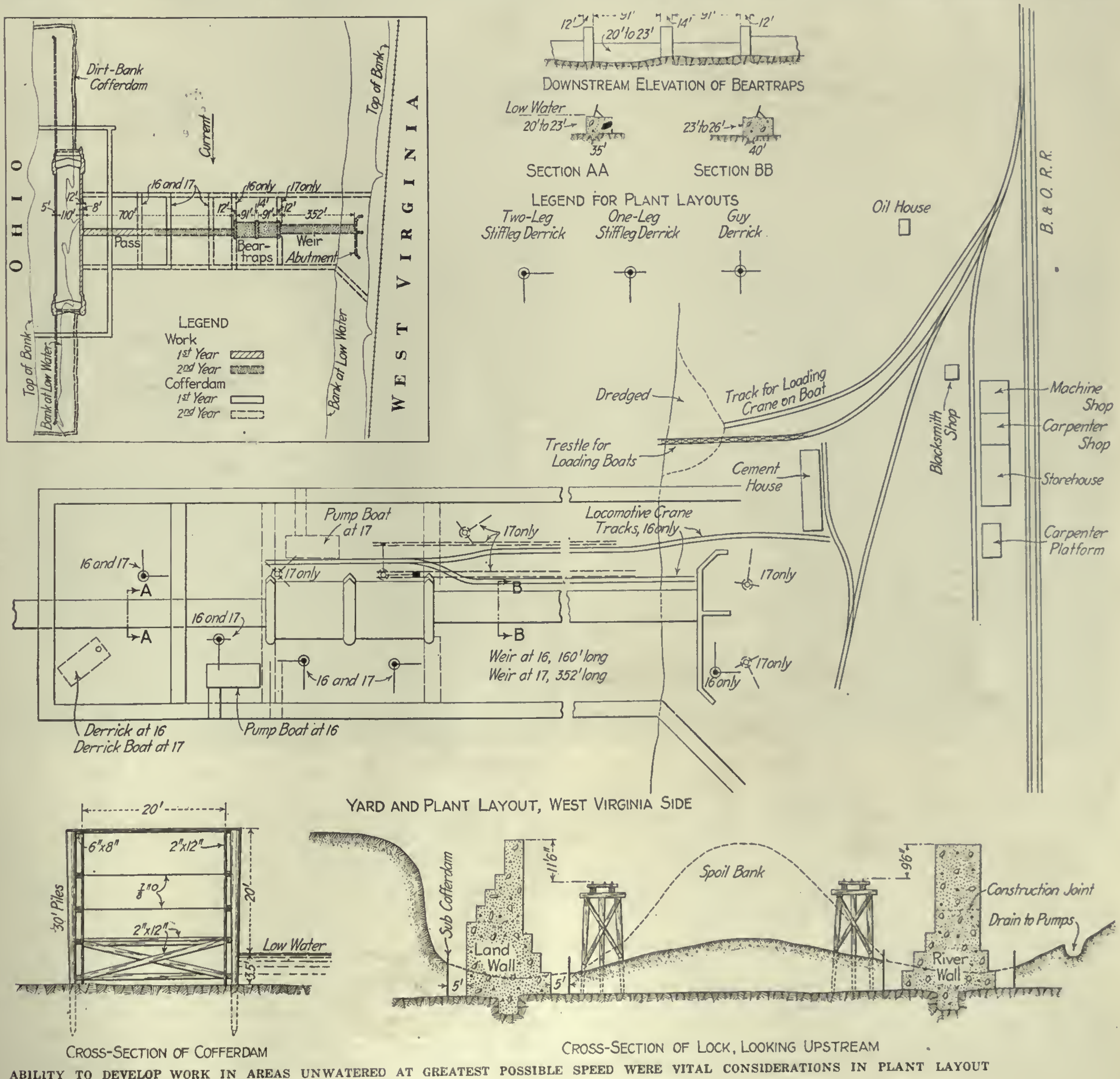
The first work on the dams done at each site was to build the cofferdams and dredge the sites for the two locks. Three-fourths of the cofferdam for the lock at dam 16 was finished and about one-half of the common excavation in the lock at each dam was completed in what remained of the 1913 working season. All the material possible was removed from the site of the permanent work and used for filling and banking the cofferdams. Though there was a large quantity of this excavation it was necessary to dredge from the river about 50 per cent of the material required for the banking and filling. The cofferdams were of the box type, 20 ft. wide and from 16 to 20 ft. above low water. The total height above the river bed ranged from 20 to 35 ft., the latter height being caused by scouring of the river bed, which took place after the channel had been restricted by previous cofferdams. Only those coffers maintained during the winter were decked.

LOCK EXCAVATION STORED BETWEEN CRANE TRACKS

While an effort was made to remove all the material possible before closing the coffers, it was found on unwatering that usually from 5 to 8 ft. of material remained over the rock. To handle this out of the cofferdam would have been expensive. As the lock floors were not to be paved at either dam, the space inside the lock walls offered an economical place for dumping. In order to take advantage of this space, however, elevated tracks for the hoisting apparatus were a necessity. Locomotive cranes on trestles slightly below the top of the walls were employed. Besides being easy to install, these tracks enabled the cranes, with their relatively short booms, to cover the foundations of the walls, reach the top of the high spoil bank required, handle all forms and pass concrete buckets to the top of the wall forms. None of these things could have been accomplished with cranes at the level of the first excavation. Because of the difficulty referred to of wasting the sub-cofferdam excavation, and the depth to rock, it was out of the question to install travelers or other plant at the level of the lock floor. The crane trestles also provided a ready support for the concrete car tracks. The trestles were made of piles, caps and stringers which met specifications for the guide-wall foundations.

LOCK CONCRETE PLANTS

Concrete for the lock walls and gate and poiree dam foundations was mixed in two 1-yd. mixers at each lock. These were mounted at the lower ends of the cofferdams under bins fed by two derricks from barges. These derricks were also used to pass forms and plant into the cofferdams. Cement was brought across the river from the railroad on the West Virginia bank in covered boats. It was ordered so that the deliveries would cover the work being done as closely as possible to save storing and rehandling. However, 4000 bbl. storage capacity was pro-



ABILITY TO DEVELOP WORK IN AREAS UNWATERED AT GREATEST POSSIBLE SPEED WERE VITAL CONSIDERATIONS IN PLANT LAYOUT vided at each dam. The boats were loaded by chutes direct from the cars or from storage. Each had a center track which matched with a movable bridge connecting with a track inside the lower arm of the cofferdams. Flat cars on these tracks, hauled by a hoisting engine, were used to transport the cement to the mixers. These mixers discharged into narrow-gage side-dump cars which were hauled by dinkies on the crane trestles. These cars dumped into wide, metal-lined wood chutes supported on the trestle and the form. With them all the lower part of the lock walls was poured. For the upper sections concrete buckets hauled on flat cars were used. They were dumped by the cranes into hoppers on top of the forms. The work on the gate foundations was largely handled by the guy derricks shown on the accompanying layout drawings.

During the first season half of the navigable pass next to each lock was inclosed in a cofferdam and completed except for a portion of the concrete work. The only thing remaining to be done on the two locks at the end of the 1914 season was the installation of the permanent pipe lines.

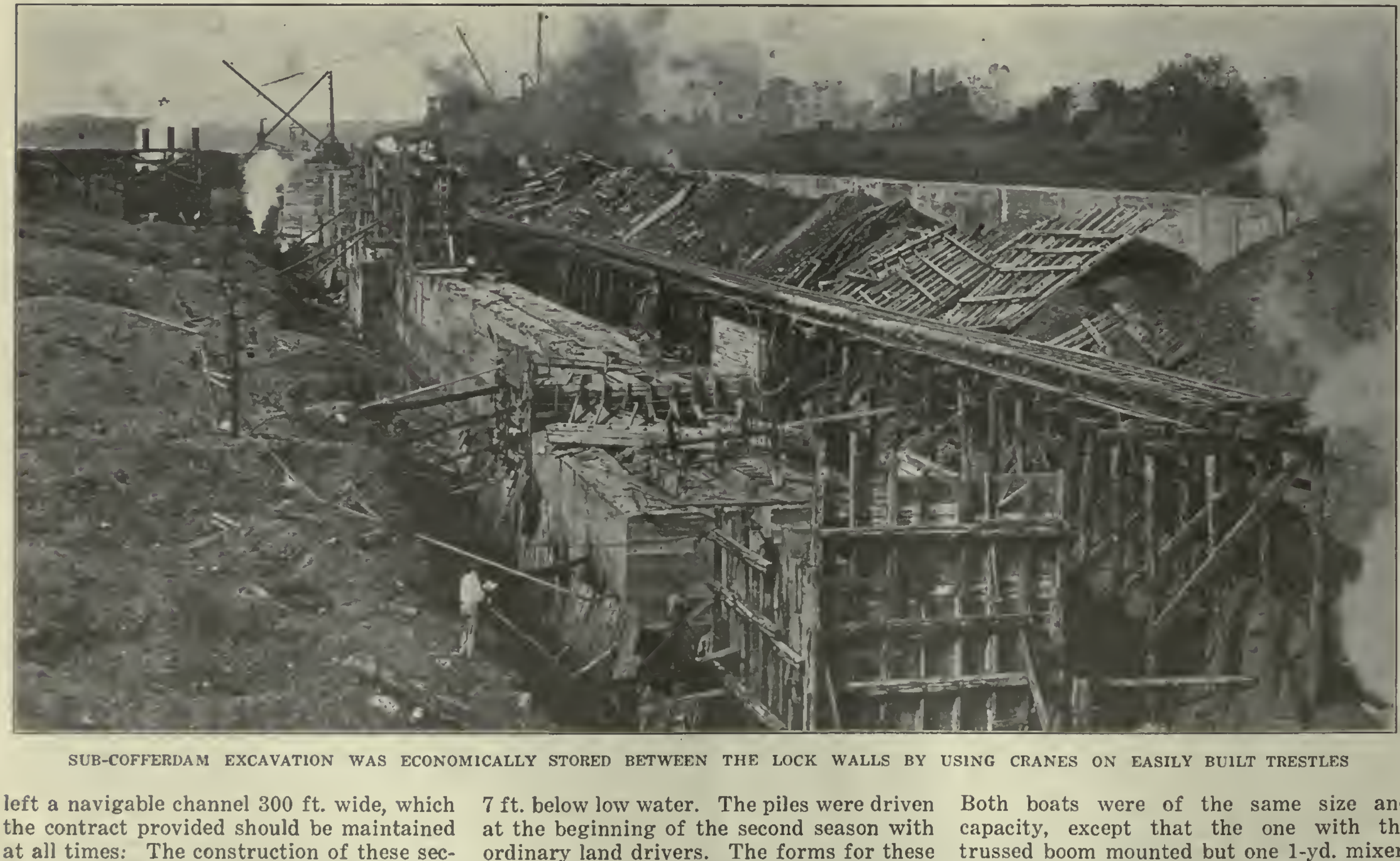
Derricks for Weir and Bear Traps

While this work was being completed the site of the channoine weir and bear-trap weirs at each dam was being dredged out and inclosed in a single cofferdam. This left a navigable channel 300 ft. wide, which the contract provided should be maintained at all times: The construction of these sections offered a totally different problem from the locks. The bulk of the concrete work for these dams is in the lock. Here the ratio of concrete to foundation and form work is highest, while in the rest of the work the ratio of concrete to preparatory work is very low. The problem in the lock is to pour concrete rapidly, while on the rest of the work the job is almost done when the forms are ready for concrete. The length of the bear-trap piers made cranes impracticable for the bulk of the hoisting work in these coffers, because of the reach required. One crane was used, however, at dam 16, but only to handle forms and the like into the coffer from the bank. The stationary and traveler derricks shown on the layout plans were employed for all other hoisting at both dams. As all the concrete could be most economically poured by mixer boats, it was unnecessary to provide any tracks or plant inside the coffers for handling concrete. At dam 17 the weir, bear traps and abutment were completed and the bear-trap leaves erected in this cofferdam. Short arms were then built to the ends of the east bear-trap pier, the east arm and the portion of the cofferdam west of this pier were torn out, and the channel over the completed channoine weir thrown open to navigation. Meanwhile the river arm of the lock cofferdam and the east part of the coffer inclosing the first section of the pass were removed. The second section of the pass was then inclosed in a coffer extending from the end of the completed section to the bear traps. The same procedure was followed as in dam 16, except that the second section of the pass was completed before the bear-trap cofferdam was constructed. Thus the final coffer at this dam inclosed the bear traps, weir and abutment.

The guide-wall cofferdams were earth banks made by dredging the site of the walls and dumping the dirt on the river side. These walls are on pile foundaions, about 7 ft. below low water. The piles were driven at the beginning of the second season with ordinary land drivers. The forms for these monoliths were handled by the locomotive cranes running on tracks supported on the coffer banks. The concrete was poured by the mixer boats.

Mobility of Mixer Boats

By carrying on the guide walls, abutment, pass, bear traps and weir at each dam simultaneously, and by using mixer boats for all concreting, the disadvantage of having a mixer plant idle half the time because there was no place to concrete was largely overcome. It was possible to move the mixing plants from place to place as sections were prepared for concreting. The work of getting ready, which takes the greater part of the time on this type of construction, could thus be prosecuted at the same time in several scattered places, each of which could be finished up in turn by the one floating concrete plant. The mobility of these floating plants thus became an important factor, the main consideration proving to be the time required for dismantling and moving the chutes. One of the boats was provided with a steel cantilever boom suspended from an A-frame. For the guide walls and 50 per cent of the remaining work this boom reached the forms direct. For the balance of the work an additional 56-ft. trussed chute was rigged. Because of the rigid support of the boom, the long chute on this boat did not sag when passing concrete, and it was possible to use it on the flat slope of 4½:1 with good results. The entire plant could be moved and started to concreting in a new place in 45 min. or less. The other mixer boat was similar to that at dam 16, except that its 120 ft. of initial reach was secured by a section of plain chute suspended from a main A-frame and two smaller A-frames hinged to the main one. Additional chutes, when required, were supported by a cable from the large A-frame to anchorages in the cofferdams. About 2½ hours were required to move this boat. Both boats were of the same size and capacity, except that the one with the trussed boom mounted but one 1-yd. mixer, while the other boat had two. The bins on both were charged from barges by derrick boats, and cement was run upon each boat on cars from the cement boats.



SUB-COFFERDAM EXCAVATION WAS ECONOMICALLY STORED BETWEEN THE LOCK WALLS BY USING CRANES ON EASILY BUILT TRESTLES

15,000 Yards Run in 31 Days

Concreting was not permitted on Sundays and holidays, and the capacity of the mixer on the boat at dam 16 was limited to 30 or 33 yd. per hour, while the actual capacity of the plant was good for from 45 to 48 yd. per hour. The maximum output under the imposed conditions was made between Sept. 16 and Oct. 15, 1915. During this time the boat averaged 26 yd. per hour, including moves and changes from one form to another. A total of 15,000 yd. was poured in this period, using three 8-hour crews. The average monthly output of this boat was about 12,000 yd. On one occasion the boom on a 4:1 slope and the 56-ft. extension chute on a 6:1 slope worked without a single clog or spill. At this time concrete was being placed in the top of the lower end of one of the bear-trap piers with the boat stationed above the cofferdam.

CONCRETE MATERIAL FROM RIVER BED

The sand and gravel were dredged from the river bed with sand dredges of the side-bucket and ladder type with a capacity in 8 hours of material sufficient for about 300 yd. of concrete, using a 1:3:5½ mixture. The storage capacity of sand and gravel on this class of work depends somewhat on the number of flats in use, but mainly on the capacity of the sand dredge. This is determined largely by the sand and gravel deposits, the proportion of sand to gravel and the quantity of each wherever the dredge happens to be working. It often occurred that it was necessary to spend considerable time moving the dredge from place to place in search of material that would pass inspection and at the same time afford digging within two or three miles of the work at 50 to 75 per cent of capacity.

DRAINAGE PROBLEM INSIDE COFFERDAMS

A keyway varying from 3 x 3 ft. to 6 x 6 ft. was channeled in the rock for all walls and foundations subject to horizontal thrusts. This was accomplished with ordinary quarry bars and air drills run from compressors driven by steam. Natural gas was used for fuel. For the second season's work on the West Virginia side of the river the air was conveyed through one of the permanent 4-in. pipe lines embedded in the foundation of the pass.

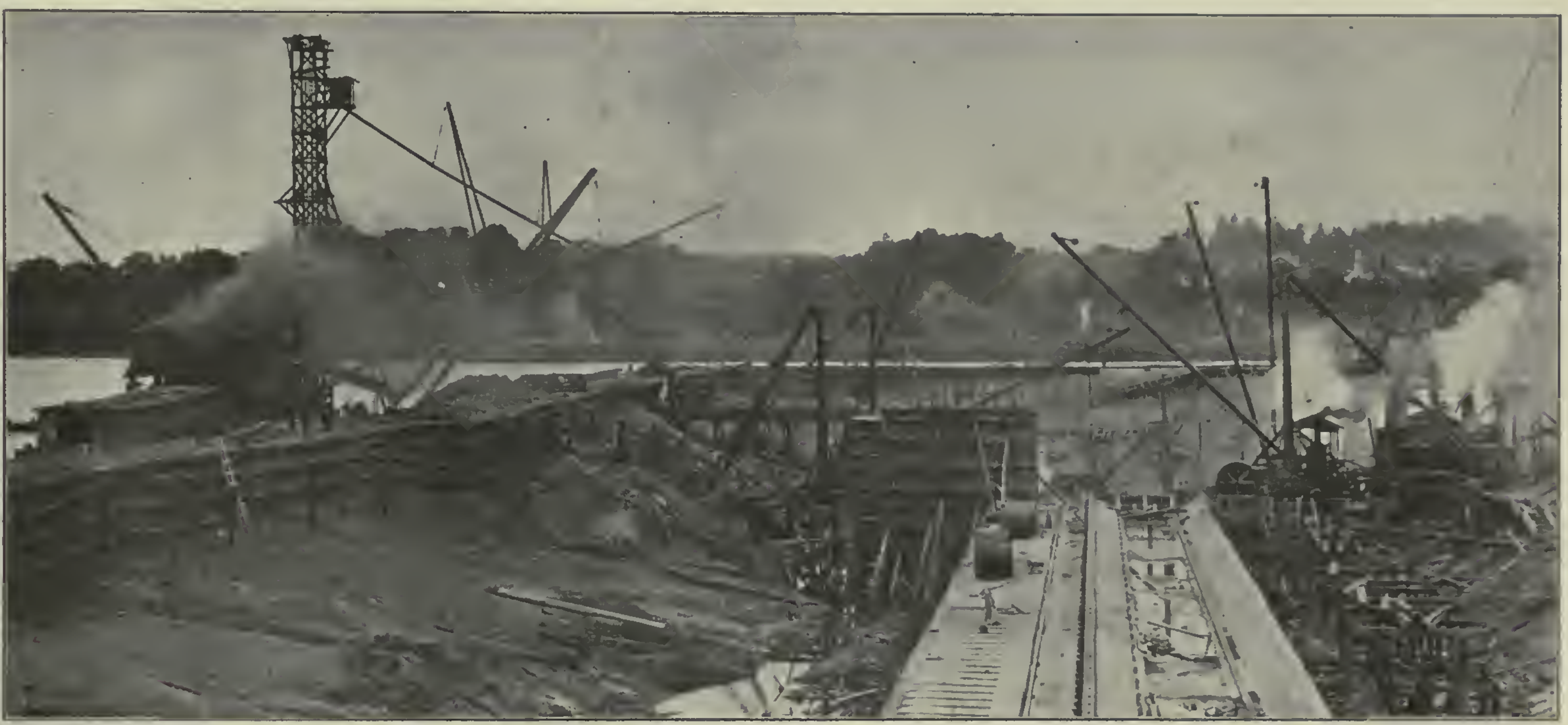
An important obstacle to overcome was the freeing of the foundations of water so that they could be prepared for concrete. It was natural for the water to drain to these places, as they were the lowest points in the cofferdam except the pump sumps. With this difficulty in view the cofferdams were built at a distance from the work so as to leave plenty of room to drain the seepage near the bottoms of the cofferdams direct to the main pumping plant before it had a chance to reach the lower levels. The seepage through the river bed and on the rock surface, which always carried a quantity of sand and gravel, was kept off the working areas by the use of short steel piles, sand bags, wooden cribs and wood sheeting. This work for holding the water back from the foundations, known as the sub-cofferdam, had of course to be done before preparing the foundations. These had to be entirely free of water before concrete could be placed. Without these sub-cofferdams it would have been necessary to remove four or five times the amount of sand and gravel, and would have made progress slow and costly.

The seepage through the sub-cofferdams was pumped into the drains leading to the main pumping plant by siphons, 3-in. and 4-in. force pumps, and at times 6-in. centrifugal pumps, depending on the amount of water to be handled. The keyways afforded sumps for these auxiliary pumps.

The main pumping plant at each dam consisted of centrifugal pumps, auxiliary equipment and boilers installed on a boat. Natural-gas fuel was used. The electric generating plant for lighting the work was also placed on these boats. The capacity of each boat was about 16,000 gal. per minute, and at times it was necessary to set up additional pumps to assist, especially at dam 17. Here the seepage through the river bed and on the surface of the rock in the pass and weir coffers was very great, and for a river stage of 8 ft. and over required an average pumping capacity of about 20,000 gal. per minute, as compared with about 12,000 gal. per minute at dam 16 for the same work. The boats rested on pile foundations inside of the various cofferdams varying from 7½ to 12 ft. below low water.

ONE DREDGE FOR BOTH DAMS

Because of the nearness of the two contracts it was possible to make expensive items of equipment do service on both jobs. Only one dipper dredge, of 3½ cu. yd. capacity, was required for the preliminary excavation on both dams. Two 100-yd. scows were used with it. A sand dredge and a steamboat were used at each dam. Six derrick boats, two gasoline tow-boats, four launches for ferrying, the pump boats, two boiler boats, sixteen sand and gravel flats, six fuel flats, six decked scows, four cement boats and the mixer boats completed the fleet used on the two contracts. Four locomotive cranes, two concrete mixers, six derricks, five 6 to 12-in. centrifugal pumps besides those on the pump boats, dinkey engines and a supply of flat cars, hoists and buckets were required at each dam. Exclusive of the derrick boats, dredge and steamboats, each job required the installation of 1000 boiler hp. Natural gas was used largely for fuel, and was used entirely in the construction camps.



LEAKS THROUGH RIVER BED UNDER COFFER ARE SERIOUS PROBLEM—THIS DAM MADE 20,000 GALLONS A MINUTE AT 8-FOOT RIVER STAGE

These dams were built by the T. A. Gillespie Company under the direction of the U. S. District Engineer Office at Wheeling, of which Maj. F. W. Alstaetter. Lieut.-Col. Henry Jervey and Maj. Thomas Jackson were successively in charge. E. A. Yates is chief engineer of the contracting firm and H. B. Mish resident engineer. Thomas S. Shepperd, vice-president in charge of the Pittsburgh office, has had general direction of the work. R. J. Gillespie is general superintendent for the contractor, N. J. Beisel was superintendent at dam 16 and R. M. Netherland at dam 17, while C. R. Andrew, junior engineer, and Ormond Butler were in charge at the respective dams for the government.

AN AUTO ROAD TO THE SUMMIT OF MT. SHASTA in California is planned by the U. S. Forest Service in the development of the Shasta national forest. Funds have been set aside by the Forest Service, it is reported, for a preliminary survey of the proposed route of this road and for an examination of the region it will traverse. Certain areas of the mountain which are considered suitable for summer homes, permanent camps and resort sites are to be surveyed and offered for lease by the government.

Road Builders Hear How New York State Department Paves with Brick

H. E. Breed, First Deputy Commissioner, Recites Experiences in Construction Details and Gives Costs at Pittsburgh Meeting

As a RESULT of its experience in building about 300 miles of brick pavement prior to Jan. 1, 1916, the New York State Highway Department has selected certain construction features as basic in the success of this type of work. These were discussed at the Pittsburgh convention of the American Road-Builders' Association last week by H. E. Breed, first deputy commissioner, whose remarks are summarized below. Mr. Breed laid stress on the mixing of grout, the proper selection of sand and favored field instead of plant sampling and testing of brick. He also presented figures on first cost and maintenance.

Construction Details

It has been claimed, Mr. Breed said, that the sand cushion prevents the crushing of the brick and gives an amount of resiliency that is necessary to a pavement of this type. This statement, however, is not borne out in practice, for a five-year-old pavement in which a mortar cushion was used has been bettered by the lack of so-called resiliency.

Many times brick are stored in piles along the road so long in advance of the construction work that they are so spattered with mud from passing traffic and so covered with dust that it is doubtful whether the grout will properly adhere to them. In all cases of this kind the brick should be thoroughly washed so that the grout will cement them together.

Bats less than 3 in. should not be used. If necessary, trim the second brick to accomplish this. The bats should be obtained from bricks culled from the pavement, and as every brick is worth from 3 to 4 cents in the pavement, the selection of bats should be made from culls so that the good half can be saved. This is an element of fairness to the manufacturers which all engineers will appreciate.

Great care should be given to the thorough mixing of the grout—sand, cement and water—first dry, then to a plastic consistency, and gradually thinned out until the mixture just reaches the consistency which will flow. In the New York State work the contractor is allowed to use 1 part of cement to 2 parts of sand where he employs some form of grout machine. Where he mixes by hand in boxes he is required to furnish grout with 1 part of cement to 1 part of sand.

Sand Important

Many bad results in brick pavements have been directly attributed to the use of poor sands. The inconsistency of present day practice, according to Mr. Breed, is shown by testing the cement and brick both with a fine degree of engineering precision and trusting the other material, sand, to visual guesswork.

Three different and distinct kinds of sand are used in brick pavements: concrete sand, cushion sand and grout sand. Concrete sand should be clean and have at least 80 per cent of the strength of Ottawa sand in compression. Its gradation should be as follows: 100 per cent passing ¼ in.; 85 per cent passing No. 6 screen; 60 per cent passing No. 20; 25 per cent passing No. 50; no variation of over 5 per cent from these figures should be allowed. Sand with over 8 per cent of loam should be rejected. These may seem to be rigid specifications, but if a foundation is to serve its purpose it should be strong enough to sustain the pavement with the minimum amount of cracking.

Cushion sand should be of such a nature that 100 per cent will pass a No. 6 screen, and it should not contain more than 20 per cent of loam.

Grout sand should be clean and of such a nature that it will have 100 per cent passing a No. 6 screen; not more than 85 per cent passing a No. 20; 30 per cent passing a No. 50; 5 per cent passing a No. 100. It should be rejected if it contains more than 5 per cent of loam.

Field Tests Favored

It has been suggested at various times, both by manufacturers and by some engineers, that it might be advisable to test brick at the plant. Mr. Breed believes that the present practice of sampling and testing brick in the field insures better results than testing at the plant, for the following reasons:

Brick are not manufactured uniformly in the same sense that cement or asphalts are manufactured as uniform products. Long experience with a given brand is necessary before the brick can be accurately culled by visual inspection. The men best fitted to cull brick by visual inspection are the employees of the brick company. The sampling from the different benches of the kiln to show the variations in burning can be done more accurately by the burner than by an inspector. Variations in temperature in different parts of the kiln give different qualities of brick. These can be assorted and selected best by the men who burn them. Factory inspection of brick places the responsibility of uniform shipments of acceptable brick on the inspector, and offers an opportunity to the brick company to dispose of cull brick, because of its lack of responsibility in the selection.

During 1915 the New York Highway Department tested 269 lots of brick, comprising 22 different brands and representing a total of 27,000,000 brick. Of these 13.6 per cent failed to meet the specifications and were rejected. This does not include the amount culled by the inspectors and rejected on the work, which, in some cases, is rather large. With brick tested at the plant, it is believed, the chances for getting good material would decrease, for if the manufacturers were willing to take such a long chance with a large outlay of freight and handling involved, they would certainly be willing to give inferior material at the plant and would load some brick from the kiln which would not be good enough to go into the work.

Costs and Maintenance

Up to Jan. 1, 1916, New York State has completed about 290 miles of brick pavements. These different pavements are of varying age, and Mr. Breed gave some figures regarding their cost. The average cost for brick pavement on a 5-in. concrete foundation is per mile of 16 to 26-ft. highway $25,750. The average cost per square yard of *pavement only* is $2.015. These figures were obtained from an average of 23 highways.

In order to get a comprehensive cost of other types in New York State, the following figures on waterbound macadam, bituminous macadam and cement concrete were presented:

Waterbound macadam:	
Cost per mile of 16-26 ft. highway	$10,250
Cost per sq. yd. of pavement only	0.648
The cost per square yard was obtained from 434 values and the cost per mile from 419 values.	
Bituminous macadam:	
Cost per mile of 16-26 ft. highway	$12,970
Cost per sq. yd. of pavement only	0.871
Both of these items were obtained from the average of 134 highways.	
Cement concrete, 6 in. thick:	
Cost per mile of 16-26 ft. highway	$15,320
Cost per sq. yd. of pavement only	1.121
Both of these items were obtained from an average of 20 highways.	

It will be noted that the difference between the pavement cost and the total cost of the highway lies, in all cases except brick, between $4,000 and $5,000. The reason why the cost of items other than pavement is apparently high on brick roads is that the cost of edging has been excluded from the pavement cost and included in the total cost.

Up to Jan. 1, 1915, there have been built in the state of New York 5,167.19 miles of all kinds of highways. During 1915 the department built 1,083.35 miles, making a total of 6,250.54 miles of road. At the present time there are 783.05 miles under contract which are not completed.

Relative Maintenance Cost of the Whole Roadway

The maintenance charge for 238 miles of brick for the year 1915 was $41,840, or approximately $176 per mile per year. This amount was increased to a large extent by a number of older pavements which had many replacements. Eliminating those, there were 107.91 miles of brick pavement which cost $14,185 to maintain and repair. This is at the cost of approximately $131 per mile. These figures, as mentioned at first, are not the figures from the pavement alone, and they include such treatment as cleaning ditches, cost of patrol where patrol was needed, fixing the shoulders which are cut up by the turning out of traffic, the cleaning of slides and maintaining of guard rail. From observation it would be safe to say that about 30 to 40 per cent of this cost is the average cost that would cover the maintenance of the pavement alone, although in some cases, for a series of years, there is practically no cost to the pavement proper.

The cost of maintenance of other types of pavement during the same year was computed on the same basis as that for the brick roads, i.e., including the maintenance of guard rail, shoulders, ditches, patrol, etc., as well as the surfacing. For gravel it cost $577 per mile for 192 miles of road; for waterbound macadam it cost $564 per mile for 2298 miles of road; for penetration method bituminous macadam it cost $448 per mile for 2387 miles of road; for bituminous macadam mixed method it cost $181 per mile for 63 miles of road. For second-class concrete roads requiring surface treatment it cost $532 per mile for 295 miles of road; for cement concrete pavement 1:1½:3 mix it cost $129 per mile for 84 miles of road.

HINTS FOR THE CONTRACTOR

Details Which Save Time and Labor on Construction Work

Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

[*Contributions to this section are solicited, and if found available will be paid for. They must be* SHORT, *and should be accompanied, if possible, by photographs or sketches.*—EDITOR.]

Locomotive Runs Three Hours on Charge From Boiler Plant

A FIRELESS steam locomotive is used for switching cars and tie trams at the Orrville (Ohio) creosoting plant, described by E. A. Sterling in the Engineering Record of Feb. 26, page 283. The locomotive is of a type which was developed in Europe some years ago and is used around distillation plants, where cinders and live ashes would constitute a fire danger. This locomotive operates by steam, the boiler being charged about seven times every twenty-four hours at the main boiler, at 150 lb. pressure. The maintenance cost of this type of switching engine is very low, and its use is said to be very satisfactory in a treating-plant yard. Its tractive power is fully equal to that of the usual type, and although it weighs only 22 tons it has pulled as many as twelve loaded gondola cars at a time. Perhaps there are construction contracts on which a locomotive of this type would be an economy.

TWELVE LOADED RAILWAY CARS AT A TIME HANDLED BY THIS FIRELESS LOCOMOTIVE

Good Form Design Saves in Labor and Lumber on Building Work

FORM designs should be arranged to reduce the number of special panels and pieces, should take into account the total quantity required, considering the movement of the forms throughout the job, and should furnish an accurate key to the quantity and size of stock required and to the order in which the component parts should be made, according to a paper presented at the twelfth annual convention of the American Concrete Institute at Chicago by R. A. Sherwin of the engineering force of the Aberthaw Construction Company.

Such a design requires a careful study of the building plans, with a view to having modified such details as would make the form work unnecessarily expensive, and the immediate preparation of a progress chart. The latter is usually determined by the time allowed for completing the building. As soon as it has been prepared, the quantity of forms and the order in which they are to be erected and moved can be determined. This chart also shows when the form design must be ready to allow sufficient time for making up and erection.

A conference is then held between the man in charge of form design and the field men, at which the sizes and kind of lumber that will be cheapest and that can be delivered on time are determined. The point at which work must begin and the location, type and capacity of the concrete plant must also be settled. The general scheme of the form work should be outlined at this conference with the field men to make sure that the design is understood and acceptable to them. If this is the case, they can carry it out much more readily.

The first study and drawings are made from a general assembly, which is selected from different combinations as the most economical for the conditions. Joists and girts should be in as few lengths as possible. Stock sizes of lumber should be used. The number of different panels and pieces should be kept to a minimum. Panels should be a whole number of boards in width, and joists should be used as panel cleats where possible. Units should be as large as can be handled, and detailed so they can be reused. Bracing should be above the men's heads, and provision should be made for easy stripping and for reshoring if necessary.

After the general assembly is made, sheets are detailed for each panel, ten panel details going on a standard-sized sheet. Each detail is marked according to a standard system of symbols. Blueprints from these sheets can be cut apart and used by the carpenters making up the panels. A key plan showing the complete assembly with the location of all the panels is also prepared. This is made very complete, as it is the only plan referred to in assembling the forms. It has been found best to use large lettering and furnish photo-reduced copies to the job, as they are much easier for the foremen to handle and refer to. As a rule, one such plan is made for each floor.

An important point to be remembered in proportioning the form members is that the posts cannot be stressed above the crushing strength of the girts which rest on them. The girts are stressed across the grain, which gives a much lower allowable load for each post, spaces them closer together and reduces the danger of deflection and settlement while the floor is being poured.

Boom Mixing Plant Big Enough to Build Concrete Houses

By R. C. HARDMAN
Colorado Springs, Col.

A NOVEL type of concrete plant used a few years ago in the construction of a group of reinforced-concrete buildings forming Fort Crockett, a coast artillery post at Galveston, Tex., resembles the ordinary boom mixer in operation, but not in size. The plant was designed in order to avoid the necessity of chuting and at the same time to provide an economical means of placing concrete in separate buildings, most of which were in a row about 2200 ft. long. This made it imperative that the plant be of a portable type. The type of building construction was such that the yardage of concrete was relatively small. A plant with tower and chutes mounted on a flat car was first planned, but the idea was discarded because of the great expense and delay incident to moving chutes when pouring the thin walls and floor slabs. The plant decided on is shown in the accompanying photograph constructing a building of the Aiken flat-wall type. The walls were hollow and 9 in. in total thickness. The height of the walls standing in the photograph is 31 ft.

The mast and the two stifflegs are carried by a triangular base mounted upon four-wheel trucks, the wheels having very wide treads. Upon this triangular base is mounted a hoisting engine and a Smith mixer having a capacity of a two-sack batch. On the opposite base of the triangle from the mixer is located, in addition to the hoist, a boiler and a large tank containing crude oil for fuel. The cables operating the bucket and trolley pass from the drums on the hoist to the foot of the mast, thence up the mast and along the lower side of the boom. The line operating the trolley has its ends fastened to either side of the trolley and is continuous around the drum. The bucket cable has its ends fastened at the end of the boom and on the drum, the block suspending the bucket being in the bight of the line. It will be seen that by this arrangement it is possible to move the trolley along the boom without changing the height of the bucket.

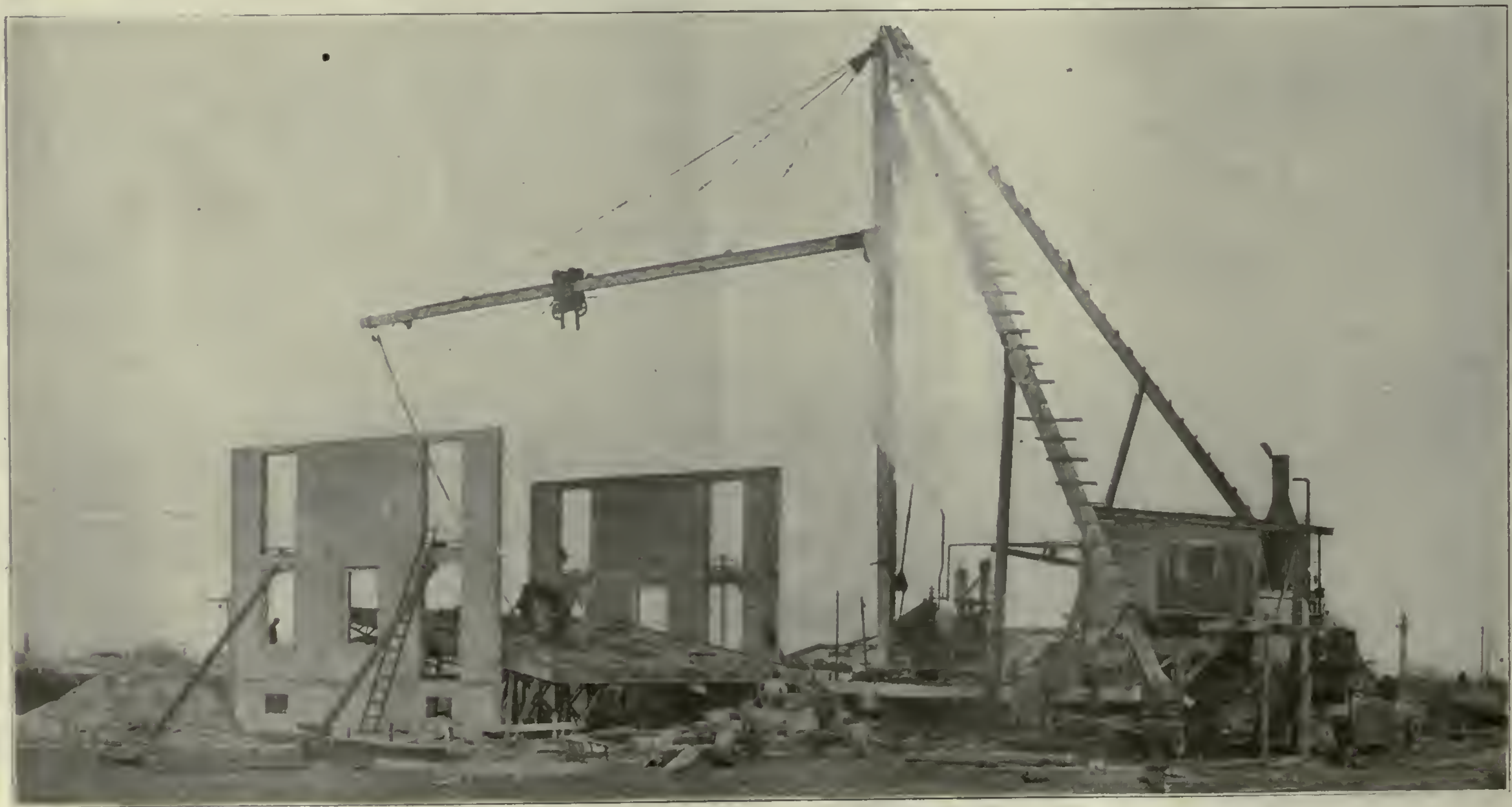
In operating the plant the bucket, which is of the bottom dump type, is set on the ground at the foot of the mast and filled from the mixer drum through a short chute. The bucket is then hoisted up the mast to a height sufficient to clear any form or other obstruction. The bucket is then run out on the boom and dumped. Some care is required on the part of the hoist runner to avoid swinging the bucket when it is started and stopped. This is especially true when the bucket is being used close to the ground.

The mast is pivoted at top and bottom so that it is free to move through an arc of about 270 deg. The boom is moved as desired and held in position by means of a tag line. The ends of this line are anchored on either side of the boom and the bight passes over single blocks on each side of the boom and hangs down between them nearly to the ground. This method of rigging the tag line makes it possible for one man to handle the boom easily, and by sitting in the bight to hold it in any desired position. The tag line requires the attention of one man anyway, as in pouring thin walls and floors the boom is constantly in motion.

The entire plant is moved by means of a set of falls attached to a dead-man and handled on the nigger-head of the hoist. As the ground on which the plant was used was soft, planks were used for the wheels. The plant has also been used for pile driving, a pair of leads containing a steam hammer being suspended from the trolley in the same manner as the bucket.

In placing concrete the capacity of the plant was dependent on the location of the forms as well as on the thickness of the wall or floor poured. Practically no time was lost in shifting the boom, as this could be done while either the bucket or trolley was in motion. In fact, the movement of the load in all three directions could be accomplished at the same time. On fairly open work, such as a 6-in. floor, as much as 150 yd. could be placed in 8 hours, while on thin-wall work about half this amount, or less, was possible. The ability of the engineman is an important factor.

The plant was designed by E. A. McGonigle of James A. McGonigle & Son of Leavenworth, Kan., who were the contractors for the work.

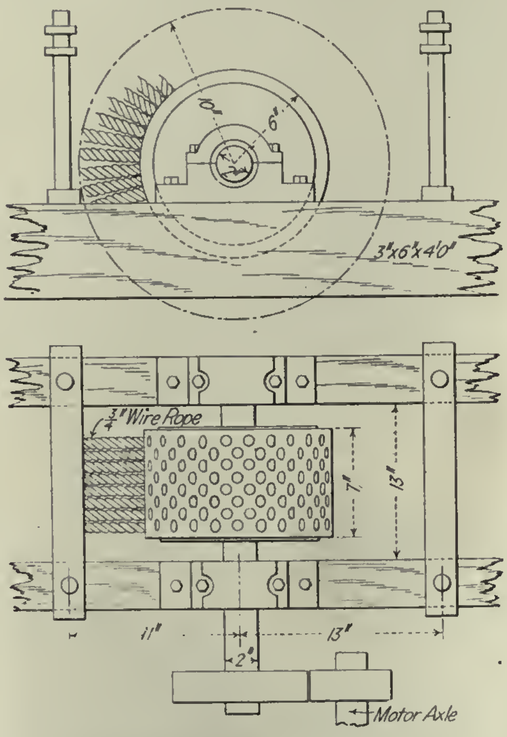


TRAVELING CONCRETE PLANT WITH LARGE-SCALE BOOM DISTRIBUTOR PLACED 70 TO 150 YARDS AN HOUR IN BUILDING ARMY POST

Brush of Old Wire Rope Run by Motor Cleans Reinforcing

By RICHARD R. BRADBURY
East Pleasantville, N. Y.

On a large contract the steel for one of the smaller structures, which had been purchased a year or more before being used and stored on the job, was economically cleaned by a rotary wire rope brush made at the work. As there were over 90,000 pounds of deformed bars in this structure, cleaning by hand would have been a long and expensive process. The circular power brush shown in the accompanying drawing performed the cleaning in a very satisfactory and expeditious manner.



BRUSH CLEANS RODS RAPIDLY AND WELL

The brush consisted of an iron box formed by a ring enclosed on each side by a circular plate, the whole being keyed to an axle which was driven by a small electric motor. Short lengths of old wire rope projected through holes bored in the iron ring, the length projecting and the spacing being arranged so that the frayed rope ends made a stiff, close-set brush. The machine was mounted on a short wooden frame, at the two ends of which were erected guides to hold the steel bars against the brush.

The ring and plates forming the iron box were of ¾-in. metal, and ¾-in. wire rope was used, in pieces of such lengths that each end projected about 4 in. from the box. After the pieces were all in place the portions inside the box were cemented together to prevent slipping. The holes in the ring through which the rope ends projected were in eight rows, staggered, the rows being spaced evenly across the ring, and holes about 1½ in. apart in the rows. The whole machine was mounted on a frame of two 3 x 6-in. planks. The guides, which were mounted on the same timbers, consisted of two uprights of 1-in. round iron, threaded, each, one upright being attached to each timber. Two ½ x 2-in. iron plates about 18 in. long were bored to slip over these uprights. The plates were held at any desired height and spacing by nuts on the threaded uprights.

This machine, which was very successful, required two men to operate. It easily cleaned over 1000 ft. of rods in an hour. The cleaning was also much more thorough than hand cleaning.

WATER-SUPPLY SYSTEMS in 155 out of 204 cities of the United States which have a population exceeding 30,000 are owned by their respective municipalities, according to data recently compiled in San Francisco. The cost of treatment per million gallons covers the wide range from 4 cents in Chicago to $17.46 in Columbus, Ohio, the report continues. In Chicago the chemical sterilizing process is used exclusively.

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

Propose Another Code of Ethics for Engineers

Western Society of Engineers Presents for Discussion an Original Statement of Basic Principles

General principles of ethics, rather than a set of fixed rules universally applicable, are embodied in the code of professional conduct proposed by a committee of the Western Society of Engineers and on which general discussion is invited before adoption. The engineering profession, holds the committee, includes many classes and degrees of responsibility, many types of service and a great variety of relationships which will tend to require modification of any code except one in which only the most general principles are expressed. The best guide to correct detailed professional relations is considered to be a keen appreciation of the general professional status, and a conscientious attempt to be guided in each specific case by the spirit of the general ideas. Society discipline, though necessary in extreme cases, is to be deplored and avoided where possible, the loss of respect of one's profession being considered sufficient for the wilfully guilty.

The whole code closes with the following recapitulation:

"The ethical standards of the engineering profession should be those of a fraternity. The engineer should recognize that he is endowed by the profession and the state with specialized knowledge for peculiar, judicial and responsible public service, involving the life, safety, comfort and convenience of his own and coming generations, and that in response to these he should so conduct himself as to be appreciative of his indebtedness to his profession for his opportunity, and make return by every effort, by a life of special usefulness devoid of unseemly greed, and filled, if possible, with a multitude of those small courtesies, the practice of which encourages the spirit of forbearance and is helpfully conducive to the fine art of living well together."

Steel Company Plans to Spend $20,000,000 at Baltimore Plant

President E. G. Grace of the Bethlehem Company has announced that, while only tentative plans have as yet been prepared, the recently consolidated companies are planning to spend from $10,000,000 to $20,000,000 in improvements and additions to the steel making and ship building facilities of the Maryland Steel Company's plant at Sparrows Point, near Baltimore, Md. Recognizing the favorable conditions and location of this plant, it is possible that the present blast furnace capacity will be doubled, with a corresponding increase in the capacity of the open-hearth and Bessemer plants.

First Unit of Twin Peaks Tunnel Bore Completed

The first construction period on the Twin Peaks tunnel at San Francisco was completed Feb. 26 when headings being driven from opposite directions met between the western portal and the Laguna Honda station. Work has been in progress for nearly a year between these two points. Crews are also working from the eastern portal toward the first station at Eureka Valley. When this point is reached there will be no other outlets until the crews meet in the longest stretch of the tunnel under Twin Peaks proper.

Alabama Power Company to Place Order for New Plant

The Alabama Power Company will place an order, probably this week, for a 20,000-kw. steam power plant to be built on the Warrior River in Alabama, according to information received by the Engineering Record and confirmed by telephone by President Mitchell of the power company. The cost of the plant will be over $2,000,000. Plans are in preparation also for an additional unit at the hydroelectric station at Lock 12 on the Coosa River, which will add 20,000 hp. to its capacity and cost about $1,000,000.

Recently Appointed Chief of Engineers, U. S. Army

BRIG.-GEN. W. M. BLACK

To Replace Oakmont Bridge on Bessemer & Lake Erie Railroad

The Bessemer & Lake Erie Railroad officials announce that work will be started at once to replace the present bridge over the Allegheny River at Oakmont, near Pittsburgh, with a new structure, said to be the largest of its kind in America. The present bridge is inadequate for the heavier engines and car loads now used, and will be supplanted by a continuous truss 1800 ft. long and 170 ft. above the river. It is expected that the new structure will be completed in about 14 months.

H. P. Borden Appointed Member of Quebec Bridge Commission

By an order-in-council the Canadian government has appointed H. P. Borden, of Montreal, formerly assistant to the chief engineer of the commission, to succeed the late C. C. Schneider as member of the Quebec Bridge Commission. Mr. Borden's work on the new bridge, with which he has been connected since the appointment of the commission, is well known to many engineers.

Organizer of Cuban Public Works Department Becomes Chief of U. S. Engineers

Brig.-Gen. W. M. Black, Corps of Engineers, U. S. A., Succeeds Brig.-Gen. D. C. Kingman, Who Retired March 6

Brig.-Gen. W. M. Black, who organized the Department of Public Works of the Republic of Cuba during the American Occupation from 1899 to 1901, and brought it to a state of high efficiency during the Intervention from 1906 to 1909, has been appointed chief of engineers of the United States Army, succeeding Brig.-Gen. Dan C. Kingman, who was retired on account of age, March 6.

General Black was appointed chief engineer officer of the Department of Havana following the Spanish-American War in 1899, and started his constructive work in that country by cleaning up the city and repairing public buildings and wharves. In 1900 he was made chief engineer officer of the Division of Cuba, in which capacity he organized the National Department of Public Works and was in charge of the preparation of the plans for the complete sewerage system and the extensive paving work in Havana, which is now being completed, with modifications. When the United States forces were withdrawn many of the projects he had started to develop had not reached a head. He rounded out and completed his work on the island during the Intervention several years later.

Reinforced-Concrete in Fortifications

He was born in Lancaster, Pa., in 1855, and received his early education in the public schools of that city and at Franklin and Marshall College. He was appointed to the United States Military Academy in 1873, and was graduated at the head of his class in 1877, after leading it during the entire course. He was then appointed second-lieutenant in the Corps of Engineers, and was assigned to duty as assistant instructor in practical military engineering at West Point. In 1888 he was promoted to the grade of first lieutenant and assigned to duty on the improvement of the Great Kanawaha River. In 1886, while on duty on the restoration of Fort Marion at St. Augustine, Fla., he used reinforced-concrete for the first time in United States fortifications. In the same year he was promoted to the rank of captain, and engaged in river work, fortifications and harbor improvements until 1897, when he was made engineer commissioner of the District of Columbia. In this capacity he prepared plans for the elimination of grade crossings in that district which were accepted by the railroads and approved by Congress.

Spanish-American War Service

In 1898, at the outbreak of the Spanish-American War, he was brevetted lieutenant-colonel and chief engineer of U. S. Volunteers, and had charge of gathering the engineer material for the field army previous to the Santiago Expedition. In that campaign he commanded the advance guard at the landing at Guanica in which the Spanish troops were driven from the town after a slight skirmish. He was commended by the general commanding the army in his annual report for his conduct of the action.

Begins Work in Cuba

After a brief period of temporary duty in the office of the chief of engineers in Washington, in 1898, he was appointed chief engineer of the Department of Havana and began his work in Cuba by cleaning up the city and repairing its public buildings and wharves. About a year later he was appointed chief engineer officer of the Division of Cuba, on the staff of Major-General Wood, and supervisor of the Department of Public Works. In this capacity he organized the Department of Public Works and prepared a code of regulations for the conduct of work, which remained in force until incorporated in the general law of executive power of the Republic toward the close of the Intervention in 1909. He also had charge of the preparation of the plans for the sewerage and paving of Havana, a $16,000,000 undertaking which is now being completed, and of the planning and construction of the widely famed Malecon, which transformed an ugly dog-tooth coral littoral into a plaza and driveway that has become the best residential section of the city, and is a favorite resort of the Havana people and tourists during the evenings when band concerts are held there.

Work on Panama Canal

Being relieved from this service in 1901, he returned to the United States, and, in 1903, was assigned to duty in Panama under the Isthmian Canal Commission to observe the operations of the French Canal Company. During a short period in 1904 he was acting chief engineer for the commission. While on duty at Panama he received a testimonial from the foreign consuls and residents of Colon for the part he took in the defense of foreign residents against a threatened attack of Columbian troops.

He was appointed to the rank lieutenant-colonel in 1905, and, in 1906, at the beginning of the American Intervention he was assigned to Cuba as advisor of the Department of Public Works of the Provisional Government. During this assignment he devised the first comprehensive system of highways built in Cuba and prepared, in collaboration with the then Colonel Crowder, modifications to the contract for sewering and paving Havana, and for the water supply and sewerage of Cienfuegos. It was at this time that the Department of Public Works probably reached its high point in volume of construction under way at one time. The works covered the entire island and included municipal improvements, waterworks, flood prevention, canals, drainage, harbor improvement, and highway construction.

Chief Engineer Officer at New York

During the Intervention he was promoted to the rank of colonel in the Corps of Engineers, and, at its end, he was appointed chief engineer officer of the Department of the East and South and, in 1911, chief engineer officer of the Eastern Division. In this office he had charge of the first New York district river and harbor improvements. He also served as a member of the New York Harbor-line board, member of the board for the examination of engineer officers for promotion and senior member of the board for the preparation of a projected intracoastal waterway between Boston, Mass., and Beaufort, N. C. Later he was senior member of the board charged with removing the wreck of the "Maine" from Havana Harbor and a member of the board to consider the modification of the harbor lines of Boston. In 1883 he was awarded the Rowland prize by the American Society of Civil Engineers for his paper on harbor improvements along the South Atlantic Coast, and, in 1912, Franklin and Marshall College conferred on him the degree of Doctor of Science.

Studied Sewage Aeration

General Black, several years ago, undertook in connection with studies of the pollution of New York Harbor, an investigation of sewage treatment by aeration, in which he worked jointly with Prof. Earle B. Phelps of the U. S. Public Health Service. The results were reported in a paper presented to the Municipal Engineers of the City of New York.

Waterworks Association to Give Prizes for Securing Members

To increase its membership among the 6000 waterworks in the United States the American Waterworks Association proposes to give a cup to that section reporting the largest increase in membership per member and a gold society badge to that member in each section who secures the largest number of new members. The association now has members representing only 8 per cent of the waterworks men of the country and a strenuous effort will be made to materially increase its membership before the meeting in New York City, June 5 to 9.

200 Guests at Banquet in Tunnel

Covers were set for 200 guests at the banquet held 100 ft. underground in the Mill Creek joint district sewer, St. Louis, Feb. 19.

The tunnel is 3.8 miles in length, of horseshoe shape, 16½ ft. by 16½ ft. in section. It was driven through solid rock, and the material was hoisted to the street level in 9 shafts along the line of the work. The concrete lining was placed by the compressed air method, and new records were made both for the driving and the lining.

TABLES SET FOR BANQUET IN TUNNEL

The general contractors for the work were the Carter Construction Company and Norton, Head & Denneen, of New York. The banquet hall was on the section constructed by the Brocklehurst & Potter Company, of New York City.

Los Angeles Sanitation Commission Reports on Sewer Problems

The commission of sanitation engineers, which was recently appointed to report on what would be necessary in the laying out of an outfall sewer system for the entire county, mention of which appeared on page 231 of the Engineering Record of Feb. 12, submitted its preliminary report to the Board of Supervisors on Feb. 29. The commission recommends an appropriation of $45,000 to finance for a year a study of the problems involved.

The funds would be expended as follows: Five commissioners should be employed at $3,000 each, to which body there should be attached an executive secretary, a number of draftsmen, assistant engineers and others, to cost about $14,000, of which $2,000 would be for the secretary's salary. The remainder of the funds would be distributed in making several investigations; namely, tidal currents, $5,000; sewer lines and disposal sites, $3,000; soil analyses and ground water conditions, $1,000; transportation, traveling expenses and incidentals, $4,500; printing of report and miscellaneous, $2,500.

After a discussion of the report it was unanimously agreed by the board that all of the communities of the county should have a voice in the final decision as to what should be done. The clerk of the board was requested to send notices to all the communities, suggesting that the representatives sent should in each instance be delegated with power to act for the town in appointing the commission to complete a final plan.

Engineers Urge Support for Bills to Increase Military Training

Twenty prominent members of the various American engineering societies, including B. J. Arnold, E. L. Corthell, A. C. Humphreys, R. D. Mershon, George F. Swain, William Barclay Parsons, and W. J. Wilgus, have issued a circular to all members of the societies requesting them to send personal letters or telegrams to their individual senators and representatives urging support for the bills introduced in Congress to provide for the extension of military training in land-grant colleges and other civil educational institutions. The wording of these communications may be somewhat as follows: "I urgently request you to support and vote for the plan covered by the Bill S-3946 introduced by Senator Pomerene, and H. R.-10,845 introduced by Representative Gard, providing for the extension of military training in civil educational institutions."

In addition, it is urged that letters should be sent to other members of Congress who might be influenced, and that as many other persons as possible be induced to take similar action.

The principal points covered by the bills are as follows:

1. That the President of the United States shall have authority to establish and maintain in civil educational institutions a reserve officers training corps, which shall consist of a senior division and a junior division. The senior division shall be established only in institutions which require four years of collegiate study for a degree, and which will comply with the conditions laid down in the bill. The junior division may be established in all other educational institutions which will comply with the specified requirements.
2. The work of the senior division requires an average of at least 5 hr. per week during two academic years. The men undergoing this training will be supplied by the government with their uniforms, and will have their expenses paid to, and from, and at the summer training camps to be established as a part of the training. The work of the junior division requires an averge of at least 3 hr. per week per academic year.
3. That the President of the United States is authorized to detail such number of army officers, of non-commissioned officers and of enlisted men as may be necessary in connection with the military education and training of the members of the Reserve Officers Training Corps.
4. That the Secretary of War shall have the authority to prescribe standard courses of theoretical and practical military training for the units of the Reserve Officers Training Corps, and to establish camps in which further practical instruction of the members of the training corps shall be given.
5. That the President shall have authority to appoint as a reserve officer anyone who volunteers for such appointment who has taken the training of the senior division, and has otherwise fulfilled the requirements laid down and that the President may appoint as a temporary second lieutenant in the regular Army any reserve officer appointed under the provisions of the bill.

J. V. W. Reynders Resigns Superintendency of Steelton Plant

J. V. W. Reynders, vice-president and director of the Pennsylvania Steel Company, resigned as general superintendent of the Steelton, Pa., plant, March 7. With the announcement of Mr. Reynders' resignation came notification of the appointment of Quincy Bent, assistant to F. W. Wood, president of the Maryland Steel Company, Sparrows Point, Md., as general manager of the Pennsylvania Steel plants at Steelton and Lebanon, Pa., a position created by the Schwab interests.

General Superintendent of Steelton Plant of Pennsylvania Steel Company Resigns

J. V. W. REYNDERS

Mr. Reynders' resignation is the first important change in the personnel of the Pennsylvania Steel plants since their purchase by the new interests. It is in line with the general policy, recently announced, of concentrating the executive officers of all recently acquired properties at South Bethlehem, Pa. Mr. Bent will have complete control over the management of the Steelton and Lebanon plants, but will be without the additional executive authority vested in Mr. Reynders. It is this fact, of lessened authority, that is believed responsible for Mr. Reynders' resignation.

Mr. Reynders was born in Hoboken, N. J., and was educated at the Gymnasium at Wesel, Germany, and at Rensselaer Polytechnic Institute. He was first employed as a designer by the Pittsburgh Bridge Company in 1886, and, after two years, went to the Snead & Company Iron Works at Louisville, Ky. Later he was with the Penn Bridge Company, of Beaver Falls, Pa. Following this service he became assistant in charge of construction of the bridge over the Ohio River and of the St. Louis Merchants' bridge. Later he was with the Union Bridge Company, of Buffalo, N. Y., and Athens, Pa., and the Edge Moor Bridge Company, of Wilmington, Del. When the bridge and construction department of the Pennsylvania Steel was organized in 1892, he was appointed engineer, and, a year later, superintendent in charge. In 1906 he was made director and vice-president in charge of the Steelton and Lebanon plants.

To Mr. Reynders is generally credited the rapid upbuilding and strengthening of the Pennsylvania company's properties. When he first became a factor in the company's policy the various plants were in poor condition physically and the organization not fitted for playing an important part in the steel business. He leaves the properties as a going concern of the highest standing in plant and personnel.

While his business duties have been heavy, Mr. Reynders has nevertheless taken time to participate in civic affairs and in the activities of engineering societies. He is one of the leading citizens of Harrisburg and has been an important factor in the promotion of the many municipal improvements undertaken there in recent years. He has been prominent in the Engineers' Society of Pennsylvania, twice serving in the capacity of president.

Searchlights and Coast Defense Play Big Part in Modern Warfare

A blizzard of no small proportions failed to prevent a large attendance at the fourth military lecture, held under the direction of the four national engineering organizations at the Engineering Societies Building, New York City, Monday night. Following an introductory address on the nation's military status by Colonel Glenn, Gen. Leonard Wood's chief of staff, Capt. Edward F. Ardery, Corps of Engineers, U. S. Army, explained present-day practice in battle-field illumination and sea coast defense. The presiding officer at this session was Robert Ridgway, engineer of subway construction for the New York Public Service Commission.

Among modern devices for lighting hostile positions Captain Ardery enumerated searchlights, flares, torches, rockets and bombs, some of which have parachutes attached to them so as to support them in mid-air for 40 sec. In the latest types of searchlights the engines driving the motor trucks among which the apparatus is transported are made to supply power for illumination. The advocates of industrial preparedness in the audience were particularly impressed by one of Captain Ardery's pictures showing a special form of searchlight equipment designed for use in the Spanish war and delivered by the manufacturers to the Army after peace had been declared.

Captain Ardery explained in detail the construction and operation of sea-coast defenses, including both the guns and their emplacements. Accurate range-finding is the basis for directing a shell to its mark and the system of observation and almost instantaneous plotting of a ship's position off shore was one of the features of the address.

Captain Ardery concluded his lecture with a description of various types of mines and the methods of placing and exploding them.

Railway Engineering Association Announces Program

The American Railway Engineering Association has announced the program for its seventeenth annual convention, to be held at the Congress Hotel, Chicago, March 21-23. Subject to change by vote of the convention, or by the time requirements of the reports, the committees will report in the following order:

Tuesday, March 21—signals and interlocking, signs, fences and crossings, water service, iron and steel structures, wooden bridges and trestles, masonry.

Wednesday, March 22—ties, conservation of natural resources, yards and terminals, uniform general contract forms, stresses in railroad track, rules and organization, roadway, ballast.

Thursday, March 23—track, buildings, electricity, grading of lumber, records and accounts, wood preservation, rail, economics of railway location.

Two illustrated papers will be presented at an evening session March 21. Robert W. Hunt will speak on "The Nick and Break Test in the Inspection of Steel Rails," and H. B. MacFarland will discuss a "Test of Douglas Fir Bridge Stringers."

The annual dinner will be held March 22 at 6.30 p. m. The speakers will include Dr. John A. Brashear, scientist and astronomer, Pittsburgh; Arnold W. Brunner, of the city plan commission, New York City; Hon. Rudolphe Lemieux, formerly postmaster-general of Canada, and Rev. Allen A. Stockdale, of Toledo, Ohio.

Following the convention the members will be given an opportunity to visit the exhibit of the National Railway Appliances Association at the Coliseum.

William Sooy Smith Dead

Gen. William Sooy Smith, one of the country's foremost foundation specialists, died at Medford, Ore., March 4. In the course of his career as an engineer he invented a pneumatic caisson, which was probably the first ever used, and revolutionized the method of constructing foundations for heavy buildings in Chicago. He also introduced the freezing process for excavating in water bearing soil in this country.

He was born at Tarlton, Ohio, in 1830, and received his professional education at the United States Military Academy at West Point. After a year of service in the army, he resigned to engage in engineering work on the Illinois Central Railroad. Soon afterward he was appointed assistant engineer to the U. S. engineer in charge of the improvements in Lake Michigan harbors, but, soon after, was forced to resign on account of his health. In 1857, he was appointed chief engineer on the construction of an iron bridge across the Savannah River for the Savannah & Charleston Railroad Company.

Noted Foundation Specialist Who Died March 4

GEN. WILLIAM SOOY SMITH

At the outbreak of the Civil War he was appointed a colonel of infantry, and during it he distinguished himself on several occasions and was promoted through the grades until he attained the command of a division, serving on the staffs of Generals Grant and Sherman as chief of cavalry in the military division of the Mississippi. His duties in this connection brought him near to death from inflammatory rheumatism and incapacitated him for future service. Holding that an officer permanently disqualified for the discharge of all the duties of his rank should step aside and allow the man who does the work to enjoy the rank, and pay, he resigned his commission against the advice of General Sherman.

When sufficiently recovered in health, he resumed practice as a civil engineer in Chicago and did considerable work as engineer and contractor for the U. S. Government and the railroad companies, including the reconstruction of the Waugoshanee lighthouse at the western entrance of the straits of Mackinac, the first all-steel railway bridge in the world at Glasgow, Mo., and the substructures of six other bridges by the pneumatic process. Also he completely changed the methods of constructing foundations for heavy buildings in Chicago, carrying the loads down through mud and soft earth to hard bottom, 50 ft. or more, by means of piles cut off below the water surface. Where these could not be driven without endangering the foundations of adjacent buildings, they were carried down by sinking columns of concrete to hard bottom and resting the buildings on them.

His first pneumatic caisson, probably the first ever used, was for the construction of the heavy sea-wall surrounding the Waugoshanee lighthouse. In 1872, he was instrumental in causing Congress to appropriate money for a thorough test of iron and steel, and, after the necessary legislation had been obtained, he served for three years as one of the members of the board to conduct such tests. He joined the American Society of Civil Engineers in 1872, and was also a member of the American Institute of Mining Engineers and the Western Society of Engineers.

Report Shows Exposition Conventions Established Records

A final report of convention activities at the Panama-Pacific International Exposition, recently submitted to Charles C. Moore, president of the Exposition, showed that conventions brought 800,000 visitors to San Francisco, and that these visitors spent approximately $30,000,000 in that city. The total number of congresses and conventions was 928, which is said to be more than double the number of the St. Louis Exposition and nearly five times the number at the Chicago Exposition. Scarcely a day passed without a convention, it is affirmed, and as many as forty conventions were held in a single day, the average being ten sessions daily for the 288 days of the Exposition. The attendance at the sessions varied from 25 to 15,000. Of the 928 conventions scheduled, 61 were held by international organizations, 541 by national organizations, 94 by Pacific Coast organizations and 232 by California organizations. The International Congress of Education was attended by delegates from 31 foreign nations and the International Press Congress by delegates from 29 foreign countries. The maximum monthly attendance was in August, when 277 conventions were held.

Engineering Society of Wisconsin Doubles Its Membership

Two years ago a half-dozen members of the Engineering Society of Wisconsin met in Milwaukee and seriously discussed disbanding the organization. On Feb. 25 and 26 eighty engineers of all classes attended the meeting at Madison and it was announced that the total enrollment is now nearly 130, a figure double that of a year ago. It is significant that the increase has been largely among contractors.

Comparatively few papers were presented, thus giving plenty of time for discussion. This idea was taken advantage of to such an extent that none of the committee reports were presented except by title.

A paper on the "Relation of Engineers and Contractors," by J. C. Pinney, outlined methods of fair dealing by which these relations can be made as agreeable and pleasant as possible without sacrificing the interests of the owner or the terms of the contract, and without requiring undue or unfair concessions from the contractor. Points brought out in the discussion emphasized that the engineer should be the impartial arbitrator; that extras should be allowed on general merits and not be traded; that general terms in specifications should be discouraged; that engineers should be responsible for the results of the contractor and not for the methods he uses.

H. W. Adam, Mayor of Beloit, presented a paper on "Beloit's Experience with Open Paving Specifications," which brought out the liveliest discussion of the meeting, although little matter new to the engineer developed.

The newly elected officers are as follows: President, John S. McCullough, city engineer, Fond du Lac; vice-president, A. A. Babcock, engineer, Wisconsin Valley Improvement Company, Wausau; trustees, Fred G. Simmons, director public works, Milwaukee, and E. E. Parker, city engineer, Madison.

Boulevard to Overlook San Francisco from Twin Peaks

San Francisco's system of boulevards is being extended by a wide scenic highway which encircles Twin Peaks in the shape of a figure eight, overlooking both the city and the ocean shore from an elevation of about 800 ft. The length of roadway in the double circle is about 1 mile, and this will connect with the boulevards which, as extensions of the state highway from peninsular points, extend along the ocean beach to the Exposition Marina and back into the city via Van Ness Avenue.

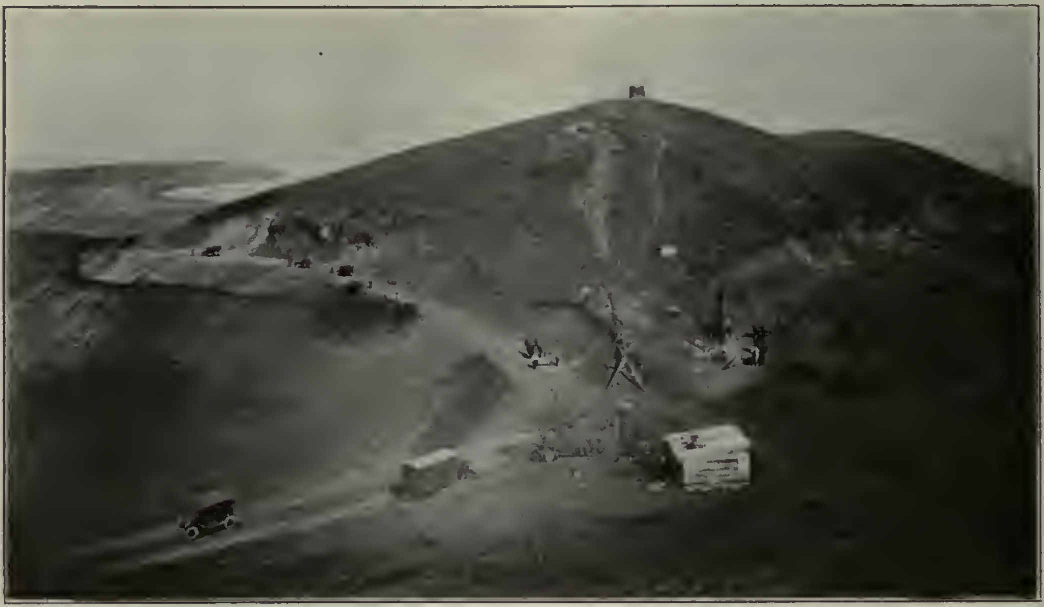


FIGURE EIGHT BOULEVARD LINKS TWIN PEAKS

The figure eight boulevard will be ready for service about April 15. It will be 40 ft. wide, with a paved width of 25 ft. The base will be of concrete, 6 in. thick, over which 1 in. of asphalt will be placed and finished with a 1½-in. binder wearing surface. The maximum grade in the approach to the road around the summits will be about 8 per cent, although 9 per cent is being used for very short distances at several points. Almost the entire right-of-way for the road was donated by the property owners.

The boulevard is being built by the city of San Francisco under the direction of M. M. O'Shaughnessy, city engineer.

Fort Worth, Texas, to Issue Building Permit Without Charge

In order to encourage building operations at Fort Worth, Tex., the city commission has decided to issue all building permits without charge. This will mean a loss of about $1,800 in revenue per annum.

Shields Water Power Bill Passed

By a vote of 46 to 22 the Senate passed the Shields water power bill, March 8.

Pennsylvania Engineers' Commission Submits Recommendations

The Pennsylvania Engineers' Commission, appointed to investigate the licensing of engineers in that state, has submitted a report to the Governor in which it is recommended that engineers in the public service, where competency may be readily determined by examination, should be subject to civil service regulations. Engineers in the employ of public service companies should be exempt from registration until the system has been tried out in state and municipal governments. Consulting engineers and experts for temporary engagements should be exempted from examination, and it is recommended that appointments to positions of high rank should be made at the initiative of the department as officer seeking to have the position filled. Some of the conclusions reached by the commission are as follows:

It is desirable in general, for the better protection of the life, health and property of the citizens of the Commonwealth, that the employment, retention and discharge of engineers, surveyors and technical men in public service, where competency may readily be determined by examination, should be subject to state or municipal civil service regulations.

In cities of the first and second class, and in the counties, boroughs, townships and municipalities of Pennsylvania, and for state work, it is desirable that such civil service examinations be conducted by a state department in order that the examinations may be governed by reasonable and consistent standards and a single body charged with the enforcement of such standards.

Such engineers, surveyors and technical employees of the state, counties and municipalities, excepting those in administrative positions, should be required to qualify before such a department. The determinations of standards and classifications should be in the hands of the board, but appointments to engineering or technical positions above a certain rank should not be governed by competitive civil service examinations. These appointments should be made on the basis of professional records. It is desirable that such appointments should be made at the initiative of the state or municipal department or officer seeking to have the position filled, but with the approvel of the state civil service examination board.

In cities of the first and second class the civil service examinations may properly be conducted as at present under independent local management.

Consulting engineers and experts for special temporary engagements should be exempt from examination, but should be required to register with the state board before beginning to practise. They should file a sworn statement of their professional record, and confirmatory statements from others, if called for, and unless promptly disapproved, this filing should be sufficient precedent to practice. The board should have power, for adequate cause, after hearing, to cancel the registration, and also to issue certificates to such experts if desirable.

The exemption of public service companies from the provisions of civil service regulations at the present time is suggested with the thought in mind that a beginning having been made in public works, prudence dictates a reasonable period of time in which to observe a working out of the system before any extension of it is considered.

Plans and specifications for public works built or to be built, operated and maintained by public service companies and municipalities, should, under the provisions of existing laws, be handled in the proper and respective departments of the state government.

It is desirable that the state civil service examination department, board or commission, should be authorized to investigate charges of incompetency or official dereliction on the part of engineers or technical men appointed through civil service, excepting cities of first and second classes, and that it alone should be empowered to disqualify such public servants, and only for adequate cause.

It is further desirable that the state civil service examination board should act in an advisory capacity in connection with the employment of consulting engineers or experts for special temporary engagements, and that no such engagements should be legal if made or continued against its disapproval.

The commission making the recommendations includes: F. Herbert Snow, chief engineer of the Public Service Commission of Pennsylvania, and for years head of the bureau of sanitary engineering of the State Health Department, chairman; John Price Jackson, commissioner of the State Department of Labor and Industry; Samuel A. Taylor, consulting engineer, of Pittsburgh; George S. Webster, director of Wharves, Docks and Ferries, Philadelphia, and J. Murray Africa, consulting engineer, of Huntingdon.

Western Road Installs Automatic Signals

The Chicago-Great Western Railroad has purchased and will commence in April the installation of automatic safety signals to extend its block system to cover entirely the main line from Chicago to St. Paul and to protect also most of the line from Chicago to Waterloo and Des Moines. The road has also purchased 10,000 tons of 85-lb. rails to replace curve-worn and light rail between Chicago and St. Paul.

News of Engineering Societies

The Engineers' Club of Philadelphia will hear Major-General William C. Gorgas, U. S. A., speak on "Sanitation" at a meeting to be held in that city, March 21.

The Municipal Engineers of the City of New York will inspect the Y. M. C. A. Building at Hanson and Fort Green Places in the Borough of Brooklyn, New York City, March 14.

The Pacific Northwest Society of Engineers heard Capt. John E. Pratt speak on "Engineering Features of Our Coast and Geodetic Survey" at a meeting held in Seattle, Wash., March 4.

The Engineering Alumni of the University of Vermont will hold its annual dinner at the Machinery Club, 50 Church Street, New York City, March 28, at 6.30 p. m. The engineering faculty of the university will attend.

The Illinois Structural Engineers' Association through its board of fifteen directors, has elected the following officers: President, J. G. Giaver; vice-president, J. P. Cowing; treasurer, H. E. Vanderlip; secretary, R. M. Gerety.

The Detroit Engineering Society will hear John H. Weller, supervisor of labor at the Packard Motor Car Company's plant, on "Modern Shop Tools and Method for the Production of Automobile Parts" at a meeting to be held in that city, March 17.

The Brooklyn Engineers' Club heard E. E. Trafton, telephone engineer of the Brooklyn Rapid Transit Company, speak on "Telephone Train Dispatching and Safety Appliances, New York Municipal Subways" at a meeting held in the Borough of Brooklyn, New York City, March 9.

The Colorado Association of Members of the American Society of Civil Engineers will discuss this evening questions pertaining to the affairs of the society. Discussion on the proposed change of society headquarters will be opened by J. E. Field, chairman of a committee to obtain information from all possible sources.

The Southern California Chapter of the American Institute of Architects held an architectural exhibition at Los Angeles during the period between Feb. 15 and March 4. The exhibit included architectural drawings, mural decorations, products used in building and allied arts and crafts, and the elevation and drawings of buildings of every character from the smallest bungalow to modern skyscrapers. About 1000 invited guests inspected the exhibit on the opening night at which time fifty architects acted as hosts. On the following day the display was thrown open to the general public.

Personal Notes

W. A. PEIRCE, formerly city engineer of Columbus, Wis., has been appointed to a position in the valuation department of the Green Bay & Western Railroad on work preparatory to the valuation by the Interstate Commerce Commission.

B. J. DALTON, formerly assistant district engineer of the western district of the Division of Valuation of the Interestate Commerce Commission, at Kansas City, has been appointed chairman of the valuation committee of the Missouri, Kansas & Texas Railways. Mr. Dalton was graduated from the University of Kansas in 1890, and entered railway service the same year. In 1891 and 1892 he was division engineer on the Texas, Louisiana & Eastern, and, in the latter part of 1892, he was on location work in New Mexico. From 1893 to 1895 he was engaged in general practice. In the latter year he was appointed division engineer on the Kansas City, Pittsburgh & Gulf, and, in 1898, chief engineer of the Kansas, Oklahoma Central & Southwestern. When that road was sold to the Santa Fé System he remained with the new interests as resident engineer on construction. From 1900 to 1903 he was assistant chief engineer of the St. Louis & North Arkansas, and of the Arkansas & Choctaw. He retired from that service to become, for two years, city engineer of Lawrence, Kan., after which he returned to the railroad field as division engineer of the Denver, Enid & Gulf. In 1906 he was appointed chief engineer of that road. Later in the same year he resigned from the office to become associate professor of civil engineering at the University of Kansas. Subsequently he became professor of civil engineering at that university. He was appointed assistant district engineer of the western district of the Division of Valuation in 1914.

H. M. MONTGOMERY AND C. W. HUMPHREY, consulting and contracting engineers, have formed a partnership under the name of Humphrey & Montgomery, with offices at 327 South La Salle Street, Chicago. They propose to continue and extend the practice of Mr. Humphrey, specializing in the design and construction of hydroelectric, steam and industrial plants, in electric transmission and distribution, in waterworks, and in reports and valuations.

D. B. DUNCAN, formerly connected with the W. D. Lewis Company of New York City, has been elected vice-president of the Eberhardt Construction Company, general contractors, of Salina, Kan. Mr. Duncan was graduated from the University of Missouri in 1905, and served for four years on the construction of the Pennsylvania Railroad tunnels under the East River, New York City. In 1909 he was appointed city engineer of Columbia, Mo., and was also connected with the L. W. Dumas, Jr., Construction Company of that city until 1913, when he joined the forces of the W. D. Lewis Company.

DANIEL W. MEAD AND F. W. SCHEIDENHELM have opened offices in the Equitable Building, 120 Broadway, New York, for the continuation of their practice as consulting engineers. Mr. Mead has been in engineering practice about thirty years, during part of which time he was engaged in contracting work. Since then he has been engaged in consulting practice at Madison, Wis., in addition to fulfilling the duties of professor of hydraulic and sanitary engineering at the University of Wisconsin. His field of engineering work has been extensive, but his main work has been along hydraulic and hydroelectric lines. In 1914, as a member of the board of consulting engineers acting for the American Red Cross and for the Chinese Republic, Mr. Mead spent some months in China investigating the problem of flood control and river regulation along the Huai River. He is also now acting as consulting engineer for the Miami Conservancy District, which is handling the problem of flood protection at Dayton, Ohio. As an author, Mr. Mead is best known for his book on "Water Power Engineering," though he has written a number of other books and many papers on hydraulic and related subjects. He will divide his time between Madison and New York. Mr. Scheidenhelm comes to New York from Pittsburgh, which has been his headquarters for a number of years, and where he has been engaged in private and consulting capacities in hydroelectric and other hydraulic work. For several years, as vice-president and chief engineer of the Hydroelectric Company of West Virginia, he was in charge of the Cheat River developments of that company. He has been specializing to a considerable extent in dam design and construction. Recently, he completed the reconstruction of the Stony River dam, which failed in January, 1914. Both Mr. Mead and Mr. Scheidenhelm are graduates of Cornell University, and members of the American Society of Civil Engineers, as well as of many other technical societies. They will continue to give their attention to hydraulic and electric developments, water supply, flood prevention and reclamation works.

RICHARD D. WILSON, superintendent of construction for the U. S. Treasury Department, Office of the Supervising Architect, has completed his assignment on the Federal Building at Hanford, Cal., and has been placed

H. H. EVANS, secretary of the local transportation committee of the Chicago city council, will act as secretary of the Chicago Traction and Subway Commission. Mr. Evans was graduated from Annapolis in 1899. He was a commissioned officer in the navy during the Spanish-American war, resigning in 1904 to go with the Cananea Copper Company, Mexico, for 1½ years. He then became assistant superintendent of construction for the Allis-Chalmers Company for three years. In 1908 he went to Chicago, and became special representative for the city in making a report on terminal electrification. Since then he has held his present position.

P. M. TEBBS, formerly assistant engineer in charge of district 12 of the Pennsylvania State Highway Department at Scranton, has been promoted to the grade of engineer of construction, with headquarters at Harrisburg, filling the vacancy caused by the resignation of John T. Gephart, Jr., which was noted in these columns, Feb. 5.

Ray Vosler, formerly civil engineer and surveyor of Greenville, Pa., has been appointed to a position on the forces of the Carnegie Steel Company at the works at Youngstown, Ohio.

Curtis A. Mees, whose resignation as designing engineer of the Southern Power Company was noted in these columns last week will engage in practice as consulting engineer at Charlotte, N. C., after May 1. Mr. Mees was graduated from Rose Polytechnic Institute in 1900, and was engaged in railway work on the Pennsylvania Lines west of Pittsburgh and the New York Central & Hudson River Railroad from then until 1902, when he was appointed assistant engineer for the Catawba Power Company in South Carolina. From 1904 to 1905 he was with the Department of Public Service of Columbus, Ohio, on the construction of its $1,500,000 sewage dosposal plant, and on waterworks design. He became connected with the Southern Power Company in 1905, when that company was organized. Among the plants he designed since then are the Great Falls, the Rocky Creek, Lookout Shoals, Fishing Creek and the Mount Holly steam plant.

Dayton Morgan Engineering Company, has recently been incorporated under the laws of Ohio, with headquarters at Dayton, with the following officers: Arthur E. Morgan, president; L. L. Hidinger, vice-president; C. A. Bock, secretary; S. B. Hutton, assistant secretary, and N. H. Sayford, treasurer. The new corporation, the creation of which was made advisable by the increasing scope of operations, will co-operate with the Memphis Company as "The Morgan Engineering Companies," and the two organizations will continue to specialize in flood prevention, drainage and reclamation engineering. The officers are the same in both organizations, except that S. B. Hutton is secretary of the Memphis Company. Mr. Morgan will continue as chief engineer of the Miami Conservancy District.

G. F. Clevenberg, until recently in the engineering department of the Central Railroad of New Jersey, is now on the government valuation work. He is at present on the roadway party in southern New Jersey that is inventorying the Central Railroad of New Jersey.

A. D. Collman and W. C. Duncan, formerly Collman & Collman Company, will hereafter be known under the firm name of Collman & Duncan, with offices in the Sharon Building, San Francisco, where they will conduct a general contracting business.

Paul A. Buol, formerly assistant chemist for the Portland Cement Company at Lehunt, Kan., has been appointed to a position in the engineering department of the St. Louis & San Francisco Railroad.

W. R. Schnabel, of Bethlehem, Pa., has been appointed first assistant city engineer of Allentown, Pa., succeeding Earl Meckley, resigned. Mr. Schnabel is a graduate of Lehigh University, and, for four years, was engaged in municipal work in Bethlehem, including street paving, sewers and general municipal improvements. For several years he was on construction work for the Bethlehem Steel Company, and lately has been office engineer for the Lehigh & New England Railroad, with headquarters in Bethlehem.

J. E. Lawton, for the past 9 years inspector and chief inspector of the Panama Canal, has resigned to accept a position as consulting engineer and sales manager for Ward & Company, manufacturers' agents, at Washington, D. C.

John Johnston, formerly construction engineer for the California State Highway department, has been appointed construction engineer for the State Department of Engineering, and will have charge of the work at Ventura, Cal.

Clifford M. Holland, formerly assistant engineer, has been selected to fill the newly created office of "tunnel engineer" of the Public Service Commission of New York. In his new position Mr. Holland will have general supervision over all of the shield tunneling involved in the construction of the city's new subway system, representing contracts aggregating about $20,000,000 for this class of work in soft ground. The new Fourteenth Street bore on route 8, section 3, a contract for which has recently been awarded, and also a tunnel at Sixtieth Street, for which plans and specifications are now in course of preparation, are important features of the construction program for which the new tunnel engineer will be responsible. Other contracts under his direction are those for route 33, sections 2 and 3, and route 48, section 3. Mr. Holland's promotion comes as a recognition of ten years' continuous service on New York subway work. He is a graduate of Harvard University, having received his degree of A.B. in 1905, and S.B. in Civil Engineering in 1906. While in college he served on Prof. Hector J. Hughes' staff of field instructors in surveying at the University's engineering camp at Squam Lake, N. H. After leaving college his first work was with the New York Rapid Transit Commission, as assistant engineer in the Battery tunnel, and when the Public Service Commission took over the subway work he was retained on the engineering staff, supervising construction both in Manhattan and Brooklyn. Year by year he demonstrated his ability to shoulder increased responsibilities, and when it was decided that the best interests of the subway construction demanded the centralization of all soft-ground tunneling under a single administrative head, Mr. Holland was considered to be the logical choice for the new post. He is an associate member of the American Society of Civil Engineers and secretary of the Harvard Engineering Society of New York.

Assumes charge of all Soft Ground Tunneling on New York's New Subway System

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CLIFFORD M. HOLLAND

J. W. Mercer, formerly assistant county engineer of Fain County, Iowa, has been appointed county engineer of Lucas County.

William C. Spiker, consulting engineer, of Atlanta, Ga., has been appointed construction engineer on the Market Street bridge across the Tennessee River at Chattanooga, and will devote a good part of his time to that work. Mr. Spiker was graduated from Cornell University in 1900, and was employed for a few months by the Central Railroad of New Jersey. In the fall of that year he was appointed to a position on the forces of the American Bridge Company, where he remained until 1902, when he joined the staff of Joseph H. Wallace, consulting engineer, of New York City. From 1904 to 1905 he was engaged in design work for Milliken Brothers of New York City, the New York Central Railroad and the McClintic-Marshall Construction Company. From 1905 to 1908 he was again with Joseph H. Wallace on the design of manufacturing plants, the development of water powers and other work. During the last year he was in England in charge of all the work above the foundations on a $2,000,000 industrial plant. In 1908 he was appointed chief engineer for the Alfred E. Noble Company of New York. He entered private practice as consulting engineer at Atlanta, in 1909.

E. W. Clarke, chief engineer of the Cambria Steel Company, has been chosen to succeed Charles E. Duncan as superintendent of rolling mills of that company.

W. P. Howe, road engineer of Crockett and Irion Counties, Texas, has resigned his position to take charge of the first fish hatchery to be established in Oklahoma.

C. E. Apple has resigned from his position as supervisor of bridges and buildings for the San Antonio & Aransas Pass Railway.

S. V. Cortelyou, assistant engineer of the California State Highway Commission, in company with county officials, is making a tour of inspection of the bridges in San Diego County damaged during the recent floods for the purpose of determining what type and class of bridges will be necessary in the future to reduce the danger from such causes to a minimum. Under the law the State Highway Commission has authority to designate the character of structures erected by the counties over streams on the state highway, and Mr. Cortelyou is making his tour at the request of officials of San Diego County, who are anxious to complete an estimate of the cost of repairs and of new structures in order that a bond election may be held at an early date.

W. H. Carruthers has resigned from the office of county engineer of Maricopa County, Arizona, to become engineer in charge of construction in that State for the Barrett Manufacturing Company.

Harold Bargeman, formerly assistant county engineer of Maricopa County, Arizona, has been appointed county engineer, succeeding W. H. Carruthers, whose resignation is noted elsewhere in these columns.

John Tomson has been appointed commissioner of the streets division of the city of Cleveland, succeeding Gus. H. Hanna, who has become president of the Lake City Manufacturing & Supply Company. Under the reorganization plans, put in effect by the director of public service, the street cleaning and street repairing divisions are consolidated. The city will be divided into 15 or 16 districts, with a foreman in complete charge of all street work in each. Heretofore, all street cleaning and repair work has been directed from the city hall on a city-wide basis.

James H. Lawrence has been appointed assistant commissioner of the streets division of the city of Cleveland.

I. W. E. Davis, commissioner of heat and light of the city of Cleveland, will also assume the office of commissioner of water of that city in May or June.

CHARLES W. ERISMAN, formerly draftsman in the bureau of township highways of the Pennsylvania State Highway Department, has been appointed acting assistant engineer of district 6, with headquarters at York, succeeding W. A. Van Duzer, who has been transferred to Scranton.

GEORGE L. SOLLENBERGER, formerly a draftsman in the bridge department of the Pennsylvania State Highway Department, has been appointed assistant engineer in charge of district 2 of the bureau of township highways, with headquarters at Harrisburg.

R. B. HAMILL, formerly chief of party in the bureau of township highways of the Pennsylvania State Highway Department, has been appointed assistant engineer in charge of district 3 of that bureau, with headquarters at Pittsburgh.

W. P. MILLER, formerly a draftsman in the bridge department of the Pennsylvania State Highway Department, has been appointed assistant engineer in charge of district 4 of the bureau of township highways, with headquarters at Warren.

TREATED TRESTLE IN THE DISMAL SWAMP, VIRGINIA

SIMPLE TANK IN WHICH TRESTLE TIMBER IS TREATED

QUINCY BENT, whose appointment as general manager of the Steelton and Lebanon plants of the Pennsylvania Steel Company, succeeding J. V. W. Reynders, is noted elsewhere in these columns, was educated at the Harrisburg Academy and Williams College. He began his work at the Steelton plant of the Pennsylvania Steel Company, at Steelton, and later was transferred to Sparrows Point to become assistant to President Wood.

HARRY G. HARPER, formerly attached to the Harrisburg office of the Pennsylvania State Highway Department, has been appointed assistant engineer in charge of district 5 of the bureau of township highways, with headquarters at Bloomsburgh.

J. CLARENCE JONES, formerly city engineer of Edgerton, Wis., has been appointed to a position in the valuation department of the Chicago & Northwestern Railway. He was graduated from Kansas State College in 1913, and was employed during the next year by the Anderson Land Company of Cedar Rapids, Iowa, on land division and subdivision work, and on paving, sewerage and water supplies. He was appointed city engineer of Edgerton in 1914 and served in that office until February of the present year.

GEORGE M. NEEL, who, for the past four years, has been engaged on the construction of an irrigation project for the Ranchos Orchard & Land Company at Taos, N. M., has been appointed engineer for the Klauer Manufacturing Company, manufacturer of metal flume and other products, of Dubuque, Iowa. It will be his duty to investigate power and irrigation projects, draw up plans and supervise the installation of the company's flumes. His headquarters will be at Denver, Col.

H. H. WESLE, formerly connected with the Miami Conservancy District of Dayton, Ohio, has been appointed to a position on the engineering forces of the Union Pacific System at Omaha.

Civil Service Examinations

Philadelphia.—Among the examinations announced on schedule 162, recently issued by the Civil Service Commission, which are dated for the near future, are the following. These examinations are open to residents of the city only. Application for them, which should be made at the City Hall, Room 976, must be completed before four days prior to their dates.

DRAFTSMEN, Highways Bureau, Department of Public Works, salaries from $600 to $900 and from $900 to $1,200 a year, to be held April 17. The duties for both positions involve drawing plans and other drafting work, besides assisting in data taking for highway work. Applicants must be 21 years of age and have had a high school training.

DRAFTSMAN, City Transit Department, salary from $1,000 to $1,200 a year, to be held April 18 and 19. This position is in connection with the designs of subways and elevated railways. The requirements are drafting work of this nature, estimating quantities, and making simple structural computations. For these requirements a year's practical experience or two year's education in a technical institution is demanded. Applicants must be 21 years of age.

DRAFTSMAN, Bridge Division, Bureau of Surveys, salary $1,200 a year, to be held April 19 and 20. Calculation of stresses of beams and girders in steel and reinforced concrete, as well as steel trusses, and designing of similar structures are duties attending this position. Applicants must have had a civil engineering education. Preference will be given to those who have had likewise experience in detailing structural work.

Examinations Previously Announced

Date		See Eng. Record
March 22-23	—Junior civil engineers, Grades 1 and 2, salaries from $1,200 to $1,680 and from $720 to $1,080 a year; valuation work, Interstate Commerce Commission, United States	March 4
April 3-8	—Architectural draftsmen, salaries from $900 to $1,200 and from $1,200 to $1,500 respectively, roadman; salary from $840 to $960 a year, and assistant engineers, salaries $2,100 to $2,500 a year, Philadelphia	March 4

New Process for Treating Wood Is Put Forth

Patented Method Is Extremely Simple and Those Backing It Claim for It a Wide Field of Usefulness

A new process for treating wood of all kinds is being put forth for commercial use by a company formed for the purpose, known as the American Wood Encysting Company, Inc. By simply immersing the green wood to be treated in an open tank containing the compound heated above the boiling point of water, the backers of the process assert that in a few hours at the most, depending on the thickness of the stick, the wood, besides being dried and waterproofed, is given a preservative treatment that is the equal of any process now in use. They claim that the method will protect crossties, structural timber and paving blocks, even under the most adverse conditions and that it will render piling immune against the teredo and other marine borers. They contend also that the treated wood is proof against termites and all other wood-destroying insects. Other important applications are of less interest to the civil engineer. The process was invented and patented by Col. R. A. Marr, of Norfolk, Va., formerly dean of the Virginia Polytechnic Institute, who has been experimenting on it for years. The first users of it were the Welin Marine Equipment Company, makers of life-saving appliances, and the Lundin Company, manufacturers of balsa wood products, both of New York City.

The process consists of encysting or coating the individual cell walls with a compound, of which paraffine acts as a base, whereby the wood is asserted to be made both impervious to moisture and insured against all known forms of decay. For certain purposes it has been found advantageous to increase the specific gravity of the treated wood to such an extent as to make it heavier than water, and this is accomplished in the above process by slight modifications in the regular treatment, which ordinarily tends to lighten the wood.

In a demonstration before a representative of this journal with small blocks of oak, longleaf pine, Oregon fir and balsa, action began almost on the instant of immersion, the bubbling on all sides apparently indicating penetration in every direction. Coloring matter had been added to the compound, and when the blocks were split up after immersion from half an hour to an hour and a half it was evident that the mixture had gone all through them. Although some of the blocks had been soaked over night in water, they appeared to be perfectly dry a minute after they were taken from the tank. One of the claims made by the company is that absolutely no preliminary seasoning is necessary, that green timber with the bark on can be treated and that such treatment accomplishes in a few hours a seasoning effect that requires from six months to several years to obtain by other seasoning methods, and at the same time prevents checking or warping.

Among many other advantages claimed for the process are that it can be applied to kinds of wood that will not take the ordinary preservatives—such kinds as white oak, osage orange, black walnut, shagbark and hickory; that it preserves the natural resiliency of woods, increases their modulus of elasticity and renders useful the cheaper varieties of wood that now check or warp too badly to be of structural value; that as "encysted" wood is perfectly clean and emits no odor except a faintly pleasant one, it can be used for floors where wood treated in other ways is out of the question; that it insulates thoroughly against electricity; that the first cost of installation as to treatment need be only a small fraction of that of the pressure types of plants now in use, and that the cost of the treatment itself is less.

Although the company has not as yet made any commercial application of its process to crossties, and admits that it has not been in a position to do so, the manager of the company suggested to this journal's representative that the elaborate stationary plant required for the treatment of 1,000,000 ties per year could, it was believed, be replaced by a portable tank arrangement at a comparatively small cost which would be operated by a locomotive, and moved about over the line to receive the ties wherever they were delivered on the right-of-way, and treated at once.

The process has not, of course, been subjected to the acid test of hard and protracted service. The Richmond Cedar Works, of Richmond, Va., which operates many miles of private road, largely trestle, in the Dismal Swamp, and has found that these trestles, built of black gum, hardly lasted two years, has been using encysted black gum throughout in them for the last two years, and it is stated that none of the treated timbers have as yet shown any signs of decay. One of the accompanying photographs shows one of these trestles; the other shows the simple tank in which the wood was treated. The encysting company also exhibits treated paving blocks in service in Norfolk for three years and in excellent condition, and others untreated in service under the same conditions two years, and almost eaten away by the termite.

The American Wood Encysting Company, Inc., has opened an office in the Forty-second Street Building, New York City. Colonel Marr is president of the company. William F. Morgan, secretary and treasurer, is also a director of both the Welin Marine Equipment Company and the Lundin Company. E. H. Raquet, who as engineer of tests of the New York, New Haven & Hartford Railroad conducted an investigation into the application of the process to crossties of various kinds of wood, has recently resigned to become manager of the encysting company.

Map of the West Shows Activities of Interior Department

A map of the western portion of the United States, showing the location of the activities of the various divisions of the Department of the Interior, has recently been published by that department. The particular activities which are indicated include national parks and monuments, Reclamation Service projects and branch offices, as well as those of the Geological Survey, Bureau of Mines, Surveyors General, Chiefs of Field Divisions of the General Land Office and local lands, rescue cars and stations of the Bureau of Mines and Indian reservations and schools. The map is 26 x 18 in. in size and is printed in four colors. Copies may be secured from the Superintendent of Documents, Government Printing Office, Washington, D. C., for 15 cents apiece.

Swivel Jointed Radius Rods Take Driving Strains in New Truck

In two new worm-driven motor truck models recently put on the market by the Kelly-Springfield Motor Truck Company of Springfield, Ohio, it is claimed that the frame is relieved of sudden shocks due to starting or quick application of the brakes.

NEW MODEL OF MOTOR TRUCK EQUIPPED WITH GEAR DRIVE

The driving strains are taken up through the radius rods, swivel-jointed at each end, while the torque and braking action is taken through the springs.

Business Notes

The L. L. Wright Roofing, Waterproofing & Construction Company, of Brooklyn, N. Y., has moved its offices and plant from 543-545 Smith Street to 248-250 Lorraine Street.

Thomas J. Nolan, agent for surety bonds and liability insurance, of 75 State Street, Boston, has admitted his brother W. Henry Nolan into partnership and the firm name has been changed to Thomas J. Nolan & Company.

The Osgood Company, manufacturer of steam shovels, dredges, ballast unloaders and other equipment, of Marion Ohio, has purchased the manufacturing plant of the Ohio Tractor Company, thereby, it is said, doubling its capacity. The larger machine tools, for which crane service is desirable, will be moved to the main plant of the Osgood Company, while the smaller tools and the foundry will be operated at their present location. The Ohio Tractor Company has acquired a new site in the south part of Marion, and is making arrangements to increase its output.

The Consolidated Engineering Company of 507 W. Jackson Boulevard, Chicago, has purchased the land, buildings, tools, machinery and equipment of the Massachusetts Fan Company and has commenced the manufacture, at Watertown, of the blower, fan and heater apparatus formerly made by that company. John E. Anderson, for the past 24 years a ventilating engineer, and, for the last 7 years, with the B. F. Sturtevant Company in its Chicago office, in charge of the ventilating and cooling department, has been appointed sales manager in charge of the Massachusetts Blower Department and Kinealy Air Washer.

E. C. Porter, who, for two years, has been commercial agent in charge of the New York City office of the U. S. Bureau of Foreign and Domestic Commerce, has resigned from that office to become executive secretary of the recently formed American-Russian Chamber of Commerce, of 60 Broadway, New York City. Mr. Porter has had direct charge of the organization and the arrangements entered into between the Department of Commerce and the Imperial Russian Government for the purpose of assisting American business interests in importing goods from Russia. As a result of these arrangements, approximately $700,000 worth of Russian materials have been brought into the United States.

Col. John C. Hooven, organizer and president of the Hooven-Owens-Rentschler Company, manufacturer of Corliss engines, of Hamilton, Ohio, died in that city, March 1. Colonel Hooven was born in 1843, and took up his residence at Hamilton in 1874. In 1880 he organized the Hooven-Owens-Rentschler Company, and started in his career as a manufacturer of Corliss engines. In 1890 additions were made to the original plant that doubled its capacity. Some of the largest engines built in the United States were constructed under Colonel Hooven's direction, and, in recent years, the company turned out equipment for large sugar mills. In addition to his interest in the engine company, Colonel Hooven organized the Ohio Electric Railway Company, the Cincinnati, Lawrenceburg & Aurora Traction Company, and the American Frog & Switch Company, and had interests in such companies as the Dayton Rubber Company and the Champion Coated Paper Company. He is survived by his wife and four sons: C. E. Hooven, treasurer and manager of the Hooven-Owens-Rentschler Company; Paul Hooven, Boston representative of the company; E. Hooven, the Chicago agent, and D. Hooven, purchasing agent of the plant.

Trade Publications

The following companies have recently issued trade literature:

Bitoslag Paving Company, 90 West Street, New York, leaflet, 10 pages. Bitoslag pavement with specifications.

Continental Public Works Company, 2 Rector Street, New York, booklet, 44 pages, contract work on asphaltic and concrete roads, showing equipment and process.

W. & L. E. Gurley, Troy, N. Y., bulletin, 8 pages, Gurley precise transits; type used on Hell Gate Bridge.

A. S. Cameron Steam Pump Works, 11 Broadway, New York, bulletin 154, 16 pages, single and double suction, centrifugal pumps and sump pumps.

L. L. Wright Roofing, Waterproofing & Construction Company, 248 Lorraine Street, Brooklyn, N. Y., catalog, 20 pages. Indestructible asphalt-cement flooring for factories, warehouses, bridges and viaducts, and piers.

Gemco Manufacturing Company, Milwaukee, Wis., catalog, 20 pages. Gemco adjustable shores for trenching, holding forms for concrete, and beams, and brace and column clamps for supporting forms.

U. S. Sanitary Septic Tank Company, Memphis, Tenn., circular folder, sewage treatment tank for individual buildings, especially those isolated in the country.

Engineering Record

A Weekly Journal Devoted to Civil Engineering and Contracting

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Railway Engineering Convention

NEXT week there meets in Chicago in annual convention one of the most useful of American technical societies—the American Railway Engineering Association. Not spectacular in its methods, seldom coming into the limelight, it works on efficiently from year to year, accumulating a mass of tremendously valuable material which is most effective in raising railroad standards throughout the country. It is an example of an association keeping constantly before it the ideal of "service" to its members. Its efforts are governed not by the desire of prestige or public position, laudable as such motives are in an engineering organization, but by the needs of the railroads of the country as represented by the association's membership. It merits and is receiving the hearty support of railroad engineers.

To Confer on Co-operation

NINE national and sixty-seven local engineering societies have been invited, through a committee of which Prof. F. H. Newell is chairman, to meet in Chicago April 13 and 14 to discuss ways and means of co-operation among engineering societies. It is unnecessary for this journal to remark that the need of and desire for co-operation among organizations of engineers have been to the fore in recent years. To rehearse the arguments supporting the co-operative movement is entirely unnecessary. What has long been awaited is some agency through which broad and effective co-operation could be brought about. The opportunity is now offered in the Chicago meeting. No society having the means and truly desirous of working for the best interests of the profession will fail to be represented at Chicago.

Lackawanna Suburban Stations

THE publication as the leading article of this issue of a description of the South Orange improvement of the Lackawanna Railroad affords occasion to call attention to the remarkable group of suburban stations this railroad has built in recent years. All of them are characterized not only by excellence of engineering design and architectural treatment, but by a liberality in the purchase of ground for an adequate setting that speaks volumes for the road's appreciation of what it can do to increase the attractiveness of the communities dependent on it for service. The stranger coming into the handsome stations at Montclair, Morristown, Chatham, Mountain Station and South Orange is sure to get a most favorable first impression of the community. General civic betterment, too, has not infrequently had its beginning in the cleaning up of a rundown railroad neighborhood, centering about a dilapidated station. The stations mentioned, to which Madison and Morris Plains, now under way, must soon be added, have been termed the handsomest group of suburban stations in the country. The railroad's chief engineer, Mr. Ray, and its architect, Mr. Nies, backed by the ample resources and broad policy of the Lackawanna, deserve great credit for the high plane of these developments.

To Local-Association Members

ON page 377 will be found a lengthy editorial discussion of a letter which a past-president of the American Society of Civil Engineers has sent to the society's local associations of members. Those who are fully acquainted with the relationship between the United Engineering Society and the "founder" societies will not be disturbed by his communication, but those not so informed will doubt seriously the advisability of the shift of headquarters. The Engineering Record knows this because one of its editors attended the meeting of a local association when the past-president's communication was read. While before its receipt the association as a whole favored the removal, the letter brought up serious doubts, and the association determined to query the society's headquarters as to the correctness of the assertions. It behooves all members of local associations, therefore, to see that the misconceptions of the communication are not allowed to stand uncorrected. The statements as to the society's relations to the United body, in case of removal to Thirty-ninth Street, are absolutely wrong.

New York's Garbage Problem

NEW YORK CITY'S garbage disposal problem appears to be no nearer solution now than it has been for years past. The Board of Aldermen, in defeating Commissioner John T. Fetherston's project for new works on Riker's Island, outlined in last week's issue, page 349, has completed a cycle whereby the Street Cleaning Department's efforts to install up-to-date equipment and secure a profit for the city from grease recovery are again at the starting point. Of course, the reason for quashing the Riker's Island project was that it would create a public nuisance. This argument found ready support from taxpayers and real-estate interests in the Boroughs of The Bronx and Queens, although Commissioner Fetherston denies that objectionable conditions will result from operating the works at the site selected. In weighing the validity of these objections another factor must be taken into consideration. The city's present contract with the private company which operates the existing garbage reduction plant at Barren Island will expire at the close of this year. Naturally a lucrative agreement such as now exists will not be meekly surrendered by those who are profiting by it. What influence, if any, this factor has had in the rejection of the Riker's Island project can, of course, only be surmised. If all proposals for an up-to-date plant, which will yield a profit to the city, are killed outright or tied up by delays the Barren Island company, even with its antiquated plant, will be the only one in the field when a new agreement becomes necessary.

State Control of Clearances

ILLUSTRATING the activities of state-utility commissions in matters that could perhaps be left pretty much to the railroads themselves, the Minnesota Railroad and Warehouse Commission has recently adopted a clearance diagram for bridges and tunnels. The diagram is compared on page 393 with the standard of the American Railway Engineering Association, and with that rejected by that society last year. While the proposition last year was opposed on the ground that it was unnecessary to increase the standard width from 14 to 15 ft., the Minnesota commission raises it to 16 ft. On the other hand, the Minnesota commission finds 21 ft. vertical clearance sufficient, whereas the railroads have adopted 22 ft., having noted that with 21 ft. trainmen on high cars are still occasionally struck. If Minnesota may decide upon 16 and 21 ft., Iowa may as easily adopt 16½ and 20½, and Wisconsin might be content with 15½ horizontal, but require 22½ vertical. Lack of a uniform standard for fixed structures such as bridges and tunnels, is, of course, not as serious as varying requirements for equipment, especially if the rules are applied only to new structures. Moreover, the railroads are the direct losers if the clearances are insufficient, as rate increases can hardly be made to take care of damage claims. It does seem that the state commissions could safely leave the entire question to the railway organizations, whose committees and other members have given it much thought.

Vicious Highway Legislation

SIX changes in as many years would wreck any organization in the business world. Yet that rate of change is what the New York State Highway Department has had to endure. After much labor and pain the Carlisle regime came in and brought order out of chaos, while its successor has been continuing to work right along the lines laid down by its predecessor. Now, however, comes the Argetsinger bill which proposes to disrupt the whole fabric again and to set it back to where it was years ago. Maintenance work is conceded by highway engineers the country over to be our most important road problem to-day. Now it is carried on in New York under the supervision of the state highway department. Under the proposed law, maintenance would be handed over to the counties to be done as and in the way the county superintendent thought fit. Not over ten of the county superintendents are capable or have an organization to handle the expenditure of the maintenance money efficiently. This system of maintenance was tried out some time ago and proved an absolute failure. Moreover, the bill is in the nature of ripper legislation, taking the present division engineers who are under civil service out of the system and replacing them by politically appointed deputy commissioners, whose required qualifications are so simple that the veriest tyros in highway building could be placed in charge of the state's important highway divisions. The bill is vicious in the extreme. The New York State Highway Department and its troubles appeared frequently in these columns up to about three years ago. Since then conditions have been immeasurably bettered. If the Argetsinger bill goes through, one can look for the return of the good old days when highway work in New York, through disorganization, was a by-word for the grossest inefficiency.

The Mooted Subway Grating

WHEN the present subway in New York City was opened complaints were quickly made about the air. They have waxed with every summer. Despite the fact that thorough analysis, made by Drs. Charles F. Chandler and George A. Soper over a period of three years, showed the subway air to be better than that on New York streets, the complaints have lately been revived, organized and swelled by a small minority of property owners whose vault space has been curtailed by the construction of ventilators on the new routes. These men would have the city pay for installing any ventilating system, however great the cost or little the benefit, that would return to them their vault space. While it is true, as those who read the report (page 382) by the special committee which has just investigated the entire subject will realize, that conditions in New York's subways are radically different from those in the subways of European capitals, requiring positive measures for relief where none are needed or used abroad, it will be apparent also that the objectors have had the utmost consideration shown them.

Although private and public engineers have worked on the problem for years, and many schemes, ranging from the ridiculous to those prohibitive in cost, have been proposed and have received the most careful consideration, the original decision of the engineers in charge of subway design—to ventilate through sidewalk gratings—has been vindicated. There is no relief in sight from some excess of heat over the outside air, except at a price which the city cannot pay. The new subways will otherwise be as well or better ventilated than any places in which men congregate. The only arguments entitled to public consideration that the objectors were able to advance have been answered.

Reproduction Cost Allocated According to Use

ON PAGE 386 the Engineering Record presents an abstract of what it regards as a remarkable appraisal report, that of W. W. K. Sparrow, assistant chief engineer of the Missouri Public Service Commission, on the Mississippi River & Bonne Terre Railway. The report goes into the allocation of investment and expenses between classes of service as does no other report that has come to the attention of this journal, with the possible exception of the Ulster & Delaware report of W. J. Wilgus, abstracted in the Engineering Record of Aug. 21, 1915. The valuation, too, of the whole road deserves careful reading. Reproduction cost, that outlaw among state commissions, is made the basis. Land values above normal market value are allowed in certain cases, being derived by a novel method which Mr. Sparrow holds is consistent with the Minnesota rate case. The Engineering Record is unable to agree with Mr. Sparrow in all of his theories. It is impressed, however, with his evident desire to play fair to both sides—the more so because it contrasts so sharply with the determination of a number of commissioners in neighboring states to shape their theories to produce the lowest figure.

Mr. Sparrow starts with an assumption that his neighbor commissioners say is impossible, but that this journal thinks is entirely reasonable and the only fair one—that everything is present except the railroad itself. He perhaps does not make it clear that he assumes the original configuration of the land, but evidently he must if he is to have any grading.

His treatment of land is somewhat like that set forth by Hammond V. Hayes last November at the valuation conference in Philadelphia (see the Engineering Record of Nov. 20, 1915, page 626). He uses the difference between actual cost and original normal value as a sum to be added, however, instead of deriving from it a basic ratio. He makes no deductions for land donated or bought for one dollar, but allows such at the present market value.

Several objections can be raised to this method. The assumption that in reproduction the same lands would be donated, the same bought at normal value, the same condemned, is rather fine-drawn, and results in some wide ranges in figures allowed for lands of equal normal value, since multiples as high as 12 are found in his report in the prices actually paid under condemnation proceedings. Nor is any account taken of the probability that the $1 consideration recited in the deed in many cases is no index of the price actually paid, which may have been considerably more than the market value. Moreover, the addition of the constant would hardly produce the proper figure for terminal or other land in a large city. For instance, because a tract originally worth $10,000 was bought for $20,000, it does not follow that if its normal value now figures $100,000 it could be obtained for $110,000. One other objection to universal application of the method—perhaps the most serious of all—is the virtual impossibility of ascertaining original normal value along the older Eastern roads. These last two objections do not apply to the road in question, however, which does not reach any large cities, and is not so old as to preclude knowledge of original values. The method, at least, gives the road the benefit of multiples actually paid and of much of the unearned increment, and does not produce a total considerably less than original cost, as the California method does.

A liberal allowance has been made for appreciation, and here again Mr. Sparrow has declined to follow the state-commission line of reasoning. The Engineering Record cannot commend his reason for allowing appreciation, which is that it classes with depreciation. Mr. Sparrow accepts the state-commission view of depreciation, stated by Milo R. Maltbie in Washington last May, and in the estimation of this journal this is Mr. Sparrow's worst error. The Engineering Record sees no inconsistency in allowing appreciation because it makes for cheaper operation and is manifestly an element of value, and then ignoring theoretical depreciation because it does not affect operating expenses and has no effect on value except to impose upon the owners the responsibility of making final renewals as they become necessary.

Coming now to the allocation of items according to use, the report comes as a natural complement of that of Mr. Wilgus, mentioned above. The Wilgus abstract treats mainly of maintenance and other operating expenses. The Sparrow report deals with the investment. It is interesting to note that the two agree that the ton-mile should be the general basis for dividing the accounts, and that freight and passenger traffic can be considered equally destructive per ton-mile. When the Interstate Commerce Commission in its recent decision in the Western passenger-rate case discussed the large number of allocation theories that had been presented to it the Engineering Record suggested the desirability of a perusal of the Wilgus abstract. The perusal of both abstracts is now recommended.

Not the least interesting feature of the Sparrow report is the redistribution of certain of the items to the several lines of the road with their various balances of traffic. This was rendered necessary because the road is small and the lines carrying no passenger traffic are a considerable part of the whole system.

Altogether the report is one deserving careful reading. The road, although small, was well organized and equipped. Even though such an analysis could not perhaps be carried out in a similar way on a larger and more complex property, the report is replete with useful suggestions and is a most worthy addition to valuation literature.

Serious Misconception Regarding the Plan to Move the Civil Engineers' Headquarters

THERE has been sent to the local associations of members of the American Society of Civil Engineers a plea directed against the proposal to move the headquarters of the society to the Engineering Societies' Building. The Engineering Record recognizes the loyalty and pride in the Society's achievements of the past-president who has circulated the appeal. On account of his fervent pleading and his standing as a past officer, the plea is likely to have considerable weight, unless the obvious misconception on which the major part of it is based is pointed out. The gentleman in question does not understand the relationship which exists between the United Engineering Society and the "founder" societies, and which would exist between that body and the American Society of Civil Engineers, should it move to Thirty-ninth Street.

The greater part of the plea rests on the premise that if it moved to the union building the American Society of Civil Engineers would surrender its autonomy, would become a branch of the United Engineering Society, would be unable in future to stand as a free agent before the public and the profession—in short, would be subordinated to the United body. Nothing could be further from the truth. The constitution of the United society provides for and requires nothing of the sort. Moreover, there is the outstanding fact that the American Society of Mechanical Engineers, the American Institute of Electrical Engineers and the American Institute of Mining Engineers have for twelve years been members of the United society without being subordinated to it. The United Engineering Society interferes in no way in their affairs. Its purpose and limitation is to own and manage the building in which they are housed, not to usurp or assume the duties of a technical body. It has never stood before the public or the profession in advocacy of any measure, engineering or otherwise; it has never been the spokesman for anything that the electrical, the mechanical and the mining societies wished to accomplish, either individually or collectively. The Engineering Foundation, established as a result of Ambrose Swasey's gift, is organized under the auspices of the United Engineering Society, but is administered by representatives of the four national engineering societies, including the American Society of Civil Engineers.

The following quotation will serve to show the tenor of the main part of the plea:

"Suppose we become an 'additional founder society,' and we desire to put before the public a measure which we have conceived and which we deem important. It must have the sanction of the United Engineering Society, representing the majority of the founder societies, which can prevent action, or, if approved, the United Engineering Society would stand before the public as the sponsor of the measure."

This statement is absolutely wrong. There is nothing in the constitution of the United Engineering Society which obliges any of its member bodies to take up anything with it, except what applies to the building or library management. As a matter of fact, the United society is without power except on building and library matters. The American Society of Civil Engineers would surrender none of its freedom. It would proceed on any subject, professional or otherwise, as it saw fit, just as each founder society does now, without reference to the United body. Furthermore, the societies now forming the United Engineering Society would never consent to the surrender of their rights. Each is as proud of its name and accomplishments as is the American Society of Civil Engineers and insists on maintaining its identity and autonomy. Moreover, any movement would have greater strength if it bore the name, as sponsors, of the American Society of Civil Engineers, the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, and the American Institute of Mining Engineers, than if it were fathered by the United Engineering Society as such.

While it seems entirely unnecessary to say more as to the falsity of the premise on which the main part of the plea rests, one other quotation will show how the membership of the American Society of Civil Engineers may be disturbed if the misconceptions are allowed to stand uncorrected:

"If we do accept the invitation," says the plea, "future national or other movements for the benefit of the profession will be headed by the United Engineering Society, and our share in the work will be merely auxiliary thereto, the ultimate result of which will be that the influence and standing of the American Society of Civil Engineers, which is now conspicuous, will gradually wane, and finally be lost in the controlling organization of which we will become a chapter."

In view of what has been said above, it is apparent that there is no foundation for such a statement. It could only be made in entire ignorance of the charter of the United Engineering Society and of the founders' agreement, to change which in the slightest particular requires the unanimous consent of the mechanical, electrical, and mining engineering societies.

The plea deals with other subjects—with the possibility of co-operation without housing in the same building, with the relative operating expenses on Fifty-seventh Street and on Thirty-ninth Street, with the library, with the comparative trend, downward or upward, of the two properties in question and of their respective neighborhoods, and with the investment the society has in its present house. All these, however, are minor in comparison with the fundamental error, and practically all of them have been discussed in previous issues of this journal.

In the matter of operating expenses, which the plea says would be $2,511 greater on Thirty-ninth Street than on Fifty-seventh Street, the Engineering Record accepts in preference the statement in the unanimous report of the society's own committee of seven, which expressly says that the operating expenses are practically the same. As to the neighborhood, the Engineering Record's own judgment runs strongly counter to that of the plea and coincides with the committee's report. The Thirty-ninth Street, rather than the Fifty-seventh Street site, is in the district with the better future.

On the matter of the library, the plea says, "If our library, consisting of 86,000 pieces, is turned over to the United Engineering Society, it seems we would lose our property interest therein, and in case we should at some future time decide to dissolve the merger and move elsewhere, the library would be left behind as the property of the United Engineering Society."

The answer to this statement is that it is not true. The library of the civil engineers would continue to be owned by that society, and not by the United Engineering Society, and could be withdrawn later if desired.

On the matter of investment, this sentence is found: "It is stated that our present home, which meets our requirements, cannot be duplicated for less than $475,000, so if it is sold at its appraised value we would lose $150,000, which, added to the $240,000 proposed in the merger, would really make our contribution $390,000 for the privilege of becoming one of the founder societies."

This statement neglects the fact that the property cost the society only $360,000, that the reproduction value is not a measure of present value, and that if the society should move to Thirty-ninth Street it will secure in exchange for the payment of $240,000 an equity worth over $500,000.

But, as stated, these considerations are minor compared to the main issue of the plea—the claim that the American Society of Civil Engineers would lose its identity. Were such the case, the Engineering Record believes that the proposal would never have been put before the membership by the board of directors, and, in fact, would have been indignantly spurned by the committee of the society which considered and reported on the subject. The plea declares that the society would give up its freedom of action, that it would become subordinate to another organization. The statements have not the least foundation in fact. The society's opportunity to do independently for the profession and the public whatever it wishes will not be one whit less than it is now. Instead, through the closer association with the mechanical, electrical and mining engineers, inevitable to the occupancy of the same building, it will have broader and more frequent opportunity to enlist the co-operation of these other bodies on matters where it deems such co-operation to be for the best interests of the society and of the profession. It has now the chance to break down the barrier between the civil engineers on the one hand and the mechanical, electrical and mining engineers on the other, and it can do it without sacrificing anything—its management, its autonomy, its prestige, its financial condition. The separateness of its present house alone would be given up—in favor of a home that, in the opinion of the Engineering Record, is not only equal to but superior to the present quarters.

LOOKING WEST DURING CONSTRUCTION—TEMPORARY TRACKS AND STATION ON LEFT, FREIGHT HOUSE ON RIGHT

"Soo Terminal" Type of Station, Being Built by Lackawanna at South Orange, Nears Completion

Space Problem Solved, in Connection with Track Elevation, by Continuing Bridge Over Avenue as Reinforced-Concrete Viaduct, 426 Feet Long, and Placing Station Underneath

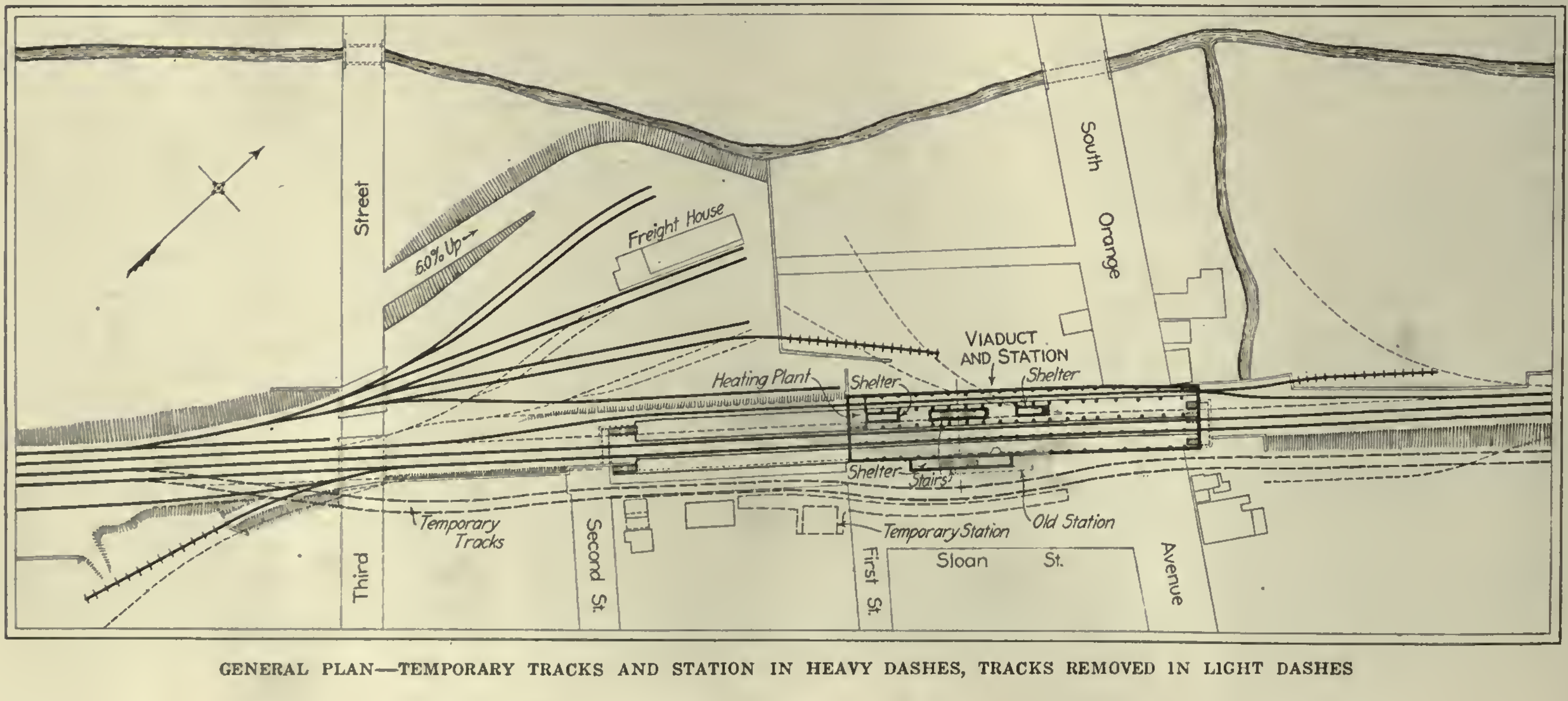
FOLLOWING the high standard the company has set for itself for grade-crossing work in New Jersey, the Delaware, Lackawanna & Western Railroad, in eliminating its grade crossings in South Orange, is putting up structures that will combine beauty with utility. The main feature of this particular improvement is the reinforced-concrete viaduct at South Orange Avenue. The solution of the grade-crossing problem at this point called for the elevation of the tracks, and as the plot of ground west of the avenue occupied by the present station was not large enough to accommodate a station alongside the tracks that would have satisfied the company's standard, the difficulty has been met by extending the bridge over the avenue as a reinforced-concrete viaduct, after the fashion of the Soo Line freight terminal in Chicago, and placing the main part of the station under the viaduct. Other advantages of this design are the provision of ample covered facilities for carriages and autos to accommodate a large number of commuters widely scattered; of a large covered platform for passengers to the street cars on South Orange Avenue, and a ground-floor baggage room and teaming platform under the viaduct structure. In the station the main waiting room and ticket office are on the ground floor, while shelter houses at the track level at once protect those waiting on the platform and give architectural character to the station. While trains have been running over the viaduct since Sept. 29, 1915, the station was not entirely completed until Feb. 1.

South Orange is on the Morris & Essex line of the Lackawanna, which leaves the main line about 2 miles from the Hoboken Terminal, and rejoins it at Denville, N. J., 35 miles west. Through freight traffic goes over the shorter main line, hence the business of the Morris & Essex line is mostly passenger, including a heavy commutation passenger traffic to and from New York. The line has three main tracks, the middle track being operated with the preponderance of traffic, eastbound in the morning and westbound in the evening.

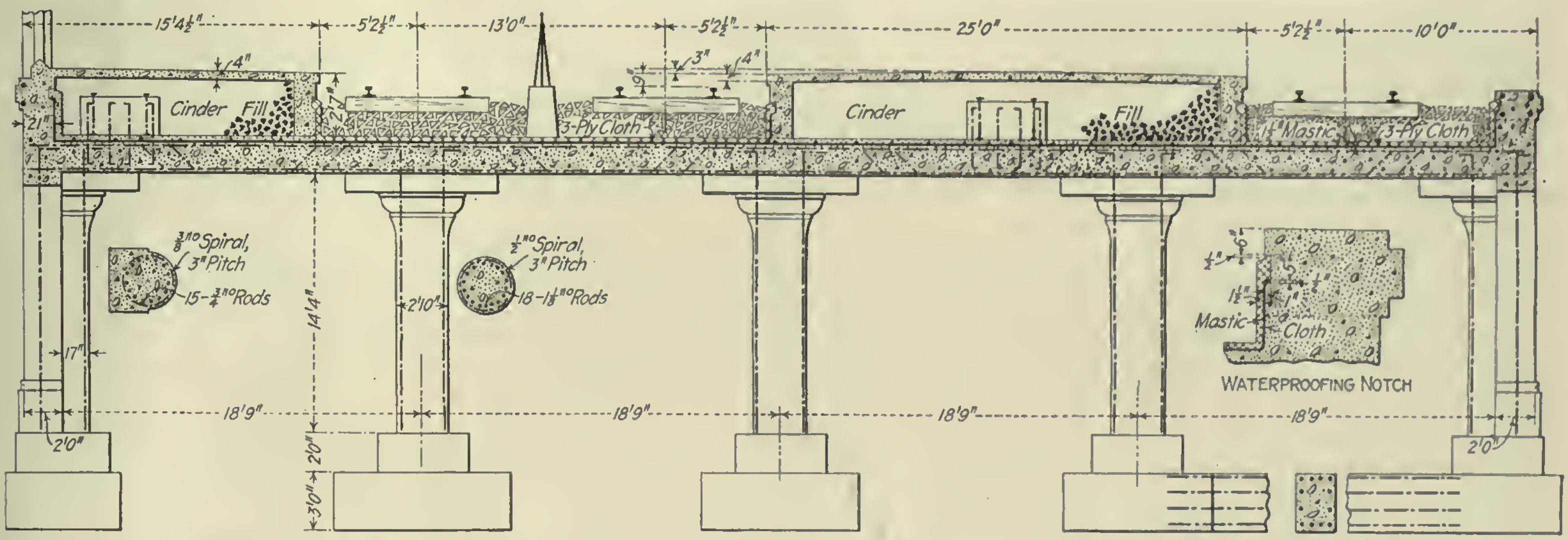
EXTENT OF IMPROVEMENT

The South Orange improvement begins about 4000 ft. east of the station and continues 2000 ft. west. Four grade crossings are eliminated. The most easterly of these crossings, Montrose Avenue, at Mountain Station, has been carried over the tracks without change in the track profile, and this work is no physical part of the work here described. The main improvement begins ½ mile east of the South Orange Station, where the tracks begin to rise on a 0.3 per cent grade, the old profile being descending at about that grade throughout the town. As soon as the viaduct is passed the tracks descend to the old profile on the ruling gradient, 1 per cent. About 1000 ft. east of the viaduct the Mead Street grade crossing is eliminated by lowering the street and bridging it with a typical slab structure. A short distance west of the viaduct the Third Street grade crossing is disposed of in a similar manner. The latter street shows on the general plan.

The general plan shows the location of the South Orange Avenue crossing and the viaduct and station. The viaduct is 426 ft. long and 79 ft. wide. The avenue crossing is at the extreme east end, while the center line of the station is about 130 ft. from the west end. The avenue and the station are connected by a broad walk at ground level,



GENERAL PLAN—TEMPORARY TRACKS AND STATION IN HEAVY DASHES, TRACKS REMOVED IN LIGHT DASHES



TYPICAL TRANSVERSE SECTION OF VIADUCT OUTSIDE OF STATION, AND DETAILS OF COLUMNS AND WATERPROOFING NOTCH

which occupies all of the space under the viaduct except that under the south row of panels, which is assigned to vehicles. The baggage room is at the west end of the station, and has a driveway beyond, while under the extreme northwest corner is the heating plant.

VIADUCT

The viaduct is designed with a uniform spacing of columns, 18 ft. 9 in. on centers transversely and 20 ft. longitudinally, except at South Orange Avenue, where the spacing is distorted in both directions, being adjusted longitudinally to the skew of the avenue and the width of roadway and sidewalks, and transversely to the narrowing of the viaduct to avoid property north of the railroad on the east side of the avenue that could not be acquired at a satisfactory figure. This gives five columns per transverse bent, five fitting the arrangement of tracks, platforms and stair wells without the complications that four would have caused. Longitudinally a wider spacing would have given vehicles on the ground level a chance to get in and turn around between columns instead of having to back in, but it would have required a heavier deck. Furthermore, with the transverse spacing remaining 18 ft. 9 in., the design would have been more uncertain, as comparatively little has been developed as to the theory of four-way reinforcement of slabs other than square or nearly so.

A typical cross-section of the viaduct is shown. Tracks 1 and 2 are on 13-ft. centers. Tracks 2 and 3 are separated by a 25-ft. island platform, while there is a second platform 15 ft. wide on the south side. The slab is uniformly 20 in. for the entire width (except for the longer spans over South Orange Avenue), the variation in stresses being taken care of, as in the case of the columns, by varying the amount of steel. The platforms are independent cinder-filled box structures built on the slab.

WATERPROOFING THE SLAB

The entire upper surface of the slab is waterproofed with Minwax waterproofing by applying three layers of Minwax cloth mopped with the necessary compound. Under the tracks and at the sides of the adjoining platforms the waterproofing is protected with 1½ in. of asphalt mastic put on in two layers each ¾ in. thick. All that part of the waterproofing extending under the platforms is made in a similar manner, except that it is protected with 1½ in. of cement mortar plastered over the Minwax cloth.

A pleasing exterior for the viaduct was obtained by bush-hammering the surface of the concrete, placing ornamental tile decorations over each column and surmounting the structure with an ornamental railing —this treatment, of course, being supplementary to the careful attention given to the general exterior lines of the viaduct. The general effect of the viaduct is shown in one of the photographs.

FLAT SLAB DESIGN

The cantilever flat-slab system, patents for which are controlled by the Concrete Steel Products Company, of Chicago, consists of a four-way reinforcement for the slab. Approximately one-half of the rods of each band are bent up over the column capitals to provide reinforcement for negative bending moment at these points. The effective depth at the columns is increased by drop panels, which also serve to reduce

DARK-COLORED BRICK STATION FORMS PLEASING CONTRAST TO CONCRETE OF SOUTH ORANGE VIADUCT the shearing stresses. The peculiar condition of loading of the South Orange viaduct, caused by the location of tracks as shown in the section of a typical bent, made certain assumptions necessary in the design of this slab.

The structure was designed to carry two 232-ton Mikado engines (four drivers, 5 ft. 6 in. on centers, with 60,000 lb. axle loads) on each of the three tracks. Owing to the high rate of speed of the trains crossing the viaduct, a large live load impact factor was added, which amounted to 68 per cent of the static live load and was proportioned in the following ratio:

$$I = \frac{L^2}{L + D}$$

The maximum negative and positive live load moments were determined by the theorem of three moments for wheel concentrations of the two engines followed by a train load of 6000 lb. per linear foot of track over seven panels for both the irregular spans over the avenue and the typical panels. For maximum moments all three tracks were considered loaded.

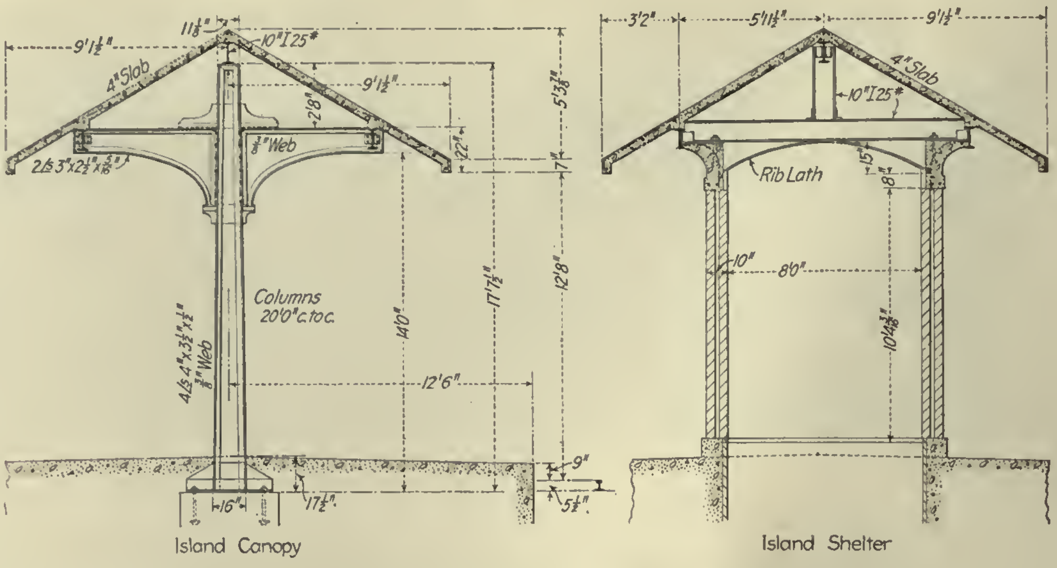
In addition to the longitudinal continuity of the slab over the columns, there is a transverse continuity. However, the moments that were computed in the longitudinal direction were distributed transversely in accordance with the method of computing simple beam reactions and the impact factor determined by the formula mentioned above. Due to the considerable amount of fixedness at the columns and the transverse continuity, 12/15 of the computed moment was used, thus giving end moments equivalent to $wl^2/15$ for determining the amount of steel required over the columns.

Following the method of calculating the negative moment over the columns, the slab at the center of the panel was proportioned for the maximum positive moment, reduced in the same ratio as was the negative moment. The reinforcement required was then distributed among the direct and diagonal bands in accordance with the coefficients of 1/40 and 1/60 respectively, or a ratio of 3 to 2, as established by the Chicago building code.

Design of Columns

The columns were designed as hooped columns, with both spiral and vertical reinforcement to take the maximum reactions due to the conditions of loading as heretofore described. The footings of the two columns of each bent, under the westbound track, are connected throughout by reinforced-concrete ties to insure a more uniform distribution of the load on these footings. The footings are designed for a soil pressure of 3 tons per square foot on a good gravel subsoil about 5 ft. below the surface of the ground.

The unit stresses used in the design of this work were 650 lb. per square inch for extreme fiber compression in the concrete, 16,000 lb. per square inch for tension in the steel, and 500 lb. per square inch for concrete columns exclusive of the steel reinforcement.



ISLAND SHELTER AND ISLAND CANOPY DESIGNED WITH CONTINUOUS ROOF

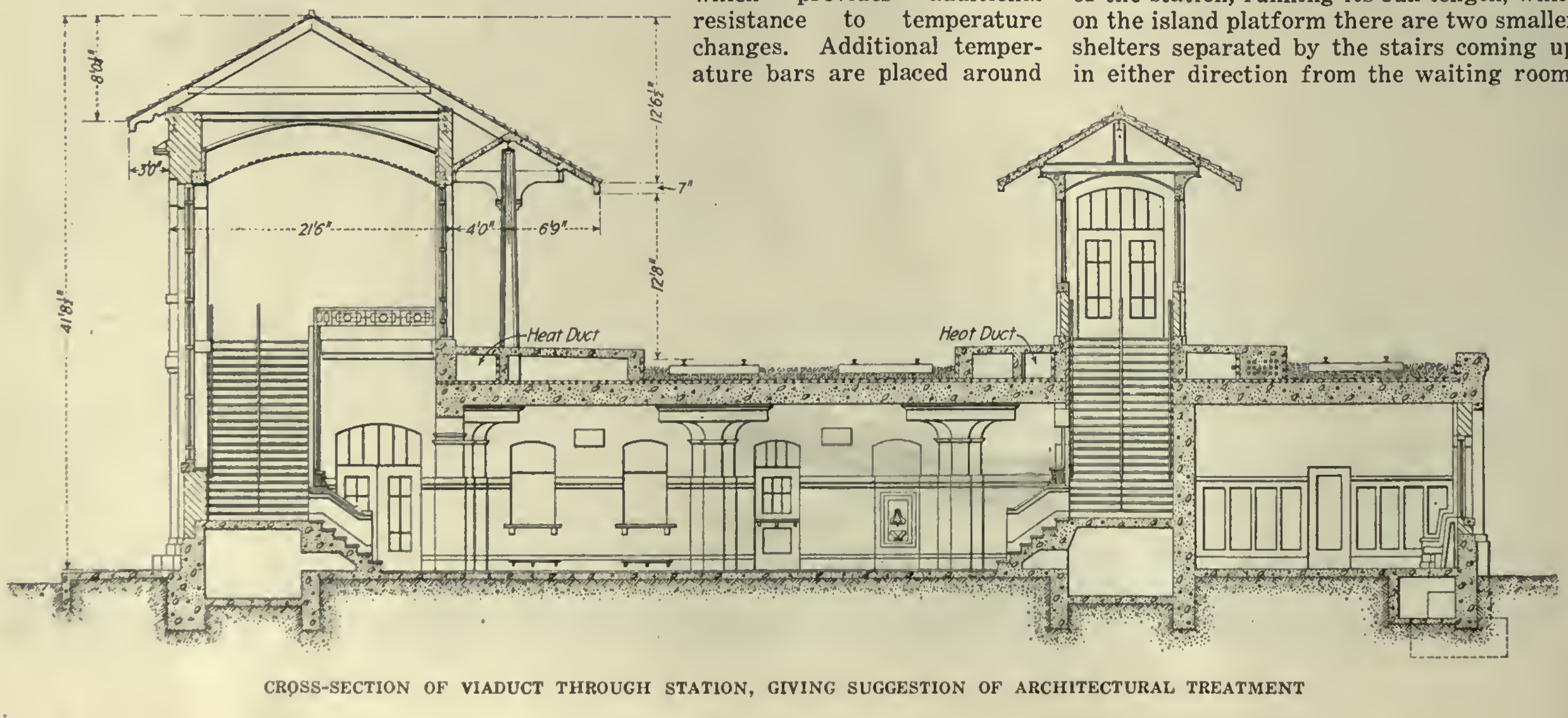
Temperature Reinforcement

The structure, 426 ft. long, has no expansion joints. The slab is reinforced for stresses due to temperature variations by bands of reinforcing steel between each row of columns, both longitudinally and transversely. There are ten ¾-in. rounds in each longitudinal band and seven in each transverse band, spaced uniformly between the drop panels and placed in the upper plane of the slab. The bars of the four-way reinforcement that are not bent up over the columns to resist the negative moment are lapped to furnish continuous reinforcement, which provides additional resistance to temperature changes. Additional temperature bars are placed around the stairway openings to bring the resistance of the reduced section to the same tensile strength as that of the full section.

At the east end there are two stair wells in the last transverse bay. These openings reduce the strength of the bay materially as a tension member, but not to the extent that the same reduction in cross-section would weaken an interior bay, because there is practically free bearing of the slab on the abutment that results in a variable unbalanced pull on the columns. For this reason cracks might be expected to develop from the transverse sides or corners of the stairwells adjacent to the last row of columns. To meet this contingency the drop panel for half its width was extended between these columns, giving a section of increased depth along the sides of the openings, and forming a beam in which extra reinforcing steel was placed. The sliding joint of the abutment was made effective by covering the seat, which was troweled carefully to a level surface, with three plies of cloth laid in asphalt.

Station

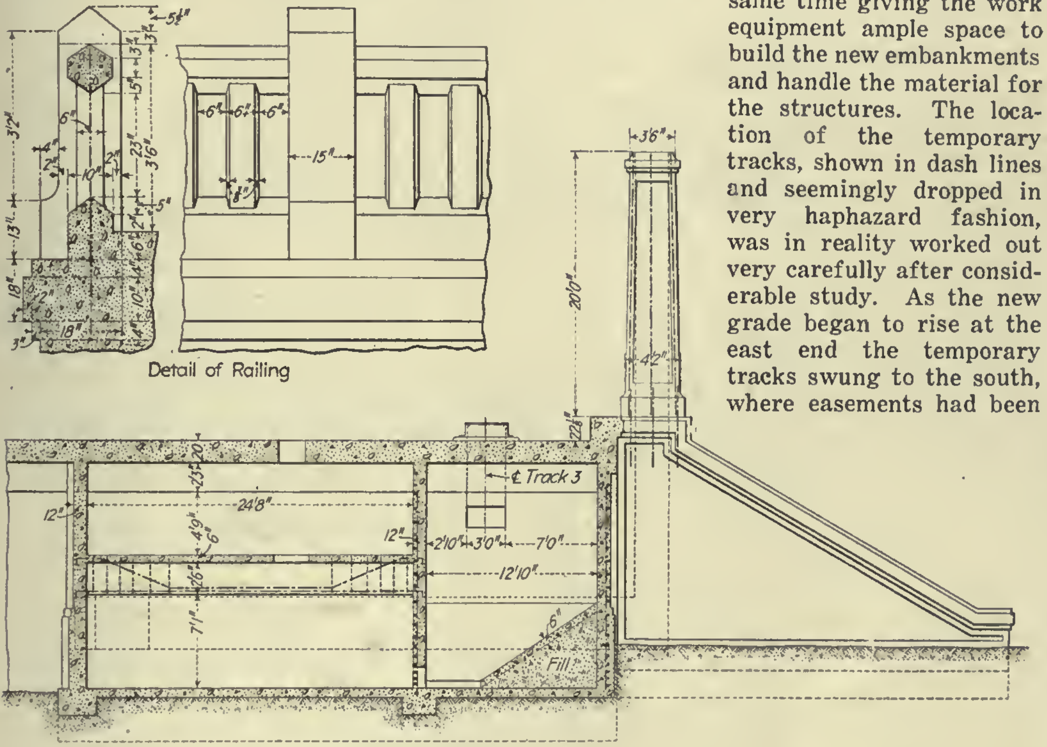
As stated in the first paragraph, the station is laid out with the main elements—waiting room, ticket office and baggage room—on the ground floor, and only auxiliary shelters on the upper level. The shelter on the south side forms the second story of the station, running its full length, while on the island platform there are two smaller shelters separated by the stairs coming up in either direction from the waiting room.



CROSS-SECTION OF VIADUCT THROUGH STATION, GIVING SUGGESTION OF ARCHITECTURAL TREATMENT

Originally it was intended to build the station of concrete to conform best to the viaduct. The architect was asked, however, to see what could be done with brick, and the result is now believed to be more pleasing, as well as less costly, than concrete. The exterior finish is of Bloomsburg wire-cut brick coming in various shades of dark red, the darkest being used as headers to form a sharp contrast. The stretchers are laid in pairs not separated by mortar. Various decorative paneling has been introduced, and the windows are trimmed with ornamental concrete blocks. The roofs are tile. The interior finish is plaster over a buff-colored brick wainscoting.

Among the architectural difficulties encountered in adjusting the brick of the station to the concrete of the viaduct was that of carrying the coping of the latter, which is on a grade, around the station. A horizontal coping at the theoretical elevation at the center line of the station was built along the station, and the adjustments were made by steep grades at the ends of the building.



Detail of Railing

Cross-Section of Heating Plant

DETAIL OF RAILWAY AND CROSS-SECTION OF HEATING PLANT UNDER VIADUCT

HEATING PLANT

The station is heated and ventilated by hot-air blast. The heating plant occupies the two north panels next to the west abutment. The housing is entirely of concrete. The chimney is brick, to conform to the station. A cross-section is shown. Coal is dumped from hopper cars into a bin through a hatch under track 3. The furnace and boiler occupy the lower floor of the two-story section, the smoke passing into a flue along the abutment and thence into the chimney at the north end of the abutment. On the upper level is a fan which draws outside air through an opening in the wall and forces it through a steam coil from the boiler, whence it passes, heated, into one of three ducts. One of these is directly under the island platform, and supplies heat for the shelters thereon; the other two are underground, and supply heat for the lower level, and also for the south shelter via a vertical shaft in the ticket office. Another fan and duct draw foul air from the waiting room through openings near the floor.

The canopies are designed to appear so far as possible a part of the station. That on the island platform is continuous as to width, height and slopes with the shelter houses. Cross-sections of the two are shown. The canopy on the south platform is similar to that on the island platform, but narrower.

Access to the platforms is had by the stairways in the station, and also by others at each end of the platforms, those at the east end leading from the east side of South Orange Avenue, and those at the west end from a tunnel in the fill beyond the viaduct at Second Street.

MAINTAIN TRAFFIC DURING CONSTRUCTION OF VIADUCT

The ever-present problem of maintaining traffic during construction was met in the case of this improvement by swinging the tracks to the south, thus avoiding the costly raising of tracks under traffic, and at the same time giving the work equipment ample space to build the new embankments and handle the material for the structures. The location of the temporary tracks, shown in dash lines and seemingly dropped in very haphazard fashion, was in reality worked out very carefully after considerable study. As the new grade began to rise at the east end the temporary tracks swung to the south, where easements had been obtained on unoccupied land and buildings removed to allow the temporary tracks to be placed entirely clear of the proposed fill.

At the east side of South Orange Avenue it was necessary to crowd in to avoid a small store, and from that point the difficulties began. One hundred feet west of the avenue it was necessary to swing out far enough to clear the old station without encroaching upon Sloan Street. It was also necessary to find a site for a temporary station after the old one had been torn down, and this was obtained as shown by leasing property just west of First Street, swinging the tracks back as far as possible to the north and building the small temporary station shown in one of the photographs, permission being obtained from the village to encroach upon Sloan Street to a slight extent with the station platform. Then by leasing and closing up the two tenements on the narrow street connecting First and Second Streets, and moving one of these back to a new foundation, room was found for the two tracks, mostly in the street itself, which the village allowed to be temporarily closed.

Beyond Second Street it became necessary again to lease private land, and also to tear down a small mill and a feed warehouse. Beyond Third Street the temporary alignment swung back to the old alignment. With this temporary location the only parts of the construction interfered with were the wing wall of the west abutment at Third Street and the embankment from that point west. At these points it was necessary to make some quick shifts at the proper time.

One of the photographs suggests the method of handling the concrete work. At first the work was handled from the east end with a mixing plant mounted on a flat car, and the concrete was placed in buggies run on falsework, on a track laid over the steel reinforcement as shown, or on the finished slab itself. Later it became possible to work another mixing plant from the west end. The slab was poured in three operations, the columns being poured first to the underside of the drop panels.

CHANGES IN OTHER FACILITIES

As is likely to be the case with such improvements, the work interfered both with various industries along the line and with the company's own local freight facilities. To take care of the former it became necessary to build three trestles and reorganize the plants they were to serve. In connection with the latter the company seized the opportunity to enlarge and otherwise improve the layout. The company had a reinforced-concrete freight house, 110 x 30 ft., on a site which was suitable for the new layout, which was to be about 7 ft. higher than the old. The company therefore simply removed the roof of the old station, filled between the walls to the new ground level, and built a new station of brick on top of the old. The concrete projects above the ground about 4 ft., just revealing the ornamental work above the old doors.

Hyde, McFarlin & Burke, of New York City, had the general contract for the entire improvement. F. D. Hyde built the station under a separate contract. The material from the embankments was hauled by the railroad from a heavy cut on another grade-crossing improvement being handled by the same contractors at Madison, N. J. The work was carried out under the general direction of G. J. Ray, chief engineer of the Delaware, Lackawanna & Western Railroad, and G. T. Hand, division engineer. A. B. Cohen, concrete engineer, had charge of the concrete design, and F. J. Nies, architect, designed the station. W. H. Speirs, assistant engineer, was in immediate charge of the construction work.

THE FLOOD PROBLEM OF KANSAS is important, according to an assertion made by H. B. Walker, drainage and irrigation engineer of the Kansas State Agricultural College, in a paper presented recently before the Kansas Engineering Society, because more than 2 per cent of the state's most productive area is subject to overflow; because 143 cities and villages representing one-fourth of the state's population are directly affected; because 13.4 per cent of the railroad mileage and 3 per cent of the highways are located in the overflow area, and because the property loss in thirteen years has been approximately $50,000,000. A plan involving twenty-six reservoirs has been proposed by the Union Pacific Railway to handle the Kaw River, and levees have been recommended by the U. S. Department of Drainage Investigations for the Neosho, Cottonwood and Marie des Cygnes Rivers.

Subway Air Exceeds Health Board's Standards, Ventilating Experts Find

Heavy Traffic, Waterproofing and Imposed Condition of Four Tracks in One Bore Responsible for Excessive Heat, Says Report of Engineering Committee

IN OXYGEN content and percentage of carbon dioxide the air of New York City's subways is shown by the results of recent tests to be better than standards adopted by the Board of Health for the air in office buildings, and is said to be practically equal to the air in city streets. In the number of bacteria per cubic meter the subway air was found to be actually superior to the air of the streets. Confirming earlier analyses of the subway air, the tests showing these results, made for a committee consisting of William Barclay Parsons, S. L. F. Deyo, J. Vipond Davies and Lewis B. Stillwell, indicate that the only basis for complaint is the excessive heat generated by train operation. Objections to this heat and the use of sidewalk gratings for ventilating the new subways gave rise to agitation which resulted in the appointment by the Public Service Commission on June 18 last of the committee named to investigate the entire question of subway ventilation. The committee, after considering the methods of ventilating existing subways, including those abroad, concluded that the system being installed in New York City is sufficient for the public health, and that while to improve it for public comfort in summer is desirable, that object cannot be attained without disproportionate expense.

NEW YORK'S SUBWAYS PRESENT NEW PROBLEM

As pointed out in the report of this committee, while the first subway was being constructed in New York other similar lines were put in operation in London, Paris, Berlin and Boston. Some of these were new electric lines, but in the case of two in London former steam lines were converted to electric operation. On none of these lines were the temperature conditions found in New York repeated. Aside from the fact that the climate of New York is warmer than that of the other cities, the high temperature in the New York subway, the committee reports, is due to three causes: First, the much heavier traffic, liberating a greater amount of heat, both from train operation and from the passengers. Second, the fact that the New York subways are necessarily constructed throughout the greater part of their length as a single tunnel section containing four tracks, giving the minimum area of contact with the ground, through which heat could be radiated, in proportion to the number of tracks. Third, the fact that protests based on the fear that foul ground water would find its way into the structure resulted in the complete insulation of the original subway by waterproofing.

SUBWAY AIR GOOD AT PRESENT

In order to ascertain whether in the course of several years' operation there had been any radical change in the air in the subways since the earlier investigations, the committee conducted a series of tests under the supervision of G. L. Lucas, general inspector of the Public Service Commission. Samples of air were taken at a number of places within the subway and at the same time in the open street. The oxygen content was found to vary from 20 to 20.9 per cent, substantiating earlier investigations. The percentage of carbonic acid gas was found to have increased from 5.67 parts in 10,000, as found in earlier analyses, to 6.2 parts in 10,000, which is well below the limit of 10 parts in 10,000 considered by the Board of Health sufficient to require an investigation in buildings where this quantity is found to be present. Only 219 bacteria per cubic meter were found in the subway air as contrasted with 255 per cubic meter found in the street air. The average temperature in the old subway has, however, increased from 5.6 deg. in excess of that of the outside air in summer to 16.76 deg.

RADICAL VENTILATING SYSTEMS PROPOSED

Immediately after its appointment, the committee held public hearings, at which those interested appeared in person or were represented by counsel and engineers, all urging the adoption of some ventilating system that would dispense with sidewalk openings. These suggestions have been grouped by the committee into four classes: First, chemical treatment of the air. Second, control of air currents in the subway by closing station entrances. Third, openings for ventilation in other places than in the sidewalk, and especially the use of chimneys in private buildings for forced draft ventilation. Fourth, refrigeration. As indicated above, the committee found that no chemical treatment of the air was necessary. The suggestions for closing the station entrances with revolving doors were considered impossible of execution, as the enormous crowds that use the subway could not be handled safely except with complete freedom of ingress and egress. Under the third heading, suggestions fell into two groups. The first proposition was for the construction of large ventilation shafts or chimneys at points within the blocks. Experiments with the existing subways convinced the committee that chimneys would not remove from the subway any considerable volume of air unless operated by forced draft. To install such a system, the committee has estimated, would represent a total capitalized cost of $14,000,000 or $2,000,000 per mile of four-track subway, without including private rights or easements. The second class of suggestions under this head contemplated using existing boiler plants for securing the forced draft. In order to secure the necessary draft, the committee states that 50 tons of coal per day would have to be burned in each block. This quantity is in excess of the winter coal consumption, to say nothing of the consumption in the summer when ventilation is needed most. To build boiler plants for this purpose would, of course, be much less economical than other mechanical means of securing forced draft. To connect the subway with only the large plants, such as those in hotels, would be insufficient and would require expensive construction. Furthermore, the connection from the subway would have to be made through the ash-boxes of the boiler plants, or the cold air from the subway would reduce the temperature of the flue gases above the fires so greatly as to put the boiler plants out of operation. Besides the probability of rushes of air interfering with economical operation of the plants, or forcing gases out to the boiler room, there is the danger that, even with mechanical equipment, fire gases would be drawn back into the subway through the ducts leading to the boiler plants by the suction of the trains.

REFRIGERATION IMPRACTICABLE

The committee states that the fourth class of suggestions goes to the root of the trouble, but that to carry any of them out would entail prohibitive cost. The average quantity of heat per hour per foot of subway liberated through train operation and from the passengers is 935 B.t.u, and the maximum amount produced in one hour was found to be 2380 B.t.u. It was concluded from these figures that those plans proposed for refrigeration which were estimated by their advocates to be possible at a reasonable cost would lower the temperature in the subways only 2 or 3 deg. Fahr. Furthermore, all of these estimates are stated to be insufficient as regards the allowance for operating cost and not to provide sufficient plant for ventilation purposes. Also, refrigeration in the climate of New York would result in the condensation of a great deal of moisture within the subway, which would cause endless trouble with the electric operating equipment. Such difficulties have already been experienced in the operation of the North River Tunnel of the Hudson & Manhattan Railroad.

SUBWAY GRATINGS LESS OBJECTIONABLE THAN PRIVATE OPENINGS

Objections presented to the committee to sidewalk gratings rested on the ground either that they constituted obstructions, reducing the width of the street, or that they were objectionable because of the emission of heated air at a disagreeable velocity. The committee found that air was emitted from the subway gratings at an average temperature of 5 to 7 deg. more than that on the street, and that the velocity averaged 1.17 miles per hour for periods when trains were passing below. Sidewalk gratings for ventilating power plants and other purposes, owned by various objecting property owners, were found to emit air at velocities as great as 12 miles per hour and at temperatures ranging from 10 to 112 deg. above the temperature of the outside air. The committee also finds that the gratings of the new subways will be much less objectionable on this score than those of the existing tunnels, and concludes that the designers have kept well within the limits for the emission of heated air hitherto allowed for ventilator gratings.

TRAINS CHANGE AIR RAPIDLY

Investigations were carried on by the committee in the new Fourth Avenue subway in Brooklyn to determine the rate of renewal which might be expected in the subway structures now being built. The Fourth Avenue subway has partitioned walls between the tracks, with small openings near the bottom spaced on 8 to 10 ft. centers. The two outside tracks are used for local service and the center tracks for express service. It was found that when a local train was passing, 92 per cent of the air from the local tunnel went through the wall openings to the express track tunnel, and that of the air in this tunnel 30 per cent passed out through the grating of the express track and 41 per cent passed through the openings of the center wall to the opposite express track. When a local train and an express train passed side by side in the same direction, a total of 27.5 per cent of the air in all four tunnels was forced out through the gratings. When an express train passed with its front platform opposite the rear platform of a local train running in the same direction, 30 per cent of the air in the four tunnels was forced out of the structure. The committee concluded that by reducing the number of openings in the center wall between the express tracks the amount of air forced through the gratings would be increased, as well as the velocity of air drawn in at station entrances. These changes could be made at small expense. It would not do, of course, to close all the partition openings, as ready access from one track to the others is often necessary for passengers or operatives in emergency.

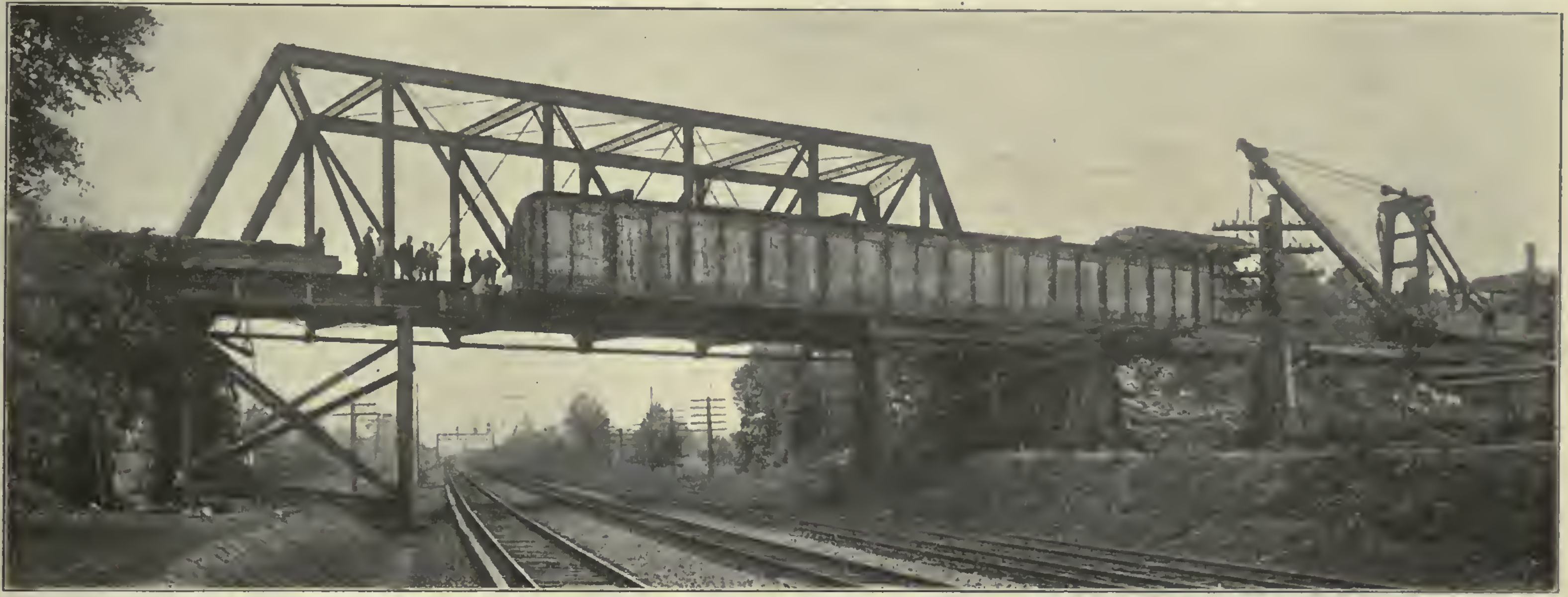
PRESENT PLANS INDORSED

As a result of these investigations, the committee has concluded that the only objectionable condition to be met is found in the high temperature in the subways during the summer months, that no general lowering of this temperature through refrigeration can be obtained at reasonable cost, and that the only practicable method of relief is the one contemplated by the designers of providing as rapid a change of air as possible to dissipate the heat by convection and conduction. In the application of this method it is recommended that the location of sidewalk gratings be carefully studied, and the conclusion is reached that when this is done the gratings will be found less objectionable than any practicable alternative method of ventilation which would secure equal safety and comfort for the public using the subways. In view of the fact that it is concluded that the natural ventilation by train movement, employing large intake and outlet areas and renewing the air at low pressure and velocity, is the only one that can be considered seriously at present, it is further concluded that any objections to the necessary gratings, either as regards their construction or use, should be considered as local problems and not as a condemnation of the general application of this system.

Girder Bridge Replaces Truss Over Fast Express Tracks

Pair of 105-Ton Girders Rolled Across 4-Track Railroad Without Supporting Falsework Between the Tracks

DISPENSING with falsework between the tracks of the four-track railroad below, because of the frequent passing of express trains on the center tracks at 70 miles an hour and more, a pair of 105-ton plate girders for the new 117-ft. double-track bridge of the Pennsylvania Railroad near Langhorne, Pa., were rolled longitudinally from falsework on one side of the road below till they overhung falsework on the other side. The new bridge, which has a concrete floor, replaced an old through-truss bridge on the Trenton cutoff of the Pennsylvania Railroad, crossing over the main line of the Philadelphia & Reading Railway. The two heavy girders, after the longitudinal movement was completed, were spread apart to double-track width, the floor system placed and concreted and the track laid. The old through-truss span, which carried the traffic up to this point, was then slid out and the new one rolled in between trains. The new span, which weighed about 1050 tons, with ballast, had to be lifted from the rollers and supported on I-beams at three corners while the abutments were repaired, and then lowered to its shoes. Instead of the slow and expensive method of driving falsework under the bridge in front of the abutments to carry the jacks, the bridge was raised by lifting angles bolted to the ends of the girders. The number of holes available for these connections was naturally limited, and it was necessary to use Mayari steel bolts, tested to an ultimate strength of 122,000 lb. per square inch, for these hitches. The old bridge trusses were tied together by two cross timbers on top, the floor system and bracing removed, and the outer truss slid, first top and then bottom, a few inches at a time, toward the other truss, which was secured to the new girder on that side, until the two old trusses were side by side and could be removed bodily with derrick cars.


TWO 105-TON GIRDERS, THIRD LARGEST IN THE COUNTRY, BEING LAUNCHED CLEAR OF FALSEWORK ACROSS FOUR-TRACK ROAD BELOW

LITTLE FALSEWORK REQUIRED

A side track south of the main line east of the bridge required eight 4-pile bents for its support. On the caps of these bents 20-in. I-beam stringers were placed, each set of beams being 28 ft. long. These were bolted together through connection angles on their ends, with the joints coming at the caps. On them the girders were unloaded. The rest of the falsework for the lengthwise roll consisted of two timber bents on either side of the Reading tracks, surmounted by eight of the 30-in. girder beams used later for the new bridge floor. These beams on the west side overhung the tracks to pick up the ends of the new girders before they reached the overbalancing point. These beams were counterweighted for their cantilever action by placing beams from the new bridge floor on them. The west bents rested on mud sills and the east bents on piles. Both sets of bents were entirely inside of the falsework for the sidewise movement, part of which was founded on piles and the rest on sills and the steps of the abutment wing walls. This falsework was surmounted by 20-in. I-beams carrying 3-in. plank and two layers of new steel rails, between which roller nests were placed. These I-beams passed behind the girder beams on the first set of falsework, and the east beams were set after the lengthwise roll was made. No other falsework was used for the new bridge. All that described cleared traffic on both roads by safe margins, both in erection and in use.

GIRDERS ROLLED LENGTHWAYS

The girders were unloaded by two locomotive cranes, and set 6 ft. 6 in. apart with the south girder 2 ft. 8 in. ahead of the other to correspond with the skew of the abutments. In this position they were braced together with timber bucks. Pairs of plates, 6 in. wide, bevelled on the ends, and varying in length from 3 ft. 6 in. to 8 ft., were bolted to the bottom flanges of the girders at four points, as shown, with countersunk bolts. These plates were backed up with fillers and punched to go over the rivet heads, the fillers being so arranged that the bottom surfaces of all the plates were in the same plane and lower than any portion of the girders. These plates furnished bearings for the girders on the rollers, which were placed on the longitudinal roller ways.

For the first longitudinal movement, rollers were placed under and in advance of the two groups of bearing plates located approximately at the quarter points of the girders, and the movement continued until the advance bearing plates were within 12 in. of the end of the I-beam roller ways, on the east side of the Philadelphia & Reading tracks.

When this position was reached, the rear ends of the girders were jacked up, rollers removed from under the rear bearing plates, and additional rollers were placed under and in advance of a third group of bearing plates located approximately at the center of each of the girders. The rear end of the girders had been counterweighted in advance with I-beams, taken from the floor of the new bridge, so that when the jacks were released the girders took a bearing and pivoted about the new center bearings introduced, thus relieving the load from the forward bearings. The rollers under the forward bearings were then removed, the girders jacked up at the rear end, and rollers replaced under the rear bearings.

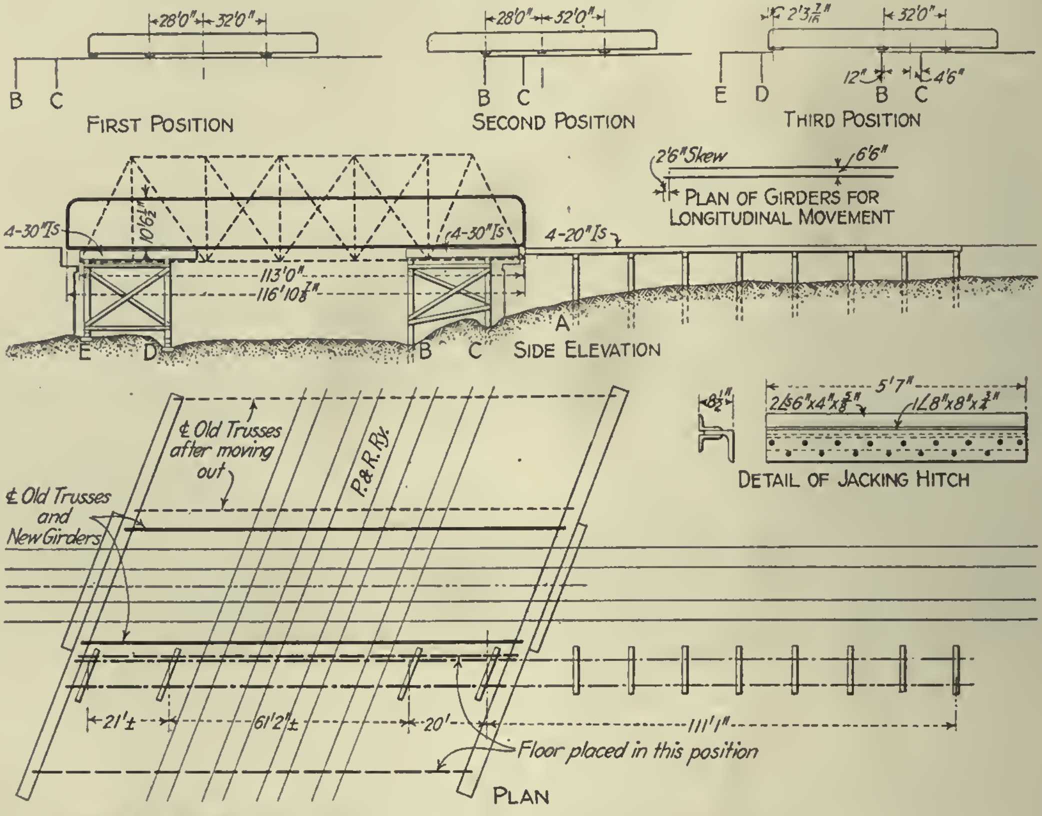
The second longitudinal movement then proceeded until the advance ends of the girders overlapped the cantilevered I-beam roller ways on the falsework on the west side of the Philadelphia & Reading tracks. The advance ends of the girders were then jacked up, the rollers under the center bearings removed, and additional rollers inserted under and in advance of the bearings at the advance end of the girders. The jacks were then released, so that in this position the girders were supported on the bearings at the advanced ends and at the rear quarter points. The third movement was then proceeded with until the entire longitudinal movement was completed.

As it was not desirable to stretch tackle across the tracks below, the entire longitudinal movement was made with a set of falls hitched between the west bent of the east falsework and the rear end of the girders, with lead line to derrick car.

For maximum loads, when the girders were resting almost entirely on the center bearing plates, the rollers were spaced on 3½-in. centers, and for minimum loads, when the weight of the girders was approximately equally distributed over two groups of bearing plates, the rollers were spaced on 7-in. centers.

GIRDERS SPREAD AND FLOOR PLACED

When the longitudinal movement was completed the south girder was rolled out the proper distance on the falsework provided for the sidewise movement. The floorbeams were then placed and the floor concreted. The bottom forms for the concrete were hung from bolts passing through short wood blocks which rested on the floorbeams. When the tracks on this new span had been laid, the old bridge was jacked up, and thin, lubricated steel sheets were placed between the underside of the shoes and the lower layer of rails on which the old bridge was to slide. As the Trenton cutoff is principally a freight route, and there were no limited trains to take care of, the old and new spans were moved separately. The old one was slid out with two sets of wire rope fails with leads to derrick cars at each side. These falls were then overhauled with runner lines and attached to shackles in the bottom flange of the near girder of the new span. As the new span was 4 ft. longer than the old, these falls passed outside the old end posts with plenty of clearance. The lead lines ran through single blocks shackled to the flange of the north girder. The new span had already been mounted on roller nests, placed between the lower and upper layers of rails, on which the girders rested. The same rollers were used for both longitudinal and sidewise movements. The new span was pulled over to position, jacked up and the rollers and rails removed. The masonry work of the old stone bridge seats was in poor condition, and had previously been replaced at one of the old bridge shoes by a large block of concrete. Three similar bearings had to be constructed for the other shoes, and a new concrete coping placed on one of the abutments. Because of the difficulty of handling the old truss span, whose bottom chords were of eye bars, this work was postponed till the new span was in place. The three shoes for which new concrete bearings were required were omitted temporarily, and the new bridge lowered onto one shoe and three I-beam grillages which spanned the sections to be cut out and replaced with concrete. The cutting was done with air drills and small gasoline-driven compressors. These could be dragged around by one man, and are said to have proved most economical. After the blocks were concreted, the bridge was raised, the grillages removed, the shoes set and the abutment coping removed and replaced with concrete. The jacking hitches, shown in the accompanying sketch, saved the erection of falsework which would have amounted to many times their cost. They were also convenient to use, as they allowed the jacks to be set on solid masonry in accessible positions.



ERECTION FALSEWORK REDUCED TO MINIMUM AND KEPT CLEAR OF BOTH MAIN LINES

OLD TRUSSES REMOVED BODILY

The old bridge trusses were each removed by two derrick cars after being brought together as indicated above. They were laid on the side of the embankment at the east end of the bridge and dismantled by driving out the pins and cutting members with a torch.

The girders in this bridge are exceeded in weight and length only by those in the Boston & Albany railroad bridge at Worcester, Mass., and those in the Nickel Plate bridge at Seventy-ninth Street, Chicago, described on page 354 of the Engineering Record for March 11, 1916.

The bridge was designed by H. R. Leonard, engineer of bridges and buildings, Pennsylvania Railroad, and erected under the supervision of George H. Brown, division engineer, by the Seaboard Construction Company of Philadelphia. The erection methods were planned and carried out under the personal direction of S. P. Mitchell, president of the contracting company.

Forest Products Laboratory Identifies Many Samples of Wood

MORE THAN 1000 samples of wood are annually submitted to the United States Forest Products Laboratory, Madison, Wis., for identification. The requests vary in importance from one case in which a party wished to know from what kind of wood a particular chess pawn was made to that of a contractor who had thousands of ties rejected by a railroad on the ground that they were red oak instead of white oak as specified.

As a rule, experienced lumbermen can readily distinguish between species commonly handled, but when a particular specimen shows some abnormal growth or discoloration they are in doubt. At the laboratory samples are usually examined under the microscope, which makes visible many characteristics not visible to the unaided eye. The distinguishing characteristics of over 400 native and 100 foreign woods have been studied and arranged in systematic order for use in identifying samples submitted.

Test Results Give Filter Loss-of-Head Data

Various Strainers, Orifices and Sand Were Tested at Oakland, Cal., for Friction Coefficients Much Desired by Filter Designers

FRICTION coefficients and loss of head through various parts of a filter underdrain system and the behavior of different kinds of sand were investigated by Langdon Pearse in connection with experiments carried out at the testing station of the People's Water Company, Oakland, Cal., in 1908, during the filtration studies at Lake Chabot. The late Arthur L. Adams was in general charge of the work, which was carried out by W. W. DeBerard and Mr. Pearse. The latter presented the information to the American Waterworks Association last spring, but the paper, of which an abstract is here given, has only recently been made available.

The tests of the loss of head in strainers used in rapid filters and in small orifices were made in an apparatus consisting of a redwood box, 18 x 18 in. square and 12 in. deep, inside measurements, a set of 4-in. pipe and flanges arranged as shown, a ¾-in. regulating valve, a level rod fitted with a hook gage, a gage glass, rubber connecting tube and a collecting bucket, holding about 45 lb. of water. Platform scales completed the equipment. The rig was set up in the testing station, the box being supported on wooden legs, while the pail was set on a sink with a drain to the sewer. At first the supply was taken from coagulated water, but the presence of floc, even though a fine screen was used, quickly forced a change to clear water.

ORIFICE PLATES TESTED

The method of operation was as follows: The orifice plate to be tested was set in position between the two flanges of the 2-in. flange union, with a rubber gasket on each side. The valve was then opened and the water allowed to flow through, the joint being carefully inspected for leaks. All the bolts in the flanges were thoroughly tightened before complete submergence. Water was then turned into the box, and when the water had risen above the flange union all the air underneath was sucked out with a small rubber tube. The space underneath was always tested for air after each run at a given head, but little air was found after the first removal. The water was then allowed to rise in the standpipe to the desired head, and when the level in the box had attained a constant elevation the hook gage was set. At first the valve was set, the readings of the head being taken every 10 sec. on the water column. It was found better to maintain a constant level, which was readily accomplished by the aid of the extension handle on the regulation valve. When the apparatus had been running smoothly for a few minutes, usually 2 and not over 5, the bucket was swung under the overflow and allowed to fill for an even number of minutes. It was then removed, weighed on scales and emptied. The weight of a cubic foot of water was taken at 62.4 lb. No correction was made for temperature.

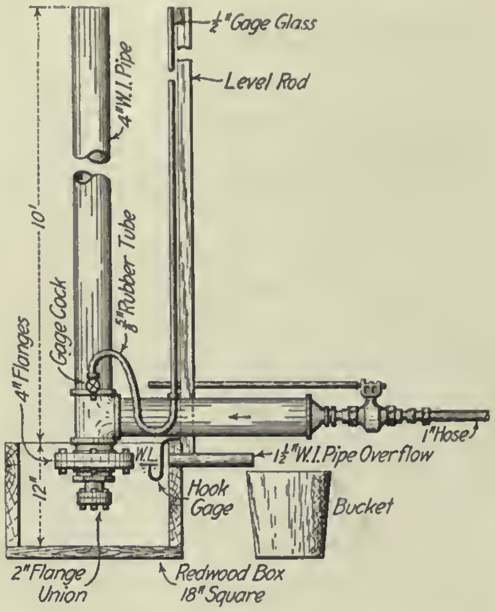
As all the tests were made with the orifices or strainers submerged, the head, h, in feet, given in the tables, is the actual head lost in passing through the orifice or strainer, and is measured by the difference of level of the water inside the standpipe and inside the redwood box.

In the tables the following abbreviations are used: d = diameter of orifice, t = thickness of plate, C = coefficient of discharge. The orifices in table 1 were holes drilled through steel plates, all burrs being carefully removed. With a very few exceptions the coefficient C varied but little for the range of head tried on any one orifice. On orifices 50 and 49 two independent sets of observations gave results somewhat at variance as noted.

STRAINER PLATE RESULTS

The resulting C is computed on both the supply pipe and the openings for strainers of the Wilson, Greer and Little Falls type.

For the Wilson type, as used at Binghamton, N. Y., the average of three heads, 2.173, 3.96 and 7.18 ft., gave C values of 0.329 based on the slots and 0.42 based on the pipe area. The pipe area is 0.864 sq. in. and the slot area 1.101 sq. in.

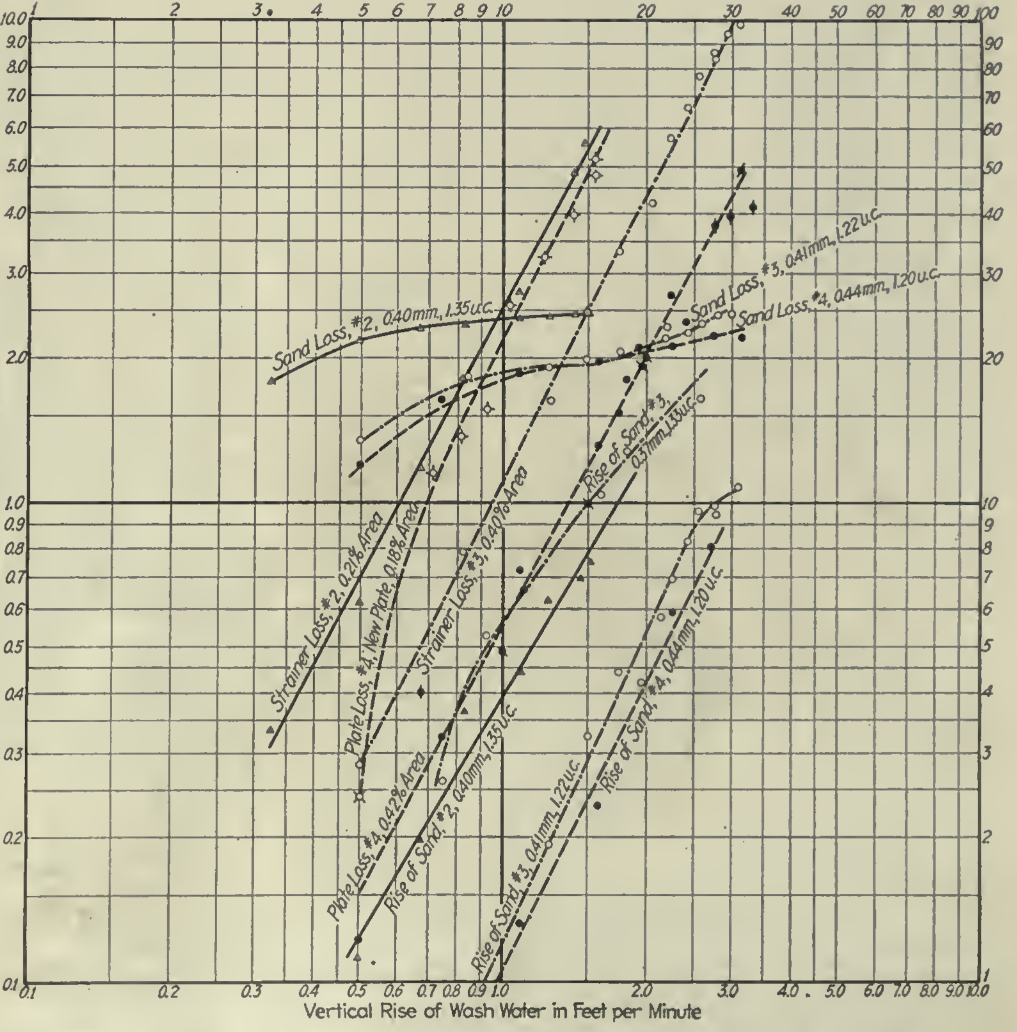


TESTING DEVICE FOR PLATES AND STRAINERS

TABLE 1—TESTS OF ORIFICES

Orifice Number	Nominal Dimensions d In.	Nominal Dimensions t In.	Actual Dimensions d In.	Actual Dimensions t In.	Ratio d/t	Aveage Value C	Range of Head Ft.	No. of Tests Averaged
54	¼	1/16	0.2486	0.0601	4.138	0.624	1.25- 9.91	13
53	3/16	1/16	0.189	0.0601	3.15	0.612	2.0 -10.0	13
52	5/32	1/16	0.1569	0.0601	2.61	0.622	1.20-10.0	11
51	⅛	1/16	0.1266	0.0601	2.11	0.635	1.99-10.0	10
50	3/32	1/16	0.093	0.0601	1.547	0.68†	1.20-10.0	10
49	1/16	1/16	0.0619	0.0601	1.03	0.741*	1.99-10.0	9
48	¼	5/64	0.25	0.0801	3.01	0.612	1.92- 9.8	11
47	3/16	5/64	0.1904	0.0801	2.38	0.612	1.99- 9.92	5
46	5/32	5/64	0.1572	0.0801	1.96	0.678	2.0 -10.0	5
45	⅛	5/64	0.1272	0.0801	1.59	0.718	2.0 -10.0	5
44	3/32	5/64	0.0935	0.0801	1.17	0.739	2.0 -10.0	5
43	1/16	5/64	0.0609	0.0801	0.761	0.852	2.0 -10.0	5

*Averaged from 2 sets, $C = 0.689$ and $C = 0.794$.
†Averaged from 2 sets, $C = 0.780$ and $C = 0.640$.



SAND RISE AND LOSS OF HEAD ARE PROPORTIONAL TO VERTICAL RISE OF WASH WATER

The Denver strainer, tested at three heads, 1.049, 1.326 and 1.555 ft., gave a *C* value of 0.731.

In the Greer strainer the throat and slot areas are 0.132 and 0.4844 sq. in. respectively. The *C* coefficients were found to be 0.7077 for the throat and 0.1929 for the slots on heads varying from 1.074 to 7.654 ft. in fifteen different runs.

The Little Falls strainer has an inlet pipe of 0.1135 sq. in. area, while the holes have an area of 0.1161 sq. in. *C* varied from 0.48 to 0.49 on the inlet area and from 0.469 to 0.479 based on the hole area. There were three runs at each of the six different heads, the latter varying from 1.07 to 3.14 ft.

In the Columbus (Ohio) strainer plate the average coefficient *C* for twenty-eight observations was 0.736 for heads varying from 1 to 10 ft.

Combined Sand and Strainer Tests Made in Filters

Tests of loss of head in the strainers and sand were made in the working experimental filters, each 4 ft. square inside dimensions. In filter 2, the underdrain was of the combined type designed to use air and water alternately through a single pipe system similar to the one installed at Harrisburg, Pa. This underdrain consisted of a 3-in. galvanized-iron pipe header with eight lateral pipes, 1¼-in. diameter, spaced on 6-in. centers. On the underside of the pipes were drilled 7/32-in. diameter holes spaced on 3-in. centers, making a total of 128 holes, with a total area of 4.81 sq. in., equivalent to 0.21 per cent of the area of the filter.

Filter 3 was designed for a high-rate wash, with water only, using a pipe system similar to the first, but with a 4-in. header and 2-in. laterals. On the underside of the pipes there were drilled eight rows of fifteen holes each, of approximately 5/16 in. diameter. The total area of the holes was 9.204 sq. in., equivalent to 0.40 per cent of the area of the filter. A wire screen was placed over the gravel and tied down to prevent displacement by the high velocity of the wash water.

Filter 4 had an underdrain modeled after that at Cincinnati, Ohio, except that it was built of wood instead of concrete, and the wire screens over the gravel were omitted. There were six plates, each containing fifty-eight holes 3/16 in. in diameter. The total area of the 348 holes in the plates was 9.6 sq. in., equivalent to 0.42 per cent of the area of the filter. During the experiments the filter was rebuilt, using plates each containing the same number of holes as before, but ⅛ in. in diameter, equivalent to 0.18 per cent of the area of the filter.

The curves shown are on a logarithmic scale. In each case for filters 2, 3 and 4 a curve is drawn showing the strainer or plate loss and the sand loss for various rates of wash water. In addition, the rise of the sand is given. In general the finer sand with a higher uniformity coefficient rose to a greater height with a given vertical rise of wash water.

Metered Services in Kansas City numbered 71 per cent of the total, according to the report for the year ending April 19, 1915, by D. L. Wheelock, superintendent of the meter division of the water department. There are at present 35,601 meters of various makes in service, of which 5059 were set during the last fiscal year.

Reproduction Cost Allocated Between Freight and Passenger Service

Engineer of Missouri Public Service Commission Uses Ton-Mile Basis Mainly in Report on Mississippi River & Bonne Terre Railway

Allocation of reproduction cost between freight and passenger service is included in the appraisal report, recently completed, of W. W. K. Sparrow, assistant chief engineer of the Missouri Public Service Commission, on the Mississippi River & Bonne Terre Railway. This railway, a small one in the southeastern part of the state, had opposed the two-cent fare law ever since its passage some eight years ago. Although the state won when the case was fought through to the U. S. Supreme Court, the court holding that the evidence did not show the rate to be confiscatory, the railway applied for relief to the State Public Service Commission when it was created a short time afterward, asking for an increase in passenger rates only. And the commission ruled that before it could pass upon the question a valuation must be made, showing the cost of reproduction new and the cost of reproduction new less depreciation, with the property in use of freight service and passenger service shown separately.

As W. J. Wilgus did in his allocation of maintenance expenses in the Ulster & Delaware case (see the Engineering Record of Aug. 21, 1915, page 226), Mr. Sparrow has made the ton-mile the fundamental basis of his division of the accounts. His problem was complicated by the fact that some of the lines of the railway carry no passenger traffic, and that certain facilities used by the whole system had to be allocated to the different lines according to their traffic, as well as to the classes of traffic of the whole system. The appraisal itself is notably different from that of some other state commissions in that, for example, contingencies, appreciation of roadbed and land values in excess of present normal market value are allowed, the latter being determined by an unusual process set forth in the report. The following abstract of the report is intended to embrace only such phases and items of the appraisal as have been handled in an unusual way.

The Railroad

The first line of the Mississippi River & Bonne Terre Railway was built about 1880, and extensions and branch lines were constructed from time to time until a main-track mileage of 64 miles was reached. Some of the lines are used exclusively for freight. The road is built through a heavy rolling country. On the main line the ruling grade is 1.8 per cent and the maximum curvature 12 deg. Of the branch lines the ruling grade is 3 per cent and the maximum curvature 18 deg. The road has its main outlet at Riverside, the northern terminus, where it connects with the St. Louis, Iron Mountain & Southern Railway.

Basis of Reproduction, Conditions as on Date of Valuation

In making the appraisal in connection with the rate controversy, we have assumed:

(a) That the road is to be reproduced as it existed at the date of valuation, of new material, at proper prices existent at that date.

(b) That the physical and topographical conditions of the country through which it passes and the condition as to population, business capacity and property values in the territory served by it are as existing at the date of valuation.

(c) That all transportation facilities existing at the date of valuation, with the exception of the property under course of reproduction, are in existence.

(d) That as the construction of the property being reproduced proceeds it shall be available for transportation purposes.

(e) That the records, plans and other historical data in possession of the company at the date of valuation are available for use and reference as a means of arriving at correct estimates.

The method of ascertaining cost of reproduction new under the assumed conditions as stated was not applied in the determination of the value of the land.

Utilization of Federal Inventory

To avoid the unnecessary duplication of work and expense the state commission sought and obtained the co-operation of the Division of Valuation of the Interstate Commerce Commission, which had begun work in the state. The division proceeded with the inventory on this property and allowed the state commission engineers to accompany the field parties and make copies of such information as they desired. The road and track party completed its work in February, 1915, and later in the year a bridge and building party and a mechanical party covered the system. The right-of-way was inventoried by the state commission's engineers, no inventory of the property being made by the Division of Valuation at this time.

For the purpose of making a division of the property between freight and passenger service, the commission's engineers made a careful and independent study of the property, classifying it under three heads, according as it was used exclusively for freight, passenger or joint service.

Clearing and grubbing has been estimated on the basis of the amount of such work that would have to be performed were the line being constructed at this time.

Shrinkage of Embankment

No addition was made to the embankment quantities as computed from the actual measurements made in the field. It is recognized that earth in a well compacted embankment will occupy less volume than in its original position, but as offsetting this the solid rock when broken up will occupy a relatively greater volume.

As a rough average approximation, clayey earth is usually estimated to shrink 10 per cent and solid rock to swell from 40 to 50 per cent. The classification of roadbed material for this line was as follows: Earth, 43 per cent; chat from the neighboring mines and loose rock, 44 per cent; solid rock, 13 per cent. If the earth is assumed to shrink 10 per cent, the solid rock to swell 45 per cent and the loose rock and chat occupy approximately the same volume, the swell in the rock will more than offset the shrinkage in the earth. Probably a part of the voids of the rock is filled by the earth, but how much is impossible of even an approximation without knowledge of the manner in which the materials were deposited.

For these reasons it has been considered quite impossible to make any approximation of the additional quantities, if there be any, as should be added on account of shrinkage, and it was therefore decided to consider this feature in connection with appreciation of roadbed, and make a blanket allowance to cover both.

APPRECIATION ALLOWED

Those opposing any allowance for appreciation claim either that it costs nothing or that if it did cost anything it was paid for out of operating expenses and therefore it would be improper to capitalize it. In reply to the first argument the writer believes that in common equity, if you are going to decapitalize on account of the action of the elements in causing physical depreciation, you certainly ought to capitalize any added value brought about by the same forces; and in reply to the second argument, the writer is of the opinion that the additional cost during the first few years of operation is incorrectly termed maintenance, and is in reality a deferred construction cost.

Our principal problem is to report all elements of value, and the seasoned and solidified roadbed has without argument an element of value not found in entirely new construction. We have no means of determining the amount of solidification or settlement, or its value, but an estimate has been made based on the increased cost of maintenance for the first five years, and an addition of 10 per cent has been made to all embankment quantities to cover both shrinkage and solidification of roadbed. This is believed to be conservative.

UNUSUAL TREATMENT OF LAND

As already stated, the value of the land has not been determined by the method of cost of reproduction new. The "fair present value," as shown in this appraisal, has been arrived at in conformity with the principles laid down in the opinion of this commission in the Missouri Southern case. In that opinion Commissioner Kennish, discussing this question, says:

"In our opinion, it was not intended to be held in the case quoted from (Minnesota Rate Cases, 230 U. S., 352) that if the company necessarily incurred cost in acquiring its right-of-way in excess of the market value of the land, that such be established by competent evidence, the court would still be limited in determining right-of-way value, to the market value of contiguous lands. For the necessary investment of a common carrier in acquiring a right-of-way is clearly a property right, and as such is entitled to protection by constitutional guarantee. . . .

"In our opinion, in determining the fair present value of the right-of-way, the company is entitled to the same value per acre as the present market value of contiguous lands, plus the added cost of acquisition as shown by the evidence."

The sum and substance of this decision is that in such cases as the company in acquiring its land necessarily incurred costs in excess of the market value of the land at that time, the fair present value shall be such original cost plus the increment in the value of the land since its acquisition up to the present date, the cost of acquisition to the company being the difference between the market value of the land at the date of acquisition and the cost to the company. Where the land was donated, or where the original cost did not exceed or was less than the market value at the date of acquisition, the fair present value is the present market value of similar and contiguous lands.

LAND DATA REQUIRED

It was therefore necessary in order to arrive at the fair present value to determine (a) the original cost to the company, (b) the market value of the land at the date of acquisition, and (c) the market value of contiguous and similar land as of the date of valuation.

In obtaining the original cost the railway company's deeds, records and all documents relating to this subject were carefully examined. Every deed was also checked up with the right-of-way maps of the company. The records of both county courts were also examined in checking up such information as was deemed necessary. In obtaining the original market value of the land recourse was had to inhabitants who resided in the neighborhood before the railway was built, and also to others well informed as to conditions and values of land at that time. In obtaining the present market value of land a most thorough and detailed investigation was made. Beginning at Riverside, the entire right-of-way of both main and branch lines was personally examined. Inquiries were made as to sales of land in the vicinity of the right-of-way within recent years, and a considerable number of such sales were run down, and the amount of the transaction ascertained. Also what were considered to be the best informed authorities were interviewed and their opinions obtained as to the market value of land in the vicinity of the right-of-way.

The unit prices were arrived at after making a careful examination of the records of this and other railway companies in this part of the state. Contracts and records of actual cost were investigated as an aid in determining the proper prices for work of similar character at the date of valuation. Material prices were arrived at after studying the prevailing prices and price tendencies during a reasonable period preceding the date of valuation. Contractor's profit, freight, inspection and other charges usually attendant to railroad construction were included in the unit prices adopted.

ENGINEERING ESTIMATED IN DETAIL

A program covering the period of construction was made out and a detailed estimate made of the cost of the engineering, embracing all the necessary work involved under the following divisions: (1) Reconnaissance, (2) preliminary surveys, (3) final location, (4) special designing of bridges and buildings, (5) construction, (6) equipment, (7) preparation of records, maps and plans.

Legal expenses were assumed to be 1 per cent on all road accounts exclusive of land. Organization, taxes, stationery and printing were assumed to be 1½ per cent on all road and equipment accounts exclusive of land. Interest during construction was allowed at the rate of 3 per cent on the total cost to reproduce new for the full estimated period of construction. No allowance was made for discounts on bonds.

Contingencies may be divided into two classes—contingencies of commission in inventory, and contingencies of construction. As regards the former, we believe that in view of the care and thoroughness with which this inventory was prepared and the very complete records of the company the error in this respect is small. As to contingencies of construction, while it is true that the knowledge gained from the study of the records and construction of the road in the past ought to be of considerable assistance in arriving at an accurate estimate, and without doubt eliminates some items of contingency, yet we believe that it would be unreasonable to assume that such knowledge would enable any one to foretell and provide for all the uncertain and indeterminate expenses entirely dependent upon circumstances and conditions which might arise were the line being reproduced to-day. No better illustration of this can be given than the present war in Europe. Had the contract for this road been let, say, a year previous to the assumed date of valuation, which was June 30, 1915, on prices prevalent at that time, the work could not have been completed on the estimate.

The value of the stores and supplies on hand as shown by the books of the company for June 30, 1914, together with what was considered a reasonable amount of working cash, was allowed under the head of working capital and stores and supplies on hand.

DEPRECIATION

At the conference held in Washington May 27-29, 1915, by the Division of Valuation, Interstate Commerce Commission, the answer of the state commissions to the question, "How shall depreciation be determined?" was as follows:

"Deferred maintenance, if any, should first be determined. Age to date of appraisal and scrap value shall be ascertained and stated. Expected life shall be determined after inspection, examination of records and consideration of all factors that affect the period of usefulness. The accrued depreciation shall then be ascertained by ratio which age bears to total life applied to cost less scrap value. Deferred maintenance, if any, shall be added to this amount."

The general principles as covered by the foregoing answer have governed the State commission's engineers in arriving at the depreciation as reported. In the case of shop machinery and equipment the service conditions determined by the engineers of the Interstate Commerce Commission and the master mechanic of the railway were adopted.

ALLOCATION ACCORDING TO USE

The decisions of the United States Supreme Court clearly established the principle that the reasonableness of passenger or freight rates shall be determined upon the fair value of the property used in each service. This appraisal, therefore, to be of any value to the commission in passing upon the merits of the railway company's application for an increase in passenger rates, must show the cost of reproduction new and cost of reproduction new less depreciation not only for the whole properties, but also for the property used in freight service and for that used in passenger service.

With this end in view the commission's engineers made a careful and detailed study of the properties in conjunction with C. H.

Fake, chief engineer of the railway, and have separated all property used exclusively in freight service, used exclusively in passenger service or used jointly.

In the Minnesota rate decision the United States Supreme Court said: "When rates are in controversy it would seem to be necessary to find a basis for a division of the total value of the property independently of revenue, and this must be found in the use that is made of the property; that is, there should be assigned to each business that proportion of the total value of the property which will correspond to the extent of its employment in that business."

Relative to the term "use," it may be considered that the use made of the track is best measured by the occupancy, or, on the other hand, that the amount of wear and tear of the track is the best gage. There also enters the question of the weather stress, which cannot be divided on any basis of use. It is estimated that from 25 to 50 per cent of the expense of maintaining a track is due to the action of the elements.

LOCOMOTIVE TON-MILE OR GROSS TON-MILE

There are also the divergent views of those favoring the locomotive ton-mile as against those who think the gross ton-mile is the proper basis for dividing those accounts and are directly affected by the weight of the traffic. Those who champion the locomotive ton-mile contend that the gross ton-mile basis does not take into consideration nor compensate for the greater speed of passenger trains over freight trains. They hold that the high-speed passenger train does more damage to the track and structures and consequently increases the cost of maintenance. Those favoring the gross ton-mile method contend that the greater speed of the passenger trains is more than offset by the destructive action of freight trains, such as drippings from refrigerator cars, which are detrimental to the floorbeams and stringers of steel bridges and to track fastenings, rails and switches; the more imperfect equipment with much higher wheel concentration, the stiffer, more rigid and less delicately adjusted springs of freight cars, which cause greater shock to the track and structures.

The writer believes that in the absence of any exact scientific basis for determining the relative amount of injury done to the track by freight and passenger service and also in view of the many unknown and indeterminate factors, such as the damage caused by elemental action, the gross ton-mile method is the more reasonable and equitable in arriving at what in the final analysis cannot be regarded as anything but an approximation. No attempt has been made to take weather stress into consideration, as it seems foolish to undertake refinements at this one point.

APPORTIONMENT BASED ON ONE MONTH'S TEST

The apportionment between freight and passenger service of that property in joint use of both classes of service is based upon figures obtained during a test extending over the month of September, 1914. The basis of the apportionment, together with the percentages for each account, are as shown in the accompanying tables. The property in exclusive passenger or exclusive freight use is, of course, allocated direct.

The apportionment of all equipment between freight and passenger service has, with the exception of work equipment, been made in accordance with the class and character of the equipment.

The locomotives have been apportioned between main and branch lines on the basis of the locomotive ton-mile rather than the locomotive mile, for the reason that the weight of the engine directly reflects its value, and consequently this method gives the more accurate and scientific results. For example, it is quite possible for the lighter locomotives to be used on the branch lines and make the same mileage as the heavier ones on the main line. In such a case a division of values on the basis of locomotive miles would give incorrect results.

The work equipment has been apportioned between freight and passenger service on the basis of locomotive ton-miles, as it is believed that the relative volume of traffic thus reflects the use made of this class of equipment. The percentage to freight service is 80 per cent, and to passenger service 20 per cent. The results thus obtained are then apportioned between

TABLE 1—BASIS OF APPORTIONMENT OF MAIN-LINE ROAD ITEMS, AND FREIGHT AND PASSENGER PERCENTAGES

Account	Basis of apportionment	Per cent of total: Freight	Per cent of total: Passenger
Engineering	Average of value of allocations, accounts 3 to 46 inclusive	77.5	22.5
Grading; bridges, trestles and culverts; ties; rails; other track material; ballast; track laying and surfacing; roadway buildings; roadway machines; roadway small tools	Locomotive ton-miles	76.5	23.5
Land for transportation purposes; tunnels and subways, right-of-way fences; crossings and signs; signals and interlockers	Revenue train-miles	45	55
Station and office buildings	Detailed estimate made separating such space in exclusive use of freight or passenger service. Space in joint service apportioned on basis of revenue train-mile.	....	....
Water stations	Cost of water supplied to each class of service	78	22
Fuel stations	Cost of fuel supplied to each class of service. Only fuel station is at Bonne Terre and is common to whole system. Apportionment between freight and passenger is made for whole system and then further apportioned between main and branch lines on locomotive-mile basis.	78	22
Shops and engine houses			
Engine house and miscellaneous buildings, Herculaneum	Cost of service rendered	66	34
Buildings under this account located at Bonne Terre	Apportionment between freight and passenger made for whole system as shown below, and then further apportioned between main and branch lines according to the percentages in Table 2	...	....
Machine and boiler shop	Cost of locomotive repairs	80	20
Engine house	Cost of service rendered	90	10
Flue rack and flue-cleaning sheds; oil houses; sand drying house; sand trestle; cinder pit	Locomotive-miles	70	30
Woodworking shop	Cost of repairs to freight and passenger cars	90	10
Blacksmith's shop; coal house; master mechanic's office and vault	Cost of repairs to all equipment	88	12
Paint shop	Used exclusively in passenger service	....	100
Store house; yard toilet house; hose house; scrap platform; sewerage and drainage; water-supply system	Average of value of above allocations	73.5	26.5
Power-plant buildings	Apportioned on basis of power supplied and amounts allocated to freight and passenger service of shops to which power is supplied		
Boiler and pump room		80	20
Transformer house		88	12
Power distribution system	Same basis as power-plant buildings	88	12
Shop machinery			
Property under this account located at Riverside, Herculaneum, Flat River, Rivermines and Elvins	Cost of locomotive repairs	80	20
Property under this account located at Bonne Terre in common to whole system.	Apportionment between freight and passenger made for whole system as shown below, and then further apportioned between main and branch lines as p r Table 2	....	....
Engine house	Cost of service performed	90	10
Machine shop; boiler shop	Cost of locomotive repairs	80	20
Flue cleaning shed	Locomotive miles	76.5	23.5
Woodworking shop	Cost of repairs to freight and passenger cars	90	10
Blacksmith's shop; master mechanic's office	Cost of repairs to all equipment	88	12
Paint shop	Used exclusively for passenger	....	100
Miscellaneous tools and equipment in Bonne Terre yards	Average of values of above allocations	82.5	17.5
Power-plant machinery	Apportioned on basis of power supplied and amounts allocated to freight and passenger service of shops to which power is supplied	80	20
Power substation apparatus	Same basis as power-plant machinery	88	12

TABLE 2—APPORTIONMENT IN PERCENTAGES OF BONNE TERRE SHOPS AND ENGINE HOUSE BETWEEN MAIN AND BRANCH LINES

Item	Basis of division	Main Line: Freight	Main Line: Passenger	Hoffman Branch: Freight	Hoffman Branch: Passenger	Crawley: Freight	Crawley: Passenger	Gumbo and Mitchell: Freight	Gumbo and Mitchell: Passenger
Machine shop and boiler shop, engine house, flue rack shed, flue cleaning shed, oil houses, sand-drying house, sand trestle, cinder pit	Locomotive miles	74.2	90.5	14.7	9.5	2.2	0	8.9	0
Woodworking shop	Car mileage, freight and passenger	83.5	91.0	8.3	9.0	1.8	0	6.4	0
Blacksmith shop, coal house, master mechanic's office and vault	Locomotive freight and passenger car mileage	82.3	91.0	9.2	9.0	1.8	0	6.7	0
Paint shop	Passenger car miles	....	91.0	....	9.0	....	0	....	0
Store house, yard toilet house, hose house, scrap platform, sewerage and drainage, water-supply system	Average of above allocations	80.0	90.9	10.7	9.1	1.9	0	7.4	0

TABLE 3—DERIVATION FROM PERCENTAGES OF TABLES 1 AND 2 OF CERTAIN MAIN-LINE ITEMS OF BONNE TERRE SHOPS

Item	Allocation of whole traffic, per cent: Freight 1	Allocation of whole traffic, per cent: Passenger 2	Allocation to main line, per cent: Freight 3	Allocation to main line, per cent: Passenger 4	Reproduction cost for whole system: Total 5	Reproduction cost for whole system: Freight 6	Reproduction cost for whole system: Passenger 7	Reproduction cost for main line: Freight 8	Reproduction cost for main line: Passenger 9	Reproduction cost for main line: Total 10
Machine and boiler shop..	80.0	20.0	74.2	90.5	$14,534	$11,627	$2,907	$8,627	$2,631	$11,258
Engine house...........	90.0	10.0	74.2	90.5	8,243	7,419	824	5,505	746	6,251
Blacksmith shop, etc.....	88.0	12.0	82.3	91.0	7,995	7,036	959	5,791	873	6,664
Paint shop.............	0.0	100.0	0.0	91.0	7,107	0	7,107	0	6,467	6,467

main and branch lines on the relative percentages that the locomotive ton-miles for each class of service for each system are at the total.

EXPLANATION OF TABLES

[Space permits the presentation of only few of the tables. Table 1 gives the basis of apportionment and the freight and passenger percentages for various of the road accounts for the main line. Table 2 shows the basis of apportionment between main and branch lines of the general shops and engine house.

Table 3 is compiled from several of Mr. Sparrow's tables in an attempt to show the application of the various percentages. The percentages in columns 1 and 2 are taken from Table 1, and those in columns 3 and 4 from Table 2. Starting with the total reproduction cost of the item, column 5, this figure multiplied by the percentage gives the amount chargeable to the freight service of the whole system, column 6. This in turn, multiplied by the percentage in column 3, gives the amount chargeable to the freight traffic of the main line, column 8. Likewise the application of the percentage factors of columns 2 and 4 to the total in column 5 gives the amounts in columns 7 and 9. The matter is set forth more fully in the various appendices of the report, but space limitations preclude their presentation here. The same process is gone through with reproduction cost less depreciation the base.

Table 4 gives the itemized cost figures for the main line and Table 5 summarizes them. The main-line figures are given rather than those for the whole system, for the reason that the percentages give a better criterion for other roads than if lines used exclusively for freight purposes were included.—EDITOR.]

TABLE 4—ITEMIZED APPRAISAL FIGURES FOR MAIN LINE

	Cost of reproduction new			Cost reproduction new less depreciation		
	Freight	Passenger	Total	Freight	Passenger	Total
	I—Road					
1. Engineering	$52,867	$15,348	$68,215	$47,907	$13,909	$61,816
2. Land for transportation purposes			(See below)			
3. Grading	676,659	171,177	847,836	732,556	184,705	*917,261
5. Tunnels and subways	4,840	5,915	10,755	4,840	5,915	10,755
6. Bridges, trestles and culverts	196,423	57,065	253,488	165,299	47,966	213,265
8. Ties	103,978	22,308	126,286	51,989	11,154	63,143
9. Rails	201,243	46,367	250,610	169,088	39,297	208,385
10. Other track material	53,210	9,050	62,260	41,181	7,109	48,290
11. Ballast	51,952	11,373	63,325	44,160	9,666	53,826
12. Tracklaying and surfacing	73,977	15,562	89,539	66,578	14,006	80,584
13. Right-of-way fences	15,119	17,562	32,681	9,135	10,643	19,778
15. Crossings and signs	7,120	7,732	14,852	6,122	6,809	12,931
16. Station and office buildings	33,792	39,872	73,664	26,512	30,822	57,334
17. Roadway buildings	5,675	1,744	7,419	3,995	1,227	5,222
18. Water stations	9,170	2,587	11,757	7,825	2,207	10,032
19. Fuel stations	2,753	947	3,700	1,926	662	2,588
20. Shops and engine houses	43,362	18,829	62,191	31,781	14,969	46,750
27. Signals and interlockers	1,405	1,719	3,124	1,140	1,393	2,533
29. Power-plant buildings	1,218	304	1,522	978	245	1,223
32. Power-distribution system	490	67	557	360	49	409
37. Roadway machines	1,857	571	2,428	1,300	400	1,700
38. Roadway small tools	548	169	717	384	118	502
44. Shop machinery	49,441	12,376	61,817	36,112	8,804	44,916
45. Power-plant machinery	1,095	274	1,369	684	171	855
46. Power substation apparatus	431	50	490	345	47	302
	$1,591,625	$458,977	$2,050,602	$1,452,197	$412,293	$1,864,490
Contingencies, 5 per cent on above	79,581	22,949	102,530	72,609	20,614	93,223
Estimated "fair present value" of land for transportation purposes	101,513	118,860	220,373	101,513	118,860	220,373
	$1,772,719	$600,786	$2,373,505	$1,626,319	$551,767	$2,178,086
	II—Equipment					
51. Steam locomotives	$196,838	$35,949	$332,787	$131,446	$19,465	$150,911
53. Freight-train cars	856,427	....	856,427	624,423	....	624,423
54. Passenger-train cars	....	60,591	60,591	....	39,175	39,175
57. Work equipment	27,344	8,386	35,730	19,471	5,971	25,442
	$1,080,609	$104,926	$1,185,535	$775,340	$64,611	$839,951
	III—General					
73. Legal expenses	$16,712	$4,819	$21,531	$15,248	$4,329	$19,577
71. Organization	41,277	8,803	50,080	34,502	7,463	41,965
74. Stationery and printing						
75. Taxes						
76. Interest during construction	131,009	32,370	163,379	110,313	28,267	138,580
Working capital, stores and supplies	65,600	16,400	82,000	65,600	16,400	82,000
Grand total	$3,107,926	$768,104	$3,876,030	$2,627,322	$672,837	$3,300,159

*This item appreciated, and the amount of appreciation has been added to "Cost of Reproduction New."

TABLE 5—SUMMARIZED ALLOCATION OF REPRODUCTION COST TO FREIGHT AND PASSENGER SERVICE, MAIN LINE

	Freight		Passenger		
	Amount	Per cent	Amount	Per cent	Total
	I—Road; Cost of Reproduction New				
In joint service	$1,436,025	71.7	$565,435	28.3	$2,001,460
Exclusively freight	336,694	100.0	....	....	336,694
Exclusively passenger	....	....	35,351	100.0	35,351
	$1,772,719	74.7	$600,786	25.3	$2,373,505
	Cost of Reproduction New Less Depreciation				
In joint service	$1,326,769	71.6	$524,767	28.4	$1,851,536
Exclusively freight	299,550	100.0	......	....	209,550
Exclusively passenger	....	....	27,000	100.0	27,000
	$1,626,319	74.7	$551,767	25.3	$2,178,086
	II—Equipment; Cost of Reproduction New				
In joint service	$27,344	76.5	$8,386	23.5	$35,730
Exclusively freight	1,053,265	100.0	....	....	1,053,265
Exclusively passenger	....	....	96,540	100.0	96,540
	$1,080,609	91.2	$104,926	8.8	$1,185,535
	Cost of Reproduction New Less Depreciation				
n joint service	$19,471	76.5	$5,971	23.5	$25,442
Exclusively freight	755,869	100.0	....	....	755,869
Exclusively passenger	....	....	58,640	100.0	58,640
	$775,340	92.3	$64,611	.7.7	$839,951
	Road, Equipment, General; Cost of Reproduction New				
In joint service	$1,599,006	71.9	$624,823	28.1	$2,223,829
Exclusively freight	1,508,920	100.0	....	....	1,508,920
Exclusively passenger	....	....	143,281	100.0	143,281
	$3,107,926	80.0	$768,104	20.0	$3,876,030
	Cost of Reproduction New Less Depreciation				
In joint service	$1,464,527	71.7	$577,199	28.3	$2,041,726
Exclusively freight	1,162,795	100.0	....	....	1,162,795
Exclusively passenger	....	....	95,638	100.0	95,638
	$2,627,322	79.6	$672,837	20.4	$3,300,159

Arch Centering of Reinforced Concrete Suspended

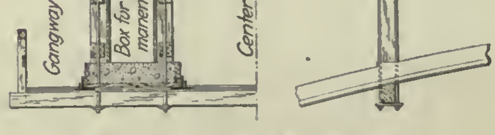
Economy and Safety Result from Unique Design for Suspended Centering Used in Erecting Reinforced-Concrete Arches

THE REPLACEMENT of an existing steel truss highway bridge by a reinforced-concrete arch structure over a torrential river subject to frequent high floods, presented a difficult erection problem because the arch centering could not be supported from below. Although the existing bridge could be utilized to suspend the centering, it was found that ordinary timber forms would be too weak when suspended from the available points on the truss bridge. As described and illustrated in the London *Engineer*, the designers, therefore, decided to use reinforced-concrete centering composed of light, flexible ribs on which the main rib could be cast. The following abstract of the article in the *Engineer* explains how the centering was designed.

THEORY OF ADOPTED DESIGN

The plan adopted was to erect by suspension a pair of light reinforced-concrete ribs, each of which would be sufficient to bear the load of a single permanent rib if prevented from deflecting, and to rely on the existing trusses above to furnish the necessary stiffening. These trusses, according to this plan, fulfill exactly the function of the trusses of a stiffened suspension bridge, the flexible reinforced-concrete ribs being merely the catenary of the cables inverted. From each panel point of the truss bridge the temporary rib is both suspended by a pair of tie rods and strutted by a post, so that it was firmly fixed at all such points.

The temporary rib was made 3 ft. 6 in. wide and 10 in. deep. It was suspended from transverse girders placed below the old floor system immediately adjacent to the panel points. The suspension rods were pairs of bolts hung from stirrups over the top of the beams, and the struts were timber posts between the rods fitted in between the top of the rib and the bottom of the



DETAILS OF SUSPENDED CENTERING

cross beam. The arrangement is shown in the accompanying diagram.

Details of Centering

The posts were bedded on seats formed on the curved concrete centering. They were spaced far enough apart to allow room for the boxing in which to mold the permanent ribs. The suspension rods passed through and supported timber crossties, which were common supports to both temporary ribs, and the whole was tightened up by the nuts at the ends of the rods. The temporary ribs were molded in shallow troughs, which were carried each by two 6 x 6-in. angles curved to the form of the arch and extending from skewback to skewback.

The temporary ribs were cast in two days. They had nearly two months to set before boxing and reinforcement were ready and all preparations made for casting the permanent ribs. To guard against adhesion they were finished very smooth and well oiled. The permanent ribs were given a month to set before the superstructure was proceeded with.

The temporary ribs were removed by being cut away at the crown. This was not a difficult operation, as they projected outside the main ribs; two masons chipped away at the concrete until the section was so reduced that the rib failed by crushing and fell away into the river.

The saving over the usual method of substantial self-supporting centering was very considerable, to say nothing of the total absence of flood risk and consequent anxiety.

Deaths from Typhoid in Pennsylvania have been greatly reduced since the State Department of Health was organized ten years ago. The rate per 100,000 was 54.8 in 1906 as against 13.0 in 1916. Estimates place the number of lives saved at 18,869.

GIRDER SPANS HAVE ARCH OUTLINES—NOTE EXPANSION JOINT AT PIER

Corpus Christi Causeway Contains 2300 Feet of Reinforced-Concrete Girder Spans

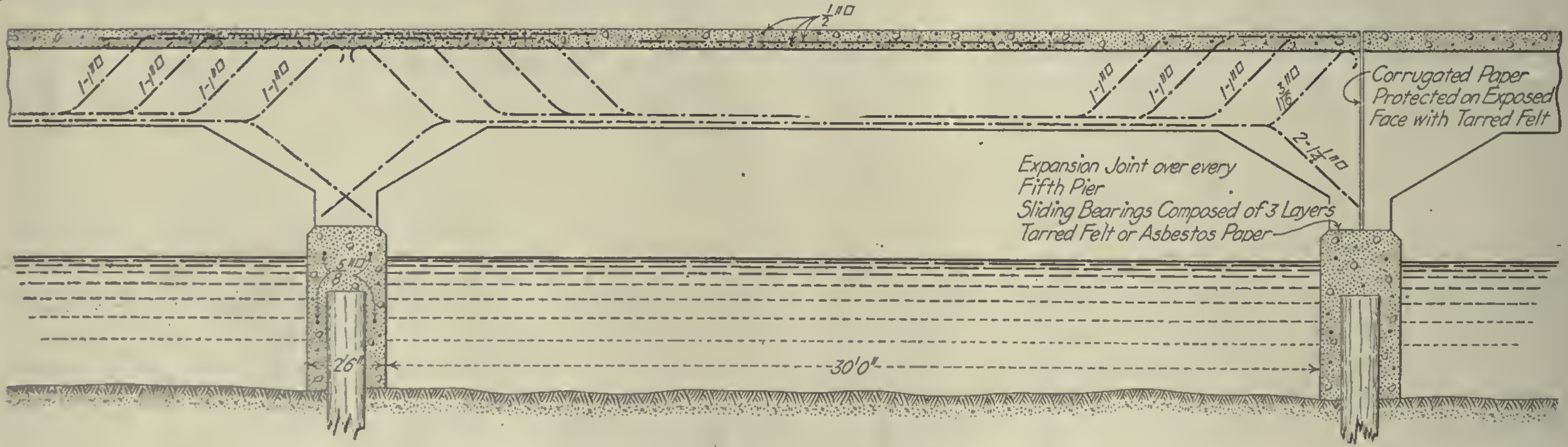
Arched Outlines Used for the 30-Foot Openings—Oyster Shell Fill Approaches 6200 Feet Long Protected by Brush Faggots and Riprap

By TERRELL BARTLETT

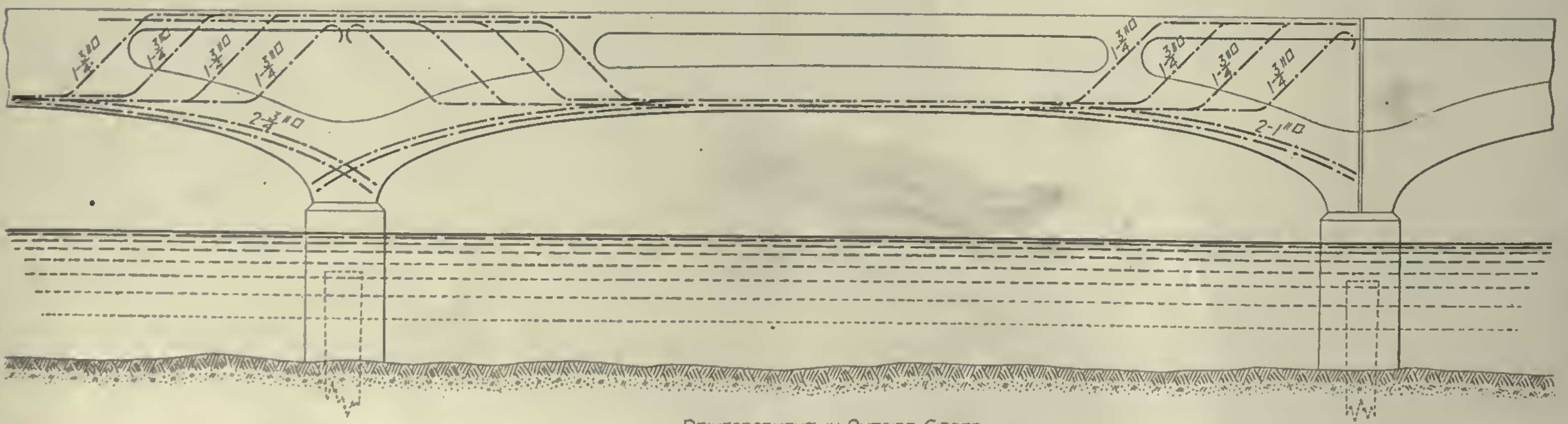
Of Bartlett & Ranney, Inc., Consulting Engineers, of San Antonio and Dallas, Tex.

THE new Corpus Christi causeway, in Texas, containing 2500 ft. of reinforced-concrete girder spans, with 30-ft. clear openings, has arched outlines suggesting arch action. The girders were designed as continuous spans, with reinforcing provided above the piers to take negative bending moment. Low concrete piers on creosoted pile foundations, oyster shell fills with brush faggots and riprap protection for the long approaches, and a short bascule span are other features of a construction of exceptional economy, completed within the original appropriation.

The causeway, recently completed by Nueces County, provides a greatly needed highway between the city of Corpus Christi and San Patricio County and forms an important link in the system of roads connecting San Antonio and a number of the resort cities of the Texas Gulf Coast. The location map herewith shows the manner in which Nueces and San Patricio counties are separated by Nueces Bay. The lack of any direct highway communication between the rapidly growing city of Corpus Christi and the highly developed farming country in San Patricio County, including the famous

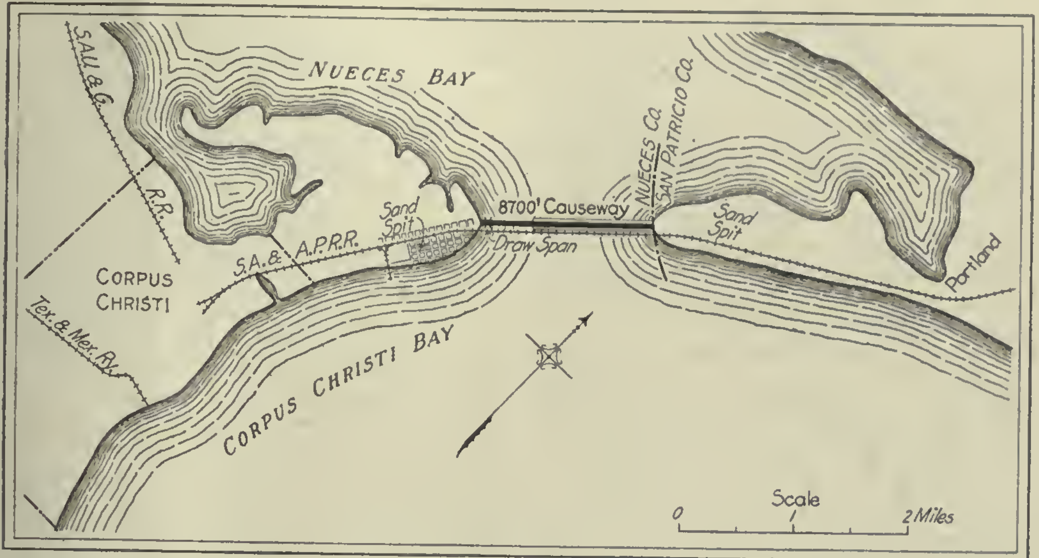

1/2"□
1-1"□
1-1"□
1-1"□
1-1"□
1-1"□
1-1"□
1-1"□
3/16"□
Corrugated Paper Protected on Exposed Face with Tarred Felt
2-1/4"□
Expansion Joint over every Fifth Pier
Sliding Bearings Composed of 3 Layers Tarred Felt or Asbestos Paper
5/8"□
2'6"
30'0"

Reinforcement in Inside Girder



Reinforcement in Outside Girder

ELEVATION OF INSIDE AND OUTSIDE GIRDERS SHOWS REINFORCEMENT, PIERS AND EXPANSION JOINTS



LOCATION MAP OF CAUSEWAY—NATURAL SAND SPITS AT EACH END

FILL PROTECTED BY MESQUITE BRUSH FAGGOTS AND RIPRAP

SOUTH END OF CAUSEWAY WITH BASCULE LIFT SPAN

Taft ranch and the cities of Portland, Gregory, Taft, Rockport and Aransas Pass, has been a great obstacle to the development of the region.

The distance between the high land at Corpus Christi and that at Portland across the Bay is 7 miles, but two natural sand spits stretch out from either shore, so that the actual width of the neck of water connecting Nueces and Corpus Christi bays and which required bridging was 1 2/3 miles. The construction adopted consists of 6200 ft. of protected fill and 2532 ft. of short spans providing waterway for passing the tide waters and the floods of the Nueces River, which drains some 15,000 square miles. It includes a small lift span with 32 ft. clearance, as required by the Federal authorities for passing fishing boats and barges.

CONDITIONS AT SITE

At low water the depth along the line of the causeway varied from 6 in. to 2.5 ft. with a maximum known tide of approximately 2.25 ft. On the Corpus Christi Bay side, or east of the structure some 500 ft., there were exposed at extreme low tide a series of three sand bars, forming a continuation of the crescent shaped shore line of the two sand spits.

These and other conditions showed a tendency of the currents which have built out the two sand spits to continue this action and extend them, except as prevented by the opposing cross currents from floods and sudden tide changes, which have maintained the width of opening between the two bays. It was therefore believed that as soon as the cross currents were blocked by a fill across part of the waterway immediate shoaling of the water on both sides would occur, and would result in the formation of beaches along the structure.

The bridged portion, consisting of seventy-six reinforced-concrete girder spans, with 30-ft. clear openings, and the drawspan were placed at the south end where the deepest water existed, and provides a total waterway at high tide of 8600 sq. ft.

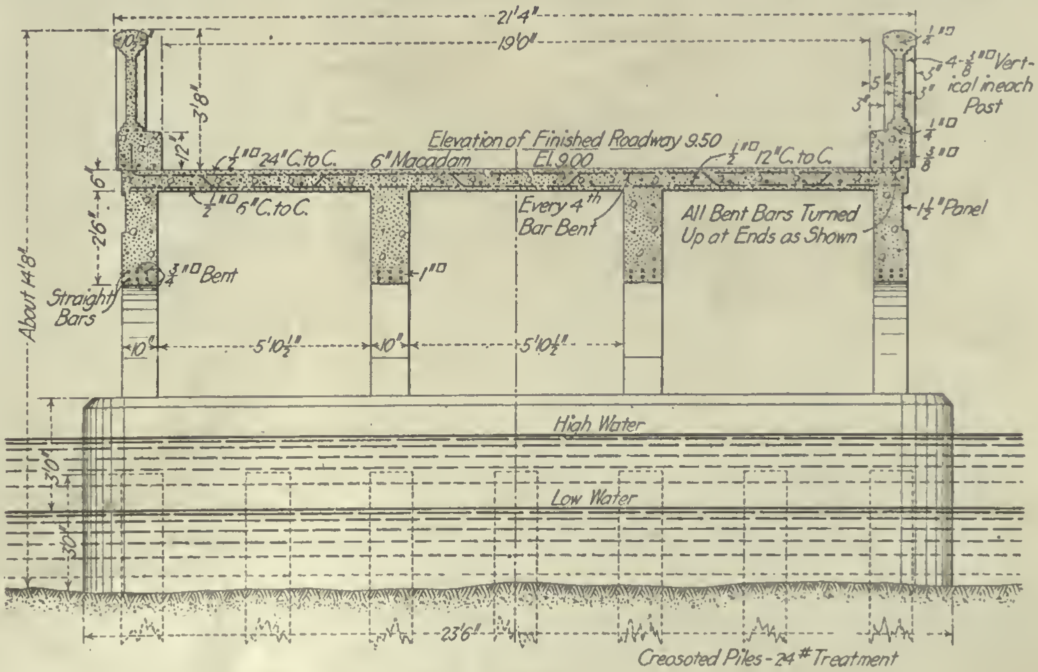
The piers consist of a bent of creosoted longleaf pine piling, 24 lb. treatment, with a concrete cap 2½ ft. wide extending down to the existing bottom. The top of the piers is at elevation 3.00 above low water datum. The concrete was placed in the water with a tremie. The piers are reinforced with four rods, two on each side of the row of pile heads, to avoid the danger of cracking opposite the piles.

The piles vary in length up to a maximum of 55 ft. They were driven to a penetration of ½ in. under a 6800 lb. gravity-drop steam hammer striking 60 blows per minute. Several piles were tested by applying a Watson-Stillman hydraulic press, which was in use on the job for testing concrete cubes. This press was inverted over the piles tested and pressure exerted on the pile against a counterweight composed of timbers. The piles showed no signs of starting under a load of 23.5 tons, the greatest which could be applied in the test, and which was substantially double the working load.

REINFORCED-CONCRETE GIRDERS

The spans are composed of four reinforced-concrete girders 32½ ft. center to center and 30-ft. clear span. The bottoms of the outer girders are in elliptical arch form, and the inside girders are corbelled. The girders and the concrete floor slab were run continuously through five spans; at every fifth pier the entire superstructure was completely cut by a contraction joint. The climate at Corpus Christi is remarkably equable, the mean temperature of the hottest and coldest months differing by only 29 deg. Fahr.

The roadway is 19 ft. 10 in. wide between concrete railings of ornamental type, the top of the floor slab being 9 ft. above low water datum. Details of the construction are shown in the drawings herewith; provision for continuity in both floor slab and girders is made by bending up the reinforcement as indicated. The roadway is drained by cast-iron gratings and scuppers



CROSS SECTION AT CENTER OF SPAN SHOWS FLOOR AND GIRDER REINFORCEMENT through the curbs as shown. A wiring conduit and anchor bolts were provided for future installation of light brackets over alternate piers.

Concrete and Form Work

The concrete was composed of washed crystalline limestone gravel 1:2:4 mix, and was reinforced by deformed square rods of medium grade structural steel. A field testing laboratory was maintained throughout the work. Tests of 4-in. cubes of concrete for girders and floor showed an average strength of 2800 lb. per square inch at 30 days.

The forms for the spans were carried without falsework upon eight lines of 10 x 20-in. timbers 32 ft. long resting on the piers in pairs on either side of the four girders. The forms were composed of dressed lumber screwed together in panels and oiled. The panels were supported on the aforesaid timbers and held in position by a system of knockdown framing requiring no nailing, and wired only for the outer girder sides. The forms were used eight times with very little reworking.

PLACING PANELED KNOCKDOWN FORMS

The drawspan is of the Strauss bascule lift type, designed by the Strauss Bascule Bridge Company and fabricated by the Phœnix Bridge Company. The girders have a span of 42 ft. from center of main trunnion to bearing of moving leaf, and provide a clear span between fenders of 32 ft. The floor is a 4-in. slab of reinforced concrete carried on steel floorbeams and stringers and with 2 in. of trap-rock granolithic for the wearing surface.

Oyster Shell Approach Fills

The approach fills, 200 ft. long at the south end and 6000 ft. at the north end, are composed entirely of oyster shell dredged from the shell reef which underlies the greater portion of the entire structure. The top width is 40 ft. and the side slopes 6 to 1, making a base of approximately 120 ft. width. A berm of 100 ft. was left between the toe of the slope and the dredge pits. The fill was dredged in to elevation 6.00 above low water and subsequently crowned to elevation 6.50 for the roadway.

The fill is protected by very shallow water on the west side; by a bar and by comparatively shoal water on the outer or eastern side fronting on Corpus Christi Bay. The anticipated shoaling action due to stoppage of cross currents as above mentioned has already developed to a noticeable extent. Although the fill is 30 miles inland from the Gulf of Mexico and is exposed to no severe storm nor wave action, it was thought best to supplement the protection from natural conditions by the following construction precautions: First, the use of oyster shell for building the entire fill; second, the adoption of very flat side slopes comparable to the slopes of the adjacent sand beaches; and third, by the use of brush faggots and riprap to protect the toes of the fill.

Brush Faggots and Riprap

The faggots consist of bundles of mesquite brush somewhat over 8 ft. long and 12 in. in diameter bound securely and tightly by four wire stays. These faggots were placed at right angles to the center line with brushy ends out and in continuous rows, simultaneously with the placing of the fill. Two rows of faggots were placed on the outer side and one on the inner side, except near the abutments, where three and two rows respectively were used. The fill, and especially the finer particles of shell, settled into the crevices of the faggots to form a solid toe. On top of the outer slope as thus constructed was placed the riprap composed of 50 per cent one man and 50 per cent two man stone placed by hand in an apron one layer thick and 14 ft. wide, as shown in one of the photographs. The heavier rocks were placed at the foot of the slope. Eighteen thousand faggots and 2600 tons of riprap were used.

The abutments and bulkhead wings protecting the ends of the fills at the junction with the bridge are of concrete extending down to the existing bottom and resting on creosoted bearing piles and a line of 6 x 12-in. creosoted sheet piles forming a continuous bulkhead.

Road Surface and Approach

The road surfacing over the concrete slab is composed of a mat course of tarviated trap rock, and the surface of the shell fill after it becomes thoroughly compacted by traffic will be treated likewise. All materials for the construction of the bridge had to be imported from distances in excess of 125 miles.

San Patricio County has constructed simultaneously a 3-mile approach along the sand spit from Portland to the county line at the north end of the causeway proper. This work consists of a 4-ft. fill with 30 ft. crest and topped with 12 in. of shell. This has been surfaced with 2 in. of asphalted trap rock constructed by a modified penetration method known locally as the "Travilla Topping."

The San Patricio approach cost approximately $25,000. The cost of the causeway proper complete including road surfacing and engineering and inspection was $166,500. The causeway was constructed by Nueces County under the administration of the Honorable Walter F. Timon, County Judge. The preliminary studies and estimates, final designs and supervision of construction were by Bartlett & Ranney, Inc., consulting engineers, of San Antonio and Dallas, Texas, with Neal Hanson as resident engineer. The contractors were W. L. Pearson & Company, of Houston, Texas.

Rapid Filters at Fargo, N. D., reduce the number of bacteria per cubic centimeter in the Red River of the North 98 to 99.5 per cent. In the raw water the counts range from 700 to 25,000, so states F. L. Anders, city engineer, in a paper presented recently to the North Dakota Society of Engineers. The hardness, which varies from 200 to 400 parts per million of carbonates, is reduced about one-half, making an estimated saving of $7,000 in the cost of soap. The treatment consists of 7 to 10 grains of lime per gallon, 1.3 grains of iron sulphate and 1/20 grains hypochlorite of lime.

First Unit of Jamaica Bay Improvement Completed

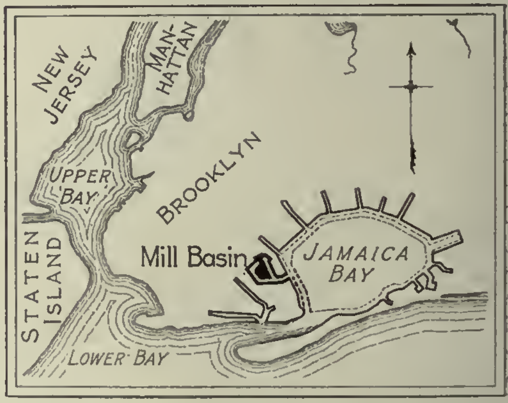
Mill Basin Development Gives Navigable Waterfront to 350-Acre Tract in Flatbush, 8 Miles from New York City Hall

The dredging of Mill Basin, the first unit of the Jamaica Bay improvement, New York City, has been completed. By it a navigable waterfront has been given to 350 acres of level land considered ideal for industrial purposes, 8 miles from the City Hall on Manhattan. This tract, which lies between the two branches of the basin, is not bulkheaded, nor is it laid out into streets, the company which holds it prefering to sell or lease the land to the industries and allow them to develop it to suit their individual needs. Rail connection is at hand. In the estimation of the owners of the tract, the completion of Mill Basin marks an epoch, presaging the ultimate creation of a large and unexcelled industrial district bordering the waters of Jamaica Bay.

Jamaica Bay has been called New York's idle harbor. The accompanying map shows its relation to the city. It has an area greater than that of Manhattan Island, and adjacent to it are 9000 acres of unreclaimed land. The harbor is landlocked, but with an easy entrance. Rail connections are available. Agitation to utilize this harbor began some ten years ago, and led to a joint arrangement between the federal government and the city whereby the government would excavate the entrance channel around the bay, while the city would excavate the basins.

The channels are to be 18 ft. deep at first, ultimately to be increased to 30 ft. The entrance channel and the main channel around the bay are to be 500 ft. wide at first and enlarged as required to 1500 and 1000 ft. respectively.

To date the main channel has been dredged to its full depth as far as Mill Basin and the entrance channel to a depth of 14½ ft. at low tide. Mill Basin is 18 ft. deep throughout. Its channels vary in width from 150 to 500 ft., and a large turning basin is afforded at the end of the west arm. The dredging was done by the hydraulic method, the material being pumped upon the land, building it up to an elevation of about 6 ft. above high tide. Rail connection deemed ample for some time to come will be afforded by a line of the Brooklyn Rapid Transit Company, the preliminaries of which are now under way. This line connects at the Bush Terminal with all the trunk-line railroads terminating on New York harbor. As previously



RELATION OF JAMAICA BAY TO NEW YORK, AND LOCATION OF MILL BASIN stated, the policy of the company owning the land between the two arms is to dispose of the unimproved land and allow the industries which locate there to work out their own developments. Consequently the only improvements to date are the buildings, bulkheads, wharves and other facilities built by several industries that have already settled on the tract.

The dredging for both the government and the city has been done by the Atlantic, Gulf & Pacific Company, of New York City. It is this company also that owns and is developing the 350-acre tract at Mill Basin. Col. H. W. Stickle, vice-president of the company, is in charge of the development.

Illinois Highway Organization Fixes Responsibility

Chart Prepared to Indicate Definitely the Duties of Members of the Engineering Staff on State Road Work

SO rapid has been the growth of the Illinois Highway Department since its organization in 1913 that it has been necessary to reorganize the force along permanent lines. The State Highway Commission consists of three members appointed by the Governor, having general control of the department. A state highway engineer, appointed by the Governor, is the executive officer of the commission. Such employees as are necessary to carry on the work of the department are appointed through competitive civil service examination.

The accompanying chart illustrates the organization as it has been adopted. The work of the department has been divided into five character divisions or bureaus with a bureau chief in charge of each of the five main divisions. These are respectively the bureaus of bridges, testing, maintenance, auditing and roads. The various bureau chiefs have responsible charge of all the work of the department of the particular character to which they are assigned.

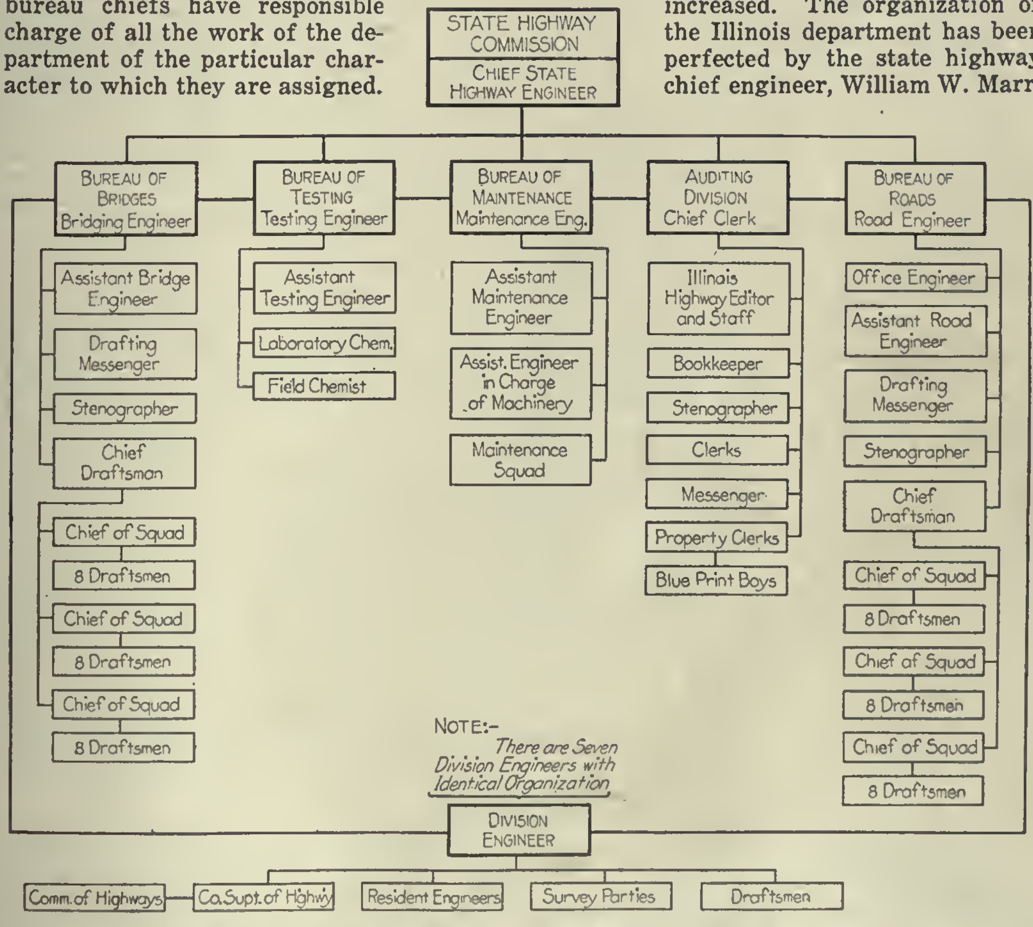
The work is further subdivided along territorial lines into seven districts, each under the direction of a division engineer, who is in direct responsible charge of all character of work in his district. The division engineers report to the respective bureau chiefs in accordance with the character of the work involved. Each division engineer is located in a permanent office in his division and has an independent organization of his own, reporting directly to him in all matters.

In addition to the division engineers, each bureau chief has reporting to him an independent office force for which he is directly responsible. There is in the organization no conflict of authority or division of responsibility. It will be noted from an inspection of the chart that no member of the department reports to or receives orders from more than one superior. The various assistants report to their immediate superior, and wherever an assistant has a specific branch of work assigned to him his subordinates report only to himself.

RESPONSIBILITY FIXED

On the other hand, no member of the department is authorized to issue instructions to any but the immediate subordinates, which operates clearly and definitely to define authority and responsibility in all cases and to obviate the confusion which naturally results when a superior officer attempts to direct work over the heads of intermediate officials.

Owing to the vast territory in which the department operates and the scattered condition of the work, the overhead and engineering cost has been comparatively high in the past, but due to the establishment of division engineers in permanent quarters and otherwise perfecting the present organization, the cost of engineering has been greatly reduced and the efficiency of the men has been materially increased. The organization of the Illinois department has been perfected by the state highway chief engineer, William W. Marr.

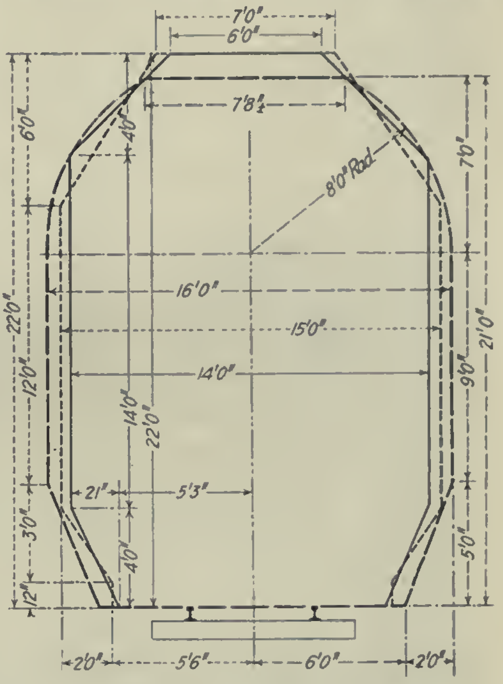


NO MEMBER OF THE DEPARTMENT MAY ISSUE INSTRUCTIONS TO ANY BUT HIS IMMEDIATE SUBORDINATES

Minnesota Commission Adopts Clearances

Issues Order Calling for 8 Feet Each Side of Center Line of Tangent Single Track for Bridges and Tunnels

IN VIEW of the fact that the American Railway Engineering Association, after lengthy discussion at the convention last year, rejected the recommendation of the committee on iron and steel structures that the standard clearance width for single-track bridges on tangents be increased from 14 to 15 ft., the recent order of the Minnesota Railroad and Warehouse Commission, specifying a width of 16 ft., may be of interest. In the accompanying diagrams the full line represents the standard now in the *Manual* of the American Railway Engineering Association, the dotted line is that rejected last year, and the dash line is that adopted by the Minnesota commission. It may be noted that the Minnesota standard height above top of rail is 1 ft. less than that of the railroads.



CLEARANCE DIAGRAMS COMPARED

Full line, A. R. E. A. standard.
Dotted line, rejected by A. R. E. A. last year.
Dash Line, Minnesota standard.

The Minnesota order contains the same proviso as is found in the *Manual* of the American Railway Engineering Association—that the clearances shall be increased sufficiently to provide the same minimum clearances on curves for a car 80 ft. long, 14 ft. high and 60 ft. center to center of trucks, allowance being made for curvature and superelevation of rails.

The order applies only to bridges and tunnels, and does not state whether it is intended to affect such structures now existing with less than the standard clearances.

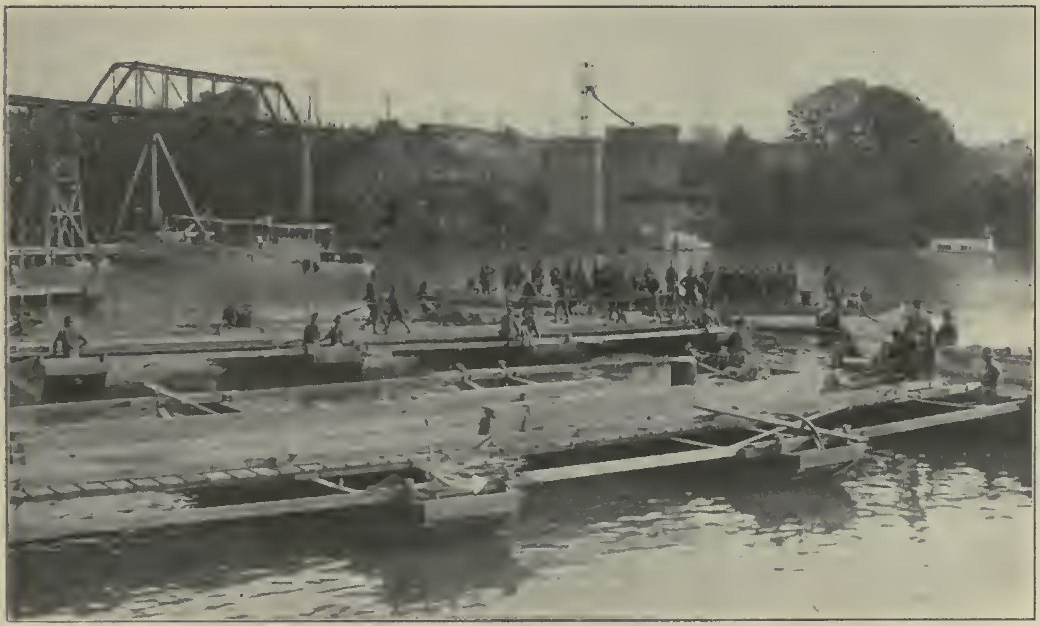
SPECIAL ASSESSMENT IMPROVEMENTS IN TEXAS cannot be forced on owners who have taken up property under the homestead laws. Hence many city streets in the state have short unpaved sections in front of homestead property. Karl Mitchell, city manager, Sherman, Tex., stated at the recent meeting of the City Managers' Association that a municipal improvement association had been formed in his city to loan money for such improvements to homestead property owners to be paid back later.

National Defense—For Engineer and Contractor

Third Article in Series Describing Army Methods for Stream Crossings by Ponton, Trestle and Truss Bridges Where Time Element Is All-Important Factor

By MAJOR P. S. BOND,
Corps of Engineers, U. S. Army

MILITARY field engineering, as we have seen in the previous articles of this series, is an adaptation of civil engineering and, in practice, differs from the latter in so far as it is governed by different economic principles and conducted under different conditions. Fortification works executed in time of peace are essentially similar to civil engineering construction, and the same is true of many engineering operations conducted in time of war on the lines of communication in rear of the fighting forces. On such works civilian engineers, without military training, may often be employed to advantage. We are now concerned, however, with field engineering, the pioneer operations of the fighting forces. Here we find a sharp contrast with civil practice. The conditions which govern the military pioneer may be recapitulated as follows:


THERE IS A REGULAR ROUTINE FOR PONTON CONSTRUCTION AND SO WONDERFULLY SIMPLE IS THE EQUIPAGE THAT UNSKILLED MEN CAN BE TAUGHT TO USE IT IN A VERY SHORT TIME

1. All works must be designed and executed to meet actual tactical needs. If constructed without due regard to the tactical situation they may be worse than useless.
2. A very large proportion of the works will be constructed to meet sudden emergencies. Opportunities to plan and carry out works a considerable time in advance of need, therefore, will be comparatively infrequent.
3. The fundamental economic principle of military engineering is that time is of the essence. Cost and durability of works are ordinarily matters of minor importance. The quickest makeshift is usually the best solution.
4. Simplicity must characterize all designs.
5. Materials which are available at or near the site of the work must be utilized to the fullest possible extent.
6. There will usually, but not always, be ample common labor available, but a dearth of skilled labor of all classes.
7. As a rule, no heavy construction plant and only the simplest tools and materials will be available.

The works resulting from these conditions are of a very simple nature. The highest expression of the skill of the military engineer is this very simplicity and the rapid adaptation of his designs to the tactical requirements of the situation and to the resources in men, tools, materials and the time at his disposal.

STREAM CROSSINGS

The ability to cross streams is essential to the mobility of the army. To facilitate such passage is one of the chief duties of the engineers. The history of war is replete with examples of delays and failures due to the lack of equipment for the rapid construction of bridges.

On Jan. 26, 1814, Napoleon writes: "If I had had ten pontons I should have captured 10,000 wagons, beaten Prince Schartsenburg in detail, annihilated his army and closed the war; but for want of proper means I could not cross the Seine."

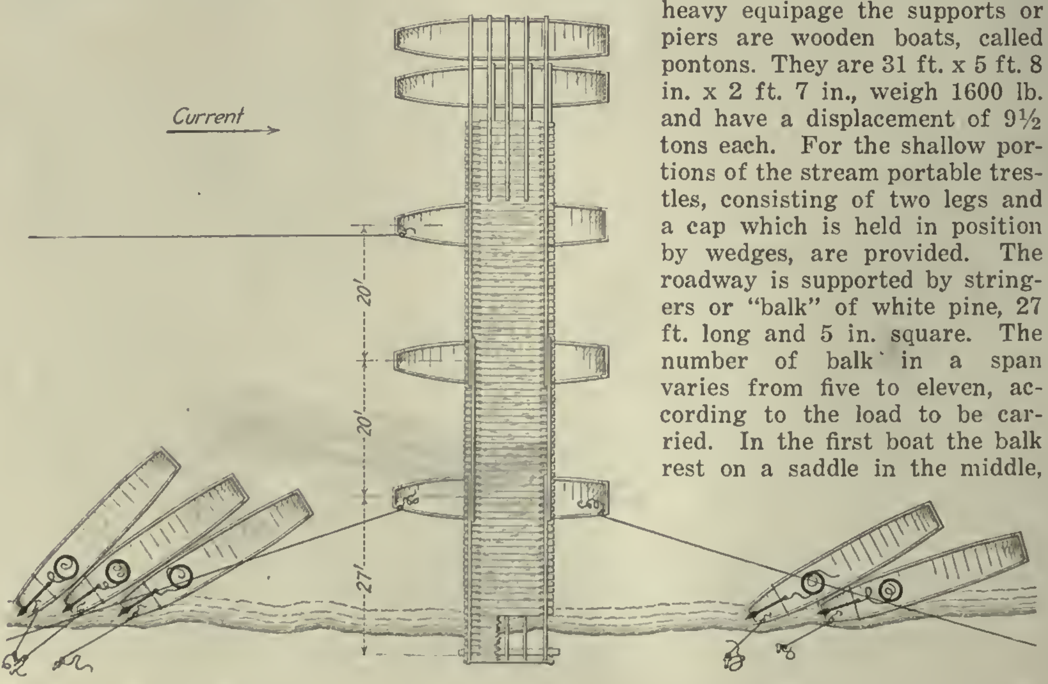
Writing to the Adjutant General under date of May 18, 1846, General Zachary Taylor says: "My very limited means for crossing rivers prevented a complete prosecution of the victory of the 9th (Palo Alto). A ponton train, the necessity of which I exhibited to the department last year, would have enabled the army to cross on the evening of the battle, taken this city, with all the artillery and stores of the enemy, and a great number of prisoners—in short, to destroy entirely the Mexican army."

The passage of streams is so very important and necessary that the mobile army cannot afford to rely entirely upon makeshifts improvised from materials collected at the site, as the quotations above will show. Indeed, in the case when a large army with its heavy trains is confronted with a wide and deep crossing, the construction of an improvised bridge might require weeks of time. The shifting tactical requirements do not wait on such delays, and to meet such situations some form of portable bridge with floating supports is absolutely necessary. Accordingly, all modern armies carry such bridges, which are known as ponton equipage.

The equipage in use in our army was devised prior to the Civil War and used with conspicuous success throughout that great conflict. It is a tribute to the wisdom of those who devised it that in over fifty years no radical changes have been made. The equipage is one of the simplest and most cunning of military expedients.

LIGHT AND HEAVY PONTONS

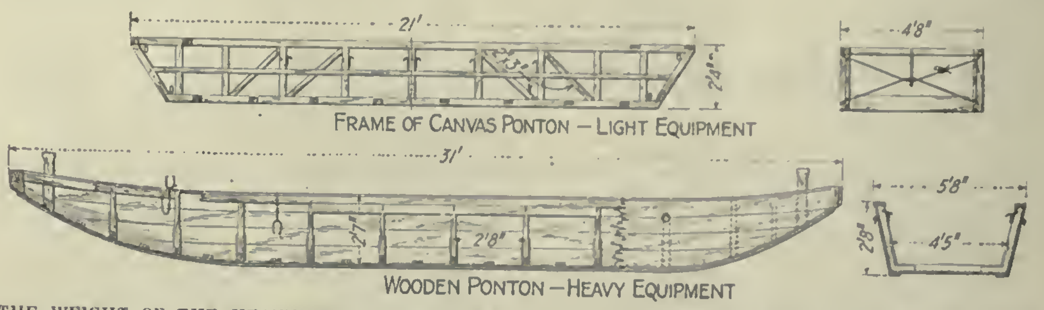
There are two forms of the equipage, known as the heavy and the light. In the heavy equipage the supports or piers are wooden boats, called pontons. They are 31 ft. x 5 ft. 8 in. x 2 ft. 7 in., weigh 1600 lb. and have a displacement of 9½ tons each. For the shallow portions of the stream portable trestles, consisting of two legs and a cap which is held in position by wedges, are provided. The roadway is supported by stringers or "balk" of white pine, 27 ft. long and 5 in. square. The number of balk in a span varies from five to eleven, according to the load to be carried. In the first boat the balk rest on a saddle in the middle,



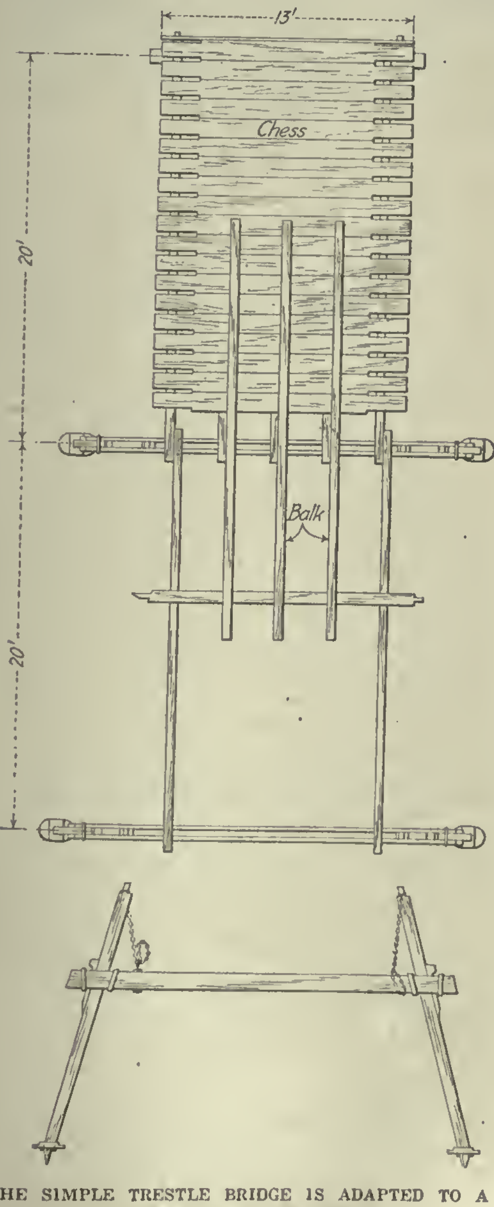
THE MOST COMMON METHOD OF PONTON BUILDING IS BY PUSHING OUT SUCCESSIVE BOATS FROM SHORE which forms a hinge to allow for changes in the level of the water. In the other boats the balk rest on the gunwales. All fastenings are by means of lashings. The deck consists of plank 1½ x 12 in. by 13 ft., of white pine, called "chess." They are held in position by side rails laid on the deck at its edge and lashed at intervals to the balk below, the lashings passing through notches in the plank. The pontons are held in position by a system of upstream and downstream anchors. The distance from center to center of supports is 20 ft.

The light train is similar to the heavy, except that the ponton boats consist of a framework covered with heavy waterproof canvas and can be dismantled for transport. They have a buoyancy of 6 tons. The balk are shorter and lighter, the span between supports is 16 ft., and the roadway narrower. The two trains may be combined in one bridge.

This material is all transported on wagons and is sufficiently mobile to accompany the troops on the march. The light train can keep pace with cavalry. The ponton bridge roadway will support, with a factor of safety of four, the heaviest loads that accompany the army. This bridge can be laid, crossed and taken up in far less time than any other form of bridge ever devised can be constructed. The weight of the heavy equipage, including the wagons on which it is carried, is 315 lb. per running foot of bridge; of the light equipage, 275 lb. Not including wagons, the weights are 169 lb. and 128 lb. respectively. It will be interesting to compare these weights with those of other forms of bridge of equal capacity.

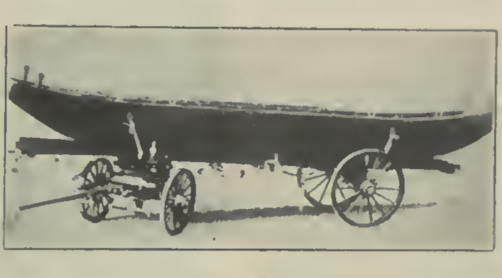

21'
2'4"
4'8"
FRAME OF CANVAS PONTON — LIGHT EQUIPMENT
31'
2'7"
2'8"
5'8"
2'8"
4'5"
WOODEN PONTON — HEAVY EQUIPMENT

THE WEIGHT OF THE HEAVY PONTON EQUIPAGE, NOT INCLUDING THE WAGONS ON WHICH IT IS TRANSPORTED, IS ONLY 169 POUNDS PER RUNNING FOOT OF BRIDGE—THE LIGHT PONTON IS A WOODEN FRAME BOAT COVERED WITH WATERPROOF CANVAS; IT CAN BE DISMANTLED FOR TRANSPORT



THE SIMPLE TRESTLE BRIDGE IS ADAPTED TO A WIDE VARIETY OF USES

There is a regular routine for construction, and so wonderfully simple is the equipage that unskilled men can be taught to use it in a very short time. The bridge may be constructed by pushing out successive pontons from one or both banks, by constructing parts along shore and floating them to position, or by constructing the entire bridge along the bank and then revolving it into position. The first method, known as "successive pontons," is the one usually employed. The procedure, as laid down in the "Engineer Field Manual, U. S. Army," is as follows: In a trench the abutment sill is laid perpendicular to the bridge axis and secured by pickets, two at each end. If necessary, one or more trestle spans are then placed and the first floating support is brought to the bank opposite the abutment. The free ends of cables fastened to the bank 30 paces above and below are passed to men aboard the pontons. A set of balk is brought up and the cleats engaged on the saddle of the ponton and lightly held by lashings. The ponton is pushed off until the cleats at inner end of balk engage the abutment sill and the mooring lines made fast. The balk are then lashed securely to the saddle and the chess (deck plank) laid. The next ponton is then brought alongside and its anchor lines (previously placed by another boat) passed aboard. The operations are repeated until the other shore is reached. The bridge is dismantled in reverse order. If the bridge is to be in position for some time a movable section or draw may be placed in the middle to allow the passage of vessels, drift, etc. The draw consists of two boats with a span of decking between.



PONTON MOUNTED ON WAGON

The construction of these bridges is one of the most picturesque and interesting of military operations. The adaptability of the equipage is very great and improvised floating supports, such as boats, rafts and casks may be used to supplement the regular equipment.

"BRIDGES OF CIRCUMSTANCE"

While great reliance will be placed upon the ponton equipage, it cannot entirely obviate the necessity for hastily constructed bridges of other types, which must frequently be improvised from materials found near the site. Such bridges are known as "bridges of circumstance." Considerable skill on the part of the engineer officers will be required to adapt the bridge to the site and materials available to produce the quickest results. The construction of a bridge is an interesting task, and there is a strong tendency to put in a bridge when a reconnaissance a little up or down stream would have revealed a practicable ford, or to build a bridge at a site where an improved ford with suitable approaches would have served the purpose at a far less expenditure of time.

The engineer confronted with a stream crossing seeks first a practicable existing bridge and in contemplation of a movement of troops all important bridges that may be used should be seized in advance to prevent destruction by the enemy or his sympathizers. Even if the bridge is insufficiently strong or has been damaged it can often be repaired or strengthened in less time than a new bridge could be built.

SIMPLE TWO-LEGGED TRESTLES

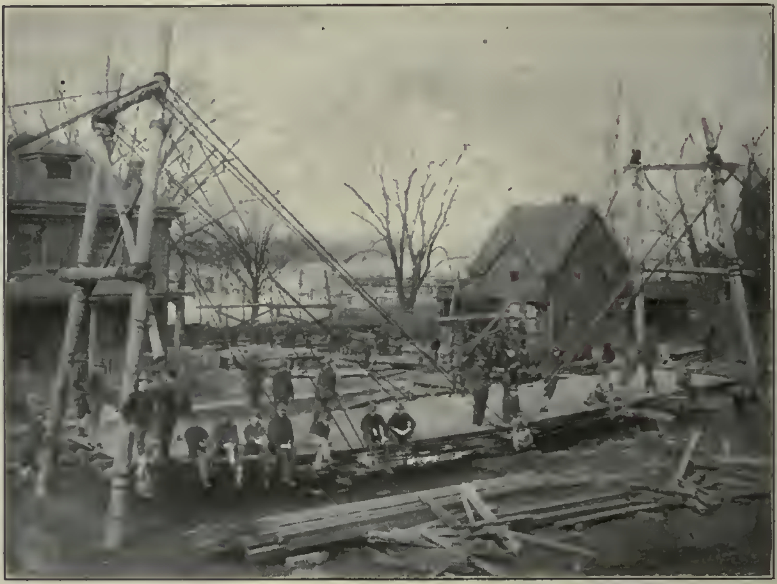
The number of types of these improvised bridges is naturally very great, but a few of them have been found specially adapted to military uses. The most common type is the simple two-legged trestle, frame or pile, which can be adapted to a great variety of conditions. The relative time and difficulty of constructing the piers and spans will fix the economic length of span. For military purposes this will usually be 10 to 15 ft., and for such a span longitudinal bracing will usually be unnecessary. But if the water is very deep or the banks high, so that large trestles are required, it will often be better to reduce their number and increase the span, employing more stringers or some form of light truss. To reduce the size of trestles the approaches may be cut down. In selecting a site the time of construction for bridge and approaches should be considered. Ordinarily a locality where the stream banks are low and firm and of equal height with a short span will be the best site. If the depth be moderate and the bottom firm the framed trestle will be best. If necessary a mud sill may be used to increase the bearing power, and if the depth is considerable or the current swift the trestles may be weighted down by boxing their sills and filling with stone.

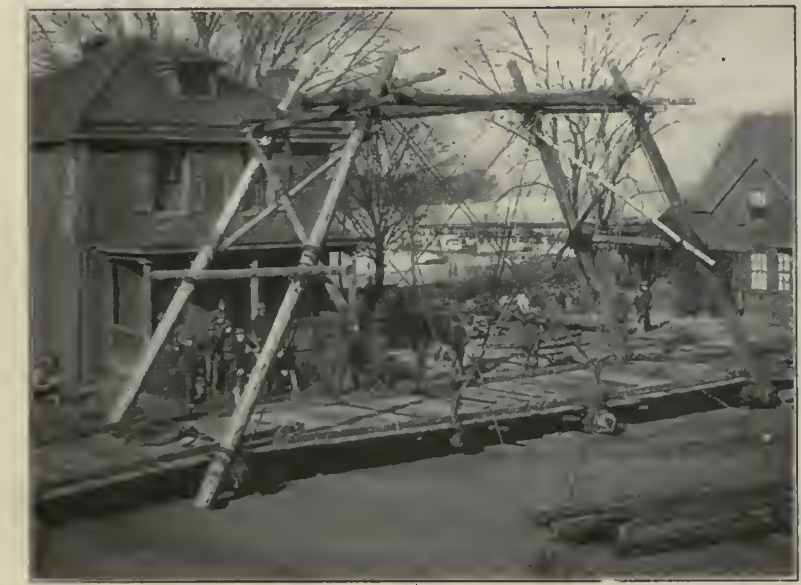
While the two-legged trestle is the favorite type, three- or four-legged (saw-horse) trestles may be employed. Cross-bracing of trestles is always necessary, and for long spans longitudinal bracing may be required. For very high trestles two or three stories may be used. Almost any materials can be utilized for trestle bridges; even bamboo has been successfully employed to carry heavy loads. In considerable depths with a soft bottom pile trestles are often to be preferred. A hasty pile driver may be improvised with a heavy block of wood raised by tackle and guided by a "spider" and a few upright poles. Of course, a light, portable power driver or hammer will be very useful in such situations, if available.

For very soft, yielding bottoms, especially if suitable piles are not available, simple log cribs filled with stone, if necessary, may be employed in conjunction with trussed spans.

Types of Truss Bridges

The purpose of trusses is to reduce the number of supports. In military field operations the use of trusses will usually be limited to situations where they can be placed with the aid of animals and tackle and without falsework. If it be necessary to place falsework, this will usually serve to carry the deck and no truss will be needed. If the bridge is to be used for some time and there is danger from flood or ice, large trusses may be placed. Such work would seldom fall to the lot of the pioneer engineer troops. An excellent example of a large military truss bridge is that built over the Kansas River at Fort Riley, Kan., by the Third Battalion of U. S. Engineers and described in this journal July 11 and 18, 1908. The usual forms of truss will be the simple king-post (or triangular truss) and queen-post, erect or inverted, with tension members of iron rods or steel cable. Small Howe or Pratt trusses and lattice or bow-string girders of plank spiked together are often employed. The difficulty of placing trusses without the aid of plant ordinarily limits their span to about 40 ft., the larger trusses being built in place when practicable. Under special conditions, as where the truss may be floated to position on a barge, greater spans may be practicable. In many situations the spar lock bridge, which in double lock is practicable up to 45-ft. span, may be constructed more easily and quickly than a truss. The supports of this type consist of two tall trestles erected on or near the bank and tilted over until their heads lock amidstream, forming a point of support. This is called single lock. In double lock the trestles are tilted until they lock with a frame placed between them, this frame forming one central span. This type has peculiar advantages from the military point of view, as where applicable it can be quickly constructed of rough materials.





BRIDGES OF THE DOUBLE LOCK TRESTLE AND SUSPENSION TYPES; CONNECTIONS MADE BY ROPE LASHINGS; ELABORATE FRAMING IS AVOIDED

Suspension Bridge Methods

Clear spans of more than 50 ft. should usually be avoided by seeking a more favorable site. When such cannot be found a suspension bridge will usually be the only type which will meet military requirements and, for moderate loads, is practicable for long spans. The essential part of a suspension bridge is the cables, and if these are available the balance of the material is usually readily obtained. A great variety of materials have been employed for cable, including manila rope, chains, bamboo, etc. The best material for cables, of course, is wire rope, and when the necessity for such bridges is possible a supply of rope with fittings should be carried by the engineers. Adjustable suspension rods or hangers may also be provided in advance—cable will serve this purpose. On account of the difficulty of handling and fastening large cables they should be limited to ¾ or 1 in., multiple cables being used when necessary.

The first step in construction is to erect the towers and prepare the anchorages for the cables. The towers will usually be of timber and of the saw-horse trestle type, to resist overturning both during construction and subsequently, as no roller bearings are employed and vertical reactions cannot always be insured. Standing trees may occasionally be utilized for towers. The anchorages consist of large logs in trenches (dead-men), standing trees or stumps, large boulders or ledges of rock, where available. Occasionally concrete is employed. The cable may be dragged across the towers or laid out, measured and anchored (temporarily, at one end, to allow adjustment) on the ground and then lifted to the towers. The sag of the cables will usually be considerable. This decreases the strain on the cables, but make the bridge very liable to undulation under live loads. Slings or suspension rods may be cable, wire rope, manila rope, round iron, or even wood. From each pair of slings hangs a transom or roadway bearer, on which the stringers and deck are placed. Oscillations and undulations may be controlled by lateral trussing of the roadway, by a trussed guard rail, by drawing the cables together at the center of the span, and by guys.

In many situations a combination of types meets requirements better than any single type. Such combinations might include frame and pile trestles, trestles and truss spans, a combination of trestles and floating supports, the latter being a very usual expedient. The deck or roadway should be no wider than necesary, both because of the weight and extra time required for construction. Ordinarily two lines of vehicles will not be passing in opposite directions at the same time. Twelve feet is usually quite sufficient for a wagon bridge, allowing for the passage of infantry or horsemen alongside the wagons. For a foot-bridge alone a less width is required. Side rails are always provided, but hand rails are seldom used except on through truss and suspension bridges.

The stringers may be of round or sawed lumber. Planking 1½ in. or more in thickness makes the best deck. Where this is not available the deck may be of poles held in place by side rails and covered with brush, leaves and earth or gravel. This makes a satisfactory deck, but, except in short span trestle bridges, is objectionable because of its weight. The fastenings are of the simplest nature, lashings, spikes and bolts being used. Elaborate framing is avoided so far as possible.

Look for Fords First

Before entering upon the construction of a bridge search should be made for a practicable ford, if the nature of the stream gives any promise that such may be found. Fords which have been used by the local inhabitants should be first examined. In determining the practicability of a ford the considerations are: (a) Nature of approaches; (b) nature of bottom; (c) depth of water, and (d) velocity of current. For the passage of mounted troops and wagons the approaches may be improved by cutting down the banks to ease the grades and by surfacing the roadway with plank, brush, gravel, etc. A sandy bottom is the most favorable and usually requires no improvement. If the bottom be rocky or yielding it may be made practicable by a deposit of sand or gravel, by fascines or bundles of brush, or by a woven mattress sunk in position.

The limiting practicable depths of fords where the current is sluggish are: For infantry, 4 ft.; for cavalry, 5 ft.; for artillery or wagons, 2½ ft. If the current is swift the depths for infantry and cavalry are 3 ft. and 4 ft. respectively. A life line may be stretched across the stream to facilitate the passage of infantry. Ice 2 in. thick will support infantry in single file; 4 in. thick, cavalry at intervals; 5 to 6 in., heavy field pieces.

IMPROVISED FERRIES

When fording is impracticable and there is not time nor material for a bridge, resort may be had to a ferry. These will be used especially in cases of wide crossings, where time is of special importance and when the number of troops to cross is small. The ponton equipment heretofore described is specially designed with a view to its use for ferrying purposes. The pontons of the heavy train will carry from twenty to forty foot troops in addition to the crew. A raft or cattamaran made of two pontons, with a span of flooring between, will carry cavalry, artillery and wagons. In the absence of the ponton equipment rafts may be constructed of logs, casks, etc.

If the current be swift a rope may be stretched from bank to bank and the float drawn across by hand. Or the current may be made to furnish motive power by attaching a block to the rope and securing the float to the block in such a manner as to hold it at an angle to the current. In the flying bridge the float is attached to and swings in a circle on a line anchored well upstream. The current may be made to furnish motive power, as in the former case, or the ferry may be drawn across by an auxiliary line secured to the bank.

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SIMPLE PILE TRESTLES ARE USED EXTENSIVELY IN MILITARY WORK

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SUSPENSION BRIDGES ARE BEST FOR CLEAR SPANS EXCEEDING 50 FEET

[*Next week—"Field Fortifications," including trenches, bombproof shelters, tunnels for subterranean attack, barbed-wire entanglements and other forms of obstacles.* —Editor.]

WATER COMPANY METER ADVERTISING in Terre Haute, Ind., is being carried on extensively since the readjustment of rates by the Public Service Commission. One of the recent newspaper advertisements showed a pyramid of 2½-gal. buckets of water with the caption "Forty buckets—pure filtered water—2 cents. Monthly minimum—60 cents for 3000 gal. Can you afford to pump and carry forty buckets of water for 2 cents?" To promote the use of meters a series of six anticipated questions are answered in literature distributed to prospects. Another set of twelve questions and answers was sent to 2200 customers whose services the directors decided to meter. These consumers had sprinkling connections, washed automobiles, used water in stables or kept boarders. Meters, set at the curb, are being put in free by company gangs working from house to house.

Letters to the Editor

Comment on matters of interest to engineers and contractors will be welcomed

Urges Pressure on Congress for Real Military Legislation

SIR: Engineers everywhere appear to be fully awake to the needs of this country for defense and to be anxious to equip themselves for their part in a general scheme of mobilizing the country's human and material resources for this purpose. It seems to the writer, however, that engineers and others are failing tragically to put proper emphasis on the necessity for the most vigorous organized activity in spreading their knowledge and beliefs, and urging upon Congress the principles which, judging from the spontaneous applause at the military lectures for engineers, are unanimously concurred in as a basis for preparedness. The more important of these principles, as the writer interprets them, are as follows:

(1) A large navy and an adequate standing army.

(2) Universal compulsory training for all males, beginning with athletics and use of rifle for boys, and broadening to include formal military training for youths and young men; no subsidy of, or reliance on, militia and volunteers for national defense.

(3) Defense plans to have the approval of our military experts. These plans should not be the products of presumptuous amateurs.

(4) Organization of all industries, means of transportation and communication and creation and safeguarding of supplies of chemicals and special steel alloys without which ammunition and armor cannot be made, and for which the country is now largely dependent on hand to mouth import.

Engineers may cheer these principles and study and drill and go to Plattsburg until they are gray, but they might as well be on Mars for all the impression they will make on legislation by these actions alone. Engineers are not politically significant; one ward leader in city politics might easily wield more influence on the vote in Congress than all the engineers who attend lectures in New York unless engineers organize to spread and enforce their beliefs.

The same is true in nearly equal measure of the half dozen or more security societies. The mail is so full of circulars of different societies calling for subscriptions of amounts of $1 to $1,000 that the ordinary recipient becomes confused and throws the documents into the waste basket. In the opinion of the writer these organizations should be combined or federated, and should pursue a campaign as vigorous as will the two national parties in the coming presidential election. Some political managers are needed, and engineers as well as others should consider it more important to assist the political propaganda than even to train themselves at the present time.

Those who read the doings of Congress know that there is no military bill in likelihood of present consideration, not to speak of enactment, that begins to comply with the principles which engineers apparently accept as indispensable. Unless the people at large can be convinced of the correctness of these principles, and Congress made aware of it, other more articulate ideas will prevail, the present interest in defense will wane—barring war—the opportunity to pass a broad unbiased scheme will be lost, and the nation will settle down again to slackness, and all the training of engineers come to nought.

THOMAS H. WIGGIN.

New York City.

Do Wooden Piles Fail?

SIR: Within the experience of the writer, covering a period of upwards of thirty years, he has never known or heard of an instance of wooden piles in building foundations failing, due to deterioration, if they were entirely below the soil. Will you kindly take the question up in the columns of the Engineering Record for the purpose of obtaining information on the subject.

ROBERT J. REIDPATH & SON.
Buffalo, N. Y.

Unbiased Specifications for City Pavements Wanted

SIR: I wish to second the motion, made editorially in your issue of Jan. 29, for a committee of the American Society of Civil Engineers to investigate pavements and to draw up specifications therefor. Millions of dollars are being spent annually in the construction or reconstruction of city pavements. Much of this work is being done to-day on the basis of specifications prepared by manufacturers interested in promoting the use of various classes of materials. While these manufacturers are, of course, interested in securing the best results for their respective materials, there are many questions on which they are precluded from rendering an expert opinion because of their special bias.

In this city I have been endeavoring to devote as much time as possible under existing conditions to studies looking to the improvement of paving methods, and I believe have secured some results which are of value. I should welcome most heartily, however, such an investigation by a trained and competent body of engineers. Such a body should be furnished with the means to make their studies thorough and complete.

I trust that some action may be taken in the near future by the American Society of Civil Engineers looking to the appointment of such a committee. There are undoubtedly many other topics which might be investigated, but I believe the one which you have mentioned is of such large importance that the work should be begun as speedily as possible.

A. H. DIMOCK,
Seattle. City Engineer.

Decimals of the Degree and the Quadrant as a Unit

SIR: I have been expecting to see some one come forward with the following suggestion: Adopt the quadrant or right angle as our unit of measurement of the difference of direction between two lines; then divide that decimally. This seems to be a logical method, for we now use the right angle loosely as a unit and 1/100 of a right angle would be about the same size as our present degree.

Any convenient symbol could be adopted for the right angle unit, such as *R*, although there is no real need of any symbol at all. The numerical value will have one figure to the left of the decimal point as a characteristic indicating in which quadrant the angle falls. Furthermore, there is no reason why the common fraction cannot be used. Assuming, for the time being, that *R* is adopted as the symbol of the right angle unit, 30 deg. appears as 0.3333 *R;* 108 deg. as 1.200 *R;* and 198 deg. as 2.200 *R*, etc.

It may be offered in objection that seven or eight decimal places are necessary to indicate seconds, but this could be no worse than giving an angle in degrees, minutes and seconds and then trailing along with several decimals of seconds. If desired, the number of decimal places could be reduced by two by taking 1/100 of a right angle as the unit, just as the centimeter is used as a unit of measurement.

EDWARD M. WALKER,
Secretary-Treasurer, Detroit Engineering Society.
Detroit.

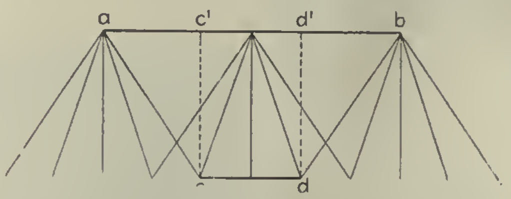
Distribution of Vertical Pressure Through Sand

SIR: The following comment is pertinent to the interesting article by Professor Enger of the University of Illinois on "High Unit Pressures Found in Experiments on the Distribution of Vertical Loading through Sand," published in the Engineering Record of Jan. 22, page 106.

The work done at the Pennsylvania State College Engineering Experiment Station was under Prof. R. B. Fehr, who is the author of the following statement:

Professor Enger's experiments on the relation between the loading and weighing area give very interesting data, which unpublished experiments here corroborate in a general way.

The accompanying diagram explains why the unit pressure of the smaller weighing area may be greater than that of the loading area. Each point in the loading area *ab* may be considered as a center from which extend diverging lines of pressure through the earth, according to our common knowledge of the distribution of earth pressure. It is, therefore, reasonable to suppose that in the case of an earth fill of only 6-in. thickness which would transmit a high percentage of the applied load, a smaller area lying directly under the load would receive not only its share of the lines of pressure from the projected area overhead *c'd'*, but some additional lines of pressure from the area *ac'* and *d'b*.



For measuring the percentage of load transmitted to a co-axial area below, circular loading and weighing areas are theoretically preferred. Practically, however, the writer's tests indicate that the shape of these areas does not cause any material difference in the percentage transmitted so long as they are of the same shape and size. For simplicity of construction and ease in varying the size of the opening in the floor of the test box, the square was adopted in the Pennsylvania State College tests.

Undoubtedly the best method for obtaining accurate data on the distribution of vertical pressure would be to vary the size of the lower circular area and to obtain the variation of vertical pressure by the method of differences. By this method of co-axial conical frusta one could readily obtain the integral effect of the vertical pressure on concentric circles, and the distribution of the vertical unit pressure would then be a matter of simple calculation. This method, however, would entail considerable time and expense, and since the simpler method of varying the position of the loading area back and forth appeared to give consistent results, which would be of practical use, the latter was adopted by the Pennsylvania State College Engineering Experiment Station.

Finally, it is desired to call attention to the superposed curves of Professor Enger's Figs. 3 and 4. It must be kept in mind that these curves are not comparable, as they represent the results of two different ratios of loading and weighing areas. Objection is made to Professor Enger's statement that the "Pennsylvania experiments have one inconsistency in common with those of Illinois—the sum of the upward pressures under a 6-in. layer of sand exceeds the sum of the applied load and weight of the sand." In the Pennsylvania experiments the pressure due to weight of the sand was practically eliminated by taking an initial dead-load reading of the scale. The values obtained are therefore percentages of transmission of the external live load only.

Furthermore, an error was made by Professor Enger in transposing the curve for the 6-in. depth from the Engineering Record of March 13, 1915, page 330. For example, at 12 in. from the center the per cent transmission should be only 5, whereas he shows it to be 13. The original data for the 6-in. depth of sand indicates that the pressure is transmitted to a point about 52 in. from the center of the loaded area. The average percentage transmission over this span of 104 in. amounts to 11.9, which, multiplied by 8 2/3 ft., gives a total vertical pressure of 103.2 per cent of the applied load. Experimental errors in this kind of work are necessarily of such magnitude that this excess, 3.2 per cent, should not be regarded as an inconsistency.

R. L. SACKETT,
Dean of Engineering and Director of Engineering Experiment Station, Pennsylvania State College,
State College, Pa.

[The foregoing letter was submitted to Professor Enger, whose reply follows.—EDITOR.]

SIR: An error was made in transposing the curve representing the Pennsylvania experiments for the 6-in. layer of sand, as was stated by Professor Fehr. Because of the scale of the drawing the correction causes a very small change in the appearance of the curve.

Professor Fehr's calculation of the upward pressure under the 6-in. layer of sand seems to be in error. He does not state how the average transmission of pressure of 11.9 per cent was obtained, but this figure seems to represent the average height of the curve for the 6-in. depth of sand published in the Engineering Record of March 13, 1915, page 330. Dividing the area of the base by a series of concentric circles 1 in. apart and using the average pressures from the curve, it can be shown that the upward pressure as given by the Pennsylvania experiments exceeds the applied load by more than 40 per cent. The upward pressure within 10 in. of the axis of the applied load is equal to the applied load.

The fact that pressure was measured on the plug when it was 52 in. from the center of the applied load indicates that the floor of the box carrying the sand deflected, thus throwing a load on the more rigidly supported plug. Experiments made at the University of Illinois, in which three forms of measuring devices were used, have never indicated vertical pressure much outside of a line drawn downward on a 1:2 slope from the edge of the loaded area.

MELVIN L. ENGER,
Assistant Professor of Mechanics and Hydraulics, University of Illinois.
Urbana, Ill.

HINTS FOR THE CONTRACTOR

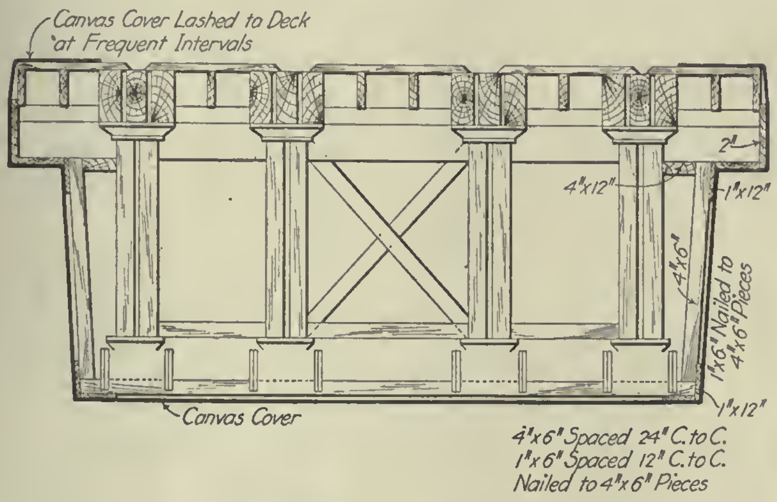
Details Which Save Time and Labor on Construction Work

Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

[*Contributions to this section are solicited, and if found available will be paid for. They must be* SHORT, *and should be accompanied, if possible, by photographs or sketches.*—EDITOR.]

Canvas Over Timber Frame Converts Ferry Apron Into Ponton

USING 7000 ft. b.m. of timber and a huge sheet of canvas, the 110-ton ferry apron shown in the accompanying illustrations was converted into a ponton by U. S. Army engineers and transferred a mile and a half to a new location at Humboldt Bay, Cal. The apron had been used for transferring cars loaded with fill for rebuilding the south jetty at the entrance to the bay, and was, with the rest of the construction plant and buildings, transferred across the entrance on the completion of the south jetty for use in rebuilding the north one. The entire moving operations are described by George F. Whittemore, junior engineer, in *Professional Memoirs* for March-April, 1916.



SECTION THROUGH APRON SHOWING CANVAS COVER

FERRY APRON WEIGHING 110 TONS WAS TRANSFERRED TO NEW SITE AT 2 PER CENT OF ITS COST BY MAKING A PONTON OF IT WITH THE AID OF HUGE SHEET OF CANVAS STRETCHED OVER TIMBER FRAME

The apron weighed 67 tons submerged, and had to be moved to place endwise between the foundations for the counterweight towers for its outer end, already constructed at the new location. The problem of moving the apron and supporting it until the counterweight towers could be transferred was solved by the scheme described, which was devised by Lieut.-Col. Thomas H. Rees, engineer officer in charge of the district.

The canvas, No. 6 duck, was made into one piece, 48 x 120 ft., one side of which was treated with two coats of hot paraffine to make it more watertight. The wooden frame built around and under the apron to support this canvas consisted of 4 x 6-in. ribs on which were nailed 1 x 6-in. strips. The ribs were spiked to 4 x 12-in. timbers, which in turn were spiked to the needle beams of the ferry apron. This frame was built at odd intervals because of the tides and the fact that the apron was being used to unload stone cars. The work began June 19 last, and was finished by July 24, on which day the apron was raised clear of the water, a heavy accumulation of seaweed removed from it, and the canvas put on. The canvas was rolled up longitudinally on the deck of the apron, one end tied to the deck and the pulling end made fast to a raft of old timbers. The raft, which served to keep the canvas up and the water out, was then drawn under the apron by a launch and three rowboats, carrying the canvas to place with it. When the edges of the canvas had been firmly tied to the upper deck, the apron was unfastened at the shore end and anchored to the wharf and to deadmen on the beach. Meanwhile, a 20-ton crane had been loaded on a barge to handle the counterweights and towers. On July 26, after the holding-back frame had been removed to the new approach, all water was taken out of the ponton with two hand pumps. The leakage through the canvas was small. When the apron floated as the cables were unclamped from the arch just before starting, a 6-in. hole was torn in the canvas at the outer end. This leak was quickly stopped by throwing an emergency sheet of canvas over it. The ponton was then shoved out carefully by hand from between the towers and made fast to a barge on each side. Though it was thought that the apron could not sink in any case with this arrangement, an airtight oil barrel was attached to each of the four corners by 50 ft. of cable, so that if the craft met with an accident its location and raising would be easier. Two tugs towed the outfit to the new site across the channel, which was roughened by a high northwest wind. The apron rode high, drawing only 3 ft. 10 in., and chaffed badly along the sides. Although rope fenders were plentifully used, several small holes were made in the canvas above the water line. It took 50 minutes to tow the apron across and 10 minutes at each end to shove it out and to place it between the towers.

After the apron was clear of the old towers, these were dismantled and landed on the crane barge, by which they were taken across and re-erected at the new site. This work was completed by July 30, when the apron was again suspended from its hinge and cables, and the canvas cover removed. The total cost of making the move was $1,330.28, which represented about 2 per cent of the original cost of the apron.

Lead Wires Measure Clearance in Adjusting Big Pump Bearings

By GEORGE B. MASSEY

Consulting Engineer, Chicago, Ill.

LEAD wires may be used to great advantage in adjusting the clearance for brasses on large bearings under heavy load. The bearings to which this method is most applicable on construction work are those of the main engines on hydraulic dredges, as other steam engines used in excavation work are usually of a rugged, steam-eating type with cranks set on the quarter, so as to avoid being caught on the dead center. In countries where coal is dear and labor is cheap, engineers are astonished at the amount of coal burned on American excavating machines, and would seem to prefer using less coal, at the expense of simplicity in construction and freedom from engine delays. The large engine on the standard American hydraulic dredge employed to drive the centrifugal pump, which ordinarily has a 20-in. discharge, is, however, usually of the vertical marine type, using steam economically by triple expansion, and exhausting into a marine-type surface condenser. On account of the large size of these engines—from 600 to 1000 hp.—there are large pressures to deal with on bearing and rod brasses. The cutoff on the high pressure is adjustable, and the same is often the case with the intermediate, so that the pressures on the bearings are apt to vary when working under different conditions. There are also bypasses to admit high-pressure steam into the intermediate and low-pressure cylinders. The adjustment of the bearing brasses throughout becomes a vital matter in the uninterrupted use of such an engine. As assistant engineer in the United States Navy, the writer made use of the navy method of adjusting large bearings, which can be employed on hydraulic dredges to insure continuity of bearing adjustments, independent of the coming and going of engineers.

The method employed is to take off the bearing caps and lay over the journal three strips of 1/16-in. lead wire parallel to each other, one at each end of the journal and one at the middle. The caps are then pulled down hard on the liners and the positions of the nuts tentatively marked. Taking off the caps, the wires are found to have been flattened, some at the top of the journal and more so at the sides. The thickness of the three wires is measured with a micrometer caliper. If the thickness is too great, the proper thickness of liners is removed and the same operation repeated until the wire thickness at the top of the journal is exactly right. The rule for the thickness of the lead wire is that it should show one-thousandth of an inch for each inch of diameter of the journal, where forced lubrication is used, but where wick feed is used, the clearance runs up to two-thousandths of an inch for each inch of diameter. Practice will show that for most shafts the proper clearance will lie between these two extremes, and by taking about 1 1/3 the diameter of the shaft expressed in thousandths good results should be had. For example, 0.012 is the proper thickness for a 9-in. shaft. This method is much more reliable than keeping tab on the liners, as they should vary with use. It also checks up on the alignment and substitutes a system for personal practice.

Dropping the Bucket to Unwind Worn Dragline Cable

AN EXCEEDINGLY simple kink which it is possible may not have occurred to many dragline operators is described by J. W. Knott in the *Excavating Engineer.* The drums on a large dragline engine do not roll easily by hand, and, especially if the fricton is tight, a bar must be used in taking off worn dragline cables unless the engine is a reversing one. Mr. Knott's solution is to hoist the bucket as high as it will go, throw in the dragline clutch and drop the bucket. This, of course, reverses the dragline drum, as well as the hoisting drum, and unwraps the dragline at a rapid rate. By repeating the operation two or three times, the old cable can be readily taken off.

Light, Strong Gin Pole Built Up of One-Inch Lumber

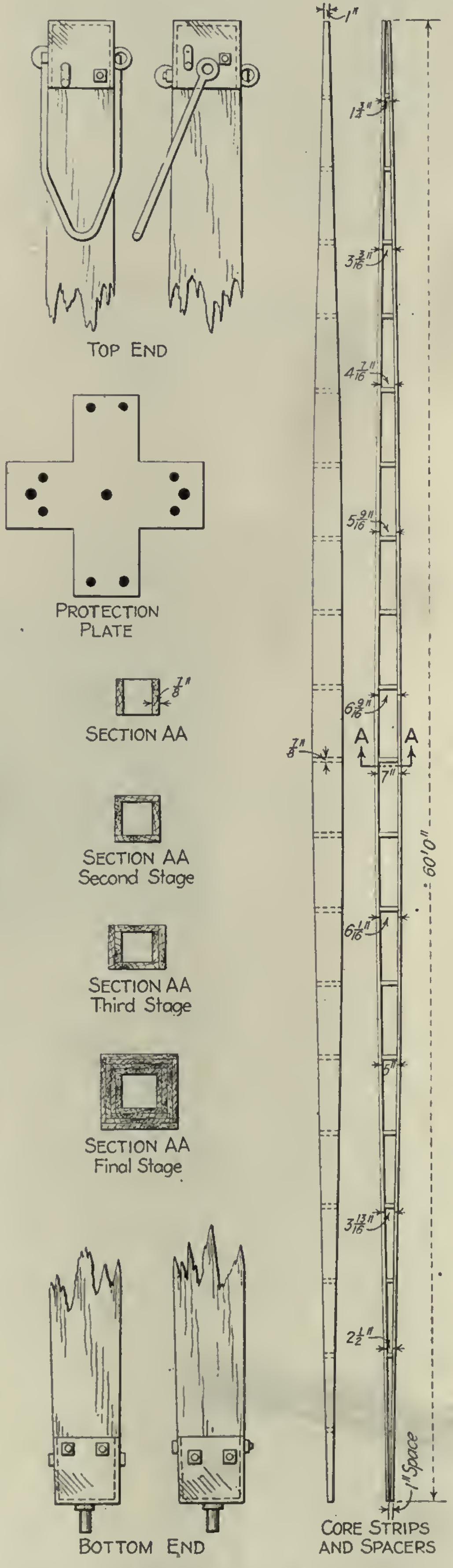
By MAX J. WELCH
New York City

FOR WORK in isolated localities the built-up gin pole illustrated in the accompanying drawing has been found very useful by contractors in the Rocky Mountain states. One of these poles, built five years ago by the writer, is still doing service in Colorado, having handled a great variety of loads on light erection work. Both Euler's and Rankine's formulas give the 60-ft. pole shown a safe loading in excess of 2 tons. The taper of the core was, however, figured by moments, which makes it evident that the same construction with different end connections would be an economical one for a derrick boom.

The core is made by nailing 7/8-in. boards in 20-ft. lengths to a series of square spacing blocks on 3-ft. centers, ranging from 1¾ in. square 3 ft. from the ends to 7 in. square in the center. The boards are then trimmed to a taper corresponding to the size of the blocks. Next, more boards are nailed in the same way to the open sides of this core, taking care to break joints with the first. These are also trimmed to the proper taper. This process is repeated until a thickness of four boards on all sides of the central hollow space is reached. The finished pole is then 14 in. square at the center and 8 in. square at the ends. Nailing should be thorough, using 8d nails for edge nailing and core blocks, 4d nails for two thicknesses of boards, 7d for three thicknesses and 10d for four thicknesses.

The ends of the pole are secured by ¼-in. steel plate. At the top eye bolts are provided for attaching the guys, while a steady pin may be fitted to the bottom.

This pole, which is practically equal in strength as a column to a 14 x 14-in. timber of the same length, weighs but little more than half as much. One can be built in a short time, and will pay for the increased labor cost over a single stick, even where the latter can be readily provided.



BUILT-UP POLE EASILY HANDLED AND STRONG AS TIMBER TWICE ITS WEIGHT

Back of Dam Coated by Cement Gun from Raft as Pool Rises

AS THE POOL rises behind the Elephant Butte dam waterproofing is being applied to its upstream face in horizontal strips 10 ft. high with a cement gun operated from a raft. The method was described in the March issue of the *Reclamation Record.*

The upstream face of the Elephant Butte Dam is being waterproofed with Portland cement mortar mixed in the proportion of one part cement to two parts sand and applied with a cement gun in a coating about 1 in. thick. Advantage has been taken of rising water in the reservoir to work from rafts specially constructed for the purpose. There are two of these, each 9 x 13 ft., made of planking on a framework laid on and attached to 16 oil barrels. One raft contains the machine, operator and helpers, small mixing box and a few sacks of cement and sand, while the other is loaded with cement and sand.

The coating is applied in horizontal strips about 10 ft. high and the length of the dam at water level. The surface is first cleaned thoroughly with scrapers and wire brushes and is then gone over with a sandblast, using coarse sand, passed through the machine to obtain the necessary pressure. This roughens the surface sufficiently to cause the mortar to adhere to it. The surface is then thoroughly moistened with a hose and the mortar immediately applied. The mortar is put on in four layers, each about one-fourth inch in thickness. It was found that a thicker coat than this applied on a vertical wall, without reinforcement, would, on account of its weight, slough off before setting. Each layer follows the preceding one before it has attained its final set, and so far there is no indication of a parting of the layers. Numerous samples taken from the face showed perfect adhesion to the concrete, it being impossible in every case to break the mortar from the concrete at the line of contact. The cost per square foot for the first 100,000 sq. ft. of this coating was 7.9 cents, including overhead and depreciation.

REINFORCEMENTS OF WOOD POLES with steel channels has proved to be very satisfactory for special terminal poles in the 15,000-volt transmission line of the Pacific Light & Power Corporation used by the Pacific Electric Railway near Los Angeles, Cal. Extra heavy wood poles 55 ft. long with top diameter not less than 9 in. were reinforced by two 6-in., 8-lb. channels, one on each strain side, with the channel flanges turned in, and extending the full length of the pole, connected by through ¾-in. bolts on 24-in. and 12-in. centers.

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

Track Elevation in Indianapolis This Year Will Cost $1,500,000

The program of track elevation work in Indianapolis this year will cost $1,500,000, it has just been announced. Pierce J. Landers, the new superintendent and chief engineer of the Indianapolis Union Railway Company, in company with B. J. T. Jeup, city engineer, has supervision of the general elevation project. The entire cost of the scheme will be $4,000,000.

Actual elevation of five tracks at the Union Station will begin late in March, according to the announcement. The elevation of the tracks between Capital Avenue and Meridian Street is contemplated before the close of the present year. In addition other preliminary work will be done so that early in 1917 the work can be pushed forward. The last link of the proposed elevation scheme is to be completed in 1918.

Plans now are being devised to allow the elevation work to go forward with the least possible hindrance to traffic. The first step in the plan is completed. This was the inclosure of Pogue's Run in a concrete conduit. The necessary concrete and steel footings to carry the elevated tracks at points of intersection were provided in connection with that work.

The construction of footings between Capitol Avenue and Meridian Street will be the first steps in the program for this year. The erection of the steel structure, now being planned to carry the tracks, with other steps involved, probably will run far into next winter. Actual changes in the present train sheds probably will come next year. The present sheds will be divided into halves, the south portion being elevated first. The north half will follow, and then the general elevation scheme will be continued eastward from Meridian Street toward Massachusetts Avenue, which will be the terminus of that part of the elevation plan. The old Illinois Street tunnel, under the present tracks at the Union Station, will be closed by the masonry work for one of the steel piers.

The actual bridge work of the elevation will appear only through the train sheds from Capitol Avenue to Meridian Street, and over the various street crossings from the latter street to Massachusetts Avenue. Between these street crossings a fill inclosed in concrete walls will be made, and the tracks thus elevated. Mr. Landers estimates that 10,000 carloads of fill material will be needed.

Engineers who have been designing the various phases of the work have provided for an archway where Illinois Street will pass beneath the tracks. This archway will be installed with an exterior facing of white glazed material. At the present time 21,726 tons of structural steel have been contracted for. The contract for the erection of the steel work will be let some time in May.

Denver Water Tangle Progresses Toward Municipal Ownership

Municipal ownership for the Denver waterworks appears nearer than for some time past, the Denver Union Water Company having recently given an option to the city officials and the Public Utility Commission to sell the plant at the "Chinn" valuation, subject to change by the Supreme Court. It will be two years before the city could take over the plant, even though the people vote favorably on the proposal to make the purchase. In view of these developments, bonds and stock of the company advanced during the first days of March.

Further, in a decision of the Wheeler-Lusk case, relative to the validity of the $8,000,000 bond issue for building a water plant, the U. S. Circuit Court of Appeals held the issue valid, although it stated in no uncertain terms that the issue was too small and that the duty of the Public Utility Commission and the city was to go back to the electors for authority to issue additional bonds. The court stated, however, that it had no power to compel such action.

Many Bidders at Vermilion County Highways Letting

Contractors from seventeen states, from Washington to New York and from Illinois to Louisiana, attended the lettings at Danville, Ill., March 14-16, for 170 miles brick and concrete roads in Vermilion County. A total of 220 contracts obtained specifications.

Many sand and gravel companies, and about 30 concrete road equipment companies had representatives at the lettings. Hotel scenes resembled those at the big road conventions.

Though, in some cases, the prices bid showed large differences between the totals of the high and low bidders the bidding was in general quite close.

To Offer Prizes for Designs of Workmen's Houses

The National Americanization Committee is offering prizes aggregating $1800 for plans, sketches, grouping and arrangements for small workmen's houses. This is part of the broad plans of the committee, which is endeavoring to secure the adoption of American standards by immigrants as rapidly as possible. A competition for designs for satisfactory substitutes for derailed freight cars now used to house construction gangs on railways is also part of the program.

The prizes are divided into two groups. The first covers plans for the housing of workmen in industrial communities not exceeding a population of 35,000. Entries in this class include plans for (1) single family houses, (2) combined family and lodging houses, which will permit separation of the families from the lodgers; and (3) boarding houses or community dwellings for numbers of single men or of single women. The prizes in this group are $1,000 for the first, $500 for the second, and $100 each for the third, fourth and fifth.

The prizes in the second group—covering substitutes for old cars now used by railway construction gangs—are $300, $200 and $100 for the first, second and third respectively.

The competition is open to engineers, architects and anyone interested in the subject. Details regarding it may be secured by addressing the committee at 20 West 34th Street, New York City.

Panama Canal to Be Open for Ships of 30-Ft. Draft, April 15

According to a cablegram received from Lieut.-Col. Chester Harding, Corps of Engineers, U. S. A., acting Governor of the Panama Canal, the canal will be open to ships of 30-ft. draft, April 15. The full text of the message is as follows:

"Conditions in Gaillard cut justify predictions that the canal will be available for ships of 30 ft. draft on April 15, subject to probable temporary delays thereafter to meet exigencies of dredging fleet in completing canal to full width and depth and in removing shoals that may possible develop."

U. S. Army Engineers Build Ponton Bridge in 14½ Minutes

Engineers who have been attending the weekly military lectures at the Engineering Societies Building, New York City, have been told repeatedly by the speakers that speed is the all-important factor in field work with an army. This statement was reduced to definite terms on Monday night when Capt. Stuart C. Godfrey, Corps of Engineers, U. S. Army, described how a ponton bridge of seven 20-ft. bays was constructed over a stream near Fort Leavenworth, Kan., in the remarkable time of 14½ min.

Following introductory remarks by Colonel Lucas of the 22nd Corps of Engineers, New York National Guard, Captain Godfrey discussed the subject of military roads, bridges and ferries. Road maintenance, rather than road building, is the chief concern of the army man, although occasions may arise when new traffic routes must be built. In new work the army engineer can use greater latitude in locating his road, and is justified in employing steeper grades, than the engineer in civil practice.

When streams must be crossed by armies the first thing for the engineer officer to do is to reconnoiter for a ford which will obviate the necessity of a bridge. For infantry, a depth of water of 3 or 4 ft. is about the limit, but cavalry can negotiate fords a foot or so deeper.

If no ford is available a bridge must be built. Captain Godfrey illustrated a large assortment of bridge types, including pontons, trestles, trusses and suspension bridges. The ponton train, he said, should not be used promiscuously, but should be held for a real emergency. In the United States service the wooden ponton boat is the standard type, but some of the European armies favor a metal boat. The Germans have employed an aluminum ponton.

Captain Godfrey concluded his address with a detailed account of the methods of military instruction in engineering practice at the United States Military Academy at West Point.

To Make Typhoid Elimination Survey of Indiana Summer Resorts

In a movement that will continue through several years in an effort to completely eradicate typhoid fever conditions at summer resorts on Indiana lakes and rivers, which have grown rapidly into prominence during recent years, the Indiana State Board of Health, through Dr. John N. Hurty, State health commissioner, has announced that the water department of the state board will conduct a sanitary survey of the resorts. Measures, looking toward better sanitation in many ways, including sewage disposal, proper construction of buildings, etc., will be taken by the state board, it is understood, wherever conditions warrant.

Michigan Agricultural Buildings Destroyed by Fire

The entire group of engineering buildings at the Michigan Agricultural College were destroyed by fire March 5. The loss is estimated at about $240,000 and the cause of the fire is unknown. Plans have been adopted for immediate reconstruction and classes have been re-established with practically no interruption. The most serious loss, it is reported, is that of records, notes and libraries of the teaching staff.

Chicago Issues New Rules for Sewer Trenching

Utilities in the space to be occupied by sewers in Chicago are subject to new rules recently put out in standard specifications by the board of local improvements of that city. The principal features of interest to contractors relate to trenches dug by excavating machines and are as follows:

Utilities in the way of trench machines of the steam-shovel type used to excavate for a sewer 3 ft. in diameter, or larger, must be removed and replaced without expense to the contractor. This diameter is reduced to 24 in. when machines of the endless-belt type are used. Below 24 in. the utility must be left in place and maintained at the expense of the contractor. Utility companies must take care of their lines when rock is to be blasted, provided five days' notice is given.

Where sewer trenches are excavated without the use of excavating machinery, except in rock, all utilities will be left in place and maintained at the expense of the contractor. A predetermined price per cubic foot of excavation, varying from 2 to 7 cents for depths from 6 to 24 ft., has been worked out for cases when the board deems it inadvisable to remove a utility.

In paved streets utility companies must replace disturbed pavement areas outside the limit of the sewer trench. The trench is defined as being the internal diameter plus 3 ft., when the wall of the sewer is 3 in. or less; 4 ft., when 6 in. and more than 3 in.; 5 ft., when 10 in. and more than 6 in.; 6 ft., when 16 in. and more than 10 in., and 7 ft. when the walls exceed 16 in.

Service lines, except water services, to buildings, must be removed without expense to the contractor on 48 hours notice, when excavating machines are used, also all interfering aerial equipment must be removed or altered. The latter, however, will not be removed to accommodate backfilling machinery, except at the expense of the contractor. Somewhat similar rules are in effect with reference to water mains.

Propose Drainage Section of Illinois Society of Engineers

Expansion of the work of the Illinois Society of Engineers to take care of drainage and levee interests by the establishment of a branch or section to include laymen as well as engineers, was the significant recommendation of the Drainage Conference held at the University of Illinois March 8, 9 and 10. The officers of the Illinois Society concurred in the action and it is likely that the formation of another engineers' organization has been averted.

More than seventy-five persons were registered at the conference; engineers, contractors, lawyers, levee and drainage commissioners and farmers. Most of the papers were not highly technical, but for the first time the Illinois engineer met the farmer in open conference and learned that the financial outcome of the whole proposition depends on the proper solution of the problems of soil texture and fertility of drained lands.

Paul Hansen, engineer of State Board of Health, outlined the relation of drainage to public health and stated that the functions of the new division of the board would be to approve and disapprove sewerage plans before contracts are awarded. The Rivers and Lakes Commission will, upon request only, review plans for drainage and levee works. Mr. Hansen gave a detailed description of the Mill Creek drainage improvement of overflow lands south of Louisville, where an expenditure of $390,000 increased land values to $3,000,000.

The paper by Jacob A. Harmon of Peoria, on "Organizing and Financing Drainage Districts," put into succinct form the methods used in the Middle West.

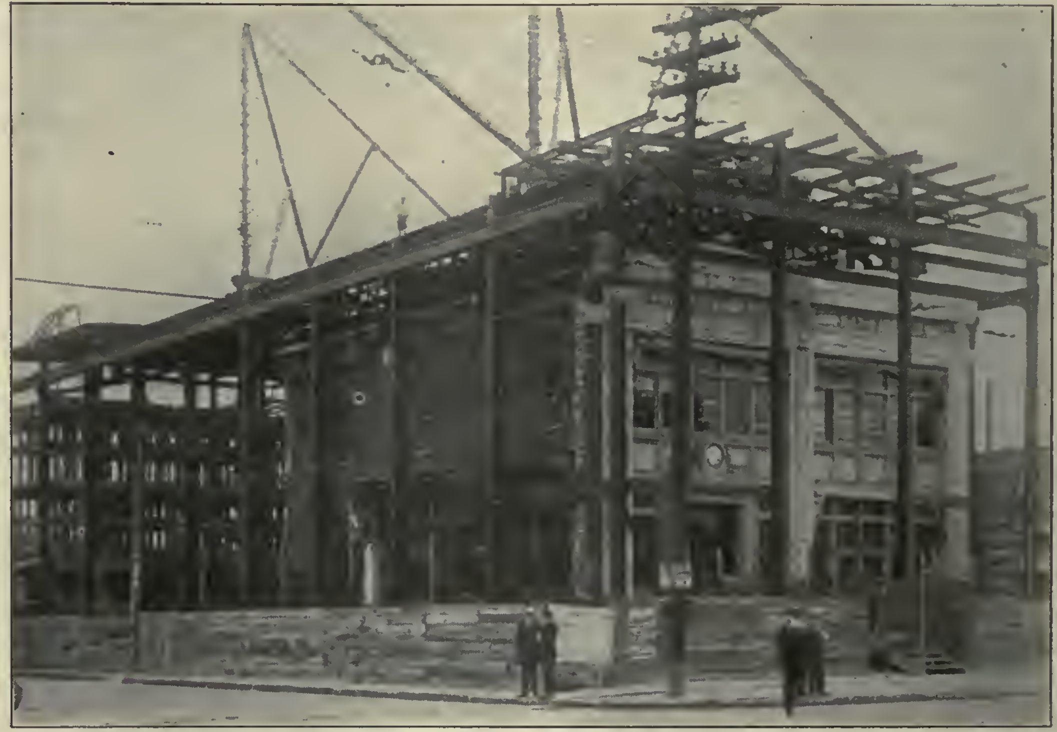
Prof. C. G. Hopkins, of the University of Illinois, rather startled his audience by his statements that many drainage propositions were foredoomed to failure because the lands, when drained, had not the chemical elements to produce crops. Settlement of muck in the Everglades, he claimed, might be as much as the proposed lowering of the water levels, in which case the land would be valueless. He stated further that a certain 600,000-acre drainage project extremely deficient in potassium, was being sold off. The real estate agents, in burning the timber and brush, release enough potassium for two or three crops and the land then becomes worthless. The unwise drainage and irrigation of unfertile areas should be guarded against in every possible way.

Prof. J. T. Stewart, of the University of Minnesota, stated that the time is fast disappearing when the engineer is told by the drainage commissioner where to locate his ditches and how deep to make them.

William A. O'Brien, of Cape Girardeau, Mo., in his talk on "Specifications for Drainage Districts," gave many valuable hints as to how to draw up specifications to fit the type of machinery to be used and thereby get economical results.

Prof. J. G. Mosier, of the University of Illinois, presented a paper on "The Relation of Drainage to Soil Texture," in which he brought out some points on the reasons why acid soils are hard to drain and why limestone increases percolation.

The university authorities were urged to consider another conference or short course for the diffusion of information on draining and flood protection.



DETROIT BANK ERECTS NEW STEEL-FRAME HOME AROUND OLD BUILDING
Old building on smaller plot was occupied until rear of new structure was ready for use, when quarters were moved, old bank was wrecked within the new building and latter was finished.

Engineers Suggest Reservoirs for Controlling Rio Grande River

Study of the problem of controlling the flow of the Rio Grande River and compelling its channel which forms part of the border between Mexico and the United States to remain unchanged, has resulted in the conclusion on the part of engineers familiar with conditions that reservoirs will best serve the purpose.

Col. C. S. Riche, of the government engineering forces at Galveston, after a study of the project reported as follows:

"The opinion seems to be general among the engineers and others of long experience with the Rio Grande, that reservoirs to control flood water in the tributaries will control the flow in the Rio Grande so that its variability will be almost unnoticeable, and the water can be supplied for irrigation at any time it is needed. Reservoirs would thus serve a double purpose.

Regulation and control of the river by open channel methods would only serve the single purpose of control of its variability of channel, nor is it likely that the river can be controlled by open channel methods at any reasonable cost."

E. B. Gore, of the Texas Board of Water Engineers, believes five impounding dams necessary. He would locate these dams on the Rio Grande, above the Pecos River and below the Conchos on the Pecos, on Devil's River, on the Rio Salado and on the Rio San Juan. This would insure ample water supply for 2,000,000 acres and develop not less than 80,000 hp. He claims that it is possible to develop 300,000 hp. with additional works.

John Wilson, also of the Texas Board of Water Engineers, concurs in the opinion expressed by Mr. Gore, while Clint Kearney, who helped build the Medina dam near San Antonio, recommends: (1) The construction of storage reservoirs to control and equalize the flow of the streams; (2) the installation of hydroelectric power plants, and the transmission of this power to San Antonio and other points; (3) the use of the water afterward for irrigation purposes.

The government has just issued a pamphlet on the Rio Grande question, which contains the opinions of Dan C. Kingman, formerly chief of engineers of the U. S. Army, and Col. W. W Harts of the U. S. Army together with detailed reports from the engineers just quoted.

Philadelphia Office of Concrete Institute Discontinued

The office of the American Concrete Institute, Philadelphia, has been permanently discontinued. Until further notice all business will be handled from the office of Leonard C. Wason, president of the institute, 27 School Street, Boston. This step was decided upon at the convention held Feb. 14-17, during the Cement Show at Chicago.

Canadian and International Good Roads Congress at Winnipeg in 1917

At a meeting of the Dominion Good Roads Association recently held at Montreal, it was decided to hold the 1917 convention of the Canadian and International Good Roads Congress at Winnipeg.

North Dakota Engineers' Society Meets at Grand Forks

The North Dakota Society of Engineers held its annual meeting at Grand Forks, N. D., Feb. 24 and 25. At the session held at the State University reports were made by Prof. A. J. Becker and others in the engineering department of the State University and tests of concrete materials and aggregates found in the state, and also of the effect upon these of freezing and of exposure to flue gases. Special attention was given to the possibilities of North Dakota clays for the manufacture of drain-tile, paving-brick, sewer-pipe, stoneware and pottery. Some of the clays of the state were said to have remarkable value for such purposes, on account of their purity, or because they do not require blending, and in some localities, lignite coal for use in manufacturing is found adjacent to the clay beds. E. J. Babcock, director of the mining experiment station of the state, exhibited specimens of commercial size, and stated that there was no doubt that pottery manufactures and other similar industries would be established in the state within a short time, as those engaged in the industry have recently begun to awaken to local possibilities. The operation of the waterworks plan at Fargo was discussed, and its costs detailed.

The sewage disposal plant which will be installed at Minot during the coming season was discussed. The Society approved for publication a code of ethics, nearly identical with that adopted two years ago by the American Society of Civil Engineers, and will urge the passage by the next Legislature of an act for the granting of licenses to public land surveyors, which has been prepared by it. This act will affect only surveyors who make plans or plats for filing with registers of deeds and similar certificates, and those holding the office of county surveyor. If surveys do not affect the title or ownership of lands or the filing or recording of plats, and if the surveyor is not holding a public office or acting in a similar private capacity, license will not be required. The officers elected for the coming year are: President, J. W. Bliss, state engineer; first vice-president, J. A. Ingram; second vice-president, H. C. Frahm; secretary-treasurer, E. F. Chandler. The next annual meeting will be held at Bismarck, at the end of January, 1917, during the session of the Legislature.

Indianapolis May Have Municipal Purchasing Agent

Mayor Joseph E. Bell has arranged for the employment of a purchasing agent for all departments of the city of Indianapolis, and has announced that he will ask the next Legislature to make provision for the employment of such an official in the laws affecting the charter of the city.

Chicago and Milwaukee Have Typhoid Epidemics

Recent reports from Milwaukee indicate that the city is suffering from a typhoid epidemic of no small proportions. Seven deaths and thirty new cases were reported Feb. 28, making 175 cases due, it is held, to drinking water. The supply to city schools was shut off Feb. 25, when the increase of more than ten a day was announced.

In Chicago, in the district furnished from the Hyde Park crib, consumers were warned to boil the water following a flood of Jan. 21, which backed sewage into the Sixty-eighth Street pumping station as described in these columns Jan. 29. By Feb. 22, eighteen new cases developed in the district served despite the precautions issued immediately to boil the water. On Feb. 3, the health commissioner stated that the water was good, but he reiterated the advice to boil it, Feb. 17.

It is reported that the sterilization plant on the crib broke down from freezing pipes Jan. 11, and was not operated again until Feb. 15.

While the Chicago newspapers are carrying plenty of warning notices, the question is not discussed of the necessity of filtration in which a sterilization plant would be used only as an emergency or finishing process, for which it has so long been advocated.

Chicago's Oldest Surveyor Dies

Oldest Living Graduate of Harvard University, Who Died March 8

SAMUEL S. GREELEY

Samuel S. Greeley, the oldest surveyor of Chicago, and the oldest living graduate of Harvard University, died in Chicago, March 8, at the age of ninety-two. Following his graduation in 1844 he was rodman and chainman on the waterworks being built under E. S. Cheseborough to supply Boston from Lake Cochituate. He then took a degree from Rensselaer Polytechnic Institute in 1845 after which he was employed as engineer in railroad location and construction in New York, Vermont and Virginia. In 1851 he studied engineering in Paris and in 1853 returned to Chicago and started the land surveying business which he continued, with one short interval, until his withdrawal from active work with the Greeley-Howard-Norlin Company a few months ago. In 1855 he was elected city surveyor of Chicago. He saw the advantages of a wood-block pavement, laid the first Nicholson blocks in Chicago and afterward invented a block pavement which was used to a limited extent.

In the late sixties he became assistant superintendent of the Chicago, Burlington & Quincy Railroad, and, at the same time maintained his own private office. He, with four others, formed the Harvard Club of Chicago and was one of the early members of the Western Society of Engineers and the Illinois Society of Engineers. As a surveyor he located many of Chicago's most important buildings and laid out subdivisions which are now thickly populated parts of the city. In the early days he was concerned as expert witness in various important litigated cases in which Abraham Lincoln, Robert Ingersoll and other eminent lawyers were engaged. For many years prior to his death he ceased to do the more laborious work connected with his profession but continued, to give his time and attention to the business.

Even up to the last year of his life he was at his office daily and gave his associates the benefit of his counsel. He loved his work and was never happier than when engaged in it.

News of Engineering Societies

The Vermont Society of Engineers held its annual convention at Burlington March 9. Officers were elected as follows: President, H. M. McIntosh; vice-president, B. M. Hayward; secretary, G. A. Reed; treasurer, A. E. Winslow; director, F. W. Denison.

The Engineers' Club of Northeastern Pennsylvania, Scranton, heard a lecture on Thursday evening, March 16, by Captain Robert S. Thomas, Corps of Engineers, U. S. A., on the "Duties of a Military Engineer." This is one of a series of lectures scheduled by the preparedness committee of the club, headed by Capt. A. B. Dunning of Scranton as chairman.

The Municipal Engineers of the City of New York will hear Kingsley Martin, formerly commanding officer of the Second Battalion, Naval Militia, New York, on "Municipal Engineers and the Navy," and Ernest F. Robinson, captain of the Twenty-second Regiment, N. G. N. Y., on "Municipal Engineers and the Army" at a meeting to be held in New York City March 22.

The Western Society of Engineers was addressed March 13 by Malcolm Elliott, U. S. assistant engineer, Louisville, on "Large Modern Lock Gates." An innovation in the way of a brief review of the contents of the current issues of technical journals was presented by H. E. Hudson and W. W. DeBerard. Announcement has been made of future meetings as follows: March 20, "Panama Canal Slides," by Dean John F. Hayford; March 27, "Electric Vehicles," four fifteen-minute talks; April 3, "A Year's Operation of Panama Canal Locks," by Messrs. Clark and Whitehead; April 10, "Operating Machinery of Willamette River Bridge," by Byron Carter.

Personal Notes

FRANK H. ESCHRICH, formerly connected with the engineering force of the Delaware, Lackawanna & Western Railroad, has been appointed a layout engineer for the Samuel Austin & Son Company, constructing engineers, of Cleveland, on construction for the Hooker Electro Chemical Works of Niagara Falls, N. Y.

GEORGE K. PARSONS, consulting engineer, has located his main offices in the Equitable Building, 120 Broadway, New York City. Mr. Parsons also maintains offices in the Riggs Building, Washington, D. C.

ROSMAR S. DEVEREUX, formerly engaged in survey work in the Maine Woods on the Ripogenus Lake project for the Great Northern Paper Company, of Bangor, Me., has been appointed to a position in the repair and construction department of the civil engineer's office of S. D. Warren & Company, paper manufacturer, of Cumberland Mills Station, Me.

ROBERT A. KOERNER, civil engineer and architect, of Terre Haute, Ind., has moved his office from 2415 Sycamore Street to 30 South Sixth Street, that city.

J. F. REYNOLDS, formerly engaged in highway engineering at Storm Lake, Iowa, has become connected with the Trussed Concrete Steel Company on the design of reinforced-concrete buildings. He was graduated from Iowa State College in 1908 and served from then until 1913 as assistant engineer on the Oregon Short Line Railroad. From the latter year until 1914 he was engaged in reinforced-concrete work. He was on highway work at Storm Lake from then until the present.

R. L. WOOD has been appointed to a position on the engineering forces of the Missouri Pacific-Iron Mountain Railway at Monroe, La.

J. L. GOTSCHALL, formerly engaged in highway work in Morgan County, Ohio, has been appointed to a position on the engineering forces of the Interstate Commerce Commission, Division of Valuation, with headquarters at Chattanooga, Tenn.

Seth P. Burnett and F. F. Henige have formed the Burnett-Henige Construction Company, 116 North Washington Avenue, Saginaw, Mich., to engaged in a contracting business.

J. E. Greiner, consulting engineer, of Baltimore, has been appointed consulting engineer on the Market Street bridge across the Tennessee River at Chattanooga.

George M. Basford has resigned from his position as chief engineer of the railroad department of Joseph T. Ryerson & Son to become president of the Locomotive Feed Water Heater Company, a new $1,000,000 concern with offices at 30 Church Street, New York City. Mr. Basford will also form the G. N. Basford Company to handle the advertising account of a number of railway supply concerns.

George H. Bremner, assistant district engineer of Central District of the Division of Valuation, Interstate Commerce Commission, at Chicago, has been appointed district engineer for the same district, succeeding De Witt V. Moore. Mr. Bremner was graduated from the civil engineering department of the University of Iowa in 1883 and entered the service of the Chicago, St. Paul & Kansas City Railway as rodman. He spent a few months as transit man with the Chicago and Northwestern and later went to the Chicago, Burlington & Quincy to do work on a preliminary survey. From August to November, 1885, he was draftsman on construction for the Chicago, Burlington & Northern, and, from December, 1885, to April, 1889, he was division engineer of maintenance-of way for the Chicago, Burlington & Quincy. In April, 1889, he was transitman in charge of a party on location for the St. Louis, Keokuk & North Western (now a part of the Burlington System), on an extension from Old Monroe to St. Louis, Mo. In July, 1890, he was made assistant engineer on maintenance-of-way for the Chicago, Burlington & Quincy at Chicago, which position he held until June, 1902, when he was appointed engineer of the Illinois district of that road. November, 1904, found him in the position of engineer maintenance-of-way of the Illinois district, and in April, 1908, he was again engineer of the Illinois district, in which position he remained until his appointment to the Interstate Commerce Commission in February, 1914.

T. L. Higgs, formerly acting city engineer of Parkersburg, W. Va., was appointed city engineer, March 1, by a unanimous vote of the council.

E. G. Campbell has been appointed engineering superintendent for the Ohio State Highway Department at Pomeroy, to succeed W. A. Looker.

William C. Dunlop has been appointed assistant engineer with the Chicago Traction & Subway Commission.

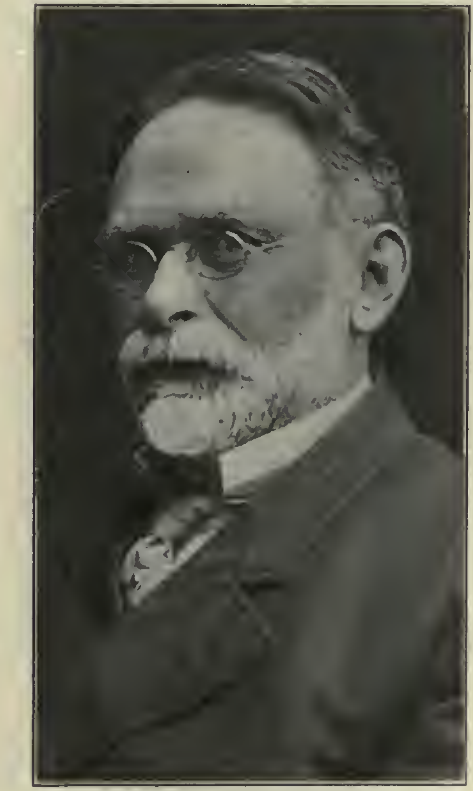
Walter A. Fischer, who has been engineer for the Western Water Company for the past four years, has again taken up contract work with the Valley Natural Gas Company, of Bakersfield, Cal. Mr. Fischer had four years' experience with the Western Water Company, and also spent ten years as a member of the firm of Glass & Fischer, who installed the sewer system at Albuquerque, N. M.

Ellis Soper of the Soper Engineering Company, of Chattanooga, Tenn., and formerly construction engineer on the Market Street bridge in that city, has been appointed chief engineer of design and construction of the plant of the Cuban Portland Cement Company at Havana, Cuba.

Charles S. Pope has accepted a position as engineer for the Warren Brothers Company of Oakland, Cal. Mr. Pope was formerly on the staff of the city engineer of Los Angeles, where he served for ten years, and rose from surveyor to a position where he was in charge of street work.

Reginald H. Thomson, for nearly 20 years city engineer of the city of Seattle, and who, since June, 1915, has been engaged in private practice in that city, was elected a member of the City Council on March 7. During his period as city engineer he made material changes in the topography of the city, removing great hills that it might extend and grow. Political precedents were broken when he agreed to enter the race for the council. In the campaign prior to the primary and general elections, he refused to address political gatherings and to debate or take any part in the preliminaries preceding an election. He made no campaign promises. When asked his platform, he invariably replied: "I will seriously consider each civic problem as it comes before the council and will vote the way my judgment tells me will be the most advantageous for the city of Seattle." His expenses for the entire campaign amounted to $40, three-quarters of which constituted the filing fee. Mr. Thomson went to Seattle in September, 1881, and entered into partnership with F. H. Whitworth. The firm, known as Whitworth & Thomson, engaged in engineering throughout the Northwest until 1888, when Mr. Thomson went to Spokane for a year on the Seattle, Lake Shore & Eastern Railway. He served the city of Seattle as surveyor from 1885 to 1886. Returning from Spokane in 1889, the engineering firm of Thomson & White was formed, which engaged in general engineering until May, 1892, when Mr. Thomson became city engineer, under Mayor Ronald. After nearly twenty consecutive years as city engineer, he resigned in November, 1911, to become chief engineer of the Port of Seattle. Early in 1912 he resigned from that office owing to litigation which threatened to indefinitely impede actual construction. He was immediately called by the Provincial Government of British Columbia to take charge of the work on the proposed new Strathcona Park on Vancouver Island, which covers 532,000 acres of land. At the outbreak of the European war, all public work in British Columbia was brought to a close, and Mr. Thomson returned to Seattle, where his present engineering offices in the Alaska Building were opened. On March 7 of the present year the county commissioners of Snohomish County at Everett, Wash., passed a resolution employing Mr. Thomson as consulting engineer for that county in the construction of roads provided for in the recent $1,800,000 bond issue. He has been asked to make a thorough inspection of all the roads to be paved, to become familiar with the situation and to advise the county on all matters in connection with the work, including the acceptance of bids.

Former City Engineer of Seattle Elected Member of City Council After Unusual Campaign



REGINALD H. THOMSON

H. A. Thomson, formerly attached to the Philadelphia office of the Pennsylvania State Highway Department, has been appointed engineer in charge of district 1 of the bureau of township highways.

Charles E. Parsons and Guy C. Simpson have organized the firm of Parsons & Simpson, with offices at 61 Broadway, New York City, and San Antonio, Tex., to engage in consulting practice, specializing in hydroelectric, irrigation, water supply, industrial, transportation and structural engineering and investigations, and reports on Mexican oil, mining and agricultural properties. Mr. Parsons, in addition to his consulting practice, is president of the Ambursen Hydraulic Construction Company. For ten years he was chief engineer of the Hudson River Power Company—now the Adirondack Electric Power Corporation—in which capacity he designed, constructed and operated the Haines Falls, Spiers Falls, Glen Falls, Utica, Ballston, Albany, Amsterdam, Troy and Schoharie power plants. He was also chief engineer, and one of the organizers of the Atlanta Power Company and the Georgia Railways Power Company. He was graduated from Union College in 1898. In 1899 he made a survey for a hydroelectric plant for the Hudson River Power Company and worked in the offices of William Barclay Parsons and H. de B. Parsons in New York City, on plans for the development of the plant. From 1900 to 1908 he was chief engineer of the power company. In 1908 he became a member of the firm of Hilliard & Parsons, consulting engineers, of Albany, N. Y. In June, 1909, he was made chief engineer of the Atlanta (Ga.) Power Company and, in 1911, he was put in charge of the purchase of lands and construction of substations and transmission lines for the Georgia Power Company. He was appointed second vice-president and consulting engineer with the Ambursen Hydraulic Construction Company in 1912, and subsequently became its president. Mr. Simpson was graduated from Massachusetts Institute of Technology in 1906 and served for a time on the three-track work of the Pennsylvania Railroad in Indiana and Ohio. Following this work he was for about five years with the Alberthaw Construction Company, the Eastern Construction Company, the Expanded Metal Company and Crom, Goodhue & Ferguson, architects, of Boston. As a contractor and construction engineer he built works to a value of about $2,000,000 in Louisiana, Texas and Tennessee. About four years ago he was with James A. McGonigle on the construction of Fort Crockett at Galveston, Tex. During the past three years he has been chief engineer of the Guadalupe Water Company of Texas, of which he was one of the organizers. His work during the past ten years has taken him frequently to Mexico and has given him an extensive knowledge of conditions in oil, mining and agricultural properties of that country.

E. H. Baldwin, acting chief of construction of the irrigation service, recently visited Phoenix, Ariz., to look over the project there in order to determine just what is needed since the flood damage. He was accompanied by W. S. Cone, manager of the local project, and L. N. McClellan, assistant electric engineer. A board consisting of a number of consulting engineers will go over the entire project, it is reported, to determine what steps will be necessary for making permanent repairs.

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Spring Clean-Up Campaign

FROM every part of the country has come commendation, in recent years, of the spring clean-up campaigns. They have become annual features not only in villages and towns, but even in the big cities. New York and Philadelphia, among other metropolitan centers, have conducted successful campaigns. The object of this note is not to point out their advantages—for they are already well recognized—but to urge city engineers and other municipal officials to begin the work of organization and preparation for their campaigns immediately. Clean-up week is generally set late in April or early in May. If plans are undertaken now there is plenty of time to decide upon ways and means and to perfect the necessary machinery to bring about a successful result.

Spoiled by Typography

ELSEWHERE in these columns is comment on the good-roads pamphlet issued by one of the motor-truck companies. In striking contrast with the attractive way in which that pamphlet has been prepared is a booklet entitled "Good Roads Bulletin for Illinois Public Schools," which the state superintendent of public instruction of that state is distributing. It contains good material—articles with the following titles: Good Roads and Good Schools, Pertinent Points about Roads, Construction and Maintenance of Earth Roads, and Roadside Improvement. Unfortunately, however, those who prepared the booklet typographically did not have a keen appreciation of the methods of presenting printed matter effectively. The type is small, the illustrations few, giving an impression of heaviness that will repel the pupil. It would have cost but little more to have presented the material in most attractive form. To use the language of business, the object of the pamphlet is to "sell" the good-roads idea to the pupils of the schools of Illinois. Selling and advertising methods and standards should, therefore, have been in mind. Moreover, the desired effect would have been produced without lessening the technical excellence of the material presented.

For Civic Beauty

ATTENTION was called in these columns some time ago to the agitation, in which engineers were participating, to prevent the defacement of parks in Washington and in New York City. At Washington the Government proposed to erect a power-house with tall stacks in Potomac Park—in such a location as to be a blot on landscape in which the Washington Monument is a prominent feature. At New York protest was directed against the placing of a pumping station in Morningside Park. It is gratifying to note that engineers, through the American Institute of Consulting Engineers, have taken an active part in both of these agitations. It is reported that the Morningside difficulty is on the way to a solution which will preserve the park unmarred. At Washington progress seems to be slower. The interests allied against the proposed location of the power plant have now made a strong appeal through an elaborate pamphlet. By argument and pictures it shows exactly what the effect of the power-house will be on various aspects of the Washington Monument and the Capitol dome. The pamphlet is most convincing. Certainly the voice of the people the country over who are anxious to make of Washington one of the most beautiful capitals of the world should force the Treasury Department to change the location to some unobjectionable site. It is urged that engineering societies throughout the country take up this matter and pass suitable resolutions. Copies of the pamphlet can be secured through the American Institute of Architects at Washington. The question is a national one, and engineers should urge a solution that will be compatible with the dignity of the nation's capital.

Uncle Sam's Purse

SENATOR NEWLANDS has introduced a bill in the U. S. Senate which would appropriate to each land-grant college the sum of $15,000 annually for the support of an engineering experiment station. It is needless to say that the Engineering Record heartily favors the establishment of such stations, not only in land-grant but in other colleges as well. It is not in sympathy, however, with a scheme which just opens another avenue into Uncle Sam's purse, without any special warrant for the government bearing the burden. The situation is different to-day than when the Morrill act, which gave government support to colleges of agriculture and mechanic arts, was passed. In 1862 the middle western states were poor, the need for scientific education was little appreciated and a stimulus was necessary to get the states to embark on the work of higher education. Now conditions have changed and there is no state which can not support magnificently colleges and universities of the highest order. The engineering experiment station is a worthy institution. In the opinion of the Engineering Record, however, the states should take the initiative and furnish the funds themselves. The least the Land Grant College Engineering Association, which is backing the legislation, might do is to agree that the states would put up dollar for dollar what the government does. Even then the Engineering Record would favor such government participation only if the work which would be done under the appropriation would be subject to the approval of the central government. Only under such supervision could there be hope that duplication and the frittering away of time and money on subjects of little or no value would be avoided.

Trailers for Motor Trucks

ELSEWHERE in this issue considerable space is given to an investigation made by Mr. Pennington of the Troy Wagon Works Company as to the utility of its trailers in connection with motor trucks. Scientific analysis on the part of manufacturers, in lieu of loose generalities by uninformed salesmen, is much to be encouraged. The efforts of the Troy company are in this direction. The company does not claim that trailers can be used wherever motor trucks are employed. Moreover, it contends, and the contention seems to be well founded, that what it has learned with respect to its own trailers cannot be applied to an ordinary wagon, not especially designed for trailer service. The main fruits of the investigation are the diagram by which the non-technical man can find out how much his truck can haul; the table of resistances for various classes of road; and the combination of the two to determine the precise limits of the field of usefulness of the truck. The Engineering Record believes that the analysis has shown again, what ought to be obvious to all who have stopped to think about the matter and compare highway transportation with rail transportation, that the trailer is a natural complement to the motor truck. Whether the tractor will ever become merely a highway locomotive, leaving the whole load to the trailers, is yet to be seen. It may come to pass. Certainly efficiency demands that the capacity of the motor truck be measured by what it can haul, and not solely by what it can carry on its back.

Complete Specifications

INDIANA engineers and architects must henceforth specify exactly what they mean and furnish bidders on state work with plans which are complete and accurate to the last detail, if the rules published March 6 by the Board of Accounts of that state, governing the letting of public-building contracts, are to be taken at their face value. These rules call the attention of public officials to the fact that it is against the law in that state for bidders to furnish, or be compelled to furnish, any part of the design of the completed work. The design must be ready before bids are asked, and must be so well done that changes in plans, which are the cause of an evasion of the law by precluding competition on the changed items, are reduced to the smallest possible proportions. The rules further point out that the engineer or architect cannot be made the final judge of disputes arising over the contract. The law does not permit the delegation to the engineer of those powers of public officials under which disputes about contracts and final acceptance of work may be adjusted. Presumably, if a contractor cannot reach an agreement with the public officials, the courts must be the arbiter. This feature of the rules may cause delay and loss, but, at least, it is pleasing to see the principle sustained that neither owner nor contractor should be able to impose on the other party through the agency of an engineer. The engineer is an employee of one of the parties to the contract, and should not be obliged to decide as an arbiter matters involving by indirection his own interests. The Indiana Board of Accounts has made a step in the right direction, and it is only to be regretted that all of our public contracts are not let on as fair a basis as that laid down in these rules.

Architect vs. Engineer

LITTLE attention, apparently, has been given to the report rendered by a committee of the American Society of Civil Engineers to the Board of Direction on Jan. 17 with reference to the licensing of architects. The committee reported that in several states there are now laws governing the practice of architecture, and that similar legislation has been actively proposed in nine other states. All of these laws, enforced and proposed, make illegal the construction of buildings except upon the plans and specifications prepared by licensed architects. In other words, all of them would impose serious hardships on the engineering profession. In Illinois, structural engineers are now licensed for the sole purpose of counteracting the architect's licensing law. Without a doubt similar legislation is necessary in the other states where architecture is now a controlled profession, while the same sort of action will be needed in the case of every state which puts the practice of architecture under government control.

The committee of the society urged that a joint committee be formed between all of the national engineering societies and that the co-operation of the American Institute of Architects be requested in an endeavor to find some plan which may further the mutual esteem and co-operation of the two professions. Pending the results of these steps, the committee further recommended that the matter be referred to the local associations, with the request that they take organized action in opposition to the enactment of any law licensing the practice of architecture, should such legislation be proposed.

The subject is a very important one and requires the active interest of the engineering profession. Only by vigilance and vigorous action will the architects be prevented from causing in other states the hardships upon engineers which prevailed for so many years in Illinois.

Without a doubt the best plan would be to secure co-operation with the American Institute of Architects to the end that both engineers' and architects' licensing laws be kept off the statute books, and be repealed where now in force. As this journal has long held, such licenses do not make for the safety and welfare of the public. That can only be provided for by examining the work of the engineer and the architect and not the individual.

Unless co-operative action is brought about, there is likely to be a serious breach between the two professions—architecture and engineering—a condition much to be deplored.

In the Interest of Good Roads

SO KEEN is now the appreciation of the need for good roads and of the bearing of good roads on a community's prosperity, that one expects all classes to co-operate in highway propaganda. Then, too the extent to which various interests have participated in good-roads campaigns is fairly well known. There is less appreciation, however, of some of the yeoman service rendered by individuals and by certain corporations. In many cases—possibly in all but few—the motive has been in part selfish, but so long as the selfish motive is subordinated, one can heartily commend the work. There are cases, of course, in which ill-advised appropriations and expenditures have resulted largely from the work of corporations who cared not for the public so long as they secured fat contracts. But these are not referred to here.

An example of the higher type of promotion is that carried on by the Garford Motor Truck Company, largely through the energy and vision of its sales manager, S. M. Williams. In fact, so much time has he given to propaganda work that he sometimes has to ask himself whether he is in the truck or the good-roads business. The connection, however, is very close. Possibly the greatest present use for motor trucks is on paved city streets, but the opportunity of the future lies in the development of traffic lines radiating out into the country and connecting nearby communities. Manifestly the greatest foe to such traffic development is poor roads. That accounts primarily for the interest of a motor-truck salesman in the good-roads propaganda. At the same time, the campaign has had, and will have, a great public benefit.

The basis of the company's activity is a 16-page, 6 x 9-in. pamphlet entitled, "Roads —Their Influence Upon Economic and Social Conditions." It presents briefly the effect of good and of bad roads on a community, emphasizing the statements with striking photographs of good and poor highways and of the farming communities always associated with the two classes. These pamphlets have been distributed by the hundreds of thousands—have been mailed to individuals by the company, have been sent to granges and farmers' institutes, have been used as campaign literature in connection with bond-issue elections. No particular type of road is advocated—merely improved roads—leaving the local authorities the determination of the suitable type.

The result of such propaganda cannot but be good. The company deserves to be commended for its work, even though it receive, through increased business, an ample reward for the financial outlay its efforts have entailed.

Changing Horses in Midstream

A NEW YORK STATE legislative committee, seemingly actuated by a desire to organize political opposition to the governor of the state, has threatened to introduce legislation throwing control of New York City's subway construction from the Public Service Commission for the First District to the city's Board of Estimate. This journal does not contend that to have the city in direct control of its own rapid-transit construction is not preferable, as an abstract proposition, to state control. There are two maxims that suggest the attitude to be taken toward a change at the present time. One is to the effect that changing horses in midstream is apt to prove disastrous, and the other, drawn from military life, asserts that a poor plan vigorously carried out is preferable to the best of plans if the latter is to be changed while the army is trying to execute it. With a "home-rule" sop thrown to the New York delegation, the estimable legislative committee would, for the sole apparent purpose of discrediting a disliked governor, disrupt or replace an engineering organization that has reached a good state of efficiency after years of hard work, and turn its $325,000,000 job, with millions outstanding in unfinished contracts, over to five city officials who already have their hands full.

The committee justifies this stand by pointing to evidence which it interprets as reflecting on the integrity of past, present and proposed members of the commission and of several of its engineers. To the engineering profession such allegations as that a $2,000,000 bribe fund was concealed in 15 per cent profit on the contract for rebuilding the Manhattan elevated lines are more productive of smiles than of credence. Although the committee objects personally to Travis H. Whitney, the confirmation of whose appointment was demanded by Oscar S. Straus as a condition of his continuing to head the commission, and although it disapproves of D. L. Turner, deputy chief engineer, for whom it would be enough to say that he also is supported by Mr. Straus, such reasons scarcely justify the committee in throwing the subway work into confusion by the proposed change. Neither would the committee be justified in such a course by any dereliction of duty on the part of former public service commissioners. Save for political intrigue, the press and public would with fullest confidence support the new commission in carrying the work to a rapid and successful conclusion. If the press and the public permit the consummation of this political trick, they will connive at a staggering blow to engineering efficiency on public works.

South American Field Begins to Materialize

SINCE the outbreak of the European war this journal has been pointing out editorially the possibilities that are offered the engineer and contractor from the United States in the countries to the south of us. With the ratification by the Uraguayan Senate of a large waterworks and sewerage system contract, which is one of the largest individual contracts for municipal improvements ever entered into by an American concern outside of the United States, it would appear that these possibilities are beginning to materialize. Details of the contract will be found on page 431.

There is no reason why such reports from now on should be few and far between. The possibilities exist. Many large cities in the Latin countries are in pressing need of municipal improvements. The fuel problem in some of the countries is so acute that the time would seem ripe to discuss hydroelectric developments. There is need of railroads and harbor and river improvements. Almost daily we read of valuable agricultural products being endangered by weather conditions due to lack of warehouses. There is need of cold-storage and meat-packing plants. A sugar mill erected to-day would pay for itself in a short time, due to the unprecedented prices being obtained for the product.

With the proper effort and the facilities, contractors from the United States should find plenty to do in South and Central America, and the West Indies. In some cases the projects may have to be suggested, and the people of the country educated up to an appreciation of the expediency of undertaking them. In most cases the work will have to be financed, but fortunately we are in the strongest financial position in our history. The obstacles, then, are not insurmountable. Similar problems have been dealt with on innumerable occasions in the United States. With proper personnel they can be handled just as successfully in other countries. The field is there. What it will amount to depends on how it is developed.

Liability of Manufacturers for Defects in Materials

LAWYERS have been awaiting with considerable interest the outcome of a case, just decided by the New York Court of Appeals, in which was involved the responsibility of manufacturers for injuries resulting from defective materials. Heretofore the rule followed by New York and other state courts, and by the United States Circuit Court, has been that manufacturers are liable for injuries that can be traced to defective materials only when the articles involved are "inherently dangerous," such as fire-arms. The New York court has now sharply departed from this rule, upholding a decision in a lower court which, it had been confidently predicted, would be reversed under the long-standing precedents above referred to. As the case is of considerable interest to all manufacturers of heavy equipment used in contracting and as it defines anew the rights of those who may suffer from defects in such equipment, the main features of the case are well worth noting.

The facts are that the purchaser of a motor car was seriously injured as the result of the collapse of one of the wheels of the car after it had been in use for a year. The manufacturer resisted a suit for damages on the ground that he was not the maker of the wheels, but had bought them from a responsible manufacturer and used ordinary caution to ascertain that they were sound. It was shown that the collapse of the wheel was due to defective wood. The Court of Appeals now holds that the manufacturer "was responsible for the finished product," and cannot shift the responsibility. The decision places squarely upon every manufacturer of a "finished product" —a hoist, for example—full responsibility for injuries that may result from defects in any part of such a product. The court specifically says that a manufacturer is not at liberty to put the finished product on the market without making such tests as will prove the absence or presence of such defects as might result in injuries through ordinary use.

It is clear that we have here a new rule of law, and one that may make serious trouble for a manufacturer who proceeds upon the old theory that he is not responsible for injuries resulting from defective parts of assembled machines or equipment. If further light on this interesting case is desired it may be found in the decision handed down by Judge Cardozo March 14, in the case of Donald C. MacPherson vs. the Buick Motor Company.

Mechanical Filters Recommended for City with Slow-Sand Plant

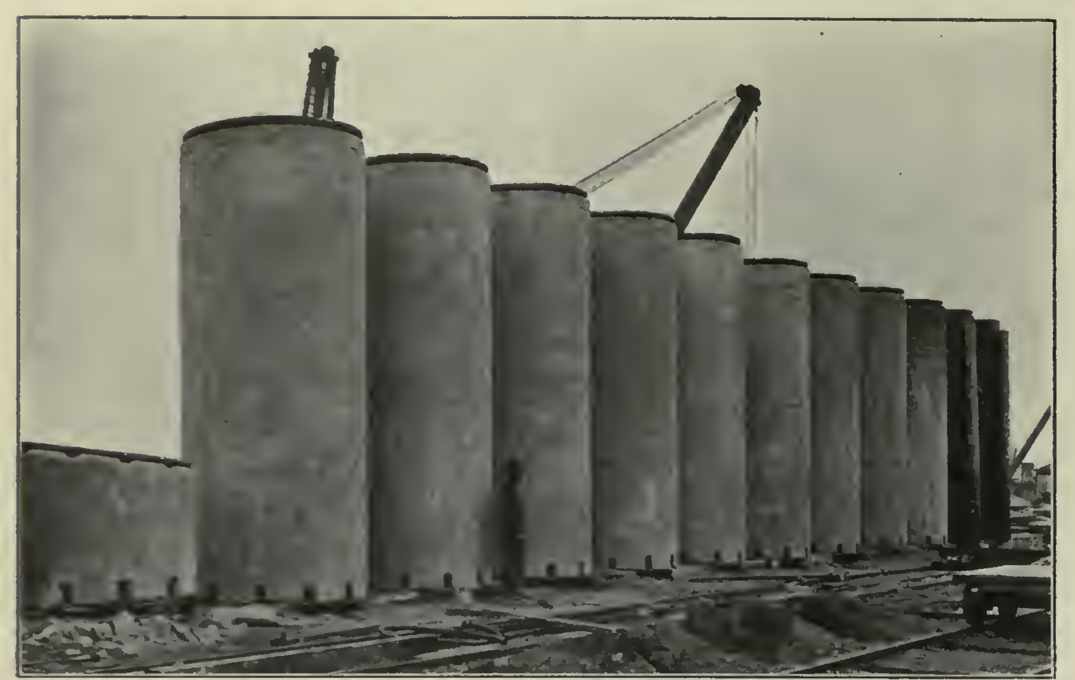
IN George W. Fuller's recent report advocating a $750,000 addition to the water-supply and purification works at Wilmington, Del., one of the most interesting features is the recommendation of mechanical filters in a city now equipped with a slow-sand plant and pre-filters. The principal reason for the suggested change appears to be the unexpectedly large amount of finely divided clay which, at times, is carried by Brandywine Creek, the source of supply. When the type of filter now built at Wilmington was considered a dozen years ago, the operating difficulties of slow-sand plants in the treatment of water highly charged with fine clay particles was not fully realized, nor was it appreciated how efficient and reliable were rapid-sand filters, such as have been installed since that time at Baltimore, Harrisburg, Columbus, Cincinnati, Louisville, Minneapolis, St. Louis and New Orleans. On the whole, Mr. Fuller finds, the existing Wilmington filters have made a surprisingly good record in the removal of clay, and this is explained largely by the amount of fine material which seems to have accumulated in the lower portion of the sand layers, below the depth efficiently reached by the teeth of the Blaisdell washing machine. Nevertheless, the accumulations of clay and other matter in the lower portions of the beds have now reached such proportions that the filters are seriously clogged and need a thorough washing and overhauling.

While the conditions described are potent arguments for coagulation and rapid filtration, they are not the only ones. Structural defects in the existing filters have made it practically impossible, at certain seasons, to realize from the works their rated output, Shrinkage cracks in the filter floors have given rise to many troubles. Clogging and air-binding have caused the most serious annoyance—conditions which were described fully by Edgar M. Hoopes in the Engineering Record, Sept. 4, 1915, page 282.

The Wilmington case will appeal to sanitary engineers because the decision as to plant enlargement, along lines radically different from the original designs, is based, not on surmise, but on actual operating results over a long term of years. This is the best kind of evidence upon which to base a decision. It should be realized, however, that progress, during recent years, in the development of the mechanical filter to its present high state of efficiency has introduced into the solution of the water-purification problem a factor which was not present before. Events at Wilmington are not the only ones which substantiate this view. In the case of the Torresdale filters at Philadelphia the same trend is manifest, for the city long ago supplemented its slow-sand filters with pre-filters, operating at high rates, and is now completing the construction of a large coagulating basin as a further measure to free the raw water of its burden of suspended matter. Thus, while the Philadelphia units are nominally of the slow-sand type, their accessory equipment carries with it decided suggestion of mechanical-filtration principles. The same tendency is being exhibited at Wilmington in a stronger degree, for in addition to his recommendation for a mechanical-filtration plant, Mr. Fuller suggests that coagulation facilities be provided as a preliminary to treatment at the existing slow-sand beds.

It is not proposed at Wilmington to have the mechanical filters supersede the existing slow-sand plant. They will serve as an additional means of increasing the output of purified water. They will, however, play another part of very timely importance. Unless they are built it will be practically impossible to shut down the present works for the repairs which are needed.

Since the war started Wilmington has assumed a position of tremendous industrial importance because of its huge output of power and explosives. The population curve has risen rapidly, and the need for an adequate water supply for present and future is more acute now than ever before.



OUTFALL PIPE CONSISTS OF 18-FOOT SECTIONS OF CONCRETE 6 FEET IN DIAMETER

Cleveland's Sewage Treated by Revolving Screens and Novel Grit Chambers

Ejectors Will Remove Grit for Filling Purposes—Long Submerged Outfall Will Disperse Sewage in Region of Cross Currents

By GEORGE B. GASCOIGNE
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THE sewage from that part of Cleveland west of the Cuyahoga River will be treated at a plant located on the lake front at the foot of West Fifty-eighth Street. It is intended to use the dilution available opposite this lake-front plant, so that ultimately the works will provide for the removal of the suspended inorganic matter; the partial clarification of the sewage; the discharge of the excess storm flow at the U. S. harbor line; the dispersion in the lake of the treated effluent, and disinfection during the bathing season.

GRIT CHAMBERS AND FINE SCREENS

In order to determine the possibility of an initial cost saving by using, for the clarification of the sewage, fine screens instead of two-story setting tanks and to protect the public bathing beach located nearby, construction of a partial plant, capable of treating the flow already discharged at this location was started. When the remainder of the sewage reaches this location it is expected to have the complete plant ready for operation, provided the fine screens produce the results which are claimed by their designers. Otherwise, the sewage will be discharged temporarily through the submerged outfall pipe without the degree of clarification necessary.

Two grit chambers of different types, with their flow channel connections and the screen house, are completed and 14-ft. circular Reinsch-Wurl screens are provided for continuous operation. Sewage passed through the grit chambers and screen for the first time Nov. 19, 1915. The outfall sewer and the submerged outfall pipe are in the course of construction.

COLLECTION AND FLOW

The population ultimately served at this location will represent 28 per cent of the city's total. Two interceptors collect the sewage and with the necessary overflows and by-passes discharge it at the plant. The westerly interceptor, which is of the combined type, serves largely a residential district and extends westward along the lake shore about 3 miles. The sewage as discharged is fresh and in amount equals about one-fourth of the total quantity to be treated. The normal flow per capita is 150 gal. per 24 hr., with an hourly fluctuation of 25 per cent. The Walworth Run sewer, which serves the territory back from the lake front, at the present time discharges into the Cuyahoga River about 2 miles upstream from its mouth. In order to divert the sanitary flow and the first storm wash of this sewer to the treatment site, a 5½-ft. circular brick sewer with an outside lining of wood cants is being constructed.

The Walworth Run diversion sewer, so-called, is in tunnel, 80 ft. below the surface of the ground and 8350 ft. in length. This sewer will deliver the remaining three-fourths of the total quantity to be treated. The normal flow per capita amounts to 75 gal. per 24 hr., with a maximum and minimum hourly fluctuation of 22 and 32 per cent, respectively. The main portion of the stock yard wastes of the city enter this sewer, which condition affects the character of the sewage.

The estimated population contributing sewage to the West Fifty-eighth Street plant will, in 1925, be 275,000. The works planned for construction will provide for this population and will treat twice the sanitary flow of the westerly interceptor and four times the dry weather sewage flow of the Walworth Run sewer, which is equivalent to 300 gal. per capita per 24 hr. The entire flow will first pass through the coarse screens and grit chambers and then 75 per cent of this amount will be either settled or screened, the difference being by-passed to the outfall sewer. The final step in the treatment process consists in dispersing the settled or screened effluent in the lake by means of an outfall tube.

COARSE SCREENS

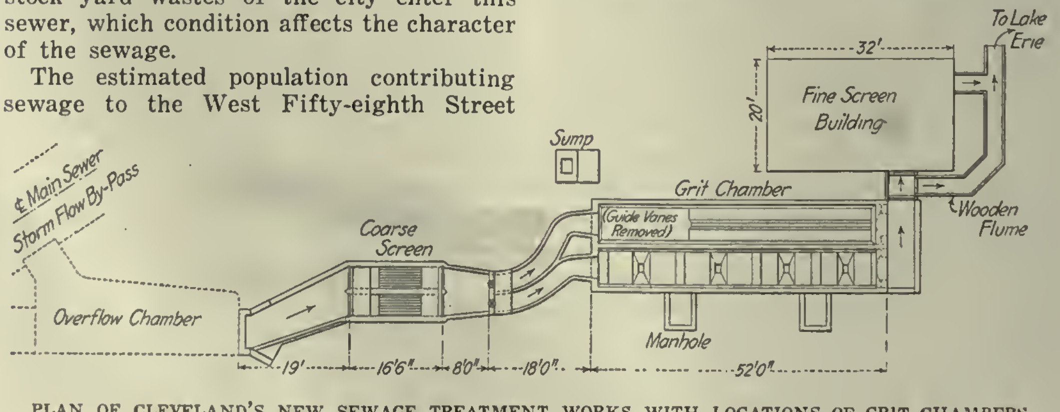
For the purpose of preventing large objects, such as boards, bundles of wire and tin buckets from reaching the fine screen and from interfering with the operation of the valves and stop planks of the plant, two coarse screens, 4 ft. wide, are located in the flow channels at the entrance to the grit chambers. They consist of ½ x 2-in. steel bars spaced on 3½-in. centers and have a platform at their top for the attendant to stand upon when raking off the screenings. The bars are separated by means of castings, so shaped that a rake may be drawn throughout the entire length of the screens. The screens, as at present installed, are placed at an angle of 30 deg. with the horizontal, and slots are available for changing this angle to 45 deg. The necessary stop plank grooves and boards are provided so that either screen may be entirely shut off from the flow.

GRIT CHAMBERS

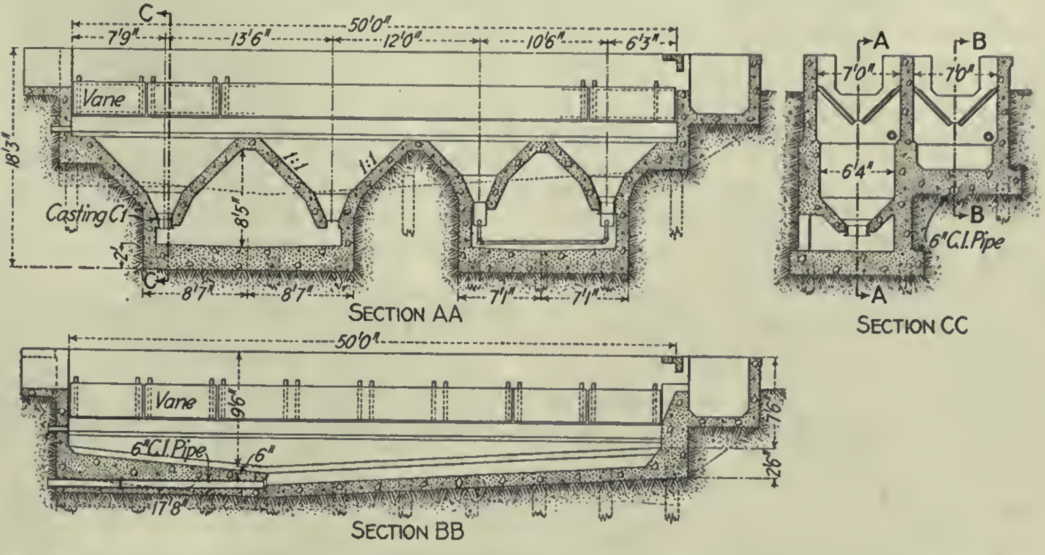
The grit chambers, as constructed, are sufficient to treat a quantity equal to twice the sanitary flow from the westerly interceptor, and when the flow from the Walworth Run sewer enters the plant, four additional chambers will be necessary. The present two are so located that with the additional four the symmetry of the works will be carried out.

In the design of the grit chambers the importance of securing a grit which can be satisfactorily used for filling purposes is paramount. Data obtained during the operation of the testing station show that grit which contains on the average more than 15 per cent of volatile matter will produce, when handled during unfavorable weather, objectionable conditions. It was thought advisable to increase slightly the cost of the grit chambers in order to secure this uniform quality of grit.

The flow section is designed to give a velocity of 1 ft. per second when the quantity passing through a chamber varies from 8,000,000 to 16,000,000 gal. per day. Each chamber is divided into two compartments,



PLAN OF CLEVELAND'S NEW SEWAGE TREATMENT WORKS WITH LOCATIONS OF GRIT CHAMBERS AND COARSE AND FINE SCREENS



GRIT CHAMBERS HAVE BOTTOMS OF TWO TYPES—WITH HOPPER BOTTOM EJECTORS REMOVE GRIT WITHOUT STOPPING FLOW BUT WITH FLAT BOTTOM TANK MUST BE SHUT DOWN FOR CLEANING

an upper or flow section, and a lower or deposition section. The flow section is made by attaching to the vertical side walls of the chamber steel plates or vanes and hanging them so that they converge to a 6-in. slot. The flow line, when sewage is passing through the grit chambers at a rate of 8,000,000 gal. per day, will coincide with a line which represents the intersection of the vertical walls and the upper surface of the steel plates or guide vanes. This construction eliminates the uncertain and variable flow section usual in grit chambers of the open type and gives a fixed and uniform section throughout the entire length of the chamber. Flows between 8,000,000 and 16,000,000 gal. are controlled by means of a modified outlet weir, so that the velocity remains constant. The weir is of the rectangular type, the central portion of which is contracted to a low head orifice.

The chambers are 50 ft. long, which permits a detention period of 50 sec. and provides for a deposit of ½ cu. yd. of grit per 1,000,000 gal. of flow. The storage capacity has been made of such size that the normal operating force can remove the grit from a chamber without seriously interfering with other necessary work around the works. If the sewage should at times contain no grit, and objectionable material is being deposited, it will be possible to by-pass the chamber sufficiently by closing the slot at the bottom of the guide vanes.

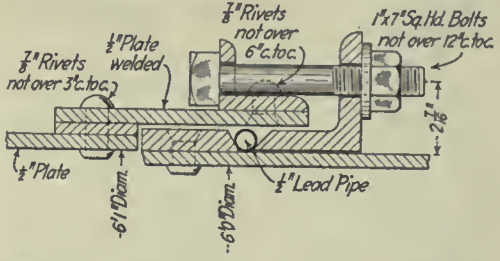
It was found from the tests with open chambers that grit will not deposit uniformly throughout the entire length of the chamber and it is believed the 6-in. slot will, to a certain extent, favorably affect the distribution. Each chamber is so constructed that 60 per cent of the total storage volume occurs in the first or inlet half, irrespective of whether or not the bottom is flat or hoppered.

In order to permit any material which rises behind the vanes to be carried away, a horizontal opening about 6 in. wide was provided in the guide vanes at their top and next to the vertical walls. There will be cross currents through the deposition chamber, but the effect from any objectionable material so deposited, and which does not get away, will be compensated for by the large quantity of good grit.

CAST-IRON Y WHICH REDUCES FROM 6 TO 5-FOOT DIAMETER SECTION OF CONCRETE PIPE

It will be noticed from the drawings that the bottoms of the two chambers differ. This is due to the method of cleaning the chambers, it being necessary in the one with the flat bottom to shut off the flow when removing the grit, while in the one with the hoppered bottom it is hoped to remove the grit without stopping the sewage flow. Sand ejectors are fastened to the bottom of the four hoppers which form the floor for one chamber and they will be operated by the city water pressure. The material so ejected will be used for filling purposes around the works, and a sand discharge line has been provided which is sufficient to carry the grit a distance of 400 ft. The grit in the chamber with the flat bottom will be removed by means of a sand ejector of the portable type, which has been provided. The possibility of operating the sand ejectors unsuccessfully is emphasized by the fact that two types of chambers were constructed.

Within the working galleries, which are located beneath the first and second hopper and the third and fourth hopper, respectively, of the grit chambers, there is placed the necessary piping and valves for controlling the operation of the sand ejectors. In the completed plant these galleries may extend across the six grit chambers, with the necessary entrance steps.


⅞" Rivets not over 6" c. to c.
1"x7" Sq. Hd. Bolts not over 12" c. to c.
½" Plate welded
⅞" Rivets not over 3" c. to c.
½" Plate
½" Lead Pipe
6'1" Diam.
6'9" Diam.
2⅞"

DIVER JOINS SECTIONS OF OUTFALL SEWER BY SUBMARINE JOINT

In order to remove the supernatant liquid and that which drains through the grit, a centrifugal pump and motor have been installed within a sump well off to the side of the inlet end of the grit chambers. The liquid so discharged will be delivered into the flow channel just back of the coarse screens.

FINE SCREENS

In order partially to clarify the sewage, a screen of the Reinsch-Wurl type has been installed in a pit within a frame building located at the outlet end of the grit chambers. The screen consists of a 14-ft. circular disk of brass with the central portion removed and a truncated cone with vertical plates inserted. In the center of the cone and plate is a shaft inclined 10 deg. to the vertical, around which the screen revolves. The shaft is supported by bearings entirely above the sewage flow, a feature which distinguishes the screen as the overhung type. The plate is perforated with openings 1/32 in. wide and 2 in. long, which represents about 10 per cent of the total screen area given over to openings. The screen rests in the pit partly submerged, and as it revolves the floating solids are carried along its surface until they are swept off by revolving brushes. These brushes are of wild hogs' bristles and at the end of arms which extend from the second central rotating shaft. A 2½-hp. motor, especially fitted, is placed on a walking bridge above the screen and provides power for revolving the disk and brushes.

The screen is rated at a capacity of 7,500,000 gal. per 24 hr., with a loss of head equal to 2 ft. This quantity is equivalent to approximately the normal dry-weather flow of the westerly interceptor. The flow line, when this maximum condition occurs, is flush with the top of the truncated cone on the inlet side. If the removal results are in excess of those expected, it will be possible to increase the capacity of the screen by enlarging the openings.

The screen was installed on trial, and the designers guarantee that the results obtained from its operation will compare favorably with those obtained from a settling tank which has a flowing-through period of 1½ hr. A tank will be constructed and operated alongside the screen in order to secure comparative results. A small room has been partitioned off in one corner of the building, which will serve as an office and laboratory. An employee of the city will make the analytical determinations and keep the operation data which pertain to the efficiency of the screen.

At the present time it is proposed to collect the screenings in burlap bags, reduce their moisture content by centrifuging and then burn the residue in a small incinerating plant located in the building. The screen was manufactured by the Sanitation Corporation of New York City and shipped in boxes ready to set up.

OUTFALL SEWER

In order to eliminate any objectionable conditions which occur opposite the sewer outlet, the present sewer will be extended 600 ft. farther out to the U. S. harbor line. This construction provides means for discharging the excess storm flow—the sewage flow which will not pass through the treatment works—in 25 ft. of water. This outfall sewer is of reinforced concrete, an open channel 4½ ft. deep, 15 ft. wide, supported on piling and has its invert paved with brick. The pile bents are on 6-ft. centers and consist of four piles each, which vary in length from 25 to 65 ft.

SUBMERGED OUTFALL PIPE

The effluent from the treatment works will be discharged outside the Cleveland breakwater through a submerged outfall pipe, where it is estimated the dilution amounts to 2 cu. ft. per 1000 population contributing. The location selected for dispersing the sewage is just off the junction of the main arm and the westerly wing of the breakwater, about 3700 ft. from shore, and where pronounced cross-current conditions prevail.

A concrete head chamber, which provides an entrance to the outfall pipe, is located off to the side of the outfall sewer about 400 ft. in from the harbor line. The outfall pipe from this chamber to the harbor line is of reinforced concrete and 6 ft. in diameter, and placed beneath the outfall sewer on timber supports, which are fastened to the two inside piles of the bents. The pipe was made at the contractors' yard near the site of the work and poured vertically in 18-ft. sections with cast-iron flanges on each end. These sections are placed by a derrick scow and bolted together by a diver.

At the harbor line and on the end of the concrete pipe there has been placed a cast-iron Y which reduces from the 6-ft. to the 5-ft. section. Conditions for the year 1925 require only one discharge line, but eventually two 60-in. lines will be necessary from this point. One side of the Y has, therefore, been bulkheaded and left ready for the future connection. Laid in a trench excavated along the lake bottom, a 60-in. riveted steel pipe extends out from the Y connection or harbor line a distance of 2600 ft. to where there is a 30-ft. depth of water.

For dispersing the effluent, a tapered section of pipe, 1000 ft. long, and having 6¾-in. circular openings spaced on 7½-ft. centers, is attached to the end of the 60-in. line. This discharge section varies in diameter from 60 to 24 in. and will be held in place by anchor piling placed along its sides. The outlet end of the tapered section has been provided with a flap gate which can be weighted so that the openings will take their intended portion of the flow and the pipe line under abnormal flow conditions will be flushed out.

The steel pipe is coated with mineral rubber asphalt and is shipped from the manufacturer in 30-ft. lengths. Five of these lengths, after being riveted together on the shore into a 150-ft. section, are lowered into place by two dredges with their cables attached around the pipe at the outer quarter points. The section fills with water as soon as it is submerged and a diver joins the sections by means of the submarine joint illustrated. The work is being performed by the Great Lakes Dredge & Dock Company.

DISINFECTION

In order to disinfect the sewage this summer, apparatus of a temporary nature will be installed over the head chamber. At the present war quotations, data obtained during the operation of the testing station tend to show that sodium hypochlorite can be applied cheaper than calcium hypochlorite or liquid chlorine.

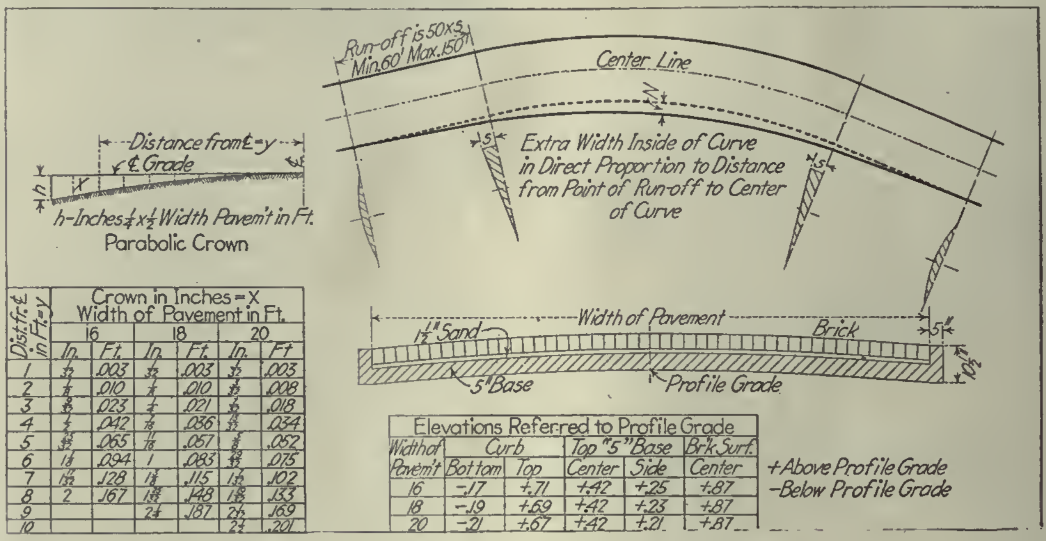
Robert Hoffman is chief engineer for the City of Cleveland, and the sewerage project is under the supervision of R. Winthrop Pratt, consulting sanitary engineer.

Superelevation for Highway Curves Systematized

Tables and Formulas for Brick Pavements of King County, Washington, Take Into Account Motorists' Tendency to Cut Corners

THE large amount of brick pavement laid in recent years in the vicinity of Seattle and in King County generally has brought out the need for some uniform system of superelevation and easy approach thereto which would be suitable for the wide variety of vehicles that use the so-called "permanent highways" of that section. In attempting to develop a standard of superelevation the difficulty encountered by the engineer in charge of this work was that curves of the same degree do not always require the same amount of superelevation.

For example, it was noted that 20-deg. curves with a 20-deg. central angle should be given much less superelevation than curves of the same degree with 90 or 100-deg. central angles. The reason for this is that

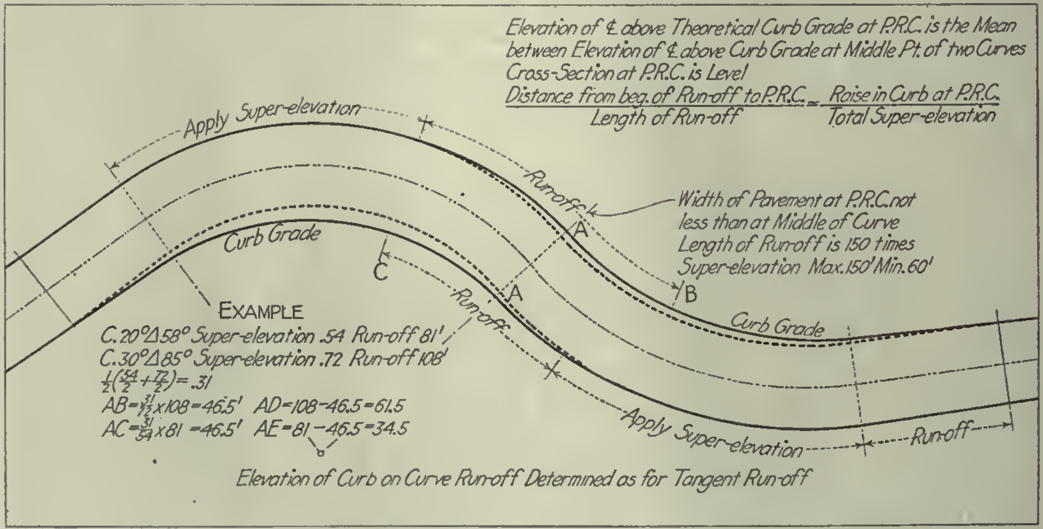


Run-off is 50xS Min.60' Max.150'
Center Line
S
Extra Width Inside of Curve in Direct Proportion to Distance from Point of Run-off to Center of Curve
S
S
Distance from ℄=y
℄ Grade
h
x
h-Inches ¼ x ½ Width Pavem't in Ft.
Parabolic Crown
Width of Pavement
1½" Sand
Brick
5"
5" Base
Profile Grade
10½"
+Above Profile Grade
−Below Profile Grade

Dist. fr. ℄ in Ft.=y	Crown in Inches=X Width of Pavement in Ft.					
	16		18		20	
	In.	Ft.	In.	Ft.	In.	Ft
1	1/32	.003	1/32	.003	1/32	.003
2	1/8	.010	1/8	.010	3/32	.008
3	9/32	.023	1/4	.021	7/32	.018
4	1/2	.042	7/16	.036	13/32	.034
5	25/32	.065	11/16	.057	5/8	.052
6	1 1/8	.094	1	.083	29/32	.075
7	1 17/32	.128	1 3/8	.115	1 7/32	.102
8	2	.167	1 25/32	.148	1 19/32	.133
9			2 1/4	.187	2 1/32	.169
10					2 1/2	.201

Elevations Referred to Profile Grade					
Width of Pavem't	Curb		Top "5" Base		Br'k Surf.
	Bottom	Top	Center	Side	Center
16	−.17	+.71	+.42	+.25	+.87
18	−.19	+.69	+.42	+.23	+.87
20	−.21	+.67	+.42	+.21	+.87

CROWN AND CURVE CONSTRUCTION WITH TABLES



Elevation of ℄ above Theoretical Curb Grade at P.R.C. is the Mean between Elevation of ℄ above Curb Grade at Middle Pt. of two Curves
Cross-Section at P.R.C. is Level
Distance from beg. of Run-off to P.R.C. / Length of Run-off = Raise in Curb at P.R.C. / Total Super-elevation
Apply Super-elevation
Run-off
Width of Pavement at P.R.C. not less than at Middle of Curve
Length of Run-off is 150 times Super-elevation Max.150' Min.60'
A
A
B
C
Curb Grade
Curb Grade
Run-off
Apply Super-elevation
Run-off
EXAMPLE
Elevation of Curb on Curve Run-off Determined as for Tangent Run-off

C.20° Δ58° Super-elevation .54 Run-off 81'

C.30° Δ85° Super-elevation .72 Run-off 108'

$\frac{1}{2}\left(\frac{.54}{2}+\frac{.72}{2}\right)=.31$

$AB=\frac{.31}{.72}\times108=46.5'$ $AD=108-46.5=61.5$

$AC=\frac{.31}{.54}\times81=46.5'$ $AE=81-46.5=34.5$

LAYOUT OF SUPERELEVATION AND RUN OFF ON REVERSE CURVES the greater the degree of curvature, the more nearly the vehicle traversing the road will follow the theoretical alignment. On any curve whose central angle is comparatively small, motor traffic in particular will cut across, actually following a curve whose degree of curvature is much less than that of the actual curve of the roadway.

OLD TABLES REVISED

Tables for superelevation prepared by the Washington State Highway Department a few years ago were at first used on the King County work. These tables, however, provided for a pavement cross-section which continued throughout the length of the curve and had a warped run-off on either side of point of curve and point of tangent equal to one-sixth of the length of the curve and limited to a minimum of 40 ft. This method of determining superelevation was satisfactory under certain conditions, but was not found generally applicable.

Tables were therefore prepared for King County work which provided for a minimum superelevation equal to double the crown of the pavement and made the surface plane instead of warped. In computing the tables the idea has been to suit the superelevation as nearly as possible to the actual line of travel which the motor traffic will naturally follow. The table for an 18-ft. roadway is reproduced herewith. The values are not all deducted mathematically, but were determined in part after study and observation of conditions on pavements in service. These tables have been used for the construction of 16, 18 and 20-ft. pavements and are said to be very satisfactory in that they not only give the road a good appearance but afford safe, easy-riding curves.

The tables were devised by Arthur P. Denton, county engineer, King County, Washington.

TABLE OF SUPERELEVATION IN FEET FOR 18-FT. PAVED HIGHWAY

Deg. of curve	Central Angle																		Deg. of curve
	12	16	20	24	30	36	42	48	54	60	64	70	80	90	100	110	120	130	140	150	160	
3	.38	.38	.38	.38	.38	.38	.38	.38	.38	.38	.38	.38	.38	.38	.38	.38	.38	.38	.38	.38	.38	3
4	.38	.38	.38	.38	.38	.38	.38	.38	.38	.38	.39	.39	.39	.39	.39	.39	.39	.39	.40	.40	.40	4
5	.38	.38	.38	.38	.39	.39	.39	.39	.39	.39	.40	.40	.40	.41	.41	.41	.41	.41	.42	.42	.43	5
6	.38	.39	.39	.39	.39	.39	.39	.40	.40	.40	.40	.41	.41	.42	.42	.43	.43	.44	.44	.44	.45	6
7	.38	.39	.39	.39	.39	.40	.40	.40	.41	.41	.41	.42	.42	.43	.43	.44	.45	.47	.47	.47	.48	7
8	.38	.39	.39	.40	.40	.40	.40	.41	.41	.42	.42	.43	.43	.44	.45	.46	.47	.49	.50	.50	.51	8
9	.38	.39	.39	.40	.40	.41	.41	.41	.42	.43	.43	.44	.45	.45	.47	.48	.49	.50	.52	.53	.53	9
10	.38	.38	.39	.40	.40	.41	.41	.42	.42	.43	.43	.44	.46	.47	.49	.50	.51	.52	.54	.55	.56	10
12	.38	.38	.39	.40	.41	.41	.42	.43	.43	.44	.45	.45	.47	.49	.51	.52	.53	.54	.56	.57	.58	12
14	...	.38	.39	.40	.41	.41	.42	.43	.44	.46	.46	.47	.49	.51	.53	.54	.56	.57	.59	.61	.63	14
16	...	.38	.38	.40	.41	.42	.43	.44	.45	.47	.48	.49	.51	.53	.55	.57	.59	.61	.63	.65	.66	16
18	...	...	.38	.39	.41	.42	.44	.45	.46	.48	.49	.50	.53	.55	.58	.60	.63	.65	.68	.70	.73	18
20	...	...	.38	.39	.41	.43	.44	.46	.47	.48	.49	.50	.53	.56	.59	.62	.65	.68	.72	.75	.78	20
22	...	...	.38	.39	.41	.43	.44	.47	.49	.50	.51	.52	.56	.60	.62	.66	.69	.72	.76	.80	.83	22
24	...	...	...	.38	.41	.43	.45	.48	.51	.52	.53	.54	.59	.63	.66	.70	.73	.77	.80	.84	.88	24
26	...	...	...	.38	.40	.43	.45	.48	.50	.52	.55	.57	.61	.65	.70	.73	.77	.82	.86	.90	.94	26
28	...	...	...	...	.38	.42	.44	.48	.50	.53	.55	.57	.62	.66	.71	.76	.80	.84	.89	.94	.99	28
30	...	...	...	...	.38	.40	.44	.47	.50	.53	.55	.57	.63	.68	.73	.77	.83	.88	.93	.99	1.04	30
32	...	...	...	...	...	.38	.43	.46	.49	.54	.55	.58	.64	.70	.75	.81	.87	.93	.98	1.04	1.09	32
36	...	...	...	...	...	.38	.42	.46	.49	.54	.55	.60	.67	.74	.80	.87	.93	1.00	1.06	1.13	1.19	36
40	...	...	...	...	...	...	.38	.44	.49	.54	.57	.60	.66	.75	.82	.90	.99	1.06	1.14	1.22	1.29	40
44	...	...	...	...	...	...	.38	.43	.49	.54	.57	.62	.70	.79	.87	.96	1.05	1.13	1.22	1.30	1.39	44
48	...	...	...	...	...	...	...	.38	.44	.50	.54	.60	.70	.80	.90	.99	1.09	1.19	1.30	1.40	1.50	48
54	...	...	...	...	...	...	...	...	.38	.45	.50	.58	.70	.82	.94	1.06	1.18	1.30	1.43	1.54	1.66	54
60	...	...	...	...	...	...	...	...	...	.38	.43	.52	.67	.81	.96	1.10	1.25	1.39	1.54	1.68	1.82	60

Venturi Meter Developed for Accurate Measurement of Irrigation Water

Effort Made to Inaugurate Equitable Basis for Charges to Water Users on Western Projects by Abolishing "Flat Rate" System

By ALAN A. WOOD

Western Representative, Builders' Iron Foundry, Providence, R. I.

TO place charges for irrigation water upon a more equitable basis than is possible under a system of "flat rates," which has resulted in endless disputes and litigation, the Venturi meter principle of accurate flow measurement has been adapted to the special conditions existing on some of the Western reclamation projects. As a result of studies in California, Arizona, Washington and Oregon a special type of recording Venturi equipment has been developed to take the place of such form of measuring devices as measuring boxes, weirs, submerged orifices, and current meters. The first installation of the new apparatus was made on the U. S. Reclamation Service's Salt River project in Arizona in 1913. Since that date the recording meters have been used in a number of other localities. The design of the Venturi tube is entirely special, being bent to form an inverted siphon. The pressure chambers have been omitted and a departure has been made from the standard dimensions and curves. All of these changes necessitated exhaustive calibration of the first designs.

RECORDING APPARATUS OF VENTURI METER IN COMPACT CASE

FLAT RATES CAUSED DISPUTES

There have been many instances of friction leading to lawsuits between vendors and purchasers of irrigation water arising from the impossibility of determining with any reasonable degree of certainty whether or not the charge for water was equitable—that is, in proportion to the amount actually delivered to the user. There have been instances in which it has been affirmed by water users that irrigation water paid for by them has been diverted by company officials for their own profit or by other unauthorized persons. In other cases users charge that the water for which they are paying is largely dissipated and lost in passage through unlined canals and ditches.

Those interested primarily in supplying, rather than actually using, irrigation water, frequently complain that over-irrigation is being practised by the farmer. Lands for which from 4 to 5-in. irrigation is most efficient are irrigated from 15 to 25 in., and irrigations as high as 45 in. per season have been known. Not only is this excessive use of water injurious to the farmer's own crops but failure to drain properly permits the run-off to ruin lower lands by bringing the alkali to the surface. Within the past ten or fifteen years the conviction has gradually been growing that accurate measurement of water delivered is the only solution to these difficulties.

IRRIGATION METER REQUIREMENTS

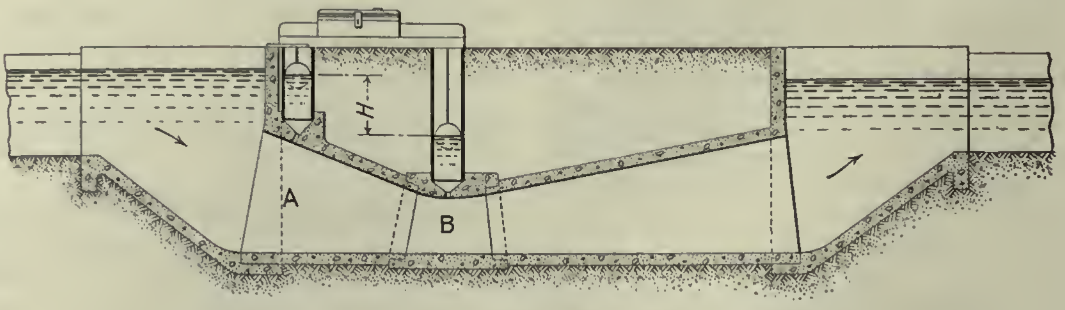
To be suitable for general adoption an irrigation meter must be reasonable in cost; must read directly in recognized units, such as acre-feet or second-feet, without the necessity of calculation; must introduce very little loss of head; must give the same discharge wherever placed; must be "tamper-proof;" must not be easily clogged by silt deposits, sticks, or debris; and must have a discharge which is not affected by variations of water level in the supplying canal. Another feature which is desirable, although not absolutely essential, is the ability to regulate and keep constant the flow through the ditches, either automatically or through the information furnished by the meter.

The weir method of measurement has been adopted to some extent on irrigation projects, but its general use is hindered by the fact that it implies a loss of head equal to approximately the depth of water flowing over the weir. In practice very few weirs are found which are designed with the observance of the generally recognized specifications for standard weirs; fewer still are kept in proper repair after installation. The channel is frequently found obstructed by silt, the bottom is built up and the end contractions partly suppressed. It is usually impracticable, except in the case of very large companies and water users' associations, to employ a competent engineer to construct correctly weirs and maintain them in proper order. Without expert supervision the results with weirs are often unsatisfactory.

Measuring boxes are in quite satisfactory use in some localities, but are generally employed to proportion the quantity supplied each user, rather than serve as a means of measurement.

Mechanical meters of the moving-vane or paddle-wheel type are used quite extensively. The axis of rotation of the wheel is either horizontal or vertical. The meter registers the flow without indicating or recording it upon a chart. In many cases the revolution of the wheel can be stopped without stopping the passage of water and the meters are somewhat subject to clogging by sticks, brush, tumble-weed, silt, etc.

It has been suggested many times that the solution of the problem of irrigation measurement would ultimately be found in the use of a device upon the principle of the Venturi meter, invented in 1887 by Clemens Herschel. Although Venturi meters have been employed to meet a great variety of conditions in municipal gravity and pumping plants, hydraulic power installations and filter plants, irrigation engineers have felt that for their work the cost of the standard Venturi meter tubes and instruments, which in the case of the usual installation is very small compared with the total cost of the work, would be prohibitive in irrigation projects. It was recognized, however, that the Venturi meter tube, which contains no mechanism, presents some peculiar advantages for irrigation measurement, among which are wide measuring range, small loss of head, and freedom from clogging.



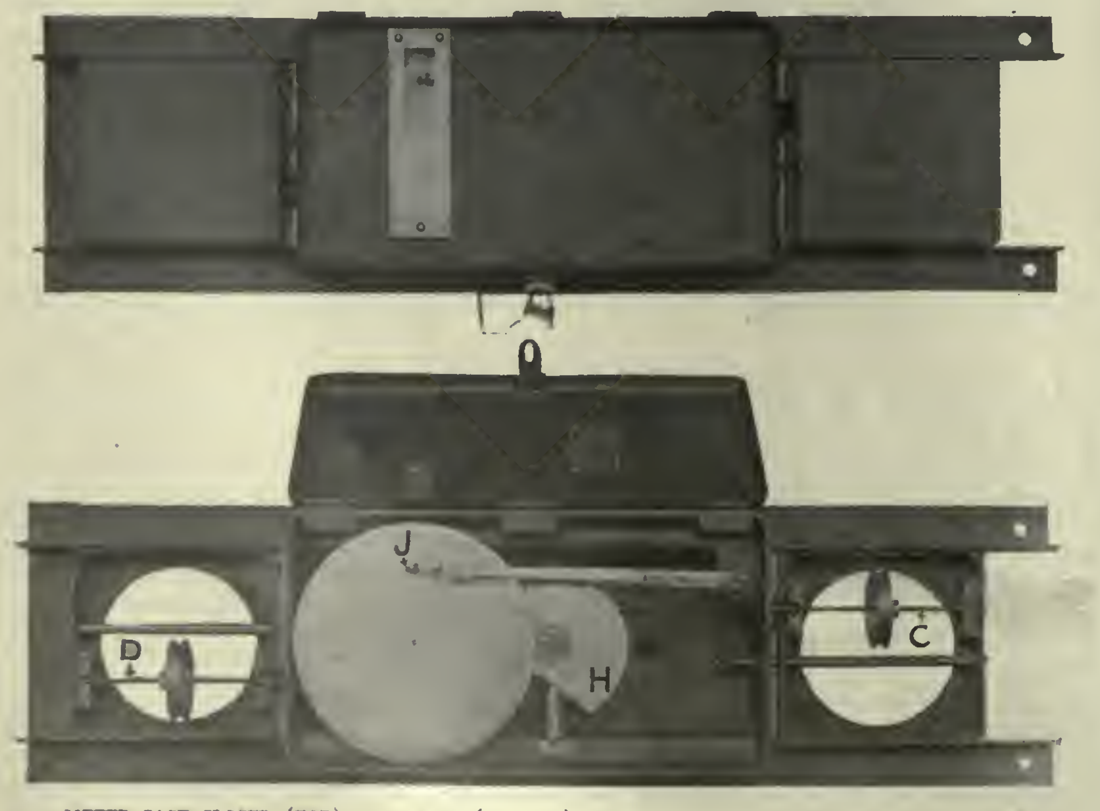
RELATION OF PARTS OF VENTURI IRRIGATION METER

As early as 1908, F. N. Connet, M. Am. Soc. M. E., chief engineer of the Builders' Iron Foundry, of Providence, R. I., perfected the design of a Venturi meter especially adapted for irrigation work. About five years intervened during which studies of conditions in California, Arizona, Oregon and Washington were made. Finally in 1913 the first installation under service conditions was made on the U. S. Reclamation Service, Salt River project, near Phoenix, Arizona.

VENTURI PRINCIPLES

The fundamental Venturi formula $V = c\sqrt{2gH}$ still obtains. V is the velocity through the throat in feet per second; c a constant, depending upon the design of the meter; g the acceleration due to gravity; and H the acting head or difference in pressure at the inlet and throat of the meter tube. The head at the inlet A in the drawing is practically the level of the canal, lateral or ditch in which the tube is placed. The head at throat B is the head at A minus the differential head, H. This difference in head is converted into velocity and is not lost in eddies or friction. The function of the outlet or downstream cone is to reduce the throat velocity gradually to that in the ditch and thereby recover the pressure temporarily lost at the throat.

In the standard Venturi meter instruments the pressures at A and B operate mercury columns when the meters are subject to heavy pressures as in hydraulic power plants. Under low head conditions, as in filter plants, the water columns in the tubes connected to the inlet and throat are used to operate floats which, in turn, actuate the instrument by cables. Several hundred installations of this type are in service.



METER CASE CLOSED (TOP) AND OPEN (BOTTOM) SHOWING ARRANGEMENT OF MECHANISM

The same principle is used in the Venturi irrigation meter instrument. Two floats operate in pipes connected to the inlet and throat of the meter tube and rest upon the surface of the water levels within those pipes. By the use of cables properly counterweighted these floats operate the shafts C and D, shown in the photograph, and these in turn, through differential and bevel gears, control the movement of the cam H. The cam moves a roller and arm which carries the pencil J. The purpose of the cam is to get from the square root of the head H to the discharge Q which is a quantity of the first power. The calibration curve of the meter is, therefore, nearly a straight line over the entire range of operation. Care was taken to eliminate friction so far as possible, and at the same time to construct the instrument with sufficient ruggedness and simplicity to enable it to withstand the severe conditions of irrigation service.

The photographs illustrate particularly the cam, the pencil arm and the chart. The latter is circular and is usually graduated for seven days. The window in the case permits observation of the chart without the necessity of swinging back the cover. The latter is hinged and fastened with a small padlock; a sliding shutter protects the glass from possible injury. When it is desired to remove the chart, the cover of the meter is lifted, the pencil slipped up, and the chart replaced.

The chart record method of measurement is advantageous in many ways. The records usually approximate a perfect circle or a portion of one and the totals can frequently be determined by observation.

Where it is desired, a chart planimeter may be used for integrating the records. Should any unusual condition obtain, such as an attempt at tampering, an indelible trace is left for the ditch rider to observe. The time of turning water on and off, the amount delivered to any particular tract, the efficiency of the irrigators may be determined from the record. The charts, therefore, form a basis for the study of water waste and an aid to systematic conservation of the supply. The advantage of the permanent record as an aid to settling disputes between vendor and purchaser is beyond question.

COMPARATIVE TESTS

Some of the first tests were made by the engineers of the U. S. Reclamation Service on the Salt River project. Since means for volumetric measurement were not available, comparison was made between the Venturi, a recently calibrated current meter, and a rectangular weir. Care was taken to obtain weir conditions as nearly ideal as possible.

The following paragraph is an extract from the report by the Board of Engineers appointed by the project manager of the Salt River Project, at the request of the board of governors of the Salt River Valley Water Users' Association.

"The test for accuracy was made on a standard 15 sec.-ft. capacity Venturi meter. All discharge measurements were made by Frank Asplind with a regulation Price acoustic meter and were checked by observation of flow through a standard rectangular weir, corrected for velocity of approach. The discharge of the Venturi meter was measured at twelve separate points, ranging from 2.96 cu. ft. per second to 16.86 cu. ft. per second, the loss of head being measured in each case. If the weir readings be accepted as standard, the Venturi meter reads 1.67 per cent low, and if the current meter readings be accepted as standard the Venturi meter reads 2.72 per cent high. Thus it will be seen that there is a greater discrepancy between the readings from the two methods used to check the Venturi meter than there is between the readings of either compared with the readings of the Venturi meter."

This may be at least partially accounted for by the fact that because the Venturi principle takes into account differences in pressure, velocity of approach, nearly always an uncertain quantity is eliminated and the coefficients of discharge are nearly constant over the entire measuring range.

The report goes on to say that both clear and muddy water as well as trash were passed through the meter tube without derangement. It was found that the meter is adapted for use in numerous cases, especially at the heads of the main laterals and on the farm turnouts.

The loss of head occasioned by the insertion of the meter tube in the ditch is under usual conditions less than 2 in.

MATERIALS FOR METER CONSTRUCTION

Various materials have been used for Venturi meter tubes, the type of construction depending upon the locality. Cast iron is, of course, desirable but the comparatively high cost of this material in isolated localities limits its use. An excellent design is the use of a cast-iron throat with ingot iron cones. In a great number of instances the use of concrete throughout is recommended and after the forms are obtained the cost is nominal. The writer does not recall any instances of Venturi irrigation meter tubes constructed of wood staves, but there is reason to believe that this design would be found suited to many localities.

In addition to the installation previously mentioned, the Venturi meters have been placed on the Yuma and Sunnyside (North Yokima) projects of the U. S. Reclamation Service; on the systems of the California Development Company at Calexico; on the property of Imperial Water Company, in the Imperial Valley, California; and for experimental purposes by Leland Stanford University at Palo Alto, and the University of California experimental farm at Davis. In some instances a gate is placed immediately following the meter and the proper amount of water to be applied can be governed to a nicety.

From the standpoint of conservation the adoption of a uniform system of irrigation metering is to be recommended. By preserving the supply, not only does the water user reduce the cost of irrigating his own lands, but the quantity of water saved makes possible the reclamation of additional lands, thus increasing the total area responsive to cultivation.

First Step Is Made in Mathematical Analysis of Capacity of Single Track

Study of Effect of Number and Location of Passing Sidings Results in Formulas Covering Trains of One Class and Rate of Speed

THE proper location of passing sidings along single track, and its effect on the capacity of line, has been under investigation during the last year by the committee on signals and interlocking of the American Railway Engineering Association in connection with the study of the problem of signaling single track. The committee makes no final report on the subject, but offers as a progress report the substance of an analysis by F. L. Dodgson, consulting engineer, General Railway Signal Company, who has been co-operating with the committee. Thus far the study has been confined to trains of one class and rate of speed. The discussion is printed here, however, slightly condensed, as suggesting a method of attack which is to be developed to cover trains of all classes.

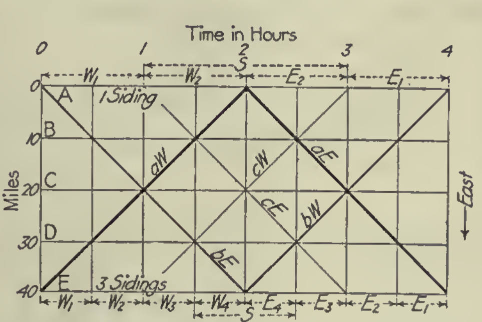


FIG. 1—LEVEL TRACK, 40 MILES LONG, UNIFORM SPEED OF 20 MILES PER HOUR FOR ENTIRE RUN

In considering the effect of passing-siding locations on the capacity of single-track railroad, it would seem to be the most logical thing to determine first, if possible, what rule or rules, if any, must be followed in order to locate the sidings so that the maximum capacity of the road will be obtained. Let us first assume a piece of level railroad 40 miles long over which we are to operate one class of trains only, these trains traveling at a uniform speed of 20 miles per hour. Fig. 1 is a train diagram of such a road, with the distance the vertical lines and the time the horizontal lines. If there were no sidings on this road, two trains could be run (one in each direction) each four hours during the day. These two trains are shown on the diagram by the two heavy lines *aW* and *aE*.

If, now, we assume that there is one passing siding on the road, it is quite evident that the maximum capacity would be reached with this located exactly in the center of the road. With this arrangement two additional trains could be run each four hours, and they are shown on the diagram by the lines *bE* and *bW*. If we represent the time required for the westbound train to run from E to C (C being the siding location) by W_1 and the time for the same train to run from C to A by W_2; likewise the time required by the eastbound train to run from A to C by E_2, and the time to run from C to E by E_1; and represent by S the spacing in time between trains running in the same direction; we will find that

$$S = W_2 + E_2 \tag{1}$$

$$\text{and} \quad S = W_1 + E_1 \tag{2}$$

$$\text{therefore} \quad W_2 + E_2 = W_1 + E_1 \tag{3}$$

or, the sums of the running times of an eastbound and a westbound train between sidings are equal.

Now let us add two more passing sidings. Again it is obvious that the maximum capacity will be obtained if these two are located midway between A and C, and C and E. If, as before, we represent the running time of the westbound train from E to D by W_1, D to C by W_2, C to B by W_3, and B to A by W_4 (B and D being the locations of the two new sidings); and also the running time of the eastbound train from A to B by E_4, B to C by E_3, C to D by E_2, and D to E by E_1; and as before make S the time spacing between trains in the same direction; we will find from the diagram that

$$S = W_1 + E_1 \tag{4}$$

$$S = W_2 + E_2 \tag{5}$$

$$S = W_3 + E_3 \tag{6}$$

$$\text{and} \quad S = W_4 + E_4 \tag{7}$$

therefore

$$W_1 + E_1 = W_2 + E_2 = W_3 + E_3 = W_4 + E_4$$

This last equation stated in words again means that the sums of the running times of trains in opposite directions between passing sidings are all equal.

From Fig. 1 it will appear, therefore, that the maximum capacity of the railroad, with a given number of passing sidings, would be reached when the sums of the running times of the eastbound and westbound trains between passing sidings were all equal.

By adding equations 1 and 2 we have

$$2S = W_1 + W_2 + E_1 + E_2 \tag{8}$$

or, representing $W_1 + W_2$ by W, the total running time of the westbound train, and, similarly, $E_1 + E_2$ by E,

$$S = (W + E)\,/\,2 \tag{9}$$

which is the value of S when there is only one passing siding.

Again, if we add equations 4, 5, 6 and 7, we have

$$4S = W_1 + W_2 + W_3 + W_4 + E_1 + E_2 + E_3 + E_4 \tag{10}$$

$$\text{or} \quad S = (W + E)\,/\,4 \tag{11}$$

If we let N equal the number of passing sidings, then, in equation 9, $2 = N + 1$, and, in equation 11, $4 = N + 1$. Therefore, by substituting N in equations 9 and 11 for the number of sidings, we obtain the formula

$$S = \frac{W + E}{N + 1}$$

In deriving the above formula we have

VARYING AND UNEQUAL RUNNING TIMES

Distance, miles	Westbound, minutes	Eastbound, minutes
0 to 10	27	30
10 to 20	27	24
20 to 30	51	27
30 to 40	39	27
Total	144	108

assumed uniform and equal speeds of trains. In order to show an application of this formula and also to prove its correctness, let us assume varying and unequal speeds. Let us assume the running times to be as given in the table.

Now in Fig. 2, plot the line *aW*, using the time for westbound trains shown in the above table, and from the point where this line crosses line A plot the line *aE*, using the time shown for eastbound trains in the same table. First, let us assume one passing siding. Then in our formula,

$$S = \frac{W + E}{N + 1}$$

$W = 144$, $E = 108$ and $N = 1$, which gives the value, $S = (144 + 108) / 2 = 126$ min.

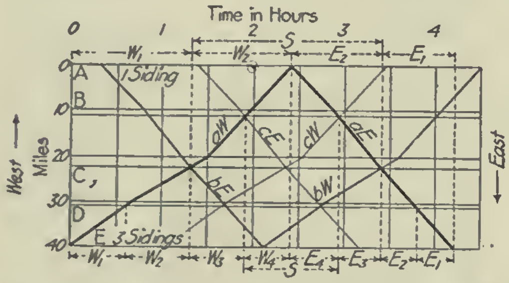


FIG. 2—TRACK NOT LEVEL, RATES OF SPEEDS VARYING ON DIFFERENT PARTS OF LINE

Now in Fig. 2, we will plot the line *bW* 126 min. from *aW* and parallel with it, and will also plot the line *bE* 126 min. from *aE* and parallel with it. Then *aE* will cross *bW*, and *aW* will cross *bE* on the same horizontal line, because the two triangle-like figures formed on the line E as a base by the lines *aW* and *bE*, and *bW* and *aE* have the same length of base, and their other corresponding sides parallel with each other and must, therefore, be the same in height. If the passing siding is located at the line C it is evident that we will again have the maximum capacity of this piece of road under the conditions given; and it is also true that the sum of the running times between A and C of the westbound and eastbound trains is equal to the sum of the running times of the same trains between C and E.

Now let us add two more passing sidings. From our formula we find that under these conditions $S = (144 + 108) / 4 = 63$. If on Fig. 2 we plot the line *cW* parallel with and 63 min. from *aW* and the line *cE* parallel with and 63 min. from *aE*, we will establish the positions of the passing sidings B and D at the points where these two lines intersect the lines *bE* and *aE*, *aW* and *bW*. As before, this arrangement gives the maximum capacity, and the sum of the running times between A and B is equal to the sum of the running times between B and C, etc. The rule, therefore, holds true when the running times are unequal and speeds not uniform.

While the method just pointed out in Fig. 2 will answer admirably as a graphic method of determining the locations of passing sidings for maximum capacity, it will not answer for determining the capacity of the railroad, because we have not taken into account the time lost by a train which takes a siding to meet another train, nor the time required for water stops.

Starting again with a uniform speed of 20 miles per hour, let us assume on our 40-mile stretch that there is a water stop at mile post 15, and further let us assume the total time lost in taking water by each train to be 12 min. The total running time, therefore, of each train would be 2 hr. 12 min. Further, let us assume that the time lost by a train taking a passing siding for another train to pass is 9 min. and that one-half of this time is consumed in entering the siding and one-half in leaving, and let us also assume that the eastbound train takes the siding. Fig. 3 shows the train diagram for such an arrangement with one passing siding.

If we let S equal the spacing between trains in the same direction, the number of trains per day, represented by T, will be $T = 1440 \times 2 \div S$ (1440 being minutes in a day and S being expressed in minutes), or $T = 2880 / S$.

We may determine the value of S as follows: Assuming that W_2 represents the time of the westbound train running between the passing siding and 0, and W_1 the time running between the passing siding and 40, and E_2 the time consumed by the eastbound train in running between 0 and the passing siding, and E_1 the time between the passing siding and 40, and also letting a represent the time consumed by a train taking the passing siding to meet another train, we have from the diagram

$$S = W_1 + E_1 + a/2 + a/2$$

also $\quad S = W_2 + E_2 + a/2 + a/2$

adding, $2S = W_1 + W_2 + E_1 + E_2 + a + a$

or $\quad S = W + E + 2a.$

If N equals the number of passing sidings, then substituting in the last equation $T = 2880/S$ we have

$$S = \frac{W + E + (N + 1)\ a}{N + 1}$$

Substituting this value of S in the equation $T = 2880/S$ we have

$$T = \frac{2880\ (N + 1)}{W + E + (N + 1)\ a}$$

It will be seen that, up to this point, there have been developed methods of finding the proper locations of passing sidings for trains of one kind and determining the capacity of a given piece of single-track road in trains of one kind. It is expected that formulas or methods will be developed for determining capacity in trains of one kind as affected by the movement of a given number of trains of other kinds run on definite schedules. Then the various formulas will be applied and tested in the analysis of actual pieces of road with their actual movement of scheduled trains.

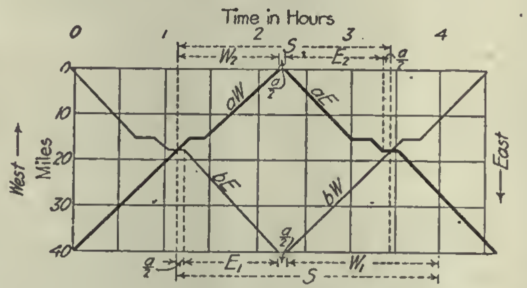


FIG. 3—ACCOUNT TAKEN OF WATER AND PASSING STOPS FOR TRAINS WITH UNIFORM SPEED

Monolithic Brick Road Built on Old Macadam Base

Cost of $1.06 a Square Yard Reached in Spite of Hand Methods Required by Small Size of Job

A PORTION of an old macadam roadway in Godfrey township, just outside of Alton, Ill., was paved in the fall of 1915 with brick laid in a 2-in. dry cement mortar bed on the leveled surface of old macadam roadway. Accurate cost data were kept on this construction. The method of construction is said to have proved very satisfactory.

After grading was completed and the forms set a 2-in. base of a dry mixture of cement and sand in the proportions of 1 part of cement to 4 parts of sand was placed between forms and then leveled and rolled. The brick used are known as "highway pavers" or "No. 1 light" brick, which will show an average rattler loss of about 25 per cent. These brick were laid upon the base and rolled with a hand roller. The surface obtained in this way was exceptionally even. The brick were then flooded with an amount of water sufficient to saturate the sand-cement base, and the joints between the brick filled with a grout consisting of equal parts of sand and cement thoroughly mixed.

COSTS

The paved strip was 446 ft. long and 14 ft. wide, containing 693.8 sq. yd. Sand cost $0.82 per ton and cement $1.35 per barrel, net. Common labor received $0.20 per hour and the foreman $3 per day. The water cost nothing, but the depreciation on pipe and the cost of connecting the water line are included in the figures given below. The roller for the subgrade was loaned, but the wages of the operator, $2.50 per day, were included in the cost data. A team with driver cost $6 per day.

The itemized cost was as follows:

Item			Total cost	Cost per sq. yd.
Labor:				
Grading, setting forms, building barricade			$58.45	$0.084
Mortar base and laying brick			60.73	.087
Filler			18.50	.027
Labor total			$137.68	$0.198
Base:				
57.32 tons sand at $0.82		$46.93		
54 bbl. cement at $1.35		72.90		
3 cement sacks short		.30		
			120.13	.173
Filler:				
5 tons sand at $0.82		$4.10		
25 bbl. cement at $1.35		33.75		
			37.85	.054
Forms:				
992 ft. 2 x 6 x 12, at $20, assuming salvage 67 per cent		$6.66		
14 ft. double template, 60 oak stakes		6.05		
Steel stakes		.85		
Nails		.35		
			13.91	.02
Miscellaneous:				
800 ft. No. 9 wire $3, salvage, 50 per cent		$1.50		
Staples		.15		
6 red lanterns	$4.50			
2 extra globes	.40			
	$4.90			
Salvage 50 per cent	2.45			
		2.45		
1 water bucket		.25		
1 sprinkler		.60		
25 per cent depreciation on shovels, squeegees, etc.		13.50		
Depreciation water line		6.00		
Teaming tools, etc.		2.00		
			26.45	.038
Finishing:				
2 teams with drivers one day			12.00	.017
Brick			338.58	.56
Final total			$736.60	$1.06

An effort was made to include a generous provision for depreciation. The size of the job necessitated hand mixing and in other ways increased the cost of the job over the unit costs that could be obtained for a larger one. The final cost per square yard does not include any contractor's profit but otherwise is thought to represent accurately what a road of this type can be built for in the vicinity of Alton. The resulting pavement is subjected to a heavy traffic leading from Alton toward the north. The low cost of this heavy-traffic road is expected to result in other roadways of the same type being built in this vicinity.

Committees of American Railway Engineering Association Complete Another Year of Work

Abstracts of Reports Made to the Annual Convention of the Association, Which Meets in Chicago This Week

[*Following its custom, there is here presented a summary of the reports made by its committees to the American Railway Engineering Association, in convention in Chicago this week. These reports have been appearing in the association's bulletins during recent months. Comment is necessarily brief. More extended abstracts of some of the reports will appear in subsequent issues. Since this summary is prepared in advance of the convention it necessarily takes no account of action on the respective reports.*—EDITOR.]

Roadway

Progress only is reported by the committee on roadways. A circular letter and list of quotations have been sent out pertaining to steam shovels, mechanical excavators, and similar equipment, but the committee withholds reporting on this until more replies have been received.

Some further work has been done by the subcommittee investigating allowable unit pressures on roadbed of different materials, but the committee is not yet ready to report on the subject. The subcommittee investigating the prevention and cure of water pockets in roadbed desires to await the demonstration of the efficiency of the remedies adopted before drawing conclusions. The subcommittee on revision of the *Manual* points out that the 24-in. depth of ballast for class A track will require a width of subgrade of approximately 26 ft.

In further explanation of the subject of haul and overhaul discussed in last year's report of the committee, two monographs —"The Profile of Quantities," by S. B. Fisher, and "The Overhaul and Distribution Diagram," by J. R. W. Ambrose, are submitted. (Bulletin 183.)

Ballast

The committee on ballast offers for adoption the following order of efficiencies of ballast: (1) Stone, (2) broken slag (not granulated), (3) gravel, (4) chats, (5) burnt clay or gumbo, and (6) cinders. The committee states its belief that the efficiency of gravel for ballast is much improved by washing, because this removes undesirable materials, and because if the plant is properly arranged the desired per cent of each size of gravel can be secured during the process of washing.

Reports from three railroads on the use of the pneumatic tamping machine are presented, but the committee is unwilling to make definite recommendations regarding the machine. The committee presents pictures and data regarding ballast "formers"; it concludes that "formers" results in considerable economy, but that specific data have not yet been obtained to make a complete report.

Regarding ballasting by contract, the committee has had much difficulty in obtaining good comparative figures, but is convinced that under certain conditions the method is satisfactory and more economical than ballasting by company forces.

The subcommittee investigating the economical and efficient depth of ballast has continued its study, and has obtained reports from ballast tests on various railroads under federal valuation. These investigations indicate that there is a much greater depth of ballast actually existing in track than has previously been supposed, and that while many standard plans show 12-in., the actual depth in main line is much greater. The committee recommends a minimum depth for class A track of 24 in. under bottom of tie on fills, and 12 in. through rock cuts or on material which will not be deformed by the application of live loads. The committee again unanimously recommends that the test outlined in the 1913, 1914 and 1915 reports be made under regular traffic.

Three appendices are presented, one on stone ballasting by contract, by John Evans, of the Michigan Central; one on the efficiency of various stone and gravel ballasts, and one on the gravel washing plan of the Brook Haven Gravel Company, at Brook Haven, Miss. (Bulletin 183.)

Ties

A set of specifications for switch ties, and a revised set for crossties to be substituted for those now in the *Manual* are offered by the committee on ties. The revised specifications for crossties change the classifications of woods to some extent, and involve certain changes in methods of handling.

On the subject of the effect of tieplates and track spikes on the life of crossties, the committee states that the practice of railroads is anything but uniform, and that the methods of properly protecting the tie are going through rapid changes, which make it difficult for them to say definitely as to the effect on the tie of any particular part of the design. The committee feels that no definite practice can be presented as having been developed to such an extent that it should be adopted, but it illustrates what it calls certain tendencies of good practice and directs particular attention to the necessity of reducing or eliminating, if possible, movement between the tieplate and the tie. Standards and other data of a number of railroads are presented.

Twenty-two pages are given to new data compiled on the use of metal, composite and concrete ties. (Bulletin 182.)

Rail

Taking both the committee report and related papers unusual attention is given to the subject of rails. No changes in the *Manual* are suggested, except that certain specifications now embodied in the *Manual* under the chapter on track are to be withdrawn and new ones substituted. These specifications cover quenched carbon and quenched alloy-steel joint bars, quenched carbon and quenched alloy-steel track bolts with nuts, and for medium carbon-steel track bolts with nuts.

Statistics of rail failures, for the period ended Oct. 31, 1914, are presented, and show that the number of failures of rails rolled in successive years since 1908 has decreased. Failures of Bessemer rails are double those of open hearth.

No conclusions have yet been reached on the effect on rails of defective equipment and improper maintenance. The committee states that it will not be able to make any definite report until the joint committee on stresses in railroad track is prepared to go extensively into the matter of making experiments to develop just what the effect of bad flat spots on wheels is on the rail.

There are appendices on "American Rail Mill Practice," and on "Internal Fissures in Rails." (Bulletin 184.)

Track

For adoption and publication in the *Manual* the committee on track recommends a design for a double switch lug; typical layouts (general plans) of Nos. 8, 11 and 16 double crossovers, 13 and 15-ft. centers; typical layouts for frogs for same; typical layouts of Nos. 8, 11 and 16 double slip crossings with square and with staggered switch points, and a typical plan of frog guard rails. The committee also recommends for adoption its report on the relation between worn flanges and worn switch points. The committee believes that neither the rule suggested last year nor any other rule will, even in a remote sense, cover the conditions aimed at, and asks that it be relieved from further consideration on the subject.

The subcommittee on economics on track labor, while reporting progress only, points out the magnitude and importance of the subject and hopes that it may be permitted to continue its investigation without taking on any other work. Last August a circular was sent out to roads not reporting special records of track sections, and the committee hopes that these roads, as well as the eighteen from which records of test sections have been received, will produce much valuable information.

Progress is reported by the subcommittee investigating specifications and designs for cut and screw spikes. Certain changes in the specifications for the former are proposed.

The committee recommends that the study of increased thickness of wheel flange, design of manganese frogs and crossings, and the action of brine drippings on tieplates be continued. Tests of the effect of brine drippings are soon to be conducted in the yards of the Chicago Junction Railway at the Union Stock Yards. (Bulletin 183.)

Buildings

One change in the *Manual* is recommended by the committee on buildings. Under the item "engine houses," it is recommended that engine houses where there is no means of turning engines be equipped with smoke jacks at each end of each stall.

A page of rules regarding freight-house scales and three pages, illustrated, regarding ash pits are offered. Where a large number of engines are handled the committee recommends the water-type pit, with locomotive or gantry crane with grab buckets. (Bulletin 183.)

Wooden Bridges and Trestles

The committee on wooden bridges and trestles submits six pages of discussion of the design of docks and wharves, together with five pages of drawings showing typical designs. The committee points out that there are few wharves and docks now being built which are not partly or entirely of steel and concrete, and the committee has assumed that these should be included in the investigation.

Abstracts of replies from about fifty railroads relative to the comparative merits of ballast-deck wooden and reinforced-concrete trestles are presented. Data are also presented concerning the use of lag screws for fastening guard timbers. In view of the fact that a comparatively small number of roads have used lag screws, and that a few have abandoned their use, the committee does not yet feel justified in recommending their adoption, in spite of the very general satisfaction expressed by some of the roads using them.

The committee recommends that it continue all three of its investigations for another year, and that it investigate the merits of galvanized iron fastenings for timber trestles, especially creosoted structures.

The committee mentions a communication from E. P. Goodrich suggesting a modification of the association's specification to admit piles near enough straight so that a line held in contact with any two points selected so as to give the maximum deviation shall not be distant from the surface of the pile at any point more than the diameter of the pile at that point. The committee believes, however, that the present specification should be retained, which requires that a line from center of butt to center of tip shall lie with the body of the pile. (Bulletin 182.)

Masonry

Specifications for the construction and driving of premolded concrete piles, together with a brief discussion of them, are offered by the committee on masonry. Patented cast-in-place concrete piles were not considered.

A five-page report on the appearance, wearing qualities and cost of various methods of surface finish of concrete is presented. This includes specifications for rubbing with carborundum or cement bricks, for rubbing with wooden floats and for washed or scrubbed surfaces, together with four conclusions for adoption in the *Manual.* The gist of the conclusions is that the spaded finish is the most durable and economical for work not requiring decorative treatment, and that bush hammering or other tool work gives the best appearance. Coating with a wash of cement is not recommended. Rubbing with carborundum bricks or wood floats is next to spading in ease of application and cost.

Regarding the design of foundations in various soils and depths of water, the committee has confined itself to the searching of records as to the general practice of investigating the carrying capacity of foundation soils. Answers to questions submitted to the membership and others are presented in tabulated form. In the near future the committee expects to prepare a form showing in what manner records of tests of foundation soils may be duly kept.

Brief reports of the activities of the Joint Committee on Specifications for Cement and the Joint Committee on Concrete and Reinforced Concrete are presented. The members of the latter committee desire the association to decide whether steel reinforcing bars rolled from steel rails are recommended, whether they are recommended provided they are used only when they do not need to be bent, and whether they are recommended for use under the same conditions as bars rolled from billets under the requirements of the specifications for high carbon steel of the American Society for Testing Materials. (Bulletin 182.)

Signs, Fences and Crossings

Following the objection raised to the old conclusions relative to track construction and flangeways at paved street crossings and in paved streets, the committee on signs, fences and crossings has gone into the matter at considerable length, and gives an extensive discussion of the subject in its report. The committee has reached the conclusion that two distinct conditions are to be met, and that three distinct forms of construction are desirable. For paved street crossings it is recommended that the regular standard track construction be used and the space occupied by the track or tracks be planked over. A plan is offered for light traffic and another for heavy. For tracks located in paved streets subject to heavy traffic, requiring granite block paving, the committee believes the construction should consist of stone or gravel ballast not less than 12 in. deep, treated ties and 141-lb. 9-in. girder rail; for tracks in streets subjected to light traffic only, standard track construction, using treated ties and stone or gravel ballast, the space occupied by the tracks to be paved to meet municipal requirements.

The committee found a variety of schemes for providing flangeways at road and street crossings and in paved streets, and it recommends that further study be made to determine the proper flangeway through crossing frogs where steam railroad tracks are crossed by trolley tracks.

The committee feels that it has exhausted the subject of concrete fence posts, but believes the matter of signs should be investigated with a view to reducing the number and adopting a standard for general use. It believes their location should also be considered. The committee also recommends that the legal requirements relative to fencing right-of-way and providing stock guards be investigated. (Bulletin 181.)

Signals and Interlocking

The committee on signals and interlocking presents a seven-page discussion of the capacity of single track which is offered as a progress report. It also submits for adoption a page of findings of the Railway Signal Association.

Because the main controlling power of signal apparatus is electrical and because the special training required is so different, the committee does not believe it is desirable to combine signal and track forces in signal maintenance. Occasionally it will, in the estimation of the committee, be found practicable and economical to combine forces engaged in maintaining various electrical features with those maintaining signals, but as a general proposition, economy and efficiency will be produced to a higher degree by co-operation and by combination. (Bulletin 181.)

Records and Accounts

Several symbols to be substituted for those now in the *Manual* are suggested by the committee on records and accounts. The committee also submits the two-page alphabetical index covering the list of conventional signs.

A page of matter is devoted to methods for reproducing maps and profiles on drawing linen for permanent record. The ordinary processes are mentioned, and brief descriptions are given of four others, the photographic, the hectograph, the planograph and the lithographic.

The committee reports progress in its investigation of the use of small forms on cardboard. (Bulletin 183.)

Water Service

The committee on water service offers nothing for inclusion in the *Manual,* but submits as information a short discussion of the cost of pumping water by various methods, together with five extensive tables compiled from data received from a number of railroads. It also presents as information a five-page discussion of protection for water stations against freezing. (Bulletin 181.)

Yards and Terminals

One new definition, that of a "holding yard," is offered by the committee on yards and terminals for adoption in the *Manual.* Progress is reported on the investigation of the handling of freight in double-deck freight houses, but the committee is not yet ready to submit its report.

During the last year the committee has observed the results obtained by the use of two of the methods for studying the working capacities of stations and approach tracks referred to in its report for 1912. The committee reports that the methods used at the Broad Street Station at Philadelphia and at the new Union Station in Kansas City have proved very satisfactory. The committee's co-ordinate train-diagram and track-occupancy diagram used at Kansas City just subsequent to the opening of the new Union Station for the purpose of scheduling trains on the proper tracks, permitted a reasonably accurate forecast to be made of the best schedule for accomplishing the loading and unloading of trains and the transfer to and from trains, also of obtaining the most efficient use of the throat tracks during the rush hours.

Studies of the operation of two hump and one flat yards for a month last year were made, and comparative results are presented in tabulated form.

Recommendations for the design, construction, maintenance and operation of railroad track scales, which have been submitted to the committee on weighing of the American Railway Association and conform in general with its "track-scale specifications and rules," are presented for consideration, but the committee does not ask that they be adopted in the *Manual* this year. (Bulletin 182.)

Iron and Steel Structures

Six subjects, including the revision of the *Manual,* were assigned to the committee on iron and steel structures. The committee believes all of them are worthy of much further investigation, and makes no final report on any of the six. Short progress reports are submitted by the subcommittee investigating methods of protection of iron and steel structures against corrosion, that investigating column tests, and that studying the relative economy of various types of movable bridges. A nine-page report of the subcommittee studying the design, length and operation of turntables is confined to a discussion of phosphor bronze for use in turntables and movable bridges. This discussion includes specifications for bronze bearing metals, a bibliography of hardness testing, a discussion of particular uses of bronze in movable bridges and a table of the composition and physical properties of bronzes.

A 25-page discussion of working stresses for bridge structures is submitted, the committee expressing the earnest hope that the proposed changes in bridge specifications will receive liberal discussion, and that at the next annual convention final conclusions may be presented for adoption.

The requirements for the protection of traffic at movable bridges, which had been in the hands of the committee for two years, have been the subject of further consideration. A résumé of the subject was published in *Bulletin* 178, and the committee recommends for adoption the specification printed on page 274 of that bulletin. It also recommends for adoption three additional specifications submitted by a committee of the Railway Signal Association. (Bulletin 178.)

Economics and Railway Location

Progress only is reported by the committee on economics of railway location. Some work has been done and subcommittee reports considered. While the results are instructive it is not thought advisable to publish them at this time.

The chairman of the committee, J. G. Sullivan, made a careful study of the statistics of coal consumption in freight service on the Western lines of the Canadian-Pacific Railway for the past eight years. These studies have convinced him that instead of attempting to base coal consumption directly on the amount of work done it is better to divide the coal into two factors; one varying directly with the amount of work done and the other with the engine-miles run. As a result of these studies the following formulas have been adopted for Western lines of the Canadian-Pacific Railway:

Single-track operation—fairly busy lines, 3.5 lb. coal per calculated horsepower hour, plus 50 lb. per engine-miles run.

Double-track operation—3 lb. coal per calculated horsepower hour, plus 60 lb. per engine-miles run.

The above figures are an average for the year, for conditions on the Canadian-Pacific Railway, Western lines, using engines equipped with super-heaters and having drawbar pull varying from 36,000 to 42,000 lb. each. (Bulletin 184.)

Wood Preservation

Much time has been given during the year to the investigation of tests for determining a standard method of finding the percentage of water contained in creosote oil when shipped in tank cars. In conjunction with committees of the American Society for Testing Materials and the American Wood Preservers' Association a very complete experiment was carried out. The results of the test, however, are presented only as a progress report. Preliminary conclusions, however, are advanced as to the correct method of securing a sample for tests. Among these preliminary conclusions is the suggestion that a certain type of sampling apparatus, illustrated in the report, be used for taking quantities in different zones in the cars.

Assigned to the committee last year was the subject of the relation of the amount of preservative and the depth of penetration to the resistance of the material against decaying. The committee has studied the service tests available in the light of this problem. It finds, however, that while the amount of preservative and the factor of decay are noted, there is no information on the depth of penetration. It is not yet able to report any conclusions whatsoever, but will continue its investigations this year. It raises the point as to the relation of mechanical abrasion in connection with the relation between depth of penetration and protection against decaying. It states that the records of timbers and piling that were not exposed to mechanical wear and in which the impregnated wood extends from ½ to 2 in. on the outside indicate that complete penetration is not necessary if the outer protective rings remain unbroken, and the ends are likewise protected. On the other hand, there is a very definite record of ties which have resisted decay until abrasion under the rail cut through the treated portion. As soon as this happened decay commenced and necessitated the removal of the ties which were otherwise in good condition.

Appendix A gives the record of service tests on different railroads under various conditions. (Bulletin 184.)

Electricity

A page of additional data regarding third-rail clearances and four pages regarding overhead clearances have been compiled and are presented by the committee on electricity.

The committee reports that the National Joint Committee on Overhead and Underground Line Construction has not yet completed its work on the revision of the crossing specifications, or completed any other new specifications. The association's delegates were actively engaged with the committee on the preparation of the revised crossing specifications when the progress of the joint committee was stopped and held in abeyance by the fact that the U. S. Bureau of Standards was about to issue a safety code which included specifications for crossings.

The committee's three representatives on the National Joint committee on electrolysis state that they have no report to make until the joint committee prepares its report. No meeting of the joint committee was held during 1915, but subcommittees have been at work preparing various sections on the report.

Nothing new is reported on the subject of installation, maintenance, water power for electrical railway operation, or maintenance organization and relation to track structures. (Bulletin 183.)

Conservation of Natural Resources

A seven-page progress report is submitted by the committee on conservation of natural resources. This includes a discussion of forestry abroad, one on wasted hydroelectric power and one on the results of electrical operation in the Northwest. On account of the war in Europe, the Conservation Association of the United States has done no work for two years, while both federal and state conservation work has been suspended, so that no progress report of work done by other conservation associations can be given. (Bulletin 182.)

Uniform General Contract Forms

A form of agreement for industry tracks is the principal offering of the special committee on uniform general contract forms. Conceding that widely different conditions, federal and state regulations and other circumstances may prevent the wide adoption of the form as a whole, even when approved by the association, the committee believes, nevertheless, that the form will be of value as a compilation and adaptation of what are regarded as the more important provisions which should be incorporated in such a document as circumstances may require.

Following a critical review of the adopted contract form, the committee recommends certain changes pertaining to bond, timely demand for points and instructions, inspection, insurance, intoxicating liquors and annulment.

Progress is reported as to forms for interlocking and railway crossing agreements. (Bulletin 182.)

Grading of Lumber

The special committee on grading of lumber calls attention to the rule adopted by the American Society for Testing Materials establishing two classes of Southern yellow pine, called "dense" pine and "sound" pine. The special committee has co-operated with the American Society for Testing Materials, and with the investigations made by the U. S. Government, and it recommends the acceptance of the definition for Southern yellow pine adopted by the American Society for Testing Materials.

The grading rules for hemlock lumber presented last year in Bulletin 174 have been revised to some extent, and the committee recommends that they be adopted as revised.

The committee states that it has been at work, in co-operation with the American Society for Testing Materials, with a view of preparing specifications for bridge timbers to be creosoted. The committee is unable, however, to indorse the tentative recommendation made by the committee of the American Society for Testing Materials. It believes that specifications for timbers to be creosoted, as far as the quality and strength are concerned, should be similar to those for timbers to be used untreated, with the exception of the relation of heartwood and sapwood. On this basis the committee has prepared specifications which it presents as information; they are simply the standard specifications for structural timber as printed in the *Manual* with all reference to the requirements as to heartwood and heart face omitted, and a clause permitting sapwood to be substituted for the heart requirements. (Bulletin 183.)

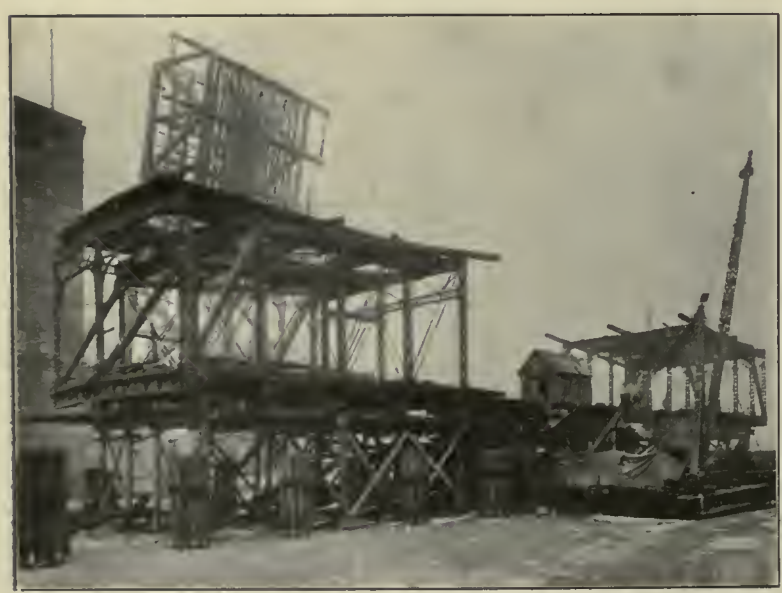
Stresses in Railroad Track

A short progress report is submitted by the special committee on stress in railroad track. It contains about the same information as that of the committee of the American Society of Civil Engineers presented at the annual meeting of that society in January. Field tests have been conducted on the main line of the Illinois Central Railroad north of Champaign, Ill. Data were taken to determine (1) the distribution of stresses and moments along the rails for a given loading, (2) the division of vertical load among adjacent ties for a given loading, (3) the distribution of vertical pressures among the ties, through the ballast and over the roadbed, (4) the depression, compressibility or thickness of the track, (5) the effect of wheel spacing of some types of locomotives and also the effect of single and double concentrated loads, (6) the effect of speed from most of the foregoing items. Tests have been conducted at 65 miles per hour. Among the variables of the track were three weights of rail, two sizes of ties and three depths of ballast. In addition to tests on standard track, minor tests have been made at spots where uneven tie spacing or worn or decayed ties might effect the stresses developed. .

STARTING TO CUT OUT CENTER OF OLD DRAW BRIDGE

ENDS OF THE OLD SPAN WILL BE CUT UP AT LEISURE

Considerable progress has been made in the development of instruments for determining the stresses. This has required considerable painstaking experimental work, and the calculation and compilation of the results of the test have also proved to require a great deal of time. The data are now being put into shape, and it is expected that the results will be ready soon for the consideration of the committee. Meanwhile the committee plans to continue the tests during the coming season, to complete the matters already partly covered and to extend the experiments to include other features, like action on curves and on tracks of different kinds. It proposes to report soon to the association the results of the tests already carried out. (Bulletin 182.)



BY THE NEXT NOON THE CENTER SPAN HAD BEEN REMOVED

Double-Deck Trunnion Bascule Bridge Put Into Use

Central Portion of Thirty-Year-Old Center-Pier Draw Span Cut Out with Oxyacetylene Torches in 1½ Days at Chicago

LESS than four days' time was required to replace the old double-deck, center-pier, iron draw span across the Chicago River at Lake Street with the new double-leaf, double-deck trunnion bascule bridge. The new bridge is 245 ft. 3 in. long between the centers of the trunnions and 70 ft. wide over all. It was erected around the old structure, while traffic on the Chicago & Oak Park Elevated line was maintained through the new leaves which were erected in a vertical position.

The program for the shift from the old bridge to the new was as follows: On Saturday, Feb. 26, at midnight, the elevated traffic was stopped over the old span and the elevated company immediately proceeded to remove the rails. The lower roadway deck had been closed during practically the whole period of erection.

On Sunday, Feb. 27, at 6 a. m., the draw span was swung into the river position and blocked up on falsework. The center portion of the old span interfering with the lowering of the leaves of the new bridge was then burned out utilizing several Oxweld acetylene torches. The sections were removed by a crane on a barge, and by noon the next day all that remained were the ends resting on the piling. The old panels of the elevated structure on each side of the river were removed and in the meantime floorbeams and stringers were placed in two panels of each leaf of the new bridge which had been omitted during construction to allow the passage of elevated trains.

While these operations were taking place the old viaduct just west of the bridge was moved south, transversely, about 4 ft. to allow the construction of the north leaf of the new viaduct in its final position. To permit uninterrupted elevated traffic during the construction of the new viaduct, an additional track will be placed on falsework south of the viaduct.

The whole of the center span panel had been removed by Monday noon and adjustments and alignments of the new leaves started. Various specified trial operations of the leaves were carried out Monday and Tuesday, until the center locks, rear locks, anchorage bearings, supports on the river piers, brakes and other portions of the operating machinery worked satisfactorily.

Ties had already been placed on such portions of the new leaves as had been possible. Tuesday night the elevated company put down the rails and the new bridge was ready to care for traffic Wednesday.

The Fitzsimons & Connell Dredge & Dock Company with P. G. Connell, superintendent, was the contractor for the substructure, which was begun in March, 1914, and completed in April, 1915. The contractor for the superstructure was the Ketler-Elliott Erection Company, for which George Hoersch is superintendent.

The work was carried out under the general direction of John Ericson, city engineer. Thomas G. Pihlfeldt is bridge engineer, Alexander Von Babo, engineer of bridge design; Clarence S. Rowe, assistant engineer of bridge construction, and William A. Mulcahy, assistant engineer in local charge.

EXCAVATION FROM THE BASES of the Culebra slides of the Panama Canal during the week ending March 6 amounted to 246,011 cu. yd., according to a report in the *Canal Record.*

Recommend Both Reservoirs and Levees to Protect Columbus from Floods

Alvord & Burdick in 400-page Report Find Cost $10,125,000 for Project Caring for Flood 45 Per Cent in Excess of 1913

PROTECTION from a flood in the Scioto River 45 per cent greater than that of 1913 can best be obtained by the Franklin County Conservancy District, Ohio, in which Columbus, Delaware and Chillicothe are located, by a combination of two unusual detention basins and channel improvements, according to a 400-page typewritten report recently submitted by John W. Alvord and Charles B. Burdick, of Chicago, chief engineers for the district. The following notes are taken from the general conclusions of the report. One of the reservoirs is on the Scioto River above Dublin, and one on the Olentangy River above Delaware. The cost, estimated at $10,125,000, includes the lands, a special $1,000,000 benefit to Columbus in the way of a water supply for the next 75 to 100 years, and numerous bridges and street improvements throughout the county.

FLOOD DATA CONCLUSIONS

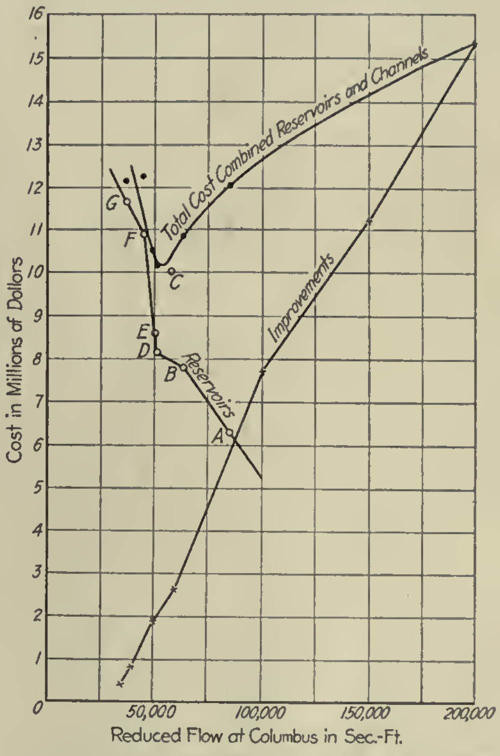
The size of the basins is such as to hold back, at Columbus, all water above 50,000 sec.-ft., the channel-capacity to be provided for through the city. The maximum runoff is taken as 200,000 sec.-ft., 45 per cent in excess of the 1913 flood, and the point of calamity would not be reached until the discharge had reached 250,000 sec.-ft. Records show that the 1913 flood is double the next greatest flood of the past 100 years. Owing, however to increased settlement and development of the valley at least six floods of record, some of which were not especially destructive, would, under present conditions, create a calamity in all probability equal to that of 1913. Flood menace, therefore, in the future is not to be measured wholly by the probability of a recurrence of the 1913 flood, but by the increasing menace of much smaller floods made dangerous by channel encroachments, combined with levees and other embankments. It is believed that in course of time the flood of March, 1913, will not only be repeated but probably exceeded, by reason of the following causes:

1. A rainfall of more than 6 in. in two days centered over the critical area below Prospect.
2. Greater rainfalls such as are on record elsewhere, centering over the whole watershed.
3. Snow accumulations melted by warm rainfalls of high intensity and duration over the critical area.
4. Gradual elimination, through improvement, of existing natural detaining basins, which on the Upper Scioto have hitherto aided in restraining excessive floods.

Taking these conclusions together it would seem the part of wisdom to provide, as a factor of safety, protective works which will prevent a calamity in a flood having at least one-half greater maximum flow than occurred in 1913. The safety of large storage basins further requires that there should be provided, as an additional factor of safety, liberal spillway capacity above this amount, capable of further fully protecting the proposed dams.

ADVANTAGES OF PROJECT SELECTED

Of the total cost approximately $2,500,000 is allowed for about 21,000 acres of detaining-basin land estimated as purchased outright. Inasmuch as practically all of this land may be continuously cultivated it will retain its agricultural value. Its cost should not be treated as entirely a burden to the taxpayers. Deducting the value of land which should be able to pay its own way, the value of water-storage capacity to Columbus, the cost of rebuilding certain structures which should be financed by the city and county, leaves about $6,000,000 as the cost of flood protection. Based on percentage of losses suffered during the 1913 flood, Chillicothe should pay 9.5 per cent; the 41,370 acres of farm lands, 10.1 per cent; Columbus, 54.7 per cent; Delaware, 3.7 per cent; the county, 6.3 per cent; the railways, 15.4 per cent, and the villages, 0.3 per cent. Water power cannot be profitably developed.



COST BALANCE BETWEEN PROJECTS FOR RESERVOIRS AND CHANNELS TO PROTECT AGAINST 200,000 SEC.-FT.

BASINS ARE LARGE

The project requires, on the Scioto River, a very large detaining basin, which will be formed by an earthen dam across the narrow valley above Dublin. The greatest height of the dam will be 143 ft. and its thickness at the base 980 ft. It will hold at spillway level 255,925 acre-feet of water and flood 9580 acres.

There will be conduits formed by tunnels in the solid limestone rock of the adjacent hillside. These conduits will be so arranged as to serve for both flood protection and water supply storage.

The project also requires a large detaining basin on the Olentangy River, about 2 miles above Delaware. This will be formed by an earthen dam 82 ft. in greatest height and 850 ft. thick at the base. It will hold at spillway level 163,202 acre-feet, and will flood 11,299 acres of land.

Two conduits tunneled in shale rock in the adjacent hillside at the river level will permit the ordinary flow to pass through the bottom of the dam.

Every precaution will be taken to provide for the safety of these dams. They will be founded on rock, will be made of extra thickness and will have ample spillways. Before they could be overtopped a flood more than three times as great as that of 1913 would have to occur. Put in another way, the spillway outlets will alone pass two and three-fourths times as much water as the maximum flow in the 1913 flood.

BALANCING CHANNEL AND RESERVOIR COSTS

It is evident that, other things being equal, the project is the best which safely passes a given flood with the least cost. Each project for reservoirs produces a different reduced flow, and, as in all these projects expenditures for channel improvements are necessary, the least cost is determined by adding to the cost of each reservoir project the cost of the channel improvements that would be required along with it. the curve marked total cost, shown herewith, represents the sum of each reservoir project with its corresponding channel improvement. It indicates very clearly that Project D, costing $8,210,712 for basins and $1,914,400 for channel improvements, a total of $10,125,112, is the most economical combination for accommodating a 200,000-sec.-ft. flood. This contemplates a channel improvement to accommodate about 50,000 sec.-ft.

Engineering for Reproduction Estimated in Detail

Missouri Commission in Mississippi River & Bonne Terre Case Works Out Campaign Instead of Using Lump Percentage

INSTEAD of adding an arbitrary percentage for engineering in estimating reproduction cost, W. W. K. Sparrow, assistant chief engineer of the Missouri Public Service Commission, in his appraisal report on the Mississippi River & Bonne Terre Railway (see the Engineering Record of Mar. 18, page 386) made a detailed estimate of what, in his opinion, would be all of the engineering work required in the construction of the road. Whether or not the accuracy of such an estimate for a large and complex railroad system would be sufficient to warrant its expense, the conditions here seemed to suggest the feasibility of such an estimate. The main line, on which this article is based, is 46½ miles long, and the estimated reproduction-cost new of the items covered by the road accounts of $2,373,507, suggests that there were probably no abnormal problems of engineering to be solved in building the road. It may be worth mentioning that the engineering as estimated figures practically 3 per cent of the estimated cost of the total for the construction accounts.

The section of Mr. Sparrow's report treating on the subject is substantially as follows:

Reconnaissance.—The main purpose for the construction of this line was to haul ore from the lead mines located at Bonne Terre, Doe Run and in the Flat River district. The governing points are therefore fixed at no great distance apart, and with the aid of the maps of the U. S. Geological Survey, the preliminary selection of a route

TABLE 1—PARTY FOR PRELIMINARY SURVEYS AND FINAL LOCATION

Locating engineer	$200
Assistant locating engineer	150
Topographer	125
Transitman	110
Levelman	100
Draftsman	100
Rodman	50
Head chainman	50
Rear chainman	50
Tapeman	40
Back flagman	40
Stake marker	40
Axemen (four at $35)	140
Cook	50
Camp helper	25
Team and driver (two at $100, furnishing own feed, drivers boarded)	200
Board	300
Total	$1,770

does not offer much difficulty. For this estimate the sum of $1,000 to cover the salary and expenses of an engineer for a period of two months is considered ample.

Preliminary Surveys and Final Location.—The composition and salaries of the locating parties used in making the estimate is as shown in Table 1. For the preliminary, or trial line, the estimate is based on 116 miles or 2½ times the main-line mileage. It is estimated that a party of the composition outlined would, in this character of country, make at least 1½ miles per day, making the cost of the preliminary surveys, 3 1/3 months at $1,770 equals $5,894, or $51 per mile. For the final location the estimated progress is figured at ½ mile per day; therefore four months at $1,770 equals $7,080. In addition to the salaries and subsistence of the party must be added the cost of the camp equipment and surveying instruments, which, after allowing for salvage, is estimated at $500. This makes a total cost of surveys of $14,474, or $310 per mile of road.

TABLE 2—ORGANIZATION OF CONSTRUCTION FORCE

Chief engineer	$300
Office engineer	175
Draftsman	100
Stenographer	75
Assistant engineers (four at $125)	500
Rodmen (four at $50)	200
Tapemen (four at $50)	200
Axemen (four at $40)	160
Teams (four at $100)	400
Tie inspector	100
Total	$2,210

Eighteen calendar months at $2,210 equals $39,780.

Construction.—The construction period is fixed at 1½ years, and the line divided into four sections of 11¾ miles each. The organization of the engineering force with the attendant salaries is given in Table 2.

Special Designing for Bridges and Buildings.—The recognized fee for consulting engineers and architects for the special designing of bridges and buildings is 5 per cent of the cost of the work, and an allowance of this amount has been made for those structures requiring such services.

Equipment and Machinery.—None of the equipment or machinery was designed by the railway, but was purchased direct from the manufacturers, and the cost of engineering would be included in the purchase price. The company would, however, require the services of a competent mechanical engineer to lay out its machine shops and determine the requirements of the company. It is considered that the sum of $1,000 should be ample to cover such services.

Table 3 summarizes the items making up the figure for engineering.

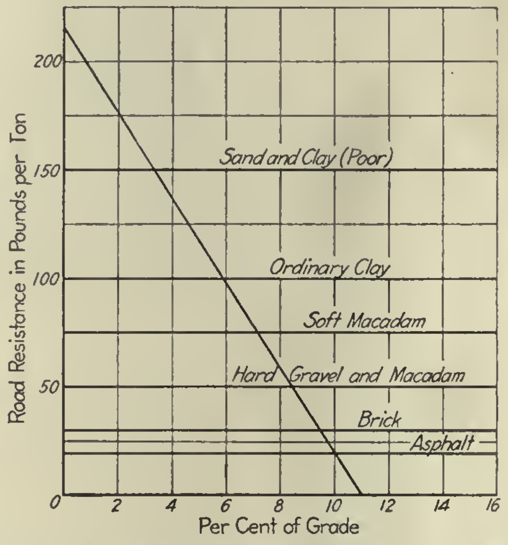
TABLE 3—SUMMARY OF ENGINEERING ITEMS

Reconnaissance	$1,000
Preliminary surveys	5,894
Final location	7,080
Camp equipment and instruments (less salvage)	500
Construction	39,780
Special designing for bridges and buildings	11,761
Equipment and machinery	1,000
Making of record maps and profiles	1,200
Total	$68,215
Cost per mile of road	$1,470

When Is It Feasible and Economical to Use Trailers with Motor Trucks?

Method, Evolved from Dynamometer Tests, of Matching Tractive Resistance with Tractive Force, Is Held to Prove Utility of Trailers

SEEKING to determine in a scientific manner when trailers are feasible and economical for use with motor trucks and when they are not, and then to translate this information into non-technical processes that any maker or user of motor trucks can readily follow, G. R. Pennington of the Troy Wagon Works Company has recently conducted an extensive investigation of the subject. Dynamometer tests were made, first, with a standard motor truck to determine the basic tractive performance of that truck on a good level road, and, second, with the same truck, to determine a table of the relative resistance of different kinds of roads to standard trucks and trailers designed for use as such. A chart was prepared, based on two simple formulas, for translating the mechanical characteristics of any truck into tractive force. By means of the table and a simple formula for grade resistances the tractive resistance of any load is found. Comparison of force and resistance shows whether the truck can haul a trailer, or more than one trailer, under the given conditions. Mr. Pennington holds that the investigation shows conclusively that the trailer has a large field of usefulness, and that it in fact forms a strong argument for the motor truck in place of the horse.



MAXIMUM GRADES NEGOTIABLE ON VARIOUS TYPES OF ROAD WITH AVERAGE LOADED TRUCK AND EQUALLY LOADED TRAILER

PURPOSE OF DYNAMOMETER TESTS

The main purpose of the dynamometer tests was to determine the resistance offered by different kinds of roads to trucks and trailers. Preliminary to this, however, it was necessary to calibrate the motor truck itself by measuring its tractive force on a good level road. A 5-ton truck of standard make was used. It weighed 9100 lb. and carried a load of 10,300 lb., making a total weight of 19,400 lb.

The tractor truck was made to haul another truck similarly loaded, and a spring-scale dynamometer connected between the two recorded the drawbar pull exerted by the former. The first truck was run on each gear with wide-open throttle. The brakes on the second truck were then gradually applied, thereby exerting a backward pull on the first truck. The dynamometer readings recorded were of the maximum drawbar pull which could be maintained steadily. The averages of these were as follows: First gear, 3500 lb.; second, 1750; third, 1050 lb.

Correction had to be made, of course, for the slowing down of both trucks due to the braking. It was estimated that the speed was reduced from 10 miles to 5 miles per hour in a distance of 250 ft., which works out to be a negative acceleration of about 0.32 ft. per second. The force necessary to cause the acceleration would be the total load (19,400 lb.) times the acceleration (0.32) divided by the acceleration due to gravity (32.2). This works out to be about 200 lb., and each of the figures given in the foregoing paragraph should be diminished by that amount.

RESISTANCES

Of three main elements constituting the resistance, the wind resistance has been considered negligible, while that of the slight grade of the road on which the test was made was neutralized by the averaging of the figures recorded in both directions. The third element, that of the road resistance, was taken from the table derived from the second part of the test—25 lb. per ton for a road of that type, or 250 lb. for the truck. The net correction to drawbar pull, therefore, to obtain maximum tractive effort of the tractor was $- 200 + 250 = 50$ lb., and the tractive forces on the first, second and third gears respectively were 3550, 1800 and 1100 lb. From the foregoing it is seen that the tractive force of the truck reaches a maximum of about 35 per cent of its weight.

The second part of the test, to determine the resistance of roads of various classes to standard trucks and to trailers designed to meet the conditions, was made with a 5-ton truck and a loaded Troy trailer. The total weight of trailer and load was 16,250 lb., or about 8 tons. The trailer had rubber tires.

The dynamometer was connected to read the drawbar pull, and the trailer was towed over different kinds of roads. The results are shown in Table 1. For practical use Mr. Pennington has expanded this table into Table 2, embracing other types of road readily compared with those covered in the

TABLE 1—ROAD RESISTANCES OBTAINED FROM ACTUAL TESTS

Type of road	Drawbar pull	Road resistance lb. per ton
Smooth brick	240	30
Hard dirt	350	43
Sand 1 in. deep	760	93
Sand 1½ in. deep	1180	143
Sand 3 in. deep	2270	280

test and taking into account the variability of roads.

ANALYSIS OF TRACTIVE FORCE

Coming back to the tractive force, this is analyzed as follows: Let F = tractive force of truck in pounds; T, torque of motor in foot-pounds; R, total gear ratio; E, efficiency of truck; W, diameter of rear wheel in inches. Then

$$F = \frac{TRE}{W/2}$$

In the tractive-force test previously described T was known to be 225 ft.-lb., W was 40 in. and the various values of R were known. Consequently the transmission efficiencies could be figured, and were found to approximate 75 per cent in each case. In addition, however, there is another efficiency factor to be taken into account in the loss of power in the motor due to wear, carbon trouble and the like. This has been taken at 66 2/3 per cent, and the product of the two efficiencies becomes 50 per cent, or one-half. On this basis the factor of ½ in the foregoing equation cancels out, and we have, reducing W to feet for convenience, the empirical formula

$$F = 12\ TR/W$$

The accompanying large diagram for finding the tractive force of any standard motor truck has been prepared on the basis of this formula, and another empirical formula for the torque, $T = 0.55\ D$, where D is the total piston displacement in cubic inches, which is readily computed from the cylinder bore, the piston stroke and the number of cylinders. As to the derivation of this formula, the torque curves of the 3- and 5-ton motors of a standard make show that at 800 r.p.m. the motors develop torques of 130 and 225 ft.-lb. respectively. The motors have piston displacements of 226.52 and 361.56 cu. in. respectively. Adding the torques together and the piston displacements, the former sum is 60.36 per cent of the latter. To be conservative this figure is diminished to 55 per cent.

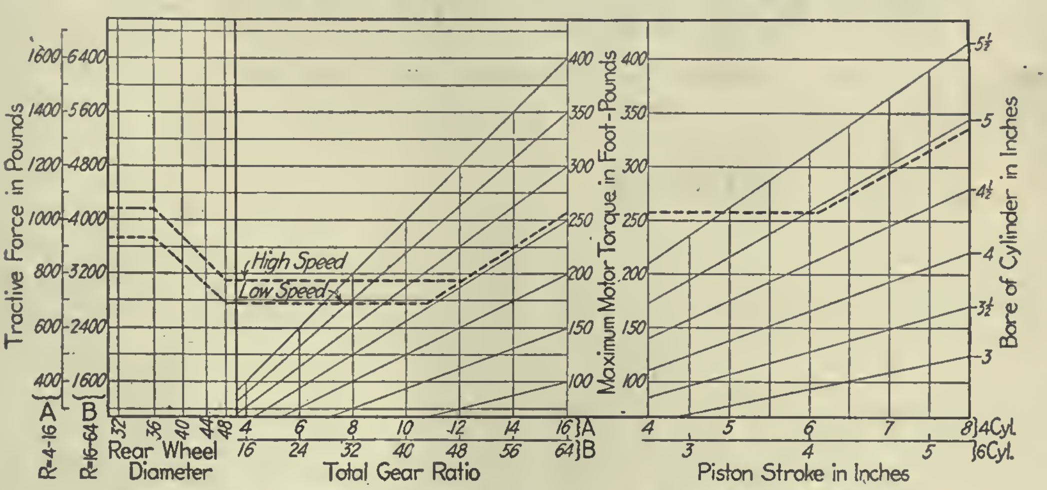


DIAGRAM FOR FINDING TRACTIVE FORCE OF MOTOR TRUCK, KNOWING ELEMENTS IN RIGHT-HAND AND BOTTOM SCALES

The three elements of piston displacement, then, together with the total gear ratio and the diameter of the rear wheel, are all that are needed to determine the tractive force of any standard truck; and all are known or easily found.

TABLE 2—ROAD RESISTANCES OF RUBBER-TIRED TRUCKS AND TRAILERS, AMPLIFIED FROM TABLE 1

Type of road	Resistance, lb. per ton
Asphalt or concrete	20
Smooth brick	25 to 35
Poor brick, ordinary cobbles or macadam	35 to 60
Hard dry clay or hard gravel	60
Soft macadam	75
Ordinary country clay road	100
Ordinary country sand road	150
Sand 3 in. deep	275 to 300

USE OF LARGE DIAGRAM

To use the diagram begin at the right end with the bore of the cylinder indicated on the vertical scale. Follow down along the oblique lines to a point directly above the piston stroke indicated by the horizontal scale corresponding to the number of cylinders. Carry this point horizontally to the left-hand torque scale, thence down along the oblique lines to a point vertically over the figure for total gear ratio on one of the horizontal scales at the bottom, thence horizontally to the left to the 48-in. line of the wheel-diameter scale, thence obliquely up to the vertical line indicating the rear-wheel diameter of the truck in question, thence horizontally to the left to the scales for tractive force, reading the A or the B scale, according as the gear ratio was above or below 16.

The dotted lines trace out the process for a four-cylinder 5-ton truck with 4 15/16-in. bore, 6⅛-in. stroke, total high-speed and low-speed gear ratios of 12:1 and 43:1 respectively, and rear wheels 36 in. in diameter. The high-speed tractive force, read from the A scale, is 1040 lb.; that on the low speed, read from the B scale, is 3730 lb.

The scales were fixed arbitrarily to accommodate the probable range of track characteristics as conveniently as possible. There is no significance, other than convenience, to the fact that the wheel-diameter and the cylinder-bore scales are not arithmetical. It is to be noted that the two A scales for tractive force must be used with the corresponding scales for gear ratio; also that if the piston stroke of the six-cylinder machine exceeds 5¼ in. the four-cylinder scale must be used and the torque multiplied by 1½, and vice versa, if the stroke of the four-cylinder machine is less than 4 in. the six-cylinder scale must be used and the torque divided by 1½.

WHAT LOAD WILL A TRUCK HAUL?

Now to determine what load a motor truck will haul on a certain road, and whether a trailer can be used, the process is as follows: From the large diagram the tractive force of the truck is obtained. Table 2 gives the road resistance per ton for the class of road under consideration. The grade resistance in pounds per ton is twenty times the per cent of grade. Ignoring wind resistance, the total resistance in pounds per ton is the sum of these two figures. If the tractive force divided by this unit resistance is more than the total contemplated weight of loaded truck and loaded trailer, the trailer can be used. If this quotient is considerably more than the total load, it may be found that two or more trailers can be used to advantage.

In applying the process it is pointed out that the maximum grade and the worst stretch of road must be used.

One further step in the study has resulted in the preparation of the small chart, in which grades and road conditions are equated. The diagonal line is the dead line determining whether or not a standard truck loaded to capacity can haul a Troy trailer equally loaded. If the intersection of grade and road condition comes above the line the trailer cannot be used; otherwise it can.

Summarizing the investigation, Mr. Pennington holds that it determines definitely and scientifically just to what extent Troy trailers can be used to advantage; that it shows that they have a large and definite field of usefulness; and that, instead of being a detriment to the motor truck, they give it a flexibility of use which should appeal to the truck manufacturers themselves.

Concrete Estimating Facilitated by Table

Weight per Foot and Volume of Concrete Beams Easily Obtained from Table Giving Cubic Feet per Linear Foot

TO SAVE TIME in designing and estimating concrete beam work, Henry A. Burr, assistant engineer, Nashville, Chattanooga & St. Louis Railway, Nashville, Tenn., has been using a table, reproduced herewith, which gives the volume in cubic feet per linear foot for rectangular beams of ordinary dimensions. For concrete weighing 150 lb. per cubic foot this table can easily be applied in obtaining the weight per foot for design purposes by simply adding half of itself to the given number and shifting the decimal point two places to the right. The total volume of the beam in cubic feet, of course, equals the value from the table multiplied by the length in feet.

CUBIC FEET IN ONE LINEAR FOOT OF BEAM

Depth, In.	Width in Inches							
	6	8	9	10	11	12	13	14
8	0.33	0.44	0.49	0.56	0.61	0.66	0.72	0.78
9	0.38	0.49	0.56	0.62	0.69	0.75	0.81	0.88
10	0.42	0.56	0.62	0.69	0.76	0.83	0.90	0.97
11	0.46	0.61	0.69	0.76	0.84	0.92	0.99	1.07
12	0.50	0.66	0.75	0.83	0.92	1.00	1.08	1.17
13	0.54	0.72	0.81	0.90	0.99	1.08	1.17	1.26
14	0.58	0.78	0.88	0.97	1.07	1.17	1.26	1.36
15	0.63	0.83	0.94	1.04	1.15	1.25	1.36	1.46
16	0.67	0.89	1.00	1.11	1.22	1.33	1.46	1.56
17	0.71	0.94	1.06	1.18	1.30	1.42	1.54	1.65
18	0.75	1.00	1.12	1.25	1.38	1.50	1.62	1.75
19	0.79	1.06	1.19	1.32	1.45	1.58	1.72	1.85
20	0.83	1.11	1.25	1.39	1.53	1.67	1.81	1.94
21	...	1.17	1.31	1.46	1.60	1.75	1.90	2.04
22	...	1.22	1.87	1.63	1.68	1.83	1.99	2.14
23	...	1.28	1.44	1.60	1.76	1.92	2.08	2.24
24	...	1.33	1.50	1.67	1.83	2.00	2.17	2.33
25	...	1.39	1.56	1.74	1.91	2.08	2.26	2.43
26	...	1.44	1.62	1.80	1.99	2.16	2.35	2.53
27	...	1.50	1.69	1.87	2.06	2.25	2.44	2.62
28	...	1.55	1.75	1.94	2.14	2.33	2.53	2.72
29	...	1.61	1.81	2.01	2.22	2.42	2.62	2.82
30	...	1.67	1.87	2.08	2.29	2.50	2.71	2.92
31	...	1.72	1.94	2.15	2.37	2.58	2.80	3.01
32	...	1.78	2.00	2.22	2.44	2.67	2.89	3.11

INVAR level rods to be furnished by an American company to the U. S. Coast and Geodetic Survey were to have been delivered this month, according to the U. S. *Commerce Reports*. War conditions have prevented the placing of orders abroad, whence the supply of invar has heretofore been obtained.

GERMAN TRENCH PROTECTED WITH STEEL PLATES ON TIMBER FRAMES

Photos. Press. Illust. Co.

TRENCH TRAVERSE (FOREGROUND) AND APERTURES FOR RIFLE FIRE

National Defense—For Engineer and Contractor

Fourth Article in Series Describing Tactical Considerations and Construction Methods Involved in Field Fortification—Selection of Position Important

By MAJOR P. S. BOND
Corps of Engineers, U. S. Army

FIELD FORTIFICATION is the most important and the most distinctively military of the many operations of the field engineer and constitutes an art and a science in itself. The art of fortification includes two branches, known as strategical or deliberate, and tactical or hasty fortification. Strategical fortifications include defensive works executed largely in time of peace for the protection of important harbors, cities, arsenals, etc. Tactical fortifications are those executed to meet the immediate tactical needs of the mobile army in the field, and are hence known also as field fortifications. The line of demarcation between the two classes is not clearly defined. Strategy and tactics are intimately connected, and so the works constructed to meet their needs vary from the elaborate coast defense works to the simple trenches of a rear guard fighting a delaying action.

The immediate purpose of field fortifications is to increase the power of resistance of the troops occupying them by decreasing their exposure to the fire of the enemy and increasing the accuracy and volume of their own fire. They thus serve to hold the enemy in check and limit his power of maneuver. Furthermore, they accomplish this result with the least number of men, thereby rendering the greatest possible number available for aggressive concentration of superior forces at the critical points.

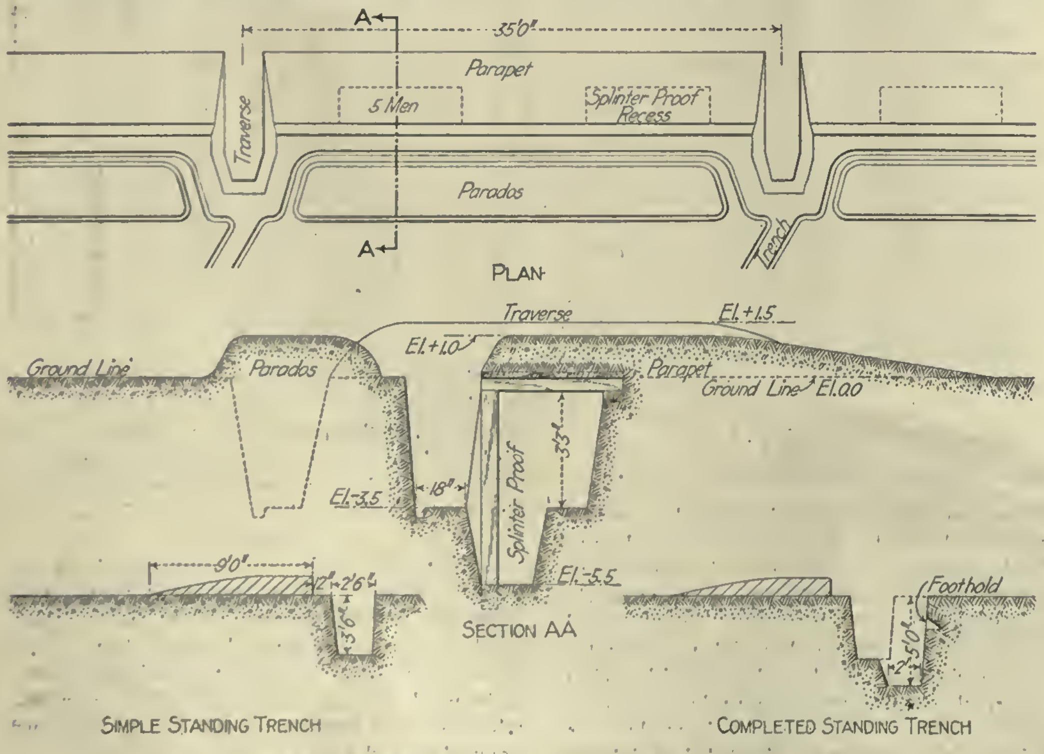
Even in a successful attack the assailant cannot advance continuously. Halts will be necessary to permit of the bringing up of supplies and reinforcements, to refresh the troops, to hold the enemy in check, to select new points of attack, to readjust the artillery positions, etc. The assailant at all such halts must cling with the spade to that which he has won with the rifle and bayonet. Troops cannot remain stationary upon the field of battle exposed to the fire of the modern rifle, machine gun and artillery.

Fortifications, therefore, while essentially defensive in their nature, will be extensively employed also in the attack. The neglect to utilize them will involve heavy losses and, if opposed to a skillful adversary, will invite defeat. On the other hand, their excessive and indiscriminate use limits the mobility of the troops and tends to destroy the aggressive spirit.

FIELD FORTIFICATIONS CLASSIFIED

The technical details of the works themselves are comparatively simple and readily comprehended, but their location, arrangement and adaptation to the tactical situation and to the terrain call for a high degree of skill, analogous to that required in road and railroad location. In general, fortifications are designed to serve two purposes: To facilitate the effective use of the weapons of the defenders; and to restrict the effective use of the weapons of the attackers. All constructions which serve either of these purposes may then be classed as field fortifications and will include the following:

(a) Rifle trenches for the firing line and cover trenches for supports. (b) Emplacements for machine guns and artillery. (c) Shelters for protection against fire, particularly shrapnel and high explosive shells, and against weather. (d) Communicating trenches between supports and firing line. (e) Observing stations, dressing stations, kitchens and latrines. (f) Obstacles to retard the enemy's advance and hold him under fire, including explosive mines. (g) Demolitions for clearing the field of fire and restricting the tactical maneuvers of the enemy. (h) Measures for concealing all works from the enemy's view. (i) Mining operations or tunneling for subterranean advance against the hostile works. (j) General communications, such as roads, foot paths, light railways, telegraph and telephone lines, signal stations, etc.



TYPICAL FORMS OF TRENCH CONSTRUCTION USED BY BRITISH TROOPS

STANDING RIFLE TRENCH WITH SAND BAG AND HURDLE REVETMENT AND SPLINTER-PROOF SHELTERS UNDER PARAPET

Most of these works must necessarily be executed by the combatant troops who are to occupy them, and all line officers should be qualified to superintend their construction. The engineers, however, will constantly be called upon for advice and assistance as to location and details, and in the execution of some of the more difficult tasks their special training and equipment will be necessary.

SELECTION OF POSITION

The matters to be considered in selecting and organizing a position are: The mission or purpose of the command, their numbers and quality; strength, position and probable intentions of the enemy; the weapons possessed by both combatants; the nature of the terrain, facilities for maneuver or retreat; whether delaying or decisive action is contemplated; the time the position must be held; the time available for preparation, etc., etc.

The first requirement of a defensive position is that it shall be one which the enemy must attack to accomplish his mission. If he can attain his purpose without such attack, then the position is useless and the time spent in preparing is wasted.

The following are certain additional considerations to be given such weight as the particular circumstances of the case may require:

(a) Is it proper to take up a position, or does the situation call for advance or retreat?

(b) Is the position suited to the strength and armament of the force which is to occupy it?

(c) Is the position to be held indefinitely? If not, for how long a time?

(d) What are the strength and intentions of the enemy? What weapons has he? Is he provided with means for aerial reconnaissance?

(e) Are there good positions with a clear view and field of fire for both infantry and artillery? Is there a good field of fire at all ranges? If not, which is more important, a near or distant field of fire?

(f) What are the facilities for advance or retreat from the position?

(g) Are the flanks of the position naturally secure? If not, what expedients may be adopted to secure them?

(h) Are the communications within the position good?

(i) Is there cover for supports and reserves?

(j) Does the terrain present natural features adaptable to defense, or will great labor be required?

(k) Is the ground in front such as to facilitate the enemy's attack? Are there natural obstacles to his advance? Are any artificial obstacles required?

(l) Is the ground in rear favorable for counter-attack in case the enemy should penetrate the first line of works?

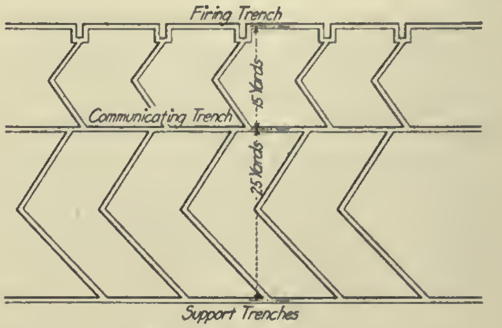
(m) Is the position naturally concealed from view, including view by aerial scouts? If not, what artificial means of concealment are possible?

These and many other important questions must be considered. A single position giving a favorable reply to all these questions will never be found. Any position must be a compromise between advantages and disadvantages.

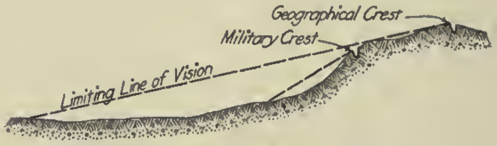
TRENCH CONSTRUCTION

Success in battle is determined by fire superiority, without which the assailant cannot advance and the defender cannot hold his ground. Field fortifications increase the fire effect of the troops occupying them and decrease the fire effect of the enemy. They are designed to afford the maximum protection and concealment while still permitting the unrestricted use of the defender's weapons. The shelter best fulfilling these requirements is the simple rifle trench, from which the soldier may deliver fire in a comfortable standing position over a low earth parapet or through a loophole in the parapet. Such rifle trenches are accordingly the principal feature of field fortifications.

The parapet is made sufficiently thick to resist penetration by rifle bullets or shrapnel, which requires about 3 ft. of ordinary earth. The parapet should be sufficiently high to afford a view of the foreground, but in order to be inconspicuous it should be no higher than necessary for this purpose. Ordinarily its height will be from 9 to 18 in. above the surface of the ground, unless excavation is very difficult, in which case a shallower trench and a higher parapet may be used. Such a trench affords no adequate protection against direct hits by high explosive shell, which would destroy the parapet and kill the man behind it. But the probability of such direct hits is very small and under battle conditions it has been found that the destruction of trenches by shell fire requires an expenditure of ammunition out of proportion to the results obtained. It is, therefore, seldom attempted. The attack of such trenches will be by means of showers of shrapnel and rifle bullets. While the actual physical effect of such fire in killed and wounded may not be great, it may force the defenders to keep their heads down below the parapet and prevent reinforcements from coming up, and this will diminish the volume and accuracy of their fire and permit the attacking infantry to advance against the trenches.



STANDARD FIELD TRENCHES



LOCATE TRENCH AT MILITARY CREST

TRENCH PLAN, SHOWING ZIGZAG LINES OF COMMUNICATION

HEAD COVER

To further decrease the vulnerability of the defenders the parapet may be provided with head cover by placing in the parapet loopholes of plank, sand bags, etc. This allows the occupants to deliver fire without exposing their heads and shoulders above

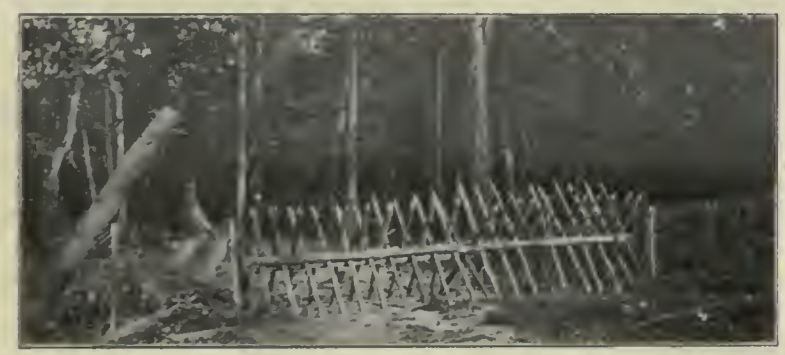
Photo. Underwood & Underwood

IN MODERN TRENCH CONSTRUCTION DAMAGE FROM AN ENFILADING, OR FLANK, FIRE MUST BE PREVENTED BY A ZIGZAG ALIGNMENT OR TRAVERSES WHICH BREAK THE CONTINUITY OF THE DEFENSIVE WORKS—VERY FEW PICTURES FROM EUROPE HAVE SHOWN THESE IMPORTANT FEATURES the crest of the parapet. Overhead cover, consisting of a shelf of plank covered with earth may also be provided. As this requires considerable time and labor to construct and greatly increases the visibility of the parapet as a target it is of limited application. The troops in the present European war are often provided with steel helmets stout enough to deflect rifle bullets and shrapnel fragments.

TRENCH REVETMENTS

The trenches are made very narrow with steep side slopes in order to reduce the possibility of shrapnel falling in the trench. If the earth will not stand naturally on a steep slope, some form of revetment must be provided. The most common forms are plank or hurdles of woven brush, sand bags, fascines, and the like. Drainage must also be provided if the trenches are to be occupied during rainy weather. If the trench can be properly graded a continuous drain may be carried along the back of the trench and led out at the lower end. Otherwise, sump holes may be provided at intervals. Surface drains may also be dug on the high ground above the trenches. To permit the movement of men along the trench it may be widened and deepened at the rear, or a separate trench parallel to and immediately in rear of the fire trench may be provided.

In order to protect the occupants from oblique or enfilade fire and to localize the effect of shells bursting in the trench, banks of earth perpendicular to the parapet and of equal or somewhat greater height may be placed at intervals. These are called traverses. They should be thick enough to resist penetration by rifle bullets and, in order to take up as little room as possible, their sides should be steep, and revetted if necessary. They are placed usually at intervals of one or two squads (8 to 16 men) and communicating trenches are dug around them, either in front or in rear.



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CHEVAUX - DE - FRISE AND WIRE ENTANGLEMENT

Bomb proof shelters are often provided in the fire trenches for the supports or for sheltering the occupants when not actually firing. These consist generally of excavations under the parapet, open to the rear. If provided with a sufficient overhead covering of earth they afford complete protection except from grenades or shells bursting in the trench. They are provided with a roof of poles or planking. The roof may be placed on the ground and the earth excavated from beneath and thrown on top. A seat should be placed at the front and the headroom should be at least sufficient for a comfortable sitting posture.

CONSTRUCTION OF REDOUT

CONCEALMENT VITAL

Concealment from the enemy's view, both before and during combat, is a most important element of protection from hostile fire. The freshly turned earth of a parapet is exceedingly conspicuous, forms an excellent target unless concealed, and considerable labor and skill may well be employed to render the works inconspicuous. The trenches should be kept off the sky line. If necessary to place them on a crest they may be concealed by shrubbery or brush placed behind them. The first requirement for concealment is that the works should be blended with the existing natural and artificial features of the terrain. The parapets should be low and all sharp angles, either vertical or horizontal, should be avoided. If built on the turf this may be cut in strips, rolled to the front and rolled back over the parapet when the latter is completed, thus concealing the fresh earth. The parapet may be covered with leaves or shrubs naturally disposed and its ends should be graded gently into the natural ground. The parapet should be sufficiently high, however, to conceal the rear lip of the trench. Loopholes in particular are conspicuous and should be concealed by a shrub or branch, which will ordinarily not interfere with fire through the hole. A low, thin hedge will completely conceal a trench immediately behind it without interfering with fire. Works placed just inside the edge of a wood are very difficult to distinguish, but if the edge of the wood be sharply defined it will itself afford excellent ranging points for the hostile fire. Diversified ground, ravines and ridges, standing crops, scattered trees, hedges, fences, etc., lend themselves to the concealment of the works and should be utilized to the utmost. Skill in this particular branch of landscape gardening will produce remarkable results and, under favorable conditions, trenches may be rendered indistinguishable even at a distance of 100 ft. If opportunity is afforded, the works should be examined from the front, the enemy's point of view, when the necessity for concealment and the measures that should be adopted will become apparent.

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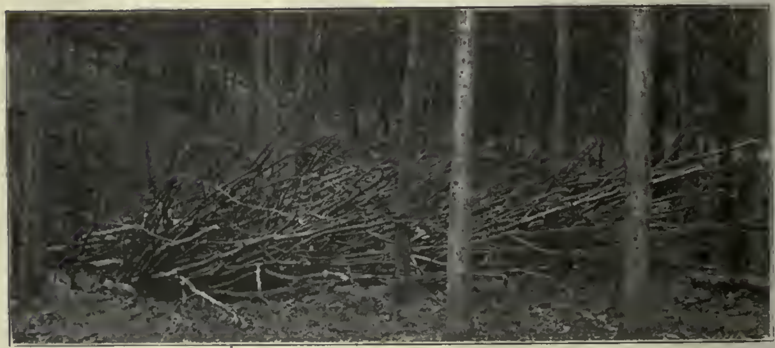
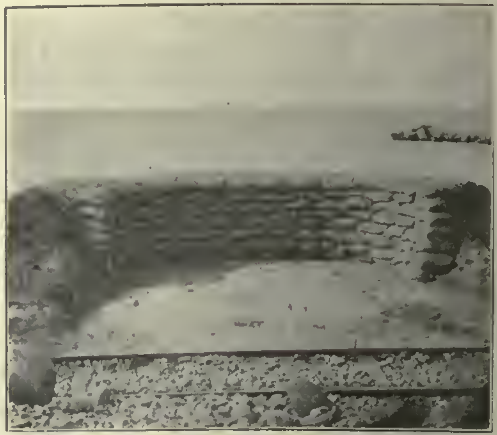
ABATIS OR MILITARY OBSTACLE OF BRUSHWOOD





SAND BAGS MAY BE USED FOR MACHINE OR FIELD GUN BATTERIES

VALUE OF NATURAL COVER

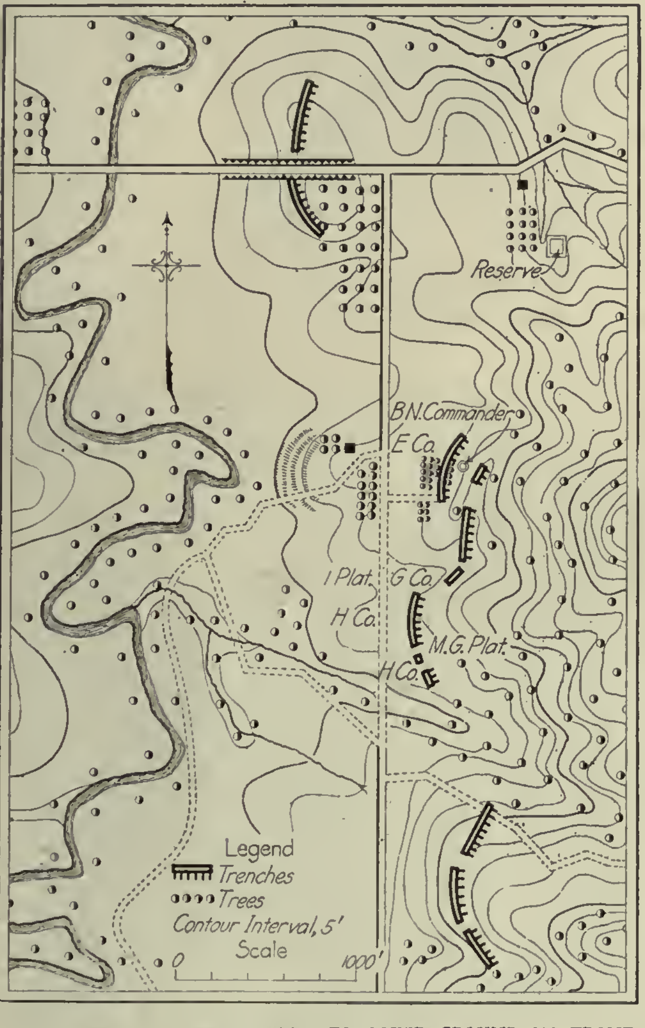
The supports for the firing line should be placed as close to the latter as the requirements for easy concealment and protection from the enemy's fire will allow. Natural cover, if available within a reasonable distance, is to be preferred, because of both superior concealment and the lesser amount of labor required in its adaptation. Natural shelter also possesses the great advantage that it does not ordinarily restrict the tactical mobility of the troops to the same extent as cramped and confined artificial shelters, difficult of ingress and egress. Accordingly, while the immediate supports of the firing line must often of necessity be immobilized in artificial shelters, for the mobile reserves who must be ready for prompt concentration at the critical points, natural shelter well in rear of the firing line will almost invariably be sought. A covering ridge just back of a firing line may afford excellent natural cover, or may be artificially prepared with little labor, but in the absence of some such natural feature, artificial cover must be provided. This will usually consist of trenches in rear of the firing line. As such trenches are not required to deliver fire, more complete protection to the occupants is possible than in the fire trenches. The trenches are usually made very deep and comparatively narrow and may be roofed over or have bomb proof chambers leading out from them. In a position which is occupied for some time these chambers may be developed into elaborate subterranean barracks, with planked cealings supported by columns, drainage, water supply, artificial light and heat, etc. In this manner hasty field fortifications are gradually developed into elaborate siege works.

Communicating trenches must ordinarily be provided to allow of a safe passage between the support shelters and the firing line. As these trenches will be occupied only for a few seconds while passing to and fro, simple concealment from view will often be sufficient. The trenches, however, should usually approach the firing line in a direction oblique to the enemy's fire, that they may not be subject to enfilade, or they may zigzag to the front. The parapet is placed on the exposed side. If the location of these trenches is such as to render them conspicuous and subject to fire, they may be roofed over (cut and cover) or a subterranean gallery or tunnel may be substituted for an open trench.

ATTACK BY TUNNELING

Subterranean attack has long been characteristic of siege operations and may also be an important feature of modern trench warfare. It is conducted by sinking shafts and driving subterranean galleries towards the enemy's works. At the end of the tunnel a large charge of explosive is set off, destroying a section of the enemy's line of intrenchments. In the confusion following the explosion an assault overground is made on the hostile works. Protection against this mode of warfare is had by means of "listening galleries," driven forward from the intrenchments. By means of these the enemy's subterranean operations may be detected and measures taken to frustrate them. The excavation is made by hand with specially constructed tools, by the use of light charges of explosives or by boring machines operated by electricity or compressed air. Small trams may be used to remove the excavated material, and in long galleries artificial light and ventilation will be required. The galleries are lined with wood sheathing as the excavation progresses.

If opportunity allows, the foreground of the works will be prepared with a view to improving the field of fire and embarrassing the movements of the enemy. Trees, buildings and other features which obstruct fire are removed, roads and bridges demolished, ranges to important points measured, etc. In this work explosives are liberally employed to save time and labor. Fire should be used sparingly, as it renders the locality conspicuous both during and after the conflagration.



HOW TRENCHES ARE LOCATED TO COVER GROUND IN FRONT WITH THEIR RIFLE FIRE

KEY TO SKETCH

There are shown the trenches of three battalions, with the detailed dispositions of the center battalion. Small circles indicate trees. The enemy is approaching from the west, and it will be observed that the fire trenches in a general way occupy the convex faces of knolls or noses, with their flanks curved back or "refused" to sweep the ravines intersecting the front. The support trenches of the center battalion are also indicated—they are close in rear of the fire trenches. The trees, buildings and other obstructions which interfere with fire are demolished. In particular the loop of the creek which protrudes into the foreground in the center of the position is an element of weakness, because this creek with the trees on its bank affords a covered or concealed approach for the enemy. Accordingly the trees around this loop are thinned out (it is not necessary to cut them all) and the débris is thrown into the bed of the stream to obstruct it and prevent its use by the enemy. An examination of this may well indicate that these trenches are carefully disposed to cover with their fire all of the ground in their immediate front. Thus it will be observed that the fire trenches of E Co. of the center battalion cannot cover with their fire the very steep (hachured) slope in their front, immediately opposite the point of the loop in the creek. But this ground is effectively covered by the machine gun platoon (M. G. Plat.), by part of H Co., and by the fire of the southernmost trench of the next battalion to the north. Similarly it will be observed that the trenches of the center and left (southernmost) battalions are disposed to sweep the ravine between their positions, after it has been opened up somewhat by thinning out the trees and underbrush. The trenches of the northernmost (right) battalion enfilade or sweep the two branches of the creek in the foreground of the battalion's position. Here the trees should be trinned out to make the fire effective.

MILITARY OBSTACLES

Obstacles of various kinds are placed in the foreground to retard the enemy's movements and hold him under the fire of the defense. Ravines which might permit concealed approach may be choked by felling trees in them. Low land may be inundated by means of dams in the streams. All obstacles should be such as to retard movement without affording cover from fire. The most effective obstacle is a belt of wire, preferably of barbed wire, strung on posts. This is known as a wire entanglement and is difficult to remove or destroy by explosives. It may be effectively concealed in high grass or standing crops. It should usually be placed close in front of the trenches in order to prevent its removal by the enemy and to hold him at the point where the defender's fire is most effective.

Other favorite forms of obstacles are abatis or slashings of trees with barbed wire interlaced, palisades or picket fences, pits covered with brush, wire fences, chevaux-de-frise, military explosive mines with charges of broken stone, and the like. As with the trenches, great pains should be taken to conceal these obstacles from the enemy's view.

As the best protection against hostile fire is concealment from view, night attacks are of common occurrence in trench warfare, and to guard against these, artificial illumination of the battlefield by night is essential. This is accomplished by means of flares, screened toward the rear, and searchlights. The searchlights are often placed on the line of the fire trenches, but generally will occupy some commanding point, such as a ridge or hillock in rear of the line. Arrangements should be made for moving them occasionally from place to place, as if fixed in one position they are liable to be reached by hostile fire.

Machine guns are employed in the fire trenches or in specially prepared emplacements in the intervals. They are extensively used to support the line at localities where infantry fire is restricted. Artillery is usually placed behind the line of infantry defense, natural cover being utilized as far as possible.

The numerous and infinitely various works included under the term "field fortifications" will usually be executed under the most trying conditions. Frequently they must be constructed actually under hostile fire. The details of the works are therefore necessarily simple, but this very simplicity is the highest expression of the skill of the designer, as there is a very great tendency to over-elaboration. It is to be borne in mind that the works must ordinarily be constructed by the troops which are to occupy them and that of the average untrained man little more than ordinary earth excavation can be demanded. The works, therefore, must be designed for rapid construction by unskilled labor with simple tools and the materials of nature. These conditions and the experience derived from meeting them have resulted in the development of certain type plans. These plans are by no means rigid but must be infinitely varied to meet the actual conditions, such as terrain, nature of soil, tools and materials, time available for construction, etc. Each situation is unprecedented and calls for new measures adapted to the circumstances. The engineer or line officer who directs the work must have a thorough knowledge derived from study and experience of the demands of the situation, the works that will be required, the relative importance of the different works, and the time that will be required to construct them. Without a comprehensive grasp of the situation the works will be poorly located and badly adapted to the situation, and confusion instead of system will characterize the operations. In the end, unnecessary bloodshed and loss of life, defeat and ruin of the combatant force, or national disaster will be the logical results of incompetence and inexperience. Hasty fortification is one of the highest of the fine arts whose practice demands in a superlative degree judgment, skill and experience, and in whose field the novice and incompetent may cause utter disaster and ruin.

[*The next installment of Major Bond's articles will deal with military road-building and maintenance.*—EDITOR.]

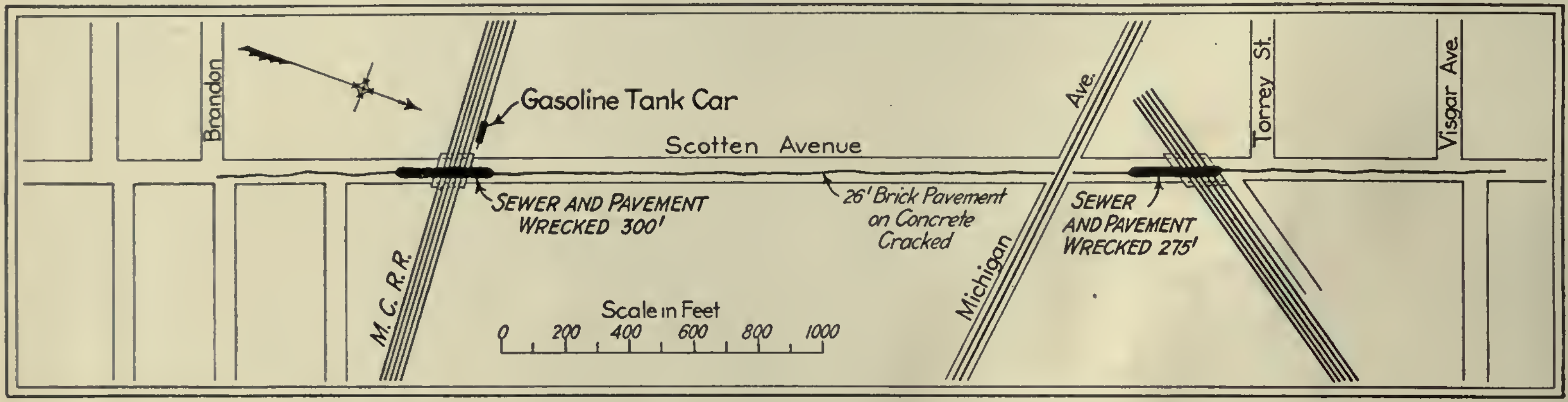
STREET PAVING TO COST APPROXIMATELY $250,000 will be done at Ontario, Cal., during 1916, according to recent reports. On the completion of this work the city will have nearly 20 miles of concrete asphaltum pavement, built at a total cost of about $500,000, and connecting with all state and county highways now built or in the course of construction.

Leaking Gasoline Caused Detroit Sewer Explosion

Valve on Tank Car Cracked by Freezing Water —Sewer Burst and Brick Pavement Cracked

By A. L. SEARS
Assistant Sewerage Engineer, Detroit, Mich.

GASOLINE from a leaking oil tank car on a railroad siding near Scotten Avenue, Detroit, entered a nearby sewer and exploded with terrific force on March 12, heaving up and cracking several blocks of brick pavement, and blowing heavy manhole covers 200 ft. from their seats.



WHERE THE TROUBLE STARTED—LOCATION OF LEAKING TANK CAR ON RAILROAD SIDING

BRICK PAVEMENT AT DETROIT WAS HEAVED UP AND CRACKED FOR DISTANCE OF 4000 FEET BY GASOLINE EXPLOSION

The gasoline leakage was noticed 8 hr. before the explosion. The manager of the oil company arrived on the ground 3 hr. later and found it impossible to stop the leak. About 600 gal. were salvaged from the car of 10,000 gal. capacity.

Tank Outlet Frozen

The leak was probably caused by water freezing in the cast-iron cap of the outlet which fractured the cap and distorted the valve inside. In bursting the cap allowed the gasoline to run from the car onto the ground, over the concrete retaining wall, entering the sewer via the catch basin. Whether the liquid vaporized under pressure of confinement in the sewer, or some smoker caused the explosion, is not known.

Location of Damage

The sewer is about 16 ft. deep, except at the two subways. The greatest damage was done south of Michigan Avenue at the Michigan Central Railroad subway. The sewer at this point is a 5-ft. 2-in. cylinder, two-ring brick, with invert 8 ft. below the top of the pavement; it was built in 1888. The sewer and brick pavement for 300 ft. at this point were entirely destroyed. The bricks adhering to the 6-in. concrete foundation were blasted into various size pieces, some weighing 2 or 3 tons. The ground was frozen to a depth of 18 in. and came up with the pavement.

The same condition occurred at the Michigan Central Railroad subway north of Michigan Avenue. The sewer here is a 4-ft. 6-in. cylinder, two-ring brick. The pavement was torn up for a distance of 275 ft. The pavement here is brick and for a distance of 4000 ft. crevices show at the surface; in some places these fissures would indicate that the arch of the sewer may have been partially destroyed. An inspection of the interior of the sewer had not been made when these notes were prepared, but it is very probable that 500 ft. will have to be rebuilt south of Michigan Avenue, not shown on the sketch.

Manholes along the line of the sewer for 1¾ miles were damaged and the covers weighing 145 lb. were blown 200 ft. or more. Windows were broken and considerable damage to property was caused. The detonation was heard for miles. An investigation was begun immediately after the accident occurred.

Tile Used for Coal Bunkers Instead of Steel or Concrete

THE coal bunkers of the Conners Creek power station, Detroit, Mich., according to J. N. Hatch, consulting engineer, Chicago, in a paper presented recently to the Western Society of Engineers, are steel plates lined with thin tile, laid in bitumastic cement. A number of Eastern power stations have concrete bunkers with steel-beam ribs. Mr. Hatch stated that the main objection to cement bunkers is their great weight, which makes the supporting structure expensive. Further, the concrete becomes pitted and rough so that the coal does not slide well. Unlined steel-plate bunkers are the lightest and would be the most satisfactory, in Mr. Hatch's opinion, if it were not for the rusting, which requires replacement in 10 or 12 years. Steel plates lined with thin lining have not, however, been in service long enough to fully demonstrate their economy.

Letters to the Editor

Comment on matters of interest to engineers and contractors will be welcomed

What Causes Peculiar Refraction on Arizona Desert?

Sir: The only condition seriously regarded as materially affecting the accuracy of stadia measurements is the unequal refraction resulting in the light rays from the top and bottom targets when the line of sight from the instrument to the rod lies close to the ground. The momentary passing of mist or disturbance from heat waves, while both affecting stadia work, are so apparent as to force themselves on the attention of the instrumentman, and he, therefore, needs no forewarning against them. The first mentioned fact is also so well known that the careful field man uses the stadia under those conditions with due precaution. The following phenomena, though, is of a type different from the refraction and heat difficulties mentioned.

In the month of December, 1915, in running lines over exceptionally rough country, where measurements with steel tape would have been slow and difficult, the writer attempted to use stadia. The conditions, both as to nature of country and atmosphere, were apparently ideal for good results. The work was located in western Arizona, in the Hualpai Mountains, on the Arizona desert. A section four miles square failing to close by something like 150 ft., the lines were rerun, using both stadia and steel tape, the same shots being repeated. The result was that while the chaining checked closely the stadia work showed a marked variation from the former readings. The instrument used was a standard Young & Sons' transit, with a very good erecting telescope, with fixed stadia wires. It has given good results all summer in other states, and a careful examination disclosed nothing wrong.

The use of stadia was then discontinued, but the writer conducted a protracted series of experiments, ending in the conclusion that, owing to some obscure characteristic of the atmosphere on the Arizona desert, the lines of sight from the top and bottom targets on a rod even sighting across deep canyons, are so unequally and erratically refracted, that only the roughest approximations to correct distances may be secured by the use of stadia. In a single series of observations, extending over about a half hour in time, an idea may be conveyed as to the behavior when it is stated that, although rod and transit were separated by a deep ravine, some thirty chains wide, each being as near as possible to the edge, the variation in the rod intercept was as great as 0.5 ft. This apparent motion seemed to be confined to the lower target, which, with the top wire of the reticule bisecting the top target, could be observed to rise or sink above or below the lower wire to the extent noted. This motion was not of the nature of a vibration, and was, in fact, so slow as to be inappreciable without the aid of the horizontal wire as a guide. The temperature was about 50 deg. Fahr. and there were no heat waves, mist, or other disturbing atmospheric condition perceptible to any of the senses.

Since the time mentioned, the writer has taken this pehnomenon up with numerous members of the field force, but has heard of only one similar incident. Charles M. Pidgeon, U. S. Surveyor, reports an almost identical experience, under similar conditions, which led him to entirely abandon the use of stadia in Arizona.

It is to be hoped that, if others have at any time observed such a condition, and can explain it, or offer a method of procedure by which the stadia may still be used with good results where such conditions obtain, a statement may be drawn from them.

Thomas A. Hayden,
Surveyor General's Office.
Phoenix, Ariz.

Writing Land Descriptions

Sir: I have noted with interest and much satisfaction, the recent communications relating to the work of the land surveyor, and desire to express my appreciation that it is not considered beneath the dignity of an engineering journal to devote some space to this less scientific subject.

It is now over 30 years since the writer ran his first retracing of land bounds, and the varied experience gained in this work, largely in New England, has impressed him with the importance of accurate field work and intelligent description of bounds.

Here in the Eastern states, the irregular lines of the parcels of land as described by the colonial surveyors, presented no easy task to the one who years later attempted to re-locate the bounds. Many of the ancient deeds, which were our only evidence to follow, offered "northerly" or "easterly" for direction, and so many "rods more or less" for length of lines. The corners as mentioned were trees or stakes, long since obliterated by time. The older residents of the vicinity when appealed to as a last hope, would each give a different opinion. Small wonder that in many instances the undisputed possession for a term of years, was the only legal loophole for a title.

Occasionally, a deed bearing the date of the eighteenth century, would be offered that was a marvel of accurate delineation, giving in degrees and minutes the bearings, and in chains and lengths the distance. Right here, however, was liable to follow one of the more serious errors. Some later surveyor, armed, perhaps, with a "blacksmith's compass," as described by a correspondent in your issue of March 4, may have attempted to retrace the lines using the original deed for a description. Without knowledge of calculating the magnetic declination, he located the bounds by following the bearing of the original description. A new land deed, bearing this later date, is used by another surveyor sometime afterwards. He may be a competent man, allowing for the variations of the compass, but only for the years since the date of the evidence given him, assuming that his predecessor did the same. We can readily see how one incompetent surveyor may vitiate land titles, although preceded and followed by competent men.

Sometimes I have thought that our technical graduates rather scorned the duties of a surveyor of land. The lure of larger and more spectacular achievements in the strictly engineering field was more attractive. And yet, the title to land is at the base of all wealth, and no better schooling may be found than a year or so devoted to country surveying, where the bounds of small parcels of land are to be retraced from the original delineations. I hope that the standard this work deserves will receive proper recognition.

F. H. Carpenter.
Providence, R. I.

Shall the American Society of Civil Engineers Move Its Headquarters?

Sir: I have your letter asking for my opinion on the proposal that the American Society of Civil Engineers join with the other national engineering bodies in the use of the Engineering Societies' Building. I have given this matter very careful consideration and favor the plan for the following reasons:

1. There is a marked tendency among the engineering societies to work along parallel rather than divergent lines. There is also need of concerted action by the different engineering societies on many questions of professional as well as general public interest, such as the licensing of engineers, the recognition of the engineering profession in the statutes and the organic law of the different states, the mobilization of the engineering resources of the country for the purpose of more effective national defense, etc.

2. The inclusiveness of the American Society of Civil Engineers, which was the first national professional engineering society to be established in this country. There are undoubtedly more members of this society who are also members of one or more of the other national societies than is the case with respect to these other societies, and, if it is desirable that the headquarters of the national societies should be closely in touch with each other and should be located under the same roof, this would appear to be more important in the case of the American Society of Civil Engineers than in that of any of the others. The Civil Engineers are undoubtedly somewhat isolated in their present location, while the other national societies are located in a single building nearly a mile away.

3. The location of the Engineering Societies' Building and the Engineers' Club contiguous to each other on Thirty-ninth and Fortieth Streets, between the two great railway terminal stations on Manhattan Island, has made this locality the engineering center of the city and of the country, and the influence of the national engineering societies having their headquarters in this engineering center would probably be greater than would be the case were the different societies located in different parts of the city. The Civil Engineers have that disadvantage, while the other national societies have whatever advantage there may be from their location in the center of engineering activity.

4. The location of all of the national societies in one building offers an opportunity for the creation of a great engineering reference library which would undoubtedly be the greatest technical library in the world. The report of the Board of Direction of the American Society of Civil En-

gineers strongly intimates that substantial gifts toward the creation and maintenance of such a great library are likely to be made, and this likelihood would undoubtedly be increased if all the engineering societies were grouped together in one building.

The above considerations have prompted me to vote in favor of the acceptance of the proposal which has been made by the United Engineering Society.

NELSON P. LEWIS.

New York City.

Sir: In reply to your letter it gives me pleasure to say that I have favored the American Society of Civil Engineers joining the other three national societies in the Engineering Societies' Building on West Thirty-ninth Street ever since the project was first broached, provided it could secure suitable accommodations for its administrative operations and for the library, at the same time preserving its autonomy. In my judgment the opportunity which would thus be afforded for cordial co-operation and association among the four great national professional engineering organizations would be highly advantageous to each and all of them in every way. The present proposition, as described and announced to the members of the American Society of Civil Engineers, especially that plan which contemplates adding two and one-half stories to the present Engineering Societies' Building for its accommodation, seems to me to meet the requirements of the situation in a highly satisfactory manner, and I trust the vote will be favorable to its adoption.

WM. H. BURR.

New York City.

Sir: Taking advantage of your generous offer to open your columns to the discussion of this subject, the undersigned wishes to express some views which are somewhat at variance with your own, as expressed in your editorial of Feb. 5, 1916.

Unless I am very much mistaken, one of the important reasons why the American Society of Civil Engineers did not join with the other engineering societies in the project financed by Mr. Carnegie in 1903, was that the American Society of Civil Engineers wished to be independent of Mr. Carnegie's aid. That situation is still unchanged.

In the editorial referred to, you state that this move would remove the physical barrier between the societies. Bearing in mind the fact that a very large proportion of the members of the several societies seldom comes to New York, and that to them the society's headquarters is merely the place from which their *Proceedings* are mailed, and remembering further that the meetings of the various societies would necessarily be held on different nights, so that the members of the different societies would not come in contact at all, just what physical barrier would this step remove?

I cannot conceive of any business which the secretaries of the different societies would have which would not be transacted by letter, or which could not be done by phone; at any rate, the time required to pass from Thirty-ninth Street to the Fifty-seventh Street building is very short.

Occupants of different suites in the same office building see little more of each other than occupants of different buildings, nor can I conceive that the business of joint committees would be facilitated by housing under one roof.

You say that the housing under one roof would declare to the country at large that all engineers were standing together, etc. Would it? The fact that we are now housed under two roofs does not by any means indicate that we are not in accord, nor would the converse be true. Furthermore, who outside of our own members would know that we were under the same roof, or care? Our public statements and actions are far more important than the address from which our literature is distributed.

It is often said that it is folly for the American Society of Civil Engineers to maintain an entire building and two large halls which are vacant most of the time and that for that reason alone we should move to the Thirty-ninth Street building, but since it would cost us the same amount, why move?

It is important to remember that if occasion for a special meeting arises, our halls are always available, as the military lectures now going on bear witness to. If we move to the Thirty-ninth Street building, this will no longer be true.

Your statement that the Fifty-seventh Street neighborhood is on the decline for the purpose of such a society house puzzles me greatly. The place is very accessible, eminently respectable, well kept and quiet, and to me seems far preferable to Thirty-ninth Street. What is there that is objectionable?

On the evening of the first military lecture, Feb. 14, 1916, about 700 engineers were turned away from the Thirty-ninth Street building by the New York Fire Department because the building was dangerously overcrowded. Some of those turned away were members of the American Society of Mechanical Engineers, coming to attend to business of their own, and who were not interested in the military lecture at all. Some of these men came from out of town, but were not permitted to enter the building. This is a condition which I would not like to see arise in the building occupied by the American Society of Civil Engineers.

True, this was an unusual condition, but it will be much more likely to occur in that building with still another and larger society housed there than heretofore.

In the building occupied by the American Society of Civil Engineers the auditorium, library and reading room are all on the same floor and with large doors between, affording very convenient places to read and visit before the regular meetings. After the meetings the members go downstairs to the smoking room on the main floor where the collation is served and where they gather to talk and walk about. It will be well to remember that in the Thirty-ninth Street building, these conveniences do not exist; the lunch is passed around among the seats after the lecture, and things are exceedingly cramped and uncomfortable. The lecture hall on the fifth floor which would be used for these meetings is low ceilinged, poorly ventilated and with the amount of smoking that goes on at the Fifty-seventh Street meetings would be almost intolerable. Our present lecture hall has a very high ceiling with ample ventilators.

One of the most enjoyable meetings of the American Society of Civil Engineers is the annual smoker, which is now held at the society house. This affair is attended by many out of town members and is the only opportunity which many members have of seeing the society's home. There is no place in the Thirty-ninth Street building where the smoker could be held, and it would have to be held in a hired hall, as is the annual reception. For me, this would remove much of the pleasure of the occasion.

I feel convinced that the Thirty-ninth Street building with the changes proposed would fall far short of being as satisfactory to the American Society of Civil Engineers as its present home on Fifty-seventh Street now, to say nothing of the additions which we might make there in the future.

Though I have talked with many who are opposed to this proposed move, I have not yet seen their views in print, and for the benefit of such members of the society who live at a distance from New York and whose opinions are necessarily influenced by what they read in influential technical papers, I urge that these views be thoroughly aired.

FRANK C. BOES,
Assoc. M. Am. Soc. C. E.

West New Brighton, N. Y.

Sir: The five arguments in your editorial "What is the New Evidence?" (Feb. 19, 1916, page 239), might have been extended to include mention of one reason for the negative vote in the American Society of Civil Engineers thirteen years ago. At that time the society was in fairly comfortable quarters, paying its own way and with a comparatively small bond issue or mortgage outstanding. As a business organization the society was maintaining relations exactly like those which it is the prime object of engineers to promote and secure in any of the engineering or business affairs intrusted to them by clients. Under these conditions many members were opposed to the acceptance of a sum out of all proportion to the small increments previously given by many members and of which all were justly proud because of the extended interest shown. The fact was understood and appreciated that the proposed donor had manifested ability of the highest order in selecting and creating avenues by which assistance reached those who were seriously in need. There is a difference between loss of a feeling of independence and loss of "dignity" and, further, there is a difference between standards "high" and "low" in the estimation of the public where charity is sought or given.

For a number of years yet the present quarters of the American Society of Civil Engineers should be reasonably ample and satisfactory. If it later develops that a location in or about Thirty-ninth and Fortieth Streets should be a center for many societies the society could procure a site, erect a larger building and be in close and friendly relations as now with all neighbors. Under this plan they would not overcrowd a structure that soon will be filled to more than two extra stories by the natural growth of the original planting. The civil engineers would thus maintain for themselves the same sense of independence that has been prized and respected in the past.

H. F. DUNHAM.

New York City.

ROAD CONSTRUCTION by the Massachusetts Highway Commission during 1915 was finished on 63 miles of state routes. The total length of state highways is now 1101 miles. About $3,000,000 has been spent in the last three years.

HINTS FOR THE CONTRACTOR

Details Which Save Time and Labor on Construction Work

Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

[*Contributions to this section are solicited, and if found available will be paid for. They must be* SHORT, *and should be accompanied, if possible, by photographs or sketches.*—EDITOR.]

Contractor's Excavator Attachment Makes Shallow Street Cuts

FOR making shallow cuts in streets where space is limited and the material must be hauled away from the site, a contractor of Rockford, Ill., has devised the outfit shown herewith as an attachment to an ordinary Austin trench machine with 24-in. buckets. It consists of a revolving cutter frame or wheel 5 ft. 10 in. in diameter, rotated by the bucket chain, which travels on a sprocket on the shaft of the cutter frame. Behind this wheel is a "crumber" or scraper plate. The cutter consists of six rows of eight rooters. There are also pitched transfer plates to carry the earth loosened by the rooters toward the bucket line, which in turn elevates it in the usual way to the cross conveyor delivering to the wagons.

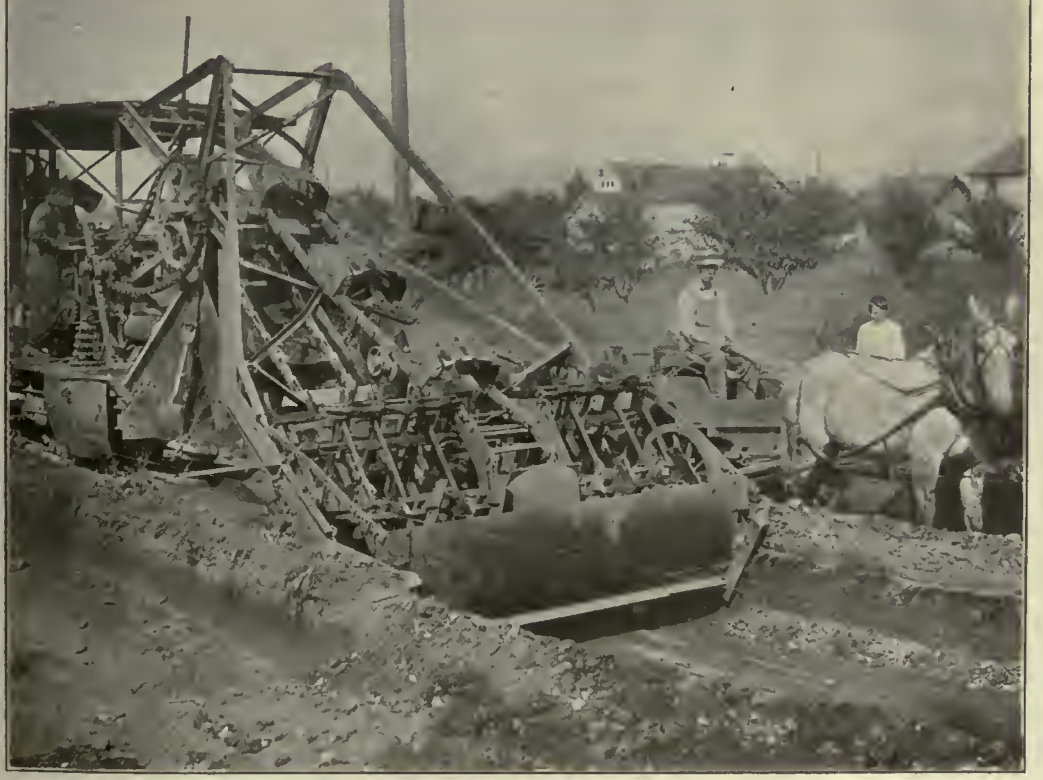
The machine cuts a strip 8½ ft. wide and from 2 in. to 5½ ft. deep. The cutting wheels operate on a boom which can be raised or lowered by screw. An indicator is provided so that the operator can run true to a grade line. It is claimed that the rate of loading is so uniform that the number of teams can be properly proportioned each day to the length of haul so that there will be very little team time lost at the machine each day.

MACHINE CUTS TO EVEN GRADE

In practice it is found best first to make the outside cuts on street work, cutting to a line to allow room for the curb and gutter and the forms. On the outside cuts the excavator is pitched to conform to the crown of the street. If the width of the street slightly exceeds three cuts a center cut is made sufficiently deep so that the surplus at each side can be leveled and rolled into the central space. It is found desirable to cut slightly below the finished subgrade and at the last cut to finish the fine grade at once by dumping sufficient material from the wagons to level it up to the desired grade. The street is then rolled at once, and in this way less work is required than for making a fine grade by removing the surface material with hand tools. Material at alley intersections is cared for by excavating deeper in front of the intersection for 16 to 24 ft. on each side. The intersection is then plowed and slip scrapers used to transfer the earth into the extra cut.

In street railway track excavation the track trench is usually 18 to 20 in. deep and 8½ ft. wide. The cut is made in one excavation. By removing the track closely ahead of the machine and by laying new track directly behind it, cars can be kept running with a break and transfer of not more than 150 or 200 ft. About 500 ft. of track trench can usually be handled in a 10-hr. day.

These machines were built and have been operated during the seasons of 1914 and 1915 in Illinois by the General Engineering & Construction Company, of Rockford. Ill.



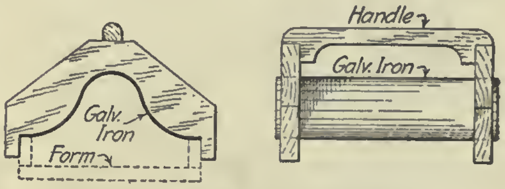
CONTRACTOR DESIGNED EXCAVATOR ATTACHMENT TO ELIMINATE HAND WORK ON STREET CUTS

Finishing Tool Saves Forms Work on Bridge Handrail

By R. C. HARDMAN

Colorado Springs, Col.

USING the finishing tool illustrated herewith, the writer constructed a short time ago an unusual concrete handrail without the use of forms other than a shallow supporting trough. The handrail had a length of about 1400 ft. and was in forty-one short sections between posts. The unusual cross-section, which did not readily adapt itself to the use of a form, was intended to prevent the ubiquitous small boy from walking on the rail to his probable injury. The shallow trough form was built around the cast concrete balusters and the reinforcement put in place. The finishing and shaping tool, fashioned to the section of the rail, was made of wood and galvanized iron. In building the rail the trough was filled with a fairly dry mixture heaped up in the center. The tool, which had projections to engage the form and to act as guides, was then used to roughly form the heaped-up concrete to the required shape. Additional dry concrete was added as required until the full section was built up. A wetter and richer mixture was then placed for surfacing, and finished smoothly by the same tool. The ends of the iron were flared upward slightly to secure better work.



TOOL SAVES FORM FOR HANDRAIL

Expansion joints were provided for the rail at intervals where similar joints were located in the bridge. These were made at the posts by inserting in the posts short sections of gas pipe of the required size to receive the rail reinforcement. The reinforcing rods fit the pipe snugly enough to allow free movement without danger of concrete entering and bonding the reinforcement to the pipe. A sheet of asphalt cut to the section of the rail was then fitted around the reinforcement and formed the joint between the rail and post.

The finish produced by this tool was free from the waves usually apparent in work of this sort. This was due both to the guides on the tool and to the exercise of care on the part of the workman.

Two Loops in Rope Save Time in Snubbing Buckets Down Incline

A LOOP spliced in each end of a 50-ft. length of manila rope, the bight of which is given a turn around a wood ship cleat, is saving time in snubbing wheeled skips down alternate sides of a double-track bridge to the deck of a motor truck at the shaft changing platforms on section 3 of routes 4 and 36 of the new Broadway subway in New York City. The shaft plants on this section, which were described on page 152 of the Engineering Record for Jan. 29, 1916, are a new departure, and consequently are being steadily improved. When it was found the loaded shiks were too light to be checked effectively by the brake, acting from below, a manila line in the end of which a loop was spliced was used to hold them. This had to be overhauled each time and rearranged on the cleat. By putting loops on both ends of the line it is now made to overhaul itself, and when a skip has descended on one track, the loop on the other end of the line is in place to throw over the next skip on the opposite track of the changing platform. As the second skip goes down, the travel of the line around the cleat is merely reversed.

WITH LOOP ON EACH END LINE DOES NOT HAVE TO BE OVERHAULED BY HAND

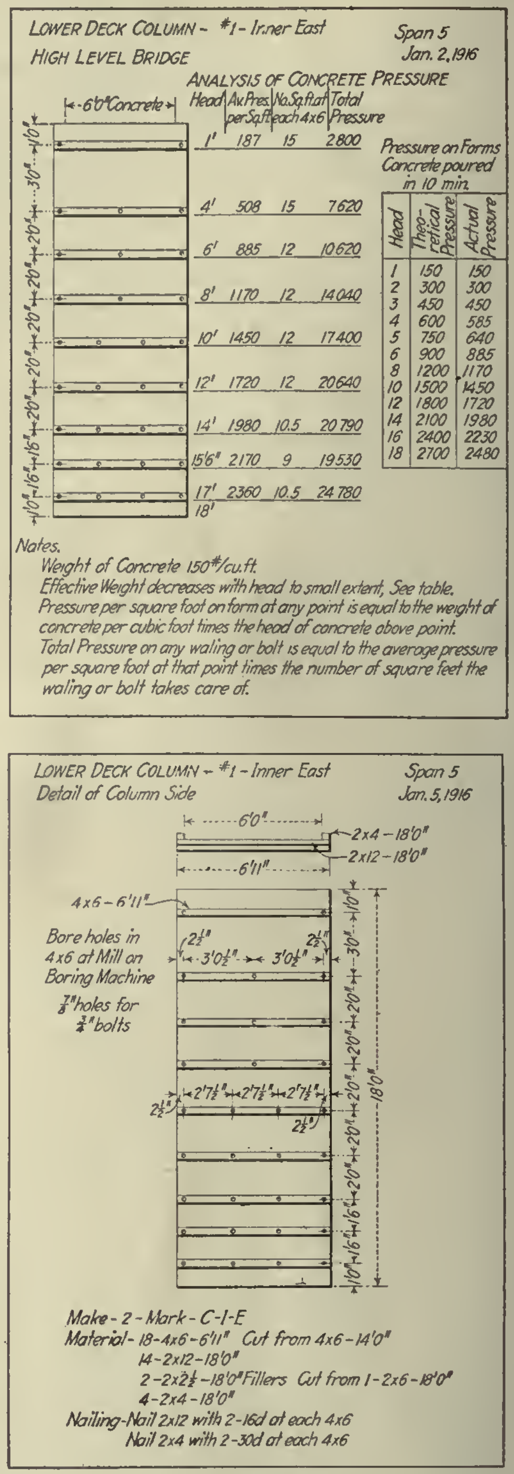
The time of loading the trucks has been further cut materially by sending down two or three loaded skips on each side in a train, so that the snub line, attached to the leading skip, is overhauled only once for each track to load one truck. The skips are coupled together with short lengths of manila rope, having eyes in each end to slip over the trunnions of the buckets. The rigging is well shown in the accompanying photographs.

This section of the Broadway subway is being constructed by the Holbrook, Cabot & Rollins Corporation, under the direction of George Hallett Clark, for the Public Service Commission for the first district of New York State.

BUCKETS TIED TOGETHER WITH SHORT LENGTHS OF LINE COME DOWN INCLINE IN TRAIN

Night School Helps Contractor's Foremen and Job

The Hunkin-Conkey Construction Company is making an organized effort at Cleveland to train their foremen in the simple branches of engineering and scientific methods of doing construction work. Many companies in other lines of work make a regular practice of training their men to work by standards and scientific methods, but in construction work there is usually too much rush to think of anything but field methods for educating foremen. In order to give the men a uniform training, increase their interest in their work and fit them for more responsible positions the foremen on the Detroit-Superior high-level bridge, eleven in all, are called together one evening a week in the drafting room of the head office of the company. Each man is provided with a drafting board, instruments and a handbook. Lessons are presented, on blueprints of uniform size, in mechanical drawing, mechanics of materials, graphic statics, hydraulics as applied to concrete pressure, concrete form design and scientific management of construction work. All illustrations are based on the work on the high-level bridge and the fifteen other jobs now under construction by the company. By associating each problem with some definite piece of work familiar to all, even men with no technical education readily grasp the principles involved. Harold E. Ketchum, superintendent of the bridge, is conducting the class.


LOWER DECK COLUMN - #1 - Inner East
HIGH LEVEL BRIDGE
Span 5
Jan. 2, 1916
ANALYSIS OF CONCRETE PRESSURE
6'0" Concrete
Head
Av. Pres. per Sq. ft.
No. Sq. ft. at each 4x6
Total Pressure
1' 187 15 2800
4' 508 15 7620
6' 885 12 10620
8' 1170 12 14040
10' 1450 12 17400
12' 1720 12 20640
14' 1980 10.5 20790
15'6" 2170 9 19530
17' 2360 10.5 24780
18'
1'0"
3'0"
2'0"
2'0"
2'0"
2'0"
2'0"
1'6"
1'6"
1'0"
Pressure on Forms Concrete poured in 10 min.
Head
Theoretical Pressure
Actual Pressure
1 150 150
2 300 300
3 450 450
4 600 585
5 750 640
6 900 885
8 1200 1170
10 1500 1450
12 1800 1720
14 2100 1980
16 2400 2230
18 2700 2480
Notes.
Weight of Concrete 150#/cu.ft.
Effective Weight decreases with head to small extent, See table.
Pressure per square foot on form at any point is equal to the weight of concrete per cubic foot times the head of concrete above point.
Total Pressure on any waling or bolt is equal to the average pressure per square foot at that point times the number of square feet the waling or bolt takes care of.
LOWER DECK COLUMN - #1 - Inner East
Detail of Column Side
Span 5
Jan. 5, 1916
6'0"
2x4 - 18'0"
2x12 - 18'0"
6'11"
4x6 - 6'11"
Bore holes in 4x6 at Mill on Boring Machine
7/8" holes for 3/4" bolts
2½"
3'0½"
3'0½"
2½"
2'7½"
2'7½"
2'7½"
2½"
2½"
1'0"
3'0"
2'0"
2'0"
2'0"
2'0"
2'0"
1'6"
1'6"
1'0"
18'0"
Make - 2 - Mark - C-1-E
Material - 18-4x6-6'11" Cut from 4x6-14'0"
14-2x12-18'0"
2-2x2½-18'0" Fillers Cut from 1-2x6-18'0"
4-2x4-18'0"
Nailing - Nail 2x12 with 2-16d at each 4x6
Nail 2x4 with 2-30d at each 4x6

BLUEPRINTS LIKE THESE HELP CONTRACTOR'S FOREMEN GRASP CONSTRUCTION PROBLEMS

THE NUMBER OF LICENSED ENGINEERS and architects in Illinois is given in a paper by W. C. Armstrong, of St. Paul, Minn. Since the enactment of the architects license law in Illinois in 1897 there have been granted, up to Jan. 31, 1915, 1124 licenses, and at that time 917 architects in the state held licenses. Since the structural engineers license law went into effect July 5, 1915 (see the Engineering Record of July 17, 1915, pages 63 and 71), 1169 applications for licenses have been made, of which number 613 have been acted upon favorably and the balance, 556, are pending investigation, with the probability that few will be rejected.

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

Railway Engineering Association Elects Officers

Fifteen-Foot Side Clearance Agreed Upon at Early Sessions—Committee Proposed 16 Ft. and Many Wanted to Retain 14 Ft.

A three-hour discussion of clearances was the outstanding feature of the first two days of the Seventeenth Annual Convention of the American Railway Engineering Association in Chicago this week. The 16-ft. total side clearance proposed by the Committee on Rules and Organization was opposed by many who wished to retain the 14-ft. now in the *Manual*. A compromise of 15 ft. was finally reached. In general the discussion was lighter than in other years, although the attendance was up to standard, with 494 members and many guests registered at the end of the second day. A full account of the discussions will appear in next week's issue. In his presidential address Robert Trimble, chief engineer maintenance-of-way, Pennsylvania Lines, Northwest System, reviewed briefly the year's work of the Association and the important railroad developments. He pointed out the difficulty of the railroads of planning for the future in the face of the uncertainties of the war, Federal valuation and state and federal legislation. The Society now has 1336 members, a net gain for the year of 100. The surplus on hand is not quite $14,000, a decrease of $3,400, owing to slow collections. The officers elected for the coming year are: President, A. S. Baldwin, chief engineer of the Illinois Central Railroad; vice-president, C. A. Morse, chief engineer of the Rock Island Lines; treasurer, George H. Bremner, assistant district engineer, Interstate Commerce Commission, Chicago; secretary, E. H. Fritch; directors, R. N. Begien, C. E. Lindsay and W. D. Pence; members of the nominating committee, A. M. Burt, A. F. Robinson, E. B. Temple, M. A. Long and W. K. Hatt.

American Waterworks Fixes Date for New York Convention

Members of the American Waterworks Association were notified this week that the thirty-sixth annual convention will be held at the Hotel Astor, New York City, June 5 to 9. The facilities for the exhibits of equipment are said to be on a grand scale and the Waterworks Manufacturers' Association promises a display far superior to that of any previous convention. Visits to points of engineering interest are being arranged as one of the convention features and an excellent program of papers is said to be assured.

A. S. Baldwin New Head of Railway Engineering Association

A. S. Baldwin, chief engineer of the Illinois Central and the Yazoo & Mississippi Valley Railroads, and first vice-president of the American Railway Association, was elected president of that organization at the annual convention in Chicago this week.

Mr. Baldwin was born at Winchester, Va., in 1861. He was educated in private schools, and after teaching school one year, entered railroad service. His first railroad employment, in 1880, was as rodman for the Richmond & Alleghany Railroad, now the Chesapeake & Ohio. The next year found him with the Iron & Steel Works Association of Virginia, engaged on railroad and blast-furnace construction, and the development of ore mines. Here, as assistant engineer and engineer, he remained for three years.

From 1884 to 1886 he was in the employ of the Baltimore & Ohio Railroad on the construction of its Philadelphia extension. He then went to the Chicago, Milwaukee & St. Paul Railway as principal assistant engineer on the construction of its bridge across the Missouri River at Kansas City. Following this, after a short period on the construction of what is now the Louisville, Henderson & St. Louis Railway, he entered the service of the Louisville & Nashville Railroad, where he remained from 1887 to 1901, serving successively as assistant engineer, assistant to chief engineer, and roadmaster. In the fall of the latter year he came to the Illinois Central as principal assistant engineer. In May, 1903, he was made engineer of construction, and in March, 1905, was appointed to the office he new holds, that of chief engineer.

Elected to Presidency of American Railway Association This Week

A. S. BALDWIN

Hearings to Be Held on New York City Building Restrictions

The dates for hearings on the tentative plans for building restrictions proposed by the commission on building districts appointed by the Board of Estimate of New York City have been set for the different boroughs as follows: Manhattan, March 27, 28, 29, and 30; Brooklyn, April 4, 10, 11 and 17; Bronx, April 3 and 5; Queens, April 6, 13 and 18; Richmond, April 12. In all cases the hearings will be held at 10.30 a. m. in the rooms of the Board of Estimate at the City Hall. The general principles upon which this districting of New York City has been based, and some of the proposed heights and use limitations will be found in the Engineering Record of Feb. 26, page 248.

To Start Work on $5,500,000 Waterworks and Sewerage Contract in Uruguay

Ad Referendum Contract Signed Last Year by Ulen Contracting Company of Chicago Ratified by Uruguayan Senate

The ad referendum contract, entered into Nov. 12, 1915, by the Ulen Contracting Company of Chicago and the Uruguayan Government, for waterworks and sewerage systems to a value of $5,500,000 in various cities of the republic has ben ratified by the Senate of that country and executed by the President. The contractor will start work as soon as possible. Some engineers and other members of the construction force have already been sent to Uruguay. Thomas S. Shepperd, vice-president of the A. Gillespie Company, who will be general manager for the Ulen Company in Uruguay, will sail with other members of the force April 1st.

Preliminary Work Took a Year

The negotiations preliminary to signing the contract consumed about a year. They were handled by John R. Ulen, vice-president of the company and E. G. Trueheart, the chief engineer.

Wherever possible native engineers and construction superintendents will be employed, and all the unskilled labor will be obtained in Uruguay. The part of the force to be obtained in the United States has already been employed or arranged for. All materials likewise have been provided for.

The contract is believed to be one of the largest ever entered into by a contractor native to the United States for municipal improvements outside of this country. A $6,500,000 bond issue was authorized for the construction of the Havana, Cuba, waterworks contract which was executed by the Runkle-Smith Company, an American concern of which R. A. C. Smith, the present commissioner of Wharves, Docks & Ferries of New York City, was a principal and $16,000,000 was provided for the Havana sewerage and paving contract, which is now almost completed, but only the first of these can fairly be classed as pioneering in a foreign field. The sewering and paving project was planned, and the contract for it entered into under the direction of authorities appointed by the United States Government.

The main office of the Ulen Contracting Company is in the First National Bank Building, Chicago. The Uruguayan office will be located in Montevideo. Henry C. Ulen is president of the company.

Lehigh Valley Considers Immense Freight Terminal

The building of an immense new freight terminal at Jersey City, N. J., for the Lehigh Valley Railroad at a probable expenditure of $5,000,000 depends on the willingness of the Jersey City officials to grant the Lehigh Valley the privilege of making various changes in the present arrangement of the streets and sewers in the area selected as the site for the new structures, and to take care of certain tax matters on the property under consideration.

Options for the desired 400 acres of land having about ½ mile of water frontage on the Jersey shore off Ellis Island are in the hands of the Lehigh officials but further than this, nothing will be done until the desired rights are granted to the railroad by the Jersey City Commissioners.

Although definite plans have not yet been made, it is understood that the new terminal will be designed to accommodate a large number of big ships as well as a heavy schedule of railroad freight. It is also suggested that there will be a connection with the new pier near Ellis Island, where heavy freight and ore from South America might be unloaded.

The proposed freight terminal will not interfere with the passenger service, which would be continued from the station of the Central Railroad of New Jersey.

Strike on Alaska Government Railroad Ended March 7

The strike of men employed on the construction of the government's Alaska railroad ended March 7, when the Federal Labor Union at Anchorage, Alaska, voted to return to work pending a settlement of the wage controversy. Four hundred men resumed work and more will be put on as soon as the union formulates a wage scale which will be fixed by a committee representing the union and the Alaska Engineering Commission. The strike began Feb. 7 when sixty tracklayers working on the Anchorage-Matanuska branch demand an increase in pay from 37½ to 50 cents an hour.

$100,000 Bonds Voted for Klamath, Oregon, Drainage

The members of Klamath district, Klamath Falls, Ore., recently voted authority to bond the district for $100,000 in order to begin the work of reclamation of the 27,500 acres of marsh land in Klamath county. The directors of this district are said to have the support of other land owners, and will issue the bonds as needed in order that work can be started without delay. The county court will be petitioned to appoint viewers to ascertain what lands will be most benefited by the bond issue. It is reported that plans are under way to perfect arrangements with the Southern Pacific Railway for connecting the district's dykes with the railway embankment near the lower lake, which arrangement would result in saving the cost of an additional dyke.

Extension Road-Building Course

The University of Oklahoma, Norman, Okla., under the auspices of the director of the school of civil engineering, James I. Tucker, has prepared a correspondence course in highway work. The complete set of twenty-four lessons is now available and about thirty have enrolled in the course. Thus far 125 lessons have been sent in, with every evidence of interest and enthusiasm.

Interest in the course is rather widespread, correspondence being now under way with highway engineers, departments and colleges in Massachusetts, Kentucky, Wisconsin and Texas.

The major part of the course is devoted to the fundamentals, such as road economics, road administration, drainage, etc. There are chapters on the types of roads particularly adapted to conditions in the Southwest—earth, gravel, stone, sand-clay and oil-mixed roads.

To Change Oregon Bridge Laws

The contractors of the State of Oregon are reported to be working to repeal the amendment to the law passed by the Legislature last year, which permits counties to construct bridges under their own supervision when the bids submitted are considered too high. Previously, all such work had to be let by contract.

Consider Macadam Highway Across the Isthmus of Panama

A macadam highway across the Isthmus of Panama is contemplated for the near future according to the February *Bulletin* of the Pan American Union. A survey for the road which will be 75 miles in length, stretching from Boquete to the Atlantic seaport of Rovola, has just been completed by J. T. Luttrell, an American engineer. It will pass through virgin country and will cross a mountain range at an altitude of 6000 ft.

Cuba May Nationalize Railways

President Menocal of Cuba signed a decree, Feb. 10, appointing a commission to prepare and submit a report, within the next six months, on a plan for the nationalization of the railways of the island. According to the *Bulletin* of the Pan American Union, the decree sets forth that the railways by raising freight rates have injured the agricultural interests of the country, that they are unable to handle the volume of traffic offered them and that the management has entered into numerous controversies with patrons of the lines. The commission will consist of the Secretary of the Interior, the Secretary of Justice, the Secretary of Finance, the assistant Secretary of State, a civil engineer, a banker, a financier and two railway experts.

Kansas City Engineers Meet

The program for the Institute for City Engineers held at the University of Kansas, March 14 to 18, contained many interesting addresses. The city engineers and other public officials were put in touch with new developments in engineering and the reliability and durability of various materials was shown by actual tests.

Papers were read on: "City Planning," "Reinforced-Concrete," "Water Purification," "Manufacturing as a Factor in City Development," "Water Softening," "Recent Development in Brick Pavements," "Asphaltic-Concrete Pavements," "Brick Rattling Test and Road Materials Test," "Concrete Road Building," "Sewage Disposal," and "Testing of Water Meters." Many of the talks were illustrated by motion pictures and proved of more than ordinary interest.

Arizona to File on Power Sites

Attorney General Wiley E. Jones has requested Senators Ashurst and Smith and Congressman Hayden of Arizona to introduce legislation in Congress which, it is hoped, will result in Arizona being granted permission to file on power sites on navigable rivers in that State, particularly along the Colorado River in the Grand Canyon.

New Asphalt Boulevard Planned for San Francisco

Plans for the new Hunters Point Boulevard, to extend from Railroad Avenue and Evans Street to the Hunters Point drydock, are being made in the office of M. M. O'Shaughnessy, city engineer of San Francisco. The boulevard will be 80 ft. wide and paved with asphalt on a 6-in. concrete base for its entire length. The maximum grade will not exceed 4 per cent. This is one of a series of projects, which, it is reported, the city engineer has outlined for the coming year to develop the industrial possibilities of the lower San Francisco district.

Iowa State Drainage Association Elects New Officers

The recent meeting of the Iowa State Drainage Association is said to have been one of the most successful ever held and it is believed that those in attendance fairly represented all phases of the agricultural interests in the United States. Representatives attended from Minnesota, Illinois, Missouri, Michigan and Washington, D. C., and the success of the 1916 meeting is credited to H. M. Sparboe, the retiring president, who had held office for five years. The officers elected for the ensuing year are: President, J. W. Boyer, Fort Dodge; vice-president, John T. Drug, Stratford; secretary, F. P. Costelloe, Ames, Iowa.

Engineers Call Upon Congress for Real Preparedness Measures

Pass Resolution at Military Lecture in New York—Captain Coiner Describes Selection of Camp Sites and Water Sterilization

Calling upon Congress to expedite its deliberations on the army and navy programs, the members of the New York military lecture course, representing the four national engineering societies, passed by a unanimous vote Monday night a resolution demanding from senators and representatives at Washington, legislation based on the opinion of experts, which will insure adequate national defense. Copies of the resolution are to be sent out broadcast so as to leave no doubt in the minds of congressmen as to the exact sentiment of the engineering profession on the subject of military preparedness.

After the vote had been taken, Captain Richard T. Coiner, Corps of Engineers, U. S. A., explained the methods of selecting and laying out camp sites, sterilizing drinking water and providing facilities for the disposal of refuse. Camp sites, he said, should be located on high, well drained ground, although ideal locations are rarely found in practice. An abundant supply of pure water is a camp necessity, and where the purity of the water is in doubt some means of sterilization must be employed. Heat is the army's most reliable water purification agent.

In one of the devices the incoming raw water was jacketed around the hot sterilized water so that by an exchange of heat the effluent was cooled and the raw water heated, thus reducing to a minimum the necessary amount of fuel. Plain boiling of water in cans is practised when no sterilizing equipment is at hand, but Captain Coiner warned the men who expect to go to camp not to do any water sterilizing experiments on the company cook's stove. "Nothing makes a cook so peevish," Captain Coiner said, "as to have his range cluttered up with the men's mess kits."

Other forms of sterilization are chemical treatment in canvas bags and a simple type of portable mechanical filter using a coagulant.

Captain Coiner concluded his address by outlining the principle precautions to take in the disposal of camp refuse.

Preparedness Resolution Passed

The resolution passed at this week's meeting follows:

"Engineers assembled in public meeting on March 20, 1916, under the auspices of the Engineers Committee on Military Lectures, believe that it is unworthy a great nation like the United States and that it is dangerous to the peace, safety and liberty of its people, to remain in our present position of inadequate military, naval and industrial preparedness.

"We believe that between pacificism and militarism there is a just, safe and proper ground, greatly in advance of our present position—a ground which involves large additions to both the navy and army, a large increase in our schools for training officers and a coordination and mobilization of the physical and industrial resources of the nation.

"We believe that this nation should never make war except to enforce peace; that when strongly supported by armed resources its influence in maintaining its own liberties and rights, and the liberties and rights of the weak and oppressed throughout the Americas will be greatly strengthened.

"We believe that Congress should give due weight to the opinion of experts and should then appropriate sufficient money to put the nation in a position of defense against attack on either the Atlantic or Pacific Coast.

"We demand that our Representatives in Congress act in accordance with this expression."

Scientists Committee Suggests Remedies for Panama Slides

That navigation through the Panama Canal will not be seriously interrupted by slides after the present obstructions near Culebra have been removed is the conclusion reached in a preliminary report made public March 16 by the committee of scientists and engineers appointed by President Wilson to investigate conditions at the Isthmus.

The committee believes that every available and practicable device should be used to turn rain from ground that is sliding and prevent its entering adjacent ground, and it suggests the following measures:

1. Covering slopes with vegetation.—The committee believes that threatening ground bordering the slides, quiescent slides, and, so far as practicable active slides ,themselves should be sufficiently covered with vegetation to prevent surface wash.

2. Closing peripheral cracks.—Before extensive movements of the ground occur warning is frequently given by the appearance of cracks peripheral to the coming slide. As soon as they are formed they should be filled up in order that they may not intercept surface water.

3. Drainage of undisturbed and threatened areas.—Undisturbed and threatened areas near the slides should be thoroughly drained both by surface and by tile drainage, to keep as much water out of them as possible, for they may become unstable and they may supply water to the slides. Experiments with tile drainage on a small scale would soon show whether it is effective enough to justify its extension.

4. Drainage of the great slides.—A complete system of open drains should be established on the great slides and the water carried away as directly as possible.

5. Drainage by tunnels.—Drainage by means of tunnels might be adapted to a few special cases, but should be tried with caution, and extended only in cases which promise results commensurate with the cost.

6. Sluicing.—It is suggested also that a cut be made by sluicing in the East Culebra slide, starting at an appropriate point on the canal and diverging from it diagonally in a general southeasterly direction, in the zone of gentle slopes and in such a position as to reach the large pond which now exists on the slide.

"In addition to the immediate remedial measures suggested above, there are certain observations and protective measures which should be undertaken with a view to the future. A few slides are now in motion, but many more are quiescent," the report adds.

The report was prepared by a committee consisting of Charles R. Van Hise, president of the University of Wisconsin, chairman; Gen. H. L. Abbott, Corps of Engineers, U. S. Army; John C. Branner, geologist, and former president of Stanford University; Whitman Cross, geologist in the U. S. Geological Survey; R. C. Carpenter, professor of mechanical engineering in Cornell University; Arthur P. Davis, chief of the Reclamation Service; John R. Freeman, consulting engineer, Providence; J. F. Hayford, dean of the College of Engineering, Northwestern University, and Harry Fielding Reid, professor of engineering, Johns Hopkins University.

Photo. Underwood & Underwood

COMMITTEE OF ENGINEERS AND SCIENTISTS DURING THEIR RECENT INSPECTION OF THE PANAMA CANAL

U. S. Coast and Geodetic Survey to Hold Centennial Exercises

The Centennial Exercises of the U. S. Coast and Geodetic Survey will be held April 5 and 6 at Washington, D. C. The meeting scheduled for the afternoon of April 5, will be devoted to addresses on the bureau of fisheries and its relation to the U. S. Coast and Geodetic Survey, the work done by the Survey in the field of terrestial magnetism, its ocean currents and deep sea explorations and U. S. Geological Survey and its relation to the U. S. Coast and Geodetic Survey.

In the evening the program will be devoted to exploiting the part the Coast and Geodetic Survey has played in the development of commerce, and the relations between it and the Lighthouse Service. Brig.-Gen. W. M. Black, Corps. of Engineers, U. S. A., will talk on the relation of the U. S. Corps. of Engineers to the Coast and Geodetic Survey, and George W. Little will speak on the subject of hydrography and charts.

The afternoon of April 6 will be devoted to discussions of the contributions of the Coast Survey to geodesy and physical geography and the international work of the Survey will be discussed. President Wilson will speak at the banquet to be held on the evening of April 6 which will end the meeting.

Harrisburg Board of Public Works Is No More

The Harrisburg Board of Public Works, after directing the expenditure of $2,250,000 in public improvements, including a filtration plant costing $325,000; a sewage improvement costing $365,000; a dam across the Susquehanna, $82,000; a bridge over the Pennsylvania Railroad tracks, $366,000; and construction of a river wall and intercepting sewers, $333,000, has been abolished. All of the work is completed with the exception of a small amount on the river dam which will be finished this spring.

National Septic Process Protective League Formed

Will Defend All Suits Against Members for Excessive Royalties for Infringement of Cameron Septic-Tank Patents

The National Septic Process Protective League was formed at a meeting of the League of Iowa Municipalities, held in Des Moines, Iowa, March 14. Dr. H. M. Bracken, secretary of the Minnesota State Board of Health, was elected president and F. G. Pierce, of Marshalltown, Iowa, secretary-treasurer. The object of the league is to defend all suits filed against its members for the infringement of Cameron septic-tank patents. All municipalities, corporations, companies and individuals interested in sewage disposal are eligible to membership, subject to the approval of the executive committee.

Reason for Action

Quite recently a number of Iowa municipalities have been notified by the Cameron Septic Tank Company of patent infringement for the use of septic tanks, filters and other appurtenances of sewage disposal plants. It was to consider these claims for royalties on sewage disposal plants that the meeting was called.

Prof. A. Marston, Ames, Iowa, discussed the development of septic tanks and the litigation in regard to the claims for royalties. H. E. Sampson, assistant attorney general of Iowa, explained the legal status of the Cameron claims, especially in the light of the recent decision against the city of Winchester, Ky.

Following a general discussion a committee on organization brought in a resolution which stated that demands for excessive royalties on account of certain alleged patents were being made; that able attorneys advised that the patent has already expired; that the interests of the general public can best be protected by contesting the validity of the alleged patent, by ascertaining the scope of its claims and by refusing to pay royalties until after the courts of final juridiction have upheld validity of the patent and the liability for royalties.

Contributions

For raising funds it was recommended that assessments be based on population of municipalities graduated as follows: $10 for towns of less than 2000 people; $15 up to 5000; $20 up to 10,000; $25 up to 20,000; $30 up to 50,000 and $35 for more than 50,000 people.

The board of direction is made up of two representatives from each State and the executive committee will consist of the officers and four directors chosen by the board, C. A. Haskins, Paul Hansen and Lafayette Higgins of the Kansas, Illinois and Iowa State Boards of Health respectively, were chosen for the executive committee, with Prof. A. Marston, Iowa State College, as the fourth advisory member. The following directors were elected: For Iowa, Dr. J. F. Cole, president, League of Iowa Municipalities, and Lafayette Higgins; Kansas, C. A. Haskins; Ohio, W. H. Dittoe, engineer State Board of Health; Illinois, Langdon Pearse, assistant engineer, Sanitary District of Chicago, and Paul Hansen; California, W. J. Locke, secretary, League of California Municipalities, and Charles Gilman Hyde, consulting engineer, State Board of Health; Minnesota, H. A. Whittaker, State Board of Health, and G. A. Gsell, secretary Minnesota League of Municipalities. To fill vacancies and to represent states not sending delegates directors will be named and approved by the president and the secretary. About thirty-five deelgates from the four States noted were in attendance.

Letters from the Cameron Septic Tank Company were quoted from to the effect that the alleged infringements of the Cameron septic tank patents are not confined to what are frankly called "septic tanks," but extend "to those which employ putrefactive reduction of sewage solids, but which for purposes of evasion have been styled 'sedimentation' or 'settling tanks,' as well as to the more recently exploited 'Imhoff' or 'two-story' septic tank." The terms for licenses are based on the cost of the plant, upon the length of time it has been in operation, and are 3 per cent per annum on the original cost of the complete plant and subsequent additions, "including the tanks, contact beds, filters or other appurtenances, for the number of years each plant has been in operation to date of settlement, plus an additional 3 per cent for the remaining unexpired term of the patent."

Competition for Designs of Workmen's Houses

As announced briefly in the Engineering Record last week, the National Americanization Committee, through a sub-committee known as the Housing Competition Committee, will award prizes for the best designs for low-cost houses for immigrants. The object is to encourage the speedy adoption of American standards of living. As a first step in this direction the housing must be satisfactory. Since these buildings must rent at a very low price, economy of construction and maintenance are vital.

Full details as to the competition, which is open to engineers, architects and all interested in the subject, can be obtained by addressing the National Americanization Committee, at 18 West Thirty-fourth Street, New York City. The following paragraphs give the chief features:

Plans Desired

The competition has two broad divisions: the design of workmen's houses, and the design of substitutes for derailed box cars, commonly used to house construction gangs on railways.

The first division includes the following house plans:

1-A: House for single family, with two bedrooms.

1-B: House for single family, with three bedrooms.

2. House for family with four lodgers. Accommodations for lodgers to be entirely separate from those of the family, except as to the dining room.

3. Boarding house for thirty single lodgers.

Details as to the conditions governing the design of substitutes for the freight car are not yet available.

General Conditions and Prizes

In the housing competition, the buildings are to be suitable for industrial communities not exceeding 35,000 in population. The density to be provided is that of sixty-five people to the net acre. Two persons are allowed to each sleeping room.

Competitors are invited to include, in their specifications, methods of construction adapted to the plans which they submit. The merits of these suggested methods and materials will be considered by the jury in making the awards.

The committee has found it desirable to change the prizes from the amounts announced in the Engineering Record last week. The total of the awards, however, will be the same as before. For each of the four problems in the housing competition there will be a first prize of $300 and a second prize of $100. For excellence of construction there will be a single prize of $200.

The prizes in the competition for a substitute for the freight car total $600.

On the jury of awards is one engineer, Morris Knowles, of Pittsburgh. On the housing competition committee are the following engineers: Charles Whiting Baker, editor, *Engineering News;* E. L. Corthell, president, American Society of Civil Engineers; Gano Dunn, chairman, Engineering Foundation; Morris Knowles, consulting engineer, Pittsburgh; E. J. Mehren, editor, Engineering Record; Calvin W. Rice, secretary, American Society of Mechanical Engineers; William J. Wilgus, consulting engineer, New York.

Course in Proper Uses of Lumber at State College of Washington

A course of instruction in the proper uses of lumber is being offered by the State College of Washington, Pullman, Wash. Many of the colleges and universities have included this course in the regular curriculum, Syracuse University being one of the latest to take the step. The first courses of this nature were given in Wisconsin, where the state university extension division has also offered a course in Milwaukee for practical men. The Wisconsin lectures are given by a member of the forest products laboratory, maintained by the federal government, but the work is sponsored by the University of Wisconsin. The Milwaukee class numbers 63 members, representing 30 corporations, many of the students being in the class on office time. The course in Wisconsin covers such subjects as the structure and identification of wood, seasoning methods of wood preservation and fire retardants. The course also specifies why certain woods are best fitted for special uses. The Washington course provides extensive work based on a specially prepared textbook, in 10 assignments, as follows: "The Structure of Wood"; "Physical Properties of Wood"; "Standard Grades and Sizes"; "Structural Timbers"; "Seasoning and Preservation of Wood"; "Paints and Stains"; "Lumber Prices"; "Cost of Wood Construction"; "Specific Uses of Woods," and "Selection of Materials."

News of Engineering Societies

The Engineers' Club of Kansas City held a smoker last evening at which an effort was made to formulate plans for a good road campaign.

The Springfield Engineers' Club held a meeting March 13 at which the proposed bond issue of $1,500,000 for improving roads in Sangamon County was the subject of discussion.

The Manitoba Branch of the Canadian Society of Civil Engineers will hold a meeting at Winnipeg April 6, when M. C. Henry will present a paper entitled "Prairie Stream Discharge."

The Engineers' Club of Philadelphia has arranged for a series of lectures on military engineering to be delivered by Col. George A. Zinn, Corps of Engineers, U. S. A., April 1, 8, 15 and 29.

The Sociedad Cubana de Ingenieros will hear Jorge Brödermann speak on "Construction of a Railroad Between the Keys in the Bay of Caibarien" at the April meeting of the society, to be held at 76 Marti, Havana, Cuba.

The American Society of Civil Engineers will meet April 5 in New York City to discuss a paper by A. C. Janni entitled "Method of Designing a Rectangular Reinforced Concrete Flat Slab, Each Side of Which Rests on Either Rigid or Yielding Supports."

The Utah Society of Engineers has added sixteen new members to its list in the last few weeks. At a meeting held March 17, A. C. Watts read a paper entitled "Safety First in Coal Mines" and L. E. Abbott of the Oregon Short Line also spoke.

The Engineers' and Architects' Association of Southern California held a meeting in Los Angeles, March 17. G. A. Reichard, who recently returned from a business trip to Japan, gave an illustrated talk on China, Japan and the Philippines. Kiyo Sue Inui, a debater and lecturer, spoke on "America vs. Japan."

The Engineers' Club of Seattle heard N. A. Bowers, Pacific Coast editor of the Engineering Record, speak on "Co-operation Among Engineers," at a luncheon held March 16. W. T. Batcheller, assistant engineer in the city light department of Seattle, spoke on "Engineering Features Entailed in Construction of the Lake Union Steam Auxiliary Power Plant."

The Montana Society of Engineers has issued the first number of a publication to be called the Quarterly Journal of the Montana Society of Engineers. The object of the publishing committee will be to keep a printed history of engineering enterprises conducted by the members of the society and to further the interests of all members in every possible way. The headquarters of the society are in Butte.

The Engineers' Club of Kansas City recently held its annual dinner at which Major S. A. Cheney, Corps of Engineers, U. S. A., who is in charge of the Engineers' School at Fort Leavenworth, Kan., told of the manifold duties of engineers in time of war. He described a trip in an aeroplane over the entire length of a division whose men, horses, guns, equipment, ammunition train, supply trains, pontoon trains, engineers corps, hospital corps, etc., occupied about 25 miles of road.

The Engineers' Society of Pennsylvania, which now has over 700 members, will hold its annual banquet at the Harrisburg, Pa., this evening. Henderson Gilbert of Harrisburg will be toastmaster and the principal speakers will be A. T. Dice, the new president of the Philadelphia & Reading, Frederick W. Fleitz, former deputy attorney general of Pennsylvania, Colonel Biddle, Corps of Engineers, U. S. A., J. V. W. Reynders of Steelton, and Quincy Bent, general manager of the Pennsylvania Steel Company at Steelton, Pa.

Personal Notes

Albert A. Northrop, formerly of the firm of Seabury & Northrop, 101 Park Avenue, New York City, sails April 1 for Montevideo, Uruguay, where he will be connected with the construction of sewage disposal and water supply systems for various cities in that country. His headquarters will be at Montevideo.

Charles E. Hewes has been appointed city manager and city engineer of Alhambra, Cal. The two offices were recently combined and Mr. Hewes will have the supervision of all branches of the city government, including the street, building inspectors', plumbing and electrical inspectors' and police departments, and the city treasurer's office. He will also do the purchasing for all departments. It is believed that under the new arrangement the city government will be operated on a more efficient and economical basis.

Thomas A. Shepperd, vice-president of the T. A. Gillespie Company, whose appointment as general manager for the Ulen Contracting Company, on its $5,500,000 waterworks and sewerage systems contract in Uruguay is noted elsewhere in these pages, first engaged in engineering work in 1900 with the Denver Union Water Company. Since then he has been on railway irrigation, municipal and hydraulic work in this country, Alaska and Mexico. He was in the latter country for five years, and, as a member of the contracting firm of McQuatters & Shepperd, completed work there to a value of $1,000,000. As engineer of the Board of Public Works of the State of Chihuahua, he had charge of the design and construction of public works to a value of $3,000,000.

N. E. Hawkins will leave his position as chief engineer of the department of waterworks of Youngstown, Ohio, to become chief engineer for the W. M. Henderson Construction Company of Youngstown, April 1. After being graduated from the engineering department of the Ohio State University in 1907, Mr. Hawkins became assistant engineer with E. G. Bradbury, consulting engineer, of Columbus, Ohio, which position he held for two years. Sandusky, Ohio, claimed him as assistant city engineer for three years, after which he accepted the position of assistant city engineer of Youngstown. Mr. Hawkins' present work includes the design and construction of a new $650,000, 30,000,000-gal. filtration plant for the city of Youngstown.

Tribus & Massa, consulting engineers, 86 Warren Street, New York City, for 19 years consulting engineer for the borough of Chatham, N. J., has been re-engaged to continue the work the firm has been handling.

Charles S. Carroll has resigned from the civil engineering faculty of Ohio State University to become associated with the Ferro Concrete Construction Company of Cincinnati, Ohio.

S. G. Swigart will leave the U. S. Reclamation service to engage in civil and hydraulic consulting engineering practice in Missoula, Mont., April 1. He has just completed four years of service as irrigation manager of the Flathead project, and previous to that was engaged in civil engineering work in Colorado. Mr. Swigart's experience during the past nine years has been in the design and construction of important irrigation structures, preceding which he practised civil engineering in Akron, Ohio, and spent several years on railroad location and construction.

Webster L. Benham, chief engineer and manager of the Benham Engineering Company of Oklahoma, Okla., has become city engineer of Blackwell, Okla. Mr. Benham is a graduate of the engineering department of Columbia University and his engineering experience covers a period of nine years, during which he has been engaged in the construction of buildings, making of special surveys and has done a great deal of sanitary engineering work. He has been engaged in consulting engineering practice in Oklahoma since 1913, during which time he has personally designed and had charge of a large amount of work.

Howard W. Holmes has left his position in the bureau of highways and bridges of the department of public works of Oregon to open an office in the Northwestern Bank Buildin, Seattle, Wash., where he will practice as a consulting engineer.

George A. Johnson, consulting engineer and sanitary expert, 150 Nassau Street, New York, has been engaged by the borough of Matawan, N. J., to prepare plans and specifications for a sewerage system and sewage disposal works, and supervise the construction thereof.

Earl A. Zeisloft has been appointed city engineer of Akron, Ohio, succeeding J. E. Gehres, resigned.

James G. Griffiths, formerly superintendent of the Alleghany Light Company of New Kingston, Pa., is now connected with the Tri-cities Water Company at Monessen, Pa.

George W. Gardner, whose appointment as borough engineer of Madison, N. J., was recently announced in these columns, has been appointed engineer for the Township of Chatham. The new work will be in addition to his duties at Madison, and as consulting engineer for other towns.

Wilbur T. Mills Company has been incorporated to conduct an architects' and engineers' office in Columbus, Ohio. The officers of the company are: President, Wilbur T. Mills; vice-president, Edwin Rossbach, and secretary-treasurer, M. Lawrence Millspaugh.

K. A. Sinclair, formerly engineer on the Columbia Highway in Oregon, has been appointed Douglas County road superintendent, with offices at Roseburg.

H. Jay Hoffert, construction engineer with the Bell Telephone Company at Harrisburg, Pa., has resigned to become sales agent for the International Correspondence Schools. Mr. Hoffert is a graduate of Cornell University.

Samuel B. Fisher, formerly chairman of the valuation committee of the Missouri, Kansas & Texas Railway has been appointed consulting engineer of that road.

Gordon C. Douglas has been appointed city engineer of Covina, Cal. Mr. Douglas was for several years with the U. S. Geological Survey, working in the California branch as a topographer and surveyor.

Joseph P. Bayne, after thirty-one years of continuous service with the city of Cleveland, Ohio, has resigned to accept the position of engineer of paving for the Cleveland Railway Company. Mr. Bayne assumed his new position March 1.

G. C. Willson, formerly principal assistant engineer in charge of the construction of what is said to be the largest fuming sulphuric acid plant in the world for E. I. du Pont de Nemours & Company at Hopewell, Va., has completed his work there and is now building a similar plant for the Hercules Powder Company at Kenil, N. J.

A. A. Baker, formerly engineer-draftsman for the Pennsylvania Steel Company at Steelton, Pa., has resigned to become superintendent of construction for the Henry Kopperas Company, coke oven builders, of Pittsburgh.

William R. Roy, Washington State highway commissioner since 1913, has resigned his position on account of ill health. His resignation will be effective as soon as a new commissioner can be appointed.

Joseph B. Baker has been promoted from assistant supervisor for the Pennsylvania Railroad System at Newport, Pa., to supervisor in the office of the assistant to the general manager. Mr. Baker was graduated from the University of Pennsylvania in 1905 and entered the service of the Pennsylvania on July 1 of that year as rodman in the construction department. He was made transitman at Altoona, Pa., in 1905 and was advanced to assistant supervisor.

Crowell M. Dennis, formerly transitman in the office of the engineer of maintenance-of-way of the Pennsylvania, is now assistant supervisor on the Cresson Division of that road. Mr. Dennis was graduated from the civil engineering department of Princeton University in 1909. He entered the service of the Pennsylvania Railroad in June, 1910, as rodman on the Baltimore division and in 1915 he was appointed transitman in the office of the engineer of maintenance-of-way at Philadelphia.

William H. Becker has severed his connection with the Arizona Eastern Railroad to act as consulting engineer for the Gila County Road Department, with headquarters at Globe, Ariz. Mr. Becker will handle the road work that is being done under a $3,500,000 bond issue.

C. H. Johnson has resigned from the position of engineer of construction for the Nashville, Chattanooga & St. Louis Railway to accept an appointment as superintendent for the Gould Contracting Company of Nashville.

W. B. Lewis, who was recently engaged in making surveys and investigating the industrial possibilities of nothern Patagonia for the Argentine government, is now superintendent of Yosemite National Park, California.

George N. Adams has been appointed city engineer of Tropico, Cal. Mr. Adams has been engaged in engineering work in California since 1905. He was recently chief of party for the Imperial District, making topographical and canal location surveys.

Otis A. Barge, after two years as superintendent of construction for Albert Kahn, architect, of Detroit, has become associated with Allen J. Krebs, general contractor, of Birmingham, Ala., and will have charge of the new office of that concern at Atlanta, Ga.

C. D. Conway has returned to his position as superintendent for the Los Molinos Land Company, Los Molinos, Cal. He will begin the preparation of ditches for the 1916 irrigation season, which begins April 1. Aside from cleaning and repairing the ditches, a number of wooden flumes are to be replaced with steel ones and the ditch along the west bank of Antelope creek is being replaced by concrete. Mr. Conway was engaged in the building of reinforced-concrete bridges in California previous to accepting his present position.

Henry E. Elrod of Dallas, Tex., has been retained by the city of Coleman to design and supervise the construction of a reinforced-concrete reservoir.

Agnew T. Dice, formerly vice-president and general manager of the Philadelphia & Reading Railway, was appointed president of that road March 15 to succeed the late Theodore Voorhees. He entered railway service in 1881 in the engineering department of the Pennsylvania, and a year later was appointed superintendent of signals for the New York Central & Hudson River Railroad, which position he held until his appointment as superintendent of the Atlantic City Railroad in 1894. He was made assistant superintendent of the Reading division of the Philadelphia & Reading in January, 1896, and a month later was appointed superintendent of the Shamokin division. He was promoted to general superintendent in 1903 and in 1910 was made general manager. Mr. Dice was appointed a vice-president in 1913.

C. P. Bowie is no longer engineer of the Associated Pipe Line Company of San Francisco. He left that position to become petroleum engineer for the U. S. Bureau of Mines, with headquarters in San Francisco.

Frank P. McKibben, professor of civil engineering at Lehigh University, has been elected vice-president of the People's Trust Company, South Bethlehem, Pa. He will continue his services as professor of civil engineering.

W. P. Chapman, formerly highway engineer for Olmstead County, Minn., with headquarters at Rochester, is now superintendent of roads for Rice County, with headquarters at Faribault, Minn.

Gilbert K. Cooper has resigned his position as chief engineer of the United Fruit Company, Costa Rica Division, to accept an appointment as inspector with the Chicago Union Station Company.

C. B. Lamont, manager and consulting engineer for the Skinner & Eddy Corporation, Seattle's newest shipbuilding concern, has opened private offices in the Hope Building. He will continue to act as consulting engineer for the Skinner & Eddy Corporation, and, in addition, will conduct a consulting engineering practice. Mr. Lamont was graduated from Cornell University in 1900 and has been engaged in work on the Pacific Coast ever since.

Karl F. Keeler of Provo, Utah, has been appointed engineer of the new high line of the government's Strawberry Valley project.

Richard H. Jamison has been appointed city engineer for Alameda, Cal. He is a graduate of the University of Pennsylvania and has been a resident of California for about 15 months.

R. Boone Abbott, formerly division engineer of the Philadelphia & Reading, with headquarters at Harrisburg, Pa., has been appointed superintendent of the Shamokin division of that road, with headquarters at Tamaqua, Pa. Mr. Abbott studied engineering while a draughtsman in the office of the division engineer at Reading. He was born in Philadelphia and entered the employ of the Reading in 1900; in 1905 he was made assistant engineer at Reading, and later in that year became assistant supervisor at Harrisburg. In March, 1906, Mr. Abbott was transferred to the New York Division, with headquarters at Philadelphia, where he remained until April, 1909, when he was transferred to Pottsville. He became division engineer of the Harrisburg division in March, 1910.

C. H. Ewing has been promoted from general superintendent of the Philadelphia & Reading to succeed A. T. Dice as general manager of that road. Mr. Ewing came to the Reading as rodman in the construction department and at the age of twenty he was assistant engineer of construction. His rise was rapid and in 1893 he became chief engineer of the Central New England Railway. He returned to the Reading in 1902 and in 1913 became general superintendent of the system.

J. E. Turk has been appointed general superintendent of the Philadelphia & Reading, succeeding C. H. Ewing. Mr. Turk came to the Reading in 1889 as superintendent of the Reading division and in 1903 was made superintendent of the Shamokin division, which position he held until his new appointment.

George E. Scarfe, who has been superintendent of electric power and water in the Grass Valley-Nevada City (Cal.) district of the Pacific Gas & Electric Company for many years, has tendered his resignation to take effect March 31. Mr. Scarfe is leaving the company to take up consulting engineering, specializing in mechanics, electricity and hydraulics.

W. G. Turner of Fort Worth has been elected president of the Texas State Good Road Association for the ensuing year.

James Allen, former chief engineer of the Washington State Highway Commission, has been appointed state highway commissioner to succeed William R. Roy. Mr. Allen immediately announced the appointment of George F. Cotterill, former Mayor of Seattle, as chief engineer of the commission. The appointment of Messrs. Allen and Cotterill became effective March 20. James Allen came to the state highway board in 1909 as locating engineering under J. M. Snow and was made chief engineer in December, 1913. Prior to joining the highway board staff, Mr. Allen had a wide experience in civil engineering on railroad construction.

J. W. Sadler, an inspector in the department of public works of Portland, Ore., and recently identified with the Oregon State Highway Department, has been named as consulting engineer for the department of public works of Portland. The appointment has been ratified by the city council.

E. M. Carter, city engineer for Ellensburg, Wash., resigned from his position March 15. It is said that he will engage in the general contracting business in California.

Roy Greene, deputy county engineer of Lewis County, Wash., has resigned his position and moved to Minneapolis, Minn.

Paul Hansen, acting chief engineer for the Illinois State Board of Health, has been made chief engineer, his appointment being confirmed recently by the Civil Service Commission. He leaves vacant the position of chief engineer to the State Water Survey, of which Prof. Edward Bartow is director.

George W. Myers, who has had charge of concrete highway promotion and construction for the Portland Cement Association, has been promoted to a position in the association's Chicago office, where he has charge of concrete highway promotion in the entire United States.

H. D. Cromwell has resigned from his position as engineer on the construction of the Fairchild Street subway in Danville, Ill., to become engineer for the Beaver Electric Construction Company of Chicago.

Obituary Notes

Frederich A. Reily superintendent of the Waterbury Gas Works, Waterbury, Conn., died March 6, at the age of twenty-seven. Mr. Reily was a graduate of the engineering department of Cornell and his death is attributed to an injury he received while playing football while attending the university.

P. T. Walsh of the Walsh Construction Company, Chicago, and Davenport, Iowa, died in the latter city, March 16, at the age of 62. He was one of the well-known early railroad contractors.

Erasmus Darwin Leavitt, of Cambridge, Mass., a man who had occupied a prominent place in the engineering profession, died March 11. He was born in 1836, and, at the age of 16, began work in the shops of the Lowell Manufacturing Company, where he served as apprentice for three years. He spent a year with the Corliss & Nightingale Company and was later assistant foreman of the City Point Works in South Boston. He was with Thurston, Gardiner & Company of Providence, R. I., from 1859 to 1861, and from the latter date until 1867 he was assistant engineer in the U. S. Navy. He was consulting engineer for the Calumet & Hecla Mining Company from 1874 to 1904, the time of his retirement. He was also consulting engineer for Henry R. Worthington of New York, the Dickson Manufacturing Company, the city of Boston, and designed the pumping machinery for the city of Louisville, Ky. As advisory engineer he designed machinery for the Bethlehem Steel Company and for South African Mining Companies. Mr. Leavitt was a member and past-president of the American Society of Mechanical Engineers, the American Society of Civil Engineers—which he joined in 1873—the American Institute of Mining Engineers, the Boston Society of Civil Engineers, the American Society of Naval Engineers, an honorary member of the British Society for the Advancement of Science, life member of Franklin Institute and member of Institution of Civil Engineers and of the Institution of Mechanical Engineers of Great Britain. He was also a fellow of the American Academy of Arts and Sciences. In 1884 Mr. Leavitt received the honorary degree of Doctor of Engineering from Stevens Institute of Technology.

John W. Braid, for twenty-six years with the George A. Fuller Construction Company, died in New York City on March 14. Mr. Braid had charge of the construction of many important buildings, including the Pennsylvania Railroad terminal, in New York City, and in Columbus, Ohio. He came to the United States from Scotland while a young man and took up work in Chicago. Soon after he became associated with the George A. Fuller Company, later rising to the position of superintendent, which he held at the time of his death.

Frederick N. Finney, former president of the Missouri, Kansas & Texas Railroad, died March 18 in San Francisco. He entered the engineering department of the Cincinnati, Harrison & Indianapolis Short Line in 1854, and, later, was connected with several roads in the Middle West. In 1867 he had risen to the position of resident engineer for the Erie & Pittsburgh Railway and in 1868 he was promoted to the grade of general superintendent and chief engineer. He took a similar position with the Canada Southern in 1870 and served with that road for three years, after which he spent a few years with different roads, and from July, 1878, to October, 1886, he was general manager of the Wisconsin Central Associated Lines, being promoted to grade of managing director on the latter date. In 1887 he left the Wisconsin Central and in June, 1890, again took up work as president of the Soo Line and second vice-president of the Duluth, South Shore & Atlantic. In 1894 he accepted a position as superintendent of construction, and director and member of the executive committee of the Missouri, Kansas & Texas and in 1904 was elected president. He resigned that position Dec. 1, 1906.

Lightner Henderson, for many years chief engineer of the firm of Purdy & Henderson, died in Chicago, March 16. He was born in 1866 at Gap, Pa., and was graduated from Lehigh University in 1899. He supervised the construction of a large number of buildings, including the Flatiron in New York City, the New York Times and Municipal buildings, the Metropolitan Life Insurance Tower and the Waldorf-Astoria Hotel, and the North American Building, the Cook County court house and the City Hall, of Chicago. He also did considerable work in Cuba and Canada. He was a member of the Western Society of Engineers, the Chicago Engineers' Club and the Franklin Institute of Philadelphia.

Louis P. Morehouse, who retired from active service with the Illinois Central Railroad in 1905, died in Los Angeles, Cal., March 18. He was born March 30, 1835, in New Haven, Conn., and after graduation from Yale in 1856 he was engaged on the preliminary survey of the New London & Stonington Railroad as rodman. In May, 1857, he was employed by the Illinois Central Railroad as assistant to the division engineer and continued in the engineering department of that road for twenty years, being promoted during that time to the position of assistant chief engineer. In 1877, in the "interests of economy," the engineering department was abolished and for a year thereafter Mr. Morehouse was in the office of the president and of the general auditor. From 1878 to 1887 he was tax agent and land commissioner and tax agent from 1887 to 1890. At the time of his retirement, in 1905, he was custodian of deeds. He was one of the original members of the Western Society of Engineers, being secretary of that organization from 1869 until 1887.

Charles J. H. Woodbury, consulting engineer, of Boston, died at his home in Lynn, Mass., March 20, at the age of 64. Dr. Woodbury was graduated from the Massachusetts Institute of Technology in 1873 and later spent several years in the engineering department of the American Bell Telephone Company. In 1908 he opened offices as consulting engineer in Boston and devoted much of his time to writing articles of a technical nature. He was a member of many engineering and historical societies and considered an expert on telephone engineering.

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The War and the Publisher

ATTENTION was called in these columns some months ago to the change in producing the red cover of the Engineering Record caused by the shortage of dyestuffs. More recently the war has had an even wider effect and few of the materials entering into the makeup of a magazine can now be secured except at prices ranging from 50 to 150 per cent above what they were a year ago. The shortage of wood pulp and of chemicals used in paper making, due to the shutting off of supplies from abroad, has brought about an acute situation in the paper field. So serious is it that one well-known trade paper does not know at this writing whence it will secure stock for its next week's issue. Inks have gone up over 200 per cent, and an engraving scale representing increases ranging from 50 to 150 per cent becomes effective April 3. A disturbing feature of the present situation is that no relief, other than the sudden cessation of the war, is in sight.

Centennial of the Geodetic Survey

WITH commendable pride the U. S. Coast and Geodetic Survey is planning to celebrate the centennial of its establishment April 5 and 6. An elaborate program of addresses, which will bring forth the achievements of the survey and the relations it holds to other departments of the government, has been prepared. The President of the United States will grace the banquet which, on the evening of April 6, will close the proceedings. It is gratifying to note that an engineering branch of the government so clearly visualizes its work, its responsibilities and its accomplishments as to take advantage of the opportunity to stand before the public and glory in the completion of a century of work well done. The survey is to be congratulated on rounding the century mark, and even more so on the esprit de corps and professional pride which prompted the centennial celebration.

To Discourage Efficiency

LAST year, through the sneaking ruse of a "rider" on an appropriation bill, the Congress of the United States prohibited the making of time studies and the payment of bonus for increased efficiency in establishments of the War Department. This year even broader legislation is planned by those opposed to these methods of obtaining increased efficiency. Congressman Travenner on Jan. 11 introduced a bill which would prohibit time-study work in any government establishment and the payment of premiums, bonus or cash rewards as additions to wages, except for suggestions resulting in improvement or economy in operation. A similar bill, introduced by Congressman Van Dyke on the same date, would prohibit time studies throughout the postal service. The introduction of these measures, however unfair and however detrimental to the nation's work, should cause little surprise. What is intolerable, however, is that so far the committee on labor of the House has granted no hearings on the measures. There is ground for suspecting that the same tactics—the sneak's method—which resulted in putting the rider on last year's army bill is in contemplation for the Travenner and Van Dyke measures. It needs only the strong light of publicity to show the insidious and baleful influences of these proposed laws. The country at large, therefore—citizens interested in improvement of government efficiency, manufacturers, engineers—should voice their protests to their senators and congressmen at the failure to hold hearings. If the citizens declare themselves the hearings will be granted, and if the hearings are granted there is little likelihood that this extremely unfortunate legislation will prevail.

Junk

THE Board of Water Commissioners of an Eastern city has just issued an annual report which is an example of the extreme limits to which city officials will go in foisting upon a long-suffering public a mass of utterly useless information concerning departmental activities. The booklet contains 65 pages. In order to arrest the attention of the reader at the outset it opens with a list of names of deceased and present members of the commission, arranged chronologically and covering the period from 1867 to 1916. There follows a two-page statement regarding several details of engineering work and then comes the big feature—the secretary's statement of receipts and disbursements. No less than twenty-three pages are devoted to tabulated trivialities of expenditures such as: "Berry's Cut Rate Drug Store, 20 cents; Elmer E. Ayers, 15 cents," etc. It all makes such interesting reading that the man who has progressed through a score of pages like this will feel a compelling desire to proceed further. His determination will not be without its reward—several pages on hydrant and valve locations. Here is a sample: "Jefferson Avenue, corner of Mozart Street, two 6-in. gates; Mozart Street, south of Jefferson Avenue, one 6-in. gate, etc." At this stage the reader becomes so thoroughly aroused that he simply cannot put the booklet down until he has digested thoroughly the next chapter, giving the names of streets on which pipe was laid during 1915. On Baldwin Street, he learns, 50 ft. of 12-in. pipe were laid. This information whets his appetite for more and as he proceeds he finds out that on Alfred Street pipe laying activities were in progress for a length of 165 ft. The climax of the report is reached in the concluding paragraph, "Extracts from Rules of Water Board." With a sigh of regret that the end has been reached so soon the reader lays the volume aside. The one ray of hope for him, however, is that another report will be issued next year.

What Is Wrong?

THE city engineer's office seems to be a school for the preparing of young engineers to take other positions. Are the salaries too small or is the training too good? No young man can be blamed for endeavoring to advance his own interests, but the numerous graduations are causing a lot of comment." Regarding the frequent graduations referred to in these sentences from the *Daily Vindicator*, Youngstown, Ohio, the Engineering Record has no information. The salaries may be too small, the opportunities too limited, the working conditions unsatisfactory, or the openings in the Youngstown district at present many and attractive. The condition described, however, is not at all uncommon in the offices of city engineers in normal times. Probably the principal reason is that young engineers can see but comparatively little opportunity ahead in municipal work—at least when opportunity is gaged by the present common standard of remuneration. Oftentimes the salaries in the lower positions are entirely satisfactory. The young man who has a college education, however, is accustomed to look to the future, and that often has a discouraging aspect in the city engineer's office. Without a doubt, when the public comes to a keener appreciation of the engineer's work and his responsibilities, the remuneration paid to the city engineering force will go up. Probably then there will be less difficulty in holding bright young men.

Service of Engineering Societies

MANY questions affecting the efficiency of engineering societies will be brought up by the conference on society co-operation which will be held in Chicago April 13 and 14. Underlying them all, however, is the fundamental one, Why does an engineering society exist? Asked in all its baldness, the inquiry seems childish, yet the plans predicated on the answer spell society efficiency, mediocrity or utter failure. The all inclusive answer is that a society exists to render service to its members. Then comes the question as to what that service shall be.

Shall it be prestige, as is largely the case in the American Society of Civil Engineers; shall it be technical information, as in the American Society for Testing Materials and the American Railway Engineering Association; shall it be personal service as in local organizations? Plainly there are different types of acceptable service. But once the type has been selected, the officers and governing boards must ever keep it before themselves and the membership. This has been done in the testing materials and railway engineering associations, as regards their ideal of developing and accumulating technical information. It has been done by the local societies in giving employment aid, in offering opportunity for social intercourse and a forum for the discussion of local engineering problems. Some of the larger societies are less definite in their ideals of service; and in that indefiniteness can be found the cause of much of the dissatisfaction which has been expressed for example, among the members of the American Society of Civil Engineers. Some years back the members apparently considered that the prestige of belonging to the society was an adequate return for their dues. Such is no longer the case. More tangible returns are expected. The requirements are seldom formulated; they are given general expression by saying that the society should "do something" for its members. The receipt of the Proceedings and the privilege of wearing the pin do not satisfy the "something" that is demanded. A satisfied membership, an enthusiastic membership is one that is being adequately served, and service is possible only when officers and governing bodies continually ask themselves, "What *should* the society do for its members? What is it *actually* doing?"

High Cost of Motor Fuels

WHILE we hear a good deal about the troubles of the motorist in connection with the high price of gasoline, the man who uses motor trucks or gas engines for any purpose in his business is entitled to a greater share of our sympathies. The motorist can lay up his car; the man who is using gas engines for industrial purposes cannot very well shut down. There is no immediate prospect of materially lower prices for motor fuel, notwithstanding efforts of congressmen to prosecute producers and the resolutions instructing various bureaus to investigate what one congressman calls "the evident oppression of the public" by the producers of gasoline.

According to the government's figures we were approaching a period of scarcity and high prices when the war began. In 1900 the United States produced about 7,000,000 barrels of gasoline; in 1909, 13,000,000 barrels; in 1914, 35,000,000 barrels, and in 1915, 42,000,000 barrels. The increase in production has, of course been large, but nowhere near as large as the increase in motor vehicles—from a few thousands in 1900 to 2,500,000 in 1915. In addition to the motor vehicles, we have, of course, to consider the great increase in the employment of gas engines for all sorts of industrial service, for farm engines and motor boats.

It appears that a source of relief more promising than congressional resolutions would be a carburetor which would handle kerosene or other distillates. There are several such carburetors on the market already, and they are at least sufficiently successful to warrant their investigation by users of internal combustion motors. This is the only immediate measure of relief from high prices of gasoline and should be availed of while we are waiting for the war to end, for improved processes to increase the output of gasoline, and for the government to exhaust its probably futile efforts to reduce prices through investigation and prosecutions under the anti-trust law.

"Wood Where Wood Is Best"

SPEAKING before the National Wholesale Lumber Dealers' Association in Philadelphia on March 15, R. S. Kellogg, secretary of the National Lumber Manufacturers' Association, stated that the necessary keynotes of all lumber advertising today are the advocacy of the use of wood only where wood is best, and of the kind of wood that is best for a specific purpose. This, it seems to the Engineering Record, is significant of a new attitude in the lumber industry, and one that ought to be assumed wherever engineering materials and equipment are in question.

We have been accustomed for years to expect that the manufacturer of machinery would not sell his equipment unless it were adapted for the use intended. It is inconceivable, for example, that the maker of a grinding machine or of an expensive turret lathe would sell his product for a use that it could not well fulfill. Nevertheless, sellers of engineering materials of many classes have not set for themselves the same intelligent standard. In paving materials the salesmanship has been particularly flagrant. The salesman has been intent only on exchanging his product for the community's hard cash, regardless of the adaptability of the material to the traffic and conditions on the given street or road. He depended upon the power of his corporation to "get" the engineer in case the product failed and the engineer refused to buy again, upon a change of administration, or upon a lack of records to prevent the real facts regarding the service of his product from becoming known.

In a general sense, this indifference as to the use of the product has been true, also, in the lumber business. The lumber dealer cared not that his material went into the worst sort of fire traps, so long as the flow of money into his pockets constantly increased. Evidently the awakening is here. All true friends of conservation and a sensible economic standard in this country will trust that Mr. Kellogg may go forward and may work out designs in timber construction which will be as highly fire-resistive as possible. The lumber men well know that some types of frame construction resist fire very well, while others furnish just so many flues for encouraging and spreading the flames.

"Wood where wood is best" is a worthy slogan.

Railroad Regulation Case Forcefully Put

THOUGH reiterating views repeatedly expressed in this journal, the following quotation taken from an article by Prof. J. Laurence Laughlin, of the University of Chicago, in the New York *Press* of March 19, deserves a careful reading. Professor Laughlin puts the fundamental difficulty of the railroads—control of revenue by the government, while organized labor, uncontrolled by government, largely determines expenditures—in a clear and forceful way. The conclusion is inevitable. If the government limits earnings, it must limit the expenses which those earnings go to pay.

Professor Laughlin sums up the case in these words:

"In any other industry [than transportation] if the laborers enforce a raise of wages, the employers can raise the price of their product to the consumer. In the case of railways this control over fixing price is denied them.

"What is the upshot of the whole matter? The railways are between the devil and the deep sea. On the one hand, the commission refuses an increase of rates, while on the other the unions demand higher wages, with the threat of stopping the whole trade of the country until their terms are accepted. Where does the public come in? If railways are quasi-public utilities and therefore subject to regulation, then regulation clearly should include the protection of the public.

"If a set of conditions has arisen which obliges the government to regulate rates, then it is equally obliged, on the basis of economic analysis, to regulate wages accordingly. Having taken one step, it must take the other. It is the public which sooner or later must pay for the increased expenses of transportation."

In the difficulty now brewing the railroad employees admit that more revenue may be needed to give them the increase they demand, but their attitude is that they should have their higher wages at once, regardless of the time it will take to get the Interstate Commerce Commission to authorize an increase of rates, and regardless also of the fact that the commission for one reason or another may refuse such an increase. It is true that the commission is not now authorized to investigate the adequacy of wages and to recommend or enforce increases. The men, therefore, cannot lay their case before that body. They could, however, and should accept the conclusion stated by Professor Laughlin and urge Congress to give the commission such authority.

The Engineering Record is not unmindful of the burden such new duties would impose on an already overburdened body. The conclusion, however, is inevitable. A way to handle those duties will eventually have to be found.

Railway Engineering Convention

IN RESPECT to the findings put forth for adoption, and actually adopted, the convention of the American Railway Engineering Association last week was something of a disappointment. "Progress only" was the report on a larger number of topics than usual. This may be due in part to the removal of the incentive to get matter into the *Manual*, on account of the publication of the new edition; and in part to the fact that many of the more common problems have been cleared up. The investigations each year are more and more in the nature of research. One feature of the convention was noticeable—an inclination to lead rather than follow legislation. The general spirit of the convention was an encouraging contrast to that exhibited two years ago, in the quibble over the inscriptions on crossing signs. Then there seemed to be widespread fear lest the action of the association might suggest to legislatures something more drastic than had occurred to them before. The members, evidently, must have perceived that radical legislation is not halted by silence, and it is well that they are now showing an inclination to be the driving force rather than the brake.

A Meeting Well Conducted

COMMENT on the convention would be incomplete without commendation of the masterly way in which President Trimble presided. His eye was ever on the program, his mind was ever on the motion before the house, and digressions were not permitted. At times, perhaps, his rulings were a little too severe, and possibly some of the testimony he deemed irrelevant was not so in fact. He put the convention through on time, however, in spite of the fact that on one or two occasions it appeared that the length of the debate would upset the schedule entirely; and the chief engineers and others whom he called to order, being, like himself, men of affairs who have to get things done without too much ceremony, probably forgot their own discomfiture as soon as they realized the necessities of the situation.

Taking the Lead in Clearances

THE Engineering Record deems it most fortunate that the association did not adopt 14 ft. for side clearances, or send the matter back to the committee and lose a year, or dodge the issue entirely. As was ably set forth by several of the speakers, no body of men in the world is better qualified than the American Railway Engineering Association to determine safe clearances, and if they take no action in the matter, or action that creates the suspicion, just or unjust, that the cost of construction is being given undue weight, they cannot altogether blame the legislative bodies for going wrong in their attemps to insure greater safety. On the other hand, since the association has passed definitely on the matter, the Engineering Record believes, as stated editorially in the issue of March 18, that legislatures can afford to leave the subject alone, or shape their measures to the findings of the association. It is to be regretted that the question of whether the association preferred 15 ft. or something greater was not given a more thorough test. The Engineering Record does not attempt to say whether the 15 ft. adopted or the 16 ft. recommended by the committee is preferable. The closeness of the vote on the 15-ft. question, however, coupled with the fact that the debate on the 14-ft. motion was practically confined to a choice between 14 and 16 ft., raises the suspicion that if opportunity had been given to debate the 15-ft. motion it might have been voted down in favor of something wider.

League for the Defense of Concrete Patent Suits

THE FORMATION of the National Septic Process Protective League (noted in the news columns of the last issue), which will take up and continue the work of an earlier organization, suggests that a similar co-operative movement is needed in order to ascertain the status of the many concrete patents which are now troubling engineers. It is impossible without much thought and study to outline any of the details of such an association. It might be found, after investigation, that it would not be advisable to shoulder the defense of patent suits filed against its members, but merely to furnish the needed resources for a most thorough investigation of such patents as were brought into litigation, the results of these investigations being made available to the members.

There is a strong feeling that comparatively few of the defenses in patent suits affecting concrete work have been well handled. The reason is evident. Much of the material is buried in technical journals in both English and foreign languages and is not readily available. Moreover, it can be brought to light only by painstaking investigation. Without a doubt, too, a tremendous amount of material bearing upon these patents exists here and there in the offices of consulting engineers and of industrial and railroad companies from one end of the country to the other. It has not been collated, however, and consequently the full powers of the defense are not adequately marshalled.

Such a league as is here proposed would bring all of these forces together, and by slight individual contributions would make an aggregate competent to handle defenses in a vigorous and satisfactory manner.

There has been much complaint that consent decrees have been secured by patentees from weak opponents, men who welcomed the opportunity to settle and get off more cheaply than if they undertook a defense. Naturally, a small contractor, with little knowledge of engineering matters, of the prior art or of the technical literature containing records of it, looks with terror upon a suit that may drag out for years and involve not only high legal fees but considerable damages as well. He welcomes an opportunity to compromise and to give a consent decree, the true merits of the case having no interest for him.

Honest patentees, would welcome defense by such an organization. If their patents were sustained in face of such a defense the validity would not be questioned by the courts of appeal other than that in which the particular case was tried.

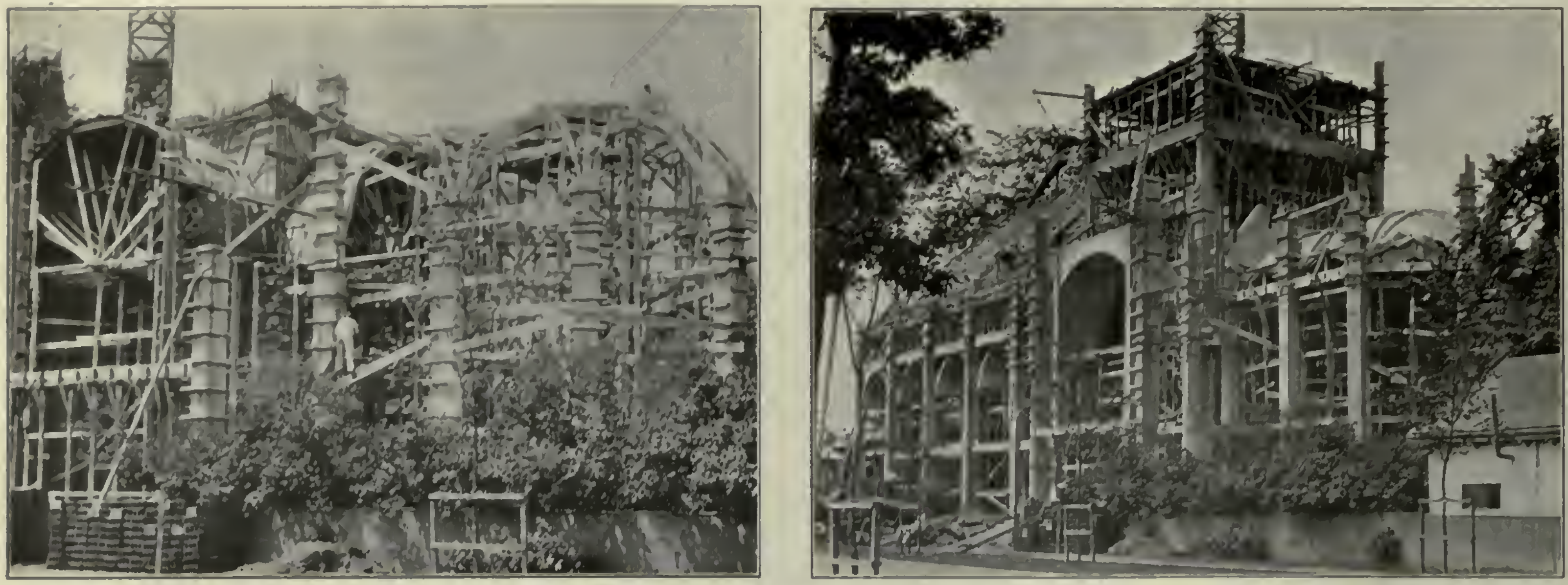
The Engineering Record would like to hear from engineers and contractors as to the desirability for forming such an association. The work awaiting it is large and important—so large and important that it is not likely to be well done if individuals and municipalities continue to act by themselves.

Complex Concrete Building Work

REINFORCED concrete is continually demonstrating its adaptability to almost any form of structural framework, no matter how complicated. Perhaps one of the most unusual and complex applications of this type of construction in building work is in the new Germanic Museum at Harvard University. Combining several styles of architecture, the structure presented many difficult problems in design, and construction. Two articles in this issue, pages 440 and 443, make it evident that the original ideas of the eminent German architects have been successfully translated into solid concrete by the associate architects and engineers in Boston, who applied American methods of designing, placing and finishing the reinforced-concrete frame.

The strong contrast which exists between German and American practice is suggested by Mr. Perry's article on the design. As stated by Mr. Perry, the analysis was based upon simple and reasonable assumptions, because the many statically indeterminate problems made an exact mathematical solution practically impossible. This is in accord with the prevailing American practice. It is quite probable that if the structure had been designed by a German engineer, an elaborate and complete mathematical engineering thesis would have resulted. A glance at the German technical periodicals will show how exhaustively their structures are analysed—the German engineer seems to revel in statically indeterminate problems and the theory of least work.

While in the simpler problems their results are probably nearer the true stresses than those obtained by our methods, in many cases the mathematical analysis itself is based upon fundamental assumptions which are not exactly realized. The American engineer believes that the practical inexactness in the placing of reinforcement, the variability of the concrete in the actual structure, the inaccuracy in form work, and the inevitable uncertainties at the foundations or at the points of combination with other parts make an exact mathematical study more or less a waste of time. The correct position undoubtedly is that the mathematical analysis should be carried to the degree of refinement justified by the nature and probable exactness of the assumptions.



COMPLICATED FORMWORK FOR GOTHIC HALL AND CHAPEL SHOWN IN TWO PROGRESS VIEWS, JUNE 10 AND JULY 26, 1915

Reinforced-Concrete Frame of New Germanic Museum at Harvard Is Unusually Complex

Domes, Vaulted and Arched Ceilings, Octagonal Tower and Roof Used to Obtain Desired Architectural Effects—Difficult Form Work

UNUSUALLY COMPLICATED form work, combined with great variety in the details of design, mark the construction of the new Germanic Museum at Harvard University, Cambridge, Mass., one of the most notable of the recent applications of reinforced concrete to architectural purposes. Especially difficult problems confronted both the architects and the designing engineers because several different forms of construction had to be harmonized and combined in one whole without producing too great complications in the actual details of erection and design. Domes, arches, steeply inclined rafters, special intersecting beams supporting the tower, complicated conical slab connections, and octagonal upper tower and roof all enter into the structural framework.

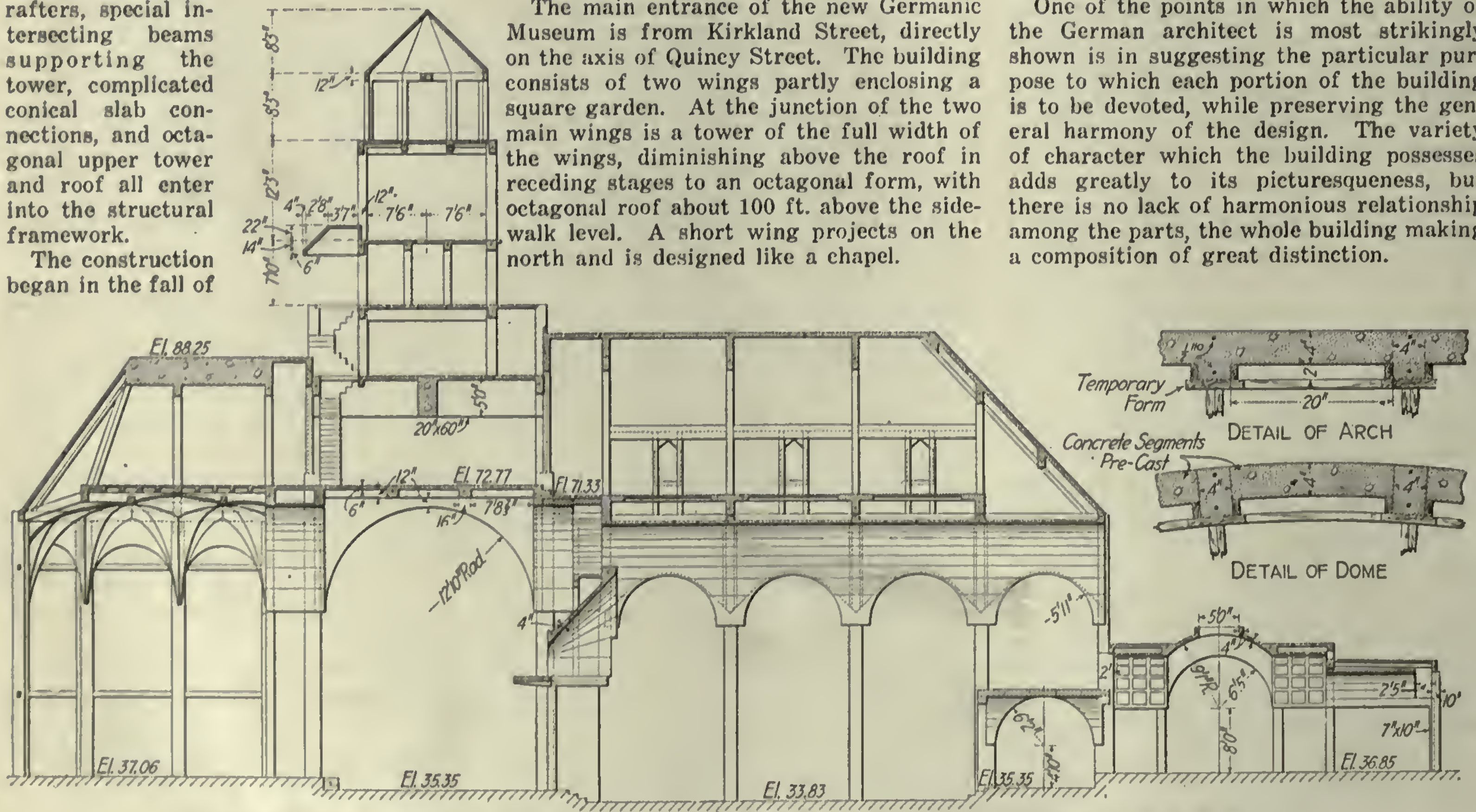
The construction began in the fall of 1914, and the first floor slabs were completed by Dec. 1 of that year. Work recommenced in April, 1915, and the structural frame was practically completed by Sept. 1, 1915. Among the unusual features in the construction work are the use of precast segments of the dome over the front entrance as forms for the concrete ribs, and the screeds on the steeply inclined roof later used as nailing strips for the timber sheathing to which the roof tile is fastened. Special attention is given to the interior finish of the concrete surfaces.

GENERAL ARCHITECTURAL PLAN

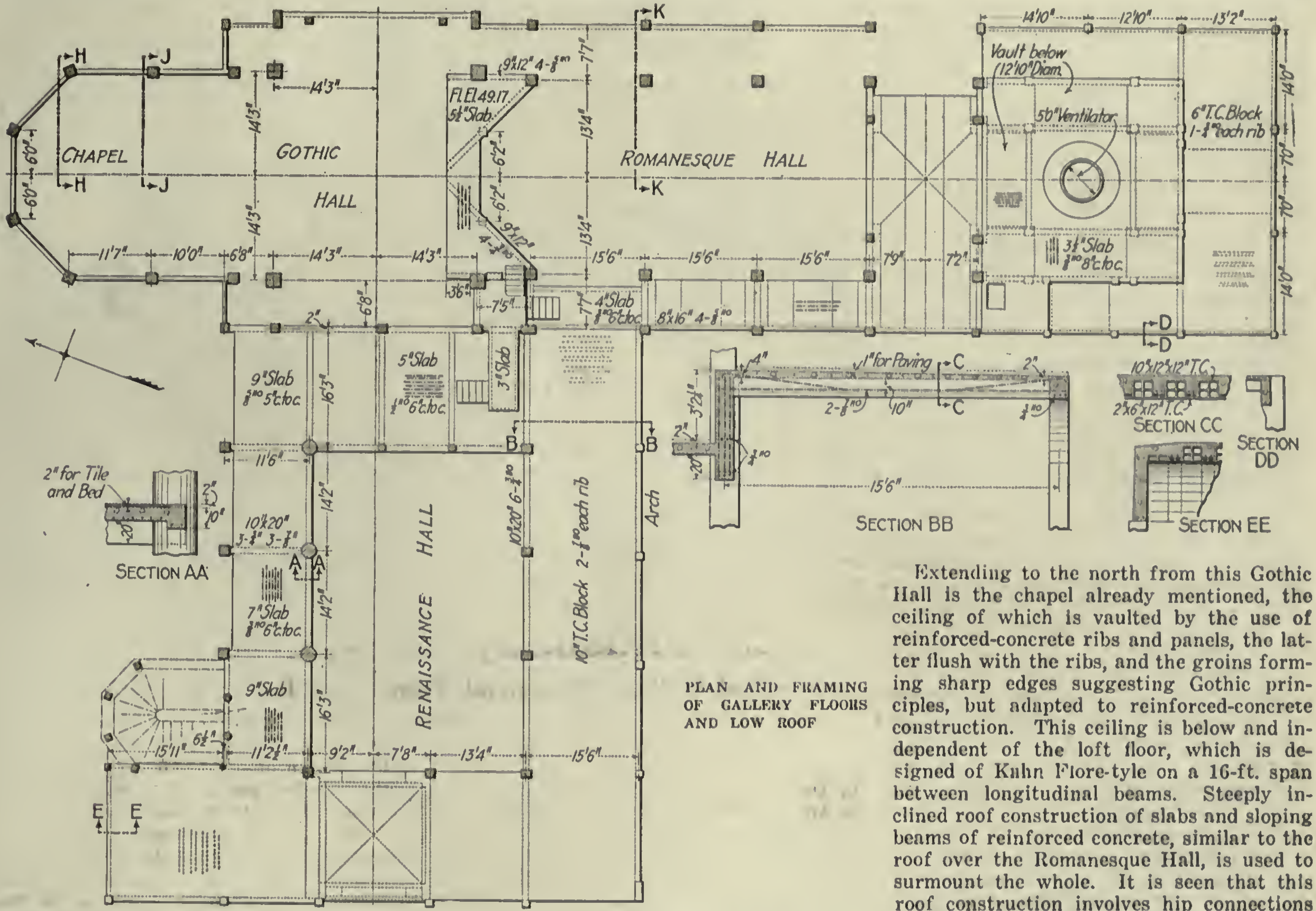
The main entrance of the new Germanic Museum is from Kirkland Street, directly on the axis of Quincy Street. The building consists of two wings partly enclosing a square garden. At the junction of the two main wings is a tower of the full width of the wings, diminishing above the roof in receding stages to an octagonal form, with octagonal roof about 100 ft. above the sidewalk level. A short wing projects on the north and is designed like a chapel.

The design of the whole building is distinctly modern and characteristically German, suggesting in its main characteristics the early German Renaissance. Its different parts are, however, so treated as to suggest, as in the case of the Romanesque wing, the period to which that portion of the building is to be devoted. Thus the chapel beyond the tower, while not Gothic in style, suggests a Gothic chapel in its main outlines and even in the treatment of its vaulting within, while the western wing, which opens from the tower and will contain the objects of the Renaissance period, is decisively Renaissance.

One of the points in which the ability of the German architect is most strikingly shown is in suggesting the particular purpose to which each portion of the building is to be devoted, while preserving the general harmony of the design. The variety of character which the building possesses adds greatly to its picturesqueness, but there is no lack of harmonious relationship among the parts, the whole building making a composition of great distinction.



LONGITUDINAL SECTION LOOKING EAST SHOWS VARIETY IN STRUCTURAL FRAMEWORK AND VARIOUS FLOOR ELEVATIONS



PLAN AND FRAMING OF GALLERY FLOORS AND LOW ROOF

The entrance vestibule, one story high, located in front of the main southern wing to which it leads, is surmounted by a dome with 5-ft. copper ventilator. The accompanying drawing indicates the structural features of this vestibule and dome. On one side is the director's room and on the other a class room and library stack, while on the left a doorway leads into the garden. Directly opposite the entrance is a large doorway leading to the main wing which is to contain objects of the Romanesque period.

The dome was constructed by using the precast unit method for the panels between the reinforced-concrete ribs. These sections, 4 in. thick, were made in multiple units on the ground, with projecting rods to take shear. They were then placed above the rib forms in the proper position and the ribs were cast symmetrically up to the crown, being bonded by the rods.

ROMANESQUE HALL

While not Romanesque in style, the hall just in the rear of the entrance vestibule is designed to suggest the Romanesque and the character of the objects which it is to contain. The main arched ceiling is about 25 ft. in span and is intersected by four arched openings, as seen in the elevations. Instead of barrel arch action, the ceiling is realy a curved slab supported by arched ribs, the latter being outlined by set joints.

The first floor is mainly of the flat slab and girder type of reinforced concrete. The elevation of the floors in the different portions of the building varies, thus separating the different halls and allowing an effective use of classic entrances. The structural design is so planned that the great casts to be installed will form a part of the composition of the interior. A duplicate of the Golden Gate of the Cathedral of Freiburg in Saxony is to be placed at the entrance between the Romanesque Hall and the Gothic Hall under the tower, while the screen from the Cathedral of Naumburg will separate the main Gothic Hall from the chapel beyond, in which objects of ecclesiastical art will be placed.

GOTHIC HALL AND CHAPEL

The Gothic Hall, formed by the intersection of the two main wings, is constructed with an arched entrance on the east. As seen by the elevations, a panelled ceiling above this central hall is formed by the beams of the loft floor at El. 72.77. This is a 6-in. slab floor of reinforced concrete carried by two intermediate beams in each direction to the 12-in. arched walls on all four sides. A stairway from the gallery floor on the south side of this hall leads above the conical slab to the loft floor above. Cantilever beams of reinforced concrete support the gallery floor.

Extending to the north from this Gothic Hall is the chapel already mentioned, the ceiling of which is vaulted by the use of reinforced-concrete ribs and panels, the latter flush with the ribs, and the groins forming sharp edges suggesting Gothic principles, but adapted to reinforced-concrete construction. This ceiling is below and independent of the loft floor, which is designed of Kuhn Fiore-tyle on a 16-ft. span between longitudinal beams. Steeply inclined roof construction of slabs and sloping beams of reinforced concrete, similar to the roof over the Romanesque Hall, is used to surmount the whole. It is seen that this roof construction involves hip connections which had to be provided for properly in the form work.

RENAISSANCE HALL

The main west wing is to contain objects of the Renaissance style, and is to be roofed with a flat wooden ceiling below the steeply inclined reinforced-concrete roof. On the north side the gallery is carried behind three large monolithic shafts or columns of dark red Vermont marble. These columns were so difficult to obtain that it was necessary to proceed with the construction without them by temporarily shoring up the gallery floor and roof beams by 6 x 6-in. timber columns.

As the top of these marble columns is about 4 in. below the bottom of the roof beams, small pipes were cast in the beams

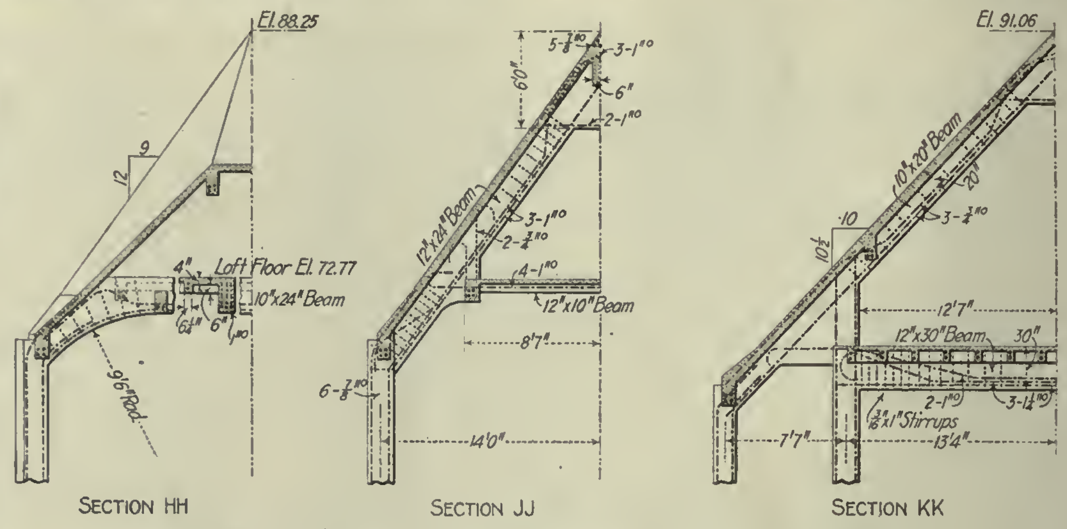
FRONT ENTRANCE DURING CONSTRUCTION

VIEW FROM INTERIOR OF ENTRANCE VESTIBULE SHOWS DOME AND VAULTED ENTRANCE above the centers of the columns for the purpose of grouting with cement mortar to bring the beams to a bearing on the columns after the latter are set in place. The steep roof construction and details are discussed in the following article. On the garden side of this wing are a series of small rooms for minor objects. These are one story in height and are roofed with a terrace which overlooks the garden.

EXTERIOR AND INTERIOR FINISH

The reinforced-concrete frame is filled in with hard-burned wall blocks plastered on the outside with cement. The main lines of support of the frame are outlined by cut stone piers and lintels forming an enframement for the stucco panels which they surround. The cornice, window enframements and the various entrances are also of cut stone, and the main parts of the building and entrances are richly adorned with carving. Over the main doorway is to be a group of St. George and the Dragon. A group of The Centaur, by Roger Noble Burnham, the American sculptor, who has also executed some other minor figures, is to surmount the stone dormer at the end of the Renaissance wing over the Frisbie Place entrance.

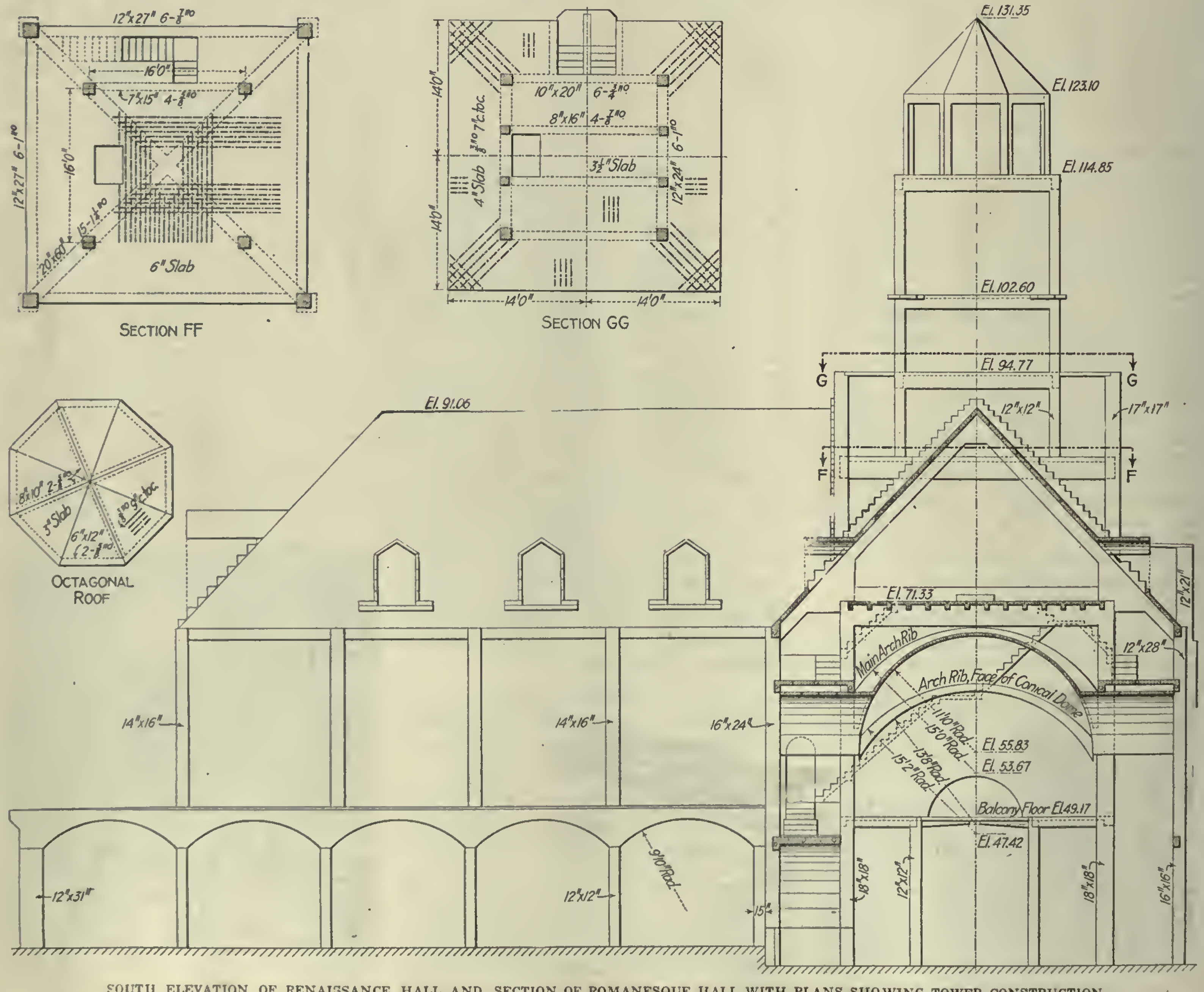
The interior finish of the concrete surfaces will expose the aggregates and frankly reveal the nature of the construction, at the same time removing the form marks and giving a pleasing appearance. While distinctly German in style, in scale the building has been made to relate itself to the immediately surrounding buldings and designed to form a notable addition to the University buildings.



HALF SECTIONS SHOW TYPICAL ROOF RAFTERS AND LOFT FLOORBEAMS

The location of these sections is indicated on the plan view on page 441.

The new building was designed in all its architectural aspects by Prof. German Bestelmeyer, a distinguished German architect recently called to Berlin from the Polytechnic in Dresden. The associate architects in active charge of the work are Warren & Smith of Boston, Mass., who prepared the drawings here reproduced. The working out of the details of the reinforced-concrete work has been done by H. B. Andrews of the Simpson Brothers Corporation, contractors for the framework, in co-operation with J. R. Worcester & Co., and the architects, all of Boston, Mass. The general contractor is W. A. & H. A. Rott, Inc., of Boston.



SOUTH ELEVATION OF RENAISSANCE HALL AND SECTION OF ROMANESQUE HALL WITH PLANS SHOWING TOWER CONSTRUCTION

Design of New Germanic Museum Required Solution of Many Special Problems

Framework of Reinforced Concrete Considered to Be Independent of Enclosing Walls and Designed to Carry Live Loads and Wind Pressure

By CHAUNCEY R. PERRY
Designing Engineer, J. R. Worcester & Company, Boston

MANY SPECIAL problems were encountered in the design of the reinforced-concrete frame of the new Germanic Museum, including analysis of domes, vaulted arch ceilings and multiple beam supports for floor or tower columns. It was realized that a complicated structure of this kind is statically indeterminate and that an exact mathematical analysis is practically impossible. Therefore simple and reasonable assumptions had to be made which would be on the safe side and yet give an economical design. As the framework was constructed independently of the enveloping hollow-tile walls, it was assumed, in nearly all cases, that the structural frame carried only its own weight and all live loads, the walls being considered neither to bring loads upon nor to support the framework, except in the tower.

This article supplements the preceding general descriptive article and will consider the loadings, the allowable unit stresses for the different proportions of mix used in the different parts of the structure, and the assumptions upon which the analysis of the unusual features of the design was based.

LOADS AND ALLOWABLE STRESSES

The assumed dead loads for the design were as follows, in pounds per square foot: Paving for first floor, 45; granolithic finish, 15; boarding, tile, etc., for sloping roofs, 18; roofing for flat roof, 8, and superimposed treads and risers for stairs, 45. The live loads prescribed for most of the first floor rooms and the gallery was 125 lb. per square foot, while 100 lb. was used for the loft floors and main stairs. For the sloping roofs the snow and wind was taken at 32 lb. per square foot, and at 52 lb. on flat roofs. Horizontal wind pressure was considered at 20 lb. per square foot.

The allowable unit stresses adopted were as follows: Stress in steel reinforcement, 16,000 lb. per square inch; stresses in concrete, according to the accompanying table for the different mixtures used.

ALLOWABLE UNIT STRESSES IN CONCRETE—POUNDS PER SQUARE INCH

Kind of Stress	1:2½:5	1:2:4	1:1:2
Axial compression	360	450	675
Compression on extreme fiber.	...	650	975
Shear, no web reinforcement..	...	40	60
Shear, bent up rods only.....	...	60	90
Shear, bent up rods and stirrups	...	120	180

Wherever stresses included effect of wind, the above amounts were increased by 25 per cent. The allowable unit pressure on the soil of the foundations was 4 tons per square foot.

BENDING AND SHEAR COEFFICIENTS

The formulas used for bending moment in slabs, beams and girders were: For simple spans, WL/8; for semi-continuous spans, WL/10, and for fully continuous spans, WL/12. The shear for slabs, beams and girders, where semi-continuous, is 0.6 W at the fixed end and 0.4 W at the free end. In regard to this last specification, it will be noted that when a semi-continuous beam carries a semi-continuous slab the maximum shear in the beam is 44 per cent greater than if both slab and beam were either fully continuous or simple spans.

The mix adopted for the main part of structure was 1:2:4, the mass concrete for foundations being 1:2½:5, while for many of the columns a 1:1:2 mix was used. With usual values for cost of concrete ingredients and forms, the rich mix with correspondingly smaller size of column is more economical than the larger column using a 1:2:4 mix. The steel reinforcement consisted mainly of Havemeyer bars, but Kahn bars were used in the rib system of loft floors.

The foundations presented no special problems, as the bearing soil was a firm sandy gravel, very different from the soft material encountered a short distance to the east in Cambridgeport near the Charles River.

DESIGN OF COLUMNS

The square or rectangular columns were reinforced, in general, with about 1 per cent of longitudinal steel, and ⅜-in. round hoops on 12-in. centers were used to tie the longitudinal rods together. Many of the columns receive lateral thrusts from the arched ceilings. These were strengthened either by increasing the size, by adding longitudinal steel, or by using a rich mix so that the combined stress in the concrete due to direct load and bending would not exceed the amount specified for compression on extreme fiber.

In the case of the columns at the sides of the Romanesque Hall, where there are four columns in each bent, the thrust was divided between the 14-in. square and the 12-in. square columns in proportion to their moments of inertia, as the pair of columns on each side are well tied together and must both deflect laterally the same amount. The four columns supporting the small dome over the entrance to the Romanesque Hall receive equal thrusts in two directions parallel to the faces of the columns. Here the thrust in one direction was combined with half the vertical load on the column and the result doubled to obtain the maximum stress.

The columns were calculated to withstand the bending caused by wind pressure on the skeleton framework, including the roof, during erection. The wind load on the finished building will be much greater than the above, but it was assumed that the enclosing wall would sufficiently assist the columns to carry this extra loading.

FLOOR AND DOME DESIGN

For the long-span floor construction in the galleries and loft floor use was made of the form of T construction known as the Kahn flore-tyle system, in some cases the metal forms being replaced by terra cotta blocks, especially where a plastered ceiling was required. Part of the loft floor was designed in the usual manner with slabs and T-beams built of reinforced concrete. The dome at the entrance to the Romanesque Hall and the groined arches in the rear of the Gothic Hall were framed by means of curved ribs, with thin reinforced-concrete slabs filling the spaces between them. The ribs were designed as ordinary arches. The barrel vault forming the ceiling over the Romanesque Hall was treated in much the same manner, the ribs being constructed first, the 4-in. curved slab being poured later and attached to the ribs by ⅝-in. curved anchor rods, which were left projecting from the sides of the ribs.

It will be noted that this ceiling is entirely separate from the loft floor above, so that each may deflect independently, the ceiling alone exerting thrusts on the columns. The ribs were of such a form that a line of resistance could easily be drawn within the mid-third zone, although a moderate amount of reinforcement was used in the ribs to tie the work together thoroughly. The short-span barrel vaults which form the ceilings under the galleries of the Romanesque Hall were figured as ordinary arches, carrying their own weight only, the curved reinforcing rods being placed in the middle of the 4-in. slab so as to resist bending in either direction.

DOUBLE DIAGONAL FLOOR GIRDERS

The two floor girders which support the square tower extend diagonally from corner to corner of the larger square below, intersecting each other at the center of the tower. These girders were assumed to act entirely independently of each other, each carrying two columns and its proportion of floor load. This asumption is evidently realized as far as the symmetrical vertical loading is concerned, because being tied together at their center lines they must both deflect equal amounts, and being of identical construction and loaded alike they will both tend to deflect equally so that neither girder will bring an additional load upon the other.

In regard to the unequal loads on the columns which these girders carry, caused by horizontal wind forces acting on the tower above, the same assumption seems to hold true. If we take first the case of wind parallel to the side of the tower, assuming a neutral axis at the central plane of the tower, each girder will be loaded with an upward force near one end, and an equal downward force near the other end. This would produce bending in the girder, with a point of inflection at the center line of the span. There would be no deflection at the center of either girder, the bending moments being symmetrical around the center line, but of opposite sign.

Similarly if we take wind in the direction of the diagonal of the square tower, the girder at right angles to the wind will be at the neutral axis, and therefore receive no load and consequently have no deflection, while the girder in the direction of the wind will have bending of the same nature as the first case considered, but of greater amount, and this girder also will have no deflection at the center of the span.

WALL LOADS OF TOWER CONSIDERED

These two diagonal girders and the columns carrying them were among the few members in the structural frame which were considered to carry masonry walls in addition to live loads and structural concrete, due to the offset in the tower which occurs just above this stage.

A similar assumption to the above was

made in regard to the girders directly below the girders just described. These girders are exposed and divide the ceiling of the Gothic Hall into a series of squares, each panel of which was reinforced equally in two directions, one quarter of the total load being supported at each edge of the panel. Each of the four girders was figured as a simple span independent of the others.

Roof Framing

The roof framing consists of long-span slabs, 5 in. thick, in general, supported by rafters which, with the slabs, form T-sections. It was desired to leave as large open spaces as possible on the loft floor, which is to be used for storage purposes, and therefore trusses with web members could not be adopted. The rafters were designed by an arch analysis. It will be noted in the drawing that the foot of the rafter is built continuous with the floor girder directly below it. However, the bending moments in the rafters and the floor beams cause a rotation around the joint in the same direction, and therefore no allowance was made for this continuity in the design of either member, though some steel was carried around the joint to prevent cracks.

The line of resistance of the arch analysis was therefore started at the neutral axis at the springing line, which was assumed to be at the top of the triangular filling above the floor beam. In other words, the arch was assumed to be two-hinged. This analysis gave about the same results as if the rafter were considered to be a sloping beam fixed at the top and figured for a bending moment of $WL/10$, but the arch method gave a much clearer determination of the combination of bending, thrust and shear at any section.

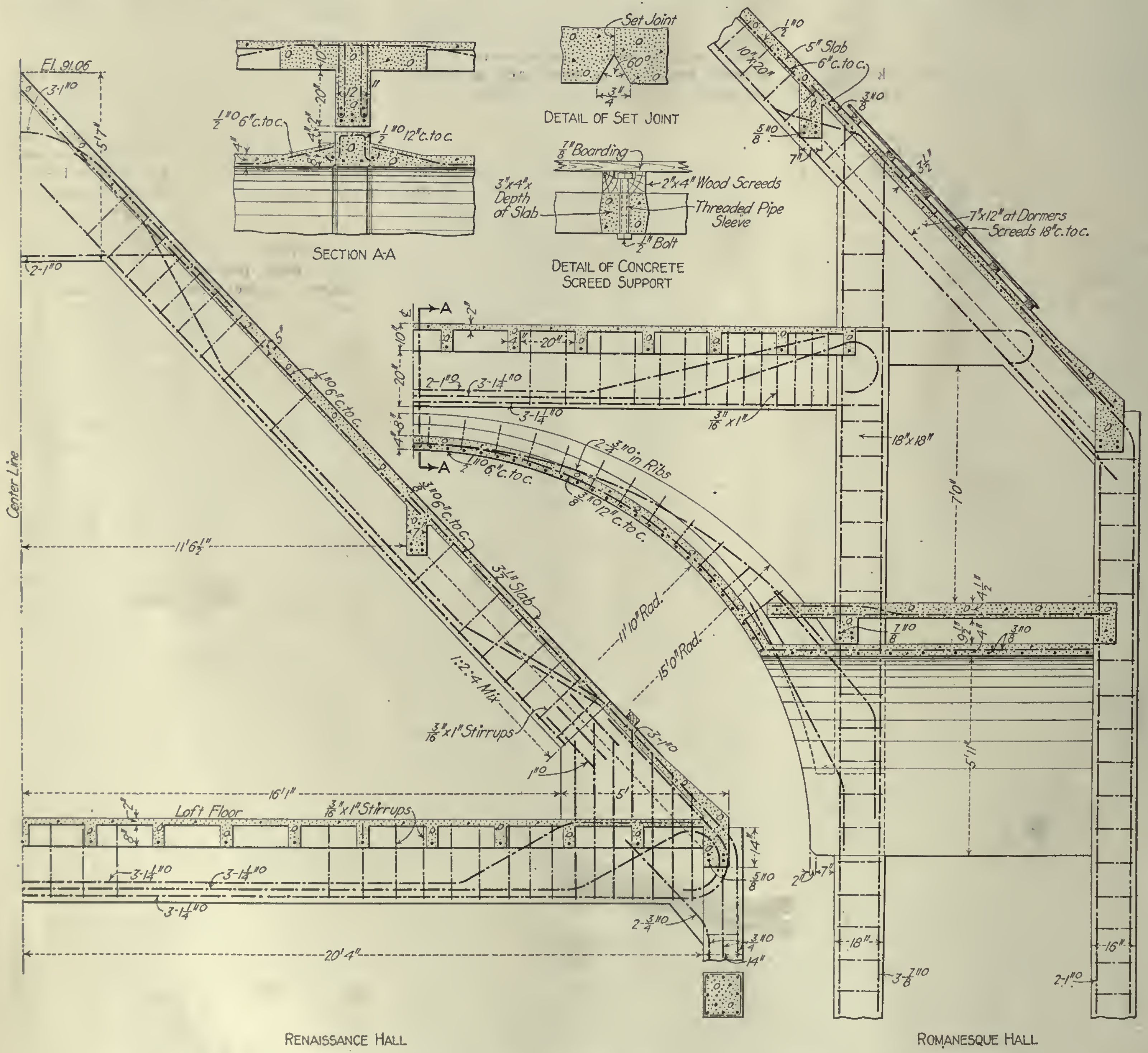
Provision for Thrust

The longitudinal thrust of the rafters was taken by rods which were placed in the floor beams, extending across the full width of building and carried out into the lower end of rafters with hooks at the ends to help develop the full tension near the ends of rods. These rods were not counted as part of the beam reinforcement.

At the lower ends of the rafters over the Romanesque Hall an exaggerated case of non-intersection of forces occurs. Here the stability of the portion outside the 18-in. square column was considered independent of its continuity with the rafter and floor beam, considering the rafter to exert an inclined thrust, the floor beam tie a horizontal pull, and the outside wall column a simple vertical reaction. At the foot of the rafter over the Renaissance Hall the depth of the floor beam was increased where connection to the column occurs by adding a triangular bracket to reinforce the web of the beam for combined shear from floor and roof loads.

Hip Construction

The rafters near the ends of wings which carry the hip beams were designed as two-hinged arches, the hips being considered to assist the arch to resist unequal loading due to wind on one side of the roof; that is, one hip was assumed to be loaded with an upward load, and the other with a downward load at the intersection with the rafter, the reactions from these loads balancing each other at the point of intersection of the hips with the ridge.



DETAILS OF RAFTERS AND FLOORBEAMS IN ROOF AND LOFT FLOOR CONSTRUCTION FOR ROMANESQUE AND RENAISSANCE HALLS

The roof purlins spanning from rafter to rafter were all made with stems vertical, largely on account of much simpler form work. Although a certain amount of T-beam action results, the roof slab forms such a sharp angle with the stem that these purlins were all figured as simple beams, neglecting the uncertainty of the slab.

Can Ground Water Be Kept Out of Sewers?

Charles P. Chase Gives Experiences Covering Quarter Century of Sewer Building in a Hundred Different Localities

EXPERIENCES during twenty-five years in sewer building in the Middle West, the difficulties encountered from the infiltration of ground water and remedies proposed were given recently in a paper presented to the Iowa Engineering Society by Charles P. Chase, consulting engineer, Clinton, Iowa. The following notes are taken from this paper:

It has been claimed by an eminent authority that when a pipe line was laid with the utmost care, with every joint perfect, wells in the vicinity became dry down to the flow line of the pipe. That such is the almost universal result the writer knows to be true, but is this pipe or sewer leakage necessarily the thing that dries the ground and wells? In sewer trenches the ground is frequently a succession of clay dikes of a more or less impervious character, crossing sand, soils and other strata, or it may be rock. These dikes hold back the water, and when cut through release the flow, which will follow the line of least resistance, now the trench, whether piped or not.

INSTANCES OF RELEASED FLOWS

In one instance, in the construction of a large system, the cutting into the top layers of underlying rock was followed by an inflow of water in such quantities that it was almost impossible to work until the trench was drained. A centrifugal pump ran thirty days at the rate of about 4,000,000 gal. per day before the water level was reduced sufficiently to allow construction to proceed. The water came in on all sides and from the bottom, then followed along the new channel, the level of the ground water being lowered 10 ft. by the cutting of an 8-ft. trench, 15 to 17 ft. deep, before a foot of sewer was built. In other systems it has frequently been observed that a ditch which, when first opened, only appeared damp, had accumulated by the next morning several feet of water. The longer the trench was opened, at least for several days, the more the amount of water would increase; then, gradually, it would begin to decrease. It has also been observed that when there was practically no water flowing inside a pipe line, water has been found running outside of a pipe and even standing over it; so we can conclude that the mere opening of the trenches, in most cases, accomplishes drainage to the grade line.

Another effect of water running outside of the pipe line was cited by Mr. Chase. After a personal observation it was known that every joint was perfectly made, the inspector in one particular case having felt over each joint with his hands all around; then the joints were covered wtih dry earth and well packed. Several years afterward some portions of this line broke down because the sandy soil in which it was laid moved and washed along the outside of the pipe line to such an extent that the support was removed. In some cases the pipes settled so much that when dug up for repairs they were found 1 in. apart. Instances also were found where the cement was all gone from joints known to have been perfect and only the oakum was left, showing that the water on the outside washed the cement away before it had thoroughly set.

BURY JOINTS IN CLAY

Good results were secured on one wet job in sand by using a mortar of 1 part Portland cement to 1 part of sand, as stiff as could be worked, using this on top of well-calked oakum joints and then burying the joint by plastering over it with a waterproof, putty-like blue clay found on the job. The clay was gathered by the wagonload and a man prepared it for use.

When the trenching is in clay and care is used, fairly tight work can be secured, but the clay must be packed tightly under and around the pipe. With the new trenching machines which move so rapidly, it is found difficult to secure this proper tamping around the pipe, especially when the automatic backfiller is used, but it can be done.

The use of subdrains and tile is frequently advocated to take care of ground water and to secure tight work in the sewers, but it is a myth and a failure, according to Mr. Chase. In Massachusetts, where it was used extensively, the drain water was almost as polluted as the sewers; in other words, the leakage from the sewers descended to the drains. It is almost impossible to keep the drains open for any considerable distance in quicksand or sandy soils where there is much water, as the sand will go wherever the water will, and unless the grade is considerable, choking occurs.

REMEDIES

In order to secure tight work, according to Mr. Chase, we must first have the best quality of vitrified, salt-glazed sewer pipe without cracks or breaks, and laid to a true line and grade in such a manner as to give the pipe a firm bearing on the soil beneath. The joint is first to be calked carefully and fully with a gasket of oakum, soaked in neat cement of about the consistency of cream and as carefully packed as for water pipe, although of course it cannot be driven up with hammer and calking tool as forcibly as for iron pipe without the danger of breaking the pipe. The joint is then to be filled with a mortar composed of 1 part Portland cement to 1 part sand. All parts of the joint, particularly underneath, must be thoroughly filled and the mortar brought to a slight bevel outside with rubber mittens. A trowel may do the work on top, but it won't work underneath except on very large pipe and the only way the inspector can tell that the joint is perfect is to pass his hands over it himself. All water must be kept away from the joint until set. This may be accomplished either by allowing the joints to stand uncovered or by covering the cement over with a plastic waterproof clay or otherwise packing clay tightly around the pipes and joints. Ordinary soil will not keep the water back if there is much of it and sod or straw or such material sometimes used is worse than water or mud itself. In wet sand or quicksand support the pipe on boards or timbers and keep the water drawn down with pumps until the cement is set, when it may be carefully covered, making sure to pack the soil firmly around and over the pipe.

The greatest objection to the use of cement in making joints is the possibility of its being knocked out of the joint before it has become hard, washed out by water or broken open or disturbed by future movements of the pipe after it is laid. To overcome the objections to cement Mr. Chase stated that he had used at various times joint mixtures of sulphur compounds, tar compounds and asphalt, but not with much success. The sulphur compounds frequently became too hard and cracked open and were said to be inferior to cement, while the tar and asphalt compounds, Mr. Chase stated, disintegrated or dissolved. Within the past few years there have come into the market some very much improved compounds for pipe joints and with them satisfactory results have been reported in a number of cases. These jointing compounds are all to be used hot and poured into the joint similar to the lead joint of water pipe, which means, of course, that at first the calking must be absolutely tight or the jointing material will go through into the pipe. A tight gasket must be used around the joint to exclude all water when the jointing is poured, otherwise the joint is liable to blow up.

PERMISSIBLE LEAKAGE

As to the standard of permissible leakage, Mr. Chase believes that 5000 gal. per mile, suggested by several engineers as a minimum, is almost impossible of attainment, except under the most favorable conditions. As an example he noted a 10-mile system built under adverse conditions with the pipe line all below the water line. After a fairly dry season the whole system leaked 40,000 gal., or 4000 gal. per mile. In this work practically every joint was considered perfect when made, as the supervision was very thorough and strict, and every joint was watched. In the spring of the following year, however, the leakage ran up to about 200,000 gal. for a period of a week, and this has been about the variation in this system ever since it was constructed. It has been in use twenty years, has never had a stoppage and is regarded by the corporation as a perfect piece of work, but the leakage is there.

"From my own observations," said Mr. Chase, "I would not be willing to attempt to guarantee a leakage of less than 10,000 gal. per mile in ordinary soils and 20,000 gal. in water-bearing sand or quicksand, 20,000 gal. per mile being about the basis that I have usually figured on."

Grain Elevators for Australia

The wheat production of Australia is showing a constant increase, so that in normal times the production is more than sufficient to supply the home consumption, and the quantity available for export is reaching a volume of more importance every year. For several years the project of installing a system of grain elevators for the handling of wheat in bulk has been under consideration. It has now been definitely decided to install a system of elevators, and the government of New South Wales has committed itself to expend the sum of $9,733,000 for this purpose. Plans are being drawn for a terminal elevator at Sydney which will have a capacity of about 3,000,000 bushels. Later other elevators will be established at New Castle and at various railway centers to bring the total capacity up to 15,000,000 bushels.

Simple Steel Frame Supports Sidewalk Shelter

Open Waiting Station at Busy Transfer Point in City of Cincinnati to Protect Traveling Public in Rainy Weather

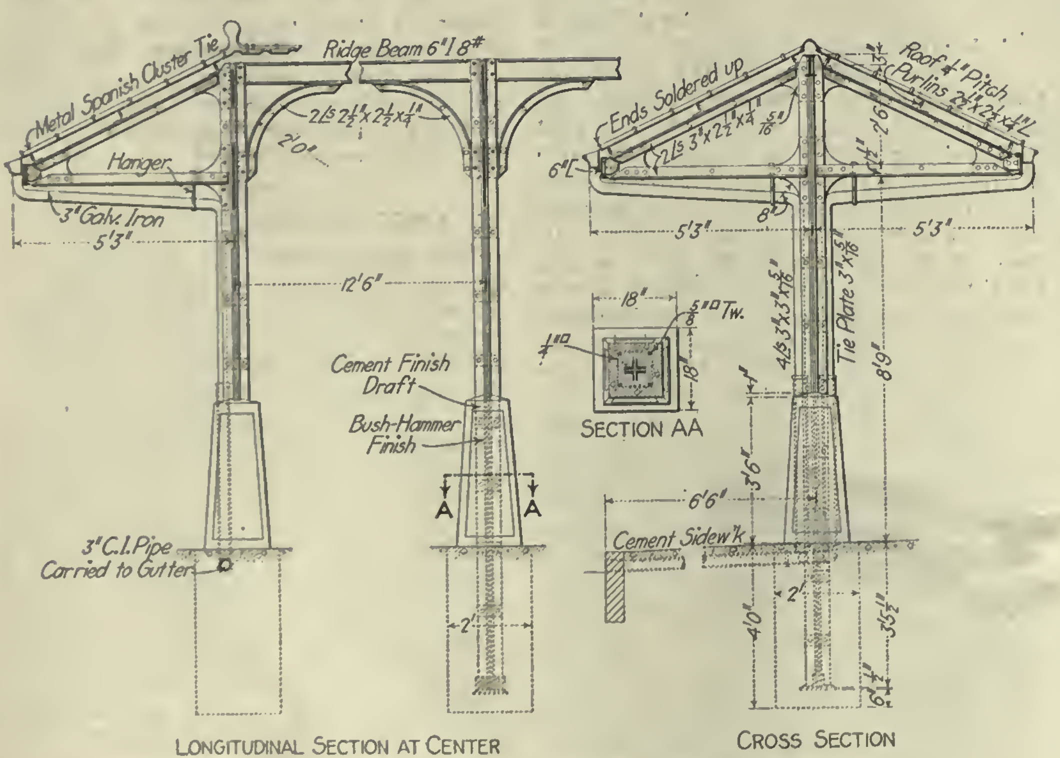
By EDGAR K. RUTH
Assistant Engineer, Engineering Department, City of Cincinnati

THE CITY of Cincinnati has recently completed a waiting station at the northwest corner of Fifth and Main Streets, the busiest transfer point in the city, and at the cost of less than $1,000 has provided a permanent improvement, which will lessen greatly the discomfort of the traveling public during both rainy and sultry weather. It has a neat appearance, requires but a small amount of sidewalk space with its single line of supporting columns, and provides shelter for at least four hundred people.

The roof is supported by one line of eight steel columns, spaced 12½ ft. apart, located 6½ ft. from the curb line and parallel to it. In plan, the roof is 10 x 97½ ft. between eave channels. The columns consist of four angles as shown in the drawing herewith, riveted back to back and anchored at a depth of 3½ ft. below the sidewalk in a 2-ft. square block of 1:2:4 concrete. Above the sidewalk the column is protected with concrete to a height of 3½ ft., the battered faces having bush hammered panels inside of smooth draft lines. Each column carries a cantilever roof truss, which supports the six lines of purlins. Ridge beams connect the tops of the columns, and eave channels connect the trusses, as shown in the drawing. Intermediate rafters, consisting of one 3 x 2½ x ¼-in. angle midway between trusses, span between the 6-in. eave channel and the ridge beam.

The roofing material is a sheet-metal imitation of Spanish tile, consisting of 28-gage sheet iron, 16½ in. wide, in one length from ridge to eave and fastened to the purlin angles by means of galvanized iron straps. A metal gutter extends around the entire roof and is connected to 3-in. cast-iron risers at the center and lower end by means of 3-in. galvanized iron pipes. The roof and gutter slope parallel to the curb at about a 1 per cent grade.

Federal officials were somewhat opposed to the construction of the station on the grounds that it would obstruct foot traffic along the sidewalk, but this has not proven to be the case.



LONGITUDINAL SECTION AT CENTER

CROSS SECTION

STEEL FRAME WAITING STATION AND SHELTER OF SIMPLE CONSTRUCTION

Railway Engineering Body Adopts Wider Clearance

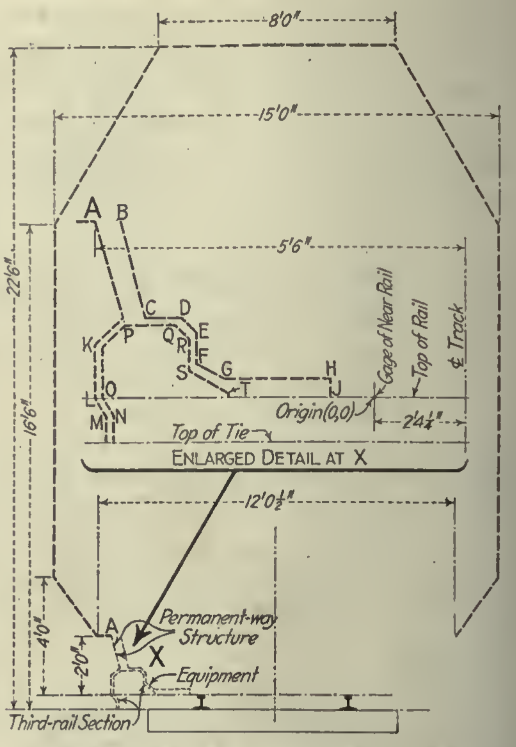
Committee Recommendations on This and Other Subjects Accepted at Seventeenth Annual Convention Summarized

AS FEWER recommendations than usual were made by the various committees of the American Railway Engineering Association at the seventeenth annual convention in Chicago last week for adoption in the *Manual*, and as a number of those made were referred back to the committee for further study, the list of conclusions formally reached by the convention is comparatively short. Probably the most notable step taken was the adoption of a minimum clearance diagram 15 ft. wide on tangent track, instead of the 14 ft., now in the *Manual*. All of the measures adopted are summarized below. Of the twenty-two committees, it will be noted that only eight figure in the recommendations adopted.

Ties.—The revised specifications for crossties were adopted with minor changes in two or three sentences. The new specifications for switch ties were also adopted.

Track.—The general plans of the typical layouts of Nos. 8, 11 and 16 double crossovers, 13 and 15-ft. centers, the typical layouts of frogs for same, and the typical layouts for Nos. 8, 11 and 16 double slip crossings with both square and staggered switch points were adopted, with certain changes in the explanatory notes proposed by the committee itself.

The typical plan of frog guard rails was adopted, with a modification to allow adjustable filler blocks. The definition of frog guard rail was adopted, as were the specifications for same, with a slight modification to permit foot guards of any sound, hard wood. The three proposed changes in the specifications for ordinary track spikes were adopted.



DETAILS OF NEW CLEARANCE DIAGRAM

Vertical and horizontal co-ordinates of points in enlarged section: *A*, 24/37¾; *B*, 24/34¼; *C*, 10⅞/31; *D*, 10⅞/25⅞; *E*, 9/24; *F*, 4$\frac{11}{16}$/24; *G*, 2½/20¼; *H*, 2½/6; *J*, 0/6; *K*, 7$\frac{5}{16}$/37¾; *L*, 0/37¾; *M*, —2½/36¼; *N*, —2¼/35¼; *O*, 0¼/36¾; *P*, 9⅞/33¾ *Q*, 9⅞/26⅞; *R*, 8/25; *S*, 3$\frac{11}{16}$/25; *T*, 0⅝/19¾.

Signals and Interlocking.— Additional specifications recently adopted by the Railway Signal Association were accepted as supplementary to those now in the *Manual*.

Rules and Organization.—The clearance diagram adopted by the association is 15 ft. wide on tangent instead of 16 ft., as recommended by the committee. For the lower 2 ft. is substituted the clearance diagram prepared by the committee of electricity, and already adopted and printed in the *Manual*. The top clearances are measured from base instead of top of rail. The new diagram is here presented as the Engineering Record interprets the action of the association.

The exceptions to which the recommended clearances will not apply were all adopted, No. 6 being modified to cover all work instead of reconstruction only. The recommendation of the committee for 13-ft. track centers on tangent was adopted, and the remaining thirteen rcommendations pertaining to the clearances of specific structures were accepted on the condition that they be revised to correspond with the new clearance diagram. The six main conclusions of the committee were also adopted.

The proposed revisions in the rules of the *Manual* were all adopted.

Yards and Terminals.—The recommended definition of a holding yard was adopted.

Iron and Steel Structures.—The specifications for the protection of traffic at movable bridges published in Bulletin 178, and the three additional specifications submitted by the committee in Bulletin 181, were adopted.

Uniform General Contract Forms.—The recommended changes in the adopted agreement form were adopted as presented.

Grading of Lumber.—The new definition for southern yellow pine adopted last year by the American society for testing materials was adopted. The grading rules for hemlock lumber offered for discussion last year were adopted, subject to the changes proposed by the committee.

National Defense—For Engineer and Contractor

Fifth Article in Series Describing Military Road Building Methods and Rules of Thumb for Estimating Strength of Highway Bridges

By MAJOR P. S. BOND
Corps of Engineers, U. S. Army

WE have seen that mobility, the power to maneuver in strategical and tactical combinations, is essential to success in military operations. Roads accordingly play an important rôle in the conduct of war. In modern warfare, with the vast number of combatants engaged and the great extent of territory covered, roads are of more importance than in the past. The motor truck has come to be an important accessory to the railroad in the transportation of troops, artillery and material of all kinds, and to realize the advantages that may be derived from its use an extensive system of good roads is essential.

In road work, probably more readily than in any other branch of military field engineering, the engineer with civil training can adapt his knowledge and experience to war conditions. Military road building is not greatly different from civil practice. The civil engineer who has a thorough knowledge of the methods that produce good roads and the broad common sense which will enable him to apply them to military needs will be successful in time of war. It is only necessary that he should thoroughly appreciate the economics of warfare which we have heretofore discussed.

U. S. Needs Military Roads

Motor transport demands good roads and even for animal transport they are to be desired. The construction of a modern paved highway takes time and, therefore, military operations will be greatly hampered if they are conducted in a country which has not been provided in time of peace with a complete system of good roads. In many parts of Europe such systems exist, and the principal highways have been built with a view to their usefulness in war as well as in peace. The United States is poorly equipped, both as to the quantity and the quality of its roads. In any military operations conducted in our territory, extensive road construction must be carried on by both combatants. Military road work will consist very largely of the improvement, repair and maintenance of existing roads, but in many of our possible theaters of war, including the United States and other parts of the American continent, extensive new construction work will also be necessary.

Photo. Underwood & Underwood

WHILE THE USE OF ELABORATE CONSTRUCTION PLANT FOR ROAD BUILDING IS LIMITED NEAR THE FRONT THIS IS NOT THE CASE BEHIND THE LINES, WHERE PRISONERS CAN BE EMPLOYED

In the location and construction of a military road the peculiar economics of warfare, which have been heretofore mentioned, should be kept constantly in mind. In the construction of a civil road or railroad the amount of money which may be profitably expended in reducing grades, securing good alignment and in paving (in the case of a road) is determined from the estimate of the nature and amount of the probable traffic. In military construction the element of cost is of secondary importance, but the question of time is paramount. The road must be opened for traffic in the least possible time. Nevertheless, the nature and amount of the traffic and the period during which the road will probably be required are not, of course, entirely disregarded. The road will usually be constructed to meet the exigency of the moment and may later be altered and improved to meet the development of the situation.

Common labor will ordinarily be plentiful, but often no plant at all will be at hand. Wheelbarrows can usually, although not always, be supplied, and for extensive work plows and drag or wheel scrapers should be obtained. Explosives will be available and may be liberally employed. The use of more elaborate plant, such as graders, steam shovels, etc., will seldom be either practicable or advisable under wartime conditions. The stretches of road to be constructed will usually be relatively short and built to connect existing roads. Motor trucks will be utilized on the good existing roads where they can move at the relatively high speed which is necessary if their economical advantages are to be realized. But on purely military roads built under service conditions most of the traffic will be by wagons drawn by horses or mules. Four and six-line teams may be and are employed in military operations when civil economics would demand two-line teams. Also, military traffic moves in trains, and teams may be doubled up and loads shifted when necessary. Extra teams and relay stations may be provided. Such traffic moves but slowly on the best roads, and hence the greatest improvements in the road will effect only slight changes in the speed of transport—though they may reduce its cost—unless motor trucks be substituted for wagons. A rough surface, if firm, is of little disadvantage to slow-moving traffic, and the same is true of poor alignment, though of course very sharp curves should be compensated by widening the road.

Roads Best Suited for Army Traffic

Brick roads are, of course, out of the question, except possibly along the main motor routes on the lines of communication. For wagon traffic their advantages are not sufficient to justify their cost and, more particularly, the time required for their construction. Even common water-bound macadam can seldom be advantageously employed. The military road will usually be a common earth road. If the soil is very sandy it may be mixed with clay for a wearing surface, and conversely. Gravel may occasionally be used to good advantage if it can be obtained along the line of the road. Pit gravel usually compacts very satisfactorily under traffic if shaped up occasionally. Stream gravel usually requires the addition of a binder. If the gravel contains many large pebbles or stones it should be screened. If stone is available a rock fill, covered with a layer of earth, may be employed at soft spots where the drainage is bad. In swampy or poorly drained ground a plank or "corduroy" road will usually be the simplest and best expedient. The logs or poles are seldom covered, and the surface, while rough, is firm and suitable for slow moving traffic. A great variety of materials may be used to temporarily increase the supporting power of a road bed, including branches of trees, bunches of brush, grass, turf, leaves, etc.

The advantages of very low gradients

Photo. Press Illus. Co.

GERMAN ARMY ENGINEERS BUILT MANY LOG ROADS OVER SWAMPY GROUND IN RUSSIA

cannot be fully realized unless a good surface is also provided, and, conversely, the advantages of a good surface cannot be fully realized unless the grades are held down. Accordingly, it is of little use to strive for very low grades on a road which is not to be paved, or to incur great expense of time and money in providing a macadam paving on bad grades. A good macadam road must have low grades. Also, for slow moving military traffic neither low grades nor good surfaces are as advantageous as for motor transport.

ROADWAY WIDTHS AND GRADES

Military traffic moves in trains, and its use of the road may be regulated. Loaded wagons generally move in one direction only and empties in the opposite direction. Under these conditions a 10 or even an 8-ft. width of road may be made to meet requirements, passing points being placed at the necessary intervals and where the extra width may be cheaply provided. Such a narrow road would of course be very unsatisfactory for unregulated civil traffic with loaded wagons passing at random in both directions and meeting at all points. A width of 16 ft., which permits the easy passage of two lines of wagons in opposite directions, is desirable if it can be obtained without excessive excavation. It will seldom be advisable to provide more than an 8-ft. width of metal if the road is to be paved.

In the location of a military road the foregoing facts must be borne in mind. In order to reduce the excavation to a minimum the road should lie close to the natural surface of the ground, even if this results in occasional steep and adverse grades, poor alignment and consequently increased length. Heavy cuts and fills, with the great yardage and the relatively long hauls which they involve, should be avoided. A gradient generally not exceeding 4 to 5 per cent, with occasional short maximum stretches of 6 to 7 per cent, may be regarded as quite satisfactory for military wagon transport if better grades cannot be secured without excessive labor. A road having a grade generally not exceeding 8 per cent with occasional slopes of 10 or 11 per cent, or even more, will be practicable, but will require relaying if the distance be considerable. It may be adopted if the nature of the terrain does not allow better natural grades.

Adverse grade should, of course, be avoided, even if this requires more distance. In the original location an effort should be made to keep the grades generally as moderate as the nature of the terrain will permit without excessive excavation, and to concentrate the steeper grades in a few localities. The road is thus opened up and the bad grades may later be reduced if necessary by cuts and embankments. By thus concentrating the unfavorable grades in a few localities subsequent improvements may be effected with the least possible relocation and interruption to traffic. Thus, if there is a possibility that the road may be used for transport for a considerable period, it will usually be better to adopt a general grade of about 4 per cent, with occasional sharp maximums of 8 to 10 or even 12 per cent, rather than a general grade of 7 to 8 per cent with nothing exceeding this. In the former case a few relocations in the maximum sections, involving perhaps some heavy excavation, will eventually produce a good 4 per cent road, whereas if the steeper general grade were adopted, complete relocation and reconstruction would be necessary to produce the same result. In the first instance the heavy work is avoided by a steep climb or a detour, which is later eliminated and abandoned. Thus the locator should consider what may eventually be required and so plan his original location as to enable the ultimate requirements to be met with the least possible reconstruction, even at the cost of temporary disadvantage in the way of occasional very steep grades. If the future requirements are uncertain it may be advisable to adopt a somewhat higher general grade, suited to the nature of the terrain and to avoid steep maximums greatly in excess of the general grade. It will be apparent that the problems of the military locating engineer are not greatly different from those of his civilian confrère. He must consider the demands of the immediate situation and meet them promptly, but so far as practicable he should also give consideration to the ultimate requirements. In locating a road for military purposes the engineer enjoys one advantage in that he is not hampered to so great an extent as the civilian by questions of right of way, property values, etc. As in all military construction, first cost gives way to speed, which often simplifies the problem.

LOCATION FROM MAP

The general location of the road is selected from a map, if one suitable for that purpose is available. The next step is a hasty reconnaissance or preliminary survey to fix the general location on the ground, determine the grades which may be obtained and the special difficulties to be encountered, the materials available along the route, etc. For this examination very simple instruments will serve—an aneroid barometer for elevations, a hand clinometer to measure gradients, distances measured by pacing. A rough sketch of the route should be prepared, and it should be marked out by placing flags (pieces of red cloth on sticks), blazing trees, etc. The detailed location may be satisfactorily executed with the same instruments in the hands of skillful and experienced men. A light transit with a vertical limb and a tape or stadia rod are better, and will usually meet the requirements.

The removal of trees, especially their stumps, is a slow process, and it is therefore well to avoid timbered areas if practicable. Also, the absence of sunlight and poor ventilation increases the difficulty of maintaining an earth road in a wood in passable condition. If it be necessary to pass through a wood the road may be curved or zigzagged to avoid the very large trees. The best way to remove a large tree is to dig around it, cut the larger roots and then pull over the tree with blocks and tackle. This removes tree and stump. If stumps are encountered they can be re-

Photo. Underwood & Underwood

SOME OF THE BIG GUNS CANNOT BE TRANSPORTED ON ORDINARY ROADS; THEY REQUIRE SPECIAL RAILROAD TRACK CONSTRUCTION moved only by explosives, which may be used liberally to save time.

For military purposes a wooden trestle or viaduct, which may be constructed in a few hours or a few days, is often preferable to a long high embankment which may require weeks to construct with inadequate plant, and will generally also have to be paved in some manner to render it passable. Skill in location will reduce the number of culverts required, often it is true, at the expense of alignment. The road should follow the high ground or ridges, and the side ditches may be led off into adjacent ravines. Also, sun and air are very important aids in the maintenance of an earth road. Culverts when employed should be of the simplest type, plank and corrugated iron pipe being the most suitable materials and sufficiently durable for military purposes.

FOR MILITARY PURPOSES A WOODEN TRESTLE OR VIADUCT, WHICH MAY BE CONSTRUCTED IN A FEW HOURS, IS OFTEN PREFERABLE TO A LONG, HIGH EMBANKMENT

DRAINAGE IMPORTANT

The bearing power of a road surface depends upon the paving and upon the drainage of the roadbed. Military roads will seldom be paved and, accordingly, particular attention should be given to drainage. Subdrainage will usually be impracticable, but ample side ditches should always be provided, except in very dry climates. The material from the ditches is used to raise and crown the roadbed. The best form of ditch is one wide and shallow rather than narrow and deep, since it is more easily constructed and kept open. Such a ditch may be constructed with a drag scraper, with a plow to loosen the earth. If the road is constructed on a steep side-hill surface or intercepting ditches may be provided to keep the water from the hillside off the road. Retaining walls should be avoided if possible, as they require much time to construct. Zigzags or switch backs may be employed to save labor on sidehill work. Retaining walls if used are built of log cribs, dry rubble, etc. Concrete will seldom be employed.

One of the economic advantages of a well paved road from the civil engineer's point of view is the decreased cost of maintenance during a period of years. We are realizing more and more that increased first cost and longer time required for construction are usually economical for permanent roads in view of the lower maintenance charges and the greater satisfaction from the use of the road, the beneficial effects on the growth, the business and social life of the communities affected, etc. But we should also realize that from a military point of view these considerations have little weight. The army does not expect and does not demand that good roads shall be built under war conditions in the theaters of actual conflict, and, moreover, it cannot brook the delay that their construction would require. Prompt results are demanded, cost is disregarded and makeshifts cheerfully accepted.

As military roads are often used for a very short time only and never beyond the end of the war, the question of maintenance over a period of years does not arise. It will be economical to build an inferior road in the first place and to keep it passable by relatively expensive maintenance measures during a relatively short period. Earth roads to be passable must be kept drained and free from ruts, and for military roads ample labor for maintenance will generally be available. The roads should be kept shaped up, ruts filled, ditches kept open. The most efficient method of maintaining earth roads is by dragging, supplemented by hand labor.

EXAMINATION OF BRIDGES

An important problem with which the military engineer will often be confronted is that of determining the supporting power or safe load of an existing bridge, and the methods that may be adopted to strengthen the structure. Good civil practice has resulted in the adoption of type plans for the various forms of bridges, the safe loads of each being carefully specified. Commercial traffic is usually heavier than that which accompanies the mobile army, and, accordingly, a well designed bridge may generally be pronounced safe for military use, provided an examination shows that it is in good condition. Also the factor of safety may, in such a case, be reduced from 5 or 6 to 2½ or 3, if this be necessary. But in our country we encounter many bridges which are not designed in accordance with good practice. Many of them are not designed at all, and in many steel bridges economy of material is carried to an extreme, the designers trusting in Providence that the bridge will never be tested to the specified loading.

The quickest method of determining the carrying capacity of a bridge is by comparing it mentally with other similar bridges whose capacity is known. This will require considerable experience and great power of observation on the part of the engineer. To calculate accurately the carrying capacity of a bridge may be a tedious operation, but approximate methods or "rules of thumb," which any competent engineer can devise for himself, will usually give results sufficiently close for practical purposes.

CONVENIENT RULES OF THUMB

An examination of the bridge by an experienced engineer will usually serve to indicate the weakest or critical parts of the structure, to which special attention should be given. A useful formula for bridge stringers of wood, such as are often encountered, is the following: Safe center load in pounds times span in feet equals $A \times BD^2$. In this formula A is a factor depending on the kind of wood, and B and D are the breadth and depth of the stringers in inches. For a factor of safety of 3, A may be taken as at least 100, even for rather poor timber. Hence, if a wooden stringer is to be safe, BD^2 should equal the span in feet times the center load in hundredweights, $BD^2 = LW/100$. The weight of the beam itself may be disregarded. The safe uniform load may be taken as double the safe concentrated center load. If the deck is sufficiently heavy the equivalent center load on any one stringer should not exceed about 30 per cent of the weight of the army wagon or artillery carriage. Under this assumption the rule gives the following: For loaded wagons or light artillery, $BD^2 =$ or $> 20 \times$ span. For heavy field artillery, 4.7 in. guns, $BD^2 =$ or $> 30 \times$ span. If the span is less than 15 ft., the span multipliers may be reduced one-third.

A convenient rule of thumb for the deck, if of wood, is that the thickness of the deck in inches should be as great as the intervals between stringers in feet. Thus, if the stringers are 3 ft. apart the decking should be 3-in. planking.

If the stringers are standard steel I-beams their safe loads vary approximately with the square of the depth. Also the fiber strength is about ten times that of wood. Hence the rules become, for long spans: For loaded wagons, $D^2 =$ or $> 2 \times$ span; for heavy field artillery, $D^2 =$ or $> 3 \times$ span.

These rules are but rough approximations, but they serve for practical purposes, and afford a test of the strength of the floor system. If this be safe the remainder of the bridge timbers are probably right, since good design demands this condition, and the floor system is most subject to wear and decay.

However, similar approximations may be applied to trestle caps of two-legged trestles or the roadway bearers of small truss bridges. Assuming the weight of a bay with its load at 20,000 lb., we have, $BD^2 =$ or $> 100 \times$ length of caps; or for steel I-beams, $D^2 =$ or $> 10 \times$ length of beam. For spans of less than 15 ft. the multipliers may be reduced by half.

The strength of simple Howe or Pratt trusses may be quickly determined by the well known method of shear and chord increments.

These rules are applicable to structures which closely follow standard design for the types considered and to the usual loads with the army. Any bridge which exhibits a radical departure from the usual designs should, in the first place, be looked upon with suspicion and, in the second place, should be examined with more than ordinary care. If unusual loads are to be brought upon the structure a more thorough examination is, of course, demanded.

If the deck planking is thin, worn or decayed, longitudinal planks may be laid under the wheels. A weak stringer may be braced by placing a post under its center, or a trestle or crib may be inserted at the center of the span, which supports all the stringers. Sometimes it will be easier to take up the flooring and insert additional stringers. If trestle legs are over 10 or 12 ft. in length they should be cross-braced, and if the spans are over 15 ft., the trestles should be braced longitudinally. Wooden trusses may be strengthened by spiking or bolting additional timbers to the chords and inserting web members of timber. A weak steel truss may be supported by one or more trestles or cribs inserted beneath.

These are but a few of the expedients that will suggest themselves to the resourceful engineer. It will usually be easier to bolster up an old bridge than to build a new one. A bridge which has been examined or strengthened should be placarded to indicate its safe load.

[*Next week Major Bond will describe methods of military reconnaissance, mapmaking and surveying. With the huge extent of modern battlefronts, maps are a commander's chief reliance in planning his campaign.*—EDITOR.]

Pig-Iron Production in 1915 Greatly Exceeds 1914 Figures

THE PRODUCTION of pig iron in the United States for the year 1915 reached a total of more than 29,900,000 tons, which is only about 1,000,000 tons less than the previous high record of 1913, and is an increase of 28.2 per cent over the production of 1914. All grades except forge iron, which decreased about 12 per cent, show an increase over the previous year. The following table, abstracted from Special Bulletin 1 (1916), of the American Iron and Steel Institute, gives the production of pig iron by grades from the years 1910 to 1915 inclusive.

All pig iron and ferro-alloys are included, whether made in blast furnaces or in electric furnaces. Pig iron made with bituminous coal is included under coke pig iron. Pig iron made with mixed anthracite and coke is included in anthracite pig iron. Pig iron made with coke and electricity is included in coke pig iron; that made with charcoal and electricity is included in charcoal pig iron. Low-phosphorus pig iron, that is, iron running under 0.04 in phosphorus, is included in Bessemer pig iron. Pig iron containing from 0.04 to 0.10 per cent of phosphorus is classified as Bessemer. The figures for 1913 and subsequent years include under basic iron a small quantity of charcoal iron of basic grade. In 1912 and prior years charcoal pig iron of basic quality was not included in the basic production. Nearly all of the charcoal iron is classed as foundry pig iron. Ferro-silicon is included in foundry pig iron. Pig iron containing 7 per cent or over of silicon is classified as ferro-silicon. Under "all other grades" are included white and mottled iron, direct castings and miscellaneous ferro-alloys, including ferromanganese and spiegeleisen.

PRODUCTION OF PIG IRON BY GRADES, 1910-1915—GROSS TONS

Grades	1910	1911	1912	1913	1914	1915
Basic	9,084,608	8,520,020	11,417,886	12,536,693	9,670,687	13,093,214
Bessemer	11,245,642	9,409,303	11,664,015	11,590,113	7,859,127	10,523,306
Foundry	5,260,447	4,468,940	5,073,873	5.220,343	4,533,254	4,864,348
Malleable	843,123	612,533	825,643	993,736	671,771	829,921
Forge	564,157	408,841	469,183	324,407	361,651	316,214
All other	305,590	229,910	276,337	300,860	235,754	289,210
Total	27,303,567	23,649,547	29,726,937	30,966,152	23,332,244	29,916,213

Judge Construes Expression Good and Wholesome Water

Because of Failure to Comply with This Specification Judge Permits City to Operate Parallel Plant

By THOMAS A. HAYDEN
Surveyor-General's Office, Phoenix, Ariz.

A DECISION, which is of interest to engineers and those connected with the design, construction, or operation of waterworks, is that handed down on Feb. 10, at Santa Fé, New Mexico, by U. S. District Judge William H. Pope, in the case of the Raton Waterworks Company vs. the City of Raton, the decision being in favor of the latter.

GENESIS OF SUIT

The suit in question was one of the outgrowths of the effort by the city to build and operate its own water-supply plant; an effort induced by the unsatisfactory service given by the waterworks company, and timed so as to make the municipally owned works available just before the expiration of the company's franchise. In pursuance of this plan, in July, 1915, the city had completed to the point of readiness to furnish water for domestic use and fire protection an entire new storage, filtration, supply and distribution system, paralleling the old plant, and proceeded to put the same in operation as fast as connections could be made.

The waterworks company immediately procured from the federal court a temporary injunction restraining the city from entering into competition with the said company in the operation of a water-supply system, until the expiration of its franchise; which, by the terms of the ordinance conferring it, granted the waterworks company the exclusive right to operate such a system for a period of 25 years from July 25, 1891. In August, 1915, the city council formally revoked this franchise, the enforcement of which ordinance the company petitioned the court, in a supplemental bill, to enjoin.

PROGRESS OF CASE

The trial of the case was lengthy and sensational, a rather unusual feature being the fining of the entire city administration, from the mayor, city attorney and city clerk to the last alderman, in sums ranging from $50 to $100, for contempt of court, on account of their having initiated proceedings affecting the case in another court while it was pending in the federal tribunal.

Scores of exhibits, consisting of bottles and jars of the water from the company's mains, covered two long tables. Testimony introduced by the defendant, the City of Raton, alone covered 1200 typewritten pages, being for the most part the reports of users of the water furnished by the plaintiff company. Argument at the final hearing, in December, 1915, occupied some 20 days.

"GOOD AND WHOLESOME WATER"

The point on which the case hinged was whether or not the company had failed to fulfil the obligation imposed upon it by the ordinance conferring the charter—of furnishing to the defendant and its inhabitants "good and wholesome water for domestic, manufacturing and sanitary purposes, as well as the better protection of the town from disasters by fire," failure so to do operating to make the charter based thereon liable to forfeiture.

Further than the above-quoted expression, the ordinance attempts no specification with regard to the water, and the matter of the exact meaning of the phrase "good and wholesome" was gone into at great length in the testimony and arguments by counsel, and was interpreted in great detail by Judge Pope in his opinion. The specific objections made and proved against the water in the present instance are unlikely to be of general interest, but the general principles involved, and the duties held to be obligatory on all those pretending to furnish water for such uses, are here defined with a degree of explicitness not heretofore appearing in any case of which the writer has knowledge, and in such a manner that the decision may well be followed as a precedent.

Referring to authority for interpretation of the term "wholesome," the decision of the U. S. Supreme Court in the case of Columbus vs. Mercantile Trust & D. Co., 218 U. S., 645, is quoted as defining the term to mean "clean, pure and fit for domestic use." Proceeding from this Judge Pope's opinion says:

CLEAN AND PURE

"It must be clean; that is, it must be free from color or odor as repels the appetite therefor or renders it unattractive or unfit for human uses. It must be pure, in that no germs of disease shall be present and no other foreign substance shall exist to an extent such as to make the water physically unfit. The human system demands for perfect health a certain amount of water. If the physical appearance and qualities of the water are such as to repel its use and to make the intended user suffer thirst rather than undergo the discomfort or nausea of its use, such water is neither clean nor pure, and its continued use may *NOT* be imposed upon a community."

Continuing, the opinion states that it does not have to be proved that a water company furnishes water which causes active diseases to deprive such company of its franchise. "But whether there be active diseases or not," he says, "to give the public distasteful water and thus to discourage and curtail its use is to derange the human system and break down its fortifications against diseases. . . . But the decision of the case is not put upon the ground that the water caused death. The public has privileges other than exemption from illness or death. The citizen is entitled to drink palatable water; he is entitled to have such for domestic and manufacturing purposes. . . . He is entitled to be clean—when he wishes to be."

Disposing of the contention that the objectionable features of the water were so only intermittently, Judge Pope again refers to the Columbus case, which says: "That the source of supply is at times adequate and wholesome is not enough. The wants of the public must, under all conditions, be supplied." In the present instance it is pointed out that the conditions complained of, while admittedly of an intermittent nature, still had recurred again and again at various times in each season, through a course of years up to the present litigation; and therefore could not be due to mere accidents or to imperfections in the company's system of a temporary nature only. The fault is clearly inherent in the said system, and lasting though it did through many years no successful attempt had been made to remedy it.

In the decision the city is conceded the unqualified right to operate its waterworks, and the enforcement of the ordinance revoking the company's franchise is assured, the sole concessions to the company being the award of rental for fire hydrants, and an allowance of six months' time in which to remove its property from streets and other premises belonging to the city.

Los Angeles Traffic Uses Rebuilt Highway Tunnel

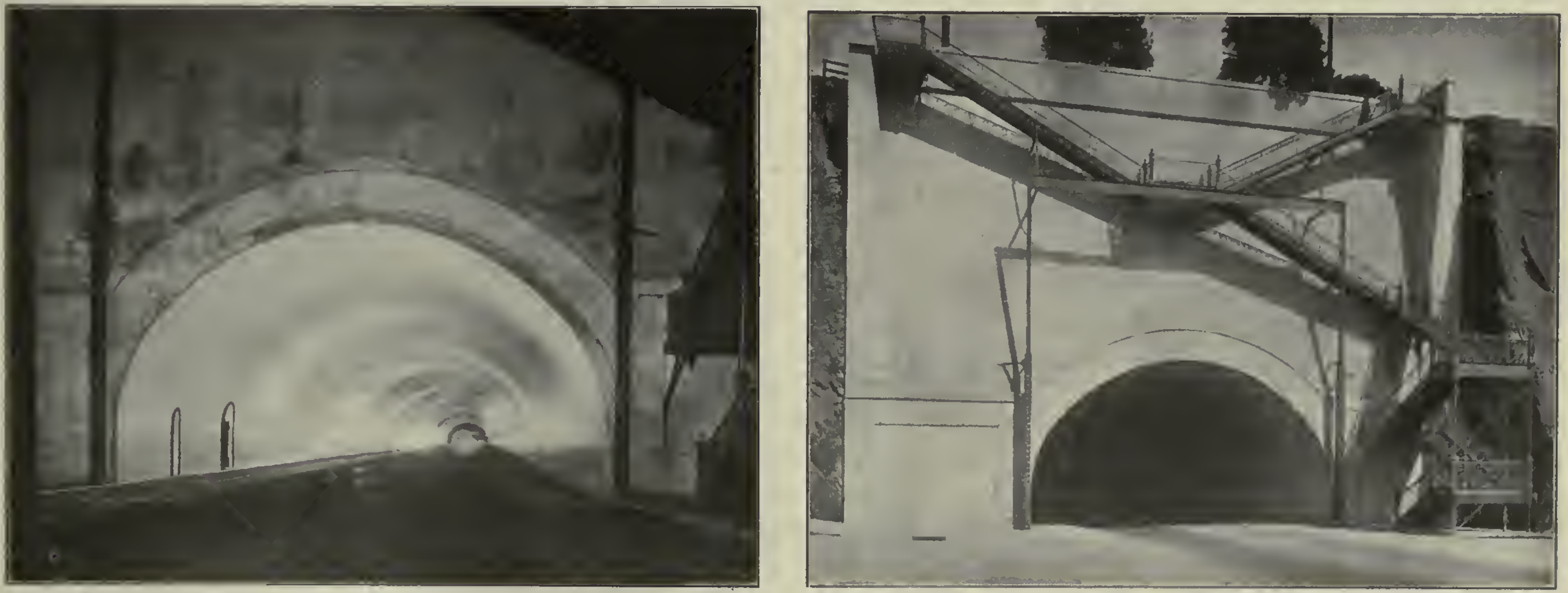
Old Bore at Steep Grade Improved by Heavy Excavation and Relining of Arch with Glazed Tile

RECONSTRUCTION work, involving a reduction in grade from 6 to 3.8 per cent, an arch relined with white glazed tile, adequate lighting and drainage facilities, and a lowering of portal levels by heavy excavation, has converted the North Broadway tunnel in Los Angeles, formerly avoided by traffic, into a much used highway route between the business district and residential sections on the outskirts of the city. The original tunnel was built in 1900, and recent improvements, begun last April, have been completed at a cost of $300,000. At the north portal the old floor level has been lowered 3 ft., and at the south end the new level is 20 ft. below the old. This has necessitated the heavy excavation in the approach cut. The tunnel is 752 ft. long, 40 ft. wide and 22 ft. in height from floor to arch. The width and height from floor to arch in the reconstructed tunnel is the same as in the original bore.

OLD FLOOR LOWERED

The first work in the reconstruction project was the excavation by steam shovel of a cut 7 ft. deep through the entire length of the tunnel which removed material to within about 2 ft. of the walls. After this excavation had been made, sections of the tunnel walls were exposed by short crosscuts, and underpinning walls 5 ft. 5 in. in thickness were built in 10-ft. sections beneath the old foundations. Beveled edge plank placed in the end of each from section before pouring the concrete formed keys which were used to interlock adjoining sections. To insure against settlement of the old structure, a rule was made that no section would be started within 70 ft. of another in which the new concrete was less than ten days old.

Some difficulty had been experienced in the original tunnel on account of the seepage which discolored the interior of the arch and rendered the tunnel damp and uninviting. Careful provision was accordingly made for adequate drainage in the re-



TUNNEL IMPROVEMENTS INCLUDED IMPROVED PORTALS, ADEQUATE LIGHTING AND GLAZED TILE LINING

NEW CONCRETE UNDERPINNING WALLS IN PLACE IN LOS ANGELES HIGHWAY TUNNEL constructed section. This was done by placing 3 in. of broken stone behind the new concrete wall below the old tunnel walls. This broken stone was placed behind sheet iron fastened to strips of wood placed vertically along the walls in such a manner that the sheet iron became the outer form for the new concrete wall.

The construction of the new arch leaves a vacant space between the two arches, varying from 3 ft. in height at the north portal to 20 ft. at the south end. This space has been found convenient for carrying conduits of various public utility companies and for tunnel lighting leads. In this space drainage is provided for any seepage that comes through the old arch and the space is ventilated by means of shafts extending to the street on top of the hill.

The floor of the tunnel was paved with creosoted Douglas fir blocks, the pavement being put down in record time by the use of three 8-hour shifts. At the south portal provision was made for the installation of an elevator in case this service should be required at some later date. Sufficient space in the westerly bank was provided for an engine room and an elevator shaft. The stairway outside the portal was extended, and now has a rise of 65 ft. to the sidewalk level on Fort Moore Hill.

LINING NEW ARCH

The new arch was built of two thicknesses of brick faced on the inside with concrete in which is set white enameled tile. The brick work was advanced in two sections, work having been begun simultaneously at the north end and at the center of the tunnel. At each of these points a heavy timber truss, curved to fit a 20-ft. length of the tunnel arch, was used as a form for the brick work. Advancing the work from the two points made it possible to keep one full crew working continuously, although one day was allowed for the setting of each section before the form was moved. That is, a crew of six bricklayers and twelve helpers ordinarily completed one of these arch sections each day so that the crew worked on each section on alternate days.

The tile work was likewise carried on in two sections. Two 50-ft. movable scaffolds were used and the tile crew consisted of about 45 men, including the helpers. The reconstruction was finally completed and the tunnel opened to general traffic with appropriate ceremonies on Feb. 19.

The awards of damages in connection with this enterprise amounted to $86,645.75 and there were forty-two claimants, twenty-five of whose claims were allowed. The awards ranged from $750 to $27,500.

Lynn S. Atkinson, general contractor, carried out the work for the City of Los Angeles.

Propose Standard Plans for Heating and Ventilating Utah School Buildings

The Utah School Buildings Commission has issued to the District Boards of Education of that state a set of proposed standard plans for arranging most effectively the heating and ventilation of small school houses, particularly one-room buildings without basements. The plans provide for an encased heater separated from the school room and arranged to furnish heated outside air in constant volume to the upper portion of the room. A ventilated wardrobe and sanitary drinking fountain above the fuel box are provided for.

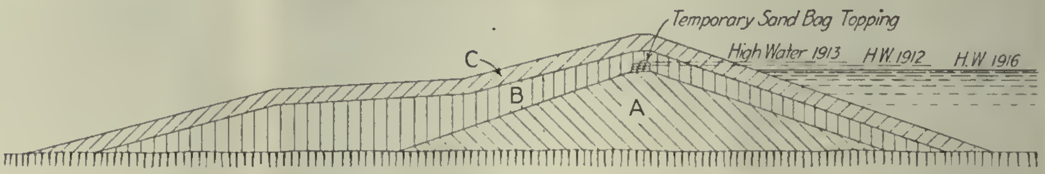
Mississippi River Flood Records Studied with Relation to Levee Grades

By Raising Embankment Elevations 6 to 7 Feet Menace from Extreme High Water Would Be Effectively Removed

By A. L. DABNEY
Consulting Hydraulic Engineer, Memphis, Tenn.

From his analysis of the Mississippi flood records of 1916 and previous years, Mr. Dabney concludes that it is now possible to fix, within narrow limits, the grades at which the levees will safely hold the largest volume of water that has ever passed Cairo, Ill. These grades, he states, should be established 4 ft. above the maximum profile indicated by his predicated gage readings. This will mean the raising of all levees an average of 6 or 7 ft. With this margin, he believes, there will result almost certain security in case of a recurrence of the flood of 1913.—Editor

THE crest of the 1916 Mississippi River flood has passed into the Gulf and has become history. This, even more than the comparatively recent disastrous floods, has brought valuable lessons to levee engineers on the lower Mississippi. It has established, or verified, the relations between several river gages, and has again demonstrated that levee districts with sections smaller than standard could hold their entire fronts against a higher flood plane than they had before experienced.



COMPARATIVE SECTIONS OF LOWER MISSISSIPPI LEVEES

1916 FLOOD MAKES RECORD

Excepting the floods of 1912 and 1913, the 1916 flood was the highest of record at Cairo. It was the highest of record, without exception, from above Arkansas City to below Natchez, Miss., a distance by river of at least 300 miles. It was held between levees without a break from Cairo to 65 miles below Helena, Ark., a distance of 370 miles. With higher stages than ever before recorded, it was held between levees from the mouth of Arkansas River to about 40 miles below Vicksburg, Miss., a distance of 240 miles. With only one break in the main Mississippi River levee that flooded a considerable area, and two minor breaks that flooded less than 50 sq. miles additional area, this flood passed between levees from Cairo to New Orleans, a distance, by river, of 950 miles. It has again forcefully demonstrated the efficiency of the Mississippi River levees.

Beginning at a comparatively low stage on Jan. 22, the Mississippi River rose rapidly at St. Louis, culminating in a crest on Jan. 31 of 31.2 ft. on that gage. In the latter part of December, 1915, and during January, 1916, there were general rains in the Ohio valley, causing the Ohio and its tributaries to rise. The stages reached by the Ohio were not excessive, but the Ohio crest, nearly meeting the crest from the upper Mississippi, resulted in the high stage recorded at Cairo, where the flood culminated on Feb. 4. The crest of this flood wave reached Memphis on Feb. 9 and Helena on Feb. 11. The rise culminated on the same day at all gages from Helena to Greenville. At Vicksburg it culminated Feb. 15; at New Orleans, March 1.

1916 FLOOD COMPARED WITH OTHERS

The 1916 flood was only 1.3 ft. below the record stage of 1913 at Cairo; 3.0 ft. below at Memphis, and 1.8 ft. below at Helena. Between Helena and Arkansas City the high water profiles of 1913 and 1916 cross. At Arkansas City the river reached 56.4 ft. or 1.3 ft. above 1913 and 1.1 ft. above the record stage of 1912; at Greenville, 0.3 ft. above 1913; at Vicksburg, 1.5 ft. above 1913 and 1.4 ft. above 1897, which had never been exceeded at that place.

Between Natchez and Baton Rouge the 1916 profile again crossed the profile of record stages, and at the latter place the crest was 1.2 ft. below the record made in 1912.

The super-elevation from Arkansas City south was due to the unusual accessions from the Arkansas and White Rivers, the crests of which were timed closely with that in the Mississippi. The Arkansas at Little Rock was 5.3 ft. below the record stage of 1844 and 3.9 ft. below 1892. At Pine Bluff it was just equal to the 1892 record. In the White River at Clarendon, the crest was 1.9 ft. above the former (1890) record.

A study of the table of highest waters reveals the fact that the Arkansas City gage, a short distance below the mouth of the Arkansas River, has usually read from 0.5 below to 2.0 ft. above the Helena gage. In 1912 it was plus 1.0 ft.; in 1913, minus 0.1 ft. In 1916 this relation went to plus 3.0 ft., which had been exceeded only twice in the years tabulated—in 1892, when the record stage since 1844 occurred at Little Rock, Ark., so timed as to produce almost its full effect on the Mississippi crest, and in 1908, with a comparatively high crest passing Little Rock about three days before the Mississippi crest reached Arkansas City. It should be noted that the effect of the Arkansas River in 1908 was even greater than the table will show. The stage recorded at Helena is for a crest that passed in March. Another crest passed that gage May 27 (44.4 ft.), and it is this which should be compared with Arkansas City for June 2. In the years which show a smaller effect by the Arkansas and White Rivers on the Arkansas City gage, the crest at Little Rock was moderate, or occurred either some weeks before or (in several instances) after the Mississippi crest had passed.

REASONS FOR VARYING GAGE RELATIONS

In making such comparisons as these it is to be remembered that levee breaks have occurred during most of the years tabulated, affecting, to greater or less extent, the gage relations. Some of the large basins were practically not leveed during the earlier years shown in the table, which was compiled by the State Board of Engineers of Louisiana from Mississippi River Commission and U. S. Weather Bureau records, up to 1913, inclusive. The stages for 1916 were procured by the writer from the Weather Bureau and district engineers.

In 1882 the flood broke the levees that existed at that time and covered practically the entire valley. Along some of the basins there were no levee systems at that time. The work of building levees to exclude the floods from these several "basins" has progressed from that time up to the present. As each district has completed a continuous levee of inadequate grade—because of insufficient funds—along its entire front, this further confinement of the water has caused the flood-plane to go higher in that part of the river, any considerable flood usually causing the levee on one or both sides to give way. Even had there been more money available, so that higher grades could be adopted, there have not been sufficiently reliable data upon which to base definite conclusions as to the effect on the gages lower down of any assumed volume of water which might enter the Lower Mississippi at Cairo and be confined between levees to the Gulf.

RESULT OF CLOSING BASINS

The closing of the Upper Yazoo basin reduced the difference between the Cairo and Helena gages from about 5 ft. in 1882 and 1883 to 2.5 ft. in 1892 and to minus 0.1 ft. in 1897. The closing of the St. Francis basin reduced the difference between the Cairo and Memphis gages from about 16.5 ft. in 1882 and 16.0 ft. in 1897 to 10.0 ft. in 1907 and 8.2 ft. in 1913.

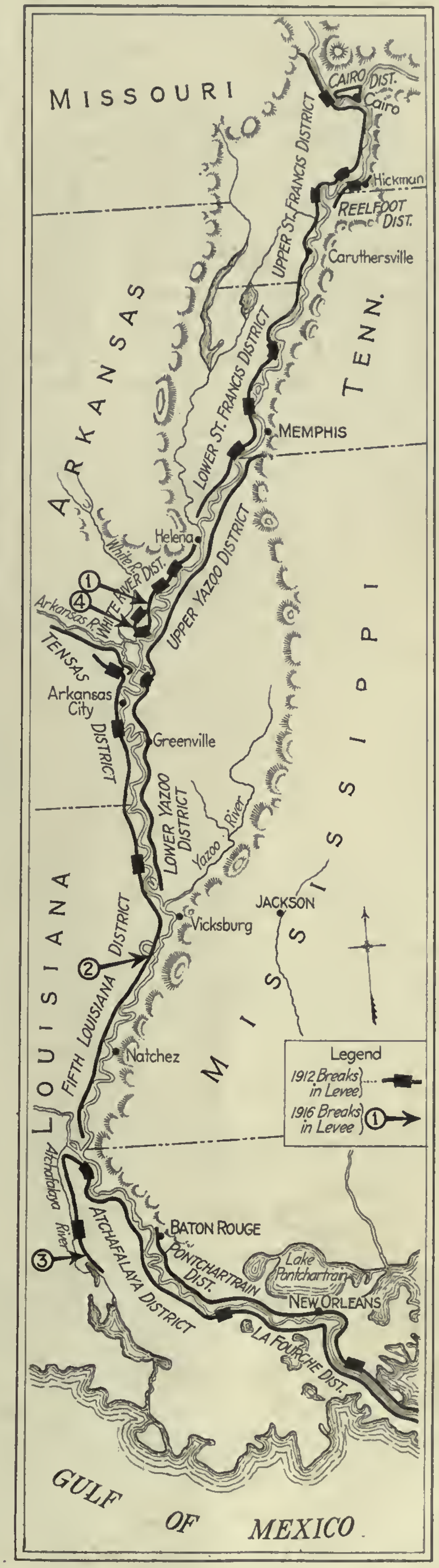
From the stage at Cairo engineers on the lower river have been able to predict fairly closely the stages to expect at their several localities, except when the "balance" has been upset by closing basins.

Levee engineers had predicted, from time to time, what the effect would be of closing some of these basins; but the taxpayers in the several districts had about as much burden as their resources would permit, and usually grades based on these predictions could not be adopted, even if they could have been accepted with positive assurance. As early as 1898, when the least difference between the Cairo and Memphis gages was about 14 ft. and the usual former difference 16.5 ft. or more, several engineers independently estimated that the closure of the St. Francis basin would reduce this difference to from 9 to 9½ ft. In 1894, when the highest stage before recorded at Arkansas City was 50.0 ft., Major William Starling, then chief engineer of the Lower Yazoo district, in a published report, predicted that a repetition of the 1882 stage at Cairo would result in a stage of 55.8 ft. at Arkansas City. It is interesting to compare these gages, in the light of history, with the above prediction. The accompanying table makes such a comparison.

COMPARISON OF GAGES WITH PREDICTION

	1882	1892	Major Starling's prediction in 1894	1916
Cairo	51.87	48.29	51.87	53.4
Arkansas City...	47.10	50.00	55.8	56.4
Difference	—4.77	+1.71	+3.93	+3.0

In connection with 1916 it is to be noted that some water escaped through the Arkansas River levees that would otherwise have passed Arkansas City, raising that gage somewhat higher, in closer conformity with Major Starling's prediction.



LOWER MISSISSIPPI RIVER AND LOCATION OF ITS SYSTEM OF LEVEES

The smaller section in this illustration is the typical levee where breaks occurred in 1912 and 1913. In the Memphis and Helena section it is about 16 ft. high and has three-on-one slope. The relative heights of the flood planes are illustrated. Water was held above the levee tops by temporary sand bag topping. The middle section is that adopted in a district 100 miles long that has not had a break for nineteen years. The largest section is that to which 50 miles of the latter district has been enlarged since 1912.

HOW LEVEES HAVE STOOD TEST

There are about 1500 miles of levee lines on the banks of the Mississippi River below Cairo. Where the valley is very narrow between the river and the hills there are, usually, no levees, and there are, also, breaks in the continuity of the system where the tributaries enter. These tributaries are the Yazoo, on the east, and the St. Francis, White, Arkansas and Red Rivers on the west. In each case the levee line ends a short distance above the mouth of the tributary, and the flood water backs up behind it for some miles.

The Mississippi River levees, augmented by extensions up the west side of the Arkansas River and up the Red River and down the east side of the Atchafalaya, protect 25,000 sq. miles from overflow. Between the years when disastrous floods occur there are usually frequent high waters that come well up against the levees, and but for the protection which they afford would flood a large part of the protected area, bringing agricultural, industrial and commercial operations to a standstill. The levees would be worth more than their cost if they only afforded this measure of protection; but a very large proportion of the area has been protected during the most disastrous floods. In 1912 there were about 14 crevasses below Cairo, yet about 65 per cent of the entire area, or 16,000 sq. miles, was not flooded. In 1913, with higher stages at many of the Mississippi River gages, there were half as many crevasses and at least 75 per cent of the area, or 19,000 sq. miles, had effective protection. The flooded area of 1916 cannot yet be stated, but it is estimated by the writer that about 90 per cent of the 25,000 sq. miles was immune from flood water.

ONLY ONE LEVEE BREAK OF ACCOUNT

There was only one break in a levee fronting the Mississippi River that flooded a large area. This break occurred on the west side of the river, about 15 miles above St. Joseph, La. There were two other breaks in main river levees, both of minor importance, comparatively. The first is marked "1" on the map. It occurred near the lower end of the levee on the White River front, at Knowlton, Ark. The land behind this levee was already covered by backwater, and no additional land was submerged. In fact, those in charge of the district were applying their energies to more important parts of the system, and while anticipating that this levee would be overtopped and would probably break, did nothing to prevent it because of the limited damage that would result. The other break, marked 4, was still nearer the end of the White River front levee, and flooded less than 50 sq. miles at Laconia Circle.

The break near St. Joseph would probably not have submerged more than 5 per cent of the entire leveed area. The water from this break combined with flood water which came down from the Arkansas River and around the upper end of the main levee system. It was this volume which flooded the greater part of the area affected by the 1916 flood. There was only one other crevasse in the main levee system above New Orleans. This was on the Atchafalaya River (marked 3), about 4 miles from the south end of the levee, and flooded very little land. It is positively stated by a good authority that this levee was cut.

There was no break in a main levee on the east side of the river from Cairo to New Orleans, although, as stated, the river was higher than ever before for a distance of over 300 miles.

The situation that resulted in a large volume of Arkansas and Mississippi River water passing through southeast Arkansas and Louisiana, requires explanation. A few miles south of the Arkansas River Cypress Creek empties into the Mississippi. The Mississippi River levee turns westward along the south side of Cypress Creek and is extended to ground high enough to prevent moderate floods from backing round the end, but not far enough to prevent very high floods from doing so. The Arkansas River levee, entirely independent of the Mississippi River system, extends from Pine Bluff down the south bank of the Arkansas to a point near its mouth. This year there were four breaks in the Arkansas River levee and the water from these, combined with water backing up from the Mississippi between the two levee lines, resulted in the overflow which caused the most damage. The situation below the Arkansas River, and also that where the breaks occurred on the White River front, are shown approximately on the accompanying map.

While the levees generally, although of inadequate section, held the 1916 flood, there would most probably have been more breaks, but for the vigilance, energy and foresight of the district engineers and the U. S. Army engineers who had charge of them, and the co-operation of citizens and contractors along the levee lines. The flood warnings by the U. S. Weather Bureau, also, have proven very reliable and a valuable aid to those responsible for the safety of levees and property.

Basis for Fixing Levee Grades

The most important fact demonstrated by this flood—and one which levee engineers have heretofore recognized—is that the largest volume of water that has ever passed Cairo could be held between levees of definite size from the mouth of the Ohio to the Gulf. If the levees are built to grades that can now be determined within a margin of 0.5 ft. above the Arkansas River and 1 ft. below and to the standard section of the Mississippi River Commission or of the Upper Yazoo Levee District, they will safely hold such a flood.

The maximum discharge of the Mississippi River at Columbus, Ky., a few miles below Cairo, was practically the same in 1912 and 1913, according to Mississippi River Commission observations. Including channel and overflow water, it was approximately 2,015,000 sec. ft. This discharge has never been exceeded in that part of the river. It is estimated that, had all of this water been held by the levees, it would have reached 57.0 ft. on the Cairo gage. This estimate is believed to be accurate within 0.5 ft.

The floods of 1906, 1907 and 1916, all of which were confined between levees, have established relations between the Cairo and Memphis gages and the Cairo and Helena gages, of minus 10.0 and 0.0 ft. respectively. For 57.0 ft. at Cairo, then, 47.0 ft. at Memphis and 57.0 ft. at Helena would be indicated. The 1916 crest, like those of 1906 and 1907, was not sustained at Cairo as long as have been some other flood crests, so that there may have been a slight flattening of these crests between Cairo and Memphis, and it is more conservative to estimate 47.5 ft. for Memphis and 57.5 ft. for Helena for longer sustained crests.

According to the high-water table, only twice since 1882 has the gage at Arkansas City recorded more than 3 ft. greater reading than Helena. For neither of these years did the stage in the Mississippi approximate the maximum. While a maximum flood wave from the Arkansas and White Rivers, if it should be exactly synchronized with a crest in the Mississippi, would probably make a gage reading at Arkansas City 5 or even 6 ft. greater than at Helena, such a synchronism of *maximum flood crests* in both the tributaries and the main stream is only a very remote possibility. (In June, 1908, the difference was 5.5. The Mississippi was at a moderate flood stage. The Arkansas nearer its maximum.) To place the estimate for Arkansas City at 3.5 ft. above Helena, for a maximum crest in the Mississippi, is believed to be conservative. Below the Arkansas River the only interruption to the parallelism of the 1916 profile

Record of Highest Water on Mississippi River and Tributaries for Flood Years, at Stations Indicated. (1882-1916)

Stream and Name of Gage Station	1882		1883		1884		1892		1897		1898		1903		1907		1908		1912		1913		1916		Highest Since 1871	
Missouri:																										
Omaha	14.50	June 28	14.20	June 28 May 25	15.90	Apr. 6	15.30	July 3	17.10	Apr. 6	14.70	July 3	14.4	June 1	17.3	July 18	19.1	July 3	18.50	Apr. 14	18.7	Apr. 7	....	....	23.60	1881
Kansas City	19.20	July 3	28.30	June 26	17.20	July 5	24.90	May 21	27.80	Apr. 17	21.50	June 12	35.0	June 1-2	23.5	July 20	30.2	June 15	23.10	Apr. 2	21.9	Apr. 16	....	....	35.00	1903
Upper Mississippi:																										
St. Louis	32.15	July 4	34.80	Jan. 12 Dec. 29	28.10	Apr. 9	36.00	May 19	30.95	May 2	27.20	May 23	38.0	June 10	28.0	July 25-6	34.9	June 20	30.70	April 6	27.2	Apr. 16-7	31.2	Jan. 31	38.00	1903
Ohio:																										
Pittsburgh	21.00	Feb. 27	26.80	Feb. 10	31.80	Feb. 6-7	22.80	Jan. 15	28.90	Feb. 24	28.50	Mar. 24	28.8	Mar. 1	35.0	Mar. 15	26.7	Mar. 20	28.10	Mar. 22	*30.4	Mar. 28	....	....	35.00	1907
Cincinnati	58.58	Feb. 21	66.35	Feb. 15	71.06	Feb. 14	43.90	Apr. 25	61.10	Feb. 26	61.40	Mar. 24	53.3	Mar. 5	65.1	Jan. 21	55.7	Mar.11-2	53.20	Mar. 27	69.8	Apr. 1	....	....	71.06	1884
Louisville	37.40	Feb. 22	43.80	Feb. 16	46.60	Feb. 16	21.80	Apr. 23	35.30	Feb. 28	36.20	Mar. 30	28.5	Mar. 9	41.2	Jan. 22	31.1	Apr. 6	28.70	Mar. 28	45.1	Apr. 2	....	....	46.60	1884
Cumberland:																										
Nashville	55.30	Jan. 22	41.60	Feb. 14	48.30	Mar. 15	38.80	Apr. 26	49.25	Mar. 20	38.80	Jan. 23	40.4	Mar. 9	28.2	Jan. 24	29.5	Feb. 16	46.50	Apr. 8	44.9	Apr. 2	....	....	55.30	1882
Tennessee:																										
Chattanooga	40.17	Jan. 19	38.17	Jan. 23	42.83	Mar. 10	37.90	Jan. 17	37.90	Mar. 15	24.60	Sept. 5	31.8	Apr. 11	19.6	Jan. 2	24.7	Feb. 17	30.20	Apr. 5	32.9	Mar. 31	....	....	54.00	1875
Mississippi:																										
Cairo	51.87	Feb. 26	52.20	Feb. 27	51.79	Feb. 22-4	48.29	Apr. 28	51.67	Mar.25-6	49.78	Apr. 6	50.6	Mar.15-7	50.3	Jan. 27	45.5	Mar. 19	53.94	Apr. 6-7	54.7	Apr. 5-8	53.4	Feb. 4	54.70	1913
Memphis	35.15	Mar. 9	34.75	Mar. 6-8	34.15	Mar. 13	34.50	May 23	37.66	Mar. 20	37.59	Apr. 10	40.1	Mar. 20	40.3	Feb. 3	35.5	Mar.24-5	45.23	Apr. 6	†46.1	Apr. 9-10	43.5	Feb. 9	†46.10	1913
Helena	47.20	Mar. 9	46.90	Mar. 8-9	47.00	May 6	45.73	May 11	51.75	Apr. 4	49.11	Apr. 17	51.0	Mar.26-7	50.4	Feb. 5-6	45.2	Mar. 26	54.30	Apr. 22	55.2	Apr. 22-3	53.4	Feb. 11	55.20	1913
Mouth White River	48.40	Feb. 28	48.00	Mar.9-12	47.90	Mar. 7-8	49.27	June 1	52.42	Mar. 29	51.05	Apr. 19	53.7	Mar.28-9	51.9	Feb. 7-8	49.5	June 1-2	56.35	Apr. 16-7	55.4	Apr. 24	....	....	......	....
Arkansas:																										
Fort Smith	21.80	Feb. 23	22.80	June 11	27.90	Feb. 14	30.90	May 19	17.00	Mar. 20	35.00	May 7	24.1	May 26	18.8	Jan. 24	32.7	May 27	21.50	Apr. 2	15.0	Apr. 11	....	....	35.00	1898
Little Rock	25.70	Feb. 25	25.80	Feb. 19	30.60	Feb. 15	31.20	May 21	23.20	Mar. 21	29.30	May 11	26.2	June 2	20.4	Jan. 25	27.8	May 30	24.00	May 4	18.8	Apr. 13	27.3	Feb. 2	31.20	1892
Mississippi:																										
Arkansas City	47.10	Feb. 28	46.35	Mar. 11	46.50	Mar. 7-9	50.00	June 1	51.90	Mar. 20	51.13	Ap.19-21	52.9	Mar.27-8	52.1	Feb. 8	49.9	June 2-3	55.33	Apr. 12	55.1	Apr. 21-5	56.4	Feb. 10-3	56.4	1916
Greenville	41.68	Feb. 27	40.40	Mar.9-13	41.10	Mar. 7-8	44.28	June 1	46.75	Mar. 29	46.16	Apr. 21	49.1	Mar. 27	47.3	Feb. 9	44.7	June 3-5	50.76	Apr. 12	50.4	Apr. 21	50.7	Feb. 11-4	50.76	1912
Lake Providence	38.32	Mar. 20	36.47	Mr.11-14	38.40	Mar.23-4	41.90	June 2	44.54	Mar. 30	44.35	Apr. 23	46.5	Mar. 27	46.3	Feb. 10	44.1	June 5	48.25	Apr. 12	48.0	Apr. 21	48.8	Feb. 15	48.8	1916
Vicksburg	48.75	Mar. 20	43.80	Apr. 7	49.00	Mar. 25	48.45	June 2-3	52.48	Apr. 16	49.40	Apr. 24	51.8	Mar. 28	49.6	Feb. 10-1	47.8	June 5-8	51.65	Apr. 12	52.4	Apr. 28	53.9	Feb. 15	53.9	1916
Natchez	47.75	Mar.28-9	44.00	Apr. 7-9	47.40	Mar.24-6	48.10	June 26	49.82	May 2	47.40	Apr. 26-7	50.3	Mr.28-31 Apr. 2	48.9	Feb. 13-4	48.7	June 14	51.42	Apr. 13-7	52.4	Apr. 26-7	53.6	Feb. 15	53.6	1916
Red:																										
Fulton	....	....	....	....	....	....	34.85	May 23	28.60	Mar. 23	27.90	May 11	31.1	Mar. 14	31.4	June 4	33.9	June 2	30.62	Apr. 6	23.9	May 24	32.2	Feb. 4	35.75	1876
Shreveport	31.40	Feb. 21	25.30	Mar.11-2	32.70	May 14	35.70	May 28	24.10	Apr. 11-3	15.00	May 21	33.1	Mar. 22	26.9	June 13	35.1	June 15	19.30	Apr. 14	12.4	May 26-7	25.5	Feb. 10	35.70	1892
Alexandria	34.85	Mar.17-8	25.45	Mar. 27	35.20	May 30 June 1-5	38.25	June 12-3	26.25	Apr. 14-5	17.40	Jan. 25	35.0	Mar 28	32.6	June 18-9	41.8	June 6	33.56	Apr. 21	24.2	Apr. 6	36.8	Feb. 16	41.82	1908
Atchafalaya:																										
Barbres Landing	49.90	Mar. 27	46.30	Apr. 8-10	48.60	Mar.30-1	49.70	June 27-8	50.95	May 13-4	42.35	May 2	50.5	Apr. 7-11	45.7	Feb. 19-20	48.0	June 14-23	53.35	May 10	50.2	May 10-1	....	....	......	....
Melville	37.00	....	....	....	....	....	35.00	July 2-5	35.10	May 15	33.90	Apr. 29 May 6	38.7	Apr. 4-5	37.7	Feb. 20	39.7	June 22	41.73	May 6-15	41.7	Apr. 24	43.2	Feb. 14	43.2	1916
Mississippi:																										
Red River Landing	48.50	Mar. 27	45.20	Apr. 9	47.30	Mr.29-31	48.87	June 27	50.20	May 14-5	44.30	Apr.28-9	50.1	Apr. 8-9	46.9	Feb. 15-9	48.7	June 14-6	53.20	May 11-2	50.6	May 10	....	....	......	....
Baton Rouge	35.95	Mar. 26	35.08	Apr. 9	36.20	Mar. 24	38.45	June 28	40.65	May 13-5	34.60	Apr29-30	40.0	Apr. 7-8-10	37.4	Feb. 17-9	39.6	June 16-7	43.82	May 11	41.3	May 9	42.6	Mar. 1	43.82	1912
Plaquemine	31.30	Mar.21-7	30.80	Apr. 9	31.70	Mar. 24	33.50	June 13	36.25	May 13-7	30.57	Apr29-30	36.1	Apr. 5-7-8	33.4	Feb. 17-9	35.2	June 15-6	39.38	May 11	36.8	May 7-11	....	....	39.38	1912
Donaldsonville	....	....	....	....	25.70	Mar. 24	30.15	June 13	32.75	May 13	27.95	Apr. 28-9	32.2	Apr. 7	30.0	Feb. 15-21	31.6	June 18	35.10	May 10	32.8	May 8	....	....	35.10	1912
College Point	23.20	Mar. 26	23.45	Apr. 9	24.10	Mar. 24	25.62	June 13	27.95	May 15	23.50	Apr27-30	27.8	Apr. 5-6	25.9	Feb. 15-9	27.1	June 17	30.18	May 11	28.2	May 7-9	....	....	30.18	1912
Carrollton	14.95	Mar. 27	15.40	Apr. 7	15.60	Mar. 18	17.35	June 10	19.17	May 13	15.90	Apr. 25	19.4	Apr. 5-6	18.7	Feb. 16	18.7	June 18	21.05	May 9	19.2	Apr. 28	....	....	21.05	1912
New Orleans	15.80	Mar. 27	....	....	16.20	Mar. 26	17.60	June 11	19.50	May 13	16.90	Apr. 27-8	20.3	Mar. 30 Apr. 1	19.8	Feb. 13-21	20.0	June 19-22	21.40	May 9	20.3	May 5-13	21.0	Mar. 1-4	21.40	1912
Fort Jackson	....	....	....	....	....	....	6.90	Mar. 31	7.20	Apr. 22-3 Nov.14-6	6.70	Apr. 23-6	8.0	Mar. 27	8.3	Feb. 14-16-18	8.1	Feb. 14-16-18	8.28	May 3-11	8.3	Apr. 23-7	....	....	......	....

*Corrected from 34.0. †Weather Bureau Record 46.50.

This table (except 1916 column) from report of Board of State Engineers of Louisiana; compiled from Miss. River Comm. and U. S. Weather Bureau Records.

to that which should obtain for a completely confined flood, was caused by the break near St. Joseph, La. No attempt will be made here to estimate the effect on the profile of this break, nor to extend a predicted maximum profile below Vicksburg.

The writer now ventures the prediction that the future gage readings from Cairo to Vicksburg, for a confined flood equal in volume to those of 1912 and 1913 at Cairo, with such a volume from Arkansas and White Rivers, as it is reasonable to expect on the crest of a maximum Mississippi crest, as follows:

Cairo	57.0 ft.	Arkansas City..	61.0 ft.
Memphis	47.5 ft.	Greenville	55.3 ft.
Helena	57.5 ft. or less	Vicksburg	58.5 ft.

If a levee system which held the 1916 flood should be enlarged to 1 ft. higher grade it would hold 1 ft. higher water; but to do so would require much vigilant attention and entail much nerve-racking suspense. There would be as much chance of disaster. The conditions have changed on the Lower Mississippi since the early days of levee building, when an occasional levee break was a matter of course, and its principal damage was to delay for a few weeks the planting of crops. The country is much more highly developed. A levee break now floods populous and wealthy towns, oil mills and compresses and stops traffic on miles of railroads. The same chances of having levee breaks should not be taken. They cannot be afforded. Grades should be established 4 ft. above the maximum profile indicated by the predicted gage readings above. This will mean the raising of all levees an average of 6 or 7 ft. With this margin, there will result almost certain security, in case of a recurrence of the 1913 flood volume, and an excellent chance to confine to the river channel a considerably larger volume, should it ever come.

New York State Highway Maintenance Analyzed

Deputy Commissioner Sarr Reports on Last Year's Work, Involving Total Expenditure of $4,210,000

FROM an analysis of last year's maintenance and repair costs on New York State's highway system, involving an improved mileage of 5926 on Dec. 31, 1915, and an expenditure of $4,210,575, Fred W. Sarr, second deputy commissioner, concludes that the improved State and county highways of all types can be perpetually maintained for about $750 per mile. There are certain factors, however, which must be considered in order to understand clearly what this figure represents, and these are discussed in Mr. Sarr's annual report to Commissioner Edwin Duffey, which has recently been made public.

SUMMARY OF WORK

On April 1, 1915, Mr. Sarr reports there were improved and accepted 5345 miles of State and county highways. The mileage was increased as the season advanced, and on Dec. 31, 1915, there were 5926 miles of improved and accepted highways, which have been maintained and repaired.

The following is a summary of work performed during the past season, including sums obligated on uncompleted contracts:

A study of the experience of the New York State Highway Department in maintaining and repairing highways during the past year indicates that the expenditures are divided into three groups.

First.—Maintenance, or the act of maintaining and preserving the various features of the highway in the same or uniform condition. The cost of such maintenance of all the improved highways of all types was approximately $350 per mile, which includes the cost of the patrol system and the material used by the patrolmen, together with the cost of the surface treatments with bituminous materials and cover and supervision.

Second.—Repair, or the act of restoring the highway to its former condition after more or less extensive deterioration during the winter season with the contingent freezing, thawing, unstable foundation, obstructed drainage, floods, washouts, sliding banks, etc., and that the cost of such emergency repairs was approximately $140 per mile for roads of all types.

Third.—Reconstruction and resurfacing. While on many of the improved highways it appears possible, with efficient maintenance, to preserve a standard of improvement from year to year, there are those that show marked deterioration in spite of efforts at maintenance and extensive repairs from time to time. This deterioration is generally due to peculiar traffic conditions, combined with unsuitable materials used in the original improvements, and is often the result of insufficient foundation over unstable material in the roadbed.

SUMMARY OF WORK DURING 1915

276 miles of highway resurfaced or reconstructed, at an average cost of approximately $5,471 per mile; total expenditures and obligations under this item	$1,510,112
2086 miles of highway given a surface treatment of bituminous material and cover of sand, fine gravel, iron ore tailings, or fine crushed stone, at an average cost of $419 per mile; total expenditures and obligations under this item	874,137
728 patrolmen employed in the work of maintenance and minor repairs, at a total cost for labor..................	403,047
Expended for material and temporary labor in making miscellaneous repairs and supplying material to patrolmen for maintenance	998,462
Expended for rentals of large units of repair equipment	58,135
Expended for purchase of equipment and tools	31,958
Expended for engineering, supervision, inspection and expenses incidental thereto	334,724
Total amount expended and obligated for all purposes, approximately.	$4,210,575

During the past year the mileage of resurfacing and reconstruction has averaged about 5 per cent of the total mileage of improved highways, at an average cost of about $5,500 per mile, for the mileage treated in this manner, or a charge of about $260 per mile when distributed over the entire improved mileage.

The total amount expended and obligated for all purposes in the year will average $750 per mile when distributed over the entire mileage of improved highways. This statement, however, is misleading in that a large percentage of the total improved mileage is of recent construction.

The first highways improved by the state under the Higbie-Armstrong act were completed in 1899, and in thirteen years, or to the end of 1911, there had been completed and accepted but about 2,600 miles, while in the last four years there have been completed and accepted 3,226 miles. In other words, 55 per cent of the improved mileage has been constructed an average of two years, while the 45 per cent has been improved an average of ten years.

BASIS OF MILEAGE COST

Assuming that no pavements should require resurfacing for a period of four years after construction, it is necessary, Mr. Sarr points out, to eliminate the 3226 miles which have been improved during the past four years from the consideration of the cost per mile for resurfacing and reconstruction. Therefore, the total expenditure for this subdivision of the work should be distributed only on such mileage as has been constructed or improved for a period of four years, and when so distributed the cost per mile for this subdivision during the past year is approximately $560 per mile.

It would seem, however, that the average life of a pavement after reconstruction would be greater than that of the first improvement, as foundational weakness that had developed would be provided for in the reconstruction. The maintenance and repairs for the first five years after the original improvement are greatly increased by heavy items which are properly chargeable to improvement, and are really a completion of the improvement, such as removal of slides from banks which have been cut into at time of improvement; the construction of retaining walls to sustain such banks and for the protection of the highway from the erosion of streams. The drainage conditions, as provided in the original improvement, are often the subject of much complaint from the abutting owners and necessitate modifications and construction of storm-water sewers, all of which develop and are taken care of in the first few years, after the original improvement. It can, therefore, reasonably be expected that the cost of maintenance repairs and reconstruction will decrease in some proportion at the age of the improvement, and that the high cost of $560 per mile for resurfacing and reconstruction, when applied to all the improved highways, would never be attained, and that the reduction in the item of repair would offset the increase in reconstruction as the improvements increased in age owing to the gradual elimination of weakness, together with the effect of efficient maintenance.

It would accordingly seem by this manner of reasoning that the improved State and county highways of all types could be perpetually maintained for about $750 per mile.

New York Transit Traffic Grows Fast

The subways of New York City carried 34,032,671 passengers in January last, according to figures made public recently, by the State Public Service Commission for the First District. This represents a 13½ per cent increase over the number of passengers carried in January, 1915. At the same time the elevated lines, on several of which third-track express service was opened late last year, carried 26,471,238 passengers, as against 713,522. At the Grand Central Station 2,141,862 tickets were sold in January of this year as against 1,796,984 in January, 1915. The Brooklyn subway traffic gained appreciably, and amounted to approximately 30 per cent of the total in January. The total number of passengers carried on all subway and elevated lines for the month was 60,503,909 as compared with 55,742,984 a year previous.

Aerial Passenger Cableway of Unique Type Crosses Niagara Whirlpool

Six Constant-Tension Steel Cables Support a 3½-Ton Car with Capacity for 46 Persons—Movable Counterweights Allow Variation in Sag

A PASSENGER cableway, said to have the longest clear span in the world, has recently been built across the Niagara Whirlpool, at a cost of $60,000. The car is carried by six parallel cables, three on each side. These cables are kept at constant tension by means of counterweights at one end which adjust themselves automatically to allow variation in sag and take up any changes in the loaded weight of the car. The design is of Spanish origin, and the enterprise was organized by Spanish capitalists as The Niagara Spanish Aerocar Company, Ltd. The following description is taken from an article in *The Canadian Engineer.*

Determining Conditions

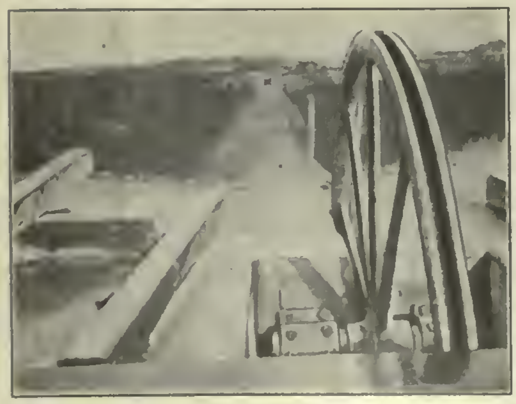
The design of the anchorages, both of which are on the Canadian side, one at Colt's Point and the other at Thompson's Point, was governed largely by the fact that the cableway was not allowed to cross the tracks of the Niagara Belt Line Railway, that the appearance of the cliffs on neither side of the whirlpool should be altered and that no towers or structures should rise above the level of the track of the railway which runs along the cliff.

The passenger car is suspended from a running gear which travels on six parallel track cables of 1-in. crucible steel rope. Each cable is anchored securely at Colt's Point by means of a 2-in. rod bent into an anchorage in a 740-ton concrete block. At the other terminus each track cable passes over a sheave and is fastened to a counterweight or stretcher. Boxes 12 ft. high by 6 ft. 7 in. wide by 11 in. deep, made of riveted steel, contain cast-iron weights sufficient to make a total of 10 tons for each track-cable counterweight.

Principle of Design—Advantages

The boxes move up and down freely in steel guides, maintaining the tension in each cable always at 10 tons, regardless of the load on the cables. When the load on the car is increased, the counterweights rise and the sag in the cables is increased until the cables take such an angle that the sum of the vertical components of the tension at the ends is equivalent to the weight of the car and its load.

Each track cable is entirely independent of the others. The breaking of any one of them would not be serious, as the other cables would support all the weight of the car without any increase in their tension. The car would drop several feet suddenly and, after a few vertical oscillations, would assume a new position of equilibrium. Thus the breaking of one cable would not imperil the passengers,—and the breaking of two cables at the same time would be very improbable.



TRACTION SHEAVE AT COLT'S POINT

The car seats twenty-four passengers and provides standing room in a raised aisle in the center of the car for twenty-two more, including the conductor. The weight of the car when empty is 3½ tons, and when fully loaded 7 tons. It is 10 ft. 10 in. wide, 24 ft. long and 23 ft. high. The accompanying photograph shows the car suspended from the six track cables.

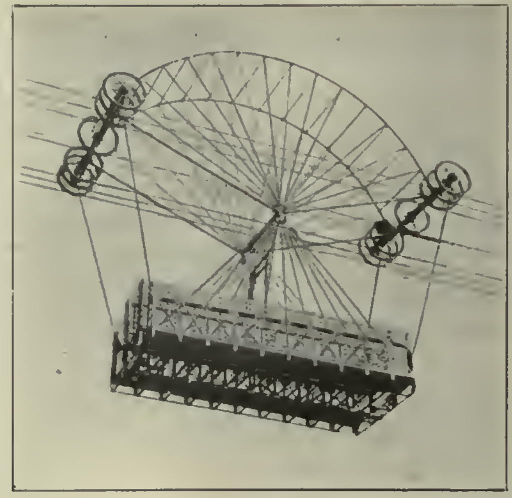
Operation of Car

The car is propelled by a ⅞-in. plow-steel traction cable fastened to one end. This cable passes over a sheave on Colt's Point, runs back across the whirlpool, over a sheave in front of the Thompson's Point station, and to the driving sheave. From here it passes around three sheaves to one of which is fastened a 10-ton counterweight box arranged in guides similar to those for the track-cable counterweights, thus creating a tension in the cable which adjusts any slack caused by the rising and falling of the car.

COLT'S POINT ANCHORAGE—AUTOMATIC STOP

The 8-ft. driving sheave is turned by a 75-hp. Westinghouse motor, through a 30 to 1 worm gear, giving a speed to the car of about 400 ft. per minute when the controller is at full speed. The trip can be made in about 4½ min., but it is planned to permit it to occupy 6 min. by running at half speed part of the time. To provide against a breakdown of the motor or interruption in the power supply, there is a clutch in the driving shaft, by means of which the motor can be disengaged and a 5-hp. gasoline engine engaged both through a worm gear and through socket wheels.

An automatic control stop is provided in each terminal which stops the car without jar within a distance of 3 ft. 4 in. In one of the photographs the stop can be seen extending from the base of the concrete block. The traction cable runs longitudinally through the 5 in. pneumatic cylinder and through the center of the piston. A clamp on the traction cable, just ahead of the car, strikes the face of the piston and also engages with it in such manner that the car cannot slip back from the landing platform.



CAR SUSPENDED FROM SIX TRACK CABLES

Erection of Cables

After the traction and track-tower sheaves had been erected, a very long rope was carried around the face of the cliff from Thompson's Point to Colt's Point. This rope was then hoisted over the tops of the trees until it could be pulled taut from point to point. A ½-in. wire rope was pulled across with the aid of a hoisting engine, and then the ⅞-in. traction cable was pulled into place. The traction cable was used to haul the track cables across.

The strength of the track cables is 92,000 lb, each, allowing for bending over the sheaves, and the working tension is 20,000 lb., so that the factor of safety is 4.6.

The sag of the track cables unloaded is 47.6 ft.; the maximum sag when loaded with car and passengers is 100 ft. The car will still be 148 ft. above the surface of the water at the point of maximum sag. The grade of the track cables varies from 16 per cent at either landing to level at the center of the span.

The general contractors were Norman McLeod, Ltd., Toronto, on a cost plus percentage basis. The superintendent in charge of the construction was Lewis S. Roy. J. E. Taylor was resident engineer, representing Wright & Howard, consulting engineers, Toronto, who were employed by the Spanish company to adapt their design to local conditions, and who prepared the plans and supervised the construction.

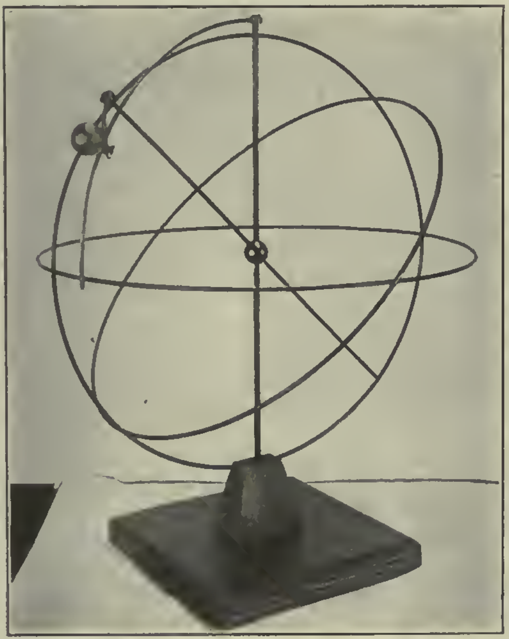
Large Iron Ore Deposits in Brazil

Brazil has the largest known deposits in the world of 70 per cent iron ore, practically free from phosphorus. The state of Minas Geras alone is estimated to have 1,500,000,000 to 2,000,000,000 tons about 300 to 400 miles from the sea coast, and bodies of iron ore exist in other states of Brazil, according to Percival Farquhar in an address at a meeting of the Federal Trade Council, New Orleans. Our eastern mills, whose expansion should take a new phase with our increasing export of steel and steel products, can use this ore to advantage, as well as Europe, where it will allow low-grade and high phosphorus ores to be used by mixture.

Rod Models Explain Astronomical Problems

By FRANCIS S. FOOTE, JR.,
Associate Professor of Railroad Engineering, University of California, Berkeley

THE accompanying photographs show two models recently constructed for use in teaching to engineering students the elements of practical astronomy usually included in a course in plane surveying.


UNIVERSITY OF CALIFORNIA MODEL ILLUSTRATES CIRCUMPOLAR STAR OBSERVATION

These models were constructed from sketches prepared by the writer, but all the detail of the design was worked out by Valdemar Arntzen, expert mechanic in charge of our department shops.

One model is for bodies relatively near the celestial equator, and is used principally in illustrating solar observations. The ball which represents the sun may be moved along the declination arc, showing the sun in both north and south declinations. The altitude arc slides through a swiveling socket at the "sun," so that the shape of the spherical triangle changes with the various changes in the sun's position. With this model it may be clearly shown why the sun rises north or south of east, why an observation for azimuth should not be taken near noon, etc.

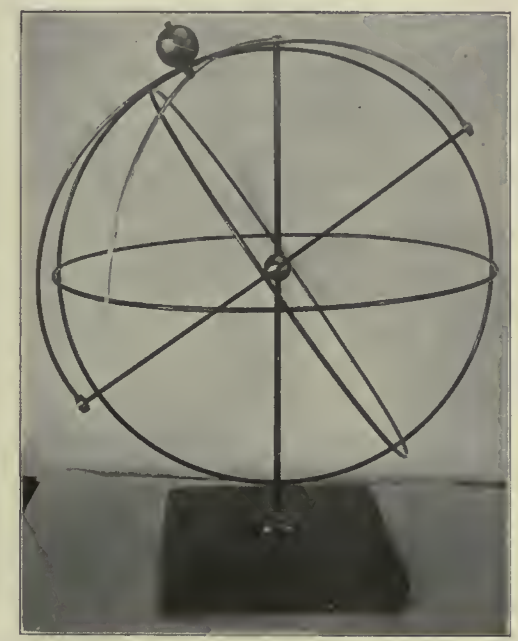
The other model is for a circumpolar star. The declination is fixed. The "star" may be moved in a full circle around the pole, illustrating changes in the shape of the astronomical triangle with changes of hour angle.

The circles representing the horizon, meridian, etc., are made of ¼-in. iron rods, and are 24 in. in diameter.

Trolley Tracks for Cleaners' Scaffolds on Buildings

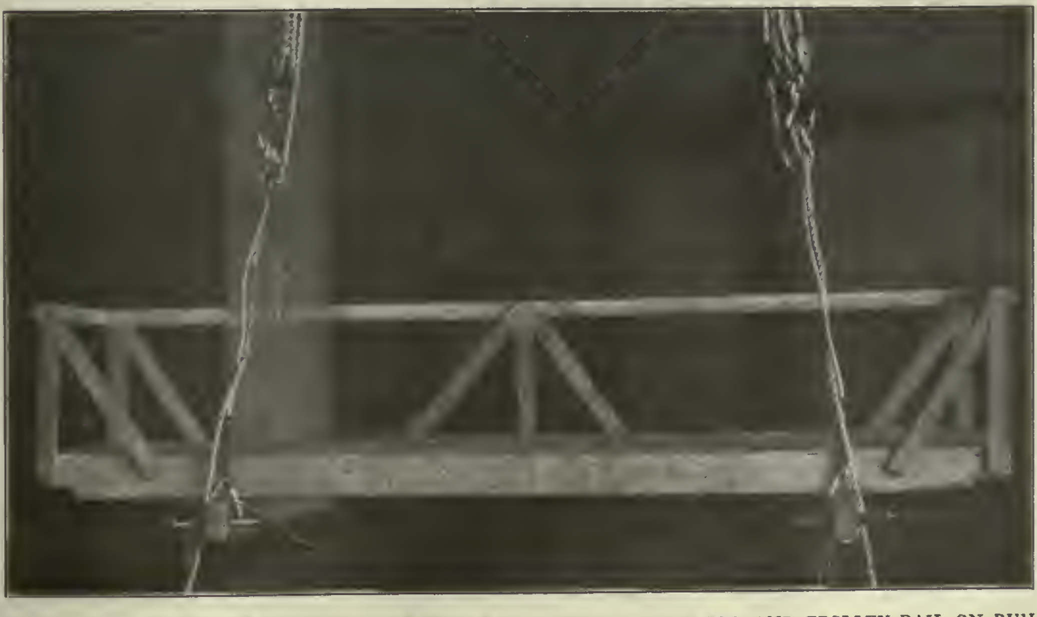
Illinois Department of Factory Inspection Formulates Rules for Safe Construction of Swinging Scaffolds

THAT an I-beam supported by brackets from the frame or walls of a factory building to furnish a support for painters' and cleaners' swinging scaffolds has the advantages of economy and safety has been pointed out by the Illinois Department of Factory Inspection, of which Oscar F. Nelson is chief. The I-beam furnishes a track for trolleys from which the scaffolds are hung. This arrangement, shown in the accompanying photograph, allows the scaffold, according to the department, to be moved rapidly in any direction, does away with thrust-outs and saves a great deal of time usually spent in rigging by the men engaged in maintaining the outside walls of buildings. Still more important, it is said to increase greatly the safety of these men, reducing correspondingly the liability risks.


UNIVERSITY OF CALIFORNIA MODEL ILLUSTRATES SOLAR OBSERVATION

The department has also recently issued an order prescribing the proper construction for light scaffolds used in building maintenance with a view to reducing accidents. A model painters' scaffold conforming to the requirements of the order is shown in one of the illustrations. Only ⅝-in. wire rope with spliced loops may be used for slings on any scaffold, while ¾-in. forged steel stirrups must be used for tuck pointers' scaffolds. Where wire rope is used, a safety strap of rope must be spliced into both loops of the sling below the platform, and a ¾-in. bolt 6 in. long, held in place by pipe washers, must be put in each end of each bolster. The bolts prevent the loops of the sling from slipping off, and the safety strap, if the bolster should slip out of the sling, would catch the ends of the scaffold plank and prevent them from falling. The bolsters themselves must not be less than 2 x 4-in. straight-grained hickory or white oak. Bails must be secured to tuck pointers' scaffolds by steel clamps, and the wall braces used on such scaffolds must be secured with U-bolts, as bolts running through the floor pieces are not permitted.

These instructions were formulated at a conference between the Chicago building commissioner, the representatives of the Employing Painters' Association and of the unions concerned, and the chief state factory inspector.



SCAFFOLD WITH SLINGS THAT CANNOT SLIP OFF BOLSTERS AND TROLLEY RAIL ON BUILDING TO SUPPORT IT FOR CLEANERS' USE

Literature

For the Civil Engineer and Contractor

New Publications

The Use of the Slide Rule. By Allan R. Cullimore, dean, College of Industrial Science, Toledo University. Cloth, 6 x 9 in., 36 pages; illustrated. New York, Keuffel & Esser Company. 50 cents.

Loblolly or North Carolina Pine. By W. W. Ashe, forest inspector, U. S. Forest Service. Bulletin 24, North Carolina Geological and Economical Survey. Paper, 7 x 10 in.; 176 pages; illustrated.

The Caisson as a New Element in Concrete Dam Construction—Proposal made in connection with the Columbia River Power Project. By O. G. Aichel, civil engineer, Portland, Ore. Paper, 7¼ x 9¾ in.; 32 pages; illustrated. New York, Spon & Chamberlain, 123 Liberty Street.

Industrial Leadership. By H. L. Gantt. Cloth, 5 x 7½ in.; 128 pages. New Haven, Conn., Yale University Press. $1 net.

Standardization of Public Employments—Part 1. Paper, 6 x 9 in.; 117 pages. New York, Bureau of Municipal Research, 261 Broadway.

The American Road—Lessons for Correspondence Instruction. By James Irwin Tucker, professor of civil engineering, University of Oklahoma, and consulting state engineer, Oklahoma Department of Highways. Six booklets; paper, 4¾ x 7½ in.; total 228 pages, with numerous questions; illustrated. Norman, Okla., Extension Division, University of Oklahoma.

Sewage Purification and Disposal. By G. Bertram Kershaw, consulting engineer, engineer to the Royal Commission on Sewage Disposal. Cloth, 5½ x 8½ in.; 340 pages; illustrated. London, Cambridge Public Health Series, Cambridge University Press. 12 shillings net.

Relation Between Properties of Hardness and Toughness of Road-Building Rock. Office of Public Roads. Paper, 7 x 10¼ in.; 5 pages; illustrated. Washington, U. S. Department of Agriculture.

Effect of Controllable Variables Upon the Penetration Test for Asphalts and Asphalt Cements. Office of Public Roads. Paper, 7 x 10¼ in., 14 pages. U. S. Department of Agriculture.

Taaining for Municipal Service. Paper, 6 x 9 in.; 51 pages. New York, Bureau of Municipal Research, 261 Broadway.

Report on Hydraulic Data and Stream Gaging, 1914, Department of Barge Canal. Supplement to the Annual Report of the state engineer and surveyors, State of New York. By G. Edward Gibson, assistant engineer. Cloth, 6 x 9 in.; 367 pages. Albany, N. Y., Department of State Engineer, Barge Canal Office.

Some Engineering Problems of the Panama Canal in Their Relation to Geology and Topography. By Donald F. MacDonald. Bulletin 86, Bureau of Mines. Paper, 6 x 9 in.; 88 pages; illustrated. Washington, Government Printing Office.

Books Reviewed

Engineering as a Career

Edited by F. H. Newell, professor of civil engineering, University of Illinois, and C. E. Drayer, secretary, Cleveland Engineering Society. Cloth, 5 x 7½ in.; 214 pages. New York, D. Van Nostrand Company. $1 net.

This book, intended as a guide for teachers, parents and young men, meets a distinct need and yet falls curiously short of the mark. A collection of essays by twenty-two engineers and educators of national repute, it runs the scale from popularized pictures of some branches of the profession to accurate descriptions of the needs and requirements of others. It is interesting to note that several eminent men representing branches of the civil-engineering profession employ the worst English in the book, are most inclined to historical diffuseness and say the least of real meaning, while the men representing the newer branches of engineering, and one or two who have had experience as educators, have contributed essays that give a real guide to the qualifications and efforts necessary for success in the fields they describe. Is this because those in the newer divisions of engineering have had to develop their assistants from untrained material, and have found the problem of the natural fitness of others for their work a pressing every-day question? This is at least a suggestive conjecture. Certainly the primitive methods of selecting and promoting men in many large civil-engineering organizations would not be tolerated for a moment by the heads of the engineering forces employed by big chemical, mining or manufacturing companies.

As a whole, the book is well worth the effort to produce it, though a second effort might result in a much superior work. The chapters on Metallurgical Engineering, Electrical Engineering, Chemical Engineering, The Lure of Private Practice and Vocational Guidance are among the best, and are nearest the purpose of the book.

Reinforced Concrete Construction

Author, George A. Hool, S. B., associate professor of structural engineering, University of Wisconsin, assisted by Frank C. Thiessen, B. S., instructor in structural engineering, University of Wisconsin. Cloth, 6 x 9½ in.; 688 pages, 575 illustrations. New York, McGraw-Hill Book Company, Inc., $5.

Reviewed by F. H. Constant

Professor of Civil Engineering, Princeton University, Princeton.

This is the third of the well-known series by the same author. The original intention of including many different types of reinforced-concrete structures has not been adhered to, and the present volume is devoted almost exclusively to bridges, especially arches. Culverts, in spite of their prominence in the title, are allotted only 35 of the total 688 pages. Structurally, the book has eight parts and thirty-seven chapters. Qualitatively, the first quarter covers the theory and design of arch bridges, and the rest of the book is wholly descriptive.

Part 1 (Arch Bridges) comprises about one-half of the work. Two general methods for the analysis of the elastic arch are given. The first is the analytical one which is in most common use in this country and leads to the simple equations for H_c, M_c and V_c at the crown for loading, temperature and rib shortening. It is illustrated by the design of an earth-filled arch for arbitrarily fixed live load, and of an open-spandrel arch in which unit loads and influence lines are employed. Considerable care is given to presenting all of the matter used in the computation of these bridges in a systematic and tabular form in the "designing sheets." The author has relied perhaps too much upon the tables to tell their own story; a clear explanation in the text of some of the more difficult points would be appreciated by the average reader.

An example of an unsymmetrical arch is worked out in a similar manner in Chapter 6. The three equations of condition for the crown stresses are given without derivation and the treatment is too brief for so complicated a subject. Chapter 7 contains a more satisfactory short treatment of arches with elastic piers. Chapter 8, of 50 pages, completes the mathematical part of the book by giving the second method of arch analysis, using the ellipse of elasticity. It is taken largely from the paper by A. C. Janni, read before the Western Society of Engineers, Jan. 13, 1913. The method is almost wholly graphical and is a modification of the one given by J. Milan in "Concrete Arches" (translated by D. B. Steinmann), in which the origin of co-ordinates is located at the center of gravity of the elastic weights, and the ellipse of elasticity is applied to the arch as a whole. Mr. Janni, however, extends the ellipse-of-elasticity principle to the individual arch subdivisions as well, a more exact but perhaps unnecessary refinement.

The presentation is not as clear as it might be, and leaves much to be read between the lines. This is to be regretted because unfamiliar graphical processes always appear more complicated than they really are, and the author states that this one is rapidly and easily applied and predicts that it is likely to be in great favor with American engineers as soon as it becomes better known.

Whatever criticisms may be made concerning the analytical part of the book, the descriptive part (beginning with Chapter 9) containing 400 or 500 beautifully executed illustrations covering both American and European bridges, could hardly be improved, and makes this the leading descriptive work on concrete (especially arch) bridges in this country. The remainder of Part I covers details and the construction of arch bridges, three hinged arches, a very interesting and timely chapter on arch patents in which the salient features of the leading patents are outlined, and a chapter of about 70 pages consisting wholly of illustrations of typical designs of the various types of arch bridges.

Part II (about 60 pages) covers slab and girder bridges; also abundantly illustrated from current practice. Part III treats of culverts, touching upon culvert efficiency, pressures on pipes in ditches and the strength of pipes, summarized from the investigations made at the Iowa State College of Agricultural and Mechanical Arts, and at the Engineering Experiment Station at the University of Illinois. Box and arch culverts, with a theoretical treatment of the former, are also included.

Part IV, written by A. W. Ransome, is entitled "Notes on Construction Plant," and is a practical discussion of the methods of handling materials, and mixing and distributing concrete. Part V, written by Leslie H. Allen, gives several examples of typical estimates for bridges with cost data. Part VI, written by William J. Titus, on "The Artistic Design of Concrete Bridges," is one of the most interesting and valuable in the book. It analyzes in detail the esthetic elements of a concrete bridge and illustrates them by many photographs of American bridges, showing both good and bad design.

Part VII on "Construction in Detail," is written by Albert M. Wolf, and covers field details and methods adapted for several important structures, notably the Yardley Bridge, the Tunkhannock and Fort Worth viaducts, and various pile trestles and track elevation subways. The work closes with Part VIII (75 pages) written by Philip Aylett and P. J. Markmann, on European concrete bridges, containing an interesting discussion of art abroad and a comparison of American and European practice, especially in regard to the beauty, lightness and economy of the foreign structures. American engineers can undoubtedly profit by the more perfect art in Europe.

The chapter on hinged arch concrete bridges, with its illustrative details, is most valuable and emphasizes this important type of structure, although American engineers may not be ready to agree at once with the author in regard to the superiority of the three-hinged arch.

The book is essentially a work of reference. As such it will fill an important place in the field of concrete construction.

Materials of Construction

Author, G. B. Upton, assistant professor of experimental engineering, Sibley College, Cornell University. Cloth, 6 x 9 in.; 319 pages, 181 illustrations. New York, John Wiley & Sons, Inc. $2.50 net.

REVIEWED BY MELVIN L. ENGER

Assistant Professor of Mechanics and Hydraulics, University of Illinois.

This book was written for students taking the laboratory course in materials of construction at Sibley College. The title of the book is misleading, since most of it is given over to cast-iron and steel. There are two sketchy chapters on non-ferrous metals and alloys, and cement and cement testing. Timber is treated casually and wrought-iron is not mentioned. There are no collections of data concerning the properties of materials.

Part 1 is entitled "The Determination of the Properties of Materials." It includes a discussion of the internal structure of materials and action under load (tension, torsion, compression and combined loadings), impact tests, hardness tests, fatigue, corrosion, working stresses and factors of safety. Derivations are given of the torsion, flexure, horizontal shear, and combined-loading formulas. Better derivations may be found in many text books on the mechanics of materials.

There is included a new and very ingenious analysis for finding the actual shearing stress in the outer fibers of a shaft when they have been stressed beyond the yield point. A similar analysis is given for the actual stress in the outer fibers of a beam when they have been stressed beyond the yield point. Concerning these analyses the author makes the following optimistic statement: "The new method for torsion and transverse test analysis may clear up controversies concerning 'Guest's Law' or other laws for conditions of failure in combined loadings, and may make tests of ductile materials in direct shear unnecessary." No derivation is given of column formulas, but the Euler, J. B. Johnson, Ritter-Merriman and Rankine-Gordon formulas are discussed. The author concludes that the J. B. Johnson and the Euler formulas should be used. The straight-line formulas for columns are not mentioned, nor is it explained how stresses due to eccentric loadings may be calculated.

Part 2 is entitled "The Nature of Materials and Control of Their Properties." It includes a discussion of the nature and origin of the structure of alloys; the shaping of steel and the control of final properties during the shaping process; the effect of carbon on the properties of carbon steels, and effects of elements other than carbon; general theory of heat treatment and heat treatments of carbon steels; cast-irons; alloy steels; non-ferrous metals and alloys, and cement and cement testing.

The book is written in a dogmatic style, and many of the statements are open to criticism. For example, it is stated that "one of the reasons for the high factors of safety used in the design of masonry and concrete is that the factor of safety has to cover the error in strength due to using a cubic test piece." In another place it is stated that "live loads applied without shock (for example a rolling load crossing a bridge at a low speed) actually set up stresses twice as great as a dead load of the same weight." There are many who will question the statement that "the experimental work of Guest, Scoble, Hancock and others has now made it practically certain that the magnitude of the stress is the controlling factor, not the magnitude of the deformation."

Except in the last two chapters references are usually not given. Instead of referring the reader to the various yearbooks of the American Society for Testing Materials he is told that "Any one desiring to know what may be proper standards and specifications for any material, so far as standards have been adopted, may communicate with this society."

Having pointed out some of the faults of the book, it must be said that it contains much valuable matter treated in a stimulating manner. Throughout the book boldface type is used to emphasize important statements and conclusions. It is a book which will be read with profit by all interested in the subject.

Letters to the Editor

Comment on matters of interest to engineers and contractors will be welcomed

Why Is Registration in Civil Engineering Decreasing?

Sir: Without taking space for discussion or modification I wish to say that I am heartily in accord with the sentiments expressed by Professor Swain in his letter published in the Engineering Record of Feb. 26, 1916.

MALVERD A. HOWE.

Terre Haute, Ind.

Director of Departments of Architecture and Civil Engineering, Rose Polytechnic Institute.

Topographic Survey of Rough Wooded Area

Sir: In the Engineering Record of March 4, under the caption of "Unusual Methods Simplify Topographic Survey of Rough Wooded Area" the authors of that paper describe what they call the *usual* method of making plane table topographic surveys briefly as follows:

"(2) the plane-table method, in which horizontal control is provided by a large number of plane-table stations established by transit and tape traverses, the contours being directly located either by using the plane-table alidade as a level or (more commonly if the ground is uneven) by using engineers' level in conjunction with the plane-table."

Far from being the *usual* method of making topographic surveys with a plane table, the method thus briefly described is a most *unusual* one, which, because of its lack of flexibility, produces accurate maps only at unusually high unit costs. A very conspicuous example of this is the topographic survey of the District of Columbia made some decades ago by one of the federal surveyors. In making this survey the contours were located on the ground with a wye level and were then mapped with the plane table. The cost of this survey was said to be somewhere near $5 per acre.

Because the economic and in all ways most advantageous use of the plane table requires considerable skill, which can be obtained only by steady experience of some length, few engineers outside of the government bureaus are adept in the most usual methods of making a topographic survey with this instrument. Briefly they may be described as follows:

The horizontal control may consist of traverse stations determined by the usual methods or of triangulation stations; the vertical control consisting of suitably placed bench marks. The horizontal position of the plane table is obtained in any of a number of ways, as by setting directly over a known station, by a graphic solution of the three-point problem, by use of stadia in carrying a plane-table traverse from a known station, by resection, etc. It is possible that the foregoing statement in no wise differs from what the authors intended to convey when writing the statement quoted above.

The point which I am anxious to make comes in when considering the latter part of the quoted statement. In the ordinary use of the plane table a height of instrument is obtained from a known station either by direct leveling, using the alidade as an ordinary level, or by reading the angle on the vertical arc of the alidade and making computations therefrom. It is this use of the vertical arc which has apparently been overlooked by the authors of the article above referred to and which makes the plane table the most flexible of mapping instruments, rendering possible with it surveys of most difficult regions at an economy of time and money and of any desired accuracy (even the highest).

In this manipulation of the plane table no effort is made to get the rod on the even contour, but rod readings are taken at all salient points of the topography and the contours interpolated therefrom. In this way every break in the ground, every change of grade, each small change in the conformation of the ground is plotted. Rod stations are made where they will best serve to obtain and portray the true configuration of the ground. In broken ground, along banks of ravines, where ravines "head up," and in hundreds of other places where the topography is intricate in detail, these rod stations will come close together, while on the more uniform topographic figures the number of rod stations per unit of area will be considerably diminished. Using this method the topographer can work his way through the most difficult country and secure a map of any desired accuracy at an economy over any other known method.

To make good this last statement the topographer must be an experienced plane-table man, and it is the opinion of those who have had to do with the training of such men that at least two years of steady experience is required before the plane-table topographer can render expert service. For this reason many engineers who are really unfamiliar with the best use of the plane table, judge it by limited performances of inexperienced men and give it a "black eye." Acquaintance with plane-table methods and results as practised and obtained by experts will always convert an engineer into an ardent advocate thereof.

As a splendid example of plane-table work of high accuracy and great economy I might cite the Topographic Survey of 1912 of the City of Cincinnati, where something like 100 sq. miles of topography were mapped on the same scale and contour interval as the survey of the District of Columbia above referred to but at a cost of less than $1 per acre. The relief of the territory mapped is somewhere near 500 ft., much of it very steep, necessitating that the vertical circles be used the greater part of the time.

In all the federal bureaus which have extensive topographic surveys to make (mostly of wild areas), the plane table is the universal mapping instrument. It deserves greater recognition by private engineers who have only occasional need for topographic surveys, and it is wholly with the idea of overcoming any adverse effect on the deserved progress which the plane table is making toward being utilized in private topographic surveys that the statement quoted at the beginning of this letter is challenged.

Hugh C. Mitchell.
Geodetic Engineer.

Washington, D. C.

[Copy of this letter was submitted to Messrs. Davis and Rayner, authors of the article in question. Their reply, signed by Mr. Davis follows.—Editor.]

Sir: I am in receipt of your letter of March 10, with the copy of a letter from Hugh C. Mitchell, challenging a statement in the article by Mr. Rayner and myself in the issue of March 4.

A careful study of Mr. Mitchell's letter seems to indicate either that he did not read the article understandingly, that he is confusing large-scale work with intermediate-scale work, or that he has not put much thought on dependence of methods on the scale, contour interval, and topographic conditions.

Having recited the conditions (scale: 50 ft. = 1 in. and contour interval, 2 ft.) the article states, "Perhaps the two most common methods on *large-scale* surveys are:"

It is generally conceded among topographic engineers that, for the scale and contour interval stated, unless the topography is very regular, the contours must be directly located if the accuracy of the map is to be consistent with the scale. Of course, it is at once apparent that the vertical angle and stadia method, which Mr. Mitchell goes to such length to describe, and with which we had supposed nearly every surveyor was familiar, can not be used to locate contours directly.

A varied experience in topographic work from the small scales and large contour intervals used by the Geological Survey to the scale of 1 in. = 40 ft. and 1-ft. contour interval used by the landscape architect, from mountainous and forested country to the prairies of the Middle West, leads us to believe that there are about as many "best methods" as there are combinations of conditions, or in other words that the problem of providing most efficient methods and best form of organization is one in which the scale and contour interval as well as the character of the topography and the state of cultivation require careful consideration. The point that Mr. Mitchell fails to grasp and the point which makes his letter misleading is that, while the method that he describes is the most common plane-table method for the intermediate scale and contour interval, say 400 ft. = 1 in. and 5-ft. interval, it is not a general plane-table method that is to be used with every scale and every contour interval and certainly could not have been rightly used with conditions of topography, scale, and contour interval stated in the article.

THESE WILLOW ROOTS BURST 6-INCH TILE DRAIN SEWER PIPE

That the method briefly outlined in the article as one of the two common methods is, as Mr. Mitchell states, "a most unusual one" is, we hope, true for *intermediate-* or *small-scale* surveys. The District of Columbia survey is a good example of the expense of needless refinements; but that the method is not unusual for large-scale surveys will, I venture to say, be pretty clearly established if one consults the present-day literature on topographic surveying.

Aside from its failure to take cognizance of the effects of varying conditions, I should like to echo the general sentiments of the letter; though I am inclined to think, from the number of state and municipal surveys on which the plane table has been the chief mapping instrument in the past few years, that there are a considerable number of expert plane-table operators who are not connected with the federal surveys and that the profession in general is not as ignorant of the possibilities of the instrument on intermediate- and small-scale work as the letter would lead one to believe. A fact that is not so generally realized, except perhaps by landscape architects, is that the plane table is equally well adapted to large-scale work, provided horizontal and vertical control is properly established and proper methods of procedure are employed. Although in general it may be said, regardless of the scale, that with experienced topographers the plane table is the most efficient of mapping instruments, the statement of the letter that "the topographer can work his way through the most difficult country and secure a map of any desired accuracy at an economy over any other known method," is to say the least a bold statement and one which I think would not prove to be true of intermediate- or large-scale surveys in heavily wooded country, of surveys made during the extreme cold of winter, or of line surveys which require the topography of only a very narrow strip. And by way of further emphasizing the impracticability of the plane table under these conditions there comes to mind a winter on railroad preliminary in the dense forests of Canada with 6 ft. of snow on the level, the temperature occasionally dropping to 60 deg. below zero, and the trees dropping their burdens of snow at the slightest disturbance.

R. E. Davis.

Urbana, Ill.

Willow Roots Crack Six-Inch Tile Sewer Pipe

Sir: The accompanying picture shows the roots of a willow tree taken from one section of a 6-in. drain tile. When first taken out of the tile it was exactly cylindrical. The specimen from which this piece was cut was 285 ft. long, ranging in diameter from large enough to burst open a 6-in. tile down to a single root the size of a thread, which is the same root as the largest one projecting from the specimen shown in the picture.

The roots had broken the tile open at the inlet of the tile and had diminished in size and number toward the outlet, which would indicate that they would not enter a tile at its outlet but will do so readily and quickly at its inlet. In this particular case the willow trees were on the opposite side of the road from the tile, but near the inlet. We have other cases where willow trees are near the outlet, but have witnessed no difficulties as shown in this case.

This tile was laid about three years ago and is an example of what may happen to an ordinary drain tile when placed in the neighborhood of willow trees.

A. R. Hebenstreit,
Tama County Engineer.

Toledo, Ohio.

Qualifications for Engineering Work

Sir: The writer has been asked on different occasions to give the Carnegie Foundation his views upon the qualifications for engineering work.

He notes with interest the editorial in your issue of March 11, based upon the last circular and card sent out by the foundation. The intimation is that the six qualifications with broad subordinate factors shall each be valued at some figure as shall make a gross percentage of 100.

Your article very properly calls attention to the fact that different qualifications, or a different order of qualification may be required for different classes of work.

The writer wishes to emphasize one feature that has apparently not been brought out, that the item "character" could not be subdivided as a factor to be combined with judgment, efficiency, knowledge, etc., in a gross percentage, but should stand at 100 per cent itself.

It has been the writer's experience in dealing with a large number of engineers that their "character" has as a rule ranked high. Responsibility, resourcefulness, and initiative are valuable elements in the make-up of an engineer, but integrity and so-called "character" must be required at as nearly 100 per cent as possible if success is to be achieved.

Louis L. Tribus.

New York.

HINTS FOR THE CONTRACTOR

Details Which Save Time and Labor on Construction Work

Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

[*Contributions to this section are solicited, and if found available will be paid for. They must be* SHORT, *and should be accompanied, if possible, by photographs or sketches.*—EDITOR.]

Heater Melts Snow to Finish Asphalt Paving Job

BY J. T. CHILD

Winnetka, Ill.

THE ROLLER heater shown in the accompanying photographs saved the day last December when an early snowstorm caught a Chicago paving contractor with 5400 sq. yd. of asphalt penetration pavement to finish on a $180,000 contract at Glencoe, Ill. The heater melted the snow and warmed the road surface with a hot blast at high temperature, and made possible the satisfactory completion of the asphalt work at a comparatively low cost.

←

SPECIAL HEATER MELTING SNOW AND WARMING ROAD SURFACE TO ALLOW COMPLETION OF ASPHALT PAVEMENT UNDER WINTER CONDITIONS

The 2 in. of crushed stone for the wearing surface was already in place on the concrete base when the snow came. It was decided to make an effort to remove the snow, heat the stone and finish the pouring before winter set in. For this purpose gasoline, hand-propelled road heaters were thought of, but proved to be too costly and slow for this particular work. However, the contractor set a crew to work which removed the heavy part of the snow with brooms and shovels at a cost of $17.

Then a Barbour heater, with a patching hood, was hired at $20 a day. The engineer received $6.50 and his helper $3.50 a day, including carfare. Pocahontas coal at $6.25 per ton, delivered, was used and about half a ton a day was necessary for this work. The heater consisted of an 8-ton tandem roller, rigged up with a special flue leading from the boiler over the top and down to a 5 x 7-ft. hood which could be lowered till flush with the pavement. The flue gases were blown through, by a forced draft, to the hood, where they were disseminated over the roadway at a high temperature. This melted the snow and frost and heated the stone, and the asphalt was then poured immediately before the stone became cold. Heated chips were used to fill the voids in the first course and also on the top dressing.

It took four days to melt the snow and complete the work on this 5400 sq. yd. The extra cost for the snow removal alone was $150 or approximately 3 cents a square yard. The finished pavement was more costly also because of the time lost in working so close behind the heater and the expense of heating the chips used. The actual pouring was done at about half speed, 1500 sq. yd. a day being done as against 3000 sq. yd. in warmer weather.

After the snow was melted, the heater followed up the recently finished pavement and sweated up any spots which were not in good condition. These places were repoured and rerolled, thus making a better job than would have been otherwise possible. In spite of the extra effort and expense, the heater more than proved its value for this emergency work as it saved the much greater expense of leaving the pavement unfinished and coming back to complete it in the spring. At present, three months after the work was done, the pavement is in excellent condition and shows no sign of raveling, nor is there any indication that it was done under different weather conditions from the main part of the job. John A. McGarry & Co., the firm which used this method, carried out the contract for the entire 63,000 sq. yd. of paving.

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MELTING ROUGH SPOTS IN PAVEMENT LAID AFTER SNOW, WHICH IS SAID TO BE EQUAL TO THAT BUILT IN OPEN WEATHER

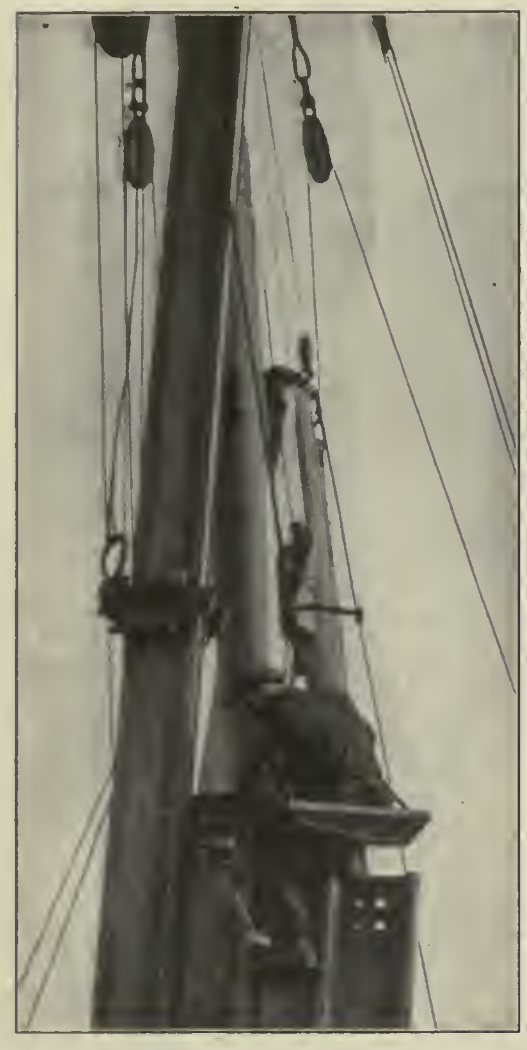
Barge Replaces Trestle in Making Rock Fills at Halifax

BY USING a dumping bridge supported between the end of the fill and a large scow by an A-frame boom, the difficulties of building a trestle on rock bottom and maintaining it while making a rock fill have been avoided in constructing the Halifax ocean terminals in Nova Scotia. The stringers of the bridge are of timber, and are suspended from the A-frame at the center of the bridge on the same principle as is used in swinging the gang plank of the familiar river steamer. Two 18-yd. side dump cars at a time can be dumped from the bridge into clear water between the barge and the end of the fill. In order to save switching, the track extends the full length of the barge to accommodate four cars that have been dumped while the fifth and sixth are dumping. Thus the only loss over operation on a trestle is that the whole train cannot be dumped simultaneously. This is more than made up by saving the time and expense of building and maintaining a trestle on rock bottom in 30 to 60 ft. of water.

The fill for the breakwater has been finished, that for the center of pier B is now being completed, and that for the center of pier A will be made in this way. All three are long, narrow fills built out from the end. Material from a heavy cut on the railroad approaching the terminal, for which the Cook Construction Company and Wheaton Brothers are contractors, is being used.

Clamp Handles Long Steel Sheet Piles in Safety

THE clamp shown in use in the accompanying photograph has replaced chains in handling steel sheet piles being driven in the open trench at the Staten Island end of the Narrows siphon in New York City by the Merritt & Chapman Derrick & Wrecking Co. Where the derrick boom is not sufficiently long to raise sheet piles by the upper end high enough to thread them, it is a common sight to see chains and wood blocks used to hitch to the pile a little above the center. In handling long, heavy piles on such a hitch, there is danger of the hitch loosening before the pile is fairly threaded to the one in which it is being entered, which would result in dropping the pile. The clamp shown removes this danger, as its grip on the pile is independent of the tension on the derrick line. It consists essentially of two wooden halves, reinforced with steel straps, which are cut out to fit around the pile, and held together at each end by a through bolt. To save carrying up wrenches each time to loosen the clamp, the heads of the bolts are countersunk and chocked in one of the wooden halves, and the threaded ends project through holes in the other half of the clamp.



CLAMP HOLDS PILE SECTIONS

The nuts for these bolts have an 8-in. wrench handle welded to them. It is necessary to take both of the nuts off to loosen the clamp, but its halves are shackled at one end to the pile line, so that there is no danger of dropping them into the water when the clamp is taken off. Captain Tooker is in charge of the construction of the trench for the contractors under Ralph E. Chapman.

Shield Moves Itself to Place to Start New Tunnel

TWO TUNNEL shields weighing 75 tons apiece recently moved themselves by two of their own jacks more than 300 feet across the open bottom of a shaft in Willoughby Street, Brooklyn, N. Y. The section of the New York Municipal Lines connecting the Fourth Avenue subway with the Clark Street tubes is being driven by the shield method on account of its depth below the street. Two shields were set up and driven west from the Manhattan bridge plaza, the north one being timed to reach the large shaft at Lawerance Street first. In constructing this shaft, two lines of posts and the crossbracing were omitted for a height of 20 ft. to clear the shields. The timbering above this gallery was knee-braced and trussed. The opening was left on the line of the south tube, and was used to pass both shields. The first shield was jacked over sidewise onto a road of 12 x 12-in. timbers laid crosswise in this passage. It was carried in a timber cradle on greased skids. The two bottom jacks were used to shove it along. As the push required was far less than in shoving the shield in solid ground, kickers braced into the ground behind were used for the jacks to push against. Blocks were inserted after each move, and the kickers moved ahead only at intervals. At the far end of its ride in the open each shield was lined up in advance of an 8-ft. thick concrete block set below the shaft floor. Between these and each shield the lower plates of the first lining ring, and an increasing number of plates of each succeeding ring were set until a full circle was completed in the last ring within the tail of the shield. In this way the shield was able to use all its jacks in taking the first shove into the new heading.

It is thought that this is the first time a large tunnel shield has ever been moved from one tunnel heading to another without taking it down and re-erecting it. To move the first shield 30 ft. sideways and 325 ft. lengthways took only two days with a much smaller crew than could have dismantled and re-erected the shield in a minimum time of three weeks.

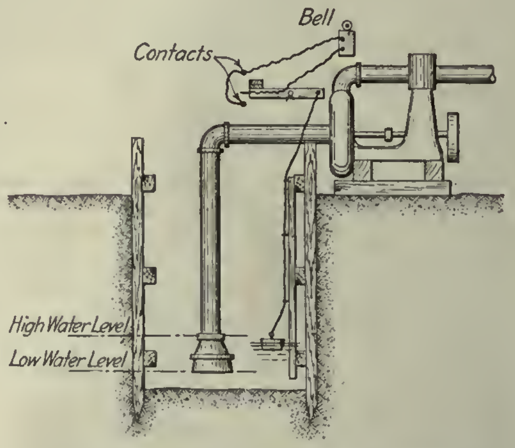
These tunnels are being driven for the Public Service Commission, Alfred Craven, chief engineer, Robert Ridgway, engineer of subway construction, and George S. Rice, engineer of the division including the work, by the Flinn-O'Rourke Company, Inc., of which George H. Flinn is president and Major John F. O'Rourke vice-president and chief engineer. Michael L. Quinn is general superintendent for the contractor.

Water Level in Sump Regulated by Electric Bell

By H. S. CARPENTER
Cobleskill, N. Y.

AN ELECTRIC alarm bell, the working of which is shown in the accompanying sketch, was used successfully by the writer to hold the water level constant at night in the sump of a centrifugal pump used to unwater the foundation in building a pumping station.

To the lighter end of an unbalanced lever hinged near the middle was attached a line at the lower end of which was a float resting on the surface of the water in the sump. The weighted end of the lever closed the electric bell circuit when the contact on its end touched either the upper or the lower contact points shown on the diagram. As the water fell the weight of the float raised the lever contact till it rang the bell by the upper contact. As soon as this happened the pump runner would close the throttle valve somewhat and slow down the pump. The water level in the sump would then rise, carrying the float with it, and the weighted end of the lever would sink till it touched the lower contact and again rang the bell. At this signal the pump runner would give the engine a little more steam and begin to lower the water again. In this way a centrifugal pump with an 8-in. discharge was able to handle a flow of 1800 gal. per min. and keep the water level constant at night without having to shut down the pump to prime it and thus interfere with work in the hole.



BELL SIGNALS WATER LEVEL IN SUMP

Before installing the bell there was trouble both day and night with the pump, but after the bell was put in use there was no further difficulty in keeping the water down.

Testing Tractors for Army Guns

The United States Army is conducting a series of tests at Fort Sill, Okla., to determine the efficiency of motor trucks and tractors in hauling 4.6-in. guns and 6-in. howitzer batteries as compared with the animal equipment now used.

HEAVY SHIELD JACKED IN TWO DAYS 325 FEET TO POSITION FOR STARTING NEW BORE

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

Paris, Tex., Almost Completely Destroyed by Fire

Entire Business Section and Half of Residence Ruined—Reinforced-Concrete Buildings Stand Terrific Tests

A fire on Tuesday, March 21, almost entirely destroyed the city of Paris, Tex., the population of which is about 18,000 persons. The burned area, estimated by the state fire marshal to be 264 acres, covered nearly 150 city blocks and composed the business section and almost half of the residential portion of the city. According to O. H. Lang, of the firm of Lang & Mitchell, architects and structural engineers, of Dallas, Tex., who sent the information to the Engineering Record, the fire brought to light some interesting subjects in connection with insurance building requirements and fire fighting methods when concrete buildings are being protected from the blaze.

1440 Buildings Destroyed

A high wind whipped the blaze into an immense conflagration, and, when the six-story Gibraltar Hotel caught fire, the flames are said to have leaped several hundred feet into the air, and by the time the fire had been put under control 1440 buildings had been destroyed, among which were 704 residences, 117 brick buildings, 113 churches, 9 public buildings and a number of less important structures.

Three reinforced-concrete buildings were the only ones to come through practically unharmed, the concrete frame of the Gibraltar Hotel was damaged only slightly and the closed elevator and stair shafts with the overhead machinery were found to be in perfect working order.

The gypsum-block partitions and wire-glass and metal windows, and reinforced-concrete work were practically unharmed by the flames while partitions, windows and buildings of materials other than these were practically destroyed. One concrete building was put to an additional test when dynamite was used to destroy surrounding buildings.

Despite the intense heat to which it had been subjected, the refrigerator system in the Gibraltar Hotel was in such good condition that ice water was available as soon as the hotel could be entered and the temperature in the ice boxes was only slightly above normal.

Fight to Prevent Pollution of New York City's Water Supply

Bills providing for the removal of the Mohansic State Hospital for the Insane and the New York State Training School for Boys at Yorktown Heights from the Croton watershed were defeated in the Senate and Assembly March 22, by votes of 23 to 24 and 65 to 71. Much public interest has been aroused in this attempt to defeat the present plans for turning the effluent from the sewage treatment plant into Mohansic Lake which is connected with Croton Lake. Governor Whitman is said to have threatened to call an extra session of the Legislature to force the abandonment of the institutions which threaten New York City's water supply.

The Real Estate Association of the State of New York has appointed a pollution committee to co-operate with the Merchants' Association in effecting the removal of the two institutions from the Croton watershed.

Editorial mention was given this subject on page 372 of the Engineering Record for Sept. 25, 1915, and a similar situation was discussed on page 594 of the Nov. 30, 1912, number.

American Railway Engineering Association Holds Meeting in Chicago

Clearance Diagram Furnishes Main Subject for Debate at Seventeenth Annual Convention—15-Foot Clearance Adopted

The clearance diagram, 16 ft. wide, proposed by the committee on rules and organization at the seventeenth annual convention of the American Railway Engineering Association in Chicago, last week, precipitated the main debate of the convention, a discussion which occupied an entire three-hour afternoon session. The diagram ultimately adopted is a compromise between the 16 ft. proposed by the committee and the 14 ft. adopted by the society several years ago. The new diagram is presented on page 446. Perhaps the next most interesting discussion was at the Tuesday evening session, when Robert W. Hunt and C. W. Gennet, Jr., presented their paper on "The Nick and Break Test for Steel Rails." In general the discussion was light, comparatively few recommendations being put forth by the committees for adoption by the association, and several of those recommendations being referred back to the committees for further consideration. The attendance, the financial status of the society, the president's address and the officers elected for the coming year were briefly reported in last week's issue.

Discussion of Committee Reports

Ballast.—Objection was raised to the classification of ballast offered, in which broken slag (not granulated) was placed second to stone, and ahead of gravel. G. J. Ray of the Delaware, Lackawanna & Western stated that his company was using washed gravel under main tracks where he would not consider the substitution of slag. His motion that the matter be referred back to the committee was seconded by Charles S. Churchill of the Norfolk & Western, who held that the difficulty with the committee's report lay in the lack of descriptive matter pertaining to the different kinds of ballast. He held that certain slag was superior to gravel, but that other slag was inferior. The motion prevailed.

There was some discussion of ballasting by contract. R. H. Ford of the Rock Island, who was familiar with the ballasting by contract done by the Missouri Pacific some years ago, and referred to in the committee's report, stated that the results had been entirely satisfactory, there being no trouble from delayed trains, and the work being done better and more cheaply than by company forces. He conceded freely that the contract method was desirable only under certain conditions.

Ties.—W. H. Courtenay of the Louisville & Nashville, commenting on the new specifications for crossties in which longleaf strict heart yellow pine was excepted from the wood to be treated, stated that in his experience such pine, although creosote would admittedly penetrate it only about ¼ in., would nevertheless last at least three times as long when so treated. J. L. Campbell of the El Paso & Southwestern, also emphasized the value of even shallow penetration. The revised specifications for crossties and the proposed specifications for switch ties were adopted substantially as offered.

Track.—In presenting for adoption the typical layouts of Nos. 8, 11 and 16 double crossovers and double slip crossings, J. B. Jenkins of the Baltimore & Ohio, chairman of the committee on track, pointed out the lack of symmetry of these layouts, and asserted that this was necessary for the proper protection of the frogs. He also asked for the inclusion in the plans of several explanatory notes, and these were adopted with the plans.

There was some discussion of the guard rail offered, objection being raised by C. E. Lindsay of the New York Central to the use of filler

Repointing the Face of the Woolworth Building

Hundreds of feet above the ordinary skyscrapers in New York men are at work repointing many of the terra-cotta blocks with which the Woolworth building is faced. The whole surface will be gone over, the joints being cut out with a channeler and a considerable tonnage of new blocks reset to replace those broken and chipped due to the expansion and contraction, and also to freezing of the moisture which has seeped into the joints. As the original mortar was not of an elastic nature it has worked out in places under the vibration. So as not to bruise or break away the enameled surface, the blow of the electric channeler used can be regulated, when the hardness of the mortar varies, by means of a variable resistance placed in the feed wires, which are attached to the ordinary electric-light socket. The cracks vary from ¼ to 1 in. in width, and must be cut back ¾ to 1 in. The photograph shows men at work channeling out the mortar on one of the small towers. The scaffold is carefully screened to prevent pieces of mortar falling to the street. Five operators equipped with Electro-Magnetic Tool Company electric hammers are doing the work for the Atlantic Terra Cotta Company.

CUTTING OUT JOINTS FOR REPOINTING ON TOWER OF WOOLWORTH BUILDING blocks bolted to the main rail rather than rail braces to hold the ends of the guard rail. H. T. Porter of the Bessemer & Lake Erie, member of the committee, pointed out that these blocks had not been found to weaken the main rail as Mr. Lindsay thought, and that they were important as footguards. Mr. Campbell urged the provision for an adjustable filler block at the center of the guard rail to allow the wear to be taken up, and this suggestion was incorporated in the vote to adopt the recommended rail. The definition and specification for frog guard rails were adopted, as were the changes in the specifications for ordinary spikes. The proposed screw spike was withdrawn when Hunter McDonald of the Nashville, Chattanooga & St. Louis pointed out that the small square head would not stand brine drippings. The designs for cut spikes and for double switch lugs were withdrawn by the committee.

Iron and Steel Structures.—Little discussion preceded the adoption of the specifications proposed for the protection of traffic at movable bridges. In connection with the subject of turntable design, one of the assignments of the committee, A. F. Robinson of the Santa Fé gave a very favorable account of the performance of three 100-ft. turntables installed on his line. He pointed out, however, that they were not foolproof, and must be designed and handled carefully.

Masonry.—Mr. Churchill objected to the conclusion regarding the appearance, wearing qualities and cost of various methods of surface finish of concrete that coating with a wash of cement was not to be recommended. He held that it had worked very satisfactorily with brick, and he thought it was equally applicable to concrete. The consensus of opinion seemed to be against him, however. The association approved the general findings of the committee on this subject, but it was pointed out that the specifications contained much matter that should be presented elsewhere as information, and the whole subject was referred back to the committee for rearrangement.

There was considerable debate on the advisability of using, in reinforced-concrete construction, steel reinforcing bars rolled from old steel rails. T. L. Condron of the committee asserted that he was unable to see any objection to this method, as he held that there was no structural change in the old rail. The general opinion, however, seemed to be that proof is lacking, that there is no structural change, and that the railroads cannot afford to take the chance. At the suggestion of Mr. Campbell that the association was not qualified to answer the committee's questions on the subject, it was decided that the committee would have to answer the questions for itself.

Signs, Fences and Crossings.—There was considerable debate over the designs submitted for track construction at street crossings and in paved streets. E. A. Frink of the Seaboard Air Line summed up the sense of the convention that the committee had not gone deeply enough into the subject and that more designs, to meet all conditions, should be submitted. The subject was, therefore, referred back to the committee.

Rules and Organization.—G. D. Brooke of the Baltimore & Ohio, chairman of the committee on rules and organization, stated that the committee had been definitely asked by the American Railway Association to recommend clearances to specific structures as it had done, and had been urged to hurry its report as much as possible. The specific clearances it proposed were shown graphically by lantern slides.

In the lengthy discussion that followed there were those who thought the association should not recommend any clearance diagram; others who thought the matter should should be referred back to the committee for further study; still others who thought the association should decide the matter and decide it at that meeting, in view of the activities of legislative bodies. Of the latter class there were various advocates of 14, 15 and 16 ft. G. W. Kittredge of the New York Central applied himself to the protection of the special clearance diagram for third rail worked out by the committee on electricity.

Mr. Courtenay, contending that the clearances proposed were excessive and would lead to legislation that would affect present construction, moved that the attempt to establish a clearance diagram be abandoned. This motion was overwhelmingly defeated. Mr. Ford then moved that the matter be referred back to the committee, with instructions that it confer with the committee on electricity and with others concerned. Mr. Kittredge pointed out that time was valuable, mentioning that a congressional bill now pending stipulates a free space of not less than 36 in. horizontally between equipment and permanent structures. Mr. Brooke pointed out that some states have already adopted clearance diagrams. A. J. Himes of the New York, Chicago & St. Louis, member of the committee, urged that the association pass upon the question at once, pointing out that legislation was pending and that the association should lead the way, and not follow. Mr. Churchill added that the association should act on the matter because the American Railway Association had requested it to. The Ford motion was then put to a vote and lost.

Prefatory to the determination of the side clearance, which was admitted to be the crux of the matter, Mr. Kittredge argued strenuously for the rejection of any diagram that would clash with the diagram worked out by the committee on electricity and adopted by the association to provide for third rail along electrified lines. While some held that the diagram for which Mr. Kittredge was contending was a special diagram not applicable in many cases, and that the simpler form proposed by the committee on rules and organization should be used for general purposes, Mr. Kittredge's motion prevailed, that for the first 2 ft. above top of rail the electricity committee's diagram be substituted for that proposed by the committee on rules and organization, and that the two diagrams be connected by the necessary horizontal lines at the elevation of 2 ft.

W. C. Cushing of the Pennsylvania Lines West then moved that a side clearance of 7 ft. from center of track be adopted. A. S. Baldwin opposed this motion. He stated that the association had two alternatives, the one being to adopt a narrow clearance and try to hold legislation to it, with the danger that public sentiment would condemn such clearance as unsafe and go to the opposite extreme; the other being to adopt a more liberal view which would be more likely to hold future legislation. Mr. Cushing conceded that he, too, desired to point out the safe way to the public, but insisted that there was no proof that 7 ft. was not safe. His motion, however, was voted down.

Mr. Lindsay then moved that a side clearance of 7½ ft. or a total width of 15 ft. on tangent be adopted from a point 4 ft. up from top of rail to a point 16½ ft. above base of rail. This motion was immediately put to a vote, which was so close that it had to be determined by a rising vote. It carried by a vote of 84 to 78.

As to the vertical clearances, the logic of a comment offered by J. G. Sullivan of the Canadian Pacific was seen by all, that the adoption of a clearance measured from top of rail would make any construction illegal if the rail were replaced by one a little higher. The vertical clearance was, therefore, changed to read 22 ft. 6 in. from base of rail.

Aside from this it was voted that the recommendations pertaining to specific structures should be revised to conform to the new diagram and that in the exceptions where the clearance diagram would not apply, which were adopted, new work be substituted for reconstruction work.

Other Committees.—The recommendations of the committee on signals and interlocking and on grading of lumber were adopted with little comment. There was some debate over the revision of the bond clause of the general agreement form, but this and the other revisions proposed were adopted without change. The committee on rail withdrew its recommendations and asked that they be received as information. It was ruled that the findings of the committee on buildings had not been before the association long enough to be passed upon, and they were referred back to the committee for further consideration. While the committee on stresses in track made no recommendations, Prof. A. N. Talbot of the University of Illinois, chairman of the committee, gave some interesting information regarding facts that the tests had already brought out. Most important of these was that the track rail cannot be treated as a girder supported on the ties, but rather the upward pressure of the ties must be considered the load and the axle loads the points of support. The bending moment in the rail directly over a tie has been found to be nearly as great in some cases as between ties.

Evening Session

At the evening session Tuesday, Robert W. Hunt and C. W. Gennet, Jr., gave an illustrated paper on "The Nick and Break Test for Rails." Their main conclusions were that while this method was not infallible, it was more dependable than the A. R. E. A. specifications, and at the same time was more fair to the manufacturer in that it resulted in a much smaller total of rejections. J. G. Sullivan and J. M. R. Fairbairn of the Canadian Pacific, A. S. Baldwin of the Illinois Central and C. A. Morse of the Rock Island, three roads that have bought rail under this test, all spoke favorably of the results obtained. Others thought that while the principle of testing every ingot was good, inspectors in general would not be able to determine the segregation visually.

At the same session Earl Stimson of the Baltimore & Ohio gave an illustrated talk on the equivalent mileage maintenance system on which he has been working for several years. In the discussion that followed it appeared that many doubted the ability of the average section foreman to keep the necessary records properly, but Mr. Stimson thought that the fact that the Baltimore & Ohio was about to extend the system to its whole main line was sufficient proof of its success.

Banquet and Exhibit

The annual banquet was held Wednesday evening. The program was long but interesting.

The National Railway Appliances Association held its usual exhibit during the week at the Coliseum. Among the unusual exhibits might be mentioned that of C. F. Massey & Company, manufacturers of concrete structures, who displayed a full-sized railroad shelter, a cattle pass consisting of a section of 7-ft. reinforced-concrete pipe, and several reinforced-concrete signs; and that of the Miller Train Control Company of Staunton, Va., and Danville, Ill., who gave a visual demonstration of their system by means of a full-size engine cab, an installation therein of the control apparatus and a working semaphore ahead to indicate the condition of the line.

Chicago Engineers Plan to Have Military Lectures

Sixteen engineers, representing various engineering societies in Chicago, have formed a joint committee on military engineering. The purpose is to co-operate with and further the interests of the engineer company of the Illinois National Guard, the proposed military training camp at Fort Benjamin Harrison and such military measures relating to reserve corps of engineers as Congress may pass. To arouse interest on military matters among engineers a course of lectures will be given similar to those delivered in New York. It is planned to have Col. W. V. Jackson open the series about April 20.

Steel Highway Bridge in Johnstown Fails Under Load

Badly Corroded Main Members of Pony Trusses Believed to Have Caused Failure Under Full Load

The steel bridge spanning the Conemaugh River at Maple Avenue, Johnstown, Pa., collapsed March 21 at 5.30 p. m., under the combined weight of six trolley cars and a crowd of about 500 workmen from the local plant of the Atlantic Refining Company. About half the men had boarded the cars, while the remainder were crossing the bridge on foot. Over a score were injured, none seriously.

According to reports the failure was gradual. First there was a loud crack, then another, followed by less violent reports of breaking steel and cracking timbers. The bridge dropped suddenly a foot or more and then fell to the bottom of the river, a distance of 12 to 15 ft. The depth of the water at this point was not over 3 ft. at the time. The cars remained upright and the trusses, though bent out of line, did not fall on the cars or pedestrians. The cars were standing close together, and when the bridge went down were wedged into the shape of a broad V, the position in which the bridge remained after it fell, as seen in the photograph.

This pony Warren-truss skew bridge over the Conemaugh was built twenty years ago by the Edge Moor Bridge Works, according to its own plans and specifications at a cost of $9,500. The span between the two abutments is 150 ft. The steel was badly corroded, and rust had almost eaten through parts of some of the main chords. The top and bottom chords of the east truss broke in two near the Franklin end of the bridge, while on the western side the chords parted in the center of the span.

Preliminary plans for the new $200,000 concrete bridge drawn by A. P. Curry, of Franklin Borough, by a curious coincidence, were mailed to the Water Supply Commission a few hours before the Maple Avenue bridge collapsed. The new structure will be 1000 ft. long, and cross the river at an angle near the location of the wrecked bridge.

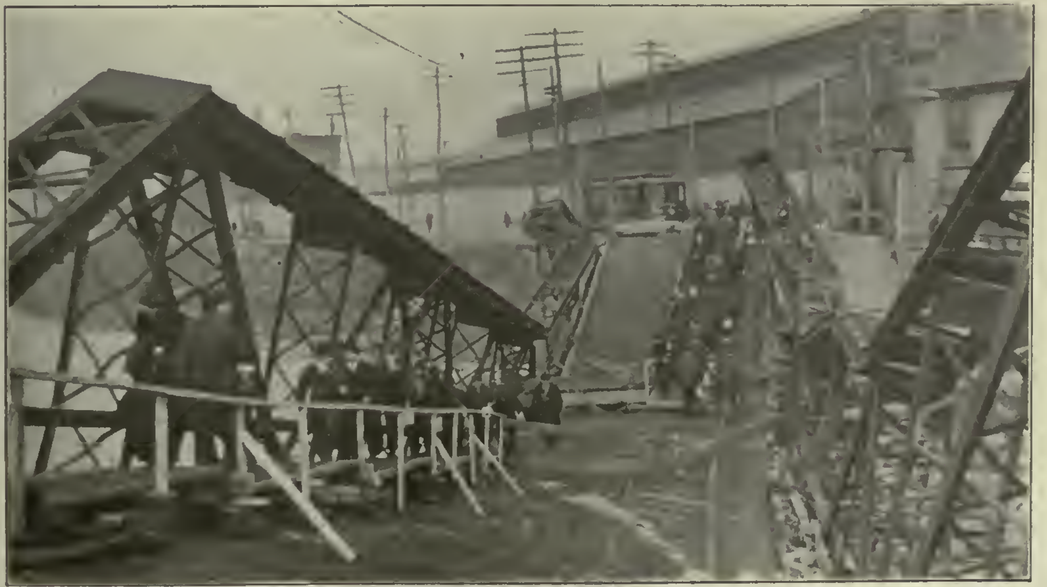


Photo. Johnstown Tribune

PONY TRUSS BRIDGE FAILURE PROBABLY CAUSED BY BADLY CORRODED STEEL

Engineers' Organization Grows

Information sent out by the American Association of Engineers, 29 South LaSalle Street, Chicago, is to the effect that from March 1 to 25 the association secured positions for fifteen unemployed engineers while thirty openings for technically trained men, ranging in salary from $1,200 to $5,000 a year, were still unfilled at the latter date. The association has now 400 certified members and approximately 150 applications for enrollment are being investigated. No charge whatever is made to employer or employee for the service this association renders.

Large Russian Trade Opportunities Await Development

Tenders on machinery for the construction of an immense irrigation project by the Russian government in Turkestan are desired at once, so that the work may proceed immediately after the close of the war, and everything from cableways to excavators and concrete mixers of the largest size are wanted. In both Moscow and Petrograd the inadequate sewer systems are to be entirely reconstructed at an early date.

THE CURRENT OF THE COLORADO RIVER CAUSED SUCH A TIGHT JAM OF DRIFT DURING RECENT FLOODS AT HANLON HEADING, WHICH IS EAST OF CALEXICO, CAL., THAT WORKMEN WERE ABLE TO WALK OVER THE TOP OF THE ACCUMULATED MATERIAL

Marcus Stow Hill, of Chicago, trade missionary, recently returned after spending seven months in Russia, where he represented eighteen Middle West companies. He reports excellent trade possibilities for all kinds of contractors' equipment.

As an example of the materials on which Mr. Hill was asked to get quotations based on the present price of materials, on the price before the war and on unit costs, the following list is given: One gravity cableway to move 3,200,000 cu. yd. into an earth dam at the rate of 1000 tons per hour; two groups of centrifugal pumps and motors of 50-sec. ft. capacity with lifts of 175 and 350 ft. respectively; two groups of 1000-hp. turbines and dynamos for heads of 200 ft.; 10 miles of 4-in. and 2 miles of 30-in. wood-stave pipe; 3 miles of 28-in. riveted pipe; four dragline excavators; two hydraulic monitors; one ditch excavator capable of handling 300 cu. yd. per hour, or several smaller ones; 7000 ft. of steel sheet piling 35 ft. long; sufficient pneumatic pile drivers to drive the piling in 100 days; pressed-steel forms for a concrete spillway; concrete mixers and rock crushers of large capacity; five 5-ton motor trucks to burn crude oil (not gasoline); rock drills and air compressors.

As soon as work is under way for this project three others of similar size will be undertaken, for which further equipment will be provided by the government. Along other lines, Mr. Hill desires prices on 16,500 malleable-iron fittings, 30,000 couplings and lock nuts, 10,000 radiator valves, cast-iron valves, exhaust fans of small size, and motors; all for immediate delivery.

As to Russian credit, Mr. Hill states that there is an abundance of ready cash in the country, due in great part to the fact that the use of vodka has been abolished. The bank deposits, according to government reports, have increased 1100 per cent. The Russians are prepared to pay good prices because of shipping difficulties, and they will furnish bankers' irrevocable confirmed credits with each order.

Capital and brains are much desired and the Russians are prepared to furnish three-fifths of the capital to carry on many of the businesses and manufacturing plants abandoned by the 150,000 Germans sent to Siberia.

Mr. Hill warned firms against granting exclusive agencies to Russians before investigating the standing of the individual, for many sales agencies are sold from one to another, none of which cares for the actual business since he only intends to sell the agency to the next man. As to mail, he suggests that all correspondence be registered so as to get past the censors quickly.

Mr. Hill will be in Chicago, 1455 Carmen Avenue, for two or three weeks before his return to Petrograd, where he expects to open exhibition rooms adjoining the Russian-American Chamber of Commerce.

Du Pont Offers United States Nitric Acid Plant

In a letter from Pierre S. du Pont, president of the E. I. du Pont de Nemours Powder Company, to U. S. Secretary of War Baker, the powder manufacturer expressed the willingness of his company to spend approximately $20,000,000 for the construction of a nitric acid plant which will make the United States independent of the foreign sources upon which it now relies for a supply of this material which is essential to the manufacture of explosives.

The process which the E. I. du Pont de Nemours Company has purchased requires large units of hydroelectric power at a low cost, and as the necessary power sites are not now available because of Government restrictions, the company has submitted a tentative plan which gives the Government an option on taking over the plant at the end of fifty years provided, of course, that the company will be granted the sites necessary for the construction and operation of the hydroelectric power plants of adequate size.

The prices at which nitric acid would be sold to the Government would be fixed by the Government both in times of peace and war.

Bridge Span Over Tennessee River Near Chattanooga Collapses

Main Truss Members Injured by Shifting Load of Underframes on Passing Freight Car Held to Be Cause of Accident

Span No. 2 of the railroad bridge over the Tennessee River about six miles north of Chattanooga, Tenn., collapsed at about 9.50 p. m., March 17, and went down with eleven freight cars. According to Curtis Dougherty, chief engineer of the Queen & Crescent Route, the accident was caused by the shifting of a load of freight-car underframes carried on a freight car passing over the bridge, striking the trusses and injuring them sufficiently to cause failure. The following data was furnished by Mr. Dougherty at the request of the Engineering Record.

The facts in regard to the collapse of one of the spans over the Tennessee River, so far as they have been developed, are as follows: One of the cars in the south-bound freight train was a flat car loaded with five steel underframes for freight cars. This load became shifted and struck the inside edge of the cover plate of the west end post at the north end of the north span, known as No. 1, causing an indentation in the cover plate at least ½ in. in depth at a height of about 11 ft. above the top of the tie. A similar indentation was found in the southwest end of the post of this span at about the same height, and another mark about 3 ft. higher up, indicating that the load was shifting further out of position during its progress over span 1.

It is supposed that on reaching span 2 this this load of steel underframes had become shifted sufficiently to injure one or more members of the west truss of span 2 by a blow, thus weakening them sufficiently to cause collapse. Proof of this theory was found when one of the steel underframes was recovered from beneath the water and found to be damaged at one end of one of the projecting arms, where some red lead paint which was used for the shop coat of the bridge was found. This blow probably buckled a compression member or severed a tension member, causing the collapse of the span.

This single track bridge of the Cincinnati, New Orleans & Texas Pacific Railway was built in 1877 as a part of the Cincinnati Southern Railway and consists of seven fixed portions and one pivot draw span. Six of the fixed spans are 210 ft. long and No. 2, which collapsed, was 260 ft. long, all of the double-intersection Whipple type.

Forces of the railway company are working on the closing of the span by the use of four plate girders spans, two about 75 ft. long and two about 44 ft. long, supported on the piers on either side of the collapsed span and on three timber towers placed between the piers.

Pennsylvania Engineers Celebrate Twelfth Anniversary

More than two hundred members of the Engineers' Society of Pennsylvania celebrated the twelfth anniversary of the society's founding at a banquet held March 25 at Harrisburg. The banquet was also a farewell dinner to the president, R. Boone Abbott, who was recently appointed superintendent of the Shamokin division of the Philadelphia and Reading, which promotion makes necessary his moving to Tamaqua, Pa. Mr. Abbott, who was the first speaker of the occasion, attempted to resign, but the engineers compelled him to reconsider.

Frederick W. Fleitz, former deputy attorney general of Pennsylvania, spoke on the efficiency of the engineer as being practically synonymous with "preparedness," and discussed the history of engineering from the building of the Citadel of Thebes to the harnessing of Niagara Falls. J. V. W. Reynders was presented with a silver loving cup by his associates and Flavel W. Wright and Thomas Earle spoke in the absence of Agnew T. Dice, who was unable to be present.

Comedy was introduced when the rise of "One, Boone Abbott" was portrayed by the use of moving pictures which offered opportunity for Theodore E. Seelye, Farley Gannett, Henry Evans and Edward Bevan to prove their ability as screen artists.

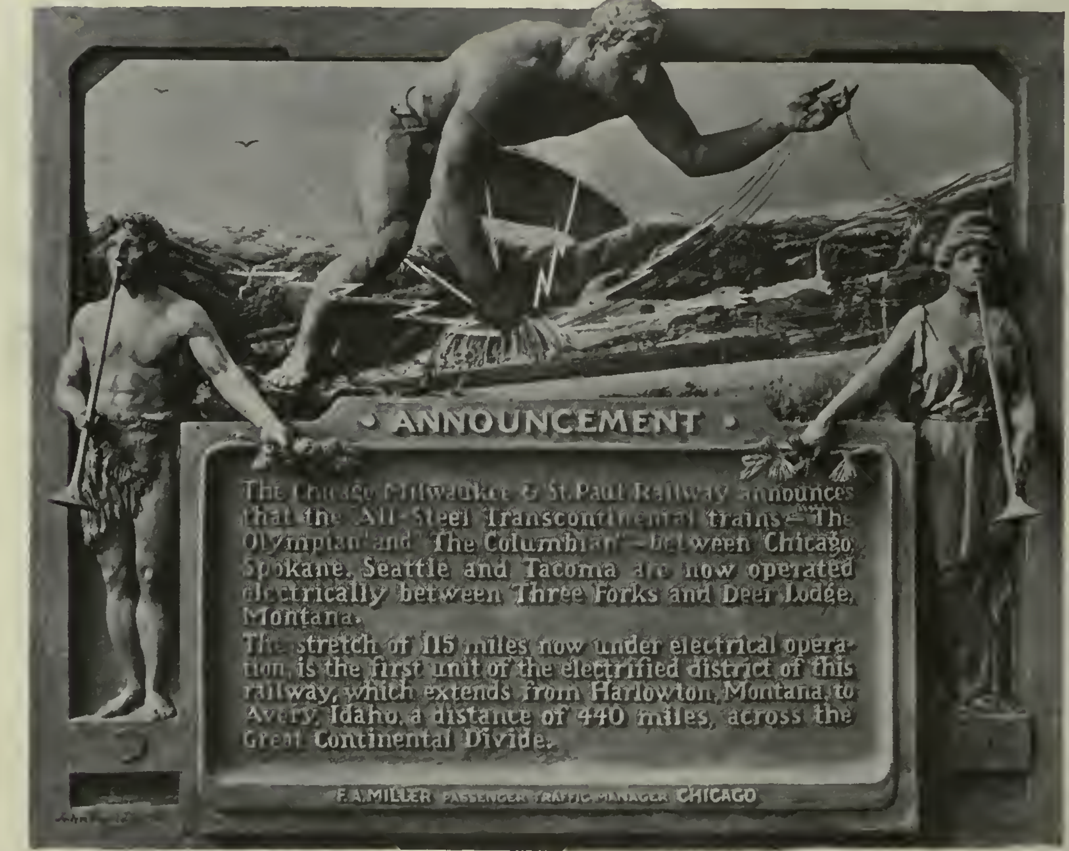
Propose Building 60 Miles of Hard Roads Around Chicago

Twenty miles of hard roads have already been authorized for Cook County outside of Chicago, and an additional 40 miles is seriously considered. Bids for the first contingent will be called for in the near future. The stretches will complete several through-route roads started last year, notably the roads south of Blue Island and south of Calumet connecting Chicago with the Lincoln Highway at Chicago Heights, Twelfth Street to the West, Archer Avenue southwest of Spring Forest and Milwaukee Avenue to the Northwest. George A. Quinlan, county highway engineer, states that the validity of the $2,000,000 bond issue has not yet been finally passed upon and in any event the construction cannot start before July.

Work Begun on Los Angeles Elevated Railway

Actual construction work on the elevated railway for Los Angeles is now under way and it is reported that the concrete foundations for the steel columns will be completed before the shipment of steel is received from the American Bridge Company. The Pacific Electric Company was ordered to start work on the elevated structure on or before July 1, 1916, and the approximate cost of construction is $166,000.

Plans are under consideration for a series of umbrella sheds to be constructed over the loading and unloading points.



• ANNOUNCEMENT •

The Chicago Milwaukee & St. Paul Railway announces that the "All-Steel Transcontinental trains—"The Olympian" and "The Columbian"—between Chicago, Spokane, Seattle and Tacoma are now operated electrically between Three Forks and Deer Lodge, Montana.

The stretch of 115 miles now under electrical operation, is the first unit of the electrified district of this railway, which extends from Harlowton, Montana, to Avery, Idaho, a distance of 440 miles, across the Great Continental Divide.

F. A. MILLER PASSENGER TRAFFIC MANAGER CHICAGO

THE CHICAGO, MILWAUKEE & ST. PAUL ANNOUNCED THE ELECTRIFICATION OF 115 MILES OF ROAD BETWEEN THREE FORKS AND DEER LODGE, MONT., IN AN IMPRESSIVE AND ARTISTIC FOLDER, A PHOTOGRAPH OF THE FRONT COVER OF WHICH IS SHOWN IN THE CUT. THE UNIQUE ANNOUNCEMENT CANNOT HELP BUT EMPHASIZE THE IMPORTANT STEP WHICH THE MILWAUKEE & ST. PAUL HAS TAKEN. THE WORK WHOSE COMPLETION IS THUS HERALDED WAS DONE AT A GREAT COST AND JUSTIFIES WHAT MIGHT BE THOUGHT EXTRAVAGANT PUBLICITY, BUT WHICH REALLY IS ONLY IN PROPORTION TO THE IMPORTANCE OF THE IMPROVEMENT

New York Engineers Vote for Universal Military Training

At Final Session of National Societies' Lecture Course Members Adopt Resolution Calling Upon Congress for Action

New York engineers went on record Monday night in favor of universal military training under exclusive federal control. By a unanimous vote the members of the military lecture course, organized by the four national engineering societies, adopted T. Kennard Thompson's resolution urging Congress to an appreciation of the view that adequate national defense cannot be realized under the volunteer system.

Although ths week's session in the Engineering Societies' Building was the seventh and final meeting of the course, as originally planned, it is proposed to supplement the work already done by week-end encampments, a course of prescribed reading and conferences with army officers. The first conference will be on combat methods, and the instructing officers will be Captain Richard T. Coiner, Corps of Engineers, U. S. Army. An additional meeting of the main lecture course is scheduled for April 24.

After an address by Brig.-Gen. H. F. Hodges, Capt. Thomas M. Robins described the methods of building, maintaining and operating railway lines in the zone of military operations.

News of Engineering Societies

The Albany Society of Civil Engineers heard C. M. Holland deliver an illustrated address on the rapid transit tunnels under the East River, New York City, which proved to be of more than ordinary interest.

The Detroit Engineering Society will hold a meeting Friday evening, April 7, at 46 West Grand River Avenue, at which Prof. D. C. Jackson of the Massachusetts Institute of Technology will speak on high power traction.

The Four State Section of the American Waterworks Association will meet at 1.45 p. m. Saturday, April 8 at Hotel Alamac, Atlantic City, N. J. Mr. Brush of the water department of New York will read a paper on "Freezing of Pipe Lines."

Members of the American Society of Civil Engineers who live in or near Detroit are urged to attend a meeting to be held April 4 in the rooms of the Detroit Engineering Society, at which time the advisability of the organization of a local association will be considered.

The American Chemical Society will meet at the University of Illinois April 18 to 21. The divisional program on water, sewage and sanitation states that there will be a final report by the committee on methods of analysis of water and sewage, and a symposium on activated sludge for which papers have been promised by H. W. Clark, W. R. Copeland, E. J. Fort, Calvin W. Hendrick, Arthur W. Lederer, W. D. Richardson and Robert Spurr Weston.

The New Haven Section of the American Society of Mechanical Engineers will hold a joint meeting with civil, electrical and mining engineers located in the vicinity of New Haven, Conn., April 5. The afternoon session to be held at Mason Laboratory will be devoted to discussions of water power of New England and power requirements of Connecticut industries. Samuel Insull, president of the Commonwealth Edison Company, will discuss progress of economic power generation and distribution that evening at North Sheffield Hall.

The Washington Society of Engineers heard an illustrated lecture on the duties and organization of engineers in war and what engineers in civil life will be called upon to do in defense of the United States, delivered by Major James A. Woodruff, Corps of Engineers, U. S. A., March 31 at the Cosmos Club, Washington, D. C. Lieut.-Col. George P. Howell, Corps of Engineers, U. S. A., will describe the selection, laying out and preparation of camps and cantonments in a territory under military control at the Cosmos Club, April 14.

Personal Notes

THE ROBERT GRACE CONTRACTING COMPANY, of Pittsburgh, has opened an office in Chicago at 208 South LaSalle Street. L. A. Mullins, formerly of Cleveland, is district manager, and W. W. Mathews, formerly assistant engineer with the Sanitary District of Chicago, is engineer. Work has just been started on the Lomax to Griffith 36-mile grade reduction and double-tracking work for the Erie Railroad.

W. M. RODGERS has resigned his position as assistant city engineer for Racine, Wis., to take effect May 1. He leaves the city engineering department after twenty-six years of service.

HOWARD S. REED, civil engineer, of Phoenix, Ariz., should have received credit for substantial help in preparing the article on the measurement of irrigation water by Venturi meters, published in last week's issue of the Engineering Record, page 411. Mr. Reed's knowledge of the peculiar conditions prevailing in the irrigation service of the West was responsible, in large measure, for adapting the Venturi meter to uses on reclamation projects.

B. C. BRENNAN has been re-elected for his fourth term as city engineer for Kenosha, Wis., by a unanimous vote. He will also act as superintendent of the Kenosha water works.

E. O. BRASHEARS, engineer for Yakima County, Wash., has been appointed a member of the advisory committee to consider roads to be constructed by the State of Washington in connection with the development of Rainier National Park.

C. C. WRIGHT has been appointed chief engineer of the Allen & Garcia Company, consulting and construction engineers, Chicago.

J. W. FRAZIER, who formerly conducted his engineering business under the firm name of J. W. Frazier Company, has combined his business interests with R. E. Sheal, formerly with the Wellman-Seaver-Morgan Company, of Cleveland, and the new firm will be known as the Frazier-Sheal Company, Illuminating Building, Cleveland. Messrs. Sheal and Frazier graduated in the same class from Rensselaer Polytechnic Institute, after which Mr. Sheal was with the Pittsburgh & Conneaut Dock Company. For the past fifteen years he has been connected with the Wellman-Seaver-Morgan Company, one of the largest manufacturers of coal and ore handling machinery in the country. The new Frazier-Sheal Company will follow the same general lines of business as the J. W. Frazier Company and is equipped to figure on the design and construction of all kinds of coal and ore handling machinery.

J. E. JOHNSON has left his office at Paducah, Ky., where he practiced as consulting engineer, to enter the employ of the Duluth, South Shore & Atlantic Railway to study railroad valuation work.

BENJAMIN E. JONES, for five years office engineer in the Helena (Mont.) office of the U. S. Geological Survey, has been transferred to the Washington (D. C.) office.

R. B. TINSLEY, who recently resigned his position as local manager for the General Asphalt Company in eastern Venezuela, has accepted a position with the construction department of the Chile Exploration Company as division superintendent of construction, and will be in charge of the construction of the new plant which the company is to build at Chuquicamata, Chile. Mr. Tinsley received his professional education at the Virginia Polytechnic Institute and first engaged in engineering work in 1905 on railroad location and construction and general mine work in the Virginia coal fields. From 1909 to 1914 he was engaged in construction work for the Panama Canal in charge of the field engineering for the Pacific locks and dams at Pedro Miguel and Miraflores, and later as superintendent of construction on the Miraflores locks and spillway dam and the control houses for both Pedro Miguel and Miraflores. When the Pacific locks were completed he was placed in charge of the hydraulic sluicing plant at Gold Hill and the construction of the Cristobal coaling plant of the Atlantic terminals. He resigned from the canal service in 1914 to engage in construction work for the General Asphalt Company in eastern Venezuela, which work was not carried through owing to conditions arising from the European War.

HARRISON W. LATTA AND J. KINTER ROBERTS, formerly connected with the Latta & Terry Construction Company, have formed the firm of Latta & Roberts, Drexel Building, Philadelphia. Some of the more important works carried on by these men were the construction of the sea-wall at the Naval Academy, Annapolis, Md., and a rifle range at the same place together with foundations for a number of the buildings. Messrs. Latta and Roberts also took active part in the construction of jettys for the engineering department of the government at Cape May, N. J., and a number of piers and bulkheads at various points along the Delaware River. They have also constructed powerhouse foundations for large corporations and have had considerable experience in concrete retaining walls and bridges. The firm of Latta & Roberts is organized to carry on the same general line of engineering and construction work.

CLYDE CURTIS of Curtis Brothers expects to complete the irrigation work on the Belle Fourche, S. D., project about May 1, after which he will move his outfit to Clarke, Neb., to begin work on a drainage ditch contract.

LOUIS P. BLUM AND W. A. WELDIN have formed a partnership under the name of Blum, Weldin & Company, with offices in St. Nicholson Building, Pittsburgh, Pa. Mr. Blum was engaged for ten years in the department of public works of Philadelphia, under the direction of C. A. Sundstrom, during which he made property surveys and designed and constructed municipal improvements. For the past fourteen years he has been associated with the W. G. Wilkins Company, engineers and architects, of Pittsburgh. He has been in responsible charge of important railroad, mine and land surveys, and his technical experience includes the design and construction of water and sewer systems and a variety of other municipal improvements. He has prepared preliminary studies of the arrangement of proposed industrial plants and supervised the location and the construction of the structures required for such plants. Mr. Weldin's technical experience includes the design of structures in steel, timber and reinforced-concrete as well as railroad location, underground development of mines, coking practice, and the design of complete industrial, mining and power plants. While construction draftsman with the H. C. Frick Coke Company he had a part in the opening of the several large mines besides making extensive improvements at other mines. He was designer with Geo. S. Baton & Company, engineers, on the plant of the Isabella-Connellsville Coke Company, at Brownsville, Pa. For the past two years Mr. Weldin has been employed as proposal engineer by the Pittsburgh Coal Washer Company, having charge of the preparation of preliminary designs and estimates for coal tipples and washers, mill buildings, pig iron casting machines and coal and coke handling plants.

NEIL W. FRENCH, formerly in the employ of the Indianapolis Union Railway, has become connected with the Illinois State Highway Commission as a junior highway engineer in the bridge department under Clifford Older.

DAVID B. GERTLER has left the employ of L. Moisseiff, consulting engineer, of New York City, to work for the American Bridge Company at Cambridge, Pa.

GEORGE T. ROONEY has been assigned to the compressed air squad which is in charge of the construction of the river tunnel portions of the new subway under the East River at New York City. Mr. Rooney has just recently completed some postgraduate work at the Massachusetts Institute of Technology.

FRANK C. BOGGS, Major, Corps of Engineers, U. S. A., recently general purchasing officer and chief of the Washington office of the Panama Canal, is now in charge of the Montgomery (Ala.) engineer district.

THOMAS G. BUSH, assistant state highway commissioner of the state of Washington since March, 1914, has resigned. He has been active in the business management of the highway department for the last two years and was formerly manager for the Pacific Coast Steel Company of Seattle and of the Spokane branch of F. T. Crowe & Company.

JOHN W. HILL has been retained as consulting engineer for several counties in the northern part of the Great Miami River water shed to make an investigation and submit a report on methods of flood prevention and to review plans prepared by the board of directors of the Miami Conservancy district.

ISAC S. VOORHEES, who has been connected with the Klamath Falls (Ore.) reclamation project for the past six years, has been transfered to the Denver, Col., office of the U. S. Reclamation Service.

JOHN S. GOODMAN, formerly supervisor of the Philadelphia & Reading Railroad at Olney, N. Y., has been appointed engineer of the Harrisburg division succeeding R. Boone Abbott, whose promotion was recently announced in these pages.

Charles R. Ege recently resigned his position as principal assistant engineer of the Washington State Highway Department to become division engineer for the Association of American Portland Cement Manufacturers, with headquarters at Spokane. Mr. Ege has been active in engineering work in the West since 1902.

Edward F. Gorman, of Sunbury, Pa., who for a number of years has been assistant in the office of the resident engineer of the Philadelphia & Reading, has been appointed resident engineer, succeeding Joseph S. Ward. Mr. Gorman spent six years as an architect in Philadelphia, and his promotion comes after eighteen years with the Reading as rodman, levelman, transit man, and finally assistant engineer.

R. Boone Abbott, whose appointment as superintendent of the Shamokin division of the Philadelphia & Reading was mentioned last week, has been promoted to fill the position of superintendent of the Harrisburg division made vacant by the promotion of R. J. Stackhouse.

Clarence C. Jacob has left his position as district engineer for the U. S. Geological Survey at Phoenix, Ariz., to assume his duties as engineer of water resources for the Survey with headquarters at Salt Lake City.

John L. Collins, consulting engineer, 30 Church Street, New York City, has been retained by the borough of Sussex, N. J., to prepare plans and supervise the construction of a sewerage system and sewage disposal works.

Carl W. Schedler, recently connected with the Foundation Company, of New York City, and later with the Hooker Electro Chemical Company, of Niagara Falls, is now superintendent for the Great Western Electro Chemical Company, of Pittsburg, Cal.

E. R. Bowerman, vice-president of the James F. Leary Construction Company, is in charge of the building of a reinforced-concrete bridge over Honeoye Creek at Honeoye Falls, N. Y.

K. E. Lancet has resigned from his position as junior structural engineer with the valuation department of the southern district of the Interstate Commerce Commission, and is now employed by the Cuban Portland Cement Company, of Havana, as engineer on the construction of the new plant at Mariel, Cuba.

F. P. Kemon has left his position as superintendent for the Duquesne Contracting Company, of Pittsburgh, to work for the Robert Grace Contracting Company of the same city. Mr. Kemon will have charge of two bridges that are being built across the Susquehanna River, at Milton, Pa., and, in addition, will superintend the erection of the second half of the 45-arch, 4000-ft. concrete viaduct across the Susquehanna at Harrisburg.

George W. White will have full charge of selecting materials and preparing of plans and specifications for the new roads to be constructed in and near Beaumont, Tex. The amount to be spent for new roads and repairs of old ones is approximately $200,000.

Ernest McCullough, consulting engineer of Chicago, whose specialty is reinforced-concrete design and construction, has become identified with the American Association of Portland Cement Manufacturers, Chicago, as chief engineer of the fireproof construction bureau. He was graduated from the University of California in 1887, and later connected with *Engineering and Contracting* and the *Railway Age Gazette*, and is the author of several technical books.

H. A. Sitterley has been appointed chief engineer of the Low Moor Iron Company of Virginia. Previous to his present appointment, Mr. Sitterley was assistant city engineer of Hornell, N. Y.

Earle L. Waterman, associate professor of sanitary engineering at the Pennsylvania State College, has taken a temporary leave of absence and is working in the office of the sanitary engineer of the state of Michigan.

W. F. Beyr, for many years assistant engineer in government service on lighthouse work and concrete construction in the Panama Canal, has become identified with the editorial bureau of the Association of American Portland Cement Manufacturers, Chicago.

S. C. Baker, after seven years with the United Pipe Company of St. Louis, Mo., has become associated with the East St. Louis & Suburban Railway as engineer and superintendent of construction.

Obituary Notes

Frans Engstrom, city engineer of Altoona, Pa., died suddenly at Pittsburgh, March 20, at the age of sixty-five. He received his education at the Royal Technical Institute, Stockholm, Sweden, and had been in the United States nearly thirty-five years.

Daniel B. Dunn, consulting engineer, of Macon, Ga., recently died at the age of seventy-two years. He was a member of the executive committee of the American Board of Engineers, and one of his latest achievements was the building of the Macon, Dublin & Savannah railroad bridge across the Ocmulgee River about two years ago.

Carl Robert Grimm, author of several works on secondary stresses in bridge trusses, died at Rengsdorf, *bei Neuwied am Rhein*, Feb. 15. Mr. Grimm designed the steel framework which caps the Philadelphia City Hall tower, and was associated with Messrs. Gustav Lindenthal, of New York City, and Frederick C. Kunz, of Philadelphia.

Civil Service Examinations

United States.—The Civil Service Commission announces an open-competitive examination for computer and estimator, salary $1,600 a year, to be held April 12 and 13. The subjects on which candidates will be examined are relative to materials and construction, involving technical and practical knowledge of materials, elementary principles of architecture and details of approved methods of design; specification writing and interpretation; estimating quantities and prices, and training and experience. The requirements are that candidates must be over 20 years of age and must have had a high school education and two years' experience in constructional work of this order.

On April 18 there is to be held an examination for an engineer-economist, salary from $2,000 to $2,500, to be employed in conjunction with the Office of Public Roads and Rural Engineering. This position will relate mainly to road building and maintenance, but on the more theoretical questions of organization, finances, public improvements and systems, and publicity. Candidates will be examined more on their experience than on their education, although a technical school or college training will be required for certain cases. These cases are when candidates have had only four years' experience; in the other case they must have eight years' experience. The age limit is 21 to 50 years.

Two examinations, one for junior signal engineers and the other for junior structural engineers, grades 1 and 2, salaries from $1,200 to $1,680, and from $720 to $1,080 a year, are announced for April 19, to be held at the usual cities throughout the country. Both of these positions are in conjunction with the valuation work of railroads carried on by the Interstate Commerce Commission. Applicants must have a well-grounded technical education in their respective fields, as well as two or three years of practical experience. Theoretical knowledge, especially in the design of signaling or bridge building and other structural work, will be particularly emphasized. The age limit is 21 to 36 years.

The War Department announces that the next examination for the position of second lieutenant of civilian candidates will occur about Aug. 21-25. It is advised that candidates who are not already qualified as eligibles for appointment to the position of junior engineer in the Engineer Department under the Civil Service Commission rules should take this latter examination, which is to be held April 12 and 13.

Forms for any one of the above examinations may be secured from the U. S. Civil Service Commission, Washington, D. C., or at any of the civil service boards in the cities where examinations may be taken. In applying for forms for the examination for computer and estimator or engineer-economist, form 1312, specifying the title of the examination for which it is desired, should be stipulated. In applying for forms for the examination for junior signal engineers and junior structural engineers, form 2039, likewise specifying the title of the examination, should be requested. Information on the examination for appointment as second lieutenant for civilian candidates may be had from the War Department, office of the chief of engineers. It is advisable to secure all information immediately.

Philadelphia.—The Civil Service Commission announces that examinations for the following positions are to be held on the dates given at the City Hall, open only to residents of the city who are at least 21 years of age. It is necessary that applications shall be made and filed four days before the date of examination.

Tracer, City Transit Department, salary $600 a year, to be held April 26. This position requires general knowledge of drawing-room work and requires that candidates shall have had one years' experience.

Transitman, City Transit Department, salary from $1,200 to $1,500 a year, to be held May 3.

Assistant Engineer (abolishment of grade crossings), Surveys Bureau, Department of Public Works, salary $2,500 a year, to be held May 4 and 5. This position involves the supervision of grade-crossing elimination work of railroads in Philadelphia and requires that the candidates have had at least three years' experience in structural work in connection with railroad engineering, as well as two years' additional experience in the design and construction of bridges, abutments, retaining walls, buildings, sewers or other municipal work. Progress report making and preliminary estimating, likewise cost data collecting, are supplementary duties. The examination will be open to only those who are 25 years of age or over.

Structural Draftsman, salary from $1,200 to $1,500 a year, to be held May 4 and 5. This position is in connection with structural steel work, especially piers, bulkheads and other river and harbor improvements in the nature of design, drawing and figuring computation. Applicants should have had at least three years' experience.

Examinations Previously Announced

Date		See Eng. Record
April 3-8	Architectural draftsmen, salaries from $900 to $1,200 and from $1,200 to $1,500 respectively; roadman, salary from $840 to $960 a year, and assistant engineers, salaries $2,100 to $2,500 a year, Philadelphia	March 4
April 17-20	Draftsmen, Highway Bureau, City Transit Department, Bridge Division, Philadelphia	March 11

Engineering Record

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Construction More Active

STEADILY, but quietly, increased activity in the construction field is becoming manifest. The increase in the Contracting News section of the Engineering Record to almost twice the usual number of pages, the several columns of personal notes—most of them changes in position or new appointments—and the increasing number of "Positions Vacant" items in the advertising section are significant reflections of the developments that are taking place. There is food for both optimism and serious thinking in respect to renewed activity along construction lines. The labor problem, due to restricted immigration, may be acute. Machines must be found to do the work of men in every possible task. The outlook for the no-plant contractor is not bright.

Florida's Road Department

BY a recent decision of the Florida Supreme Court, the validity of the legislative act creating a state road department and providing for its expenses has been established. There is now no obstacle to prevent the department from proceeding with its work and the appointment of the salaried commissioner authorized by the act. That the state will be benefited greatly cannot be doubted. The good roads spirit in Florida is well developed. An unusual element in the public addresses at conventions and other gatherings is the consideration given to the tourist. It is not only for the convenience of the citizens of the state that good roads are urged, but for the transients that come and go, for it is well known among those who think that the tourist is a large factor in Florida's prosperity. The promoters of the movement have succeeded in convincing the general public of the tourist's value to the extent that it is willing to spend money not only to improve the roads, but to beautify them as well.

Neglect of Bridge Maintenance

WHEN a steel highway bridge located where many people cross it every day is allowed to deteriorate through corrosion of the main members until final failure occurs when fully loaded with electric cars and human lives, there is pressed home once more the fact that criminal negligence and thoughtless taking of chances too often mark city administrations in this country. Fortunately, in the case of the pony-truss span failure in Johnstown, Pa., reported in the news section of last week's issue, no loss of life resulted. If the span had not settled so gradually and remained practically in a vertical position without overturning, the human sacrifice would have been sufficiently impressive to have startled even the politicians. The present city engineer, it is reported, had recently condemned this bridge, among others in Johnstown, and asked for an appropriation for repairs. As usual, nothing had been done. In the Johnstown bridge a main diagonal web member had rusted away near the timber floor until only about one-sixth of the original section remained. This member, an end diagonal, probably failed first and the badly corroded chords, unable to carry the added strains, soon followed. In addition to lack of painting and proper inspection, another simple and well-known precaution in laying the timber flooring to prevent corrosion was neglected. At least 1 in. clearance should have been provided around the steel to avoid water pockets and allow the use of a paint brush. Furthermore, the bridge was originally designed with duplicate trusses and cantilever sidewalk on one side only, without provision for trolley tracks on the roadway. When the single track was laid it was located (with great engineering wisdom) next to the truss carrying the sidewalk load. The most simple and elementary requirements of maintenance and inspection appear to have been entirely neglected.

Flood Lesson at Rochester

WHILE last week's flood of the Genesee River at Rochester, N. Y., did not duplicate, in loss of life and property damage, the catastrophe of the Ohio Valley in 1913, it established a new high-water record for that vicinity which is highly significant in the lesson it should teach. The moral is forcefully presented by James P. Wells in his analysis of the local situation on page 476 of this issue. The sudden melting of the deep blanket of snow which covered the Genesee watershed was responsible for the unprecedented rise in the river. The peak of this year's flood is estimated at 50,000 sec.-ft. as compared with the largest previous volume of 45,000 sec.-ft. recorded in 1913. The swollen stream, passing through the city center and encountering obstructions in the way of bridge piers, canal crossings, etc., inundated streets and railway tracks, undermined pavements, flooded cellars and caused about $300,000 worth of damage. Luckily the rise in temperature which caused the snow to melt was not accompanied by any heavy rainfall. To this happy combination of circumstances Rochester can attribute her escape from what might well have been a calamity. But it is entirely possible that a spring thaw and a severe rainstorm might occur simultaneously. In fact, in March, 1913, a precipitation of 5 in. was recorded. If a similar amount of rain had fallen last month to augment the runoff from the snow it is estimated that a 100,000 sec.-ft. flood would have resulted, causing a repetition of the scenes at Dayton and Columbus three years ago. Surely these facts should impress upon the city officials of Rochester the need for proper flood prevention measures. There is an opportunity to forestall a possible future catastrophe by prompt action, based upon expert engineering advice. The point is that such action, after the next flood, will be of little avail. Now is the time to take this year's lesson to heart.

Course in Business Economics

ALTHOUGH outside what might be called the technique of engineering, a post-graduate course in business economics, just opened at Harvard University, deserves mention. Leading to the degree of Ph.D., the course requires the usual residence study of about three years, subjects being selected from a group of thirteen titles embracing public finance and taxation, economic history, economics of agriculture, accounting, marketing, foreign trade, industrial management and labor problems, money and banking, transportation, insurance, corporate organization and finance, and statistical method. All candidates for the degree are obliged to take a course in economic theory. The primary intention of the new course is to meet a rising demand from all parts of the country for men who are qualified to teach business, not from the point of view of tradesmen who have strayed into the teacher's chair, but from that of the economist who has learned how economic theory has been tested by application to the concrete problems of modern business. Without question the influence of such instruction will ultimately be felt in the teaching of collateral branches accompanying both undergraduate and advanced courses in engineering in technical institutions, and will contribute to the broadening of the engineer's training by emphasizing the close relationship existing between "pure" economics and present-day business.

The Shields Bill

FOR years this journal has been urging the need for federal legislation which would encourage the rapid development of our wasting water powers. As is well known the only form of permit which can be secured now is revocable at any time. Under this provision capital has been deterred from water-power investment. So patent is the present unfavorable situation, so apparent is it that true conservation demands the utilization of energy now being wasted, that the demand for suitable legislation is heard from every quarter. Year after year measures have been introduced. Much time has been consumed in hearings, yet always the pressure of legislation has resulted in the measures dying with the termination of the sessions. In the fall of 1913 the National Conservation Congress met in Washington to discuss the question. The water-power committee brought in not only majority and minority reports but also a set of "unanimous recommendations," which had the support of the entire committee. These recommendations, too, were the burden of the majority and minority reports, which differed from each other and from the "unanimous recommendations" in minor respect only—and chiefly in the emphasis which the minority report laid on the danger of water-power monopoly. An examination of the Shields bill, side by side with these recommendations, shows that each of them has been embodied in the Shields bill, save only that which provides that the government should reserve the right of receiving a compensation for the power granted. It is the omission of such a reservation which has brought forth the chief opposition to the measure. As to this matter there is ground for argument. The only reason for demanding such a clause is that the state public-service commissions, to which the bill gives the right of regulating intrastate rates, might be subservient to the wishes of the water-power companies. Rates might thus be set which would fail to return to the public its share of the water-power benefits. With our present experience in regulation, however, the danger is rather that the attitude of the commissions toward the companies will be inimical. Where power is transmitted across state boundaries the Interstate Commerce Commission would control the rates. The real injustice to the public would come, in the opinion of this journal, in cases where a power was granted for the use, exclusively or in large part, of a single industry. And this would apply whether the industry received the grant directly or through a subsidiary. Where a power is so granted, the company may get an inordinate return and the public nothing. There should be a clause in the bill, therefore, which would allow the government to lay a tax on that part of the power used by a grantee-proprietor whenever power so used exceeds 40 per cent of the total generated. With this addition the Shields bill should meet the hearty approval of thinking citizens. So amended it would adequately protect the interests of the public, and make it possible to attract investors. The bill should then receive favorable action in the House.

"With the Greatest Possible Frankness"

IN ITS issue of March 18, page 377, the Engineering Record published an editorial discussion of a communication addressed by a past president of the American Society of Civil Engineers to the local associations of that body. Certain grievous errors were pointed out. The past president in question was Col. John A. Ockerson. He has now, following word from this journal that it would print his comment on the editorial referred to above, sent a discussion which appears on page 490 of this issue.

The Engineering Record has printed letters from quite a number of members of the society opposing the removal plan. It has refrained from commenting on them, holding that it was well that both sides be given presentation. But when statements are not in accordance with the facts and are calculated to influence quite a number of members, this journal feels itself obligated to point out the errors. It does so in pursuance with Colonel Ockerson's own declared wish that the matter be discussed "with the greatest possible frankness."

Colonel Ockerson persists in reiterating the view expressed in his letter to the local associations as to the relation which would exist, should removal be determined upon, between the American Society of Civil Engineers and United Engineering Society. He argues that the United Engineering Society has "other functions" because it issued the invitation to the civil engineers to join in the use of the Thirty-ninth Street building. This is not an "other function." It is *the* function for which the united body was organized—to own and manage the building. The American Society of Civil Engineers was to be invited to use the structure. Who but the United Engineering Society, the owner and manager of that building, could have issued the invitation?

Colonel Ockerson shifts the argument when he infers that merger is intended because of what correspondents of the Engineering Record have said. His communication to the local associations stated unequivocally that the American Society of Civil Engineers would in public matters become subordinate to the United Engineering Society. That some persons hope that such will be the case does not affect the fact that under the charter and the founders' agreement such is *not* the case. Moreover, the national societies of electrical, mechanical and mining engineers have been in the Engineering Societies' Building for nearly ten years, without surrendering any of their rights or their autonomy (except as to housing) to the United Engineering Society. Yet, despite this ten-year record, Colonel Ockerson holds that this maintenance of autonomy is merely the Engineering Record's opinion.

The letter, too, indicates a failure to understand clearly the relation between the United Engineering Society and the Engineering Foundation. While the latter was organized under the auspices of the United Engineering Society, the management of the two organizations is separate. Moreover, the societies which are members of the United society do not by themselves manage the Engineering Foundation. The American Society of Civil Engineers and even the general public are represented on the board of management.

On the matter of operating costs, Colonel Ockerson's figures are undoubtedly those which the committee of the board of direction had in mind in presenting the plan to the membership. The Engineering Record's former criticism in this connection, therefore, does not hold. Yet knowing that the figure in question is $2,511, or even $3,711, the Engineering Record is ready to join with the committee of the board of direction in the opinion that this is not a "material difference" when a matter of such moment is involved.

With Colonel Ockerson, this journal agrees that the subject should receive full discussion and that it should be viewed "with the greatest possible frankness." With this object solely in view it has believed it necessary to point out the very apparent error in Colonel Ockerson's position.

Optical Determination of Stress

JUST a hundred years ago Sir David Brewster, one of the great masters of physical experimentation, discovered that transparent materials become double refracting under stress, and having a singularly practical mind he suggested that the stresses in bridge arches could be rendered visible and studied by making a glass model and examining it in polarized light. The suggestion lay unutilized for many years, but not long ago it was taken up abroad and put to practical use. In fact a French engineer has recently studied a glass model of a proposed reinforced-concrete bridge and applied the data obtained in an arch of more than 300-ft. span. In the hands of several English engineers the work has been carried even further, so that it is now possible to obtain not only general but specific and quantitative information regarding the effects of strain in structures and machine parts of very varying character. Glass being somewhat inconvenient to use and work, xylonite, which can be readily formed into shape, has been adopted as the best material.

The principle is very simple, being merely to form a model of the thing to be investigated in xylonite and then to examine it by polarized light, loading it or applying stresses in various directions corresponding to those for which it is designed. When the material is under no strain the apparatus is so set up that it is opaque to polarized light. On applying load the internal stresses appear first in faint luminous bands and then in bands regularly varying in color as the stresses are increased, showing the exact effects produced in various parts of the model by thrusts or tensions or twists applied in the desired directions. Even the unaided eye can give a fairly good account of the situation, while if more exact measurements are desired the stresses shown at any particular point can be compensated by the application to a similar member of a stress working at right angles to the first until the effect of the former is neutralized. The result of change of section in beams can be thus very readily examined and the numerical results obtained in this simple way are found to check excellently with those derived from ordinary mechanical experiments on similar forms.

Many cases of the distribution of stresses in structures can be examined mathematically, but as the situation grows more complicated analysis is increasingly difficult and finally, in dealing with complex forms, predetermination becomes extremely difficult if not impossible. By testing models optically a good idea can be quickly obtained of the situation even in the most intricate cases, since the distribution of the strains due to service can be imitated with considerable precision. Among the mechanical problems which have been studied in this way are, for example, the stresses in a pipe under high pressure, showing the heavy stresses at the interior surface, falling off in a perfectly definite way as the exterior is approached, a case which is, of course, quite computable. An examination of the effects of rivets is, however, by no means so easy from the theoretical standpoint, yet the models show it at once and when the optical data are combined with those obtained with the lateral extensometer the principal stresses can be obtained with a very gratifying degree of precision. Again the configuration of irregular parts of machines to produce the most favorable stress conditions can be very quickly found and it is even practicable, starting with a model, to cut it down until the stress conditions become satisfactory and then to apply the data thus obtained to the actual structural material, of which the mechanical characteristics are, of course, very well known. In cases where extreme lightness is necessary and one has to work with reduced factors of safety, an experimental study of models by the optical method is likely to give important information.

The whole matter has been referred to before in these columns, but its progress has been rather rapid, and engineers who are working upon nice problems of mechanical design would do well to follow up the literature of the subject, which is mostly to be found in the English journals, and take advantage of the facilities for investigation offered by this method of rapid analysis.

The Daily Press and the Engineer

TOO OFTEN engineers give expression to a feeling of resentment toward the daily newspapers because engineering subjects are not treated as their importance justifies. That the feeling is not warranted in many cases and that the editors are anxious to present live, technical information to their readers, was well illustrated a few weeks ago by a heart-to-heart talk between James Keeley, editor of the *Chicago-Herald,* and the members of the Chicago Trade Press Association. He clearly indicated that he saw the need of and wanted to print trade and technical news. The material, however, must be furnished in the right shape. Engineers are not accustomed to put very much information in 300 words, but that was Mr. Keeley's specification as to length. No doubt the necessity for brevity, coupled with the inability of the newspaper staff to condense a really meritorious engineering news story into 300 words, accounts for the relatively small amount of such material handled by the larger newspapers. It was the first time a metropolitan newspaper editor had met with the trade and technical publishers to discuss such a topic and the outcome means much for the fields they represent.

Newspapers in smaller towns are not so cramped for space and the *modus operandi* of getting engineering matter into them is a much easier problem. The editors of the smaller cities also are alive to the engineer's value. The *Minneapolis Journal,* for instance, recently reprinted from the *Memphis Commercial Appeal* an editorial on the necessity of giving engineers the money and unhampered authority to solve the Mississippi levee problem.

Much advice has been given as to just how to get engineering publicity, but it all comes back to the fact that publicity is a commodity and must be paid for. Some one must compress the 3000-word story into the 300-word paragraph. The compression costs something, but it is worth the cost.

After the War

IT may be premature to consider the possibilities at the end of the present world's conflict, for it is yet far from ceasing. Still, the attainment of peace seems not wholly beyond the horizon, and one must look forward to the time when fifteen million men or so return to the occupations of peace. The problem of dealing with the industrial situation which will then arise is enough to appall the most optimistic of political economists. The whole production of the world will have to be reorganized, since it must be turned from the necessities of war to those of peace in the shortest possible time. Every nation now in the struggle will emerge from it with a terrible load of debt and an inevitable burden of taxation, hard to stagger under even in the most prosperous times. It will be necessary then to mobilize all the forces of industry, all the resources of engineering and manufactures, to begin to make good the damage which has been done.

Ordinarily there is a certain stimulating period of enthusiastic relief which follows war and gives an impulse to this work of organization. The great task of finding work for the returning soldiers must be planned long in advance in order that the sudden change in conditions may not bring complete, even if temporary, demoralization. The situation is rendered all the worse by the millions of cripples who must be given opportunity to earn a living. There will be, of necessity, great political changes, here and there, perhaps, of a very revolutionary character. The great question as to whether the relations of the state and the citizen do not demand that the powers of the former shall be marshalled to give a chance for honest labor to the latter, will arise with a new and imminent insistence. No economist yet has been able to furnish an adequate answer, except under imposed conditions which may actually have passed out of existence in the present world upheaval

From the standpoint of the American the problem is less acute, but it must be pointed out that when the war ends our country will confront a situation unique in its political and industrial history, less menacing than that abroad, but certainly to be given the gravest consideration. In the first place, this country has recently passed through a period of some depression, later built up, perhaps, into an ephemeral prosperity by the enormous amount of manufactures and exports directly or indirectly resulting from the removal of fifteen or twenty million Europeans from the field of productive labor. This particular sort of prosperity must necessarily terminate with the war. Even now the slightest rumor of peace sends a certain group of stocks downward, and the great factories all over the country, which are working overtime, even twenty-four hours a day, on war orders, must look forward to a sudden cessation of activities, a dropping back to normal or less than normal output, except in so far as our own necessary and sorely needed preparations for defense may serve for a time to soften the shock. The certain results will be, merely for the reasons already mentioned, acute labor troubles, the undoubted reduction of war wages, and superimposed on this the most violent of competition from the European nations striving desperately to employ their men.

It is perfectly safe to say that every factory now left standing will be pushed into work, and the several governments will probably be driven to extraordinary measures of aid to encourage shattered capital and demoralized labor into an alliance for their mutual safety. This again reacts on the industrial situation here, of which a still more serious phase is extremely likely to appear in the suddent onset of a great wave of immigration from countries sorely burdened with taxes and offering but slight inducements to the laborer. However complacently one may look at the good results of the immigration in the first half of the nineteenth century, he must sorrowfully admit that the additions of the second half were relatively less valuable, ultimately ending in abnormal increase in unskilled labor which has had a somewhat demoralizing result on industry. At the present time it is perfectly clear, whatever views one may have about immigration, that the end of the war will see an army of the unemployed many times greater than any force of soldiery that the United States ever put into the field.

To meet this situation will require the utmost skill and foresight in industrial organization and in statesmanship. It seems almost inevitable that the danger should be met, at least temporarily, by arbitrary barriers to check the predatory onslaught of both goods and labor. It will be no time to let down the bars and invite ferocious competition in manufactures or among those who produce them. The sooner our statesmen awaken to the sense of the responsibility that confronts them and realize that an industrial situation is arising which never has been paralleled in kind or degree in the whole history of the world, the better chance America has of escaping actual disaster. It is idle to speak of precedents derived from the experience of petty wars when manufacture was unorganized and transportation undeveloped. There will be no escape from the most colossal industrial struggle which the imagination can outline, and woe to that country which does not make ready to defend its industrial frontiers.

How Buildings Were Appraised in Revaluation of Real Property of Los Angeles

Requirement That Entire County Be Covered in Ten Months Necessitated Unusual Field and Office Organization and Methods

By J. C. BANNISTER
Building Valuation Engineer, Joint Bureau of Appraisal, Los Angeles

TO OBTAIN an equalization of values of real property throughout the city and county of Los Angeles along the lines of recent study and investigation, a Joint Bureau of Appraisal is just completing a ten months' revaluation of the land and buildings. The work has been done under the general direction of James G. Stafford, superintendent of the bureau. Alexander MacKeigan had charge of the valuation of the land. The valuation of the buildings, to which this article will be confined, was under the direction of the writer. In devising a system for the valuation of buildings it was necessary to originate a plan of action to suit the needs of the situation and the means at hand for accomplishing the results. However, the general plan adopted was similar also to those used elsewhere and was briefly to obtain the cost of reproduction based on unit foot estimates made by competent men in the field with all necessary data before them, and then to apply percentages of depreciation to fit the various cases.

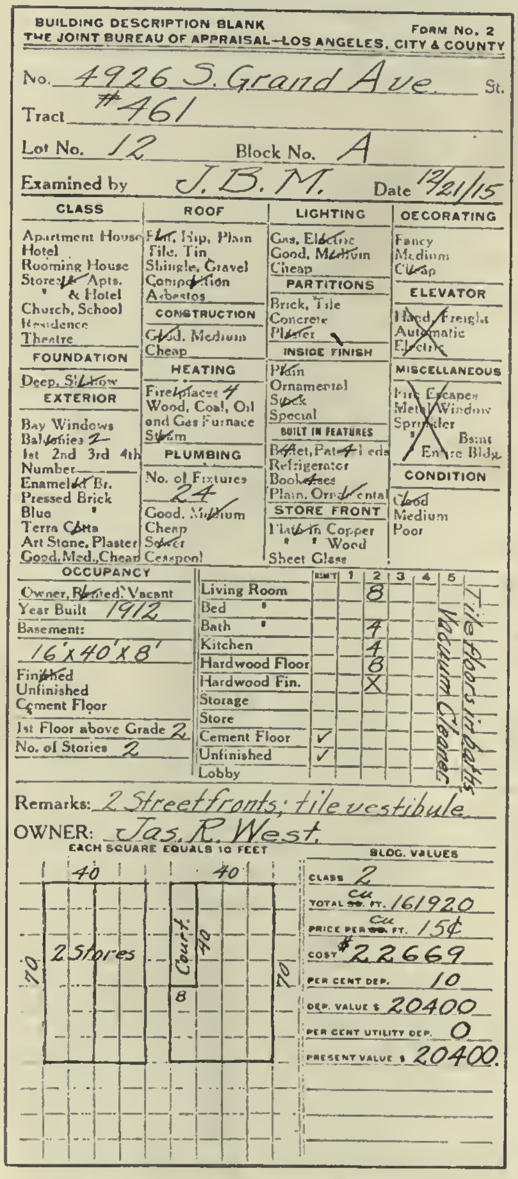
Values for Assessment Purposes

Before entering upon a discussion of the methods used it will be necessary to outline briefly the special features required of values fixed for assessment purposes. In general it was necessary to allow far less latitude in the matter of personal judgment on the part of the appraiser than is allowed in ordinary appraisal, for two reasons: First, the time available was so short as to preclude the expenditure of more than a very small amount of time in the appraisal of any one building, hence it was necessary to use some method which would permit a very rapid exercise of judgment in the matter of fixing values; second, since the average taxpayer justly wants to know the why and wherefore of values fixed on his property in relation to that of his neighbor, it was necessary to have sufficiently rigid rules for the placing of these values to insure the department against criticisms on the fairness of the methods used. Hence, flexibility was necessarily sacrificed to a certain extent.

Building Classification and Schedule

The first task was the preparation of a classification covering the various types of buildings to be encountered, and a schedule of unit prices to fit each type. It was necessary that this schedule should be flexible enough to allow a certain amount of exercise of judgment on the part of the man fixing the unit cost, and yet to provide a definite basis for reference in cases of dispute. With this in view the schedule was worked up with the idea of fixing certain standards of value from which prices might be applied to like structures with slight necessary deviations one way or another.

From his own experience, and with the aid of data in his possession, the writer compiled this schedule of costs and verified it by a series of detailed estimates. In every instance the result aimed at was a value for each building which would represent the average of the few low bids which a number of contractors would make on the building under normal conditions, and with prices of labor and material at the average level taken over the last five years. A copy of the classification was sent to a number of the contractors of the community, with a request that they fill in the blank spaces provided for the cost factor according to the dictates of their experience and such data as were in their possession. This classification consisted of brief specifications covering each type of building, and each class, just sufficient for the average builder or architect to be informed of the kind of building intended to be valued. The responses to this request seemed to indicate that generous consideration had been given the answers put down. The results were tabulated and the averages struck.



BUILDING DESCRIPTION BLANK
THE JOINT BUREAU OF APPRAISAL—LOS ANGELES, CITY & COUNTY
FORM No. 2

No. 4926 S. Grand Ave. St.
Tract #461
Lot No. 12 Block No. A
Examined by J. B. M. Date 12/21/15

CLASS: Apartment House, Hotel, Rooming House, Stores & Apts., " & Hotel, Church, School, Residence, Theatre
FOUNDATION: Deep, Shallow
EXTERIOR: Bay Windows, Balconies 2, 1st 2nd 3rd 4th, Number, Enameled Br., Pressed Brick, Blue ", Terra Cotta, Art Stone, Plaster, Good, Med., Cheap
ROOF: Flat, Hip, Plain, Tile, Tin, Shingle, Gravel, Composition, Asbestos
CONSTRUCTION: Good, Medium, Cheap
HEATING: Fireplaces 4, Wood, Coal, Oil and Gas Furnace, Steam
PLUMBING: No. of Fixtures 24, Good, Medium, Cheap, Sewer, Cesspool
LIGHTING: Gas, Electric, Good, Medium, Cheap
PARTITIONS: Brick, Tile, Concrete, Plaster
INSIDE FINISH: Plain, Ornamental, Stock, Special
BUILT IN FEATURES: Buffet, Pat. 4 Beds, Refrigerator, Bookcases, Plain, Ornamental
STORE FRONT: Plate in Copper, " " Wood, Sheet Glass
DECORATING: Fancy, Medium, Cheap
ELEVATOR: Hand, Freight, Automatic, Electric
MISCELLANEOUS: Fire Escapes, Metal Window, Sprinkler, " Bsmt, " Entire Bldg.
CONDITION: Good, Medium, Poor

OCCUPANCY: Owner, Rented, Vacant
Year Built 1912
Basement: 16'x40'x8'
Finished, Unfinished, Cement Floor
1st Floor above Grade 2
No. of Stories 2

	BSMT	1	2	3	4	5
Living Room			8			
Bed "						
Bath "			4			
Kitchen			4			
Hardwood Floor			8			
Hardwood Fin.			X			
Storage						
Store						
Cement Floor	✓					
Unfinished	✓					
Lobby						

Vacuum Cleaner
Tile floors in baths

Remarks: 2 Streetfronts; tile vestibule
OWNER: Jas. R. West.

EACH SQUARE EQUALS 10 FEET
40 40 70 2 Stores Court 40 8 70

BLDG. VALUES
CLASS 2
TOTAL ~~SQ.~~ CU. FT. 161920
PRICE PER ~~SQ.~~ CU. FT. 15¢
COST $22669
PER CENT DEP. 10
DEP. VALUE $ 20400
PER CENT UTILITY DEP. 0
PRESENT VALUE $ 20400.

STANDARD FORM FOR FIELD DATA

The value of the results, however, was considered to be not in the averages, as they were more or less distorted, due to the fact that a range of value was asked for for each class. The individual ideas as expressed showed what the extreme range for any one type should be, and the intermediate factors for each class could be interpolated. This check on the original schedule as arranged by the writer proved of immense value in the ultimate working out of the system, as reference was made directly to the contributor, whose values showed an unusual variation, and the ensuing discussion often proved of controlling importance.

Application of Cost Factors

A few of the rules of application of the cost factors should be stated in order to show more clearly the items taken into consideration. Where a cost factor is applied on a square foot basis, the entire floor area exclusive of the basement is included, porches being considered as floor area. Basements, where they occur, are usually very small, and are to be figured at a definite price per cubic foot, depending on the amount of finish and the construction of the walls. The cube of a building embodies that volume between the bottoms of the average footings and the tops of the average fire walls. Neither light wells nor open courts of small area are deducted.

Physical Depreciation

Having a fair, reasonable basis for the calculation of the cost of reproduction, the next step was the establishment of a method for arriving at a percentage to apply for the natural or physical deterioration occurring in buildings of the various types. It should be made clear that this depreciation includes nothing but the natural decay of material comprising the structure, and contains no element of obsolescence. It is based on the length of life of the building, taking into consideration the various elements of which it is composed, and upon its present state of repair.

TABLE 1—MEAN LIFE OF BUILDINGS—BRICK APARTMENT, CLASS "C"

Material	l Life relative to 75 yr., per cent	c Cost relative to total cost of building	$l \times c$ Cost of items
Foundations	100	11	$1,100
Masonry	100	16	1,600
Steel	100	11	1,100
Lumber	50	20½	1,025
Ornamental iron	50	2½	125
Plaster	50	10	500
Partitions	50	2	100
Electric wiring	33	3	100
Painting	10	3	30
Plumbing	33	12	400
Heating	33	4	132
Marble and Tile	25	5	125
		100	$6,337

$\frac{6337}{100}$ = 63.37 per cent of 75 yr., or a mean life of 47½ yr.

For working out a table for this depreciation various methods were resorted to. The first step was the determination of the average length of life of the different buildings according to the classifications adopted. There are considerable data available on this subject based upon observation and experience in different parts of the country. However, the unusual climatic conditions encountered in Los Angeles, together with the mushroom-like growth of the country, which has introduced a class of buildings adapted to rapid and cheap construction, present problems not met with elsewhere.

Length of Life

From a close study of the buildings of this city and from such local data as were obtainable, a fair idea of the length of life of all types of buildings was reached. This necessitated the actual checking up of buildings of known age and in varying states of repair, and the delving into records of buildings known to have been wrecked on account of their being uninhabitable, and then deriving an average length of life. To check this rather indefinite method a solution suggested by R. P. Bolton in his "Building for Profit" was used. This method involves the use of detailed estimates of a series of buildings of each class as in Table 1.

The lengths of life given the various items in these computations were determined from observations of various cases and from upkeep records of various buildings in this city. The ratio which each part bears to the whole is most readily expressed in terms of its monetary value, as the quantities do not relate to each other in any common terms, except that of money. While the cost is not related directly to the length of life of the building, yet, as the aim is to find the proper falling off of value due to structural deterioration, the assumption is very nearly correct.

This operation was gone through with for a large number of buildings, and a general average taken. The results thus obtained were given the greatest weight in determining the final results, which are given in table 2.

A study of these results showed that for all buildings other than those of frame construction the length of life given corresponds very closely with those used in doing similar work in other cities, and by such authorities as Bernard, Sommers and the Wisconsin Tax Commission.

No building is given complete depreciation, for obviously so long as it is habitable it is of some value from a structural standpoint. Hence 80 per cent was arbitrarily adopted as the maximum depreciation allowed. There are insufficient data on hand to determine the length of life of buildings of the fireproof variety, as none of them are of sufficient age to warrant any deductions. After various estimates had been made by all known methods, the final decision was for a depreciation of 1 per cent per year for all types of fireproof construction.

RAPID DEPRECIATION OF FRAME BUILDINGS

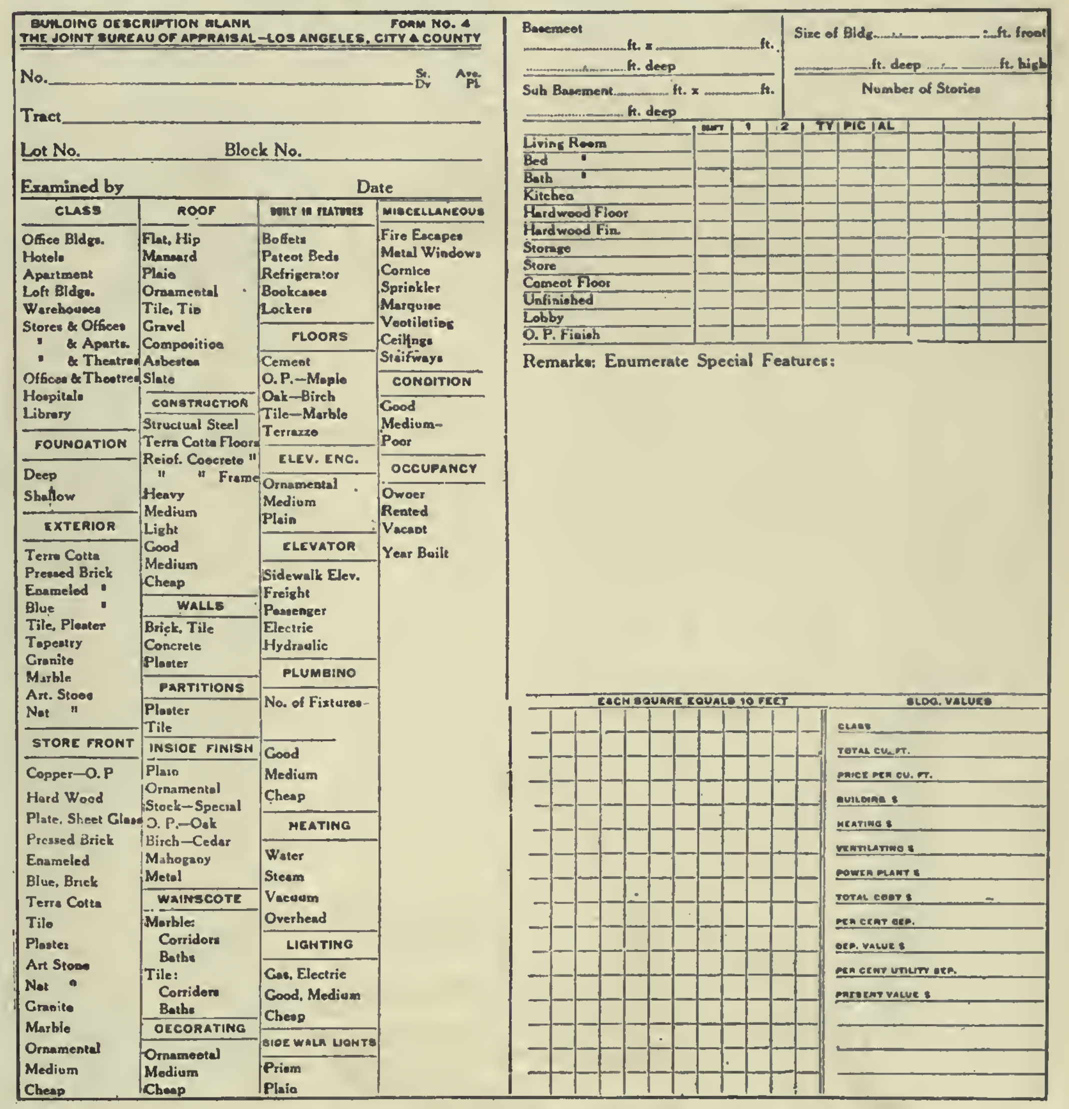
The rapid depreciation allowed for frame buildings is due to the fact that a large proportion of these buildings was constructed and sold direct to the public by investment and building companies. They were built for quick sales and were for the most part of the bungalow type, which has been very popular with the homeseeking people who come to Los Angeles. They are that type of house which presents a fair appearance to the untrained observer, but which is literally "thrown together." Protection from the elements is not a factor of design, and in the majority the joints will open up while they are to all intents and purposes new buildings.

Another deteriorating effect is the result of the extremes of wet and dry weather which prevail in the different seasons. The humidity during at least seven months of the year is very low, and during the remaining months an average of nearly 16 in. of rain falls each season. This has its effect on exposed timber, and, while not so severe as that imposed in other climates, is still a factor carrying some weight when taken in conjunction with lax methods of protecting the structural parts of the wood frame.

LOWER RATE FOR RESIDENCES

The term of life for residences is given as somewhat longer than for bungalows. This is simply because the builders of the two-story class of houses are somewhat more removed from the idea of "shacks"—that is to say, these buildings are usually of better construction; their structural parts are more protected and heavier, and the workmanship and material are of a better and more permanent character.

Observers of this depreciation table will doubtless notice the high percentage of deduction allowed for bungalows and residences for the first year of their life. This was thought necessary on account of the fact that when the "brand newness" of a building used as a home is gone there is a noticeable falling off in the demand for it. This is doubtless the experience of the real-estate men in all parts of the country, but it is especially true in Los Angeles because of the fact that there are always new homes available, and at terms alluring enough to preclude much thought of a second-hand purchase.



BUILDING DESCRIPTION BLANK FORM NO. 4
THE JOINT BUREAU OF APPRAISAL—LOS ANGELES, CITY & COUNTY

No.__________ St. Dv Ave. Pl.
Tract__________
Lot No. Block No.
Examined by Date

CLASS
Office Bldgs.
Hotels
Apartment
Loft Bldgs.
Warehouses
Stores & Offices
" & Aparts.
" & Theatres
Offices & Theatres
Hospitals
Library

FOUNDATION
Deep
Shallow

EXTERIOR
Terra Cotta
Pressed Brick
Enameled "
Blue "
Tile, Plaster
Tapestry
Granite
Marble
Art. Stone
Nat "

STORE FRONT
Copper—O. P
Hard Wood
Plate, Sheet Glass
Pressed Brick
Enameled
Blue, Brick
Terra Cotta
Tile
Plaster
Art Stone
Nat "
Granite
Marble
Ornamental
Medium
Cheap

ROOF
Flat, Hip
Mansard
Plain
Ornamental
Tile, Tin
Gravel
Composition
Asbestos
Slate

CONSTRUCTION
Structual Steel
Terra Cotta Floors
Reinf. Concrete "
" " Frame
Heavy
Medium
Light
Good
Medium
Cheap

WALLS
Brick, Tile
Concrete
Plaster

PARTITIONS
Plaster
Tile

INSIDE FINISH
Plain
Ornamental
Stock—Special
O. P.—Oak
Birch—Cedar
Mahogany
Metal

WAINSCOTE
Marble:
Corridors
Baths
Tile:
Corridors
Baths

DECORATING
Ornamental
Medium
Cheap

BUILT IN FEATURES
Buffets
Patent Beds
Refrigerator
Bookcases
Lockers

FLOORS
Cement
O. P.—Maple
Oak—Birch
Tile—Marble
Terrazzo

ELEV. ENC.
Ornamental
Medium
Plain

ELEVATOR
Sidewalk Elev.
Freight
Passenger
Electric
Hydraulic

PLUMBING
No. of Fixtures-
Good
Medium
Cheap

HEATING
Water
Steam
Vacuum
Overhead

LIGHTING
Gas, Electric
Good, Medium
Cheap

SIDE WALK LIGHTS
Prism
Plain

MISCELLANEOUS
Fire Escapes
Metal Windows
Cornice
Sprinkler
Marquise
Ventilating
Ceilings
Stairways

CONDITION
Good
Medium-
Poor

OCCUPANCY
Owner
Rented
Vacant

Year Built

Basement ______ ft. x ______ ft.
______ ft. deep
Sub Basement ______ ft. x ______ ft.
______ ft. deep

Size of Bldg. ______ ft. front
______ ft. deep ______ ft. high
Number of Stories

	BSMT	1	2	TY	PIC	AL				
Living Room										
Bed "										
Bath "										
Kitchen										
Hardwood Floor										
Hardwood Fin.										
Storage										
Store										
Cement Floor										
Unfinished										
Lobby										
O. P. Finish										

Remarks: Enumerate Special Features:

EACH SQUARE EQUALS 10 FEET

BLDG. VALUES
CLASS
TOTAL CU. FT.
PRICE PER CU. FT.
BUILDING $
HEATING $
VENTILATING $
POWER PLANT $
TOTAL COST $
PER CENT DEP.
DEP. VALUE $
PER CENT UTILITY DEP.
PRESENT VALUE $

HOW THE STRUCTURAL FEATURES WERE CLASSIFIED IN DETAIL

OBSOLESCENCE

The last step in the preparatory work was to devise a method for allowing a depreciation for that subtle, elusive factor of building valuation which has been called obsolescence. At the present time the final decision on this subject is pending, a tentative plan having been submitted to the two assessors which they have under advisement.

This plan which seems by all means the most feasible is as follows: Those sections of the city which have developed a high utility for either retail business, apartments or industrial purposes have been districted according to the degree of obsolescence occurring in the different sections, and the proper percentages marked on the map for each district, for buildings used for residence purposes only. For buildings of other types it has been found impossible to follow any prescribed form of procedure, each case presenting so many different features as to preclude the making of a rule which would fix arbitrarily the amount to deduct.

For the purpose of fixing the percentages to deduct in the different residence districts a close study was made of property sales, and from a comparison of sales made of improved property with those of unimproved it was possible to arrive at amounts which seemed to fit the actual conditions. The cause of the falling off in value of residences in the districts referred to was chiefly two-fold: First, the value of the land had increased, due to the character of surrounding improvements, they being of a kind which served a higher utility, either business, industrial or apartments, thus making the total value of the property such that the rental from a residence thereon failed to pay an adequate income on the investment; second, the presence of this property, of a different utility in many instances, made the surrounding property undesirable from a residence standpoint, it being impossible to sell property in the neighborhood for residence purposes. Thus the only utility for buildings of this kind was for rooming houses, or they were sometimes converted into flats, in a vain effort to preserve their economic value.

The argument has been advanced to the writer that because one of these buildings was earning a higher income than one similar in a different location, the value of the former was appreciated rather than otherwise. It appears that many people often lose sight of the fact that real property embodies the land and all that is permanently affixed thereto. The investment must be considered as a whole and not in part, and if the income fails to meet the expenses of holding, it is a certainty that the property is not properly improved, or that the owner is counting on the speculative element in the land to yield him an adequate return from his investment.

RAPID SHIFTS IN BUSINESS CENTERS

The rapid growth of Los Angeles is again responsible for introducing a variable factor into the general formulas of appraisal. This is due to the rapid shifts in the business centers made necessary by a large increase in population, and the consequent outgrowing of quarters which had been deemed sufficient for a much greater length of time than they actually were. This is particularly true of the business buildings, there being any number of structures in the older parts of the city in a fair state of repair which are not serving the purpose for which they were designed, because the location is not adapted to that purpose. Many of them are standing idle, and some are partially serving a perverted utility.

In dealing with cases of this kind there is only one method of procedure, and that is the exercise of judgment guided by a thorough study of each individual case.

OPERATION OF THE SYSTEM

Before it was possible to begin actual operations it was necessary to devise suitable blanks for the keeping of field notes and for the handling of the large mass of data and computations necessary. The slips illustrated herewith indicate the method used in the collection of the information pertaining to the establishment of records and for applying the cost factors. The field men were divided into two groups: Those who measured and described the buildings and made the necessary sketches, and those who applied the cost factors according to the schedule.

The first of these groups worked in crews of two men each. They were required to approach the occupants of each building and gain from them, and from a personal inspection of the interior, the required information. This was usually done by one man while the other busied himself with taking the measurements and getting the outside information. To this end the first man worked one building ahead of the second, turning over the slip with the inside information complete.

Measurements were taken to the nearest foot, and the measurer used an awl or other sharp instrument which he stuck into the building or the ground to hold the end of his tape. Cloth metallic tapes were found to be the most practicable, as when steel tapes were used breaks were so frequent as to affect materially the amount of work done, as well as being a considerable item of expense. The metallic tapes were lighter and sufficiently accurate for the purpose.

The men who did this work were selected because of past experience in building work. Architects, estimators and contractors being plentiful owing to the depression in this field, a number of excellent men were found.

PRICING

Men who were capable of "pricing" were more difficult to find, and required a large amount of training before they were qualified to do this work. Even after a considerable time spent at this work it was frequently necessary to spend a few hours in the field with them in order to maintain the same standards uniformly throughout. Little difficulty was experienced, however, with buildings requiring a cost factor less than $1.50 per square foot. Above this figure frequent checkings were necessary, and when the price applied was more than $2 per square foot it was a rule to have all such work checked by a second person. It was found advisable to have two men work together through a district which contained a large number of expensive buildings, as the discussion sure to ensue in regard to the proper prices always resulted in greatly increased accuracy of the work done.

It should be interesting to note some of the factors which were always considered in fixing a unit price on any building. The factor which has the greatest influence is what might be termed the amount of concentration of material, or the degree of compactness of the structure. A failure to gage this factor properly means failure in the final result. The general appearance is a matter of relatively small importance, and

TABLE 2—PHYSICAL DEPRECIATION OF BUILDINGS IN PER CENT—USED BY JOINT BUREAU OF APPRAISAL, LOS ANGELES, CAL.

Age in Years		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	Life in Years
Cal Hs'e	Good...	10	13	16	19	22	25	28	31	34	37	40	43	40	49	52	55	58	61	64	67	70	73	76	78	80																25
	Med....	10	14	18	22	26	30	34	38	42	46	50	54	58	62	65	68	71	74	77	80																					20
	Poor....	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80																										15
Sheds	Good...	4	8	12	15	19	23	26	29	32	35	38	41	44	47	50	53	56	59	62	65	68	71	74	77	80																25
	Med....	4	9	14	19	24	28	32	36	40	44	48	52	56	60	64	67	70	73	76	80																					20
	Poor....	4	10	16	22	28	34	40	45	50	55	60	65	70	75	80																										15
Garage Barns	Good...	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80																					20
	Med....	4	9	14	19	24	29	33	38	43	48	53	58	62	66	70	74	77	80																							17.5
	Poor....	4	10	16	22	28	34	40	45	60	55	60	65	70	75	80																										15
Bungalow	Good...	10	12	14	16	18	20	22	24	20	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72½	75	77½	80						35
	Med....	10	13	16	19	22	25	28	31	34	37	40	43	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80											30
	Poor....	10	14	18	22	26	30	34	38	42	45	50	53	56	59	62	64	66	68	70	72	74	76	78	79	80																25
School Church Stores	Good...	4	7	10	13	16	19	22	25	27	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80						35
	Med....	4	8	12	16	20	23	26	29	32	35	37½	40	42½	45	47½	50	52½	55	57½	60	62	64	66	68	70	72	74	76	78	80											30
	Poor....	4	9	14	19	24	28	31	31	37	40	43	46	40	52	55	58	61	64	67	70	72	74	76	78	80																25
Ap'ts Flat	Good...	6	10	14	18	22	25	28	31	34	37	40	43	46	48	50	52	54	56	58	60	62	61	66	68	70	72	74	76	78	80											30
	Med....	6	11	15	20	24	28	32	35	38	41	44	47	50	53	55	57	59	61	63	65	67	60	71	73	75	77	80														27.5
	Poor....	6	12	17	22	26	30	34	38	42	46	40	52	55	58	60	62	64	66	68	70	72	74	76	78	80																25
Residence	Good...	7	10	13	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	73	74	75	76	77	78	79	80	40
	Med....	9	12	15	17½	20	22½	25	27½	30	32½	35	37½	40	42	44	46	48	50	52	54	56	58	60	62	64	60	68	70	72	74	76	77	78	79	80						35
	Poor....	11	16	18	20	22	25	28	31	34	37	40	43	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80											30
Class C Ap'ts Hotels	Good...	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	47	48	40	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65*	55
	Med....	6	9	12	15	18	21	24	26	28	30	32	34	36	38	40	42	44	46	48	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70*	50
	Poor....	6	10	14	18	22	25	28	31	34	36	38	40	42	44	46	48	50	52	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75*	45
Hotel Residence	Good...	6	7½	9	10½	12	13½	15	16½	18	19½	21	22½	24	25½	27	28½	30	31½	33	34½	36	37½	39	40½	42	43½	45	46½	48	49½	51	52	53	54	55	56	57	58	59	60*	60
	Med....	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65*	55
	Poor....	6	9	12	15	18	21	24	26	28	30	32	34	36	38	40	42	44	46	48	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70*	50
Store-Lofts Garage	Good...	2	4	6	6	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60*	60
	Med....	3	5½	8	10½	13	15½	18	20½	23	25	27	29	31	33	35	37	39	41	43	45	46	47	48	40	50	51	52	53	54	65	56	57	58	59	60	61	62	63	64	65*	55
	Poor....	4	7	10	13	16	19	22	25	28	30	32	34	36	38	40	42	44	46	48	50	51	52	53	54	55	56	57	68	59	60	61	62	63	64	65	66	67	68	69	70*	50
Factory	Good...	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	50	58	60	62	64	66	68	70	71	72	73	74	75*	45
	Med....	2½	5	7½	10	12½	15	17½	20	22½	25	27	29	31	33	35	37	39	41	43	45	47	40	51	53	55	57	59	61	63	65	67	69	71	73	75	76	77	78	79	80	40
	Poor....	3	6	9	12	15	18	21	24	27	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80						35
Wh'se Church	Good...	2	4	6	8	10	12	14	16	18	20	22	24	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53*	65
	Med....	2½	5	7½	10	12½	15	17	19	21	23	25	27	29	31	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58*	60
	Poor....	3	6	9	12	15	18	20	22	24	26	28	30	32	36	36	38	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63*	55
School Theatre	Good...	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	61	62	63	64	65	66	67	68	69	70*	50
	Med....	2½	5	7½	10	12½	15	17½	20	22½	25	27	29	31	33	35	37	39	41	43	45	47	49	51	53	55	57	59	61	63	65	66	67	68	69	70	71	72	73	74	75*	45
	Poor....	3	6	9	12	15	18	21	24	27	30	32	34	36	38	40	42	44	46	48	50	54	54	56	58	60	62	64	66	68	70	71	72	73	74	75	76	77	78	79	80	40
Class A Fireproof	Good...	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	19	21	23	25																					90
	Med....																																									82.5
	Poor....																																									75

*Beyond 40 years' percentage of depreciation increases by one per cent per annum for life of building, shown io last columo. Maximum depreciation never over 80 per cent.

it was this difficulty that the men who did the pricing had the greatest trouble in overcoming. To aid the pricers the areas of the buildings were computed in the office before being priced, and then with the aid of a pocket slide rule such items as plumbing fixtures, patent built-in beds and other items of the structure could be gaged by computing the amount of floor area per fixture, or per apartment or room.

EFFECT OF STORY HEIGHT

With this same idea of concentration the question of story height belongs. This, in the writer's opinion, has the greatest influence upon cost of any of the items mentioned. An instance of this may be cited in the case of two office buildings known to the writer. They are both built to the limit of height for steel frame buildings in this city; that is, 150 ft. above the sidewalk. One has eleven stories in this height, and the other fourteen. The first is a very expensive building as regards decoration and interior finish, while the second is very plain, and almost cheap in these regards. The first cost 29.5 cents and the second 35.2 cents per cubic foot. There is nothing to which to attribute the 20 per cent advance other than to the small story height of the second building.

In all the pricing the men were required to adhere strictly to the schedule, as in no other way could uniform standards be maintained. Whenever it was thought necessary to deviate from this schedule the matter was referred to the head of the department for consideration. This only applied, of course, when the building was such as to demand a price beyond the extreme limits of all the classes of any one type.

OFFICE COMPUTATIONS

With the cost factors properly applied, the next step was to turn the description slip over to the office force for computation. This process of computation was divided into four steps. First, the areas of the buildings were computed, as before noted, and the percentage of depreciation was set down in its proper place. Also, the basements were computed at a uniform rate per cubic foot, this rate depending on the completeness of the finish, and the kind of walls. In residences the heating plant was also figured separately and set down in the place provided on the slip. Basements and heating plants in frame residences were figured separately, because a very large number of buildings of this type have nothing of the kind in their make-up.

This work was all done by one man, and was then entirely checked by a second, it being found necessary to go over one person's work completely in order to insure accuracy. The remainder of the work was done on a computing machine, operated by skilled girls.

During the course of the computations numerous errors were discovered which had been made by the field men in the collection of the data. These errors were mostly of omissions, but it was necessary to have two men continually in the field for the purpose of correcting these mistakes. The greatest difficulty was encountered in obtaining the exact locations of the various buildings; that is, the legal descriptions of the property upon which they were located.

The filing of these slips completed the process of valuation, and the files were turned over to the assessors for entry on their rolls.

Favors Federal Department of Public Works

C. E. Grunsky in Paper Before Inland Waterways Congress Presents Advantages of Consolidating Engineering Branches of the Government

BELIEVING that if the people of the country understood the problem, it would not be long before some one of the Cabinet positions was replaced by a secretary of public works, C. E. Grunsky, consulting engineer, San Francisco, argued in favor of a federal department of public works before the recent Inland Waterways Congress in San Francisco. He pointed out the lack of interrelation and co-operation between various bureaus and other subdivisions of the Government engaged in engineering work. Co-ordination of these branches would, in his judgment, result in increased efficiency, not alone due to lower costs, but to the better results that would follow from the definite responsibility that would fall upon such a department.

The following extract from his address indicates the branches which he believes should be united under one head, and states briefly the advantages which he expects would result therefrom:

ARMY ENGINEER CORPS

The nearest approach in our scheme of government organization to such a department is the Engineer Corps of the army. The men trained at West Point who qualify as engineers are placed in charge of military defenses and of the nation's river and harbor work. Their record is an enviable one and the magnitude of the enterprises which they direct entitles the Engineer Corps to first consideration when a Department of Public Works is to be organized.

Personally, based on fair experience, some of which was gained in close contact with members of the Cabinet, I am convinced that if the country understood the problem it would not be long before some one of the Cabinet positions were replaced by a secretary of public works.

SCOPE OF DEPARTMENT

In such a department the employment of the engineer staff insofar as permanent positions are concerned should be for life. The accessions to the staff from West Point should be supplemented from the engineering schools of recognized standing. There should be uniformity of rank regardless of the school at which the engineer was trained. But there would naturally be some distinction in the requirement of military service.

It will not be necessary to go further into detail beyond indicating some of the bureaus that would naturally be assigned at once to such a department. There would be the Engineer Corps of the army, and the Reclamation Service, the Isthmian Canal Commission, the Alaska Railway Commission, the Coast and Geodetic Survey, the Water Resources Branch of the Geological Survey, the office of the Supervising Architect, now under the Secretary of the Treasury; the valuation bureau of the Interstate Commerce Commission, and no doubt other bureaus, with later additions of those that are likely to be created to handle swamp-land reclamation and road work. All of such bureaus naturally belong in a Department of Public Works where their activities would be properly co-ordinated, and where such co-ordination would result in increased efficiency not alone due to lesser cost, but because of the better results that would follow from the general and definite responsibility falling upon such a department.

Rail Failures Ascribed to Poor Quality of Steel

W. C. Cushing Presents Results of Studies Showing That Segregation of Elements Is a Large Factor—Remedies Proposed

THE result of a long series of studies of the causes of rail failures, continued since 1911, were presented by W. C. Cushing, of Pittsburgh, Pa., in a paper of 145 pages, presented before the recent annual convention of the American Railway Engineering Association in Chicago. From his summary the following abstract has been taken to indicate the principal causes of defective heads and of broken rails, and the remedies proposed.

SEGREGATION

Defective heads are nearly always accompanied by a poor quality of metal, and the segregation of the elements carbon and phosphorus is for the most part responsible for the trouble. Brittleness and hardness nearly always follow segregation, and the sulphur is in many cases found to be rather higher than the average.

It would appear that the removal of slag could be accomplished by better care in tapping the furnace stack and pouring from the ladles, plenty of time being allowed for it to come to the surface in each operation.

It should be no more than necessary to call attention to the defective heads with pieces of old tie-plates and other scrap material in them to put a stop to the practice of using that method for protecting the stool of the ingot mold from cutting, yet instances of this have been found in rails rolled since 1909, when such complaints were first made.

As the percentage of phosphorus is nearly always above the limit of 0.10 in cases of split heads, the use of open-hearth steel will control the evil effects of that element.

Control of the segregation of the elements would seem to be possible by the use of the "sink-head" process for making sounder ingots, and more careful teeming, plenty of time being given to allow the chemical reactions to take place. One mill has used this method with good results.

CARE IN ROLLING

The sources of trouble are not ended with the production of a sound ingot. Greater care should be exercised in blooming and rolling, and improved methods should be introduced. Previous studies indicate that large and heavy reduction in the blooming rolls is injurious to the finished product, as it initiates the cracks which result later on in the seams, responsible for many failures, especially in broken bases. The remedy seems to be lighter reduction.

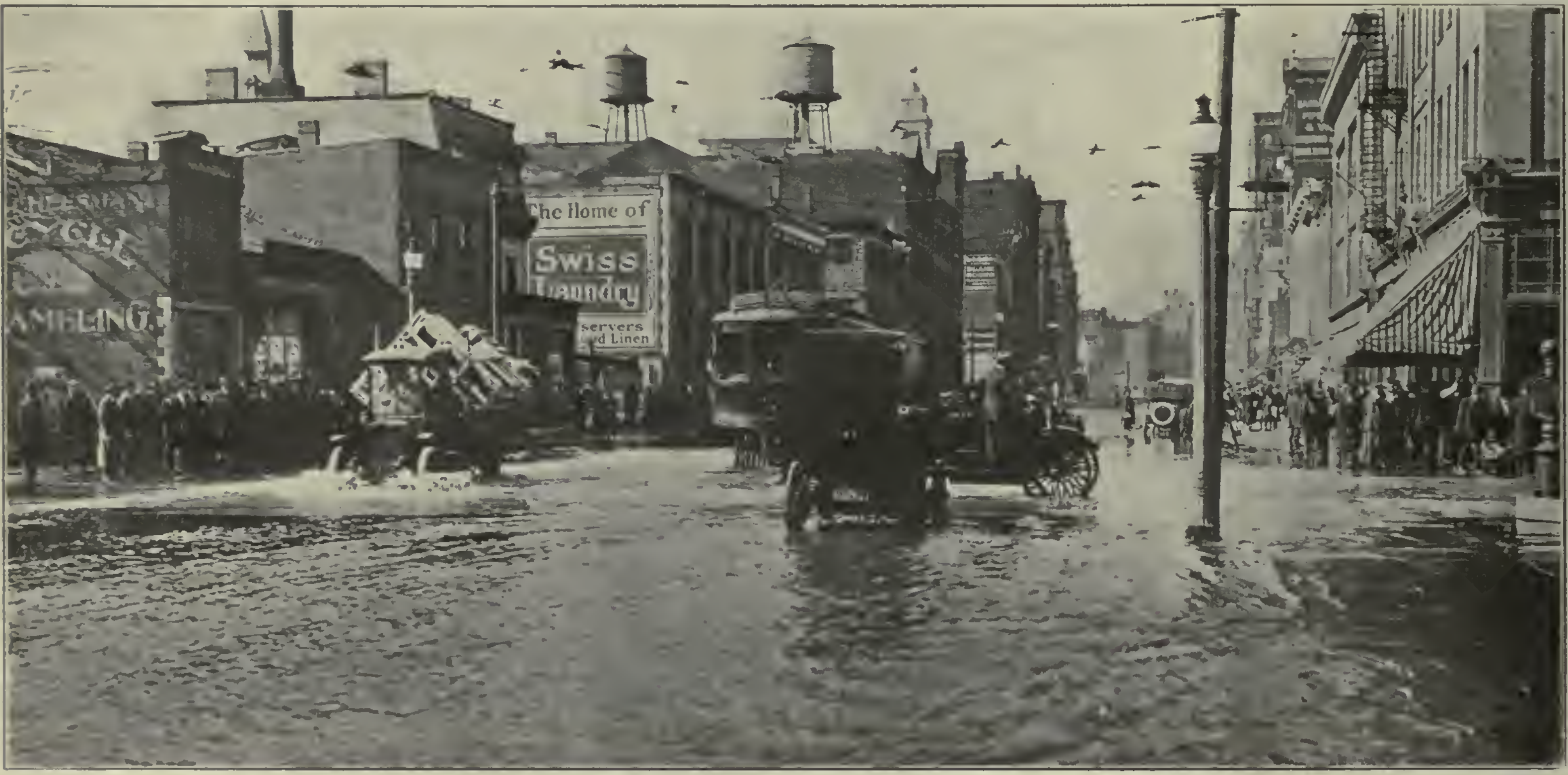
The cases of long-service rails and rails worn out in the tracks seem to show that high carbon is not the only consideration for more durable material, as rails with low carbon have lasted longer under the same conditions than rails with higher carbon though this is by no means always the case. The temperature of rolling is undoubtedly a very strong, if not the strongest, factor in producing homogeneous and durable material.

Record Flood from Melting Snows Passes Through Rochester, N. Y.

Volume of Flow Estimated at 50,000 Second-Feet Exceeding Amount in 1913—Damage Estimated at $300,000

By JAMES P. WELLS
Consulting Engineer, Rochester, N. Y.

SWOLLEN by melted snow to the record volume of 50,000 sec.-ft., the Genesee River swept through Rochester, N. Y., last week, flooding streets and railway yards, undermining pavements and causing property damage estimated at $300,000. It was the worst flood in the city's history, reaching a crest height of 8.52 ft. at the Johnson & Seymour dam in the heart of the city, as against a height of 7.99 ft. recorded during the 1913 flood. Fortunately this year's moderation in temperature on the snow-covered watershed was not accompanied by a heavy rainfall. With a heavy precipitation, combined with the melting snow, the flood volume might easily have attained 100,000-sec.-ft. proportions.



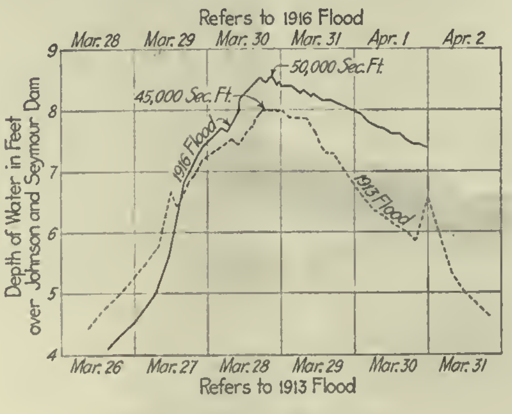
RIVER WATER FLOODED EXCHANGE STREET, IMPEDING MOVEMENT OF VEHICLES AND STREET CARS

GENESEE RIVER DATA

The Genesee River rises in Potter County in the northern part of Pennsylvania, close to the New York state boundary, and flows in a northerly direction across the state of New York. In the northern part of the drainage basin the topography is rough and hilly. For 20 miles above Portage the fall of the river is slight, the slope being only 6.2 ft. per mile. At Portage there is a drop of 330 ft. in 3 miles. From the foot of Portage Falls to Mount Morris, a distance of 17 miles, the river flows through a deep gorge with a total fall of 180 ft. From Mount Morris to Rochester, in a distance of 46 miles, the river winds back and forth through broad flats with a total fall of only 55 ft. At Rochester, within a distance of 2 miles, there are three falls, with a total drop of 231 ft.

In times of flood the water from the upper river and from Canaseraga Creek is discharged upon the broad flats between Mount Morris and Rochester, and a huge lake is created over the entire area. Directly south of Rochester high-water marks have been found 3 miles on one side and 4 miles on the other side of the main river. These flats act as a huge detention basin. The flood waters from the upper courses of the river are temporarily held and the flood at Rochester is prolonged and greatly diminished. In the summer, when the ground water is low on the flats, floods have occurred at Mount Morris greater in intensity than at Rochester.

In 1865 the Genesee valley experienced a very heavy flood which, at Rochester alone, caused a damage of over $1,000,000. Forty-eight years later, during the last few days of March, 1913, a day or two later than the great floods of the Ohio valley, another flood occurred which was greater in volume at Rochester than any since 1865. This was caused by heavy rainfall over the entire upper watershed. Though there was practically no snow on the ground this rain was sufficient to bring about a flood which overflowed into the streets at Rochester and did considerable damage, not only in the city but throughout the entire Genesee valley. The maximum flow during this flood was estimated at 38,000 sec.-ft. at Mount Morris and 45,000 sec.-ft. at Rochester.



FLOODS OF 1916 AND 1913

80 INCHES OF SNOW

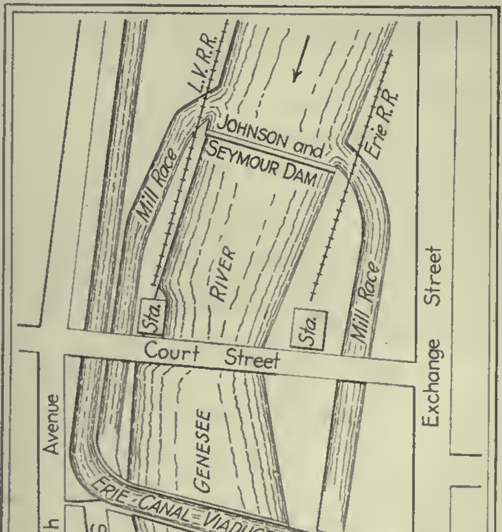
In the latter part of the past month Rochester has again experienced a flood greater, even, than the one of 1913, due not to heavy rains but to melted snow. On March 28, 1913, 7.99 ft. of water passed over the Johnson & Seymour dam in the central part of the city. On March 30, 1916, the peak of the flood was reached when 8.52 ft. passed over the dam. This is equivalent to about 50,000 sec.-ft. This flood was caused by the melting of heavy snows which had fallen in February and March upon ground which was to a large extent, if not entirely, saturated. At Rochester during the month of February there was a snowfall of 36 in. and in March 44 in., making a total of 80 in. for the two months, roughly equivalent to 8 in. of water. This large amount of snow was present over practically the entire watershed. Cold weather continued all through the months of February and March up to within a few days of the flood, giving no opportunity for the snow to melt. The weather suddenly turned warm with a slight rainfall of not over ½ in. The succession of high temperatures during the day and low temperatures at night extended the flood considerably and prevented a much more serious condition.

The greatest menaces to the safety of the business section of Rochester are the aqueduct which carries the Erie Canal across the river and the Main Street bridge. Main Street is the principal thoroughfare of the city and the only business street running east and west across the river. Four-story business blocks are built up on each side of the bridge, resting on piers in the river. The openings between these piers are insufficient to take care of the water, even when unobstructed by driftwood. Large trees often become lodged against

FLOOD CONDITIONS IN SOUTHERN SECTION OF ROCHESTER

HOW SAND-BAG DAMS WERE PLACED TO HOLD WATER BACK

the piers and have to be cut away. During the last flood the arches of the aqueduct were completely filled, as were the openings under the Main Street bridge. The cellars of some of the buildings were considerably damaged. In one instance a stream poured over the floor of a store into the street. After the crest of the flood had passed part of the pavement in Main Street collapsed, and at the present writing no traffic has been allowed through the street. South of the Johnson & Seymour dam the water rose to such a height that it overflowed the Erie Railroad tracks and flowed down Exchange Street to Court Street, where it again entered the river through a millrace. The tracks of the Erie, Pennsylvania and Buffalo, Rochester & Pittsburgh railroads, entering Rochester from the south, were under water and trains could not be brought into the city.



GENESEE RIVER AT CITY CENTER

FLOOD RECORDS COMPARED

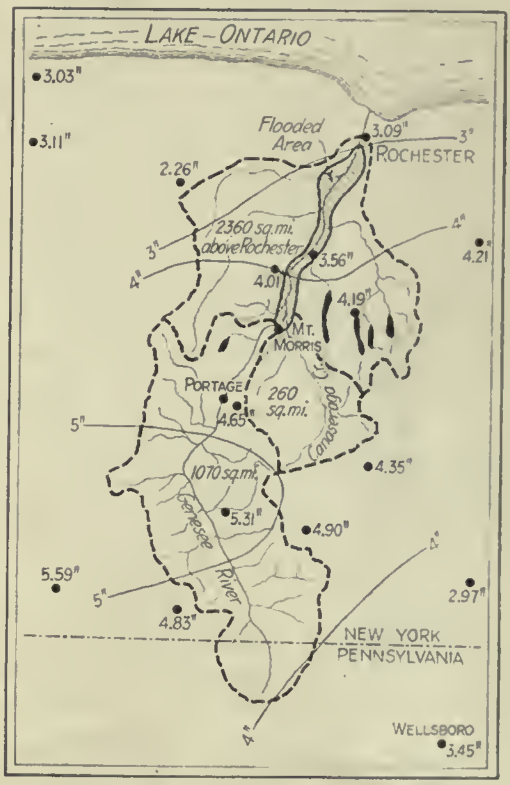
While the loss of property throughout the valley probably did not exceed $300,000, the flood should serve as a warning as to what might happen if a combination of certain conditions on the watershed should occur.

As has been stated above, the present flood was due only to the melting of snow. It resulted in a flood of 50,000 sec.-ft. In March, 1913, approximately 5 in. of rainfall on the upper watershed, with little if any snow on the ground, produced a flood of 38,000 sec.-ft. at Mount Morris and 45,000 sec.-ft. at Rochester. If such a rainfall, which is not at all improbable, should occur on the Genesee watershed when the ground was covered with such a depth of snow as in the present year, it is very likely that there would be a flood of at least 80,000 sec.-ft. at Mount Morris, with a correspondingly greater flow from the other tributaries. Under such conditions, with the river flats already saturated, the flood at Rochester would undoubtedly amount to from 80,000 to 100,000 sec.-ft.

The storm which produced the heavy rainfall in the Genesee valley in 1913 was the same storm which produced rainfalls of over 10 in. in some parts of the Ohio valley. Preceding the flood of 1913, the average rainfall on the watersheds of the Scioto and Olentagny Rivers, which unite at Columbus, Ohio, was 9.14 in. This produced a flood estimated at 80,000 sec.-ft. On the Scioto, a stream with a drainage area of 1050 sq. miles, and a flood of 60,000 sec.-ft. on the Olentagny, a stream with a drainage area of 520 sq. miles, or a combined flood of 140,000 sec.-ft. from the 1570 sq. miles comprising both watersheds. The drainage area of the Genesee is 1070 sq. miles at Mount Morris, and Canaseraga Creek, which enters the river directly below Mount Morris, has a drainage area of 260 sq. miles. The combined area is 1330 sq. miles, or 84 per cent of the combined drainage area of the Scioto and Olentagny, which produced a flood of 140,000 sec.-ft.

Such a rainfall as occurred in 1913 in the Ohio valley has not occurred in the Genesee valley since records have been kept, but there is nothing to indicate that such a rainfall might not occur at any time. In 1889 the rainfall was extremely heavy over an area of 20,000 sq. miles in Pennsylvania, in some places exceeding 10 in. At Wellsboro, a short distance to the southwest of the Genesee basin, 9.8 in. fell, of which 7.5 in. fell in less than 10 hr. A similar storm, covering a large area, occurred in New England in 1869. That such a heavy rainfall has not occurred on the Genesee watershed for several decades appears to be due only to chance. In the event of such a rainfall on saturated or frozen ground there is no doubt that the flood at Mount Morris would equal at least 80,000 sec.-ft., and at Rochester from 80,000 to 100,000 sec.-ft. With a rainfall of 9 in. and an appreciable amount of snow on the ground a flood much greater than the above would result. In view of these facts it is evident that the city of Rochester would not be going beyond the limits of conservatism by preparing for a flood of a least 100,000 sec.-ft.

At the present time the city has under construction the deepening of the river channel through the city. It is estimated that upon the completion of the river deepening plans the channel will take care of from 60,000 to 70,000 sec.-ft. This is not sufficient. With a flood of 100,000 sec.-ft. at least 30,000 sec.-ft., in itself a good-sized flood, would have to find its way back to the river through the streets in the heart of the business section. There would undoubtedly be a repetition of the conditions in Dayton and Columbus in 1913.



GENESEE WATERSHED AND RAINFALL RECORDS FOR MARCH 23-27, 1913

Drainage area at Rochester, 2360 sq. miles, at Mt. Morris, 1070 sq. miles.

Removal of some of the obstacles to the natural flow of the river in the Rochester business section and the construction of retaining walls would greatly help matters, but not to a sufficient extent. Reservoir control of the waters of the upper river appears to be a solution which would give the greatest benefit, not only to Rochester but to the entire valley between Mount Morris and Rochester. For several years the construction of a large storage reservoir at Portage has been advocated by engineers and commissions. Extensive surveys and plans were made by the New York State Water Supply Commission. It was planned to construct a masonry dam 152 ft. high, which would set the water back 15 miles, creating a reservoir with a total capacity of 19,000,000,000 cu. ft., part of which was to be available for power purposes.

There is not sufficient space to discuss here the various reasons why this has not been done. The chief difficulties appear to be legal. The cost was estimated at less than $5,000,000 without any power plant, and this sum included the relocation of 17 miles of the Pennsylvania Railroad and the purchase of all the necessary property. The construction of this reservoir, if a sufficient amount of its capacity were reserved for flood protection purposes, would greatly reduce the danger of destructive floods in the Genesee valley and at least partly, if not entirely, remove the danger with which Rochester is at all times menaced. It is to be hoped that steps will be taken leading to some adequate solution before the disasters of 1913 in the Ohio valley are repeated on the Genesee.

Inverted Siphons Replace Bridges Where Canals Meet Roads

THE extensive system of main canals and laterals which traverse Imperial Valley has presented in many places the problem of how to get the highway across the canal without interfering with the function of either. Bridges were built across the larger canals, but due to the fact that the channels are above ground level, each bridge required a heavy grade on the approaches and the larger canals often imposed upon the highways grades heavier than were required anywhere else in the district.

It was formerly believed that inverted siphons would not be feasible on account of the great quantities of silt which the irrigation water carries and which it was thought would soon fill up an underground conduit. A few experiments, however, showed that for velocities of 2 ft. per second or more, inverted siphons made of corrugated pipe would keep the conduits clear of silt, although 3 ft. per second is desirable for carrying the heavier sands. Since these facts were developed a great many siphons have been installed, and a much more satisfactory road system has resulted.

A large number of the recently constructed siphons are of corrugated iron pipe, the collars and head walls being of concrete. In the northern part of the county, as in the Imperial Water Company No. 3, the head walls and the barrels themselves are often made of concrete because gravel can be easily secured in this vicinity. Actual demonstration has proved, it is claimed, that concrete barrels can be constructed more economically than corrugated iron pipe can be purchased. In the southern part and more thickly settled district, it is true that a great number of timber siphons have been constructed owing to the lack of materials for concrete construction, but by far the greatest number are of corrugated iron pipe with either concrete or timber head walls.

The inverted siphon scheme of crossing also obviates the difficulty formerly experienced where it was necessary to carry two canals across a road and across each other near the same point, particularly where it was necessary to provide for heavy traction engines. This problem is now solved by the use of two inverted siphons, one beneath the other, crossing at right angles, and each intersecting the road at 45 deg.

Due to the scarcity of good gravel in the valley and the resultant high price of concrete structures, it is customary to build inlet and outlet wells for inverted siphons of Oregon pine. It has been found that these wooden wells last about eight years in the dry soil of this district and this length of life is considered as suitable as more permanent work, due to the likelihood of some change in location or design being required at the end of that time.

Imperial Valley has for many years been supplied with water by the California Development Company, for which company J. C. Allison was chief engineer at the time of its recent sale.

Experts Report on Meters for Chicago

Committee of Engineers Recommends the Metering of Public and Big Business Buildings Now and Eventually All Consumers

THE city of Chicago is now using 254 gal. of water per capita per day. A large part of this amount is due to wasteful usage or to leakage, and engineers agree that the only relief from this is through metering. A special engineering sub-committee on water waste of the City Club of Chicago has recommended that the following preliminary steps should be undertaken in 1916:

PROCEDURE

(a) The City Council should appropriate $10,000 for the construction of meter vaults at the curb where meters cannot be set in basements. Such vaults, readily entered by meter readers and set and owned by the water department, have been found necessary in Cleveland and many other cities. The department is prepared to set over 2000 meters on large business places as soon as the City Council appropriates the necessary funds.

(b) All unmetered premises devoted in whole or in part to business uses and all public buildings should be metered.

(c) The city water department should have the authority to set meters, not only, as now, where the frontage rate is $100 per year and more, but where it is $50 a year. Later the limit should be reduced to $25.

The popular opposition to meters, according to the report, is so great in cities where metering has not been tried that it is of vital importance to take lessons from the experience elsewhere. Meters can be made so popular, as in Cleveland and Milwaukee, that city councils and the public will be unanimously in favor of them; or the subject may be so botched, as in the past in Philadelphia, that public sentiment will be equally strong against them.

CONDITIONS FOR SUCCESS

For success four conditions must be fulfilled:

1. Minimum rates must be established whereby everyone now paying water bills will be obliged to pay for a certain amount of water, whether used or not. The consumer would then pay at the regular metered rate for all water used in excess of that amount.

2. Meters must be furnished, set and maintained at the expense of the water department and through department employees.

3. Meters must be furnished not only to such districts and individuals as are known or suspected of wasting water, but should be furnished indiscriminately, so that the meter will not come as a penalty for carelessness or wastefulness, but, to those who are careful, as a sane method of reducing water bills.

4. The city administration undertaking the task must look upon the meter not at all as the means in the aggregate of increasing revenues to the department, but rather as a means of decreasing future investments in extension of mains, pumping stations, etc., and of improving the pressure. Meters will more than pay for themselves in these ways, while if they are accompanied with such rates as will increase the revenues or even keep the growth of revenues quite up to the present rate, they are sure to bring such a burden for a while to the less prudent of the community as to make the whole idea obnoxious to the people.

COMMITTEE PERSONNEL

The personnel of the committee making the recommendations is E. W. Bemis, public utility engineer; Ray Palmer, former commissioner of electricity and gas, and H. W. Clausen, assistant city engineer.

Resurface Bituminous Macadam for 8.6 Cents per Square Yard

THE Lowden road at Oregon, Ill., has recently received an asphaltic surface coat. Originally it was a bituminous macadam road of soft local stone from 3 to 10 in. thick penetrated with about 2 gal. of Aztec road binder per square yard. Later, when the soft stone used began to show through the asphalt surface in places it was decided to treat the entire surface with a light application of a high-grade asphaltic material and a very hard, coarse sand. The following cost figures taken from the *Illinois Highway Bulletin* do not include contractor's profit or overhead expenses. In a length of 16,222 ft. a total of 30,906 sq. yd. of road surface was treated with 1/3 gal. of Trinidad B asphalt and 0.016 tons of torpedo gravel or stone chips per square yard. The average haul of materials was 1½ miles. Labor was 25 cents per hour and teams 50 cents per hour.

In the following table giving the itemized cost of the work it will be noted that certain items were paid by the state highway department from the maintenance fund.

ITEMIZED COST OF WORK

	Cost in Cents per Sq. Yd.
Engineering and Inspection	0.00*
Superintendence	0.35
Bituminous material, 9617 gal. at 7.7 cents f.o.b. siding	2.39*
Torpedo gravel and stone chips, 484 tons: stone $1.40; gravel $1.82½ f.o.b. siding.	0.12* 2.55
Hauling torpedo gravel and stone chips	0.84
Heating and applying bituminous material, demurrage, etc.	1.04
Spreading torpedo gravel and stone chips	0.56*
Sweeping and cleaning old road	0.05
New equipment (pump)	0.07*
Freight on equipment	0.15
Incidental expense	0.22
Culverts and patching holes	0.27
Total cost	8.61

*Indicates paid by the state highway department from maintenance fund.

Spiral Steel Placed in Power House Foundations

Solid Steel Slab Column Bases Reduced in Size by Hooping the Reinforced-Concrete Footings to Increase Allowed Stress

IN ORDER to keep within commercial sizes for the dimensions of the solid steel slab bases of the columns in the new Philadelphia Electric Company Power House, described in the Engineering Record of Feb. 19, page 340, it was necessary to increase the allowable bearing pressure on the reinforced-concrete footings. The Philadelphia building code at the time of the design limited the direct pressure on reinforced concrete to 500 lb. per square inch. By hooping the concrete immediately below the columns, however, the allowable pressure was raised to 1,000 lb. per square inch, although only 800 lb. per square inch was used.

TYPICAL HOOPED PIER REINFORCEMENT

The accompanying photograph shows the appearance of the hoop reinforcement for a typical column carrying a load of 900,000 lb. The reduced size of the steel slab here used was 34 x 34 x 5¼ in. and the maximum size used on a hooped footing was 38 x 38 x 5¾ in. All hooping was 48 in. in diameter, with ¾-in. round steel in spirals on 4-in. centers.

CONCRETE BASES OR SCREEDS

As it was essential that the bearing under the steel slabs should be as perfect as possible, and to avoid air pockets which might be caused by grouting after the slabs were wedged and leveled in position, it was decided to do away with grouting altogether by forming cement bases on top of the reinforced concrete, and allowing the steel slabs to rest directly on these cement bases or screeds. It was found possible to work these screeds to a remarkable degree of accuracy. The allowable variation from a perfectly level surface under the slab was only 1/64 in. This method gave practically perfect bearing for the slabs and allowed inspection of the screed before the steel slabs were placed. The accompanying photograph shows a finished screed, with the remains of some loose hay used to protect it from the frost.

SCREEDS ACCURATELY LEVELED

Vertical rods encased in the hooping were extended up to the outside of the steel slabs, and horizontal reinforcing rods were used around the screeds. The screeds and steel slabs were all encased in stone concrete.

Test Douglas Fir Stringers

New Method of Creosoting Removes 35 Per Cent of Total Moisture and Reduces Strength of Wood Only 16 Per Cent

THE average strength of representative Douglas Fir stringers, subjected to a process of creosoting involving boiling under vacuum and resulting in the removal of 35 per cent of the total moisture in the specimen, has been shown to be approximately five-sixths of the original strength, compared to a one-third decrease with other processes. The conclusion also has been drawn that the decrease in strength is not confined to the area of the stringer penetrated but that the whole structure is weakened. The decrease in the compressive strength of treated specimens when the load is applied parallel to the grain has been found to be only 6 per cent, while compressive tests perpendicular to the grain showed a decrease of 26 per cent. The tests, arranged by the St. Helens Creosoting Company, St. Helens, Ore., were conducted under the supervision of Atchison, Topeka & Santa Fe Railway engineers and officials, O. P. M. Goss, consulting engineer for the Pacific Coast creosoting and timber interests, and other interested parties. The results were reported by H. B. MacFarland, engineer of tests for the Santa Fe, to the recent convention of the American Railway Engineering Association.

A test lot of 356 stringers was procured, out of which 61 representative specimens were selected. Nine of these were put to special tests after being treated, while 52 stringers were cut in two and comparative tests made of the untreated and treated halves of each specimen.

RESULTS COMPARED

A comparison of the results of the transverse tests, applying loads at the third points, of 7 x 16 in. by 14 ft. span treated and untreated stringers shows that of the 52 representative untreated specimens, 16 failed by shear, 29 by tension, 3 by tension and shear, 2 by crushing and tension, one by crushing and shear and one by crushing, while the following numbers of treated stringers failed from the causes noted: 32 shear, 14 tension, 4 tension and shear, and 2 crushing and shear. The number of treated specimens failing due to shear is just double that of the untreated ones. The average elastic limit of the untreated pieces was 4269 lb. per square inch as compared to 3481 lb. per square inch for the treated stringers. The average modulus of rupture was 5691 lb. per square inch for the untreated and 4680 lb. per square inch for the treated stringers. The average longitudinal shear for the untreated pieces was 411 lb. per square inch, which was 78 lb. per square inch greater than that for the treated specimen.

COMPRESSION TESTS

Specimens for the compression tests, applying the load parallel to the grain, were 5 x 5 x 12 in. in size. It was found that the maximum load for the untreated pieces was 4114 lb. per square inch and 3869 lb. per square inch for the treated blocks.

Applying the load perpendicular to the grain of 6 x 6 x 30 in. blocks showed that the treated specimens had an average elastic limit of 322 lb. per square inch, which was 116 lb. per square inch less than the average for those that were not treated.

The average area penetrated by creosote as determined by this test was 20.41 per cent.

The conclusions, as presented in the report, are:

1. Moisture may be successfully removed by boiling under vacuum. Moisture determinations show that, on an average, 35 per cent of the total moisture was removed by the process.
2. The removal of moisture by boiling under vacuum, preliminary to creosoting, decreases the physical strength of the material.
3. The weight of creosote per unit of volume for treated material is dependent on the structure of the specimen. Springwood offers greater resistance to treatment than summerwood.
4. Special tests of treated stringers indicate that the decrease in physical strength due to treatment is not confined to the area penetrated by creosote. The entire structure is affected.
5. The compressive strength parallel to the grain was decreased 6 per cent.
6. The compressive strength perpendicular to the grain was decreased 26 per cent.
7. Although the average strength of the treated material is appreciably decreased, its stiffness, as measured by the modulus of elasticity, is not affected.
8. In general, the average strength of Douglas Fir bridge stringers, subjected to the boiling-under-vacuum process of creosoting, was five-sixths of its original strength.

National Defense—For Engineer and Contractor

Sixth Article in Series Describing Methods of Military Map Making and Topographical Surveying for Tactical Uses

By MAJOR P. S. BOND
Corps of Engineers, U. S. Army

IN these times, when the combatant forces are numbered by millions, when the theater of war may embrace an entire continent, and when troops may be transported hundreds of miles in a single day, the need of complete and accurate maps and information is far greater than in the past, when military operations were more restricted as to numbers and area. It will be evident that the commander cannot view the field of conflict nor the progress of events except as portrayed on a map. The modern game of war, then, is played upon a map. On a table in his tent or office the strategist records and watches the ever-changing situation and plans the movements of troops many miles away.

The simplest scouting expedition or reconnaissance requires a map for its rapid and successful prosecution, and its report, to be intelligent, must be accompanied by a map or sketch. Each outpost, each camp, each march is recorded and reported on a map. Each section of a line of defense must be mapped. The enemy's dispositions, movements and works are reported by means of maps and sketches. It is, therefore, absolutely essential that all officers from the highest to the lowest should be able to read a map and also to make one.

HOW MAPS ARE MADE

The duty of mapping will fall especially upon the engineers. It is incumbent upon them to collect, amplify and bring up to date all existing maps and to arrange for their reproduction and distribution. The engineer officer must be able to make a map on foot, from an automobile, an aeroplane, or on the back of a horse. He must be able to sit on a hill and map the country in front of him, estimating the distances and sensing the topographical features which he cannot see.

Accurate maps require much time and skill for their preparation. If they are not available in advance of hostilities the army must prepare its own maps of the theater of operations under war conditions. This will delay and hamper their operations, both because time will be required to prepare the maps, and because maps produced under such conditions must necessarily be rather crude and inaccurate. Accordingly, the preparation or collection, in time of peace, of accurate maps, suitable for military use, of all possible theaters of war is an essential part of any scheme of national defense. Commanders have frequently been compelled to conduct campaigns without good maps prepared in advance, but it is certain that they were thus greatly handicapped.

There is much of our own country which has not as yet been accurately surveyed, and of Mexico, Central and South America and the Orient we possess no satisfactory maps. The best available maps for military purposes are those of the U. S. Geological Survey. In time, this survey will cover the entire country and will form an important item of our scheme of preparedness, but at present much remains to be done.

MAP SCALES FOR ARMY WORK

The scale of the maps is a matter of great importance, and for military uses maps on various scales will be required. For strategical operations over a considerable area small scale maps will be needed. These, of course, cannot exhibit topography in detail, but only the more important strategical features, such as rivers, mountains, main highways and railroads, important cities, fortifications, etc. Useful scales for strategical purposes vary from about ½ in. to the mile to 10 miles to 50 miles to the inch. If such maps are not available in suitable form at the outbreak of hostilities they must be prepared by a compilation of miscellaneous and often discordant data. Errors in the important distances may be, to some extent, eliminated by astronomical observations in the field. For tactical purposes maps must be on a scale sufficiently large to portray topographical details, yet not too large for convenient use in the field. Experience indicates that a scale of 1 in. to the mile fulfills these requirements. The U. S. Geological Survey maps are on a scale of 1:62,500, which is approximately 1 in. to the mile (12 x 5280 = 63,360). The map executed by the military sketcher in the field for use in conjunction with the 1-in. maps will vary from 1 to 3 in. to the mile for road sketches, and from 3 to 6 in. to the mile for position or area sketches.

It is certain that in any military operations in which the United States may engage, extensive surveying and mapping, both on a small and on a large scale, will be required subsequent to the outbreak of hostilities. When the surveys can be executed under cover of the first-line troops the methods for mapping will be based upon those employed in time of peace, except that refinements and hair-splitting accuracy will be relegated to the background and speed will become paramount—as in all military engineering. The control will be established by astronomy, triangulation, traverse and extensive leveling. The filling in will be done chiefly by the methods of individual military sketching. On such surveys many of the great number of civilian surveyors in the United States may be usefully employed, if under the direction of engineer officers who appreciate military requirements and understand military methods.

In survey work executed with the fighting forces at the front quick results will invariably be demanded, and must generally be obtained with such simple instruments as can be conveniently carried on the person of the topographer, or with no instruments at all. These conditions have resulted in the adoption of instruments and methods which are characteristically military. While a number of methods are employed, that most commonly used is a crude and hasty adaptation of the plane table method of surveying, in which the skill and experience of the topographer must compensate for the lack of accurate instruments.

THE MODERN GAME OF WAR IS PLAYED UPON A MAP—THE STRATEGIST RECORDS AND WATCHES THE EVER-CHANGING SITUATION AND PLANS THE MOVEMENT OF TROOPS MANY MILES AWAY.

The military plane table consists of a small board, 12 x 12 in. in size or less, which is held against the body of the sketcher or mounted on a light portable tripod. The board is leveled by eye or by a small spirit level placed on the board or attached to one of its edges. It is oriented by means of a compass, which may be in a separate case, or may consist merely of a declinator attached to the edge of the board. The alidade is a small, flat ruler with folding sights, or more commonly a simple, three-cornered piece of wood, the sights being taken along its upper edge. The horizontal position of points is determined by intersection and resection, by laying off the directions and measuring the distances, etc. Distances are measured by pacing and counting with a "tally," by a speedometer. or an odometer on the wheel of a vehicle, by the "walks" of a horse, or by time at a known gait, either afoot, in a vehicle, or on horseback. In some cases, especially in "place sketching," where the sketcher cannot occupy the ground he is to map, distance may be determined by some form of simple range finder, or by angles measured with a pocket sextant or compass from the

THE MILITARY METHOD OF MAP MAKING IS A CRUDE ADAPTATION OF THE PLANE TABLE METHOD OF SURVEYING—THE SKETCHING BOARD IS ORIENTED BY COMPASS AND A RULER SERVES AS AN ALIDADE.

ends of a known base (intersection). The sketcher will construct the necessary scales of paces, wheel revolutions or time. If the length of his own stride or the gait of his horse has not been determined, this will be done by several pacings of a known distance. The scales are laid out on paper and pasted to the edges of the alidade. Horizontal angles are laid off by compass sights or in some cases measured with a pocket sextant and laid off with a protractor.

SLOPES QUICKLY DETERMINED

Absolute elevations are determined with a small pocket aneroid. Slopes are measured by sighting along an edge of the sketching board, held in a vertical plane, and reading the slope by means of a plumb line and graduations on the lower edge of the board. They may also be measured by a simple hand clinometer, such as the Abney, with which very close results are obtained by a skilled operator. The sketcher will be provided with a set of scales of "map distances." A "map distance" is the horizontal map interval between contours. It varies with the scale of the map, the vertical interval between contours, and the slope of the ground. As the first two are fixed the map distance varies with the slope, and the scales indicate the map distances or horizontal intervals between contours for various slopes. Having measured a slope, the number and position of the contour points is determined by applying the map distance scale for that slope, no computation being necessary. If the slope is not uniform the contour points are adjusted by eye, but their number is fixed by the scale. Elevations thus determined may be checked with hand level (or the clinometer set for zero slope) and aneroid barometer.

SELECT CRITICAL POINTS

The method of procedure in making such maps is to determine as accurately as practicable by the methods above described the true horizontal position and elevation of a number of critical points in the terrain, and then, using these as a skeleton or control, to fill in the intervening topography by eye. The speed with which such a map can be made and its accuracy when completed will depend very largely on the skill of the sketcher in selecting and locating the critical and prominent points of the terrain which will be of use to him in selecting stations affording good views of as large an area as possible, and in estimating intermediate distances and slopes and interpreting ground forms. The valley or stream lines and the hills and ridges form the natural skeleton for a topographical sketch. If the position of the stream lines and two or more elevations on them be determined, together with the position and height of the adjacent knolls and ridges, the topography is readily sketched in by eye. If the sketcher has skillfully selected and determined the controlling elevations and distances the chance of cumulative errors is greatly reduced and the sketched-in topography may compare favorably in accuracy with a painstaking instrumental survey. Skill in such work is attained only by practice. The greater the skill the smaller the number of controlling points that will be required. If the sketcher is a proved adept at estimating distances he can dispense with many of the careful measurements which the novice would be forced to make.

MILITARY SKETCHING BOARD OUTFITS PACKED IN CARRYING CASE

DESIRABLE DETAIL

Care should be taken to avoid cluttering the map with details, but it must, nevertheless, exhibit all features that are of military importance. The conventional signs employed are few and simple. Extensive wooded or cultivated areas are designated by tracing their outline and noting the nature of the growth—"shocked corn," "standing wheat," "open wood,"' etc. Notes should describe the nature of roads—"good macadam, 16 ft.," "good earth, 12-ft., ditches," etc. The span, width of deck, height, material and practicable load of bridges is indicated by notes. Buildings are never drawn to scale, but the size and construction of important buildings may be indicated by a note. Fords are designated by noting width, depth and velocity of stream, nature of approaches and bottom. The names of railroads, gage, number of tracks, location and capacity of stations, sidings, water tanks, the rolling stock available, etc., are noted, as also the names and distances of adjacent stations in both directions, the vulnerable points of the road, such as large bridges, tunnels, etc. Telegraph and telephone lines are of special importance; the adjacent towns to which they lead should be ascertained by inquiry. Streams which may be used for water supply should be roughly gaged. Ground suitable for camp sites or defensive positions should be noted. The local resources in the way of crops, animals, foodstuffs, tools, machinery, etc., should be ascertained approximately. Towns are described by giving their populations, nature of industries, stock and output of mills and factories, important buildings, railroads, telegraph and telephone communications, etc. There is hardly a local feature which may not be of importance from a military point of view. The reconnaissance will generally be for the purpose of investigating certain particular conditions, but

SOMETIMES THE TRANSIT IS EMPLOYED FOR ACCURATE MILITARY SURVEY WORK even under such instructions very important matters outside of the instructions should be reported. The officer charged with such duty must have his powers of observation and acquisitiveness developed to a high degree.

Map 10 Miles a Day

By the methods herein outlined a competent sketcher may map 10 or more miles of road per day, sketching in also the topography on each side which is visible from the road. In sketching an area he may cover from ½ to 2 sq. miles in a day, depending upon his skill and the nature of the terrain. Where an extensive area is to be surveyed the work is divided into a number of small areas, with natural or artificial lines of division, which are mapped simultaneously. A number of these areas will be in charge of a principal sketcher whose duty is to distribute his subordinates, fixing the limits assigned to each. He makes certain that each individual sketcher connects with his neighbor on either flank by having one or more points in common, without overlapping or duplicating work further than is necessary to join the two sketches in one. He carries an aneroid barometer with which he gives each sketcher the elevation of his starting point. He may be accompanied by an assistant who measures the distances and sketches the important features along the base line from which the area sketchers start. This is used later to combine and co-ordinate the individual sketches. These are turned in simultaneously and are pieced together and retraced or otherwise prepared for reproduction. As the sketches are usually made on translucent vellum, they may be printed directly.

Mapping operations on a large scale will ordinarily involve the correction, amplification, compilation and reproduction of maps, and this duty will fall to the Engineer Department. So far as possible it should be done in the office, away from the haste and confusion of the field, but much of this work must necessarily be done in the field, especially reproduction. Actinic printing processes are often too slow for satisfactory reproduction in the field. The best field method now generally employed is lithography, or rather zincography, since the excessive weight of litho stones renders them inconvenient for rapid transportation. The engineer troops are accordingly supplied with an efficient and portable outfit for map compilation and reproduction, including drafting, photographic, actinic printing and lithographic (zinc) apparatus. This is one of the most important items of their equipment.

Map-Reading Vital

While not every officer and non-commissioned officer will be called upon to make maps and sketches, all, from the highest to the lowest, will frequently have to read and interpret them. An officer who is not an adept in map reading will be at a great disadvantage in the exercise of independent command. The map should convey to his mind a fairly accurate picture of the actual ground, and he should be able to rapidly and accurately obtain any information which the map can furnish. Such facility is acquired only by long practice. To locate one's position on a map, to orient it, to determine the difference of elevation or the distance between two points are apparently simple matters, but if it is a question of moving troops there are many other considerations. What are the widths, character and condition of the roads? What grades will be encountered? At what average speed can a wagon train move? Is the road open or shady? Can it be easily observed from adjacent heights, or possibly fired upon? What towns lie upon it? Is there a telegraph line alongside? Are there bridges over the streams? If so, are they in good condition and amply strong to carry the loads accompanying the army? If not, how long will it take the engineers to fix them? Are there fords nearby? What are the depths of water? What effect do floods have? Is a certain locality suitable as a camp site for a certain body of troops? How about the water supply? Is there shade? Is the drainage satisfactory? Is fuel available? How should the various organizations be disposed? Is the locality defensible? Where should the outpost line be placed and how many men will be required to cover it? If a defensive position is to be taken to cover some important point or some movement of troops, where is the best general line for occupation? Can the enemy avoid it or must he attack? Is there natural cover available? How about the roads and other communications? Are there good observing stations and sites for the artillery? Is the field of fire satisfactory? What natural obstacles exist? How about the facilities for retreat or withdrawal? Are the flanks secure? What materials for construction will probably be available? Can civilian labor be secured—if so, to what extent? These and many similar questions must be tentatively answered from maps, sketches and reports of reconnoitering parties, but it is to be remarked that the final dispositions will almost invariably be made upon the ground itself, for the best map cannot answer all questions that arise.

One interesting problem that is often encountered in military operations is that of visibility, a question as to whether a certain point or area is visible from a certain other point. Such a problem can seldom be solved with great precision on a map, but an approximate solution will often be required.

Photographs from Balloons or Aeroplanes Are Valuable

Photography is of little practical use for map making for military purposes except in the case of photographs taken from a balloon or aeroplane at a considerable height, which are in effect a form of map. But photographs are a valuable accessory to maps in giving a clearer appreciation of the terrain as it appears to the eye. They are of great value for showing the construction and condition of bridges, wharves, buildings, etc. Landscape sketches are usually of more value than photographs, inasmuch as they give special prominence to the important features of the terrain, omitting the mass of details which obscure the critical points.

[In next week's article Major Bond will discuss demolitions and siege operations.—Editor.]

Useful Feet-Miles Conversion Table for Highway Engineers

HEREWITH is a table for the conversion of feet into decimals of a mile. This table was made up and used by Clayton E. Swain in compiling data for the annual report of the Connecticut State Highway Department:

Table for Convertino Feet into Decimals of Miles

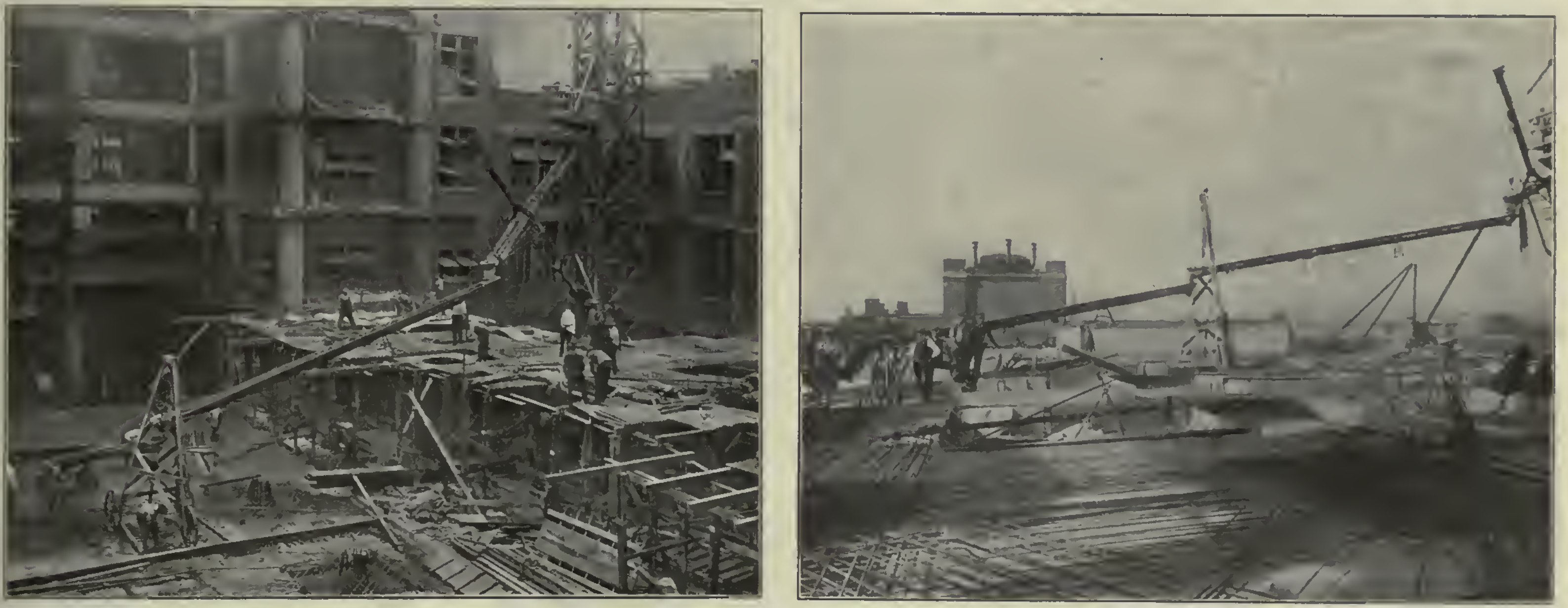
Miles	0	1	2	3	4	Miles	0	1	2	3	4
.00	00	5280	10560	15840	21120	.50	2640	7920	13200	18480	23760
.01	53	5333	10613	15893	21173	.51	2693	7973	13253	18533	23813
.02	106	5386	10666	15946	21226	.52	2746	8026	13306	18586	23866
.03	158	5438	10718	15998	21278	.53	2798	8078	13358	18638	23918
.04	211	5491	10771	16051	21331	.54	2851	8131	13411	18691	23971
.05	264	5544	10824	16104	21384	.55	2904	8184	13464	18744	24024
.06	317	5597	10877	16157	21437	.56	2957	8237	13517	18797	24077
.07	370	5650	10930	16210	21490	.57	3010	8290	13570	18850	24130
.08	422	5702	10982	16262	21542	.58	3062	8342	13622	18902	24182
.09	475	5755	11035	16315	21595	.59	3115	8395	13675	18955	24235
.10	528	5808	11088	16368	21548	.60	3168	8448	13728	19008	24288
.11	581	5861	11141	16421	21701	.61	3221	8501	13781	19061	24341
.12	634	5914	11194	16474	21754	.62	3274	8554	13834	19114	24394
.13	686	5966	11246	16526	21806	.63	3326	8606	13886	19166	24446
.14	739	6019	11299	16579	21859	.64	3379	8659	13939	19219	24499
.15	792	6072	11352	16632	21912	.65	3432	8712	13992	19272	24552
.16	845	6125	11405	16685	21965	.66	3485	8765	14045	19325	24605
.17	898	6178	11458	16738	22018	.67	3538	8818	14098	19378	24658
.18	950	6230	11510	16790	22070	.68	3590	8870	14150	19430	24710
.19	1003	6283	11563	16843	22123	.69	3643	8923	14203	19483	24763
.20	1056	6336	11616	16896	22176	.70	3696	8976	14256	19536	24816
.21	1109	6389	11669	16949	22229	.71	3749	9029	14309	19589	24869
.22	1162	6442	11722	17002	22282	.72	3802	9082	14362	19642	24922
.23	1214	6494	11774	17054	22334	.73	3854	9134	14414	19694	24974
.24	1267	6547	11827	17107	22387	.74	3907	9187	14467	19747	25027
.25	1320	6600	11880	17160	22440	.75	3960	9240	14520	19800	25080
.26	1373	6653	11933	17213	22493	.76	4013	9293	14573	19853	25133
.27	1426	6706	11986	17266	22546	.77	4066	9346	14626	19906	25186
.28	1478	6758	12038	17318	22598	.78	4118	9398	14678	19958	25238
.29	1531	6811	12091	17371	22651	.79	4171	9451	14731	20011	25291
.30	1584	6864	12144	17424	22704	.80	4224	9504	14784	20064	25344
.31	1637	6917	12197	17477	22757	.81	4277	9557	14837	20117	25397
.32	1690	6970	12250	17530	22810	.82	4330	9610	14890	20170	25450
.33	1742	7022	12302	17582	22862	.83	4382	9662	14942	20222	25502
.34	1795	7075	12355	17635	22915	.84	4435	9715	14995	20275	25555
.35	1848	7128	12408	17688	22968	.85	4488	9768	15048	20328	25608
.36	1901	7181	12461	17741	23021	.86	4541	9821	15101	20381	25661
.37	1954	7234	12514	17794	23074	.87	4594	9874	15154	20434	25714
.38	2006	7286	12566	17846	23126	.88	4646	9926	15206	20486	25766
.39	2059	7339	12619	17899	[illegible]179	.89	4699	9979	15259	20539	25819
.40	2112	7392	12672	17952	23232	.90	4752	10032	15312	20592	25872
.41	2165	7445	12725	18005	23285	.91	4805	10085	15365	20645	25925
.42	2218	7498	12778	18058	23338	.92	4858	10138	15418	20698	25978
.43	2270	7550	12830	18110	23390	.93	4910	10190	15470	20750	26030
.44	2323	7603	12883	18163	23443	.94	4963	10243	15523	20803	26083
.45	2376	7656	12936	18216	23496	.95	5016	10296	15576	20856	26136
.46	2429	7709	12989	18269	23549	.96	5069	10349	15629	20909	26189
.47	2482	7762	13042	18322	23602	.97	5122	10402	15682	20962	26242
.48	2534	7814	13094	18374	23654	.98	5174	10454	15734	21014	26294
.49	2587	7867	13147	18427	23707	.99	5227	10507	15787	21067	26347

Screening and Concrete Plants for Building Use Gravel from Cellar Excavation

Building of Methodist Book Concern in Cincinnati Completed Rapidly with Economical Layout Including Wheeled Trestles for Support of Chutes

By W. R. HOWARD
Cincinnati, Ohio

CRAMPED by having only one side of the lot open, and that accessible only through a 14-ft. street, the contractor for the Methodist Book Concern's new building in Cincinnati managed, with a well-planned layout, to complete the second unit of the reinforced-concrete structure at the rate of 365 cu. yd. a day. Circumstances favored the contractor by providing suitable sand and gravel for concrete in the basement excavation, which reduced the quantity of aggregate to be delivered through the narrow street, yet complicated the layout problem by necessitating a screening and crushing plant on the lot. By handling all the concrete materials mechanically, and by putting wheels on the trestles supporting the chutes, the total concrete gang was cut down to fourteen men, two foremen, a fireman, and a hoisting engineer.



LIGHT WHEELED TOWERS CUT SIZE OF GANG NEEDED TO SHIFT CHUTES ON CINCINNATI BUILDING CONSTRUCTED IN HALVES

PURPOSE AND DESIGN OF BUILDING

The new building for the Methodist Book Concern is on Plum St., Cincinnati. It is of reinforced-concrete construction, with a stone and brick front, and brick fire walls on the two sides and the rear. The front half of the building is used for a retail store and offices, while the other half is used as press rooms, composing rooms, and shipping department. The building is approximately 120 x 190 ft. in plan and designed for nine stories and basement, although the present structure is only six stories high. The average story height, 13 ft. 3 in. Typical floor bays are 20 ft. by 20 ft. 6 in., of flat slab or girderless floor construction, supported on round columns having spiral and vertical reinforcing. The slab thickness ranges from 8½ to 14 in., and is the same for all the floors including the roof. On the floors there is a 3-in. concrete fill covered with 1 in. of finish.

BUILDING CONSTRUCTED IN HALVES

Only half of the building was erected at a time, the front half being erected first, in the fall of 1914. By erecting the building in two separate parts, no interruption to business was experienced by the owners except at the time of moving their presses and other machinery from the old building to the new. In erecting the front portion, enough steel was left projecting out of the floors to make a good connection and bond with the corresponding floors that were constructed later. This is shown in one of the accompanying photographs.

In the excavating of the footings for the first half, good gravel was encountered. In bidding on the job this gravel was not figured on, but it was found by tests that the sand and the gravel were suitable for concrete. A rotary screen was rigged up at that time and considerable gravel was screened, the sand being used for concrete.

EXCAVATING DERRICK MOVED ON OLD FLOOR

As there was considerably more excavation for the second half of the building, a derrick was built to handle a ¾-yd. clamshell bucket. The derrick had a 20-ft. mast and a 40-ft. boom, which gave it a fairly large working radius. While excavation for the footings and the cellar was going on, the floor of the old building was left standing in order to facilitate the moving of the derrick from place to place to excavate for all the footings. The floor was wrecked as the excavation advanced. Due to lack of storage room, about 2000 cu. yd. was sold for construction purposes. This left about 3500 cu. yd. of gravel in the basement, besides about 800 cu. yd. of rock, which was salvaged from the old stone walls. About 75 per cent of the rock was stored on a nearby lot and hauled back after the rock-crushing plant was installed.

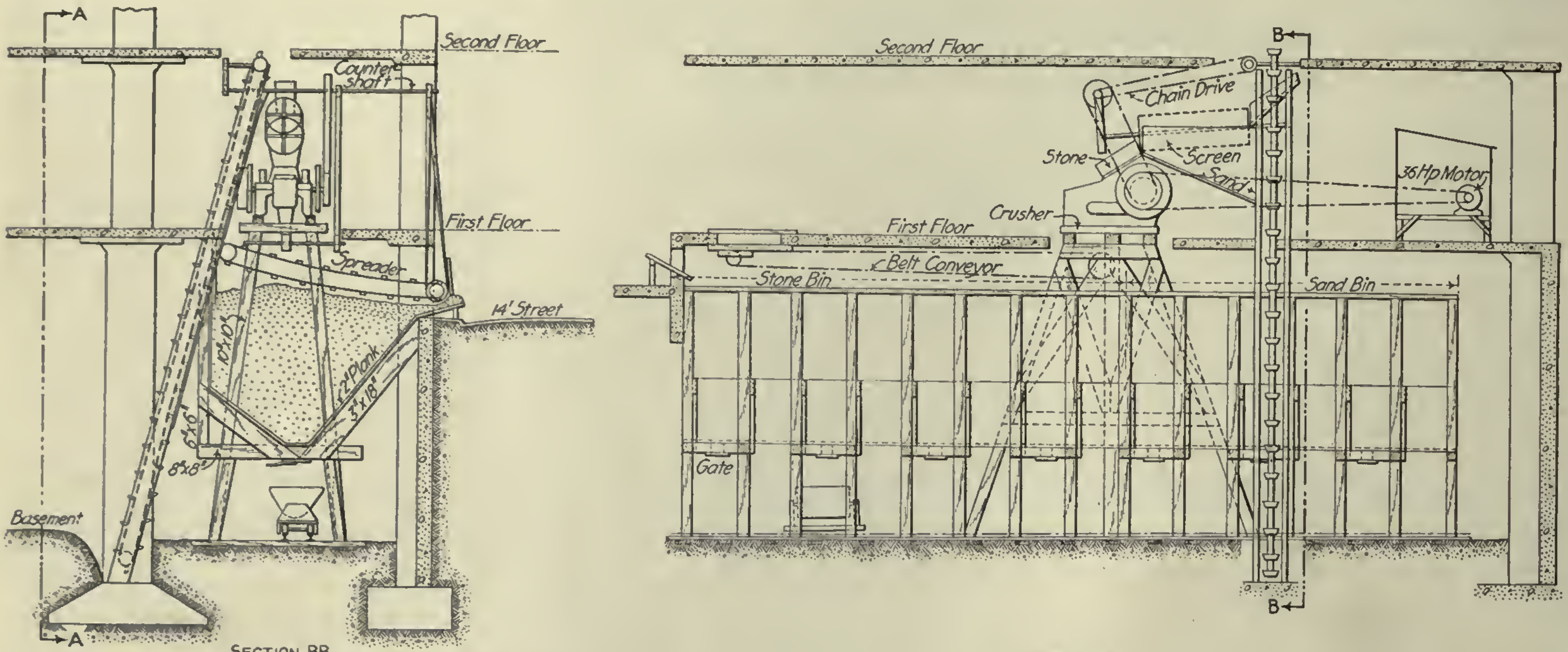
CELLAR EXCAVATION SCREENED FOR CONCRETE

In order to handle the remaining gravel and stone in the basement economically, a rather novel layout was designed, which is shown in the accompanying drawing. The equipment consisted of a bucket conveyor, a rotary sand screen, a stone crusher, a belt conveyor and a spreader. Power was obtained from a 35-hp. D. C., 220-volt motor. By means of a small dump scraper operated by a hoisting engine, the gravel was dumped at the foot of the bucket conveyor, which carried it up to the screen. The screened sand fell down chutes into the sand bin. The rock rolled down into the crusher and from the crusher it was handled the length of the stone bin by the belt conveyor. As the gravel was about half stone and half sand, about 100 cu. yd. of stone and 100 cu. yd. of sand was obtained in one day's operation.

The method of getting the rock out of the basement was similar to that of removing the gravel, only the scraper was not used. The rock was dropped into the conveyor by hand, the rock being first broken into suitable sizes that could be handled by the conveyor. The screen was so installed that it was a matter of a few moments to hoist it out of place when rock was being handled, the rock going directly to the crusher. All power to run the machinery in the plant was obtained directly or indirectly from the motor.

CRUSHER PEDESTAL SET IN BINS

The crusher sat on a pedestal constructed of 10 x 10 in. timbers which was about 20 ft. high, so as to bring the bottom of the crusher at the first-floor level when that floor was concreted. The pedestal was well X-braced and the six legs were battered in two ways, thus making a very strong structure, which was required as the type of crusher used caused heavy vibration. The bin, which was built around the crusher, aided greatly in steadying the pedestal. The sand and stone bins were about 60 ft. long, the stone bin being about two-thirds of the total length. As seen from the drawing, the bin was constructed close to the wall, so that material delivered to the job in wagons or trucks could be dumped directly into it. A 14-ft. street was the only open side of the second half of the building. There was no room for storage on it as the street had to be kept open at all times to traffic, it being a short cut between two main streets. For hauling materials dump wagons were used, which could be backed up to the building and dumped directly into the bins. When the bins filled up on the street side the ma-



SECTION BB

SECTION AA

CARS FED MIXER FROM BINS FILLED FROM STREET OR WITH CRUSHED AND SCREENED MATERIAL FROM CELLAR EXCAVATION

terial was carried back by means of the spreader, which did away with any hand shoveling. Material could also be dumped into the stone bin from the driveway. This place was used exclusively by the motor trucks, as it was awkward work for the trucks to back up to the building in the narrow street. As many as twelve cars of material were dumped in these bins in one day, and at no time was traffic held up.

Concrete Plant Required Few Men

The concreting plant was designed so as to be operated at a maximum speed with a minimum amount of labor. A four-bag batch mixer was used with a floor hopper. All material was delivered to the mixer by means of side-dump cars running on 2-ft. gage track. The bodies of the cars were built so as to hold just enough sand and gravel for a four-bag batch of 1:2:4 concrete, the body of the car being divided into two departments. These cars were run up under the bins, as shown in the drawing. As there was a 1.6 per cent grade running back from the turntable, the cars were pushed back under the bins by two men, were filled and allowed to run back by gravity to the turntable. This turntable revolved on ball-bearings, and two men were stationed at this point to take care of the cars. Turning the cars through a right angle, they were pushed toward an incline where a cable was hooked onto them which pulled them up to the floor hopper. This cable was operated by the same engine that hoisted the concrete up to the floors. When the cars reached the floor hopper the contents were dumped into it and the cars ran back to the turntable by gravity. The movement of the cars was so arranged that a loaded car was always waiting at the turntable to be pulled up the incline. By having one man attend to the dumping of the cars and put the water in the mixer, two men handle cement, and one man dump the mixer, a total of eight men was sufficient for actually mixing the concrete. The hoisting engineer and fireman completed the crew. Two men were needed to handle cement because it was unloaded in the driveway and delivered to the mixing platform by means of gravity rollers on an incline from the driveway to the charging platform. Upon reaching the platform the cement was carried away and piled beside the hopper by one man, while the other man dumped the cement into the hopper. By means of the gravity rollers the cement was handled for less than half of the cost of handling by hand.

Wheeled Trestles Made Moving Chutes Easy

The method of handling the concrete after it leaves the elevator can be readily seen from the photographs. The concrete was delivered to the floor by means of chutes. The first chute was hung from the tower by means of a 40-ft. boom. The two other chutes were suspended from wheeled trestles. Altogether three large chutes and two small hand chutes were used. The large chutes were each 36 ft. long, thus giving a working radius of about 125 ft. The wheeled trestles made it very easy to move the chutes radially. Generally in pouring concrete by the aid of chutes, high trestles are used without wheels, requiring a large number of men on the floor to move the chutes. With the wheeled trestles a gang of five men and a foreman moved the chutes and also attended to the tamping and grading of the concrete. Counting the man in the crow's nest on the tower, a gang of six men and a foreman was sufficient for placing the concrete. Altogether, for mixing and placing concrete a gang of fourteen men and two foremen was needed, together with the hoisting engineer and fireman. This made the labor cost of concreting very low when the yardage of concrete handled is considered, the average day's run being 365 cu. yd.

The hoisting of the concrete hopper, boom and chute was greatly expedited by having them fastened to a sliding frame made of two 6-in. channels. The channels slid on the two corner posts of the tower. This whole sliding unit was hoisted by means of a set of triple falls, the lead line being run down to the niggerhead of the engine.

All the equipment, both the concreting and crushing plants, was designed by J. E. Hodges, superintendent of the Ferro-Concrete Construction Company. One of the interesting features of the erection of the building was the speed and ease of the erection of the form work. The Hodges system of adjustable forms was used exclusively. By this method a floor was easily erected and concreted every six working days. The total area of form work per floor for the second part of the building was approximately 19,000 sq. ft.

The building was designed by S. Hannaford & Son, architects, of Cincinnati. The general contractor for the job was the Ferro-Concrete Construction Company, also of Cincinnati.

Automobiles Run on Four Cents a Mile in Supervising Road Work

THREE low-priced cars have been run for nineteen months at an average of 4.13 cents per mile in supervision work on the Washington-Atlanta highway, according to E. W. James, chief of road maintenance of the Office of Public Roads. The car which has made the last mileage averaged 28.4 miles a day on a basis of 30 days a month, while one of the other cars averaged just 50 per cent more than this. Transportation per mile of road under supervision formerly cost 52 cents a month for livery. With these cars it cost 20 cents a month. The chief saving, however, was in the time on the road of the men using the cars.

The figures published by Mr. James do not include labor. Those for two of the three cars correspond very closely, while those for the third car are slightly higher because of storage charges and greater tire costs. The gasoline for one car cost only 81 per cent of that for the other two, but storage and miscellaneous charges on this car were high. Of the average operating cost of 4.13 cents per mile, 35.7 per cent was miscellaneous, 24.8 per cent was for gasoline, 20.3 per cent for tires, 12.6 per cent for storage, 5.6 per cent for oil and 1 per cent for grease. The costs cover the period from the end of May, 1914, to the beginning of the present year.

Forest Service Is Taking Census of 1915 Lumber Production

The U. S. Forest Service is making a census of the 1915 lumber production in co-operation with the National Lumber Manufacturers' Association. A preliminary statement will be made about May 1. The census bureau was too busy this year to take this census.

How the Forest Service Bridges the More Remote Stream Crossings

Inexpensive Suspension Bridges Are Built Across Mountain Streams of the Northwest Under Unique Construction Difficulties

ADMINISTERING the affairs of national forests in the Northwest has in recent years involved the construction of seventy-nine bridges, varying in type from light cable footbridges to timber structures designed for heavy traffic. Seven suspension bridges have been built in the states of Oregon and Washington, and in several cases the structures were required at points so remote that the greatest problems and the major part of the cost have been in delivering materials to the site.

Only limited funds have been available for this work, and in many cases the difficulties were such that it has been feasible to construct the bridges only because the supervisor and his rangers have devised ingenious schemes. When the need for a new bridge becomes evident an examination and report is made by the supervisor or his representative, and often when construction difficulties preclude doing the work by contract, the Forest Service designs and builds the structure with its own funds and forces.

TRANSPORTATION DIFFICULTIES

In the case of the Thunder Creek bridge, a suspension bridge with a 96-ft. span, the heavy snows of the region made it necessary to design for a snow load of 125 lb. per square foot. This called for two 1¾-in. suspension cables, 200 ft. long, each weighing 1170 lb. These presented a serious transportation difficulty, as the only access to the site was over a rough mountain trail 30 miles in length.

An effort was first made to deliver these cables to the site on pack animals by distributing the weight on five mules. This attempt failed, the entire train of mules going down under the combined weight of the cable and the strain of keeping their footing on the rough and narrow trail. A second attempt was made by twenty men, who packed the cable in on their shoulders for some 13 miles over the most dangerous part of the trail, each man carrying a length of 10 ft. In this manner after considerable hardship the cable was delivered to the site successfully. In spite of the difficulties, however, the total cost of the completed structure was only $2,515, of which $500 was contributed by Whatcom County.

In the case of the Skagit River bridge near Ruby Creek, an old wooden truss erected at the site by miners was used as falsework during the building of the new structure, and was then removed. The new bridge has a span of only 84 ft., but stands 150 ft. above the water, its towers being founded on rock cliffs at the entrance to what is known as Canyon Diablo. The depth of water in this canyon at some points is as much as 80 ft., with only 14 ft. between the tortuous, perpendicular walls. Cedar for bridge-floor and side rails was not available near the site, and it had to be rafted down from a point 6 miles upstream. This operation was dangerous, not only on account of hidden rocks and rapids, but because of the rapidly increased current at the approach of the mouth of the canyon. The work was completed, however, without accident.

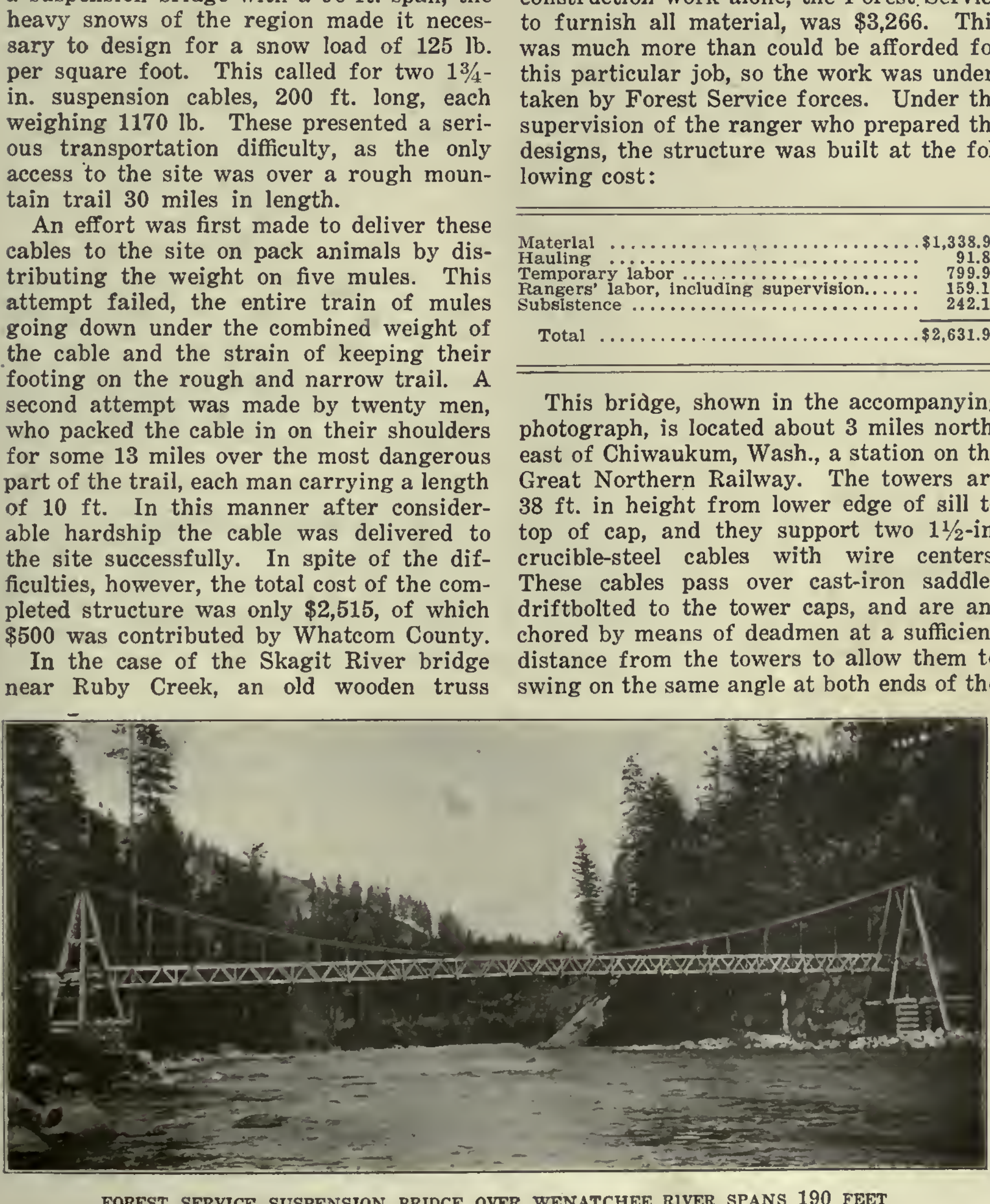
DIABLO CANYON BRIDGE IS 150 FEET ABOVE THE WATERS OF THE SKAGIT RIVER

WENATCHEE SUSPENSION BRIDGE

When decision to build the Wenatchee suspension bridge was reached, bids were asked from a number of companies on a structure of 190 ft. between towers, plans for which were prepared in the office of the district supervisor. The lowest bid on the construction work alone, the Forest Service to furnish all material, was $3,266. This was much more than could be afforded for this particular job, so the work was undertaken by Forest Service forces. Under the supervision of the ranger who prepared the designs, the structure was built at the following cost:

Material	$1,338.92
Hauling	91.82
Temporary labor	799.94
Rangers' labor, including supervision	159.16
Subsistence	242.12
Total	$2,631.96

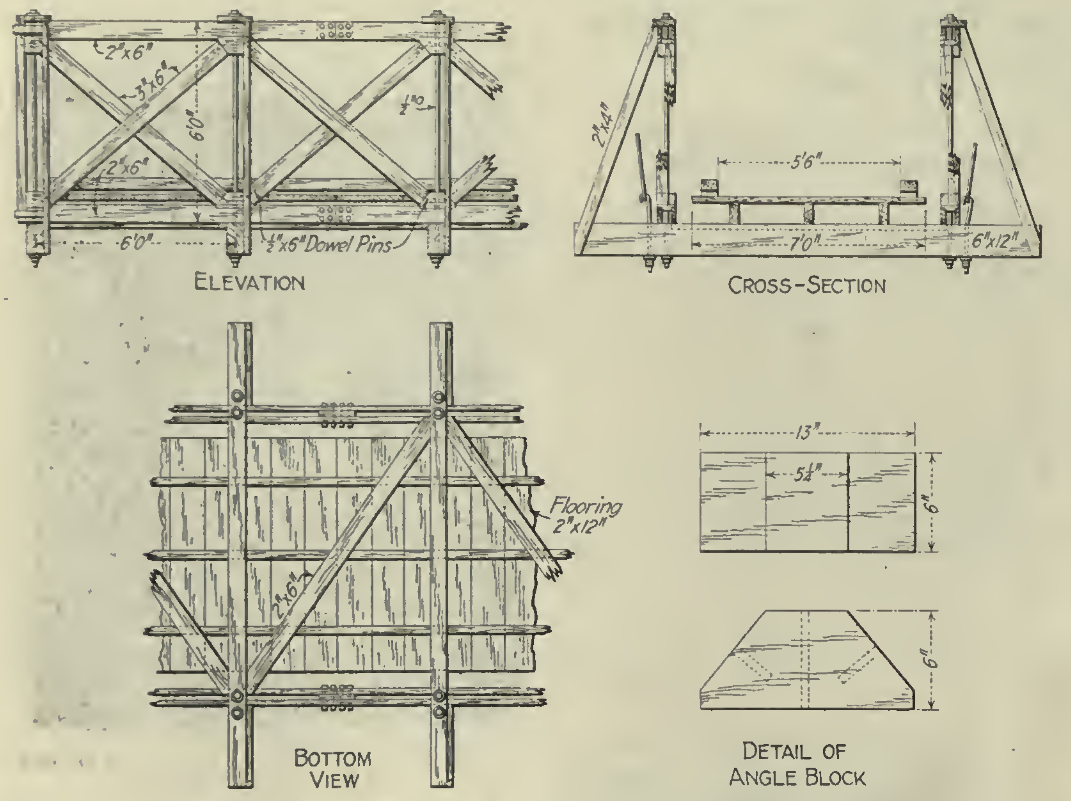
This bridge, shown in the accompanying photograph, is located about 3 miles northeast of Chiwaukum, Wash., a station on the Great Northern Railway. The towers are 38 ft. in height from lower edge of sill to top of cap, and they support two 1½-in. crucible-steel cables with wire centers. These cables pass over cast-iron saddles driftbolted to the tower caps, and are anchored by means of deadmen at a sufficient distance from the towers to allow them to swing on the same angle at both ends of the structure. The tension is adjusted by two 24-in. turnbuckles at the west end. The camber in the center of the span is 1 ft.


FOREST SERVICE SUSPENSION BRIDGE OVER WENATCHEE RIVER SPANS 190 FEET

The cribs and towers were erected first. A slender cord was then passed across the river in a boat, and with the cord a stout wire was drawn over. To the wire one of the ½-in. guy cables was attached, and with this, by the aid of a home-made capstan, the large cables were drawn across the stream and securely anchored to the deadmen. The cables were brought to their proper position by means of the turnbuckles. A carriage was then slung from the cables, from which workmen could put on the suspender rods which support the floor structure.

The floor of the bridge is supported by ½-in. rods and ⅜-in. cables fastened to the main cables by 1½-in. Crosby clamps at 6-ft. intervals. Towers and cribs are constructed of Douglas fir, cut at the site, the bark being removed before the timber was placed in the structure. The specifications required the cribs to be placed on solid foundation near the water's edge. Daps were required at all angular timber joints so that a sufficient depth to secure the necessary nailing surface was provided, and the number of 30d nails or ⅞-in. driftbolts were specified at each important joint. Four guy cables were used for steadying the towers, two being used on each end of the span with the tower ends fastened on the bank of the stream, one above and one below. Rock was used to fill the cribs, and about 4 cu. yd. of it was placed around the main braces and ends of each crib on the upstream side of the structure. For the latter purpose no pieces weighing less than 100 lb. were permitted.

On each bank the anchorage for the cables consisted of a cedar log, 33 in. in diameter at the small end and 20 ft. long, which was placed in a pit 7 ft. deep. A sheet of soft steel 6 in. wide and 3 ft. long, bent to fit the curvature of the log, was fastened directly under the cable at the points of heaviest strain, and the cables were passed twice around the log. Rocks of suitable size were put in the pit before the deadman was placed, after which the excavation was entirely filled with rocks, 25 per cent of



STIFFENING TRUSS DETAILS FOR COWLITZ RIVER SUSPENSION BRIDGE

which weighed not less than 200 lb. each.

The towers were given a brush treatment of creosote, and the whole structure was painted a dark green with creosote shingle stain. The ironwork was covered with asphalt paint. Wire netting on the sides to prevent sheep from falling off is removed and rolled up in the fall and replaced again in the spring. After being in use four summers, during which time more than 100,000 sheep and numerous pack and saddle animals crossed the bridge, it is reported that no settlement can be noticed.

COWLITZ BRIDGE

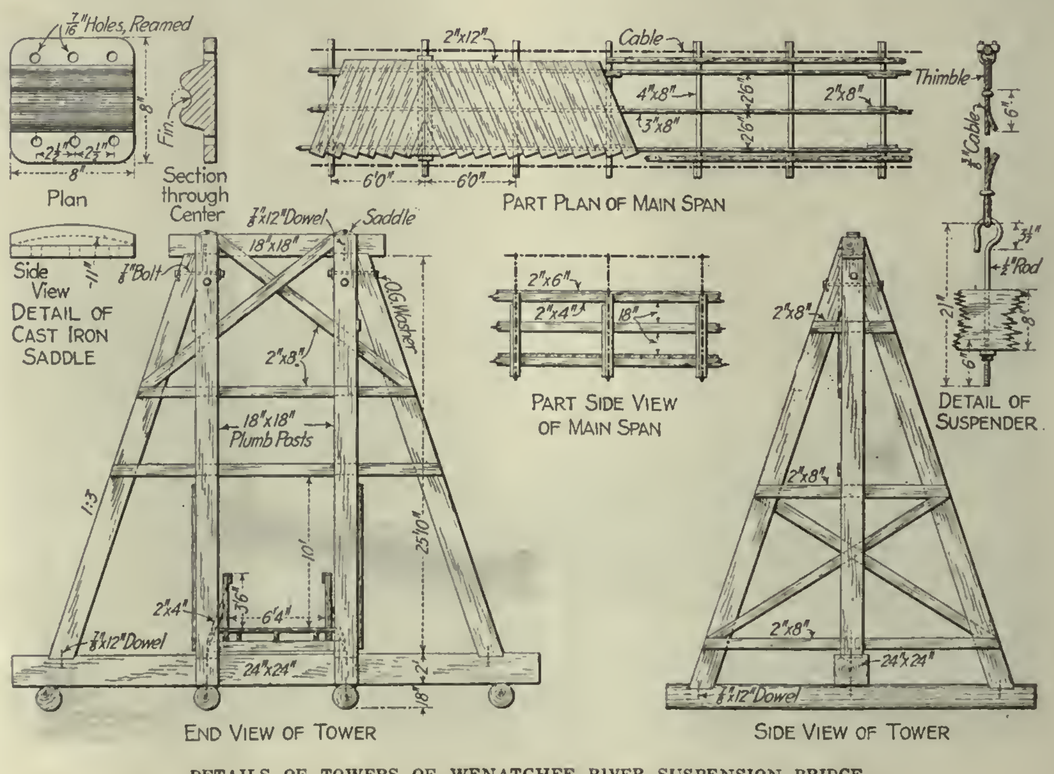
For the Cowlitz River crossing a suspension bridge was decided upon which would have a span from tower to tower of 180 ft. The towers are of hewed timber built on cribs 18 ft. high. Two 2¼-in. cables were used, each having a total length from anchor to anchor of 373 ft. On account of the size of the main cables, which were of crucible steel with wire center, it was impracticable to use a turnbuckle for adjusting the strain, and this strain was provided for by the use of open bridge sockets babbitted to the cables at each end and made fast to the anchorage by 1⅝-in. cables. The sockets are adjusted to a take up of 18 in., which is considered sufficient for any needed adjustment of the main cables.

On one end of this structure it was possible to anchor the cables in solid rock, but at the other end a solid block of concrete, weighing approximately 37 tons, was cast in a pit with the top of the concrete 10 ft. below the surface. Eyebolts 3½ in. in diameter were placed in this concrete block, and to these were attached the 1⅝-in. cables carrying the bridge sockets. This extensive anchorage process was considered necessary on account of the loose shifting formation at this point combined with the heavy strain.

FLOOR AND STIFFENING TRUSS DETAILS ARE DESIGNED TO PREVENT VIBRATION

The floor is 5½ ft. wide between wheel guards, and is supported from the cables by the usual suspension system. From top of rail to the floor timbers a system of 2 x 12-in. diagonal braces is placed in pairs, connected with dowel pins and braced from rail to floor with vertical tie rods. It is claimed for this type of construction that practically all vibration is eliminated, even when large logs are dragged over the bridge. Precaution was taken against deterioration of those parts of the cable placed underground. Exposed steelwork, on account of the variable weather conditions, required frequent and thorough application of oil and white lead. All manufactured material used in this bridge was hauled in winter over 43 miles of rough road from the nearest railway station.

The work of the Forest Service in the Northwest in District 6, comprising Oregon, Washington and Alaska, is in charge of George H. Cecil, district forester, whose headquarters are at Portland, Ore.



DETAILS OF TOWERS OF WENATCHEE RIVER SUSPENSION BRIDGE

Nick and Break Test for Steel Rails Advocated

R. W. Hunt and C. W. Gennett, Jr., Present Results Tending to Demonstrate Advantages of Such Tests for Both Railroads and Manufacturers

APPLICATION of the nick and break test to a large tonnage of standard A.R.A. 90-lb. rails, type *A*, ordered by a leading railroad of the Middle West, was made by the Algoma Steel Corporation, of Canada, and the results tend to show that a decrease in the number of rails rejected as compared to the specifications of the American Railway Engineering Association is effected, but with greater protection for the railroad. In a fully illustrated paper of 25 pages presented by R. W. Hunt and C. W. Gennett, Jr., before the annual convention of the latter association at Chicago on March 21-23, the advantages of this test are clearly explained. The conclusions reached are here given, after stating the specifications used for the test.

The specifications provide that the test pieces which have successfully withstood the drop test and also a piece representing the top end of all other top rails shall be nicked and broken. If the fracture shows interior defect the "A," or top rail of the ingot, shall be rejected, and a piece shall be cut from its bottom end to represent the "B" or second rail of the same ingot. This piece shall then be nicked and broken, and if its fracture shows interior defect, the rail represented shall be rejected. The testing by nicking and breaking shall proceed progressively in this manner on all the rails of each ingot, if necessary, and they shall be accepted or rejected according as the fracture of the test piece representing them shows interior defects.

CONCLUSIONS

The most important conclusions which can be deduced from the results of these tests are:

1. That the application of the nick and break test specification results in a distinct saving to the mill in the number of rails rejected as against those that would be re-

jected under the American Railway Engineering Association specification. These rejections have been reduced from 5.56 per cent to 2.98 per cent, resulting therefore in a saving to the mill of rejected rails amounting to 46.4 per cent.

2. That the application of the nick and break test specification is a greater protection to the railroad than would be the American Railway Engineering Association specifications, for the rejections under the former include 1.33 per cent (of the total number of rails rolled) which would have been accepted under the American Railway Engineering Association specification. Thus, of the total number of rails rejected under the nick and break specification, 44.6 per cent would not have been rejected under the American Railway Engineering Association specification, so that practically one-half of the rails rejected under the former specification would have been accepted under the latter, and laid in the track.

3. If, as has been shown by public records, the number of rails that fail in service and have to be replaced because of unsound or unhomogeneous metal, represents nearly one-half of the total number of failures occurring on the railroads each year, obviously then, by the application of the nick and break test specification, which is a protection against unsound and unhomogeneous metal, a material reduction in the number of these rail failures would be effected.

Test Made of Model Weir

Laboratory Investigation Thought to Furnish Encouragement as to Reliability of Deduction from Small-Size Dams

By BEN D. MOSES
El Paso, Tex.

AS AN INVESTIGATION of the flow of water over model dams or weirs, the following description of a test made on a very carefully constructed model and presented as a thesis by J. W. Dismukes, a senior at the University of California, is quite worthy of note.

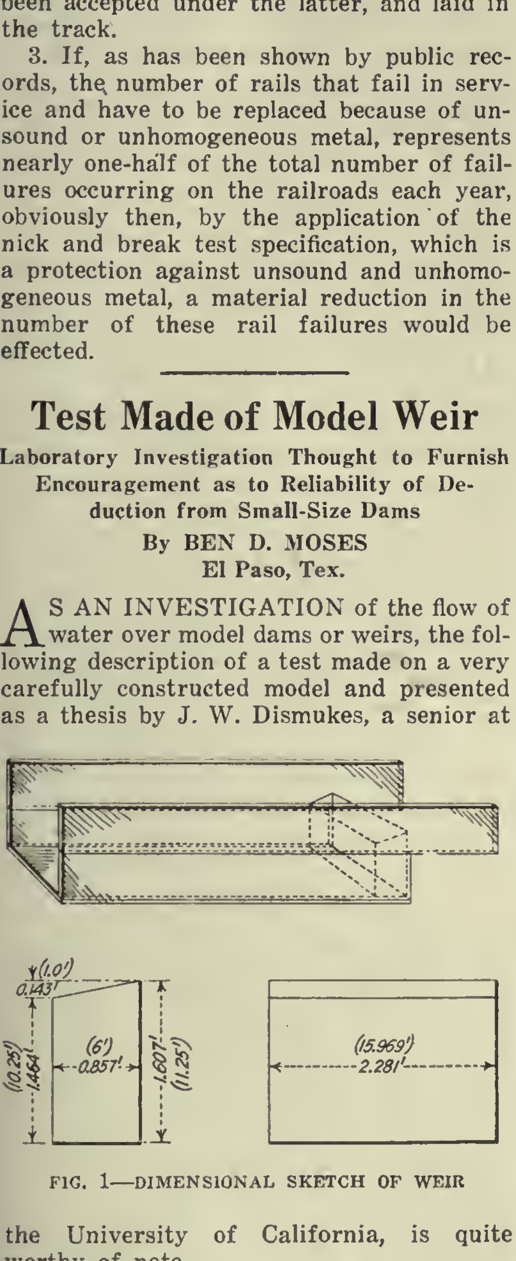


FIG. 1—DIMENSIONAL SKETCH OF WEIR

In seeking a dam or weir after which to make his model, Mr. Dismukes finally chose one of those calibrated at Cornell University in 1903 and described in Water Supply Paper 200 of the U. S. Geological Survey. That known as Series 39 and called the Dolgeville model seemed most fit, as it could be most readily reduced to his scale, and besides being of simple construction, had a fairly consistent curve for the coefficient *c*. All dimensions on the Cornell weir were reduced 7:1, resulting in a model of 2.281 ft. instead of 16 ft. crest length. (See Fig. 1.) All conditions of approach and suppression were reproduced as nearly as possible. Ordinary pine lumber was used for the flume and approach, and redwood for the weir itself, the greatest care being used with all dimensions.

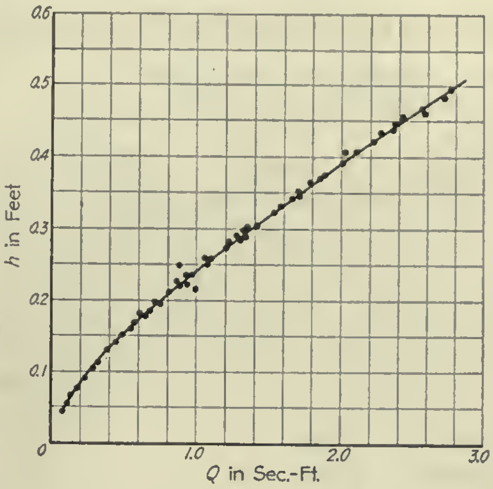


FIG. 2—CALIBRATION CURVE FOR MODEL OF DOLGEVILLE MODEL

The quantity of water was measured volumetrically in a previously calibrated concrete tank 7 x 7 x 12 ft. fitted with a hook gage reading to millimeters. A special carriage mounted on rollers served to deflect the water from one tank to the other. The time of cutting the stream was caught with a stop watch, and altogether the operation was most accurate. Rubber tubing leading from the bottom of the approaching flume to a well supplied with a hook gage served as an effective means of obtaining the head on the weir. Still carrying out the 7:1 relation, the heads were taken at two places, one 1.47 ft. and the other 2.29 ft. above the weir.

TABLE SHOWING COMPARISON BETWEEN ACTUAL EXPERIMENTAL QUANTITY OVER WEIR AND THAT OBTAINED BY FORMULA $Q = n^{5/2} q$

h = head on Cal. model, ft.	$H = 7h$ = head on Cornell model	q = quantity over Cal. model, sec.-ft.	Q = quantity over Cornell model from their data	Q^1 = quantity over Cornell. Weir computed from $Q^1 = 7^{5/2} q$	Difference, $Q^1 - Q$	Per cent difference, $(Q^1 - Q)/Q$
0.05	0.35	0.092				
0.10	0.70	0.260	33.0	33.61	0.6	1.8
0.15	1.05	0.480	61.6	62.10	0.5	0.82
0.20	1.40	0.760	94.0	98.40	4.4	4.69
0.25	1.75	1.060	130.0	137.10	7.1	5.46
0.30	2.10	1.380	169.0	178.9	9.9	5.85
0.35	2.45	1.720	209.0	222.5	13.5	6.56
0.40	2.80	2.060	252.5	266.6	14.1	5.60
0.45	3.15	2.430	298.4	314.1	15.7	5.26

After the weir was installed, leveled and calked a few preliminary runs were made, after which a series of 72 runs was made, the head and quantity being obtained for each run. These have been plotted in Fig. 2, and the curve attests the accuracy of the observations. There remains now to study this curve, and for this purpose nine points were chosen, using the experimental data.

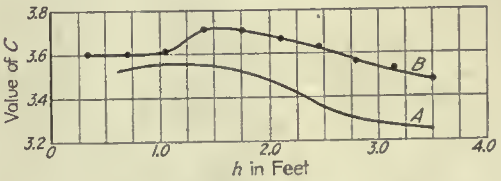


FIG. 3—VALUES OF *c* FOR CORNELL MODEL, A, AND CALIFORNIA MODEL, B

Curve A, Fig. 3, gives *c* as obtained at Cornell, and curve B that for the model at California, the head multiplied by 7 in each case for the purpose of comparison. It is to be noticed that above heads of 1.4 ft. on the Cornell model (or 0.2 ft. on the California model) the curves are at the same general type, and that the coefficient for the smaller weir is greater than that for the larger. This difference seems rather to be in favor of than against the principle, since it has been shown in the writer's article in the Engineering Record of Feb. 19, page 246, that on models of less than 7-ft. crest this actually will occur.

Now let us apply the principle $Q = n^{5/2} q$, in which Q is the quantity over the Cornell model; q that over the California model for the corresponding head, and n, the reduction factor in our case 7. (See Engineering Record of Aug. 16, 1913, page 193, "Flow Over Model of Sunol Dam.") Then $Q = (7)^{5/2} q = 129.6\, q$.

The accompanying table shows the results, and is self-explanatory, while the curves in Fig. 4 are a graphical representation. This is of course the result of one test only, and in spite of the fact that a difference is encountered of some 6 per cent, the consistency of the results is encouraging.

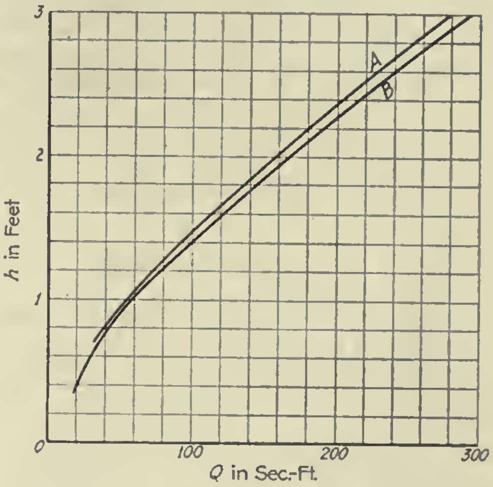


FIG. 4—CALIBRATION CURVES FOR THE TWO MODELS, A AND B

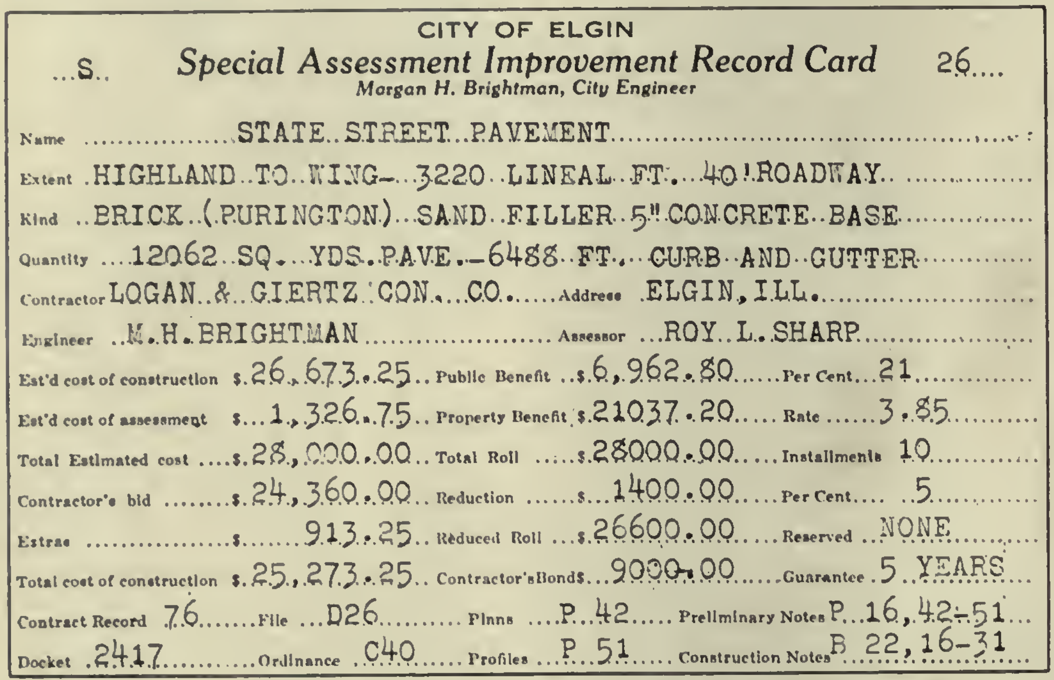
Find Wooden Grillage Foundation Rotted

Settlement of the foundations of a building in Milwaukee adjacent to a sewer excavation was found to be caused by stone piers sinking through a rotted wooden grillage. In the contract of John F. Casey for an intercepting sewer on the east side of the Milwaukee River all open trenches were supported by steel sheet piles, driven below the subgrade in one operation after the material for 6 ft. had been removed. The piles had not been pulled until after the trenches had been entirely backfilled. With one exception no caving occurred, according to the annual report of T. Chalkley Hatton, chief engineer of the Sewerage Commission, under whose direction the work is being prosecuted. After the steel piling had been pulled in front of 537 Edison Street the stone piers supporting the front of this building settled. Upon investigation it was found that these piers had been supported upon wooden grillage, which was entirely rotted, and the slight outward movement of the supporting earth, doubtless due to the excavation of the trench in the street, had transmitted sufficient movement to these piers to drop them through the rotten wood upon which they were resting.

City Improvement Records on 4x6-Inch Cards

City Engineer Evolves System to Enable Him to Answer Questions Instantly on Progress of Special Assessment Work

THE engineer for the board of local improvements of any Illinois city doing a considerable amount of public improvement work by special assessment is constantly being called up to furnish, either for his own use or for the advice of others, a vast amount of general information relating to the various public improvements of his city. Where the obtaining of such information may require the reference to board minutes, council proceedings, court records, filed contracts, etc., it often involves much trouble, annoying delays and loss of valuable time. This is especially true where those records may have been irregularly or carelessly kept, or when they have been filed in other departments or even in other cities, as is frequently the case in regard to court records. Some years ago M. H. Brightman, city engineer of Elgin, Ill., desiring to eliminate the continual reference to original records for improvement data and to retain such data in convenient form in his own office, devised a system of record cards which he has found to be of great value as a time and patience saver. Mr. Brightman submitted a paper describing his card system of keeping such a record recently before the Illinois Society of Engineers. This paper is reproduced practically as given.



CITY OF ELGIN

...S.. *Special Assessment Improvement Record Card* 26....

Morgan H. Brightman, City Engineer

Name ..................STATE..STREET..PAVEMENT..................................
Extent .HIGHLAND..TO..WING-...3220..LINEAL..FT....40'ROADWAY.....................
Kind ..BRICK..(PURINGTON)..SAND..FILLER..5" CONCRETE..BASE.................
Quantity ....12062..SQ...YDS..PAVE.-6488..FT....CURB..AND..GUTTER.............
Contractor LOGAN..&..GIERTZ..CON...CO......Address .ELGIN, ILL...........................
Engineer ..M.H. BRIGHTMAN........................ Assessor ...ROY..L..SHARP.......................
Est'd cost of construction $.26,673.25.. Public Benefit ..$.6,962.80......Per Cent...21..............
Est'd cost of assessment $...1,326.75.. Property Benefit $.21037.20..... Rate ......3.85..........
Total Estimated cost ....$.28,000.00.. Total Roll .....$.28000.00.....Installments 10..........
Contractor's bid ....$.24,360.00.. Reduction ......$...1400.00.....Per Cent.... ..5.............
Extras ....$.......913.25.. Reduced Roll ...$.26600.00.....Reserved ..NONE............
Total cost of construction $.25,273.25.. Contractor's Bond $...9000.00......Guarantee .5 YEARS....
Contract Record 76.......File ...D26........... Plans ....P..42..... Preliminary Notes P...16,42-51...
Docket .2417............Ordinance .C40...... Profiles ....P..51..... Construction Notes B 22,16-31............

PRINCIPAL FACTS AND FIGURES REGARDING IMPROVEMENTS ARE RECORDED ON FACE OF 4 X 6 INCH CARDS—ONE CARD USED FOR EACH IMPROVEMENT

HOW SYSTEM WORKS

All the principal facts and figures concerning the different improvements of the city are recorded on standard 4 x 6-in. filing cards printed with suitable headings for that purpose, one card being used for each improvement. The entire system, alphabetically arranged and filed in a small metal case, occupies an inconsiderate space in the corner of the office desk, and yet is always at hand for instant reference, furnishing without delay or inconvenience the answer to a thousand and one questions and acting as a memorandum and guide for the engineer in carrying on his work.

On the face of each card at the top, blank spaces are provided for the name of the improvement, its location and extent, general nature of its construction and the principal quantities involved. In reference to a brick pavement improvement, for example, after the name of the improvement would appear the street in which the work was laid, the points to and from which it extended, the length and width of roadway improved, kind of pavement, including nature and thickness of base, make of brick and kind of filler, together with the yardage of pavement and the lineal feet of curb or curb and gutter, and any other quantities of major importance that may have been included in the improvement. Following the above are spaces for the name and address of the contractor doing the work, and the name of the engineer under whose supervision the improvement was made and the name of the special assessor preparing the assessment roll.

Below and along the left side of the card are blanks for the following amounts, in the order named: Estimated cost of construction; estimated expense of making and collecting the assessment and other lawful expenses; total estimated cost of the improvement; contractor's bid; cost of extra work, and total actual cost of construction. Opposite these amounts are to be recorded the following: Amount assessed as public benefit, or the "city's share," and its percentage of the total amount of roll; amount assessed against property benefited and the average rate so assessed per lineal foot of normal frontage; total amount of assessment roll and the number of installments into which the assessment is divided; amount and percentage of reduction applied to the original roll, if any, after completion of improvement, and amount of the contractor's bond and length of time for which the work was guaranteed.

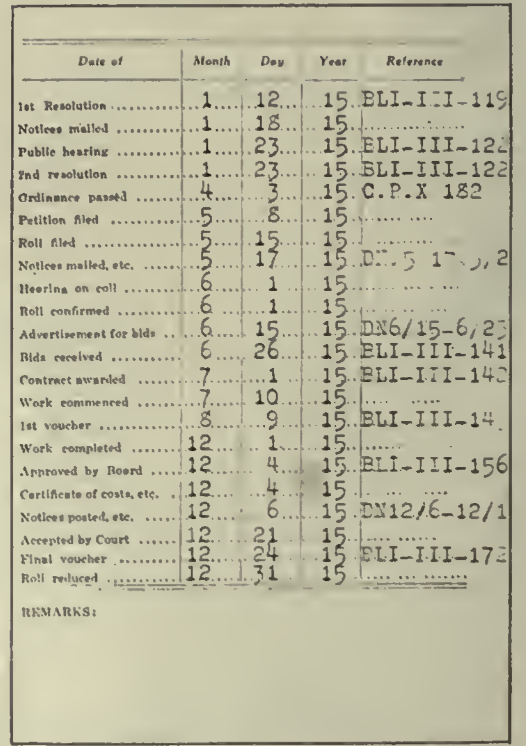
IMPORTANT DATES RECORDED

On the reverse of the card are spaces for entering the dates of important steps in the progress of the improvement as follows: Adoption of the first resolution by the board; mailing of notices of public hearing; holding of public hearing; adoption of separate resolution; passage of ordinance; filing of petition in the county court; filing of assessment roll; notices mailed, published and posted for hearing in court; court hearing on assessment roll; confirmation of assessment roll; advertisement for bids; bids received; awarding of contract; work commenced; issuance of first voucher to contractor; work completed; improvement approved by board; filing of certificate of costs, etc., in county court; notices published and posted for court hearing on acceptance of improvement; improvement accepted and revised roll confirmed; issuance of final voucher and reduction of original roll.

Opposite the column of dates is another column at the top of which Mr. Brightman, for want of a better heading, has placed the word "reference." He has used this column to good advantage by noting in the space opposite each date, initials and numbers referring to minutes of board meetings, council proceedings, etc., that may be connected in some way to the date opposite. For instance, opposite the date of the adoption of the first resolution, B. L. I. III, 125, means that on page 125, Vol. III of the proceedings of the board of local improvements is recorded the adoption of such resolution. D. N., 1/16-1/26, opposite the date of the advertisement for bids would indicate that such advertisement was officially made in the *Daily News* from Jan. 16 to 26.

At the bottom of the card on the reverse side a considerable space has been left blank for noting remarks of any nature deemed necessary in connection with the improvement. In this way each card furnishes a record of the bulk of the general data relative to the improvement which it represents. While this data covers all that is most commonly required, yet it is evident that occasional reference must be made to more detailed and complete records for information that could not possibly be recorded in this way.

To facilitate this further reference work, blanks are provided on the face of the card



Date of	*Month*	*Day*	*Year*	*Reference*
1st Resolution	1	12	15	BLI-III-119
Notices mailed	1	18	15	
Public hearing	1	23	15	BLI-III-12
2nd resolution	1	23	15	BLI-III-122
Ordinance passed	4	3	15	C.P.X 182
Petition filed	5	8	15	
Roll filed	5	15	15	
Notices mailed, etc.	5	17	15	[illegible]
Hearing on roll	6	1	15	
Roll confirmed	6	1	15	
Advertisement for bids	6	15	15	DN6/15-6/2
Bids received	6	26	15	BLI-III-141
Contract awarded	7	1	15	BLI-III-14
Work commenced	7	10	15	
1st voucher	8	9	15	BLI-III-14
Work completed	12	1	15	
Approved by Board	12	4	15	BLI-III-156
Certificate of costs, etc.	12	4	15	
Notices posted, etc.	12	6	15	DN12/6-12/1
Accepted by Court	12	21	15	
Final voucher	12	24	15	BLI-III-17
Roll reduced	12	31	15	

REMARKS:

REVERSE SIDE OF CARD CARRIES DATES AND REFERENCES at the bottom to be filled in with court docket number and the file or index numbers referring to other records in the engineer's office, including field notes, plans, profiles, specifications, ordinances, contract records and copies of all legal or other papers and documents connected with the improvement. An index letter and number are placed at the upper corners of each card to aid in filing and for cross referencing.

Give Conclusions on Activated Sludge Tests

T. Chalkley Hatton and William R. Copeland Make Elaborate Report of Findings at Milwaukee Testing Station

NUMEROUS tests have been carried on at Milwaukee to determine the variations under which the activated sludge process of sewage treatment could be used to the best advantage. The conclusions reached are summarized in the annual report for 1915 of T. Chalkley Hatton, chief engineer, and William R. Copeland, chief chemist, of the Milwaukee Sewerage Commission. The following notes are abstracted from the report:

Comparing the fill-and-draw method with the continuous flow method, there is no material difference measured in terms of required air, cost of aeration, volume of activated sludge required, clarification, nitrates and stability obtained, and the removal of bacteria and organic matter. In terms of cost of construction and operation the continuous flow method, the report states, is the superior method.

In order to maintain clarification and stability and to remove at least 95 per cent of the bacteria from the raw sewage, the nitrogen cycle must be carried far enough to develop from three to five parts of nitrates per million. Carrying this cycle further increases the value of the sludge, but whether this increase is greater or less than the cost of the increased air employed is a matter still to be determined.

The most economical ratio between diffusing and tank surface has not been determined. The ratios thus far used at Milwaukee have run from 1:6.5 to from 1:8.5, and the results have given no indication as to which is the best.

MANY DIFFUSERS TESTED

The best method of diffusing the air has not been definitely determined, although there are many which might be said to be available. (See Engineering Record, Feb. 19, 1916, page 255.) As the use of the process becomes more general this problem will doubtless be satisfactorily solved. The open air jet reduces the pressure of air, but reduces its efficiency, owing to the bubbles being too large. This objection might be overcome by reducing the size of the orifice. An orifice 1/1000 in. in diameter under a 5-lb. pressure discharges air bubbles 1/32 in. in diameter. It is problematical whether such minute orifices could be practically operated, because of the tendency of the small particles of dust carried in suspension in the air to stop them up. Another objection to the open air jet is the tendency to clog the air feed with sludge drawn into the pipe through the orifice when the air is shut off. Great difficulty has been found in this respect in operating the open jets.

Filtros plates, if furnished of uniform porosity, are fairly satisfactory, in fact the most satisfactory agent tried. However, the bubbles discharged are too large to produce the greatest efficiency, and the loss of pressure due to friction through the plate is expensive. This latter might be reduced by making the plates thinner and reinforcing them with wire similar to window-glass reinforcement. Filtros plates are now manufactured 1½ in. thick and 12 in. square, and are sold upon the basis of passing, when dry, a certain quantity of air in cubic feet per minute under a pressure due to 2 in. head of water. This quantity varies directly as the porosity of the plate. The pressure increases from ten to twelve times when the plate is wet. A plate passing, when dry, 2 cu. ft. of air per minute, loses under a 2-in. water pressure about ¾ lb. initial pressure in the passage of the air through the plate, and in addition ¼ lb. for each cubic foot of air passed per minute per square foot of surface.

So far as observations at Milwaukee have gone there is no difficulty in maintaining a clean plate, providing clean air is delivered to it. The sludge which might rest upon the surface of the plate is not absorbed when the air is shut off. It may be in time that the porosity of the plate might be reduced by bacterial growths requiring sterilization for their removal.

The monel metal cloth has been tested but a short time. The observations indicate that smaller bubbles issue from the surface of the cloth than from the filtros plate, although the former is more porous than the latter. This is probably due to the smooth surface of the cloth to which bubbles cannot hang while being built up, as is the case with the rough granular surface of the filtros plate. There is, of course, much less frictional loss through the cloth than through the plate.

TIME AND AIR VOLUME VARIATIONS

The purification of sewage obtained varies decidedly with the volume of air applied. Small volumes applied for five or six hours do as well as larger volumes applied for three or four hours, but the time of aeration required to obtain a like effluent does not vary directly with the volume of air applied per unit of time. There is also a limit to the volume of air applied per period of application, below which it is not possible to secure any significant degree of purification. If less than 1 cu. ft. of air per gallon of sewage treated be applied for a period of four hours, the degree of purification rapidly decreases until little or none is effected, but if the period of application was continued a sufficient length of time any degree of purification required might be obtained. In any case the question of efficiency, volume of air required and period of application is affected largely by the degree of purification desired, and this degree should be established as one of the first steps in designing a disposal plant in which this process is to be employed.

The sludge produced by the process drains out upon the ordinary sludge drying beds in less than one-half the time of the Imhoff tank sludge, but this dewatering is accomplished differently; the first liquor removed from the sludge passes downward through the bed, upon the surface of which the sludge settles, whereupon the remaining liquor rises on the top of the sludge and must be drawn off. The sludge has no apparent odor. Its moisture content can be reduced from 98 per cent to 94 per cent and its volume decreased 40 per cent, by pressure due to a 26-ft. head of water.

Literature

For the Civil Engineer and Contractor

New Publications

WATER SUPPLY PAPERS, U. S. GEOLOGICAL SURVEY. Paper, 6 x 9 in.; illustrated. Washington. Government Printing Office.

SURFACE WATER SUPPLY OF THE UNITED STATES, 1913. Part 9—Colorado River Basin. Paper No. 359; 260 pages.

A WATER-POWER RECONNAISSANCE IN SOUTH-CENTRAL ALASKA.—Paper No. 372, 173 pages.

SURFACE WATER SUPPLY OF THE UNITED STATES, 1914. Part 5—Hudson Bay and Upper Mississippi River Basin. Paper No. 385; 247 pages.

THE AMERICAN YEAR BOOK, 1915. A Record of Events and Progress. Edited by Francis G. Wickware, B. A., B. Sc. Cloth, 5 x 8 in.; 862 pages. New York and London, D. Appleton & Company. $3 net.

This is the sixth annual issue of a book designed to meet the needs of writers and seekers for facts. It contains in addition to general information chapters on engineering, mathematics and astronomy, geology, chemistry, physics, forestry, mineral industries and other subjects of interest to engineers, recording the progress made during the year.

Books Reviewed

Live Load Stresses in Railway Bridge—Formulas and Tables

Author, George E. Beggs, A. B., C. E., assistant professor of civil engineering, Princeton University. Cloth, 6 x 9 in., 123 pages; illustrated. New York, John Wiley & Sons, Inc. $2 net.

This textbook, if judged by the fifty-eight pages of analysis of influence lines, with formulas and examples of their application, claimed to "give an easy and exact solution of the maximum live-load stresses in any structure whose influence lines can be drawn," can hardly be conceded to have established its claim, nor is it a real contribution to the practical analysis of live-load stresses. Present methods and formulas, used in connection with moment and load tables giving partial sums, are shorter and simpler, and avoid the danger introduced by the author in the use of formulas which are manipulated until their physical significance is entirely lost.

If, on othe other hand, the book be judged by the fifty-six pages of tables, there is no question that students and engineers not already in possession of this material, much of which is not new, will find useful data, especially in the collection of live-load moment and shear values for girder and truss bridges for Cooper's loadings.

It might be questioned why three Cooper's loadings (E40, E50 and E60) are each given complete and separate tables, when the well-known ratios between them (not mentioned in the book, however) can easily be applied with a single setting of the slide rule to find final stresses for any system from values found for any other. The examples seem easy because all dimensions are in even feet, for which the tables are computed. Nothing is said about interpolation, which is, of course, generally necessary and increases the amount of computation required. The double interpolation necessary in using Tables 10 to 21 inclusive is not explained. For the usual uneven span lengths this interpolation takes considerable time; graphical diagrams for such variables are, therefore, much superior.

It is unfortunate, also, that the logic of arrangement was not more carefully considered. The text is divided into eleven articles, and in several cases reference is made to later diagrams or to later theoretical relations not yet developed. This is particularly noticeable in the discussion of equivalent uniform loads, the definition and explanation of which, given in Article 9, should have followed Article 3.

In fact, the great usefulness of equivalent uniform loads, especially for long-span and higher structures, is not adequately presented. The claim of the author that his method and equations are especially advantageous for the complicated higher structures is not demonstrated. The only example given is the simple case of the three-hinged arch, and it can be shown that the usual graphical method using groups of wheels and their centers of gravity plotted on a tracing-cloth rider, will give the stresses more simply and rapidly. The general criterion $\Sigma Ws = o$ for influence line use, will give the position of loading for maximum stress much more directly than the author's formula.

While appreciating the originality of the fundamental formulas and the great amount of time spent in the operation of an adding or computing machine to prepare the complete tables given (some of which are carried to eight significant figures!), the conclusion cannot be avoided that, although in the classroom the book may be useful as a basis for mathematical exercise, for actual application by the designing engineer the new methods proposed have no clearly proved advantages over the best present methods.

Letters to the Editor

Comment on matters of interest to engineers and contractors will be welcomed

Shall the American Society of Civil Engineers Move Its Headquarters?

Sir: Some time ago you asked me for an expression of my personal opinion on the question, Shall the American Society of Civil Engineers move its headquarters? Since reading your editorial of Feb. 5, and your plea for an "open mind" in deciding the question, I feel what I want to say on the matter would be a substantial repetition of what you have already said. I have also read the objections which are raised against the proposed change by some of the members of the society. It does not seem to me that the objections which can and have been raised are such as to warrant the members of the society in voting against the proposed change.

The question, as Past-President Hunter McDonald states, was taken up as early as January, 1915, in an informal talk between Messrs. McDonald and Herschel. It was soon after brought to the attention of the other members of the board of direction, and action was taken as stated in the report submitted to our membership by the board.

This report is in a sense a colorless document, and advisedly so. The members of the board felt that in submitting such a report, the document should be confined to a statement of facts, and that based upon this presentation of the matter, the members of the society should with an "open mind" decide the question at issue.

Personally, I believe that the proposed change, if carried out, will make for a better recognition of the members of our profession by the public, for a better acquaintanceship with the members of the other engineering societies, for a mutual helpfulness and hearty co-operation in all matters affecting our common profession of engineering. The establishment of a first-class technical library, the possible endowment of which would release funds for additional committee work, is another reason for our going under the same roof with the members of the other engineering societies.

There is no danger that by making this move the American Society of Civil Engineers will lose its individuality. I have before me as I write the plea from an honored member of our society in which the statement is made: "Upon the broad proposition of accepting or rejecting this offer, there should be no question; it should not be accepted. It would be a lowering of the dignity and influence of the American Society of Civil Engineers to go into partnership with any society, however distinguished." It seems to me that the members of the societies with whom we hope to live under the same roof have done as much to establish the dignity of the profession of engineering and to extend its influence as we, the members of the older society.

My plea is for the opportunity of that touch of elbow which makes for brotherhood. Charles D. Marx.

Stanford University, Cal.

Sir: The writer here endeavors to answer very briefly the salient arguments of your editorial of March 18, page 377, while at the same time recognizing the value of your opinions when the field of speculation as to the results of the proposed merger has been entered.

It is fully understood by the writer that the chief functions of the United Engineering Society at present are to own and manage the Engineering Societies' Building. That it has other functions seems to be established by the fact that it has issued an invitation to the American Society of Civil Engineers to join in the occupancy and ownership of that building. To that extent, at least, it is the spokesman of the societies connected therewith.

Some of the chief promoters already advocate "enlarging its powers," and some of your correspondents oppose the move "unless it would be possible to merge all of the societies into one American institution of engineers." Another says, "It is certainly a fact, so far as the public is concerned, that the home of the profession is in the Engineering Societies' Building."

So, on the whole, it seems reasonable to suppose that the proposed merger, if carried out, would develop into a single organization embracing the several units, and there are members who favor such union, so why not recognize that probability rather than try to deceive ourselves by ignoring it?

Whether such procedure would or would not be advantageous to the profession, it certainly would eliminate the identity and individuality of the societies entering the merger.

You say that the statement suggesting that the American Society of Civil Engineers would lose its identity, give up its freedom of action, or become subordinate to another organization, "has not the least foundation in fact"; that is merely a matter of your opinion, and that it is entitled to consideration is readily conceded. But the quotations cited herein, and the extent of the control now exercised by the United Engineering Society, with the avowed purpose of "enlarging its powers," show there is some foundation in fact for the statements relating thereto.

If it can be shown that the best interests of the profession at large will be realized by the merger of all of the societies into one organization, that will be the proper thing to do.

The writer's views are not in accord with such a proposition. He believes that the stimulus of a healthy rivalry is necessary to bring out the best there is in the several societies.

You say the Engineering Record accepts in preference the statement in the report of the society's committee, "which expressly says that the operating expenses are practically the same" in the two buildings. The report you quote does say for equal accommodations that the cost of opertaion and maintenance "need not be considered, there being no material difference in the annual cost of operation"; it does not, in the last clause, cover the cost of maintenance at all.

No great stress is laid on the importance of this item, but since the figures given have been questioned by you, attention is invited to the following statements of fact:

The first committee of three appointed to investigate matters relating to the proposed merger, reported to the board of direction of the American Society of Civil Engineers certain figures, including the relative cost of operation, from which it was shown that the cost in the Thirty-ninth Street building would be $2,511 greater than in our present quarters. A minority report of the same committee says there is "a difference of $3,711 in our favor" in our present quarters.

No other figures were developed by the larger committee, and these figures are quoted in explanation of the term "no material difference." Engineers, as a rule, prefer to use actual figures rather than general terms.

You state that the American Society of Civil Engineers is already a member of the "Engineering Foundation," which is organized under the auspices of the United Engineering Society. The invitation extended to us by the United Engineering Society reads as follows: "That out of its desire to welcome the American Society of Civil Engineers into the fraternity of the founder societies, etc., etc., the United Engineering Society hereby . . . . invites the American Society of Civil Engineers to consider entering the United Engineering Society as an additional founder society." Your statement manifestly does not agree with the language of the invitation.

Now as to the library. You say that the answer to the statement that we would lose our property interest in the library is "that it is not true." That is, to say the least, rather a blunt statement to make in a supposedly candid argument, and needs material qualification, as perhaps does also the statement you quote.

In general terms, the present regulations provide "that the present library of each society shall remain the property of that society." That future purchases of books for the joint library shall be made and paid for by the United Engineering Society, and such purchases shall be the property of the United Engineering Society. The existing rules do not, however, prohibit the purchase and ownership of books by the individual societies. Here is further evidence that the functions of the United Engineering Society are not limited to the ownership and management of the building, as you say.

A report to the Board of Direction of the American Society of Civil Engineers gives the results to be expected under existing rules as follows:

"These separate libraries lose their individual values, as they are not kept up to date, and such arrangement results in duplication, expense and loss of efficiency. If a great technical library is to be created, it should be made efficient from the beginning, and there seems to be no reason, under these conditions, why a property right which can never be of value to the owners should be perpetuated."

Whether this view is correct or not, it seems more than probable that it will prevail, and as a consequence the "great technical library" proposed will be owned and controlled by the United Engineering Society.

In the matter of investment in the Engineering Societies' Building, it must be apparent that the American Society of Civil Engineers would simply be a shareholder in a property which could not be sold without the consent of the United Engineering Society, which controls it.

Your assumption that there is a tangible barrier between the civil engineers and the other societies which needs breaking down is hardly warranted by the facts, since many of the engineers belong to more than one society, and there is ample evidence of successful teamwork where very cordial relations existed.

A full discussion of this important subject should obtain. It should be viewed from all angles, with the greatest possible frankness, so that when all the evidence is weighed without prejudice the correct judgment will prevail.

This is the sole object of the writer in entering the field of discussion. In a matter of such importance there will necessarily be a great variety of opinions, and they should be illuminated by the widest possible publicity.

J. A. OCKERSON.

St. Louis, Mo.

[Colonel Ockerson persists in this letter in his erroneous view as to the relation which would exist, should it move its headquarters, between the American Society of Civil Engineers and the United Engineering Society. Moreover, he is confused as to the relation of the United Engineering Society to the Engineering Foundation. Since these are matters of much importance to the profession attention is called to comment on them in the editorial pages of this issue.—EDITOR.]

SIR: You ask my opinion of the advisability of the American Society of Civil Engineers joining the other national engineering societies in the Engineering Societies' Building in New York, and my reasons therefor.

I was one of those who favored such a union when it was originally considered by the American Society of Civil Engineers, and nothing has since occurred to change my mind.

The arguments both for and against this movement are so well and fully stated in the communication recently issued by the board of direction to the membership of the American Society of Civil Engineers that there is not very much left to be said.

Possibly more stress might well have been laid upon the fact that the proposed movement will not in any way affect the identity, independence of action or policy of the American Society of Civil Engineers in its own special field. When the matter was originally considered and voted upon a good many members seemed to have been influenced by the fear that in thus joining with the other societies the American Society of Civil Engineers would to some extent lose or impair its independence of action and suffer in other ways from the connection. It may be said that in all matters other than those where united action is desirable and voluntary the relation of the different societies practically will be little more than that of co-tenants in the same building.

The preparation and publishing of papers, the accumulation of data and adequate professional libraries and the opportunities offered for personal and professional intercourse supply ample justification for the existence and maintenance of these societies. But the time will come, if it has not already arrived, when their numerical strength and financial resources will warrant them in not only extending present, but in entering upon new, fields of usefulness to their membership, the profession at large and the public. What direction these new activities should take is a very interesting question. One field that offers great possibilities of usefulness is that of original research and experimental work.

The generous gift of Mr. Swasey for the establishment of the Engineering Foundation, has supplied a nucleus around which the societies, by united action, might build up a great technical laboratory, not only for original research but for important studies, analyses and tests of materials, and other technical investigations for the membership, at cost, along lines similar to the library searches now conducted by some of the societies. The benefits to both the membership, the profession and the world at large that surely might be counted upon are so obvious that they need not be discussed here.

While neither one of the societies would probably be able alone to develop and support such an institution, it would easily be possible by their united efforts.

S. WHINERY.

New York City.

SIR: The communication of the board of direction of the American Society of Civil Engineers, embodying a proposal of the three engineering societies, constituting the United Engineering Society, to go into partnership in their building erected for them by Andrew Carnegie free of its cost of more than one million dollars, has been received and its contents carefully considered.

It was my hope that this question had been finally settled 12 years ago, when by a vote of the society it was rejected by a majority of about two to one. The same reasons exist to-day against its adoption as then, except those reasons are many times more cogent.

As the only surviving member of what have been designated "charter members" of the society (the members of the first year of its existence), I do respectfully but most earnestly protest against its adoption at this time.

The American Society of Civil Engineers, since the first year of its existence, 1853, has increased from a membership of about 50 to nearly 8000, notwithstanding the 7-year lapse during the Civil War.

Its membership occupy honorable positions in every country of the globe. The last list of membership gives the details with its growth in membership; it has grown much faster in the professional character of its members and in the influence of the society as an organization until, at the present time, it is not surpassed in character and influence by any of similar societies in the world.

"Our society," our board tells, "now has a fine building adequate, in the opinion of many members, for its present needs and, as they think, capable of such enlargement as may be rendered necessary during the next 15 or 20 years."

The money value of all its improvements, consisting of a lot 75 ft. front and 110.7 ft. depth, on which has been erected a four-story building of size to fill the lot—the value of the lot and building is estimated at $475,000, on which there is a mortgage of $50,000. No other debt.

With the income from fees from 7600 membership, which is fast increasing, what more encouraging outlook and future could be asked for our society? Should its increasing membership require more extensive quarters, we can safely trust to the admirable management of our finances by our board of direction as we did 12 years ago, to get us out of our troubles.

All the foregoing has been accomplished without help from any source and with no danger of having the name of a multimillionaire nailed over our portals.

The proposal from the United Engineering Society is that we shall give up this elegant home on Fifty-seventh Street, and, on certain terms, join with the other three societies (the electrical, the mining and mechanical engineers' societies in the occupancy of the Engineering Societies Building on Thirty-ninth Street, erected for them free of cost by Mr. Andrew Carnegie about ten years since at a cost of $1,050,000. The cost of building and grounds is placed at $1,717,000.

Upon the broad proposition of accepting or rejecting this offer, there should be no question; it should not be accepted. It would be a lowering of the dignity and influence of the American Society of Civil Engineers to go into partnership with any society, however distinguished. With the four engineering societies occupying the proposed building, it would be in the nature of an immense apartment house, with no more privacy. We have elegant headquarters on Fifty-seventh Street, with all the conveniences of such a building. Were we to accept the proposal of the United Engineering Society, it would necessitate the sale of the building, with all its pleasant associations. In these "war times" it would be difficult to sell it at its true value.

Gentlemen of the American Society of Civil Engineers, we have fought the fight and in an existence of about 60 years we have attained a proud eminence among the scientific societies of the world; we have an elegant home on Fifty-seventh Street, New York, sufficient for our needs, and are virtually out of debt. Let us be content and remain where we are.

In conclusion, there does not appear to me any good reason why this change, a momentous one to our society, should occur. Of course, there should be the most cordial co-operation with these three organizations, as they exist to-day. They are all *special* branches of Engineering, but the principles of *civil engineering* lie at the foundation of each of them. But this co-operation can exist just as cordially with the headquarters of each a few blocks distant as if they were "next door."

William D. Pickett,
Hon. M. Am. Soc. C. E.
Lexington, Ky.

Sir: In the issue of the Engineering Record of March 11, comments by different ones are published in connection with the possible moving of the headquarters of the American Society of Civil Engineers to the Engineering Societies' Building.

As a long step forward, the writer is in favor of the change, but is quite in accord with the expressed view of Wm. Barclay Parsons that a complete union of all the engineering societies should be sought, merging into one great national institution. This would not deter specializing, or the investigation of matters of particular interest to different groups. Such a course would inevitably increase the power and prestige of that which is truly a profession.

Louis L. Tribus.
New York City.

Sir: On my return to New York I find your request for my views on the proposed moving of the headquarters of the American Society of Civil Engineers to the Engineering Societies' Building. This seems to me to be a very desirable move.

First, it will tend to improve and extend the good feeling between our society and the other great American engineering societies, and make it easy for them to continue to act in concert, therefore making the influence of all very much greater when the occasion for exercising such influence shall arise.

In this regard it might be stated that in Canada there is only one great engineering organization, which combines the civil, mechanical, mining and electrical engineers. As a result, the Canadian Society of Civil Engineers has a very much greater influence with the government than any of our four national societies can ever hope to attain acting individually—although each of them is in a better financial condition and has a much larger membership than the Canadian society.

In Canada a man is not authorized to practise engineering unless he joins the Canadian society.

The financial consideration should be a minor one, as the American Society of Civil Engineers is by far the strongest—from a financial standpoint—of the four, and can well afford to stay where it is, build a new house, or add two and a half stories to the Engineering Societies Building, as it may prefer.

Combining the libraries will be another great advantage, and the location on Thirty-ninth Street will be more convenient for most New York members as well as all out-of-town members.

As I believe that you would prefer brevity I will close by sincerely hoping that the members of the most powerful society of civil engineers in this country, if not in the world, will add to its own wealth, prosperity and influence, as well as that of the other engineering organizations, by moving into the Engineering Societies' Building.

Of the two plans, A and B, I would much prefer A, but to allow for any new contingency that may arise, I am voting C, knowing that the board of direction can safely be intrusted to use good judgment.

T. Kennard Thomson.
New York City.

Sir: In considering the proposition for the American Society of Civil Engineers to join with the three other large engineering societies in the occupancy of their building on West Thirty-ninth Street, I feel that it would be most undesirable to lose sight of the club-house feature and to deicde the matter by conclusions reached by strictly impersonal reasoning. I feel that the atmosphere upon entering the headquarters of the foremost engineering society of this continent should be essentially human, extending that intangible welcome and hospitality that appeals so keenly to the occasional visitor and makes a pleasant greeting to the regular member, and that that first impression should be maintained throughout the building. The whole scheme of lobby, halls, rooms, furniture, decorations and attendants should be designed with the object of eliminating in every particular the stiffness and formality so noticeable in offices of large corporations where everything is for purely utilitarian purposes and where one feels that he should transact his business and depart without unnecessary delay. It is impossible to soften the angularity of a succession of adjoining rectangular rooms or to relieve the unattractiveness of halls lined with closed doors and terminating in a bank of elevators. It is a fact that the present society house is inadequate in some respects and that changes are desirable, but I believe that, in making any change, the club-house feature should be continued and extended and that the effort should be to foster and promote sociability and companionship in every conceivable way commensurate with the dignity of the association, architecturally, personally and psychologically. I am of the opinion that it would be extremely difficult to bring about such desirable conditions in the building suggested.

Arthur W. Tidd,
Mem. Am. Soc. C. E.
Yonkers, N. Y.

Sir: The first thought of the members of the American Society of Civil Engineers must be one of appreciation of the generous spirit shown by the United Engineering Society in both of its offers. The second thought naturally concerns the desirability of the change. In any such proposal of change, where physical necessity is not involved, inertia is likely to cast the deciding ballot in the negative without regard to the merits of the case, unless the affirmative side is thoroughly developed. This is particularly true in this case where the question is an old one, which was decided in the negative when previously submitted. The ballots having been sent out in advance of discussion will tend to bring out a vote "by return mail" on this basis.

More rapid progress could have been made if those in charge of the matter had broken the news of these offers at the annual meeting of Jan. 19, and the United Engineering Society would doubtless have been pleased to extend to the society, if desired at that time, an invitation to visit the building and become better acquainted with the present and proposed housing arrangements.

It appears to the writer that the general membership of the society is in the position at present of wanting to be shown clearly how and where the society would be accommodated, what the new home would be like, and the advantages to all concerned. The financial statements submitted will be accepted as showing that the move is perfectly feasible from that standpoint and on a very reasonable basis.

The writer is not in favor of the acceptance of offer B, as on the basis of present evidence it would mean the removal of the associated societies now occupying the rooms, who would "have to seek other quarters." Aside from present occupancy, these smaller societies who could not afford a home of their own, appear to have more of a reasonable claim there than the comparatively affluent American Society of Civil Engineers. It would evidently be only a short time before the additional stories would be required and new adjustments be necessary, if this plan were adopted.

On the question of accepting offer A, the writer is of open mind and entertains the hope that the plan will be developed favorably. The general advantage of closer co-operation is evident: have plans for further co-operation been made, and if so, do they show that they can be carried out only after this change? Will it be a disadvantage to have the meetings on the fifth floor and the headquarters ten stories above? Will our space permit a room large enough for a reception or gathering of any kind?

The social aspect is of importance, and much has been said informally concerning the possibility of increasing the attractiveness of the present home of the American Society of Civil Engineers, to provide additional accommodation of this nature. Can this be better accomplished in the proposed change, perhaps by a lounging room or rooms where members could come at any time for conference, where out-of-town members would be welcomed and attracted.

We are proud of our present library and efficient staff; with the very much larger combined library there should be added advantage, if equally accessible for use. In this connection, could not hours be arranged for parts of the building and library, that will permit more efficient use by others than the unemployed, including late evening hours, Sundays and holidays. The combined societies might afford what neither one alone could undertake.

It is to be hoped that the proposed general method of operations, together with other pertinent information, can be furnished for the guidance of the members, in time for definite action in June.

W. E. Belcher.
New York City.

HINTS FOR THE CONTRACTOR

Details Which Save Time and Labor on Construction Work

Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

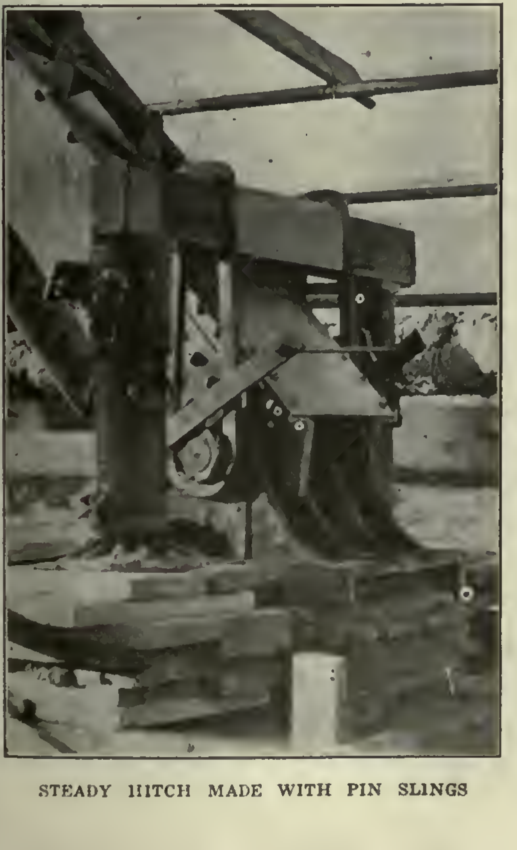
[*Contributions to this section are solicited, and if found available will be paid for. They must be* SHORT, *and should be accompanied, if possible, by photographs or sketches.*—EDITOR.]

Rigid Jacking Hitch Made with Pin Slings for Raising Bridge

By R. C. HARDMAN
Colorado Springs, Colo.

THE JACKING hitch illustrated herewith proved quite steady, though made with slings. It was used in raising a 105-ft. 85-ton, single-span truss bridge over the Arkansas River at the mouth of the Royal Gorge, where falsework could not be built at any reasonable cost and where it was not convenient to arrange for jacking under the bridge seats. The end of the bridge was raised 5 ft. in three lifts of 13, 32 and 15 in. The shoes were raised alternately a few inches at a time and concrete blocks placed under each before the other was lifted. One truss having thus at all times a solid bearing, it was easy to keep the bridge in alignment. The pedestals built up also furnished a good base for the jacks.

These slings were made of 1¼-in. square steel shaped at one end to fit snugly around the hexagonal nuts and at the other end to fit over the top flange of a 6-in. I-beam. Strap iron ties bolted at the ends were used to prevent the slings from slipping off the nuts. Strips of sheet lead were used between nut and sling to secure a uniform bearing, the nuts first having been turned so that one side was at the bottom. The I-beams were filled out flush with the flanges with wood blocks, upon which were nailed small strips on each side of the slings to prevent lateral movement. Under each sling on the flange of the I-beam was a ¾-in. steel plate to distribute the load and prevent crippling of the flange. The jacks were placed as close together as possible in order to reduce the bending moment in the I-beams to the minimum. The roller bearing plates were fastened to the bridge seat, and the jacks were set directly on the abutment for the first lift. Four geared jacks, three 35-ton and one 25-ton were used.



STEADY HITCH MADE WITH PIN SLINGS

The raising occupied 2½ days, but the actual time chargeable to this part of the work was only 10 hr. The labor cost, including the concrete pedestals, was only $15.34.

JACKS TIGHTEN LASHINGS OF 13-TON GIRDER FOR DANGEROUS ASCENT OF MOUNT WILSON

Motor Truck Carries 13-Ton Loads of Steel Up Steep Mountain

THE CARNEGIE Observatory on the summit of Mount Wilson near Pasadena, Cal., was confronted with unique conditions in transporting structural steel members of considerable size and weight required for supporting the new telescope which is under construction. Seven structural steel members of various forms and sizes to be included in the telescope support weighed from 8 to 13 tons apiece. The difficulty arose in the transportation of these members from Pasadena to the summit of the mountain, which is accessible only by a mountain road which is a continuous upgrade for nine miles with many hairpin turns. There was insufficient room at the turns for maneuvering mule teams, and of course the cost of hauling by any kind of winch arrangement would have been great. The difficulty was solved by J. A. Stoner, president of the Mack Motor Truck Company of Los Angeles, who was willing to try out the proposition with one of his 6½-ton Saurer trucks.

Mr. Stoner personally drove the truck seven trips to the summit, each time with one of the large pieces of steel. The two most difficult types of load were the two 13-ton, 28-ft. girders, one of which is shown in the illustration, and a steel drum 10½ ft. across. The difficulty with the girders was that the front wheels on one side were entirely concealed from the driver by the forward end of the girder. To keep within the narrow limits of the highway where it skirted cliffs on one side and canyon precipices on the other he had to depend on wigwag signals from a man riding the front of the girder. The steel drum was so wide that in twenty-five places it hit the bank and either skidded the truck and its load or the load itself.

Maneuvering at the hairpin turns was a risky proposition, as a miscalculation of 4 or 5 in. would have sent the truck over backwards, so near did it have to run to the edges of precipices. The truck carried these successive overloads without damage and was later sold for service in hauling ore in Kingman, Ariz. Two features of its construction which were instrumental in enabling it to carry the excessive overloads without damage are the high efficiency of the cooling system and the design of the motor brake which operates under compression in low gear, permitting safe backing at the short turns, all of which are on inclines. As will be noted from the photograph, jacks and heavy chains were used to bind the structural steel to the truck with sufficient tension in the lashings to make the truck and its load practically a structural unit, thus obviating risk of shifting, which might have had disastrous results at many points en route.

Fire Engines Used to Clear California Waterway

An unusual method of dredging a river channel was recently employed to remove silt that had clogged one of the most important slips connecting the river and the ocean at Long Beach, Cal., to such an extent that the traffic was seriously blocked, when a stream from a firehose was brought in play. The fire engines were brought to the scene and a powerful stream of water plowed through the accumulated mud so that a clear passage was made in a short time, which allowed the smaller boats to get to the ocean.

Plans are under way to have this slip immediately cleaned of mud, but as a temporary means of clearing the way, the firehose proved most effective.

Contractors Suggest Schemes for Subaqueous Pipe Line

By ELIOT N. SMITH

Resident Engineer with J. Byers Holbrook, Consulting Engineer for Jersey City

Contractors who bid upon the Passaic and Hackensack River crossings of Jersey City's proposed new water supply pipe line were invited to submit proposals based upon their own ideas of how the work could best be handled, in addition to the general scheme of construction outlined in the specifications of the Board of Commissioners. Although all of the bids opened Dec. 2, 1915, were rejected, several of the proposals showed careful study of the problem by the contractor and were, apparently, very advantageous to the city.

The Passaic River at the point of crossing is about 500 ft. wide, with a maximum depth of 16 ft. and a hard sand bottom. The Hackensack is about 1000 ft. wide with a maximum depth of 32 ft. and a soft mud bottom. The pipe was to be laid in a dredged trench with a minimum cover of 3 ft. Eleven bids were received and most of them included at least one alternate proposal. The various methods proposed were as follows:

Price Per Foot, Including Dredging the Trench and Placing the Pipe But Not Including Foundation

Contractor	Method (A)	(B)	(C)	(D	(E)	(F)	(G)	(H)
1	$77.70	....	$43.52	....	....	....	....	....
2	87.00	....	....	....	....	....	$56.75	$113.50
3	52.00	$36.00	....	....	....	....	....	....
4	....	....	....	$130.00	....	....	....	....
5	71.00	....	....	....	$54.00	....	52.00	99.00
6	56.79	....	30.00	....	....	....	....	....
7	....	....	45.62	....	....	....	....	....
8	78.20	....	....	....	....	$65.18	....	....

(A) Engineer's Method.—A double line of 48-in. flexible-joint cast-iron pipe was proposed. Joints were similar in design to the modified Ward joint adopted by the Board of Water Supply of New York City for the Narrows siphon. This type of joint depends on a double row of jib screws around the circumference of the bell to force additional lead into the joint and avoid the necessity of calking under water. (See description of this work in the Engineering Record, (Dec. 19, 1914, p. 656). Each line of pipe was to be laid on a foundation of capped pile bents, two bents to each 12-ft. length of pipe. Joints were to be made up on a launching cradle mounted on a scow, down which the pipe was to slide as additional lengths were placed and the scow advanced.

(B) Same as method (A) except that taper spigots were substituted for all but about one-fifth of the flexible joints.

(C) A double line of 48-in. standard bell-and-spigot cast-iron pipe on a pile foundation similar to the foundation described under (A). Most of the contractors proposing this method planned to make up the pipe on deck scows in sections of 2 to 4 lengths, with all joints completely calked. Each section was then to be handled as a unit, without straining the joints, by suspending it at a number of points from a truss or girder. By means of this truss the section was to be picked up and lowered into position on the previously prepared foundation. The next section was then to be made up on deck and lowered to position. The spigot at the end of the new section, according to this scheme, was entered into the bell of the section already placed and the joint calked with lead wool by a diver. Any additional calking necessary to make the pipe line tight was done by divers, and in addition the pipe could be calked internally.

(D) Same as (C). One of the contractors proposed to calk the pipe on shore, bulkhead the ends and launch it. He also proposed to make the foundation for the pipe of piles driven 3 ft. on centers and covered with a 2-ft. bed of concrete placed under water.

(E) Same as (C). Another contractor proposed to assemble and calk the pipe for the entire crossing on the bank of the river, carrying it on wheel trucks running on rails. The pipe would then be launched as one unit by rolling the entire line along a previously constructed track laid on a firm foundation on the bottom of and across the river. Recalking was to be done by divers.

(F) Same as (C), except that the bells and spigots were provided with an interlocking device serving to tie adjacent lengths of pipe securely together. This contractor proposed to substitute, in the Passaic River crossing, supports built up of concrete in bags and laid directly on the bottom of the dredged trench, instead of the pile bents specified.

(G) A double line of 48-in. riveted steel pipe protected with approved pipe coating and encased in several inches of concrete, resting on pile bents as described under (A).

(H) A single line of 72-in. riveted steel pipe; otherwise similar to (G). The procedure under both (G) and (H) was to make up the pipe on launching ways on shore, thread pre-cast, reinforced concrete pipes over the steel pipe as fast as it was riveted up, grout the space between the steel pipe and the enveloping concrete pipes and gradually push the compound pipe out into the river where it was suspended from floats or scows until the entire crossing was completed. It was then lowered to position on its pile foundation, tested, and calked internally if necessary. This is the method followed when the existing 72-in. steel pipe line was laid across the rivers in 1902.

The accompanying table shows approximately the prices for the alternate schemes proposed by the various bidders, compared to the flexible joint method (A), described in the specifications. Roughly, methods (C), (E) and (F) (standard bell-and-spigot) cost from 50 to 80 per cent as much as method (A), and either methods (G) or (H) (48-in. or 72-in. steel pipe encased in concrete) cost from 65 to 75 per cent as much as (A). Of course these bids were based on quotations obtained last November and radical changes have occurred since that time.

New specifications have been prepared based on method (H), involving a 72-in. steel pipe encased in concrete.

50-Foot Cylinder Pier Pulled with Compressed Air

By decking the top of a 4-ft. steel cylinder which went $3\frac{1}{2}$ ft. out of plumb in sinking the foundations for the Lincoln Memorial in Washington, and turning on compressed air at 100 lb. per sq. in., the cylinder was readily withdrawn so that it could be sunk again in a vertical position. The method is described in an article on the Lincoln Memorial by Captain James A. O'Connor, of the Corps of Engineers, U. S. A., in the current issue of *Professional Memoirs*. The $\frac{3}{8}$-in. and $\frac{1}{2}$-in.-thick steel shells for these cylinders were sunk by weighting them and using jets, afterward excavating the material inside in the open. Open sheeted pits about 20 ft. deep were dug to start the cylinders in. This one had struck an old pile which deflected it.

In withdrawing the cylinder an air-tight deck of 6-in. timbers was bolted to angles at the top of the cylinder. The cylinder was then allowed to fill with water, and a strain of more than 50 tons was taken on it by means of jacks and chains. The valve in the air line, which was connected just below the deck, was then opened quickly, admitting air to the cylinder at 100 lb. pressure. The object in filling the cylinder with water was to limit the air space, since it takes an appreciable length of time to overcome the inertia of a 50-ft. column of water. Observations on the pressure gage connected with the cylinder showed a pressure of 90 lb. per square inch for several moments after the air valve had been opened. The first twelve attempts raised the cylinder 1 in., the strain on the jacks being taken up each time. On the next trial the cylinder shot up 15 ft., and was then easily removed.

The weight of a complete shell figures about 6 tons, and the uplift on the deck from the compressed air about 80 tons, not allowing for any impact. Allowing for 25 ft. of penetration, this would give the skin friction overcome as a little less than 800 lb. per square foot.

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

Strike Delays Construction of New York Subway

The claim of a new laborers' and timbermen's union for recognition and a simultaneous demand for an increase in wages, regular weekly payment and strict adherence to the 8-hour law have seriously affected construction work on New York City's new dual subway system. It is believed there would be no objection on the part of the contractors to dealing with the union if it could be demonstrated that the union was a bona fide organization controlling these classes of labor in New York City territory. On this point the views of the contractors and of the organizers differ, the former understanding that the new union is not affiliated with organized labor and the latter claiming that it is.

According to figures published in the *Public Service Record*, on March 1, 12,093 workmen were employed daily, of whom, it is estimated, the classes involved in the strike number 7000. It is said that, altogether, 5000 men had quit work by April 5. The open-cut sections, which depend for progress entirely on the laborers and the timbermen, are most affected, though a number of contractors retained enough men of these classes to continue work. The East River tunnels, where there is no timbering and the muckers belong to the sandhog union, are least affected.

The contractors claim that the prices at which the work was let will not permit them to grant the demands for wage increases. They are now handling the situation as individuals and it is likely that no concerted action on their part will be taken till the matter has developed further. No attempt to employ men to take the places of the strikers has been made, as there are not now enough men in the labor market to make the effort worth while.

Will Start Work on Nave of New York Cathedral

Work on the nave of the Episcopal Cathedral of St. John the Divine, in New York City, which will be the largest church in the United States, will begin May 8. The work is expected to take 5 years and to cost nearly $3,000,000. The transepts, choir and crossing were completed some years ago and were fully described in the Engineering Record.

The cost of the first stage of the new work is estimated to be about $78,000, and it is hoped that contributions will have been plentiful enough by the time the first work is completed to authorize the continuance of the construction. The nave, when completed, will be 260 ft. long, 135 ft. wide and 160 ft. high, with a single large chamber, the interior height of which will be 125 ft.

The cathedral was designed by Cram & Ferguson, architects, of New York, and the contract has been let to Jacobs & Young, also of New York City.

Plan Extensive Work for Hetch Hetchy System in 1916

M. M. O'Shaughnessy, city engineer of San Francisco, in a report recently made on construction work for the Hetch Hetchy system, gives the following as the principal work contemplated in 1916: Construction of the Hetch Hetchy railroad, contract for which was awarded in December, 1915; completion of diversion tunnel and diversion dam; preparation for foundations of the main Hetch Hetchy dam; preparations for construction of temporary power plant to supply power for construction operations at the dam site; exploration borings to determine the character of formations through which the aqueduct tunnel will pass; completion of contract for clearing the reservoir site; continuation of aqueduct tunnel from Early Intake toward South Fork; additional road and trail construction, and the continuation of hydrographic, meteorological and survey work, as well as the protection of the city's water rights.

The aqueduct in the initial development, the report states, will consist of 88 miles of pipe, 5½ ft. in diameter, and 66 miles of tunnels, 10 ft. to 10½ ft. in diameter, a total length of 154 miles to the county line of San Francisco. The tunnels are at present designed for 200,000,000 gal. daily, although it is estimated that the ultimate consumption in the San Francisco Bay region will be 400,000,000 gal. daily from this source. However, it is believed that as the full quantity will not be required for many years, the saving in first cost and interest will greatly exceed the cost of driving a second parallel tunnel when necessary.

Establish Validity of Act Creating Florida Road Department

By a decision overruling a demurrer filed by Leon County against a previous order to pay over to the state treasurer a certain percentage of the automobile license tax for the maintenance of the recently created state road department, Chief Justice Taylor of the Florida Supreme Court removed the last obstacle to the department's proceeding with its work and appointing, in the near future, the road commissioner and assistants authorized in the act.

The state road department was created last year and the five members constituting it were appointed in October, as was noted on page 494 of the Engineering Record of Oct. 16, 1915. To defray its expenses and to pay the salaries of the commissioner and assistants authorized, 15 per cent of the amounts collected as license taxes on automobiles was set aside. Some of the counties, however, refused to pay the required percentage of the taxes collected, on the ground that the act creating the department was not valid.

It is considered likely, in view of the fact that Edward Scott, chairman of the road department, in an address delivered at the recent good roads convention at St. Augustine, stated that the department was only waiting for a decision in the test case to make such an appointment, that the salaried road commissioner will be appointed at the meeting of the board to be held April 12.

Kansas State Agricultural College Holds First Highway Conference

The first conference in Highway engineering ever held at the Kansas State Agricultural College recently took place at Manhattan, Kan. The features of the conference were discussions of problems relating to the location, construction and maintenance of roads. The office of public roads and rural engineering, Washington, D. C., provided an illustrated exhibit of road and bridge models and practical demonstrations in road grading and building were given by the college authorities. One feature of the conference was a large map of Kansas, 6 by 10 ft. showing by means of colored tacks and stars, the roads, bridges, drainage and irrigation projects constructed under the supervision of the State engineer's office. The conference will be made an annual affair.

Philadelphia Engineers Query Board on Ockerson Letter

Action Taken Because of Fear That Members May Be Influenced by Misconceptions Regarding United Engineering Society

Colonel John A. Ockerson's letter to the local associations of members of the American Society of Civil Engineers was the chief topic for discussion at the meeting of the Philadelphia Association of Members on April 3. As a result of the discussion resolutions were passed asking the board of direction to say, in an official communication to the members, whether certain statements in the Ockerson communication were correct or not. It was feared that these statements, which upon inquiry the Philadelphia association finds have no basis in fact, may influence unfairly votes on the pending measure regarding the removal of the American Society of Civil Engineers to the Engineering Societies' Building. There was also read at the meeting a communication addressed by the secretary of the society, Charles Warren Hunt, to the San Francisco Association of Members, but sent also by Mr. Hunt to the other local associations.

Paragraphs Questioned

The paragraphs in Colonel Ockerson's letter to which the Philadelphia association objects, and regarding which it asks the board of direction of the society to issue an official statement are as follows:

"An invitation has been extended to the American Society of Civil Engineers to enter 'the United Engineering Society as an additional Founder Society.' This invitation itself shows that the destinies of the 'Founder Societies' is largely if not wholly controlled by a superior authority, and the fact must not be overlooked that the relationship which exists between the United Engineering Society and the Founder Society which gives the former authority over them has not been presented in detail to our members.

"Suppose we become an 'additional Founder Society' and desire to put before the public a measure which we have conceived and which we deem important. It must have the sanction of the United Engineering Society, representing a majority of the Founder Societies, which can prevent action, or, if approved, the United Engineering Society would stand before the public as the sponsor of the measure. This illustration applies equally to all the Founder Societies."

(The communication from Colonel Ockerson was discussed by the Engineering Record editorially on March 18, and a letter and a further discussion thereon are found in this issue.)

The chief speaker of the evening was Clemens Hershel, who was chairman of the board of direction's committee which drew up the report to the members on this subject. Following his presentation of the chief features of the plan there was general discussion, participated in by members of the association and by a number of invited guests. Unfortunately for the best presentation of the subject, no one among the membership present nor among the guests was opposed to the plan.

Tunnel Engineers Hold Dinner

The engineers in charge of construction of the eight tunnels being built under the East River for the Public Service Commission of New York City held a dinner at the Hotel Savoy, April 1, at which emphasis was laid upon the necessity for loyalty in the success of a large and hazardous undertaking.

C. M. Holland, tunnel engineer for the Public Service Commission, and his seven resident engineers were present. Commissioner Travis H. Whitney, Alfred Craven, chief engineer, Robert Ridgway, engineer of subway construction, Daniel T. Turner, deputy engineer of subway construction, and George Rice, division engineer, were guests at the affair, as was Major John F. O'Rourke, vice-president and chief engineer for the contractor doing the work.

Call for Conference on Engineering Co-operation

A conference on engineering co-operation to be participated in by all engineering societies and organizations, both national and local, is to be held in Chicago April 13 and 14 in the rooms of the Western Society of Engineers. The following ten subjects are to be considered: Co-operation among engineering organizations—Is it desirable? In what way is it practicable? Benefits of co-operation in securing greater efficiency in the larger matters of concern to the individual engineer, to the profession, and to the public. Methods of co-operation now in practice in various localities; results attained in Philadelphia, St. Louis, St. Paul and other places. Various kinds of engineering societies and committees and the relative efficiency of their operations. Relation of the specialized or exclusive national engineering societies to their local sections or branches and to the more inclusive local engineering society or club. Result of co-operation in securing wider diffusion of knowledge on engineering subjects, as illustrated at Cleveland and elsewhere. The engineering profession as a whole in its present condition as regards public esteem. Reasons for decline in attendance at engineering colleges—Is it indicative of healthful conditions or of proper methods of education? Employment; methods and results as practised by various engineering societies; an exchange of ideas. Legislative activity, proper limits to be set, dangers to be avoided and needs of more systematic and better directed efforts. The committee is headed by Prof. F. H. Newell, University of Illinois, who states that it is the idea to do much of the work both by sub-committees and in general conferences until some consensus of opinion has been reached, at least on some of the fundamentals and to stimulate activity toward the accomplishment of definite results along lines which are now being so broadly discussed.

International Corporation Will Finance Uruguay Work

The American International Corporation has announced that it will finance the waterworks and sewer systems contract in Uruguay on which the Ulen Contracting Company, the contractor, has made preparations to begin work at once, as was noted in this journal on page 431 of the issue of March 25. The work will be paid for by a bond issue, which the International corporation will market.

This step is in accordance with the purpose of the corporation to assist American contractors in foreign fields to finance the works they may undertake, as was indicated in an interview with Willard Straight, its vice-president, which was published on page 93 of the Jan. 15 issue of the Engineering Record.

Chicago to Make Water Survey

The city council has appropriated $17,500 to make a water survey during 1916. That Chicago now uses 254 gal. of water per capita per day is largely due to the leakage and wasteful usage, and engineers of the City Club recently recommended general metering as the only relief from this. However, the $8,960,000 water budget for this year permits no move in that direction.

Committee on Classification of Technical Literature Assigns Subjects

Best Method of Procedure in Making Classification Is Discussed at Meeting in Engineering Societies Building on April 1

A general outline for the proposed classification of technical literature was approved, and definite assignments of the different subjects to the various societies were made at a meeting of the Joint Committee on Classification of Technical Literature held April 1 in the Engineering Societies' Building, New York City. Thirteen delegates from the thirty-two technical societies represented on the committee were present. They discussed the importance and value of the proposed classification, not only for individuals and librarians, but for manufacturing and commercial organizations. Dr. Edgar Marburg, representing the American Society for Testing Materials, emphasized the necessity for adopting the best procedure for ensuring the successful completion of the classification within the near future.

Following the reading of a paper by the secretary, W. P. Cutter, librarian of the United Engineering Society, on "How to Make a Classification," the recommendation of the executive committee to assign different parts of the general outline to suitable organizations from among the various bodies represented was debated. After prolonged discussion on the relative advantages of this method and of the alternative proposed by Mr. Cutter, by which a well-qualified librarian or expert should first work up the complete scheme of classification, a motion to adopt the executive committee's proposal was passed.

List of Assignments

The proposed list of assignments of technical subjects to the various societies was adopted as follows: Aerial transportation to the Aeronautical Society; vessels to the Society of Naval Architect; roads, streets and pavements, American Highway Association; road vehicles, Society of Automobile Engineers; Railroads, American Railway Engineering Association; rolling stock, Master Car Builders' Association; waterways, surveying and structures, American Society of Civil Engineers; materials of construction, American Society for Testing Materials; excavation, geology and mining, American Institute of Mining Engineers; hydraulic and sanitation, American Waterworks Association; electricity, American Institute of Electrical Engineers; water-power, American Society of Mechanical Engineers, and gas to the American Gas Institute.

At the suggestion of the acting president, F. R. Low, representing the American Society of Mechanical Engineers, the presidency of the joint committee was offered to H. W. Peck, of the American Gas Institute, who originated the project in the latter part of 1914. Mr. Peck was unanimously elected.

Chicago Engineers Study Military Preparedness

The Chicago Joint Committee on Military Engineering has arranged a program for one event a week, beginning April 20, when Lieut.-Col. W. V. Judson, will open the series with an address on "The Civilian Engineer and National Defense Organization and Duties." Major P. S. Bond, Cleveland, will give an illustrated lecture on "Service of Reconnaissance and Demolition," April 27, and Col. Mason M. Patrick, Detroit, will talk on "Coast Defense," May 4. By this time outdoor work will be feasible and an exhibition drill in bridge and pontoon building by the engineer company of the Illinois National Guard will be arranged. Capt. Raymond Sheldon, Eighteenth Infantry, U. S. A., will conduct a tactical walk and defense problem May 20. Other events of like nature have been scheduled until July 25, with correspondence courses and practical work to be organized during the summer.

The following officers have been elected: Wharton Clay, chairman; Capt. Robert W. Hunt, vice-chairman; Robert F. Hall, secretary-treasurer. The other directors are: Bion J. Arnold, W. W. DeBerard, J. De N. Macomb, Jr., H. S. Baker, Robert I. Randolph and Vernon C. Ward, Jr.

American Society Members Form Branch in Chicago

The Illinois Association of Members of the American Society of Civil Engineers was formed March 27 in Chicago to further the general welfare of the parent society. Forty-five members attended the meeting in the rooms of the Western Society of Engineers and adopted a constitution proposed by A. S. Baldwin, C. F. Loweth and Albert Reichmann, committee on organization. The annual dues are $2, and no restrictions as to territory are defined. The organization proposes to handle the business affairs only, as heretofore many of the 260 members in Chicago have felt that they were subject to taxation without representation.

There is no thought of having any technical discussions at quarterly meetings. It is intended that the new association shall work in perfect harmony with the Western Society of Engineers in this respect.

The officers elected are as follows: President, Onward Bates; vice-presidents, C. F. Loweth and A. N. Talbot; secretary-treasurer, E. N. Layfield.

Causeway at Sacramento Opened

The opening of the $393,000 Yolo concrete causeway was recently celebrated in an informal manner when approximately 2500 automobiles and 8000 people crossed the roadway on the first day it was put in service. The structure, which was described on page 248 of the Aug. 28, 1915, issue of Engineering Record, is 16,310 ft. long and connects the east and west sides of the Sacramento Valley, which are separated by the waters of the Yolo basin. The Governor of California is expected to officiate at the formal celebration of the completion of the causeway to be held May 12.

Paint Trailers En Route to Speed Delivery to U. S. Army

A unique and rapid shipment of equipment for the United States troops in Mexico, was recently made by the Troy Wagon Works Company, of Troy, Ohio. Twelve trailers, made by that company for use with Jeffrey Quads, were shipped on a special train at 5.00 p. m. March 24 and arrived at El Paso, Tex., March 28.

Owing to the necessity for speedy delivery, the fact that the trailers were not yet painted was not allowed to delay the shipment. Painters were put on the train and completed the finishing touches en route.

$70,000 Voted to Deepen Channel of East River, New York

The House of Representatives, at the April 4 session, voted an initial appropriation of $200,000, with authorization of continuing contracts for $500,000 for a 35-ft. channel in the East River, from deep water in the New York harbor to the navy yard. This was the only new item in the Rivers and Harbor Bill, and was recommended by the President.

Road Work in Washington

In the March 4 issue of the Engineering Record an article was headed "Oregon County to spend $750,000 on roads during year." The work is to be done in Snohomish County, Wash. A. B. Dean is chief deputy of the county.

President May Authorize Investigation of Power Sites for Nitrogen Plants

Amendment Authorizing $15,000,000 Appropriation and Setting Aside Five Water Power Sites Expected to Cause Big Discussion

What is expected to be one of the biggest debates in the Senate in some time is scheduled to come up during the discussion of the Army bill. The fight will center around Senator Smith's (of South Carolina) amendment for a $15,000,000 appropriation and authorizing the President to set aside not less than five water power sites, upon which it is proposed that the government erect plants to manufacture nitrate. The bill is practically the same one that was killed in the House, but Senator Smith claims that he has sufficient backing to put it through the Senate as an amendment to the Army bill.

The Army bill is now passing through the volunteer army stages and the power plant amendment in all probability will follow the finishing of that item.

Senator Smith's bill, besides providing for the $15,000,000 appropriation and the authorization of the President to set aside at least five sites for power plants, provides for an investigation by experts as to the best methods of using the water power of the country in developing nitrate plants.

That the Smith plan has the support of Senator Underwood is evidenced by his stand and his charges that the du Pont Powder Company had attempted to defeat legislation for a government plant. Last Tuesday he again attacked the du Pont Company after reading a letter from Pierre S. du Pont, president of the company, saying his concern had not sought to defeat the Muscle Shoals nitrogen plant.

American Society Move Develops No Opposition

With the exception of one written communication, no opposition to the proposed move of the American Society of Civil Engineers from its present house to the Engineering Societies Building on Thirty-ninth Street developed at the regular meeting Wednesday night. When the subject was discussed at a previous gathering of the civil engineers there was criticism to the effect that the opposition was not given an opportunity of stating its side of the case. At this week's meeting, therefore, a particular effort was made by the presiding officer, George S. Tuttle, to induce the opponents of the change to express their opinions. There was no response to his words.

President Elmer L. Corthill spoke in favor of transferring the society headquarters to the Thirty-ninth Street building, and his views were reinforced by brief addresses from Prof. William H. Burr and Clemens Herschel. Secretary Charles Warren Hunt answered a number of questions dealing with the financial and library features of the proposal.

San Diego to Build Dam and Reservoir

The city of San Diego, Cal., gained an important victory in its efforts to carry out a proposed water development project, roughly estimated to cost $2,000,000, when a decision was rendered by the United States land office at Los Angeles, granting permission to the municipality to appropriate waters of San Diego River and to use a site near El Capitan for constructing a reservoir. Construction of a dam 160 ft. high, to divert approximately 22,000,000 gallons of water a day, and an aqueduct and pipe line, about nine miles long leading into the University Heights reservoir is contemplated.

News of Engineering Societies

The National Fire Protection Association will hold its annual meeting May 9 to 11, in the Insurance Exchange, Chicago.

The Engineers Club of Seattle recently heard Dr. M. A. Mathews give an informal discussion of "Engineers I Have Met."

The Engineers Club of St. Paul held a meeting April 5, at which W. E. McCourt, professor of Geology at Washington University, discussed engineering geology.

The Engineers Club of Philadelphia has arranged for a lecture on the evolution of the automobile to be given by Howard E. Coffin, chief engineer of the Hudson Motor Car Company, April 18.

The Pacific Northwest Society of Engineers, of Seattle, Wash., listened to William T. Roberts, chief engineer of the Inter-County River Improvement Commission, tell of some of the problems in the flood control of the White, Stuck and Puyallup rivers, at the meeting April 1.

Personal Notes

SIMON BRUNER, one of the partners of the Roche Bruner Building Company of Cincinnati, has retired from active participation in the business. His son, Mark Bruner, will continue in the firm with M. J. Roche. During the ten years of partnership the company has built some of the largest structures in and around Cincinnati. Its most noted work is the newly completed office building for the Western & Southern Life Insurance Company.

GUY PINNER has been appointed bridge engineer of the Seabcard Air Line, effective April 1.

W. O. SCHEUERMAN resigned from his position as assistant bridge engineer of the Seaboard Air Line April 1.

J. E. KISSEL is now acting engineer, maintenance of way, for the Peoria & Eastern Railway.

B. M. CHENEY, who has served as acting general inspector for the Chicago, Burlington & Quincy for the past year, has been made general inspector of permanent way and structures for that road, with headquarters at Chicago. Mr. Cheney began his engineering career as a rodman for the Burlington, Cedar Rapids & Northern Railway in 1900. In 1902 he became resident engineer for the Des Moines, Iowa Falls & Northern Railway. In 1903 he went to the Illinois Central, and in 1904 was made assistant chief engineer on construction for the Inter-Urban Railway, with headquarters at Des Moines, Iowa. He accepted an offer from the Burlington in 1906 and for the following four years was assistant engineer on construction and maintenance of the Beardstown division. Mr. Cheney was promoted to the position of assistant to the general inspector of permanent way and structures in 1914 and in 1915 was acting general inspector.

R. T. SAILMAN, until recently division engineer on the Winnipeg Aqueduct, has resigned from his position to join the "American Legion, 212 Battalion, C. E. F., which is being organized at Winnipeg, Canada.

Ernest P. Goodrich has announced that he will resign from his position as consulting engineer for the Borough of Manhattan, N. Y., to take up new duties. Mr. Goodrich has been active in the improvement work for the west side of New York City and now that the detailed report is completed he will devote his attention to city planning and work affecting state and federal organization. He was, for four years, chief engineer for the Bush Terminal Company, and has also acted in an advisory capacity for several cities.

A. M. TURNER, formerly acting engineer, maintenance of way, for the Peoria & Eastern Railway, has been appointed district engineer for the Cleveland, Cincinnati & St. Louis, with headquarters at Columbus, Ohio. Mr. Turner will have charge of track-elevation work.

STONE & WEBSTER ENGINEERING CORPORATION has removed its New York office to 120 Broadway.

HERSCHEL O. HALBERT has left his position as assistant road engineer for Baltimore County, Md., to become associated with George W. Drury, bridge contractor, of York, Pa.

SAMUEL A. GREEN has been appointed assistant road engineer for Baltimore County, Md., succeeding Mr. Halbert, whose resignation is mentioned in this issue.

HIRAM N. SAVAGE has resigned from his position as supervising engineer for the U. S. Reclamation Service to become consulting engineer for the Sweetwater Water Company of San Diego, Cal., in which capacity he will direct the work to be done on the Sweetwater storage and distribution system.

J. B. MORLIDGE has left the employ of the city of Newport, Ky., after 12 years of service, to engage in the general practice of engineering, specializing in pavements, highways and sewerage. Mr. Morlidge's office will be in the Mitchell Building, Cincinnati, Ohio.

J. C. TRAVILLA has been engaged to act as consulting engineer on the road work to be done in St. Louis County, Mo.

S. A. COBB has been appointed highway engineer for Clackamas County, Ore.

T. A. ROOTS is now supervisor in the highway department of Clackamas County, Ore.

C. S. WHITNEY is now employed as assistant engineer for John Parkinson, architect, of Los Angeles, who has charge of the design for the new Los Angeles Union Terminal buildings. Previous to his present connection Mr. Whitney was associated with the Stone & Webster Engineering Corporation and Gustav Lindenthal, of New York City.

VICTOR A. AUFFANT has left his position with the Department of the Interior of Porto Rico to become municipal engineer of Ponce, Porto Rico.

LAKESIDE DREDGING COMPANY of Detroit, Mich., has moved its office to the Penobscot Building.

HARRISON ENGINEERING & CONSTRUCTION CORPORATION is the new name of the Harry B. Harrison Company of Buffalo. The new name gives a better idea of the nature of the firm's business, which consists of paving, sewer, sewage-disposal and reinforced-concrete construction work.

C. McCREA has resigned from the U. S. Reclamation Service to become associated with B. C. Lillis, consulting engineer, of Billings, Mont.

ARTHUR FALKENAU, vice-president of the Hooper-Falkenau Engineering Company of New York City, has become acting consulting engineer for the Canadian Car & Foundry Agency.

C. N. HARRUB, formerly with the New York Continental Jewell Filtration Company, of New York, has accepted a position as sanitary engineer for the United States Public Health Service.

C. W. WALLS has left the state highway commission at Salem, Ore., to enter the mercantile business.

PARKENHAM W. BEATTY is now chief engineer for the Buenos Aires Underground Railway, which is a part of the holdings of the Anglo Argentine Tramway Company, of Buenos Aires.

R. T. Wells has resigned from his position as city engineer, of Parsons, Kan., to engage in the engineering business in Bartlesville, Okla.

James H. Johnston has resigned from the position of superintendent of streets and sewers for Newburyport, Mass., to accept a similar position at Leominster. In addition to the supervision of streets and sewers, Mr. Johnston will have charge of the Leominster parks.

Richard W. Rea, civil and hydraulic engineer, of Portland, Ore., has resigned from the position of chief engineer of the Coast Culvert & Flume Company, of that city, to open an office in the Spalding Building. He will specialize in the investigation, design and construction of municipal water supply, irrigation and drainage works. During the year 1912 Mr. Rea was assistant engineer on the final location and design of the $5,000,000 Kittitas "Highline" canal project, and during 1913, 1914 and part of 1915 he was chief engineer for the Cascade Irrigation District, at Ellensburg, Wash. On this last work he re-designed and rebuilt the entire main canal system, the work done including over ½ mile of tunnels and five miles of 150 second-foot capacity, semi-circular, metal flume, besides the enlargement of approximately 35 miles of earth canal. On March 21 he was appointed project engineer for the Ochoco Irrigation District, at Prineville, Ore., and will put parties in the field about April 10 for the purpose of making final surveys and plans for construction of the canal system. The project comprises approximately 18,000 acres of settled lands adjacent to the city of Prineville, and the estimated cost is about $800,000. The work as now projected includes, as the principal item of expense, an earth fill dam 130 ft. high, to store 40,000 acre-feet of the flood waters of Ochoco Creek. Mr. Rea's headquarters on this work will be Prineville, Ore.

E. E. Terrell has been elected county surveyor for Hennepin County, Minn. Mr. Terrell is a graduate of the University of Wisconsin and has been in the county surveyor's office at Minneapolis for the past nine years.

Frank Lotz has been appointed city engineer of Vader, Wash.

A. R. Cullamore has resigned from his position in the engineering department of Toledo University to accept the position of dean of the engineering department of Delaware College.

Frederick H. Robinson, who has just retired as head of the civil engineering department of Delaware College, will be the first beneficiary of a $25,000 pension fund given the college recently.

F. H. Shaw, consulting engineer, of Lancaster, Pa., has opened a New York office in the Woolworth Building, where he is prepared to take charge of the design and construction of engineering work, including water, gas, sewerage, railway and hydro-electric installations.

Elmer A. Porter has resigned from his position as district engineer for the U. S. Geological Survey to accept a position as engineer in charge of water distribution on the lower Sevier River, with headquarters at Delta, Utah. Mr. Porter has been connected with the U. S. Geological Survey in Alaska and took part in the Twin Falls project in Idaho and U. S. Reclamation work in the state of Nevada.

A. R. McGinness has been promoted to the position of superintendent of construction for the U. S. Reclamation Service, with headquarters at Ballantine, Mont. He is a graduate of the engineering department of the Colorado Agricultural College and has been connected with the Government since 1912, previous to which he was engaged in railroad and municipal engineering work in this country.

Olmsted and Gillelen, consulting engineers, of Los Angeles, have been retained by the city of Fresno, Cal., to make a survey of that city to determine the feasibility of the proposed sanitary and storm-sewer system. The success of a bond issue of $500,000 for the construction of the sewer system depends upon the favorable report of these engineers.

Ralph L. Rizer has been appointed city engineer of Cumberland, Md., to succeed James P. Gaffney, retired. Mr. Rizer's promotion comes after ten years of service in the city engineering department of Baltimore, most of which time was spent as assistant city engineer.

I. Kvitrud has been promoted from the position of engineer and assistant estimator for Splady, Albee & Smith, general contractors, of Minneapolis, to the position of assistant superintendent, with headquarters at Sioux City, Iowa.

C. W. Obert, who has been associated with the American Society of Mechanical Engineers for the past three years in the capacity of associate editor of the Journal of the Society, has accepted the invitation by the council of the American Society of Heating and Ventilating Engineers to become secretary of that organization. Mr. Obert has already assumed his new duties, with headquarters in the Engineering Societies Building, New York City. He was associated with the Boiler Code Committee when that body was preparing the report for publication in its final form and was made a member and secretary of that committee February, 1915. Mr. Obert was also connected with the editorial staff of the Engineering Record at the time when its pages were devoted largely to heating and ventilating subjects.

Obituary Notes

William E. Hoyt, consulting engineer for the New York Central Lines, died at Rochester, N. Y., April 2, at the age of 71. Mr. Hoyt was graduated from the Massachusetts Institute of Technology in 1868 and entered railway engineering service that year. After holding several positions in the engineering departments of various roads, he became assistant engineer for the New York Central in 1900 and in 1907 was made special engineer for that railroad, which position he held until his death.

Civil Service Examinations

United States: The Civil Service Commission announces an open competitive examination May 9, 1916, for valuation analyst in the division of valuation, Interstate Commerce Commission. The salaries in the first grade range from $3,600 to $5,000 and in the second grade from $1,800 to $3,300. Appointments to these positions will be principally for duty in Washington, D. C., but some appointments may be made for duty in the field. The duties of this position will be to compile data and to prepare complete, concise and logical reports upon valuation subjects, and to analyze, edit, and digest reports submitted by sections of the division of valuation. Competitors will not be assembled for examination, but will be rated on the following subjects, which will have the relative weights indicated.

1. Education .... 30 points
2. Experience .... 30 "
3. Reports and writings submitted.. 40 "

Applicants should have had actual experience in the final preparation of financial, statistical, or valuation reports upon public utilities, and possess the ability to prepare such reports in a concise, clear and logical form. Applicants for positions under grade 1 must show that they have had at least 18 months' responsible experience in the final preparation of financial, statistical, or valuation reports upon public utilities and must be between 30 and 60 years of age. For grade 2 positions, such experience for at least six months must be shown and the age limit is between 25 and 50 years. In each case this experience should have been gained in the employment of a public authority or commission engaged in the effectual regulation of public utilities, or with an important public utility, or in investigations of a similar character. Experience with mercantile concerns, with large utilities in routine positions, or with small utilities with limited operations will not be accepted as qualifying experience in this connection.

An open competitive examination for associate engineer-physicist will be held May 2 in the Bureau of Standards, Department of Commerce, Washington, D. C., or Pittsburgh, Pa. Salaries range from $2,000 to $3,000 a year. The duties of this position will be to investigate structural and engineering materials. It is desired to secure eligibles who are proficient in mathematics and its application to physical and engineering problems, and who are fully able to initiate and carry on independent research in the field of engineering. They should have experience in the investigation of engineering and structural materials, the operation and calibration of testing machines, and the interpretation of the results of investigations. Applicants must be between 30 and 45 years of age.

Forms for any one of the above examinations may be secured from the U. S. Civil Service Commission, Washington, D. C., or at any of the civil service boards in the cities where examinations may be taken. In applying for forms for the examination for valuation analyst, form 2039 should be requested and form 2118 is to be filled in by those desiring to take the engineer-physicist examination.

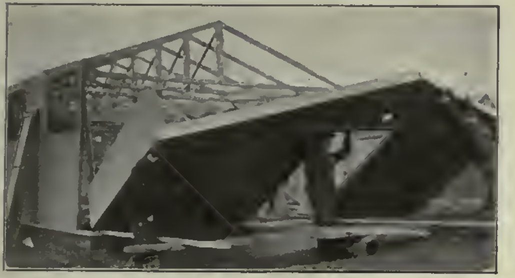
State of New York. Examinations for junior electrical engineer, Public Service Commission, will be held May 6. Salary $901 to $1,200. Candidates must have had at least three years' training in a technical school of recognized standing and not less than one year's experience in electric railroad or electric lighting work or in the manufacturing or installation of electrical or mechanical apparatus. Details may be obtained from the State Civil Service Commission, Albany, N. Y.

Examinations Previously Announced

Date		See Eng. Record
April 3-8	Architectural draftsmen, salaries from $900 to $1,200 and from $1,200 to $1,500 respectively; rodman, salary from $840 to $960 a year, and assistant engineers, salaries $2,100 to $2,500 a year, Philadelphia	March 4
April 12-13	Computor and Estimator, salary $1,600 a year	April 1
April 17-20	Draftsmen, Highway Bureau, City Transit Department, Bridge Division, Philadelphia	March 11
April 18	Engineer economist, salary from $2,000 to $2,500	April 1
April 19	Junior signal engineers, salaries from $1,200 to $1,680, and junior structural engineers, salary $720 to $1,080	April 1
April 26	Tracer, salary $600, Philadelphia	April 1
May 3	Transitman, salary $1,200 to $1,500, Philadelphia	April 1
May 4-5	Assistant engineer, salary $2,500, and structural draftsmen, salary $1,200 to $1,500, Philadelphia	April 1
Aug. 21-25	Second lieutenant of civilian candidates	April 1

Portable Small Steel Buildings

Consisting essentially of various pressed steel panels and structural steel units fastened together by slotted keys, and locking wedges with an ordinary hammer, portable steel buildings which are claimed to be durable, economical and easily built in place are now available for use as contractors' temporary offices on the job, tool houses, time-keeper's offices, and as railroad section houses, switchmen's houses and bunk houses for construction gangs. In a 32-page booklet issued by the Trussed Concrete Steel Company, of Youngstown, Ohio, entitled "Kahn Portable Steel Buildings," the details of the construction, with many illustrations and examples of applications, will be found fully explained.



RAISING END OF SMALL BUILDING

Price lists together with special order blanks will be furnished by the company on request.

PORTABLE CONTRACTOR'S HOUSE IS OF ATTRACTIVE APPEARANCE

By making the various panels of standard size and interchangeable, buildings of any size or arrangement of wall space, windows and doors can be erected. The solid wall panels of heavy gage steel are formed by large dies operated by powerful presses, with simple panelling which adds to the appearance. Light and ventilation are provided by glazed panels of steel sash welded into the standard wall panel, with pivoting and adjusting devices. Roofs are built up of special rolled steel roofing plates designed and keyed to ensure water-tightness, with an air-tight interlocking connection, and supported by standard unit trusses, complete in themselves and electrically welded at the joints. As seen in one of the accompanying photographs, no bolting or riveting of any kind is used, and the trusses are braced to insure rigidity.

Advantages

Among the advantages claimed for these buildings, which are essentially distinguished by their portability and ease and rapidity of erection, are the following: Fireproof qualities, which are particularly valuable in garages; durability—the application of a coat of paint every four or five years should ensure practical permanence; simplicity in erection by the use of the slotted keys and locking wedges driven by a hammer, all sections being easily handled by two men, who can erect any building complete; flexibility, ensured by the use of standard unit panels which can be added at any time if increase in size is desired, and weather-proof qualities, provided by special weather stops in joints between the panels and between the roof plates.

New Cement Plant Opens

The Duluth plant of the Universal Portland Cement Company, known as Mill 7, It has a daily capacity of 4000 barrels. As in the case of other Universal mills, blast furnace slag and limestone are used in making the cement. The plant adjoins that of the Minnesota Steel Company from which the slag is secured. The limestone comes from Calcite, Mich. The mill is operated by power furnished by the Great Northern Power Company from its hydroelectric plant at Thompson, Minn., on the St. Louis River, 15 miles distant. A power of 4000 kw. at 66,000 volts comes into the plant over a transmission line. The power company has a transformer station at the plant where the voltage is stepped down to 2200. The Universal Portland Cement Company has its own transforming station which steps about half of the current down to 220 volts, the other half being used direct at the 2200 voltage.

The plant is built of concrete and steel, the 17 buildings being constructed of reinforced-concrete, or of steel frames with curtain walls of concrete blocks. The floors and roofs are also of concrete. The storage tanks, 27 in number, are of circular concrete design. The plant employs between 300 and 400 men, for whose accommodation an industrial town has been constructed near the plant. The town is called Morgan Park, and will house the employees of the Minnesota Steel Company as well. All the houses, streets, alleys, curbs, and sidewalks in this town are of concrete construction. There are approximately 450 residence buildings, including apartment houses and single dwellings.

This plant is designed to furnish prompt service for the rapidly increasing demand for cement in the Northwest. This section has hitherto been supplied from mills in Iowa, Illinois, Indiana and Michigan.

Mixer Company Reorganizes

The Ransome Concrete Machinery Company, of Dunellen, N. J., has been reorganized and will begin the enlargement and improvement of its plant immediately. E. L. Ransome, who has been connected with the company since its establishment in 1892, will continue his work as chairman of the board of directors and consulting engineer, and J. J. Givens will continue as treasurer.

Frank L. Brown, of San Francisco, is the new president and manager, and comes to his position after years of varied experience in engineering work on the Pacific Coast. The other officers and directors of the new organization are: G. F. Stiele, general manager of the News Print Manufacturing Association, and connected with the National Harvester Company of Chicago; Howard K. Brooks, vice-president of the American Express Company; F. M. Smith, who owns large interests in California railways, and H. M. Brittan, for many years associated with the Washburn-Moen Manufacturing Company, of Worcester, Mass.

The new organization has opened executive offices at 115 Broadway, New York City.

Motor Tractor with Power Winch Can Be Put to Varied Uses

The special feature of the new Model 36 motor tractor of the Knox Motors Associates, of Springfield, Mass., is a powerful winch, attached to the rear of the tractor frame, and driven from a power attachment on the transmission. A heavy sprag attached to the rear axle makes it possible to anchor the tractor quickly previous to making use of the winch.

The truck can tow in either direction. At the rear of the tractor frame a large steel hook is attached and a heavy buffer spring is inserted to absorb the shock of sudden starting. An automatic locking device prevents the escape of the chain or ring which may be inserted for towing. Two front hooks of the twisted type are attached for use in cases where it is desirable to tow backward or to anchor the tractor in addition to the sprag.

The chassis is designed to support a weight of from 2 to 4 tons in any form of body which may be desired, thus insuring the necessary degree of traction, and enabling the tractor to act as a carrying as well as a hauling vehicle. Steel wheels are provided at small additional cost, either as a substitute for the standard rubber-tired wheels or as extra equipment, thus insuring the successful operation of the tractor even under unusually unfavorable road conditions.

The winch is equipped with 150 ft. of cable and is driven from a power attachment on the transmission through a propeller shaft and two universal joints to a worm and gear on the winch shaft. The winch drum is loose on the shaft and is driven through a clutch which may be released by hand when it is desired to reel off the cable. With the motor running at 1000 r.p.m. the cable is hauled 40 ft. per minute.

The tractor is claimed to be a practically unbreakable, trouble-proof hauling vehicle, especially adapted to heavy work and unusually severe road conditions. For example, where it is called upon to haul a heavily loaded four-wheeled trailer, or a train of trailers, up an abnormal grade, the trailer wheels can be blocked, allowing the tractor to run ahead of the load a distance equal to the length of the winch cable. It can then be anchored by means of the sprag and the 20,000-lb. draw-bar pull exerted by the motor through the winch utilized to bring the loaded trailer or trailers to a position directly in back of the tractor. In bad going, the winch may also be used to pull the tractor or trailer up on to solid ground when either has become mired.

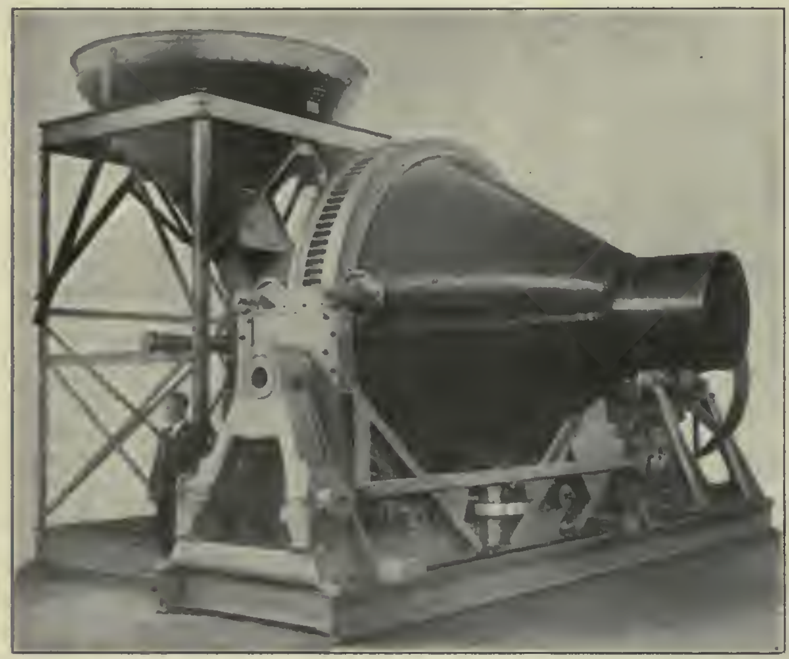
SPRAG ANCHORS TRACTOR SECURELY

The winch feature also equips the tractor to perform a number of useful tasks in connection with the transporting of heavy tonnage. In the lumber field, for example, the winch can be used to pull heavy logs or timbers into place preparatory to loading, etc. Contractors can use the winch for wrecking buildings and for hoisting heavy materials.

Immense Tilting Mixers Made for Use at Salisbury, N. C.

The largest concrete mixers ever manufactured have just been completed for the Hardaway Contracting Company, of Washington, D. C., to be used in pouring 60,000 cu. yd. of concrete a month until the dam at Salisbury, N. C., is finished. They were built by the T. L. Smith Company, Milwaukee. The two tilting mixers, each having a capacity of 108 cu. ft. of mixed concrete per batch, are twice the capacity of any used on the Panama Canal.

Each machine is mounted on steel skids and weighs 46,000 lb. The hopper is supported by the steel frame and the mixer itself is equipped with a power tilt and an Allis-Chalmers clutch pulley. The mixer drums are made of ⅜-in. steel and the inside diameter of the drum is 9½ ft.



ONE OF THE NEW GIANT MIXERS, HAVING A CAPACITY OF 108 CU. FT. OF MIXED CONCRETE PER BATCH, BUILT FOR USE AT SALISBURY, N. C.

Combined Transit and Level Has No Extra Parts

An improved convertible or tilting level, which has no loose parts not in use when in either position, has recently been placed on the market. The crossbar and standard for holding the telescope when in transit position are cast in one piece. The center of the bar is cut away to permit the telescope to be placed in the standard with the level below in active position. This also gives room to raise or lower the telescope 45 deg. above or below the horizontal. The instrument can be converted, it is claimed, into the modified form in 10 seconds. It is made by the David White Company, Milwaukee, Wis.

New Expansion Joint Material for Roads Easily Handled

A new expansion joint material for concrete, brick and black pavements, that needs only to be unrolled, cut and laid in place, has been put on the market in the Barrett Company, 17 Battery Place, New York City, under the trade name of "Barrett's Expansion Joint."

It is a mastic, which comes in ribbon form, in a variety of widths and thicknesses, ready to lay. It contains no felt or paper reinforcement. A new method, known as the "Fibre Weld" process, gives to the bituminous mastic the requisite cohesiveness to stand handling and storage in the ribbon form, without affecting the elasticity that is necessary for expansion requirements. It possesses, it is stated, all the elasticity of a poured bituminous joint with all the advantages of easy handling.

It is claimed that the material is not injured by street acids or automobile oils. It does not become brittle with age or cold weather and does not soften or run in hot weather.

Its chief advantage over the usual poured bituminous joint is the elimination of heating or pouring apparatus, and a great reduction of the labor item, as it takes only a moment to unroll the joint and cut and put it in place.

Construction Companies Merge

The McClintic-Marshall Company, of Pittsburgh, manufacturer and erector of steel buildings and bridges, has purchased the plant and business of the Riter-Conley Manufacturing Company of that city at a price reported as $3,250,000.

It is said that the Riter-Conley plant will be operated independently under its present name. It is expected that J. Gilmore Fletcher, who has been president of the company, will resign to look after other interests.

Business Notes

Parker Supply Company, manufacturers of expansion bolts, screw anchors and sheet-metal-workers' specialties, has moved to 785 East 135th Street, New York City.

C. W. Levalley, president and general manager of the Chain Belt Company, of Milwaukee, has been made chairman of the board of directors. He founded the company 25 years ago to make detachable chain belt for farm implements. The company gradually got into the elevating and conveying machinery business and nine years ago entered the concrete mixer field. W. C. Frye, who has been with the company for 20 years, succeeds Mr. Levalley as president, and also retains his present position as treasurer. He is also treasurer of the Sivyer Steel Casting Company, vice-president of the Federal Malleable Company and a director of the new Electric Steel Company, of Chicago.

The Canton Culvert and Silo Company, of Canton, Ohio, has won its appeal in the Court of Appeals in the District of Columbia against the Consolidated Car Heating Company. The latter organization had applied for a trade mark, substantially identical with the No-co-ro mark registered by the Canton company, and covering high-corrosion-resisting metal. The court declared that "appellant was the first to adopt this mark and has established a trade reputation in connection therewith. There was no legitimate reason or excuse for its adoption by appellee (The Consolidated Car Heating Company) upon this line of goods and we are not disposed to indulge in refinement where such a manifest appropriation appears."

Trade Publications

The following companies have recently issued trade literature:

J. I. Case Threshing Machine Company, Racine, Wis., catalog, 9 x 12 in; 32 pages. Case road building machinery.

Builders Iron Foundry, Providence, R. I., Bulletin 86, 6 x 9 in.; 51 pages. Presents the principle and advantages of the Venturi gas and air meter.

Joseph Dixon Crucible Company, Jersey City, N. J., booklet, 3¼ x 6¼ in., 20 pages. Dixon's waterproof graphite grease for pumps, elevators, exposed gears and machinery, dredging machinery, etc.

Ludowici-Celadon Company, Chicago, catalog, 9½ x 13½ in; 105 pages. An illustrated technical presentation of various forms of roofing tile, together with necessary data on tile roofing construction.

Link-Belt Company, Chicago, book 213, 80 pages, Link-Belt elevators, conveyors and machinery for handling and storing gravel, stone, sand, cement, etc., in which are included locomotive cranes and grab buckets.

American Rolling Mill Company, Middletown, Ohio, booklet, 6 x 9 in; 38 pages. Describes methods of using "Armco" iron flumes, Lennon type, and contains tables for computing carrying capacity, freeboard, etc., of these flumes.

Unit Construction Company, St. Louis. Catalog, 8 x 11 in., 13 pages, illustrated. The first eight pages are blueprint plans of "Unit Bilt" concrete trainsheds, roundhouses and car barns for various railroads. The remaining pages are photographs of similar structures completed or in process of construction.

Ingersoll-Rand Company, 11 Broadway, New York City, booklet 9201, 6 x 9 in., 128 pages, illustrated. The core drill, its functions and field of adaptability in connection with contracting, stone quarrying and mining are discussed in this catalog. The Calyx core drill and outfit is described in relation to these respective fields, and its peculiar advantages indicated. Among these is its great range in drilling capacities from 250 ft. in the small size to 4000 ft. in the largest.

T. L. Smith Company, 3104-X Hadley Street, Milwaukee.—Folder covering the Smith Mixerette, the smallest of the Smith line. This machine has a capacity of 3 cu. ft. of mixed concrete per batch, or approximately 5 cu. yd. of mixed concrete per hour. The folder illustrates all the possible combinations of this machine—with different kinds of power, with a hoist attached, and with a loading bucket. It will prove of interest to those desiring a small capacity, well-built outfit.

American Sheet & Tin Plate Company, Pittsburgh.—8½ by 11 in., 22 pages. A reprint from the "Journal of Industrial and Engineering Chemistry" reporting researches on the corrosion resistance of coppered-steel. The article is by D. M. Buck, metallurgical engineer, American Sheet & Tin Plate Company and J. O. Handy, director of laboratories of the Pittsburgh Testing Laboratory Company, Pittsburgh, Pa. The synopsis of the conclusion indicates that the results of tests will probably be disputed by adherents of the pure-iron theory. The bulletin discusses, as readers of the Engineering Record well know, a highly controversial subject.

Foote Concrete Machinery Company, Chicago, Catalog No. 7, 7 x 10 in., 128 pages, illustrated. The opening pages picture various parts of the Foote plant. Following this is a description of the details of their five different sizes of en-discharge paving mixers and five sizes of side-discharge building mixers. This is accompanied by numerous illustrations of each type and of the arrangement of a railroad car plant. The remainder of the catalog shows photos of Foote mixers on the job, ending wth a set of dimension drawings of the different types of mixers together with their respective output and yardage tables.

Engineering Record

A Weekly Journal Devoted to Civil Engineering and Contracting

Published by McGraw Publishing Company, Inc.

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Record Water Wheels

NOT long since we were wont to look upon a 5000-hp. water wheel as a high-power unit. In fact even in 1902 such a unit was believed to impose fairly serious problems in design. To-day, however, we talk of 30,000-hp. and 50,000-hp. wheels with less awe than we did about 5000-hp. units then. It is pretty well known among hydraulic engineers that the manufacturers have designed and stand ready to back with guarantees wheels of the high powers mentioned. Such has been the progress since the early days of this century that these big wheels to-day impose no greater problems than did the 5000-hp. units then. The 30,000-hp. units, designed for a plant in Tennessee, may not become realities unless there is favorable hydroelectric legislation, but there is good reason to believe that the 50,000-hp. units, designed for use in the Niagara district, will materialize within a reasonable time. The electrical problems on these big Niagara wheels have not yet been worked out, but there is little doubt that the electrical engineers will be able to deal as satisfactorily with their end of the problem as the hydraulic engineers feel that they can with the hydraulic side.

Grouting

IN THIS issue begins the first of a series of articles on grouting by James F. Sanborn, division engineer of the Catskill aqueduct. The process has a wider field of usefulness than most engineers realize, and was developed after years of experiences on the Catskill work to a high state of efficiency. Many engineers not conversant with the results that have been achieved in grouting believe that the process is more or less uncertain and, in any event, applicable principally to compacting material behind a concrete lining. While this is the work for which it is generally employed, there are other fields for grouting which appear most promising. In the sinking of wet shafts grouting has already demonstrated its effectiveness and has been a means of saving a large amount in the cost and maintenance of pumping equipment. There are also attractive possibilities of grouting a tunnel heading which must pass through water-bearing ground. Tunnel foremen, however, are generally skeptical about delaying operations for this purpose, always hoping that the next shot will carry the heading beyond trouble. Their hopes, however, are not always realized, and often it would have been better to have suspended the work temporarily, grouted the seamy rock from drill holes in the heading and then proceeded without the trouble incident to a large flow of surplus water. Grouting also opens up opportunities in the solidification of rock at dam sites. The process is doomed to failure if entrusted to men who are not thoroughly familiar with its details, and for this reason Mr. Sanborn's practical suggestions as to how the best results may be achieved will prove particularly valuable.

Lesson in Demolition

DEMOLITION of a concrete structure, particularly if it be of the reinforced, thin-wall, circular-bin type, presents a problem which would vex a military crew. As there are no very heavy, vital sections, dynamite often cannot be placed at points that will bring the structure to earth in such a way that the fall will do further damage. The moving-picture enthusiasts and the two hundred spectators who went to see the South Chicago cement storage tanks dynamited, expected a tremendous crash and a breaking into fragments, as is the case when a chimney is thrown down. They were disappointed. Although all the columns were dynamited, the steel reinforcing rails, Atlas-like, bore their burdens valiantly. Only after the oxy-acetylene torch had cut every one of them away and the wooden shores replacing them had been fired, did anything like a crash occur. The tanks dropped over on one edge, a matter of 12 ft., but even then the thin shells of the tanks showed no signs of distress. Finally the slow process of pulling away a piece at a time from the top brought results. The experience with these bins should be of the greatest value in future operations of a similar kind. The problem was a relatively new one and recalls the early experiences in wrecking concrete buildings. The operation was slow and tedious. The oxy-acetylene torch has simplified the operation while air tools have helped to expedite the work.

New Defense Society Proposed

ENGINEERS who have attended the lecture course in military engineering, under army supervision, which has recently been concluded in New York City, and those who are enrolled in similar courses in other cities, will find William R. King's suggestion on page 507 of this issue constructive and timely. Mr. King proposes, in effect, the formation of a national defense association of engineers, his contention being that the interest in preparedness which has been aroused in technical circles should not be permitted to wane, but should be further stimulated in order that it may bear fruit in the form of further military training along intensive lines and in a utilization of the great political power of such a national organization as is suggested. The last point—the bringing of pressure to bear on our legislators at Washington—was strongly urged by Thomas H. Wiggin in his letter to the Engineering Record, published in the issue of March 18, page 397. There are many undesirable features of the Hay and Chamberlain army bills, now pending in Congress, and there has been a strong attempt, credited to a lobby of the National Guard, to defeat any proposal for a volunteer force such as was embraced in former Secretary Garrison's Continental Army plan. Mr. King, apparently, would combat such influences as this with his national association. Engineers, of course, do not wish to see the army program degenerate into a "pork barrel," but it is a question whether Mr. King's objects could not be secured by co-operation among the national engineering organizations rather than by the creation of a new national body for defense. There are already so many national security organizations that their efforts are being divided, rather than than concentrated. Then, too, the expense and administrative work required for such an organization as Mr. King suggests would be considerable, and there would appear to be no particular reason for it when the profession has at hand its own societies equipped to handle such work.

What is needed is not another defense society, but a unification of existing bodies into a single organization which could make its influence felt.

Garbage Disposal for New York

NEW YORK CITY is finally committed to a definite, though unsatisfactory, plan of garbage disposal. The Board of Estimate this week ratified the project for the installation of a plant on Staten Island, as noted in the news columns of this issue, and Commissioner John T. Fetherston has signed the contract for the new work. In the opinion of the officials of the Street Cleaning Department, the Staten Island installation is not the one best suited to the city's needs, but inasmuch as it was a case of half-a-loaf or none at all, the plan for the works has been put through. Commissioner Fetherston, in a report issued recently, recommended a location on Riker's Island in the East River, but such a storm of protest arose from property owners that this project had to be abandoned, although under this plan the city would have owned the land and taken over the works from the contractor at the end of a five-year period. In the case of the Staten Island installation the contractor furnishes the site and erects and operates the plant, paying to the city the sum of $900,000 during the five years the contract is in force. There is no definite arrangement for the city's acquisition of the works after this time, so that when the contract expires the situation will be about the same as it is now.

The acceptance of the Staten Island proposal postpones for years any feasible plan of eliminating the annual expense of the final disposal of all classes of waste (including ashes in addition to garbage), which, in 1914, resulted in an expenditure by the city of approximately $1,400,000. Through the complete utilization of all classes of refuse material it has been estimated that the city, directly or by contract for a period of 15 years, could install processes which would result in an annual profit, instead of a payment of $1,400,000 per year.

This unfortunate situation confronting the administration, Commissioner Fetherston points out, is beyond the control of the Department of Street Cleaning. Every effort has been made, through legislation and under existing laws, to reduce the cost of disposal, but Governor Whitman vetoed the final disposition bill in 1915 which would have allowed the city to build and operate its own plant. Inasmuch as the present contract with the company disposing of the city's waste at Barren Island expires this year, the only alternative is to accept the Staten Island plant. The city has had the benefit of expert advice regarding the course it should follow. Having disregarded it, the taxpayers must be prepared to pay the bill.

Justice to the Contractor

SINCE the publication in the Engineering Record of Nov. 6, 1915, of the editorial entitled "Making the Contractor the Scapegoat for Engineering Inefficiency," and the subsequent publication on Jan. 15, 1916, of Hillis F. Hackedorn's plea for equitable contracts, this journal has heard much comment favorable to the drafting by a competent committee of a standard form for the general clauses of engineering contracts. This journal has often expressed its criticism of the unfairness of engineering contracts which place absolute power in the hands of one who necessarily occupies a partisan position—the owner's engineer. That the power is abused cannot be denied. One has only to talk to contractors under conditions where they know that they can unburden their minds without danger to realize how true it is. Moreover, the one-sided form of contract cannot be defended by saying that the well-qualified engineer will not abuse the power given him. That may be true, but the fact is that these *ex parte* contract clauses are used by the fair and unfair engineer alike and in the latter's hands prove the undoing of the contractor and a disgrace to the profession. The small-minded, unfair engineer takes his cue as to the letter of the contract from the eminent engineer; he does not, however, copy and carry out the spirit with which the latter discharges his responsibility.

What is the remedy for this condition? In the judgment of the Engineering Record Mr. Hackedorn has suggested it—that representative bodies of engineers and contractors get together and draft a standard form of contract. The American Institute of Architects and the National Association of Builders' Exchanges have done notable and very satisfactory work in this connection. What they have done for the building field other organizations should do for general contracting.

The American Society of Civil Engineers is by all odds the body best qualified to do this work. Within its membership are any number of engineers and contractors competent to draft these clauses. Contractors and engineers should be equally represented on the committee. In order, however, to inspire the greatest confidence on the part of contractors it would be well to invite representative contractors, not members of the society, to co-operate with the committee.

There is a great work ahead for such a committee.

High Prices, Labor Shortage and Prospective Work

WITH market conditions and general business good, it has now become a question whether high prices of materials—principally structural—and a shortage of labor will curtail the large volume of construction work that would normally be carried out under such conditions. From present indications it appears that high prices of materials will be responsible for no more than a partial diminution of construction activity. It is thought that the top has been reached in steel. While conditions do not point to a break and a sudden drop in prices, it seems that the mills will have a chance to catch up and that the insistent demand for steel at any price is over. Certain it is that enough has already been bought to account for a good volume of construction. While it may be that prices will not decline far enough to tempt the railroads to extensive construction, there is an insistent foreign and domestic demand for many manufactured articles that continues to warrant industrial expansion. There is plenty of capital to finance this expansion. It is possible that when the markets of the world are again opened to American investors by the close of the war, with prospects of larger returns than can be had at home, and this industrial expansion is brought to an end, the first fall of prices will bring out railroad and public work which cannot be carried on at present.

Labor flows to the activities that can afford to pay it most. At present urgent needs of the warring nations make it profitable for them to pay certain industries here so well that those industries can supply themselves with labor at the expense of every other activity. For the railroads and public-improvement projects to attempt to meet these prices would make improvements cost more than such utilities could afford to carry later. How seriously this will curtail the total volume of contract work is as yet an unanswered question. If too great a volume of such work is attempted, contractors will have to bid against each other for what labor is left after the war industries have supplied their needs. For this reason, large firms are already hesitating to take on much new work. Immigration has been practically shut off since the war broke out, and with the way clear in other respects for considerable permanent expansion, this country finds itself with the same or a less number of workmen than it had two years ago, and with no outside supply to draw on.

It is likely, therefore, that while the price of materials will neither rise nor fall greatly, the price of labor will go up; that the volume of construction will not be unusually large as compared with normal times; and that the only phenomenal expansion will take place in private industries which peculiar conditions have made very profitable.

To Classify Technical Literature

AT the recent meeting of the joint committee on classification of technical literature, composed of representatives of American technical societies, a tentative classification was proposed, and it was decided to assign to each society the subject or subjects which it could best cover. This work is of great importance. A logical classification of all technical literature will be found not only of immediate practical value, but invaluable in the future as an aid to further scientific investigation and research. To be able quickly to locate all the available literature on a given subject is one of the first requirements for that thoroughness which results in progress and new knowledge.

It must not be assumed that college professors or recent graduates only are to be benefited by such classification. One of the most impressive facts emphasized at the meeting was the interest which large manufacturing and commercial companies have in this subject. Many already have extensive classifications of the literature in their own fields, and employ trained librarians to care for and add to their accumulation of books, pamphlets, reports and data.

The Engineering Record questions the wisdom of two of the assignments—roads, streets and highways to the American Highway Association, and hydraulics and sanitation to the American Waterworks Association. While to the uninitiated these seem logical assignments, those familiar with the two associations know that they do not rank with the other technical societies to which sections of the classification have been referred. However excellent the work of the American Highway Association in its sphere, it does not pretend to be a technical body. The American Waterworks Association has done some good technical work, but it is not organized on lines which would insure the greatest co-operation with the work of the committee. These two groups of subjects should have been assigned to the American Society of Civil Engineers, and it is regrettable that that body was not represented to assist with its counsel in the distribution of subjects.

Now that the success of the whole movement is in the hands of the various technical societies, this journal strongly urges prompt action on the part of each body. A most careful selection of the best man or men in each particular subject must be made, preferably those having a deep interest in indexing and classification. The principles upon which the whole scheme is based should be clearly presented to them. Success then depends upon the vigor and interest which these men manifest in prosecuting the work, and there should be an immediate request for resignation if professional or other work so prevents their participation as to delay the work unduly. In a work of such importance there should be no difficulty in getting the right men—in fact, they should be eager to contribute their services.

Medieval Revival in Warfare

THERE is a touch of gruesome humor in the doings in the trenches. As one looks over the results of modern scientific effort and resourcefulness he is inclined to quote that old saw, "There is nothing new under the sun." Could the hosts who fought in Flanders several centuries since look down upon the scene of their battles, they would, while noting vast improvements, miss little of their old equipment save the bow. Indeed, it is rather a wonder that, in the renaissance of ancient methods, the bow has not yet appeared on the firing line. To be sure, we have the aeroplane dart, intended for the same amiable purpose, but even the bow itself might prove a weapon not to be despised in repelling a night attack where general direction is about the only thing to be hoped for in the way of aim. It is extremely interesting to note the way in which modern technical ingenuity has taken up and improved the exact line of offense and defense which has marked close range warfare almost from the earliest use of firearms.

On the defensive side the steel headpiece has reappeared in the trenches after more than 200 years of disuse. It is rather better made, considering what is required of it, than the old pattern, and saves many a head from being broken by shrapnel bullets, which it easily turns. In fact, it is reported successfully to deflect bullets traveling 2500 ft. per second or more. Ordinarily speaking, such a projectile would penetrate at short range a half-inch of boiler iron very easily if it struck squarely point on, but the modern bullet, having a long and tapering point to decrease the air resistance, is fairly easily turned aside, if it strike at an angle, as is likely to be the case, a well-shaped headpiece. Except for this great penetrating power we should doubtless have body armor as well; in fact, it is being tried in Italy. Its place is partially taken by small loopholed steel shields behind which a rifleman can work his way forward with a fair degree of immunity from hits.

Another very useful item in defense is the trench periscope, of which divers patterns may be found advertised in the foreign papers. It is a simple combination of mirrors very useful for looking over a parapet, either directly or with a pair of binoculars, the mirrors being made large enough to permit the latter use. Old Hevelius, who flourished about 1650, might well smile to see his polemoscope put to such good use. This instrument, on which he set great value, was quite exactly the same thing, except that it was combined with a single-barreled opera glass. Its modern form is merely better made and gives a bigger field.

The barbed wire entanglement is substantially the old abatis improved in structure. A tangle of barbed wire is certainly better than a small tree with its limbs carefully sharpened and turned point forward to the enemy, particularly if the wire is thoughtfully painted green, as in some large shipments recently, so as to make it less conspicuous. In the same connection one must not forget the pits with sharp stakes driven at the bottom, and the amiable caltrops, those four-pointed iron affairs which, thrown on the ground, always stand with one point up. The old ones, to be sure, were of roughly forged iron, while technical skill has now benevolently provided caltrops of stamped steel with visiously sharp edges and points adapted to the same old work. The water-filled moat is no part of field fortifications now, but its place is well supplied by the desperate defense organized along canals and the old tactics of flooding the country to drown the foe.

When it comes to means of offense, modern ingenuity has made admirable use of medieval precedents to an extent that is really astonishing. First to the front comes clattering down through the centuries the Roman catapult, the spring engine invaluable for heaving stones in attack or defense. It was used all through the Middle Ages until temporarily driven out by cannon and has once more appeared here and there in the trenches, just as serviceable as when Caesar's legions used it with less dangerous projectiles. Indeed, it and similar weapons are singularly convenient when the ranges draw within that which can be conveniently managed by an ordinary mortar. The German fire-throwing machine, too, comes of an ancient and honorable lineage, going back to the days when the besieged doused the enemy with boiling oil and burning pitch. It is a very simple device, this flame projector—merely a tank filled with petrol under a pressure of several hundred pounds per square inch, and provided with a suitable long nozzle from which the liquid, inflamed as it leaves the tube by an electric spark, can be directed in a neat stream into the enemy's trenches over a distance of a hundred feet or so. Had petrol been available 500 years ago it would have been welcomed for similar use on many a castle rampart. Even the bomb spreading poisonous gases cannot lay claim to high novelty, since it is a direct descendant of the Chinese stinkpot, which goes back to unknown centuries. The wholesale use of deadly gases poured from the trenches and borne by the wind against the enemy seems, however, to be an innovation—a refinement, perhaps, of the old scheme of smoking the enemy out, tried in many a medieval siege.

Studying missile weapons a little further one finds reversion to deadly schemes foreshadowed, at least, in the wars of the Middle Ages. The hand grenade, for generations a favorite weapon at short range, has once more come into its own. To be sure the modern grenade case, charged with high explosive, is vastly more effective than the crude bomb hurled by many a stalwart grenadier two centuries or so ago. Now, as then, it takes various forms, sometimes thrown directly, sometimes lashed to the end of a stick to give a better swing, and yet again delivered by some rude kind of sling which brings up vague recollections of the fate of Goliath.

Modern ingenuity has presented one interesting novelty in the grenade mounted on the end of a rod, which can be shot from an ordinary rifle. The propulsion of a shell bigger than the bore of the weapon from which it is fired must be given a prominent position among modern innovations in trench warfare. It has, indeed, quite displaced the trench mortar of earlier times, the piece light enough to be carried by a couple of men and yet efficient in lobbing small bombs into the trenches with a tiny charge of powder to drive them. A 10-in. projectile launched by a 3-in. mortar, however, must be credited to modern engineering skill.

It is only fair to note that the advent of these cheerful innovations has been met by improved trenches, deeper and narrower than of yore, and when feasible partly roofed over so that popping a bomb into them is much like trying to snap a nickel into a slot machine. Similarly the modern trench is more liberally provided with traverses, or their equivalent, than were those in which Uncle Toby valorously served, so that even when a shell drops into the slot it very likely will disable no more than two or three men.

The mitrailleuse, again, however clever its mechanical design, finds ancient prototypes in the armories of Europe, and oddly enough even the sliding block of the Krupp breech action may be found in a piece of the sixteenth century in the Berlin Arsenal. The old-time arms maker was far less deficient in inventive ingenuity than in means of execution.

Mine, counter mine, and petard, all have their modern equivalents, reinforced by gun-cotton and trinitrotoluol, but used with no more desperate courage now than in the Thirty Years War. Even the familiar scheme of screening guns and men by carefully placed foliage harks back to the time when Birnam Wood came to Dunsinane. In adroit concealment, however, the war widely utilized an improvement which is strictly of modern origin; the painting of ships, guns, and even men, in streaks and spots of varied colors so that they are quite lost in the shifting light over either sea or land. This has its origin, doubtless, in recent investigations of protective coloration in certain animals, which nature has provided with spots and streaks that blend so perfectly with the creature's wonted surroundings as to render it almost invisible at a short distance. Here increasing knowledge of the conditions of visibility has enriched the art of war with a radically new device.

All in all, it is rather remarkable to discover how the close-range trench warfare of the present has brought back means of destruction altogether similar to those of the ferocious hand-to-hand struggles of the Middle Ages.

Grouting an Effective Remedy for Stopping Leakage in Tunnels and Shafts

First Article in Series Summarizing Experience on Catskill Aqueduct—Successful Work Depends Upon Attention to Details

By JAMES F. SANBORN
Division Engineer, Board of Water Supply, New York City

Into "bad ground" tunnel contractors have sunk thousands of dollars of prospective profits. A knowledge of up-to-date grouting methods for cutting off leakage, however, might have shifted much of this loss over to the profit side of the ledger. In this series of articles Mr. Sanborn crystallizes the experience of many years in the grouting of the Catskill aqueduct tunnels. The process, properly applied, has a wide range of usefulness—in consolidating material behind concrete linings, in cutting of large flows of water in tunnel headings and shafts, and in consolidating material at dam sites. To achieve success in this work a thorough understanding of the problem is essential and strict attention must be given to such details as the drilling and placing of grout holes, consistency of mixture, injection pressure, selection of equipment, control of flow, character of rock seams, etc. On such points as these the reader will find in this series of articles a fund of valuable information.—Editor.]

ON the extensive tunnel work of the Catskill aqueduct grouting was used as one of the major operations in securing a water-tight structure, particularly in the case of the pressure tunnels, which operate under heads of several hundred feet. In the case of the Hudson River siphon the depth of the tunnel below hydraulic grade is 1500 ft. where the aqueduct crosses the river at Storm King. In spite of these unusual heads, operating tests of the aqueduct prove it to be remarkably tight, showing the efficiency of the grouting of rock seams and openings in connection with the sound concrete lining.

CAR WITH UPPER PLATFORM FOR REACHING GROUT HOLE CONNECTIONS IN ROOF

One often hears the remark that grouting, in itself, is very uncertain in its results, and for that reason cannot be relied upon in construction work. It is, indeed, regarded as a last resort in some cases for repairing defective work and frequently, no doubt, has failed of success. This belief seems to be due to the fact that in cases where failures result the work is done in the dark, so to speak, for the reason that the grout is forced through pipes or holes cut into masonry or invisible seams of the rock. To secure good results in grouting the greatest pains must be taken in conducting the process, with every attention to the details and a thorough understanding of the nature of the problem.

CATSKILL GROUTING SUCCESSFUL

It is noticeable that in the pressure tunnels of the Catskill aqueduct the grouting was most successful in fulfilling its purpose in those cases where it was used outside of a particularly well made and impervious concrete lining, thoroughly protected from water under pressure while the concrete was setting. Here the conditions were favorable for the successful application of the process and the work was well done with adequate equipment.

MOTOR-DRIVEN COMPRESSOR USED IN TUNNEL FOR LOW AND HIGH PRESSURE WORK

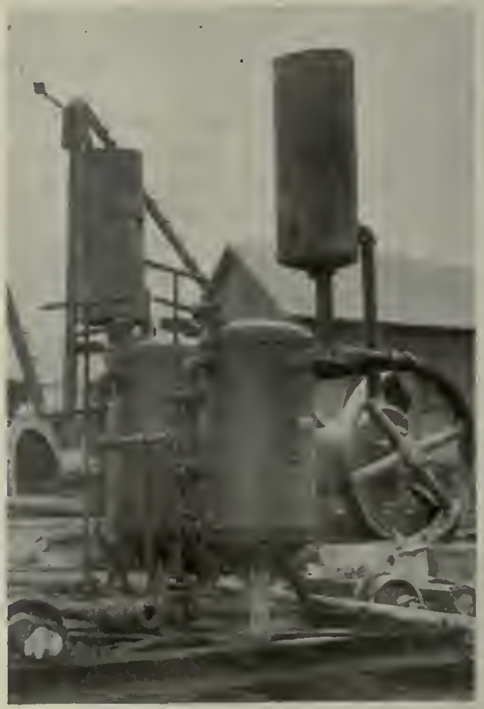
The grouting process also was used with considerable success to cut off heavy flows of water from many seams in shaft sinking and tunnel driving, with conditions very unfavorable for a complete circulation of grout, and while of great advantage to the work in such cases the success was not always so marked in completely cutting off the leakage as was the grouting back of the concrete lining. Grouting was also used with marked success at several of the dam sites for filling seams in the rock beneath the dam foundations.

In view of the importance of securing a thorough job of grouting in cases where, in the permanent work, provision was made in this way for eliminating the leakage from dams or tunnels under pressure, careful consideration of the geology of the rock and the distribution and nature of the openings was made, and the method of grouting carefully adjusted to meet this condition. For example, in the case of porous water-bearing sandstones, the irregular character of the openings was entirely different from the fault planes marked by heavy movement and crushing of the rock frequently encountered in ancient gneiss and granite along certain parts of the line. Similarly the clean-cut, well-defined joints in the horizontally bedded bluestone of the Catskill region, where little faulting has taken place, must be treated in a different manner from the ancient and highly disturbed shales of the Wallkill Valley section. Very thorough studies were made in the beginning of the work to secure data on all available experience in grouting wet ground under high pressures, as it was realized that the success of the pressure tunnels depended largely on the possibility of waterproofing them against outward leakage.

Considerations of the best method of drilling and placing holes for grouting, the proper consistency of the grout mixture, the best cement to use, what injection pressure should be applied and the best means of producing and controlling the flow of grout were among the matters most vital to the success of the process.

GROUTING EQUIPMENT

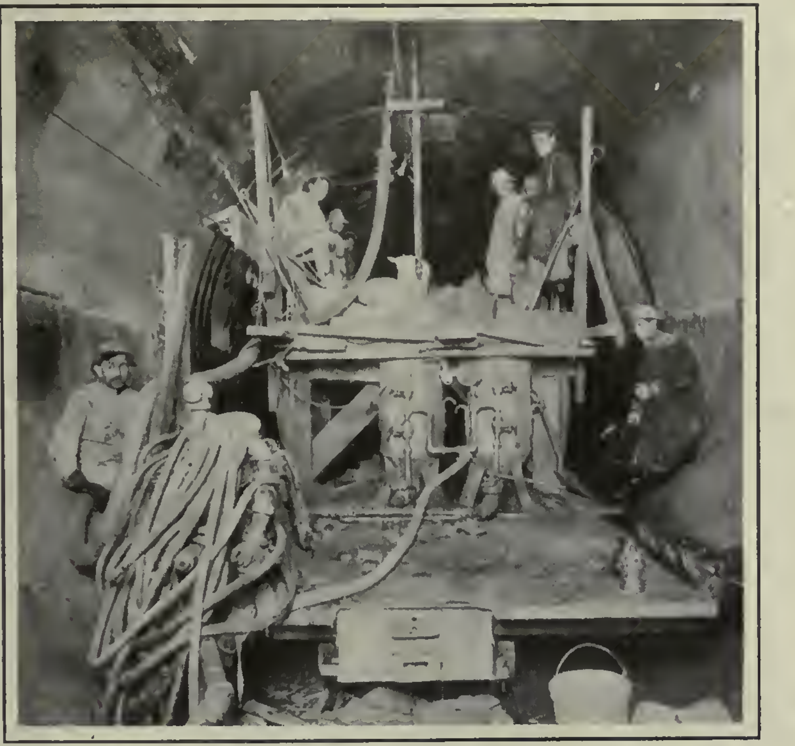
As the purpose of grouting is to force a mixture of sand, cement and water into the spaces to be filled, the best equipment to use in any case depends very much upon the pressure necessary to make the grout travel, and the consistency of the mix best adapted to the kind of openings to be filled. If a considerable yardage of grout is required, an equipment with large capacity is desirable, while a smaller quantity placed slowly under high pressure may demand a different equipment to secure the best results.



TWO AIR-MIXING, AIR-EJECTING GROUT TANKS OF TYPE USED ON CATSKILL WORK

Grouting is often done by pouring through pipes arranged in such a way as to secure the necessary pressure. Commonly, however, more pressure than that afforded by the head of grout alone is required. The equipment ordinarily used may be classed as follows:

1. Reciprocating pumps furnishing a continuous flow with independent means of mixing the grout.



LOW PRESSURE GROUTING CAR WITH UPPER CHARGING PLATFORM AND DUPLICATE TANKS RECEIVING AIR FROM SHAFT TOP

ANOTHER TYPE OF RIG ON PLATFORM CAR—NOTE THE MEASURING TANKS EMPLOYED FOR THE MIXING WATER

2. Grouting tanks, which are of two classes—(a) paddle mixing and air ejecting and (b) air mixing and air ejecting. The Canniff tank of the latter type was used very largely on the work of the Board of Water Supply, particularly in grouting the shafts and pressure tunnels.

Douglas hand pumps were used in the low pressure grouting of the dry packing of the new Croton aqueduct, where the grout was mixed by hand in a tub. Similar pumps were used for the high pressure grouting of the Torresdale tunnel, operated by five men. Small Cameron pumps, air driven, were used in grouting the Battery tunnel of the New York Subway, and such pumps are commonly employed for grouting when the quantities to be placed are small. At a French mine shaft, sunk by grouting, the valves consisted of steel balls, weighing 10 lb. each, which struck so hard in closing as to prevent the accumulation of grout on the valve seats. In several shield-driven tunnels the grout pump consisted of a large cylinder into one end of which the mixed grout was drawn, and forced out under pressure by a piston or plunger driven by compressed air. Studies for such a device were made by the designing department of the New York Board of Water Supply, but it was never used on the work. The wear in the cylinder and stuffing boxes of such a machine is very great.

The paddle mixing and air ejecting type of grout tank has been extensively used on shield-driven tunnels and elsewhere. They have many advantages, and are economical when large quantities of grout are to be placed, as in grouting dry packing. The moving parts and stuffing boxes wear rapidly, while the paddles and shaft become coated with grout. As the machines receive very little care in a tunnel, they wear out fast.

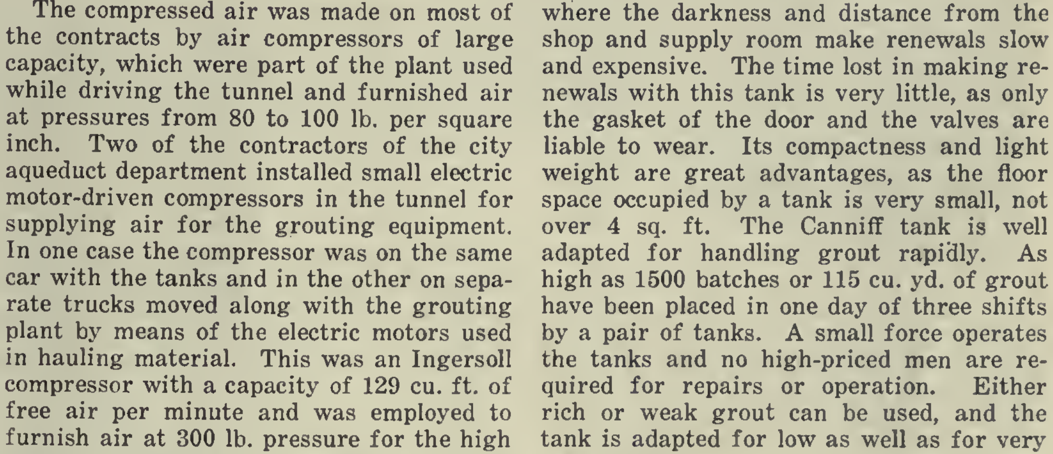
In grouting the shafts and pressure tunnels of the Catskill aqueduct the equipment consisted of tanks of the Canniff type, in which the grout was mixed, a batch at a time, and ejected by compressed air power through a heavy wire-wound high pressure hose, attached by fittings to pipes previously secured in position at the point where the grout was to be introduced; 2-in. or smaller grout pipes and 2½ or 3-in. hose was commonly used.

COMPRESSED AIR REQUIREMENTS

The compressed air was made on most of the contracts by air compressors of large capacity, which were part of the plant used while driving the tunnel and furnished air at pressures from 80 to 100 lb. per square inch. Two of the contractors of the city aqueduct department installed small electric motor-driven compressors in the tunnel for supplying air for the grouting equipment. In one case the compressor was on the same car with the tanks and in the other on separate trucks moved along with the grouting plant by means of the electric motors used in hauling material. This was an Ingersoll compressor with a capacity of 129 cu. ft. of free air per minute and was employed to furnish air at 300 lb. pressure for the high pressure grouting, thus getting rid of the slow and wasteful Westinghouse boosters which the same contractor had used on a previous job. It was found that compressors with a capacity smaller than 100 cu. ft. of free air per minute, which were tried on one of the contracts, were unable to supply enough high pressure air at 300 lb. per square inch for the grouting operation.

The chief advantage of the Canniff grout tank is that it has no moving parts to be cut out by grit, leak air, and delay the work for repairs, as happens in the case of pumps. This advantage is greatly in favor of the grout tank, particularly for tunnel work, where the darkness and distance from the shop and supply room make renewals slow and expensive. The time lost in making renewals with this tank is very little, as only the gasket of the door and the valves are liable to wear. Its compactness and light weight are great advantages, as the floor space occupied by a tank is very small, not over 4 sq. ft. The Canniff tank is well adapted for handling grout rapidly. As high as 1500 batches or 115 cu. yd. of grout have been placed in one day of three shifts by a pair of tanks. A small force operates the tanks and no high-priced men are required for repairs or operation. Either rich or weak grout can be used, and the tank is adapted for low as well as for very high pressure.

A disadvantage of the Canniff tank is shown when used for high pressure work, when the grout is discharged very slowly into fine seams, taking a long time. In such cases the cement has time to settle out of the mixture and clog the openings. However, as very thin grout should be used in such cases, the difficulty is not very serious practically.



GENERAL LAYOUT OF MOVABLE GROUTING PLANT IN TUNNEL

Unless great care is taken with any type of grout tank to shut off the discharge valve, the instant the last of the grout leaves the tank, an after-blast of air follows, which has a bad effect in stirring up the grout. The air tends to collect in the space to be grouted and is displaced with difficulty by the cement. The men operating the tanks, however, become very expert in controlling the discharge. Both the air-mixing tank and the paddle-mixing tank discharging a single mixed batch by compressed air pressure, are well adapted to mixing and discharging a large quantity in a short time, especially into a large open space which takes grout easily. In work requiring high pressure, using thin neat grout, the results with the Canniff tank are also very good. The grout commonly used was 1:1, but grout of a consistency of 1 cement to 2 sand was often mixed and discharged without trouble.

The air mixing and air discharging type of machine is, theoretically, the most unsatisfactory of all, and in the first specifications for the Catskill aqueduct it was not regarded with favor, but has been extensively used, and has come to be regarded as the most economical device for grouting in the tunnels. The air mixing feature of the Canniff tank is only partly successful, as it is necessary to use a paddle for stirring up the sand and cement. When charging the tank the water is first added, then a bag each of sand and cement, and with the mixing valve in the bottom open slightly air bubbles up through the charge, which is further mixed by hand with a few turns of an iron paddle. The door is then closed hard, air turned on the tank, the mixing valve closed, and the discharge valve opened.

In some cases, to do away with the after-blast of air as the batch started to leave the tank, the air supply valve was closed, and the air in the tank expanded, forcing the grout through the hose. This method was not commonly used.

To avoid the bad effect of allowing the air to blow through the hose, which results in waste of power as well as injury to the grout already placed, the air valve is closely watched to note the fall of pressure attendant upon the discharge of the grout, and a further warning is given through the "kick" of the hose as the grout is discharged through it.

PLANT FOR LOW PRESSURE WORK

The low pressure grouting car and equipment used in several of the tunnels are shown in the photographs. For the low pressure work two grout tanks were mounted on a car provided with a platform for handling the cement and sand, which was emptied directly from the bags into the grout machine (a bag of sand and a bag of cement to each batch), although two bags of sand were sometimes used to each bag of cement in grouting dry packing. The water was commonly added by hand by means of a bucket from barrels on the car or from the tunnel invert, although one contractor provided water tanks with an overflow at a designated height. These water tanks, of light gage steel, were mounted on the grout tank and were emptied by a three-way valve. A belted centrifugal pump kept a continuous stream of water circulating to supply the tanks, but did not prove as reliable as a small air-driven reciprocating pump, which was used later. The sand and cement were transported on flat cars by the tunnel mules or trolley motors to the grouting equipment and handled by hand. It is essential for the rapidity of low pressure grouting work that plenty of material be always stacked up on the grouting platform, as the operation is so rapid that the stock is quickly exhausted unless constantly renewed.

PLANT FOR HIGH PRESSURE WORK

For the low pressure grouting, the air supplied by the compressors on the surface was found adequate, but for high pressure grouting air at 300 lb. pressure per square inch was used on account of the high ground-water pressures, often over 100 lb. per square inch.

The high pressure grouting equipment consisted of a car, smaller than that used in the low pressure grouting and carrying one or two grouting tanks. The amount of grout used in the high pressure operation is only about one-tenth of that placed in the low pressure operation and, furthermore, it takes much longer to discharge each batch.

In addition to the grout tank, the high pressure grouting car carried a Westinghouse air pump or booster operated by compressed air from the tunnel plant at 100 lb. pressure, delivering air at 300 lb. pressure to the grouting tank. Another grouting tank was commonly mounted on the car, but was used only as a receiver for the high pressure air. As in the low pressure operation, the grout was discharged through a wire-wound hose from the tank to the grout pipe set in the concrete or rock. Each pipe to be grouted was provided with a nipple and special plug cock to which the hose was attached by a union.

QUANTITY OF GROUT PLACED IN 12-FT. AQUEDUCT TUNNEL—TYPICAL STRETCH

	Length of tunnel grouted	No. of connections made	Shifts worked	Cu. yd. liquid grout
Low pressure grouting*	10,113 ft.	170	69	1,744
High pressure grouting†	10,113 ft.	1,670	113	150

*Most of the grout placed in the low pressure operation filled the space above the concrete in the tunnel roof.

†Most of the high pressure grouting was to cut off leaks from seams in the rock, and to fill pans.

At the Hudson River siphon it was necessary to use 700 lb. per square inch in grouting. As it would be exceedingly expensive to provide air at this pressure, an air-driven Cameron pump fitted with a small plunger on the water-end was employed, and water at 700 lb. pressure was pumped into the Canniff tank in which the grout was mixed. This device proved successful in grouting against a ground-water pressure of 475 lb. per square inch in the Hudson River siphon, 1100 ft. below water level. About 3000 ft. of tunnel was grouted by this device, and a similar equipment was used in grouting the famous wet seam met in the Hudson siphon near the east shaft while driving the tunnel. The water pumped in at the top of the tank to displace the grout mingled with the charge and diluted it considerably.

Very little trouble was experienced due to blowing off of fittings, although rather serious accidents have resulted from this cause. One of the men had his jaw broken by a grout hose early in the work, which no doubt had a good effect in making everybody look well to the safety of the gang. One of the foremen was struck in the face by the grout when blowing out a clogged hose, and lost the sight of one eye. The men charging the tanks suffered greatly from cement burns, because of the generally wet condition around the grouting machine.

GROUTING OF SHAFTS

Grouting was employed during shaft sinking to cut off flows of water which would interfere with the progress of the work, and during tunnel driving for the same purpose. Most of the grouting was done, however, after the completion of the tunnel and the placing of the concrete lining. It was used, first, to complete the filling of the considerable space over the concrete arch beneath the rock roof, which could not be completely concreted, as well as the spaces in dry packing of rock outside of steel roof support, which was extensively used. Secondly, in cases where water was encountered flowing into the tunnel through seams, provision was made by appropriate systems of piping to impregnate the seams with cement for the purpose of cutting off the inward flow of water, and at the same time prevent the escape of water from the tunnel after it is in service.

Of all the operations connected with the tunnel work, shaft sinking is perhaps the slowest, most hazardous and expensive per cubic yard of material handled, especially when much water is encountered, as water falling to the bottom of the shaft and collecting to a considerable depth makes the mucking of the broken rock extremely difficult. After drilling and shooting, much time is lost in getting the pumps under way again and the water rapidly collects and floods the bottom.

It is evident, therefore, that to keep the water out of the shaft, as it is sunk, grouting of water-bearing fissures in advance of excavation must be of great advantage. This process is best accomplished by drilling holes in the bottom of the shaft in lengths not exceeding about 20 ft., and generally from 5 to 10 ft., placed around the outside of the area to be excavated. As a precaution against flooding the shaft, when a heavy flow is expected, pipes fitted with valves are set in the drill holes when they are started, and the drilling is continued through the valve, which can be quickly closed when the water is struck. When all is ready, the grout is poured or pumped into the rock seams through pipes attached to the fittings connected with the drilled hole.

As in all grouting, for filling large cavities thick grout is placed, while for success in filling very fine seams, exceedingly attenuated mixtures are employed—5 lb. of cement and 25 gal. of water in the early stages of injecting the grout—with the idea that the water will carry the cement as far as possible into the fine seams and avoid blocking up close to the drill hole. This is a very important point if complete success in the process of shaft sinking is to be attained.

After the water is cut off, sinking is resumed with light shots to avoid re-opening fissures in the rock closed by the grout. A number of shafts in other work have been sunk by this method through extremely wet ground which would have been impossible, or at any rate far more expensive to sink if pumping alone had been depended upon. Flows as high as 3000 gal. per minute have been cut off by this method.

On the Catskill aqueduct about fifty shafts, from 80 to 1100 ft. deep, were sunk for the tunnels. As a rule, no very great difficulties were met, as the rocks in this region are old, well compacted and strong, and, except in a few places, have not suffered disintegration to such a degree as to make shaft sinking particularly difficult because of the presence of great quantities of water. In few shafts was the maximum leakage over 200 gal. per minute, but in several cases it was so great that grouting was used during sinking to cut off or reduce the flow of water. For example, shaft 4 at High Falls (later described), which was very wet, was flooded out six times. In one period of the sinking no less than ten pumps were placed in the shaft and with air and discharge lines made it literally impossible to carry on the shaft sinking operations. Grouting, however, was done with success.

ELIMINATE COSTLY PUMPING

When the quantity of water exceeds 15 or 20 gal. per minute in a shaft, it is generally necessary to install pumps, and when the quantity exceeds 200 or 300 gal. per minute, the pumping item becomes very costly because of the power required and the added trouble and delay of installing power lines for air and for pump discharge. The mucking is much delayed, as the men are unable to see the bottom and they naturally work more slowly in the water. Shaft 4 at High Falls on the Catskill aqueduct is an example of a timber-lined shaft which was grouted ahead of the excavation. All the water was not sealed off and pumping had to be employed to keep the bottom clear so sinking could proceed. Shafts 4, 20, 21, 22 and 24 in New York City, in which grouting was done, were all lined and concreted and the leakage almost completely excluded as the shafts were sunk. Had they been timbered shafts the quantity of water entering would have been very great. In all these shafts many water-bearing seams were met as the holes were drilled in the bottom. Pipes were swedged into the holes and grout forced in by air pressure from a tank machine. The completeness of the grouting was tested by drilling more holes, which were grouted in turn, and the same holes were frequently grouted several times as the upward rush of water under pressure often seemed to wash out the grout before it had time to set.

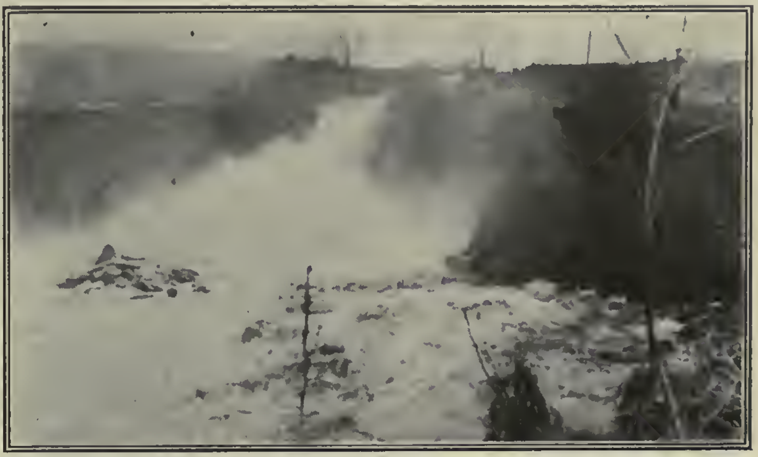
FLUME WAS FULL AT TIME OF BREAK

[*In the next installment of this series of articles Mr. Sanborn will describe shaft-sinking difficulties and how they were overcome by grouting.*—EDITOR.]

Sioux Falls Flume Failure Threatens Water Supply

Water Rushing Down 14 per Cent Grade Undercuts Toe Wall at End of Spillway, Destroying Flume for 600 Feet

FAILURE of the flared spillway and several hundred feet of steep lined flume at the end of a drainage ditch carrying surplus waters of the Big Sioux River by the city of Sioux Falls, S. D., March 12, made the waterworks officials apprehensive for a time that the cutting would recede through a ridge and drain the gravel beds from which the water supply is obtained. The ditch is about 16 miles long and makes possible the cultivation of a large area of bottom lands in the valley of this extremely sinuous river channel. The greater portion of Sioux Falls is located in a loop of the river. The ditch discharges below the city and the falls, cutting across the neck of the loop, with an abrupt fall at the end, of 100 ft. in the last 1000 ft. When the officials became apprehensive of losing their water supply they started to shut off the water at the upper end of the flume, but the farmers whose property would have been flooded obtained a restraining order. Fortunately the cutting slowed down materially after receding about 600 ft., as it encountered stiff clay, and at last reports the water is still tearing down the 14 per cent portion of the grade and dropping more than 60 ft. into the enlarged channel cut back from the river.



WATER DROPS 60 FEET FROM END OF BROKEN FLUME NEARLY TO RIVER LEVEL

Through the ridge at the upper end the flume is 24 ft. wide on the bottom. The steep part is 8 ft. wide on the bottom, 7 ft. deep and has 1½ to 1 slopes. The concrete is 8 in. thick on the bottom and 6 in. thick on the slopes, and was reinforced with ½-in. rods 3 ft. one way and 2 ft. 9 in. the other way. The toe wall at the end of the flume was extended only 6 ft. into the soil, whereas rock is said to be about 14 ft. farther down.

The slope of the flume was flattened toward the discharge end from the steepest portion, 400 ft. of 14 per cent grade, to 300 ft. of 11 per cent, 50 ft. of 6 per cent and 65 ft. of 3 per cent.

Observations made ten days after the break showed the water discharging through an overhanging portion of the flume 12 ft. long, but there was a considerable volume discharging over the clay underneath the flume. It is reported that the water has heretofore worn holes through the flume that had been repaired from time to time. With the large joints there is plenty of chance for water to get beneath the slabs. Until the flood season has passed no attempts can be made to repair the flume.

Defense Association of Engineers Is Proposed

Plan to Capitalize Interest at Military Lectures in Permanent National Organization

By WILLIAM R. KING, M.E.
New York City

Monday night, March 27, marked the termination in New York City of that most eminently successful course of lectures on the subject of military engineering, which, organized under the auspices of a representative committee selected from the various national societies, has served for the past two months to focus the attention of the engineering profession on the essential part which must inevitably fall to their lot in any adequate and comprehensive movement taken for our national defense. The success of this series of lectures has been demonstrated, not only by reason of the general, concrete and interesting view of the subject which has been so liberally provided, but pre-eminently by the enthusiasm, unity of purpose and overwhelming interest which has been aroused among the members of the engineering profession, irrespective of age or professional affiliations.

BROKEN SLABS INDICATE FLUME LINE

Nightly, as the course progressed, this audience of conservative and thoughtful men gained in fixity of resolve and intensity of interest, only to realize, with universal and heartfelt regret, that the course is run and no goal reached; that the potential energy of concerted action by some 3000 participants must be dissipated without further finite results.

It is true that, inductively, some fragment of this energy has been transferred to that more active field which the justly popular training camp movement is intended to supply, but to the rank and file, those who have been so unfailing in attendance at these meetings, and especially to men of more mature years, no further field for united effort is open for exploitation. Marooned, with appetites abnormally developed, yet deprived of further food for thought!

But why should the momentum thus far acquired be permitted to dissipate without useful effect? The energy evolved by such a movement conserved, controlled and directed in proper channels, is capable of exerting great influence, not only educational, but psychological and political as well. To perpetuate, to utilize, to stimulate such potential force, is it not desirable that this "good will," and "going value" should be incorporated in a permanent organization?

NATIONAL ASSOCIATION OF ENGINEERS FOR DEFENSE

To the members of the present temporary committee the rolls of participants in the lecture course are available. The means being at hand, the curve of enthusiasm at its peak, the present is the time to act. It is not the intent that the suggested association should in any way supplant, compete with or encroach upon the sphere of usefulness now so ably filled by existent national associations, but, rather that it shall supplement and extend their work by specialization and adaptation to military needs, and at the same time form a rallying point for those of our profession who would prepare themselves, in times of peace, better to meet their obligations when called for our national defense.

In the development of the proposed organization all efforts should be directed along practical, rather than conventional and academic, lines. The essence of success must lie in active participation by each individual member in the work of the society, and not in a perfunctory and passive attendance at "annual meetings."

Military engineering, with its infinite ramifications, is not a subject for treatment in a "one-volume" course. Each elemental component represents a case of specialized adaptation to military use of some parallel line of civil activity. Hence, while such a graphic and comprehensive series of lectures as engineers of the metropolitan district have recently been privileged to enjoy has done much to delineate broadly the general subject, for a more advanced, a "post graduate" course of study, a restricted field of effort becomes desirable and specialization essential.

Let the broad scope of the projected association for educational purposes be sectioned, and specific subjects assigned to and treated by departments. As possible divisions there may be instanced ordnance, high explosives, munitions, fortifications, submarines, aeroplanes, etc. A course of study in each department should include a comprehensive series of practical and detailed lectures, supplemented and expanded by frequent and informal conferences, and assisted by a selected course of reading.

Apart from the educational advantage of thorough familiarity with "the state of the art," and proficiency in the theory of the subject, which must accrue to each from co-operation in a departmental course, even more important are the results in the form of new development which may be anticipated—the natural outcome of mental induction and the stimulation of numbers on minds already proficient in the civil practice of their profession and who are now keen to adapt their specialized knowledge to military uses.

As a body this association should prove a source of considerable political influence. Free from all party allegiance, its collective power may be advantageously employed to advance all measures taken for national defense. Geographically, there should be no limit to the expansion of this association. Composed, as it will be, of members of the several national societies, with the co-operation of these societies little difficulty is to be anticipated in the ultimate establishment of flourishing branches in all of our larger cities. May we hope that the present committee will take action along the lines which have been suggested?

Small Irrigation Canals Lined with Concrete to Prevent Seepage Water Loss

Part I of Article Giving Details of Construction and Cost of Work on Okanogan Project in Washington

By C. E. EDWARDS
Civil Engineer, Okanogan, Wash.

As a result of lining with concrete about 40 per cent of the canal and lateral system of the Okanogan irrigation project in Washington seepage losses have been reduced from 51 to about 15 per cent of the total water received from Salmon Creek at the headworks, and an insurance against water shortage during seasons of minimum runoff has been provided. The lining has been placed in the sections of the canals where seepage losses were greatest, these locations having first been determined by current meter measurement. The economic feature of the improvement, as a conservation measure, is indicated by the fact that the annual runoff of the stream which feeds the system has varied from 56,500 to 17,350 acre-ft., a condition which calls for rigid curtailment of loss by seepage during periods of minimum yield. While information on the lining of large canals is not difficult to obtain, comparatively little is available on small canals and laterals such as those of the Okanogan project.

SEEPAGE LOSSES

The losses in the canal system for 1911, with 43 miles of canals and laterals in operation and only 1 mile concrete lined, was 51.1 per cent, an average of 1.2 per cent per mile of canals operated. The loss for 1915 was 20.4 per cent, with 76 miles of canals and laterals operated and 21 miles concrete lined, or an average of 0.27 per cent per mile of canal operated. Three small laterals carrying from 5 to 15 sec.-ft. have been all concrete lined. These laterals are from ½ to 1½ miles long, and a careful checking of the weir measurements of all the water turned in and turned out shows that there is practically no loss at all in these canals. About 4 miles of lining have been placed since the close of the 1915 irrigation season and another 1½ miles will be lined before the season for 1916 opens. It is estimated that this will reduce the losses in the system to less than 15 per cent for the season of 1916. The capacity of the canals concrete lined has varied from 1 cu. ft. per second up to 140 cu. ft. per second.

The seepage conditions on the Okanogan project are typical of a large number of irrigation systems throughout the West. Sooner or later, when the water becomes scarcer and more valuable, similar steps will be taken on these systems, not only to conserve the water supply but also to safeguard crops that would be injured by a lack of water caused by a serious break in the canal, which always occurs when the need for water is greatest and the canals are working to their maximum capacity.

The work of placing the concrete lining on the Okanogan project was started in the fall of 1911 and has been carried on in the spring and fall since that time. On account of having to do the work during the non-irrigation season, the time available in which concrete can be laid with safety from frost is reduced to 3½ months for each year. The work was not pushed the first two years on account of the high cost of getting cement in without railroad transportation. At that time cement on the work cost from $6 to $7 per barrel. The Great Northern Railroad was completed in 1913, and the cost of cement on the work was reduced to $3 per barrel and has been reduced as low as $2 since that time.

The methods and costs for 1911 and 1912 are not given, but the methods were similar and the costs higher than those for 1913-15, when the writer had charge of both the engineering and superintendence of this work under the supervision of the project manager.

DESIGN OF CANALS

In the original designs most of the canals were built with 1 on 1½ slopes on the upper portions of the project and 1 on 2 side slopes on the lower or sandier portions of the project. A friction factor of $n = 0.025$ was used in designing the unlined canals; a factor of $n = 0.015$ was found to be safe for concrete lining. The canals as already built and in operation were generally too large for lining without backfilling. A plaster lining 1½ in. thick was decided upon, with a backfill of sand and gravel of at least 3 in. on the bottom and side slopes.

The side slopes of the lining in most cases were made 1 on 1½, but some 1 on 1 lining was placed in the smaller ditches. On canals which had been constructed with a bottom width of 3 ft. or wider, and side slopes 1 on 1½, the amount of backfill required was from 4 to 8 in. deep, depending on the size of the canal. For canals with side slopes of 1 on 2 the backfill was sometimes 2 ft. deep near the top of the lining. This occurred only in sandy sections where the cost of the backfilling was comparatively cheap. On the smaller canals the amount of backfill required varied from 3 to 6 in. in depth.

In designing the cross-section a berm from 4 to 6 in. wide was made on all lining. This berm serves the double purpose of strengthening the top of the lining, and, by backfilling on top of it, prevents surface water from getting under the lining and filling up the backfill. In warm weather this would do no harm, but during the early spring, when the snow melts, a thaw during the day, followed by a hard freeze at night, will freeze the water in the backfill before it has had time to drain away, causing the lining to heave and crack.

Where the ditch is all in fill a 4-in. berm has been used with good results, but on sidehills, where there is considerable surface drainage into the canal, experience has indicated the need of a wider berm, and here a 6-in. berm, well backfilled on top, has proved very satisfactory.

When well-defined drainage channels entered the canal they were taken care of by lowering the side of the lining from 4 to 6 in. for a short distance, and widening the berm to 1 ft., so that the water could get into the canal without washing down and getting under the lining. Where necessary, pipe and rock drains have been made through the lower bank of the canal to drain the backfill.

GRADE AND ALIGNMENT

The center lines of the canals were run with a transit and stakes set every 10 ft. These stakes were then driven to grade and care taken to keep them in line, as the same stakes were used for line and grade. The hubs were set on the grade of the top of the backfill so that a template could be set and centered on these hubs to act as a guide in placing the backfill. By setting the grades this way it is not necessary to move them when the lining is placed. After the backfill had been placed and flooded, and before the final finishing to neat lines preparatory to plastering, the grades and alignment were checked.

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SHAPING CANALS TO PROPER SECTION PRIOR TO PLACING OF CONCRETE LINING—SHOVELERS REMOVING EXCESS MATERIAL FROM TRENCH BOTTOM

When new canals were constructed with the idea of lining immediately, they were excavated to neat lines and a minimum thickness of 3 in. of backfill placed. But where canals had been in use it was necessary to cut off the overhanging sod berms, even where the cross-section was being reduced, in order to guard against any settling away of the backfill under these overhanging berms.

WORKING CREW

The crew for this work consisted of a foreman with from 10 to 20 laborers, depending on the size of the ditch and the amount of material that was required to be moved. The efficiency of the crew was considerably reduced if the men were strung out over a long section of canal.

In determining the amount of material to be removed, if any, two men worked ahead with a template to which a carpenter's level was attached. They excavated trenches at each grade hub, these trenches being taken out to the neat lines of the section, as it should be before the backfill is placed. The excess material between the trenches was removed by the remainder of the crew, each man taking a 10-ft. section, which kept the crew as nearly together as it was possible for them to work to advantage and tended to increase the efficiency of the crew by making it easier for the foreman to check up the quality and quantity of each man's work. No straight-edge was used on this work, as extreme accuracy was not necessary. It was the duty of the foreman to see that the men handling the template used care in centering and leveling it on each hub and also to see that the template was held vertical and at right angles to the center line of the canal. This is very important on sharp curves, if a good job is to be obtained.

HAULING AND PLACING OF BACKFILL

The irrigable lands of the Okanogan project are underlaid with sand and gravel to an unknown depth. The soil is from 1 to 10 ft. deep, probably averaging 2 ft., and below this lies sand and gravel which has been deposited in various slopes and positions, so that it is almost impossible to tell what grade of material will be encountered without digging test pits at very close intervals. A good grade of sand and gravel can be found along the canals at irregular intervals. It is seldom necessary to haul either sand or gravel more than 1 mile for backfill material or aggregate for concrete.

The backfill material was hauled and dumped on both sides of the canal, wherever possible, in order to save passing it across by hand. Where necessary, temporary bridges were constructed for the purpose of getting the material dumped on both sides of the canal and they also saved considerable time in getting equipment and other material back and forth along the cut where the banks were too narrow for teams to turn.

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WHERE POSSIBLE THE MIXER WAS LOCATED AT THE SIDE OF THE TRENCH, BUT SOMETIMES IT WAS NECESSARY TO CARRY THE PLATFORM ACROSS THE CANAL

On account of the small yardage handled from each pit it seldom paid to build a loading trap, so that most of the material was loaded by hand. From 6 to 12 shovelers under a sub-foreman were employed in the pit, depending on the room available and the grade of material being handled. Each teamster helped to load his own wagon. On account of lack of roads to haul over and hard places to get into only 1 cu. yd. was hauled per load. The average length of haul for this material was about ¼ mile.

When the backfill was hauled the size of the placing crew varied from 6 to 12 men, under a sub-foreman, the size depending on the amount of material available and whether it could be dumped on one or both sides. Where the amount of backfill required was available it was necessary for the placing crews to keep well up with the hauling in order to avoid a shortage or oversupply of material in any one place. One of the placing crew helped the teamster to dump his load, as dump boards were used entirely on this work. No dump wagons were employed as the teams were all hired from water users and they used their farm wagons fitted up with dump-boards of 1-cu. yd. capacity.

In placing the material 3 men with a template went ahead and at each grade hub they put the backfill in up to grade just even with the template all around. These 3 were followed by from 3 to 6 others and the sub-foreman, who filled in between the hubs until the slope projected inward a little beyond the template line. The sub-foreman worked with his men and used his judgment as to how much extra material was needed after flooding prior to the concrete lining work. For a backfill 6 in. deep it was usually necessary to place about 6½ in. of sand and gravel mixed or 7 in. of coarse sand. Where the backfill material could be taken out of the upper bank, which was possible on about one-third of the work, one sub-foreman could handle 30 men to good advantage. Each man was given a 10-ft. section to fill and the foreman checked up each section as it was finished and sent the man ahead. In this way no slack work was done and no unnecessary material was put into the canal that would have to be removed when finishing.

FLOODING AND FINISHING BACKFILL

After a section which was to be lined had all been backfilled it was flooded as near to the top of the canal as safety would permit. Where there were no permanent checks sack dams were built at regular intervals and the water was backed up in this manner. The distance between these dams varied from 200 to 1000 ft., being governed by the slope of the canal. Only a small amount of water was used in flooding and this was let in slowly to avoid washing the backfill down from the slopes. The dams were all constructed before the water was admitted, and after the first dam was full the water was allowed to run over the top so that the first section could be soaking while the lower sections were being filled. After the upper section had been soaked a couple of hours the work of taking down the dams or lowering the checks was started, the upper dam being taken down first. This was done slowly so as not to release too much water and wash the backfill in the lower sections or cause the water to be lowered too fast above the dam, as this had a tendency to make the backfill slough down off the slopes if there was a large proportion of sand in the material used for that purpose.

After the water had drained out the finishing was started as soon as possible, usually the next day. This work was handled by a crew of from 12 to 15 men, under a sub-foreman, who were organized as follows: Three men went ahead with a template, which was fitted with a carpenter's level. This template was the exact size of the neat section of the canal before the lining was placed. It was centered and leveled over each hub and set at right angles with the center line of the canal. Then thin strips, usually 1 x 2 in. or 1 x 3 in., were inserted under each side of the template for the straight-edge to slide upon. These strips were 2 in. longer than the sides of the template and the upper ends were set flush with the top of the template, the bottom ends being pressed into the backfill so as to hold them in place. The strips were then firmly embedded in the backfill by tamping the material under and against them with shovels. As soon as this had been completed the template crew moved the template on to the next hub and so on down the canal, sufficient strips being provided for 25 or 30 hubs. The rear hubs were carried ahead as the straight-edging was completed.

STRAIGHT-EDGES SMOOTH SIDES

As soon as the template crew was out of the way two straight-edge crews were started. These crews consist of three men each, one crew working on either side of the canal. The straight-edges were made of 2 x 4-in. by 12-ft. pieces, planed smooth on all four sides. One man worked on each end of the straight-edge and the third man stood between with a shovel and removed the excess material away from the bottom, when necessary, and filled up any hollow places that occurred on the slopes as the straight-edging was done. The straight edge was run flat the first time and the last couple of times it was run on edge to take out any bow in the slopes.

After the side slopes had been straight-edged down so that they were in the same plane as the strips that had been placed by the template crew, the straight-edge was set on top of the strips and pressed back on the berm so as to leave the top of the berm level and smooth, at least 6 in. wide, and on the same grade as the top of the strips. On narrow-bottom canal one straight-edge crew worked two or three sections ahead of the other, on the opposite side, so that they would not interfere by being in each other's way.

EXCESS MATERIAL REMOVED

Following the straight-edge crews were from 3 to 6 shovelers who took the excess material out of the bottom of the canal and away from the edge of the berm and leveled the bank ready for laying running boards. On canals with a bottom width of 4 ft. or less no attempt was made to straight-edge the bottom, but the shovelers were followed by a man with a square point shovel who leveled up the bottom and squared up any rounding corners at the junction of the bottom and side slopes. This work is important, as any rounding corners which may be left will hold the bottom of the plasterer's straight-edge out and cause a kink in the alignment of the side slope at this point and in addition will make the lining thicker and cause a waste of material. If these kinks occur at frequent intervals they will set up cross currents in the canal and reduce its capacity to a very appreciable extent. This is more particularly true of small canals having a steep grade and a high velocity.

(*To be concluded.*)

Irrigation Laws Developed in California

Radical Changes Have Been Made Since the First Legislation Was Passed in 1887—Irrigable Land Now 21,000,000 Acres

AFTER thirty years' experience with irrigation projects, California has tried out and improved irrigation district laws until a system has been developed which in recent years has been frequently copied by other states. A considerable number of large irrigation districts have been well established and are now operating successfully. Among these are the Modesto, Turlock, Oakdale, South San Joaquin and Alta districts. Numerous smaller districts are none the less active, and a great many others are now in process of organization. Each district is a political entity and is recognized as a political subdivision of the state.

The laws authorizing the organization of these districts have undergone radical changes since the first irrigation law was passed in 1887, but their constitutionality and the validity of the bonds they issue has been upheld by test cases carried through to the United States Supreme Court. As the law now stands, before an irrigation district can be organized in California, the state engineer must approve the adequacy of the water supply and the plans outlined for the irrigation system; the county board of supervisors in which each district is located must authorize the organization of the district, and the voters are allowed to exercise full governing power over its affairs.

LEGAL STATUS

Except for purposes of organization, there is in California little difference between a school district and an irrigation district. The payment of principal and interest in both instances is assured by the sovereign power of taxation. All bonds of the irrigation districts are rated as legal investments, and under the ruling of the Treasury Department the income from these bonds is exempt from all state taxation, as well as from federal income tax, and individuals need not report the income derived therefrom.

The board of directors of each irrigation district has power to levy taxes to meet principal and interest in all outstanding bonds, and this tax ranks on a par with all taxes raised for city and school district purposes. The bonds for each district comprise a direct first charge on all real estate in their respective boundaries. Tax records show that of the $5,379,037 levied in this manner only 0.4 per cent were allowed to become delinquent. This percentage is less than that in many California cities. Of the $12,000,000 of irrigation bonds issued in California since 1897 there has been no default in the payment of principal and interest.

IRRIGABLE AREAS

It is estimated that the total area of land in California susceptible of irrigation is about 20,865,000 acres. Experiments reported by state and federal research bureaus state that these lands require from 1 ft. to 5 ft. in depth of water applied each year to obtain the best results. The quantity varying, of course, with the soil, kind of crops, locality, etc. Compared to these irrigable areas, reports of the geological survey and the state engineering department indicate the total average flow of all streams of the state to be annually about 60,000,000 acre-feet, or nearly 3 ft. per annum for all arid lands.

The Central Irrigation district, which was the first to be formed in California, was organized in 1887. It voted bonds for $750,000 and involved an area of 156,550 acres. This district and a number of others which followed in rapid succession in the next four years were not successful. The lack of success, however, was not because irrigation was not required on their lands, or because the projects were not feasible, but rather because of the loose manner of doing business and internal opposition. For example, in the $80,000 bond election affecting 13,000 acres of land in the Kraft district unanimous approval was given to the proposed issue. The total number who voted at the election, however, was nine.

In the past 15 years 62 irrigation districts have been formed in California, involving a total area of almost 3,000,000 acres, and under the recent amendments to irrigation district laws there has been a very great increase of activity in the formation of new districts. Residents of the Anderson-Cottonwood district of Shasta County, which is in the Sacramento River basin, are just completing the organization of a district which includes 30,000 acres of irrigable land. A bond indebtedness of $400,000 has been voted to purchase water rights and construct an elaborate system of ditches. The Imperial Valley Irrigation District in southern California is probably the largest and most important ever organized in the West. An account of the transaction involving $3,500,000, whereby the district took over the properties of the California Development Company, appeared on page 707 of the Engineering Record, issue of Dec. 4, 1915. The Carmichael and Paradise districts in the northern part of the state are both seeking to perfect their own organizations, and the West Side Irrigation District at Tracy will vote upon a bond issue at an early date.

Upper Pit River basin	180,000 acres
Feather River basin (Alpine valleys and hills)	158,000 acres
Foothills	565,000 acres
Sacramento Valley	2,400,000 acres
Scattering	2,000 acres
Total	3,305,000 acres

The reclamation service co-operating with state authorities has reported that the Iron Canyon project on the Sacramento River would permit of storing 600,000 acre-feet of water for irrigation and power. This project, if consummated, would become a factor in flood control that would affect the lower reaches of the river. Other dam sites in the mountains have been examined by the reclamation service, whose total storage capacity is estimated to be 7,000,000 acre-feet.

A STANDARD SCORE CARD has been issued by the Utah School Buildings Commission for the use of inspectors of school buildings in the State. All the desired information is classified and the inspector simply rates the conditions found on the basis of ten as perfect. Details for inspection are given in thirty-six items, under the following main divisions: site, building, class rooms, cloak rooms, heating apparatus, ventilation, toilets and water supply, and janitor service.

National Defense—For Engineer and Contractor

Seventh Article in Series Describing Demolitions with Fire and Explosives and Methods of Conducting Siege Operations

By Major P. S. BOND
Corps of Engineers, U. S. Army

DEMOLITION is always an important accessory of tactical operations. It serves to hamper the movements of the enemy, to frustrate his plans and, by the removal of obstacles, it facilitates the operations of our own forces. Demolition on a large scale, except in emergency, should not ordinarily be permitted without the express order of a responsible commander, as otherwise military expediency may degenerate into vandalism. Ill-timed or premature destruction may involve very unfortunate consequences.

FIRE AND EXPLOSIVES

As in all the operations of war, so in military demolition there is demanded adequate results in the minimum of time. Demolition is the particular function of the engineer troops, but as it may be required at any time in any part of the theater of war all troops are now equipped with demolition outfits. These outfits must necessarily be simple, light and portable, while capable at the same time of producing powerful effects. The means of demolition best adapted to military requirements are fire and explosives. The former requires no equipment, the latter provides a powerful instrument of light weight.

Demolitions are frequently accomplished by the fire of high explosive shells from large guns. Indeed, for the destruction of hostile fortifications and obstacles protected by the hostile fire, this will often be the only practicable means. It is, however, always expensive and often uncertain and inapplicable. Where it is possible to place charges of explosive judiciously, greater, more certain and more prompt results can usually be obtained.

The advances made in recent years in the manufacture of high explosives have placed a powerful weapon in the hands of the military. But knowledge and experience in the effective practical use of explosives is not common, and it is very important that all officers, and especially engineer officers, should be fully instructed in practical demolition. An explosive for military demolitions should be: (a) Stable for long periods; (b) unaffected by ordinary variations of moisture and temperature; (c) not unduly sensitive to shock in handling, transportation, etc.; (d) not unduly difficult to detonate; (e) quick enough to give good results even when unconfined; (f) convenient in form and consistency for transportation and use under field conditions.

These requirements call for a high explosive of medium strength, solid in consistency, and put up in damp-proof packages of standard size. A number of commercial explosives meet these requirements fairly well, and none is invariably preferred to the exclusion of all others. It will be a question, usually, as to which can be most readily obtained in sufficient quantity. Among these explosives are gun-cotton, nitro-glycerine, dynamite, jovite, the picrates, fulminates, Sprengel safety mixtures, gunpowder. Dynamite is the most common commercial explosive and is well adapted to military uses. Nitro-glycerine is dangerous in handling and transportation because of its liquid form. The fulminates, particularly mercury fulminate, are especially useful as detonators for other explosives because of the abruptness and violence of their action. They are accordingly extensively used for caps, primers, etc.

Explosion is produced by detonation, for which purpose a small cap or primer of fulminate is inserted in the charge. The cap may be fired by means of a powder fuse or by electricity. The latter is the preferred method, but requires a magneto-electric exploder and lead wires. If these are not available the fulminate may be ignited by means of a powder fuse. Two classes of fuse are employed, time and instantaneous. They are distinguished by the color of their wrappings. Time fuse burns at the rate of about 3 ft. per minute; instantaneous fuse, 120 ft. per second. Caps and fuse must be kept away from other explosives.

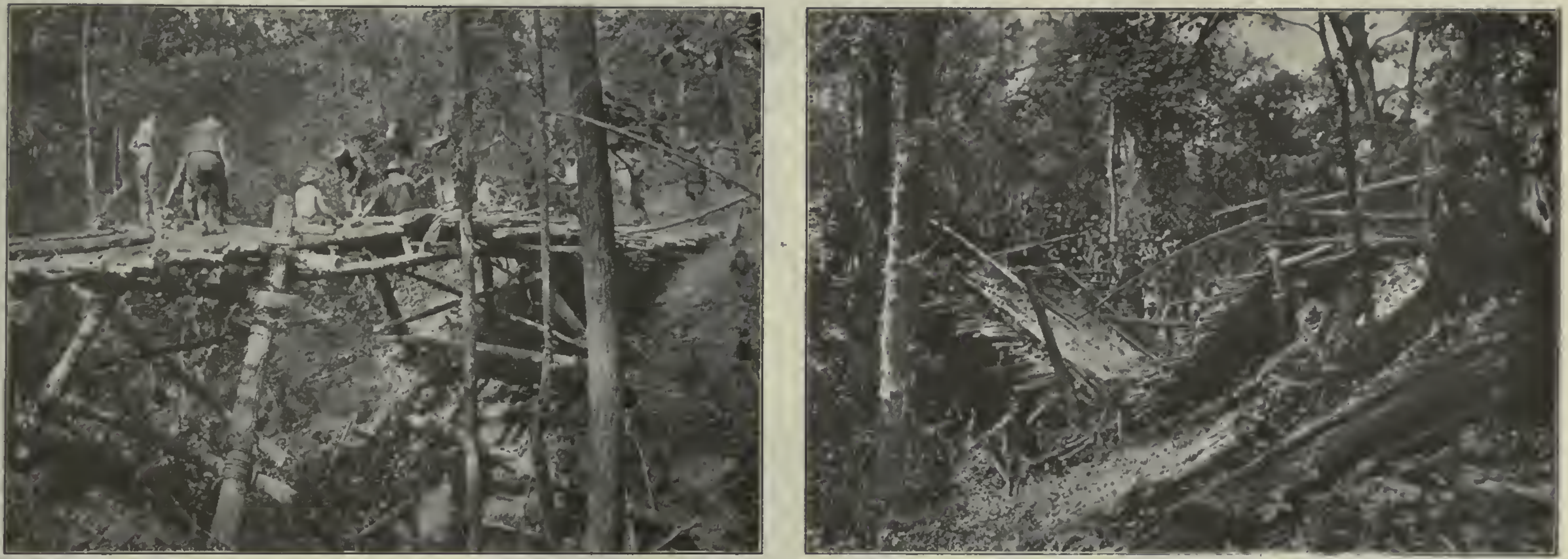
Charges should be tamped in some manner whenever this is practicable, as their effect is thus greatly increased. Timbers should be bored to receive the charge when practicable. Charges placed to destroy concrete, steel, etc., should be tamped with earth or mud. If tamping is impracticable the charges must be increased. Skill in placing the charge will greatly increase its effect. Several small charges judiciously distributed will often produce better results than one large charge, but care must be taken to insure simultaneous detonation.

HOW STRUCTURES ARE DEMOLISHED

In the case of an important demolition a reconnaisance or examination should, if practicable, be made to determine the extent of the destruction required and the easiest, surest and most expeditious manner of accomplishing it with the men and equipment available. The damage inflicted should be sufficient for the purpose in view and no more. If the purpose is merely to delay for a short period the use of a certain bridge it may be sufficient to remove the deck instead of destroying the trusses. A telegraph line may be temporarily interrupted by cutting the wires, but for complete demolition the poles should be cut down and burned. In the case of railroads, which are frequently attacked, it is easier to demolish a bridge than to tear up track, but it is much more difficult to repair the damage in the former case. It is as easy to remove a rail on a curve as on a tangent, but it takes more time to prepare and place a curved rail. The proper charges of explosives to accomplish certain results have been determined by experiment and are given in the manuals. They serve as a useful guide, but cannot take the place of experience and good sense.

The following notes will indicate the methods employed in some of the important military demolitions:

All timber structures may be destroyed by fire. For rapid work they may be sprinkled with coal oil, tar, or other inflammable liquid before ignition. Framed structures of wood or steel may be destroyed by attacking the weakest members of the framing. In a truss bridge the chords may be cut at their thinnest points. Bridges are most effectively demolished by overthrowing their piers or abutments, which wrecks the entire structure. The most vulnerable points of roads and railroads are the important bridges or viaducts. Railroads may also be attacked at culverts and tunnels. If these vulnerable points cannot be reached, railroads may be interrupted by removing rails, preferably on curves. A fire is made of the ties, the



DOUBLE LOCK SPAR BRIDGE CONSTRUCTED ENTIRELY OF MATERIALS OBTAINED AT SITE AND DEMOLISHED SOON AFTERWARDS BY AN EXPLOSIVE CHARGE rails placed therein and twisted while hot. An entire section of track may be removed by opening the joints at each end, loosening the ballast and then overturning the section. It is best to select an embankment and throw the loosened section down the slope. Railroads may be crippled by removing or wrecking the rolling stock, especially locomotives, by demolishing switches and water tanks. It is generally better to wreck the road at several points rather than to concentrate the work of destruction in one locality.

Highways are very difficult to destroy, but the passage of vehicles may be interrupted by digging trenches across them, by firing land mines in the surface or filling deep cuts with debris. Buildings may be demolished by closing all openings and firing a large charge in a central position. Telegraph lines may be interrupted by cutting the wires, but for complete demolition the poles should be cut down and burned, which also destroys the cross arms and insulators. At stations the instruments are removed or demolished and the records seized.

Woods are rendered useless as cover by fire or by cutting down the trees with tools or explosives, lopping off the branches and throwing them into ravines. The trunks may be left on the ground and it is neither necessary nor practicable to remove the stumps, as it takes too much time.

Masonry arches may be attacked by explosives at the haunches or crown. In a multiple arch bridge the destruction of a pier involves the two adjacent arches. Locks are rendered useless by destroying the gates or filling valves. Supplies and materials of all kinds are ordinarily destroyed by fire, after sprinkling them with inflammable liquid, or mixing inflammable and non-inflammable materials.

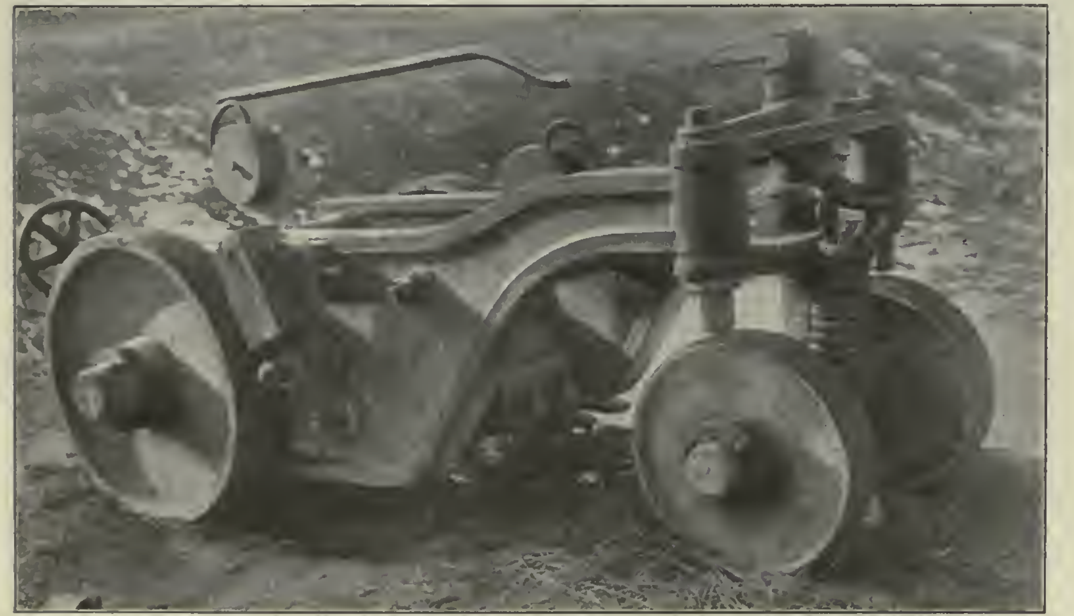


Photo. Underwood & Underwood

THIS MACHINE WAS HAULED BY THE RUSSIAN ARMY TO TEAR UP THE ROADS OVER WHICH THEY WERE RETREATING AND MAKE THEM IMPASSABLE FOR THE PURSUING GERMANS

Barbed Wire Entanglements

Obstacles placed in front of trenches are very difficult to destroy because they are deliberately constructed with that end in view and are under the fire of the defenders of the trenches. They are often demolished by shells and grenades, but such methods are slow, expensive and unsatisfactory. Wire entanglements are the most effective of all obstacles and the most difficult to destroy. They may be cut with nippers under cover of darkness or behind a steel shield. The process will usually be accompanied by heavy loss of life. Often it will be better to bridge over the obstacle with bundles of brush, hurdles, plants, sections of board-walk specially prepared, etc.

Siege Operations

The increasing power of modern firearms has tended toward the obliteration of the sharp distinction between siege and field operation. Important localities whose strategical value can be foreseen are still fortified, however, in times of peace. Such defensive works are very elaborate and of great strength and they are provided with every conceivable device and facility for resisting attack. An assault upon them has little prospect of success unless the works have been at least partially demolished, inasmuch as they present great physical obstacles and afford such thorough shelter to the defenders that it is difficult to shake their morale or diminish the effectiveness of their fire by means of rifles, machine guns or light field guns. The defenders will also be provided with ordnance of the most powerful types, they will be intimately acquainted with the foreground, which is specially prepared in advance to embarrass the attack, and they will possess large supplies of ammunition and excellent facilities for its storage and use. The fire of the defenders and their protection will, therefore, be more effective than is possible with less formal preparation.

Photo. Press Illust. Co.

THE BARBED WIRE ENTANGLEMENT HAS PROVED TO BE AN EFFECTIVE MILITARY OBSTACLE — IN THIS PICTURE GERMAN TROOPS WITH WIRE CUTTERS ARE ENDEAVORING TO REMOVE THE OBSTRUCTION

Such fortifications must generally be thoroughly demolished before their defenders can be dislodged, and for this purpose guns of large caliber, hurling great charges of explosives, are required, coupled often with extensive mining operations such as have been described in a previous article of this series.

Reducing a Fortress

The first step in the reduction of such a fortress, which should be carried out if practicable, will be to cut off its supply and reinforcements as well as its communication with the outside world by surrounding the place with a line of troops. This is called the line of investment. It should generally be drawn as close to the fortress as the effectiveness of the defenders' fire will permit. It is not necessarily continuous, but must usually be fortified. The investing troops may have to resist attack from more than one direction, inasmuch as the enemy may endeavor to break the investment by sorties of the garrison of the fortress, or by the attack of a field army operating in conjunction with the garrison. If the civil population has not been previously withdrawn they are compelled by the besieger to remain in the fortress in order the more rapidly to exhaust its food supplies.

The investment having been completed or found impracticable, one or more points of the fortress are selected for the formal attack. If the attacker is well supuplied with heavy ordnance the works may be generally demolished and rendered untenable by a vigorous bombardment.

The points selected for attack will be those where the fortifications appear to be weakest, where the attacker's fire may be most easily concentrated, where the foreground is most favorable for his operations, where he is least apt to be interfered with by sorties or attacks from the outside, or where the consequences of success will be most disastrous to the enemy, etc., etc.

Zigzag Trenches Advanced

The heavy guns are then emplaced and the bombardment commenced. When the defenders' artillery has been brought under control an attempt is made to break out an infantry trench as close as practicable to the fortress. This is called the "first parallel." Zigzag approaches are pushed forward from the first parallel and a second parallel is broken out. To avoid as far as possible the enemy's fire this work is usually done at night—all in one night if practicable. Successive parallels are thus established and pushed as close to the enemy's works as his fire will permit. Meantime the operations are covered and the fortress damaged as much as possible by a practically continuous bombardment. From the last parallel mines are driven forward to demolish the works. The enemy will oppose these operations with fire, by sorties of the garrison and by countermining operations against the besiegers' works. A breach in the fortress having been effected by bombardment and by mining, the besieger delivers an assault from the last parallel, supported by the fire of his artillery.

The various means for reducing a fortress, therefore, are:

(a) Starvation as to ammunition, food supplies, etc.

(b) Demolition of the works by the fire of large caliber guns and by mining.

(c) Assault of the works from a trench or "parallel" established as close as practicable.

These methods may be employed singly or in combination, depending upon the strategical situation, the purpose in view and the circumstances of the case. Successful assault will usually, however, be impracticable without a previous bombardment.

[*Mobilization of the nation's material resources will be the subject of Major Bond's next article.*—Editor.]

Master Piles Eliminate Rangers in Deep Steel Sheet-Pile Trench

Staten Island End of Narrows Siphon, New York City, Built Under Water Near Existing Structures in Specially-Designed Open Trench

THE necessity for excavating a deep trench close to an existing pier in connecting the Staten Island end of the water supply siphon across the Narrows in New York Harbor to the work in Arrietta Street created an unusual problem that was solved by a submarine trench constructed without waling through the use of a novel design of steel sheet-piles.

The Narrows siphon, a 36-in. cast-iron flexible-joint pipe line which will carry Catskill water from Brooklyn to Staten Island, as described in the Engineering Record of Dec. 19, 1914, page 656, was laid by a derrick scow equipped with a special skidway on which the joints were made above water and down which the pipe slid into a dredged trench as the derrick scow progressed across the Narrows. It is planned to slide the end section of the line, connecting to the main in Arrietta Street, down a skidway in the same manner, but, owing to existing water-front improvements, a channel could not be dredged to accommodate the boat which laid the rest of the line. At the same time, to keep the pipe out of harm's way, deep excavation was required up to the Staten Island bulkhead line, alongside of an existing box sewer and close to the pile-supported warehouse of the American Dock Company. Open trench construction, with steel sheet piling to retain the dirt, and a skidway supported from the piling down which this section of the pipe line could be slid as it was assembled and calked on shore, was decided on. It was thought best to make the closing joint with divers, to avoid pumping a closed cofferdam including the end of the line already laid, as the outer end of such a cofferdam would have been in deep water under more than 50 ft. head, which would have made its construction and maintenance costly. At the same time, if the structure were not to be pumped, it was realized that to place ordinary waling and bracing (to resist the earth pressure) under water with sufficient accuracy to permit laying the skidway on an even grade would be most difficult.

MASTER PILE CONSTRUCTION DEVELOPED

This difficulty was overcome by supporting the steel sheeting in a series of arcs from master piles, which are braced against each other across the trench by timber struts. These struts rest on shelf angles, bolted by divers to the master piles after driving. The stress produced by earth pressure between the master piles is transmitted to them through the interlocks of the standard sheet piles making up the trench wall. This arrangement, shown in the accompanying drawing, not only made possible the construction of the skidway to an accurate grade, but facilitated dredging out the trench, because digging could be done against the sheeting, handling the bucket at high speed without fear of ripping out the bracing.

DESIGN OF SHEET PILING

The accepted design of sheeting for the trench called for pairs of steel master piles, from 35 to 65 ft. long, driven 15 ft. apart in line with the trench. The intervening bays were formed of interlocking steel sheet piles driven on arcs with a 2-ft. ordinate. Between each pair of master piles the wooden cross struts were located at such intervals that if any strut were accidentally displaced its neighbors and the master piles would not be over-strained. The lateral pressure at the toe was taken care of by a similar strut placed below the pipe-line grade, both master piles and sheet piles extending 9 ft. below the excavation to protect the bottom. Wedges were placed at the ends of each bottom strut, the pipe cradle being suspended from the next strut above, so that upon completion of the pipe laying these wedges could be withdrawn and the master piles pulled without disturbing the pipe.

In the out-shore bays the outside material slopes down to within about 20 ft. of pipe-line grade and the difference in longitudinal pull due to its decreasing pressure is taken up by a pair of longitudinal timbers placed outside the master piles as close to the bottom as possible. East of the last master pile the interlocking sheet piles are driven flaring outward so as to breast sufficient material to resist the final longitudinal pull. In the westerly bays the friction of the outside material and two lines of shallow sheet piles extending beyond the first pair of master piles compensate for the decreasing longitudinal pull due to the up-slope of the trench at that end.

PRESSURE CONDITIONS ASSUMED

A design for the steel master piles was prepared considering the outside material to act as a fluid, but observation of this material showed an assumed angle of repose of 1 on 2 to be safe if motion were prevented. The adopted design was modified correspondingly, the weight of the immersed outside material being taken at 60

A SPECIAL TRAVELER WAS DEVELOPED FOR HANDLING THE LONG SHEET PILE SECTIONS ON THE NARROWS SIPHON OF THE CATSKILL AQUEDUCT—SOME OF THE MASTER PILES WEIGHED 4 TONS lb. per cubic foot acting under the Rankine formula for earth pressure. This gave a maximum bending moment on the master piles of about 200,000 ft. lb., a maximum compression on the critical bottom strut of 118,000 lb., and a maximum horizontal tension on the sheet-pile interlocks of 1300 lb. per lin. in. For the master piles 18,000 lb. per sq. in. flange stress and 12,600 lb. rivet shear were allowed, and for the oak struts in compression 820 lb. per sq. in. Below the excavated portion of the trench it was assumed that the material between toes was stiff enough to transmit the pressures on it.

4-Ton Master Piles

The master piles, some of which weigh 4 tons each, have a section modulus of 131 in.,[3] each web being composed of one 12-in. I-beam weighing 50 lb. per lin. ft., the inner flange being a 12-in. channel weighing 25 lb. per lin. ft., and a standard 12½-in. pile weighing 38 lb. per lin. ft., with ball and socket edges bent inward, making up the outer flange. All three elements were riveted together columnwise with ⅞-in. rivets on 3 to 4½-in. centers. The main beam section was selected on account of its thick web, which was designed to resist any eccentric thrust of the cross struts. It was also realized that a chunky section was needed to withstand fabricating strains involved in bending the pile element. The tops were reinforced with heavy ⅝-in. plates to distribute the blow of the driving hammer, and at each point where the 12 x 12-in. struts occurred rivet heads were countersunk on the back of the 12-in. channel, and open holes provided for loose heavy angle brackets, extra holes 3 in. above and below the theoretical location, taking care of possible irregularify in driving. At the top of each master pile was riveted an angle bracket for the reception of a 12 x 12-in. timber cap strut on which to lay track for a traveling pile driver. A pair of 1-in. diameter sway rods in the bent directly beneath stiffen the structure crosswise against vibration. The six easterly pairs of master piles were provided with heavy vertical angles riveted outside the pile element in suitable lengths to receive the 10 x 10-in. longitudinal timbers taking up the differential stresses. Four 1⅜-in. pulling holes were drilled through the web-reinforcing plates in the top of each master pile. All these details were riveted on with vertical projections so as not to impede driving.

The interlocking steel sheet piles in the curved bays between the master piles were of the United States type, 12½ in x 38 lb., weighing about 35 lb. per sq. ft. They varied in length from 32 to 63 ft., the heaviest single piece weighing about 2400 lb. The interlocks of these piles are required to show a strength in tension of not less than 9500 lb. per linear inch. Every alternate pile driven through the deepest material was furnished in two lengths, with splice plates and bolts to facilitate handling without an unnecessarily long boom. These piles were also provided with pulling holes.

At the westerly end of the trench the rising grade of the pipe-line required sheeting not deeper than 24 ft., and here United States interlocking steel sheet piling, 9 in. x 6 lb. per lin. ft. was provided to be braced in the usual way without any master piles. The tops of the master piles are 5 ft. above datum, and the tops of the sheet piles are 3 ft. above datum, it being considered desirable to keep these tops in plain view in order to detect any unforeseen movement beneath.

The construction of the trench and of the pipe line required the use of several new methods and resulted in the development of the special traveler shown in the accompanying photograph. The work will be described in detail in a later article.

Personnel

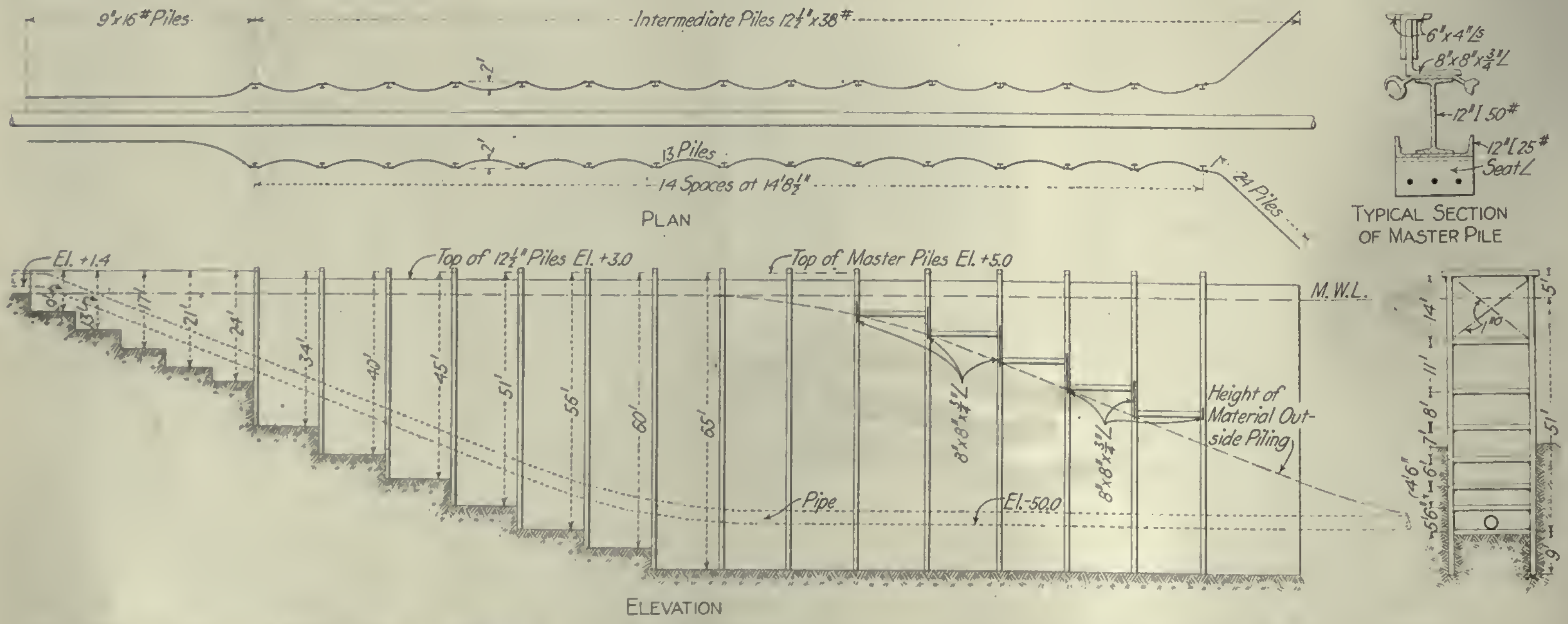
The Merritt & Chapman Derrick & Wrecking Company is building the Narrows siphon for the Board of Water Supply of New York City, of which J. Waldo Smith is chief engineer, Alfred D. Flinn deputy chief engineer, Walter E. Spear department engineer, and John P. Hogan engineer in charge of the division including the work. Edward H. Hopson is in direct charge for the Board of Water Supply as resident engineer on the contract. The construction work was planned by William L. Chapman and Ralph E. Chapman, members of the contracting firm, and is being supervised by the latter, for whom Captain Tooker is in charge at the job. The traveler and skidway were designed by Long & Miller, engineers, of New York City. The steel sheet piling, including the master piles, was furnished by the Carnegie Steel Company, whose New York engineer, Fred T. Llewellyn, is responsible for the general design and details of the steel trench construction. This design was checked by the Board of Water Supply under the direction of Thomas H. Wiggin, its senior designing engineer.

Elm Roots Clog Sewer

A ROW of elm trees 20 ft. distant and parallel to a 6-in. sewer was the cause of the complete stoppage of flow in the line. This sewer was laid in Concordia, Kan., in 1903 and in November, 1915, when it was dug out, the pipe was found filled for a length of 200 ft. with elm roots varying in size from ¼ in. in diameter to the size of a pin. The tile were of the usual vitrified, bell-and-spigot type, and close examination showed that very little attention had been given at the time of construction to making water-tight joints. As a result the elm roots soon entered the sewer through the joints in the pipe and finally destroyed its usefulness as a drain.

ROOTS WHICH BLOCKED SEWER PIPE

The accompanying photograph indicates what a solid mass the roots had formed. It gives sufficient reason, according to Black & Veatch, the consulting engineers of Kansas City making the examination, for those engineers who have made a practice of rigidly inspecting joints in sewers and of insisting that the greatest care be exercised in making these joints.



THE STEEL SHEETING IS SUPPORTED IN A SERIES OF ARCS FROM MASTER PILES, BRACED AGAINST EACH OTHER ACROSS TRENCH BY TIMBER STRUTS

Dynamite, Oxy-Acetylene, Fire and Cranes Required to Wreck Concrete Bins

1000-Ton Structure Falls 12 Ft. on Edge Without Apparent Damage—Reinforcing Nullified Effect of Blasts in Supporting Columns

DYNAMITE, oxy-acetylene torches, fire and wrecking cranes were employed successively in razing five tall, thin-walled, reinforced-concrete, cement storage bins, built fifteen years ago at South Chicago. Heavy charges of dynamite in the supporting columns produced no effect. Oxy-acetylene torches were then employed to cut off the steel rails that reinforced them, the weight being shifted to wood shores. Even the effect of the heat and flames of burning kerosene-soaked shores, roaring up through the barrels of the tanks, apparently had no disintegrating effect, as the structure was not wrecked when it dropped on edge. Wrecking cranes finished the work, starting at the top and pulling the tanks apart in chunks.

SUBJECT TO STEEL MILL GASES

The structure was the stock house of the Universal Portland Cement Company, located on the premises of the Illinois Steel Company. There were four cylindrical tanks and an interspace bin on centers 26 ft. apart at a clear height of 12 ft. above the 3-ft. foundation slab. The tanks were 53½ ft. high, measured to the eaves of the roof, which was 70 ft. above the ground level. The tank walls were 7 in. thick, half way up, and 5 in. the remainder of the distance. The group was designed and built by E. Lee Heidenreich, and was the first of the kind built in America.

WRECKING 15-YEAR-OLD BINS PROVED A SLOW JOB

The wall reinforcement consisted of 1 x 4-in. mesh galvanized Clinton electrically welded wire with the larger percentage of wire vertical in the center of the walls. Alternately, inside and outside, spaced on 4-in. centers, were horizontal round rods ranging from 1 in. in diameter at the bottom to ⅜ in. at the top. These rods were hooked together at the ends.

The conical tank roofs were 2 in. thick, of 1:3½ mortar, and were reinforced with wire fabric, radial and circumferential rods. The thrust of the roof was taken by a 5-in., 13.9-lb. Z-bar band under the eaves. The conical bottom was built with the top of the cone upward and the outlets around the circumference. The bottom was 4 in. thick, reinforced in the same manner at the top.

Each tank was supported by eight struts, those struts on the center lines and diagonal lines between bins being approximately 1 ft. 10 in. x 7 ft. 10 in., and those at other points 1 ft. 10 in. x 3 ft. 5 in. in plan. They were of 1:3:4 concrete, in which were imbedded eight and four 70-lb. steel rails respectively. These rails were banded together and butted against a ½-in. steel plate at top and bottom.

TWELVE-FOOT FALL DAMAGES TOP COURSE

BOTTOM INCLOSED BY CURTAIN WALL

The lower part of the structure was inclosed with a 1-in. curtain wall reinforced with 1 x 4-in. wire fabric. The elevator boot and head house were of steel construction and supported Monier siding reinforced-concrete plates 2 x 5 ft. x ⅝ in. thick. These plates resemble sheet piling in shape, the flange overlapping the steel angle section and top of the plate below.

The foundation of the structure was a flat slab 66 ft. square, reinforced with a grillage of steel rods. This foundation, which was one of the first flat-slab construction in this country, was built upon slag fill

DYNAMITING THE COLUMNS OF NO AVAIL

The original plan was to tip the building over toward west, hoping that it would collapse when falling. Eight holes were drilled in each of the columns, except those on the east side of the building, and loaded with ½ lb. of dynamite to the hole. These loads, however, failed to cause the collapse of the columns. The reinforcing rails were then cut with an oxy-acetylene flame. Before each column was wrecked timber shores were set up to carry the load temporarily.

This done, the wreckers expected that when the columns on the west side were removed the bins would fall. To knock them out a preliminary blast of about 30 lb. of dynamite was fired which did practically no damage. Then 60 lb. was set in, and braces were placed between several shores and the columns that were to be blasted, so that the shores would be knocked out by the explosion. The blast was terrific, but the bins did not fall; in fact, no damage was done to them and the shores were not knocked out.

BURNING THE SHORES DROPPED ONE SIDE ONLY

The next step was to shore around the remaining west columns. Firewood was piled up around all shores and in the interior.

Before resorting to the fire it was necessary to finish the wrecking of the west column, so a crane was brought up and cables were attached to the cut rail sections, which were pulled out, thus leaving the east side columns and the shores holding the tanks. Kerosene was then dashed on the wood and the fire was lighted. It burned for at least 45 min. before the bins fell. The west side dropped 12 ft. to the concrete foundation and the columns under the east side buckled backwards, permitting that side to settle about 3 ft. The bins settled at an angle of about 20 deg. from the vertical and became stable at this position. When they fell the head house was snapped forward, falling through the southwest tank roof, and carrying it with it. A close inspection of the east and north sides showed that the tanks were set upon the base beams and columns without any reinforcement bond. These columns and beams were destroyed when the bins fell. One column remained upright, the bin having slid from it, thus permitting it to puncture the hopper bottom.

60 LB. OF DYNAMITE LEFT TANK STILL STANDING

At this stage the wreckers were but little nearer the completion of their task than at the start and it was evident that some other procedure must be followed.

WRECKING CRANE PULLS TANKS APART

The next and last scheme was to destroy the tanks in small sections starting at the top, so three cranes were rigged for pulling them apart in chunks. The cranes, rigged with 1-in cables, hitched on to the wreck of the head house and pulled, but the cables broke and were replaced with 1½-in. cables. The head house was finally pulled down after one crane was wrecked. With it came part of the roof and the top courses of the west bins. Several broken ends remained. To these the cables were attached and by strenuous pulling the courses formed by successive days' work were torn away. As fast as the concrete was pulled down it was lowered into freight cars and carried away. The structure yielded more readily to this method of attack because the only vertical reinforcement was the wire fabric, and many instances evidenced the fact that little care had been exercised by the builders in securing a good bond between successive days' work. Close examination indicated the excellent conditions of the reinforcing steel.

TANKS SETTLED BACKWARD ON REAR COLUMNS WHEN THEY FELL

EVEN FIRE DID NOT AID IN DESTRUCTION

CONCLUSIONS OF AN OBSERVER

The wrecking of this structure afforded in excellent opportunity of studying the strength of concrete structures and the degree of protection afforded the steel reinforcing by the concrete in which it was imbedded. The conclusion reached by J. W. Lowell, observer for the cement company, brought out these points:

The strength of the structure was no less than marvelous when it is recalled that a shell but 5 and 7 in. thick and 55 ft. high, weighing 2,000,000 lb., fell a distance of 12 ft., landing at an angle and on one edge, was apparently not damaged in the least. This occurred after several hundred pounds of dynamite had been shot in its foundations and supports, each of which caused a sufficient disturbance to rock the structure and which would have demolished an ordinarily constructed building. There was one other extreme condition effective at the same time, and that was the extremely hot fire which roared up through the bins as through a chimney, causing severe stresses due to a very rapid change of probably 300 deg. Fahr. of temperature in less than 45 min.

The reinforced-concrete had been in service for fifteen years under severe conditions of exposure, not only because there was no protection from atmospheric conditions, but also because the structure stood on the lake shore and was located on the premises of a large steel mill, which continually liberates large volumes of gases known to attack steel.

BARS, RAILS AND MESH INTACT AFTER FIFTEEN YEARS

The steel reinforcement was protected by various thicknesses of concrete and cement mortar. The steel rods and mesh in the tank walls were covered with from 2 to 3½ in. of cement mortar. The mesh, which was galvanized, and the rods, which were not, were equally well preserved. There was rust on the rods in places, but the concrete surrounding such spots was not discolored—a point considered sufficient indication that the rust was on the rods before they were embedded. The rails in the pilasters were exactly as they had come from the rail mills, clean and blue, with a thin white film of cement over them. In several places the steel scale on the rails came off with the concrete when it was broken away.

WALLS AND FLOOR BROKE IN LARGE PIECES

The curtain wall surrounding the lower part of the structure was built up of cement mortar with a reinforcing of galvanized wire mesh embedded from ¼ to ½ in. from the outside face. Wherever this embedment was complete there was no sign of rust or disintegration, and this condition was practically uniform throughout.

The most remarkable example of protection offered by the concrete was in the case of the Monier siding plates, which were only ⅝ in. thick and in which the wire fabric in many cases was found to be embedded from ⅛ to ¼ in. This steel was fairly well preserved. There were, however, numerous places where the wire was seriously rusted, indicating that this amount of embedment was not sufficient to give permanent or complete protection. It was noticed that at several places where there were open cracks, both the steel wire and rods had been acted upon and heavily coated with rust. At such places the sides of the cracks were blackened by the atmospheric conditions and the concrete surrounding the steel was discolored by the rust. Several small places where such conditions prevailed were noticed where a complete bond had not been obtained between consecutive courses of concrete. These spots were small, and even though the reinforcement might eventually become damaged at such places, the effect on the structure in general would be negligible.

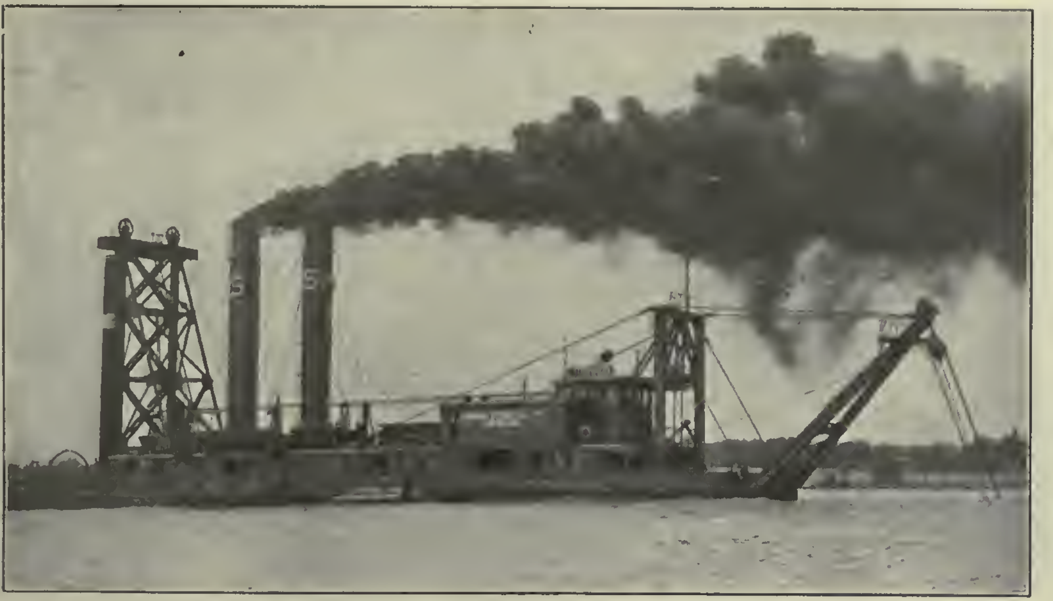
Freight Traffic at Sault Ste. Marie Shows Marked Increase

The total freight traffic at Sault Ste. Marie of 71,290,304 tons for the season of 1915, when compared to that of 1914, shows an increase of 29 per cent, or 15,920,370 tons, according to statistics compiled in the U. S. Canal office at Sault Ste. Marie under the supervision of L. C. Sabin, general superintendent. Individual items showing an increase were wheat, copper, iron ore, lumber and general merchandise.

The passages through both the American and Canadian canals numbered 21,233, an increase of 13 per cent.

The season of navigation continued for a period of about 8¼ months, during which time the average monthly freight traffic was 8,626,827 tons.

The traffic through the American canal was 89 per cent of the total freight, 85 per cent of the total net registered tonnage and 50 per cent of the total passengers.



THIS DREDGE HAS PUMPED AS MUCH AS 1650 YARDS, PLACE MEASUREMENT, IN AN HOUR ON THE TORONTO HARBOR IMPROVEMENT WORK

Large Suction Dredges Depend on High Velocity for Extraordinary Output

Discharges of 38,500 Cu. Yd. Recorded for One Dredge on Toronto Harbor Improvements, Involving 32 Million Yards of Fill

TWO 1700-ton dredge boats are pumping from 12,000 to 38,500 cu. yd. of material apiece daily from the lake and harbor bottom of Toronto to make the 32,000,000-yd. fill required for the harbor improvements now being carried out by that city. In point of capacity, if not of displacement, they are thought to be the largest single dredging units ever operated or built. Though no precedent existed for their design, so successfully was this worked out that the Cyclone, the first one commissioned, ran three weeks without stop from the time steam was first raised in her boilers, and handled in that time half a million yards of material. These dredges depend for their tremendous output and their success in handling heavy material and small boulders on high velocity of flow rather than on large-sized suction and discharge lines. Their main centrifugal pumps, with a shaft speed of from 210 to 225 r.p.m., impart a velocity of from 15 to 18 ft. per second to the stream as it leaves the fan casing, maintaining a pressure of 85 lb. per square inch on the discharge line and a vacuum of from 22 to 25 in. on the suction line. Though both lines are but 2 ft. in diameter, an output of 1650 cu. yd. per engine hour has been recorded, and both dredges can maintain an average output of from 1000 to 1200 cu. yd. per engine hour in all material. This efficiency is attained largely through the greater transporting power of the high-velocity stream, which enables the pump to handle a much higher per cent of solids than is usual.

EXTENDED PORT IMPROVEMENT

The comprehensive harbor improvements being carried out at Toronto were described in the Engineering Record of Sept. 19, 1914, page 326, and the general plan published at that time is reproduced herewith. The dredging work so far done has been at the mouth of the Humber River and in Humber Bay, filling the upper curve of the shore at this point; in the eastern channel and at its inner end, and in the channel from the harbor to the turning basin.

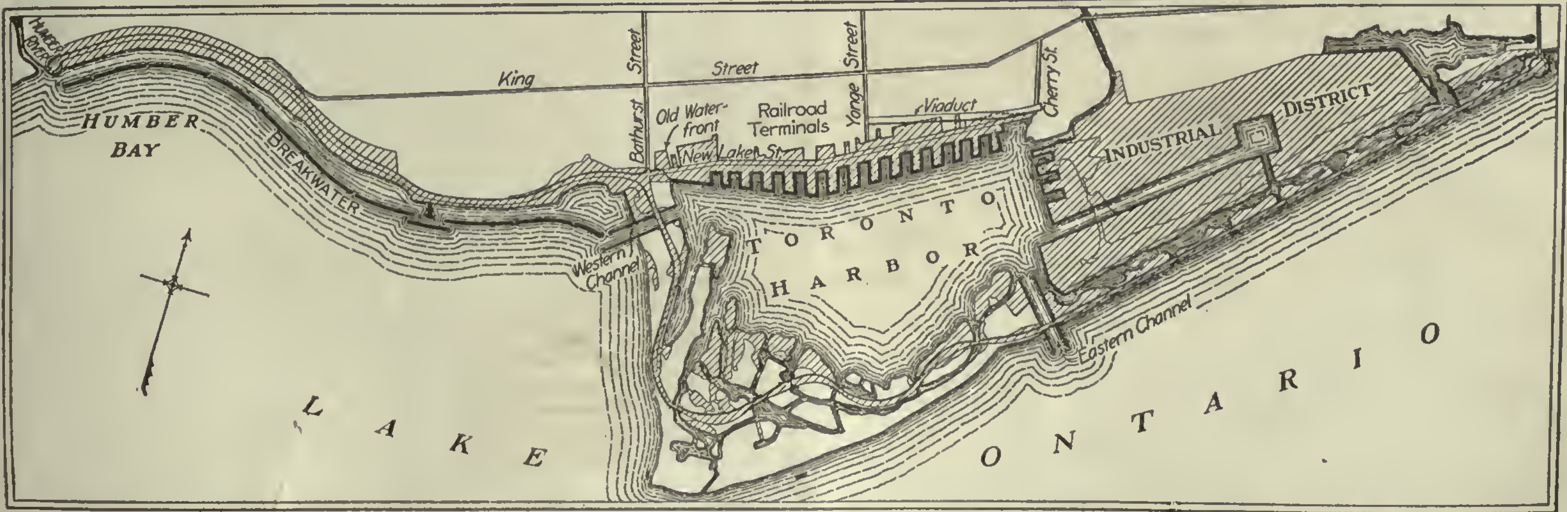
The material dredged at the mouth of the Humber River consisted of gravel and boulders up to a foot in diameter, with which was mixed much peat, some clay and a large quantity of crib work and driftwood. This last clogged the cutter head of the Tornado, which has done all of the dredging at this point, and caused frequent delays to raise the latter so that the timbers could be removed. It was here that the low record of 12,000 yd. for one day's output was made. The other dredge, the Cyclone, and also lately the Tornado, has been digging the more favorable material, largely coarse sand, which makes up the bulk of the dredging. In this much higher average outputs have been maintained.

FEW BENDS IN PIPE LINES

These dredges are designed with a ball joint in the suction line at the top of the ladder, and with a long-radius bend in the discharge connecting the pump to a line carried under the deck to the stern of the dredge, where it joins the floating discharge line. This reduction of frictional resistance is accomplished by setting the main pump with the axis of its fan chamber at right angles to the long axis of the hull, giving a straight lead in a vertical plane for the suction. The tendency in the design of large dredges has been to use a swing joint with two bends at the top of the ladder, and either to set the pump with its fan chamber parallel to the axis of the hull, requiring another bend in the suction, but giving a straight lead for the discharge, or to set the pump as was done in these dredges, requiring four bends in all in the suction and one in the discharge line. The ball joints used on these dredges have proved perfectly tight and are asserted to have given satisfaction in every way.

The hulls, which are shown in the accompanying drawing, are of structural steel. Transverse girders carry the machinery deck, and, through light longitudinal girders, the bottom plates. Lighter transverse girders above support the main deck. Both sets are carried by two main longitudinal girders, or keelsons, and by the gunwales. These girders have solid webs for most of their length. Between them are located the main pump and auxiliary equipment and the four marine boilers. Outside them are the coal bunkers, trimming tanks and storage space for oil. The bulwarks shown were not, of course, put on the hulls until after all of the machinery had been installed. They enable the dredges to stay out in moderately bad weather, although the boats must seek shelter in heavy storms. They are especially needed because it is the intention to use the boats on the Atlantic coast after the work at Toronto is finished.

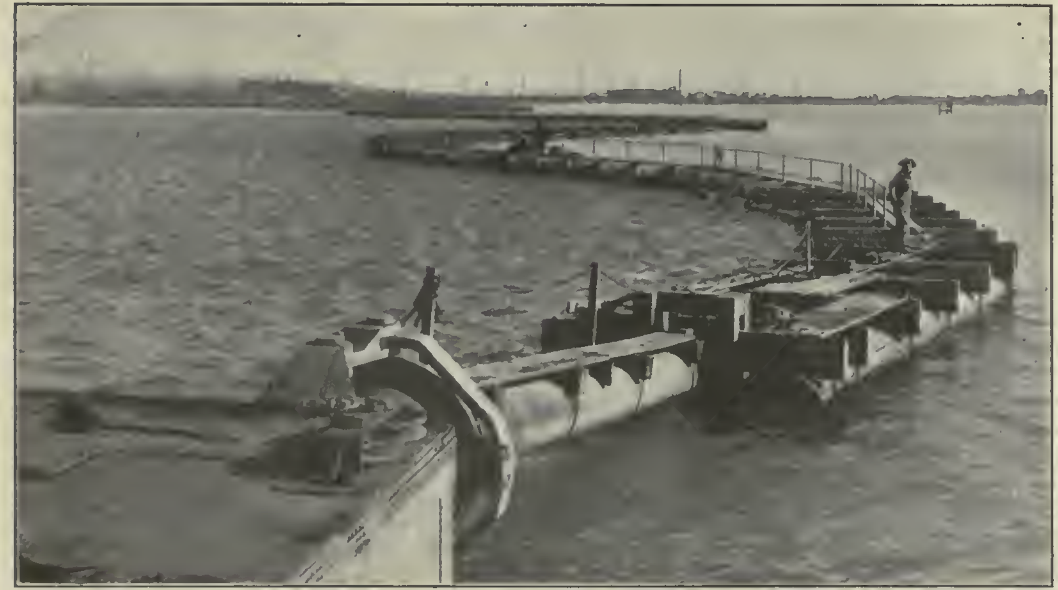
The main pumping engine is a triple-ex-



FIRST DREDGING WORK ON 32,000,000-YARD IMPROVEMENT DONE AT MOUTH OF HUMBER, IN HARBOR AND IN CHANNEL TO TURNING BASIN

MAN WHO HANDLES DREDGE KNOWS BY GAGE BOARD AND "FEEL" OF HOISTING LINES WHEN DISCHARGE A MILE AWAY CARRIES RIGHT PER CENT OF SOLID

pansion vertical unit of 1750 h.p., 18¼ x 28 x 46, with 20¼-in. stroke, operating on 200-lb. steam pressure. It is fitted with a separate condenser from that used for the auxiliary equipment, which makes it possible to maintain a vacuum of 28¼ or 28½ at all times, greatly increasing the efficiency of the engine. The main pump casing has an internal diameter of 11 ft. 10 in., and its 5-ton runner has a diameter of 8 ft. 4 in. Assembled, both weigh 45 tons. The pump casing is lined with removable castings except for the outer ring, which is replaced entire when necessary. That on the Cyclone has had 1½ in. of cast steel worn from its 4-in. thickness after pumping almost 4,000,000 yd. during the past season, and will be renewed this winter. The runners do not wear seriously.



BALL-JOINTED DISCHARGE LINES ARE ANCHORED AT INTERVALS TO REDUCE TENSION

A complete set of spare parts is kept on board each dredge, and all the auxiliary equipment, including the 15-kw. lighting units, is installed in duplicate. A crane spans the engine room to handle heavy parts in making repairs. The four boilers have a combined grate area of 300 sq. ft. and a heating surface of 11,000 sq. ft. They have a working pressure of 225 lb. Three of them are sufficient to operate the dredge, and they are used in rotation, each being idle every fourth week. This surplus equipment has saved a great deal of money, as a few weeks' loss of working time for one dredge represents a sum sufficient to pay for the extra installation.

LADDER REACHES 50-FOOT DEPTH

The ladders on these boats meet the unusual requirements of dredging to a 50-ft. depth. This depth was necessary to obtain enough material to make the enormous fill. The ladders are 85 ft. long, contain 85 tons of structural steel and weigh, complete with cutter, shaft and engine, more than 125 tons. They are made up of two outside girders, with cross diaphragms, which are solid for their upper halves and support the suction pipe, which runs through them below the axis of the ladder. The cutter engine is mounted on the inner end of the ladder. The five-blade cutter head, 8 ft. 6 in. across, is operated through a 9-in. diameter shaft at a speed of 15 r.p.m.

The ladder is 11 ft. 6 in. deep and 12 ft. wide at the dredge, and is hinged on cast-steel trunnions 30 in. in diameter on either side at the back of the ladder well. These trunnions are riveted to the hull, and over them fit horseshoe-shaped cast-steel collars, open at the bottom, which are riveted to either side of the ladder. The ladder is thus held in place only by its own weight, and it is consequently easy to ship and unship. Rubbing strips at the forward end of the ladder well, 16 ft. from the center of the trunnions, correspond with inclined stiffener angles on the ladder, and keep the hull and ladder in vertical alignment.

78-FOOT SPUDS

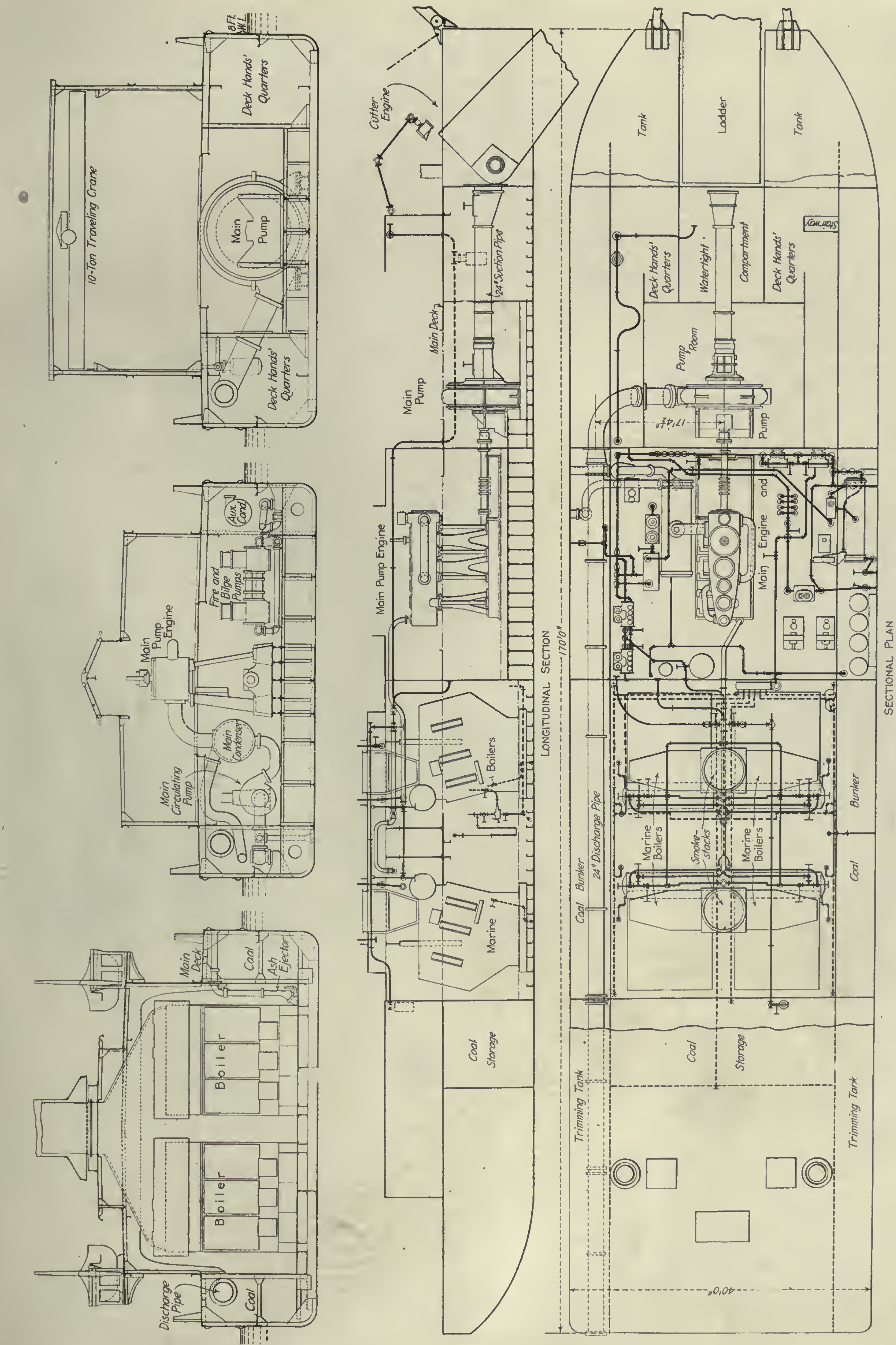
The spud frame, shown on the rear of the boat, supports two 78-ft. spuds. Each is made of a single stick of fir 42 in. in diameter, shod with a 10-ton cast point. The two spud engines have 42-in. drums, and the spuds are each handled on a single 1⅜-in. line. As with all the sheaves on these dredges, those on the spud frames are of very large diameter. It is pointed out that the saving in wire rope through having sheaves of the proper size on a big dredge, where many thousand feet are in constant service, is very appreciable.

On these spud engines, as on all the rest of the machinery, all castings are of steel. The only wood on the boats is in some of the fittings of the operating cabs. The main floors are of cement and composition rubber, and everything has been detailed so that it is easy to keep the boats as clean as the best installed permanent power plants. This not only prolongs the life of the boats, but is said to exert a distinct influence on the class of men it is possible to hold, and on their attitude toward the work.

PIPE LINES EASILY MOVED

The floating part of the discharge lines is made up of 60 and 90-ft. lengths of lap-welded pipe of ½-in. metal, mounted on steel pontoons, and connected with pressure-tight cast-steel ball joints. The line was designed and its units were built at the site by the contractor. In use it trails behind the dredge with a little slack, being anchored at intervals to prevent winds or currents from laying hold of a sufficient length of it to subject it to undue stress.

The land pipe line is thought to be a distinct advance over anything used heretofore. It comes in 12-ft. lengths, each readily handled by four men. One end of each length is flared 1 in. for a distance of 1 ft. A pressure-tight joint is made in a few seconds by driving a plain end into a funnel end with a light timber ram. In spite of the skepticism of the dredge captains, these joints did not part under pressure. The secret of their success is said to lie in the selection of the proper thick-



MAIN PUMP LINES HAVE BUT TWO BENDS AND AUXILIARY EQUIPMENT IS INSTALLED IN DUPLICATE; PARTS READILY CHANGED WITH OVERHEAD CRANE ness of metal, which, for a 2-ft. line, is ¼ in. Each line, after it reaches the shore, forks with a two-way valve, so that one discharge can be shifted at a time without shutting down the dredge.

ONE MAN CONTROLS OPERATION

The dredges are operated on the familiar principle of swinging them by side lines around first one spud and then the other. The two side lines pass through sheaves near the outer end of the ladder. They are fastened to anchors which are set a considerable distance ahead of the dredge on either side, and thus do not have to be moved during the day's run. The dredges swing through an arc whose chord is from 225 to 250 ft. The limit of depth for a single cut has not been reached, though 20 to 25-ft. cuts are being made in one operation.

The twenty-one levers controlling the throttles, brakes and frictions of the spud hoists, and the swinging, anchor and ladder hoists, are banked in the operating cab at the forward end of the deck house, and are handled by one man. Before this man are gages showing the vacuum in the suction and the pressure in the discharge line. These tell him as he swings the dredge whether the material is coming too fast or too slow. The "feel" of the tension on the swing lines also gives him a good idea of whether or not he is cutting into the bank too fast.

Each dredge is in charge of a captain with a chief engineer, two assistants, an oiler, a leverman, five firemen and six deck hands for each shift. All of the deck hands are sometimes needed to take care of the floating pipe line. When not so employed, they are loading and passing coal.

All of the men are required to live ashore. A galley is provided and food kept on hand for overtime workers.

The land ends of the pipe lines for each dredge are handled by a foreman and six or seven men. Two powerful electric searchlights with an effective radius of 2700 yd. are mounted on each dredge to illuminate any section of the pipe line which requires attention at night.

The Toronto harbor improvement is being carried out for the Toronto harbor commissioners under the direction of E. L. Cousins, chief engineer, and J. R. Wainwright, assistant chief engineer, by the Canadian Stewart Company, Ltd. C. F. Franson, vice-president of the Stewart Company, has the general direction of the work and designed all of the dredging and other floating equipment.

Cracks in Sioux City's Pavements

In the Engineering Record of March 4 there appeared an article entitled "No Cracks in Sioux City's Concrete Pavements," giving an abstract of a discussion read by the city engineer of Sioux City, T. H. Johnson, before the Second National Conference on Concrete Road Building. The opening sentence conveyed the same idea as the title, in these words: "Not a single cracked section has developed in Sioux City's 1,000,000 sq. yd. of concrete pavement, some of which has been in service 5 years." Mr. Johnson calls the attention of the Engineering Record to the fact that this goes beyond the statement he made. He did not state that there were no cracks in any of the Sioux City pavements, but that there were "continuous miles of it without a single cracked section."

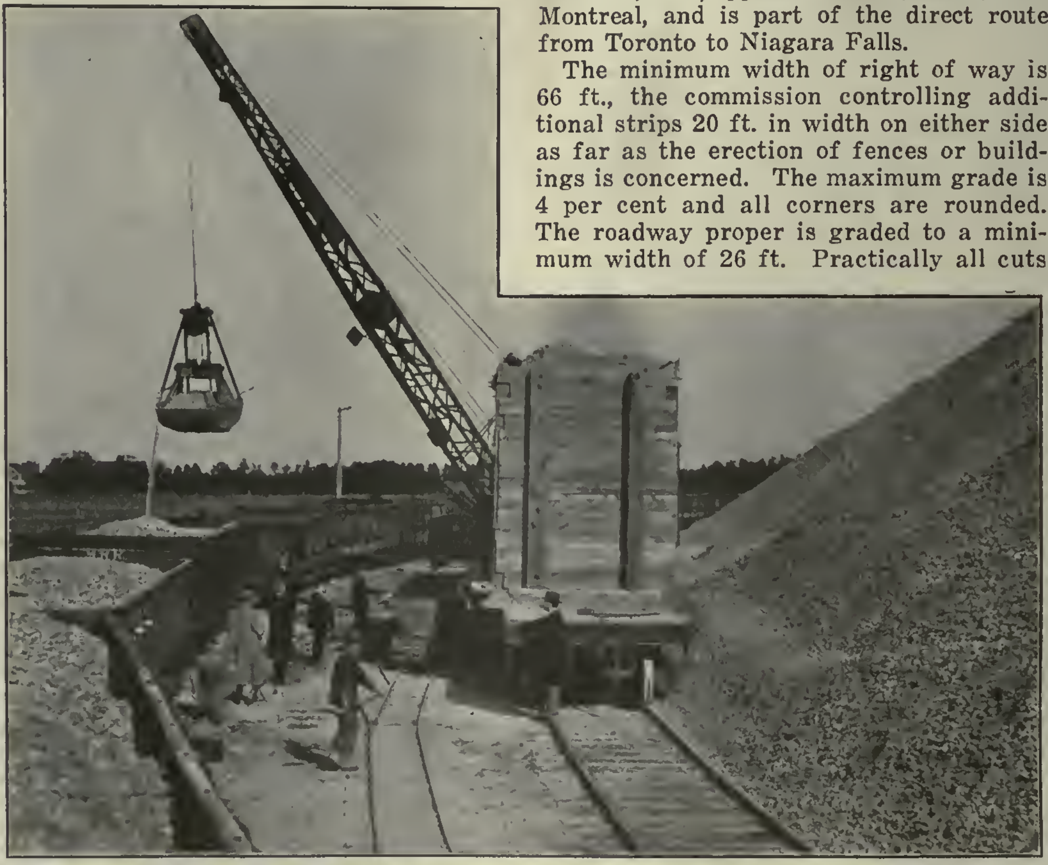
36-Mile Concrete Road, Built by Day Labor, Will Link Canadian Cities

In Toronto-Hamilton Highway Construction Special Methods Were Developed for Handling Concrete Materials—50-Foot Finishing Bridge a Feature

By H. S. VAN SCOYOC

Chief Engineer, Toronto and Hamilton Highway Commission

THE Toronto and Hamilton Highway Commission is joining the two largest cities in Ontario with a 36-mile concrete roadway that will be longer than any other continuous stretch of concrete 18 ft. in width yet completed. The project is being carried through at this time because of industrial conditions that were created at the beginning of the great war in which Canada, as a part of the British Empire, is engaged. In August, 1914, unemployment was a serious problem, more particularly in the larger centers of population. It was felt that the approaching winter would cause much suffering if some form of relief work was not undertaken. Highway construction was suggested as a suitable field, and the Toronto to Hamilton roadway was proposed as the most promising one because many of the municipalities interested in its construction had already expressed a desire to have the work undertaken.



CONCRETE AGGREGATES UNLOADED BY LOCOMOTIVE CRANES AND CLAMSHELLS

CONSTRUCTION BY DAY LABOR

A commisison was appointed Sept. 17, 1914, and was successful in having suitable resolutions passed by the interested municipalities during the succeeding month. Actual construction was begun early in November. It was felt that day labor offered the only satisfactory method of providing work for those in greatest need. So many deserving men sought employment on this work that it was necessary to make frequent changes in the gangs. Work was continued during the winter where the grading was the heaviest. The problem of the unemployed became less acute as summer progressed, and at the present time it is the lack of laborers, rather than lack of work, that is serious.

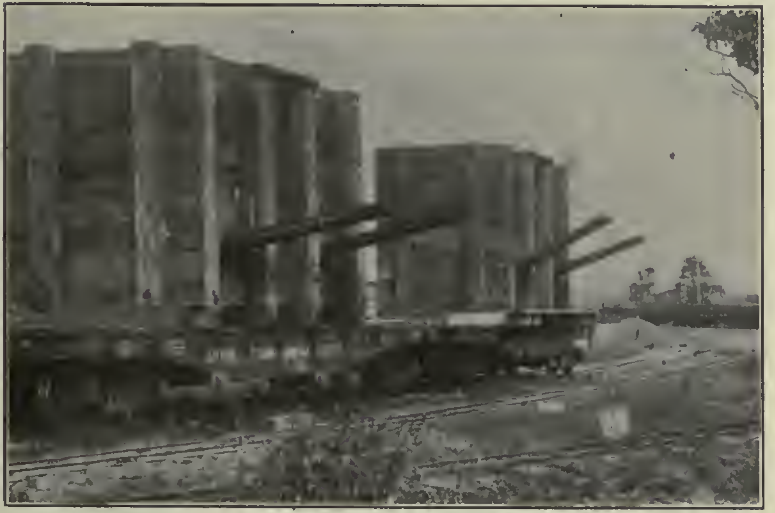
The highway, in general, follows established road allowances, although in some instances diversions have been made to correct alignment or shorten distances. The route chosen skirts the shores of Lake Ontario, passing through one of the most intensely cultivated sections of the Province. The scenic beauty should prove a strong attraction to tourists. It forms what is possibly the most important link in the highway that will eventually join Windsor, Ont., opposite Detroit, Mich., with Montreal, and is part of the direct route from Toronto to Niagara Falls.

The minimum width of right of way is 66 ft., the commission controlling additional strips 20 ft. in width on either side as far as the erection of fences or buildings is concerned. The maximum grade is 4 per cent and all corners are rounded. The roadway proper is graded to a minimum width of 26 ft. Practically all cuts have been taken out to a width of 40 ft. and a width greater than 26 ft., provided on the heavier fills. All structures have been extended or replaced with the exception of bridges spanning four rivers, and it is anticipated that these bridges will be replaced in the near future, as they are not satisfactory for present traffic conditions. The minimum clear width on bridges and culverts constructed or reconstructed is 26 ft. They have been built of plain or reinforced concrete. Reinforced concrete pipe has been used under farm approaches and for the pipe culverts under the roadway proper.

The concrete paving is 18 ft. wide, 6 in. thick at the edges, and 8¼ in. at the center. The crown is parabolic and the subgrade level. The specifications are practically those of the American Concrete Institute, except that the proportions used are 1:1½:3. Cement fine aggregate and coarse aggregate have been carefully inspected. The cement has come from one store-house and was thoroughly sampled before shipments were begun. Additional tests have been made from time to time. The sand has been tested at the pits before being shipped, both as to grading and loam content, and all broken stone has been inspected at the quarry. Test cubes have been made up from the concrete as it has gone into the roadway. They have been subjected to the same curing processes as the roadway itself.

ORGANIZATION AND EXTENT OF WORK

Under the chief engineer the principal heads have been a division engineer and a superintendent of construction. The road has been divided into four sections each with a resident engineer reporting to the division engineer, and a general foreman reporting to the superintendent of construction. From the city limits of Toronto to the city limits of Hamilton the distance is approximately 36 miles, but up to the present time construction has been limited to the 31 miles nearest Hamilton.



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FOR LOADING INDUSTRIAL CARS WITH SAND AND STONE PORTABLE WOODEN BINS WERE USED

In addition to this main highway the scheme includes a secondary road 7200 ft. long on which the concrete is 9 ft. in width. A portion of the main highway in the town of Oakville has been paved with concrete to a width of 50 ft. in the business section and 30 ft. in the residential section.

It was planned originally to distribute the materials from three yards which would have divided the distances equally and given an average haul of a little more than three miles. Delays made more distributing points desirable, however, and five sidings have been used.

EQUIPMENT

In the larger yards the unloading has been done by locomtive cranes and clamshell buckets. At the other points it has been by hand. Practically all of the materials have been hauled by an industrial railway outfit, consisting of three 7½-ton steam locomotives, 110 V-shaped dump cars, each holding 1¼ cu. yd., and about 15½ miles of 24-in. gage sectional track.

The concrete for the roadway has been mixed in five ½-yd. and one 1/3-yd. cube pavers with booms and overturning buckets. Water has been taken from the lake through 2-in. pipes by five triplex pumps driven by 8-hp. gasoline engines. The grading outfit consisted of five rollers, one gasoline tractor, two scarifiers, graders, pick ploughs, rooters, slushers, wheelers, etc.

SPECIAL CONSTRUCTION METHODS

For loading the small cars with sand and stone a special device was used that differs in some respects from those ordinarily employed. Wooden bins having a capacity in excess of one train-load as hauled on the industrial railway, were built on standard gage flat cars of 100,000 lb. capacity. Two were provided for each crane, one for sand and one for stone. Each had two chutes so spaced that two small cars could be loaded at one time, one laborer being able to manipulate both chutes. By this plan two cars were loaded in less than half the time required for loading one car direct from the bucket. It is possible to avoid practically all waste in loading in the yard. The cars can be loaded evenly so that the material is properly distributed on the sub-grade, preventing not only waste but the necessity for handling excess material or the possible delay due to a shortage in delivery. It was possible to spot the bins rather than the cars, which permitted the locomotive to do other work. A train can be loaded without the crane. This is especially advantageous when an extra trip is made, as it is not necessary for the crane runner to work overtime. The plan is of greatest benefit when the number of small cars is limited and the haul short, as the delay in the yard is reduced to a minimum.

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WHERE PAVING WAS 50 FEET WIDE TWO MIXERS WERE USED TO HASTEN CONSTRUCTION

50-FOOT FINISHING BRIDGE

Where the paving was 50 ft. in width a special bridge was constructed. Four 6-in. I-beams were taken from one of the discarded steel bridges and so clamped that the I-beams were free to move in or out. The ends rested on steel rails which were kept well greased, the bridge being easily moved with pinch bars. It was a very satisfactory solution to a rather perplexing problem, as it supported four floaters at no great height above the surface of the pavement.

Where the paving was 50 ft. in width two ½-yd. mixers were worked side by side. The plan was of advantage in that a greater yardage was laid daily than would have been possible with only one machine which would have reduced the length of time that traffic was forbidden in the business section. It was not economical, however, as far as the labor cost per square yard of paving was concerned.

Instead of depending upon a strikeboard for the proper crown, rows of stakes were set across the street at intervals of 6 ft. Two rows were driven with each move of the mixers, as it was found impracticable to set them in advance. This meant quite a loss in mixing time on account of the large gang employed. It would have been more economical under these conditions to have laid the concrete with one mixer working in the center of the street, as the decrease in time lost would have more than paid for the extra cost of distributing the concrete.

It is hoped at the present time to have construction work completed in the early fall.

The division engineer of the Toronto-Hamilton highway is Charles Johnston and the superintendent of construction R. T. Bell. The commission consists of George H. Gooderham, chairman; G. Frank Beer, honorary secretary; Ruben H. Lush, W. S. Davis, M. C. Smith, Hugh Bertram and Controller T. W. Jutten.

Pennsylvania Railroad Employees' Records for 1915 Are Exceptionally Good

In four classes of tests, including obedience to stop signals, not a single failure on the part of any employee of the Pennsylvania Railroad Lines East of Pittsburgh occurred in 1915, the third year in which no passenger has been killed in a train accident on this road. A total of 4,364,519 tests and observations were made to determine how well the train-operating rules were being obeyed and the results show that only one error occurred in 1110 trials, giving a record of 99.9 per cent of absolute perfection. An exceptionally high record was made in the observance of rules intended for the safety and protection of the employees themselves. Accidents to employees were reduced 11 per cent. Only eight failures to follow strictly the rules governing watchmen stationed at grade crossings occurred in 62,934 trials.

PORTABLE CONCRETE PLANT BUILT LOUISVILLE CANAL WALL

Portable Concrete Plant Builds Louisville and Portland Canal Wall

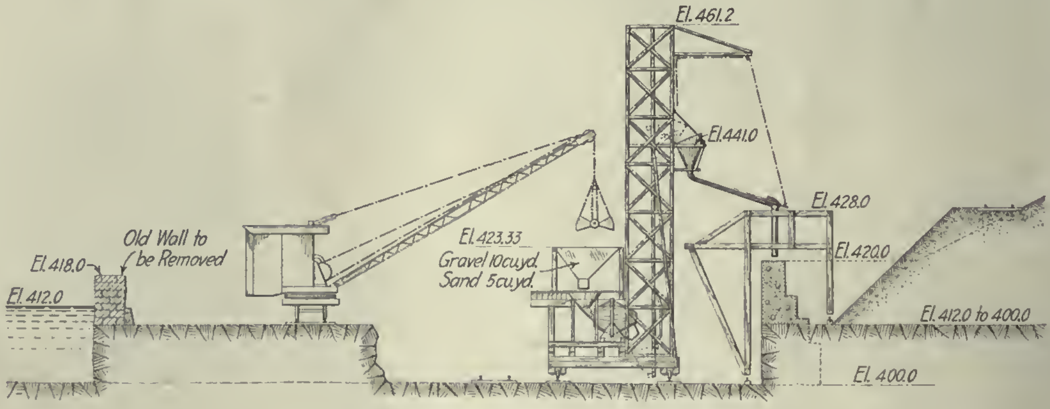
Rock Drilling Experience, Dynamite Trials and Excavation Layout Plans Features in Canal Widening Construction

A PORTABLE concrete plant, fed by a locomotive crane delivering aggregate from the barges paralleling the work into the mixer storage bins, was employed in placing the concrete for the new wall of the widened Louisville and Portland Canal built around the Falls of the Ohio at Louisville, Ky. The work of widening the canal from 90 to 200 ft., construction of new locks, reconstructing the dam to provide a 9-ft. low-water stage and cleaning the basin at the head of the canal, is part of the improvement of the Ohio River from Pittsburgh to Cairo, approved by Congress in 1910. The first items are under contract and the second was described in the Engineering Record of June 26, 1915, page 794. The third and fourth items have been constructed. Work on the widening of the canal began May, 1913, and will be completed by June, 1916, as it was 90 per cent finished March 1.

EXTENT OF NEW WORK

The canal is to be widened from Fifteenth Street to Twenty-sixth Street, the old canal filled and an emergency dam of the Boulé type constructed above the locks. The dam is to be closed in case of accident to the locks. The contract calls for excavating the canal to a width of 200 ft.; constructing a new concrete canal wall and removing the old masonry; constructing a concrete pier for the new bridge over the canal at Eighteenth Street (see the Engineering Record of Aug. 14, 1915, page 199); building concrete foundations for the section of the emergency dam between the old and the new north canal walls; extending the drydock culvert and drainage culverts, and building a retaining wall across the old locks below the guard gates.

Some of the quantities are 770,000 cu. yd. of earth excavation, 205,000 cu. yd. of rock excavation, 550 lin. ft. of drilled bolt holes, 490 cu. yd. of reinforced concrete, 16,951 cu. yd. of plain concrete and 48,300 sq. ft. of channeling; all to be completed in three years.



LOCOMOTIVE CRANES LIFTING AGGREGATE FROM CANAL BOATS TO CONCRETE PLANT

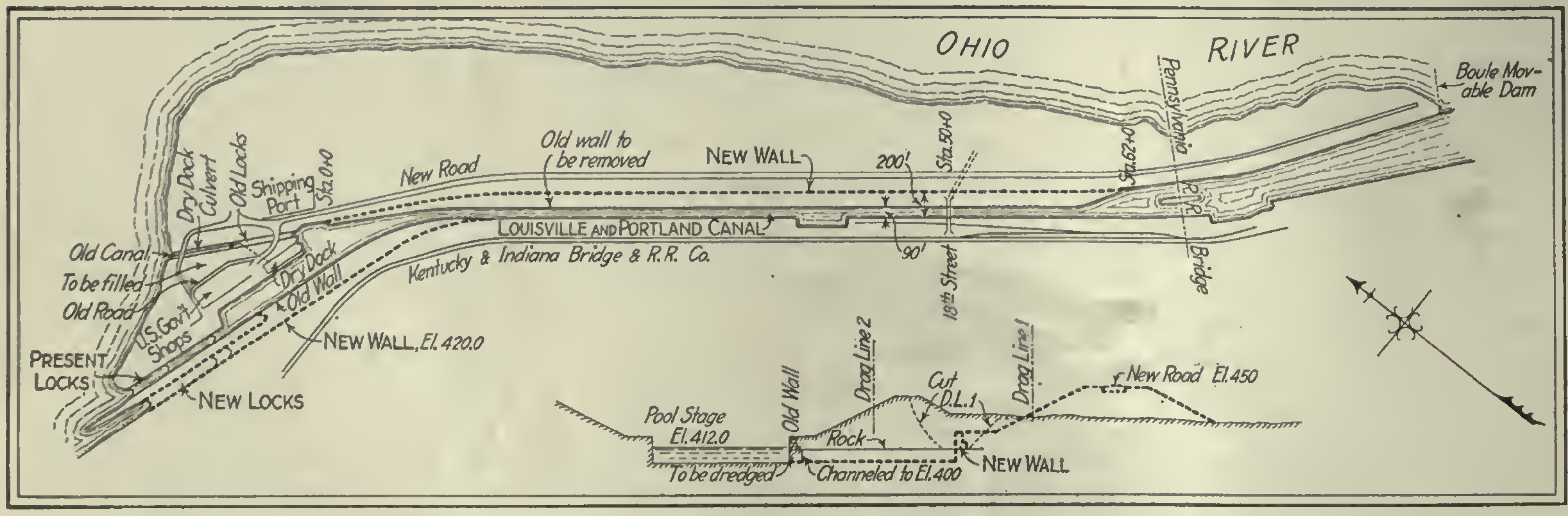
In developing a working plan a contour map on a scale of 40 ft. to the inch was made, and each scheme proposed was studied with the aid of blue line prints of this plan. This investigation quickly showed the advantages and disadvantages of each scheme and aided materially in the selection of equipment. The working plan was for dragline 1 to start at Sta. 59 and work west, making the embankment; dragline 2 was to follow, loading all the surplus on cars, to be disposed of in the new levee from Sta. 59 to 80 and in filling in the old canal. Owing to delays in the erection of the draglines, No. 1 was helped out from Sta. 50 west by Thew shovels and teams, and the Marion shovel loaded some of the surplus east of Sta. 50.

The levee from Sta. 59 east was made from a trestle, the rise from the loading track to the trestle being made on a 3-per-cent grade, easily ascended with four loads. The fill in the old canal was made from a trestle on one side and from the old roadway on the other.

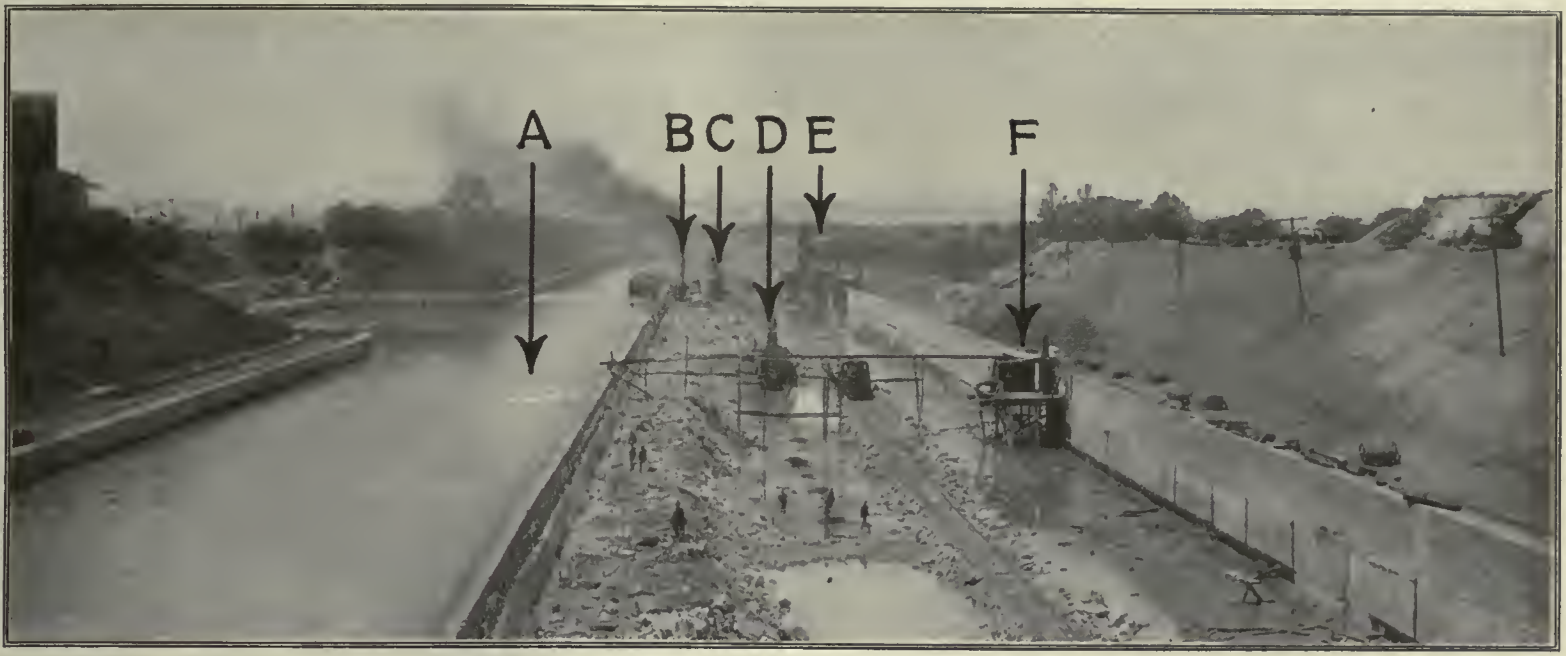
About 15 ft. of earth was left behind the old wall as a cofferdam, but later was removed, as it was found to contain a great deal of rock and was of little value as a dam. A prism also was left behind the new wall to serve as a backfill. After the completion of the new wall this material was pulled down by teams with slip scrapers. The embankment was left 15 per cent high to allow for shrinkage—an amount found to be close to the actual shrinkage when the banks were finally shaped eighteen months later. The slopes were planted with Bermuda grass by the government forces.

ROCK HARD ON DRILLS

The rock work followed behind dragline 2. The ledge consisted of 5 ft. of hard



THE LOUISVILLE AND PORTLAND CANAL IS BEING WIDENED TO 200 FEET



THE NEW LOUISVILLE AND PORTLAND CANAL WILL BE 200 FT. WIDE

From left to right: (a) Old canal. (b) Channeler cutting down rock behind wall to be removed. (c) Locomotive crane feeding. (e) Concrete plant building the new wall. (f) Electric-driven pumping station. (d) Steam shovel loading rock.

limestone over cement rock, which was slightly softer. The rock was difficult to drill and channel, and did not shoot well for shovel work. In chaneling a five-piece drill of 1-in. steel was tried, but found to be worthless. A change was made to a three-piece bit of 1⅛-in. steel, and even with this bit the steel was often broken and bent.

The first work was done with the wagon drill, but the smallest hole that could be drilled was too large to allow a proper distribution of the dynamite. Tripod drills with 3⅝-in. cylinders were substituted; they used hollow steels, through which live steam was forced to muck out the holes. The tripod drills made a hole of 1⅝ in. at the bottom and gave a much better distribution to the dynamite. Steam was furnished by a 60-hp. horizontal boiler and a 40-hp. vertical boiler mounted on a flat car. This car was kept close to the drills so that the steam loss was small. There was practicaly no time lost due to moving the boilers, and the drills could be reset in 7 min.

DRAGLINE REMOVING STRIP BETWEEN COFFERDAM AND CUT NO. 1

MOUNTED BOILERS FED THE FIVE TRIPOD STEAM DRILLS

TRY VARIOUS HOLE SPACINGS

Different spacing of holes was tried, but the best distribution was found to be 7-ft. squares with a hole in the center of the square. All holes were drilled 18 in. below grade, but at times even this depth did not pull the bottom ledge. Between these steam drill holes smaller holes were drilled with air through the limestone ledge to break this ledge and save block holing. The large holes were loaded at the bottom and at the bottom of the limestone ledge, and the small ones were single loaded.

Different strengths of dynamite from 40 to 75 per cent were tried, but it was found that the best results were obtained with the 75 per cent. An average of 0.4 lb. per cubic yard, pit measurement, was required.

The rock was handled by a Marion shovel and disposed of in the levee from station 80 to 84, in riprapping the river slope from Sta. 70 to 80 and in the roadway from Sta. 50 west. The surplus was used in filling the old canal.

Before filling the old canal it was necessary to extend the discharge culvert for the drydock to the river, from a point where it entered the old canal, a distance of 600 ft. The culvert required a cut of 20 ft. through mud deposited from the river. It was a box of reinforced concrete 4 ft. wide by 6 ft. high, resting on the ledge or on piers founded upon the ledge. The cut was very wet, and steel sheet piling was used for a cofferdam at the river and for the ditch some 200 ft. back from the river. The remainder was sheeted with wood.

OLD WALL SERVES AS COFFERDAM

As stated above, it was first intended to leave 15 ft. of earth behind the old canal wall to serve as a cofferdam, but this scheme was abandoned. The first 1000 ft. of wall exposed was backed by a thin slab of concrete to stop the leakage, but the concrete was not found to be very effective and required considerable calking. The remainder was left open and wooden wedges were driven in the weep holes from the back of the wall. The small leaks were stopped by means of a mixture of sawdust, cinders and manure placed on the outside in wooden boxes nailed on long rods. (See the Engineering Record, June 19, 1915, page 785.) These boxes had holes in the bottom and the suction of the water carried the material into the holes and stopped the leaks. The method proved very effective.

Before blasting the last cut next to the old wall the ledge was channeled back of this wall, leaving a strip of from 8 to 12 ft. under the wall to be dredged out. The first section to be dredged extended from Sta. 62 to Sta. 27. At Sta. 27 a cross dam was placed between the old and new walls. It consisted of Lackawanna steel sheet piling tied together with rods and filled with sand and gravel. The material was placed in lifts of about 12 in. and made an effective puddle. When the dam was first unwatered there was a great deal of leakage, but this was gradually checked, and at the end of a week the dam was practically dry.

The pumping plant consisted of three 12-in. centrifugal pumps direct connected to 50-hp. motors. Ordinarily one of these pumps handled all the water. In addition to the pump the contractor constructed a 24-in. sewer from Sta. 0 to the drydock.

Portable Concrete Plant

The new canal wall is of concrete, 4 ft. wide on top and stepped so that the width is approximately 50 per cent of the height. The wall rests on the ledge, the face being flush with the channel cut. It is doweled to the rock with 1-in. square twisted rods spaced on 3½-ft. centers.

The concrete was deposited in alternate monoliths of 40 ft. The concrete plant, as shown in the sketch, was made from old timbers on hand, and, according to the contractor, proved very efficient. The arrangement is simple and few men were required to operate it. The sand and gravel were taken from barges in the canal by a clamshell bucket of the 20-ton Link Belt locomotive crane and placed in the small storage hoppers. From these the aggregates were dropped into the charging hopper and there measured and the cement added; then they were dropped to the 1¼-yd. Smith mixer, hoisted and spouted to place. The batch used was 4 bags of cement, 11 cu. ft. of sand and 24 cu. ft. of gravel. The plant has a capacity of 50 cu. yd. per hour. Both the mixer and the hoist were motor driven and used approximately 40 kw. per 100 cu. yd. of concrete at 1½ cents per kilowatt. This was found to effect a decided saving over steam.

Three sets of Blaw forms holding 7½ cu. yd. each were used and held in place a minimum of fifty hours. The record run was thirty-five sections of 1400 lin. ft. in thirty-five consecutive working days.

Most of the plant was used on a single 8-hour shift. Dragline 1 was on double shift throughout and the entire plant was on double shift during 1914, but it was found that the greater overhead and pumping charges on the single shift were more than offset by the greater output.

Practically the entire plant was bought new for this contract. A portion of it is as follows: Two Lidgerwood-Crawford dragline excavators with 70-ft. booms and 2-yd. Page buckets; one Ingersoll-Rand and one Sullivan duplex channeler; one Ingersoll-Rand wagon drill and five jackhammer drills; five Sullivan tripod drills; twenty-four 12-yd. Western air dump cars; one spreader car; five Porter standard-gage locomotives; one 20-ton Link Belt locomotive crane; one 3800-lb. Monarch pile hammer; three 12-in. Morris centrifugal pumps driven by 50-hp. motors; seven Nye pumps; one 6-in. Buffalo centrifugal pump; one ⅞-yd. Thew shovel; one 1⅛-yd. traction steam shovel; and one Marion steam shovel with 2½-yd. dipper.

The government work at Louisville is under the direction of Major J. C. Oakes, Corps of Engineers, U. S. Army. F. I. Louckes is assistant engineer and R. E. Strecker is junior engineer.

The contractor was the Henry Bickel Company, Louisville, Ky. A. G. Butler is superintendent and engineer in charge.

The subcontract for dredging the old wall was let to the Western Rivers Company, Point Pleasant, W. Va. Mr. Eppling is in charge for this company.

Letters to the Editor

Comment on matters of interest to engineers and contractors will be welcomed

Railway Construction Methods in Australia

SIR: I notice that you have paid me the compliment of including an abstract of my paper on Railway Construction Methods in Australia in your number of Dec. 4, 1915, and commenting on it.

With much that you say I am in accord, but when writing of construction work "started on the heels of the surveyors," I had no intention of suggesting that the location work suffered in consequence. The instances then in my mind occurred in very easy country, where all location problems were easily threshed out more quickly than the center line could be staked and works set out.

Given the same conditions as to quantity and continuity of the work, and freedom to use materials which prove during progress of works to be most economical when both first cost and maintenance are considered, it seems to me that there should be no material difference in costs whether I should build the railways as manager for the Government, or manager for a first-class contracting firm.

After long experience of contractors, both successful and unsuccessful, I find the unit costs of my work for the Government, when put alongside theirs, are certainly not higher.

MAURICE E. KERNOT,
Chief Engineer for Railway Construction, Victorian Railways.

Should There Be Only One Government Survey Bureau?

SIR: For more than one hundred years the United States Government has been engaged in the extension of public surveys. While public land surveys were undertaken some years before the United States Coast and Geodetic Survey was organized, yet the two branches might be said to have developed simultaneously.

The United States Coast and Geodetic Survey has always enjoyed the confidence and respect of scientific men at home and abroad. It has laid a foundation for a complete triangulation network covering the entire country. It has determined with accuracy the elevation of many stations. It has surveyed our coast line and prepared topographic maps of the contiguous country. It has always enjoyed the aid and co-operation of the army and navy officers except in times of war.

Because the work of the United States Coast and Goedetic Survey demands the services of highly-qualified technical men, it has been difficult for the politician to use it as a toy. This element of strength may also have involved an element of weakness insofar as logical growth is concerned. It is unnecessary to say that the politician has been more successful in other branches of public service where surveying has been prominent.

The engineer is anxious to erect his professional monuments so that his successors may have cause to praise him and to support his integrity and his skill. There seems to be no good reason why general public surveys should be conducted by more than one department of the government. The Coast and Geodetic Survey has an enviable record. It has already erected much of the framework upon which all other surveys may be supported.

It would be interesting to engineers, and possibly to law-makers and administrative officers at Washington, to have an expression of opinion from those who are concerned only insofar as they desire this work to be performed in the best possible manner. If good reasons can be given for distributing the work through many departments, regardless of the qualifications of the officers having general supervision, heedless of the cost entailed by the duplication of staffs and equipment and without much consideration of uniformity in methods and limits of error, then, like the lion and the lamb, science and politics must lie down together, awaiting the time when public sentiment, shaped by a more general understanding of conditions, will demand a change.

CLARENCE T. JOHNSTON.
Ann Arbor, Mich.

[The Engineering Record will be glad to publish letters from its readers on this subject. There is much to be said on both sides. —EDITOR.]

Courtesy Is Appreciated

SIR: I wish to call the attention of your readers to the exceptional manner in which the contract letting for the construction of Vermillion County Bond Roads was handled at Danville, Ill., March 14, 15 and 16.

In conversation with the many material men, equipment salesmen and contractors, both successful and unsuccessful at the time of the letting, we found without exception unbounded enthusiasm and outspoken praise for the courtesy shown, the facilities offered and the accommodations for work given by the commissioners and their superintending engineer, P. C. McArdle.

There was no question as to detail of construction, choice of material, description of material, grade, in fact, any engineering information at all that was not furnished at once and fully by the superintending engineer's office. Plans profiles, cross-sections, quantities of work—every item that could possibly come up for investigation—had been thoroughly investigated and the most trivial things were given the same careful attention as the most important.

We feel that in so unusual a matter as the contracting for the construction of the Vermillion County Bond Roads in Illinois, the successful handling to the greater satisfaction of all parties concerned, is a thing to be greatly commended, and in making this statement, we give the opinion, not merely of ourselves, but also the opinion of other contractors who bid on the work, successfully and unsuccessfully, as often expressed to us.

A. W. EISENMAYER, JR.,
Vice President, Granite City Lime & Cement Company, Danville, Ill.

HINTS FOR THE CONTRACTOR

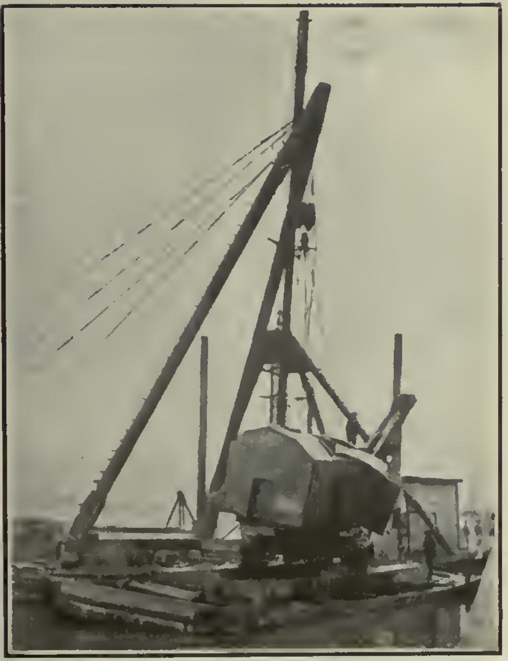
Details Which Save Time and Labor on Construction Work

Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

[*Contributions to this section are solicited, and if found available will be paid for. They must be* SHORT, *and should be accompanied, if possible, by photographs or sketches.*—EDITOR.]

A-Frame on Scows Rescues Steam Shovel from Canal

A heavy A-frame on the head end of two dump scows tied together was recently used in lifting a 35-ton Thew shovel from a flooded portion of the bank-widening work on the Louisville & Portland Canal. The frame was made of 14 x 14-in. timbers with an 18 x 18-in. spud timber base. It was braced securely to the hoppers and tied to the head log of the scows to prevent kicking out. The top was held by four guys, one to each corner. The fall line runs through the outer end boom sheave on the derrick boat, thus taking part of the load off the A-frame. The fall line was of ¾-in. cable with a block of six sheaves, making twelve parts of line in all. The rigging on the scows was counterbalanced by loads in the two rear hoppers and by a dredge dipper and dipper stick that were on the scows for repairs. A government diver hooked the cable slings around the shovel axles at each wheel so that it was picked up nearly level. A barge was run underneath and the shovel placed on it. The four boats were then moved across the canal and the shovel set on the canal wall. The entire job took about four days.



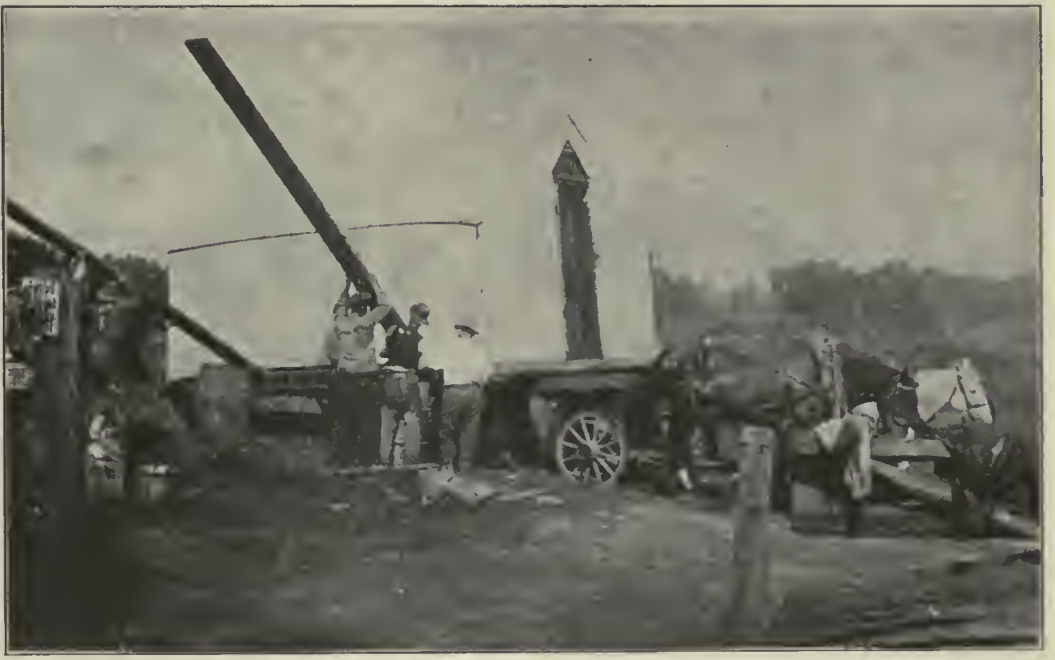
BARGE CARRIES SHOVEL TO BANK

The scows used were each 70 x 20 x 7½ ft., and, when loaded with the shovel, the front ends were 2.8 ft. out of water and the rear ends 5.4 ft. out. The shovel was picked up without an accident of any kind. The contractors in charge have rated the capacity of the outfit at 50 tons.

The outfit was rented from the Western Rivers Company, the sub-contractor taking out the old wall as noted in the Engineering Record on page 794 of the June 26, 1915, issue. Mr. Eppling is their superintendent. The work was carried out for the Henry Bickel Company, general contractors, under the direction of A. G. Butler, superintendent and engineer in charge.

Camp Buildings on Big Road Job Moved Without Being Knocked Down

At one time during the summer of 1914 more than 1000 laborers were employed on the Toronto to Hamilton highway, described on page 520 of this issue. Most of them were fed and housed by the highway commission. The location of camps was changed as the work progressed. Some of the camp buildings were moved without being knocked down, as shown in the accompanying photograph. In one instance the cookery was loaded on skids and hauled to the new location by a gasoline tractor without even taking down the range, the cook preparing a meal en route.



HOW CAMP BUILDINGS ON TORONTO-HAMILTON HIGHWAY WERE MOVED

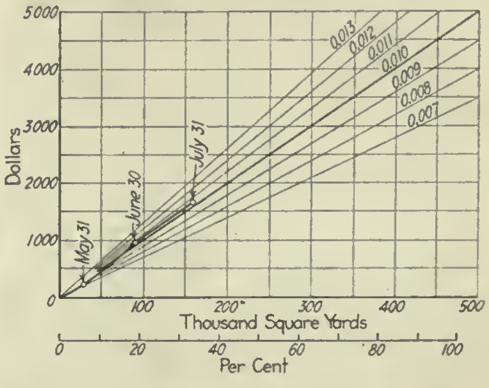
Motion Pictures Hold Lumberjacks in Northern Woods

Motion pictures, shown with a nightly change of program, have enabled the Guerney Lumber Company in Wisconsin to hold steady crews at their camps near Ashland, where formerly the end of a month seldom found more than a man or two at work who had started the month. The lumberjacks would go to the cities, "blow in" their roll and then seek employment at another camp. The motion picture idea was suggested, according to the National Lumber Manufacturers Association, by one of the office employees of the concern. There had been so much trouble in holding men that the company secured an outfit and an operator and gave the plan an immediate trial. A small admission price is charged, which the men are more than glad to pay, and the little show hall is crowded every night and Sunday afternoon with lumberjacks who do not go to town and fail to return next day. The idea has been so successful that several other companies expect to try it in the near future.

Charts Show Monthly Progress and Expenditure on Road Work

By H. S. VAN SCOYOC
Chief Engineer, Toronto-Hamilton Highway Commission

A graphic method of comparing preliminary estimotes with actual monthly results has been found of value in day labor work on the Toronto-Hamilton concrete highway construction. It should be of equal interest to contractors. The vertical divisions on the accompanying diagram represent quantities, the horizontal ones costs. The heavy diagonal line is the estimated unit cost, and the other diagonal lines correspond to unit costs slightly higher and lower than the one used. They serve as the scale by which the monthly results can be interpreted. The scale at the bottom shows the total estimated quantity as well as the percentage completed at the end of each month. Where a def-



MONTHLY PROGRESS AND EXPENDITURE CHART

inite rate of progress has been anticipated this information should be added. The particular sheet shown is for rolling, but similar sheets are used for each item appearing in the preliminary estimate.

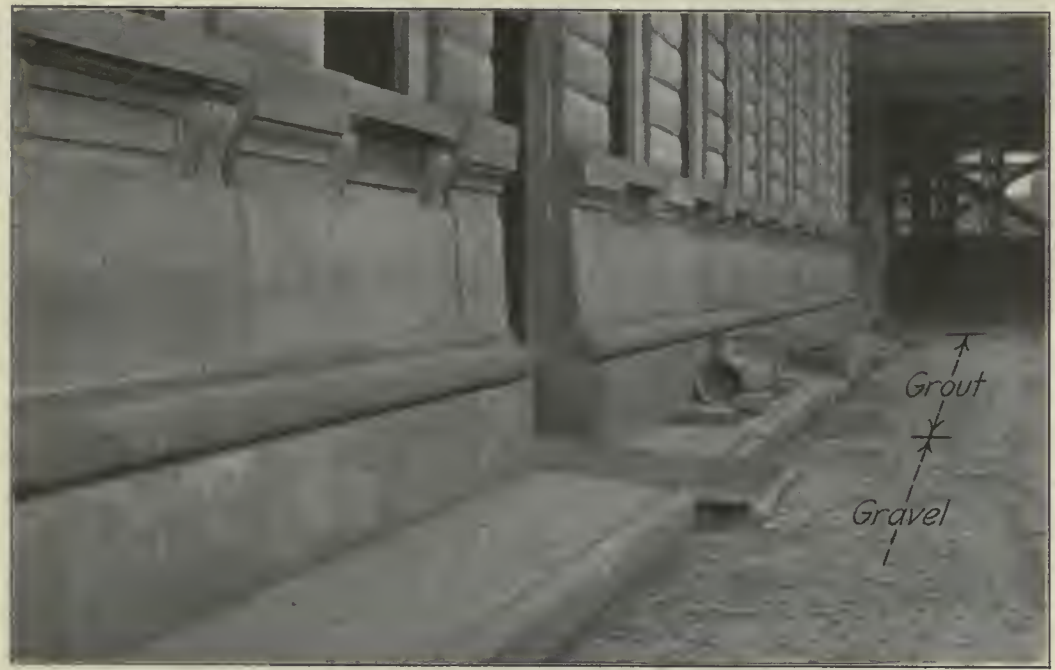
Pipe Wrench Can Be Made from a Chain and Crowbar

By JOHN G. BAILHACLY
San Francisco, Cal.

A HANDY pipe wrench can be made in an emergency on jobs where such a tool is not readily available from a chain and a crowbar. It can be used to advantage on pipes ranging in size from 6 to 8 in.

The bar is set up at an angle, through a knot in the chain, on top of the pipe. The chain is then passed under the pipe, around the lower end of the bar and back under the pipe, then wrapped twice around the pipe. The free end of the chain is held and the bar is pulled in the direction it is desired to turn the pipe. This tightens it to a fast grip and the pipe will turn with bar. When the bar is pulled back about 60 deg. it is moved forward for another turn, at the same time pulling hard on free end of chain and sliding it back to the original position without allowing enough slack in it to allow the loop around the bottom of bar to slip off. If the chain is of too large a diameter, there may be a tendency to slip, but this may always be overcome by taking additional wraps around the pipe.

One man can handle the wrench, but it is better to have two. The resistance against slipping is so great that there is very little pull on the end of the chain that is held in the hand.



SETTLEMENT OF STREET OVER TUNNEL STOPPED WHEN GRAVEL WAS USED

Gravel Proves Superior to Grout on New York Tunnel Work

GRAVEL, forced outside the cast-iron lining of the various subway tunnels being driven by the shield method in New York City on the work of the Flinn-O'Rourke Company, Inc., has prevented visible settlement of the street surfaces and light structures under which the tunnels have been carried. The gravel is blown through the grout holes in the lining rings by the use of compressed air, in a manner similar to that in which a sand blast is obtained in the ordinary operation of cleaning the fronts of stone buildings.

The gravel used is of two sizes, bird sand and grits, the latter being the larger, and averages about ⅛ in. in diameter, the bird sand being of about one-half that size. The mixture is both dense and compact.

In the shield driven tunnels that have been built heretofore grout was used for the purpose of filling the space outside the tunnel lining, which is 6 in. smaller in diameter than the shield. The operation usually takes place 50 ft. or more behind the tail of the shield, in consequence of the readiness with which the grout would otherwise flow over the cast-iron lining into the shield. The gravel, being a solid substance, can be blown into the grout holes immediately in the rear of the shield so that as fast as the shield moves forward the space all around the cast-iron lining can be filled with the gravel before the overlying ground has had time to settle into the space vacated by the shield. In the nature of things the grout has never been satisfactory because of the settlement taking place in advance of the grouting and the fact that, as grout requires several hours to harden, the material can settle into it.

The experience in former tunnels in New York and Brooklyn with the use of grout indicates that under pressure it escapes in all directions through the sand and does not fill the voids left by the tail of the shield. The gravel cannot get away in this manner and seems to completely fill all voids. The accompanying photograph shows plainly the settlement of the street and curb over a grouted section of tunnel and the perfect grade of the street and curb over a section where the gravel was used. The break in the curb corresponds to the ring through which the first gravel was shot. The photographs were taken in Old Slip, Manhattan.

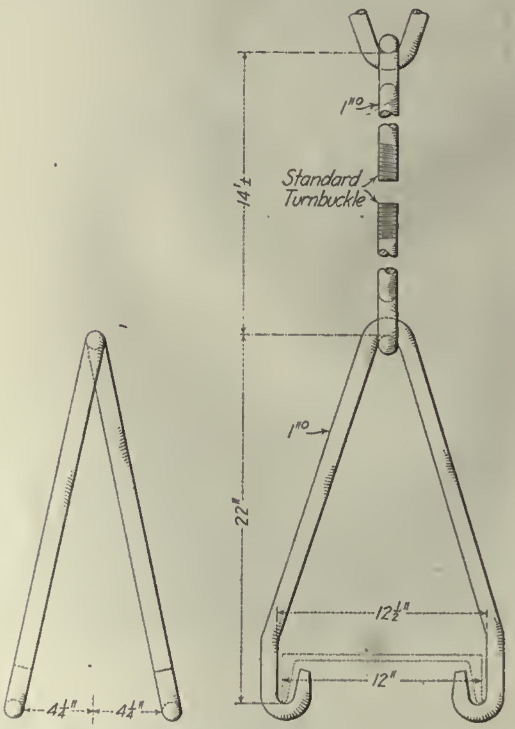
As the contracts with the Public Service Commission were drawn before this method was originated and provided definitely for grouting outside the lining, this is done also, the grout machines following a short distance behind the gravel injector. But for this clause it is thought that grout would hardly be required in addition to the gravel.

In addition to the use of gravel around the tunnel in Old Slip, the same method has been employed in Brooklyn over the Interborough tunnels on Clark Street, and over the New York Municipal Railway tunnels in Montague and Willoughby Streets, with the same success in preventing settlement of the streets or buildings. When the trouble experienced in driving the Interborough Railway Company's tunnels up Joralemon Street is remembered, the importance of the new method is evident. At that time Joralemon Street was completely wrecked and many of the buildings had to be rebuilt. use are being driven by the Flinn-O'Rourke Company, Inc., of which George H. Flinn is president, and Major John F. O'Rourke, vice-president and general manager, for the Public Service Commission, of which Alfred Craven is chief engineer and Robert Ridgway engineer of subway construction. Michael L. Quinn is general superintendent for the contractor.

Fishhook Ties for Sheet Pile Trench

THE fishhooks, so-called, shown in the accompanying sketch, are made so that they could be easily placed by divers on the master piles of the steel sheet pile trench described on page 513 of this issue. They are slipped over the channel face of the pile and then turned till they engage the channel flanges. After a pair of them are connected with a turnbuckle and tightened they cannot come off.

This trench, in which is being made the shore connection of the Staten Island end of the Narrows siphon under New York Bay, has a flared mouth which collects waves in an onshore wind. Under some conditions these waves have piled up until there was a head of several feet on the inside of the trench. Rather than trust to the cross struts, which could only act in tension through the bolts in their ends holding them to the seat angles, these ties were used.



FISHHOOK TIES FOR SHEET PILE TRENCH

The work is being done under the direction of Ralph E. Chapman of the Merritt & Chapman Derrick & Wrecking Company, the contractors, with Captain Tooker in charge.

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

Scouring Out of Abutment Foundation Causes Bridge Failure

Bridge Abutment at Alpena, Mich., Built on Blue Clay and Gravel with No Piling Is Destroyed by Thunder River Floods

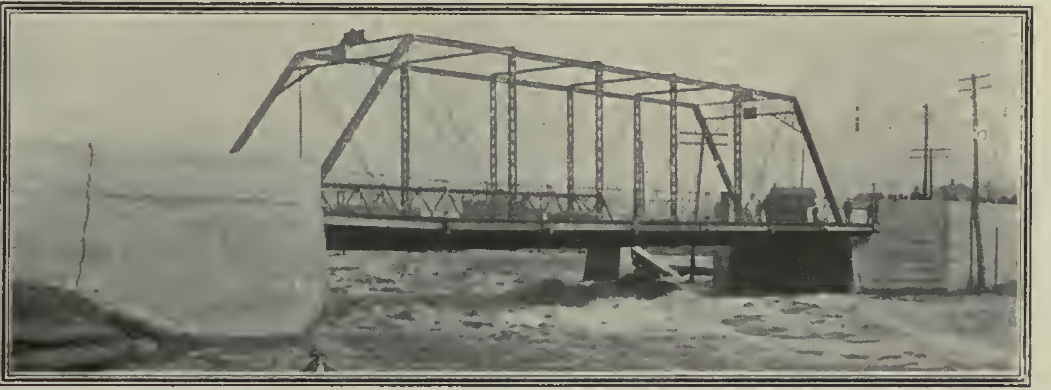
The concrete abutment of a bridge over Thunder River at Alpena, Mich., which had withstood the floods of 27 years, was almost completely destroyed April 2, when an unprecedented discharge of 10,000 sec-ft. was reached. Investigation has shown that the foundation for the abutment was carried down only 2½ ft. below low water mark and was built on a mixture of gravel and blue clay with no piling.

The first indication of failure occurred Saturday, April 1, in the shape of a slight settlement of the abutment and a crack in the concrete retaining walls along the approach, as shown in the top picture. The next morning, April 2, the water washed out the earth filling and the end of the bridge settled about 2 ft., as shown in the picture to the left. About 6.30 p. m., April 2, the abutment and bridge suddenly toppled into the river and by the next morning the approach walls had collapsed.

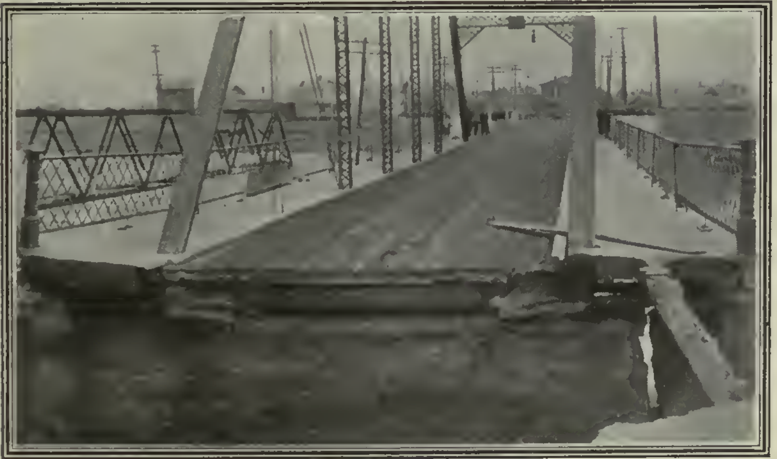
According to H. G. Roby, hydraulic engineer, of Alpena, Mich., the foundations were not carried down to a depth sufficiently great to give a firm footing, and the scouring section of the river became great enough to overcome the narrow margin of safety with which the abutments were constructed.

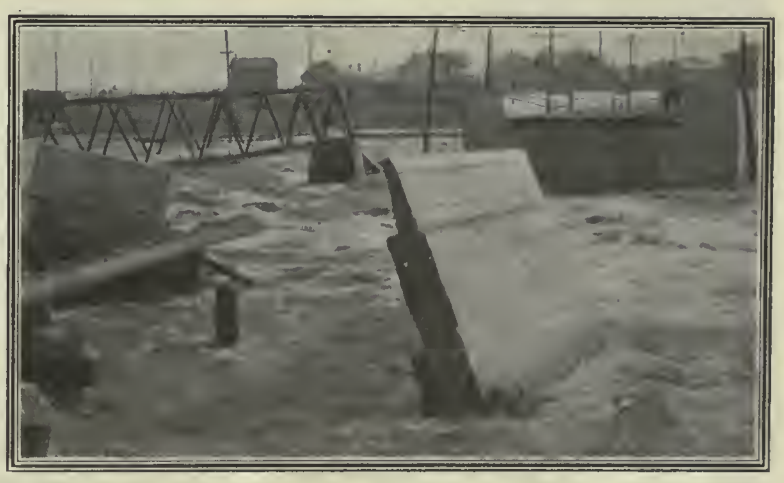
During the 27 years the bridge had been in service, floods up to 7000 sec.-ft. had no effect on the abutments. The head on a dam about 400 ft. upstream from the bridge was raised to a maximum of 16 ft. and seven 14-ft. wide tainter gates were open at the time the abutment started to fail. The velocity of the water, as it passed the bridge, was about 12 ft. per second and the direction of the current was diagonally against the abutment which failed. Mr. Roby supplied the information and the pictures of this dam.

THE FIRST INDICATION OF FAILURE WAS THE CRACK IN THE CONCRETE RETAINING WALLS WHICH IS PLAINLY SHOWN IN THE UPPER PICTURE. THIS HAPPENED SATURDAY, APRIL 1



ON APRIL 2 THE BRIDGE SETTLED 2 FEET, AS SHOWN IN THE LOWER LEFT PICTURE, AND THE COMPLETE FAILURE THAT NIGHT IS SHOWN IN THE LOWER RIGHT ILLUSTRATION





St. Louis Engineers Question American Society's Removal

At a meeting of the St. Louis Association of members of the American Society of Civil Engineers held April 3, a resolution was adopted which stated that the communication from the board of direction of the society set forth, in adequate terms, the advantages of accepting the invitation to remove the society's headquarters to the Engineering Building, but did not include objections thereto.

In the opinion of many of the St. Louis members, the objections to the removal, if they exist, should have received as much publicity as was given the advantages.

The St. Louis members commended Col. J. A. Ockerson for giving expression to some of the objections to the removal and voted their appreciation of the work he has done for the society.

Pasadena, Cal., Plans Sewage Disposal Plant to Cost $319,172

After nearly a year's time spent in studying the sewage disposal problems of Pasadena, South Pasadena and Alhambra, Cal., the board of engineers of the three cities has recommended the installation of a plant the estimated cost of which is $319,172. Pasadena's share of the expense is put at $212,247, South Pasadena's at $53,430, and Alhambra's at $53,495. The operating expenses will be approximately $5,400 a year, which allows for a chemist and three attendants.

The engineers investigated the possibility of turning the sewage into the ocean, but this was not feasible on account of the high cost of building so long a sewer and the necessity for treatment before the effluent could be turned into the sea.

New York May Save Over $1,000,000 on City Repairs

Combining New York City's 71 Repair Shops Will Eliminate Present Costly Duplication of Equipment and Labor

By consolidating the seventy-one repair shops now being operated by New York City and giving the head of the new department jurisdiction and control over the management and maintenance of the Brooklyn bridge, operation of the railroad on the bridge, collection of fares and tolls, and construction repair, maintenance, and management of all other bridges in the city, John R. Keefe, chief of the bureau of repairs, estimates a saving of over $1,000,000 a year can be made. The bill to effect this reorganization of the present bridge department under the title of department of plant and structures was recently presented to the Senate, at Albany, and its passage will mean the elimination of much of the present duplication in machinery, buildings and labor. Robert Adamson, fire commissioner of New York City, is said to have made the report to Mayor Mitchell which resulted in the action now being taken.

The bill also provides that the board of estimate may transfer all of the work in connection with the construction maintenance, upkeep, and repair of buildings and structures, the repair of boats, vehicles, apparatus and equipment, to the department of plant and structures.

A possible location for the proposed new building is at the eastern end of the Queensborough bridge. The cost of the building and site would be approximately $1,500,000, much of which could be offset by selling some of the present buildings and grounds.

Under the system now employed, 71 repair shops, superintended by 14 different commissioners, are in operation in different parts of the city at an annual cost of $4,022,394. Many of these shops do the same kind of repair work and few of them are said to be suitably housed or equipped. Each shop having its own machinery, employees and trucks, there is, necessarily, much duplication in equipment and labor as well as a waste of space.

The system under consideration will mean one central repair shop whose annual operating expense will be $2,987,868—just $1,034,526 less than the present cost. Only one set of mechanics and their machinery will be required to handle each class of work; the new machinery will be better protected in a suitable structure; trucks will travel definite routes which will not overlap, and a central stock room will eliminate carrying of supplies at several points. The number of employees necessary under the proposed plan is estimated to be 2500, which is approximately 25 per cent of the number now employed.

New York's West Side Improvement Plans Now on Exhibition

A set of forty-four plans covering the general features of so-called West Side improvement of the New York Central Railroad in New York City has been completed, based on the tentative agreement between the city and railroad reached in January. Copies of the plans are now on exhibition at Grand Central Terminal and at the office of the Board of Estimate and Apportionment. The board will hold a public hearing on the matter April 25. The present tentative agreement was reached by the board's committee on port and terminals, and acceptance by the board itself is necessary before construction work can be started.

As stated in the Engineering Record of Jan. 22, page 126, the salient features of the plan include an elevated structure on private right-of-way east of West Street from St. John's Park to Thirtieth Street; an elevated structure in Twelfth Avenue and the marginal way from Thirtieth to Fifty-ninth Street; covered tracks under Riverside Park and from 135th to 153d Street; covered tracks through the present cut in Fort Washington Park; a viaduct over Dyckman Street, and a cut-and-cover tunnel under Inwood hill. Four yards and terminals are to be provided: A downtown terminal at the south end along West Street to replace that at St. John's Park; a larger one at Thirtieth Street, with tracks on two levels; a main yard and water terminal on the site of the present yard at Sixtieth Street, but with the trackage entirely rearranged, and an uptown terminal, to be used largely for milk, above Manhattan Street. A new high-level drawbridge at Spuyten Duyvil will be required, and above that point the passenger tracks will be spread and the freight tracks carried over and down between them to avoid junction crossings.

Line to Be Electrified

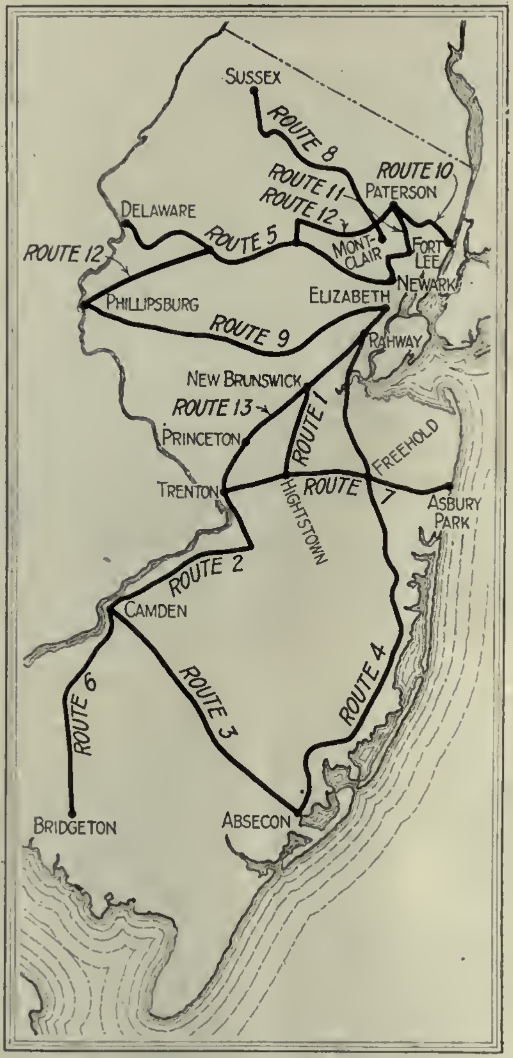
The entire line is to be electrified, the change from steam to electricity being made at Harmon, where the change is now made on passenger trains. The electrification is to be completed in four years from the signing of the agreement, and the whole improvement is to be completed in six years. The estimated cost is given at $50,000,000, but this figure covers the necessary features only. It is understood that additional features desirable to make reasonable provision for the future will make the cost much higher.

The plans have been developed under the joint direction of engineers for the city and the railroad. The city is represented by Ernest P. Goodrich, consulting engineer to the borough president of Manhattan; C. W. Staniford, chief engineer of the Department of Docks and Ferries, and John F. Sullivan, engineer of the Bureau of Contract Supervision of the Board of Estimate. G. A. Harwood, chief engineer of electric zone improvements, and H. D. Jouett, designing engineer of West Side improvements, represent the railroad.

New Jersey Highway System to Cost $7,000,000

With the adoption of the Egan good roads bill by the New Jersey Legislature and its formal approval by the governor, this measure providing for the construction of a state highway system at a cost of $7,000,000 will become effective next fall, and will then be submitted, by referendum, at the general election in November for final ratification.

This act, known as Senate Bill No. 126 and introduced by Senator Egan, of Hudson county, authorizes the construction of thirteen trunk highways throughout the state, including a total distance of about 350 miles and connecting many of the important municipalities. The fund of $7,000,000 to be provided for the construction, an average expenditure of about $20,000 per mile, is to be raised by bond issue and taken care of annually by a portion of the revenue received by the state motor vehicle registration department.



SHOWING THE LOCATION OF NEW JERSEY'S $7,000,000 HIGHWAYS

The new state highway bond issue will comprise either registered or coupon bonds, bearing interest at the rate of 4 per cent a year, payable semi-annually, and in denominations of not more than $1,000 nor less than $100. The payments will be arranged so that the first $500,000, par value, of the bonds shall be payable one year from date of issue, the second amount two years from date, and so on until all are paid. The state motor license fund aggregates about $1,300,000 a year, of which about $720,000 will be required annually to defray the principal and interest of the proposed bond issue.

The bill provides for the establishment of a highway commission, to be composed of the governor, president of the Senate, speaker of the House, state road commissioner, and the chairmen of the Senate and House highways committees of the last Legislature. This commission is to plan and arrange for the construction of the thirteen trunk routes indicated on the diagram map shown in the illustration.

Oregon Takes Steps Toward National Preparedness

The advantage of utilization of the water power resources of the State of Oregon, for the manufacture of nitrates to be used in making munitions in time of war and in the production of fertilizers in time of peace, are thoroughly discussed in *Bulletin* 5, recently issued from the office of the state engineer of Oregon.

The indirect benefits to navigation, irrigation and commerce are pointed out and tentative plans and cost estimates are also included in the bulletin. The authors, who have even gone so far as to discuss the possibilities of marketing the power from the proposed plants, are: John H. Lewis, state engineer; L. F. Harza and G. Stubblefield, consulting engineers, of Portland, and Elmer J. McCaustland, dean of the school of engineering and director of the engineering experiment station at the University of Missouri.

Committee Named for American Waterworks Convention

Arrangements are already under way for making the thirty-sixth annual convention of the American Waterworks Association, to be held in New York City June 5 to 9, the most complete in the organization's history. The committee appointed to develop plans for this year's meeting consists of D. W. French, chairman, superintendent of the Hackensack Water Company, Weehawken, N. J.; Charles R. Bettes, superintendent, Queens County Water Company, Far Rockaway; William W. Brush, deputy chief engineer, Department of Water Supply, New York; Alfred D. Flinn, deputy chief engineer, Board of Water Supply, New York; John D. Kilpatrick, consulting engineer, New York. The entertainment committee of the Waterworks Manufacturers Association includes William C. Sherwood, D. S. O'Brien, J. H. Caldwell, R. E. Milligan, E. T. Pardee and F. S. Bates.

Facilities for exhibits and meetings, which are to be held at the Hotel Astor, are said to be unsurpassed. The exhibits will be staged in the main ballroom of the Astor and there will be individual rooms for meetings of committees.

A feature of the convention will be the presentation of a cup to the section reporting the largest increase in membership per capita. Replies received by President Nicholas S. Hill, Jr., from the various sections and from committees on increase in membership indicate that there will be a lively competition for this trophy.

$40,000,000 River and Harbor Bill Passed by House

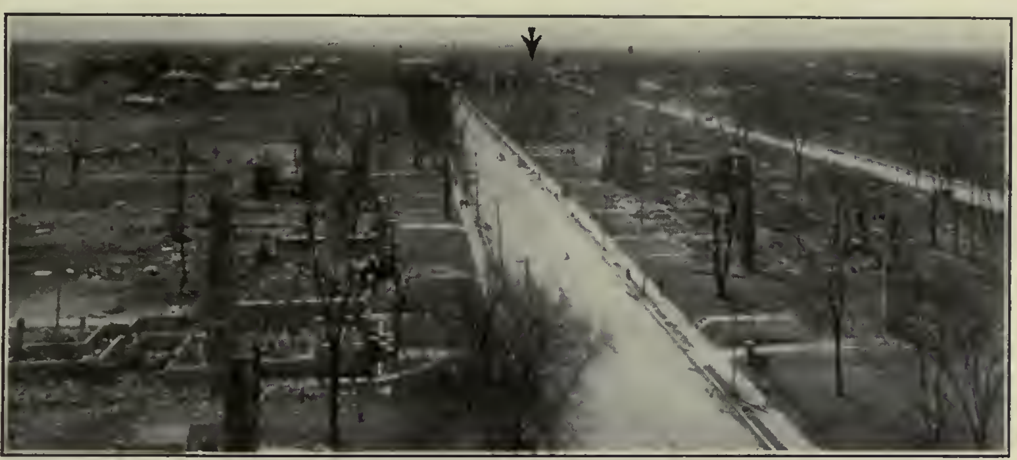
The annual River and Harbor appropriation bill, carrying $40,000,000, passed the House of Representatives April 11, by a vote of 210 to 133. With the exception of $700,000 to be spent in deepening the approaches to the Brooklyn Navy Yards, the entire amount is for continuing the work on improvement projects already authorized. The bill now goes to the Senate for a final vote.

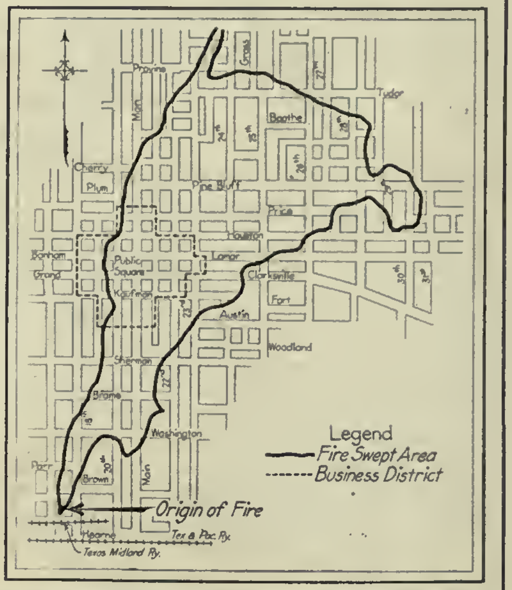
New York Engineers Will March for Preparedness

Plans have been made for a large delegation of engineers to participate in the parade in favor of military preparedness, which will be held in New York City, Saturday afternoon. May 13. Mayor Mitchell, Major-General Leonard Wood and Admiral N. R. Usher will review divisions representing forty professions and trades. The parade will be entirely nonpartisan and no uniforms, horses, wheeled vehicles or advertising will be permitted. The object is to demonstrate the extent of the sentiment of the business and professional men of New York in favor of preparedness.

The engineers will form a division, subdivided into the four general branches—civil, mechanical, mining and electrical engineering. Engineers are invited to parade whether they are members of any technical organization or not.

The committee which had charge of the New York military lectures, of which J. S. Langthorn, 250 West Fifty-fourth Street, New York City, is secretary, has undertaken the general organization of the engineering division for the parade and has appointed sub-committees in charge of chairmen as follows: Civil engineers, Charles Warren Hunt; mining engineers, Bradley Stoughton; mechanical engineers, Calvin W. Rice; electrical engineers, F. L. Hutchinson.





PARIS, TEX., FIRE SPREADS OVER FAN-SHAPED AREA. THE ARROW IN THE UPPER PICTURE INDICATES THE PLACE WHERE THE FIRE STARTED, THE EXACT LOCATION OF WHICH POINT IS SHOWN ON THE MAP TO THE RIGHT. AS IS PLAINLY SEEN, THE FIRE SPREAD OVER A FAN-SHAPED AREA, WHICH INCLUDED NEARLY ALL OF THE BUSINESS SECTION

Views of Fire-Swept Paris, Tex.

1,440 BUILDINGS WERE DESTROYED BY THIS FIRE. THE LEFT CENTER CUT SHOWS THE DAMAGE DONE TO THE INTERIOR OF THE POST OFFICE BUILDING. RIGHT CENTER, GENERAL VIEW OF THE BURNED DISTRICT LOOKING TOWARD FIRST NATIONAL BANK AND COURT HOUSE, WHICH BUILDINGS ARE SEEN IN THE BACKGROUND. THE BOTTOM ILLUSTRATION SHOWS THE POST OFFICE AND FEDERAL BUILDING. THE PARIS FIRE WAS DESCRIBED IN DETAIL ON PAGE 463 OF THE ISSUE OF APRIL 1

Photos by Lang & Mitchell, Architects, Dallas, Tex.

New Haven, Conn., to Have Sewage Disposal Plant

The first move toward securing a sewage disposal plant for New Haven, Conn., entailing an expenditure of nearly $1,000,000, was made when authority was granted last week for the selection of five sanitary experts of that city to act in conjunction with the aldermanic committee on sewers and sanitation.

An investigation will be made this summer, with the assistance of the United States public health service experts. This is said to be the first move the officials of New Haven have made to eliminate the pollution of that harbor.

Report Issued on Municipal Clean-Up Campaigns

A résumé of the various methods and plans adopted by many of the 2500 cities in the United States which took an active interest in "clean-up weeks" during 1914, is contained in the report of data gathered by the bureau of municipal information of the New York State conference of mayors and other city officials, dated March 1. The extensive programs carried out in most of the larger cities show that "the clean-up" movement is not confined to cleaning of streets and vacant lots but extends to the inspection of sanitary conditions in buildings, yards and alleys and even goes so far as to investigate conditions with regard to fire prevention.

Begin Work on Honduran Section of Pan-American Railway

Work on the construction of the Honduran section of the Pan-American Railway, which, it is expected, will eventually link the railways of North America with those of the southern continent, was inaugurated at Simisirán, Honduras, Feb. 26. The line will run from the Salvadoran frontier on the west to the Nicaraguan boundary on the east, and will link the railway systems of the United States, Mexico, Guatamala and Salvador with those of Nicaragua and Costa Rica.

Former Subway Chief Engineer Tells Why He Resigned

In a 48-page pamphlet, just printed, Henry B. Seaman, formerly chief engineer of the New York Public Service Commission, recites the events which led to his resignation from that position in September, 1910. The pamphlet is entitled "An Impossible Engineering Position" and, according to Mr. Seaman's statement in the preface, "describes the condition within the Public Service Commission which led the American Institute of Consulting Engineers to demand that an engineer of reputable standing be appointed upon the Commission."

Unique Dinner to Honor Brig.-Gen. W. M. Black

In recognition of services he rendered New York City as federal engineer of that district and in honor of his recent promotion to the office of chief of engineers, U. S. A., Brig.-Gen. William M. Black was entertained at a dinner given by R. A. C. Smith, dock commissioner of New York City, on April 6. Nearly 100 men were present and a unique idea was carried out by having decorations designed to illustrate some of the work of General Black.

A reproduction of New York's skyline brought to mind the removal of Coenties reef; a picture of a battleship nearing the navy yard suggested the reason for deepening the river channel, and a trans-Atlantic steamer, about to land, brought to mind the 1000-ft. piers.

A few of the prominent guests were: Col. F. V. Abbot, Brig.-Gen. Appleton, August Belmont, Irving T. Bush, Nicholas Murray Butler, Prof. W. H. Burr, S. W. Fairchild, Admiral Harris, Corporation Counsel Hardy, A. Barton Hepburn, William Loeb, Jr., E. H. Outerbridge, Ex-Senator Root, Admiral Usher, U. S. N., Gen. Leonard Wood, and John F. Wallace.

[redacted]

TUNNEL ENGINEERS HAVE UNIQUE MENU

The souvenir menu and song book for the East River (New York) tunnel engineers banquet, which was mentioned in last week's issue, was a well executed and highly interesting piece of work. The attractive front cover, shown above, is representative of the originality that was evident in all of the eight pages.

Nickel Plate Will Make Large Cut by Hydraulic Method

Preparations are being made by the New York, Chicago & St. Louis (Nickel Plate) Railroad in connection with grade-crossing elimination work on the West Side in Cleveland, to excavate 750,000 cu. yd. of material with hydraulic jets, and sluice the material into a near-by gully. This will involve lowering existing tracks. Additional right-of-way has been or will be acquired, and a cut wide enough for two tracks will be made, the present main tracks will be replaced by two in the cut, and then the remaining section will be taken out. Equipment for this work has already been ordered. The work will be carried out under the direction of A. J. Himes, engineer of grade crossing elimination.

News of Engineering Societies

The Alumni of the Massachusetts Institute of Technology among the Pennsylvania Engineers' Society held a dinner under the auspices of that society at Harrisburg on April 7.

The Georgia Drainage Association will meet at Monroe, Ga., May 4 and 5. Many prominent engineers from the South will participate in the work to be done.

The Engineers Club of San Francisco heard Capt. Richard Park, of the United States Board of Army Engineers, give an interesting discussion on military engineering, April 6.

The Engineers Club of St. Louis recently held a meeting at which B. H. Mann, signal engineer of the Missouri Pacific, presented an illustrated paper on railroad day and night signals.

The Harvard Engineering Society of New York will hold a meeting, April 26, at the Harvard Club, New York City. An inspection trip to the West Orange Edison plant will be made that day provided enough members express their desire to attend.

The Engineers Club of Trenton held a dinner April 13, at which Alvin Bugbee, superintendent in the Trenton water department, delivered an illustrated lecture entitled "Preparing Our Water System for Filtered Water."

The Springfield (Ill.) Chapter of the American Association of Engineers was organized with twenty-three members April 3. The officers are: Chairman, A. S. B. Little; vice-chairmen, C. E. Briggs and C. E. Bilger; secretary, T. H. Crandall.

The Engineers Club of Philadelphia will hear Col. Geo. A. Zinn, corps of engineers, U. S. A., discuss "Military Engineering" at a meeting to be held this evening. Colonel Zinn will also speak on this same subject April 29, and conclude the series of four lectures given by him on this subject.

The Southwestern Waterworks Association, representing the states of Kansas, Arkansas, Texas, New Mexico, Louisiana, Missouri and Oklahoma, will hold a convention at the Raleigh Hotel, Waco, Texas, May 8-10. Interesting business and entertainment programs have been arranged, and exhibits will be shown in the basement of the hotel.

The Brooklyn Engineers Club, at a meeting in the society rooms April 13, enjoyed an illustrated lecture on "The Manhattan Bridge Plaza Improvements," by Charles N. Pinco, assistant engineer in the department of bridges, New York City. An informal smoker will be held at the Imperial Hotel, Brooklyn, April 25, tickets for which will cost $1. The proceeds will be devoted to improving the society's headquarters.

The Colorado Association of Members of the American Society of Civil Engineers will be addressed to-night by Andrew Weiss, project manager, United States Reclamation Service, on "The Drainage of Irrigation Projects, with Special Reference to the North Platte Project." The committee on change of headquarters will make a progress report. Charles D. Marx, past president of the society, and Edwin Duryea, Jr., director, will be the guests of the association. L. R. Hinman, secretary, reports a good attendance at the regular Wednesday luncheons.

The American Institute of Electrical Engineers will meet at the New Willard Hotel, Washington, D. C., April 26, under the auspices of the Washington section and the committee on development of water power. The program for the meeting, as at present arranged, includes an address by President John J. Carty, and papers on the following subjects: "Electrochemical Industries and Their Interest in the Development of Water Power," by Lawrence Addicks; "Water Power Development and the Flood Problem," by Allerton S. Cushman; "The Relation of Water Power to Increased Transportation," by L. B. Stillwell; "The Relation of Water Power to the National Defense," by W. R. Whitney, and "The Water Power Situation, Including Its Financial Aspect," by Gano Dunn.

Personal Notes

H. M. CORLISS, who is connected with the F. T. Ley Company, of Springfield, Mass., has been transferred from Hartford, Conn., where he had charge of the concrete work on the Nepaug dam, to Longmeadow, Mass., to take charge of tunnel work to be done for the Southern New England Telephone Company.

LESLIE K. HARLOW has been appointed resident engineer in charge of conduit construction for the Bay State Street Railway Company, with headquarters at Newport, R. I.

M. R. LEWIS has recently been put in charge of an experiment station conducted by the U. S. Department of Agriculture, at Twin Falls, Idaho

Vaughn Wood has resigned from his position in the harbor department of Los Angeles to become connected with the Missouri, Kansas & Texas Railroad.

Percy H. Wilson, who recently resigned from the position of secretary for the American Portland Cement Manufacturers' Association, has opned offices in the Land Title Building, Philadelphia, where he will engage in consulting practice. His work during the eight years he acted as secretary to the association made it the effective organization it now is. Mr. Wilson is a graduate of the civil engineering department of the University of Pennsylvania, and from 1894 until 1907 was connected with the River and Harbor Improvement Company, of Camden, N. J., during which time he rose from the position of superintendent to that of engineer and an executive of the company.

R. H. Randall, assistant engineer in charge of topographic surveys at Dayton, Ohio, has gone to Jackson, Mich., where he will take charge of a topographic survey for that city.

H. L. Dougherty was promoted to the position of superintendent of highways in Washington county, Pa., April 11. Mr. Dougherty has been with the state highway department four years and was attached to the office in district No. 10, with headquarters at Wellsboro, at the time of his promotion. He is a graduate of Pennsylvania State College and became connected with the state highway department as rodman in 1912.

Gem State Water Company, of Ogden, Utah, has been organized to complete work begun by the Lost River Water Company on the Big Lost River irrigation project. Construction work will begin immediately at Mackay, Idaho.

A. W. Thurston, formerly assistant engineer for the Utica Gas & Electric Company, of Utica, N. Y., is now connected with the engineering department of the National Tube Company, at Lorain, Ohio.

W. G. Ure has been transferred from King's Mills, Ohio, to the main office of Wells & Gray, Ltd., Toronto, Canada.

Joseph P. Newell, George C. Mason and Jay L. Stannard have been selected by the Oregon chapter of the American Society of Civil Engineers to assist the city council of Portland in the investigation of alleged frauds in connection with the construction of the Montavilla trunk sewer.

Eric T. King, for ten years an assistant engineer with the board of water supply of New York City, has resigned to become assistant to Lederle & Provost, sanitary experts and consulting engineers, of New York City. Mr. King studied sanitary engineering at Union College, from which he was graduated in 1905. After graduation, he spent six months with the U. S. Geological Survey on river-control studies in Oklahoma, and five months as water supply engineer with the department of health of New York. Since May, 1905, he has been engaged on the preliminary work and construction of various portions of the Catskill water supply system for New York City, including the siphon tunnel under the Hudson River, steel and cast-iron pipe lines, and Silver Lake reservoir.

L. W. Swett, until recently associated with Prof. A. N. Talbot of the University of Illinois, has been appointed superintendent of construction for the Brooks Construction Company, of Fort Wayne, Ind. Previous to graduation in 1914, Mr. Swett spent several years on gold dredging work in Siberia.

C. B. Harding has been appointed structural assistant in the department of public works of Portland, Ore., and assigned to duty on the work being done on the Oregon-Washington Railroad and Navigation Company's line in that city.

Robert B. Robinson, formerly division engineer for the Oregon Short Line, has been appointed engineer, maintenance-of-way, which position has been created to take care of the maintenance of the increased mileage of that road. Mr. Robinson began engineering work during the summers of 1894 and 1895 in Government service and in 1896 was leveler and transitman for the St. Louis, Peoria & Northern Railroad. He was assistant construction engineer on the Mere Docia levee and drainage commission works in Illinois during 1897, and, in the spring of 1898, took up special civil engineering studies at the University of Illinois. After a few months at that university, he became associated with B. B. Harts, consulting engineer, cf Clinton, Iowa, and in 1899 joined the engineering department of the Union Pacific. His promotion comes after service with the Oregon Short Line from 1904 to date.

Edgerton C. Garvin, at present connected with the Government engineer's office at Savannah, Ga., has moved to Brunswick, Ga., to become assistant engineer in charge of the harbor works at that city. Mr. Garvin was graduated from the engineering department of George Washington University in 1907, spent the summers from 1900 to 1906 in the employ of the U. S. Geological Survey and has been doing special harbor and river work for the engineering department of the government since 1908.

Arthur F. Holland, in the employ of the H. Koppers Company, of Pittsburgh, has been transferred to Jersey City, N. J., to act as field engineer on the construction of a plant to be erected for the Seaboard By-Product Coke Company.

W. S. Wicker has resigned from his position as assistant engineer for the Baltimore Sewerage Commission to become a member of the field engineering force of Chester & Fleming, consulting engineers, of Pittsburgh, with headquarters at East Liverpool, Ohio.

J. D. Ankrom has left the employ of the war department, where he held the position of inspector and engineer for the Wheeling district, to accept a position as assistant field engineer for H. Koppers Company, with headquarters at Jersey City, N. J.

E. Newman will again assume his position as assistant engineer and superintendent of construction for the San Joaquin Light & Power Corporation's plant at North Fork, Cal. Work on that plant was suspended last November and Mr. Newman expects to complete the job this season.

Rudolph P. Miller, who did important work as expert for the building committee of the board of aldermen of New York City in its revision of the building code, has been retained by that committee to assist in revising the part of the code dealing with theaters.

John P. Shea, formerly with the Aberthaw Construction Company, has become associated with Stone & Webster Construction Company as general foreman on work being done for the Blackstone Valley Gas & Electric Company, at Pawtucket, R. I.

Warren A. Hoyt has discontinued his consulting engineering practice in Chicago, to engage in the building business in central Pennsylvania, with headquarters at Altoona. He will specialize in reinforced-concrete construction.

E. H. McGovern has been made resident engineer of the Cleveland, Cincinnati, Chicago & St. Louis Railway, with headquarters at Columbus, Ohio.

C. L. Douthett, division engineer of Vermilion County (Ill.) bond roads, has moved from Danville to Sidell to take charge of 20 miles of concrete road construction.

A. G. Hillberg, hydraulic engineer, of New York City, has been retained to investigate and report upon a proposed hydroelectric development on the Gila River, above Red Rock, N. M. Mr. Hillberg recently completed the designs for a 25,000-hp. hydroelectric development located at the mouth of the White Rock Canyon of the Rio Grande River.

Wihtred Cook, who has been associated with H. E. Riggs, of Ann Arbor, Mich., is now a member of the engineering staff of the Rochester Railway & Light Company, with headquarters at Rochester, N. Y.

F. H. Sherrerd has resigned from his position in the city engineering department of Newark, N. J., to take effect May 1.

L. R. Coleman has left the employ of the engineering department of the Delaware, Lackawanna & Western to enter the engineering department of the Pennsylvania Railroad, with headquarters at Trenton, N. J.

M. M. O'Shaughnessy, city engineer of San Francisco, has been permitted to accept the position of consulting hydraulic engineer for San Diego. His work for San Diego will consist of the reconstruction of several dams.

George W. Fuller, consulting engineer, of New York City, has been retained to advise on the question of the most suitable sewage disposal project for that city.

M. D. Anderson is temporarily in charge of the Arizona district of the U. S. Geological Survey, succeeding C. C. Jacob, whose transfer was noted in the April 1 issue.

Henry Harvie has resigned from his position as designing engineer for the Rochester Railroad & Light Company to become chief draftsman for the hydraulic department of the Hydroelectric Power Commission of Ontario, with headquarters at Toronto.

W. K. Hatt, professor of civil engineering at Purdue University, gave a course of lectures upon the fundamentals of reinforced-concrete construction during the past week at the University of Ohio.

W. F. Langelier, assistant to Prof. Edward Bartow, director of the Illinois State Water Survey, has accepted a position as assistant professor of sanitary engineering at the University of California. Mr. Langelier has had charge of the tuning up of several Middle West filtration plants, among which are those at Evansville, Ind., and Quincy, Ill.

L. Spalding has been appointed acting supervisor of structures of the Bessemer & Lake Erie Railroad. Mr. Spalding was graduated from Cornell University in 1913 and subsequently spent a few months with the Pittsburgh, Shawmut & Northern. He went to the Bessemer & Lake Erie about two years ago.

Obituary Notes

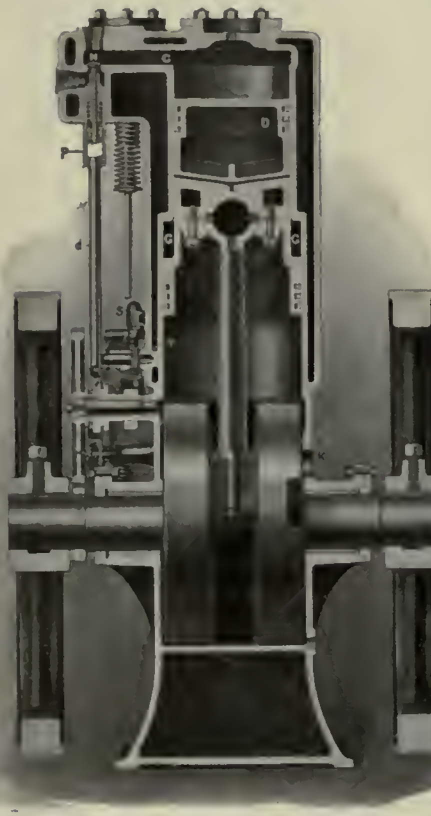
Sir Colin Campbell Scott-Moncrieff, well known as an authority on irrigation, died in London, England, April 6, at the age of 80. He was the creator of the present system of irrigation in British India, where the canals aggregate, in extent, the circumference of the globe, and he also inaugurated a similar system in Egypt. Since these works, which took almost half a century to complete, he has been consulted in irrigation projects by the Turkish, German, and Russian governments, and was largely responsible for the idea carried out by Russia in the river regulation and canal construction of its transcaspian and central Asian possessions.

Col. H. Ashton Ramsay, who was the only living honorary member of the Engineers' Club of Baltimore, died recently in that city.

New Air Compressor Burns Kerosene, Gasoline or Gas

A portable, two-stage, vertical air compressor, the power for which may be obtained by using gasoline, kerosene or gas, has been brought out by the Lyons Atlas Company of Indianapolis. The power and air cylinders are contained in a single casting, which effects an appreciable reduction in weight and number of parts, and makes the device more compact.

When the air piston is at the top of its stroke, the crank case is full of air at atmospheric pressure, admitted through port *K*, shown in the illustration. On the downward stroke, this air is compressed in the crank case after which it flows into the annular chamber *G*, and raises the absolute pressure therein to approximately 20 lb. A valve closes as the piston starts on the upward stroke, and as soon as the pressure in the annular space *G* reaches the receiver pressure, the discharge valve opens, allowing the air to pass into the receiver during the remainder of the upward stroke. Since the pressure in the crank case assists the piston on the upward stroke, and the location of the port in the crank disc is such as not to open port *K* until atmospheric pressure is reached, but little work is lost and high efficiency is said to be secured.

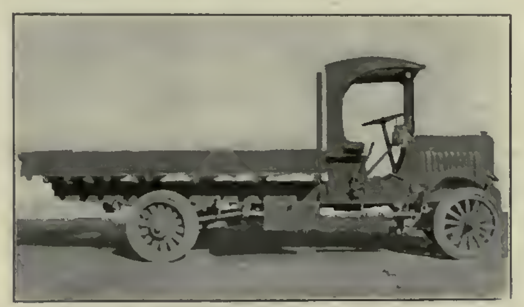

LIGHT WEIGHT AND COMPACTNESS ARE THE ADVANTAGES CLAIMED FOR THIS COMPRESSOR

Light Weight Is Feature of New Worm Drive Motor Truck

Lightness without diminished strength was the principal object sought in the design of the Riker worm-drive motor truck, which, though perfected over a year ago, has only recently been put on the American market to any extent, the output having gone almost exclusively to the warring countries in Europe. The low proportionate weight is attained by the quality of the materials used. The frame, for example, is of chrome nickel-steel instead of pressed steel.

Practically no aluminum is used in the makeup of the Riker truck, the transmission case and the crank case being of manganese bronze. This, in fact, is an exclusive feature of the Riker truck. On the 3-ton model the rear-spring suspension is from 3 in. to 4 in. greater than the spring suspension used on the ordinary 5-ton trucks.

It is believed, by the manufacturer, that the trucks are, for their size, the lightest on the market and that they are the only trucks equipped with five-bearing crank shafts.

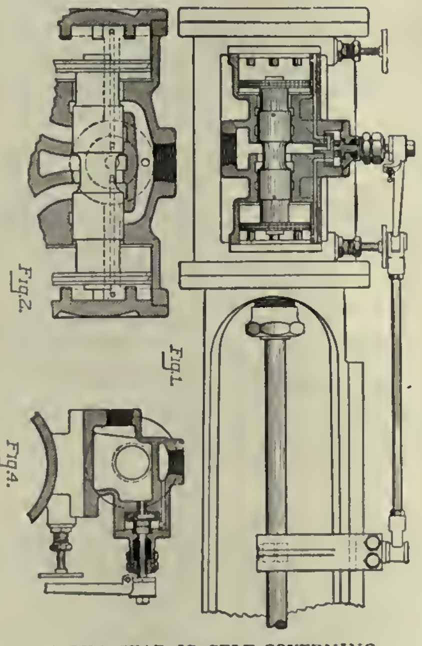

SPRING SUSPENSION GREATER THAN USUAL TRUCK

The type has been tried out under severe conditions in war service. It is manufactured by the Locomobile Company of America, of Bridgeport, Conn.

New Type of Valve Regulates Steam According to Work

A new pump has been put on the market by the American Steam Pump Company of Battle Creek, Mich., which is equipped with a new type of valve gear that, it is claimed, because it is mechanically actuated, insures positive action at all times, and, due to a self-governing device with which it is equipped, will permit only enough steam to enter to do the required work.

The new pump, known as the "American-Marsh," is of simple construction. The steam valve is of the balanced piston type, equipped with expansion rings, while the auxiliary valve is of the semi-rotative disc type which wears to a perfect seat. There are no slide valves to wear and no loose links or tappets in the valve gear.



VALVE GEAR IS SELF-GOVERNING

As will be noted from the accompanying cut, it has a steam valve which is mechanically actuated, and which is also self-governing. The fact that it is mechanically actuated, it is claimed, insures positive action at all times, while the self-governing device allows only just enough steam to enter it to do the required work. If the work is light, the admission of steam is cut down, while if the work is heavy the portage is automatically enlarged. This feature, it is said, insures low steam consumption.

Chicago Concern Moves Office

The Chicago office and sales rooms of the Goulds Manufacturing Company, of Seneca Falls, N. Y., will be removed to 12 South Clinton Street, April 20.

Solid Steel Windows Successfully Withstand Test

A test was recently conducted by the New York State Industrial Commission at the fire-testing station of Columbia University to determine whether solid steel windows would successfully withstand the heat they would be called upon to meet under actual fire conditions.

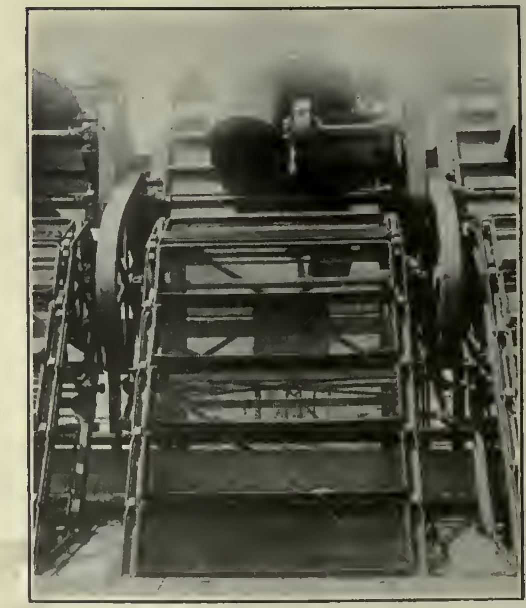
The test was conducted by Professor James S. MacGregor, of Columbia University, with Fenestra solid steel windows. He reported that "after the test, all three vents of the windows used were opened without difficulty and could be swung, closed and locked with ease."

The results of the test are said to remove a handicap to the use of such windows, especially in the State of New York. An old state law practically limited the sale of solid steel windows to units not exceeding 5 ft. wide and 9 ft. high. The demand of manufacturers and building owners, however was thought to be for a steel window that could be used singly or in combined units of practically any size needed. The approval of the industrial commission of this type of window is an added assurance to building owners that they can use solid steel windows for safety against the fire hazard.

Intake Screens Driven by Motors

A few experimental installations of automatically cleaned traveling screens to provide clean water in power plants and to screen sewage have been successful enough to warrant the manufacture of the screens by the Chain Belt Company of Milwaukee. Among the first installations were the Northwest and Fisk Street plants of the Commonwealth Edison Company of Chicago; the Delray plant of the Edison Illuminating Company of Detroit, and the Commerce Street plant of the Milwaukee Electric Railway & Light Company. The battery of three screens, a section of which is shown, was the first installation placed at the Northwest plant.

The machines consist of wire screening baskets mounted on two strands of endless steel chain belt passing over top and bottom sprockets which are mounted on a structural steel supporting frame. Each screen, with its attendant equipment, is driven by its own motor mounted near the top of the frame. Number 12 copper wire is strung to produce 0.625-in. mesh. The baskets, measuring 5¼ x 1½ ft., form a continuous screening apron as they move slowly upward through the water. As they pass over the top sprocket, they dump their loads into a trough and are cleaned by water from a continuous spray pipe.


SHOWING A PART OF THE BATTERY OF THREE TRAVELING SCREENS

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Extravagance in Passenger Terminals

ANENT the charge often made against the railroads of extravagance in large passenger terminals, Robert Trimble of the Pennsylvania system, retiring president of the American Railway Engineering Association, presented some interesting figures regarding the proposed Union Station in Chicago at the recent convention in that city. Of the $50,000,000 estimated cost of that terminal, he stated that in round numbers $35,000,000 must go for land, regardless of the structures placed upon it; $5,000,000 for street changes and changes in other public facilities, and $5,000,000 for tracks, signaling, power plant and the like, leaving only $5,000,000 for the headhouse and concourse. Mr. Trimble admitted that by making these structures, which constitute what the public regards as the station, strictly utilitarian it might be possible to save $2,000,000 of the $5,000,000. He thought, however, that the $2,000,000 was justifiable advertising. And it appears to this journal that an expenditure of 4 per cent extra in so large an undertaking for the beautification of the work and the comfort of the railroads' patrons is not an inordinate expenditure. Mr. Trimble merely presented from a different angle a fact that this journal has pointed out, that the buildings, however monumental, are only a part of a large railroad station. Nobody will deny that the Union Station in Chicago needs to be replaced. It would be the height of folly to replace it with a plant just able to meet present needs. Ordinary foresight demands a layout that will serve for a long time to come, and there would be abundant criticism if the railroads concerned should make the prominent parts anything other than a credit to the city.

"Saving New York"

ATTENTION was called in the Engineering Record of March 11 to the movement under way in New York to keep manufacturing out of the section now occupied by the clubs, hotels, theaters and high-class retail-shopping establishments. The plan is to bring pressure upon the women's-clothing manufacturers—the offending parties—by the retail establishments, whereby these stores promise to favor those whose factories are outside of the zone it is desired to restrict. It is astonishing to see the support which this privately managed "city planning" movement is receiving, and also to note the attention that the proposal is receiving outside of New York. The plan has been favorably received and if it results successfully, as is sincerely hoped, should become the forerunner of similar movements elsewhere. On the face of it, it may appear unjust to those whose establishments are already in the forbidden district. Such, however, is not the case, for ample time is given them in which to move their establishments. Furthermore, their prosperity is directly dependent upon that of the big retail establishments, whose success is going to be considerably curtailed if the manufacturing centers continue to close in upon them. If the plan is a success the manufacturers now directly affected will be certain to profit from the preservation of the high-class character of New York's retail section. The movement is well worth following closely, for it offers a procedure for industrial restriction which can be made effective even though laws aiming at the same result cannot be secured.

Filters and Finances

DESPITE board-of-health reports and typhoid epidemics which take their yearly toll, some cities are so tied up with water-company franchises and finances that little or no relief can be obtained in any reasonable time. At the little town of Monroe, Mich., at the western end of Lake Erie, filtration is the only practicable procedure because the sudden and enormous fluctuations of pollution are so great that only laboratory control of a chlorine plant could meet them. The town is too small to warrant the expense of a laboratory. Even then, granting that it would not produce objectionable odors and tastes, chlorine can only sterilize. It cannot clean water. In consequence the citizens resort to polluted wells. The financial difficulties in Monroe, like those in many another small town, are controlling. The company's charter provides that no franchise agreement can be entered into until within one year before the date of the charter's expiration, Jan. 1, 1919. In two years some marked change in the business relations between company and city may be expected. It would take over a year to build a plant, and the company does not feel that its present income is commensurate with the added expense of filters. To work out some satisfactory supplementary agreement is highly essential, but the state board of health has no power to force an adequate solution of the difficulty. Court procedure may offer hope, but one can never be certain as to the results. Furthermore, co-operation is always a better way out, when it is possible, than strife. Even without the power of insisting on some agreement, it should be the function of state boards of health to take the initiative in such cases. The welfare of the public demands it. An outside agency, moreover, frequently can bring about an agreement when the parties left to themselves can make no progress.

He Gave His Life

THIS month the "Bulletin" of the Iowa State Highway Commission contains a striking and well deserved tribute to A. E. Rommel, engineer of Mahaska County, who died in an attempt to break up an ice gorge which was backing up the water of the Des Moines River over valuable property for a distance of 10 miles. The work was known to be very hazardous, but Rommel, with not a thought of his own safety, assumed the responsibility. His mettle can best be judged by the fact that he went to his death after refusing to place his companion in greater peril after the two had hung for a time to a tree and after unsuccessful attempts to draw Rommel up into the branches. A tribute to him, in the following words, appears in the Oskaloosa "Times": "Was the effort ill advised? Was it the duty of the State to handle this situation? It matters not. There came a call for help. The board and its engineer heard the call and answered it. Rommel lost his life and the county the most capable engineer it is ever likely to secure. . . . Here was a man. His heart was in his work. The interests of the county were his interests. He worked night and day when the needs of the county required it, and found recompense in the knowledge of work well done. Absolutely square himself he frowned upon graft or deceit in any form. His work was an open book. The various contractors for the county knew him well, admired his ability and strove to carry out his plans." Possibly the administrators of the Alvord medal of the Western Society of Engineers may find that Rommel's widow should receive the award this year for service to the public in an inconspicuous manner. Such an award would indeed be a tribute to the man who did not hesitate at the call of duty.

Joint Sewage Disposal Project

THERE has just been made public the report of a board of engineers on a joint sewage treatment project for the cities of Pasadena, South Pasadena and Alhambra, Cal. The proposal contemplates an installation of Imhoff tanks, sprinkling filters and secondary sedimentation basins, but as considerable opposition to the location of the proposed works has arisen, it remains for the future to determine whether they will actually be built. One feature of the report, however, is of interest, because joint projects of this sort are by no means common. This feature relates to the proportioning of the cost of the works. The plan is to divide the expense on a pro rata basis according to the population of the three municipalities. This fact is of interest to those who recall the early history of the

Passaic Valley sewer in New Jersey, where the proposal to charge the several localities on the basis, not of the population, but upon the assessed valuation of their property succeeded in disrupting the plan. The California report states the case concretely when it says: "The outfall sewer and the purification works are designed to provide for the disposal of the sewage from a given population; consequently the proportioning of the cost and maintenance should be on a population basis." The combined populations of the three cities are given for the year 1916 and estimated at ten-year intervals until 1956. On the basis of the averages thus obtained Pasadena would be called upon to assume 66.3 per cent of the cost, South Pasadena 15 per cent and Alhambra 18.7 per cent. Putting this in round numbers, the board of engineers recommends a definite division of two-thirds, one-sixth and one-sixth respectively for the three cities for the first ten years, irrespective of minor changes in population which a later census may show.

False Economy

AN EXAMPLE of false economy in construction, resulting in the failure of an engineering structure, is illustrated by the washing out of an intermediate pier in the highway bridge over the Susquehanna River at Athens, Pa., on April 2. Two 185-ft. spans of the three-span steel superstructure were carried down by the gradual settling and failure of the pier, due to underscouring.

The bridge, constructed in 1914, replaced an old covered timber-truss structure built in 1840. The original timber-crib pier, filled with stone, supported the truss spans by a timber frame. About the year 1875 this frame was replaced by stone masonry, and the timber crib protected by means of riprap on the sides and lower end. When the new bridge was constructed it is understood that the county commissioners, to save expense, stipulated that the old piers should be used. A timber cofferdam was placed around the pier in question, about 4 ft. from it, and an attempt made to pump it out. This being found impossible, because water came up through the riprap, the concrete was poured between the cofferdam and the pier to form a jacket carried down to the top of the riprap. It is probable that a change in the action of the current was thus effected, causing a noticeable suction and whirlpool action on the downstream end which undermined the crib.

The county's engineer states that the formation of a gravel bar about 300 ft. downstream contributed to the deep scouring action. Even if that be the case, it does not lessen the emphasis which should be placed on the need of thorough examination of foundation conditions at suitable intervals and particularly when changes in the structure are contemplated. Such a study would probably have shown the necessity for careful safeguarding against scour.

It is stated that this is the second bridge lost by Bradford County because of improper foundations. A few more dollars spent on new piers or on a really effective reinforcement of the old piers would probably have saved the loss which must be assessed upon the public, and will be charged against the engineering profession.

Rational Selection of Road Types

THE selection of the type of road in far too many cases is beyond the jurisdiction of the engineer. The noteworthy attempt on the part of the engineers of the Illinois Highway Commission to put road-type selection on a scientific, economical basis, as described on page 536, is a step which all road enthusiasts should welcome. Road promotion in Illinois counties is going almost too fast for the county officials to keep up with it, and one of the most serious road problems now confronting the State is the danger that many counties will rush into bond-issue plans without as careful consideration of their individual problems as the magnitude and importance of the undertaking warrant. Bond houses will not, as a rule, finance engineering enterprises without having rational detailed plans before them, but for some reason they are not so particular when highway work is concerned.

The 1915 legislature gave the counties the right to select types of roads, including even state-aid roads. Concrete and brick roads are to be maintained by the state, gravel and macadam at the joint expense of state and county, and earth roads at the expense of the county. Bond issues in series of not less than ten, nor more than twenty, years were authorized. Further, the state-aid allotment as it becomes available may be used to pay off bonds to the extent of one-half the cost of construction. This makes possible the construction of a whole county system within a short time. Therefore, the state officials are vitally interested in seeing that the county systems are economically planned.

No one would think of building a sewer system entirely of 6-in. pipe nor of 6-ft. conduits. Almost invariably some balance is sought between service required and benefits conferred. In laying out county highway systems Mr. Marr has followed this obvious line of reasoning. Evidently a road which carries but five vehicles per day ought not to cost as much as one having a traffic of 5000. The problem is not so simple as that, but the principal factors are ascertainable and the application not difficult, so that the correct answer, considering all available materials, is readily obtained, and the reasonableness of the choice obvious to the average man. A prominent consulting engineer recently stated that he never felt that he had earned his fee unless the facts had been so clearly stated that the recommended choice was perfectly obvious to his client. The Illinois method of county-road selection is based on this method of presentation.

In practice the road-system committee is furnished with cost tables and charts for different types of road, for different widths, with 1 to 5 miles haul, so that the estimates can be made up roughly without difficulty. The effect has been to arouse a healthy interest which leads to a system much more nearly correct than any biased haphazard selection.

The National Industrial Inventory

THE naming, this week, of the members of the Naval Consulting Board's committee of engineers on industrial preparedness will serve to focus more than the usual amount of attention upon the current installment of Major Bond's series of articles, outlining the chief elements of a plan for mobilizing the nation's resources as a measure of national defense—the very problem which the committee has begun to solve. Too much importance cannot be attached to this feature of the national-defense plan. General Wood and other military authorities, in almost every address they have made for months past, have dwelt upon its significance and have pointed out that engineers are the men best qualified to perform this service. This fact President Wilson appreciated when he called upon the five national engineering societies — civil, electrical, mining, mechanical and chemical—to take charge of the work.

That the nation-wide industrial inventory, by states, will be conducted with speed and thoroughness is certain, for it is in hands of men of the highest professional standing, selected with care on the sole basis of fitness for the task in hand. As Major Bond points out in this issue, there has been hardly a military campaign in the history of the world in which the belligerents have not been hampered by a shortage of ammunition and supplies. Thus it is essential for the newly formed committee not merely to tabulate the country's manufacturing plants, with their personnel and output, but to arrange with the heads of these works for the actual production, in time of peace, of samples of the supplies which they would be called upon to furnish in case of war. In this way each manufacturer will have ready, on a small scale, trained men and machines for the particular service assigned to him.

Is a Plumber an Engineer?

THE QUESTION here used as a title may bring a smile to the lips of readers. Yet, in Indiana, it has a practical bearing. Some time since the Indiana State Association of Master Plumbers decided to change its name to that of the Indiana Society of Sanitary Engineers. Questioned as to the change, a prominent member of the plumbers' society stated that the master plumber had long ago outgrown his name. "He is called upon," so the gentleman says, "to engineer practically all installations of sanitary appliances pertaining to a building, and he is worthy of a higher degree than the simple name heretofore allotted him." With locomotive drivers going by the name of engineer, with plumbers posing as sanitary engineers, with business engineers and advertising engineers all about us, the term engineer promises to become as much abused as that of "doctor" or "professor." The way to stop the abuse does not now present itself. Certainly it is a matter worthy of the consideration of engineers generally, and particularly of engineering societies.

One can well question whether in the Indiana case the Indiana Engineering Society and the Indiana Sanitary Association are not somewhat at fault. The master plumber above quoted professes that he has never heard of either organization. Judging by the tone of his letter he cannot be classed with the ignorant, and the question therefore presents itself whether the Indiana Engineering Society and the Indiana Sanitary Association have taken a sufficiently important part in public affairs to impress themselves upon the people of their State. It is safe to assume that had they played a large part in public affairs, the gentleman in question—and many other master plumbers—would have heard of these associations. Moreover, the inference is fair that they would have conferred with these associations.

While there is much food for thought in the action of the Indiana plumbers, is there not reason, too, for questioning whether the engineers no less than the plumbers should bear some responsibility for the action?

The general question of restricting the use of the term "engineer" is discussed by N. M. Stineman in an article on page 546, which applies directly to the case of the Indiana plumbers.

The Conference on Engineering Co-Operation

ENGINEERING co-operation was in the heart of every man who attended the second conference of the Committee on Engineering Co-operation in Chicago last week. Fifty engineers, from more than forty societies, talked over the activities which are making their organizations of increasing service to their members and to the profession.

Isham Randolph put the spirit of the conference into words: "Let us have a central organization—call it what you will—which has no authority to command, but which has ears to hear and the voice to be heard. Let those ears be open to every plea or promise of common good, and let that voice go out to all affiliated bodies, carrying this plea or this promise for the common good. Let us come together at least once a year and feel that 'touch of nature which makes the whole world kin,' and growing out of that kinship let us consider and do those helpful things which will bless our comrades and overflow with helpfulness to our country and our kind."

Little legislation was attempted, a remarkable thing, for seldom do American citizens get together, no matter how informally, without proceeding to pass resolutions. The offering of an opportunity to the participating societies of defraying the expenses of the committee, and the establishment of a sub-committee to present to a third conference a plan for bringing about co-operation upon matters of common interest formed the sum total of concerted action.

The real success of the conference and the real benefit come in the exchange of ideas as to how the various societies were justifying their existence and were proceeding in the three matters of publicity, employment and legislation. Cleveland took away the prize for publicity methods. Within a few hours after the arrival of its efficient secretary, front-page items relating to the conference appeared in one of Chicago's metropolitan dailies. Furthermore, an interview with the Associated Press manager indicated that he wanted engineering matter, but, of course, he had specifications. Cleveland engineers get publicity. They have the formula and it works. There is no reason why it cannot be applied elsewhere.

One of the younger Chicago organizations has grappled most strenuously with the employment question, with the result of an estimated saving in the profession of $7,500 in the last six months. The idea of co-operative clearing houses in all large cities for engineers out of work is as yet a dream. No very workable plan has been devised. Some of the ideas expressed at the conference will no doubt bear fruit in a more detailed discussion at the next conference.

The efforts of the national societies' committee on engineering-reserve-corps legislation and of the naval consulting board are good examples of the necessity and advantages, professional and patriotic, of co-operation in matters relating to legislation. To get effective co-operation on legislation will always be difficult, except on the most obvious matters. With effective publicity methods in operation, however, both employment and legislative problems will be the easier to solve.

Engineering societies to which the ideas expressed at the conference will be brought back cannot help but have their future activities quickened and their ideals of service raised or confirmed.

The effort was well worth while.

One-Sided Contracts and the Engineer

THE one-sided contract, in which the engineer is the sole arbiter of his own work, is strenuously defended by engineers of the highest standing and competence. This is due not so much to experiences which may have shown that under no other form of contract can good work be secured, as to confidence in the legal strength of clauses, each of which has been tried in the white heat of legal actions and has not been found wanting. The intrinsic fairness of these clauses is seldom given much thought by these competent men, for they intend to use them not to oppose the contractor but merely to secure justice to their client. Unfortunately, all engineers are not actuated by the same high motives, and these one-sided contracts are used constantly to cover up the engineer's mistakes and incompetence.

Last week in an editorial entitled "Justice to the Contractor," the Engineering Record called attention to the contractors' side of the question. From the engineer's standpoint alone, however, there are equally weighty reasons why the profession should combine to produce a standard form of contract equitable to both parties. Some practical instances will help to emphasize the need.

There is at present at bar in an Eastern State a suit over a municipal contract, in which the city's counsel has repudiated the city's engineer over the correctness of a set of borings, maintaining that the engineer has no authority to assure their correctness. What does this mean? That this city, at least, does not think engineering service worth while in the very matter which is the basic reason for having engineering work done. If preliminary investigation and design are reaching such a low point of efficiency that they no longer save money for owners, what is left for engineers to do? The city referred to is not alone in taking such a position. Evidence presented to this journal indicates plainly that many owners, both private and public, have formed a similar low opinion of what the engineer can do to cheapen construction. As the engineer is paid in proportion to this estimate of him, does this not, in part, explain his low compensation? The evidence is also overwhelming that this condition is due to the admitted fact that the incompetent and the careless can pass for engineers without challenge.

Why is this true? Owners do not know what properly drawn contracts and specifications are. We have no standards which deal adequately with the business relations involved, or which make it plain that quantities should be accurately estimated and guaranteed. Owners do not know how much money a high type of engineering service will save. They do not know how much incompetent engineers cost them. Often they do not know until too late that their engineers are incompetent. Why? Largely because these same incompetents are, by American practice, made the final judges of their own mistakes. There being no adequate standards, how is the owner to discover that mistakes have been made? The so-called engineer covers his errors by throwing the cost temporarily on the contractor, who has no immediate recourse. Next time, however, the contractor adds to his bid on work handled by such an engineer, and the cost comes home to the owner. The owner does not analyze the situation, but he sees that he has saved nothing over his neighbor, who lets contracts direct to firms that do their own designing, and thereafter that owner is not apt to pay much for engineering work.

Is it not time to check a practice that results in such conditions by drawing up standard contracts that are two-sided and just from a business standpoint? They should provide that the engineer cannot unload his mistakes onto the contractor, and for an appeal in such cases to one or more men of the requisite experience, preferably named in the contract but who have no other connection with it.

The work must be undertaken by a strong engineering society, and none is in a position to do the work so well or to exercise as large an influence as is the American Society of Civil Engineers.

Rational Method of Selecting Types Evolved for a Comprehensive County Road System

Traffic Census, Population and Property Valuation Are the Bases Used in Equalizing the Cost—With These Relations Understood an Economic Selection Will Be Made in Most Cases

By WILLIAM W. MARR,
Chief Engineer Illinois State Highway Commission

BOND issues for county roads in Illinois are being promoted faster than comprehensive plans for construction on an economical basis can be developed. Under these conditions the State Highway Commission is exerting every energy, although hampered by lack of funds, to educate the county officials to the necessity of selecting road types (a prerogative given to the counties in 1915) by some rational system which will equalize the cost per year per user. As the basis for the selection in a broad, general way, the principal factors are traffic census, population and property valuation. Already experience has shown that with these factors laid down on large maps before county boards an economic selection of types will be made in the major portion of the counties.

Snap Judgment Poor Policy

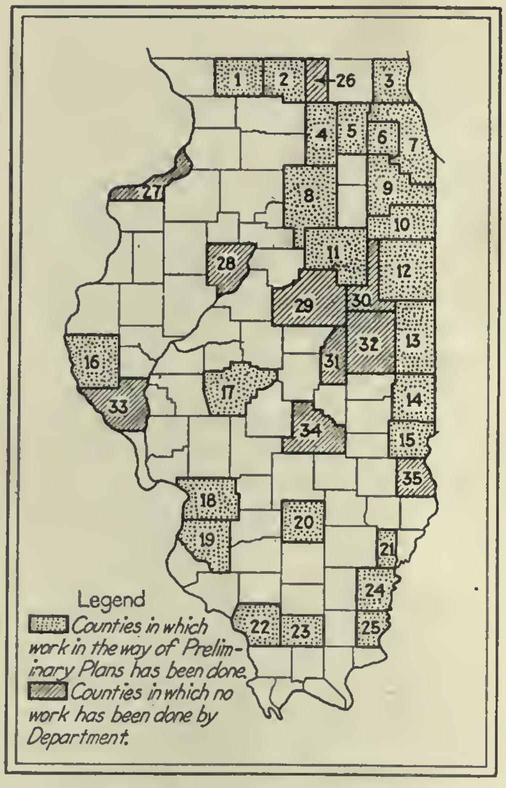
The average American is inclined to be hasty and is often unduly influenced by impressions. If he happens to have driven recently over any considerable mileage of one type of road which was in good condition, the contrast between the type which he found good and all the rest which he found bad is very impressive, and thus we find large numbers of people who are strongly prejudiced in favor of some particular type or against some other type. Nothing can be more illogical from the standpoint of economy. Every type has a value or ability to render service and a corresponding cost. The cost of service, then, is the first cost plus maintenance cost plus the interest on the money divided by the number of users, and, therefore, if the type is properly adapted to the traffic, the cost of service is approximately the same on all types.

The construction of a system of roads at one time presents a very different problem from the construction piecemeal of a few main roads of limited extent and benefit in a restricted district. When a single road is built it must necessarily be of a type which will accommodate the sudden and marked increase of traffic that always follows the opening of a newly improved road, because of the great number of vehicles drawn from shorter and unimproved arteries, between source and destination, to the smoother and more agreeable surface. The building of another road in the vicinity will have an immediate bearing on the amount of traffic carried by the first, and a financial loss results either through building a more costly type than necessary to sustain the normal traffic, or through involving an excessive maintenance cost by developing an abnormal traffic.

Equalize Cost to All Users

The design of a system of roads enables us to take advantage of the economy of proportioning the type of road to the traffic it will be called upon to bear. To make the point clear it must be kept in mind that the cost of a road comprises three principal elements of expense—the first cost, the maintenance charge and the interest on the money invested. These are all variable quantities, but by proper design the cost to the user may be made approximately constant throughout any system of roads, just as a sewer system composed of various sizes of pipe may be designed to carry the amount of water reaching any part on it, and the cost spread over a benefited territory in proportion to the benefits received.

The following figures have been prepared to illustrate this point and should not be taken to represent average cost or even the cost in any particular case; the purpose being solely to show that by proper design the road types may be so proportioned to the traffic that the cost of service or cost per user may be made approximately constant.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Legend
▨ Counties in which work in the way of Preliminary Plans has been done.
▨ Counties in which no work has been done by Department.
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ILLINOIS COUNTIES CONTEMPLATING HIGHWAY BOND ISSUES

For this ilustration we have taken an oiled earth road at $1,000 a mile, a gravel road at $5,000 a mile and a concrete road at $10,000 a mile. We have also assumed money worth 5 per cent, and have taken a period of five years for computation, though any number of years would serve the purpose. The amount paid by the county is in conformity with the Illinois law.

$1,000 Earth Road

	Cost	Paid by county
Interest	$250	$125
Maintenance	500	500
Oil first year	200	100
Oil second year	200	200
Oil third year to fifth year.	300	300
First cost	1,000	500
	$2,450	5/$1,725
Average per year..................		$345

Assuming an earth road carries an average of 100 vehicles, then the county pays $3.45 per user per year.

$5,000 Gravel Road

	Cost	Paid by county
Interest	$1,250	$625
Maintenance	500	250
Repairs	500	250
First cost	5,000	2,500
	$7,250	5/$3,625
Average per year..................		$725

Assuming a gravel road carries twice as many vehicles as the earth road, or 200 vehicles, the county pays $3.62 per user per year.

Assuming a concrete road carries twice as many vehicles as the gravel road, or 400 vehicles, the county pays $3.12 per user per year.

$10,000 Concrete Road

	Cost	Paid by county
Interest	$2,500	$1,250
Maintenance (paid by state)	500	....
Repairs (paid by state)...	125	....
First cost	10,000	5,000
	$13,125	5/$6,250
Average per year..................		$1,250

It thus appears that the cost per user to the county is about the same on all types. The amount of traffic on each of the various roads of a completed system is very nearly in proportion to tributary population and the value of the surrounding property. This makes it possible to design a balanced system of roads on a percentage basis of assessed valuation.

Our principal object in road construction is to produce and maintain a smooth surface for travel, and it matters little to the user what type of road he travels over so long as it is smooth and serviceable at all times.

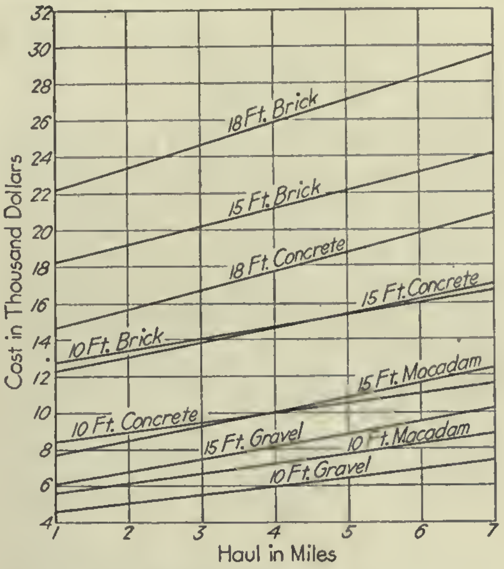
When once we have a smooth surface the cost to the user is the total cost divided by the number of users. Thus, if a road costs $10,000 a mile, and there are 100 users, the cost of serving each user would be $100; while if there were 1000 users the cost would be only $10 for each. It follows from this that if the same type of road is built for 100 users as is necessary for 1000 there is a tremendous waste of money, as it would be entirely practicable to produce and maintain a smooth road which will accommodate a traffic of 100 at a less expense than is necessary for 1000.

If we knew the amount of traffic which each piece of road in a system of roads would be called upon to carry, it would be possible to select a type for each section, the total cost of which, including the maintenance and interest, would make the cost per user approximately the same on each section of the system. This means that in a properly designed system one type is as good as another—that is, a gravel road in the right place is as good as a brick road where brick is required, and, because of the difference in cost, a great deal better than brick would be where only gravel is needed.

HOW TRAFFIC CENSUS IS USED

It will be said that we cannot arrive at an exact measurement of the traffic over any considerable number of roads. This is true, but it is not necessary that we should in order to take advantage of many economies in design. If, for instance, we learn from a single traffic count taken at the same time on each of the roads of a proposed system, that one road is carrying 5, 10, 20, 100 or 1000 times as much as another, this alone will be a valuable guide in selecting the proper type for any particular road of the system, and, taken in conection with such other factors as cost and availability of materials, population of the district and value of surrounding property, we are able to estimate very closely the true economic type.

Again, it may be said that we do not know exactly how much traffic any particular type will bear. This also is true, but it is not necessary that we know this exactly. Even if we did know what a type will do in one locality it does not follow that it will do the same in another, as the cost may be different or the repairs and maintenance less efficiently done. What we do know is approximately how the various types of road surface behave, and, when taken into account, this is sufficient to produce a wonderful economy in the design of a system of roads as compared with the piecemeal one-road-at-a-time method.



COST PER MILE OF DIFFERENT TYPES OF PAVEMENT IN DE KALB COUNTY

Of course, it cannot be denied that the whole problem of road construction and maintenance is very complex in its many details, but there are a few fundamental principles clearly understood and well-defined upon which economy of design rests. If these elementary truths are not generally recognized it is because the road problem is comparatively new and the economic design of road systems almost entirely so.

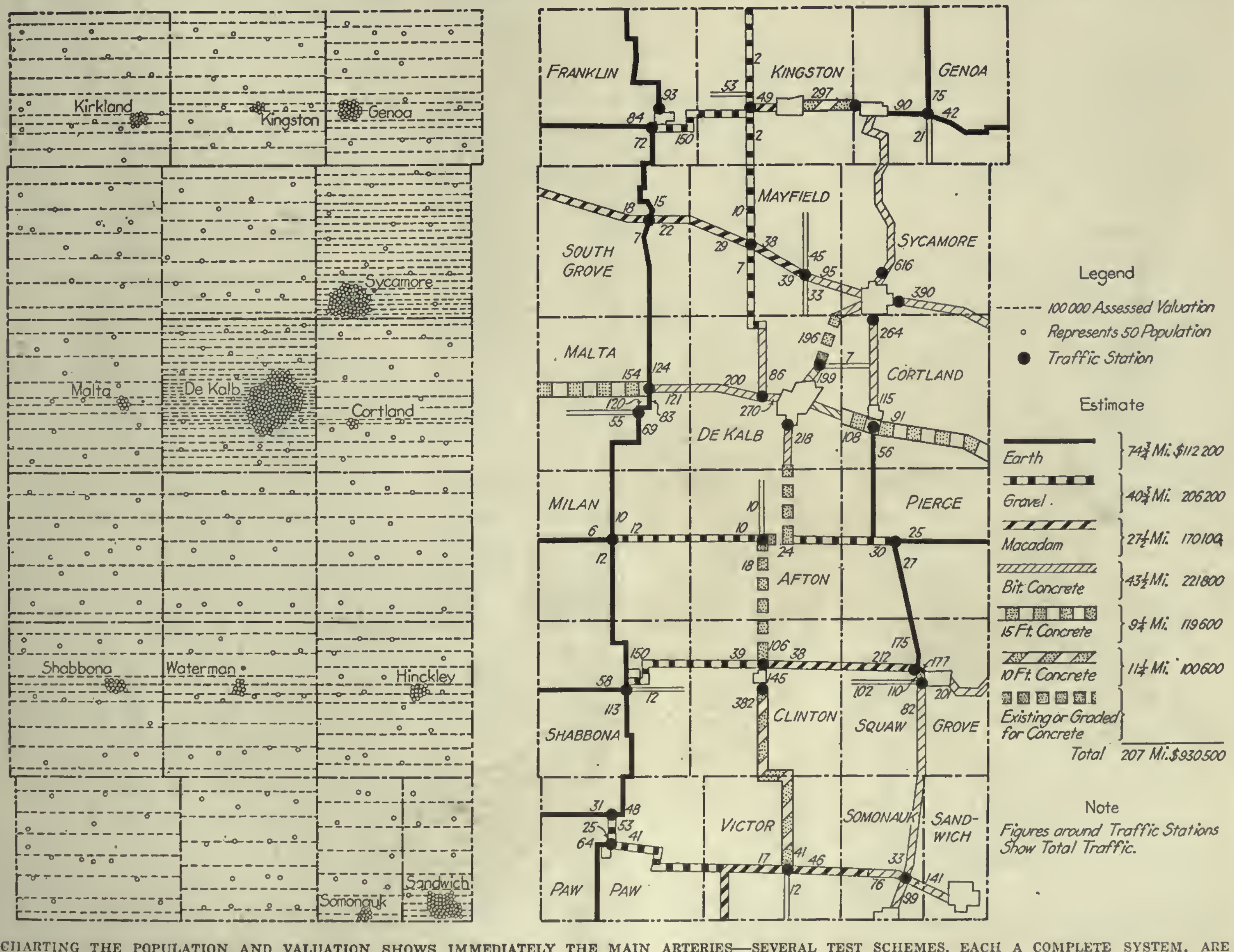
FUNDAMENTAL PRINCIPLES

A few of the most vital of the fundamental principles of economic design are the following:

Money has a certain definite earning value, and, in the outlay of a fixed sum upon any improvement, this earning value or interest over the life of the improvement becomes as much a part of the cost as the first cost itself. For this reason any money unnecessarily spent in construction must be considered as interest bearing for purposes of computing cost.

The use of local materials, while more or less generally considered, is seldom developed to anything like the economic limit. Too frequently materials for use in construction are imported where the expense is by no means justified. If a local material is of such a quality that it will give only half the service of an imported material, but costs less than half as much, it is economy to use the local material. In other words, if less than 50 cents worth of local material will give half as much service as a dollar's worth of a better imported material, then it will be economy to use the local material.

The maintenance of roads in those sec-



CHARTING THE POPULATION AND VALUATION SHOWS IMMEDIATELY THE MAIN ARTERIES—SEVERAL TEST SCHEMES, EACH A COMPLETE SYSTEM, ARE DEVELOPED tions of the country where no considerable mileage has ever been permanently improved is very little understood, and the public generally has a very exaggerated idea of the cost of perfect maintenance of improved roads, due, no doubt, to the enormous sums squandered in the maintenance of unimproved roads. It should be borne in mind that a large mileage of properly constructed roads may, through the use of modern machinery, scientific methods, trained men and constant attention, be maintained at a cost surprisingly low as compared with the average cost in short sections without organization or adequate equipment.

It is astonishing how much money is sometimes wasted in construction, either through improper design or inefficient methods. Into this problem comes the type adapted to the road to be improved, the sequence of construction, the wanton waste of materials either in width or thickness of the metaled way, and many others.

The reconstruction of roads previously improved, either with hard surface or with permanent grading and draining, offers many opportunities for scientific economy, and a recognition of the best possibilities in reconstruction enables us to work with a closer margin of safety in the original design as well as to take advantage of the development of the art.

In designing a system of roads, therefore, to be paid for by taxation, it will generally be found that from considerations of economical service the more expensive types will be required in the districts from which the greater part of the taxes are collected, and that the sparsely settled districts have returned to them in actual value of road constructed a greater amount than is actually paid by them. This is as it should be, for unquestionably the centers of population derive a benefit from the improvement of rural highways for which they should and do pay.

How Selection Is Actually Made

The first step in the preparation of plans for a county system of roads is to make a map of the county and vicinity showing the townships and the adjacent townships of surrounding counties. On this map should be shown in addition to the cities and villages of the county in question such other large cities and villages in the nearby counties as may be readily indicated, and which will have a bearing on the amount of traffic to be expected through the county under consideration. Such a map prepared for De Kalb County, Illinois, is shown herewith. The circles indicate a population of fifty people geographically distributed and are taken from the U. S. census reports. The lines drawn across the township indicate a valuation of $100,000 each, also geographically distributed.

At a glance it is seen that De Kalb Township, with the city of De Kalb, is the center of population and valuation. Sycamore Township and the city of Sycamore is second in importance, and so on. It is also apparent that the line of traffic starting from the southeast corner in the county and running up through Hinckley, west to Waterman, north to De Kalb, northeast to Sycamore, and north to Genoa would carry the greatest north and south traffic, and a line running east and west through De Kalb would carry the greatest east and west traffic through the county. This line east and west through De Kalb happens to be the Lincoln Highway, and on each side of the county there are numerous important cities and villages along this line. It is therefore safe to say that such a road will carry very much more than a road east and west—for instance, through the townships of Milan, Afton and Pierce—and that it should consequently be of a much heavier and more substantial type than the line through the three townships named, which, on account of low valuation and population, and also because there are no large cities either east or west of this tier of townships, can never expect to carry as great a traffic as the Lincoln Highway.

The two factors of assessed valuation and population are very good guides in determining the amount of traffic which may be expected on any road, or at least the relative amount which one road will carry as compared with another. Neither one, however, or any single factor entering into the determination of the amount of traffic can be relied upon to give accurate results even relatively, but, considered in connection with other factors, it is possible to lay out a system of roads and estimate very closely the relative amounts of traffic which may be expected.

Take Traffic Census Simultaneously

The next step is to make a count of traffic on each of the roads of the proposed system. A traffic census taken on one day will ordinarily suffice for this purpose. Even though the total amount of traffic on any one road varies widely with the day of the week, the season of the year, the condition of the roads or the weather, it is safe to assume that the traffic over a whole system is approximately the same relatively under the varying conditions, barring, of course, a road which is in very much better condition than any of the surrounding roads. It therefore follows that when all of the roads of a system are improved the relative distribution of traffic under varying conditions of season, weather, etc., will be approximately constant, and it is the relative importance of the roads which we are seeking to determine. If, then, the traffic census is taken simultaneously throughout the system, and recorded on a map with large, red numbers, and this information is considered in connection with the assessed valuation and the population, it will enable us to determine with comparative accuracy the relative importance or amounts of traffic on each of the roads.

Several plans are then prepared and submitted to the committee of the county board appointed to investigate. This committee then considers the plans in connection with its own knowledge of local conditions and requirements and makes a report recommending that some particular plan be submitted to a vote of the people as provided by law.

All the preliminary studies and plans are made for the purpose of settling the broader questions of cost, type, etc., which are of general interest to the taxpayer who must pass upon the proposition. After this has been done the details, always important but of less general interest, may be worked out from the results of more elaborate study and careful surveys. The numerous tentative plans are necessary in order that we may compare their individual advantages and disadvantages and finally arrive at a balanced plan, which may be designated either too light or too heavy, but which will nevertheless be harmonious throughout. The cost of service will go up somewhat, either through increased maintenance cost, if the design is too light, or through increased interest and first cost if the design is too heavy. It is not at all likely, however, that any serious mistake under ordinary conditions will be made either way, and certainly not so great as by haphazard selection.

There is another great advantage in preparing a number of preliminary plans in that they serve to clear the situation to the average man on whom we must depend for support if we would have success.

Advocates Self-Supporting Rapid Transit Line

Build in Steps at Philadelphia as Needed and Charge a Fare That Will Pay the Cost, Says Director William S. Twining

STATING that new rapid transit facilities in Philadelphia should be built in moderate steps, each to be assimilated by the city and the operating company before the next is undertaken, and that a sufficient fare should be charged from the outset to make each step a paying proposition without increasing the tax rate of a future generation to pay interest on construction cost, the new report of William S. Twining, director of city transit, points out the waste that would result from building the entire proposed system at present inflated prices under the present plan of meeting the cost from a large fifty-year bond issue and charging a 5-cent fare, which would not pay the way of the new lines for some time to come. The report also concludes that in tunneling under the city hall the city is going to an unnecessary expense to locate a station where it would later produce needless congestion. A further study of traffic conditions has suggested a partial relocation of the distributing loop in the business sections, but aside from this the report is concerned chiefly with the proposed methods of financing the proposed construction.

Terms of Operation Should Be Known at Once

The report considers inexpedient the undertaking of the whole construction program during an era of abnormally high prices and before the operator of the system has been determined upon and the terms of operation settled. It is suggested that these terms should be definitely known before more construction than is now authorized is undertaken. It appears that the demand for the construction of the entire system as a unit is a political one, backed by local organizations in all the territory that would be benefited by the present plan. In order to put a check on this demand it is suggested that the necessary legislation be obtained to enable the city to assess the interest charges of the construction on the property in the districts benefited. As this, however, would not be possible without constitutional amendment and the lapse of four or five years, it appears that the issue over the construction plan will be a straight one of business methods vs. political methods.

Construct Trunk Lines First

It is suggested that the comprehensive plan of routes now contemplated should be divided in two sections, the first consisting of the trunk lines in the 25-minute streetcar zone from the city hall. Of these lines, which include the Broad Street subway and delivery loop from Oregon to Erie Avenues, the Frankford elevated line to Bridge Street, the Twenty-ninth Street line and the Woodland Avenue line, only such lines should be built at the present abnormal prices as may be considered necessary and terminal sections. This would include the Frankford elevated line and the Broad Street subway, including the loop, from Spruce Street to Erie Avenue with an extension of the Walnut Street line of the loop to Sixteenth Street. It is proposed to make the Broad Street subway four-track from Ridge Avenue at the north end of the delivery loop to Erie Avenue, and to make all the other lines two-track. To bring the city hall station several feet nearer the street, to discharge its passengers outside of the city hall square where they will not have to cross crowded streets to get anywhere, to space the station better with reference to the Chestnut Street station below it and the Vine Street station above it, and to reduce the cost of construction near the city hall, a relocation of this section is proposed which only goes under one corner of the city hall building. Instead of making the north side of the delivery loop a line under Arch Street, where it is estimated that less than 20 per cent of the inbound passengers would alight, it is proposed to close this side of the loop by constructing a diagonal line under Ridge Avenue from Eighth Street back to Broad Street, thus serving a larger area.

Following this construction and the completion of the remainder of the trunk and terminal sections, it is suggested that the remainder of the proposed system be treated at extensions to be built and financed as conditions warrant.

Financial Benefits to City

If the proposed modification were carried into effect, it is estimated that by charging a slightly increased fare, at no time more than 5.7 cents, and reducing it as conditions warrant, the city's annual deficit would be reduced to $40,000—practically wiped out—by 1940, as compared to a total deficit of $30,000,000 to be expected in 1940 under the plan now contemplated. Only once during this time under the proposed plan would a deficit greatly in excess of $600,000 occur, while under the present plan from the time of operation till 1936 the annual deficits would exceed $1,000,000 and would several times exceed $2,000,000. According to the proposed plan, with a total capital investment on the part of the city and the operating company by 1921 of $39,506,000, 8.69 sq. mi. of territory could be brought within a 25-minute ride of the city hall. According to the present plan an expenditure of $63,548,000 would be made to bring into this zone a total area of 14.72 sq. mi., at a cost per square mile of 46 per cent in excess of that under the proposed plan. The financial comparison is more favorable to the proposed plan than is shown, as the net income from the Camden tunnel, which both plans agree should be built by private capital, is credited to the annual deficit under the present plan, but not to that under the new proposal.

Boston Elevated Railroad to Build Creosoting Plant

A creosoting plant is to be built by the Boston Elevated Railroad for treating ties and other timber material used in its structural work.

Small Irrigation Canals Lined with Concrete to Prevent Seepage Water Loss

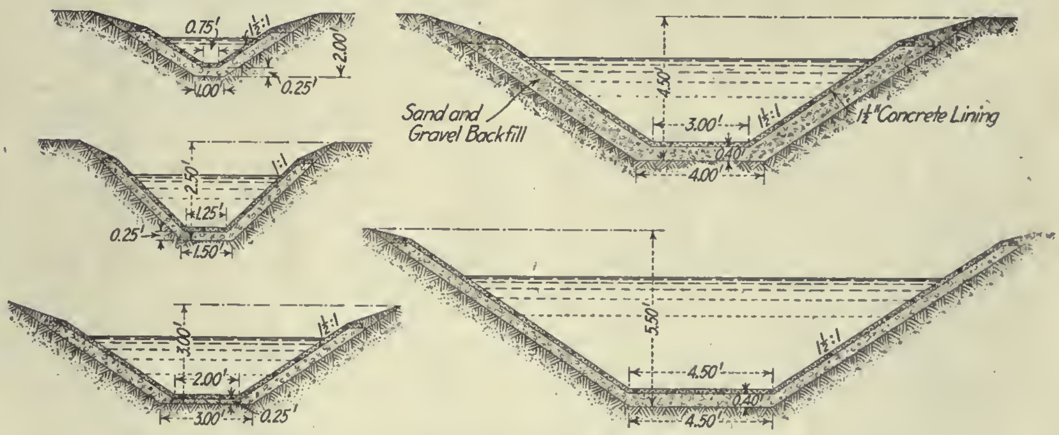
Part II of Article Giving Details of Construction and Cost of Work on Okanogan Project in Washington

By C. E. EDWARDS
Civil Engineer, Okanogan, Wash.

In the first part of this article in last week's issue, page 508, Mr. Edwards discussed the design of the canals, grade and alignment, working crew, hauling and placing of backfill and the shaping of the ditches with templates. This week's installment deals with the concrete mixing and placing, wages of working force and detailed costs.—Editor.

THE supply of aggregate for concrete was usually obtained close to the work; the haul seldom exceeded 1 mile and the average haul was ¾ mile. The aggregate was hauled in advance and placed at regular intervals along the canal, usually about 50 cu. yd. in each place.

Pit run was generally used; everything larger than would pass through a 1-in. mesh screen was taken out. The material, therefore, contained an extra amount of sand, but this was desirable in order to make the concrete easier to plaster and get an impervious surface. Frequent tests were made for the amount of voids in the aggregate, and the amount of cement was varied accordingly. A minimum of 5 sacks per cubic yard was used and a maximum of 6 sacks per cubic yard was sometimes required and used. The average for all the work was 5.2 sacks for each cubic yard of concrete placed.



CROSS-SECTIONS OF LINED CANALS FOR WHICH COSTS ARE GIVEN

Mixing Concrete

Most of the mixing has been done with a ¼-yd. Northwestern mixer, mounted on trucks and operated with a 5-hp. gasoline engine. The mixer is equipped with a self-loading bucket, the discharge end of the drum being operated with a door, which made it convenient for loading wheelbarrows. A tilting mixer could not be used to advantage on this kind of work.

The mixer came equipped with a 1-in. rotary pump for supplying water, but this pump did not prove satisfactory on account of the long supply pipe and high lifts that were occasionally necessary. After the pump had worked about two months it would no longer supply a sufficient quantity of water when operated from the mixer. It was then taken off the mixer and mounted on a small platform and connected to a 1½-hp. Fuller & Johnson gasoline engine. This outfit was placed next to the water supply and the water forced through the supply pipe instead of drawing it through, as was necessary when it was mounted on the mixer.

Three rotary pumps were worn out in six months' work. A 5-in. piston pump has been used since that time, and has given satisfaction, supplying more than twice the amount of water that the rotary pumps did with the same amount of power. The pumping outfit is practically automatic, requiring very little attention except to keep up the supply of gasoline and oil. It will run eight hours on 3 quarts of gasoline and ½ pint of oil, and supply enough water under a 10-ft. lift to mix 75 cu. yd. of concrete. The supply pipe from the pump to the mixer was from 300 to 450 ft. in length, depending on the length of set up and location of the mixer. The mixer was always located as near the middle of the set up as local conditions would permit.

The platform for the mixer was set on solid ground whenever possible, but in a good many cases the banks were so narrow that it was necessary to build the platform out over the lower bank or across the canal. The minimum size of the platform was 16 ft. square and, where possible, this was increased to 16 x 20 ft., and the mixer set crossways on the end nearest the aggregate. The floor of the platform was nailed down in all cases to make it solid so as to facilitate the movement of the wheelbarrows to and from the mixer.

The time of unloading the batch into the wheelbarrows after the mixing is completed is one of the limiting conditions to a maximum output, and special effort was made to eliminate all delay at this point. An incoming and outgoing runway was built in each direction, so as to avoid confusion at the mixer. Two complete sets of platforms and runway boards were used. The set not in use was moved ahead to the next set up and was all in place when the mixer was ready to be moved ahead.

When loading, the bucket was filled one-third full of aggregate and then ½ sack of cement was put in. The bucket then was filled two-thirds full and a full sack of cement added, the balance being filled with aggregate. Two men are required to shovel the aggregate and one man to handle cement. The water is turned on as the bucket starts to discharge, as it was found by experiment that this gave the best results in getting all the batch mixed to the same consistency. Sufficient water was applied to make the concrete wet enough to spread easily.

The man that ran the engine operated the loading bucket and the water supply and signaled the man loading the wheelbarrows when the batch was mixed. Under ordinary conditions a batch was mixed every 2½ min., 1 min. being taken to mix the batch before the discharging was started; 1½ min. for unloading was usually required. A batch made five or six wheelbarrow loads. The average output of the mixer was 6½ cu. yd. per hour.

Wheeling Concrete

The concrete was hauled in wheelbarrows having a maximum capacity of 3 cu. ft., the maximum haul being 450 ft. and the average 200 ft. From seven to nine wheelers were employed, each man hauling from 6 to 7 cu. yd. in 8 hr. The runways were made of 1½ x 12-in. and 1½ x 10-in. tamarack planks, 16 ft. long, usually laid on the lower bank of the canal. The 10-in. planks are plenty wide enough for experienced wheelers, and do not split at the ends quite as readily as the wider planks. Then, too, they are cheaper and easier to handle when moving.

When the banks were low and the concrete lining came close to the top the running boards were set 3 ft. from the edge of the lining whenever possible, on account of the passing wheelbarrows bothering the plasterers while they were working near the top of the lining. When it could be used to advantage the canal bank outside the running boards was leveled up so as to provide a return track for empty wheelbarrows. When it was not economical to do this frequent turnouts were made, so that the empty wheelbarrows could avoid the loaded ones without stopping to wait.

Placing Concrete

The best organization for placing concrete in ditches having a bottom with from 2 to 5 ft., where the output averaged 50 cu. yd per day, was found to be four three-man crews, each crew being composed of two plasterers and one shoveler. These crews were distributed along the canal as follows: For a setup 700 ft. long crew 1 started at the upper end of the section, crew 2 about 160 ft. below crew 1, and crew 3 about 190 ft. below crew 2, and crew 4, 190 ft. below crew 3. Crew 4 worked 160 ft. The two middle crews were each given 39 ft. extra, as it was found that the concrete spread so much easier on the shorter hauls than it did for the longer hauls.

All four crews worked down the canal in this way; the average length of haul was kept the same until the setup was completed. The crews were alternated from the long to the short haul on each setup so as to make up for any possible inequalities in the amount of work required from each crew.

The platforms for dumping the concrete on at the point where it was being applied were made 6 ft. square and set on trestles 2 ft. high for ditches having a bottom width of 2 ft. or more. The platforms were laid across the ditch without trestles when the bottom width was less than 2 ft. These platforms were made of 1½-in. plank nailed on four 2 x 4-in. stringers, set on edge. On the back end of the table near the corner next to the runway a short 1-in. strip was nailed for holding in place the running board that connects the table with the runway.

This running board was set at an angle of 45 deg. to the center line of the canal, and always pointed up the canal toward the shoveler so that in dumping the wheelbarrows—always done over the front end—the shoveler could clean out any concrete that might stick to the bottom of the wheelbarrows as they were being turned back by the wheeler. It was found that considerable time of both shoveler and wheeler was saved if the wheelbarrows were tipped ahead just before they reached the bottom of the running board and allowed to land full force upside down on the platform. This requires some skill on the part of the wheeler and is rather hard on the trays of the wheelbarrows, but the extra saving in time for the whole crew more than pays for the damage to equipment, as the concrete usually comes out clean and the shoveler is not delayed at all by having to stop to clean out the barrows.

Cost of Linino Canals with Concrete

Item	Section A		Section B		Section C		Section D		Section E	
Width of bottom, feet	0.50		1.25		2.00		3.00		4.50	
Total depth, feet	1.10		2.00		2.25		3.20		4.60	
Perimeter in feet (including berm)	5.45		7.93		11.10		15.52		22.06	
Side slopes	1:1.5		1:1		1:1.5		1:1.5		1:1.5	
Cu. yd. concrete per 100 ft. of canal	2.52		3.65		5.15		7.15		10.20	
Cu. yd. backfill per 100 ft. of canal	5.00		7.5		12.00		38.0		28.0	
Lin. ft. per cu. yd. of concrete	39.50		27.40.		19.40		14.00		9.82	
Location	sidehill		sidehill		sidehill		level		level	
Item.	Per cu. yd.	Per lin. ft.	Per cu. yd.	Per lin. ft.	Per cu. yd.	Per lin. ft.	Per cu. yd.	Per lin. ft.	Per cu. yd.	Per lin. ft.
Foundation	$1.518	$0.038	$2.540	$0.093	$2.750	$0.142	$3.005	$0.215	$1.400	$0.143
Plant	1.367	0.035	0.895	0.032	0.840	0.043	0.693	0.050	0.731	0.075
Gravel and Sand	1.023	0.026	0.960	0.035	1.080	0.055	1.021	0.073	0.630	0.064
Cement	2.990	0.076	2.930	0.104	2.520	0.130	3.117	0.223	3.254	0.332
Water	0.013	0.001	0.022	0.001	0.026	0.001	0.011	0.001	0.024	0.002
Mixing	0.411	0.010	0.404	0.015	0.380	0.020	0.350	0.025	0.343	0.035
Wheeling	0.705	0.017	0.582	0.021	0.508	0.026	0.450	0.032	0.431	0.044
Placing	1.000	0.025	0.923	0.035	0.900	0.046	0.790	0.056	0.900	0.091
Sprinkling	0.108	0.003	0.100	0.004	0.100	0.005	0.042	0.003	0.036	0.004
Supplies	0.160	0.004	0.120	0.009	0.157	0.008	0.063	0.005	0.046	0.005
Superintendence	0.140	0.003	0.120	0.005	0.120	0.006	0.120	0.008	0.120	0.013
Time and Cost Keeping	0.120	0.003	0.100	0.004	0.154	0.008	0.120	0.008	0.100	0.010
Engineering	0.260	0.007	0.204	0.007	0.160	0.008	0.095	0.007	0.050	0.005
Total for Concrete	8.297	0.210	7.160	0.262	6.945	0.356	6.872	0.491	6.665	0.680
Total for Concrete and Foundation	9.815	0.248	9.700	0.355	9.695	0.498	9.877	0.706	8.065	0.823

The shoveler used a No. 2 scoop shovel with which he placed the concrete on the slopes for the plasterers, who were equipped with a wooden float, a plasterer's trowel, a straight edge for the side and another for the top of the berm. In ditches more than 2 ft. deep ladders were used on the side slopes and the straight edges for the sides were nailed to these ladders. The plasterer spread the concrete to an even surface with his float on a strip about 18 in. wide, down the slope, at one time, the thickness being gaged by the strip just completed and the straight edge on the ladder. After this strip has been floated smooth it is finished with the plasterer's trowel. After the plasterer moves his straight edge or ladder ahead he always strokes the edge of the concrete just completed to give it a bevel. If this is not done a hair crack will sometimes appear at this joint after the concrete has started to set.

Plaster Lath Best Joint

Every 10 ft. a contraction and expansion joint was made. Several kinds of joints and jointers were tried. The easiest and most satisfactory joint was made with a common plaster lath, which was sharpened on one edge. To make the joint, this lath was pressed into the concrete to a depth of 1 in. and then immediately removed. The crease made was then stroked gently with a trowel to smooth down any rough edges made by removing the lath. The plasterers worked opposite each other and took turns in placing the bottom.

The corners where the side slopes join the bottom and the berm were rounded, as this was easier than making square corners and gives a very good appearance. The outside edge of the berm is sloped off as soon as the straight-edge is removed. This widens the berm a little and gives an increased security from damage by surface water getting under the lining after the backfilling on the berm has been done.

An average day's work for one crew of two plasterers and a shoveler was 12 cu. yd., but as much as 16 cu. yd. have been placed by one crew on several occasions. With lining only 1½ in. thick 12 cu. yd. of concrete makes about 2500 sq. ft., and 16 cu. yd. makes 3250 sq. ft. of lining.

A track man was employed who kept the runways in order, helped the shoveler of the placing crews to move the shoveling tables when necessary and did such other work as the foreman directed. One man was employed in sprinkling the backfill ahead of the plasterers as the surface dried somewhat from the time the flooding was done until the concrete could be laid.

It was necessary to wet the concrete after it had been placed to keep it from getting too dry while curing, and as it damages the concrete to back the water up in the canal high enough for this purpose, another man was employed to keep the concrete wet for six or seven days after it has been placed. This work was started 24 hours after the concrete had been placed. The water for this work was backed up in the canal about 6 in. deep and the man walked along the banks and pulled the water up the slopes with an implement made for this purpose, which consisted of a light narrow board 2 ft. long, fastened at right angles to the end of a long handle. This was much quicker and more effective than sprinkling and one man could wet 1 mile of small canal with a 16-ft. perimeter four times a day.

Water Supply

The water supply was kept up within 400 ft. of the mixer by running it into the canal and holding it with low sack dams. As each move was made another dam was built and the water allowed to follow down. A sack dam was found the most convenient and dependable on account of the ease and safety of handling the water over green concrete. As the dam could not be built until the upper section was completed, precautions were taken to have everything in readiness beforehand. For the average move, which requires 30 min., the water supply is the last thing ready, and any delay on this account would increase the cost of moving considerably with the whole crew waiting for water. One of the laying crews built the sack dam and let the water down. This crew was designated each time by the foreman.

MOVING AND SETTING UP

When the rotary pump, which was mounted on the mixer frame, was used, it was necessary to lay the pipe in the bottom of the ditch in order to get a gravity flow up to within 20 ft. of the mixer; otherwise the pump would not supply a sufficient quantity of water on account of the difficulty in making tight joints on a pipe that was being moved daily. Some time was always lost in getting the pump primed after each move.

With a separate pump and engine the pipe was laid on the bank, out of the way of the plasterers, and could be moved in about half the time without damaging any lining in taking it apart at the unions and getting it out of the canal.

It required four horses to move the mixer on all moves on account of its weight of nearly 3½ tons and the low trucks, which made it very hard to move over rough roads. The average time for moving and setting up ready to start again was 30 min. and the minimum 20 min. When finishing mixing for the previous set-up all the wheelbarrows were filled and run to the placing crew on the lower end of the set-up, so that in most cases this crew was kept busy plastering while the move was being made.

SALARIES AND WAGES PAID

Concrete foreman, per month	$100.00
Team and backfill foreman, per month	90.00
Surveyman, per month	85.00
Timekeper, per month	85.00
Rodman, per 8-hr. day	2.50
Operator for Mixer, per 8-hr. day	3.75
Plasterers, per 8-hr. day	2.60
Shovelers (concrete), per 8-hr. day	2.60
Shovelers (hopper), per 8-hr. day	2.40
Laborers, per 8-hr. day	2.20

COST DATA

Careful cost records have been kept on all the canals lined, which amounts to 134,000 lin. ft. of canal and has required 7500 cu. yd. of concrete. There is submitted herewith a condensed summary of these records for the different sized canals and laterals. These costs cover all expenses except overhead charges from the connected offices of the Reclamation Service.

Part of the lining has been in use for four seasons and has given good service and shows no signs of wear. Up to date it has required no expense for maintenance, except at a few places on some of the first work. Where drainage inlets were not constructed at the time the lining was placed.

The friction factor for this kind of lining as determined from experiments varies from $n = 0.010$ for canals having a straight alignment and perfectly free from shifting sand and pebbles on the bottom, to $n = 0.015$ for canals having numerous curves and a limited amount of moving sand along the bottom.

No trouble has been experienced on account of expansion or contraction injuring the lining, even when the water is rotated and the canal is dry half the time during the summer. In general, the lining has proved very satisfactory and the indications are that it will give good service.

5-Ton Garbage Reduction Plant Yields Profit to City

Test of New Works at Pontiac, Mich., Indicates Absence of Odors—Gross Revenue $14.70 Daily

By GEORGE R. BASCOM
Municipal and Sanitary Engineer, University Extension Division, Madison, Wis.

A SHORT test of the newly constructed garbage reduction plant at Pontiac, Mich., was recently made by the writer and Leon Smith, assistant city engineer of Madison, Wis. The findings are briefly as follows: The plant operates in a perfectly sanitary manner, without any offensive odors. Both of us are agreed that any city could place such a plant in a central location and operate it so that no objectionable odors could be noted. The only disagreeable feature of the works is the coming and going of the garbage wagons, but if up-to-date equipment for collecting the garbage were used it would be possible to operate in almost any section of the city in a manner which would not be objectionable. The odors of the average automobile garage are much more dangerous and much more unpleasant than the odors of the Pontiac plant. In fact, we could smell nothing when standing outside the doors of the building, while inside there was noticeable an odor which was about the same as the smell of licorice or chicory. It was in no sense strong or offensive.

BY-PRODUCTS RECOVERED

The elimination of the odors is accomplished by digesting the garbage in steel tanks under 70 lbs. of steam pressure, and, throughout the process, drawing off the usual offensive odors by means of a vacuum pump. These gases are condensed and discharged into the sewer. To make sure that the condensed gases are properly disposed of, a solution of nitrocene is injected into them prior to discharging into the sewer.

Our test of the Pontiac plant showed that by this method there is made available at least 250 lb. of tankage and 43.75 lb. of grease per ton of raw garbage treated. The value of the tankage depends on the fertilizing properties contained in it and varies with the quality of the raw garbage and with the process of reduction. I am led to believe from the method used in digesting or cooking the garbage and from the analysis of the Pontiac tankage, that it is worth more than the average garbage tankage. An estimate of the value of the Pontiac tankage was made by W. H. Strowd, of the University of Wisconsin, who specializes in feeds and fertilizers. His report follows:

"I give below the value of a ton of garbage tankage on the basis of the analysis which you handed me and which is returned herewith. The following prices per pound of plant food materials are used. These are the figures adopted by the Association of Eastern Experiment Stations for 1915, and are based on the average wholesale prices of the materials for a period of six months beginning Sept. 1, 1914:

"Nitrogen, 20 cents; phosphoric acid, 4 cents, and potash, 8.5 cents. From these figures the value of the plant food in a ton is as follows: Nitrogen, $12.20; phosphoric acid, $2.76; potash, $1.53. Total, $16.49."

The following analysis of the Pontiac tankage, as made by Andrew J. Patten, of the Michigan Agricultural College, is the one referred to in Mr. Strowd's report: Nitrogen, 3.03 per cent; phosphoric acid, 3.45 per cent; potash, 0.9 per cent. Mr. Patten states in his report:

"This sample agrees very well in composition with other samples of garbage tankage analyzed in this laboratory."

PROFIT IN TANKAGE

The statement by Mr. Strowd shows the value of the tankage to be $16.49, which means (using the data obtained at Pontiac), that there is available from tankage alone a value of $2.06 per ton of raw garbage, if it is uniformly as rich as the sample. This is about three times as valuable as the average tankage which is obtained from garbage-reduction plants using solvents to obtain the grease. At $6 per ton, which is a fair average of the selling value of garbage tankage, and taken on a basis of 250 lb. per ton of raw garbage, there is available 75 cents per ton of raw garbage from the tankage alone.

The value of grease can conservatively be taken at 5 cents per pound—it has been bringing 6½ cents in Chicago during the last few months. On this basis, the grease obtained is worth $2.19 per ton of raw garbage. The combined value of the by-products is, therefore, equal to $2.94 per ton of raw garbage.

Offsetting this revenue, we found the cost as follows:

Two men—one foreman and one assistant—operated the plant, and when the additional tank is installed (which should be done before summer time) they can take care of 5 tons of raw garbage per day. The coal used during our test amounted to much more than would be needed if some changes were made in the equipment, as, for example, the installation of a press to assist in drying the tankage and by the substitution of an electric drive for the agitator in place of the steam engine now in use. On a basis of $4 per day for the man in charge and $2 per day for the assistant, and computing the coal at $5 per day, we have the operating cost at $11 per day.

If we neglect the smaller items such as lubricating oils, waste, light, telephone and such larger items as interest on the investment, depreciation and maintenance, the statement of the Pontiac plant is as follows:

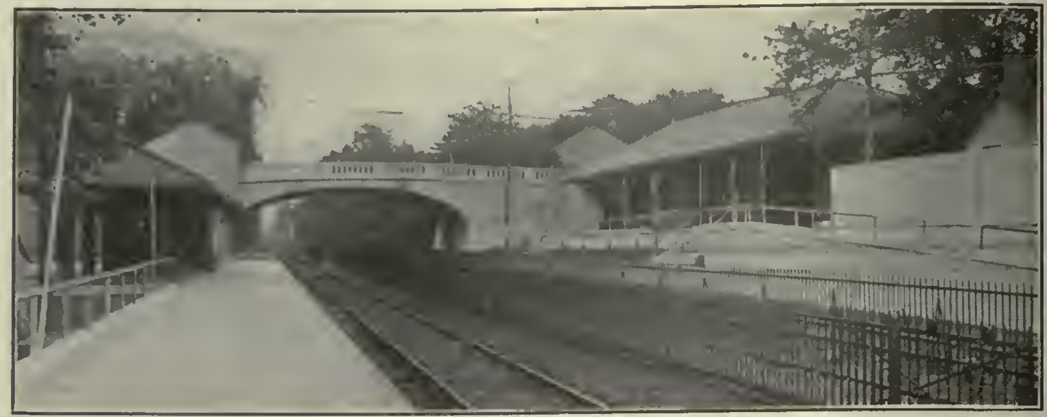
Gross revenues—5 tons of raw garbage per day at $2.94 per ton, $14.70; cost of reduction, $11; net revenue per day, when operating on a basis of 5 tons, $3.70.

This study has justified an opinion which I have held for some time, that garbage reduction is feasible in small cities both from a sanitary and from an economic standpoint. The fact that most of our *garbage burners* are municipally owned and operated at a loss to the community while most of our *reduction plants* are privately owned and operated at a *profit,* should stir city officials to investigate and engineers to demonstrate further the limits of the reduction process. If garbage in quantities as small as 5 tons per day can be made to cover the operating expenses of the process of reduction, there will be cause for hesitating in burying, burning or even feeding garbage in small cities.

The equipment used in the Pontiac plant was designed and erected by Henry Wagner, consulting and sanitary engineer of Cincinnati.

A Small Railroad Station That Pleases the Eye

In Mountain Station, South Orange, the Delaware, Lackawanna & Western Railroad Has Produced Far More Than a Mere Shelter



STATION, ARCH AND SHELTER HOUSE BLEND INTO ONE HARMONIOUS WHOLE

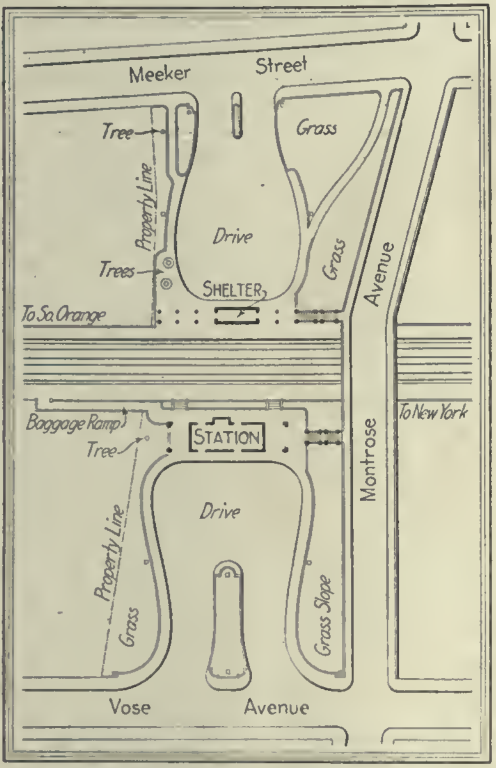
WHAT can be done with sufficient money to make a small railroad station a thing of beauty instead of a mere shelter from the elements is strikingly shown at Mountain Station, in the town of South Orange, N. J., on the Delaware, Lackawanna & Western Railroad. The new station is incidental to the elimination of a grade crossing nearby. When it was decided to carry the avenue over the tracks, on an ornamental arch, it became necessary, to satisfy the Lackawanna esthetic standard, to replace the old frame structure. Photographs are shown of the new station, which consists of a main building on the south side and a smaller shelter house on the north side. Not the least attractive features are the ample approaches. In fact in the entire improvement—buildings, arch, approaches and minor details—the esthetic side has been kept uppermost.

PARK SPACES PROVIDED

The drawing shows the general layout at the station. The railroad company owned some of the property between its tracks and Vose Avenue, and all of the remaining land between Vose Avenue and Meeker Street was acquired for the approaches. The illustrations show the arrangement of driveways, walks and park spaces, the graceful curves introduced, the location and character of lighting standards and the other features that give the grounds individualism.

The buildings and portico columns are of dark-red Bloomsburg wire-cut brick. The roofs are of green tile. The Montrose Avenue arch is of concrete, given a rough finish with smooth trim, and is surmounted by ornamental concrete balusters. It may be mentioned in passing that in the various stairways safety treads, which have been found to rust and discolor the concrete, have been eliminated. Instead of them carborundum has been mixed into the surface concrete itself, giving a rough surface which has proved entirely satisfactory.

The improvement is in a residential section of the better class, and efforts were made to minimize the damage to abutting property. To avoid encroaching on the property east of Montrose Avenue and south of the tracks the avenue, which formerly ran straight from the Vose Avenue to the Meeker Street intersection, was swung westward as shown.



ARRANGEMENT OF STATION, SHELTER HOUSE AND PARKED APPROACHES

GRADING RAISES STREETS

The Meeker Street intersection had to be raised some 5 ft. At the northeast corner was an estate with a level expanse of lawn and shrubbery. Instead of walling this off with concrete or earth fill the company graded the whole corner up, so that now one or two walled-in trees furnish the only evidence that the streets were raised.

There were a number of large trees along the east side of Montrose Avenue and elsewhere where grading was required. These were not destroyed, but wells of porous concrete were built around them, preserving the old ground surface at the bases of the trees. One of these wells is about 10 ft. deep.

PERSONNEL

The improvement, like the larger section of the South Orange work described in the Engineering Record in the issue of March 18, page 378, was carried out under the general direction of G. J. Ray, chief engineer of the Delaware, Lackawanna & Western Railroad, and G. T. Hand, division engineer. F. J. Nies, architect, designed the station and landscape features, A. B. Cohen, concrete engineer, designed the arch, and W. H. Speirs, assistant engineer, directed the work in the field. Hyde, McFarlin & Burke of New York City, had the general contract for grading and building the arch, while F. D. Hyde of that company built the station under a separate contract.

NOT THE LEAST ATTRACTIVE FEATURES OF THE STATION ARE THE BROAD APPROACHES—THIS IS THE SOUTH APPROACH

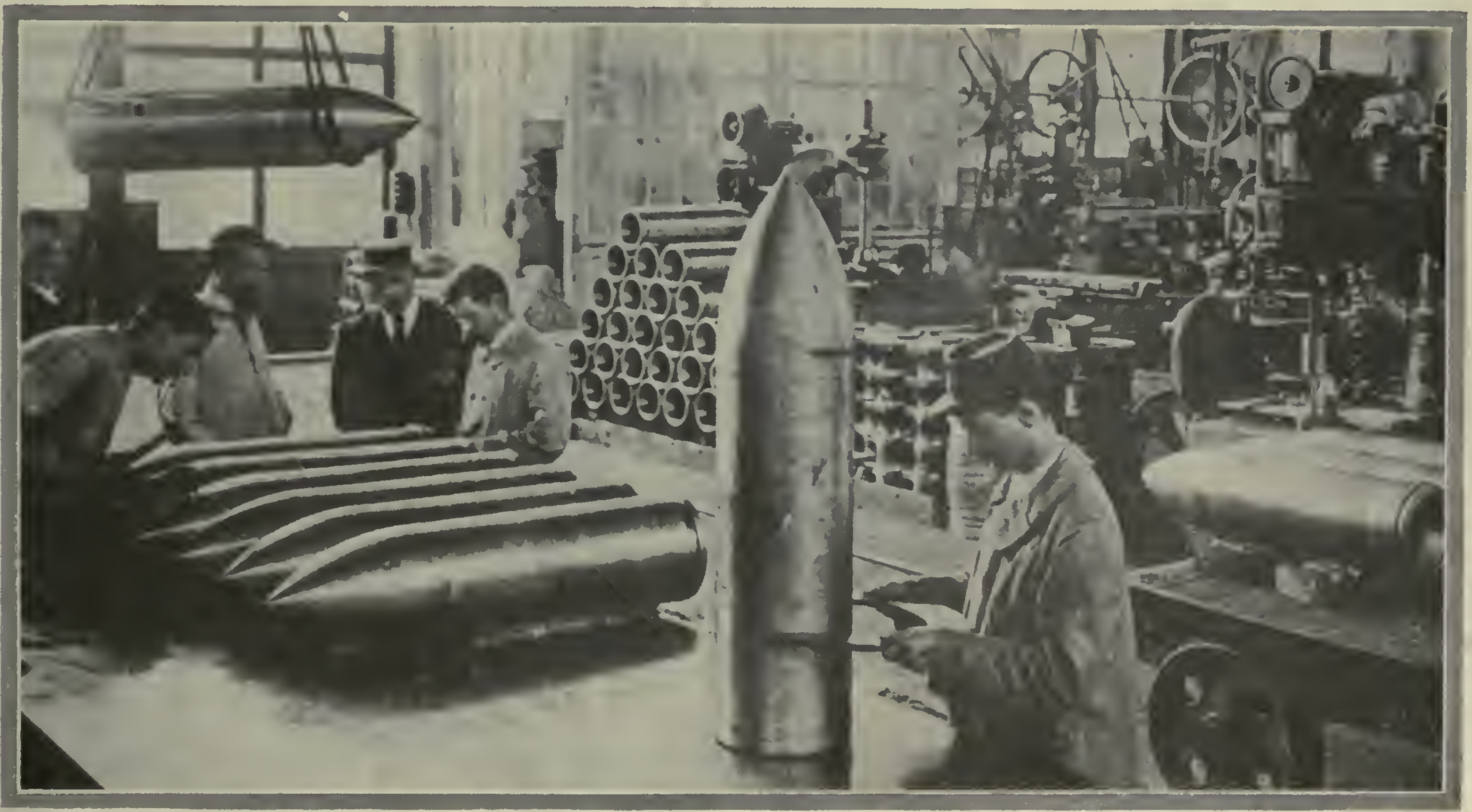
Plan Outlined for Mobilizing Nation's Resources as Preparedness Measure

Eighth Article in Series on National Defense for Engineer and Contractor Discusses Campaign of Thorough Organization

By MAJOR P. S. BOND
Corps of Engineers, U. S. Army

THE modern theory of war, as we have seen, contemplates in its highest development not only the universal training of the personnel, but the complete mobilization of the material resources of the nation. An army numbering millions requires in its operations vast quantities of supplies of all kinds. Unless these supplies are forthcoming as needed, the nation's defenders, however intelligently organized and splendidly trained, will be unable to oppose successfully the fully equipped troops they will be called upon to meet in the event of war with a foreign power. Such has been the situation of more than one of the nations in the present war.

The supplies necessary are not limited to weapons, ammunition, foodstuffs and clothing, but include the great bulk of the products of our farms, mines, forests and factories. There is also demanded the service of our transportation systems by land and water. Our material resources exceed those of any other nation and are ample for the prosecution of a great and protracted conflict. They are at present, however, very poorly organized from the point of view of military necessity. This is plainly indicated by the lack of system, the delays and extravagance which are attending the furnishing of munitions of war to the European nations. Europe has paid for our inefficiency, but the experience acquired by our manufacturers and their agents will be of undoubted benefit to our own defensive policy.



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AT MUNITION PLANTS MANUFACTURERS AND ENGINEERS MAY RENDER VALUABLE SERVICE AS CONSULTING EXPERTS

In mobilizing our material resources it is necessary first to ascertain our probable needs in the event of war. We should then investigate and make record of the sources from which these needs may be supplied, and finally execute all possible preliminary measures necessary to stimulate production. The problem is a vast one, second in importance only to the training of personnel. We can here consider but a few of its most salient features under the three general heads, (a) probable needs; (b) investigation of sources of supply; (c) stimulative measures.

The materials required for the conduct of war may be classified under two heads:

(1) Commercial materials, tools or appliances; that is to say, those which are manufactured and used in large quantities in times of peace.

(2) Materials of equipment which are peculiar to warfare and not ordinarily manufactured at all, or to a limited extent only, for commercial purposes, and which cannot, therefore, be readily obtained on short notice.

The line of demarcation between the two classes is not definitely fixed. Examples of the first class would be axes, barbed wire, automobiles, shoes, anesthetics, dynamite; of the second class, military rifles, portable intrenching tools, haversacks, pontoon boats.

In the event of war the regular and volunteer forces would be called at once to the colors and sent to the front as rapidly as they could be equipped and trained (in the case of volunteers). In order that these troops may be promptly equipped for duty it will be necessary to keep on hand in time of peace a reserve of material, especially of the second class. This reserve should obviously be no larger than necessary—it will be great enough in any case. Its storage and care will be expensive, some of it will become obsolete from time to time, and some will deteriorate and become useless in storage. All of it will represent an investment paying no direct return except in case of war. The amount of each item of this reserve will depend, first, on the requirements of war and, second, on the predetermined rate of production and delivery subsequent to the outbreak of war.

The plans of the general staff will contemplate certain contingencies, and the enrollment, training and equipment of successive levies of men to meet these contingencies. Measures for the mobilization of the material resources should be based upon the greatest probable requirements, but should look further to the possible ultimate utilization of all our resources. A consideration of these probable requirements will indicate what will be needed at the outbreak of war and the rate of production that must be maintained thereafter, if military operations are not to be delayed or hampered by lack of equipment and supplies. Supplies for military purposes can be more readily, quickly and cheaply obtained the more nearly they conform to commercial types and standards. Hence, as far as practicable, they should be identical with, or similar to, the products of peace time. Many of them, of course, must be specially adapted to military needs.

Having tabulated these materials the next step is an investigation of the sources of supply, but to avoid delay, the two investigations may be prosecuted simultaneously. All existing supplies which can be commandeered in case of need without undue hardship to the civil population, such as automobiles and animals, should be located and recorded. Every manufactory in the land, both large and small, should then be investigated to ascertain what material it could produce for military purposes under war conditions. The somewhat modified requirements of the civil population during the war must, of course, also be considered and provided for. This material would not, in all cases, be limited to the regular output of the factory. We should consider not only what the factory does ordinarily produce but what it might reasonably be counted upon to produce with due regard to efficiency and economy. It will be necessary, also, to ascertain the time that would be required to equip the plant and train the operatives to produce a different line of products. The average American industrial plant cannot change in a day, a week, or even a month from its regular output to a new line, unless careful and intelligent preparation be made in advance. Without such preparedness it might be a year before the plant would be operating in an efficient and economical manner in the production of munitions, and then perhaps *it might be too late.* This consideration is regarded as of vital importance to the national defense.

One of the most important features, therefore, of the mobilization of resources is a study of the stimulative measures that may be planned in advance to increase the rate of output. There will be many such measures and they must be carefully thought out. The writer undertakes to direct attention to but a few of these. To begin, as has been pointed out, military supplies should, as far as practicable, conform to established standards. The plans and specifications of these materials should be submitted to the scrutiny of manufacturers. They will thus be able to point out many modifications which will cheapen and speed up the output without seriously affecting the military value of the product. So far as possible, the manufacturers should specialize along their regular lines. The revised plans and specifications should be placed with the manufacturers for study as to measures necessary for rapid production.

SAMPLES OF SUPPLIES

Experimental samples of each class of supplies should be produced. This would indicate the methods to be followed in manufacture and the tools and machines that would be required in addition to the regular equipment of the factory. These models and samples, with detailed instructions as to methods of fabrication, should then be placed with important factories or groups of factories. All special tools, machines, gages and patterns that would be needed should be devised. An ample reserve of these accessories should be kept on hand by the government and also placed in the factories themselves, and necessary arrangements made to augment the supply, to the end that at the outbreak of war all factories from which material would be demanded might be properly and quickly equipped to produce this material.

The assistance of the manufacturers themselves will be most helpful. Organizations of manufacturers to assist in the investigation and lining out of plans have been suggested. A thoughtful and interesting study along these lines was presented in a pamphlet recently published by Martin J. Gillen, president of the Mitchell Wagon Company. (See Engineering Record, Nov. 13, 1915, page 589.)

It should be remembered that many of our most important manufactories lie close to the Atlantic seaboard and might be subject to capture in case of invasion. Due allowance should be made for this fact, unfortunate from a military point of view, and corresponding reliance placed upon manufactories farther in the interior of the country which might better hope to enjoy immunity from hostile interference.

Having determined the probable rate of output, a reasonable allowance should be made for a possible increase in demand and for the possible effect of the emergencies of war time on the predetermined rate of output of industrial plants.

INDUSTRIAL PERSONNEL

The mobilization of our industrial personnel would be a necessary and important feature of this general scheme. During the war the demands of the civil population would be greatly modified and production along certain lines would be much diminished. Certain factories, very many in the aggregate, could be devoted exclusively to the production of munitions of war, and should make preparation in advance, so far as practicable, to take up this work. A readjustment of the industrial personnel would be required to meet war conditions. Many workmen would be thrown out of employment by diminished demand for certain commodities and would be available for transfer elsewhere. Many also would be drawn for service in the volunteer army. There are certain industrial operations in which women are nearly, if not quite, as efficient as men. The field of their usefulness should be investigated with a view to releasing many men from industry to serve with the army. In this manner the women could perform a duty quite as necessary and important as actual service in the field.

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IN THE READJUSTMENT OF INDUSTRIAL PERSONNEL TO MEET WAR CONDITIONS WOMEN ARE PERFORMING DUTIES QUITE AS IMPORTANT AS ACTUAL SERVICE IN THE FIELD

The question of resources is not limited to the supply of munitions of war. The government must look also to the needs of the civil population during war time. For a nation which has not been self-sustaining during peace—and none of the civilized nations is entirely so—and finds its outside sources of supply cut off by war, the problem may be a serious one. The United States can be entirely self-supporting. We can produce within our own borders all of the necessaries of life, and this is an important element in our potential strength. Nevertheless the transition from the conditions of peace to those of war will be a tremendous wrench and the suffering among certain elements of our population, even in localities not directly touched by war, will be great.

THE LABOR PROBLEM

Many of the industries which supply the things that make life worth living without being absolutely necessary to its mere maintenance, or those producing for export or relying on imports, would be paralyzed by the cessation of demand for their products or the impossibility of marketing their products or obtaining their materials. Their employees would be thrown out of work and would have to be otherwise provided for. Thus the demand for amusements, such as the theater and music, would be greatly diminished, as also the demand for luxuries in food and dress. Financial operations, trading in stocks and bonds and real estate, building operations, the promotion of new industries would all be greatly curtailed. Imports and exports might be absolutely shut off—our foreign purchasing and selling markets closed to us at the very time when the home markets were dull. While many of the activities would eventually revive, the hardships for a time would be very great. Governmental aid and governmental foresight will be necessary to maintain confidence, prevent the sudden changes in conditions, allay panics, and afford succor, all with a view to ameliorating, as much as possible, the hardships which war inevitably entails. As the government depends on the people, so also would the people depend on the government.

ENGINEERS AID INVESTIGATION

To conduct the investigations and institute the measures herein outlined, the assistance of the engineering profession will be absolutely necessary. Steps have already been taken by the President of the United States to enlist the aid of the great engineering societies in carrying out these investigations. As the inquiry proceeds the stimulative measures which may be advantageously employed should become apparent.

Many manufacturers and engineers with manufacturing experience may render valuable service as consulting experts to the plants engaged in the production of war munitions, and the engineering profession should make known to the government the identity of the men who are qualified to render this important service. In the event of war there would be organized in the War Department a bureau to supervise and stimulate the production and arrange for the transportation and delivery of supplies. Many engineers would be employed in such a bureau.

Manufacturers' associations and labor unions must play their part as a patriotic duty. It is very desirable that we be spared the humiliating and distressing spectacle of frequent strikes over questions of wages and hours of labor at a time when the fate of the nation is in the balance.

In the event of war the demands on our transportation systems will be very heavy and it is necessary that we take careful account of our stock. Many railroads and steamship lines would be taken in complete charge by the federal authorities and all would be subject to a degree of federal military control. This control must be sufficient to meet military needs, but can best be exercised through the medium of our big, experienced railroad men. If any attempt is made to replace the expert personnel of the railroads with army officers having little or no experience in railroad administration and operation, a paralysis of our transportation systems would be the logical result.

This mobilization of our resources in material and transportation must probably be based on the voluntary service which is contemplated by our military policy. Nevertheless, as the government has the power to institute compulsory service in case of need, so also has it the power to commandeer the output of our factories, and even to regulate the sale of the necessaries of life to the civil population.

War Prices and Their Effect

One question not to be overlooked is that of the prices to be paid for war material. The prices charged the European nations by American manufacturers have, in general, been excessively high, due in large measure to our lack of knowledge of requirements and our inefficiency in a new field of industry. It is believed that our manufacturers generally would have no wish to derive excessive and unreasonable profits from the agony of the nation. And, on the other hand, they should not be required to bear more than their share of the burden by being paid less than the cost of production. It is in the interest of both parties that fair and reasonable prices should be fixed upon in conference and revised from time to time to meet changed conditions. The prices should not be perfectly rigid but capable of adjustment, perhaps on a "cost plus fair profit" basis, or on some other basis which would avoid the necessity for audit of the manufacturers' accounts.

The mobilization plans and data should be kept up to date. The opening of new factories, the enlargement or discontinuance of any already listed should be noted, and allowance made for the effect of changes in industrial conditions, etc. Plans and specifications should be modified or improved where necessary to meet changed conditions or keep pace with industrial progress and invention. Schedules of prices as agreed upon or fixed by the government after investigation should be prepared, and the quota of each factory determined and assigned.

With this information as to our resources in hand, and with all practicable stimulative measures in effect, the government will be able to avoid much of the delay and confusion which have in the past so frequently marred the success of military operations. It will be possible to determine intelligently the nature and amount of the reserve supplies and equipment which should be kept on hand, and the number, capacity and location of the government munition plants which should be maintained in time of peace. In common with the training of our personnel this mobilization of our resources in advance of the outbreak of war will cost money—not a small sum. But in the event of war the returns on the investment would be large, and, as with most things that are worth having, this security is worth paying for. We must divorce ourselves completely from the false hope that we can obtain something for nothing—a hope, be it said, long dear to the hearts of the American people, and which has too frequently in the past been characteristic of our military policy.

In conducting the investigations as to resources and in supervising and stimulating the output, the engineering profession can render a most valuable patriotic service as intermediaries between the War and Navy Departments and the producers. The country will be greatly dependent upon the profession in this matter, since there is no other class of men, civil or military, so well qualified to perform this important duty.

History's Lesson

There has been hardly a military campaign in the history of the world in which the belligerents have not been more or less hampered by a shortage of ammunition and supplies, either immediate or prospective. Thus in the present war, Russia on several occasions has been unable, in spite of ample personnel, to oppose successfully the German troops because of a shortage of material, and she has been compelled to forego success which might have been gained, and has been forced to sacrifice many valuable lives which might otherwise have been spared. Several of the great "drives" indulged in by various belligerents have fallen far short of a full measure of success partly because an inexhaustible supply of ammunition was not available.

Now it is true that we possess accumulated wealth and material resources exceeding those of any other nation, and our manufacturing equipment and methods are the greatest and most efficient in the world. If our advantages in these respects could be brought to bear we could furnish the materials of warfare at a rate with which no other nation could keep peace. Should we not take advantage of these circumstances to insure our success in case of war, and to purchase that success with the least expenditure of our most valuable possession—the lives of the nation's defenders? In other words, if a fighting man knows that he has an inherent advantage over all possible opponents in some one particular which they cannot evade, is he not wise if he develops this advantage to the utmost and then conducts the combat in such a manner as to make his advantage the determining factor in the result? Superior material alone cannot win battles nor compensate the lack of trained personnel, but its possession constitutes an advantage which, other things being equal, will determine the issue of the conflict.

Sir John French, late commander-in-chief of the British forces, says:

"The power of defense conferred by modern weapons is the main cause for the long duration of the battles of the present day, and it is this fact which mainly accounts for such loss and waste of life. Both one and the other can, however, be shortened and lessened if attacks can be supported by a most efficient and powerful force of artillery available; but an almost unlimited supply of ammunition is necessary, and a most liberal discretionary power as to its use must be given to artillery commanders. I am confident this is the only means by which great results can be obtained with a minimum of loss."

[*Next week Major Bond will conclude his series of articles by telling in what respects civil engineers and contractors are qualified to meet the military obligations of citizenship and what they may do to increase their efficiency.*—Editor.]

Philadelphia Trade Body Opposes State Regulation

Committee Formed to Study "Reasonable Regulation of Railroads" Makes Preliminary Report, and Invites Opinions

FEDERAL incorporation of interstate transportation companies, subjection of such companies to federal regulation only, and the reorganization of the Interstate Commerce Commission into district courts, composed chiefly of business men and railroad men, are among the changes suggested by the Philadelphia Bourse to a committee formed to study the "reasonable regulation of railroads."

A year ago, as the result of a conference of representatives of ten of the leading commercial organizations of Philadelphia, the Joint Committee on Reasonable Regulation of Railroads was formed. Subsequently a subcommittee was created, and the leading trades bodies throughout the country were asked their views on the subject. The views mentioned in the first paragraph are those of the Philadelphia Bourse, whose president, George E. Bartol, called the original conference.

"Regulation Means Responsibility"

The subcommittee has just submitted a report to the committee at large, and the latter body in giving out the report requests all trade and commercial organizations to give the subject careful consideration and advise the committee of any action or any views formulated. The committee does not make detail recommendations. It does, however, express itself in part as follows:

"Governmental regulation means the assumption by the government of responsibility for the success or failure of the railroads, for it is apparent that attempts at regulation which fail in appreciation of the true objective, in constructive method or in technique, may result in the complete disorganization of the roads.

"Regulation cannot be conceived from the narrow standpoint of merely reducing rates; that point of view loses sight of essential needs, both of the railroads and of the country at large, and must, in the nature of things, defeat its own ends.

"A proper view of governmental regulation must take into account the encouragement of railroad building and operation, the better mobilization of present facilities, and the modification of harmful competition, as well as the prevention of inequalities of service to the public, and the enactment of rates greater than those properly chargeable in an open competitive field.

"A proper system of regulation in this country must start with the conception that the railroads are the great highways of the nation, and that all barriers erected by the States, or however arising, which impede the natural flow of commerce along these highways must be removed.

"Finally, the single regulatory body,

through which alone coherent action can be obtained, must be so constituted as to handle, expeditiously and well, the great volume of business to come before it, a series of problems involving every phase of national life and activity."

SUGGESTIONS OF PHILADELPHIA BOURSE

The conclusions of the Philadelphia Bourse, which are presented as suggestions, are in full as follows:

1. Legislation to be urged that will provide for federal incorporation of companies engaged in the interstate transportation of goods or persons.
2. All companies engaged in such business under charters granted by any state or territory, or the District of Columbia, to be privileged to accept federal charters without surrender of their state charter, and without impairment of the rights of the several states with regard to taxation upon property value of corporations within their borders.
3. All corporations accepting federal charters to be subject to regulation by the federal government alone, through the Interstate Commerce Commission.
4. The Interstate Commerce Commission to be reformed into district courts, one court for each freight traffic district, as now organized in the form of territorial freight traffic districts.
5. Each court to have a president judge (a jurist), three associate justices (business men), three associate justices (expert railroad men). The district courts to have full power to regulate the corporations operating under federal charters within their districts without appeal, except as to questions of principle.
6. The president judges to form a Supreme Interstate Commerce Court, sitting in Washington, to determine questions of principle of country-wide application.
7. The district courts to sit at some central point in their respective districts. To hold court for six weeks out of each three months throughout the year.
8. The Supreme Court to hold court for one month twice a year.
9. All decisions to be rendered within sixty days of final argument.
10. Definite limits to be placed upon the powers of the Interstate Commerce Commission along the lines of regulation of rates, corrections of inequalities and abuses, and arbitration of labor disputes, with such other features as a closer study of the subject may suggest.

International Power Transmission

International power transmission by submarine cable is now a fact, lines between Sweden and Denmark having been put in service in January. The cables run from Palsjo, just north of Helsingborg in Sweden, to Marienlyst, a village north of Elsinore, Denmark. The underwater distance is 3.35 miles, the transmission voltage 25,000, and the energy transmitted 5,000 kw. The two power cables are laid parallel to each other 100 meters apart, while a protecting steel cable, with a breaking strength of 40 tons, is run parallel to the power lines and 100 meters from the nearest. Iron towers 25 meters high on either shore, in line with the protecting cable, warn vessels against attempting to anchor. These towers carry green lights at night. There is a steam station on the Danish side to act as a reserve, in case of interruption on the submarine line.

Restricted Use of Term "Engineer" Advocated

Present Indiscriminate Practice Confuses "Engine Driver" with Technically Trained Man—An Opportunity for Editors

By N. M. STINEMAN
Office Engineer, Engineering Department, Chicago, Milwaukee & St. Paul Railway, Chicago

RECENTLY a controversy arose in the daily press of Chicago on the question of the meaning of the word "engineer." A man who holds a license as stationary engineer was appointed by the mayor of Chicago as smoke inspector, a position which clearly should be filled by a mechanical engineer. The supposition is that the mayor does not comprehend the distinction between a mechanical engineer and a stationary engineer. In connection with this appointment Arthur Kneisel, secretary of the American Association of Engineers, published an article in the *Chicago Daily News* in which he called attention to the fact that there is a distinction between a mechanical engineer and a stationary engineer, that the word "engineer" has a dual significance, and that this dual significance should be kept in mind when appointments of this kind are to be filled. Other engineers entered the discussion, and several articles were published before the matter came to a rest.

IMPROPER USAGE GENERAL

It is indeed unfortunate that in America most people associate the word "engineer" with a man in greasy overalls who runs an engine or a boiler. The man who operates the boilers of an apartment building is called an engineer, although, as we shall see in a moment, the name is entirely a misnomer when applied to him. He may be a good mechanic, but he is not an engineer. The gray-haired man who drives the locomotive of a trans-continental limited, and who holds the lives of hundreds of human beings in his care, belongs to the very highest type of mechanic; but he is not an engineer—except in the United States and Canada.

Much has been said and written on the importance of educating the public to the true meaning of the word "engineer." In this case, as in many others, it is of far greater importance that engineers themselves be educated to the true meaning. So long as engineers use the word improperly, how can they expect to educate the public to the true usage? So long as engineering magazines and text-books use the word improperly, how can we expect engineers to become entirely clear in its use? It seems obvious that the place to begin is not with the public, but with engineering literature—at the other end of the line.

Now let us investigate the words commonly used in other countries and other languages to designate the man who runs an engine and the man who is a civil engineer (using the latter in the broad sense). To begin with, other languages do not contain a word directly equivalent to the English word "engine." The word commonly used is analogous to the English word "machine," and the different types of engines are designated by proper modifiers. Thus, in French and German, respectively, a steam-engine is a "machine à vapeur" and a "dampfmaschine." In consequence, the man who runs a stationary engine is designated by a word analogous to the English word "mechanic" or "mechanician." Other languages do contain a word similar to the word "locomotive," to designate that particular type of engine. The word used to designate the man who runs a locomotive might, in most cases, be translated into English as "locomotive conductor."

PRACTICE IN OTHER COUNTRIES

The following table shows, in columns 2, 3 and 4, the words commonly used in various languages to designate the men who in this country are known as civil engineers, locomotive engineers, and stationary engineers, respectively:

Language (1)	Civil Engineer (2)	Locomotive Engineer (3)	Stationary Engineer (4)
French ...	Ingénieur	Conducteur de machine	Mécanicien
Spanish ..	Ingeniero	Conductor de locomotora	Maquinista
Italian ...	Ingegnere	Conduttore di locomotiva	Macchinista
German ..	Ingenieur	Lokomotiv-führer	Maschinist
Swedish ..	Ingeniör	Lokomotiv-förare	Maskinist
Danish ...	Ingeniör	Lokomotiv-fører	Maskinist
English (England)	Engineer	Engine driver	Engineman
English (U. S. and Canada) .	Engineer	Engineer	Engineer

From this table it is evident that in countries other than the United States and Canada there can be no misunderstanding as to the meaning of the word "engineer." Only in the English-speaking portion of North America is its use in a state of confusion. We have succeeded partially, though not entirely, in acquiring the habit of using the correct words in connection with the driving and care of automobiles. Why not correct ourselves in other respects? Nothing could be more logical than the forms used in England, where the civil engineer is known by his true name, the man who runs a locomotive is known as an "engine driver," and the man who runs or takes care of a stationary engine is known as an "engineman."

This discussion may be considered as a direct appeal to editors of engineering magazines and writers of engineering text-books. When editors receive an article on construction work in which the writer refers to the man who runs the hoisting engine as the "engineer," they have it in their power to use the blue-pencil and to write in its place the proper word, "engineman." Editors have the power to cross out the words "locomotive engineer" and to write in their place the more logical words "engine driver." In reviews of new engineering books there is an opportunity to call the attention of the authors to any improper use of the word "engineer" which their books may contain. In this manner editors can gradually bring engineers themselves into the habit of using the words properly. Then, and not until then, can we hope to make any progress toward educating the public.

[*Comment on this subject will be found in the editorial columns.*—Editor.]

Exports to Argentine Increase 53 Per Cent in 1915

The United States ranked second in imports into the Argentine Republic in 1915. The total value was about $54,193,342, an increase of 53 per cent over 1914; this despite the fact that the total imports of the republic decreased 16.5 per cent.

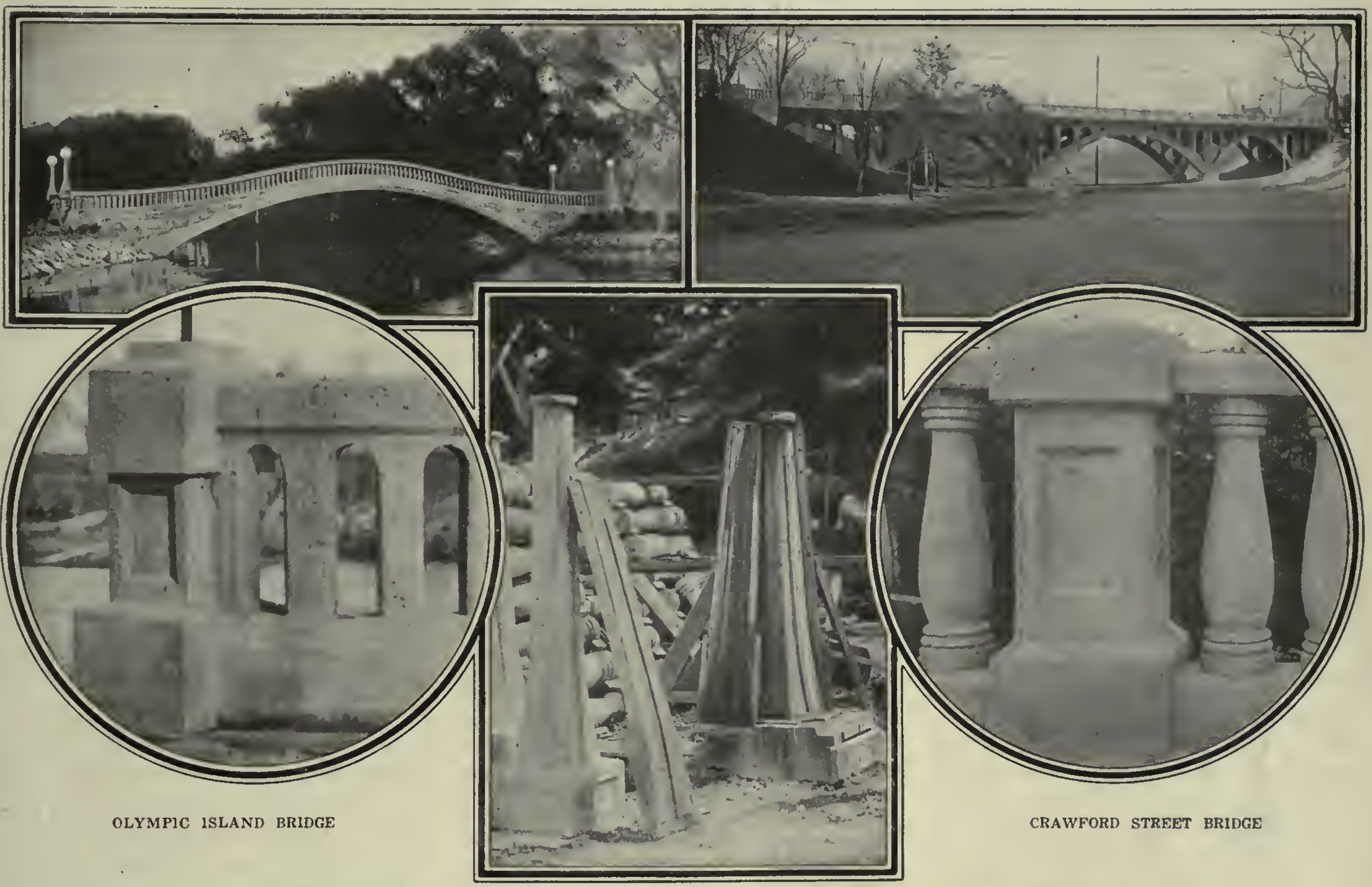
Concrete Balustrades Enhance Appearance of Bridges

Arch Bridges in Toronto Have Ornamental Sidewalk Railings—Molding and Finishing Methods Described

By L. N. EDWARDS

Railway and Bridge Section, Department of Works, Toronto, Canada

ONE of the most important and often the most troublesome of the details in modern reinforced-concrete bridge construction is the sidewalk railing or balustrade. Perhaps more than any other single part of the bridge, this detail must be properly ornamental and must please the eye of the casual observer. From his impression of its fitness he frequently passes judgment upon the beauty and strength of the structure as a whole. The two concrete balustrades here described are well adapted to their purpose, and have shown no spalling or cracking due to temperature changes. The details used in their construction are rather unique.



OLYMPIC ISLAND BRIDGE

CRAWFORD STREET BRIDGE

HOW THE CONCRETE SIDEWALK RAILINGS AND BALUSTERS ON TWO TORONTO BRIDGES WERE TREATED

OLYMPIC ISLAND BRIDGE BALUSTRADE

The Olympic Island bridge, built in Island Park, Toronto, to connect Center Island with Olympic Island, consists of a reinforced-concrete arch span having an overall length of 84 ft. The accompanying photographs show the completed structure with its concrete balustrade.

The concrete used in the balustrade is composed of cement and granite chips in the proportion of 1:2½, the coarse material of the chips passing a ¼-in. sieve, and the fine material serving as fine aggregate. A smooth surface finish of the cap and base was produced by rubbing with carborundum bricks until the granite aggregate was exposed. The intermediate or web portion was given a rough finish by the removal of the surface with a stiff wire brush, thus exposing the angular chips of granite. To add to the appearance the aggregate was composed of granite of several colors.

As a precaution against the cracking of the balustrade by the action of temperature or other deformations, three expansion joints were provided in the balustrade cap. These joints were made with four ply of asbestos roofing felt and were provided with a copper dowel to give general rigidity to the joint. This dowel was surrounded with two ply of felt at one end to prevent bonding in the concrete. For the verticals, two asbestos-felt joints were provided, one located at the top surface of the base, the other near the top of each vertical at the springing line of the semi-circular portion of the openings between verticals. Asbestos felt was used for these joints for the reason that its color closely corresponds with that of the concrete.

The balustrade above described has been in service two years, and gives no evidence of cracking in any of its parts. It therefore seems probable that this quite common defect has been, in this case, entirely overcome.

CRAWFORD STREET BRIDGE BALUSTRADE

The Crawford Street bridge over Bellwoods Park consists of three reinforced-concrete, open-spandrel arches with smaller approach arches, as shown in the accompanying photograph. The sidewalk balustrade used upon this structure is of concrete composed of cement and granite chips in the proportion of 1:2. All surfaces were ground by the use of carborundum bricks to give a smooth even finish, exposing the crushed granite aggregate.

The balusters, top rail and electric light pillars were molded and finished in separate units. The forms for the balustrade base were first constructed upon the sidewalk slab and after the base had been molded and finished, the forms were built for the balustrade posts and that portion of the posts below the post caps was cast. As soon as the concrete of the latter had taken a firm set the balusters and caps were assembled and the posts completed by molding the caps in place.

REINFORCEMENT

The ½-in. square twisted rods forming the reinforcing of the balusters and extending about 2 in. beyond their ends formed dowels which were embedded in cement mortar in holes provided in the caps and bases. All balusters were formed in lead-lined wooden molds and all caps and electric lighting pillars were formed in wooden molds. The balusters were finished by revolving in a lathe under a carborundum brick. All other portions of the balustrade were finished by hand rubbing.

In order to fully provide against possible cracking of the balustrade through temperature or other deformations, the ends of all caps and bases abut against two ply of asbestos felt, thus preventing adhesion between the concrete forming the posts and that forming the caps and bases, and rendering each panel section of the balustrade practically an independent unit.

The effectiveness of these provisions for expansion appear to be proved by the fact that slight movements have been observed, but no evidence of cracking or spalling has developed.

FOUR FLOODS, ONE HIGHER THAN THE STAGE OF WATER SHOWN, DID NOT STOP WORK ON PIERS FOR NEW BRIDGE

Foundations for Dayton Bridge Finished in Four Months Despite Four Floods

Caisson Piers for Pennsylvania Lines Bridge Sunk Through Old Masonry and Timber Mat While Water Rises Almost to Old Bridge

CONTINUING to sink caissons with the aid of gin poles and hoists mounted on top of the cofferdams after the river had drowned the derricks set up for the pier work and had almost reached the girders of the temporary bridge above, the Foundation Company completed two caisson piers and practically finished two abutments constructed in cofferdam for the new bridge of the Pennsylvania Lines over the Miami River at Dayton, Ohio, in the four months between Dec. 1, 1915, and April 1. Four floods, the first three of which occurred while the piers were under construction and practically reached the top of the old bridge piers, and the last two of which flooded the abutment cofferdams, prevented the completion of the work in a still shorter time.

TRUSSES TO REPLACE DECK GIRDERS

The old bridge, 641 ft. long, of 7 deck girder spans, was damaged in the flood of March, 1913, by the washing out of pier 4, counting from the east bank, and the tipping of pier 5. It was restored on pile piers, and is now to be replaced with a 3-span truss bridge of slightly greater length. The construction of the new abutments required the demolition of the old, which were spanned temporarily by girders on pile bents placed by forces of the railroad company. The same was done at pier 2, which fell at the site of the old tipped pier 5 and the pile pier which had been driven around it. Pier 1, however, fell between old piers 2 and 3. None of the work for carrying the double track main line was started until after the contractor's forces reached the site on Dec. 1.

CONCRETE CAISSONS EMPLOYED

This left pier 1 as the best place to start work. An island was thrown up on a sand bar, partly by wheeling from the east bank and partly by a grab bucket handled by the derrick set up on the down stream side to sink the caisson, and the oak cutting edge erected on it. Timber framing for the cofferdams to surmount the caissons, in which the pier shafts were built, went ahead while the work of building the forms, placing reinforcing and concreting the working chamber was completed. Concrete was mixed on shore and pushed out in buckets on flat cars on a cantilevered industrial track carried on outriggers slipped between the ties of the downstream track and kneebraced to the lower flanges of the downstream line of girders.

As the piers were started at elevation 724, about a foot above the average winter stage of the river, and sunk from 26 to 28 ft., and as there was about 18 ft. clearance between the islands and the lower side of the old bridge, but two buildups of cofferdam and one of shafting were required. Sinking was started on pier 1 Jan. 2, and air was taken off twenty-seven days later, after concreting the working chamber.

FLOODS DELAY START OF SECOND PIER

During this time two floods had interfered with the work of demolishing the old masonry of the tilted pier 5 and building an island at the site. Nevertheless, the second caisson was ready for air on February 3 and had been sunk and sealed thirty-one days later. As the old bridge did not offer any means of suspending this caisson the old pier was cut only to the water level before erecting the new cutting edge. It was found cheaper and quicker to use a steel cutting edge, and sink through the old masonry and the timber mat on which it rested, than to dredge out the old pier, most of which was under the bridge, and refill the site to make an island.

On top of the cofferdams for each of the caissons was set a hoist in addition to the derrick set on piles at each pier site. A gin pole leaned over the upstream air locks of each pier handled dirt buckets. At the first pier this rig was used during high water on both locks, using both drums of the hoist. The hoists and gin poles were raised once for each caisson when the air locks were raised. This was done by the derricks on

TRACK CANTILEVERED FROM GIRDERS OF OLD BRIDGE USED FOR CONCRETE AND DIRT CARS—RIVER 4 FEET ABOVE LOW WATER the lower side and by a locomotive crane on the upstream side.

The excavated material, which was gravel, clay and finally hardpan, was used for weight only on pier 1. On pier 2 the concrete was built up rapidly during sinking, and furnished enough weight. The dirt taken out with the gin poles was dumped around the piers. What did not wash away in the floods was barely enough to fill in around the piers when the cofferdam sections were unbolted above the working chambers and pulled out. All the other excavation, including that for the abutments and the weight removed before starting the shaft of pier 1, was dumped at the ends of the bridge and spread by wheeled scrapers on the levees, which were being strengthened at the time. The narrow gage track and dump cars were used to transport the dirt from the piers.

ABUTMENTS EASILY FLOODED

Each abutment was in the front face of the levee and consequently the steel cofferdams for them could not be protected from floods. Both cofferdams were very wet even at low river stages. The west abutment, which is founded on piles, was built with two derricks. The east abutment was founded on hardpan and the work on it was handled by one derrick and the crane. Both cofferdams were excavated to about 18 ft. below the prevailing water level.

The time required to complete the work was increased by the great quantity of old masonry and timber to be removed, which ran the total excavation up to more than 7000 cu. yd., or 2500 cu. yd. in excess of the total new concrete work. The remaining piers, two of which are concrete, stone faced, on piles, and the rest of which are stone on timber mats, will not be removed until the new bridge is in place.

The work has been carried out for the Pennsylvania Lines by the Foundation Company under the direction of John W. Doty, vice-president; M. L. Peppard was superintendent and Sam Snyder general foreman. For the Pennsylvania Lines the work was in charge of E. E. Stetson, assistant engineer, under W. C. Cushing, chief engineer of maintenance of way, Southwest systems.

Write to Geological Survey for Information on Rocks and Minerals

The U. S. Geological Survey answered 50,000 letters of inquiry last year concerning the earth's crust and what it contains. These letters asked not only about the geology of this country, but also about the rocks and minerals of foreign countries. More and more inquiries for information about our mineral resources are coming from South and Central America.

The Survey is in close touch with the 90,000 producers of minerals in United States and is ready to answer questions about the annual production of 70 different minerals or mineral products. Furthermore, the Survey knows the places in the United States where more than 425 different minerals may be found, so that it is in a position to act as a public agency in bringing the mineral producers and consumers into touch with each other. The Survey can make simple mineral determinations and give information as to the identity and use of minerals submitted to it. All inquiries should be addressed to the Director, U. S. Geological Survey.

Grouting An Effective Remedy for Stopping Leakage During Shaft Sinking

Second Article in Series Describing How Difficulties on Catskill Aqueduct Shafts Were Overcome by Injections of Cement and Sand

By JAMES F. SANBORN
Division Engineer, Board of Water Supply, New York City

[*In the first of this series of articles, published last week, Mr. Sanborn explained the general principles which should govern grouting operations, selection of equipment, and methods of cutting off leakage in tunnels. The second article, this week, recites in detail the difficulties in shaft-sinking on the Catskill aqueduct, and how they were overcome—Editor.*]

AT HIGH FALLS, N. Y., a wet shaft was sunk about 500 ft. for the construction of the Catskill aqueduct. The shaft was 10 x 22 ft., with the usual rectangular timber. The strata penetrated were as follows: 6 ft. of glacial drift, 260 ft. of Helderberg limestone; 39 ft. of Binnewater sandstone, 39 ft. of High Falls shale and 134 ft. of Shawangunk grit.

Immediately on the site of the shaft a shot-drill hole 4 in. in diameter had been sunk to the Shawangunk grit and a smaller diamond drill hole continued through the hard grit to the foot of the shaft. Water under pressure was struck in the Binnewater sandstone, a very fine grain rock, generally porous, with numerous open seams. The High Falls shale is a rather soft rock, much broken up at the site of the shaft, while the Shawangunk grit is an exceedingly hard and brittle white quartzite, intersected by numerous narrow seams bearing water.

LARGE LEAKAGE ANTICIPATED

Pumping experiments made before sinking the shaft indicated that a great deal of water would be encountered, and the contract made provisions for a pumping plant having a capacity of 1800 gal. per minute. The shaft was sunk through the limestone without difficulty. At a depth of 80 ft. water rushed in through the 4-in. bore hole at the rate of 600 to 800 gal. per minute and the shaft was flooded.

After additional pumps had been installed and the bottom of the shaft recovered, the bore hole was grouted through a 1-in. pipe extending to the conglomerate bed, a depth of about 360 ft. Before grouting, the shaft was allowed to fill up with water to equalize the pressure in order to prevent the washing out of the grout by entering water. Sinking through the limestone was almost all in tne dry, and excavation was rapidly advanced.

At a depth of 215 ft. water was struck in the Binnewater sandstone, and at a depth of 260 ft. the shaft was making 225 gal. per minute. At this depth an additional flow of about 600 gal. per minute came in through one of the drill holes and again flooded the shaft. It was slowly pumped out and an attempt made to grout the water-bearing seams, but, owing to breakdowns of pumps, the shaft was again twice flooded. The holes were drilled through pipes provided with valves, swedged firmly in the rock, so that a sudden flow encountered in the drill hole might be shut off. Leakage from the sides and around the pipes in the bottom of the shaft amounted to 450 gal. per minute. After three weeks of pumping, drilling was resumed.

At this time it was discovered through the evidence furnished by the drills that for the next 8 ft. the ground to be excavated was extremely soft and porous, with open seams of a maximum width of 8 in. The largest seam was at one point within 18 in. of the rock bottom of the shaft, at which point the water leaked freely through cracks, indicating that when the rock was shot there would be a great inflow of water, which, it was feared, could not be handled by the pumps.

SIX GROUT TANKS USED

Grouting was accordingly undertaken to cut off all water-bearing seams in the rock. Since the stratification was horizontal and the bedrock of limited thickness, it was hoped that by grouting off the seams the water would not follow the work down, and again appear at the bottom as excavation progressed. A battery of six Canniff tanks was placed on the surface and the grouting carried on through a 2½-in. pipe leading down the shaft with a 2-in. hose connected at the bottom. The grout from the first holes leaked back into the shaft around the pipes and through seams in the bottom, and it was thought that a concrete blanket might be necessary to make the grouting successful, but on account of the inward leakage the difficulty of placing a watertight layer of concrete would have been great.

After numerous experiments ground horse manure was injected with the grout, finally clogging the openings and making the seams in the bottom fairly tight. In three days 2900 bags of cement were forced in and the holes closed off. After the grout had set, additional holes were drilled and struck water under pressure at a depth of 14 ft. These holes were next grouted and took 60 bags of cement.

100-FT. HOLES GROUTED

In view of the success of the grouting it was decided to put down diamond drill holes to the top of the conglomerate, a depth of about 100 ft., and attempt to grout the ground to that depth. Six holes were drilled, 3-in. in diameter for the upper 5 ft. in which pipes were secured and provided with gate valves at the top. Through these valves three diamond drill holes 1-in. in diameter and three holes 2-in. in diameter were sunk. At a depth of 50 ft. water was encountered. After completion, the holes were grouted, and took 175 bags of cement at a pressure of 275 lb. per square inch.

After a total delay of four months, sinking was resumed. In the first 15 ft. excavated numerous well grouted seams, with a maximum width of 8 in., were passed. Below this point no large flows of water were encountered, but the seepage from the sides increased. At a depth of 280 ft. the shaft was making 350 gal. per minute, and at a depth of 320 ft. the flow was considerably more than 600 gal. per minute.

It is the opinion of W. L. Canniff, expressed to the author, that many of the small leaks encountered through the ground penetrated by the diamond drill holes might, perhaps, have been cut off by the grouting if, instead of attempting to grout the full depth of the holes at once, the holes had been sunk 20 ft. and then grouted, before again drilling another 20 ft. and grouting. However, as the holes drilled at shaft 4 were small, and were not reamed to remove cuttings, there is no certainty that grouting before completing the drilling would have been of much advantage.

During all the work at shaft 4, in addition to the troubles incident to pumping the water, hydrogen sulphide gas, with which the water was strongly charged, made it exceedingly disagreeable for the men working in the shaft. The gas caused painful inflammation of the eyes, necessitating at times the changing of shifts every three hours. In many cases the men were forced to leave the work for several days.

PILOT DRILL HOLE IN SHAFT

At a depth of 320 ft., a considerable flow of water, from a pump chamber excavated in the side of the shaft where the grout had not penetrated, increased the total pumping to a maximum of 725 gal. per minute. Below this elevation a pilot drill hole was kept well below the bottom and all seams were grouted, none of them taking more than 50 bags of cement. All drill holes showing water in any quantity were grouted with fairly good results in cutting off the leakage.

In several cases the nipples through which the holes were drilled were wrapped with flannel before being driven in, a practice which was common at the Detroit salt shaft, which was sunk by the grouting method. Wooden wedges, oakum and cement were also used for the purpose of confining the grout pipes. Horse manure was added to the grout in a number of cases.

In grouting the holes, a weak grout was used at first, and the quantity of cement was gradually increased; if the grout continued to flow freely, sand was added, until the pipe began to clog. The grout injected into the rock set very slowly and seemed to develop little strength, although serving to seal up the seams. A total of 971 bbl. of cement was used in the grouting.

While in this case the grouting did not serve to cut off all the water, and great expense was necessary to keep the shaft dry by pumping, it is felt by those familiar with the conditions which existed that the sinking of the shaft was very much advanced by the grouting method employed.

SHAFTS IN NEW YORK CITY

Shaft 4, on contract 63, a concrete-lined shaft of the Catskill aqueduct in New York City, was sunk a depth of 240 ft. in Fordham gneiss, a rock generally sound and hard. The shaft was dry to a depth of 150 ft., when a flow of 150 gal. of water per minute was encountered while drilling. In a few hours the quantity diminished until there was a constant flow of 50 gal. per minute. After pumping out the water which flooded the shaft, the drill holes were plugged, and the concrete shaft lining was placed to within a few feet of the bottom of the excavation.

The drill holes were next grouted, using neat cement in the proportion of about 15 lb. to each gallon of water, by means of a Canniff tank and air pressures from 100 to 225 lb. per square inch. In this grouting, 46 bags of cement were used and the leakage was completely cut off.

Sinking was resumed without incident until at a depth of 181 ft. water was struck under a pressure of 70 lb. per square inch. The maximum flow was not determined, as the holes were plugged when they were drilled, and the flow from each was cut off by grouting as before. Pilot holes 14 ft. long were then drilled, and all struck water, in some cases carrying fragments of rock 1-in. in diameter. The material washed from the drill holes indicated that the water must come from a badly disintegrated seam. The 14-ft. holes were grouted, but did not take much cement, which left a doubt as to the sufficiency of the grouting. The shaft, however, was sunk 5 ft. without increase of water, exposing a 2-in. seam well filled with grout.

The bottom of the shaft was in disintegrated rock well grouted. A number of 16-ft. holes, 18 in. apart, were drilled around the rim of the shaft, and grouted, one at a time, as they were sunk. Each hole took about 2 batches, except those on one side of the shaft, which leaked at the rate of 100 gal. per minute and could not be made tight. This leakage was cared for by the pumps, as compressed air from the powerhouse was then available, and no more grouting was done. As sinking continued there was no further increase of leakage, and sound rock was struck at a depth of 200 ft.

CRUSHED ZONE ENCOUNTERED

The water-bearing ground penetrated by the shaft at a depth of 181 ft. showed a crushed zone of gneiss with a maximum thickness of 8 ft. on one side, disintegrated below for an additional depth of 4 ft. This fault plane dipped south, and was afterward struck in the tunnel, where the roof broke high for over 100 ft. and water flowed from the seam. When the tunnel was lined the flow from the seam was carried in pipes through the concrete, and was successfully cut off by grouting at a pressure of 300 lb. per square inch. Several holes were drilled into the seam from the tunnel before the concrete lining was placed in order to grout it as completely as possible.

As shaft 4 is a permanent waterway shaft, it was decided not to depend entirely upon the grouting of the surrounding ground. The thickness of the concrete shaft lining was increased to an average of 29 in. for some distance above and below the fault, heavily reinforced with horizontal and vertical bars.

Regarding the success of the grouting it is to be noted that the disintegrated ground was found well impregnated with grout, but the leakage was still 100 gal. per minute. After the shaft lining was placed and the water-bearing pipes grouted, the shaft made but 3 gal. per minute.

In the seam first struck, at a depth of 150 ft., it was found on examination of the rock after excavation that the water-bearing seam was well filled with cement, and the water cut down from 50 to 15 gal. per minute at that time, some of it coming from other parts of the shaft.

In the disintegrated fault zone near the bottom of the shaft, however, where about 1,000 bags of cement were injected through many holes, there was still an inflow of 100 gal. per minute, although hard set grout was found, filling spaces 1 ft. or more thick, and from that size down to cracks 1/16 in. or less in width. All this was thick grout. In this shaft more than 100 holes were drilled for the grouting operation, and a great deal of work was done in an effort to cut off the water. Over a month was spent in the grouting work at the lower seam.

From the experience at this shaft it appears that in the first seam struck, which was a perfectly definite opening almost all in one plane, the grouting was successful in cutting off the water permanently after a few shifts spent in grouting, but in the wide fault zone with its many seams, large and small, filled with soft and disintegrated gouge, even after the expenditure of much time in grouting the flow of water was not entirely controlled.

On contract 67 of the Catskill aqueduct, on the lower east side in New York and Brooklyn, grouting was used to cut off water during excavation in four shafts sunk in rock. These shafts were all lined with concrete and made as nearly as possible watertight by grouting the water-bearing seams. At all times on this contract pipes and valves were kept ready for controlling the flow from drill holes tapping water as the sinking proceeded, and grouting equipment was prepared to meet any such emergency.

If the shafts had been lined with timber and had no grout been injected, it is likely that the trouble from water would have been very much greater than it was.

CONCRETE BLANKET IN SHAFT TO HOLD GROUTING PRESSURE

Shaft 20 was sunk in Fordham gneiss without much water. In sinking this shaft a few small flows of water were encountered, which were cut off without difficulty by the concrete lining, but at a depth of about 425 ft. an inflow of 30 gal. per minute was encountered in the drill holes in the bottom of the shaft. Five days afterward this water had been cut off by the grouting method, which was as follows: Long holes were drilled in a concrete blanket 2 ft. thick, placed over the rock before grouting was started. Before the blanket had set the holes were drilled and another 2-ft. layer of concrete was placed. After 48 hr. grouting was undertaken at a pressure of 300 lb. per square inch and the water cut off. After the grouting, this shaft was sunk without difficulty and very little water was encountered in the seams.

Shaft 21 was sunk in granodiorite to a depth of 750 ft. below the East River. The rock was hard, seamy and rather wet, with wet zones about every 60 or 80 ft., which were grouted in every case with considerable success. At one place a concrete blanket, as in the case at shaft 20, previously mentioned, was built over a seam to hold the grouting pressure, and proved successful. The concrete lining was built in stretches of about 50 ft. as the sinking progressed and the water coming through the lining was grouted off in order to keep the bottom as dry as possible.

VALVED PIPES CONTROL FLOW

Shaft 22, in Brooklyn, was sunk through gneiss and granodiorite, in rock carrying only a few small flows of water, except in the case to be described, where water-bearing seams were grouted through drill holes sunk in the bottom of the shaft.

At El. — 430 a flow estimated at over

200 gal. per minute was encountered in a drill hole. A pipe carrying a valve was immediately driven into the hole, the flow controlled, and other holes, 5 to 20 ft. deep, were drilled to locate the extent of the area bearing water, which was found on one side of the shaft. On account of the great number of seams in the rock a first attempt to grout was unsuccessful. After building a concrete blanket around two of the pipes in the wet portion, the water was cut off on a second attempt, using a pressure of 350 lb. per square in., only six days after the water was first struck. Subsequent excavation showed that the water was all cut off, except 20 gal. per minute, which was eliminated after placing the concrete lining.

Fine Seams Filled with Cement

At one of the holes grouted seams not over 1/16-in. wide were completely filled with cement. These seams were sharply defined breaks in hard rock, and so intersected as to provide a good opportunity for circulation of the grout, with the result that the operation was successful with only a few shifts lost.

Shaft 24 of the City aqueduct tunnel was sunk through 200 ft. of granodiorite and gneiss with a sand cover 100 ft. deep below water level. The rock was blocky, seamy and more or less crushed. The grouting reduced the shaft leakage to 25 gal. per minute. During the next week the leakage increased to 41 gal. per minute, and on the week following to 50 gal. per minute, all from the seams which had been grouted.

Subsequently, in the neighborhood of the seam at El. — 196, the ground began to scale badly, with danger to the men working below. The flow of water increased. Both the increase in leakage and the scaling of the rock must have been due to an accumulation of ground water head, following the sealing of seams by grouting.

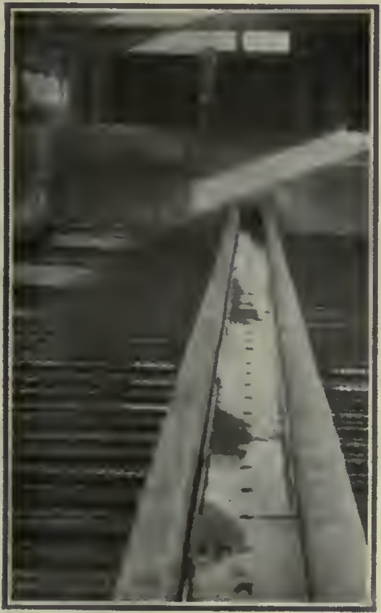
After lining the shaft with concrete, and grouting off the leakage from the pans and pipes, sinking was resumed. Although 20-ft. pilot holes were drilled on each round in preparation for grouting, no considerable flows of water were subsequently encountered.

[*Next week—Grouting tunnel headings in bad ground.*—Editor.]

Sewage Filters Have Unique Distributing System

Cast-Iron Troughs with Scalloped Edges Spaced 6 Inches Apart Cover Surface of Stone Filter at Pana, Ill.

SCALLOP-EDGED cast-iron troughs 6 in. apart distribute the sewage over the trickling beds of the new 200,000-gal. daily sewage treatment works at Pana, Ill. The plant consists of a settling tank of the double compartment type, with a detention period of from 1 to 2 hr., automatic dosing tanks, a trickling filter, a secondary or humus tank and a sludge-drying bed, all designed to care for the sewage from 4000 people. The plant has just been completed and was described Jan. 27 in a paper by A. C. Stanfield presented before the joint meeting of the Illinois Society of Engineers and Surveyors and the Illinois Section of the American Waterworks Association. The following notes are taken from this paper:



CAST-IRON DISTRIBUTORS HAVE SCALLOPED EDGES FOR FEEDING SEWAGE TO FILTERS

FACTORY TYPE OF CONCRETE COVERS ENTIRE PLANT

COVERED TWO-STORY TANK FEEDS FILTER AT RIGHT BEYOND PARTITION

SMALL PIPES UNDER INFLUENT CONDUIT SUPPLY DISTRIBUTING TROUGHS NOT YET PLACED

The trickling filter is 60 ft. wide, 90 ft. long, and 7 ft. deep. It is surrounded by concrete walls and rests upon a concrete floor having corrugations to form drain channels. The channels are covered by large stone to prevent the entrance of small stone and discharge into a larger drain which has an outlet into the secondary settling basis. On the floor of the filter is placed a layer of stone ranging in size from 6 to 8 in. set on edge by hand, and on top of this layer is 5½ ft. of 1¼-ft. to 2-in. stone and on top of this a final layer of ½ to 1-in. stone.

The distributing system consists of five main concrete troughs running from the dosing tanks across the filter, each trough supplying one-fifth of the filter. These troughs are reinforced and supported upon concrete piers resting on footings beneath the floor of the filter, and each trough is provided with fifty-six 1-in. feed pipes in its bottom, spaced equidistant along its center line. Each pipe has a horizontal tee on the bottom, providing two openings into the distributing trough beneath. Immediately below the feed pipe and running at right angles therewith, are placed cast-iron distributing troughs. These troughs are 2 in. deep by 4 in. wide at the top and 3 in. wide at the bottom. On the outside of each wall of the trough, placed ½ in. below the top edges, projects a ledge having a scalloped edge from which the water drops 8 in. to the stone below. The top edges of the sides are notched with triangular notches ½ in. deep and spaced 1 1/3 in. apart. These troughs are about 6 in. apart and rest upon concrete beams supported by columns.

The openings to the feed pipes in the bottom of the main troughs were formed of 1-in. galvanized pipe, but these were found to be too large and they were reduced with lead bushings to 9/16 in., giving a more uniform distribution throughout the whole length of the trough. The total area of the filter, less deductions for columns, is 1 1/3 ft. per capita, based on 4000 population to be served.

Roof Over Plant

The tank and filter are entirely inclosed by a reinforced-concrete building 86.5 x 93 ft., designed to furnish good light and ventilation, to protect the filter from low temperatures, and from débris being deposited upon it. The structure is fireproof except the doors and windows. All windows are protected by heavy wire screens. The outer walls have a pebble dash finish, and the roof slabs have a sidewalk finish painted with Weatherwear paint. The Kahn system of reinforcing was used throughout and the cast-iron distributing troughs were furnished by the Paris Machine & Foundry Co., Paris, Ill.

Including land, legal fees, engineering and supervision the plant cost $31,000, or an average of $7.75 per capita.

The W. S. Shields Company of Chicago, was the designing and consulting engineer and Mr. Stanfield had charge of construction.

Lincoln Highway Completely Marked

Since the beginning of work in 1914 on the 3384 miles of Lincoln Highway it is estimated that $2,250,000 have been expended. For all practical purposes the road is now completely marked from New York to San Francisco. The main part of the improvements are in New Jersey, Pennsylvania, Ohio and California.

Meter and Pumping Costs in Detroit

Theodore A. Leisen Gives Costs of Meter Setting and Testing, Results of Bleach Application and Unit Cost of Laying Pipe

THE consumption of water in Detroit in 1915 increased 9.4 per cent, but the population increase was 14 per cent. The average daily consumption was 162 gal., a reduction in the per capita rate of 5.4 per cent, as compared with 1914. However, the reduction must not be attributed to increase in the use of meters, according to Theodore A. Leisen, general superintendent of the waterworks system, in the latest annual report, because the increase in metered services was largely in the last few months of the year—too late to have an appreciable effect on the consumption. Through metered services passed 44 per cent of the total amount and they furnished 50.6 per cent of the revenue. Deducting the water used for industrial purposes the domestic consumption was 106 gal. per capita daily.

At the peak hourly load June 28, the rate was 50 per cent in excess of the average. The fire department records indicate that 0.04 per cent was used for fire purposes.

METERING

During the year a campaign for metering all services resulted in placing 5000 meters on old services. A total of 15,042 meters was set and 2913 removed, making a total of 29,180 in service. The cost of installing and testing meters is given in Tables 1 and 2.

TABLE 1—COST OF INSTALLINO METERS IN DETROIT

Size in inches	Average labor and cartage	Average material	Average cost
⅝	$0.76	$5.22½	$5.98½
¾	0.76	7.82½	8.58½
1	0.76	10.15	10.91
1½	1.69	21.50	23.19
2	1.69	35.50	37.19

TABLE 2—COST OF TESTING METERS IN DETROIT.

Sizes in inches	Number	Flows—Full to	Average cost
⅝	6276	1/16	$ 0.05½
¾	4827	1/16	0.07
1	830	1/16	0.08
1½	99	¼	0.47
2	77	⅛	0.47
3	35	¼	2.10
4	25	⅛	2.10
6	6	⅛	2.10
8	1	⅛	3.36
16	1	1	13.40

PUMPING STATION RECORDS

The actual station duty of all engines was 95,923,000 ft. lb. per 100 lb. of coal burned, an increase of nearly 8 per cent over the previous year. The cost of pumping 1,000,000 gal. was $3.12, 22 cents less than the previous year. The cost per 1,000,000 gal. raised 100 ft. is segregated as follows: Labor, $1.24; fuel, $1.09; oil and supplies, 5 cents, and miscellaneous, 14 cents.

TABLE 3—COSTS PER FOOT OF LAYINO WATER MAINS IN DETROIT, 1915.

Size in Inches	Material, etc.	Labor	Overhead charges	Total
6	$0.57	$0.32	$0.04	$0.93
8	0.71	0.35	0.04	1.10
10	0.98	0.58	0.08	1.64
12	1.27	0.78	0.10	2.15
16	2.19	1.40	0.18	3.77
24	4.20	3.30	0.43	7.93
36	6.12	3.93	0.52	10.57
48	12.63	6.88	0.59	20.40

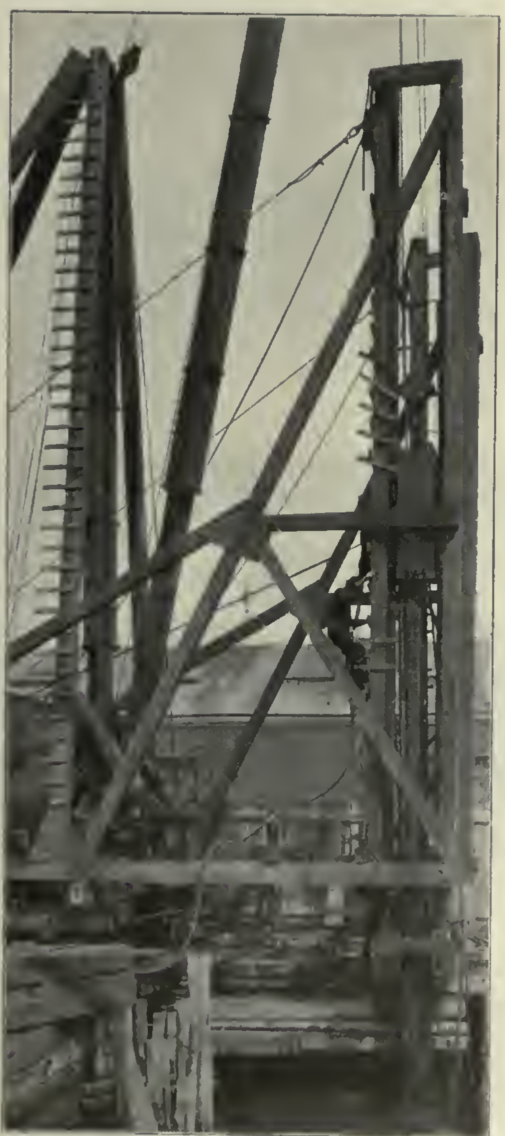
Bleach at the average rate of 6 lb. per 1,000,000 gal. resulted in the practical elimination of evidence of the colon bacillus in the treated water. On gelatine at 20 deg. C. the river water count was 218 per cubic centimeter and the treated water, 19. In the river water B. coli tests were positive on 20 days in 1 cu. cm. samples and on 123 days in 10 cu. cm. samples. In the treated water the tests were positive on 1 and 5 days respectively for 1 and 10 cu. cm. samples.

During the year 42.14 miles of new mains were laid at the unit costs as shown in Table 3.

Shore End of Narrows Siphon Built in Open Trench Dredged to Depth of 50 Ft.

Steel Sheeting of New Design, Driven by Special Traveler, Encounters Riprap and Boulders—Six Divers Employed at One Time

DRIVEN to grade and position with great accuracy, the steel sheet piling in the unusual trench for the Staten Island end of the Narrows siphon of the Catskill Aqueduct in New York City required some unexpected bracing and a good deal of diving work while it was being dredged out. This is thought to be due neither to the driving methods nor to the design. Boulders and riprap encountered at considerable depth in driving a few of the bays forced the sheeting into the trench, giving the arcs in these bays a greater length at the bottom than at the top and pulling apart one interlock in each of them. After timber frames had been set close to the sheeting to take the tension that would otherwise have been transmitted to the master piles through the interlocks of the sheeting, the excavation was completed, the skidway for placing the pipe built by divers and the pipe laying begun at the shore end of the trench, sliding the pipe down the incline as outlined in the article on page 513 of the Engineering Record for April 15, 1916.



MASTER PILES DRIVEN IN LEADS ON CANTILEVERED FRAMES

SPECIAL TRAVELER FOR HEAVY PILES

The first master pile was driven at the inshore end of the trench on Aug. 13, 1915, by the special traveler shown in the accompanying photograph. This traveler was equipped with a 78-ft. boom and a pair of vertical timber guides in which each master pile could be set, and through which the hammer followed the pile as in a pair of leads. The piles, all of the United States type, were blocked from these guides and kept in a vertical position, none of them landing more than 6 in. out of plumb. All but one of the master piles were driven within a fraction of an inch of grade. Driving on this one was stopped a few inches high because the pile had begun to twist. Only one pile went so far out of line as to require pulling and redriving.

The traveler was first erected on falsework built close to the shore to avoid blocking a private right of way. When sixteen master piles had been driven, the regular traveler track was built on them and the traveler, which weighed 48 tons, was picked up by one of the contractor's big derrick boats, turned around and set on this track. The traveler then finished driving the master piles, the last of which were in place by Sept. 30, when the guides were removed from the rig.

DRIVING THE SHEETING

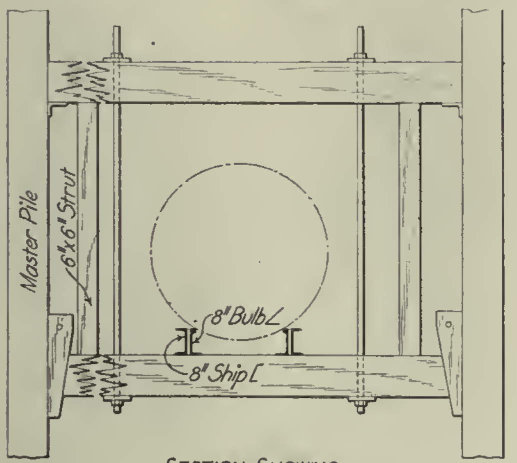
Next the sheet piles for the flared ends of the structure were set and driven to grade and the traveler began to back up, setting and driving the intermediate sheeting as it went. To increase the speed of this part of the work a derrick boat began at the same time setting and driving the intermediate sheeting mid-way of the structure, working from its south side, and a stiffleg derrick was set up at the shore end to handle and drive the shorter sheeting used at that point. A 5000-lb. McKiernan-Terry hammer was used in driving some of the master piles, a 7500-lb, hammer of the same make being substituted later. A 4800-lb. Hamilton hammer was used largely in driving the intermediate sheeting.

MANY OBSTRUCTIONS MET

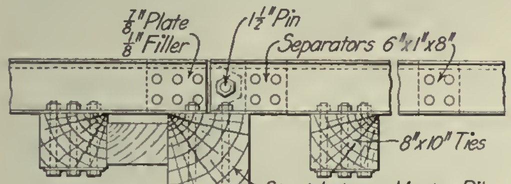
An old crib, brick footings and a quantity of heavy riprap, requiring blasting and dredging, considerably delayed the progress of driving the master piles. The progress made aside from these delays was a pair of these piles a day. The bottom, consisting of tightly-packed sand and gravel, was not favorable for driving, and some of the master piles required fifty blows to the inch at the last, even with the use of two or three jets per pile. The character of the ground penetrated is shown in the accompanying photograph of the lower end of the only master pile which was pulled. The jets used carried a pressure of 100 lb. at the surface, and most of them were made to 2-in. pipe or smaller. They were also extensively used to jet down the sheet piles, 10 to 15 ft. of penetration being secured with many of these by raising and dropping them and jetting before the hammer was set on them.

Grab Buckets Do Excavating

The sheeting was practically all driven by Nov. 18, and the work of excavating and bracing the trench begun. The traveler was dismantled, and the trench excavated to grade by the stiffleg derrick and a dredge boat, using grab buckets. After experimenting with several types, an extra-heavy Williams clamshell was found to be far superior for this work, according to the contractors, a 1¼-yd. and a 2-yd. bucket being used throughout. As the excavation progressed, the cross struts were put in by divers. In addition to the shelf angles provided for seating these cross struts, plates bent in the shape of a Z were used on the ends of those struts which supported several master piles that had turned slightly in driving. This was done by having a diver take a template at each of these places at the level of the shelf angles. The struts were then framed to the templates, allowing for the thickness of the plate. The plates were bolted to the ends of the struts so that the bent edge of each plate which engaged the master pile made an acute angle with the face of the plate which bore against the pile. This made it impossible for the struts to slip out sidewise, and unnecessary to wedge them or put any strain on the connection to the seat angles.



Section Showing Method of Hanging Pipe

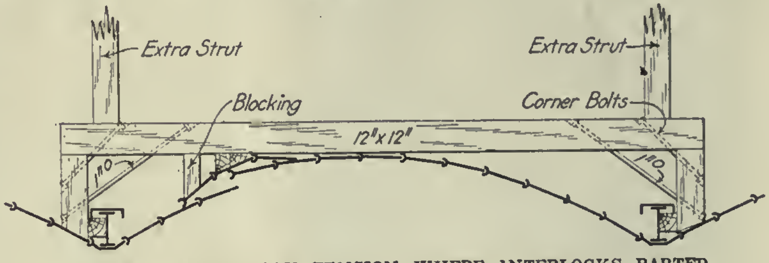


Detail of Guides

TRACK AND LOWER BRACES LIFT IN PLACE UNDER PIPE

THREE RIGS WERE USED AT ONCE TO HASTEN WORK OF DRIVING INTERMEDIATE SHEETING

As the excavation progressed it was found that in four or five days the interlock had parted near one of the master piles. This condition is one which it is thought could not be avoided. Standard pile sections 60 ft. long are limber, even when threaded in an arched sheet. Boulders or large riprap stone were struck well below the surface in each of these bays in such a way as to deflect the sheeting in toward the trench, making the distance along the sheeting from one master pile to the other greater at the bottom than at the top, where the piles had been threaded. As the ground was very stiff and under a good pressure from material above, the tension in the arched sheeting could not possibly force the ground aside, and something had to give. The gaps thus caused were closed by driving two or three sheet piles over them inside the trench. This served better than driving them outside, where they would have struck some of the obstructions that caused the original break, and was much quicker. To take the tension which should have been transmitted along the structure by the chain action of the sheeting, as explained in the article above referred to, trussed timber frames like that shown in the accompanying sketch were used. These frames left the center of the trench unobstructed and furnished a support to the extra sheet piles driven to cover the holes. They were set as the excavation progressed, and did not greatly delay the work, although a separate template had to be made for each of them.

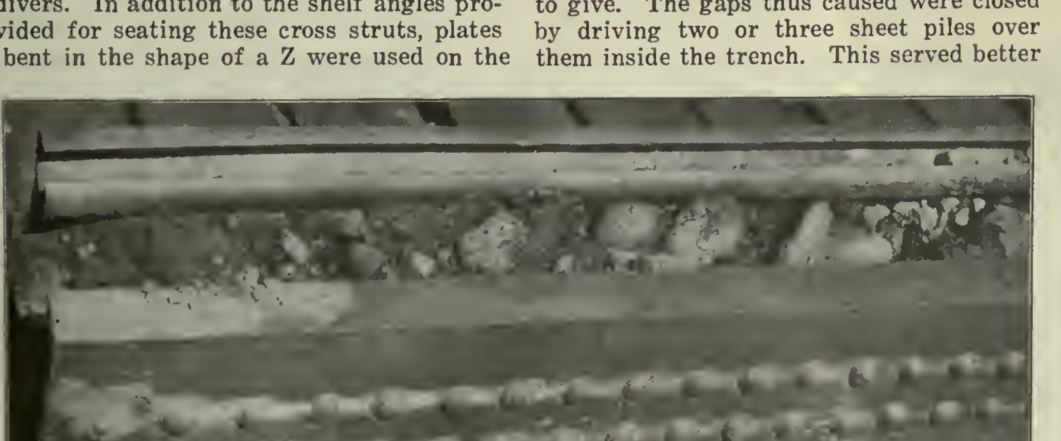


TIMBER FRAMES TOOK TENSION WHERE INTERLOCKS PARTED

Placing the Skidway

These operations left the trench unobstructed for placing the pipe skidway according to the original plans. This skidway, the construction of which is shown in the accompanying drawing, was placed by the divers. The pipe laid in it is being handled by the stiffleg derrick. As may be remembered from the drawing published in the article referred to, a long stretch of this skidway at the outer end is level. It is planned to hitch a heavy tackle between the end of the completed line and the outer end of the section being laid in the trench, luff the main fall of a derrick boat through this tackle and pull the sections together as the lengths of pipe are added on shore. The joint being used in the line was tested to destruction in tension to determine the possibility of pulling the pipe in this way, and showed a strength almost equal to that of the pipe itself. If the pull required becomes excessive, the section of the line in the trench can be dragged to place in halves, and two joints made under water. On two lengths of this pipe a long, tapered spigot has been cast to facilitate entering the pipe at these joints.

When this has been done the skidway, which is hung by bolts from the braces above, will be unbolted by divers. The struts below the skidway do not rest on shelf angles, being merely wedged to the



COMPACT GRAVEL, SHOWN ADHERING TO ONLY PILE YET PULLED, MADE DRIVING DIFFICULT master piles. The wedges will be knocked out and these struts left permanently in the ground as a support to the pipe line. The trench will then be backfilled above the pipe, and the upper braces and their shelf angles taken out as the filling progresses. This will leave the entire system of sheeting clear for pulling with inverted hammers and other means.

The Narrows siphon is being constructed for the Board of Water Supply of New York City by the Merritt & Chapman Derrick & Wrecking Company. J. Waldo Smith is chief engineer and Alfred D. Flinn deputy chief engineer of the Board of Water Supply, for which Edward H. Hopson is resident engineer under John H. Hogan, division engineer, and Walter E. Spear, department engineer. William L. Chapman and Ralph E. Chapman of the contracting firm planned the construction work, which was carried out under the personal direction of the latter with Captain Tooker in charge of the work.

Various Aggregates in Test Concrete Road

City of Philadelphia Constructs 2-Mile Pavement on Oxford Pike to Make Comparison of Latest Theories and Practice

FOR the purpose of comparing the latest practice and theories of concrete road building, the city of Philadelphia last year completed a test road on Oxford Pike, 11,250 ft. in length and 18 ft. wide. It is subdivided into five principal sections, each 2250 ft. in length and consisting of a different composition of concrete. Bituminous wearing surfaces about ¼-in. in thickness were placed on one-half of each section. The following details in regard to the construction have been abstracted from the annual report of William H. Connell, chief engineer of the Philadelphia Bureau of Highways and Street Cleaning.

MAN ON MOVABLE BRIDGE FLOATS SURFACE

The construction was commenced on Oct. 5, 1914, and continued until Dec. 4, when, on account of cold weather, it was suspended until March 30, 1915. The concrete was completed on May 18, 1915, 66 working days being actually consumed on the work. The lateness of the season in which work was done was not conducive to the best results and is responsible, in a measure, for rather high costs. In all cases when the temperature was below freezing the road was covered with hay and canvas. The bituminous surfacing materials were applied between August and September.

The five principal sections were subdivided into two sections, each of which, 1050 ft. long, was left covered, while the remaining 1200 ft. was treated with four different bituminous wearing surfaces, the length of each of these treated portions being 300 ft. The materials employed for the wearing surfaces were Tarvia, Ugite, asphalt cut-back and Unionite. The cross-section of the road was uniform throughout the entire length, being 18 ft. in width and having a thickness of 7¼ in. at the center, 6½ in. at the quarter points and 5 in. at the sides, the bottom being a flat plane.

BUILT ON OLD MACADAM

The pavement was built on an old waterbound macadam roadway, which varied from 9 to 18 in. in depth and which was first spiked and then scarified, after which the macadam was removed to a depth of 5 in. below the finished grade. Then it was thoroughly rolled with a 10-ton roller.

The concrete used was composed of 1 part cement, 2 parts fine aggregate and 3 parts coarse aggregate. The aggregates varied in the different sections. In the first, Jersey gravel and whole pebbles were used; in the second, sand and trap rock passing a 1½-in. ring and retained on a ¼-in. screen; in the third, trap rock grit, and trap rock fulfilling the same requirements as in the second; in the fourth, trap rock grit and limestone of the same size requirements as in the case of the trap rock, and, in the fifth, sand and trap rock grit mixed in equal proportions and trap rock. The mixing was performed in a Ransome concrete mixer equipped with a charging device. The surface of the concrete was finished with a template cut to the cross-section of the road and then floated with wooden floats from a movable bridge built to span the concrete. Transverse joints were provided at intervals of 30 ft., and, with the exception of 10 joints which were laid at an angle of 30 deg., all were laid at right angles to the roadway. Two types were used: prepared bituminous joints and steel protected joints.

SUBSECTIONS GIVEN A BITUMINOUS SURFACE

The prepared bituminous joints consisted of ¼-in. prepared felt, which extended through the entire thickness of the concrete. In order to secure straight joints, especially on the grades, and to facilitate the placing of the bituminous material, ¼-in. iron plates were placed across the road at each joint with the felt against it, and when the concrete was in place the joint was removed.

The steel-protected joints consisted of plates 2½ in. in depth and ¼ in. thick, which were installed with a truss-Con holding device, which was removed as soon as the concrete was placed, ¼-in. prepared felt extending through the entire thickness of the concrete being used between the plates.

OLD MACADAM REMOVED TO DEPTH OF 5 INCHES BEFORE PLACING CONCRETE

WITH FEW EXCEPTIONS JOINTS WERE LAID AT RIGHT ANGLES TO ROADWAY

After sweeping the surface of the concrete thoroughly, 1/5 gal. per square yard of Tarvia B was applied with a pressure distributor. After this had thoroughly dried, ¼ gal. per square yard of Tarvia A was applied by the same means, at a temperature of 250 deg. and covered with a thin layer of ½-in. clean trap rock chips in the proportion of 10 lb. per square yard. Three days later a second coat of Tarvia A, ¼ gal. to the square yard, was applied with a pressure distributor, and covered with a thin layer of ½-in. trap rock chips in the proportion of 20 lb. to the square yard.

In the Ugite section, after sweeping the surface of the concrete, 1/10 to ⅛ gal. per square yard of Ugite A was applied with a pressure distributor, and, after two hours, covered with a thin layer of ½-in. clean trap rock chips in the same proportion as the first treatment on the Tarvia section. The following day, 1/3 to 3/10 gal. per square yard of Ugite 3 was applied at a temperature of 250 deg., also by a pressure distributor which, in turn, was covered with a thin layer of ½-in. clean trap rock chips, 20 lb. per square yard. The following day the second application of Ugite 3, of 1/3 to 3/10 gal. per square yard, was applied with a pressure distributor and covered with ½-in. trap rock chips in the same proportion. This application was rolled lightly with a 5-ton roller.

In the asphalt cut-back treatment a paint coat consisting of 50 per cent naphtha and 50 per cent of asphalt having a penetration of from 55 to 65, and in an amount of ⅛ gal. per square yard, was applied with a pressure distributor. Twenty-four hours later an application of 1/3 gal. per square yard of asphalt with a penetration of from 70 to 80, cut-back with from 35 to 40 per cent of naphtha, was applied with a pressure distributor. After two hours this was covered with a layer of trap rock chips graded from ⅛ to ½ in., 25 lb. being used to the square yard, and then thoroughly compacted with a 5-ton roller.

Unionite was applied on the day after the concrete surface had been thoroughly cleaned and a paint coat consisting of equal parts of asphalt with a penetration of from 58 to 65, and naphtha, in an amount of ⅛ gal. per square yard, had been applied. It was spread and rolled with a 10-ton roller, the thickness of the course being from ¼ to ⅜ in. after rolling. The Unionite consisted of specially prepared rock asphalt, ¼-in. crushed stone and Unionite asphaltic cement in the proportions of 47½ per cent rock asphalt, 2½ per cent asphaltic cement and 50 per cent stone, previously coated with asphaltic cement.

Treated Ties Save Growing Trees

Of the 3,000,000 crossties used every year by the Chicago, Burlington & Quincy Railroad for replacement purposes over 70 per cent are treated with a preservative. According to J. H. Waterman, superintendent of the railroad's wood-preserving plant at Galesburg, Ill., the millions of treated ties in their tracks now last from twelve to twenty years, whereas untreated they last on an average of eight years. In each of the twenty divisions of the Burlington system there are tracks for experimental purposes containing 26,000 treated ties of different species, which are all carefully inspected at least once a year for the actual results of treatment as shown by the service test.

Literature

For the Civil Engineer and Contractor

Books Reviewed

Irrigation Practice and Engineering—Vol. 3

Author, B. A. Etcheverry, head of department of irrigation, University of California. Cloth, 6 x 9 in.; 438 pages; 186 illustrations. New York, McGraw-Hill Book Company, Inc. $4 net.

REVIEWED BY F. H. NEWELL

Head of Civil Engineering Department, University of Illinois, Urbana.

The third volume of this work fulfills the promise of the two preceding books and rounds out a series of much interest and value, not merely to the engineer but to investors and others concerned in irrigation development. In this, the last of the series, Professor Etcheverry takes up irrigation structures, including not only those in general use, but also many especially devised or found necessary under different conditions of topography and climate. This is probably the most complete and suggestive collection of details of such works which is to be found in any one place.

The preceding volumes are devoted to fundamental principles and problems, while the one under consideration deals with such topics as diversion works, scouring sluices, main headgates, spillways, road crossings and measuring devices. The last named are of particular interest, as modern development is largely along the line of securing greater economy in the use of water. This can be accomplished only through more complete records than those of the past, giving the amount of water entering the canal, flowing in its principal branches and delivered to each of the hundreds of thousands of users taking water from the system.

The book is notable for the variety of the illustrations and the concise, yet clear, description of the larger facts worthy of the attention of the engineer.

Web of Steel

A novel by Cyrus Townsend Brady, and Cyrus Townsend Brady, Jr. Cloth, 336 pages, illustrated. New York, Fleming H. Revell Company; $1.35 net.

In "Web of Steel" the authors have selected the design and sudden failure of a great international bridge as the main incident of a tale in which engineering is blended with romance. While the Bradys disclaim any attempt to portray actual events, the engineer will recognize in the situation with which the book deals unmistakable resemblances to certain phases of the failure of the Quebec Bridge nine years ago. The story centers about a young engineer who, while assisting his father, a man of prominence in the profession, in the design of the great steel structure, becomes engaged to the daughter of the president of the company which is erecting the bridge. When partially completed the structure falls into the river. The young designing engineer, while in no way responsible, assumes the blame for the accident to protect his father's reputation and disappears, leaving his girl behind. She finds him, after a long quest, on a Western irrigation project after he has all but lost his life in a heroic effort to save a dam from being washed out during a flood.

The first eight chapters of the novel are tedious reading, but after the authors reach the dramatic incident of the bridge failure and the consequences the story moves rapidly and holds the reader's interest to the end.

Letters to the Editor

Comment on matters of interest to engineers and contractors will be welcomed

Architect vs. Engineer

SIR: Your timely and able article on page 406 of the March 25 issue is of great importance and will doubtless do much good. It meets my hearty approval and points the proper way to a broader and better policy than can possibly obtain through any license scheme no matter how complete in detail or thoroughly applied.

No form of legalized trade unionism can be made of general public interest though it may be made to serve a measure of limited private interest very well at public expense. Its mischievous tendencies are of a subtle, vicious nature, apt to invite all sorts of dangerous political complications and corrupt the whole body politic.

A broad democracy and free country can never thrive under the burdens of a complete license system. No able architect or engineer wants it and no others should be given such a dangerous political plaything.

WM. RUSSELL SMITH.

York, Pa.

SIR: I was much interested in your editorial in your issue of March 25 on "Architect vs. Engineer." I am convinced, however, that the author of this editorial, in common with most engineers, views the alleged controversy between architects and engineers from the wrong standpoint.

There is no conflict between the two professions, nor can there be as such. Architecture is building and even one with the most rudimentary knowledge of the English language knows that when an engineer, or for that matter, a doctor or a lawyer, designs and supervises the construction of a building, he is practicing architecture. The mere fact that he may style himself an engineer or otherwise than as an architect has no bearing on the case.

In my humble opinion, the entire controversy is caused by the common misuse of the terms. Each and every building is a piece of architecture and may and usually does embody the work of many sciences and arts. The structural framework of the building, its foundation and its ventilation plant are as much architectural features of the building as are the colors of the frieze, the outline of its cornice or the colors of the pigments used. Many engineers contend that certain classes of commercial buildings should be in charge of engineers. I have no quarrel with them except that I maintain when they are designing buildings they are practicing architecture. The man who plans is the architect, no matter what he calls himself.

I am willing to grant you this controversy between architects and engineers in the states where architecture is controlled by law is caused by the fact that in such states no one can style himself an architect unless he qualifies under the law as an architect. In states where there is no legal restriction to the use of the title, whoever heard of any man, whether engineer or contractor, who specialized in the construction of buildings who styled himself anything but an architect. The term architect has always been and, without doubt, always will be, used to designate the men specializing in the design and supervising of the construction of buildings. Building engineering is a part of architecture; therefore, how can we separate laws pertaining to architectural engineering from laws pertaining to the other elements which go to make up architecture?

Personally, as an academic condition, I do not agree with your contention that all laws regulating both architects and engineers should be wiped off our statute books. Nor do I believe that you would go so far as to argue that all laws regulating the professions of law and medicine, pharmacy, dentistry, etc., should be wiped off the statute books. In Illinois, at least, I believe the universal opinion of those qualified to judge is that the working of the architects' law during the last 19 years has resulted in improving very materially the professional standing of the profession of architecture. The quality of the work turned out by the profession is pronounced by able judges to be far superior to that turned out in communities where anyone may style himself an architect without any restriction whatsoever.

I am convinced that if you will correspond with the leading members of the engineering profession who have specialized in building work, you will find that a very large majority will agree with the writer's contention. I think you will also find that it is only those engineers who are not qualified by education and training to pass the elementary examinations conducted by the various state boards of examiners of architects, who are insisting that the engineers should be given equal rights with the architectural profession to design and supervise buildings, overlooking absolutely the legal and lexographers' definition of terms, which would style him an architect whenever he so acts.

Chicago, Ill. A CHICAGO ENGINEER.

Do Wooden Piles Fail?

SIR: The conclusion of Robert J. Reidpath & Son, in the Engineering Record of March 18, that piles and wood in other form, when buried in the ground and protected from air, do not decay, is undoubtedly correct. Much depends, however, on the character of the ground. A light, sandy soil, for example, is probably less of a protection than heavy clay or loam. This has been noticed in the case of telegraph poles, those set in cinder ballast being decayed to a greater depth below the ground line than those in heavier foundations. Since the agents of decay in wood are living vegetable organisms known as fungi, and as these require air, moisture, moderate temperatures and food in order to develop, it follows that the cutting off of the air supply would prevent the growth of decay organisms.

Supplementing the observations of Mr. Reidpath, it is reported that old Fort Marion in St. Augustine, Fla., was built on a pile foundation, and as this building was erected in the seventeenth century and no failure due to subsidence of foundation has been noted, it is obvious that the piles must have remained sound, since the subsoil is not of stable character.

It is, of course, well known by engineers that creosoted piles should be used where exposed for part of their length to air or water, and that timber properly creosoted will resist decay almost indefinitely, even at the ground line, or in teredo infested waters. As evidence of this are recent reports on timber piles in the coal docks of the Lehigh Valley Railroad at Perth Ambody, N. J., that are still sound after 30 years' service, and marine piling in the Gulf of Mexico which has given 40 years' service.

E. A. STERLING,
Manager National Lumber Manufacturers' Association.
Chicago, Ill.

What Is an Engineer?

SIR: Educators are proverbially conservative and cling to those educational instruments that appear in the past to have been effective in developing men, not only in mind, but in character. It appears to me that this spirit of conservatism, although it may be a blind following of tradition, is a saving grace rather than a fault in these times, when so many persons would like to try experiments on our young people.

Many of our colleges are attempting to overcome a dissipation of the mental energy of our younger generation, and to confine their energies to disciplinary studies that produce mental staying power, and a power of organized thought. Of course, this process is fundamental to the pursuit of any professional career.

Personally I think that our modern technical education is as good an instrument for this particular training as the old education in the humanities.

I appreciate the fact that our modern technical education lacks the mental stimulation that came from the old education wherein the pupil re-thought the thoughts of the great intellectual leaders of the world. What is there in modern technical education to replace the ancient classics with their inspiration, with their discipline in the accuracy required in composition? Where in laboratory work and testing materials and the study of mechanics will we find intellectual food to replace the reading of Republic of Plato? Where is the equivalent for the breadth of view that the student of history obtained from Gibbon? Has any educational instrument of recent times replaced the study of formal logic?

And yet our modern technical education does produce effective workers and useful citizens, and I hope that I shall never be as pessimistic about the results as my honored colleague, Professor Swain.

It is, of course, disheartening to find that our seniors in technical colleges as a rule have but little intellectual life. But, after all, they have been passing through the grammar of engineering. It is just as if a student in a classical college should not pass beyond grammar and composition. Some inspirational courses covering the lives of the engineers and describing the complete circumstances of some great work of engineering, should be given. Many a student who has dropped engineering courses at the end of the sophomore year on account of lack of interest, and afterward takes a position in the field, realizes the fascination of the work of the engineer.

With respect to the results of the inquiry announced by Professor Mann: I am sure that college students will be glad to hear the good news that the things they take delight in, namely, the pursuance of general college activities, what President Wilson called "the side shows," have a value of 75 per cent, whereas in the things that they don't care to do and which the professors are spending the greater part of their effort to force them to do, there is a value of only 13 per cent. These results of Professor Mann's inquiry seems to me from the standpoint of practical college administration to be fantastical.

Every one knows that the study of mathematics not only gives proficiency in algebraic transformation and trains the mind to the logic of a mathematical process, but it produces character as does any hard task, faithfully pursued.

I am enclosing a form of estimate cards which we have used for a good many years in Purdue University to determine the personal qualities of our students.

W. K. HATT,
Professor of Civil Engineering, Purdue University.

Name .... Class ....

Age at graduation .... Elective ....

Honors ....

Qualified for 1 2 3 / Preference a b c: Teaching .... Drafting .... Designing ....
Selling .... Journalism .... Fieldwork ....
....

Peculiarities or Physical Defects ....

....

DEPARTMENT ESTIMATE

A—Good B—Fair C—Poor

Habits	Popularity	Address	Mental Caliber ....
Industry	Accuracy	Speed	Self Reliance ....
Reliability	Originality	Drafting	

Best known by ....

Remarks ....

HINTS FOR THE CONTRACTOR

Details Which Save Time and Labor on Construction Work

Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

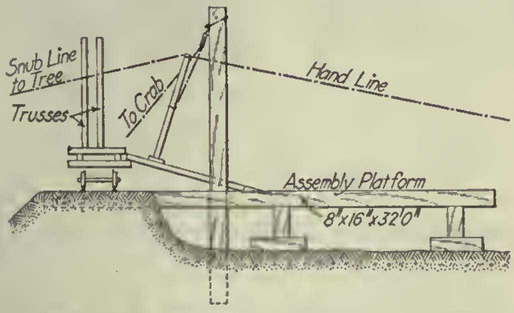
[*Contributions to this section are solicited, and if found available will be paid for. They must be* SHORT, *and should be accompanied, if possible, by photographs or sketches.*—EDITOR.]

Skidding Bridge Trusses in Vertical Position Off Flat Cars

By W. G. MILLER
Indianapolis, Ind.

SIX BRIDGE trusses each 63 ft. long were recently unloaded by the writer from flat cars without any of the usual hoisting equipment, spread apart on a platform at the side of the main line, assembled with their floor beams, etc., and moved into place to form part of a bridge over the Big Raccoon River on the Central Indiana Railway near Bridgeton. The three spans to which these trusses belonged had formerly been part of a six-span bridge on the Big Four Railroad, which had been taken down and stored at the Beech Grove shops of that railroad. The trusses were loaded in two sets on four cars with three trusses side by side on two flat cars. The other material for the three spans was loaded on two gondola cars, the entire loading time being a day and a half.

The only tools used in unloading the trusses were two crabs, ten screw jacks and the necessary tackle and timbers. There was one train each way during the day, and the unloading was arranged not to interfere with them. There was a fill of about 5 ft. at the point where the material was unloaded. A platform made of six stringers spaced about 10 ft. apart was built level with the track, being blocked up from the ground. Ties were removed from the track and the ends of the stringers passed under the rails. Two stringers were set up, one at each end of this platform, as gin poles in the location shown in the accompanying sketch. They were erected far enough apart to allow the trusses to pass between them. The cars carrying the first load of trusses were then spotted and skids placed from the car floors to the platform and blocked. The two crabs were then chained down to the track, one at each end of the railway cars. A line from each crab led over a block at the top of each gin pole. These lines were tied to two chain hitches, one at each end of the first truss to be unloaded. Snub lines of 2-in. manila rope were tied to the top of the truss and paid out around trees on the opposite side of the track. A small piece of oak was set under each end of the truss to form a sliding surface on the skids.



TRUSSES UNLOADED "STANDING UP" WITH SIMPLE HOISTING EQUIPMENT

The truss was jacked off the car to the skids and tilted over till it made a right angle with the skids. The ropes on the crabs and the snub lines were slacked off as the bottom of the girder was pinched along the skids with bars. Hand lines on the side of the truss next the platform were also used to help slide it along.

Each of the remaining five trusses was unloaded in the same way. The stringers, bracing and other material was taken out of the gondola cars with the aid of the gin poles and crabs. Each span in turn was assembled and riveted on the platform, jacked over on to the track and pulled out to place by a locomotive. The new bridge replaced a pile trestle containing one 90-ft. girder span, which had made trouble in previous floods by catching drift. The work was carried out by the writer as superintendent of construction.

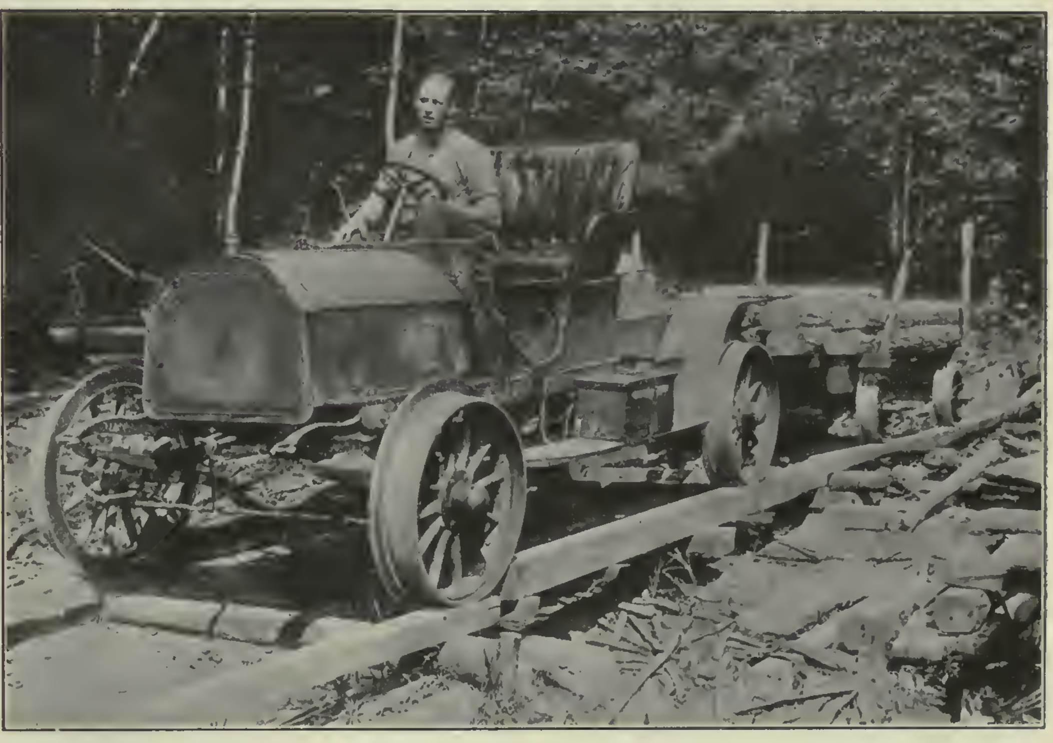
Cut Vent Holes and Fill Settles to Firm Foundation

AT VARIOUS points the Coleman-du Pont concrete road, in Delaware, was constructed over swamps. Ordinarily these were drained before the fill was deposited, but in one case the cost would have been prohibitive so the fill was made directly on the surface of the swamp, which floated on several feet of black muck. Below this was a solid foundation of sand and bog ore. It was thought that the weight of the embankment would carry it down to this stratum, but it did not. The difficulty was surmounted by cutting holes through the swamp surface near the toe of the fill. The muck was forced up through these and the solid earth settled down to the firm foundation.

Loads of Lumber Transported by Automobile Without Building Road

By GEORGE W. RICHARDS
Cleveland, Ohio

A READILY-LAID track of 4 x 4-in. maple rails laid on tree-trunk ties has been used recently in Massachusetts to secure transportation at automobile speed from a portable sawmill operating in the woods to the nearest county road, a distance of 2 miles or more. A second-hand 35-hp. automobile with flanged cast-iron rims placed on its wheels was used to draw a platform car on which the lumber was loaded. The line had a maximum grade of about 7 per cent. The ties were obtained when the line was cleared, and were laid directly on the ground, being blocked up only where absolutely necessary. One man by spending about a day's time a week was able to keep the line in good condition. There was a turntable at each end of the line so that the car was always pulled. The outfit did the work of three two-horse teams.



MUCH CHEAPER THAN ROAD-BUILDING, TRACK ENABLED AUTO TO REPLACE THREE TRUCKS

Motor Trucks Operated on Long Hauls Over Bad Roads in West

By GEORGE F. YOUNG
Bend, Ore.

TRAVELING over what would be considered in the East bad roads, with 3 to 4-ton loads of through freight, automobile trucks are being operated in this district on long hauls under conditions similar to those affecting road transportation to remote construction work at a cost of 41 cents per mile. The costs which are given in the accompanying table are for operating a regular freight and express line, but practically all of them except office expense and the items for rebates, bad accounts, etc., would be the same in hauling for construction work.

Items	Total cost	Cost per mile
Road expense	$1,086.28	$0.0383
Wages of drivers	2,335.41	0.0823
Office expense	165.91	0.0058
Miscellaneous	202.81	0.0071
Interest	240.00	0.0080
Depreciation (2 trucks allowing 5-year life)	1,600.00	0.0564
Tire cost	1,812.47	0.0642
Cylinder oil	278.06	0.0098
Other oil and grease	38.12	0.0013
Gasoline	2,050.64	0.0723
Maintenance (new parts)	1,327.54	0.0468
Repairs in garages	175.73	0.0052
Supplies, hardware, etc.	138.59	0.0049
Rebates, bad accounts, etc.	304,61	0.0107
Total operating cost	$11,756.17	$0.4131

These figures are for a 300-mile round trip haul over rough country roads where no particular road work had ever been done aside from clearing away the brush and rocks. The roads were used for freighting with narrow-tired wagons and the ruts were very bad. A total of 716,592 lb. of freight were handled during the time for which these costs are given, nearly all of it traveling in one direction. The two 3-ton trucks made altogether in this time a little more than 28,000 miles. The average loaded speed was not more than 6 or 8 miles an hour, and the roads would not permit running the trucks light at more than 12 miles per hour. Hauling was continued throughout the winter in heavy snow, and throughout wet weather in heavy soil. There were numerous steep grades, and one end of the road was mostly sand and volcanic ash which made bad going in dry weather. Gasoline cost from 26 to 28 cents, and the drivers were paid at the rate of $100 per month. It is thought that because the trucks had double rear drive wheels, throwing all the load in running over the rutted parts of the road on the outside tires, that the tire expense was much greater than would have been the case with a single wheel of the same gage as the ordinary wagon tire.

Although the trucks were rated at 3 tons capacity, they were rarely loaded with less than 6500 lb. of freight in addition to gasoline and oil for the round trip. The writer has no costs on team hauling through this country, but the freighters formerly asked $30 a ton for this and shorter hauls, and none of them made any fortunes.

Another firm operating one 3-ton truck and one 1½-ton truck through this country finds actual operating expenses, without allowing for depreciation, to be 30 cents per mile.

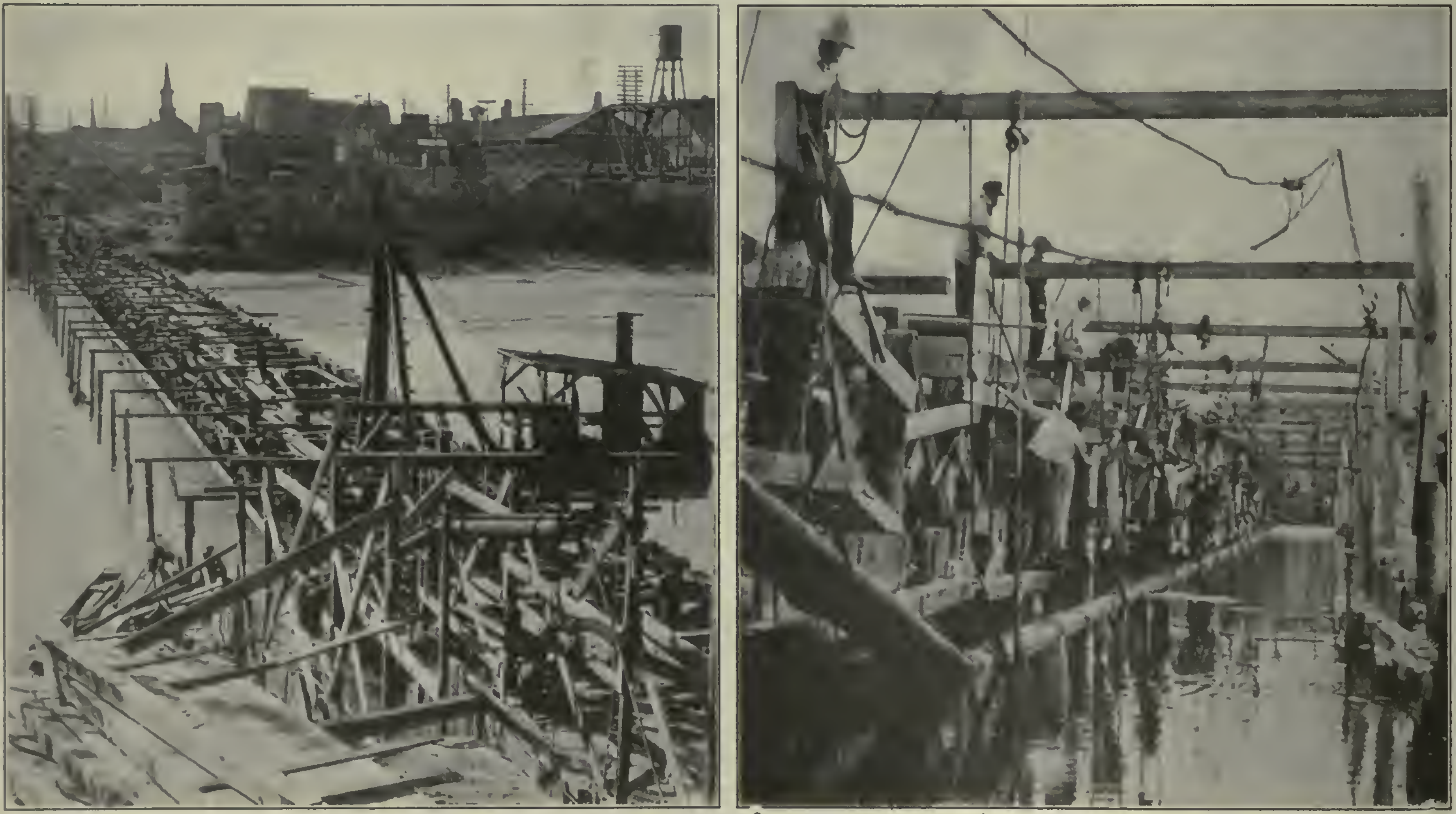
Gas Mains Across Brazos River Welded and Lowered in One Piece

By C. R. SUTTON
Indianapolis, Ind.

TO SAVE pumping out a trench in quicksand and also to reduce the length of time falsework would have to be maintained across a very treacherous river, two 10-in. gas mains were recently laid at Waco, Tex., by welding each into a complete section extending clean across the river and lowering the sections with tackle. A trench to accommodate the gas mains and also twelve submarine cables was sheeted and excavated about 14 ft. below the river bottom into a bed of gravel. The sheeting was anchored with rods to piles driven above and below it, and no braces were set across the trench. This work was done by a traveler derrick run on falsework above the trench. As the river is subject to destructive rises all through the year, the 20-ft. lengths of pipe were first welded into 100-ft. sections so that the lines could be connected up and lowered with the least possible handling over the water.

The oxy-acetylene welding process was employed, using Norway iron welding wire as a filler and making a butt weld with plain pipe ends. It took about 45 min. to make each joint in this way, though it is thought that with the beveled-end pipe now manufactured joint welds can be made in two-thirds of this time. Prest-O-Lite dissolved in acetylene was used as a fuel in the welding process. The drip pockets, one of which is shown in one of the photographs, were made by welding sections of boiler plate together and to the pipe.

As several pipe lengths, extending above water, were welded to each end of each line before lowering, the lines had to be weighted to sink them to the bottom of the trench. This was done by attaching pieces of scrap steel sheet piling, also cut up with the torches. The work was in charge of the Phoenix Construction Company and was carried out under the direction of their engineer, B. Diem.



TWO TEN-INCH GAS MAINS EACH WELDED INTO ONE PIECE WERE LOWERED TO PLACE TO SAVE WORKING TIME OVER TREACHEROUS TEXAS RIVER

Back Dump Motor Truck Best for Asphalt Repairs

THE BACK dump motor truck has been found the best adapted to distributing the materials for asphalt paving repairs by John P. Binzen, engineer of maintenance, highways and sewers, of the Borough of the Bronx, New York City. Power from the motor is used to elevate the body, and at the proper elevation the material can be pulled out by a raker without the necessity of having a shoveler on the truck. The raker quickly learns to gage the quantity that is needed, so there is very little waste.

Heavy Snowfall for March

Only once in the last 20 years has the snowfall for March in New York exceeded the total of 25.5 in., recorded last month by the local Weather Bureau. The New York record for March, 28.5 in., was established in 1896. The cost of this season's snow-removal work in New York, it is estimated, will be nearly $2,000,000. The average temperature for March and February of this year has been 27.5 deg. For both months the snowfall has aggregated 36.6 in.

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

Will Call for Bids for Immediate Reconstruction of Burned City

Destruction of Paris, Tex., Affords Ideal Opportunity for Modern City Planning Involving Expenditure of Over $400,000

Following the almost complete destruction of Paris, Tex., by fire, noted in recent issues of this journal, the officials of that city have been actively engaged in remodeling the old plans and laying out parks, roads and fire districts in such a way as to greatly increase the city's attractiveness. W. H. Dunn, city planner and landscape architect, has been retained to prepare plans and under his direction the main thoroughfares will be made 80 ft. wide instead of 60 ft. as before, and all other streets will have a minimum width of 50 ft. as compared to the old 40 ft. plan.

About four miles of new streets will be opened up; the square will be parked and a new site between Nineteenth and Twentieth and Sherman Streets for a market square has been purchased by the city for $26,000.

Two plans have been suggested for the new civic center, one being to rebuild the court house and city hall on blocks 10 and 19 respectively, park the two intermediate blocks 11 and 12 and build a permanent road due northeast from the center to an existing road outside the city. The second plan suggests building the city hall on block 15, parking blocks 5 and 180 and erecting a public library, or some similar structure, at the north end.

Building lines are being set for all types of buildings in every part of the city and the state fire insurance commission code has been adopted. Every building within the fire limits will be required to be practically fireproof, and special importance will be laid on the desirability of non-combustible roofs.

A considerable amount of paving was badly damaged by the fire and will have to be relaid and extensive areas of wood block paving were badly burned. About 2000 yd. of new wood block paving will be laid beside that necessary to repave the damaged part.

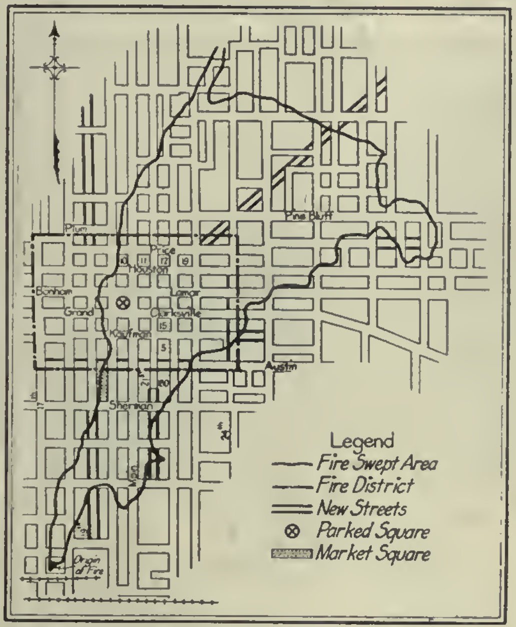
Bonds of amounts named have been voted for the following purposes: $10,000 for city comfort station, $10,000 for remodeling present sewage disposal plant, $50,000 added to present funds for construction of school houses. R. G. Taylor is city engineer.

The government has appropriated $200,000 for the construction of a new post office building, plans for which are being made at Washington, D. C. A new court house will be erected at an approximate cost of $150,000, under the supervision of Sam Bedford, county auditor. Bids on this work will be called for about May 10.

New York Subway Strike Settled —Union Recognized

An agreement between New York subway contractors and the International Tunnel & Subway Constructors Union of America, entered into April 18, has settled the strike called recently on the New York subway construction work and will, it is hoped, prevent the occurrence of any future strike while the new system is being finished.

The agreement was signed by a committee representing all of the contractors involved and by the president of the United Portable & Hoisting Engineers, who went out on a sympathetic strike, in addition to the representatives of the new union. It does not affect the compressed air workers, who had gone out on a strike of their own while negotiations were pending, but it was expected that most of the subway work would be reopened on full time beginning with April 19. The wage increases agreed to by the men, which were considerably lower than those asked for in the beginning, are: Laborers, $2 for 8 hr.; timber men, $2.75 for 8 hr.; timber men's helpers, $2.20 for 8 hr.; concrete machine runners, except where engineers have jurisdiction, $2.50 for 8 hr.; wood form makers, $2.75 for 8 hr.



SHOWING HOW PARIS, TEX., WILL BE REMODELED

Propose New Road to Divert Traffic from Two Crossings

To divert traffic simultaneously from two grade crossings at Montgomery, Ala., where the same road crosses the railroad twice, the Seaboard Air Line Railway has made the city an offer to build at its own expense a connecting road 4500 ft. long, at an estimated cost of upward of $50,000. The road is the lower Wetumpka Road, which carries a heavy traffic. One of the crossings is over the throat of a yard, and several accidents have occurred there in the last two years. The new road would not eliminate the crossings; this would be difficult because the old road is built up almost solidly for half a mile. The new route would be shorter, however, and would presumably take most of the through traffic.

Plans are now being prepared in the office of the division engineer at Savannah, Ga. The proposal of the railroad includes the offer of a fixed sum to the city for maintenance.

Nitrate Plant Amendment to Army Bill Passes U. S. Senate

The amendment to the Chamberlain army bill appropriating $15,000,000 for a government hydroelectric plant to produce nitrates for fertilizers and making explosives passed the Senate April 14, by a vote of 43 to 22.

The action came as the result of an amendment by Senator Smith, of South Carolina, which provides for the sale of Panama Canal bonds to raise the necessary $15,000,000. The amendment, as noted in the issue of the Engineering Record of April 8, authorizes the President to make available not more than five water power sites for the construction of nitrate plants.

Engineers Selected For Nation-Wide Inventory of Industrial Resources

Naval Consulting Board's Preparedness Committee Chosen from Members of Five Professions in Every State

Selected from the membership of the five national engineering societies—civil, mechanical, electrical, mining and chemical—the names of the engineers who will conduct a census of the nation's industrial resources, in co-operation with the Naval Consulting Board, were made public this week. Five men have been chosen from each state, one from each of the five professions, and they will work under the general direction of Howard E. Coffin, chairman of the committee, and W. S. Gifford, chief statistician of the American Telephone & Telegraph Company, who is acting as supervising director of the survey.

In making public the names of the committee members, Mr. Coffin said: "The names and standing of these men speak for themselves. They have been selected by their own professional associates and the only standard has been that of efficiency and integrity. They work without pay—indeed, the services of many of them could not be bought. In my judgment they form a vast, flexible organization, the like of which has not been known in this or any other country—an organization, moreover, which is, from top to bottom, absolutely non-partisan and non-political."

Members of Committee

The names of the civil engineer members of the committee, by states, follow:

Alabama—J. S. Sewell, Alabama Marble Company, Gantt's Quarry.

Alaska—R. J. Wulzen, Alaska Gold Mines Company, Thane.

Arizona—J. B. Girand, consulting engineer, Phoenix.

Arkansas—Charles H. Miller, president, Miller Engineering Company, Little Rock.

California—Wynn Meredith, engineer with Sanderson & Porter, San Francisco.

Colorado—H. S. Crocker, consulting engineer, Denver.

Connecticut—H. R. Buck, of Ford, Buck & Sheldon, Inc., Hartford.

Delaware—Andrew Bryson, Brylgon Steel Casting Company, New Castle.

District of Columbia—C. B. Hunt, engineer of highways, Washington.

Florida—L. R. McLain, president, Florida Engineering Company, St. Augustine.

Georgia—G. R. Solomon, Solomon-Norcross Company, Atlanta.

Idaho—M. S. Parker, St. Maries.

Illinois—R. W. Hunt, president R. W. Hunt & Company, Chicago.

Indiana—William K. Hatt, professor of civil engineering, Purdue University, Lafayette.

Iowa—George H. Boynton, president, Northern Gravel Company, Muscatine.

Kansas—D. H. Whitmer, Whitmer Contracting Company, Pittsburgh.

Kentucky—Richard Montfort, consulting engineer, L. & N. R. R., Louisville.

Louisiana—Arsene Parelliat, engineer, Hercules Company, Ltd., New Orleans.

Maine—E. C. Jordan, consulting engineer, Portland.

Maryland—H. D. Bush, Carnegie Steel Company, Baltimore.

Massachusetts—Fayette S. Curtis, president, Old Colony Railroad Company, Boston.

Michigan—Gardner S. Williams, consulting engineer, Ann Arbor.

Minnesota—William L. Darling, chief engineer, Northern Pacific Railway, St. Paul.

Mississippi—M. L. Lynch, Jackson.

Missouri—Daniel Bontecou, consulting engineer, Kansas City.

Montana—Eugene Carroll, vice-president and manager, Butte Water Company, Butte.

Nebraska—Elliot Holbrook, special engineer, Southern Pacific Company, Omaha.

Nevada—W. T. Gould, Nevada-California-Oregon Railway, Reno.

New Hampshire—Robert Fletcher, director, Thayer School of Civil Engineering, Dartmouth College, Hanover.

New Jersey—Morris R. Sherrerd, chief engineer, Board of Street and Water Commissioners, Newark.

New Mexico—O. H. B. Turner, chief engineer, St. Louis, Rocky Mountain & Pacific Company, Raton.

New York—J. G. White, president, J. G. White & Company, Inc., New York.

North Carolina—J. L. Ludlow, consulting engineer, Winston-Salem.

North Dakota—T. R. Atkinson, consulting engineer, Bismarck.

Ohio—Chester W. Larner, hydraulic engineer, Wellman-Seaver-Morgan Company, Cleveland.

Oklahoma—H. V. Hinckley, consulting engineer, Oklahoma City.

Oregon—George C. Mason, vice-president, Hurley-Mason Company, Portland.

Pennsylvania—George S. Davison, president, Gulf Refining Company, Pittsburgh.

Rhode Island—John W. Ellis, consulting engineer, Providence.

South Carolina—John McNeal, consulting engineer, Columbia.

South Dakota—Bruce C. Yates, assistant chief engineer, Homestake Mining Company, Lead.

Tennessee—William W. Carson, professor of civil engineering, University of Tennessee, Knoxville.

Texas—John B. Hawley, consulting engineer, Fort Worth.

Utah—A. F. Parker, Ogden.

Vermont—Frank O. Sinclair, consulting engineer, Public Service Commission, Burlington.

Virginia—E. T. D. Myers, Jr., consulting engineer, Richmond.

Washington—A. O. Powell, consulting engineer, Seattle.

West Virginia—A. M. Scott, Charleston.

Wisconsin—D. W. Mead, consulting engineer, Madison.

Wyoming—Edward Gillette, Sheridan.

$750,000 Municipal Bonds Voted in New Mexico Cities

Recent bond elections in cities of New Mexico have resulted in contemplated expenditure of over $750,000 on city improvements. Albuquerque will issue $400,000 worth of bonds to purchase waterworks and $300,000 will be spent by the city of Alamogordo for water, light and ditch improvements. Springer has voted $37,000 for improvements on waterworks, while Las Cruces will spend $19,000 for waterworks and sewers.

Bond issues of $50,000 each for waterworks and improvements were defeated in Gollup and Cimarron.

$45,000,000 to Avert Floods

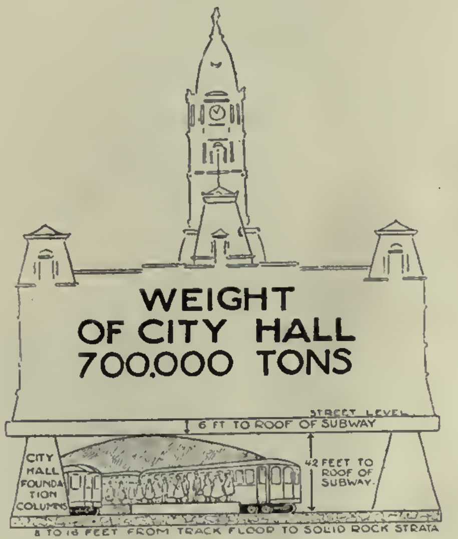
A bill authorizing the expenditure of $45,000,000 for the prevention and control of floods on the Mississippi River and $5,600,000 for the Sacramento River was reported to the House of Representatives, April 18, by the committee which has been investigating the problem for weeks.

The measure provides that not more than $9,000,000 shall be expended on the Mississippi in any one year and that not more than $1,000,000 shall be spent on the Sacramento. The appropriation of the Federal Government for the latter project is also made contingent on the expenditure of an equal amount by the state of California.

New York Engineers Organize for Further Military Training

Open-Air Drills, Week-End Encampments and Target Practice in Armory Ranges Planned—To March as Body in Preparedness Parade

Four hundred New York engineers of those who attended the military lecture course organized by the Military Engineering Lectures Committee, who have since been drilling in six companies under the instruction of officers of the New York National Guard, have formed an executive committee to enlarge the scope of the training and to co-operate with the lectures committee so as to relieve it of the detailed work necessary to this end. The new committee consists of: R. S. Buck, engineer of maintenance-of-way, New York Railways Company, temporary chairman; C. R. Hulsart, assistant engineer, Board of Water Supply, temporary secretary; Major W. H. Roberts, Board of Estimate, temporary treasurer; and A. S. Dwight, mining engineer; D. A. Sealey, assistant to Robert Ridgway, Public Service Commission; A. Maxwell, engineer of tests, New York Edison Company; K. G. Martin Mergenthaler Linotype Company; and H. D. Hammond, associate editor, Engineering Record. This committee will arrange for rifle practice at the Twenty-second and Seventy-first Regiment Armories, and for Saturday and Sunday extended-order drills and field work at Van Cortlandt Park and Governor's Island, in addition to the work now being done at these armories on Tuesday and Thursday evenings. It is expected that, when the men become more proficient in fundamentals, blackboard lectures on military tactics will be added.


WEIGHT
OF CITY HALL
700,000 TONS
STREET LEVEL
6 FT TO ROOF OF SUBWAY
CITY HALL FOUNDATION COLUMNS
42 FEET TO ROOF OF SUBWAY.
8 TO 16 FEET FROM TRACK FLOOR TO SOLID ROCK STRATA

THE NEWSPAPER ARTIST DREAMS

The illustration, which appeared in a recent issue of a Philadelphia newspaper, is explained by that journal in the following caption:

"So that the reader may have illustrated plainly just how City Hall is affected by the proposed tube and station under the hall, the artist has drawn from the description of the engineers the above illustration. It will be noted that the approximate weight of City Hall building is 700,000 tons, which rests upon foundations laid on the solid rock formations found at a depth of 48 to 64 feet below the street level. The tube rests upon its own columns, which are laid on the same solid rock foundation. There is a skin of earth between the street level and the tube roof which approximates six feet. From the track floor of the tube, to the ceiling of the subway, there is 42 feet allowed for overhead work, which includes, of course, the crust of concrete which constitutes the roof of the tube. Examination has shown that the City Hall foundations are crumbling and that the shoring and underpinning provided to support them can be accomplished only with great difficulty, according to the report of the Mayor's commission. It is this extra work which will increase the cost of construction of the City Hall station. This increase is estimated unofficially at 100 per cent over the $1,700,000 contract price."

Engineers will be surprised to hear that a 700,000 ton building can be supported by a beam of earth 6 ft. deep and of 300 or 400 ft. span. The artist may have "drawn" from something beside the engineers' description.

An immediate work of the committee will be a card index in military form giving the usual records, and also the special professional qualifications, of each man, to assist the War Department in assigning the men should an engineer reserve be organized or should a sudden necessity arise. The organization will take part as a body in the engineers' parade in favor of military preparedness, May 13.

It is the intention of the committee to furnish, with the assistance of the officers of the regular army and of the National Guard, all the immediate facilities for military instruction that can be arranged without interfering with the business duties of the members of the battalion. Later these men can complete their training by qualifying for an engineer reserve, if one is organized, by attending the Plattsburg camps or by joining individually organizations of the National Guard. Recruits to the battalion will be welcome, according to the committee.

Illinois Directors for Industrial Preparedness Raise Funds

A fund of $25,000 is to be raised to cover the expenses of the Illinois state directors of the organization for industrial preparedness and associate members of the Naval Consulting Board. The directors met in the rooms of the Western Society of Engineers, Chicago, and elected F. K. Copeland, chairman, and William Hoskins, secretary, representing the mining engineers and chemists, respectively. The other directors are Capt. Robert W. Hunt for the civil engineers, Dr. W. F. M. Goss for the mechanical engineers and P. Junkersfeld for the electrical engineers.

To meet the immediate requirements of the board, the nucleus of a fund was made by Captain Hunt, acting in his individual capacity, contributing $500, Mr. Copeland, on behalf of the Sullivan Machinery Company, contributed $500, and Mr. Junkersfeld, on behalf of the Commonwealth Edison Company, $500.

Local societies, whose services the chairman may feel would be helpful to the work of the board, will be asked to appoint committees for consultation and co-operation.

Texas Takes Steps Toward Correct Sewer Construction

As a result of the passage of the Anti-Stream Pollution Act by a recent session of the Texas Legislature, 425 cities are forced to change their sewer systems. Of this number, 130 have sewerage systems at this time, and the majority are taking steps toward complying with the law. V. M. Ehlers, state sanitary engineer, recently made an investigation and his report shows that additions to sewer systems will be necessary in 22 towns.

Another interesting development is that engineers designing sewer systems or improvements for towns and cities in Texas will not secure approval of their plans unless they show all possible extensions to the sewer, whether then contemplated or not. This step has been found necessary by the state sanitary engineering department in order to protect cities and towns from a complete reorganization of sewer systems when extensions are made or from the installation of pumping plants necessitated by failure to provide proper levels for gravity flow.

Idaho Road Work Is Started

R. T. Hassard, assistant state highway engineer, at Boise, Idaho, has completed arrangements for immediate commencement of work on the Salmon River road, known as the North and South Road, which is to be part of the highway extending from Mexico to Portland. The work, which, it is expected, will take three years to complete, will be done by convict labor and about 40 prisoners have already been put to work.

Fire at Nashville, Tenn., Does Over $1,500,000 Damage to Buildings

The fire which recently destroyed Nashville, Tenn., originated in a collection of frame shanties on the outskirts of the city, was whipped into a terrific conflagration by a 50-mile-an-hour wind and did $1,500,000 worth of damage before it smoldered out. The flames made a clean sweep of buildings, trees, fences and all other combustible material and even the ground in the path of the fire was burned to a brick red.

The rapidity with which the fire spread can be easily imagined when one case is cited. A twelve-room two-story frame house, the roof of which was of good tin, seemed to burst into flame spontaneously and in 14 minutes it was completely destroyed.

Many of the buildings were of good brick construction, and had slate roofs and all interior walls and partitions of brick. Wood was used only for floors, joists, trim, roof trusses and window frames. This type of building did not even act as a retardent. Lime-stone steps, foundations and trim were almost calcined, while Portland cement steps, porches and plastered surfaces were less damaged.

The fire has made it much easier to fix and enforce stringent construction rules and make large areas where all buildings must be fireproof or fire-retarding types. The municipal building code, which has been under revision and discussion for the past ninety days, has not yet been adopted and doubtless will cause many protests from prospective cheap builders. The board of insurance underwriters and a committee from the Engineering Association of the South are acting in an advisory capacity in preparing the new code.

Panama Canal Opened April 15

After being closed to traffic for nearly seven months the Panama Canal has been cleared of obstructions and was opened April 15. A vast amount of material has been removed and the canal at the cut at Culebra has been widened 300 ft. for a distance of ¼ mile and dredged to a depth of 35 ft.

Plans Prepared for Houston, Tex., Sewage Disposal Plant

E. E. Sands, city engineer of Houston, Tex., has completed plans for the installation of sewer systems and disposal plants using the activated sludge method, for which $1,000,000 bonds were issued. The area required will be small and the plants can be built just above the high water level of the channels along which they are located. The pumping heads will be reduced to a minimum and the construction cost plus the capitalized operating and maintenance expense will be less than for any other method investigated.

The north side plant will consist of four and the south side plant of two units. Each unit is capable of handling the sewage for 37,100 people or an average flow of 2190 gal. per minute, or a maximum flow of 2680 gal. per minute. The average detention period in the aerating tanks will be 110 minutes and the minimum period 90 minutes.

The north side plant has been designed to accommodate an average overflow of 12,600,000 gal. per day with a minimum flow of 8,750,000 gal. per day and a maximum of 15,400,000 gal. per day. The south side plant has been designed to accommodate an average flow of 6,300,000 gal. per day, a minimum of 4,375,000 gal. per day and a maximum flow of 7,700,000 gal. per day.

The power house at each disposal plant will be equipped with high pressure blowers. At the north side disposal plant, three blowers will be installed, each capable of delivering 3750 cu. ft. of air per minute measured under a pressure of five pounds. Two of these blowers will answer all requirements. At the south side plant two blowers of the same capacity will be installed.

The estimated cost of disposal plants and pipe lines is $639,000 and the operating cost is given as $61,939 per annum.

All Spans of Memphis Bridge Closed Except One

Progress on the erection of the new Harahan bridge over the Mississippi River at Memphis, Tenn., for the Arkansas & Memphis Railway Bridge & Terminal Company, has proceeded until the superstructure is now practically complete, except the semi-supended and cantilever span between piers 3 and 4. The falsework for this span was washed out last December, as described in the Engineering Record of Jan. 8, page 62.

CANTILEVER ARMS AND SUSPENDED SPAN—FIXED SPAN ON LEFT

The accompanying photographs show the appearance of the structure early this month. The 418-ft. suspended span and the erection traveler are clearly seen, indicating the size and nature of the trusses. The cantilever arms are 186 ft. long and the fixed span in the distance (between piers 2 and 3) is 621 ft. long. A general description of the structure will be found in the Engineering Record of Nov. 8, 1913, page 516. Ralph Modjeski, of Modjeski & Angier, consulting engineers, of Chicago, designed the structure, which is being fabricated and erected by the Pennsylvania Steel Company, of Steelton, Pa.

ERECTION TRAVELER RETURNING AFTER CLOSING SUSPENDED SPAN

$10,000,000 Voted for Construction of New York Highways

A bill appropriating $10,000,000 for state highway construction was passed by the New York Senate April 15 and now goes to the Governor for approval.

Forty-Two Societies Represented at Chicago Conference

Second Convention on Engineering Co-operation Discusses Publicity of Engineering, Employment and Legislation

A chance to hear how the "other" engineering society is effectively serving its members, fulfilling its obligations to the public and actually working out its destiny were the main features of the second conference of the Committee on Engineering Co-operation, held in Chicago April 13 and 14. Little action was taken beyond asking a sub-committee, with Prof. F. H. Newell as chairman, to bring in, at a future conference, a plan for promoting co-operation among engineering societies in matters of general interest to the engineering profession.

The preambles stated that existing agencies through lack of proper correlation appear inadequate for the solution of these problems and in order that the resources of the profession may be made available for the most useful service to the nation, state and municipality, and that the practice of engineering may be rendered more efficient and less burdensome in those places where its development has been most difficult; and that it is the sense of the second conference on engineering co-operation —representing national, state and local societies, and comprising various branches of engineering—that these ends may be attained through a closer association and co-operation of engineering societies.

Twenty short papers on co-operation and relations between national, state and local societies were presented at the five sessions. In the three-minute talks on the organizations they represented, delegates became quickly acquainted with the problems and successes of forty-two societies.

Local Co-operation Demands Inclusive Membership

Willard Beahan of the Cleveland branch of the American Society of Engineers, believes in close co-operation among the local sections of the national societies in any one center. Meetings should not be held separately, nor should separate journals be published. Joined, they are a more effective body for civic betterment. Snags arise when any attempt is made to co-operate with other cities, as under present rules the correspondence must go through the home office, where so much time is lost and tape unwound that interest is killed.

John Howe Peyton, president of the Nashville section of the Engineers' Association of the South, could see no insuperable difficulties to overcome. "Find the right man to take the lead and give him unlimited support," was his proposal.

Paul Hansen described an ideal plan for state and municipal societies, whereby civic duties and influence in matters of legislation would register with more force.

J. W. Woermann of the St. Louis Engineers' Club outlined the rise and fall of the disbanded Associated Engineering Societies organization, and mentioned the four national society sections which are closely co-operating in St. Louis. The adoption of a standard boiler specification is one of their latest achievements.

Cleveland Gets Publicity

C. E. Drayer, secretary of the Cleveland Engineering Society, presented many illustrations of the devious ways by which publicity of engineering is obtained in newspapers. Editors cannot keep real news out of their columns, and it is simply up to the engineering societies to pick, or develop, a man who knows news when he sees it.

The Cleveland engineers are planning an initial copy of a popular, profusely illustrated engineering magazine modeled after the *National Geographic Magazine*. Other societies and individuals having interesting photographs are asked to join in the effort to produce such a journal.

Minnesota Has Found the Way

George H. Herrold, president of the Civil Engineers' Society of St. Paul, told the story of the latest example of local co-operation. He stated that the first thing was to get engineers acquainted with the Minnesota Joint Engineering Board. They found the weekly lunch was the best means, but at first men did not even want to eat together. They apportioned the list among those most interested with poor results, and finally, by getting young ladies to do the telephoning, the luncheon attendance was increased to fifty engineers. They feed the speaker first, and he talks while the remainder eat. In the summer inspection visits, automobile trips and even house parties have resulted in making the "engineer become a little more human."

H. J. Burt, chairman of the committee on legislation of the Western Society of Engineers, which obtained the Illinois structural engineers' license law, outlined the duties of the engineering society in legislative matters.

Contractors Want Concerted Action

"The Engineer and the Contractor" was the subject of a talk by DeWitt V. Moore, who represented the American Society of Engineering Contractors, which association was organized to get co-operation of all interests concerned in completing a structure. He also discussed the proper way to handle a society publication and mentioned that his organization had turned over the publication of its journal to outside parties. A joint committee to standardize specification clauses was of the greatest moment, in his opinion.

"Employment of the Engineer" was the topic assigned to Arthur Kneisel, secretary of the American Association of Engineers. In his opinion, it is rank foolishness to talk professional ethics to the man whose family is suffering for the lack of necessities of life. The object of the association is to raise the standards of ethics of the profession, he said, but since it could not talk ethics to the hungry man it proceeded to feed him and put him in touch with work. About 250 men have been served in six months, at an estimated total saving to them of $7,500. Twenty branch service clearing-house offices are contemplated when the membership will warrant the expense.

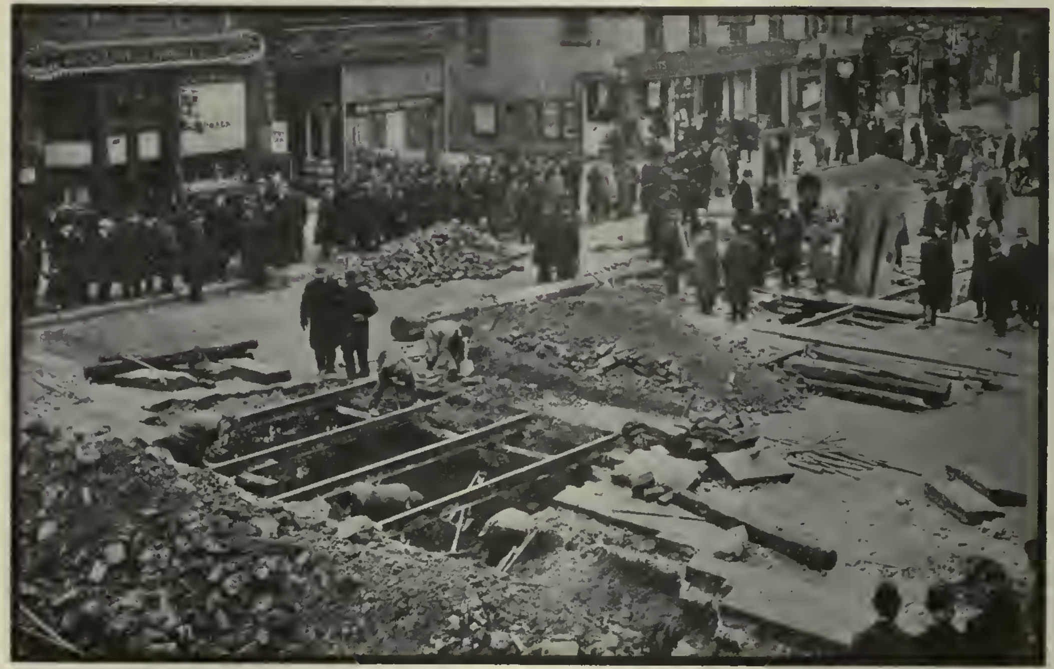
The co-operation of the St. Louis Engineers' Club for handling this function in St. Louis is under contemplation and any method which experience and wisdom may suggest will be gladly entered into with any other organizations, said Mr. Kneisel.

Stone Pavement in Rochester Undermined by Flood

Maximum high water in the Genesee River at Rochester, N. Y., recently caused the collapse of 12 sq. yd. of the Medina block stone pavement, with its concrete base, at a point a little south of the car track and west of the Main Street bridge, which was indicated on a map on page 477 of the issue of April 8. The pavement caved in to a depth of 10 ft., as shown in the illustration.

The washout was apparently due to the existence of an abandoned stone sewer 3 ft. 9 in. wide and 5 ft. 3 in. high, which was constructed in 1832 and superseded in 1863.

The water from the river, which at the time stood about 5 ft. above the top of this sewer, entered it either through, or under, the present bridge abutment, or between the present and a former buried bridge abutment.



SHOWING THE COLLAPSE OF PAVEMENT IN ROCHESTER, N. Y.

The water broke through an old egg-shaped sewer 1 ft. 9 in. x 2 ft. 6 in. and entered an existing sewer manhole west of the bridge 18 ft. below the surface. Flooding of cellars might have resulted had not the new sewer tunnel, 8 ft. square and 40 ft. below the surface, been sufficiently completed so that connections with the existing sewer were made. The only inconvenience occasioned has been the closing of Main Street to street car traffic, during which time the local trolley company has taken occasion to renew its tracks in this locality. An investigation of the river end of the abandoned sewer will be made when the water lowers.

The information and photograph were supplied by John F. Skinner, principal assistant engineer of Rochester.

Offer Prizes for Pictures of Good or Bad Roads

For the purpose of establishing in Washington a national exhibit on good roads problems, prizes to the amount of $2,600 have been offered by the National Highways Association for pictures of good and bad roads. The contest will close at noon Nov. 7.

There will be 166 prizes in all ranging from $500 down to $5. Competitors may submit as many photographs as they desire and will not be limited to one prize, each picture being judged upon its own merits regardless of the person from whom it came. The judges of the contest are Theodore Roosevelt, Ida M. Tarbell and Mark Sullivan. The money was subscribed by Gen. T. Coleman du Pont and Charles H. Davis, president of the association.

Civilians Who Worked on Panama Canal Want Bonuses

Approximately 5000 men who helped build the Panama Canal are reported to have organized to support a bill in Congress which will provide for recognition of civilians employed in building the Canal in some manner commensurate with Congressional recognition of army, navy and public health officers.

According to the statement issued by the Panama Canal Employees' Association, civilians were unjustly ignored when bonuses were distributed by Congress. C. O. Simmons, chairman of the committee representing the association, is quoted in the statement as indorsing the bill, which asks for the appropriation of $9,000,000 to be applied as bonuses for the civilian employees.

Major-Gen. Goethals is said to be in favor of the movement.

Texas Engineers Will Fight Cameron Septic Tank Company

Prominent engineers in Texas are opposing the contentions of the Cameron Septic Tank Company that royalties are due them on processes used by disposal plants in 75 towns in that state. The state sanitary engineering department has been urged by many of the municipal officials to form an organization for defense of the claims made against their respective cities and towns.

The alleged royalties will, it is believed, influence the progress in sewage disposal matters in that state. V. M. Ehlers, state sanitary engineer, has requested a number of the prominent engineers of Texas to advise him as to their position in the matter, predicated on articles that have appeared recently in engineering papers.

His answers have always been against the allegations of the Cameron Septic Tank Company.

Mohansic Water Bill Passed by New York Senate

At the April 17 session of the New York Senate the Mohansic bill, providing for a commission of three to negotiate the removal of the Mohansic State Hospital for the Insane and the New York State Training School for Boys from the Croton watershed, was passed by a vote of 30 to 10.

Senator Wagner's amendment, which would give positive assurance of the removal of the institutions from the Croton watershed, was killed.

Civil Engineers Discuss Local Section Co-operation

Officers of Other National Bodies as Guests Give Experiences of Their Societies with Branch Organization

Co-operation between national engineering societies and their local branches, and between these local branches and local engineering societies or clubs was the theme that officers of the other national societies were invited to discuss at the meeting of the American Society of Civil Engineers in New York, April 19. W. L. Saunders, past president of the American Institute of Mining Engineers; Paul M. Lincoln, past president of the American Institute of Electrical Engineers, and D. S. Jacobus, president of the American Society of Mechanical Engineers were the guests of honor. The president of the American Society of Civil Engineers, Dr. E. L. Corthell, was prevented by illness from attending.

Dr. Corthell dictated a letter, however, in which he outlined the form of organization he deemed necessary to knit the whole profession together. First, there should be a conference committee of the national societies and then local joint committees in each large center of population. The national and local committees should be in constant communication.

Experience with Sections

Mr. Lincoln, speaking from an experience with sections going back over ten years, advocated the greatest possible autonomy for local branches of national bodies. In this view he was emphatically indorsed by Mr. Jacobus and some of the later speakers. The American Institute of Electrical Engineers now has thirty-two sections, and appropriates annually a sum varying with the membership to help pay the expenses of the section. The institute pays the expenses of a delegate from each section to the annual meeting. Mr. Saunders later explained that the mining engineers do this also.

Mr. Jacobus gave some details of section management in the mechanical engineers' society, and emphasized especially the good derived from the forty student sections. He declared that the national societies must look after the young men, bringing them in early and preparing them to carry forward the high ideals of the profession.

In the mining engineers' society, Mr. Saunders explained, sections are formed not only on geographical but also on technical lines—the anthracite specialists in one, the metallurgists in another, etc. Though their first sections were established only five years ago, the benefits have already been very great.

Each of these first three speakers advocated strongly co-operation between local branches in each population center, saying that it was the policy of their national bodies to encourage such joint work. The details of the co-operative plans at Chicago, Boston, Philadelphia, Atlanta and St. Louis were explained.

Following these specially invited speakers there were excellent discussions by the following members of the American Society of Civil Engineers: Charles D. Marx, past president; J. F. Coleman, director; F. G. Jonah, director; Daniel Bontecu, vice-president; George F. Swain, past president, who pointed out the importance of keeping the moral and ethical sides of professional work constantly in mind; H. S. Crocker, director, and John Bogart, formerly secretary and a director of the society. Clemens Herschel, vice-president, presided.

Demand for Engineers Increases

According to announcements by the faculty of Pennsylvania University, increased industrial activity has created an unusual demand for trained engineers. Most of the seniors at that college are reported to have arranged for positions which they will occupy after graduation and over fifty desirable jobs are advertised on the bulletin boards.

Board of Direction Acts on Ockerson Letter

As noted in the Engineering Record of April 8, page 495, the Philadelphia association of members of the American Society of Civil Engineers on April 3 asked the board of direction to state officially whether the society would surrender its autonomy in favor of the United Engineering Society in case it were determined to remove headquarters to the Engineering Societies' Building. Statement that it would so surrender its autonomy in affairs of a public nature had been made by Col. John A. Ockerson. The board at its meeting April 19 adopted the following resolution: "Voted, that there is nothing in the constitution or management of the United Engineering Society to warrant the assertions [those of Colonel Ockerson] above quoted. The United Engineering Society is the equivalent of a board of trustees created by the three Founder Societies occupying the Thirty-ninth Street building, of which this society has been invited to become a fourth, and was created and is carried on for business purposes connected with the management of the real property and libraries of the Founder Societies."

American Society Speaks on Constitutional Changes

In order to learn the sentiment of the members, the committee on revision of the constitution of the American Society of Civil Engineers recently sent out an inquiry on six points under discussion. The vote on these was canvassed at the meeting of the committee April 19 and the result announced at the meeting of the society on the same day.

Approximately 3150 ballots were cast. The sentiment was against the admission of women, by a small majority. The vote stood 85 per cent in favor of giving the board of direction the power to discipline and expel members, while on the formation of a new grade for salesmen the vote was equally decisive, but in the negative direction—that is, the members were opposed to such a grade. The proposal to raise the requirements of admission was defeated by a close vote. The establishment of some form of district organization was indorsed by 85 per cent of those voting. The final question—whether the duties of a professor of engineering should be considered equivalent to practice "in responsible charge of work," as a basis for admission or of transfer to a higher grade, was answered in the negative. The vote, however, was close.

News of Engineering Societies

The Utah Society of Engineers held an annual banquet April 19 at Salt Lake City, at which Dr. W. C. Ebaugh, formerly of the University of Utah, was toastmaster.

The Engineers' Society of Western Pennsylvania held a meeting April 18, at which Isham Randolph, consulting engineer, of Chicago, discussed the necessity for a national department of public works.

The Atlanta Section of the American Society of Civil Engineers has elected the following officers for the year 1916: President, Paul H. Norcross; vice-presidents, V. H. Kreigshaber and William C. Spiker; secretary-treasurer, Prof. Thomas P. Branch.

The Canadian Society of Civil Engineers, at a meeting held in Montreal April 13, heard John Murphy give an informal description of his recent trip over the Panama Canal. Lieut.-Col. F. A. Snyder described an original diagram for making military scales for interpolation of contours and reduction and enlargement of maps.

The Boston Society of Civil Engineers held a meeting last evening, at which Dr. Alexander C. Humphreys, president of Stevens Institute of Technology, read a paper on reform and regulation of public service utilities. The board of government submitted a report relating to permanent bench marks in Boston and the vicinity.

The Engineers' Club of St. Louis heard Major Wildurr Willing, Corps of Engineers, U. S. A., deliver his third lecture on military engineering April 19. Major Willing devoted his time to a discussion of the duties of engineers with the mobile army in the zone of the advance. Carl Gayler gave a short lecture from the standpoint of the civilian engineer on trenches.

The Society of Engineers of Eastern New York held a meeting at Albany April 12, at which the following officers were elected: President, John E. Yorkston, Schenectady; vice-president, Lewis F. Moody, Troy; treasurer, Edgar Croasdale, Schenectady; member of finance committee for three years, Charles H. McCulloch, Albany; member of executive committee for three years, George E. Conlee, Amsterdam.

Personal Notes

Bert E. Anderson has left the engineering department of the Pennsylvania Railroad to enter the employ of the Standard Steel Car Company at Butler, Pa.

J. E. Shoemaker, who recently resigned as principal assistant engineer of the Port of Seattle Commission, has formed a partnership with Peter Swanson and entered the general contracting field.

Paul Gendell, manager of the Engineers' Society of Pennsylvania, Harrisburg, Pa., and editor of the journal of that society, has resigned to become secretary of the Dubois (Iowa) Chamber of Commerce. Mr. Gendell came to Harrisburg eleven years ago and, with the exception of one year, when he was with the Missouri Pacific Railway Company as assistant engineer, was connected with the engineering department of the Pennsylvania Steel Company bridge and construction plant at Steelton, Pa., until his association with the engineers' society a year ago.

Lyman Griswold, of Portland, Ore., has been appointed assistant engineer on the engineering investigations connected with the Ochoco Irrigation District, near Prineville, Ore. He will be principal assistant to R. W. Rea, in direct charge of all field parties and investigations. Mr. Griswold has had extensive experience in railroad construction, especially on the Oregon Trunk Railway from Fallbridge, Wash., to Bend, Ore., as well as in irrigation work in the West.

L. L. Kelly has been promoted from the position of resident engineer for the Norfolk & Western to that of assistant engineer, with headquarters at Norfolk, Va.

William P. Wiltsee, assistant engineer for the Norfolk & Western, has been transferred from Norfolk, Va., to Roanoke. He has been in the employ of that road since 1901, during which time he has risen from the grade of transitman to that of assistant to the construction engineer, in responsible charge of work relating to new lines.

C. S. Fisher has accepted a position with the Lanowe Construction Company, of Detroit, as civil engineer in charge of construction of a new beet sugar plant being constructed in that city.

N. C. Grover, chief hydraulic engineer in the water resources branch of the United States Geological Survey, has recently returned after a two months' visit to the Hawaiian Islands and the Pacific Coast.

Clifford B. Moore, consulting engineer, of New York City, has been appointed a member of the examining board of city surveyors to succeed E. P. Goodrich, whose resignation was noted in the issue of April 8.

J. W. Stanchfield, contractor, of Seattle, Wash., will remove his business to Astoria, Ore., where he will engage in general contracting work.

Raymond L. Gebhardt has been promoted from the position of division engineer for the Lehigh Valley Railroad, at Easton, Pa., to that of trainmaster of the Seneca division, with headquarters at Hazleton, Pa.

G. R. Solomon, of the firm of Solomon-Norcross Company, drainage engineers, of Atlanta, Ga., has been appointed a member of the board of directors of the organization for industrial preparedness. The appointment was made by Josephus Daniels, Secretary of the Navy.

N. F. Thompson, engineer of grade crossings of the New York Central Railroad at New York, has been appointed assistant district engineer for the New York district, with headquarters at New York. Mr. Thompson is a graduate of Rensselaer Polytechnic Institute, class of 1907. Prior to graduation he had been in the employ of the New York Central, and after graduation he remained there, in the office of the engineer of grade crossings, first as draftsman and later as assistant engineer. Late in 1909 he was appointed assistant engineer of grade crossings, and in the spring of 1912 he was advanced to the position he has recently left.

E. S. Voorhees, assistant engineer in the office of the engineer of grade crossings of the New York Central Railroad at New York, has been appointed engineer of grade crossings, succeeding N. F. Thompson, promoted as noted elsewhere. Mr. Voorhees was graduated from Yale University in 1907. Following graduation he entered the employ of the New York, New Haven & Hartford Railroad, where he remained for a year and a half. Late in 1908 he began his service with the New York Central in the maintenance-of-way department at Albany. After about six months he went over to the engineering department as inspector at Watertown, N. Y. Three years later he returned to Albany as assistant engineer, where he remained only a few months, until about the middle of 1912. He then came to New York to the office of which he is now made head.

G. W. Knight and L. A. Quale have opened an office in Chattanooga, Tenn., to engage in the practice of sanitary and hydraulic consulting engineering. Mr. Knight was formerly assistant engineer to R. Winthrop Pratt, consulting engineer, of Cleveland, and Mr. Quale was recently connected with the Cleveland waterworks department. The firm has been retained by the "Twin Cities" of Bristol, Va.-Tenn., to report on the water supply resources, and in addition, will prepare a report on water supply, sewerage and pavements for Newport, Tenn. The firm has also been retained by Florence, Ala., to oversee the construction of a filtration plant to be erected by day labor.

F. E. Weymouth, whose appointment to the position of engineer of construction for the U. S. Reclamation Service, with headquarters at Denver, Col., was mentioned in the issue of Feb. 12, recently made a trip to Yuma, Ariz., to look over that project. He was accompanied by L. M. Lawson, manager of the Yuma district.

Clyde Aitchison has resigned from his position as chairman of the Public Service Commission of Oregon to accept an appointment as solicitor for the National Association of Railway Commissioners, in which capacity he will represent the state commission in connection with the valuation of railroads being made by the Interstate Commerce Commission. His headquarters will be at Washington, D. C. Mr. Aitchison has been a member of the Oregon commission since 1907, and previous to then was secretary of the Oregon Tax Commission appointed to redraft the state tax laws.

Capt. Stuart C. Godfrey, Corps of Engineers, U. S. A., delivered a lecture Friday, April 14, before the members of the newly formed volunteer engineer corps at the Massachusetts Institute of Technology. His subject was "Duties and Organization of Engineer Troops" and lantern slides, furnished by the government, were shown.

S. E. Barnes, formerly manager of the general contracting department of the R. T. Ford Company, has accepted a position with the New York Central Railroad in the valuation department, in charge of valuation of buildings.

Rankin Duval, a graduate of the engineering department of the University of Kentucky, has been appointed road engineer for the construction of the $100,000 bond roads in Scott County. His headquarters will be at Georgetown, Ky.

Clyde T. Morris, professor in the engineering department of the Ohio State University, represented the Ohio Engineering Society, of which he is president at the conference on engineering co-operation held April 13, in Chicago.

Frank R. Lanagan, city engineer of Albany, N. Y., was the principal speaker at the meeting of the Whitehall Section Improvement Association, held April 14, in that city.

Thomas K. Mixler has resigned from his position with the T. A. Gillespie Company, of Pittsburgh, to become connected with the American Bridge Company, at Gary, Ind. Mr. Mixler is a graduate of the engineering department of the University of Pittsburgh.

James F. Donovan has been appointed to succeed R. L. Gebhardt as division engineer of the Lehigh Valley at Easton, Pa.

Edwin D. Hayward, B. S., Massachusetts Institute of Technology, at present associated with the faculty of De Pauw University, will soon assume his duties at the University of California, as instructor in civil engineering.

Paul H. Gilbert has been promoted to the position of transitman for the Pennsylvania Railroad with headquarters at Reading, Pa.

Frank McLaughlin, who for the past few years has been connected with James Stewart & Company, has resigned his position with that company to accept one with the Foundation Company, as superintendent in charge of the erection of a chemical plant for the Eastern Manufacturing Company, at South Brewer, Me. Mr. McLaughlin was graduated from the London Polytechnic College, of London, England, in 1905. During the construction of the Pennsylvania Railroad tunnels he was superintendent of concrete construction on tunnels under the East River, New York City. His last work with James Stewart & Company was as superintendent of construction of the Bridgeport plant of the Remington Arms & Ammunition Company.

A. W. Walker has been appointed engineer on the drainage system for the Grand Valley drainage district, with headquarters at Grand Junction, Col. He will have charge of surveys investigations, plans and estimates for that system.

Charles P. Light has severed his connection with the American Highway Association as field secretary, and will associate himself with the Fidelity Mutual Life Insurance Company, of Philadelphia, in a managerial capacity, May 1, with headquarters at Washington, D. C.

H. W. Lewis, who has recently had charge of surveys and construction for the Standard Oil Company of New York, in Columbia, South America, is now superintendent of construction in charge of concrete jetty work being done by the state of New Jersey at the Shark River outlet, at Belmar.

T. L. Bradford, who recently resigned from his position as bridge designer with the New York state barge canal, has accepted an appointment with the American Bridge Company, with headquarters at Ambridge, Pa.

August E. Hansen and Waldo S. Coulter announce that they have formed the firm of Hanson & Coulter, hydraulic and sanitary engineers, with offices at 2 Rector Street, New York City. It is the purpose of the new firm to act as designing, consulting and superintending hydraulic and sanitary engineers in water supply and water purification, water power development, sewerage and sewage treatment, sanitation of buildings, garbage disposal and river improvement. Mr. Hansen is a graduate in sanitary engineering of the Massachusetts Institute of Technology, class of 1902, and has been associated for the past nine years with Lederle & Provost of New York City. During this time he has had complete and direct charge of numerous projects in the water and sewerage field. Previous thereto he was five years assistant engineer with Andrew D. Fuller, consulting sanitary engineer, of Boston, Mass.; treasurer of the E. M. Porter Plumbing & Heating Company, Springfield, Mass.; principal assistant engineer with Paul Gerhard, consulting sanitary engineer, of New York City, and engineer in charge of construction with Williams, Proctor & Potts, consulting and contracting hydraulic and sanitary engineers, New York City. Mr. Coulter has been associated with Lederle & Provost for the past five years, in charge of hydraulic and sanitary work for municipalities, corporations and estates. During about three years of this time he was in Argentina, where he conducted tests, prepared plans and constructed treatment works for slaughter house, wool scouring and tannery wastes in Buenos Aires. Previous to this he was for four years on the design and inspection of work on the N. Y. State Barge Canal. During seven years Mr. Coulter was employed by the Metropolitan Water and Sewerage Board of Massachusetts upon a variety of work related to water supply, highways, sewers and sewage treatment.

John R. Graham, for the past five years general foreman of the street and sewer departments of Lynn, Mass., has been elected commissioner of streets, to succeed the late George M. McPhetres. The new commissioner was born at Lynn fifty-two years ago and is an expert road builder.

Obituary Notes

Emery J. Kerrick, until recently employed in superintending the development of the Morris and Gerhard estates in Philadelphia, died recently in St. Petersburg, Fla., at the age of 54. Mr. Kerrick was born in Frenchtown, Pa., and was graduated from the Susquehanna Collegiate Institute, at Towanda, in 1887. After teaching school for a year, he entered Lafayette College in 1888 and was graduated from the engineering department in 1891. For one year immediately following his graduation, he was employed in the bridge department of the Lehigh Valley Railroad, after which he became assistant engineer in charge of the construction of the Reading terminal, in Philadelphia. He resigned this position to become associated with Chester E. Albright, civil engineer, of Philadelphia. In 1897 he engaged in business for himself and from this time until his death he had been continuously engaged in engineering and contracting work. He executed several large contracts for the Philadelphia Rapid Transit Company, among them being the work at the Sixty-ninth Street terminal and the construction of a street railway from Chelton Avenue to the city line. He also executed a number of important contracts for Philadelphia.

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"In the Engineer's Judgment"

APROPOS of the editorials which have appeared in the last two issues of this journal advocating equitable general clauses in engineering contracts, the following quotation from specifications drawn up by an eminent consulting engineer is worth noting. It is but one of many examples that could be cited as to the inequity of the conditions engineers commonly impose on contractors. Following a statement that the cement for the work in question should pass the standard tests of the American Society for Testing Materials comes this sentence: "The engineer also reserves the right to submit the cement to any additional kind of tests that in his judgment may be essential and to reject any cement that is found by him to be unsatisfactory." In other words, after the contractor has purchased all of his cement to comply with the definitely stated conditions he may at any moment be put to a large loss merely because the engineer has discovered some new kind of test. How can the engineer lay claim to judicial position in the enforcement of contracts and specifications when he will allow himself to write such clauses as the one quoted?

Society Service

IN THE April "Journal" of the Boston Society of Civil Engineers there appears an article on service for the society by Edmund M. Blake, in which he lays special emphasis on the thought that membership in a society should carry with it not only the privilege of receiving something, but also the duty of giving service to the society and to the profession. Extracts from the paper appear on page 580 of this issue. Mr. Blake says: "We cannot draw from a bank unless we have put in something to draw upon, and the more we put in the more we can draw out. * * * With this conception [a true spirit of service] firmly established in his mind, the engineer who joins a society will consider of first importance the question of what he can add to the society and not of what he can get out of the society in return for his annual dues. Service for the society will follow, and soon there will be no need of arguing the other side—that of the benefits to be received from membership in the society." Mr. Blake's words may well be taken as a supplement to the editorial "Service of Engineering Societies," which appeared in the Engineering Record of April 1 and which has caused considerable comment. Societies well may ask themselves whether they are affording full opportunity for their membership to be of service to the organization and to the profession. The easy answer is that everyone is invited to prepare papers, but that answer merely dodges the issue. Many will serve when drafted for service who would not volunteer to help.

Co-operation in Chicago

ENGINEERING societies in Chicago are working together for the common good to an increasing degree. Last week the Western Society of Engineers opened its doors to perform a national service. It will be the headquarters of the representatives of national societies engaged in the industrial census of the Naval Consulting Board, and will lend the services of its secretary and staff in the prosecution of the work. The Western Society of Engineers is an "inclusive" organization, and it is worth noting that the members of the Illinois committee, representing the national civil, electrical, mechanical, mining and chemical organizations are on its membership roll. Such a large opportunity to serve the nation comes at infrequent intervals and it was, therefore, eagerly grasped. Another instance of the co-operation spirit in Chicago is afforded by the support given the course of military lectures which was started April 20. Only through united effort could the committee, which is more or less self-appointed, have financed the course.

Short Highway Courses

SHORT courses in highway engineering have proved their usefulness. This is the consensus of opinion of the officers of the schools which have held them and also of the men who have attended. The Engineering Record has obtained opinions from the heads of the civil-engineering departments of various universities which have conducted such courses and a brief compilation of these views is published on page 586. Without a dissenting voice they agree that the courses serve a useful object. One believes that better results would result if the courses were shortened to three days. Another expresses the opinion that intermediate sessions should be held at local points. A third states that he is considering just such a step. The short highway courses have evidently proved their value. They have attracted and held all classes interested in highway work—the engineer, who designs and oversees, and the contractor, who executes. Better roads will undoubtedly follow in the sections favored by these courses. The suggestion regarding intermediate courses at local points has in it the germ of great possibilities, but the step must be considered carefully. It is the shortness of the courses that now attracts the roadbuilder. If the number of sessions be increased he may be kept away, thus defeating the very object of this growing and needful educational service.

Wooden Shingles Again

CLOSELY connected with the lessons to be learned from the great fire in Paris, Tex., pointed out in the article on page 572 of this issue, is the old story of the tremendous fire hazard of the ordinary shingle roof. There is little doubt that this conflagration, ranking among the big fires of recent years, with losses exceeding $10,000,000, could have been confined within a small area if the high wind had not carried burning shingles for blocks to ignite other buildings having shingle roofs. Of the total number of 1440 buildings destroyed, over 1000 had shingle roofs. Perhaps no more convincing example of the danger in the use of untreated wooden shingles in a closely built up community could be found than that furnished by this latest conflagration. Practically the only residence in the path of the flames which was but little damaged was roofed with incombustible material. In the reconstruction of the city the use of wooden shingles without fire-retardant treatment should be absolutely prohibited. This journal believes that this unnecessary fire hazard from shingle roofs should be eliminated by law in all large towns, as it has already been eliminated in the larger cities.

Novel Tunnel Practice

IN DRIVING the 8-mile Wilson Avenue waterworks tunnel in Chicago, a day labor job, described on page 568 of this issue, the city engineer's forces have introduced an extraordinary feature. Muck is carried back from the heading a short distance, sized by means of a screen and used for making the concrete lining, the whole operation taking place within the bore. Large pieces of rock, rejected by the screen, are hauled to the surface through the shafts and disposed of, but the fine material blasted out is put back again into the lining by a pneumatic placing outfit without ever emerging into daylight. Thus the operations of tunneling and lining are carried on simultaneously and part of the heading muck is returned to the work. It is expected that the work will be finished a year ahead of the estimated time. Of course, such a scheme is not susceptible of general application. Not every tunnel passes through rock which is suitable for use as concrete aggregate and certain formations could not be depended upon to break to sizes which would supply a sufficient quantity of small-size material for concrete making. The Chicago engineers, however, present records which indicate that the methods they are using on the Wilson Avenue work are saving both time and money.

Municipal Asphalt Repairs

THE Borough of the Bronx, New York City, has built an asphalt plant and makes its own repairs to asphalt streets. The results, as indicated by the first six months of operation, during which the work was done at a cost of more than 33 per cent lower than the lowest contract price ever obtained, as described on page 579, give promise of future economy. From the experience of the Bronx and the success of other municipally-operated plants there is no doubt as to the economy of municipally-made repairs. But a word of warning is in order. It is not the building of the asphalt plant alone that made the saving in the Bronx possible. The human element has played an important part. The generally conceded advantage of doing work by contract lies in the fact that a contractor, by employing only such men as are of value to him and by eliminating waste motion and costly red tape, is able to do work at a profit at less cost than the general run of municipalities can do it themselves. This advantage of the contractor does not apply in the case of the Bronx. For years past there has been a noticeable and increasing esprit de corps among the employees of its highway department, and a keen appreciation of the worth of subordinates on the part of the higher officials. The engineer in charge of maintenance violates in many respects the popular conception of the city employee. He is not a clock watcher or a politician. Quite frequently he is on the job at 5 o'clock in the morning, and he works Saturday afternoons, perhaps sometimes on Sunday. His subordinates are of a similar type. The Bronx has appropriated the contractor's main advantage. Results on the part of its employees count more than friendships and political affiliations. This is efficiency. Hence the saving in asphalt-repair costs.

Disciplining Society Members

WHEN 85 per cent of the membership of a society votes for a proposal one is justified in assuming that the hearty support of the membership can be relied upon in the execution of the plan proposed. That percentage, 85, was registered in the recent poll of the American Society of Civil Engineers in favor of granting to the board of direction power to discipline and to expel members. With such a clear indication of the feeling of the members there is no doubt that the revised constitution, now under consideration, will make such provision that the right of appeal to the membership at large will be denied. The present method of bringing a member to task is entirely too cumbersome and little can be expected from it in the way of raising or maintaining the society standard. But it must not be thought that the mere incorporation of this enlarged power in the constitution will entirely solve the problem of the maintenance of a high standard. The machinery must be perfected for handling cases of discipline in a well-defined and expeditious manner. A "committee on grievances" is needed, and it should be within the power of any member to bring matters to the attention of that committee. The present constitution requires that ten men join in presenting matter for discipline to the board. In fact, a grievance committee properly constituted should not wait until matters are formally brought to its attention, but should ever be on the alert to discover and act on cases in which improper conduct on the part of the membership is reflecting on the society. Possibly when the new constitution is adopted the code of ethics will become a document vital in the life of the society and will not continue, as now, a dead letter—a law without machinery for its enforcement and penalty for its violation. Eighty-five per cent of those voting have indicated that they will support the officers in the setting up and maintenance of high ethical standards. It is to the interest of the society and the profession at large that these larger powers be placed just as soon as possible in the hands of the board, and, through it, in the hands of a grievance committee.

Natural Cement

ENGINEERS and contractors will follow with interest the efforts being made by the Utica Hydraulic Cement Company to enlarge the market for its brand of natural cement, in competition with Portland. The younger generation is almost wholly ignorant of the older material. Portland has been the supreme master of the cement field for nearly 20 years. Thousands of dollars—hundreds of thousands would be more exact—have been spent in investigations of the properties of Portland, both by itself and in mortar and concrete. Committee work of the most thorough character has been carried on by the American Society for Testing Materials in developing its standard specification for Portland. All this has tended to push natural into the background. Furthermore, commercial conditions have aided to bring about the almost total eclipse of natural cement in engineering construction. The price of Portland began dropping rapidly fifteen years ago and has at times been the same as natural. Then for long periods the difference in price would be so small that engineers were glad to pay the slight excess for the better-controlled product. The aggressiveness of the Portland manufacturers was also a factor, the remarkable advertising and publicity methods helping to keep the advantages of the higher-class product before the users and their engineers.

And yet the older product had much merit. Slow setting, low strength and variability in composition were the disadvantages charged against it. Important structures built of it—dams, aqueducts, buildings—have given satisfactory service. Its use in aqueducts and buildings was largely as mortar for the masonry. Undoubtedly there is still a field for it—in the mortar for brick and stone work and in some forms of mass construction. Its low strength and slow setting rule it out in reinforced work, while the setting will count against it wherever forms are much of an item.

The progress that will be made in recreating a market for natural cement is impossible to predict. With present prices of Portland and natural, there will be temptation to use the latter where its use is permissible. On the other hand, engineers are naturally slow to turn from present standards, particularly when the alternative material is confessedly inferior in important qualities. Fundamentally, then, the progress of natural will depend upon price. Should the margin between it and Portland remain large for a considerable period an increase in its use can be looked for.

The Bond Articles and Military Preparedness

IN this week's issue appears the ninth and final article of Major Bond's series, "National Defense—for Engineer and Contractor," which was begun in the issue of March 4. The concluding chapter, on page 575, discusses the qualifications of engineers and contractors to meet the military obligations of citizenship, and suggests methods of increasing their efficiency as part of the program of national defense.

When the publication of such a series of articles was conceived, following General Wood's address before the Brooklyn Engineers' Club last December, the civil engineer's interest in military preparedness was a negative quantity. In some quarters there was grave doubt as to the wisdom of publishing military articles in a technical paper devoted to civil engineering and contracting. The enthusiastic response to the series is a convincing answer to the pessimistic. It is conservative to state that Major Bond's contributions have been the most widely read articles ever published in an engineering journal. The paper which best serves its readers is the one with vision —with the ability to sense the big event while it is still in the formative stage and to plan a campaign which will not merely reflect the interest of the profession along the new line, but stimulate it. How many technical men a year ago would have taken seriously a prediction that the members of the profession would soon be appointing military committees, organizing military lectures, participating in preparedness parades, drilling and planning encampments? Yet this is exactly what has happened.

From the outset the Engineering Record has consistently employed every means available—editorials, news items and special articles—to foster a sentiment in favor of adequate measures of national defense, and it is believed that these efforts have been no small factor in awakening the profession to a realization of its military obligations. Major Bond's series is ended, but the momentum of the movement which it was designed to stimulate is sweeping the country with a force that is gaining in strength every day.

British Aid to Research

THE terrible stress of the European war has forced upon public attention the need of swift and efficient investigation into the production of many things which are demanded for national protection and convenience. Every one of the combatants has undertaken actively in one way or another to develop the technical as well as the military and naval resources of the country. In particular, England has done a very interesting thing in setting up the Advisory Council for the Organization and Development of Scientific and Industrial Research. It is a body which has to look to the general treasury for funds and be responsible to the Privy Council for the administration of them, but it has authority to do things in a large way. Results are already appearing, although the council was set up hardly more than nine months ago.

The opening of the war found England terribly dependent upon Germany for technical supplies, which when cut off left a wide gap which must somehow be filled. The same condition applies now to this country, save for the impelling necessity of war, since many materials once imported must be made at home. It is high time for the Government to take an active hand in the work. It is because Germany has done precisely this, and in advance of necessity, that German technical industry has advanced to a point where the world was dependent upon it. The scientific departments of the United States do splendid work in spite of inadequate appropriations and the United States might well afford to increase the activities of its already organized institutions tenfold.

The English advisory council, however, works along broader lines, driven by the necessity of prompt action. It not only liberally supports governmental activities, like the National Physical Laboratory, but also works in co-operation with independent technical bodies, making the necessary appropriations to carry out important work immediately. The council is co-operating at the present time with eight or ten technical bodies, including, for instance, the institutions of mechanical, electrical and gas engineers, to enable them to push forward necessary work in the most direct and efficient way. The very first result has been to put the country in the way of getting out of the very grave difficulties met from the lack of optical and laboratory glass.

A word about the way in which the work is handled. The advisory council is composed of seven distinguished scientific men, with Lord Rayleigh at their head, and with a small administrative organization. It is assisted by sub-committees of experience, in part nominated by the council and in part by the several industries with which they are closely concerned, thus resembling the co-operative efforts of our Bureau of Standards. It is the policy of the council to keep in touch with the development of industry through these sub-committees and to be ready to extend instant help to any deserving case. This particular organization seems excellently suited to obtain instant contact with important problems without the council itself being perpetually beset by hopeful investors. Moreover, the English body is getting after results by the quick route of utilizing existing facilities. Laboratory equipment is to be found in many places, and the advisory council has been glad to utilize it without drawing upon its appropriations for anything beyond working funds. The right men are of more importance in industrial research than elaborate quarters and costly equipment, and the advisory council has been apparently pre-eminently successful in going after and getting the talent necessary to do the work.

The main thing in the whole movement is to obtain speedy results in solving technical problems important to the needs of the country, and for this purpose the English organization has proved itself well adapted.

Signs of Progress in Haiti—The Engineer's Interest Therein

EDITORIALLY this journal stated, in the issue of Oct. 9, 1915, that if a stable government should be established in Haiti the country would offer one of the most profitable fields for engineering promotion and development known in recent years. Such a government has been practically established, and assured, under the protection of the United States. Already there are signs of progress.

The municipality of Port au Prince has undertaken extensive improvements, including the sanitation of the city and the construction of a wharf. It is said that an electric railway is to be built from the capital city to Petionville, a wonderful summer resort, high in the mountains, less than a day distant from the city for a man afoot, yet hitherto little used despite the intense summer heat of Port au Prince.

Haiti has a large population in proportion to its size. It has natural resources and possibilities of almost incalculable value. But the country possesses none of the improvements of modern civilization. This is not unnatural. Previous to the landing of American marines last year, there were few men of influence sufficient to bring about public improvements who could with assurance state that they would not be exiled or meet with a violent death within the month. So why bother about the peril of an epidemic when that of the firing squad was so much more imminent!

Now that they are relieved of such anxieties, their minds turn naturally to the inconvenience, discomfort and danger of their surroundings. Those possessing vast tracts of land, now wildernesses, but potentially the richest sugar-growing soil to be found, are going to realize why it is that they are land poor, while almost within range of the naked eye, on a clear day, are the mountains of an island in which property owners are growing rich from the products of a soil that is considerably less fertile than theirs. The answer in all cases is improvements; improvements possibly at a rate and on a scale, when taken in relation to the area of the country, never before known. The demand is just beginning to be felt. Soon it will become insistent.

And here, as everywhere, material progress means but the solution of engineering problems.

Steering a Straight Course in Valuation

NO SUBJECT that comes within the scope of the civil engineer to-day requires clearer thinking than that of valuation. The interests at stake for the consuming public, and in a double sense for that part of it which holds investments in public utilities, are tremendous. Variations of 10 per cent in small items, when multiplied by the hundred thousands and the millions to represent their aggregate occurrence on, for example, the railroad lines throughout the country, give exceedingly large figures. The questions of property appreciation, depreciation, development expense, land values—all have a material bearing on the end results.

Were everyone thinking sanely, the problem, such is its complexity, would be difficult enough. Unfortunately, lawyers and economists with little practical experience in railroad management, engineering or finance have been called into the problem. There has resulted a variety of theory that is bewildering to all but those who have the knowledge and strength to cling close to fundamentals, despite every "wind of doctrine." Silly are some of the theories, vicious others, while many seem to be framed merely to get, despite the equities in the case, as much as possible for the side advancing the argument.

In this bewilderment it is needful to steer straight. It is necessary to be unafraid, and to rap each unsound theory that comes from a sufficiently noted, or better, notorious, source to give it standing. New theories must be judged from the standpoint of sound principles and must be rejected if they run counter thereto.

Much of the bewilderment has undoubtedly been due to the desire of many who are interested in or concerned with valuation work to read all the literature constantly being issued on the subject. Such a course, if one's foundation is not solid, is almost certain to lead even the conscientious astray. While it is necessary to know the chief of the erroneous doctrines in order to refute them whenever occasion affords, it is a waste of valuable time to try to follow each new theorist through his tangled logic to his absurd conclusions. Only the more important, therefore, of the erroneous and vicious theories need to be given consideration.

Cling close to the fundamentals, read carefully the writings of those who have already shown themselves to be on sound ground, be familiar with the more important of the erroneous doctrines, and neglect all the mushroom theory and literature—such is the soundest advice that can be given him who would follow valuation development and wishes to conserve his time.

Tunnel Muck Turned into Concrete Lining Immediately Behind Heading

Chicago Waterworks Engineers Drive Tunnel by Day Labor, Save City $250,000 and Utilize Special Mounted Concrete Equipment

MINE-RUN material put through a 4-in. screen plus cement makes up the concrete lining in the 8-mile Wilson Avenue waterworks tunnel which the city engineer's force of Chicago is building by day labor to provide an additional supply to the rapidly growing northwest portion of the city. The cost is going to be $250,000 below the lowest bidder's estimate and the time of completion one year under the forty-two months schedule, if present progress of 20 ft. per day is maintained. Henry W. Clausen, engineer of waterworks construction, made these estimates recently in a comprehensive paper on the project before the Western Society of Engineers. General articles on the new supply were printed in the Engineering Record of Jan. 16 and 23, 1915, pages 73 and 103, respectively. The intake crib there described has since been put in place and on April 18 the interior was pumped out ready for the sinking of the shaft. The cutting edge made a watertight joint with the clay. The following is an abstract of that part of Mr. Clausen's paper dealing with the methods used in driving and lining the tunnel.

TUNNEL MUCK WHICH IS USED FOR LINING CONCRETE

Different Heading Methods Tried

In order to obtain positive information as to which method of tunneling was the most economical, speedy and best adapted to local conditions in Chicago, it was decided to try out a number of different methods of mining. Accordingly, the standard method of top heading and bench, operating on the two-shift basis, was used at the Shore shaft—the entrance to the 3-mile tunnel under the lake to the crib—and the Lincoln Avenue and the Lawndale Avenue shafts. These shafts were selected for the two-shift method on account of the territory being more or less built up and the necessity for inconveniencing the rest of the community as little as possible. This method involves the drilling of from twenty-eight to thirty-four holes in the heading and eight to twelve holes in the bench. The cut holes are from 12 to 14 ft. deep and some 15-ft. steel was made up in order to still further increase the shot.

The bottom-heading method with break-down roof, on the three-shift basis, was used in the single heading from the Mayfair shaft. This territory was not so thickly built up and it was found that no complaints resulted from the blasting operations carried on during all hours of the day and night. This method involves the drilling of about twenty-three holes in the bottom heading and five holes in the roof heading. The cut holes are from 9 to 10 ft. deep.

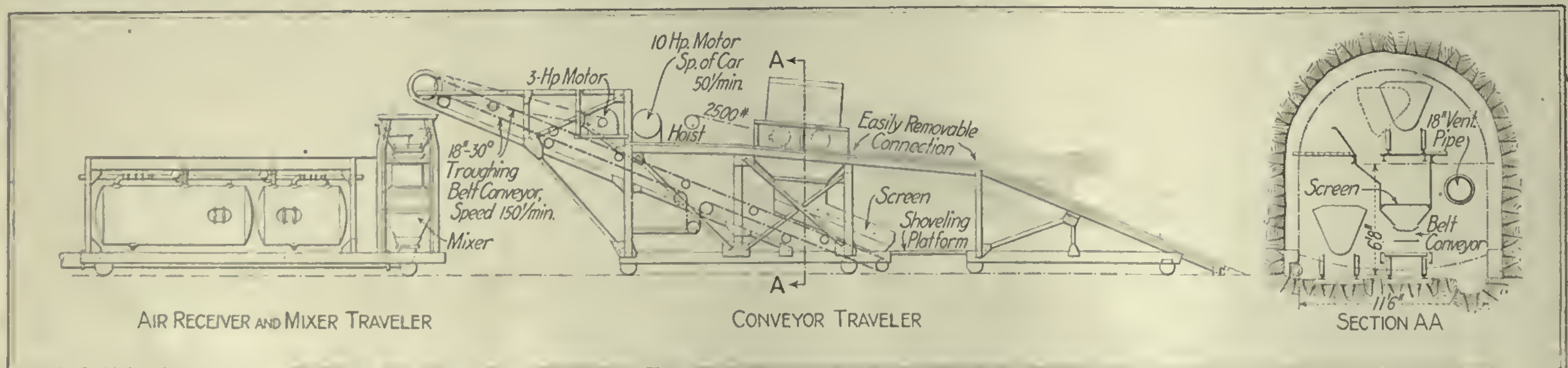
BULKHEADED FORMS RECEIVE CONCRETE FROM RISING PIPE

At the latter shaft an experimental shooting platform was constructed for the purpose of intercepting the rock shot down from the roof, thus avoiding blocking the free passageway to the bottom heading for a certain time while the rock from the roof was being mucked out. The platform was constructed of steel and lasted but a short time, finally becoming so badly bent as to make it of no further use. It is Mr. Clausen's belief that no such device, however constructed, will ever ultimately pay in work of this kind.

Experience showed that the top-heading-and-bench method is the most economical for this rock operated on the two-shift basis. The reason for this is two-fold: In the first place, if there is any quantity of water it is not blocked by the breakdown shot of the top heading; the second and most important reason is that on the two-shift basis a certain task can be given to the gang which must be completed before the work is left. In other words it is the duty of the miners to set up columns, drill and load their holes and shoot their rounds before going home. Likewise, it is the duty of the muckers to muck out all the rock from the previous shift. It is understood that the time of the shift ends whenever these tasks are completed.

With a well-organized crew, for a 10 to 12-ft. round the muckers will complete their work in from 6½ to 7 hours and the miners in from 7 to 7½ hours. If the gang is not up to standard it may take them 9 to 10 hours, for which they only receive one day's pay. The fact that a shift can be held responsible for a definite amount of work spurs each man on to do his part.

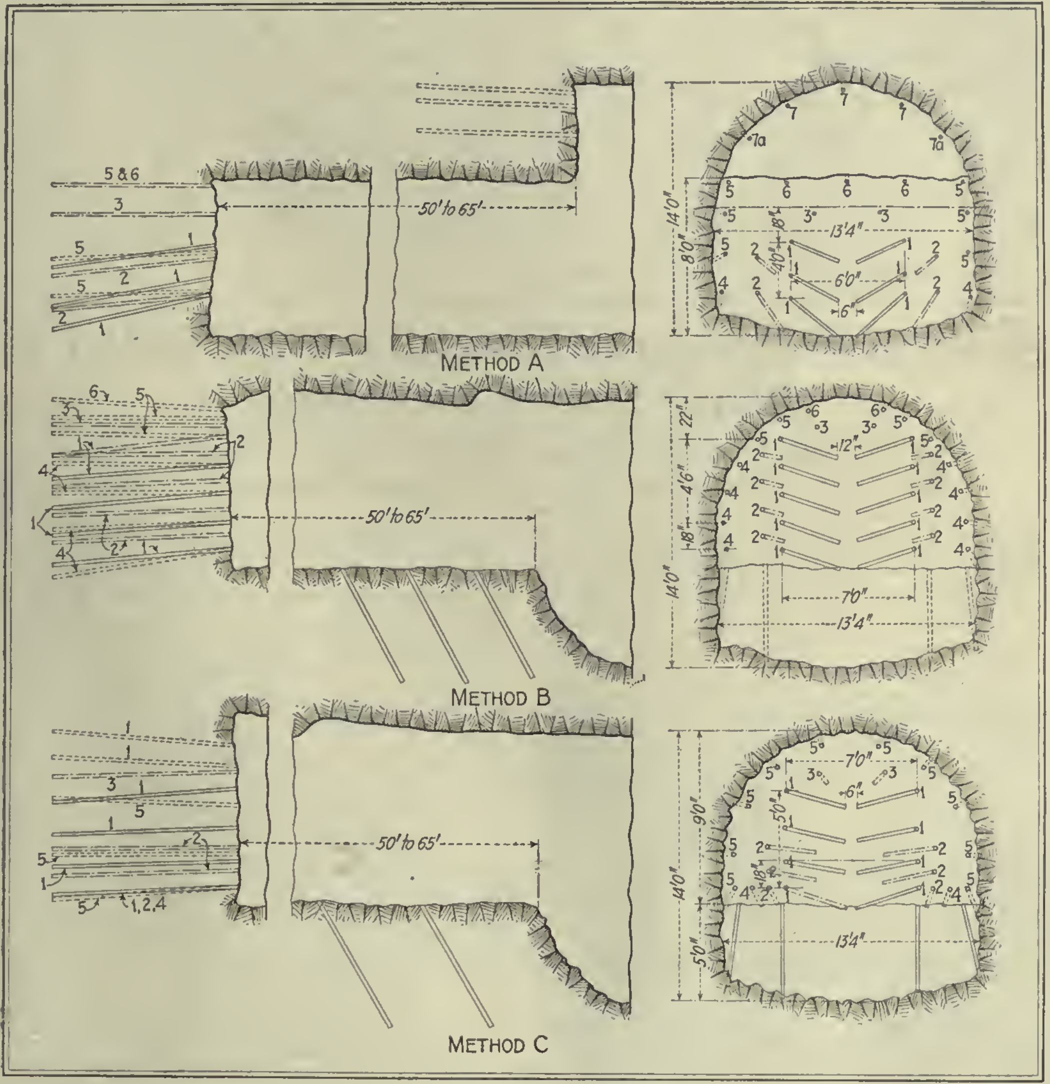
INCLINE TO CONVEYOR TRAVELER WHICH FEEDS MIXER RIG



MUCK SCREENING OUTFIT IN CHICAGO TUNNEL PUTS INTO MIXER ALL MATERIAL SMALLER THAN FOUR INCHES

Furthermore, by timing the beginning of the shifts properly a comparatively even load factor can be maintained on the power equipment.

In the three-shift method the gang only works 8 hours and quits, the succeeding shift taking up the work where the previous shift left off. If, for any reason, the previous gang neglected its work it is hard to place this responsibility without argument and question. This later fact is of extreme importance in operating under the civil service system, because absolute evidence must be forthcoming before a man can be discharged. Experience also showed that the total daily progress was not any greater by the three-shift than by the two-shift method, although a greater number of men were working with the three-shift method.



BOTH TOP AND BOTTOM HEADINGS WERE TRIED IN TUNNELING

METHOD A.—Holes 1 shot first and reloaded until cut is out. Holes 2, 3 and 4 are then shot, followed by holes 5, 6 and 7, shot at same time. All holes 10 ft. long, and loaded with 8 sticks of dynamite. No delay fuses in holes 1, 2, 4 and 7a. First delay fuses in holes 3, 5 and 7. Second delay fuses in holes 6.

METHOD B.—Holes 1 shot on first shot; reloaded and shot until cut is out. Holes 2 and 4 are then shot. Next holes 3, 5 and 6. Next holes 1, 2 3 and 5 are shot with no delay fuses. Holes 4 and 6 are shot with first delay fuses. Holes in bench are shot before heading holes. Holes 9 shot with no delay fuses; holes 10 with first and holes 11 with second. Bench and heading holes loaded with 7 or 8 sticks of dynamite. Bench holes 8 ft. long and heading holes 12 ft.

METHOD C.—Holes 1 shot first with no delay fuses; then reloaded and shot with holes 2, 3, 4 and 5 on second shot. Holes 1 on second shot are loaded with no delay fuses, holes 2 with first delay, holes 3 and 4 with second delay, and holes 5 with third delay. Holes 1 loaded with 9 sticks, holes 2 with 8 sticks and holes 3, 4 and 5 with 7 to 8 sticks. Each stick 1 lb. exploder in next to last stick. Heading holes 12 ft. and bench holes 10 ft. deep.

As an example of the increasing progress of this work it may be stated that the best average daily excavation done by contract on a 12-ft. tunnel in Chicago was about 8 ft. per 24 hours. On the Southwest Land and Lake Tunnel a progress of 15 ft. per day was made, but the excavation required so much trimming subsequently that the actual daily progress was much less than 15 ft. The average daily excavation performed by the city by the day-labor method is about 20 ft., many days being as high as 22 and 23 ft. The maximum obtained has been about 26 ft. When excavating rock at this rate a round trip of the cage would be made every 56 seconds, 7 seconds being used each at the top and bottom for loading a car. The descent would be made in 10 seconds. The bottom of the shaft at Lincoln Avenue, in order to facilitate this operation, has a spare track on one side of the cage to handle empty cars. Three hundred steel side 1 yd. K. & J. dump cars are used. They are specially designed with roller bearings and half-size automatic couplers. They are hauled by 40-hp Baldwin gasolene locomotives.

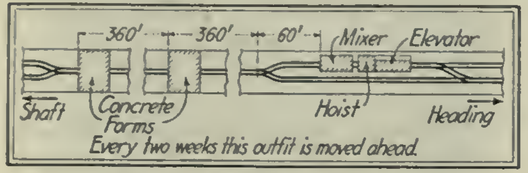
The usual method previously employed by contractors in lining tunnels of this size was to excavate the drift completely previous to starting the lining of the tunnel, bringing all material to the surface where it was stored or otherwise disposed of to the best advantage. After the mining was completed the excavated rock stored on the surface was crushed and screened, mixed with sand and cement and brought into the tunnel and placed by hand behind forms of steel or wood. From 30 to 35 ft. per day were lined in this way. When the drift was long the concrete sometimes had its initial set before arriving at the forms. This method of handling was necessary on account of the restricted space, making it impossible to carry on both operations of minging and lining in the same heading at the same time. It also operated to extend the ultimate time for completion on account of having to line the entire drifts after all mining was completed.

PLATFORM TO CATCH BLASTED MUCK WAS SOON BROKEN UP

It was noticed in the Wilson Avenue tunnel that the rock in the mine-run condition contained considerable fine material and apparently would make good concrete. Various compressor foundations and other miscellaneous concrete work on top were made with this material, showing excellent results. Test cubes, eighteen in all, were made with various proportions of cement, aged thirty days, and broken at the Armour Institute of Technology. They indicated that the concrete was of satisfactory strength. Realizing the possibilities not only of completing the work very much earlier but of saving the expense of hauling the material back and forth required for the lining, as well as the cost of purchasing crushed stone and sand for the concrete, it occurred to the engineers that a method could be devised which would line the tunnel with the mine-run rock in

BELT CONVEYOR UNDER SCREEN DISCHARGES INTO MIXER HOPPER the same drift as the mining was carried on, thus carrying on both operations simultaneously.

After considerable thought and study a scheme was worked out which would accomplish this purpose. It consists of a screening and loading machine which handled all the rock coming from the heading, permitting the material less than 4 in. in dimension to be deposited in the hopper over a pneumatic mixer. The oversize is rejected and loaded by hand into a car standing nearby. A pneumatic mixer deposits the concrete through an 8-in. pipe placed behind the Blaw steel forms especially designed for clearance, at a distance of as much as 800 ft. away. The screening machine, built from city designs by the Stephens-Adamson Manufacturing Company, and the concrete mixer, are designed to run on roller-bearing wheels operating on one track and within the clearance of the final tunnel dimensions. The concrete forms in 30 ft. sections are made of steel operating on a traveler on roller-bearing wheels. By this system approximately 60 ft. of forms are filled in two shifts, the concrete setting only about 16 hours before the forms are removed. The clearance on the forms and the concrete machinery is so arranged as to permit of unhampered operation of the trains through and past the concreting outfit.

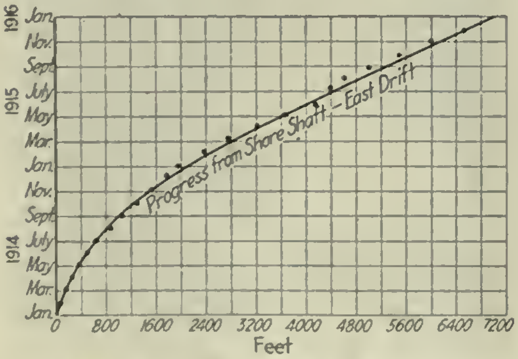


THIS OUTFIT MOVED EVERY TWO WEEKS

Haunch Walls Built by Hand

In advance of the steel forms guide walls are constructed by hand-mixed concrete. These walls are made of wooden forms set to the true line and grade from the engineer's centerline and grade plugs. The walls guide the steel forms so that the finished lining is absolutely true to line and grade. This is something that it was difficult to get a contractor to do, his policy being rather to fit the hole as blasted as near as possible and thus avoid trimming —a method sometimes resulting in the tunnel being a series of short tangents varying anywhere from 2 to 6 in. from a straight line.

Up to the end of 1915 the cost per foot for excavating 26,715 ft. of tunnel was $41.88 and for lining $15. It is estimated that the cost per foot of cleaning will be $2, of removing plant 60 cents, and of unforeseen contingencies $2; a total, including engineering and inspection, of $61.48. The lowest bid received in June, 1914, was $60 per foot, to which it is estimated $2 should be added for contingencies and $6.20 (10 per cent) for engineering and inspection. The saving will be therefore slightly more than the cost of the engineering and inspection, but the time will be reduced one year.



PROGRESS RECORD FROM SHORE SHAFT—EAST DRIFT

Organization

The work was planned and is being executed by John Ericson, city engineer, reporting directly to L. P. Morehouse, commissioner of public works. Directly connected with the design were M. B. Reynolds, engineer of waterworks design, and H. S. Baker, assistant city engineer. H. W. Clausen, engineer of waterworks construction, is immediately in charge of the construction division of the Bureau of Engineering. He is the general superintendent, as it were, of the tunnel as well as of other waterworks construction.

After the above, at each shaft of the tunnel, the standard organization of the construction division is followed, namely: An assistant engineer, who is in local charge of the work. Reporting to him is the tunnel foreman, who has general charge of all the labor and upon whose experience as a miner the assistant engineer naturally relies more or less. The drilling and blasting of the heading are in charge of a heading boss, who reports directly to the tunnel foreman. The miners who operate the drills and load and explode the charges placed in the borings or holes, together with their helpers, are under the immediate jurisdiction of the heading boss. The muckers working in the heading load the blasted rock into cars and are under the direction of a mucking boss who also reports directly to the tunnel foreman but of course works in harmony with the heading boss during the period when both are engaged in the heading. Reporting also to the tunnel foreman are the concrete foreman handling the concrete apparatus and forms, straw boss over a small track gang, hoisting engineers having charge of the power plants at each shaft and other unattached workmen, such as top laborers and pumpmen.

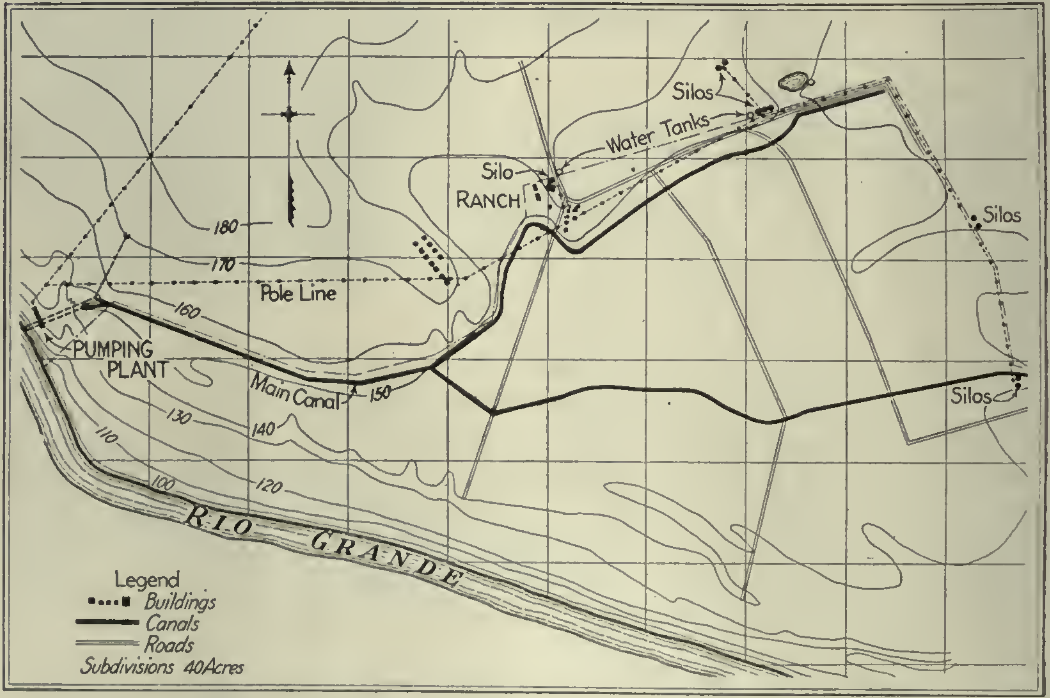
Electricity Supplants Mesquite-Fired Boiler as Power Source for Pumps

Air Chambers Absorb Back Lash Through Wooden Discharge Line When Pumps Stop—High Centrifugal Pump Efficiencies Obtained

MESQUITE as a fuel for steam-driven irrigation pumps proved the undoing of a 1000-acre project on a Texas ranch 12 years ago. Coal hauled 18 miles from Eagle Pass tried as an alternate proved too expensive and the project remained dormant until electricity revivified it in 1913. The acreage is part of a 160,000-acre ranch in Maverick County bordering for 40 miles on the Rio Grande. Provision is made to bring an additional 1500-acre tract under water from the rehabilitated pumping plant at a later date.

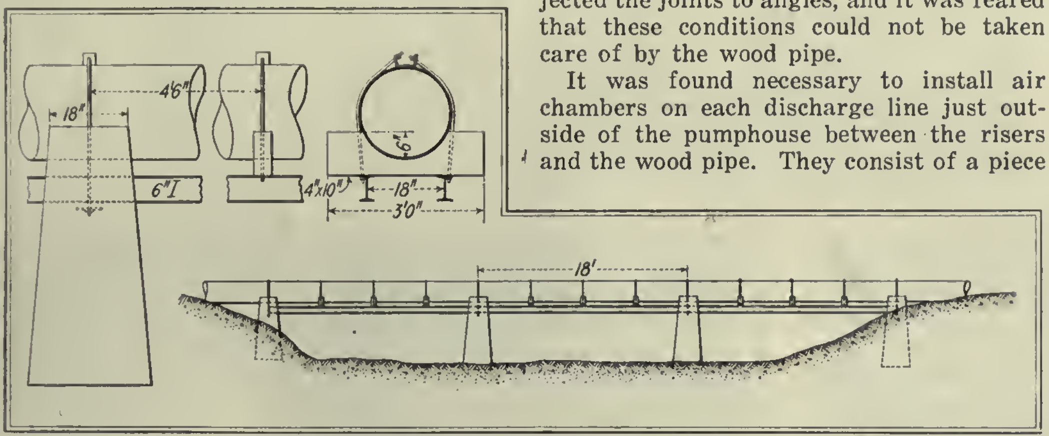
Why Original Plant Failed

The steam pumping plant was erected at the extreme upper end of the ranch and consisted of a simple Corliss steam engine, two 125-hp. water tube boilers and a No. 16-centrifugal pump. The engines and boilers were located on the ground level, 34 ft. above mean river level and 170 ft. from the river. The pump was at the bottom of a brick-lined pit 14 x 16 ft. in plan and 25 ft. deep and was belt-driven from the flywheel of the engine—the position of the belt being about 45 deg. from the horizontal. Water was pumped from a sump lying directly under the pump and connected to the river by a brick gravity flow intake. The water was discharged through a spiral riveted riser into a wooden flume located over the pump house. This flume carried the water to the canal head about 600 ft. away.



TOPOGRAPHICAL MAP OF THE INDIO RANCH SHOWING COMPLETE PLANT LAYOUT

The plant was more or less of a failure from the start, as the native mesquite wood for fuel proved to be costly and unsatisfactory. After a season or two of operation all the available mesquite had been used and so an attempt was made to haul coal by wagons from Eagle Pass, 18 miles distant; this proved entirely unpracticable. Then the gravity intake gradually filled with silt until it became practically useless and the plant was closed down and the irrigation project abandoned.



METHOD EMPLOYED IN CARRYING PIPE LINE ACROSS ARROYO

Decide to Install New Plant

In the summer of 1913 B. G. Barnes, general manager of the cattle company, again became interested in irrigation in so far as growing cattle feeding crops was concerned and decided to replace the old plant by entirely new equipment and structures suitable to the conditions.

After considering several types of prime movers it was decided to install electrically driven pumps and buy power from the International Electric Company of Eagle Pass, which agreed to build a power line to the ranch. The old steam equipment was dismantled and sold and the pump pit floored and lined with 6 in. of reinforced waterproofed concrete. A vertical centrifugal Worthington pump direct-connected to a 100-hp. General Electric induction motor was installed, the pump being placed in the bottom of the pit and the motor on the floor level above. The suction pipe is 160 ft. long and is a 16-in. flanged wrought-iron pipe. The discharge riser is a 14-in. wrought-iron pipe and there is a balanced check valve immediately above the pump. The riser discharges into a 20-in. wire-wound wood pipe with wooden collars. The wood pipe is located just below ground level and is 1700 ft. in length. At a point 750 ft. from the pump plant a cast-iron Y is inserted and one branch line 50 ft. long leads to the present main canal and the other branch line continues up the hill for 900 ft. to a point 70 ft. above mean river level, where it is proposed at some future time to develop a tract of land subject to a canal at this elevation.

This plant had a satisfactory operation for the season of 1914 and in the fall of that year it was decided to install a second unit of the same size as the first, but as the new unit was to be of the horizontal type it was necessary to construct a new pit, which is located on the downstream side adjoining the old one, and the two are connected at the bottom by an archway. The new pit is 12 x 16 ft. in plan and 2¼ ft. deep with 12 in. at the top, increasing to 18 in. at the bottom. The 12-in. floor is of reinforced waterproofed concrete.

The conduit between the new unit and the canal head consists of 350 ft. of wood pipe similar to the first installation and 250 ft. of 20-in. galvanized spiral riveted steel pipe in 20-ft. lengths, having flexible bolted connections, the reason for using the steel pipe being that a small arroya had to be crossed which would necessarily expose the pipe. In addition, for the last 160 ft. the line was on a sharp rise to the canal head, which subjected the joints to angles, and it was feared that these conditions could not be taken care of by the wood pipe.

It was found necessary to install air chambers on each discharge line just outside of the pumphouse between the risers and the wood pipe. They consist of a piece of 14-in. pipe 16 ft. long and closed at the top end. Before the installation of these chambers, upon switching off the power, the units quickly came to a dead stop and the back lash in the pipe lines created such a shock that it always sprung the wood pipe, causing leakage, which it was feared might ultimately cause their failure. After the chambers were in place the back lash was seldom felt and when it was it was so slight that no damage was done. The air chambers are shown in the view of the pumphouse.

The priming of the pumps is done by Nash rotary vacuum pumps, one direct-connected to a 1½-hp. motor and the other belt-driven by a 2-hp. motor. The piping of each primer is so arranged that either pump can be primed by either primer. The primary power line consists of 18 miles of three-phase, 13,500-volt line of No. 4 medium hard drawn copper wire on 40-ft. poles spaced 275 ft. apart. By changing the insulation the line voltage can be increased to 22,000.

Farm Use for Electricity

Having got the pole line so close, it was extended for farm use by a 2300-volt line carrying current from the step-down station to the ranch buildings two miles distant, where it is used for lighting and for operating the water supply system. The water level in the elevated tank is controlled by a float control switch and the pumping unit is a centrifugal pump direct-connected to a 5-hp. motor. The forge blower, band saw and other small tools in the blacksmith and carpenter shops are also motor-driven.

One of the unique and practical applications made of electricity on the ranch is the operation of the ensilage cutters. There have been constructed sixteen reinforced concrete silos 20 ft. in diameter by 60 ft. high, each having a capacity of 500 tons. They are located on the borders of the farm in groups of from two to four and a power line furnishes power to them all. The ensilage cutters are belt-driven by a 35-hp. 2300-volt induction motor. After two seasons of operation this arrangement has proved entirely satisfactory. The motor is mounted on a small housed-over truck so that it can be moved from silo to silo.

High Efficiencies Are Obtained

In April, 1915, the pumping units were tested and high efficiencies were obtained. The static head of the vertical unit is 55.34 ft. and the total head, including friction and pump losses, is 72.59 ft., making friction and pump losses of 17.25 ft. The water was measured by a 4-ft. Cippoletti weir placed in the canal several hundred feet below the canal head. Power input was measured by an integrating wattmeter. Head was measured by pressure and vacuum gages and a mercury U tube. An average of ½-hr. readings taken for 12 hr. gave 3636.5 gal. per minute discharge, a power input of 104.9 hp. with a calculated water horsepower of 66.6. Allowing 91.5 per cent motor efficiency and 90 per cent shaft-bearing efficiency, the horsepower input at the pump was 86.38, which gave a pump efficiency of 77 per cent.

PIPE LINE FROM TEXAS PUMPING PLANT CROSSING AN ARROYO

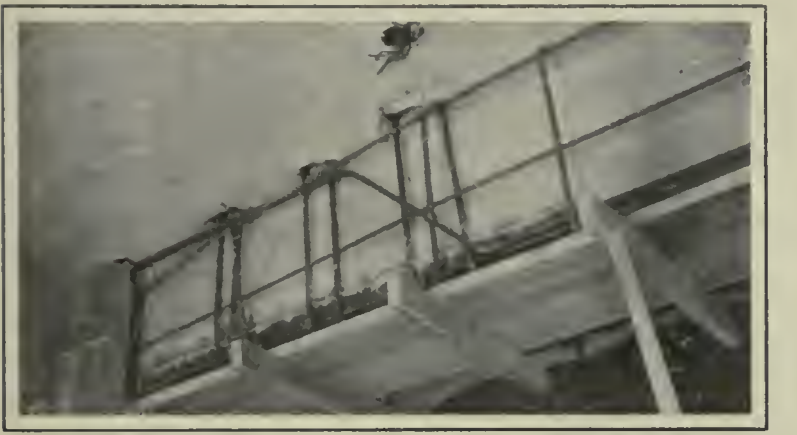
The static head of the horizontal unit is 55.01 ft. and the total head, including friction and pump losses, 70.63 ft., making friction and pump losses of 15.62 ft. The average discharge was 4726.4 gal. per minute and the power input was 103.64 hp. with a calculated water horsepower of 84.2, which gave a pump efficiency of 81.24 per cent. The machinery and equipment was furnished by A. M. Lockett & Company of Houston and New Orleans, with the exception of the wood pipe, which was furnished by the Pacific Coast Pipe Company, Seattle. All designs and plans were made and the construction supervised by B. G. Slining, consulting engineer, of San Antonio.

Three Reinforced-Concrete Buildings Alone Resist Flames in Paris, Texas, Fire

Methods of Repairing Beams and Tying-in Walls to Strengthen Injured Structure Outlined—Wire Glass Windows and Gypsum Partitions Withstand Test

CONVINCING evidence of the effectiveness of reinforced concrete as a fire-resistive construction is furnished by the fact that three reinforced-concrete buildings directly in the path of the Paris, Tex., fire were the only buildings that came through practically unharmed. As described in the Engineering Record of April 1, page 463, and illustrated in the issue of April 15, page 529, this fire was extremely destructive, ranking as the fourth of the great fires in this country. The total losses are estimated between $10,000,000 and $12,000,000, about $4,500,000 being covered by insurance.

The people of the city have already begun reconstruction on improved and modern lines, widening streets, planning open courts, and adopting rigid fire limits and fire-resistive construction. The lesson to be learned from the effects of the fire are here outlined, and a description is given of the methods used in repairing minor injuries to one of the reinforced-concrete structures.


REINFORCEMENT ADDED AND CONCRETE BEAM WIDENED

GYPSUM PARTITIONS WITHSTAND FIRE TEST

BUILDINGS LITTLE DAMAGED

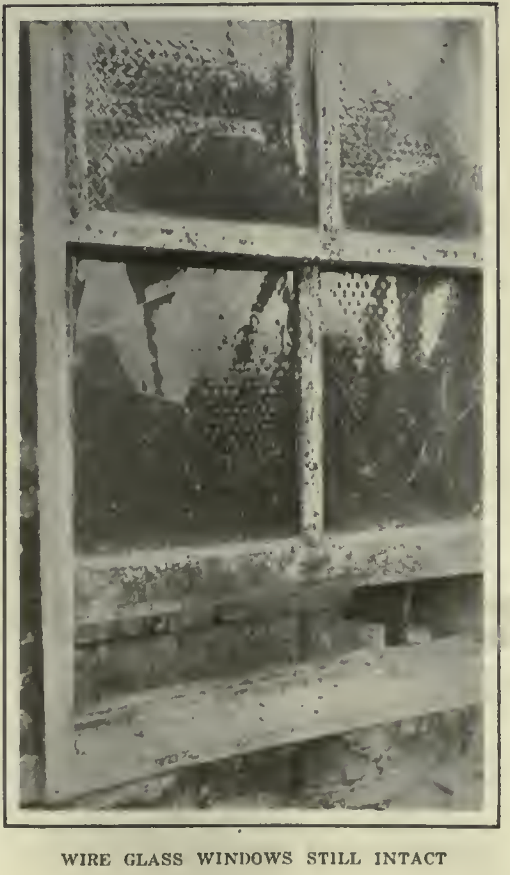
There were three reinforced-concrete buildings in the direct path of the flames, and these are the only structures so located which now remain standing. The least damaged of these is the Wise apartment house. A livery barn at the rear and a residence on the south side of this building were completely destroyed, and on the north side a store building full of merchandise stood within 10 ft. of the apartment. The heat was so intense that the interior furnishings must have caught fire from radiation alone. All the windows on this side were of glass with steel frames, and every window was shut. Not a pane of glass came out, although the glass melted and flowed, bulging badly and cracking, as shown in one of the accompanying photographs. The upper half of the windows were of ribbed wire glass and the lower half of glazed wire glass. The ribbed glass bent much more than the glazed, and in one case actually flowed from the top and the pane curled over.

The building which ranks second in small amount of damage done by the fire is the Gibraltar Hotel. This structure also had other buildings burned on three sides of it. The two sides of the hotel were equipped with wire glass windows and steel sash, which excluded the fire. The rear of the building, however, was equipped with wooden sash and plain glass, and the fire soon found its way through these openings. Everything composed of wood or other combustible material was entirely destroyed, except on the ground floor and in a few of the front rooms.

GYPSUM BLOCKS STAND WELL

All partitions were constructed of gypsum block, and although in most cases the plastering was entirely removed from the walls, the blocks remained intact. An accompanying photograph shows the gypsum block walls with the plaster burned away. There is no sign of damage to any concrete in the building, and the steel-framed windows, although ruined, performed their function and can even now be raised and lowered. The elevators, inside fireproof walls and steel doors, remained in running order, and the refrigerating plant in good working condition. The estimated damage to the building was about 42 per cent.

The third building was the First National Bank. Buildings were destroyed completely on all four sides of this structure, and it is reported that these buildings were also dynamited in an attempt to check the fire. The west and north sides were equipped with wire glass and steel sash, and in every case the windows remained intact. The south and east sides had plain glass windows and, with a few exceptions on the fifth floor, these are entirely gone. With the exception of the fifth and ground floors there is nothing left in the building but the reinforced-concrete columns, beams and floors. The partitions were chiefly of wire lath, and these were completely destroyed.


WIRE GLASS WINDOWS STILL INTACT

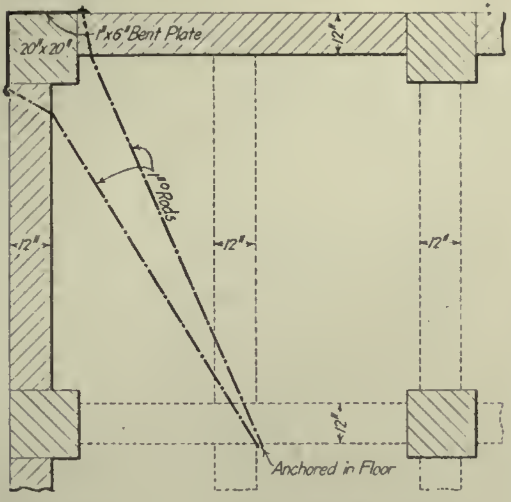
REPAIRING DAMAGED BEAMS

In some cases the reinforced concrete in this building was badly damaged, probably due to the effects of dynamiting the adjacent building. Several of the beams cracked badly, and the west wall separated from the rest of the building. In two cases the beams failed so badly that a continuous solid concrete wall was built under the failed sections. Practically every column is being strengthened by the addition of 3½ to 4 in. of concrete on each side.

The floor was constructed of T-beams and a 5-in. slab. For beams which are in very bad condition, 1 in. or more of the floor surface is removed and twelve holes are drilled. Small angles are placed on the lower corners of the beams and U-bolts are inserted and drawn up with plates and bolts. These are shown in an accompanying photograph, the U-bolts being spread at the top in order to get good bond between the new steel and new concrete. Reinforcing rods are placed as shown, and the forms built around the beams. New concrete is then poured through the holes made for the U-bolts and through additional holes made along the length of the beams. The depth of the beam is thus increased by 3½ to 4 in., and the width by 6 to 7 in.

ANCHORING THE WALLS

To tie the corners and intermediate columns of the building the following method is being used: Level with the floor surface the outside brick facing is removed and a 6 x 1-in. continuous bent steel plate is placed around the column, as shown in the accompanying drawing. The 1-in. rods are then anchored down through the floor at one end, passing along the top of the floor through the outside wall and tightened by nuts at the outside end. New concrete is then laid on the floor surface to cover the rods.



METHOD OF TYING THE CORNER COLUMN

The building is being salvaged by the firm of Lang & Witchell, architects, of Dallas, Tex., and a local firm of contractors, Finn Owings & Company, are doing the work.

UNPROTECTED STEEL FAILS

This fire also demonstrated the fact that unprotected steel is practically sure to fail in case of fire. The court house was of the old type of fireproof building, with stone exterior, steel I-beams and flat-arch tile floors, with steel roof trusses and book-tile and slate roof. The steel is simply a tangled mass, some of it practically tied into knots.

The people of Paris are taking advantage of their loss to properly plan the streets and parks and lay out a better city. All the main thoroughfares will be changed from 60 ft. to 80 ft. in width and all 40-ft. streets widened to 50 ft. About 4 miles of new streets will be added. The present city square will be parked and a new market square has been laid out. A permanent road leading from the present main road several miles northeast of the town will be constructed directly into the center of the city. A new city hall, court house, and school building will be constructed and the government has appropriated $200,000 for the erection of a new post office. Building districts are fixed for all types of buildings in every part of the city. The code of the State Fire Insurance Commission has been adopted and everything within the fire limits will be required to be of fire-resistive construction.

Transverse Brick Tests Proposed as a Measure of Pier Strength

That transverse tests of brick will give a fairly reliable measure of the strength of brick piers when laid up in mortar is announced as a result of the series of tests on large brick piers made by the U. S. Bureau of Standards (see Engineering Record of April 10, 1915, page 460) and an auxiliary series of tests of the bricks for transverse strength. In a paper on this subject presented at the thirtieth annual convention of the National Brick Manufacturers' Association by J. G. Bragg, assistant physicist, results of these tests were given.

In conclusion it was stated that considering the results of this investigation, while additional data is needed to justify the assertion that a ratio based on the transverse tests of bricks could be established which would be of assistance in estimating the strength of brick masonry, this method is much more efficient and more satisfactory than the usual crushing test of the brick.

Storage Reservoir Feeders Planned to Abate Naugatuck River Nuisance

Co-operation among 25 New England Manufacturers Leads to Comprehensive Project for Water Conservation—Three Dams Proposed

By CHARLES H. PRESTON, JR.
Consulting Engineer, Waterbury, Conn.

SHORTAGE of water for industrial purposes, accompanied by insanitary conditions resulting from decomposing sewage deposits during dry months, led twenty-five corporations with manufacturing plants along the Naugatuck River in Connecticut to co-operate in a project for equalizing the stream flow by means of a series of three dams in the upper Naugatuck drainage basin, designed to impound 13,000,000,000 gal. of water at a cost of several million dollars. The first of the three dams to be built will be of cyclopean masonry, 142 ft. high and 1300 ft. long on top, and will contain 800,000 cu. yd. of masonry. The manufacturers, cities and villages will petition the General Assembly in January, 1917, for charter rights to begin the first development.

LEAD MINE BROOK AT SITE OF DAM NO. 2

STREAM FLOW VARIES

The Naugatuck River, flowing through a narrow valley of the western section of Connecticut with precipitous hills on either side, and numerous dams and mill ponds that cause a fluctuating stream flow, is, length considered, the most important stream in New England from an industrial point of view. The extremes in run-off, together with control of water by the many dams across the river, result in the river bed being dry in numerous places during the months of June, July, August and September of each year. Towns, villages and cities along its course empty their sewage, untreated, into it together with manufacturing wastes of many descriptions, causing the river to become badly polluted, a condition probably the most insanitary in the State. The river banks during these dry months are coated with heavy layers of decomposing sludge and other deposits, visible at low water, particularly south of Waterbury to its confluence with the Housatonic River at Derby.

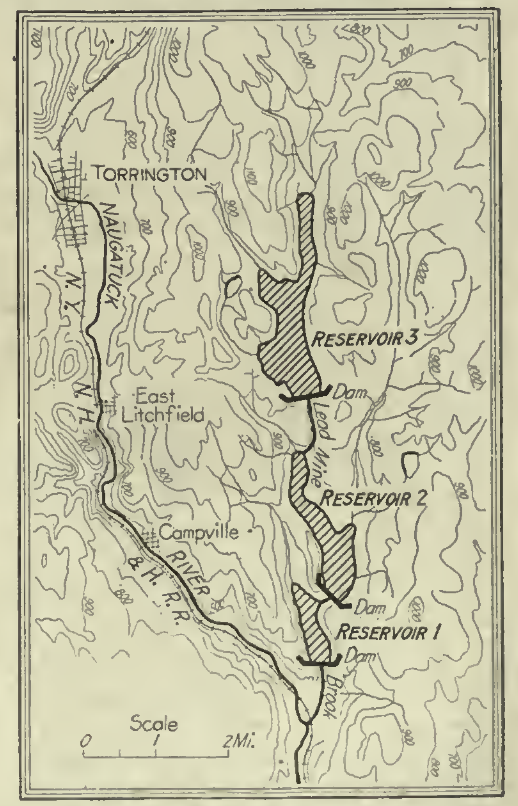
From its sources, Hart Brook, Hall Meadow Brook, the East Branch and Lead Mine Brook in the towns of Norfolk, Goshen, Winchester and Torrington, all of which are in Litchfield County, to its confluence, the river is 44 miles in length and its watershed, varying in width from 5 to 10 miles, has a total area of 326 sq. miles. Its daily discharge at Waterbury varies from 125 to 5500 sec-ft., and this extreme change will occur in 5 hours.

The estimated population of the watershed is 150,000, comprising a total of 25 cities, towns and villages, the most important of which are Torrington, Thomaston, Waterbury, Naugatuck, Seymour, Ansonia and Derby. Statistics of manufacture include metal, rubber, galvanizing, silk, textile and dye works, laundries, paper mills, grist mills and breweries, a total of 130, of which 95 are brass or other metal works.

The grade from the town of Winchester to Derby is 1300 ft. and the average precipitation during the past 29 years has been 48.88 in., by months as follows: January, 4.25 in.; February, 4.14 in.; March, 4.49 in.; April, 3.74 in.; May, 3.82 in.; June, 3.32 in.; July, 4.65 in.; August, 4.48 in.; September, 3.77 in.; October, 4.10 in.; November, 3.64 in.; December, 4.33 in.

MANUFACTURERS JOIN FORCES

Shortage of water for industrial purposes, together with extreme insanitary conditions along the river, was the direct cause of a movement, taken up by the twenty-five corporations whose sites adjoin the river banks, to investigate a method of relief. On April 13, 1914, manufacturers of the Naugatuck Valley, in general meeting called for the purpose of discussing proposed water conservation in the upper Naugatuck drainage



LOCATION OF THREE PROPOSED IMPOUNDING RESERVOIRS ON LEAD MINE BROOK basin, voted an appropriation of several thousand dollars for an engineering investigation and report on the proposed project. Lead Mine Brook, in the town of Harwinton, was selected for the proposed first development.

The total area of Lead Mine Brook watershed is 24 sq. miles. It has a length of 9 miles and varies in width from 2½ to 5 miles. Records taken at the stream since September, 1914, to date show the following monthly yield:

Total yield in million gallons varying from 7.2 to 6347.6.

Average yield per square mile, million gallons per day, varying from 0.0110 to 9.3200.

Average yield per square mile, second-feet, from 0.017 to 14.421.

Rainfall in inches from 0.12 to 7.13.

Rainfall collected, 0.02 to 8.17 in.

Percentage of rainfall collected, from 2.4 to 341.7.

The width of the Naugatuck River varies from 67 to 325 ft., but the average of 25 different points between Torrington and Derby is 125.5 ft. Of the 326 sq. miles of watershed included within the Naugatuck River drainage basin, Torrington has a run-off of 54 sq. miles, Thomaston 128 sq. miles, Waterbury 210 sq. miles, Naugatuck 254 sq. miles, Seymour 307 sq. miles, Ansonia 323 sq. miles, and Derby the total of 326 sq. miles.

WHEN POVERTY HOLLOW IS FLOODED BY RESERVOIR NO. 2 THE COUNTRY WILL BE UNDER 90 FEET OF WATER

NAUGATUCK RIVER BED EXPOSED AT SEYMOUR, WHERE DRAINAGE AREA IS 307 SQUARE MILES

RAINFALL AND RUN-OFF

With the average annual precipitation of 48.88 in. and six-tenths of this precipitation representing run-off, there is annually passing through Torrington 27,694,558,000 gal., Thomaston 65,861,377,000 gal., Waterbury 107,382,791,000 gal., Naugatuck 129,808,031,000 gal., Seymour 157,211,552,000 gal., Ansonia 164,998,094,000 gal. and Derby 166,591,144,000 gal.

If fully conserved, this Naugatuck River run-off, passing through the river channel daily for an entire year, would produce a stream flow at the different points as follows, each on the basis of 125.5 ft. in width: Torrington, 5 in. in depth; Thomaston, 12 in.; Waterbury, 20 in.; Naugatuck, 24 in.; Seymour, 29 in.; Ansonia, 30 in., and Derby, 31 in. With the low rate of run-off during the four dry months of each year and the huge volume of untreated sewage, chemicals and other impurities discharged into the river, the conditions are extremely insanitary, and the proposed development, from this point of view, as well as the greatly increased water power for the numerous corporations, is a matter of vital importance.

The conservation of water in the upper Naugatuck drainage basin is by far the most practicable method of equalizing the stream flow of the river, and the improvement to the cities and towns along its banks, particularly below Waterbury, would make the project a worthy one, if from no other than a sanitary point of view. The development of Lead Mine Brook in total would create a stream 12 in. in depth and the average width for the four dry months of each year, and with further developments on tributary streams north of Lead Mine Brook a full, dependable stream flow sufficient to flush the river to a sanitary condition throughout the four months could be secured.

Manufacturers, as individuals and corporations, have long pondered this idea and municipalities have craved the adoption of this or any other plan that would give them relief, if no more than temporary, from unsolved sewage disposal problems and from stenches as unhealthy as they are repulsive. At present the river is an open sewer. To such an extent is it used for sewage disposal purposes that for 100,000 people living along the banks south of Waterbury it is an annual midsummer nuisance and menace. If it were not for the copious discharge of mill acids and chemicals, some of which help to counteract the noxious sewage, conditions would no doubt be even worse than they are, if such could be possible.

In midwinter severe weather covers up and freezes down, and in the spring the heavy rains and thawing snow flush and cleanse; but in midsummer the water dwindles by waste and evaporation and the current is by far too small either to carry off accumulations or adequately serve industrial purposes.

THREE DAMS PROPOSED

It is proposed to build a series of three dams of cyclopean masonry to be designated as Nos. 1, 2 and 3. The first of the three to be developed will be No. 2, which is of gravity type, having a length on top of 1300 ft. and a maximum height above top of foundation of 142 ft., 13 ft. thick at top and 118 ft. thick at the base. This dam will create a pond covering 316 acres and will impound 3,413,000,000 gal., will contain 800,000 cu. yd. of masonry and will cost $1,000,000. With the others, Nos. 1 and 3, developed, it is planned to impound about 13,000,000,000 gal. of water. The total cost will be several million dollars.

The manufacturers, cities, villages and towns will petition the General Assembly in January, 1917, for charter rights to begin the first development, No. 2 reservoir, which will take rank among the notable dams of New England on account of its dimensions. It is designed on conservative lines to meet extreme conditions of precipitation, run-off and temperature changes. The commission appointed by the manufacturers of the Naugatuck Valley, with full charge of all preliminary investigations and reports, is ex-Senator Lewis A. Platt, chairman, of Waterbury; W. H. H. Wooster, secretary; the Seymour Manufacturing Company of Seymour, and the writer. The project, including plans and specifications, has been fully approved by the State Board of Civil Engineers, which has issued a certificate of approval.

Patrol Maintenance Saves Gravel Roads Under Heavy Traffic

The gravel or dirt-and-gravel roads of New Hampshire are maintained under severe motor-vehicle traffic by local patrolmen under the direction of the State Highway Department. As stated by the *Highway Magazine*, the success of this method is due to two essentials: Honest, efficient and decently paid patrolmen, and a willingness of the department to spend $200 or $300 per mile per year, or even more in exceptional cases, on plain gravel-road maintenance. The patrolmen are not ordinary laborers, but intelligent natives.

Each man is required to provide himself with a horse, dump cart, chain, shovel, pick, iron bar, hoe, rake, axe and brush hook, and is expected to spend his whole working day of nine hours, six days a week, on the job during the working season at a daily wage of $3 to $3.50. In brief, the patrolman's duties are to patrol his section frequently and to see that the road is clear of stones, broken glass or anything of a foreign nature; to see that the ditches and shoulders are cleaned, the culverts clear and bushes cut, and to pay particular attention to the cleaning of the culverts and ditches after a rain. He is to patch any ruts and holes that may appear and drag the road after every rainstorm or shower or whenever the road surface is damp. He is also required to report to the division engineer any dangerous place or conditions on the roads or bridges within the towns of his section. These are not actually under his supervision, however. It is also planned that hereafter one experienced man will give his whole time as inspector for the patrolmen. Ordinarily from $1,000 to $1,200 a year are available for each patrol section for wages and material. By good judgment on the part of the patrolman and the division engineer, this system works out admirably and makes the patrolman's job one of a high grade of intelligence and workmanship.

National Defense—For Engineer and Contractor

Ninth and Final Article in Series Describing How Engineers and Contractors Can Increase Their Military Efficiency in Time of Peace

By Major P. S. BOND
Corps of Engineers, U. S. Army

WE have now considered our present military policy and have seen how this policy precludes that thorough preparation for war which is possible only by means of large standing armies and trained reserves. It will be apparent to the reader that the national defense relies at present chiefly upon the patriotic willingness of our citizens to prepare themselves partially during peace for volunteer duty in war. We have briefly reviewed some of the principal operations of military field engineering and have indicated the essential differences between military and civil practice.

In what respects are our civil engineers and contractors qualified to meet the military obligations of citizenship, and what may they do under present conditions to increase their efficiency? There is no class of our citizens more intelligent or more patriotic than the engineering profession. But patriotism which finds its sole expression in tear-dimmed eyes and choked throats is of no practical value to the national defense. The highest form of patriotism—the only useful form—is that which recognizes the obligation of citizenship and voluntarily prepares to meet it.

CONTRACTORS VALUABLE MATERIAL

The engineer officer, as we have seen, must be both a soldier and an engineer. If it be necessary for the volunteer candidate to acquire both these qualifications, a considerable period will be required for his proper training and he will not be ready to take the field at the same time as the volunteers of other arms. Our civil engineers and contractors, possessing in advance the technical training in construction, constitute the best material for the supply of engineer officers. Contractors may be of very great help. The hustling American contractor possesses most of the qualifications so necessary in the successful military engineer. He is often in these days a man with technical training, he is always used to outdoor work, he knows how to handle men and is familiar with construction plant, he has initiative and resource—otherwise he would seek a different profession—and he appreciates the importance of speed in construction work. The eye of the military appraiser turns appreciatively upon the contractor, who possesses so many of the qualifications he seeks.

Contractors' foremen, being used to handling men and outdoor construction, will constitute excellent material for non-commissioned officers of engineers—the pioneers of the mobile army. For the rank and file of the volunteer engineer battalion we may find ample material in our great industrial organization. Of all these candidates there is none more valuable than the man who has had experience as a laborer on general contract work. He is usually handy, used to outdoor work and exposure and, to a considerable degree, is disciplined in a military sense. The contractor, his foreman and his gang are of great value as a military asset. Men with some outdoor experience will ordinarily be preferable to those whose careers have been limited to the office.

TRAIN IN TIME OF PEACE

But, however thorough his technical training, however extensive his experience, and however great his natural adaptability and resource, the civilian engineer has very much to learn before he will be qualified to perform his military duties. He must learn his duties as a soldier, acquire a practical knowledge of tactics, and adapt his civil engineering knowledge to military requirements. In most instances he must divest himself of certain preconceived ideas and methods. In view of the very short time that will be allowed for intensive training after the outbreak of war before the volunteer army will be called upon to take its place in the line of battle, it is absolutely essential that some portion of this necessary training be obtained in time of peace, especially in the case of engineers. How may this be accomplished? Assuming the patriotic willingness of the engineering profession to meet the obligations of citizenship, how may they be afforded the opportunity to acquire training?

The first step manifestly is to interest the profession in this important matter of national defense. They must be brought to a realization of what our military policy is, the extent of its reliance upon voluntary service, and how important is the part of the engineer in any scheme of defense that is likely to be adopted by the American people. It is not only necessary to arouse this interest on the part of the profession, but to maintain it, which is equally important and far more difficult. With a great war now going on in Europe there is little difficulty in interesting the people of this country in military affairs. But experience shows that our martial ardor cools very rapidly as the scenes of actual warfare recede into the past.

SUBSIDIZE INSTRUCTION

It will be necessary to devise some system by which those men who are willing to undergo training can be instructed in the duties of military engineering. It is too much to expect of the average civilian engineer that he would pursue a lonely

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THE PROBLEM OF FIELD TRAINING FOR PRACTISING ENGINEERS MIGHT BE ACCOMPLISHED BY AN APPLICATION OF THE BUSINESS MEN'S CAMP EXPERIMENT TRIED AT PLATTSBURG LAST SUMMER course of study on a subject outside of his regular practice, one, moreover, which holds out no promise of financial return. The driving force or incentive to the pursuit of such study would be lacking, and the men would be glad to have some form of compulsion or obligation applied. Moreover, such study would produce little result except under the guidance of professional engineer officers. Moreover, the study should be supplemented by practical training in the field. To produce results, then, it is apparent that this instruction must be subsidized and directed by the War Department. The engineering societies might advantageously act as intermediaries between the government and the individuals, chiefly in the important matter of attendance, though it is not intended to suggest that the instruction be limited to members of such societies.

Several schemes for such instruction suggest themselves. A number of colleges and universities have at present courses of military instruction, and it is possible that the number will be increased in the not distant future. At engineering colleges this military instruction might readily be extended to include a course in practical military engineering, with class-room work, lectures and field instruction. The course would cover the more important duties that have been heretofore outlined. This course would be similar to that now pursued at the U. S. Military Academy, the federal government co-operating with the institution in furnishing instructors and equipment. Such a course would have considerable military value and would certainly be useful also from a purely civil point of view. It could be readily inaugurated and the expense would be inconsiderable in comparison with the benefits. Schools having such departments could afford some of the tactical and technical training which the profession of military engineering demands.

The Plattsburg Camp Idea

The problem of reaching effectively the graduates or practising engineers is more difficult. It might be accomplished by an application of the "business men's camp" experiment, such as was conducted recently at Plattsburg, N. Y., and at other places. The greatest difficulty in the way of success is that of attendance. This, of course, must be entirely voluntary, and is in the hands of the engineers themselves and of their employers. It is probable that many patriotic employers, if they could be made to realize the great need for and importance of such training, would pledge themselves to grant leave with pay to engineers desiring to attend the instruction. It is unfortunately true that under our present military policy we must appeal to and rely largely for success on the patriotic spirit of individual citizens. The burden is thus unequally distributed and must always be unless compulsory service is adopted. The federal, state and municipal governments, which employ large numbers of civilian engineers, might well set a good example in this way by making it possible for their technical employees to attend such instruction camps. If systematic attendance can be secured all other difficulties in the way of reasonable measure of success may be overcome.

To obtain the best results congressional action would probably be necessary. There would be many details to work out, but the scheme holds some promise of success and is at least worth an experiment. The writer is aware that from the point of view of efficiency the scheme has disadvantages in common with all other schemes based on voluntary service. But we must face conditions as we find them and do the best we can under the difficulties that exist. Rational preparedness for defense is necessary for the maintenance of peace and dignity—indeed, for the assurance of our continued national existence. As our former Secretary of War has pointed out, if we wish to avoid compulsory service on the one hand and almost utter defenselessness on the other, our citizens must prove that a voluntary system based on patriotism can be relied upon to insure adequate defense, even if it does not provide the best possible defense.

Field training in military engineering has been developed to a high degree of practical efficiency in the regular army and, under the supervision of officers of the Corps of Engineers, can be readily adapted to the instruction of civilians. The government owns or may obtain the use of tracts of land suitable for the instruction camps in the vicinity of many large cities, such as New York, Chicago, San Francisco, St. Paul, Minneapolis, Kansas City, Washington, etc. The engineers resident in such cities could thus reach the camp at a small expense in time and money. Each camp would be in charge of several regular engineer officers with a detachment of engineer troops and the necessary equipment in the way of instruments, tools and materials.

Field Instruction

The course of instruction should be prepared in advance, and should be varied and progressive to stimulate interest while carefully avoiding unnecessary fatigue. As in the school training, previously referred to, it should be along both tactical and technical lines. The details of camp life and the operations of field engineering are essentially interesting and the course of instruction, if intelligently carried out, would leave with the students the impression of having enjoyed a profitable and pleasant vacation, and this would go far toward insuring their attendance at subsequent sessions. More advanced courses would be prepared for men in attendance at their second or third encampment.

The instruction should properly be extended over several encampments. It would include camping methods, camp administration and sanitation, simple infantry drill and the manual of arms, marches, security measures in camp and on the march, battle exercises, target practice, and instruction in practical military engineering along the lines heretofore discussed. The instruction would include examinations and discussions of previously constructed works, demonstrations by the regular detachment, the actual construction of simple bridges, sections of road, trenches, obstacles, etc., the use of the ponton equipage, demolition and sketching by the students themselves, the solution of simple tactical problems, including, in particular, the selection and organization of a defensive position, the writing of orders, lectures, critiques and discussions.

A very simple course of instruction along these general lines would require several successive encampments. Such a course would not make expert military engineers of the students, but it would afford them a practical conception of military methods, show them how much there is to be learned, and stimulate their interest in military affairs. They would undoubtedly become more valuable as a military asset than perfectly green men having no conception of the nature of military operations.

This field training could advantageously be supplemented by a correspondence course of practical problems in military tactics, map reading, and military engineering, accompanied by a course of reading. Reading alone would be of little value, inasmuch as we obtain no mental training when another does our thinking for us, and even the knowledge acquired is quickly forgotten. It is experience and responsibility that develop judgment, initiative and the power of decision. When a student reads a text book on the art of war the responsibility for the facts alleged and the deductions made rests entirely upon the author. From such works the student temporarily acquires a certain amount of information, but he certainly assumes no mental responsibility and without this he receives no training. When, however, he undertakes the independent solution of a practical problem, whether in the field or at his desk, the responsibility rests upon his shoulders alone and the results he obtains are impressed upon his mind as practical experience. These principles should form the basis of the instruction in the field work and correspondence courses. Reading is indeed of value, but has its greatest value in connection with original and independent effort on the part of the student.

Solution of Practical Problems

The solution of these practical military problems, whether on a map or in the field, constitutes what is known as the applicatory method of military instruction. It is the method which is pursued by all modern armies, being properly regarded as the best substitute possible in time of peace for the actual experiences of war. Without doubt this study is one of the most stimulating and entertaining of mental activities.

The problem as stated sets forth the situation of or circumstances surrounding a certain imaginary body of troops of which the student is assumed to be the supreme or one of the subordinate commanders. The statement covers the position and strength of the friendly troops, the local conditions as to terrain, weather, etc., certain information concerning the enemy, usually more or less incomplete and inexact, the orders and instructions of higher authority, etc. From a careful consideration of all this information the commander shapes his course of action. He first determines his mission or purpose. Often this will be embodied in the orders he has received, but circumstances may arise which compel him to disregard orders which did not contemplate these circumstances. His mission must then be deduced from his knowledge of the situation as a whole and of the wishes or intention of his superior. It may demand a course of action at variance with the orders he has received and it is here that his judgment is called into play.

Having determined his mission, the commander reviews the various courses open to him and comes to a decision on the course which appears to offer the greatest promise of success. This decision will require a rapid, but thorough consideration of all the possibilities of the situation. He next prepares the details of a plan for carrying out his decision and finally embodies this plan in orders to his subordinates. The review or estimate of the situation, the deduction of the true mission, the arrival at a decision, and the preparation of the plan and orders constitute the solution of the problem. These interesting and instructive mental processes will be no innovation in the brain of any thinking man, inasmuch as they are characteristic, not only of military problems, but of all the serious affairs of life.

EXAMINATION FOR COMMISSIONS

Individuals who had received training of this nature in college, or who had attended a certain stipulated number of instruction periods in camp, or both, should be given an opportunity to qualify by suitable examination for a commission in the volunteer engineers. Such a commission might properly carry with it a small allowance to be paid by the federal government. The possibility of obtaining such a commission would have a stimulating effect, especially among the younger men, since, even without a money allowance, it would constitute an honorable distinction. The man who, while pursuing a civil calling, still recognizes the obligations of his citizenship and endeavors, even to a small degree, to fit himself for the discharge of those obligations, is and should be recognized as the best type of practical patriot. Such men are the real patriots on whom alone we can rely with any degree of confidence for the maintenance of the national defense. The writer believes that there are many such men among our engineers and contractors and that the nation would do well to afford them the necessary training, which they are ready to receive.

The educational schemes which have been outlined are to be regarded as tentative only. Their details have not been worked out and they are undoubtedly incomplete and perhaps faulty in many respects. The writer does not urge them as a policy to be adopted. Such a policy must be based on careful study by our governmental and military authorities, assisted by the civil profession. But whatever policy may be adopted for the mobilization of our resources in engineering personnel it will depend for its success on the interest and voluntary co-operation of the civil engineers of America. If, actuated by a spirit of practical patriotism, our engineers desire to prepare themselves to meet the obligations of citizenship in the defense of their country, means can be found to give them a portion of the training of which they are in need.

[*The End.*]

Rock Drilling with Deep Hole Wagon Rigs Shows Speed at Low Cost

Mobility of Outfits and Ability to Sink Three Holes from One Set-Up Make for Economy on Heavy Excavation

By CHARLES A. HIRSCHBERG
Of the Ingersoll-Rand Company, New York

SUFFICIENT time has elapsed since the introduction of the first deep-hole drilling rig about five years ago to determine definitely the fitness of such apparatus for use in rock excavation. An analysis of the uses to which it has been successfully put, and the results accomplished, demonstrate conclusively that such work as the excavation of rock in deep crushed-rock quarries, extensive railroad cuts and canal work is the especial field of the deep-hole drilling rig.

The main problem presented by such work—the rapid breaking up of large areas of rock—is such that the ordinary type of drilling machine mounted on a tripod will not do, for, if the latter is light enough to permit of easy and quick mobility, it is not powerful enough to drill the depth and diameter of holes necessary to rapid and economical excavation in this class of work. If, on the other hand, heavy enough tripod drills are employed, they lack quick mobility and the time consumed and difficulties encountered in this respect make the operation of resetting for each hole slow and expensive.

The deep-hole rig, with its means for traction and ability to drill a number of holes at one setting, at once permits the employment of powerful drilling machines and eliminates a large portion of the dead time of resetting.

An idea of the economy which obtains, in labor alone, with these drilling rigs may be had when it is understood that they will drill from 150 to 250 ft. of large diameter hole per day with a crew of three men. With the tripod method the footage rarely exceeds 70 ft., and is more often as low as 60 ft. It would, therefore, require from three to four tripod drills to accomplish as much work, or from three to four times the labor and, of course, a proportionately greater amount of power.

Large diameter holes permit heavy powder loading, making springing unnecessary. This again means a material saving, as the springing of holes requires extra powder, extra labor, and in a great many cases results in the partial loss of holes, due to their becoming filled with muck in the springing process.

→ 3.—SERIES OF HOLES DRILLED AND PREPARED FOR BLASTING IN KENSICO QUARRY, CATSKILL AQUEDUCT

← 4.—FIFTY-FOOT HOLES DRILLED FOR GROUTING AS A MEANS OF REPAIRING BRIDGE

The progression of drilling with a deep-hole rig is shown in Fig. 1. The drill frame is swung at right angles to the line of progress, the jack-screw set, and a hole drilled. The drill is then raised and swung parallel with the line of progress and another hole drilled. Again the drill is raised and swung at right angles, to the opposite side, and a third hole drilled.

In this manner three holes are put down from each position of the machine, two on a line at right angles, the distance apart depending upon the sweep of the drill frame, and one-half this distance in advance of or behind the others, and on a line midway between them. The drill wagon is then moved forward or back the proper distance and the operations repeated. When the required length has been covered, the drill is moved over and another triple row of holes, paralleling the first, put down, and so on continuously. Blasting is generally begun after sufficient ground has been drilled, while drilling progresses further on.

For successful drilling of deep holes it is necessary to provide a means for freeing the hole of cuttings during drilling operations. For this purpose a water jet is provided which is placed in the hole alongside the drill steel. A pipe about ½ in. in diameter is suspended from the top of the derrick, which can be raised or lowered to suit the position of the drill bit. This pipe is connected by means of rubber hose with either a pump mounted on the top of the drill wagon turntable, the pump suction being connected to any convenient water supply, or to a water pressure line. The amount of water fed into the hole is under the control of the operator.

In operating, the drill runner stands on the turntable, where he has control over

TABLE 1—PROGRESS WITH 15-FOOT FEED WAGON DRILLS ON CALUMET SAG CHANNEL OF CHICAGO DRAINAGE CANAL

	No. of 10-hour shifts	No. of Holes	Total Lineal Feet	Av. per shift
July, 1912	9	173	1,453	161
August, 1912	31	563	4,947	160
September, 1912....	50	1,051	8,512	170
October, 1912......	54	1,052	8,968	166
November, 1912....	49	537	6,197	126
December, 1912. ..	45	442	6,184	137
January, 1913......	47	750	6,809	145
February, 1913....	35	699	5,783	165
March, 1913 (2d lift)	38	643	4,909	129
April, 1913	52	796	10,464	201
May, 1913.........	54	897	10,820	200
June, 1913.........	54.9	1,016	13,287	244
July, 1913.........	50	838	10,679	213
August, 1913......	49.6	980	11,179	225
September, 1913...	52	984	12,170	234
October, 1913......	58.4	1,177	14,293	245
November, 1913....	50	739	10,679	214
December, 1913....	46.8	635	9,058	193
January, 1914......	36.9	533	7,304	200
February, 1914....	..	...	......	...
March, 1914.......	16	219	2,974	185
April, 1914.........	50.5	910	11,629	230
May, 1914..........	52	1,040	12,434	239
June, 1914.........	50.4	973	11,245	223
July, 1914.........	54.8	1,044	12,411	226
August, 1914......	84	1,445	18,219	217
September, 1914....	37	676	7,117	192
November, 1914....	..	...	......	...
December, 1914....	12	12	2,565	211
March, 1915.......	12.6	173	2,422	192
April, 1915........	20.7	343	4,768	230

Average feel per drill per 10-hour day for entire 2½ years = 199.1.

the operation of the drill. The helper tends to the water jet and steel, lowering the pipe with the steel. As soon as a hole is finished a wooden plug is dropped into it, to keep it clear until ready for loading.

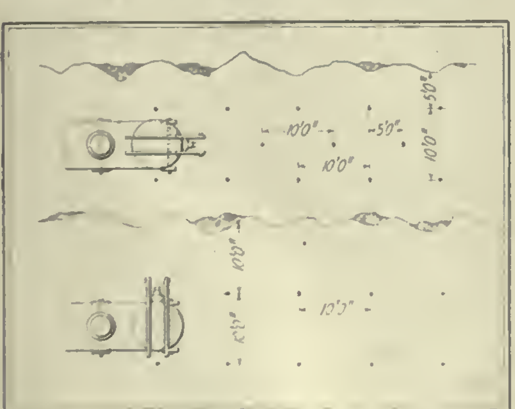
TYPICAL INSTALLATIONS

A few typical installations and records of accomplishment are described in the following.

Picture 2 shows one of sixteen deep hole drill wagons used on the Champlain Barge Canal, working ahead of a Marion steam shovel. The holes drilled averaged 12 ft. in depth and 4 in. in diameter. They were spaced on 5 and 10-ft. centers. Each hole was drilled with one length of steel. The average drill hole footage, per shift, for each drilling rig was between 160 and 200 ft.

On the Calumet Sag Channel of the Chicago Drainage Canal the contractors employed two 15-ft. feed steam wagon drills. The rock encountered in this work was hard Lemont limestone with flint strata. The excavation was made in three lifts, holes averaging 11 ft. 9 in. in depth and 3¼ in. in diameter. Two-inch hexagonal steel with cross-bits was used. The first lift was very much broken; the second and third lifts were solid. Table 1 shows the drilling progress made by the contractors under these conditions.

Another contractor secured the following results with two 20-ft. feed, steam wagon drills. The rock on this contract was hard Lemont limestone with flinty strata and containing horizontal seams filled with a cementaceous mud. In many places the rock was very shattered. The holes averaged 17 ft. in depth and 3½ in. in diameter. Two-inch hexagonal steel with cross-bits was used.



1.—PROGRESSION OF DRILLING WITH A DEEP-HOLE RIG, SHOWING HOW THREE HOLES ARE PUT DOWN FROM ONE SET-UP

The wagon drill employed in the quarry at Valhalla, N. Y., of H. S. Kerbaugh, Inc., contractors for the Kensico dam of the Catskill Aqueduct, was of the electric-air type, taking current from wires strung in the quarry. The holes drilled averaged 50 ft. in depth, bottoming 3 in. in diameter, and 30 ft., bottoming 4½ in. in diameter. Under test conditions 104 ft. of hole was drilled per shift.

It has been estimated that the cost per foot, based upon power and labor charges alone, on an average day's work of 50 ft. of hole (which was very conservative) approximated 14 cents per foot. The extraordinary feature, however, was the power cost. This sometimes ran as low as 30 cents per day and never exceeded 70 cents. Picture 3 shows a series of holes drilled and prepared for blasting in the Kensico quarry. It is surprising to note that the work was done by this type of rig on ground with a decided grade and irregular in contour.

2.—ONE OF SIXTEEN WAGON DRILLS ON CHAMPLAIN BARGE CANAL

Contractors on the United States Government Locks at Sault Ste Marie, Mich., employed four 18-ft. steam wagon drills. The rock drilled was Potsdam sandstone, considerably broken and containing many mud seams. Holes varied in depth from 18 to 27 ft. All holes bottomed 4¼ to 4½ in. in diameter. Cuttings would not mix satisfactorily with water and they were therefore drilled dry and a ⅜-in. jet of air at 100 lb. pressure was used to clean the holes.

Prior to the installation of these four wagon drills, fifty tripod drills were used, but could not keep ahead of the steam shovels. The four wagon drills which displaced them were 1000 ft. ahead of the shovels within three months after installation.

Table 3 gives the record of each traction drill working three shifts during July, 1913. Each drill ran three eight-hour shifts except where indicated.

A drill wagon was put to a rather novel use by Smith & McCormick, contractors, several years ago in repairing a heavy concrete bridge or arch over a tunnel of the Erie Railroad at Bergen Hill, N. J. Holes were drilled varying in depth from not less than 40 to more than 50 ft. in the concrete structure, which was of heterogeneous nature, comprising rough stones, more or less iron and other rubbish compacted with occasional loose or unfilled spaces, and, as a result, presented considerable drilling difficulties.

The purpose of the holes was to permit of pouring cement grouting to solidify the concrete mass, which had developed numerous cracks after completion. Picture 4 shows the rig at work as well as one of the 50-ft. steels employed for drilling.

TABLE 2—PROGRESS WITH 20-FOOT FEED WAGON DRILLS

July 11 to Dec., 1914, and Feb. 22 to Aug. 8, 1915.

1914	Total lin. feet	Av. per shift	Max. shift	Min. shift
Drill No. 1—130 day shifts (10 hr.)......	27,739	213.4	425 ft.	68 ft.
Drill No. 1—49 night shifts (10 hr.)......	7,347	149.9	264 ft.	17 ft.
Drill No. 2—112 day shifts (10 hr.)......	28,174	251.5	425 ft.	85 ft.
Drill No. 2—30 night shifts (10 hr.)......	4,129	137.6	272 ft.	34 ft.
1915				
Drill No. 1—142 day shifts (10 hr.)......	37,658	265.1	475 ft.	64 ft.
Drill No. 2—139 day shifts (10 hr.)......	38,335	275.8	510 ft.	51 ft.

FIVE CHURN DRILLS SUPERSEDED

During last year the Dewey Portland Cement Company of Dewey, Okla., installed a steam wagon drill for work in its cement quarry. Up to that time this drilling had been done with five churn drills, which were displaced.

The first row of holes was drilled within 10 ft. of the quarry face, this distance being sometimes increased to 15 ft. A second row of holes was drilled 10 ft. back of the first row. Holes were spaced 10 ft. apart in the rows. All holes were drilled with a single steel to a depth of 20 ft., bottoming 3½ in. An average drilling progress of ten and sometimes eleven holes per day obtained. In blasting, from thirty to fifty holes were exploded at one time.

The drilling crew consisted of three men receiving the following wages: Main operator $3 and two helpers $2 each per ten-hour day. No accurate record was kept of the coal consumption, but this was estimated to be 1300 lb. per day, costing $3 per ton delivered. Based on the foregoing costs and including the items of maintenance and depreciation, the cost per foot of hole drilled was 7½ cents per foot. This cost compares with 25 cents per foot for the churn drills formerly used.

It was further found that, owing to the ability to place the holes better, blockholing was reduced about 50 per cent.

TABLE 3—ROCK DRILLING AT SAULT STE. MARIE

Date	No. 1	No. 2	No. 3	No. 4
1..............	194	136	120	272
2..............	254	85	200	306
3..............	194	170	200	234
7..............	207	100	126	252
8..............	253	176	136	270
9..............	209	256	187	288
10..............	240	†68	143	198
11..............	*144	*153	*85	108
12..............	†25	..	156	..
14..............	150	194	270	*119
15..............	100	216	154	234
16..............	†25	180	126	171
17..............	*125	216	221	304
18..............	*100	306	264	313
19..............	*125	270	*119	213
21..............	*85	198	187	304
22..............	*156	*108	*95	144
23..............	153	162	160	272
24..............	*136	180	172	240
25..............	121	198	†36	240
26..............	*106	*119	198	352
28..............	*228	†102	126	206
29..............	260	272	198	255
30..............	260	*85	220	204
31..............	*120	*187	†40	*152
Total	3,990	4,136	3,939	5,652
Average per shift	65.4	62.6	58	79.7

*Two shifts.
†One shift.

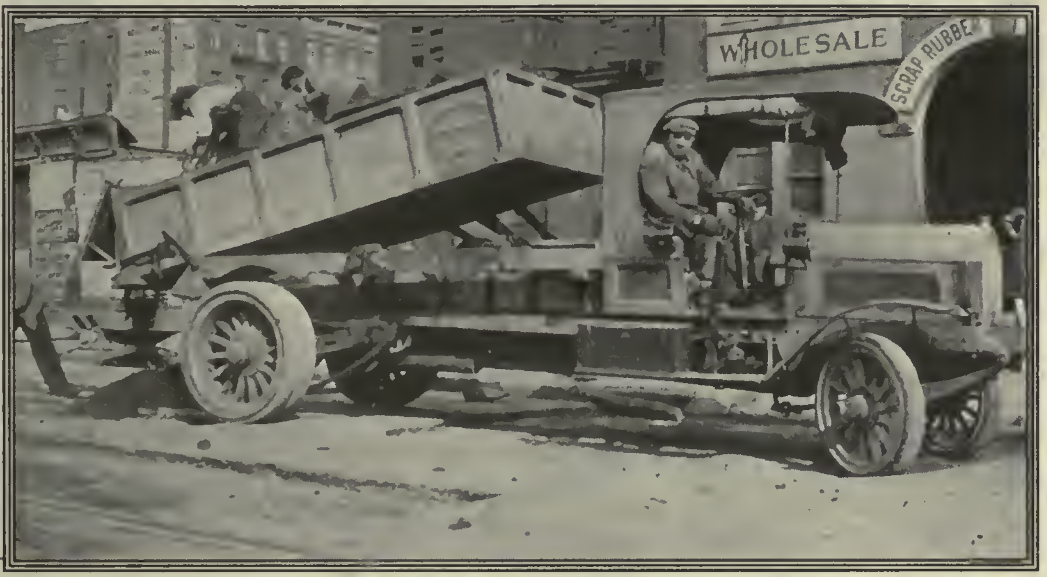
Bronx Borough Makes Its Own Asphalt Repairs—Effects Big Saving

Erects $11,000 Plant and Hauls by Motor Truck—Cost Over One-Third Less Than Lowest Contract Price

THE Borough of the Bronx, New York City, has 2,529,391 sq. yd. of asphalt pavement. Much of it is subject to very heavy traffic and has been laid many years. Up to the last year the borough had been doing its repair work by contract. The best price obtained for surfacing only was $1.32 per square yard. Last season it built an $11,000 asphalt plant by force account and made its own repairs. The cost of repairs, despite the difficulty of locating the right men for the work under civil-service regulations, was reduced to 90 cents per square yard.

ASPHALT PLANT

The plant is located on the Bronx River at a point practically equidistant from the extreme points of the asphalt pavements in the borough. There are two long stretches of road, on upper Broadway and White Plains Road, which are remote, but these are new pavements which will not require any considerable repair work for several years to come.



MATERIALS HAULED BY BACK-DUMPING 5-TON MOTOR TRUCKS

The plant consists of a Cummer semi-portable outfit, housed in a neat, though cheap, frame building inclosed with corrugated sheeting. The building is constructed in such a manner that it can easily be taken apart and moved to another location. There are two units, a melting kettle and a mixing unit, operated by means of a 25-hp. electric motor, direct connected. The motor operates the dryer, two elevators, the mixer and the dust collector. A small 1½-hp. electric motor operates the barrel elevators. The stone dust is brought to the mixing platform by the latter.

A single mixing box, having a capacity of 5 cu. ft., is used in mixing both binder and wearing surface. The plant was guaranteed to produce 65 tons of mixed material in an 8-hr. day, and has more than met this requirement, 70 tons per day having been produced.

The plant force consists of a foreman in charge, a mixer man and a helper, on the mixing platform; a fireman, attending to the fires under the dryer and the asphalt kettle; one general utility man, oiling, assisting in the preparation of tickets, loading coal, wood, cement, etc.; two men at the cold-sand elevator to feed sand and stone to the dryer, and two watchmen.

The mixed paving material is hauled to the street in five horse-drawn bottom-dumping trucks and two 5-ton back-dumping motor trucks. The latter have given very good service, particularly as they are used not only for hauling the hot asphaltic material and the excavated material from the street, but, on occasions, are used for transporting paving blocks, sand, brick, stone, cement, lumber and the various materials used in the maintenance of the sewers and highways of the borough.

For convenience in loading the mixed material, the mixing unit was erected on piers to provide a clearance of 9½ ft. under the mixer slide.

The Bronx River is navigable by barges so that the materials can be brought up by water when convenient.

ASPHALT PLANT HAS NEAT APPEARANCE

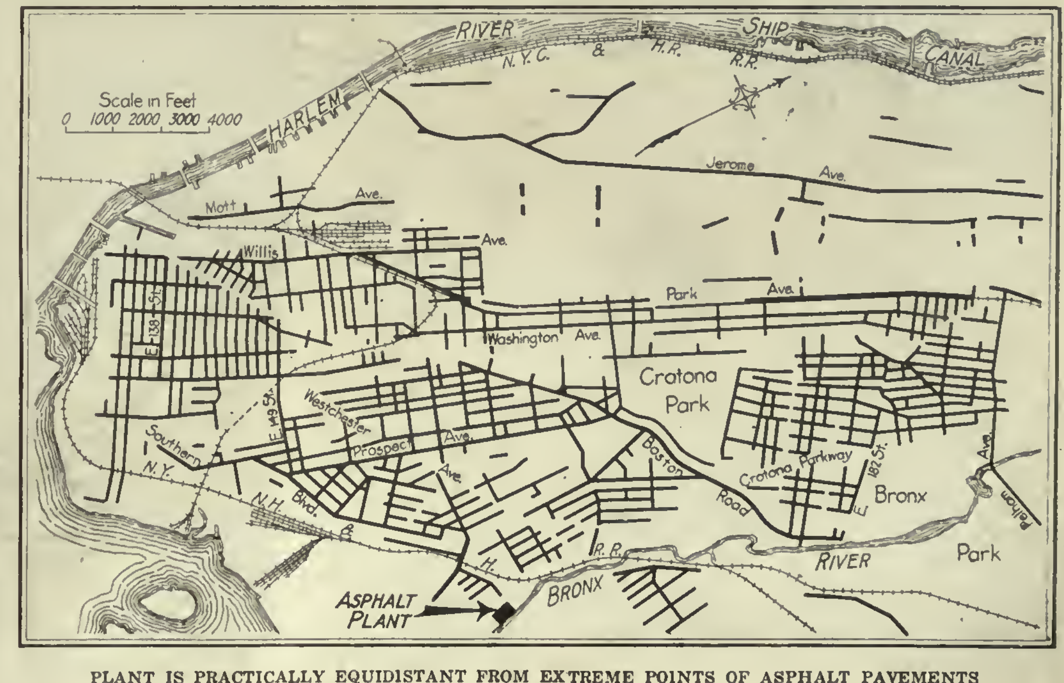
There are two repair gangs, each totaling eighteen men, and consisting of a foreman, steam-roller engineer, roller boy, two rakers, a tamper, a smoother, and nine asphalt workers and two watchmen. They begin on certain routes and work along them until the repairs are finished. There is no jumping from point to point.

The trucks are so regulated as to their working hours that the repair gangs are not kept idle at any time awaiting material. One truck is at the asphalt plant at 6.30 a. m., so that it arrives at the work loaded by the time the men start. This truck returns to the yard early, and does not stay out more than the regular 8-hr. day.

MOTOR TRUCKS USED FOR HAULING

Two 5-ton Mack trucks are used. These back dumpers elevate the load for dumping by their own power. Sometimes both the binder and the top course are transported in the same truck. During the last season 53,400 sq. yd. of surface repairs were made. The cost per square yard, including labor, material, etc., depreciation and interest on plant and trucks, but excluding other overhead, was 90 cents. These other overhead items are not included in the contract figure cited in the first paragraph, so that the costs are incomparable.

The repair work is under the direct supervision of John P. Binzen, engineer of maintenance, highways and sewers, of the borough. John G. Borgstede is commissioner of public works; R. H. Gillespie, chief engineer of sewers and highways, and J. Stewart Wilson, superintendent of highways. The asphalt plant was designed by Mr. Binzen and erected under his direction. by employees of the highway department.



PLANT IS PRACTICALLY EQUIDISTANT FROM EXTREME POINTS OF ASPHALT PAVEMENTS

Success of Society Depends on Service of Every Member

Application for Membership Should Carry with It Not Only Willingness to Give but Actual Co-operation

EDITORIALLY the Engineering Record, on page 437 of the issue of April 1, asked the question: "Why does an engineering society exist?" and gave as the answer that the society exists to render service to its members. Edmund M. Blake, in a paper published in the April *Journal* of the Boston Society of Civil Engineers, asserts that the service of the society to the member will naturally follow if each member is not merely *willing* to give service to the society and the engineering profession in general, but *actually does give* such service. Some of Mr. Blake's conclusions follow:

Society Depends on Its Members

The building up of an engineering society depends upon the correlated service of every member. Application for membership should carry with it not only the willingness to give, but the intention of so doing. Engineers are following the greatest profession in the world, and have adopted it as their life work only after careful thought, deep consideration of all the branches of life's activities, and, usually, a long scientific or practical preparation. If they are not loyal to engineering as a profession they should abandon it at once. If they are loyal to it, then its upbuilding and strengthening should be one of the primary motives of their work.

Represents Co-operative Effort

An engineering society represents a co-operative effort by the engineering profession to consolidate its members into a concrete and unified organization for the upbuilding and strengthening of the profession; for the benefit of personal contact and professional interchange of engineering knowledge, ideas and advice; for the purpose of commanding a broader recognition and a higher valuation of the engineering profession by the public, and for the publication and dissemination of the best in engineering theory, design and practice, and a compilation of data.

The individual member should be instilled with the true spirit of service, with an ambition to contribute toward the accomplishment of these purposes more than his share, and with a very clear realization that his application for membership in the society is not accepted primarily as adding one more wheel unit to the installation, but rather in the nature of additional second-feet of flow to be credited to plant capacity.

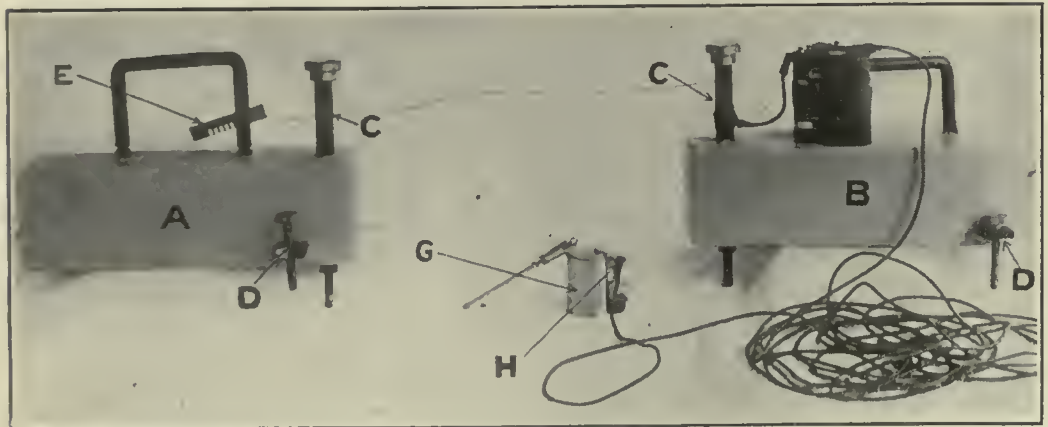
With this conception firmly established in mind the engineer who joins the society will consider of first importance the question of what he can add to the society, and not of what he can get out of the society in return for his annual dues. Service for the society will follow and soon there will be no need of arguing the other side—that of the benefit to be received from membership in the society.

This conception will not foster any false valuation of present personal contributions to the society, but will create an ambition to make the net final contribution represent the maximum individual output, always remembering that the engineering society is one great concrete medium of contribution to the engineering profession.

New Device Measures Wear on Concrete Roads

Instrument Developed by A. T. Goldbeck Makes Possible the Accurate Determination of Changes in Roadway Surfaces

TO obtain definite knowledge of the wear on concrete roads a device has been designed by A. T. Goldbeck, engineer of tests, U. S. Office of Public Roads and Rural Engineering, which will provide a definite and fixed datum from which the wear on concrete road surfaces can be determined accurately from year to year. The instrument, as described by Mr. Goldbeck in the *Journal of Agricultural Research*, consists of a fine wire stretched tightly across the road at a constant height, together with an inside micrometer for measuring the distance from the surface to the wire. Measurements taken 1 ft. apart across the road permit the plotting of its cross-section. If these measurements are repeated at long intervals the change of cross-section, or the decrease in the thickness of the road, will be revealed. The accompanying illustrations show the instrument in detail and its method of application on the road.



BUZZER SOUNDS WHEN CONTACT IS MADE BETWEEN MICROMETER AND WIRE

Details of Apparatus

Pieces *A* and *B* are made of cement mortar and have embedded in them steel rods, *C*, drilled with holes slightly inclined with the horizontal. A fine piano wire about 0.01 of an inch in diameter is passed through these holes, and is stretched across the road from block *A* to block *B*. The tops of the rods are each provided with a disk-level bubble, so that when placed in position they may be adjusted to a vertical position. Block *A*, which is heavier than block *B*, is provided with two adjusting screws, *D*, for adjusting rod *C* to the vertical. Block *B* rests on two points only, one the lower end of rod *C* and the other the end of adjusting screw *D*. Constant tension is produced in the wire by the weight of block *B*, which is pivoted about the bottom of rod *C* and is adjusted to a horizontal position by means of rack *E*, provided at the end of the wire. As the weight of block *B* is constant, the tension in the wire, and consequently the amount of sag for like spans, must remain the same. A definite and fixed datum is thus provided, which should remain constant from year to year, and which is very easily established by merely placing the end blocks of the apparatus in their proper position on the road.

WEAR ON ANY KIND OF ROAD SURFACE MAY BE DETERMINED BY INSTRUMENT

The bottoms of rods *C* are spherical in shape, and, when in use on concrete roads, they rest on the flat tops of bronze plugs cemented in the road surface. These plugs are ½ in. in diameter and are 1¾ in. long. They are set ¾ in. below the surface, and their tops are protected by means of a brass pipe plugged with a bituminous-sand mixture during the long intervals between readings.

Line Marked with Chalk

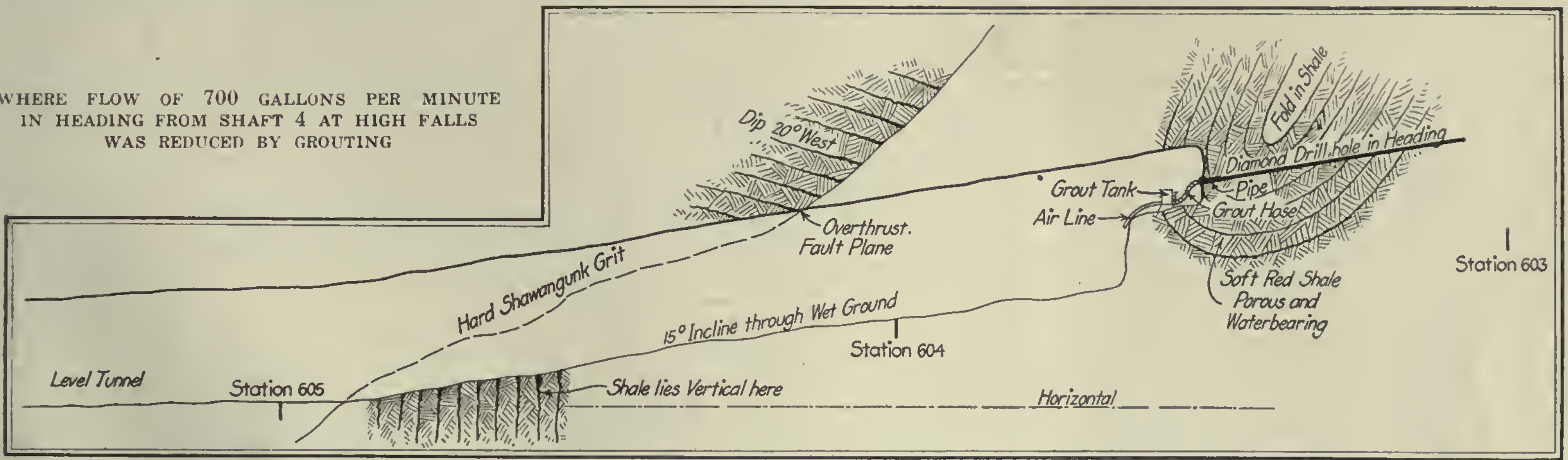
In obtaining the wear measurements a chalk line is first snapped across the road between the bronze plugs, and the points at which it is purposed to take readings are marked on this line. At these points a steel block, *G*, 2 in. in diameter, is placed, in order to avoid measuring the small local inequalities in the road surface. In the top of this block a flat-bottomed cylindrical recess is made, and an ordinary inside micrometer is held in the recess, while its upper end is adjusted to contact with the steel wire stretched across the road. An electric buzzer, *H*, is mounted on the side of this block, and, when contact is made between the micrometer and the wire, an electric circuit is completed through it. Readings may be taken to the nearest 0.001 in., although this degree of accuracy will not be necessary.

Wet Ground Tunneling Facilitated by Grouting in Advance of Heading

Third Article in Series Describing Aids to Progress in Bad Ground and Methods of Filling Cavities Over Arch of Bore

By JAMES F. SANBORN
Division Engineer, Board of Water Supply, New York City

IN the hard rock tunnels of the Catskill aqueduct water was often encountered in the drill holes while driving the heading, coming out under a pressure of 100 lb. to the square inch or more. A wet tunnel is always slower and more expensive to drive than a dry one, as it is more difficult to keep the men working under a wet roof, and the necessity of pumping the water is an additional expense. However, in only two cases on the Catskill aqueduct work was an attempt made to reduce the flow of water in tunneling by the grouting process. In shaft sinking, as described in last week's issue of the Engineering Record, page 549, water is often reduced or entirely stopped by grouting the drill holes, and this process might be used more commonly in tunneling, but for the fact that a tunnel superintendent never likes to stop drilling and shooting to bring in a grouting rig, hoping always that the water will not increase on the next shot. In the cases described the grouting in the heading was not altogether a success in the first instance, but in the second case a flow of about 300 gal. per minute was cut off which would have had to be pumped 1100 ft. up a shaft for a period of a year or more. The grouting in this case resulted in a direct saving to the city in pumping charges of $4000 per month.



WHERE FLOW OF 700 GALLONS PER MINUTE IN HEADING FROM SHAFT 4 AT HIGH FALLS WAS REDUCED BY GROUTING

While driving the heading from shaft 4 of the Rondout siphon in High Falls shale, a flow of 350 gal. per minute was struck while drilling in the heading. Grouting was at first unsuccessful, as the shale was too weak to stand the pressure of 250 lb. per square inch, but on a subsequent attempt about 75 gal. per minute was cut off. Drilling was resumed and two holes tapped water-bearing seams about 14 ft. from the face, yielding a flow of 75 gal. per minute from one hole and 300 gal. from the other. These holes were successfully grouted and reduced the total water pumped from 975 to 600 gal. per minute at the end of the year. Part of the decrease was due to the grouting and part to the reduction in groundwater head. This heading was driven up a 15 per cent grade so that the water ran freely away to the large pumps at the shaft. With the water collected at the heading, it might have paid to grout off the leakage before resuming the driving, but as pumps were in place and the contractor was paid for pumping, less effort was undoubtedly made to shut off leakage by grouting than might have been the case under other conditions. If a bulkhead had been built against the heading to permit the use of the high grouting pressures which the case required, better results would, no doubt, have been secured, as the shale rock was too weak to withstand the grouting pressures.

When the tunnel from the east shaft of the Hudson River siphon had progressed about 300 ft. a slight flow of water issued from the top dry holes. On shooting the cut, a stream of about 180 gal. per minute was struck, and after a few days it increased to 425 gal. per minute. The shaft was flooded and after it was pumped out a 4-in. pipe was placed in the apex of the cut and a concrete bulkhead built around it. The flow at this time was 210 gal. per minute. This line was piped up the shaft to the second pump chamber, and the water, through its own pressure, was raised to an elevation of 800 ft. above the seam at the heading. On resuming drilling in the heading eight pilot holes from 10 to 20 ft. in length were drilled, five of them making water and discharging a maximum of 550 gal. per minute. It was decided to grout the water-bearing seams, as it was the general opinion that water in great quantity would be struck when excavation was resumed. A concrete bulkhead 5 ft. thick, reinforced by rails, was built across the face of the heading, with grout pipes extending through the bulkhead. The grouting was first undertaken, using a Cameron pump and very fine neat grout. After 42 bags of cement had been pumped into the heading the pump valves were so badly worn that the pressure could not be maintained. A pressure of 450 lb. was developed by the pump.

The grout was afterward injected by pumping water into a Canniff grout tank in which the grout was first mixed, forcing the grout into the rock by water pressure. This method was successful and nearly all the water flowing from the drilled holes was shut off. Fully 1000 lb. per square inch water pressure was obtained by the pumps. After the grout had been allowed to set the heading was shot. Several rounds were taken from the heading without any increase of water. The seam was found as anticipated, striking north 60 deg. west and so effectually filled with grout that the water was cut off even after excavating past the seam. The width of the seam varied from ¼ to ½ in. In the roof a small amount of water dripped down, but otherwise there was no leakage.

Upon excavating the bench some days later the seam appeared to be well filled with cement in the bottom. After the bench excavation had progressed 13 ft. beyond the original leaking fissure, one of the bench holes struck a flow of about 110 gal. per minute, but after the bench was shot the flow disappeared. It was supposed that the seam was plugged by the displacement of the rock and the fine debris forced into it.

Grout was used with two principal objects in view—to complete the filling of spaces not filled by the concrete and form a backing against the hydrostatic pressure for the purpose of preventing the rupture of the concrete lining, and also to fill seams in the rock and expansion spaces in the concrete lining to serve the purpose of waterproofing, by preventing the escape of water when the tunnel is in service.

The space over the concrete arch in rock tunnels cannot be completely filled, as the soft concrete packed into the key settles away by gravity, leaving a void as much as 2 or 3 in. high above the concrete arch. Places where the rock breaks high are filled as completely as possible, and afterwards completed by injecting grout in the form of mortar. Experience has shown that this grout is very effective; no voids of considerable size are left. Where dry packing is used in bed ground which requires a support of permanent steel ribs and lagging, grout is injected to fill the spaces between the pieces of rock forming a rubble or cyclopean concrete.

Drains and drip pans placed between the rock and the concrete lining to waterproof the soft concrete against the incoming water from rock seams, is another illustration of that class of cavities of large size where thick mortar grout is used as a backing for the concrete. In this case the water is discharged through weep pipes through the freshly placed concrete to prevent the water, which is frequently under high pressure, from washing and disintegrating the lining before it has set. When it is necessary to shut off this water after the concrete has hardened, grout is injected to fill the drains and pans.

The grouting of large cavities requires the use of 2-in. pipes, through which the grout is injected. They must be carefully placed to lead the grout to the lower part of the cavities. Vent pipes leading from the summits of the cavities are placed during the period of concreting to permit the escape of air and water as the grout is injected. These vents further serve the purpose of telltales to show when the cavity is completely filled with grout.

For filling cavities of large size, sand and cement grout in a mixture of one part of each is used, mixed with a quantity of water just sufficient to produce a grout not too thick to be easily pumped.

Work of grouting large cavities divides itself under two heads. First, grouting dry cavities displacing water; and, second, grouting wet cavities displacing water. When both wet and dry cavities lie in close proximity and are connected, the best results are obtained by grouting the dry cavities first and permitting the grout to set before attempting to fill the wet cavities. If the wet cavities are grouted first, the water ordinarily shifts to some nearby dry cavity, thereby multiplying the number of wet cavities to be grouted.

GROUTING DRY CAVITIES

When considerable stretches of tunnel are to be grouted, the usual method is first to grout the space over the arch and the dry packed stretches, using an air pressure of about 40 lb. to the square inch, and, after this grout has set, to make a second trip through the tunnel to complete the grouting of any spaces over the grout first placed and also to grout all pipes and pans carrying water.

The first, or low pressure grouting, employs thick 1:1 sand grout, while the second, or high-pressure grouting, employs only neat cement grout injected generally under a pressure of 300 lb. to the square inch. Entirely different methods are used in the two processes and a special plant is required in each case.

LOW-PRESSURE GROUTING

In the low-pressure grouting of the Catskill aqueduct tunnels about 90 per cent of all the grout was placed. The procedure was as follows:

A connection was made to a grout pipe at the end of the arch, and batch after batch of grout injected. Water flowed from the grout, and vent pipes ahead, which were closed in turn as soon as grout appeared. Where it was intended to grout again valves were placed on the pipes and these were closed, but in general the flow of grout from the vents was cut off by driving in conical wooden plugs. High-vent pipes, which were to be subsequently opened and regrouted on the second grouting, were closed by driving a wad of oakum back into the far end of the pipe. At the end of the shift the oakum was removed by means of a wormer, or if the pipe was filled, it was drilled or rodded out preparatory to the high-pressure grouting.

It was customary, in grouting the over arch space, to let the grout run ahead from 200 to 300 ft. before moving the grouted connection forward, as it was found that by pushing the grout under pressure it filled the spaces better and made a complete contact with the roof.

In a number of instances the tunnel roof broke very high and vent pipes 15 to 20 ft. long were used, extending into high summits above the roof of the tunnel. Pipes for introducing the grout into such high places were carried only to the top of the concrete and the grout injected through these, as it was found that the sand and cement separated considerably after grouting was done through the high pipes first and allowed to flow down through the dry packing.

SHRINKAGE CRACKS

The concrete lining of the aqueduct tunnels adheres to the rock up to the quarter bends of the arch, bonding to the walls and preventing longitudinal movement which would take place due to changes in temperature of the concrete. In the upper portion of the arch, however, the concrete is not in contact with the rock and at the joint between arches placed in successive days' work a crack invariably appeared, due to temperature changes.

When the space over the arch was grouted these transverse cracks were large enough to permit the flow of grout, and after leaking grout for a time, they are generally filled satisfactorily. It is found extremely important that no water pressure be allowed to accumulate on the soft grout, as the thin layer filling the expansion crack is invariably washed out by an accumulation of ground water pressure before it has had a chance to harden. It was a common experience after the ground water had accumulated to see joints showing a slight seepage at such expansion cracks below the quarter points of the arch where the cracks would show thin where the grout had been unable to fill them, whereas the crack in the crown of the arch, having been completely filled by grout, showed no water. Honeycomb spots on the arch concrete were also completely and satisfactorily filled with grout, so that very few such places were found to leak water even after gages placed on grout pipes through the lining registered a pressure of 100 lb. to the square inch.

WET ARCHES

In the case of considerable leakage from the rock when the tunnel was driven, water entering from the rock was carefully panned and the water led by pipes through the concrete, but it sometimes happened that the panning was not successful or the seams admitting water extended considerably beyond the edges of the pans. In the case of wet arches the method first tried was to grout the dry arches on either side, leaving the grouting of the wet arches for a subsequent operation. It was found better, however, not to attempt to make a separate job of the wet arches, but to grout them continuously with the adjacent section, as experience proved that the grout was more likely to set, since the water from the wet arch followed along with the grout and found its way to vent pipes in adjacent sections. During the process of low-pressure grouting the vent pipes were always left open in order to prevent the accumulation of a head of water on the fresh grout.

ROCK SEAMS

The grouting of rock seams outside of a tunnel lining is, perhaps, the most difficult type of grouting. In the first place, it is hard to drill holes which will give adequate access of the grout to the rock seams. In the drilling operation, even though the hole encounters the crack in the rock which carries the water, the pounding action of the drill is liable to calk the cavity with powdered rock, so that when the grout pressure is applied it will not enter freely. However, a great deal of this work was done with marked success in cutting off leakage into the tunnels and, conversely, in preventing the escape of water from the tunnels in service. The deep-seated pipes from which grouting was to be done were left open during the low-pressure grouting of the tunnel arch and dry packed sections, in order to vent the water and insure proper setting of the low-pressure grout.

High-pressure grouting of the rock seams advanced from one end of the wet section to the other. Usually the holes near the invert were filled first, the pipes in the sidewalls and then in the arch being filled in turn. As a preparation for grouting, connection was made to a deep-seated pipe and the air pressure of 90 lb. to the square inch was turned on in order to force back the water in the rock seams, and also to clear out any rock chips or debris. The application of air also gave an indication of how large a section could be filled from a particular pipe connected, as the adjacent pipes would show pulsation when affected by the air traveling through the rock seams. To get a definite idea of the rock water pressure a gage was attached ahead of the grouting.

THIN GROUT USED

On starting to grout a very thin mixture was used, about ¼ of a bag of cement and a tank full of water. Air pressure was applied, sufficient to inject the grout, and after 50 batches had been injected, if the tank pressure remained low, not over 100 lb. to the square inch, the mixture was thickened by doubling the amount of cement, and the grouting continued. If the pressure required still continued low after injecting another 50 batches, the amount of cement was again increased, and these processes continued until a rise in the air pressure was required to force in the grout, showing that the seams were beginning to fill up. From this time on the consistency of the mix was held constant. The object of the above method was to suit the grout to the size of the seam without prematurely plugging it.

Grouting was continued until the pipe refused grout under a pressure of 300 lb. to the square inch, when the pipe was drained out and closed with a batch of thick grout. It frequently happened that neighboring pipes would show less and less flows of water injected with the grout from the hole where the connection was made; the seams, apparently, were filling for a considerable distance away.

As a rule, there is a chance to inject grout into rock seams, and where the chances are poor, no definite rule can be given. The inward leakage is, in a sense, an index of the amount of grout that can be injected.

For injecting grout into rocks which show a seepage, but no considerable flow of water, three arrangements of grout piping were tried.

1. Drilling in enough deep-seated pipes to collect the water and protect the mortar from washing.
2. Putting in a drip pan with independent additional deep-seated pipes to the rock seams.
3. Using drip pans alone, grouting them with thin grout, then draining the pan and filling it with thick grout to complete the backing.

Experience seemed to indicate that the second method was a little the best, although in most cases the third method gave complete satisfaction in cutting off the water.

The accompanying table gives data bearing on the effectiveness of the concrete lining backed up and made tight by grouting to stop the inward leakage:

How Grouting Stopped Inward Leakage

Tunnel	Length, miles	Depth below water, feet	Inward leakage during excavation, gal. per min.	Inward leakage after lining is completed, gal. per min.
Rondout siphon....	4½	450	3,600	56
Wallkill siphon.....	4½	300	1,100	75
Moodna siphon.....	4½	1,100	2,000	85

GROUTING SHAFT CLOSURES

Many of the construction shafts sunk for driving the Catskill pressure tunnels were sealed for 50 ft. or more above the finished waterway by concreting them solidly against the rock. The volume of these concrete plugs vareid from 450 to 700 cu. yd. and the question arose as to the amount of shrinkage that would take place in such a body of grout during the process of setting. In order to fill any space that might form between the concrete of the rock, horizontal ring pans of sheet tin were placed at frequent intervals against the rock and were completely grouted through pipes, provided for the purpose, after the concrete had set. These grouting pans served a two-fold purpose. First, to collect water seeping from the adjacent rock, thus preventing water from washing channels through the newly placed concrete, and second, to furnish a grouting space for filling any shrinkage crack or honeycombed place that might result. When grouting these pans, it was observed in several cases that air would blow from one pan to another, showing that a connection already existed, which was completely filled by the grouting operation.

At the bottom of almost every shaft there was a shower of water resulting from leaks under the shaft above, and special pains had to be taken to protect the concrete and make provision so that the grouting rings and drains should be effective when grouting was undertaken. In no case has any considerable leakage come through a shaft plug since the aqueduct was put in operation, showing that the grouting was effective.

[*The End.*]

Presents Plan for Development of Canada's Capital

Federal Commission Would Form Separate District for Ottawa and Hull, and Create Imposing Capital City

A REPORT looking to the development of a capital city for Canada befitting the size and importance of the Dominion has just been presented by the Federal Plan Commission, created in 1913 to study the situation. The report recommends the separation of Ottawa and Hull into a separate federal district, and the molding of the two cities into an appropriate governmental seat. The plan sets aside 120 acres for government grounds, in addition to that occupied by the buildings, and other areas for parks and other purposes. The recommendations also embrace streets, bridges, railways and water transportation. These notes are taken from the *Canadian Engineer*, in which is a more extended abstract of the report. Some of the specific recommendations are as follows:

CENTRAL OPEN SPACE

The central area in the city will be a great open space running southward from Chateau Laurier and the Plaza Bridge, and at the same level. Canal, railway and cartage traffic will be on a lower level. The present Grand Trunk station will be enlarged into a Union Station. The present post office will be removed and an imposing one erected facing the Plaza. A new city hall and various law courts and registry offices will also be constructed facing the Plaza.

The land west of the parliament buildings will be used for departments of the government. Here, in time, a second group of buildings will be constructed to harmonize with those on Parliament Hill. These buildings will house the chief governmental activities, but bordering on the east of Major Hill Park and stretching along Sussex Street there will be other buildings less ornamental in character and built for practical utility.

The plan contemplates the devotion of only about 120 acres to government buildings, over and above that actually occupied by the buildings themselves. For this purpose Washington uses about 300 acres; but less land is required at Ottawa, owing to the advantageous position on the high banks of a river.

STREETS

A great thoroughfare connecting the east and west portions of the city will be made of Laurier Avenue, which will be widened to 90 ft.

To provide better connection between the two portions of the business section of Ottawa, a new diagonal street will be constructed which will be carried over the railway and canal by a viaduct. Somerset Street will be widened and developed as a cross-town artery. Numerous other streets and roads will be widened and improved. Street-car congestion will be removed wherever necessary. A street car subway under Sparks Street or Wellington Street is recommended, thus removing the cars from Sparks Street, which is narrow and will be greatly congested. Considerable highway construction is recommended.

It is recommended that trunk arteries be laid down immediately in proper location, so that outlying areas will be built up to conform properly with them. The present park system is to be improved and other park areas acquired.

BRIDGES

Five new bridges will be built across the Rideau River and also five across the Rideau Canal. Four new bridges are recommended for construction across Brewery Creek and the Gatineau River. It is proposed to park the banks of Brewery Creek, the Gatineau River and the Ottawa River, interfering as little as possible with existing industries.

Three bridges for the Ottawa River are included in the plan; one being at Little Chaudiere Falls; another, of monumental character, to connect Ottawa with the municipal center of Hull; and a third just below the mouth of the Gatineau River. The commission says that the bridge leading from the municipal center of Hull should be a high-level bridge, and that it would be desirable to provide two levels, one for transportation and one for general traffic, although this bridge is now shown on the plan as having but one level. The present traffic conditions surrounding Victoria Bridge, say the commissioners, suggest this high-level bridge as an improvement for the near future.

A tunnel will be built under the city, connecting the railway entrances from east and west, and all trains will operate through this tunnel. Two general freight areas, one at the east and one at the west side, with necessary depots, are recommended. Industry will be segregated into certain areas, and the height of buildings will be controlled, in order to insure the government buildings being the dominating groups.

The overflow from the Rideau River will be controlled by the removal from the river channel of the old wooden piers and loose stone, the removal from the river bed of boulders, the dredging of channels through the shoals, the raising of the Minton Bridge, the opening of a channel through the embankment of the Canadian Pacific bridge, and the widening of the channel past Maple Island.

It is recommended that the government acquire as a national park upward of 100,000 acres to the north of Ottawa.

RAILWAYS AND WATERWAYS

The report includes a comprehensive study of the local railway situation, and recommends that the railways within the district be placed under the control of the governing body of the federal district. Electrification of the unified system is suggested, with terminal operation and control, the district to acquire by purchase or agreement all trackage and terminals within its territory. Grade separation, requirements for expansion, obstacles placed in the way of growth by present railway situation, present traffic facilities and operation, growth of traffic, future freight-handling systems, and numerous other topics also are discussed in the report.

Specific recommendations are made for water terminals and for the development of the waterfront for commercial purposes wherever possible, care being taken that no real sacrifice will result to existing business interests.

Recommendations are made that the canal be retained in its present location; that the clearance for fixed bridges be established at 12 ft. instead of 30 ft., as at present; that the canal be developed to afford recreational facilities; that no more industrial developments be permitted to take place along the banks of the canal between the Rideau River and the Ottawa River; and that as soon as possible such industries as now exist along this stretch of the canal be removed to other locations.

The members of the Federal Plan Commission are Sir Herbert Holt, chairman; Sir Alexander Lacoste, K. C. Montreal; Frank Darling, Toronto; R. Home Smith, Toronto; and the mayors of Ottawa and Hull. The commission was created by an order-in-council Sept. 12, 1913, it being provided that the government should pay half of the cost of the plan, and that the other half should be paid by the two cities, according to population, the municipal authorities having expressed their desire to co-operate with the government in the work. E. H. Bennett acted as consultant on city planning and E. L. Cousins as consulting engineer.

Tests of Hollow-Tile, Flat-Arch Floor Slabs Show Effects of Concentrated Loads

Table of Safe Loads Compares Test Results with Present Practice—Tie-Rod Stresses Measured—Empirical Formula Proposed

By CLYDE T. MORRIS
Professor of Structural Engineering, Ohio State University, Columbus

TESTS of hollow-tile, flat-arch floor slabs for the purpose of finding both the ultimate strength and the width of distribution of concentrated loads, and for determining the actual stresses in the steel tie rods, have been made during the last few years at the civil engineering laboratory of the Ohio State University. The results of these tests of thirty-five arch slabs appear to show a distribution of the concentrated load to the two middle rows of tile only, leading to the conclusion that it is not safe to consider more than two 12-in. rows of tile as supporting a load concentrated on one square foot. A comparison is made between the results of these tests, using an empirical formula based upon them, and the values in tables of safe loads often adopted in practice. The measured tie-rod stresses seem to warrant the conclusion that an effective depth of ⅞ the depth of the tile would be a perfectly safe assumption in the design of tie rods.

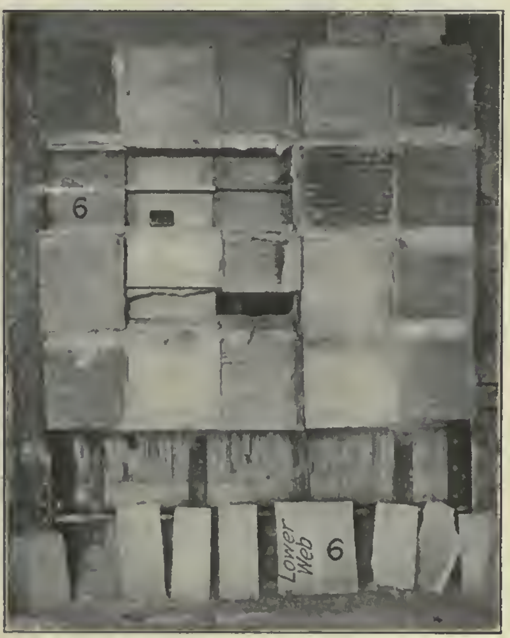
Tables of Safe Loads Used

Hollow-tile flat-arch construction is widely used for floors of fireproof buildings, yet methods of computing stresses in such floors have never been satisfactorily developed, and the design of these floors at present depends almost entirely on tables of safe loads published in various handbooks. Practically all of these tables have as a basis tests made and published by the National Fire Proofing Company. The loads are always given in pounds per square foot uniformly distributed, and practically no information is available concerning the action of these floors under concentrated loads. Probably the severest test to which such floors are subjected in practice is the passage over them of such heavy loads as office safes and trucks carrying heavy machinery. Most specifications for buildings require, in addition to safety for a certain load per square foot, that the floor must be safe for a given concentrated load on a limited area.

CONCENTRATED LOAD APPLIED AT CENTER OF SLAB THROUGH SAND BOX

The reduction of a concentrated load to a uniform load per linear foot which will give the same center moment as the concentrated load is a simple matter. But in a floor of indefinite width, which is the common case confronting the designing engineer, what width of floor may be considered as effective in carrying a concentrated load? So far as the writer has been able to find, the answer to this question is not available.

Another problem confronting the designer is the proper size and spacing of the tie rods in tile arch floors. These are usually spaced by some rule of thumb rather than by any calculation of the stresses which they have to carry. It is often assumed that the interior panels need few or no tie rods, on the theory that the thrusts of the adjoining arches balance each other. Other designers put the same number of tie rods in the interior panels as in the exterior. As far as the writer knows, no tests have been published in which the stresses in the tie rods were measured.



LOWER SIDE OF SLAB 9 AFTER FAILURE

The series of tests on tile arch floors here described was started in the Department of Civil Engineering at the Ohio State University as thesis work, under the direction of the writer, for the purpose of investigating these problems.

Methods of Testing

Two 12-in. steel I-beams were used as floorbeams, between which the arches were placed for testing. The arches were built on the floor between planks as shown in one of the photographs, with the tie rods in place. They were laid up with 1:3 mortar, to which was added hydrated lime of an amount equal to 20 per cent of the cement. The arches were covered with cement sacks and kept wet for several days, and tested at an average age of 7 days. Most of the arches were laid up with the tiles end to end, but a few combination slabs with side construction keys and skewbacks were tested.

The day before the arch was to be tested the planks were removed and the I-beams slipped on in their place, care being taken not to disturb the rods or to break the bond between the rows of blocks. The ends of the arches were bedded in mortar on the I-beams, the nuts on the tie rods tightened up and the whole allowed to stand twenty-four hours before testing. This gave an even bearing of the tile on the beams.

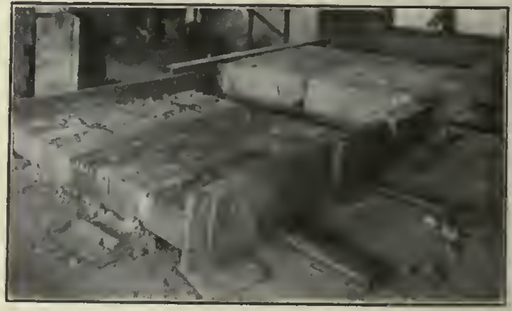
Concentrated Load Applied

In all thirty-five slabs were made and tested. The load in each case was applied over an area of one square foot at the center of the slab. This was accomplished by filling with sand a bottomless box 12 in. square and 6 in. deep and applying the load through a plunger 11 in. square resting on the sand. The plunger was loaded by means of an I-beam lever and a screw jack resting on the weighing table of a testing machine. Deflection readings were taken, and the character of the failure was noted in each case. In the last twelve arches tested the deformations of the tie rods were observed by means of a Berry strain gage.

Table 1 gives a summary of the results of all the tests. All slabs were four 12-in. tiles wide except in tests Nos. 2 (six tiles wide), 22 (two tiles wide) and 23 (one tile wide). The addition of the mortar joints makes the total width of the slab in feet a little more than the number of tiles.

Analysis of Results of Tests

All of the arches tested failed by the crushing of the blocks of the two middle rows. These were crushed on top at the middle and on the bottom at the skewbacks. In many cases the vertical webs were crushed along diagonal lines between these points. In only thirteen out of the thirty-five arch slabs tested was there any evidence of injury to any of the tiles outside of the two middle rows. A comparison of the tests of the one, two and four-row slabs, and a consideration of the manner of failure above described, would lead to the conclusion that it is not safe to consider more than two rows of tile as supporting a load concentrated on one square foot.



HOLLOW-TILE SLABS FOR TESTING

The average load at which the first crack appeared was 30 per cent of the ultimate, and the least load showing a crack in any test was 16.4 per cent of the ultimate. This would indicate that the factor of safety of 7 used in the National Fire Proofing Company's tables is well chosen and could not safely be reduced.

The tile in the arch fails in the same manner as the concrete in a simple reinforced-concrete beam, and therefore the resisting moment for a given depth of arch should be constant. More tests are desirable along this line to establish this assumption. Table 1 gives the bending moments computed from the ultimate loads on the assumption of simple beam action, and average moments with a factor of safety of 7. The concentrated load was assumed to be distributed over two 12-in. tile rows only.

TABLE 1—SUMMARY OF RESULTS OF ALL TESTS

Test No.	Type	Span Ft.	Span In.	Ult. Load, Lb.	Max. Defl, In.	Max. Tie-rod Stress	Mom. in Ft. Lb. Per Ft. Width: Conc. Load	Dead Load	Total	Mom./7
					6-Inch Slabs					
1	End	4	0	4,625	0.842		2,312	45	2,357	
2	End	4	0	4,600	0.861		2,300	45	2,345	
8	End	5	0	3,000	0.370		1,875	70	1,945	
24	End	4	1	5,400	0.66	9,840	2,755	46	2,801	
25	End	5	1	3,900	0.42	8,400	2,478	72	2,550	
							Av. for 6 in.,		2,400	343
					8-Inch Slabs					
3	End	4	0	6,540	0.470		3,270	53	3,323	
4	Comb.	4	0	4,060	0.160		2,030	53	2,083	
7	Comb.	4	4	5,700	0.446		3.088	63	3,151	
9	End	5	0	5,800	0.808		3,625	83	3,708	
12	Comb.	5	4	7,000	0.340		4,667	94	4,761	
15	End	6	0	5.020	0.549		3,765	120	3,885	
18	Comb.	6	4	4,740	0.596		3,752	133	3,885	
26	End	4	0	7,500	0.24	6,000	3,750	53	3,803	
27	End	5	1	7,000	0.29	12,320	4,448	86	4,534	
28	End	6	1	6,750	0.84	16,000	5,132	123	5,255	
							Av. for 8 in.,		3,839	548
					10-Inch Slabs					
5	End	4	0	8,640	0.348		4,320	62	4,382	
6	Comb.	4	4	9,600	0.306		5,200	73	5,273	
10	End	5	0	8,200	0.560		5,125	97	5,222	
13	Comb.	5	4	10,760	0.696		7,173	110	7,283	
16	End	6	0	9,600	0.778		7,200	139	7,339	
19	Comb.	6	4	8,530	0.478		6,753	155	6,908	
21	End	7	0	9,840	0.405		8,610	190	8,800	
22	Comb.	5	4	10,700			7,133	110	7,243	
29	End	4	0	7,000	0.27	4.040	3,500	62	3,562	
30	End	4	10	7,500	0.65	8,000	4,531	90	4,621	
31	End	6	0½	10,950	0.52	10,200	8,270	141	8,411	
32	End	7	0	10,400	0.33	10,000	9,100	190	9,290	
							Av. for 10 in.,		6,528	932
					12-Inch Slabs					
11	End	5	0	9,590	0.267		5,993	110	6,103	
14	Comb.	5	4	12,430	0.762		8,287	125	8,412	
17	End	6	0	14,740	0.584		11,055	159	11,214	
20	Comb.	6	4	12,770	0.605		10,110	177	10,287	
33	End	4	10	10,300	0.50	7,920	6,233	103	6,325	
34	End	5	11	11,300	1.20	22,800	8,357	154	8,511	
35	End	6	11½	7,300	0.79	9,360	6,350	215	6,565	
							Av. for 12-in.,		8,202	1,172

TABLE 2—SAFE LOADS UNIFORMLY DISTRIBUTED IN POUNDS PER SQUARE FOOT
FACTOR OF SAFETY 7

Span ft.	Span in.	6-in. arch Eq.1	6-in. arch N.F.P. Co.	8-in. arch Eq.1	8-in. arch N.F.P. Co.	10-in. arch Eq.1	10-in. arch N.F.P. Co.	12-in. arch Eq.1	12-in. arch N.F.P. Co.
3	0	320	482	569	767	889	1,114	1,280	1,524
3	6	235	354	418	563	654	819	940	1,120
4	0	180	271	320	431	500	627	720	857
4	6	142	214	253	341	395	495	569	677
5	0	115	173	205	276	320	401	461	543
5	6	...	...	170	228	265	331	380	453
6	0	...	...	142	191	222	278	320	381
7	0	...	...	...	...	163	204	235	280

TABLE 3—MEASURED AND COMPUTED THRUSTS PER FOOT OF WIDTH

Test No.	Depth, in.	Span, ft.	Span, in.	Total load	Moment per foot	Stress in tie rods per foot	Calculated stress per foot	Per cent of calculated
24	6	4	1	5,400	2,755	4,920	6,290	
25	6	5	1	3,900	2,478	4,200	5,660	
		Average for 6 in......				4,560	5,975	76
26	8	4	0	7,500	3,750	3,000	6,430	
27	8	5	1	7,000	4,448	6,160	7,620	
28	8	6	1	6,750	5,130	8,000	8,800	
		Average for 8 in......				5,720	7,617	75
29	10	4	0	7,000	3,500	2,020	3,360	
30	10	4	10	7,500	4,531	4,000	4,350	
31	10	6	0½	10,950	8,270	5,100	7,940	
32	10	7	0	10,400	9,100	5,000	8,730	
		Average for 10 in.....				4,030	6,095	66
33	12	4	10	10,300	6,223	3,960	7,110	
34	12	5	11	11,300	8,357	11,400	9,550	
35	12	6	11½	7,300	6,350	4,680	7,250	
		Average for 12 in.....				6,680	7,970	84

As a basis for an empirical formula we may use the equation for the fiber unit stress f in a solid rectangular beam,

$$f = 6M/bd^2 \qquad (1)$$

in which M is bending moment in inch-pounds; b is width in inches, and d depth in inches. This formula assumes a solid cross-section, and of course the actual maximum fiber stress in the tile would be many times that given by the formula on account of the openings in the tile.

Using the moments with the factor of safety of 7 given in Table 1, we get from this formula fiber stresses agreeing very closely for the different depths of arch and averaging about 53 lb. per square inch. From these tests the use of equation 1 with an allowable unit stress of from 50 to 60 lb. per square inch would seem to be justified. Table 2 gives safe uniform loads for several spans and depths, figured by equation 1, with $f = 60$, and in adjacent columns are given the safe loads from the tables of the National Fire Proofing Company.

In the tests made no concrete was placed on top of the arches. If one or two inches of concrete were used on top of the tile, as is the common practice in construction, there is no doubt that the strength of the floor would be considerably increased. On the other hand, the test arches were rather carefully made and would certainly average better than many floors laid by common labor in practice. Tile is a fragile material, and unless extreme care is exercised by the inspector, cracked and broken blocks are liable to be covered up in the work and not detected, so that it would seem advisable in this type of construction to use a liberal factor of safety.

COMPARISON OF SAFE LOADS

A comparison of the figures in Table 2 indicates that the safe loads given by the National Fire Proofing Company's table have a factor of safety of from 4.6 to 5.9, figured on the basis of the ultimate strengths shown in these tests and the assumed distribution of the concentrated load to two rows of tile.

It will be noted that in collecting the results of these tests no distinction has been made between end construction arches and combination; that is, arches with side construction keys and skewbacks. These tests indicate that one type is as strong as the other.

STRESSES IN TIE RODS

In the arches in which the tie-rod deformations were measured only two rods were used. The arches were all of four rows and the rods were spaced 25¼ in. apart, thus coming in the mortar joints on either side of the two middle rows of tile. The rods were ¾ in. in diameter and were made long enough to project about 2 ft. beyond the floorbeam on one end. A piece of gaspipe about 18 in. long was used as a washer on this end of each rod to transfer the thrust, as shown in one of the photographs. Each gaspipe had two holes drilled in one side large enough to admit the points of the strain gage. Thus the elongations of the rods were measured directly.

For these tests the floorbeams were set on other steel beams so that they would be free to move apart, held only by the tension in the rods and the friction on the bearings. The resulting tie-rod stresses given in Table 1 are the sums of the stresses in the two rods, or the total thrusts of the arches. As in the arch calculations previously given, the thrusts are assumed to be due to only two rows of tile.

Table 3 gives the measured thrusts per foot of width at the ultimate load and the corresponding thrusts computed from the bending moments by dividing by ⅞ of the depth as the effective depth. The measured thrusts average about 75 per cent of the calculated thrusts figured on this basis. The difference is probably due to bond between the mortar and the rods, which causes them to act like reinforcing rods in a concrete beam. Several authorities recommend the use of an effective depth 2.4 in. less than the depth of the tile in all cases. From these tests this amount of reduction is apparently unwarranted, and an effective depth of ⅞ the depth of the tile would seem to be perfectly safe. More tests along this line are greatly needed.

The work was carried on during the school year 1911-12 by R. C. Kempton and H. H. Nussmeyer and during the school year 1913-14 by H. J. Kohn and C. F. W. Schaufele. The tile for the tests was furnished by the National Fire Proofing Company.

Coating for Blueprint Paper Can Be Produced by Simple Method

As a result of the great increase in price of potassium-ferri-cyanide, which is extensively used as a coating material for blueprint paper, an economical method of preparing it has been devised by the Bureau of Chemistry of the U. S. Department of Agriculture. Before the beginning of the war this material could be obtained for 55 cents a pound. It now sells for $6 a pound, and it is exceedingly difficult to obtain in this country even at that price.

Potassium-ferri-cyanide can be produced by oxydizing a solution of potassium-ferrocyanide with chlorine gas. At the same time a small amount of potassium chloride is produced which, however, does not interfere with the color and the durability of the prints. It is unnecessary, therefore, to separate the potassium chloride by crystallizing the potassium-ferri-cyanide provided that the latter is to be used on the spot and soon after it is prepared.

A simple apparatus has been devised by the Bureau of Chemistry for preparing potassium-ferri-cyanide solution in this way. At the prevailing prices of materials, the solution can be made by this process at the cost of approximately $2.80 per pound, calculated on the dry salt basis. At the prices which prevailed before the war, which may be regarded as normal, the cost would be approximately 35 cents per pound.

Short Highway Courses Attract Practical Men and Serve Useful Purpose

Consensus of Opinion of Those Holding Courses and of Those Who Attended Indicates That They Make for Good Road Building

BELIEVING that there is a growing interest in the short courses in highway engineering being offered by a number of universities this journal has made inquiries as to the degree of usefulness they had attained. The consensus of opinion is such as would indicate that the courses serve a very useful purpose, that they attract all classes of men interested in road work—engineers, contractors, supervisors, material men and even the general public—and that those who attend feel that the time they have devoted to them has been profitably spent.

Sessions at Local Points

The course at the University of Illinois attracted and held the attention of contractors, who continued throughout the greater part of the two weeks. County superintendents of highways constituted the greater part of the attendance, but there were many others who appreciated the opportunity of getting together and freshening their knowledge of recent methods. F. H. Newell, head of the department of civil engineering, is of the opinion that there can be no doubt that the courses are advantageous and should be continued, not only as annual meetings, but with intermediate sessions at local points or correspondence in the nature of the popular correspondence courses in other subjects.

Ohio State University held no short course in highway engineering during the past year, due to an oversight in making the budget. It has held courses in the past which, according to E. T. Coddington, acting dean of the college of engineering, were found quite satisfactory. These courses were attended by all types of men engaged in road work, the contractors and so-styled practical men being well represented.

Courses Appreciated

Cornell University holds a one-week course. This year's was the second. On each occasion men from the state highway department, contractors, road material men, county and town commissioners and state engineers attended. E. E. Haskell, dean of the college of engineering, is of the opinion that much good can be done by getting all the people interested together at least once a year for the purpose of hearing excellent papers and drawing out discussion, on important matters. Since the close of the school he has received numerous letters from men who were in attendance, expressing their appreciation of the efforts made and hoping they would continue.

The Maryland Agricultural College has given two five-day courses. At the first those in attendance represented all types, from men interested in roads in a general way to those actually doing road work. At the second there was a material change in the class, there being a large proportion of contractors and others keenly interested in road work. As far as its power of attraction for road superintendents is concerned the course has not been a success. T. H. Taliaferro, professor of engineering, believes this is largely due to the difficulty of impressing on the men the necessity of getting in closer touch with road work. The county engineers have manifested an interest in the courses, and a greater number of them attended the second than did the first. Professor Taliaferro is of the opinion that to produce the best results from the type of course given at his college it will be necessary to reduce it to a lesser number of days and make it much more intensive if possible. He also has under consideration the question of giving short courses in the different sections of the state with the hope of increasing the interest in them.

The University of Michigan has given a one-week short course for the past two years. At the first the attendance was between 130 and 140 and, at the second, just over 200. Every man in attendance was directly engaged in highway engineering work. No attempt was made to secure the attendance of men who were interested especially in city paving, and no lectures have been given at either of the courses by anyone directly or indirectly connected with any paving company, manufacturer of any materials, or the manufacture of machinery.

Friendly Relations Established

Of the course given at the University of Michigan, Thomas H. Noble, chairman of the Gross Ile (Mich.) Road Commission, a body appointed by the township board, which serves without salary and pays its own expenses, says, in part: "The school of instruction as given at the University of Michigan is decidedly popular in its character, conducted by Michigan men for the benefit of Michigan men and dealing with Michigan conditions. The embarrassment, which often prevents free and open discussion in meetings of this kind, is quickly dissipated by the atmosphere of free-masonry which is encouraged by the university, with the result that the best ideas of a very earnest and hard-headed body of road builders are exploited for the benefit of all."

Mr. Noble expressed the hope that the short course at the university will become a permanent institution. "Although still young in its influence," he declares, "it has already been the means of establishing confidential relations between the university and every community in the state which is interested in road improvement."

The attendance at the meetings has been liberal and characterized by enthusiasm and earnestness and the representation from remote sections was especially notable. Friendly relations through its influence have been established among officials in every sphere at the road building fraternity, which have stimulated a correspondence throughout the year that has helped to solve many important problems.

Subjects Dealt With in Courses

The courses in general cover a wide variety of subjects. Financing is dealt with, as are road economics, maintenance problems, materials in the respective states and in general, design, preparation of plans, surveys, drainage, oiling, surface treatments, road building machinery and tools, and many other subjects. Among the speakers are numbered faculty officers, state highway officials, manufacturers, government road engineers, government chemists and others.

Reconstruction Needed on New York Highway Bridges

At Present Rate of Construction Many Years Would Be Required to Bring Them Up to 15-Ton Standard

THE marked increase in the weight of the individual loads passing over New York state highway bridges during the past 15 years has by far outstripped the provisions made to accommodate it. As noted on page 742 of the December 11, 1915, issue of the Engineering Record, less than one-third of the total number of highway bridges in the state are capable of sustaining a load of more than 8 tons. The reconstruction necessary to bring them up to the 15-ton standard required by present-day conditions would cost $30,000,000, according to data furnished by George A. Ricker, formerly first deputy commissioner of highways of the state. At the rate of construction during the years from 1911 to 1914 it would take from 17 to 74 years to attain that end.

Legislation Committee

The legislation committee to investigate highway bridge conditions, the appointment of which was noted in the previous article mentioned above, has collected much valuable information relating to bridge and highway work, through correspondence conducted by its secretary, and has compiled data in regard to the bridge and highway laws of nineteen other states where the improvement of roads has been in progress for a number of years. Charles O. Pratt, chairman of the committee, has made a 500-mile inspection trip over a route that was selected as being typical of the same number of miles in any other part of the state. Two hundred and eighteen bridges were examined and reported upon. The findings substantiate the original conclusions in regard to the general conditions of New York State's highway bridges, and urge the need of new legislation at an early date to make possible the standardization of such construction.

At present there is no guarantee of security to the traveling public because of the absence of any general competent supervision. That the matter is of great importance is made evident by the constantly increasing number of claims against the state for damages in connection with the failure of bridges. There are now before the Court of Claims more than 100 cases involving an aggregate sum of $1,000,000. The failure of one bridge alone when a motor bus dropped through into a canal and 23 persons were injured has resulted in claims for nearly $200,000.

State Universities Add Courses in Lumber Study to Their Curriculum

Twelve State Universities have in the past year added college courses in lumber and its uses to their college curriculums. These schools are Syracuse University, and the following state universities: Maine, Wisconsin, Minnesota, Idaho, Washington, Oregon, California, Colorado, Georgia, Iowa, Pennsylvania and Massachusetts.

Work Already Done to Adapt New York Highway Bridges to Present-Day Demands

OLD BRIDGE OVER NORMAN'S KILL AT NORMANSVILLE

NEW STRUCTURE BUILT TO REPLACE OLD NORMANSVILLE BRIDGE

CONCRETE ARCH CONSTRUCTED TO REPLACE IRON BRIDGE AT LE ROY

OLD SINGLE SPAN BRIDGE AT POMFRET REPLACED IN 1914

NEW CONCRETE STRUCTURE AT POMFRET HAS TWO 35½ FOOT SPANS

CUT-OFF AND CONCRETE ARCH REPLACED OLD BRIDGE AT LUZERN

Letters to the Editor

Comment on matters of interest to engineers and contractors will be welcomed

Shall the American Society of Civil Engineers Move Its Headquarters?

SIR: Article 1, Section 3 of the constitution of the American Society of Civil Engineers says: "Its objects shall be the advancement of engineering knowledge and the maintenance of a high professional standard among its members."

Article 6, Section 2, states, among other things: "The board of direction *shall manage the affairs* of the society, in conformity to the laws under which the society is organized and the provisions of the constitution. It *shall direct the investment and care of the funds of the society*, make appropriations for specific purposes * * * and *generally direct its business.*" (The italics are my own.)

In view of the fact that probably not more than 2 per cent of the membership of nearly 8,000 care, particularly, where or how the society is housed, provided it accomplishes the purposes set forth in Article 1, Section 3, of its constitution, and the further fact that probably not to exceed 20 per cent of the membership have ever seen, or expect to see, the society headquarters, would it not be better to cease this unseemly controversy which, to a great majority of the membership, seems purely academic, and which bids fair to become the subject of heated contention, and place the whole matter where it properly and legally belongs—in the hands of the board of direction?

W. G. STONE.

Utica, N. Y.

SIR: With reference to the proposed removal of the headquarters of the American Society of Civil Engineers to the Engineering Building on Thirty-ninth Street, I beg leave to say that I am heartily in favor of the project.

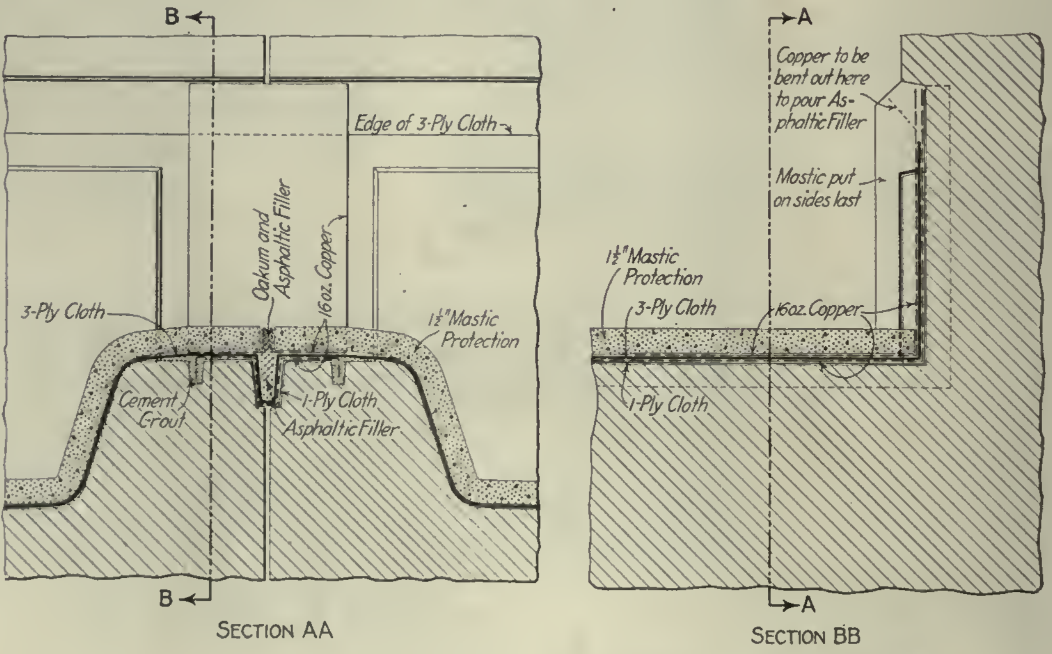
My reason is that I believe in the fullest possible co-operation between engineers of all classes and in maintaining the closest possible touch between them. We form one profession and in order to have the greatest influence in affairs we should be recognized as one profession, and we should pull together and co-operate as far as possible. There is no doubt in my mind that these results can be better secured if the four national engineering societies are housed together in one building, in which other societies may also be accommodated, and which will be recognized as the engineering headquarters of this country. Not only will this plan secure a better and more economical utilization of rooms not often needed by one society, but it will bring about large savings in the conduct of the library, and increase its scope, avoiding duplication and making it the great engineering library of the country, if not of the world. I believe also that the dignity and standing of the engineering profession as a whole will be increased if there is one engineering building which can be pointed to as the center and headquarters of the entire engineering profession. Moreover, the location on Thirty-ninth Street is more convenient from a business and transportation point of view than our present location.

I can see no disadvantages in the plan sufficient to offset these advantages, and in fact I can see no disadvantages whatever. The American Society of Civil Engineers would not give up any of its independence of action or of administration, but would simply be in a position where it would be easier to act together with the other societies and where members of our society would be more apt to meet members of the other societies. The plan would, therefore, help to extend acquaintance and promote co-operation.

Cambridge, Mass. GEO. F. SWAIN.

How the Lackawanna Waterproofed Its New Viaducts

SIR: My attention has been called to the fact that misleading, or at least incomplete, statements of the facts with reference to the method of waterproofing the Martins Creek and Tunkhannock viaducts, on the new line which the Lackawanna just built west of Scranton, have been made by a firm advertising its waterproofing materials. Since the writer's name has been used in connection with some of these advertisements, and wholly without authority being given to the advertiser, he feels that it is essential at this time to make a short and concise statement of the facts, so that there need be no further misunderstanding as to the kind of materials used or how the work was done.



EXPANSION JOINT DETAILS FOR LACKAWANNA RAILROAD'S CONCRETE VIADUCTS

Both the structures above referred to were treated alike, the same waterproofing materials being used in each case. The only material difference is the fact that the Martins Creek structure is a three-track viaduct, with two separate lines of drain pipes in the floor system, while the Tunkhannock is a two-track structure, with but one line of drain pipes.

The floor system over each main arch is divided into three parts by four transverse expansion joints, two adjacent to each pier and one at each of the quarter points of the span. The floor is drained by down spouts through all spandrel walls, excepting those at the two intermediate expansion joints, and the drainage is discharged into the openings between the two ribs of the main arch. The drainage is prevented from flowing over the expansion joints by dikes built across the floor.

The waterproofing proper was done by using three plies of Minwax saturated cotton fabric laid in Minwax hard waterproofing. The concrete was first mopped with the Minwax hard waterproofing, applied hot. The three layers of cloth were then laid in the usual manner, each layer being mopped before the application of the succeeding layer. This waterproofing was carried up the sides of the parapet wall to the top of the ties and directly across all expansion joints, so that the waterproofing was in reality continuous from one end of the bridge to the other. At the expansion joints one additional layer of the saturated fabric was laid across and folded in the expansion joint beneath a copper flashing, similarly laid, over which the three layers of waterproofing were placed. A fold was provided in the waterproofing at the joints to provide for expansion, and the entire joint filled with the Minwax hard waterproofing, poured hot. Detail of this expansion joint is illustrated on the accompanying sketch.

As a protection to the waterproofing, the Johns-Manville asphaltic mastic, mixed with torpedo-washed gravel, was applied hot in 2¾-in. layers over the entire area of the waterproofing. In order to avoid injury to the waterproofing by the hot mastic one ply of Johns-Manville asbestos felt was first laid over the entire area of the waterproofing. An opening was left in the mastic directly over the center of each expansion joint. This opening was filled with the Minwax hard waterproofing compound. The Johns-Manville asphaltic mastic was used for protection in preference to brick or concrete, since our experience elsewhere with this mastic, under ballast, indicates that it does not crack and in reality forms a secondary waterproofing surface on which the drainage readily passes to the down spouts.

G. J. RAY,
Chief Engineer D. L. & W. R. R.

HINTS FOR THE CONTRACTOR

Details Which Save Time and Labor on Construction Work

Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

[*Contributions to this section are solicited, and if found available will be paid for. They must be* SHORT, *and should be accompanied, if possible, by photographs or sketches.*—EDITOR.]

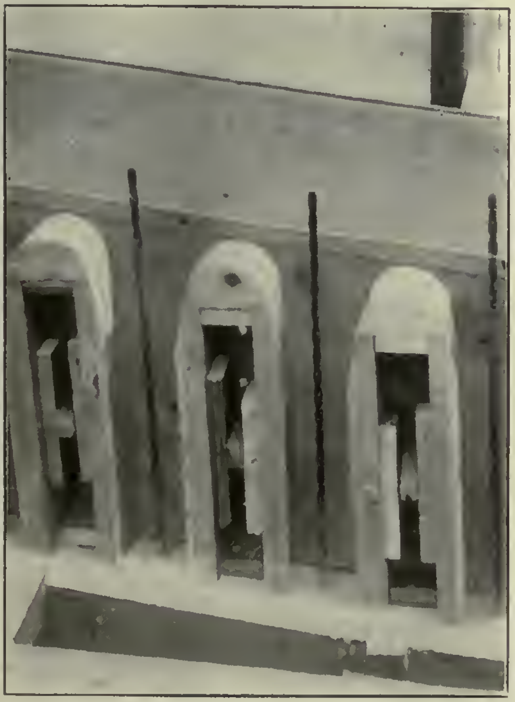
Edging Tool for Concrete Roads Easily Made on Job

AN EDGING tool to give a 3-in. circle on a concrete road is hard to find in a store. Samuel Hobbs, field engineer of the Massachusetts Highway Commission, in a paper presented at the March convention of that commission, described a method of making one which could be easily followed by the average job blacksmith.

A 12 x 7-in. piece of sheet iron should be heated, and one edge rolled to a 3-in. quarter circle over a wooden form. The metal should be clamped in this shape until cooled. A handle may be attached to the upper side, and the edge which is to touch the side form may be ground thin on an emery wheel.

Handy Forms for Balustrade

FORMS fitted together so as to stand under the pressure of the concrete without much nailing, and which were therefore easy to remove and re-erect, were used in making the balustrades on the Olympic Island bridge at Toronto, described by L. M. Edwards on page 547 of the Engineering Record for April 22, 1916. The side pieces were held apart by blocks at the top and bottom and by two other blocks in the center with a wedge between them. After the concrete had been poured and one side form removed, these blocks and wedges could be quickly taken out, releasing the whole form.

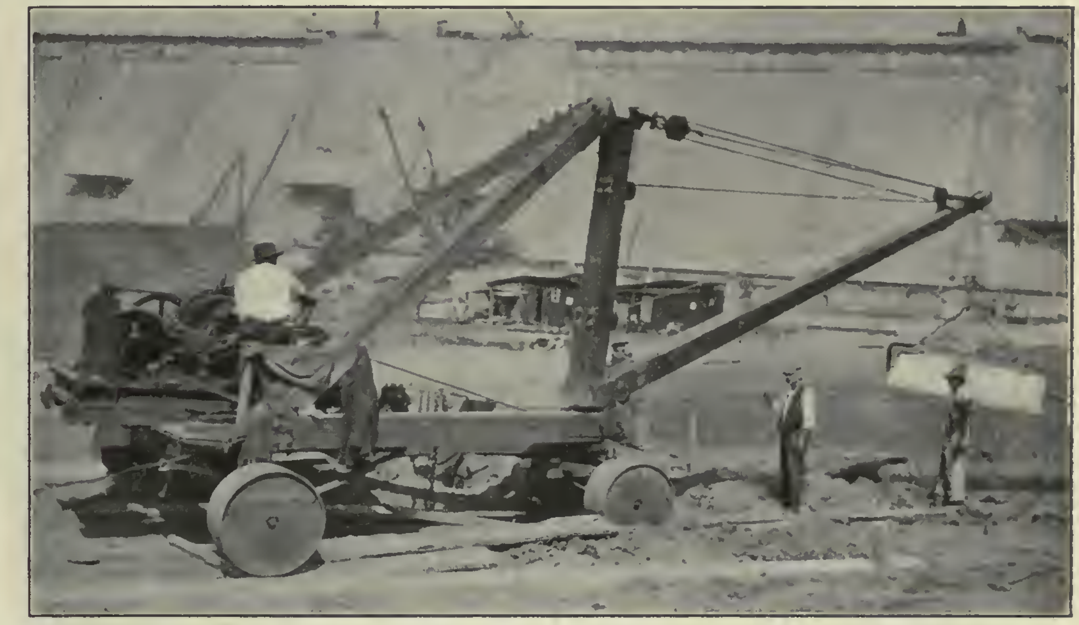


BALUSTRADE FORMS NEED LITTLE NAILING

Home-Made Machine Sets Concrete Curbing in Soft Ground

By RICHARD R. BRADBURY
East Pleasantville, N. Y.

THE wide-tired traveler shown in the accompanying photograph was made on the job to place more than 20,000 lin. ft. of concrete curbing on ground, much of which was too soft for loaded wagons, in the park below the Kensico Dam of the Catskill Water Supply near New York City.



HOME-MADE WHEELS WITH 14-IN. TIRES USED ON DERRICK THAT SET CONCRETE CURB IN 1300-POUND SECTION OVER 25 ACRES OF SOFT GROUND

This curbing was cast in short lengths in the same yard with the concrete blocks for the dam, and was all set by the small derrick. The area over which the work was distributed was about 25 acres, part of which was readily accessible to wagons and over the rest of which the ground was often too soft for teaming. The sections of curbing averaged about 6 ft. in length and weighed about 1300 lb. apiece, so that a large derrick was not needed. The machine was built of such material as was on hand, however, and was heavier than necessary, being able to handle 9 tons.

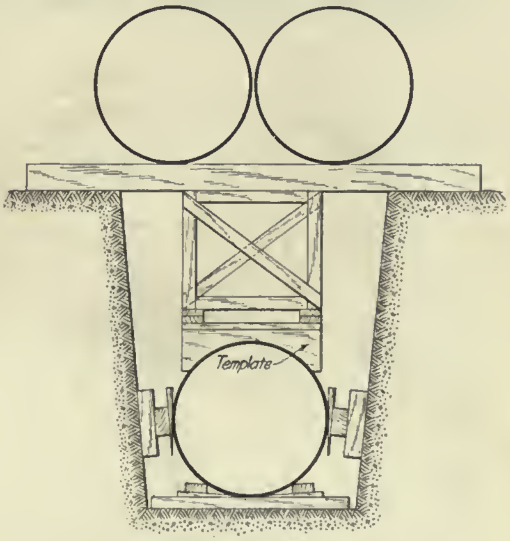
The stiffleg derrick was built of 10 x 10-in. timbers with a 9-ft. mast and 25-ft. boom. The hoist was double-drum, driven by a 15-hp. electric motor. No swinging gear was used, the boom being swung with a tag line. Derrick and hoist were mounted on a wagon frame which was originally fitted with ordinary wide-tired wagon wheels. These did not prevent the machine miring and were changed for solid wooden wheels with iron tires about 14 in. wide.

The sections of curbing were hauled from the block yard in wagons and unloaded in small storage piles as near the derrick as practicable. From these small piles they were snaked by the derrick as needed for distances of 300 ft. or more. The derrick could set about six lengths of curbing without moving. It then pulled itself forward by a line anchored ahead until it was in position to set six more lengths. It was guided when moving by two men at the wagon tongue.

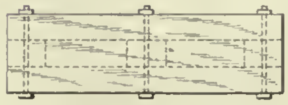
The gang employed in setting curb with this machine was usually made up of one carpenter foreman, one hoist runner and two laborers. They averaged about 150 lin. ft. of curb in an 8-hr. day. The dam is being built by H. S. Kerbaugh & Company, Inc., for the Board of Water Supply.

Pipe Lengths on Light Bents Hold Mains Down During Tests

WATER mains under test have to be kept from pulling apart longitudinally, rising vertically and creeping sidewise. The longitudinal movement is prevented by the



CROSS-SECTION



PLAN OF TEMPLATE

WEIGHT OF PIPES HOLDS MAIN DOWN

same bracing that holds the cap on. Sidewise movement can be easily prevented by blocking and wedging the pipe in between the opposite banks, which are usually quite close.

To prevent the vertical movement some contractors backfill high over the normal top of the trench. This method does not serve well if the test pressure is high, and, in any case, is wasteful, as the trench usually has to be re-excavated for quite a length to permit the removal of the cap and the continuance of the line. Another way is to load extra pipe lengths on the main under test, using supports erected according to the individual judgment of the handy-man or calker who happens to be doing the work.

A systematizing of the latter method—or an adaptation of the two if the test pressure is especially high—will save the water main contractor money if there are sufficient test sections on his job to warrant it.

A supporting platform can be made by sawing two 4 x 12-in. planks as templates, cross-connecting them securely and nailing a 2 x 12-in. plank on them. Two of these platforms should be provided, one for each end of the pipe. If it is intended to leave the main under test uncovered for more than one length, enough should be provided to carry back as far as the main has a tendency to rise. Light bents should be constructed sufficiently strong to sustain the load that may be put upon them, and of a height determined by the average depth of trench.

The templates should be set down on the main and the bents placed on them and secured by plank straps lightly spiked. Squared timbers are then laid on top of the bents parallel to the trench, and skids resting on the bank on each side placed on the timbers. Extra pipes can then be rolled onto the skids, using as many as are needed to obtain the desired weight, and wedged in place. The whole weight does not need necessarily to rest directly on the pipe—in fact, it is desirable that it should not. It should rest mainly on the banks, but the bents should be fitted in so snugly that to rise at all under the pressure the main would have to lift the entire weight. In the case of an exceptional trench depth the height of the tops of the bents could be adjusted to suit by blocking up. If when actually under pressure the main shows a tendency to rise despite the weight of all the pipes that can find a place on the skids, dirt to the amount required to overcome the tendency can be shoveled on it. This will occur only under a very heavy test pressure.

The advantage of this method lies in the fact that the greater part of the work is done at one time and not repeated. Once the templates and bents are built it is simply a case of blocking to suit. The method is reduced to a rule-of-thumb process. The units will be light enough to be handled and hauled from point to point without difficulty, and there need be no timber butchering. Another advantage is that the contractor need not waste labor placing a weight that is more than is required. He can roll on such pipe as he thinks are necessary. A water main, under test, does not jump suddenly out of a trench. It slides up slowly. If the man observing notices a tendency to do so he can have more weight rolled on as needed.

Steam Rollers Travel Slowly—Motor Truck Will Hasten Trip

STEAM rollers are slow travelers. On road work much time has been wasted and the work delayed while the roller was journeying from one distant point to another. The Kelly-Springfield Steam Roller Company hauls rollers from the plant to the railroad yards for shipment on a 3½-ton Kelly-Springfield motor truck, having found this a much quicker way than to drive the roller under its own power. This method could be followed to advantage by road contractors if the distance is great enough to justify it.

HAULING STEAM ROLLERS BY MOTOR TRUCK QUICKER THAN RUNNING THEM BY OWN POWER

Loading a steam roller on to a motor truck on the job, however, is a more difficult matter than it is to load it at the shop, but the difficulty can be easily overcome. Most platform trucks are equipped with winches, either motor-operated or hand-operated. One way to get the roller up would be to place inclined skids at the tail of the truck, and draw the roller up with the winch. Another method would be to run the roller up on the bank—which is quite frequently a feature of the general run of country roads—under its own power and drive it along, laying down planks to facilitate its journey over the soft ground to a point where the bank is somewhat higher than the truck platform. Skids could then be laid down over the intervening gap and the roller easily placed on the truck. These are but two suggestions. Confronted with the task of doing such a job the average truckman would quickly devise a good method.

Tilting Platform Puts Material Into Elevated Bins

FOR GETTING material into an elevated storage bin the contractor for the new Plankington Hotel, Milwaukee, is using a simple home-made platform which, when elevated, dumps automatically into the bins. After the dump wagons have driven over the platform and dumped their loads, cables from a hoisting engine are attached to each end and the skip raised until the side nearest the bins strikes the overhead hoisting frame which extend at an angle of 45 deg. This frame is hinged at its lower side to the bins. As the platform strikes the frame both move to a vertical position, discharging the material into the bins. The William J. Hoy Company is contractor for the hotel.

SUPPORTS FOLD TO VERTICAL POSITION

Lumber Exhibit Sent to Paris

As a means of attracting trade in the era of reconstruction after the war, timber models of buildings which can be built advantageously with wood have already been shipped to Paris, for exhibition, by the Southern Pine Association. This group of miniature buildings was prepared by the National Lumber Manufacturers' Association in Chicago. It includes cross-section models of a mill-constructed building, house, barn, silo, and small farm buildings.

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

Fire Jumps 1800 Ft. Across Low Lands at Nashville

Sixty-six-Mile Gale Spreads Flames with Remarkable Rapidity Due to Shingle Roofs—Nearly 650 Buildings Destroyed

The fire which recently destroyed a large part of the residential district of Nashville, Tenn., as noted in last week's issue, was remarkable for the rapidity with which it spread, as well as the shape of the area covered. The flames, which started in a group of small frame houses, the location of which is shown on the map, were whipped into a roaring conflagration by a 66-mile northwest gale. Burning shingles were carried 1800 ft. across an unoccupied area, frequently flooded by the waters of the Cumberland River, near the tracks of the Louisville & Nashville Railroad, to point 2 on the diagram. A path 1250 ft. wide and 2¼ miles long was burned through this second district, the most valuable residence section. The fire at the third point was caused by shingles blown in that direction when the wind changed.

Well Equipped to Fight Fire

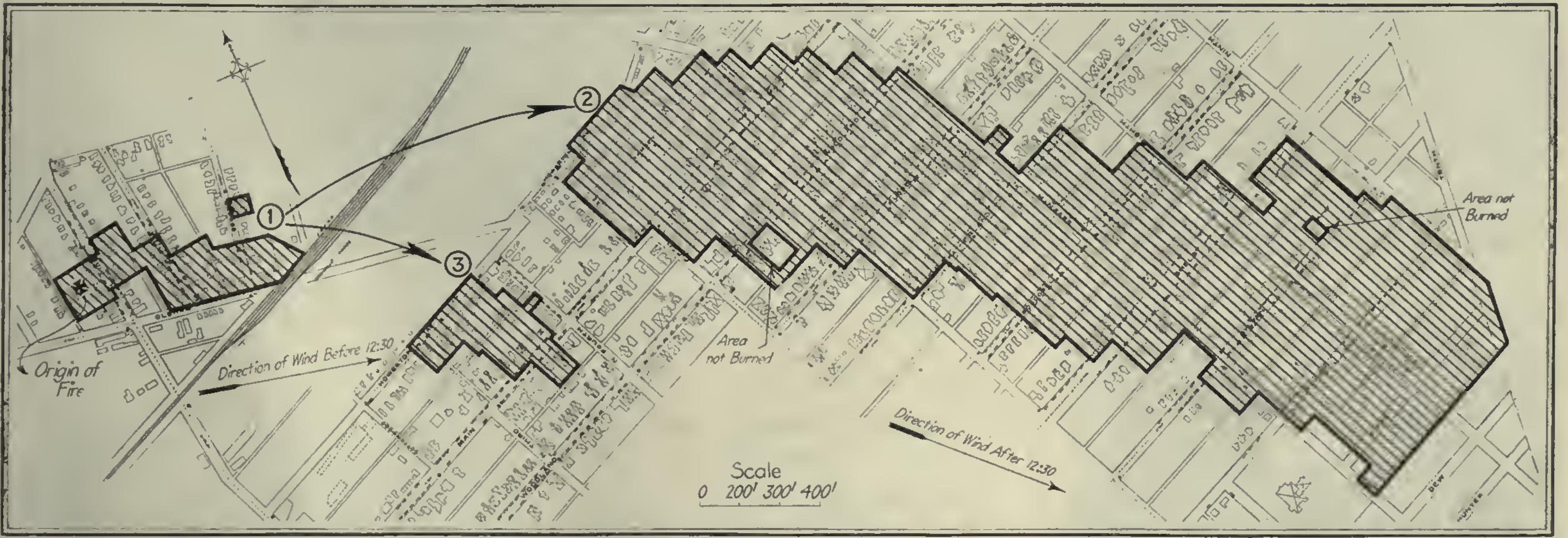
The velocity of the wind at 10.30 a. m. on March 22, the day on which the fire started, was 66 miles per hour, from the northwest. The lowest velocity during the fire was 44 miles. Despite the fact that no rain had fallen for several days, the fire in the first district was easily confined to about 33 small houses because the facilities for fire fighting were excellent. The water pressure was 94 lb. per square inch.

When the fire spread to the second district, which is heavily outlined on the map, the fire department abandoned all hope of doing more than confining the blaze to a narrow path, and that they did this successfully is shown by the outline of the burned area.

Flames Spread Rapidly

Approximately 648 buildings were destroyed, of which 229 were servant houses, garages and stables of frame construction, and 419 were stores, churches, schools and dwellings, of which 159 were of frame construction with shingle roofs, 180 were frame construction with fire-resisting roofs, one was brick with shingle roof and 79 were brick with fire-resisting roofs. The estimated loss, as noted in the issue of April 22, was $1,500,000. The reconstruction of small residences has already been started.

This information was furnished by Robert H. McNeilly, assistant professor of civil engineering at Vanderbilt University.



INDICATING THE POINT WHERE THE FIRE STARTED AND THE THREE SECTIONS OVER WHICH THE FIRE SPREAD. NOTE THE LONG DISTANCE BETWEEN POINTS 1 AND 2 OVER WHICH BURNING SHINGLES WERE BLOWN

Side Track Bankhead Road Bill

The Bankhead good roads bill, which was recently under consideration in the U. S. Senate, and provided for the appropriation of $75,000,000 to be used for road building, with an equal amount contributed by the states, was finally put aside April 21, without reaching a vote. Under the recently adopted legislative program, the measure will be displaced by the rural credit bill and it is believed that there will be no roads legislation this session.

Engineer Urges Creation of New Government Department

In a recent address before the Engineers' Society of Western Pennsylvania, at Pittsburgh, Isham Randolph, consulting engineer, of Chicago, dwelt upon the desirability of creating a new department of the government to have charge of all the public works other than those of a military nature. He pointed out that at present the government public works, other than those of fortifications, are divided among four departments, causing a loss of efficiency and economy.

Mr. Randolph stated that the time is at hand when the full services of every army officer are needed for national defense work and that the other works, such as improvements of rivers and harbors, should be undertaken by civilians who could devote all of their time without danger of being transferred frequently.

Los Angeles Incinerator Damaged

It has been reported that an explosion at the operating plant of the municipal refuse incinerator at Los Angeles did damage amounting to $250,000.

May Rebuild Dam at San Diego

A survey has been made by the San Diego (Cal.) engineers located at the dam at Lower Otay, with a view to the reconstruction of that structure.

Seattle's New Port Improvements Overtaxed

Facilities Considered a White Elephant Last Year Are Now Used to Capacity—War Business with Russia the Cause

(Editorial Correspondence)

Some of the commerce which has been kept off the Atlantic by war conditions has reached a destination in the Eastern Hemisphere by traveling west. Seattle has advanced in a few months to a much more important distributing point than ever before. The total value of exports consigned to Russia and transshipped from Puget Sound in January was about $2,000,000. In February this suddenly increased to $12,000,000. Several lines of Japanese steamers have pressed into this service every available vessel, and these, together with steamers of Russian, American and British registry, the tonnages under each flag varying in the order of listing, are now making rush trips to deliver freight as speedily as possible to the Siberian railroad terminal and to Oriental ports generally.

Smith Cove Dock Crowded

When the Smith cove dock, which is 1710 ft. long, 300 ft. wide, and has 2½ miles of railroad trackage, was completed by the Seattle Port Commission last year, there were those who referred to it as a white elephant. It is significant that this dock has recently turned away business. The same condition has, in general, obtained all along the Seattle waterfront.

Moreover, though the proposition to construct a municipal belt-line railway did not receive the necessary two-thirds vote at the recent election, it did receive a majority.

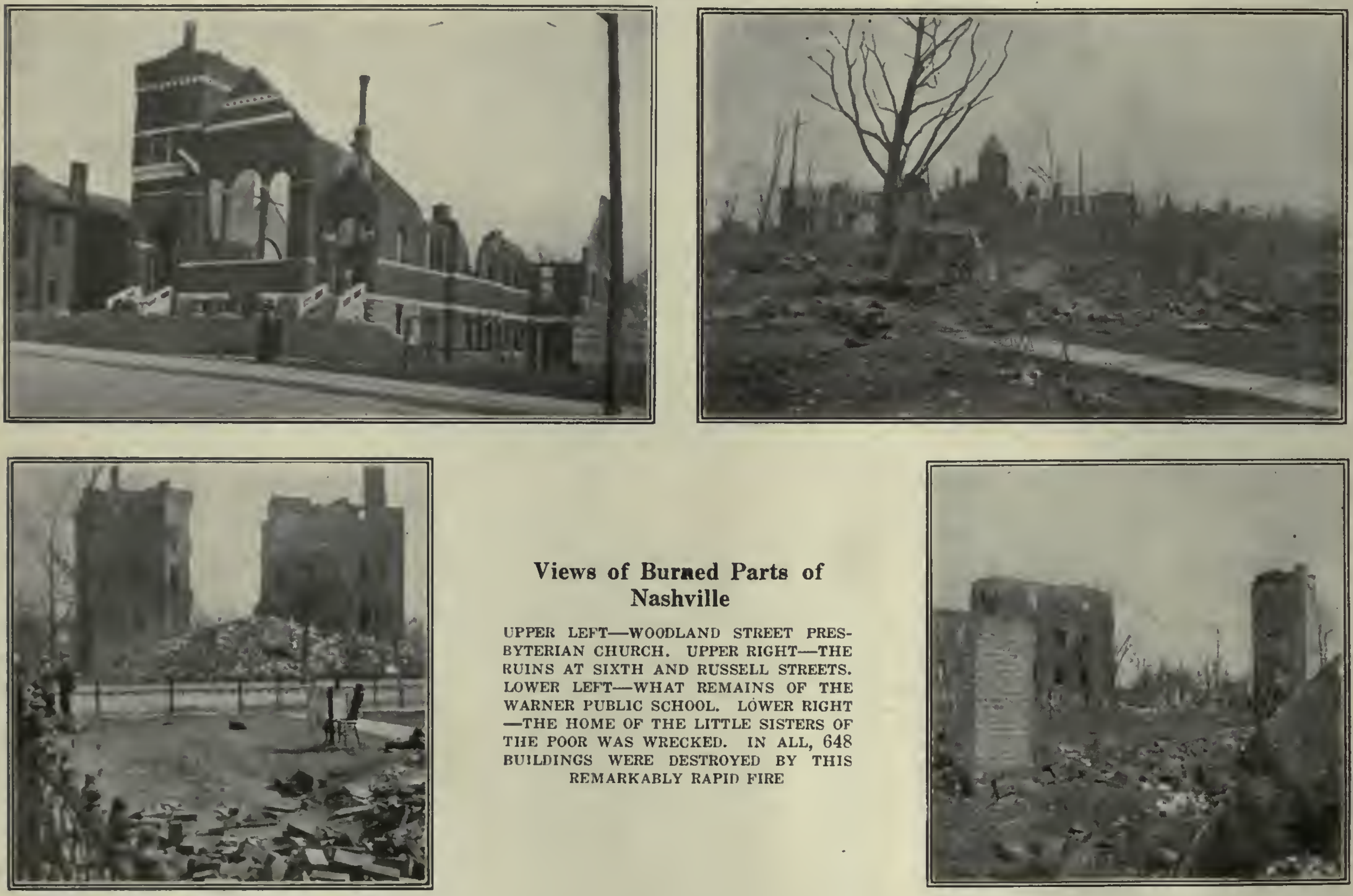
Other Activities

In addition to heavy overseas traffic, three other elements are contributing to Seattle's waterfront activity—Alaska copper, shipbuilding and lumber. In 1914 copper to the value of almost $3,000,000 came from Alaska to Puget Sound ports. In 1915 this business increased at one bound to more than $12,000,000, and this year it is confidently expected that the value of copper shipped from Alaskan mines will be $25,000,000, more than double the value of the amount shipped the previous year.

The shipbuilding industry has experienced a great boom. The Seattle Drydock & Construction Company has under way three large ocean steamers and it is reported that two newly organized Seattle firms have contracts for six more.

The lumber industry is to a certain extent as much of an index of local conditions in the Northwest as the steel market is of conditions in Eastern manufacturing centers. The extremely dull times of a few months ago are past, many of the lumber camps are active and more are rapidly opening up.

In short, the chief problem the Puget Sound district now faces is entirely opposite to that of a year ago. Then, depression reigned and engineering developments, such as they were, were made in the face of conditions. Now, everything invites expansion, and the main question is as to the magnitude of the improvements which will be justified by the percentage of the enlarged trade which will be retained after conditions on the Atlantic are normal.



Views of Burned Parts of Nashville

UPPER LEFT—WOODLAND STREET PRESBYTERIAN CHURCH. UPPER RIGHT—THE RUINS AT SIXTH AND RUSSELL STREETS. LOWER LEFT—WHAT REMAINS OF THE WARNER PUBLIC SCHOOL. LOWER RIGHT—THE HOME OF THE LITTLE SISTERS OF THE POOR WAS WRECKED. IN ALL, 648 BUILDINGS WERE DESTROYED BY THIS REMARKABLY RAPID FIRE

New York City's Bridge Department Bill Passed

The passage of the bridge department bill which, as noted in the April 15 issue, will save the city of New York over $1,000,000 a year by reorganizing the present bridge department under the name of department of plant and structures, passed the Senate April 17 by a vote of 28 to 15, and was passed by the Assembly April 20.

Washington Engineers Meet May 1 to Discuss Road Building

The first road builders' institute in the state of Washington will be held at the University of Washington, Seattle, May 1 and 2, at which time authorities on technical phases of highway construction will address county commissioners, engineers and road supervisors.

To Gather More Data on Los Angeles Sewage Problems

The board of supervisors of Los Angles county has decided to retain the commission of sanitary engineers for another two months and to instruct them to compile the following additional data: What degree of purification of sewage is necessary before the effluent can be used upon land for irrigation, without being a nuisance or a danger to health; how much purification is necessary before the sewage can be discharged into the ocean without damage or danger, and just what degree of success has been attained in these two methods of disposal in other cities of America.

The commission was also asked about the necessary distance of sewage-disposal plants from residences, the process for reducing and purifying sewage, and several similar matters. The final question which the commission is expected to answer is whether or not the contemplated plant to be established near Ramona Acres, by Pasadena, South Pasadena and Alhambra, will accomplish the desired results without becoming a nuisance.

Extensive Grade Separation in Kenosha, Wisconsin, Ordered

The elimination of practically all of the important grade crossings in the city of Kenosha, Wis., is called for in an order issued April 20 by the Railroad Commission of Wisconsin. The order specifies that the main tracks of the Wisconsin division of the Chicago & North Western Railway shall be elevated from a point south of Selma Avenue in the town of Mount Pleasant, which is south of the city limit, to a point north of the city limit in the town of Somers. All of the grade crossings on this division will be eliminated, and subways will be provided at fifteen streets. In addition there will be pedestrian subways at three points. The tracks of the Kenosha line are to be elevated from the junction with the main line westward to Ridge Street, and on this line a subway will be provided at Fremont Avenue.

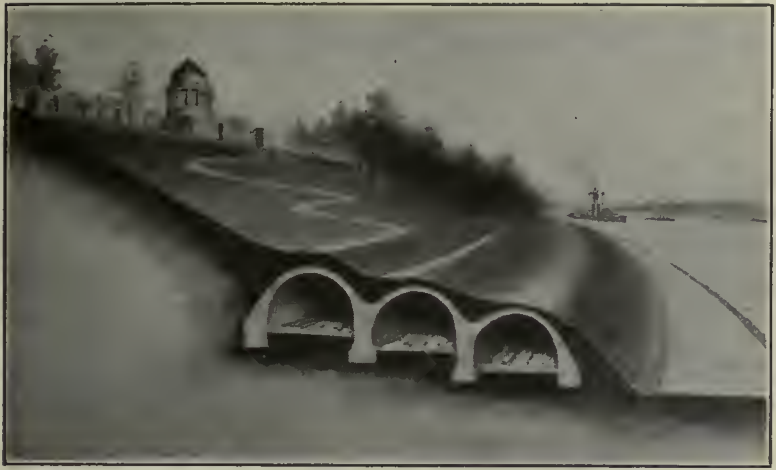
The yard at Main Street is to be depressed, and a viaduct will carry the street over the depressed tracks. The lowering of these tracks and the building of the viaduct over them will necessitate the construction of a new bridge over the river or a change in the grade of the old bridge. The city has the option of building a new bridge or changing the old one.

The order provides that the work be started on or before July 1, 1917, and be completed by December 31, 1919. The entire cost will be about $1,600,000, exclusive of property damages. The railway company is required to bear the entire cost of all work within its right-of-way lines, and the city all work outside of the right-of-way lines. The street railway company is required to perform all work necessary in changing its tracks, including the necessary grading and paving, and in addition is required to pay a small sum to the city for its share of the cost of the work on the bridge over the river, and another to the steam railroad as its part of the cost of the Main Street viaduct over the yard.

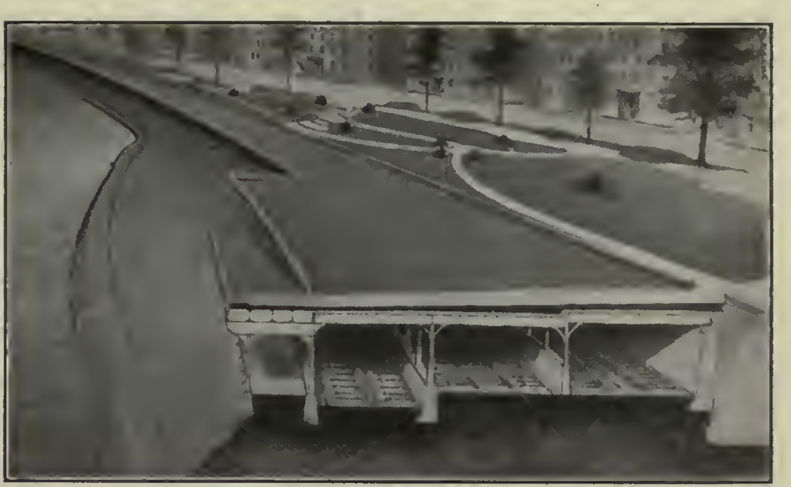
Efficiency League Formed to Promote Good Roads

To advance the interests of several municipalities and townships in that county, and bring about better co-operation, the Efficiency League of Cuyahoga County has been formed, with headquarters at Cleveland, Ohio. The league expects to promote good roads by offering prizes for the sections showing the greatest road improvements by the end of the coming season.

W. A. Stinchcomb, county highway superintendent, gave an instruction lecture on dragging earth roads at the second meeting of the league.



WHERE THE DEPTH IS AVAILABLE ARCHES WILL BE USED



AT OTHER POINTS, A FLAT ROOF OF STRUCTURAL STEEL

How West Side Tracks in New York Are to Be Covered

The accompanying sketches are representative of types of covering proposed for the New York Central freight tracks, in connection with the West Side improvement in New York City. (See the Engineering Record of April 15, page 528.) The flat structural steel construction is to be used most of the way along Riverside Park. Opposite Grant's Tomb, where the slope is steeper, and also under Inwood Hill, arches are to be employed.

The plans for the $50,000,000 project are now on file with the Board of Estimate and Apportionment of New York City, and the first public hearing on them will take place Monday, May 1.

President Asks Business Men's Co-Operation in Defense Plans

The Committee on Industrial Preparedness of the Naval Consulting Board recently made public a letter from President Wilson, addressed to the business men of the country, in which the President asks the business men to co-operate with the Consulting Board "for public service in national defense." The committee, as announced in last week's issue, is now organizing the industries of the country for use in case of war, and it is in support of that work that the President addresses the business men of the nation.

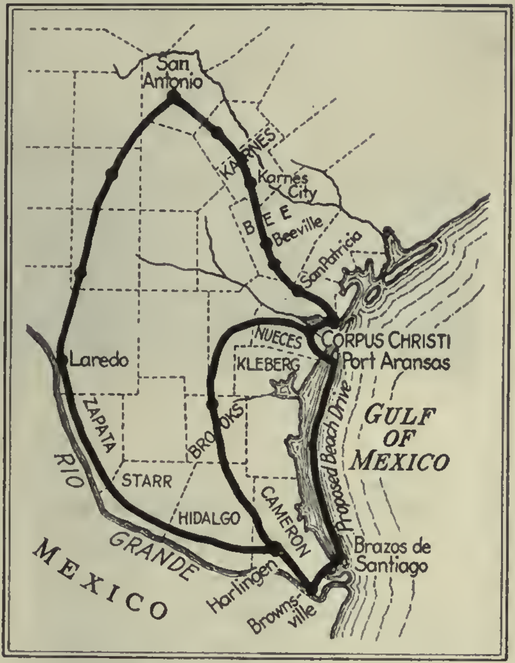
The engineers who will take the field on May 1 will be under the direction of state boards of five men each in every state, Alaska and the District of Columbia. These boards in turn are directed by W. S. Gifford, who is chief statistician of the American Telephone and Telegraph Company, who has been made footloose by his company for this work.

The work of the Committee on Industrial Preparedness is receiving the support of the President, the naval and military heads at Washington, and the Chamber of Commerce of the United States. In addition, the Associated Advertising Clubs of the World have undertaken, without cost to the government, a nation-wide advertising campaign in support of the committee's plans.

Chicago Engineers Crowd Hall to Hear Military Lectures

The course of lectures on military engineering, started in Chicago April 20, was a success beyond the expectation of its managers, the Joint Committee on Military Engineering. More than 300 engineers taxed the capacity of the hall at the Hamilton Club and listened with intense interest to the 1½-hr. illustrated lecture on "The Civilian Engineer and National Defense—Organization and Duties," by Lt.-Col. W. V. Judson, Corps of Engineers, U. S. A.

The main purpose of the lecture course, which also includes tactical walks, exhibition drills and visits to military posts, is to arouse the interest of engineers in military engineering. To this end, the practical feature of urging men to support various military organizations was not neglected, officers of the local companies being given an opportunity to speak about their own work.



PROPOSED 810-MILE TEXAS HIGHWAY IS RAPIDLY MATERIALIZING

Lt.-Col. George W. Burr, commandant Rock Island Arsenal, spoke April 27 on "Modern Ordnance." More than 400 enrolled for this lecture.

"Coast Defense—Its Problems and Their Adaptability to the Civilian Engineer" will be the subject of the lecture May 4 by Lt.-Col. Mason M. Patrick, Corps of Engineers, U. S. A., Detroit.

Over One-Third of 810-Mile Texas Highway System Completed

Over 354 miles of the 810-mile Diamond Loop Highway in Texas have been completed. The road, which will be of macadam throughout its length, will connect the cities of Corpus Christi, San Antonio, Laredo and Brownsville. It will be 30 ft. in width.

Bond issues have recently been voted to a total of $215,000 by the Aransas Pass district and Starr, Brooks and Zapata counties for the completion of further links. Elections have been called to vote on issues amounting to $260,000 by Hidalgo County and Port Aransas, and elections are being considered for $325,000 more by Nueces, Kleberg, Cameron, Bee and Karnes counties.

From Laredo to San Antonio the road is almost completed, and from the former city to Zapata it is said to be in excellent condition.

Engineers and Lumbermen Discuss Douglas Fir

Selecting Douglas fir structural timber according to fiber quality was considered at a recent conference between technical engineers and lumbermen held in the offices of the West Coast Lumbermen's Association, at Seattle. The engineers participating were, for the most part, members of Committee D-7 of the American Society for Testing Materials. Hermann von Schrenk, consulting timber engineer, of St. Louis, Mo., and John A. Newlin, in charge of timber testing at the U. S. Forest Products Laboratory, Madison, Wis., were prominent in the discussion.

The society aims to develop specifications for Douglas fir. This material, it was stated, is rapidly coming into increased use, particularly in the East, and a vigorous demand has arisen, both among engineers and architects, for more accurate descriptions of what constitutes the best quality.

Dodo Creates Interest in Preparedness

THE JOINT COMMITTEE ON MILITARY ENGINERRING, AT CHICAGO, WHICH ORGANIZATION IS CONDUCTING AN ACTIVE AND AGGRESSIVE CAMPAIGN FOR MILITARY PREPAREDNESS, PLACED THE BIRD SHOWN IN THE PICTURE AT A PROMINENT PLACE IN CHICAGO STREETS TO ADVERTISE ITS MILITARY LECTURES. THE COMPLETE CAPTION READS: "DODO, THE ORIGINAL PACIFIST, COULDN'T FIGHT, COULDN'T FLY, COULDN'T RUN. UTTERED A CRY LIKE A GOSLING."

New Jersey Sewage Works Association Discusses Problems

Methods employed by various cities for keeping trash out of sewers were pointed out by Frederick T. Parker at the first meeting of the New Jersey Sewage Works Association, April 18, at Plainfield, N. J., and in the discussion which followed, the removal of grease from sewers, and its disposal, were also considered. An instance cited was the situation in Atlantic City, where, it is estimated, 10,000 barrels of grease could be collected every year if the ordinance requiring the installation of grease traps could be enforced.

I. Z. Collings, of Collingswood, showed that the life of a sewer connection in a yard containing a weeping willow tree was one year. He also described the collection of gas from a separate digestion chamber at Collingswood, saying that in 24 hr., with a 4-ft. gas bell, he had collected sufficient gas to run his 10-hp. engine for 19 min. The 36 ft. of gas collected did the work of 38 ft. of gas from the regular source of supply.

Change Method of Supervising New York Subways

By a unanimous vote, the New York Senate, April 17, passed the Thompson committee bills, amending the public service law and taking from the Public Service Commission, supervision of the construction of New York City subways and elevated railways.

The measure provided that after the board of estimate has decided upon a subway, the Public Service Commission shall turn over to a commission to consist of one member from each borough, with the mayor and controller serving as members ex-officio, all supervision of construction. The bill is a direct out-growth of the investigation of the Public Service Commission conducted by the Thompson committee.

Export Company Sending Engineers to Russia

To study the needs of the Russian markets for contractors' equipment, factory requirements and all kinds of machinery with which engineers have to do, R. Martens & Company, Inc., of New York, are sending sixteen engineers into various parts of that country, each accompanied by a Russian engineer. At present these men are going through factories in the United States.

They will travel in pairs during the summer and return to Russia in the fall, said Richard Martens, a Russian, who is vice-president and director of the company. He also outlined the opportunities for Russian export business, but cautioned exporters not to insult the Russian buyer by using methods not allowed here. Mr. Martens' firm is now receiving, and storing, ten motor trucks a week of from 3½ to 5-tons capacity for delivery after the war is over.

Seattle Engineer Urges Water Power Development in U. S.

Immediate steps to pass such legislation as will protect investment in water power development and make the terms of lease and profit fair and liberal in order to attract capital in this direction were urged by Henry J. Pierce, consulting engineer, of Seattle, in a recent address on "War and Water Power," given before the Chicago Association of Commerce. The water power available in this country amounts to 61,000,000 hp., of which, according to Mr. Pierce, only 10 per cent is now being used, while the greater part of the 35,000,000 hp. of Europe is already developed.

Besides being a great economic saving, making possible the irrigation of vast lands now practically untouched and the creation of new industries in the cities, the development of this power will make possible the utilization of cheap electrical energy for extracting nitrogen from the air and converting it into fertilizer and nitric acid. The United States is almost completely dependent on the sodium nitrate deposit in Chile for the nitric acid used in the manufacture of ammunition, and imports 625,000 tons of nitrate a year from that country at a cost of $21,000,000, of which $7,500,000 is duty to the Chilean government. In the present situation of Germany our country would be helpless. However, that nation, with its great hydroelectric developments, can secure the necessary nitrogen from the air.

Half of Longest Bore in Twin Peaks Tunnel Is Completed

The 12,000-ft. bore in the Twin Peaks tunnel, at San Francisco, which is under Twin Peaks proper, is nearly half completed and the hardest part of the excavation is said to have been accomplished. The situation, as outlined in a report from the city engineer's office, is as follows:

"The red rock and cherts which cover the surface of Twin Peaks and which were found in the early part of the excavation, are now rapidly changing to a sandstone like that in the Laguna Honda quarry. It is safe to assume that this class of sandstone will be in the entire formation through the high portion of the hill, which will contribute considerably to the easy excavation of the structure.

"The last 46-ft. ring in the arch of the Laguna Honda station has been poured, and nothing now remains to be done but to construct the elevator pits and stairways, which will be rapidly poured in the coming weeks. Also the southwesterly portion of the tunnel up to the station will be completed before May 10.

"At the ventilator drift near the north boundary of the Relief Home tract there is still a constant flow of 325,000 gal. of water daily, which has been lifted by pumps to the surface. A pilot has been excavated to the Laguna Honda station to drain the formation so as to expedite the work of completing this portion of the tunnel.

"Practically all the serious problems in connection with the structure have now been solved and nothing remains to be done but to excavate the straight section of the tunnel. Due to the hard sandstone rock that has been encountered, the previous heavy lining will undoubtedly be diminished."

New Garbage Plant for New York on Staten Island

The Board of Estimate and Apportionment of New York City recently approved a contract for the erection of a garbage disposal plant at a site on Staten Island, and the award has been made to Gaffney, Gahagan & Van Etten. The works will receive the garbage of the boroughs of Manhattan, The Bronx and Brooklyn. The Board of Aldermen, on March 7, defeated a resolution authorizing the construction of a plant on city-owned land at Riker's Island, this installation being recommended by Commissioner John T. Fetherston of the Street Cleaning Department.

Under the terms of the contract for the Staten Island plant, the contractor is to erect the works on private land and make payments to the city aggregating $900,000 during the five-year term covered by the contract.

The works will have a capacity of 2000 tons daily and will employ the Cobwell process of disposal. While the Staten Island plant was not considered by Commissioner Fetherston to be the best one for the city it was recommended as a last resort, because the city's present contract with the operators of the Barren Island plant terminates at the end of this year and immediate provision for the future is necessary.

Bridge at Ninetieth Street, Cleveland, Completed

This bridge is a recently completed structure at East Ninetieth Street on the Cleveland & Youngstown Railroad, a rapid-transit line being built to connect a residential section of the city of Cleveland with the business district. The steel span in the background is over another railroad, where headroom was lacking.

Estimates to Be Made for Yuma, Ariz., Irrigation Project

L. M. Lawson, manager of the Yuma project, has received instructions to begin the survey upon which the U. S. Reclamation Bureau can base estimates for the cost of pumping and power plants in connection with the irrigation of what is known as the Yuma mesa unit of the project. Actual construction is expected to begin about Oct. 1.

Engineers May Attend Military Encampments Without Loss of Pay

The Public Service Commission for the First District, New York City, has adopted a rule which will permit its employees to attend military encampments for practically four weeks without loss of pay.

Demand for Engineers Increases

A news note headed as above appeared in the April 22 issue in which it was stated that "over fifty desirable jobs are advertised on the bulletin boards of Pennsylvania University." The institution referred to should have been the Pennsylvania State College.

News of Engineering Societies

The Western Society of Engineers will hear Capt. H. B. Sauerman talk on "Fortification," May 1.

The Engineers' Club of Trenton, N. J., at a meeting April 27 heard C. C. Creighton, mechanical expert of the Galena-Signal Oil Company lecture on the history and development of the oil industry.

The Engineers' Club of St. Louis has arranged for A. G. Allen, assistant engineer in the valuation department of the Missouri Pacific Railway, to speak on "A Railroad Reconnoissance through the Hudson Bay Country" at a meeting April 26.

The Municipal Engineers of the City of New York held a meeting in that city April 26, at which James Sanborn, division engineer of the Board of Water Supply, presented a paper on the preservation of boring records and underground data.

The Engineers' Society of Western Pennsylvania will hold a series of military lectures, the first of which will be given May 3 by Lieut.-Col. Francis R. Shunk, on the subject of "The Organization and Duties of Engineer Troops." The meetings are to be held in Carnegie Music Hall, Pittsburgh.

Personal Notes

C. R. Anderson, supervisor of the Mahanoy and Hazleton division of the Lehigh Valley Railroad, has been appointed division engineer, with headquarters at Hazleton, Pa. He succeeds J. F. Donovan, who is transferred to the Auburn division.

M. V. Haas, U. S. junior engineer, recently in charge of the U. S. engineer's office at Brunswick, Ga., has been promoted to a similar position at San Juan, Porto Rico. From 1907 until 1910 Mr. Haas was employed by the U. S. engineer office at Manila, after which he was connected with lock construction work at Dallas, Tex., and later was engaged in flood protection work for the engineering department of Cincinnati, Ohio. He again entered the service of the government in 1914, with headquarters at Brunswick, Ga., where he was stationed until his recent promotion.

Lynn Crandall has resigned from his position as assistant engineer of the U. S. Geological Survey, at Salt Lake City, to become chief hydrographer of the Twin Falls North Side Land & Water Company, of Jerome, Idaho, where he will have charge of hydrometric investigations.

Samuel V. Spry, formerly assistant in the office of the Utah state engineer, has resigned to accept a position at Washington in the government consular service. Mr. Spry was formerly with the consular service in Hungaria.

Halford Erickson, chairman of the Railroad Commission of Wisconsin, and regarded by many as one of the leading thinkers among state commissioners, has resigned from the commission.

Frank L. Wheaton has been promoted from the position of engineer of construction for the Delaware, Lackawanna & Western Railroad, to that of division engineer, with headquarters at Binghamton, N. Y. Mr. Wheaton was graduated from Dartmouth College in 1886 and immediately thereafter accepted a position as resident engineer for the Chicago, Rock Island & Pacific Railway. He remained in the service of that road until 1889, when he went to the Lehigh Valley Railroad as assistant engineer. In 1890 he engaged in private business, but again took up railroad work in 1898 as resident engineer for the Chicago & Northwestern Railway. He remained with this road until 1900, when he was appointed assistant engineer for the Delaware, Lackawanna & Western, at Hoboken, N. J. He spent 1902 and 1903 as resident engineer for the Pittsburgh, Shawmut & Northern but returned to the Lackawanna in 1903 as engineer of track elevation at Newark, N. J. Mr. Wheaton was terminal engineer for that road, at Hoboken, during 1904 and 1905, and since then has located the Hopatcong-Slateford and the Nicholson cut-offs. He was also resident engineer of the Bergen tunnel and had charge of the construction of the Hopatcong-Slateford and the Nicholson cut-offs.

W. W. Morehouse has resigned from his position as county engineer for Marshall County, Iowa, to accept an appointment to a similar position for Polk County, with headquarters at Des Moines.

Edmund T. Perkins, consulting hydraulic engineer, of Chicago, addressed the civic-industrial section of the Chicago Association of Commerce, April 21, on "Our Undeveloped Resources."

Amos Schaeffer, consulting engineer in charge of sewers for the Borough of Manhattan, has been promoted to the position of consulting engineer for that borough, succeeding E. P. Goodrich. The position formerly held by Mr. Schaeffer will be abolished and the work divided among other city officials. Mr. Schaeffer was born in 1867, at Fleetwood, Pa., and was educated at Franklin and Marshall College and at Sheffield Scientific School. He was in the employ of the Lehigh Valley Railroad for two years and from 1894 until 1897 was assistant in the office of the city engineer of Niagara Falls. In the latter year he was appointed topographical draftsman for New York City, in the department of sewers of the Borough of The Bronx and was appointed consulting engineer for that borough in 1910. In 1914 he became consulting engineer for the bureau of sewers of the Borough of Manhattan.

Charles Saville, formerly director of sanitation for the city of Dallas, Tex., has just been promoted to the position of director of public health, in which capacity he will have complete charge of all city matters relating to his department. Mr. Saville was graduated from Massachusetts Institute of Technology in 1906 and for four years thereafter was connected with the Massachusetts Board of Health. From May, 1910, to September, 1911, he spent in Europe studying municipal sanitation problems. Upon his return he became associated with the firm of Hering & Gregory, consulting engineers, of New York City, from which he resigned in 1914 to take up studies at the School for Health Officers of Harvard University and shortly after he became connected with the city of Dallas, Tex.

George C. Andrews has been appointed to fill the recently created position of supervising engineer of the bureau of water of Buffalo, N. Y. Mr. Andrews is a graduate of Lafayette College and was recently connected with the New York State Barge Canal as resident engineer at Lockport.

Robert H. Large, formerly general coal freight agent of the Pennsylvania Railroad, has been promoted to the position of coal traffic manager of that system. Mr. Large entered the railway field in 1895 as rodman in the maintenance-of-way department of the Pennsylvania and took up work in the freight department the following year, in which department he has risen to his present position.

William Grant, a member of the firm of Grant & Fulton, consulting engineers, of Lincoln, Neb., has been appointed associate professor of civil engineering, in charge of water supply and sanitary engineering, at the University of Nebraska. Mr. Grant was graduated from that university in 1897 and for ten years following graduation he was in the employ of the Chicago, Burlington & Quincy Railroad, was city engineer of Lincoln for three years and has since been in private practice. He spent two years, 1912-1913 and 1913-1914, at the Massachusetts Institute of Technology in special study along the lines to which his present appointment relates. He will continue his connection with the firm of Grant & Fulton.

Donald M. Cook has resigned from his position in the engineering department of the village of Winnetka, Ill., to accept a similar appointment in the engineering department of Flint, Mich.

Ernest P. Goodrich, whose resignation as consulting engineer for the Borough of Manhattan was noted in a recent issue, was entertained at a luncheon April 20 given by the heads of the various municipal deparments. Over 60 city officials were present to show their appreciation of Mr. Goodrich's work.

B. H. Tong has been appointed to a position with the Armstrong Engineering Company, of Taylorville, Ill., and will soon take up his duties as assistant superintendent of construction for that company, with headquarters at Varilla, Ky.

Roy L. Greene has resigned from his position as deputy county engineer of Lewis County, Wash., to accept an appointment as engineer in the fireproofing department of the Berg Manufacturing Company, of Canton, Ohio, with headquarters at Minneapolis.

H. Bittman, structural engineer, of Seattle, Wash., has removed his office to larger quarters in the new Washington Securities Building.

J. C. Smutz has been appointed engineer of Pawnee City, Neb.

F. O. Dufour has resigned as senior structural engineer of the Central District, Division of Valuation, Interstate Commerce Commission, to become associated with the Stone & Webster Engineering Corporation, with headquarters at Boston, Mass., effective May 1.

R. J. Palmer has been appointed resident engineer for the Norfolk & Western. at Norfolk, Va.

Francis W. Du Bois has resigned from his position as U. S. surveyor, at Little Rock, Ark., to enter into a partnership with Hobart L. Cory, to conduct a consulting engineering business at Baker, Mont.

The Turner Construction Company, of New York City, has opened a branch office at 45 Milk Street, Boston, to handle the New England business of the concern. W. R. Sides will have charge and A. C. Tozzer will be general superintendent.

J. D. Cupp was recently appointed principal assistant to the city engineer of Lima, Ohio, and at present is devoting his time to making river surveys.

Francis M. Veatch will leave his position with the University of Kansas to become assistant engineer for the state board of health of Kansas. Mr. Veatch was graduated from the University of Kansas in 1913 and has been conducting investigations of sewage-disposal plants since then.

Reid Jones, formerly designing engineer for Bartlett & Ranney, Inc., consulting engineers, of Dallas, Tex., has resigned from that position to engage in consulting engineering practice with C. S. Thomas, Jr., of St. Louis. The firm of Thomas & Jones will engage in general engineering and contracting work, with offices in the Chandler Building, San Antonio, Tex.

Paul T. Cahill and **Kyle W. Armstrong** have formed a partnership for the practice of architecture and engineering, with offices in the Hippodrome Building, Cleveland, Ohio, under the firm name of Cahill & Armstrong.

William C. Atwater has left the employ of the Des Moines Bridge & Iron Works to become associated with the Four Wheel Drive Auto Company of Clintonville, Wis.

A. T. Thompson, formerly city engineer for Chippewa Falls, Wis., has resigned from that position to engage in the practice of consulting engineering in Stevens Point, Wis. Mr. Thompson was appointed consulting engineer for the latter city April 11 and will have charge of design and construction of paving and sanitary and storm sewers for that city.

Milo R. Maltbie of the advisory board of the Division of Valuation, Interstate Commerce Commission, has resigned to become chamberlain of the city of New York.

J. D. Galloway, consulting engineer, of San Francisco, is chairman of a committee on military engineering which proposes to carry out a series of events similar to those now being conducted in Chicago.

George S. Nickerson, formerly engineer for the North Fork Ditch Company, at Sacramento, Cal., has been advanced to the position of general manager and chief engineer.

I. E. Goodner, formerly of Aurora, Nev., is reported to have been appointed consulting engineer for the Paradise Irrigation project, at Chico, Cal.

George W. Fuller, consulting engineer, of New York City, has been retained to act in a consulting capacity for a local sewage disposal project at Phillipsburg, N. J., and not, as stated in the April 15 issue, for New York City. The firm has also been engaged to prepare preliminary plans for a sewage-disposal plant at Lima, Ohio.

Joseph R. Sterling, for the past eight years chief engineer of the Inter-Urban Railway Company and the Des Moines (Iowa) City Railway Company, has resigned from that position to become associated with the Des Moines Asphalt Paving Company, of Des Moines, Iowa.

Bion J. Arnold, consulting engineer, of Chicago, has been appointed a member of the naval consulting board, representing the American Society of Aeronautical Engineers, succeeding H. A. Wise Wood, who recently resigned.

P. O. Crawford has resigned from his position with the Afghanistan government, where he was employed on a hydroelectric installation, to take charge of the construction of a dam and hydroelectric plant for the California Oregon Power Company, near Hornbrook, Cal.

H. G. Roby has recently been appointed city manager for the city of Alpena, Mich. After graduating from Dartmouth College, he was with D. W. Mead, consulting engineer, of Madison, Wis., for some years, and later was superintendent of construction for the Oliver Mining Company, in charge of a water-power development on the Menominee River.

Robert A. Cummings, consulting engineer, of Pittsburgh, Pa., has been elected a member of the British Institution of Civil Engineers.

Samson K. Cohen has accepted a position with the Boston & Maine Railroad, at Roxbury, Mass., as structural draftsman engineer. Mr. Cohen was graduated from the Massachusetts Institute of Technology in 1910 and has since been connected with the American Bridge Company, the New England Structural Company, the Isthmian Canal Commission, at Culebra, and the Missouri Pacific Railway.

F. T. Morrissey has resigned from his position as superintendent of the light and water works at Winamac, Ind., to take effect May 1.

Obituary Notes

Charles E. Wickham, division engineer for the Delaware, Lackawanna & Western Railroad, at Binghamton, N. Y., died in that city April 16. He was born at Southampton, England, in 1863 and was educated at the Iowa State University. He entered the service of the Burlington, Cedar Rapids & Northern Railway as chainman in 1884 and in 1885 had risen to the grade of resident engineer and draftsman. He went to the Kansas & Colorado Railway in 1887 as office engineer and later in that year was, appointed assistant engineer for the Chicago, Rock Island and Pacific Railway. He spent parts of the years 1890 and 1891 as topographer for the Mexican Southern Railway and returned to the Rock Island late in 1891 as assistant engineer, from which position he resigned the following year to become superintendent of construction for the Peoria Terminal Railway. In 1893 he again became connected with the Rock Island and was roadmaster for that road until 1897, at which time he was promoted to the position of division engineer, at Chicago. In 1901 he was made general roadmaster in charge of lines east of the Missouri River and his appointment with the Lackawanna followed shortly.

F. W. D. Holbrook, acting head of the department of yards and docks at the Puget Sound Navy Yard, died in Seattle, Wash., April 13. He was prominent in engineering circles, especially in the latter half of the last Century. Since that time Mr. Holbrook was resident engineer at the east end of the Hoosac tunnel. He became division superintendent of the Yellowstone division of the Northern Pacific Railway in 1886 and held the position of secretary for the Seattle Board of Public Works from 1890 to 1892. From the latter date until late in 1915 he was with the department of yards and docks, at the Puget Sound Navy Yard, being acting head of the department a great part of the time. During his long period of service he was prominently connected with the building and development of Western railroads. Mr. Holbrook was born in Boston, Mass., in 1840.

J. P. K. Miller, chief engineer for the H. C. Frick Coke Company, died April 9 at Scottdale, Pa.

John M. Buckminster, a retired civil engineer, of Boston, Mass., died in that city April 21. He was born in 1850 and received his education at the Lawrence Scientific School. Mr. Buckminster was associated with the constructon of waterworks at Lynn and Walden, Mass.

Charles H. Preston, engineer and architect, of Norwich, Conn., died at his home in that city April 20. Mr. Preston was for several years in the employ of McQuirk & Bacon, architects and builders, and later studied at Northwestern University, Chicago, after which he returned to Norwich to open an office. He was employed to assist in the design and construction of many local structures among which are the Thayer, Shannon and Majestic buildings, in Norwich. He also prepared plans for most of the buildings at Taftsville to replace those destroyed by the fire in that city a year ago.

John K. Brown, who retired in 1900 from active service as assistant engineer of maintenance-of-way for the Missouri Pacific Railway, died recently at Wichita, Kan. Mr. Brown was born in 1832 and entered railway service in 1856. He had been in the employ of several different roads previous to his association with the Missouri Pacific and had surveyed and helped construct part of the Oregon Short Line, as well as sections of the Missouri Pacific and the Boston, Hartford & Erie railroads.

James Malcolm Gleaves, chief clerk in the San Francisco office of the U. S. Surveyor General, died at Berkeley, Cal., April 14, at the age of forty-eight.

David H. King, retired builder, of New York City, died at his home in that city April 20. Mr. King was born in 1850 in the city in which he died and at the age of twenty entered the building business in which he later won success. He constructed, among other New York buildings, the old Equitable Building, lately destroyed by fire, and the Madison Square Garden. He was president of the New York Dock Company for eight years preceding his retirement from active business life in 1909.

Edward Kane, former superintendent of the Chicago water pipe extension department and trustee of the Sanitary District of Chicago since 1910, died April 24 in that city.

Robert J. Cunningham, recent state highway commissioner of Pennsylvania, died April 26 at his home in Sewickley, a suburb of Pittsburgh. Mr. Cunningham was born in 1860 at Elizabeth, Pa. He started work at the age of 16. He was elected controller of Alleghany county in 1902 and 1906 found him in the state senate, from which he resigned in 1908 to again become controller of Alleghany county. He was appointed state highway commissioner in 1915.

Civil Service Examinations

Massachusetts.—The Massachusetts Civil Service Commission will hold an examination for dredging inspector May 5 at Boston. The salary is $3 a day. Only citizens of the United States who have been residents of Massachusetts for the past two years may take this examination. Blanks and information may be obtained from the civil service commission, room 151 State House, Boston.

Examinations Previously Announced

Date		See Eng. Record
May 3	—Transitman, salary $1,200 to $1,500, Philadelphia..	April 1
May 4-5	—Assistant engineer, salary $2,500, and structural draftsman, salary $1,200 to $1,500, Philadelphia..	April 1
May 9	—Valuation analysts, salaries $1,800 to $5,000; Interstate Commerce Commission	April 8
May 2	—Engineer-physicist; salary $2,000 to $3,000; U. S. Bureau of Standards...	April 8
May 6	—Junior electrical engineer; salary $901 to $1,200; State of New York.....	April 8
Aug. 21-25	—Second lieutenant of civilian candidates......	April 1

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Societies and Education

AN UNUSUAL amount of space is given in this issue to articles and comment on engineering education, engineering society activities and the field of the engineer. The space devoted to these subjects is a fairly good indication of the widespread interest which these subjects hold for the members of the profession at the present time. Professor Mann's studies and the facts brought out with reference to the decline in the registration of civil-engineering students have directed new attention to engineering education, while the proposal to move the headquarters of the American Society of Civil Engineers and the activity of local societies throughout the country have opened up new vistas of society usefulness. Both are healthy signs, for the engineer's education and his cooperative activities are the chief factors determining his status. Careful reading is therefore urged of the discussion between Professors Mead and Swain, of the article by Mr. George and the letter from Professor Newell. Aside from the intrinsic merit of the subjects, each of these articles contains new and interesting points of view.

Surfaced Concrete Roads

WHEN the California Highway Commission a couple of years ago decided to devote the bulk of its $18,000,000 bond issue to a type of construction consisting of a 4-in. concrete base with a thin bituminous wearing surface the prediction was freely made that the roads would be a failure. The commission faced the problem of developing a huge mileage of state highways with insufficient funds. It had the alternatives of choosing between a small mileage of high-priced construction, serving only the main centers of population, or a relatively large mileage built at a lower cost and covering the entire State. It selected the latter, and with this decision as to policy went the "thin bituminous top" construction. Highway engineers in other states have shown a keen interest in California's work and have, of course, been eager to learn how the type adopted has been standing up under service. This question is answered by Walter C. Howe, division engineer, in a report submitted Feb. 26 to Austin B. Fletcher, state highway engineer, and printed, in part, on page 603. Basing his conclusions on an experience with 400,000 sq. yd. of construction, some of it two years old, Mr. Howe states that for average highway traffic the bituminous carpet of heavy asphaltic oil and broken stone screenings has begun to demonstrate that it is an economical and very successful type of surfacing. It must, however, be laid by an experienced crew and under expert supervision. It is not a panacea, for it is unsuitable for extremely heavy traffic. When properly laid, however, and under moderate traffic the life of the surfacing, Mr. Howe believes, will, with moderate repairs, exceed the period of three or four years originally predicted for it. In appraising the value of the thin bituminous surfacing on a 4-in. concrete base, for general use, engineers in other states should give due consideration to the fact that the California roads are not subjected to the rigors of wide temperature changes so common in most sections of the United States.

Self-Examination

PROFESSOR NEWELL in his letter to the editor on page 620 of this issue, commenting upon a recent editorial in this journal, expresses clearly, but in greater detail, the thought in the minds of the editors in pointing out the need for constantly keeping before the officers and membership of a society the ideals toward which it is supposed to be striving. The thought around which Professor Newell's comment revolves is that constant self-examination is necessary in order that a society may constantly increase the value of its service to its members. When an individual, a society, a corporation does one or two things very well the natural temptation is to let well enough alone and to consider that the full obligation has been discharged. If the temptation be yielded to, the individual or the body is in a dangerous position. Others will rest not, but by constant self-examination will endeavor to improve, with the result that the complacent ones are passed in the race or at least have their relative prestige lowered. The adage, "Constant vigilance is the price of safety," can well be paraphrased for the individual, for the society and for the corporation to read, "Constant self-examination is the price of success."

Society Service

IN THE April "Journal" of the Boston Society of Civil Engineers there appeared an article by Edward M. Blake (see last week's issue) in which he lays special emphasis on the thought that membership in a society should carry with it not only the privilege of receiving something, but also the duty of giving service to the society and to the profession. Mr. Blake says: "We cannot draw from a bank unless we have put in something to draw upon, and the more we put in the more we can draw out. . . . With this conception [a true spirit of service] firmly established in his mind, the engineer who joins a society will consider of first importance the question of what he can add to the society and not of what he can get out of the society in return for his annual dues. Service for the society will follow, and soon there will be no need of arguing the other side—that of the benefits to be received from membership in the society." Mr. Blake's words may well be taken as a supplement to the editorial "Service of Engineering Societies," which appeared in the Engineering Record of April 1 and which has caused considerable comment. Societies well may ask themselves whether they are affording full opportunity for their membership to be of service to the organization and to the profession. The easy answer is that everyone is invited to prepare papers, but that answer merely dodges the issue. Many will serve when drafted for service who would not volunteer to help.

For President, A. S. T. M.

FOR the first time in the history of the American Society for Testing Materials the name of a representative of the producing interests has been offered by the nominating committee for the presidency of the society. A. A. Stevenson, vice-president of the Standard Steel Works Company, at present vice-president of the society and for many years one of the most active and valuable members of committee A-1, on standard specifications for steel, is the nominee. The nomination is a tribute to Mr. Stevenson's sterling character and to the high quality and purpose of his work in the society. At the same time the fact that it has not feared to propose for the highest position in the organization a representative of the producing interests, is a tribute to the broadmindedness of the society as represented by its nominating committee. It is a fitting compliment, too, to the spirit which the manufacturers have displayed in their work in the organization. In the early days of the organization doubts were expressed as to the possibility of a permanent and thoroughly trustworthy body in the deliberations of which the manufacturers were given so large a voice. For that reason the management was unusually circumspect at the start, careful lest some misguided producer might endeavor to take improper advantage of his membership privilege. But those fears have long since been dispelled, and, if anything, the raising of a producer to the presidency has been too long delayed. Now it is fully recognized that the society could not have become so useful to the engineering profession had the manufacturers been eliminated from membership and their tremendous contributions to the development of engineering science rejected. The organization owes its success no less to the ability and sterling work of the producing interests than to the contributions and ability of the nonproducing members. Mr. Stevenson's nomination is fitting recognition of this fact.

New York's Boring Records

NO ARGUMENT is needed to convince engineers of the value of sub-surface information obtained by means of drills, test pits and larger-sized excavations, but until the Municipal Engineers of the City of New York conceived the plan for a single permanent collection of local rock cores and other samples no one apparently had visualized the immense importance of a round-up of the city's underground records. For many months past a committee of the Municipal Engineers has been assembling data secured from all available sources, and at a meeting last month James F. Sanborn made the important announcement that space for the collection had been secured in a room set apart for the purpose in the Municipal Building, and that the Board of Estimate and Apportionment had voted $5,000 for the work. This is good news for New York contractors as well as engineers. It means that information regarding underground conditions, formerly unavailable, or available only after tedious investigation of scattered and fragmentary records, will now be centralized and easy of interpretation. But the committee has not stopped at the mere collection and classification of rock samples. It is proposed to formulate a set of rules and suggestions with reference to proper methods to employ on underground surveys. Thus the whole routine will be standardized and the results increased in value manyfold. Engineering organizations in other cities might well follow the example of New York's Municipal Engineers. There is opportunity for constructive work and it is precisely along this line that local engineering societies can demonstrate their value to the community at large.

Alaska's Government Railroad

WHOEVER has pictured in his mind the government railroad in Alaska winding its way through tortuous canyons, leaping across chasms on bridges requiring ingenuity to design and daring to erect, plunging through tunnels and doubling around mountains to gain elevation, will be disappointed when he reads the article by Mr. Riggs of the Alaskan Engineering Commission, on page 600 of this issue. There will be none of these engineering triumphs, because none of them will be necessary. Except for the difference in climate and vegetation, and the difficulties of getting men, materials and supplies to the work, the line could as well be over the Alleghany Mountains, and even there at one of the easiest points. Broad Pass, for example, is 5 miles wide and only 2400 ft. above sea level. As to what the problems have been in Alaska, what has been done with the funds available, whether or not the road is needed at all, the Engineering Record leaves that to the readers of Mr. Riggs' article. One point not brought out in the article, but mentioned by Mr. Riggs elsewhere, is the character of construction. A common criticism of governmental works has been their elaborateness, in disregard of the traffic and other necessities. This criticism hardly applies to the Alaska railroad. Following the example of private pioneer railroad builders, the government is suiting the construction to the traffic in sight, and building a railroad serviceable but not fancy. The Alaskan Engineering Commission and the Department of the Interior deserve commendation for this policy. Other government agencies, including the Congress which appropriates money for the improvement of impossible muddy creeks, should take notice.

New Engineering Field in Chambers of Commerce

MR. JAMES Z. GEORGE, industrial engineer for the New Orleans Chamber of Commerce, points out a new and very attractive field for engineers in his article on page 604 of this issue. Once attention is called to it one is surprised that the opportunities were not fully appreciated before. Community building is very largely an economic and engineering problem. Other matters, such as the commercial and social life of the city, need attention, but all rise from an engineering and economic foundation. Chamber-of-Commerce activities in municipal-engineering matters is not an innovation, though the New Orleans method of handling this activity, through a qualified salaried engineer, is new. The main departure at New Orleans, and the one that is sure to be copied elsewhere, is the function of the industrial engineer in the promotion and development of the industrial life of the community. Most of us know of the spread-eagle and red-fire methods of attracting industries, and know how little thought is given to the economic questions which should be considered in locating a plant. Failures—many of them—were to be expected. But where there has been one failure there are probably now, merely eking out an existence in "stimulated" locations, half a dozen factories which would be paying plants if fundamental economic considerations had not been neglected.

But aside from the opportunities and advantages on which Mr. George has enlarged, the Engineering Record sees in the entrance of the engineer into this field another decided benefit. It should give an opportunity, through publicity, to throw engineering work into its proper relation into the community's life. The commercial, and latterly the social welfare, factors have dominated the work and the publicity of chambers of commerce to the almost entire exclusion of engineering matters. When engineering problems do come to the fore, they are treated with a bias born of unconscious, but nevertheless deplorable, ignorance.

Engineers and engineering societies have given especial attention to publicity in recent years. They should recognize the position described by Mr. George as an opportunity for more effective educational work, as an ally for giving engineers and engineering their proper place in community affairs.

Engineers qualified by training—long and broad training in industrial matters—and with sales and publicity instincts, may well give consideration to the new field. The appointment of Mr. Paul Gendell, formerly manager of the Engineers' Society of Pennsylvania, to the secretaryship of the DuBois, Pa., Chamber of Commerce indicates that there are already those who see the opportunity.

Present-Day College Education

"I NEVER feel that I have hit hard unless there is a rebound," said a famous orator, and that thought comes to mind in reading the discussion between Professors Mead and Swain on college education, which appears on page 607 of this issue. Professor Swain hit hard in his original communication. He spoke frankly on matters that are of the gravest concern to educators—the characteristics of the men they turn out. It was but natural that his views should meet with opposition—opposition based on misunderstanding of his position or on radically different experience.

As often, in controversial matters, some of the differences are more apparent than real. For example, on the matter of common sense, Professors Mead and Swain are not far apart, though they differ as to the cause of whatever lack of common sense they concede.

On some points, though, there is wide difference, and though Professor Swain contends that there is no difference in the schools, one cannot but feel that there must be disparity in some of the factors between East and Middle West. On any other theory it is hard to account for the divergence. Is it in the spirit of the schools? Is it in the home training, preparatory schooling or attitude of the men? Only a thorough acquaintance with the two sections of the country in question, and with their young men and educational institutions could justify one in speaking with finality.

On one point in controversy—whether or not college men, on the average, are accurate and thorough—the divergence should be less than it is. The experience of the Engineering Record favors Professor Swain's rather than Professor Mead's position. Recent college graduates who are accurate and thorough are not easy to find. One cannot expect from them the finish of practitioners in the handling of technical problems, as Professor Mead well contends, but employers have a right to expect in the young men habits of accuracy and thoroughness and the power of sustained, logical thinking.

On one point the agreement of the two professors is particularly gratifying—that "more moral training and more discipline" are needed. Such training and discipline are crying needs throughout our entire educational system. In fact, military drill for pupils in the grades and in the high school has many advocates because of the disciplinary effect, aside from all considerations of a strictly military character. One consulting engineer, employing normally from 30 to 40 men, has found his work to suffer so much from the employment of undisciplined college graduates that he makes a practice of securing West Point and Annapolis men whenever possible, and as a second choice takes technical graduates who have worked their own way through college. His experience is that these men have learned to obey and submit more readily to the routine of the organization.

Professor Swain well commends the work of Dean Herman Schneider at the University of Cincinnati. Dean Schneider, by the plan of alternate periods in school and in the shop, secures a constant appraisal of the student's scholastic attainments, and puts his knowledge to constant test in practical work. Most of the shortcomings of which Professor Swain complains cannot continue under such test. The student must mend his ways or force his own elimination from the course. The discipline is a severe one, but perforce most beneficial, for the qualities most worth while are developed through arduous work.

Controversies such as that here discussed have a very decided value. They throw into relief important questions. These must be thrashed out if the sanest and best development is to ensue.

National Freight-Handling Companies

DESPITE all the attention given it, the handling of freight at terminals seems to show very little improvement. Here and there mechanical devices, particularly at ports, have effected economies, but when the whole problem, including the haulage from shipper to terminal and from terminal to consignee, is considered the conclusion is forced on one that progress has been slow. On page 606 of this issue the matter is discussed again. Mr. Marshall has hit at the root of the difficulty when he proposes large, well-organized trucking companies. Efficiency in freight handling, as far as city haulage is concerned, is low because each small shipper and consignee works independently and according to his own whim. No effort is made to handle the business as a whole, scheduling and classifying it in accordance with any well-thought-out plan. In fact, with a multitude of individuals, each seeking to serve his own interests, co-ordination is impossible. The remedy, obviously is to substitute large companies which will subordinate the whims of individuals to a system that will make for greater efficiency and, in the long run, be a benefit to all parties. This scheduling of freight handling, and haulage by night as well as by day, in order to iron out the peaks and thus secure maximum use of haulage equipment and freight terminals, has previously been advocated in this journal.

When, however, Mr. Marshall proposes the formation of national companies to do this work he breaks forth into a new field. The minute this plan is proposed question arises as to details. These Mr. Marshall has not given, and consequently judgment on the plan will depend entirely upon the supposition as to details made by each individual. Shall this company handle the trucking at either end only, or shall it, like the express companies, own its own cars and assume full responsibility for the goods in transit. If it were to take the latter course, the procedure would be a radical change from present practice. The first plan, of merely handling the haulage, would be but an extension of the local company organization mentioned in the previous paragraph.

Whatever the details, however, careful study of the possibilities of this scheme and of other serious plans that may have the same end in view are worthy of close analysis and study. Terminal charges are so excessively high that any measures that will reduce them will be a boon to the transportation interests and will materially cut down the transportation overhead which all commodities must now bear. Progress toward a solution is exceedingly slow, and it would not be surprising if effective reduction of terminal rates would wait upon the discovery of some radically new method of treatment. Applications of methods now well known have not been received with much enthusiasm by the railroads, while the large trucking organization, local or national, capable undoubtedly of reducing costs, apparently does not hold out promise of sufficient economies for individual shippers to encourage capital to embark in the enterprise. A trial with it, however, might quickly develop the weak spots and advantages, and lead the way to a thoroughly satisfactory solution of the problem.

Another Enormous Railroad Improvement for New York City

FOR MANY YEARS negotiations have been going on to bring about radical changes in the West Side freight line of the New York Central Railroad in New York City. The problem was a big one, and very complex. The main basis for the improvement was the demand for the renewal of the tracks from the grades of Tenth and Eleventh Avenues. At the same time the users of Riverside Park and other parks sought to have them relieved from the smoke and bad-odor nuisances and the shutting off of the public from the Hudson River front. These, with improvements wanted at other points, involved practically the entire 12-mile line. Among the agitators were not a few who, indifferent alike to the rights of corporations and to the invaluable service rendered by this particular corporation in bringing food to the city, wished to throw the railroad bodily into the river. Others, more reasonable but nevertheless obstructionists, opposed what they thought would give the New York Central a permanent monopoly on the bulk of the city's business. All manner of minor objections were raised to practically every change all along the line. Naturally the New York Central, having rather definitely established its right to be there, had no intention of spending millions without obtaining any offsetting advantages. Hence the protracted negotiations, which have now resulted in a tentative understanding between city and railroad. The main features of that understanding are set forth on page 612.

As a reading of the article will indicate, the expenditure of $50,000,000 to $100,000,000 on the project ranks it with the recent passenger terminal improvements of the Pennsylvania and the New York Central in New York City. Moreover, it is without doubt the most expensive freight terminal improvement ever projected.

Since the preparation of that article the public hearings mentioned have begun. Judging from the first of these, last Monday, there is almost unanimous approval of the project as a whole. The main objections are on two points. Certain uptown associations look askance at the unwillingness of the railroad to build the bluff above Manhattan valley out over the steel roof it offers to construct over its main tracks, and believe that even then the uncovered yard beyond may become a nuisance and spoil the park. Hence they want at least a reservation in the contract that the yard may be covered later if the city desires it. Then certain idealists who cling to the idea of a marginal railway and belt of warehouses around Manhattan fear that the proposed change south of Thirtieth Street, where the New York Central seeks a private right-of-way, will be a barrier to the development of this general warehouse belt.

This journal believes that both of these objections are unwarranted. As to the marginal railway and warehouse belt, the Engineering Record is heartily in favor of this form of terminal development where feasible. Looking over the New York Central plans and noting what facilities this one railroad deems necessary for its individual purposes, one is inclined to doubt whether a line adequate for all of the New Jersey roads is feasible in lower Manhattan. Assuming that it is, however, the present project leaves ample room for the later development, and even though the warehouse belt may have to be narrow in places, that local restriction does not seem serious to a line around lower Manhattan.

As to the covering of Manhattanville yard, the electric operation and the fact that the yard will be far below the level of the park make it unlikely that it will ever be a serious nuisance. Those who point to the lower level of the proposed Thirtieth Street yard as proving the feasibility of operating a covered yard overlook the fact that the latter is a loading and delivery yard, where there will be comparatively little switching.

In a nutshell, the railroad has conceded about all it will to the city, and Controller Prendergast made it plain at the hearing Monday that every objection raised there had been thrashed out in conference. The outstanding feature of the tremendous project is that the railroad offers to spend a large sum of money on a piece of work that will improve civic conditions vastly. It is, therefore, unwise to indulge in further argument over details, or to hold down this company that is ready to act, because it is thought that other railroads might at some later date desire to participate in the work. The proposed improvement would be a boon to the city and the Engineering Record hopes it will go through substantially as planned.

The Government Railroad in Alaska—What Two Years and Limited Funds Have Accomplished

In Expenditure of $2,467,914 Alaska Northern Railroad Has Been in Part Paid for and Rehabilitated, Extension to Matanuska River Practically Completed and Entire Line Located

By THOMAS RIGGS, JR.
Member Alaskan Engineering Commission

LOOK FIRST at a map of Alaska. The panhandle is a narrow fringe along the sea and does not need a railroad. It is served entirely and well by water. A narrow-gage railway from Skagway to Whitehorse breaks through the mountains and forms a part of the White Pass and Yukon Route to the waters of the Yukon and its tributaries. As far as this article is concerned, we can eliminate the panhandle. The great balance of Alaska, approximately one-sixth of the United States, is without adequate means of transportation.

From Cordova on the east side of Prince William Sound the Copper River & Northwestern Railway, a standard-gage road, runs northward along the Copper River to Chitina at Mile 131 and then bends eastward for 65 miles and halts against a mountain, but directly under the ore bins of the Bonanza Mill. The marvelous Kennecott copper mines were the real reasons for construction, although the railroad is now performing the functions of a common carrier in the development of a wonderful region of mineral resources.

LIGNITE EXPOSURES APPEAR IN SANDSTONE CLIFFS IN NENANA COAL FIELDS

On the west side of Prince William Sound, a standard-gage road, starting life under the name of the Alaska Central Railroad and now called the Alaska Northern Railroad, having its terminal at Seward, extends northward a distance of 71 miles. In the interior of Alaska a narrow-gage railroad 46 miles long serves the Fairbanks mining district. On the Seward Peninsula two little roads slumber peacefully on the Arctic tundra. A few other short stretches of construction in various parts of the territory serve strictly local demands or are out of commission entirely.

So much for railroad transportation in Alaska until the act approved March 12, 1914, put new life into moribund schemes for the mineral and agricultural development of a country so rich in possibilities as almost to cause skepticism.

In 1912, under authority from Congress, President Taft appointed a commission, consisting of Maj. Jay J. Morrow of the Corps of Engineers, U. S. A.; Alfred H. Brooks, of the U. S. Geological Survey; Leonard M. Cox, Civil Engineer, U. S. N., and Colin M. Ingersoll, consulting engineer, of New York, to examine into railroad possibilities in Alaska and report on routes which would best serve the development of Alaskan resources. Their work was admirably accomplished and an exhaustive and valuable report submitted.

ENGINEERING COMMISSION IS FORMED

In May, 1914, President Wilson, advised by Secretary Lane of the Interior Department, appointed William C. Edes, chief engineer, Northwestern Pacific Railroad; Lieut. Frederick Mears, superintendent, Panama Railroad, and Thomas Riggs, Jr., engineer, Alaskan Boundary Commission, a commission to make certain surveys, estimates and investigations on which routes could be definitely selected by the President and a railroad constructed, for which purpose Congress had authorized a sum not to exceed $35,000,000. The commission was in the field from the latter part of May until November and then returned to Washington and submitted a report. Briefly the results accomplished in miles were as shown in Table 1.

TABLE 1—MILEAGES SURVEYED IN 1914

Definite railroad location	122.86
Preliminary surveys	875.99
Valuation surveys	70.80
Reconnaissance surveys (Kuskokwim)	726.00
	1,795.65

In addition, members of the commission inspected the harbors of Cordova, Valdez, Portage Bay, Seward and Controller Bay; made a careful examination of the Copper River & Northwestern Railway, covered the route between Seward, the Matanuska coal fields and Fairbanks, and between Fairbanks and the Nenana coal fields via the Tanana River flats, visited the Bering River coal fields, covered the route between Fairbanks and Valdez and Chitina, and made a detail examination of the survey between Valdez and the Copper River over Marshall Pass.

For the preliminary work Congress had appropriated $1,000,000. Of this amount the commission expended $393,059.92, this covering surveying equipment, pack trains and launches, transportation, salaries of fourteen parties, maintenance of headquarters at Ship Creek, compensation of weather observers at Portage Bay and Ship Creek throughout the winter, caretakers of stock and equipment at Ship Creek and Fairbanks, reduction of field notes, preparation of maps, charts and profiles and the final report.

$2,000,000 APPROPRIATED FOR CONSTRUCTION

For the fiscal year 1915 Congress appropriated a further sum of $2,000,000 to start actual construction along a route to be selected by the President, and in April the President, through Secretary Lane, announced his selection of route, a copy of which has already been published in the Engineering Record. [See the issue of April 17, 1915, page 482.] Briefly stated, the road is to go from Seward on Resurrection Bay to Fairbanks, a distance of 466 miles, with a 38-mile branch to the Matanuska coal fields and a 5-mile branch to Ship Creek (or Anchorage, as it is now called). As part of the contemplated system the President authorized the purchase of the Alaska Northern Railroad for the sum of $1,150,000, for which a preliminary installment of $500,000 was paid, the balance to be paid in one year.

Through executive order the supervisory power was placed in the hands of the Alaskan Engineering Commission under the direction of the Secretary of the Interior. Mr. Edes was continued as chairman and chief engineer, with full veto power over all administrative matters. With $500,000 obligated to the Alaskan Northern Railroad Company there remained only a little more than $2,000,000 to be expended on construction. It was considered that the best results could be obtained by concentrating construction largely from one headquarters. The flat land near the mouth of Ship Creek was selected as the most available point for initial operations.

The chairman established himself at Seward, which has become the executive headquarters. To Lieutenant Mears was assigned the first brunt of construction, and to the writer the completion of location surveys from near Broad Pass to Fairbanks. For convenience the parcelling of authority was entitled Seward Division, Anchorage Division and Fairbanks Division.

HEADQUARTERS ESTABLISHED AT SEWARD

At Seward are established all the headquarters executive offices. The members of the commission report monthly to the chairman, who in turn reports to the Secretary of the Interior. All accounts from other divisions receive administrative action here before being forwarded to the auditor of the Interior Department at Washington for settlement.

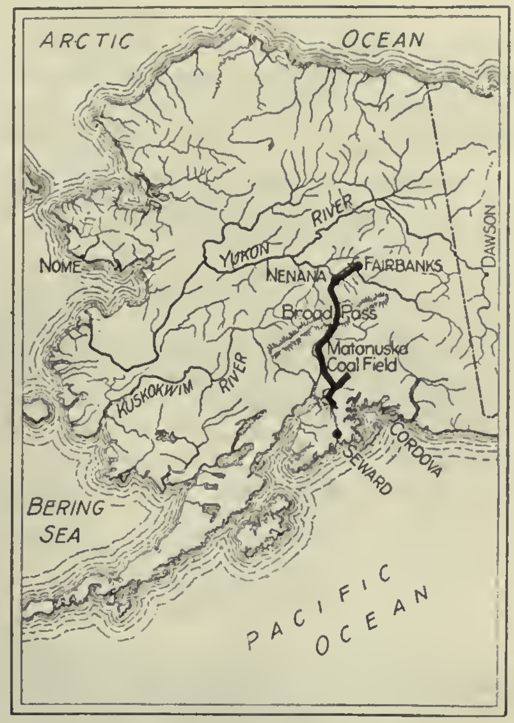
On his arrival in May at Seward the chairman moved into the offices of the Alaska Northern Railroad, and pending adjustment of certain suits against the railroad took it over on lease. A small amount of reconstruction was attempted and the road put in shape for gas-car traffic as far as Mile 53. Beyond this the road was out of commission, owing to slides and washouts. In August the transfer of the road was effected and all property, including the dock, was turned over to the government. William C. Edes was designated as president, Frederick Mears as vice-president, and B. H. Barndollar secretary and treasurer. From the traffic receipts a small machine shop was erected and a number of minor repairs to the road were made.

For convenience the office of the purchasing agent is located in Seattle, C. E. Dole, formerly chief clerk of the Purchasing Division of the Isthmian Canal Commission at Washington, being in charge.

FIRST CONSTRUCTION IS AT ANCHORAGE

The romance and honor of initiating the first government railroad construction in Alaska belongs to Mr. Mears.

Anchorage lies on Knik Arm of Cook Inlet. The range of spring tides is nearly 40 ft. Direct dockage is impossible under present conditions, and all steamers must lie in the roadstead discharging cargo to lighters, which come ashore on the tide. The first condition to be faced was that of landing material, men and supplies. There were available only one 60-ton cargo lighter, formerly the property of the Navy Department; a 50-ft. navy steamer; a flat-bottom stern-wheel boat, built by the commission the previous year, and a few privately owned gasoline launches. In a hurry additional lighters and power craft were accumulated, a high-tide wharf and warehouse was built, and a spur track laid through the mud to the higher ground along Ship Creek. Gradually a dismal, tent-dotted flat took on the appearance of a construction headquarters, pile drivers chugged industriously at landing wharves along the creek, a track stretched its way through material yards, and stiffleg derricks and locomotive cranes handled the fast-increasing supply of construction material.



POSITION OF LOCATED LINE

In June grading was actively prosecuted. In almost every operation the small-contract system was employed. Clearing, grubbing and grading were let to stationmen—associations of laborers who take on a contract at an agreed-upon unit cost. Clearing and grubbing are paid for by the acre, and grading goes by the cubic yard. By this method very satisfactory results were obtained, and in all probability the method will be continued throughout the period of construction. Bridge work is done under force account, as is also tracklaying.

The first 150 miles of the accepted line lie entirely within the Chugach Forest Reserve, and authority was obtained from Congress to take material from the forest free of charge. The timber used from the forest is largely spruce or hemlock, and while inferior to the timber of Puget Sound, still answers all the immediate requirements for ties, piling and trestle posts. The larger bridge timbers are all brought from Washington or Oregon, as spruce of sufficient size and quality is not readily obtainable in Alaska, and owing to the local climatic and industrial conditions, cannot compete to advantage with the imported article.

Three locating parties operated in the Anchorage Division and a temporary telegraph and telephone line was pushed through to Kern Creek to connect with the line of the Alaska Northern.

Up to Feb. 29, 1916, in the Anchorage Division part of the results accomplished are given in Table 2:

TABLE 2—CONSTRUCTION DONE IN ANCHORAGE DIVISION UP TO END OF FEBRUARY

1.	Clearing and right-of-way	797.68 acres
2.	Grubbing	145.28 acres
3.	Excavation	941,819 cu. yd.
4.	Track, 56-lb. rail	81,367 lin. ft.
5.	Track, 70-lb. rail	195,548 lin. ft.
6.	Telephone line	213,395 lin. ft.
7.	Piles in trestles	107,801 lin. ft.
8.	Iron in trestles	161,926 lb.
9.	Lumber in trestles	822,380 ft. b. m.
10.	Logs in culverts	112,559 lin. ft.
11.	Iron in culverts	12,558 lb.

Toward the close of the year, funds being practically exhausted, the organization was reduced to a minimum, and aside from a little track laying and the completion of the bridges under course of erection, work was brought to a standstill.

ALONG THE SHIP CREEK BRANCH—THE GRADING HERE AS ELSEWHERE IS BEING DONE MAINLY BY STATION MEN

The line from Anchorage to Matanuska River is now practically completed.

TRANSPORTATION PROBLEMS FOR SURVEY PARTIES AT NORTH END

Operations in the Fairbanks Division consisted simply of location and valuation surveys. A definite location was made from Carlo Creek, Mile 331, to Fairbanks, Mile 466. Toward the close of the season a valuation was made of the 46 miles of the Tanana Valley Railroad running from Chena and Fairbanks to Chatinika in the heart of the mining district. While the surveys themselves presented no serious difficulties, the matter of transportation in the interior is always one of delay and expense. The skeleton parties left Seattle early in May and proceeded via steamer and railway to Whitehorse, thence overland 150 miles around the frozen lakes to Carmacks on the Lewes River, where a steamer was waiting to leave as soon as telegraphic reports showed the river to be clear of ice. On May 22, 1915, the first party was disembarked at Nenana, where waiting packhorses transported them up the Nenana to Carlo Creek. The other party started at Fairbanks and worked to a junction with the first party on the Nenana River. The juncture was made late in September and the parties were disbanded, the engineers proceeding to Seward over the wagon road, to take up office work in connection with their surveys. A final location was made on 135 miles.

COUNTRY SURPRISINGLY "EASY" FOR RAILROAD

A matter of wonderment to all engineers is the character of country through which location has been effected. The maximum grades are found in the mountainous Kenai Peninsula, where grades of 2.2 per cent exist in two summits. It is even possible, albeit at great expense, to reduce this grade to a 1.5-per cent maximum, compensated. There exists a short sketch of 2.13-per cent compensated grade near Mile 278. North of Broad Pass, the summit of the Alaska Range, the maximum grade is 1 per cent compensated. Curvature is held down to 10 deg. maximum, except in a very few instances where it approaches 14 deg. Broad Pass itself seems to have been designed to carry a road to the interior country. With an elevation of only 2400 ft. above sea level it lies a great wide gash in mountains towering on either side. To the west stands Mount McKinley, with an altitude of 20,300 ft., to the east are his husky offsprings, reaching in certain peaks elevations of more than 14,000 ft.

With few exceptions difficult construction is confined to Turnagain Arm and the Nenana Canyon where heavy rock work is encountered.

In the enabling Act authority is granted to utilize such equipment from the Panama Canal as may be no longer required on the Isthmus. In pursuance of this authority several thousand tons of engines, cars, track and shop material were shipped to Anchorage and are now there in use.

THE NEW TOWN OF ANCHORAGE

Another feature of the Act was the power granted to the President to withdraw from entry such townsites along the right-of-way as might be of use to the railroad. A number of such tracts have been withdrawn and on one, Anchorage, a thriving town is already established. For its own use the commission first selected such tracts as were needed, following which a portion of the withdrawal was subdivided into town lots and sold at auction to the highest bidder. A one-third payment was made on the purchase price and the remainder is to be paid in five equal installments without interest. So far the sale value of lots has reached $177,105.

The town is in a rather anomalous position. Title is still vested in the government, and the community has no authority by which its needs can be met by taxation. Unfortunately all money collected from the sale of lots is by law turned into the Treasury of the United States and in consequence the commission, as well as being engaged in the construction of railroads, perforce must look to the welfare of the town. Roads had to be cut and graded, a post-office, jail and schoolhouse built, waterworks installed and sanitary regulations enforced.

In the regulations for the disposal of lots was contained the clause that in no event, under pain of forfeiture, should liquor be sold. That this was a wise provision none can now deny, and as a consequence in this our northernmost possession there exists a railroad construction camp in which disorder seldom appears and the jail is seldom occupied. The few illicit sellers of whiskey have been rounded up and punished.

The financial figures in Table 3, taken from a report of the chairman, will be found of interest to the engineer:

TABLE 3—STATEMENT OF EXPENDITURES FOR ALL DIVISIONS, COMPILED FROM LATEST INFORMATION RECEIVED FROM FIELD

Balance remaining from appropriation of $1,000,000 (provided in accordance with terms of Alaska Railroad Act approved March 12, 1914) Feb. 1, 1915, in hands of U. S. Treasurer and special disbursing agents of Alaskan Engineering Commission			$607,095.00
Appropriation becoming available July 1, 1915, sundry civil appropriation act for fiscal year 1916			2,000,000.00
Amounts reimbursed to appropriation, "Construction and Operation of Railroads in Alaska," Feb. 1, 1915, to Nov. 30, 1916			2,902.30
			$2,609,997.30
Total available for expenditures on "Construction and Operation of Railroads in Alaska," Feb. 1, 1915, to Nov. 30, 1916			2,609,997.30
Expenditures, Anchorage Division, to Nov. 30, 1915:			
Wharves and docks, Anchorage		$28,841.00	
Marine railways for repair and storage of floating equipment (included in "Wharves and Docks").			
Dredging operations, Anchorage		1,099.00	
Terminal yards, Anchorage		53,576.00	
Construction of Ship Creek spur line, Anchorage to Ship Creek Junction (4.8 miles)		97,927.00	
Construction of main line, Ship Creek Junction to Matanuska River		790,406.00	
Machine shops, engine house and other permanent railway buildings, Anchorage		19,474.00	
Temporary telephone line, Kern Creek to Ship Creek (Anchorage)		7,201.00	
Winter quarters for permanent employees, Anchorage		25,747.00	
Wintering live stock		4,266.00	
Construction work, Anchorage townsite		42,363.00	
Maintenance of hospital, Anchorage		11,246.00	
Public buildings, Anchorage (post office, marshal's office, school house)		8,310.00	
Construction of winter trail, Anchorage to Bird Point		952.00	
Anchorage commercial telephone system		2,764.00	
Freight and repairs, equipment transferred from Canal Zone		132,390.00	
Cost of floating equipment: Launches, barges, boats, etc.		63,657.00	
Location surveys, south end of main line and Matanuska coal field branch		77,111.00	
Unapplied construction material and supplies on hand		408,837.00	
Total Anchorage Division		$1,776,167.00	
Note.—The following expenditures for equipment have been included in the cost of the Ship Creek spur line, main line, Ship Creek Junction to Matanuska River, and Anchorage terminal yards:			
Pile drivers, locomotive cranes, locomotives and cars, track jacks, and track tools	$44,585.87		
Horses, wagons, etc.	28,673.86		
Sawmill and sundry machinery	4,929.20		
Grading machinery and equipment	15,551.81		
	$93,740.74		
Location surveys, north end, main line, Carlo Creek to Fairbanks, to Dec. 31, 1915		46,793.50	
Payment of first installment on purchase price for Alaska Northern Railway (Aug. 25, 1915)		504,188.49	
Commission and headquarters office expenses (to Nov. 13, 1915)		76,700.00	
Rehabilitation of Alaska Northern Railway (to Nov. 13, 1915)		49,000.00	
Purchasing office, Seattle, Wash. (to Nov. 13, 1915)		12,100.00	
Treasury settlements in November (freight bills and sundry miscellaneous items)		2,965.17	
Total expenditures as above			$2,467,914.16
Known balance (Nov. 30, 1915) from latest available information from the field (unexpended)			$142,083.14

It must be remembered that the above figures include a very high transportation cost with rates from Seattle ranging from $6.50 per ton on steel rails to Anchorage to $120 for other classification of freight to the interior country. Penalties for heavy pieces are appalling. First-class passenger rates from Seattle to Anchorage are $55 and to Fairbanks $130.

In February, 1916, Congress included in an urgent deficiency bill the sum of $2,000,000, so that the commission might continue its activities until the regular appropriation contained in the Sundry Civil Act should become available. With this amount the summer's supplies are being ordered and contracts for construction being let. It is hoped that by the close of the calendar year a great stride toward final construction will have been made.

Table 4 gives the approximate locations of the various points of interest in miles from Seward.

TABLE 4—APPROXIMATE MILEAGES

Point	Miles
Seward	0
First Summit	12
Second Summit	45
Top Summit	46
Spencer Glacier	53
Portage Creek	64
Kern Creek	71
Anchorage Junction	116
Anchorage	121
Eagle River	126
Knik River	145
Matanuska River	147
Chickaloon (coal fields)	186
Little Susitna	167
Willow Creek	185
Talkeetna	226
Indian Creek	268
Broad Pass	311
Carlo Creek	331
Riley Creek	334
Nenana Canyon Head	345
Opposite Healy Creek (Nenana Coal Fields)	357
Nenana Bridge	368
35-mile crossing	380
Lost Slough	890
South side bridge across Tanana	407
Goldstream, first crossing	425
Goldstream, second crossing	454
Happy Summit	456
Fairbanks	466

BENEFITS TO BE DERIVED FROM RAILROAD

The principal benefits to be derived from a railroad will be the opening up of coal fields for the use of the people of the United States and Alaska. Nearest the coast on the route of survey lie the Matanuska coal fields. A recent test of a sample from these fields shows the coal to be available for use by the Navy. The coal is a fine-quality, semi-bituminous coal, comparing favorably with the semi-bituminous coals of West Virginia and Maryland. For export purposes this product can be shipped either from Seward all months of the year or from Anchorage for seven or eight months of the year when Cook Inlet is free from traffic-hindering ice. The advantage of shipping from Anchorage is that the haul is 110 miles shorter than to Seward, with practically no adverse grades. With certain harbor improvements to facilitate loading and unloading at all tides, colliers of any size can navigate Cook Inlet during the open season and approach bunkers erected to suit the size of the trade.

One hundred miles from Fairbanks are the Nenana lignite fields. These lignites are low in ash content and high in calorific value. While it is hardly possible that these coals will ever be exported from Alaska, they are well adapted for domestic use.

After ten years of great mining activity around Fairbanks the wood available for fuel has been destroyed within the economic limits of wagon and sled haul, and the mining industry is appreciably slackening. The Nenana lignites will supply the fuel wants, and the lower-grade auriferous gravels will be made productive and profitable. Cordwood in the Fairbanks mining district has now reached the enormous price of from $10 to $16 a cord, according to locality. Lignite should be delivered to the consumer at a maximum price, including wagon haul, of $8 a ton. With a fuel value of one ton of coal to two cords of wood, a saving is effected which makes all the difference between a substantial profit and a bad loss. The average plant in frozen placer mining burns ten cords per day. What a wonderful difference in operating a small low-grade mine whether the daily fuel bill is $40 or $160!

Carpers and pessimists see small profit to be gleaned from a government-owned and government-operated railroad, but the histories of all railroads show that development always follows completed construction. There may be a few lean years, but progress along a line of transportation is sure. In the case of this railroad we have first an assured market for coal at both the northern and southern terminal. On Kenai Peninsula and up the Susitna Valley numerous mines, both lode and placer, await transportation which will reduce the prohibitive costs of crude conveyance. Broad Pass bids fair to become a low-grade lode district with heavy shipments of concentrates. The Kantishna district, once famous for placers, 75 miles west of the lower Nenana, has long held interest as a lode possibility and is even now shipping out antimony ore of a high grade. Sixty miles north of Nenana, where the line crosses the Tanana River, is a new placer camp in the Tolovana country, which may even equal the Fairbanks district; the output to be sluiced in the spring clean-up is variously estimated from $500,000 to $1,000,000. At Nenana the railroad will distribute coal and supplies to the lower Tanana River and to a thousand miles of the Yukon. Fairbanks will be the terminus. The Fairbanks district contains about 5000 people and during the ten years of its life has produced upward of $100,000.000 in mineral wealth, and still the major part of it is undeveloped.

Then there is agriculture. In 1914 the agricultural products of the Tanana Valley were valued at $115,000, and agriculture has hardly started. Alaska, if put to it, can furnish her population with all farm and garden products, and will eventually do it.

It has been stated that ten persons to the mile will pay the operating expenses and maintenance of a railroad. In the near future we will have more than this, and the railroad, which adversaries of the measure have termed "a governmental altruistic experiment", will result in a commercial success.

Costly Grubbing for Roads

On some of the stretches of the Cascade Highway in King County, Washington, the engineer's report shows that the cost of grubbing stumps from the right-of-way amounted to $400 per acre. This cost is chifly due to the fact that on these stretches of the line there was an unusual number of very large stumps.

California's Bituminous Carpeted Concrete Roads Show Durability in Service, Report States

Division Engineer W. C. Howe of State Commission Reports on First Costs, Construction Methods and Maintenance for "Thin Top" Work

In spite of predictions of failure for the ½-in. bituminous wearing surface which the California Highway Commission has applied to its 4-in. concrete roads, this type of construction is said to be proving its economy and durability by actual service tests. It appears from a report by Walter C. Howe, division engineer, to Austin B. Fletcher, state highway engineer, that the life of the thin bituminous top will, with moderate repairs, exceed the term of three or four years estimated for it. This conclusion is reached as a result of an experience with 400,000 sq. yd. of surfacing in Division 5 of the state highway system between Salinas and Santa Barbara, all of which, with the exception of a few thousand square yards laid under adverse conditions, is said to be in excellent condition. Mr. Howe discusses the construction methods and costs of this work in the following extracts from his report:

PERMANENT INSTALLATION OF A CALIFORNIA OIL-HEATING PLANT

The covered road oil storage tank in the foreground has a capacity of 25,000 gal. The steam boiler and road oil pump are in the little building, to the left of which appears the oil retort or heater. The motor truck tanks are fed with hot oil from the retorts.

EQUIPMENT USED AND CREW

The equipment necessary to apply this wearing coat in the most economical manner consists of the following:

1. A semi-portable oil heating plant, one arrangement of which, together with the necessary items, is shown in the drawing.
2. One or two, preferably two, 5 or 6-ton motor trucks, with power dump bodies, one of which is interchangeable with a 1000-gal. pressure oil distributor which is operated by truck motor.
3. One 9-ft. broom, horse-drawn street sweeper.
4. Set of car unloading chutes or portable bunker of sufficient capacity to hold 12 tons of screenings.
5. Lot of small tools such as shovels, round and square point, broad-blade hoes, fibre and steel stable brooms, etc.

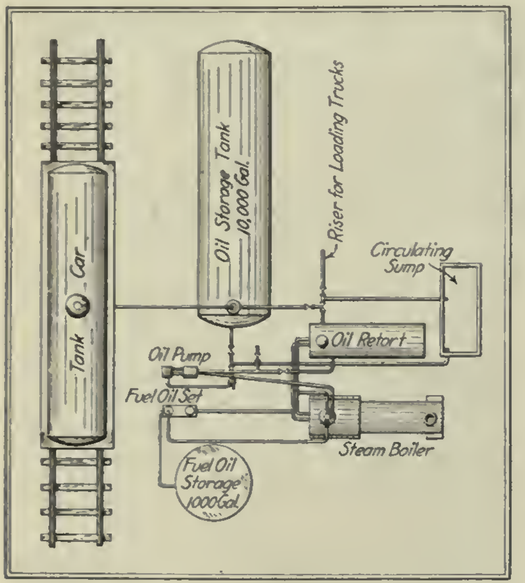
With such an outfit, costing about $12,000, approximately 3000 sq. yd. of completed surfacing can be laid daily under average conditions for about eight or nine months of the year in California; or, say, a yearly output of 600,000 sq. yd. The life of the equipment without excessive repairs is about 5 years. With interest at 6 per cent and depreciation at 20 per cent, this fixed charge per square yard of surfacing would be about one-half of one cent, based on the output noted.

The size of crew used in this work varies from ten to eighteen men, with a two-horse team for the sweeper. The following scale is a fair average of the wages paid to an experienced organization:

DAILY WAGES OF CREW

Foreman	$5.00
Oil plant operator	4.50
Motor truck drivers	4.00
Oil distributor operator	3.00
Skilled labor (covering oil)	2.50
Teamster	2.50
Common labor (unloading cars, etc.)	2.25
Two-horse team	2.25

A description of the work on one section of highway is given by Mr. Howe to illustrate the cycle of operations: About two to three weeks before the actual application of oil was contemplated, the two motor trucks were put in service hauling screenings from cars at railroad sidings, and spotting them along the pavement in convenient piles. Two methods of spotting piles of screenings were used, as shown in one of the drawings. At the same time the equipment comprising the oil-heating plant was shipped to the job. A location approximately in the center of the section to be oiled, alongside a railroad siding, was utilized for an oil plant site, and the heating plant similar in arrangement to that shown in the drawing was erected. Four men, a foreman at $4.50 and three laborers



TYPICAL ARRANGEMENT OF OIL-HEATING PLANTS ADOPTED ON CALIFORNIA'S HIGHWAY COMMISSION'S THIN BITUMINOUS TOP WORK

at $2.50 each, made the complete installation in ten days.

A few days before the arrival of the first car of oil a crew of eight men, each equipped with a hoe, a square point shovel and a stable broom, went from one end of the pavement to the other, scraping loose and brooming off all earth and detritus adhering to the pavement. Tightly-packed earth and manure will not be removed by the rotary broom. Everything being in readiness to commence oiling operations, one of the motor trucks, having been equipped with the oiling apparatus, and hot oil being available at the oil plant, the pavement crew (8 to 10 men and two-horse team on sweeper) prepared a strip of concrete one-half the pavement width for a length of 4400 to 4500 ft., by careful brooming, to remove dust film and dirt. One of the most important steps in placing this surfacing is this work of cleaning the concrete, and it must be done thoroughly.

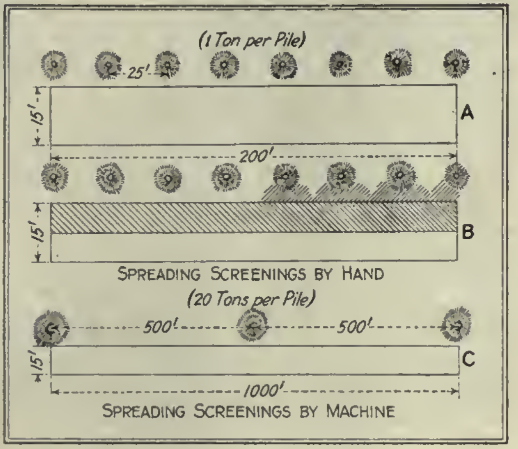
The hot oil was then sprayed on this strip at the rate of ¼ gal. per square yard, the oil being at a temperature of 275 to 325 deg. Fahr. at the time of application. The pavement crew, strung along with 300 to 400-ft. intervals between the men, immediately covered the oil roughly with a light coat of screenings, and as soon as the oil was completely covered the horse-drawn sweeper, with broom locked against revolving, was driven back and forth the length of the strip until the screenings presented a smooth, uniform appearance. The traffic was then turned on to this oiled and screened strip and the remaining half of the concrete pavement was closed to traffic and cleaned to receive its coat of oil.

HOW THE HOT OIL IS APPLIED TO THE CLEAN CONCRETE SURFACE OF THE BASE

OIL APPLIED IN STRIPS

In this manner—a single application of ¼ gal. of oil per square yard in successive strips, each about 4200 ft. in length, first on one-half and then on the adjoining one-half of the pavement—the work was carried forward until the entire pavement had received a first coat of oil and screenings. Traffic was allowed to pass over a strip as soon as it was thoroughly covered with screenings.

A second coat of oil and screenings, exactly similar in quantity and method, was then applied over the whole section on top of the first coat, care being used to sweep the initial covering clean of loose screenings or dust before applying oil. With the completion of this second coat the bituminous surfacing was practically abandoned to traffic, one man and a small wagon and horse being left on the work to add additional screenings wherever oil showed signs of working to the surface. This care against "bleeding" was maintained for about three weeks, and in a short time thereafter the traffic had given the surfacing a smooth, uniform asphaltic appearance.



TWO METHODS OF DISTRIBUTING SCREENINGS ALONG ROADS

In the upper sketch one strip of concrete base, 7.5 ft. wide, has just been oiled, and laborers are throwing screenings on the fresh oil from the small stock piles as shown by the shaded area. In the lower sketch a small hopper discharging into a 30-in. revolving disc, suspended horizontally, is attached to the rear end of the motor truck dump body. Two laborers with truck feed screenings to hopper and load trucks from stock piles.

The use of coarse sand for the second coat, in place of screenings, has been tried with apparently satisfactory results, but it is Mr. Howe's belief that the use of good, hard broken stone screenings, free from the dust of fracture, for both coats of oil will make a more lasting and satisfactory surfacing than the sand.

COST OF SURFACING

A brief summation of costs of the surfacing above described is given. These items of cost are averages taken from seven different jobs, the smallest of which covered 12,800 sq. yd., and the largest 116,000 sq. yd., the total being about 400,000 sq. yd. The table includes the cost of all repairs to equipment, together with the full cost of all incidental tools, etc.

ONE STRIP OF PAVEMENT HAS JUST BEEN GIVEN A COAT OF OIL AND SCREENINGS

It has been freely prophesied that this surfacing will have a life of from three to four years with moderate repairs. That it will have even a longer life, Mr. Howe believes, is now very probable, and such repairs as have been made in the case of the 400,000 sq. yd. previously mentioned, will amount to less than $200, or about $0.0005 (one-half mill) per square yard. Some of this surfacing is almost two years old. With the exception of one small piece of surfacing containing a few thousand square yards, which was improperly put down due to adverse conditions, all of the 400,000 sq. yd. is in excellent condition.

AVERAGE COSTS OF BITUMINOUS SURFACING

	Per sq. yd. of Pavement
*Unloading screenings	$0.0035
Hauling and piling screenings	0.0130
*Spreading screenings on oil	0.0037
*Unloading tank cars and heating oil	0.0056
Hauling and spreading oil	0.0050
*Cleaning surface to receive oil	0.0040
Screenings (cost f.o.b. cars R. R. sidings)	0.0325
Asphaltic oil (cost f.o.b. cars R. R. sidings)	0.0142
*Interest and depreciation	0.0045
*Supervision and overhead	0.0025
Total cost per sq. yd	$0.0885
On approximately 1c. per square foot.	

*These items vary but little no matter what the location of the work. Other items are variable and depend upon length of haul, nearness to sources of supply, etc.

An expensive surfacing would very quickly have exhausted the $18,000,000 highway bond issue fund, while replacements of the thin bituminous surfacing can be made from year to year as necessary from the maintenance fund provided by the motor vehicle tax. The people thus directly benefit by the increased mileage of permanent smooth highway over which they may travel.

Forms on Louisville and Portland Canal Wall—A Correction

The forms for the wall of the Louisville and Portland Canal at Louisville, Ky., the construction of which was described in the Engineering Record of April 15, page 524, held from 60 to 200 cu. yd. per 40-ft. section, instead of 7½ cu. yd., as a typographical error made the article state.

Engineer's Work Puts Community Building on Sound Economic Basis

Chambers of Commerce Must Base Their Industrial Work on Thorough Engineering Investigations if They Are to Prove of Permanent Benefit

By JAMES Z. GEORGE
Industrial Engineer, New Orleans Association of Commerce

THE FIRST fifteen years of the twentieth century have witnessed an awakening to the availability of the engineer for work outside of the mere design and construction of machinery or structures. Those with dollars at stake, or problems to solve, have come to an appreciation of the usefulness of the concomitant imagination, ingenuity and good judgment of the man of well-rounded engineering education and experience. The ability to visualize the abstract and plan and execute it into the concrete, and do it all systematically, has won him a welcome in all walks of life.

The work here spoken of, and to which the attention of the engineering profession is directed, is in connection with the institutions charged with the upbuilding of the commercial, civic and industrial interests of communities—the chambers of commerce, as they are usually called.

INCEPTION OF CHAMBERS OF COMMERCE

The inception of these institutions was almost wholly as a "booster" organization for the purpose of advertising the community. Good was accomplished even by these earlier organizations: the mere getting-together of the leading men in any community is potentially good. Also, many industries were induced to move to, or were organized in, these "boosted" cities, with the help of free sites, nontaxation or cash bonuses. Some of these plants have made good, but most every center I have ever visited has one or more "booster" industries, now boarded up and surrounded by rust and weeds.

The greatest benefit the "booster" clubs conferred was the germination of the seed which has grown into the tree of the saner, more businesslike and efficient community-building chamber of commerce of 1916.

NEW IDEALS

The present and ever-growing demand is that the chamber of commerce be a leader and not a follower; that it render a real service to the community. A very serious call is made on the chamber of today. New industries! More industries! To open up new lines of trade and use more of the available raw products at hand; more and larger payrolls to buy the local merchant's goods—in order that the community may attain industrial supremacy.

But, besides the work in developing industries already in the community or bringing new ones in, there is a legion of other opportunities. Better service from local public-service corporations, favorable transportation rates and service, local-traffic interchange facilities, first-class sanitation, good roads and streets; welfare work, including housing, city planning, parks, playgrounds, employment, wages—all these and more are fit subjects for the chamber's action.

Can the engineer-economist be of service in this work? After eight months' close study of, and experience in, the situation the writer unhesitatingly says he can. What other vocation so fits one for such a multiplicity of duties? A statement of the qualifications necessary is attempted, but with some misgivings.

QUALIFICATIONS NEEDED

These qualifications are education, experience and temperament. Education is, of course, very important; not merely the education got within college walls, but rather the interested reading, study and data-collecting of the years, paralleled by practical work. This must have included not only subjects bearing directly upon design, construction and operaton of enneering works, but collateral or allied and human-interest subjects as well.

Experience is more or less parallel with education. Of course, the experienced industrial engineer's training is of great value in this work. But the writer does not consider the field closed to the other branches of engineering. What broader training does anyone get than in the multifarious phases of large construction or operating work? These institutions do not need so much the actual engineering ability of the technician, as that general, well-rounded education and experience which comes from years of encounter with engineering problems and works.

The final qualification is temperament. Putting this last does not mean a lessening of its importance. The writer does not know of a work that requires more *sauviter en modo*, and at the same time aplomb, than does this one.

The more need there is for the industrial engineer in the building of a community, the more radical are his ideas going to appear. Hence, only the most patient work to educate those interested and the community to these needs will insure success. It means, further, a need for most careful and painstaking preparation before any suggestion is offered. Again, it means the ability to enthuse others in the work to be done that the engineer may have the co-operation. This is most essential in community work.

WORK AT NEW ORLEANS

It will no doubt be of interest to know a little of the work and aims of the industrial engineer of the New Orleans Association of Commerce, which, so far as is known, is the first position of its kind in the United States.

The manager of this institution was the first to get the "vision" of this new order and to realize that community building, to be sound and lasting, must proceed along strictly economic lines. As a part of his plan, in August, 1915, the writer was appointed to the position of engineer-in-charge of the industrial department, and also of assistant general manager of the general organization. The appointment was no doubt owing to the fact that for nearly two years he had been the investigating engineer for the consulting engineers of the port, in the preparation of several important reports, necessitating a close study of this city from a commercial, transportation and industrial standpoint. This statement is made to show that while in the position only eight months, the engineer has had the advantage of several years of study of conditions surrounding industrial development at New Orleans.

FIRST WORK

The first work undertaken was a complete engineering report on the organization and operation of the New Orleans Association of Commerce. To do this required a careful investigation of like institutions. The first step was to make a chart comparing this association with many others in the matter of total revenue, revenue per capita of population, members per capita, percentage of losses in collections, etc., etc. After finding by comparison just its status, it was then possible to make suggestions. These ran all the way from the installation of a modern filing system to the creation of new departments and the broadening of the services of those already in operation. This report and plan of organization has been adopted by the manager as the "bible," as he calls it, for 1916.

In the new plan adopted the position of the industrial engineer in the general organization is about that of "works manager," thus relieving the general manager of all details of operation of the departments and "machinery." This scheme, of course, gives the general manager more time for broad development and policy work.

PLAN OF ACTION

The first principle enunciated was that while every effort would be made to bring in new industries, the greatest effort should be made to expand the individual industries already located here—some 900 in number, large and small. The factory already operating and making good in a small way has evidently passed through the experimental stage and it is in many cases easier to help it to expand its output and thus employ more men and distribute a larger product than to bring another factory in.

Industrial or efficiency engineering, as practised in the northern and eastern industrial centers, is, generally speaking, unknown here. There is not, to the writer's knowledge, an efficiency engineer, capable of advising on organization, production, wage scales, etc., as yet in general practice in this section. Of course, it is utterly out of the question for this department actually to study and assist in bringing each individual plant up to efficiency. The aim is to educate and advise only, to prepare the field for the practising industrial or efficiency engineer.

To accomplish this, those members of the association who are interested in industrial economy are being asked to affiliate with the industrial department. When this has been even partially accomplished we will be in a position to study more carefully the individual and mass needs.

To begin this educational work, a series of lectures by the best experts of the country on the subjects of organization, production, cost accounting and selling was arranged for.

In addition to this, arrangements have

been made for the publication monthly of brief pamphlets. The first is on "Industrial Development at New Orleans." The others will include "Efficiency," "Safety," "Fire Prevention," "Data Filing," etc.

Financial Guidance and Help

In handling specific services to members the executive committee of the department has been divided into numerous sections, such as industrial, finance, safety, fire prevention, employment and opportunities, etc. Committees have also been appointed to study the possibility of by-products for certain of those industries now operating here.

Many industries already in operation will need more capital if they would expand. New industries to be organized here, and those coming from other points, will also need financial guidance and help. To render this service a special section of the executive committee of the industrial department has been organized, consisting of a prominent business man, a large manufacturer and the president of a bank. These three, sitting with the chairman of the department, examine and pass on the merit of such of these propositions as are brought before them. Before putting a proposition up to this committee the writer makes a very full investigation and engineering report on the promoters and the possibilities of the project. If the committee approve the proposition, the report and a statement of approval is then mailed out to the members of the association. This service is to take the place of bonuses. That it will prove valuable is guaranteed by the ability of the committee investigating and approving the proposition.

Briefs for New Industries

In attracting outside industries, instead of sending broadcast general claims as an industrial center, those industries in which supply of raw materials, transportation, markets, etc., are most attractive here have been selected, and engineering briefs on these subjects are being prepared. Under this plan the economies must be developed to the highest point, otherwise industries will not be attracted. And while probably a little slow, this procedure is absolutely sound and will win.

This same reporting service is also rendered to members who contemplate the organization of some particular industry.

Miscellaneous Services

The industrial department is also investigating the local conditions surrounding loans to workingmen, with the idea of developing a remedial loan bank.

Space does not permit detailing here the many other specific services planned and to be developed in this department as quickly as the demand and financial strength make it possible to do so.

In addition to the work within the association of commerce and its industrial department, as a representative of this institution, the industrial engineer is also a member of a public engineering committee which is investigating and planning a public work of great interest and magnitude.

In fact the work for the engineer to do in community upbuilding is limited only by the ingenuity and good judgment of the engineer. It is pleasant work, too, for many reasons, chief among which is that it is a constructive public benefaction—a phase that the writer is sure appeals very greatly to the engineering profession.

The writer sincerely hopes that other engineers will join in this work and thus further demonstrate to the public the capacity and adaptability of engineers for work of the broadest character.

Are National Express-Freight Companies Needed?

Could They Not Effect Systematic Delivery of Freight to and from Terminals, and Eliminate Present Congestion?

By A. JACKSON MARSHALL
Secretary, Electric Vehicle Section, National Electric Light Association, New York City

IS THERE NOT a field for national companies, comparable to the express companies, to handle freight to and from large railroad and steamship terminals?

The costly congestion of freight at railroad and steamship terminals has reached such proportions that before long remedies will of necessity have to be evolved. A study of the problem would indicate that railroads and steamships are carrying freight most efficiently between points, but the handling of merchandise to and from and in the terminals leaves much to be desired. It therefore appears that changes will have to be effected in the transportation of freight to and from the terminals and in the handling of merchandise in the terminals themselves. While great improvements have been made, much more could be effected in these two phases of local freight handling.

It seems to the writer that the full measure of possible success can be obtained only when the local transportation and the handling of freight in the terminals are considered jointly, instead of as two separate and distinct phases. No matter how perfectly developed the method of freight handling in the terminals may be, the highest efficiency cannot be obtained unless the movement of freight to and from terminals by trucks be such as will exactly fit into the scheme of terminal operation and vice versa.

It is apparent that the local transportation of freight is unsystematic and very costly. It is hardly necessary to review the chaotic conditions existing in this branch of the work, which seem to get worse instead of better. Almost everyone is familiar with the losses resulting from the influx and outflow of freight during certain hours of the day at the terminals, and the inactivity at other periods, due to the fact that nearly everyone wants service at the same time, which it is a physical impossibility to render. The thousands of trucks compelled to wait their turn pile up a loss that is counted in the tens of millions.

Why Not Night Operation?

If each truck had a definite time to call for or deliver merchandise to terminals and the schedules were observed, the terminals perhaps operating by night as well as by day, delays and losses due to congestion would be reduced to a minimum. Furthermore, trucks and trailers could systematically operate better at night, since they would not be compelled constantly to buck street traffic with attending delays and accidents. Sooner or later the growing traffic of our cities will force the use of streets at night. There is hardly more reason why the streets of our city should not be used at night, especially for the transportation of freight, than there would be to confine the use of railroad tracks to day traffic.

If the existing trucking individuals and concerns could get together and work out a method of co-operating systematically in the development of a scientific schedule of operation, much could be accomplished. Otherwise it appears that the railroads must either go into the delivery of freight direct from shipper to consignee, or that large and efficient local transportation companies will have to be formed to work sympathetically with the railroads in the elimination of freight congestion, with its attending losses. No matter what method or methods may be employed, action, and prompt action, is imperative.

National Express-Freight Companies

The more thought the writer gives to the subject, the more it appears that organizations possessing the qualifications of efficient express companies would prove to be the solution, for such organizations would have an intimate and practical knowledge of railroading, understand the receipt and dispatch of merchandise through terminals, have national and international organizations and the connections necessary to the forwarding of freight, and know the local transportation phase of the work. Furthermore such a development would not be in the nature of an entirely untried experiment, for the transference of express is not so unlike the handling of freight, except that the latter is somewhat more bulky and usually does not move so rapidly. But it is the writer's personal opinion that the costly congestion of freight could be materially eliminated and far-reaching economies affected if organizations similar to express companies would go into the business of express freight, possibly operating their own terminals and fleets of motor trucks for local transportation, operating along the same general lines employed in the handling of express.

The idea of national organizations competent to handle the freight business on much the same basis as express has been handled seems to be such a simple solution of the problem that the writer has hesitated heretofore to give public expression to it, fearing that it had a weak spot unknown to him which possibly prevented others, better informed, from having expressed the thought before. However, the idea is advanced for whatever value it may have, and if it is not feasible, the fact will shortly be known. The details incident to such a development could be worked out if the main thought is acceptable.

Railroads Teaching Road Making

The first "good roads special" of the Chicago, Burlington & Quincy Railroad started April 11 on a five-day tour through Iowa. It carried government officials and lecturers in the employ the State, who gave talks and demonstrations, and also a complete exhibit of road-building machinery and models of all kinds of roads from dirt to hard pavements. The special was composed of audience and exhibition cars in which the lectures and demonstrations were given free to the public in each of the towns and cities visited.

Does Present-Day College Education Produce Accuracy and Thoroughness?

A Discussion Between Professors George F. Swain and Daniel W. Mead Arising from the Former's Strictures on College Graduates

[*As a contribution to the discussion on the decrease in the registration of students in civil engineering, Prof. George F. Swain severely criticised present-day college education in a letter to the editor of the Engineering Record, published on page* 291 *of the issue of Feb.* 25. *Professor Swain's contention was that many go to college who are not fitted or disposed to benefit by the instruction. That fact, combined with collegiate standards of attainment below those of the business world, produces men who, on the average, know nothing accurately and thoroughly. Prof. Daniel W. Mead differed emphatically with Professor Swain. He has expressed his disagreement in the letter published below, to which, at the request of the Engineering Record, Professor Swain has replied. The reply also appears here.*—EDITOR.]

Professor Mead's Criticism

Professor Mead's criticism of Professor Swain's position is as follows:

I WAS much surprised at the extraordinary communication from Professor George F. Swain, contained in your issue of Feb. 26. If what Professor Swain says is true, the wisdom of continuing the engineering schools of the country, or at least any schools to which such remarks justly apply, would seem doubtful.

From over thirty years of practice over most of the United States and personal contact with many hundred engineering graduates of various engineering schools, more than a hundred of whom have been in my own employ, I desire to go on record in direct opposition to most of the statements made by Professor Swain. My acquaintance and experience have been confined largely to the schools and graduates of the Central States, and my opinion must be regarded as based on such acquaintance and experience. If the schools of the East can accept as valid the assertions of Professor Swain, they certainly have cause for immediate and profound reform.

TECHNICAL COURSES DIFFICULT

It is undoubtedly true that many young men from families in good circumstances enter college as a matter of course, and without any adequate desire for knowledge or training. Such men, at least in our Western colleges, seldom enter the technical courses, which are uniformly noted as the most difficult in the college curriculum; or if they do, seldom follow such courses for more than the first year or two.

In my opinion, the great majority of technical students, even though they do not continue in technical lines, are greatly benefited by the training they receive. For men who are to take part in practical business life, a technical course is greatly superior to the classical or even to the general college courses. All will doubtless agree that if the thoughtless and heedless young men who, on account of conditions, are more often found among the sons of rich men, could be set to work and brought to realize the duties and responsibilities of life instead of wasting their time either in college or society, they as individuals, and the nation as well, would be better off. It is not believed that the decrease in attendance at technical schools is from this class.

There is no doubt that an earnest young man can secure much valuable information from a correspondence course, a night course, or by individual study without outside instruction; but it is equally true that the same man, with the energy to do such work under adverse conditions, can and would gain still greater advantages from the personal instruction afforded by a course in any good technical school.

ACCURACY AND THOROUGHNESS

Professor Swain's remarks on accuracy and thoroughness are unwarranted. He has confused skill in particular operations, which can result only from extensive practice, with the actual qualities of accuracy and thoroughness. Skill or accuracy and thoroughness in the application of technical training, like other similar individual characteristics, are highly desirable qualities and should be inculcated so far as conditions warrant. All such attributes while important are only incidental to technical instruction. Only a certain amount of time can at the best be devoted in a technical course to attaining these desirable ends, and a curriculum largely devoted to their acquisition would degenerate into a business course, valuable in itself for certain definite ends but neither to be expected nor desired as the sole or even the principal aim of technical education. Other things are no less essential in college work, and skill, accuracy and thoroughness, like practical experience, knowledge of men, and breadth of education, must largely be left to be developed in practical life. Even a limited consideration of education should lead to the conclusion that four years in a technical school cannot be expected to lead to accuracy and thoroughness, to logical thinking, or to close observation in any special line. Four years' training in a trade, in business, or in a trade or business school where the student devotes his entire attention to a single line of work, would undoubtedly lead to better results along that specific line; but the training would not have the breadth demanded in a technical course.

The college standard of accuracy and thoroughness is not established by the students but by the instructors, and if the present standard in any engineering school is open to criticism, such criticism must be directed to the engineering faculties rather than to the students. It is possible that more time and energy should be devoted to such work in all technical institutions.

ACQUAINTANCESHIP AND ATHLETICS

If "the greatest benefit which most men derive from college comes from the acquaintances which they form, and the discipline they get from athletics," then our technical schools must indeed be regarded as failures. Association with others is indeed an important part of college education, but in the schools of the Central States comparatively few technical students take active part in college athletics, and hence such advantages are comparatively insignificant. It is indeed questionable if in the majority of cases the athletic side is not more of a detriment than a benefit, at least when much time or energy is devoted to the same.

It is probably true that many college men have an unwarranted idea of their own abilities, and this can be remedied only by actual contact with life. In this they do not differ largely from college professors or others who have not mingled largely with practical affairs. No man has a fair opportunity for self-knowledge until he is able to compare himself with others in the real problems of business or professional work.

CONCEIT AND COMMON SENSE

The common idea of the self-conceit and self-assurance supposed to be possessed by the graduates of technical colleges is largely erroneous. It has been repeated until it has become a popular fallacy. My personal contact with large numbers of young men both in and outside of college does not warrant the opinion that as a rule they possess this characteristic to any objectionable degree. Neither does my experience substantiate the statement that an engineering education is detrimental to the native common sense of young men. Freshmen in technical schools are not noted for any conspicuous development of this faculty; neither are our technical graduates more deficient in this line than should normally be expected from their environments. Common sense can be developed only by contact with real practical experience; it cannot be largely developed in technical schools, but even a fairly well balanced course is not detrimental to this faculty. Only men from those institutions that are too highly specialized have to unlearn the subjects taught in any first-class school.

It is true that in a general course the student does not acquire any great knowledge of any specialty; if he has become interested in the subject and has learned how to study it, he has learned all that is necessary or desirable when the purpose and extent of the course are considered.

PURPOSE OF A TECHNICAL COURSE

Much of the unthinking, popular opinion of college work arises from an apparent lack of an appreciation of the purpose of a technical course and what results should be expected therefrom. I have outlined in another place my conception of the elements of an engineering course as follows:

"All who have given much thought to the subject of education will agree that . . . the purpose of technical education is not so much to impart technical knowledge to the student as to furnish the training which will enable him to understand and investigate the conditions which surround a problem, to determine the fundamental principles on which its successful solution depends, to ascertain and analyze the elements which influence or modify it, to design the structures and works needed for its successful development, and to supervise the proper construction of such structures or works and carry them to a consummation of successful and economical completion.

"For the purpose of technical education instruction is required:

"1. In the fundamental principles of those sciences on which the practice of the engineer necessarily depends.

"2. In those methods and calculations which must be applied in such practice.

"3. There should be included to as great a degree as possible instruction in those human elements that concern the personal relationship of the engineer with his fellows, with his clients, with contractors, and with the public, and also those matters of judgment, equity and ethics upon which the highest success of the engineer depends no less than upon his technical knowledge."

Handicap of Old Ideas

That our technical schools fall far short of the best that can be done must be admitted. The effect of old educational ideas still handicaps technical work. Too much time is devoted to foreign languages, which in the large majority of cases is of doubtful benefit, while the study of English, which is largely essential to professional preferment, is neglected. Mathematics and the sciences are taught in too abstract a manner and their concrete application is often neglected. In many cases, the courses prescribed are unbalanced and they are frequently too special.

There may be, and probably is, a considerable difference in the attitude of instructors toward the student in different institutions and in different parts of the country. The best training in ethical and moral principles obtains when the student has opportunity for intimate personal contact with his instructors both in and outside of the classroom. No such advantage obtains where lectures are entirely formal, and such opportunities seldom exist in active business or professional work where the man gains his information only in the school of hard knocks.

I agree fully with Mr. Swain that "more moral training and more discipline" are needed; but this and other betterments can be accomplished better by intelligent and united effort than by captious criticism.

Professor Swain's Reply

To this criticism by Professor Mead, Professor Swain replies as follows:

I THANK the Engineering Record very much for allowing me to see the letter from Professor Mead and to send my reply so that the readers may have both in the same issue.

In order to make the issue clear, let me summarize in a few brief statements the opinions which I expressed, and then proceed to consider how Professor Mead meets these statements.

Summary of Professor Swain's Position

The opinions I expressed were the following:

1. A large proportion of the students in our colleges and engineering schools would do better for themselves if, instead of going to college, they went to work and earned their own living.

2. The collegiate standard of accuracy, thoroughness and achievement is lower than that of the commercial and business world.

3. The *average* college graduate knows nothing accurately or thoroughly, cannot think logically or observe correctly, has not gained habits of accuracy, and does not know how to obey orders. His knowledge is a half knowledge of many facts, but he does not see them in the right proportion, or know how to use them.

4. It is not infrequent that a college or engineering education has educated nearly all the common sense out of a man.

5. Probably the greatest benefit which most men derive in college comes from the acquaintances which they form, and the discipline they get from athletics.

6. A young man who goes to work instead of going to college, who learns in his work what he needs in order to rise above his fellows, and who supplies this need by correspondence courses, or by night courses at some of the available institutions, will be apt to acquire more real knowledge than the average college graduate.

7. The average college graduate does not realize his limitations, and often goes into the world with a good deal of conceit and unwarranted self-assurance.

8. Our colleges and engineering schools offer great opportunities for those who are able to take advantage of them, but many of those who attend do not know how to take advantage of them, or do not desire to do so.

9. There is a tendency observable in some of our colleges to consider that any student should be able to graduate, and to look upon the failure of a student as largely the fault of the instructor. There is also a tendency, even if unconscious, to measure success by numbers. As a consequence, our colleges and engineering schools are turning out large numbers of routine rule-of-thumb men.

10. What is needed is more moral education and more discipline, for the entire body of boys and girls, and less so-called higher education. A decline in numbers in our higher schools, therefore, would only be a matter of regret if accompanied also by a decline in average ability.

"Wisdom of Continuing Schools"

Professor Mead begins with the statement that if what I say is true "the wisdom of continuing schools to which such remarks justly apply would seem doubtful." This conclusion is illogical, for it would, of course, be folly to discontinue a school which can do much *for those students who are able to take advantage of its opportunities*. Professor Mead probably would not argue that because an electric-lighting plant delivers in light but a very small proportion of the energy of the coal, the wisdom of continuing the plant would "seem doubtful." A thing may be in the highest degree worth doing though its efficiency be small, because the thing that it does accomplish is so valuable.

Taking now the previous summary of my opinions, let us see how Professor Mead answers them.

1. Professor Mead seems to agree with this opinion. He says "it is undoubtedly true that many young men . . . enter college as a matter of course and without any adequate desire for knowledge or training." Also "all would doubtless agree that if the thoughtless, heedless young men . . . could be set to work . . . instead of wasting their time either in college or society they . . . would be better off." This is precisely what I stated. Professor Mead and I might not agree as to the proportion which such young men form of the whole, and of course this is variable. Professor Mead says "the great majority of technical students . . . are greatly benefited by the training they receive." This is probably quite true. The question is whether they would not be *more* benefited by a training in the "University of Hard Knocks." My belief is that a large proportion of students do not receive benefit enough to pay for the cost.

Standards of Accuracy and Achievement

2. Professor Mead thinks this statement is unwarranted and says that I have "confused skill in particular operations which can result only from extensive practice, with the actual qualities of accuracy and thoroughness."

The word "skill" does not appear anywhere in my letter. It is rather surprsing to accuse me of implying that engineering schools should teach details and the acquisition of "skill in particular operations" which can only come from practice, rather than teaching fundamental principles, considering that all my life I have urged the opposite. A student in college, however, should aim to acquire habits of accuracy and thoroughness, and should know his fundamental principles accurately and thoroughly, and my observation is that the standard in these matters which will enable a young man to graduate from almost any college or engineering school is a standard which in practical business would cost him his job.

Professor Mead says that the college standard of accuracy and thoroughness is not established by the students but by the instructors, and that possibly more time and energy should be devoted to these things. The source of the standard has nothing to do with the question, but I quite agree with the last statement.

Accuracy and Thoroughness

3. Professor Mead apparently agrees entirely with this opinion. He goes farther and says that four years in a technical school *cannot be expected* to lead to these qualities. It is true that he refers to acquiring these qualities in some "special line," and thinks, apparently, that "breadth" is better than to so acquire them. If this is his meaning, then he fails to see that the qualities referred to are universally applicable. A man who can reason logically can reason logically in any subject; a man who has the habit of accuracy, carries it into all that he is called to do. Hence the importance of gaining these qualities. If Professor Mead thinks that a smattering of many things, without these qualities, is better than these qualities themselves, I think he will find few to agree with him, and in my opinion such a view is educationally vicious in the extreme. Anyway, Professor Mead admits that a college or engineering course does not give these qualities, and so he agrees with me.

4. With reference to this, Professor Mead somewhat misinterprets my words. If in his experience as a teacher, however, he has not frequently encountered cases in which the extensive and abstract study of mathematics and the other subjects in our engineering curricula has injured the student's practical common sense, his experience has been very different from mine.

Acquaintanceship and Discipline

5. The opinion here expressed will, I am sure, be supported by a great many college and technical graduates who have reached the age when they can look back and form a fair judgment of the value of their college course. I believe that discipline is sadly

lacking to-day in most of our colleges. In athletics, however, the student is *obliged* to submit to discipline, and it greatly benefits him. I have heard of some business houses which make a practice of choosing the college men they employ from among the students who have been prominent in athletics.

Furthermore, it does not logically follow that if my opinion is correct, our technical schools must be regarded as failures, because even if *most* men derive their greatest benefit from the sources which I have stated, there would still be a very large number deriving much benefit in other ways. Besides, the benefit of a large acquaintance is a very real one.

I am no advocate of the extensive indulgence in athletics, and quite agree with Professor Mead that such excess would be a detriment.

6. Professor Mead touches this statement, and admits that an earnest young man can gain much in the ways that I have stated, but thinks that the same young man would gain still greater advantages in a technical school. The trouble with Professor Mead's argument here is that the *obstacles* which the young man encounters in his daily work spur him on, and make him see the necessity for perfecting himself still further, and moreover, make him see more clearly just what he needs; whereas the same man starting in an engineering school assumes an attitude of submissive receptivity, and lacks the spur, the obstacle and the vision.

Some sort of combination of practical work with college education might be very beneficial in this respect, and I am inclined to look upon the work which is being done by Dean Schneider at the University of Cincinnati as one of the most promising developments in modern technical education.

CONCEIT AND SELF-ASSURANCE

7. With reference to the seventh point, Professor Mead agrees with me, saying "it is probably true that many college men have an unwarranted idea of their own ability," and yet thinks that the idea that they possess self-conceit and self-assurance is largely erroneous, and that they do not, as a rule, possess these qualities to any objectionable degree. I did not state that they possessed these qualities "as a rule," or to an "objectionable degree," but I am quite content to let my statement remain as it was written, feeling sure that it will be agreed to by the majority of those who have observed the average new-fledged college graduate.

8. Professor Mead apparently agrees with this statement for he does not take exception to it. I quite agree with his own statement as to what an engineering course should be, and I have many times emphasized essentially the same ideas.

Professor Mead does not take exception to my ninth statement, and agrees with my tenth.

In the opening portion of his letter, Professor Mead states that his own experience has been largely in the schools of the Central States, and this leads me to remark that I do not believe that there is any essential difference between the colleges and technical schools in different parts of the country. This opinion is based on my long experience with students from almost every section of the country, and from most of our universities.

Professor Mead implies that my letter is an instance of "captious criticism" and that improvement in our educational system, which he agrees is needed, can be accomplished better by intelligent and united effort. To this I will say that my letter was not a criticism, but a mere statement of opinion. If every teacher were conducting a business and employing the product he turned out in the school, he would see the school work in a different light. Of course, engineers like Professor Mead and myself do employ our own graduates, yet we naturally differ somewhat in our judgments. However, Professor Mead apparently agrees with six of my ten opinions, and is illogical in his disagreement with some of the others.

WHAT OTHERS THINK

As a matter of fact, opinions quite as strong as mine, and even stronger, are exceedingly numerous, and from sources of highest authority. Professor Mead and other readers of the ENGINEERING RECORD may be interested to read the following quotations.

Herbert Spencer said (Autobiography, Vol. 1, p. 388):

"The established systems of Education, whatever their matter may be, are fundamentally vicious in their manner. They encourage submissive receptivity instead of independent activity."

Ruskin expresses his opinion of modern education as follows (of King's Treasuries):

"Modern education, for the most part, signifies giving people the faculty of thinking wrong on every conceivable subject of importance to them."

Mr. Abraham Flexner. in an interesting book entitled "The American College," uses the following language:

"Now, as a matter of fact, the college does not even rise to the accepted standards of the commercial world, to whose demoralizing influence its scholarly ideals are occasionally alleged to have succumbed. For college standards of success are actually below those that prevail outside. A youth may win his degree on a showing that would in an office cost him his desk."

President W. H. P. Faunce of Brown University, made the following statement:

"The young people of today, as compared with those of fifty years ago, are chiefly deficient in power of sustained attention and original thinking. They cannot, or at least they usually do not, think as clearly, as patiently, and as cogently as did their fathers. They do not as quickly distinguish the irrelevant from the pertinent, the kernel from the husk, as the men of the last generation. They have an amazing fund of information; they are wide readers of bright ephemeral literature; they have tasted every fruit on the great tree of knowledge; they know a thousand interesting scraps; they are more versatile and ingenious and attractive than any other of the recent generations. But they are quickly led astray by sophistry, and easily led to surrender conviction when it conflicts with interest."

President Wilson, in an address at Washington University, said:

"A man who takes a course of four years of social life at some university has thrown away four years of that natural power to work which descended to him from his great progenitor, Adam. He now finds himself face to face with actual work in its true sense, and he also finds that he is not ready to work; his faculties are undeveloped, his fund of information is limited and very hazy; he is a college man, but he is not a trained man, nor an educated man. It is a singular fact that our universities are standing upside down, not on their heads—which might be not altogether a bad thing—but on the wrong end."

Listen now to Prof. Charles H. Grandgent of Harvard, who in his most interesting address as president of the Modern Language Association of America, entitled "The Dark Ages," expressed himself as follows:

"I suggest, indeed, that we alter the Century definition to something like this: 'The dark ages, an epoch in the world's history, beginning with or shortly after the French Revolution, marked by a general extension and cheapening of education resulting in a vast increase of self-confident ignorance. It was induced by the gradual triumph of democracy, and will last until the masses, now become arbiters of taste and science, shall have been raised to the level formerly occupied by the privileged classes.'

"It is pitiful to see the agonies that the ordinary college student has to suffer, if he is obliged to learn anything outright. It is amazing to see how readily he forgets the things which he is told and which, for the moment, he apparently understands."

President Foster of Reed College in Portland, Ore., said very recently, "It is possible to graduate from almost any college without an idea in one's head."

Judge Robert S. Lovett, lecturing recently at Yale, stated that only thirteen out of forty-six executive heads of railroads in this country are college graduates, and of forty-one accounting heads, thirty-five have never had a college dipolma.

Finally, President Nicholas Murray Butler of Columbia, in a recent report says, "It is little short of deplorable that there should be so much and so various evidence of the utter worthlessness, judged by lasting results, of a large part of the work done, or supposed to be done, in elementary school, in secondary school, and in college."

MORAL AND RELIGIOUS TRAINING

If Professor Mead dislikes or disagrees with these opinions, let me assure him that he may not lay the flattering unction to his soul that they may apply to the schools of the East but do not apply to the schools of the Middle West. Nor will he be justified in assuming, however pleasant it may be to do so, that the engineering schools are exempt from the faults referred to, although I have urged for years the advantages of an engineering training as compared with a classical training.

Finally, let me say that it seems to me that one of the great faults in our entire educational system is that it puts the emphasis on the wrong place, namely, on the acquisition of knowledge, or intellectual culture. This I think is particularly true of our engineering education. Now purely intellectual culture does not touch the conscience, or affect the deeper springs of human action. It does not make a man a better father, a better husband, a better neighbor, or a better citizen. I am therefore glad that Professor Mead agrees with my last conclusion. We need more moral and religious training, more discipline from the cradle up in regard to our duties to others, and less intellectual culture in comparison.

Small Sewage Pumping Station for Park Site

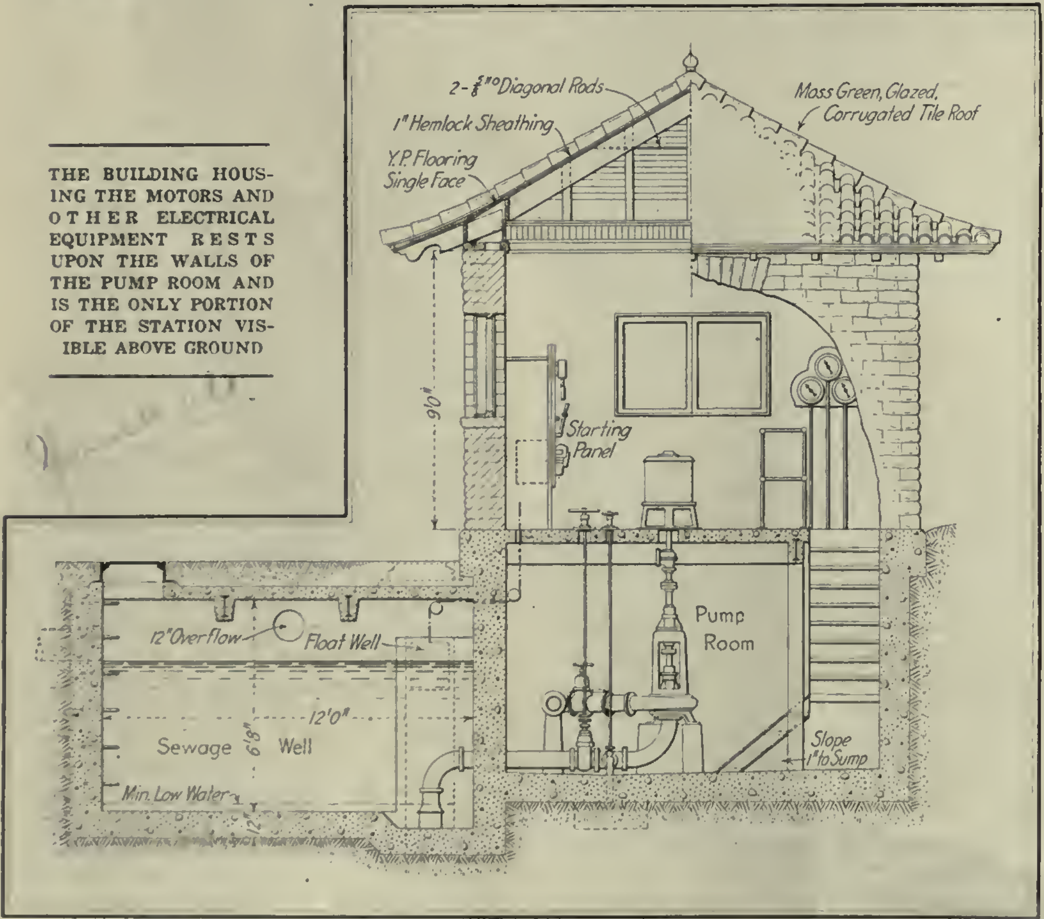
Centrifugal Pumps, in Duplicate, Serve District of 2000 Population in West Chester, Pa. —Control Is Automatic

By W. DE WITT VOSBURY
Of Remington & Vosbury, Consulting Engineers, Camden, N. J.

BECAUSE of its location in a public park the new sewage pumping station at West Chester, Pa., serving a district with a population of 2000, was designed to present an appearance which would not suggest its purpose. The walls, roof and floors of the well and pump chamber, where exposed, were washed with soda solution and rubbed to a smooth finish with a carborundum stone. The building was constructed of a local gray-blue stone, laid in broken courses, with flat stone arches spanning the door and window openings. The roof is covered with moss-green, glazed, corrugated tile. All exterior woodwork is painted white, while the interior woodwork is yellow pine with natural finish.

LOCATED IN A PARK, THE STATION WAS DESIGNED FOR APPEARANCE AS WELL AS UTILITY

As shown by the accompanying illustrations the structure consists of a receiving well, adjoining which is the chamber containing the pumps, valves and piping. The building housing the motors and other electrical equipment rests upon the walls of the pump room and is the only portion of the station visible above the ground. The walls, roof and floors of the well and pump chamber were built of reinforced concrete, waterproofed. The stairway connecting the motor and pump rooms was also made of concrete, cast over a light structural frame.



THE BUILDING HOUSING THE MOTORS AND OTHER ELECTRICAL EQUIPMENT RESTS UPON THE WALLS OF THE PUMP ROOM AND IS THE ONLY PORTION OF THE STATION VISIBLE ABOVE GROUND

The sewage is screened before it enters the receiving well in a separate chamber located a few feet from the well. There are two sets of inclined bar screens so arranged as to be easily lowered or raised; the spacing of the bars is also adjustable. The screens are cleaned each day, and such solids as will not pass through are collected and deposited in a cesspool located alongside. The contents of the latter are removed at frequent intervals and taken to the disposal plant.

At the expected maximum rate of inflow the time required for filling the receiving well will be about 45 min. The storage capacity, which is only 5000 gal., was purposely made small in order that the sewage might leave the station and reach the disposal works while still fresh. The floor directly beneath the intakes to the pumps is depressed to form a shallow sump, thereby lowering the suction line to the floor level. This is desirable, as it permits of the removal of practically all of the sewage at each pumping and a large portion of the matter that has settled out and which, if allowed to remain, would eventually undergo septic action. The sediment which does collect is removed periodically by stirring while pumping is in progress.

PUMPING EQUIPMENT IN DUPLICATE

The pumping equipment is in duplicate. Each unit consists of a 4-in. vertical centrifugal pump, direct connected to a 15-hp. single-phase, 60-cycle, 220-volt, repulsion induction motor, operating at a speed of 1200 r.p.m. The pumps are of the open impeller type and especially designed for sewage work. In order to reduce the length of the driving shaft each pump is mounted on a foundation 18 in. above the floor level. It should be noted, however, that, upon starting, the pumps are always under a suction head. For each unit there is a separate 6-in. suction pipe extending through the partition wall and terminating in a bell mouth, the bottom of which is level with the floor of the well and over the sump.

The discharge piping is arranged with separate gate and check valves for each pump, the layout of the whole being such as to occupy a minimum of floor space. There are also two small drainage sumps in the floor of the pump room, each connected by independent pipes to the suction lines of the adjacent pumps. The valves in these drain pipes, as well as the valves in the suction and discharge lines, have extension stems and, in case of accidental flooding, may be operated from the floor above.

Connection between the motor and pump shaft of each unit is made with a standard flexible coupling placed next to the motor. A thrust bearing at the top of the pump frame carries the weight of impeller and shaft. To reduce vibration each shaft has one adjustable guide or steady bearing, automatically lubricated with fluid oil. Whenever it is desired to remove the upper half of a pump casing for inspection a section of the driving shaft may be disconnected and withdrawn through the floor.

CONTROL IS AUTOMATIC

The automatic starting and stopping of each motor is controlled by a separate float switch, the pilot current from which actuates a self-starter. In addition to the latter there is mounted in duplicate on the starting panel an automatic circuit breaker having overload and no voltage release, with time limit attachment. There are also two pilot lights to indicate full line voltage and a four pole, double-throw switch. The starting panel is made of blue Vermont marble and all exposed brass and copper parts of the electric equipment are highly polished. Both the static and total discharge pressures are indicated in feet and pounds by three pressure gages mounted in the pump room. One gage is connected to the main discharge; the other two are between each pump and its respective check valve.

The maximum population of the district tributary to this station is estimated at 2800. It is doubtful, however, if the number will exceed 2000 during the life of the equipment, and this figure has, therefore, been used in all calculations.

Based upon the latter estimate and the known water consumption per capita in the districts already sewered the total 24-hour flow will be 130,000 gal., with a probable maximum rate of 128 gal. per minute.

Although pumps of smaller size would have been quite able to handle the flow, 4-in. pumps with a capacity of 400 gal. per minute were selected.

The feature determining the selection was the ability, owing to the larger openings in the impellers, to pass solids up to 1-in. in diameter without danger of clogging.

The sewage is pumped under a total head of 65 ft. through an 8-in. cast-iron force main, a distance of 1600 ft. At the rate of 400 gal. per minute the velocity is about 2.5 ft. per second, and the pipe is therefore self-cleansing. The specifications stipulated a pump efficiency of not less than 50 per cent and actual tests made after completion gave results slightly greater than this amount.

The contract for the work was awarded to the M. and T. E. Farrel Company of West Chester, at a price of $3,750 for the station and force main and $2,540 for the mechanical equipment. The latter was installed by Lewis, Robinson & Gant of Philadelphia, as sub-contractor. Remington & Vosbury of Camden, N. J. were the engineers.

Build Crushed Stone Plant for Tunnel Muck

Material from Chicago Waterworks Tunnel in Residence District Is Hauled by Motor Trucks to Specially Built Crushing Plant

THE question of disposing of the excavated material from the Wilson Avenue waterworks tunnel, which is being built in Chicago, was a serious one, particularly at the Shore shaft in a residence district built up almost solidly. After considerable effort the city, which is driving this 8-mile tunnel by day labor, as described in the Engineering Record of April 29, page 568, was finally able to make a contract with the Peoples Crushed Stone Company to take away the stone as fast as produced from the Shore shaft, to which all the muck from the 3-mile extension into the lake would come, and to remove the rock piled at the other shafts within a reasonable time after the completion of the work. The plant was described recently by H. L. Clausen before the Western Society of Engineers.

The contract, Mr. Clausen stated, provided that crushed stone for the lining of the tunnel should be furnished to the city upon requisition from time to time. The city was glad to be able to make this contract, inasmuch as it was relieved of a considerable expense in the removal of such a large quantity of excavated material, totaling more than 400,000 cu. yd. The company erected at Montrose Avenue and the north branch of the Chicago River a crushing and washing plant capable of handling between 750 to 1000 cu. yd. per day of 10 hours.

AVERAGE TIME TO LOAD AND UNLOAD TRUCK IS 15 MINUTES

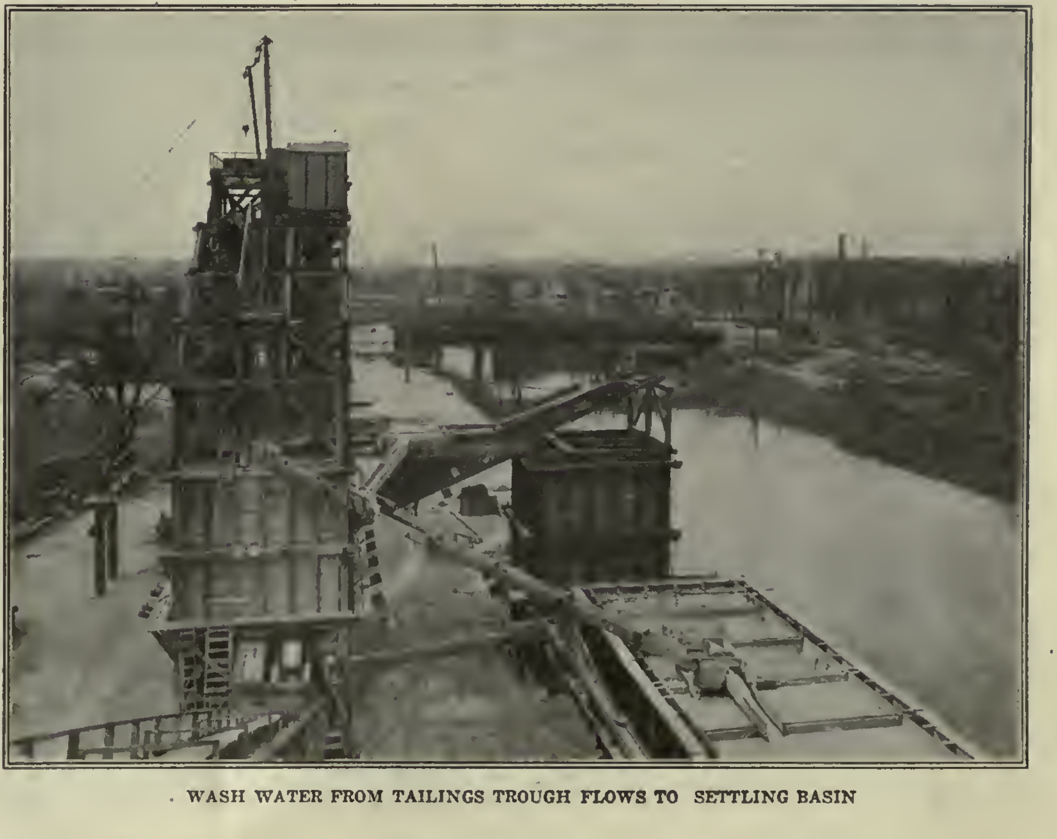
The plant consists of a No. 7½ gyratory crusher with concaves set to pass a 3½-in. product. From this crusher a No. 8 continuous-bucket elevator, having 85-ft. centers, elevates the crushed material to the top of the plant, at which point 500 gal. of water per minute is introduced by means of a centrifugal pump. The screening plant consists of two sets of conical screens located side by side four in a row, one slightly lower than the other. The first screens are perforated with 2½-in. holes, the second with 1½-in. holes, the third with ¾-in. holes and the fourth with 5/16-in. holes.

From these screens to 500-cu. yd. bins below the stone is stored ready for loading into trucks or wagons for the market. The oversize from the first screen passes through a No. 4 recrusher with concaves set for 1½-in. product. The tailings from this crusher are transported by means of a belt conveyor to the main or No. 8 conveyor and re-elevated to the screening plant. Under the bins a horizontal belt conveyor will transfer the product of any bin to an inclined conveyor at the rear for piling and storage purposes. The tailings from the 5/16-in. screen are carried to a settling bin consisting of a V-shaped trough, at the bottom of which two inclined 12-in. screw conveyors running at about 20 r.p.m. elevate the fine material into a storage bin. the water running down the screw by gravity into the settling basins below, from which the centrifugal pump furnishing all the water to the plant receives its supply. The stone crushed by this plant and the screenings are sold in the open market in competition with stone and gravel and torpedo sand.

Inasmuch as only one of the shafts, the Mayfair, is located on a railroad, all the excavated rock is removed from the various shafts by means of 7½-ton auto trucks having a capacity of 4 cu. yd. of mine run or 5 cu. yd. of the crushed material. The average time required to load and unload a truck is 15 min. and the speed on the road will average about 10 miles per hour or better.

The crushing plant cost about $50,000, and the standard price for the material at the bin is $1 per cubic yard, or $1.50 per cubic yard delivered within a radius of 3 miles of the plant.

Henry W. Clausen, engineer of waterworks construction, has immediate charge of the tunnel work. The design and construction of this project are under the direction of John Ericson, city engineer, and H. S. Baker, assistant city engineer.


WASH WATER FROM TAILINGS TROUGH FLOWS TO SETTLING BASIN

West Side Improvement Plans of New York Central Railroad in New York Filed

Involve Relocation, Track Elevation, Yard Reconstruction, Covering of Tracks Through Parks and Electrification, at Cost of Upward of $50,000,000

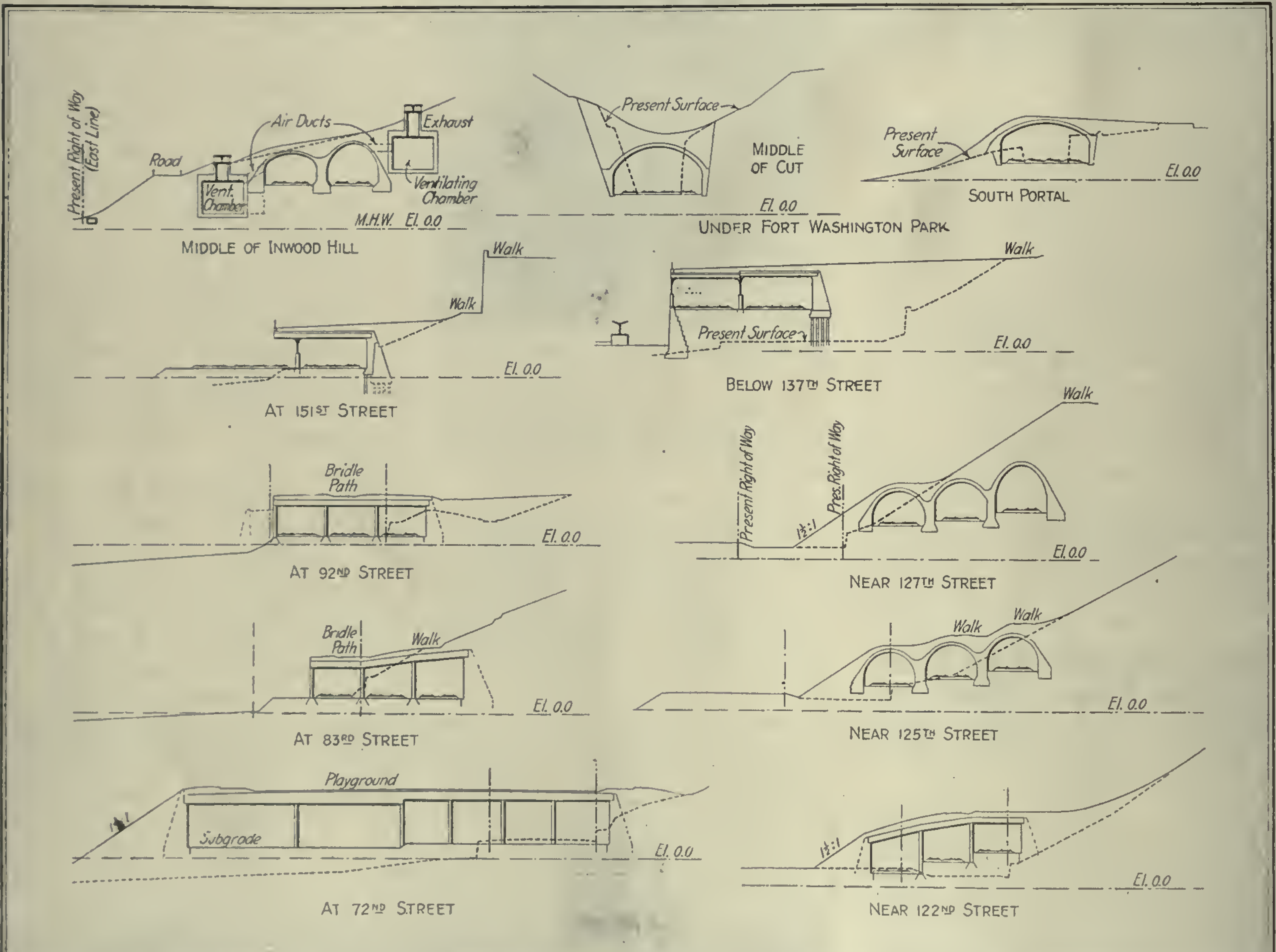
WHAT IS DESTINED to become, next to the rapid-transit expansion under the dual contract, the biggest engineering work of the day in New York City seems likely of consummation now, after many years of negotiations. Plans are now on file with the Board of Estimate and Apportionment of New York City covering the main features of the so-called West Side improvement of the New York Central Railroad in that city. The first of a series of public hearings on the project, prior to the execution of the agreement by city and railroad, was scheduled to be held Monday of this week, but this article went to press before the outcome of that hearing was known. The main features of the improvement, which covers the railroad's 12-mile freight entrance to the city, and involves extensive relocation, track elevation, extra trackage, reconstruction of yards, the covering of the tracks through miles of parks, and the electrification of the entire line, have already been set forth in the news section of this journal. (See the issues of Jan. 22, page 126, and April 15, page 528.) The purpose of this article is to elaborate on some of the main features and present a few details.

WEST SIDE LINE AT PRESENT

The West Side freight line, as the accompanying general plan indicates, leaves the main line at Spuyten Duyvil, across Spuyten Duyvil Creek from the extreme northern end of Manhattan. At this point the main line turns away from the Hudson River. The freight line crosses the creek and continues down the east bank of the Hudson to Sixtieth Street, where it swings over into Eleventh Avenue. It occupies Eleventh Avenue down to Thirty-third Street, and then swings over to Tenth Avenue. It then follows Tenth Avenue down to the junction with West Street, continues down West Street to Canal Street, turns east in Canal Street to Hudson Street, and south in Hudson Street, and terminates at the St. John's Park freight station at Beach and Hudson Streets, within a mile of the city hall. The entire line is operated by steam.

The line has two main tracks and numerous sidings. The main yard is between Seventy-second and Sixtieth Streets, where there are seven piers, four transfer bridges, a grain elevator, an engine terminal and various storage and switching tracks—none of them long enough for full trains. Between Thirty-seventh and Twenty-ninth Streets is another yard, or more properly a group of yards that have grown up more or less at random to meet local needs. They serve freight houses, a milk terminal, an express terminal, a market, four piers (with two intermediate piers not directly served), two transfer bridges, and various warehouses. There are limited switching facilities, necessitating operation across streets at grade. At St. John's Park, the end of the line, there is a freight house only, covering two city blocks. There are a freight house, milk station, team tracks and a small storage yard at Manhattanville, and a team yard at Inwood.

The line crosses Spuyten Duyvil Creek on a very low swing drawbridge. From here south to Sixtieth Street it is in the open on the water's edge most of the way. It passes through Fort Washington Park, a rugged point jutting into the river, in a deep rock cut. It crosses Dyckman (200th) and Manhattan (130th) Streets at grade, both of these streets being busy thoroughfares leading to ferries. It also crosses at grade 158th, Ninety-sixth and Seventy-ninth Streets, and eight streets in the vicinity of Manhattan Street. It runs along the full length of the foot of the slope of Riverside



THESE CROSS-SECTIONS CHOSEN FROM MANY SUGGEST THE VARIETY OF WAYS IN WHICH THE TRACK ROOF WILL BE ADJUSTED TO THE PARK SURROUNDINGS

Park, between the park and the river, and along the park extension north of 135th Street, and complaints of smoke and offensive odors from cattle trains have been rife. From Sixtieth Street south, where the line occupies city streets, operation is restricted to slow speed, with special boxed-in locomotives. In spite of this there have been numerous accidents, mainly to persons stealing rides, and the agitation to remove these tracks from the street has been the foundation of the entire improvement.

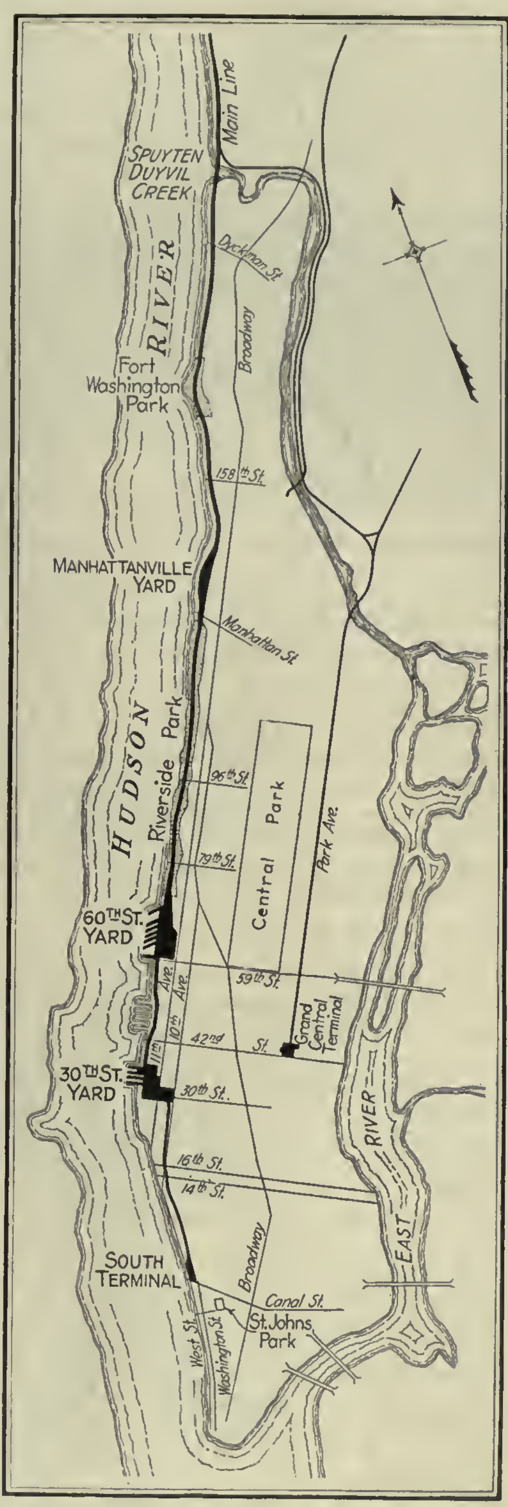
SCOPE OF IMPROVEMENT

Comparing with the foregoing, when the whole project is completed there will be an electrified line with from two to six main tracks for the entire distance. Along the present city parks and the new one to be created north of Dyckman Street at Inwood, the tracks will be covered and much of the waterfront released to the city. All grade crossings will be eliminated. The tracks will be removed from Eleventh and Tenth Avenues and West Street, being replaced by an elevated system in Twelfth Avenue and the Marginal Way from Sixtieth to Thirtieth Street, and from there south on a private right-of-way. The yard and local freight facilities will be much improved.

The improvement will begin a mile north of Spuyten Duyvil, where the present six main-line tracks will begin to spread outward into the river. Of these the two outer tracks are the present freight tracks that continue down the west side. These will, in their new position farther out in the river, ascend on a filled approach on a 0.65-per cent grade to the new drawbridge, remaining as northbound and southbound tracks respectively. Between the two southbound passenger tracks a second southbound track will climb on a steel viaduct on a 0.65-per cent grade to the new drawbridge crossing over the most westerly passenger track at Spuyten Duyvil, and similarly a second northbound track will pass from the new drawbridge over three of the passenger tracks and come down on another viaduct between the two northbound passenger tracks. A typical cross-section of this arrangement is shown.

NEW DRAWBRIDGE

The new four-track swing bridge will be about 20 ft. higher than, and from 65 to 120 ft. east of, the present bridge. It will be about 300 ft. longer than the present bridge, and will have two 100-ft. clear spans normal to the channel.



WEST SIDE LINE RUNS ALMOST FULL LENGTH OF MANHATTAN—HEAVY LINE SHOWN IS PROPOSED LOCATION

Where the new line strikes the hill south of Spuyten Duyvil Creek its center line will be about 136 ft. east of the present center line. From this point the four tracks will be laid in a cut-and-cover tunnel 2550 ft. long under Inwood Hill, under what is now private residence property, but will be taken over by the city for a park. In places the subgrade is above or barely under the present ground line, and it will be necessary to build up over the arches.

Emerging 500 ft. north of Dyckman Street just off the present right-of-way, the line will cross this street by a steel bridge on the site of the present crossing, and then the tracks will come down on a 0.65-per cent grade to the present tracks.

In this connection the filed plans show a tentative location and profile for future tunnel tracks to branch off on the river side 2500 ft. south of Dyckman Street, descend northward on a 1.03-per cent grade, and pass under Spuyten Duyvil Creek outside of the present drawbridge. The connection with the main line is not developed.

COVERED CUT AT FORT WASHINGTON PARK

The present rock cut through Fort Washington Park will be widened to allow an additional track on each side, after which the four tracks will be arched over and filled above to conform as nearly as possible to the natural topography.

Below this park the main tracks will increase to six in number. A bridge and ramp will carry 158th Street over the tracks and down to the water's edge.

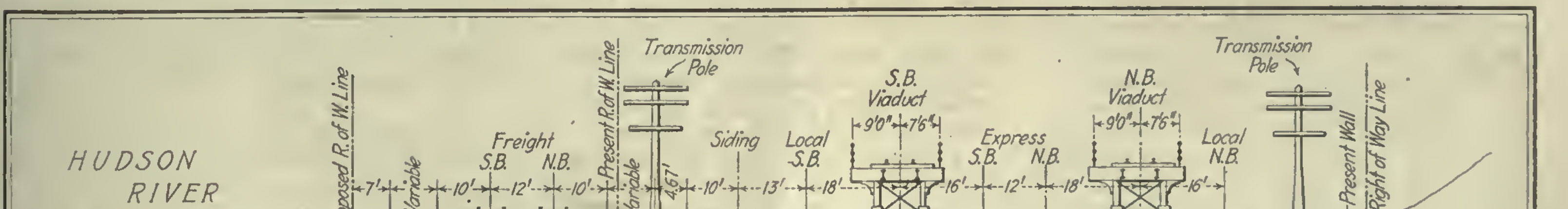
Beginning about 153rd Street two lead tracks will switch out on the river side for the uptown yard known as the Manhattanville yard, the tracks of which will begin to fan out at 145th Street, the yard terminating at 133rd Street. The layout will consist of a freight house, three milk tracks with platforms, six team tracks and a storage and switching yard for about 700 cars.

Beginning at 148th Street the six main tracks will begin an ascent on the established grade of 0.65 per cent to get over the streets in the Manhattanville valley. They will pass over the freight house and part of the yard, which will remain at the lower level.

This yard is alongside Riverside Drive and the extension to Riverside Park, and there has been much objection raised to it. The manner in which the main tracks will be covered and the objectionable features reduced will be set forth presently.

TRACKS COVERED ALONG RIVERSIDE PARK

Crossing 133rd, 132nd, 131st, Manhattan and 129th Streets on bridges, the tracks being spread at this point for a future station, the line will encounter the original Riverside Park at the bluff surmounted by Grant's Tomb. From here to the south end of the park the tracks will be covered, now occupying practically the present right-of-way, now crowding in 50 or 100 ft. where the park slope is low and greater depth of



COMPLETE FLEXIBILITY OF OPERATION BETWEEN MAIN LINE AND FREIGHT TRACKS WITHOUT JUNCTION GRADE CROSSINGS NORTH OF SPUYTEN DUYVIL NECESSITATES THIS TYPICAL CROSS-SECTION cut is required to avoid an unseemly hump over the tracks. The entire trackage, including the throat of the new yard at the south end of the park, where there will be twenty tracks, will be covered, and the park will be graded over the roof to natural slopes beyond. Ninety-sixth and Seventy-ninth Streets will be carried over the tracks and down to the water's edge on ramps.

Of the large yard at Sixtieth Street, nothing will be retained except the elevator, piers and transfer bridges, and the piers will be extended to double their length. The south main-track outlet will be moved, of course, from Eleventh to Twelfth Avenue. The southeast corner of the yard, together with additional land to be required between Sixty-second and Sixty-ninth Streets, will be replaced by a local freight yard, with freight houses, team tracks and milk platforms. The many curved stub tracks will be replaced by straight through tracks with more switching leads. New tracks will occupy the site of the engine terminal, rendered useless by the electrification, and the approach to the yard will be extended north to Eighty-second Street. The new yard will accommodate 80-car trains in halves, and will have a total capacity of about 2700 cars.

It is at this point that the new location will begin. The main tracks will have ascended through the yard, and at Fifty-ninth Street they will enter Twelfth Avenue and the Marginal Way on an elevated structure. They will have been reduced in number to four, but alongside them on the river side space will be reserved for extension of the viaduct and the laying of two municipal tracks, unrestricted as to use, as provided in the agreement. Between Fifty-second and Forty-first Streets the tracks will swing to the east to clear the inshore extensions for the 1000-ft. piers at and above Forty-sixth Street, one of which is now under construction.

TWO-LEVEL YARD AT THIRTIETH STREET

Between Thirty-seventh and Thirtieth Streets will be the reconstructed Thirtieth Street yard, which will have nothing in common with the present yard except the land occupied and four lead tracks on pier 76. The new yard will be a double-decked terminal, with tracks, freight houses, warehouses, express terminal, milk station and team driveways systematically arranged on both levels, and with connections between the two levels. It will occupy ten city blocks.

From this point south there will be only two main tracks. These will swing around the yard into Thirtieth Street on a 23-deg. curve, the tentative municipal tracks continuing down the Marginal Way. The two New York Central tracks will turn off Thirtieth Street into a private right-of-way just far enough west of Tenth Avenue to avoid the properties fronting on the avenue. At Sixteenth Street it will cross to a similar position east of the avenue, at Gansevoort Street it will take a location just west of Washington Street, and it will finally end at a new terminal bounded by Canal, West, Houston and Washington Streets. In all of this section on private right-of-way alignment will be sacrificed to a considerable degree to bring the line on the most feasible right-of-way.

PARK TREATMENT AN IMPORTANT FEATURE

A very material part of the improvement will be the park treatment, embracing the covering of the tracks through the parks, and the grading and landscape treatment over the covering to conform with the surroundings. The work to be done along these lines in Riverside Park alone is estimated at upward of $10,000,000, and an additional $4,000,000 is expected to be spent on similar work at other points. The roof over the tracks will vary from a shallow structural steel construction with a few feet of earth on top, where there are numerous tracks and little available depth, to arches of various rises where feasible. In general the main tracks will be paired, with the roof supports between pairs, and to facilitate the park treatment along the slopes the pairs of tracks will at many points be on different levels.

A number of typical cross-sections are shown. As the sections show, the roof along Riverside Park will in many cases be sloping wholly or in part. At the extreme south end, where in return for additional easement secured by the railroad for the remodeled Sixtieth Street yard, the railroad will roof over a considerable area and make it part of the park, the problem of lack of available depth has been solved by the laying out of a playground on the broad flat roof, with only a 6-in. earth covering and a gentle slope for drainage. At the bluff at Grant's Tomb arches are feasible, and to help preserve the steep slope there will be a different profile for each pair of tracks.

AT MANHATTANVILLE

Along Manhattanville there will be a different sort of treatment. Because of the yard at the water's edge it is not feasible to carry the park across and slope it down to the river. The height of the park slope and difference in elevation between the main tracks and the yard, however, make it possible to carry the park out over some of the tracks in a high-level area overlooking the river and ending at a parapet. The roof over the tracks will begin at 135th Streeet and extend north to 152nd Street. As the sections show, the roof will be a flat one of structural steel. This may be covered with a thin layer of earth, built up back to the bluff. At the south end, where the main tracks are much higher than the yard, all six will be spanned, and the park at the parapet will be about 45 ft. above the yard. At the north end fewer tracks will be spanned and part of the structure will be cantilevered. The railroad will build the steel roof only at this point, leaving the city to do the grading.

The deep rock cut at Fort Washington Park will be arched over and fill placed over the arch, as shown in the two cross-sections, for 1300 ft. The treatment of Inwood Hill will be similar in a general way to that above Grant's Tomb in Riverside Park. Arches will be used except at the south portal, where there will be a short stretch of flat roof with a parapet at the outer edge.

The Inwood Hill section presented here shows two ventilating chambers. These are a feature of the Inwood tunnel and of that along Riverside Park. The one pair of chambers at the middle of the half-mile Inwood tunnel will serve it. For the three-mile tunnel under Riverside Park there will be eight ventilating exhausts and five inlets. The open face on the river side of the construction along Manhattanville yard will provide the ventilation at this point, and the tunnel through Fort Washington Park is not long enough to need any provision for this.

As pointed out in the note in the Engineering Record of April 15, the figure of $50,000,000 commonly mentioned as the cost of the work is virtually the minimum figure to provide what may be called the necessities. The engineers who have been in touch with the problem for years realize that by the end of the six years set for the completion of the improvement the additional features likely to be incorporated will probably double or treble the cost.

The plans have been developed through the collaboration of the engineering department of the New York Central Railroad and a board of consulting engineers acting for the port and terminal committee of the city's Board of Estimate and Apportionment. The members of the committee were Ernest P. Goodrich (recently resigned), consulting engineer to the borough president of Manhattan; C. W. Staniford, chief engineer of the Department of Docks and Ferries, and John F. Sullivan, consulting engineer of the Bureau of Contract Supervision. For the railroad, G. A. Harwood, chief engineer of electric zone improvements, was in general charge, and the plans were prepared in the office of and under the immediate supervision of H. D. Jouett, designing engineer of West Side improvements.

Warehouse Crane Runways Carried on Wall Brackets

New Orleans Cotton Buildings Designed with Reinforced-Concrete Walls to Resist Heavy Lateral Pressure and Carry Crane Loads

ONE of the features in the reinforced-concrete warehouses now under construction in the port improvement at New Orleans is the design of the walls between the various one-story building units. As described in the Engineering Record of March 27, 1915, page 402, six large cotton warehouses, covering an area of about 50 acres, are being built upon creosoted timber piles and are divided into compartments, generally about 32 x 100 ft. in plan, by reinforced-concrete fire walls. In addition to a description of the design of these walls, which contain brackets for carrying the crane girder rails, various special details will be illustrated.

The warehouses, which are so designed that they can be extended in the future, if desired, are in two symmetrical rows of four buildings each. The two through cotton warehouses are each 676 x 173 ft., 45 ft. high, and the two large f.o.b. and consigned cotton warehouses are each 676 x 273 ft. and 35 ft. high. Fire walls in each are 12 in. thick, spaced 32 ft. on centers, and detailed as shown in the accompanying typical section.

Expansion joints are provided at the middle of the larger buildings, and detailed with special care to insure weather-tight joints. In the smaller buildings the expansion joints are located off center, but are directly opposite those in the larger buildings. This was necessary in order that the crane runways could be extended through from one building to another. The flashing used and the methods of attaching it are shown in the large-scale drawings herewith, showing both face-wall and dividing-wall joints.

FIRE WALL DESIGN

The walls are designed to resist the vertical loads from the roof and cranes and the

NEW ORLEANS COTTON WAREHOUSES OF REINFORCED-CONCRETE—NOTE REINFORCING STEEL FOR WALLS ON LEFT

bending stresses caused by the eccentricity of the crane loads and by the horizontal pressure of the piles of cotton. Cotton was assumed to weigh 20 lb. per cubic foot, and, where piled against a wall, to exert a horizontal pressure equal to one-sixth of the vertical pressure. Cotton in the through warehouse was assumed to be piled 30 ft. high.

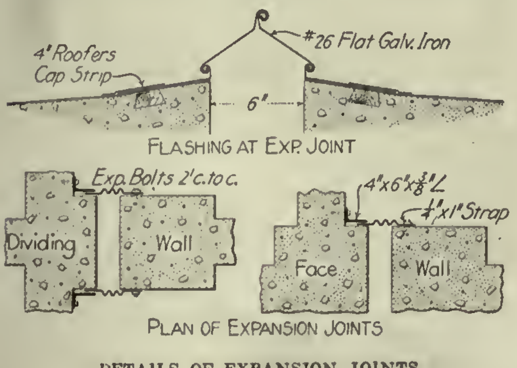
In addition to resisting the above loads, the walls and pilasters have sufficient reserve strength below the elastic limit of the reinforcement to resist a horizontal pressure of 200 lb. per square foot which might be exerted by the top two layers of cotton (4 ft.) becoming saturated and swelling. This saturation might occur in case of a fire and consequent opening of the sprinkler heads.

The working stresses used are those recommended by the Joint Committee for 1:2:4 concrete. For the case of combined direct stress and bending, the total stress allowable was kept the same as for axial compression.

CRANE RUNWAY BRACKETS

The crane loading on each rail consists of two wheels spaced 9 ft. 7½ in. on centers, with a maximum load of 10,250 lb. each. The wheel supports are designed as a continuous shelf or bracket, carried by the walls without beam action. The details of the reinforcement used are shown in the drawing herewith. The rails are supported and held in place by the malleable iron inserts shown, spaced 3 ft. on centers, and so designed that the bolts and clips holding the rails are easily inserted and adjusted.

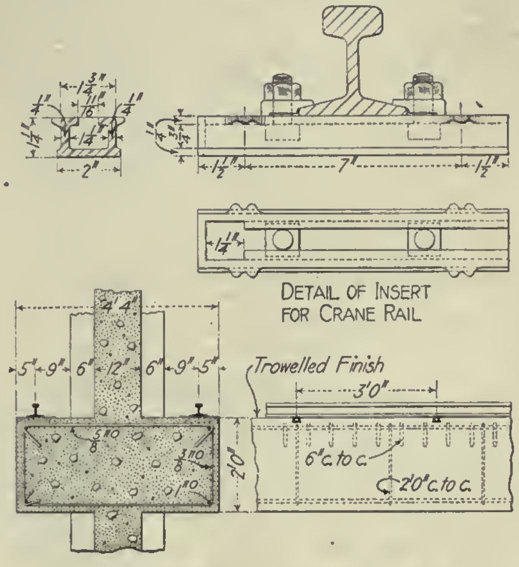
In designing the brackets, the concentrated crane loads were assumed to be uniformly distributed over a horizontal distance of 2 ft., the depth of the bracket. The ⅝-in. rods on 6-in. centers at the top of the bracket provide for the tension and aid in the distribution of unsymmetrical loads to the walls as eccentric loading. In computing the bending stress in the walls, the concentrated crane loads were assumed to be distributed along the wall between lines on a 2:1 slope, spreading over greater length as the distance below the load increased.



FLASHING AT EXP. JOINT

PLAN OF EXPANSION JOINTS

DETAILS OF EXPANSION JOINTS

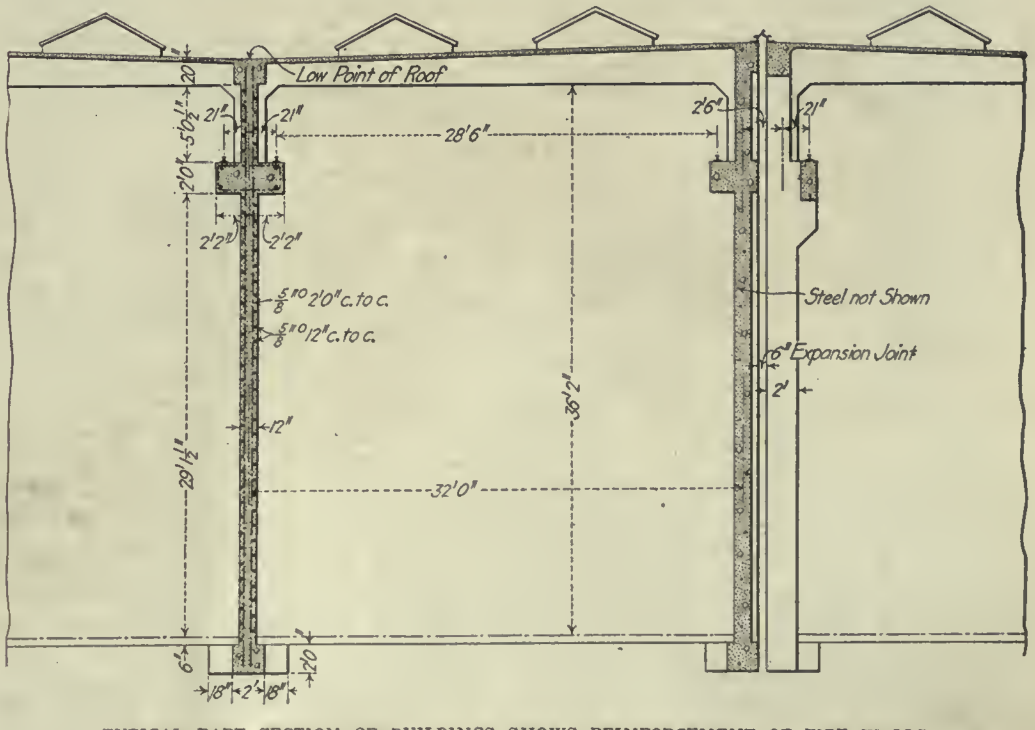


CONCRETE BRACKETS CARRY CRANE RAIL

The warehouses were designed for the Board of Commissioners of the Port of New Orleans by the consulting engineers, Ford, Bacon & Davis, of New York, New Orleans and San Francisco, who are supervising the construction being carried out by the Jefferson Construction Company of New Orleans, La.

World's Largest Oil Well

Under a pressure of 1035 lb. per square inch and flowing at a rate of 260,000 bbl. a day, a well, known as Cerro Azul No. 4, near Tampico, Mexico, and said to be the greatest oil well in the world, was recently brought in by the Mexican Petroleum Company, Ltd. The well casing had been tested to a pressure of 1050 lb., which was practically equaled by the pressure registered after the well was closed. The force of the escaping gas under this pressure blew the 2-ton drill bit out with it and threw it 125 ft. from the well. Its cable became entangled with the valve at the top of the casing and tore the latter off. The drill bit and the escaping oil, which subsequently rose to a measured height of 600 ft., demolished the derrick. It is estimated that 1,000,000 bbl. escaped before the flow was shut off by sliding an extra valve over the casing in a tongue-and-groove track clamped to the head of the well. More than half of this oil was saved in temporary reservoirs, and the rest of it was burned after it had run some distance from the well and before it left the company's property.



TYPICAL PART SECTION OF BUILDINGS SHOWS REINFORCEMENT OF FIRE WALLS

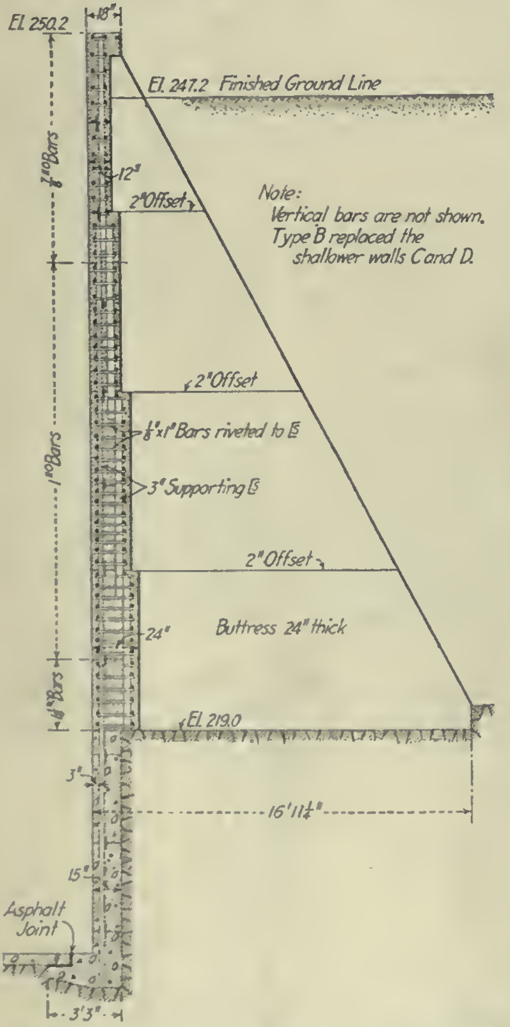
Huge Circular Reservoir in Dubuque Protects Congested-Value Business District

A Study of Alternate Sites Led to an $80,000 Saving—Thin Buttressed Walls 41 Feet High Found Most Efficient

By DABNEY H. MAURY
Consulting Engineer, Chicago

THE selection of a reservoir site near the congested-value district, thereby saving a city of 40,000 people $80,000, circular wall design in which the hoop principle was not utilized, and innovations in the inlet, outlet, and overflow, are features of the reinforced-concrete reservoir, 180 ft. in diameter and 41 ft. deep, at Dubuque, Iowa, completed last year. The larger and older portions of the city, including its business district, are built on the comparatively low land between the bluffs and the Mississippi River. The newer residential districts cover the bluff to the west at elevations of from 140 to more than 300 ft. above low-water mark.

The city takes most of its water supply from wells in sand and gravel in the low ground near the river and close to the main pumping station, which is located in the extreme northern end of the city opposite Eagle Point, where the bluffs jut out boldly close to the shore. The water from the wells is pumped into the surface storage reservoir of 650,000-gal. capacity, from which it is repumped into the distribution system. The latter is divided into two services, high and low, and until recently the low-service pressures were limited by the level of water in what is known as the Level Reservoir, with flow line at El. 136. This reservoir has a capacity of 1,000,000 gal., and was built a number of years ago to impound a small supply of water from old mine workings. From 200,000 to 400,000 gal. of water per day are still collected from these old workings. The high-service pumps, which are electrically driven, take their supply from this reservoir, which is also fed by the low-service mains, and deliver it into the high-service mains. A standpipe having a capacity of 440,000 gal. and a flow line at El. 397 is connected to the high-service distribution system.



TYPE B WALL AND BUTTRESS—HORIZONTAL STEEL CARRIES ALL STRESSES TO ROCK THROUGH BUTTRESS

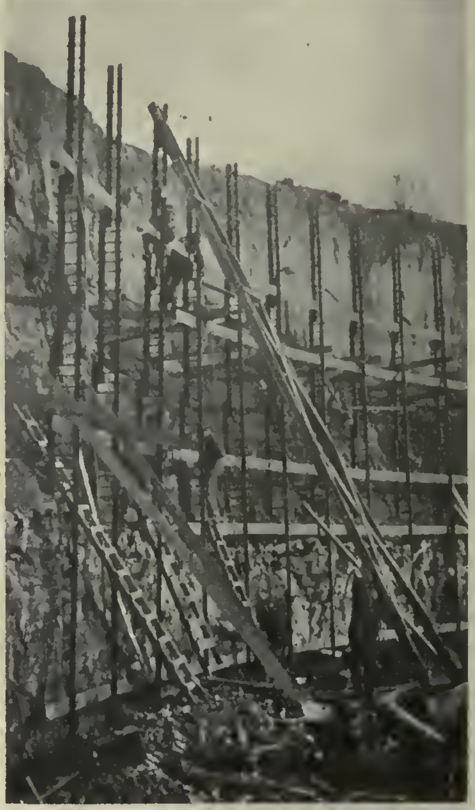
Several years ago the Board of Waterworks Trustees selected a site for an elevated reservoir of a capacity of 7,500,000 gal. in a city park on top of the bluffs at Eagle Point, opposite the main pumping station. A topographic map of the proposed reservoir site had been prepared and test pits had been sunk through the top soil to bed rock, when the writer was called in, late in 1913, to pass upon the preliminary plans and estimates and upon the suitability of the topography and soil conditions for a reservoir of the capacity contemplated.

Value of Reservoir Site Near Congested-Value District

It was at once apparent that the location of the reservoir with regard to the distribution system and with regard to the congested-value district, which was comparatively small in area and nearly 3 miles south of the pumping station, was far from being a desirable one. It was explained to the board that if all the water required at times of fire, or of other excessive demand, had to traverse the long lines of mains leading southerly from the pumping station, the friction loss would be very much greater than if there were another source of supply, such as a large reservoir, near the place of maximum demand.

To illustrate this point computations were made on the assumption that the rate of domestic consumption during sprinkling hours on a hot day would be 3500 gal. per minute, which quantity of water would be distributed throught the city; and that, in addition, 4000 gal. per minute would be required to meet the demands of a fire near the center of the congested-value district.

These computations showed that with the reservoir located opposite the pumping station, the total friction losses in the mains alone, not including hydrant branches nor hydrants, would be more than 41 lb.; whereas with the reservoir located on the bluffs to the west of the center of the congested-value district the corresponding friction losses would be only about 3 lb. The computations further showed that under the assumed conditions of demand it would cost more than $200,000 to reduce these friction losses to 3 lb. by putting in additional mains. The expenditure of so large a sum would, of course, be out of proportion to the benefits derived and if the results had to be obtained by installing additional mains, it would be more economical to spend less money and put up with somewhat greater friction losses. It would not be economical, however, to make the additional main smaller than 20 in. in diameter, and the cost of even a 20-in. main would be more than $80,000. This latter sum was accordingly considered the lowest possible estimate of the advantage possessed by a reservoir site opposite the congested-value district, over the one which had originally been chosen.



ERECTING STEEL DAMS AND BAR SUPPORTS

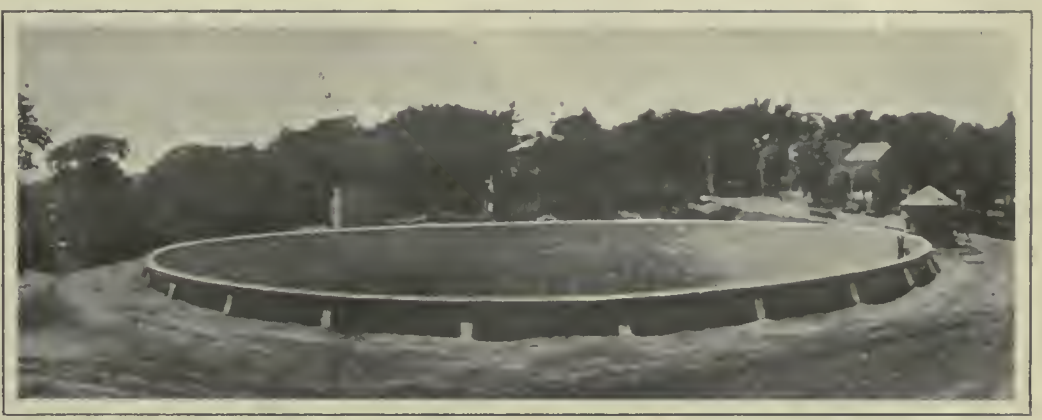
The proposed location was therefore abandoned and another reservoir site secured on the high ground on the bluffs, opposite the center of the congested-value district on the south side of Third Street between Burch and Summit Streets.

Rock Topography Determined

Five test pits and sixteen test borings were made to determine the underlying rock topography. The ground sloped each way from a ridge which crossed the north end of the lot from northwest to southeast, and the rock surface conformed roughly to that of the overlying earth, which is a reddish-yellow clay, fairly homogeneous in character. The rock is a limestone containing occasional pockets or nodules of various minerals, most often of galena or of some of the zinc ores, although pyrites of iron or copper are not uncommon. Some of these ores were said to carry small percentages of silver. These limestone formations are those which, fifty or seventy-five years ago, were somewhat extensively mined at Dubuque, as well as in the vicinity of Galena, Ill. Many evidences of old workings are still to be seen in the neighborhood of the reservoir site. The most notable characteristic of the rock is its exceptionally well-defined horizontal stratification.

Considerations Governing Design

It was naturally desirable that the reservoir should be as large as might be economically possible, and a capacity of 7,500,000 gal. was finally decided upon. This provides a storage of nearly three days' supply at present rates of consumption.



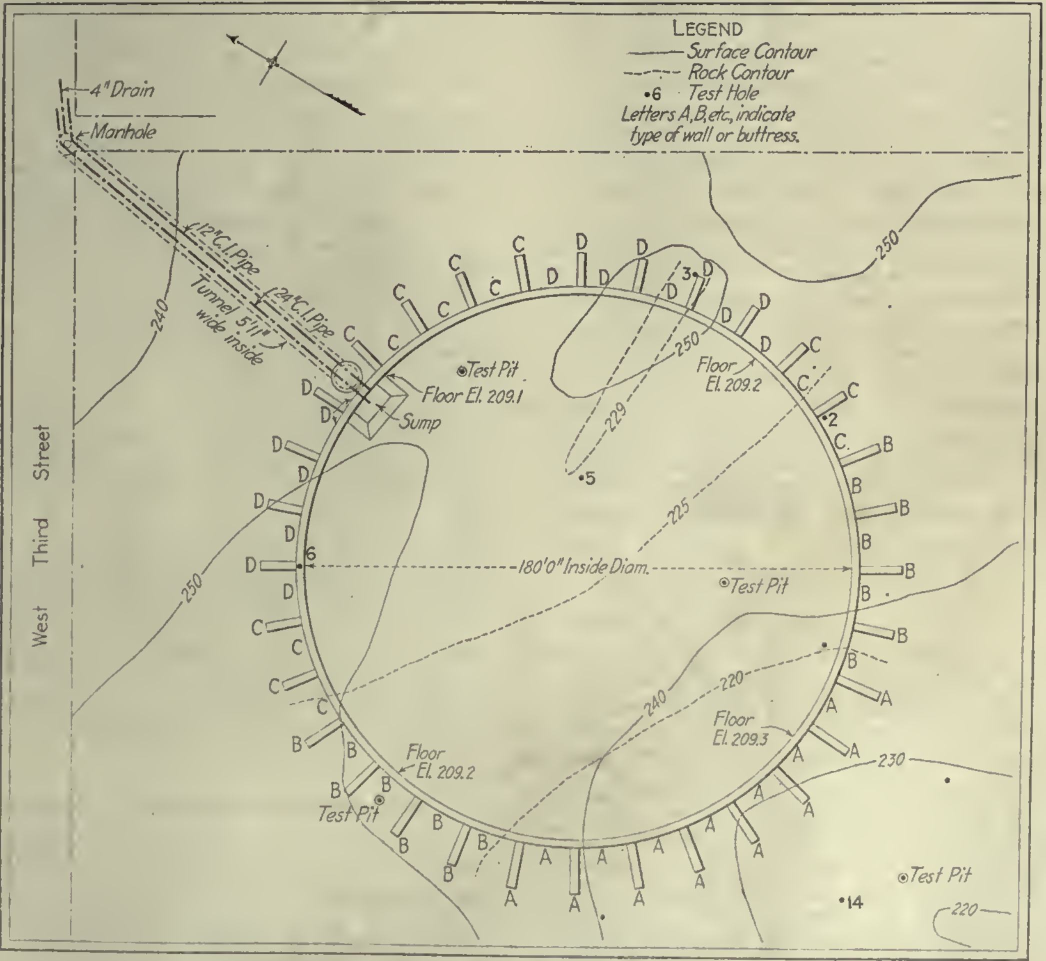
THE DUBUQUE RESERVOIR HOLDS 7,500,000 GALLONS CLOSE TO POINT OF CONSUMPTION

The pressure at which water had formerly been pumped to the low-service territory was much below that at which the pumping engines could safely be operated. To increase this pressure would give greatly improved fire and domestic service to all points within the low-service district, would enable a large part of the high-service district to be transferred to low service, thus saving the cost of pumping water a second time to the area so transferred, and would cause the main steam pumps to operate at more nearly their full load and, therefore, with greater economy. Consideration of these facts and of the elevations of the surface of the ground at the site selected led to the conclusion that the flow line of the reservoir should be not far from El. 250, Dubuque city datum. This elevation requires a discharge pressure of about 110 lb. on the main steam pumping engines and gives static pressures of from 90 to 105 lb. at the hydrants in the congested-value districts.

The most suitable ground on the site purchased was that nearest to its northern end, fronting on Third Street. It was found that a circular reservoir would fit the topography of the lot better than a rectangular reservoir, in addition to leaving room in the northeast corner for an imposing approach to the reservoir, and in the northwest corner for a new high-service pumping station to be built later. The circular form also required the minimum length of wall for any given depth and capacity, and involved the smallest possible danger of cracks resulting from expansion and contraction of the wall.

The fact that the various strata of rock were absolutely separated from each other by horizontal joints determined the shape of the reservoir bottom, which was made level with only enough slope on the upper surface of its concrete lining to give the necessary drainage toward the outlet pipe.

The selection of the best type of wall was not, however, so easy, and the final decision was not reached until computations and estimates had been made on a score of different wall sections. It was promptly decided that in the design of the wall no credit should be given for earth pressures acting against its outer surface. The lower portion of the wall would be built solidly against the sides of the excavation in the rock, and it was reasoned that in spite of the fact that the rest of the wall would be surrounded by earth almost up to its top, it would not be safe to count on any help from the external pressures of this earth resisting the internal water pressures, because of the fact that at times of dry, cold weather there would be a tendency for the clay outside of the wall to contract and to shrink away from the wall, with the result that the water pressures in the reservoir might set up disastrous stresses in the wall before the wall could stretch sufficiently to come into bearing against the clay. The design of the wall was therefore made just as strong as though there were no earth outside of it.



THE DUBUQUE RESERVOIR HAS BENT SLAB WALLS BETWEEN SUPPORTING BUTTRESSES

The question of whether or not the reservoir should be covered was given much thought. It was estimated that a covered reservoir would cost about $17,000 more than an open reservoir. The temperature of the water as it leaves the surface condensers is probably never below 55 deg. Fahr., so that there could be no serious trouble from ice, even if the reservoir had no roof. As it was planned to inclose the entire structure by a strong ornamental fence, built a sufficient distance from the wall to prevent pollution of the water by visitors, and as the elevation of the wall above the ground would reduce the risk of contamination by dust or the like, it was believed that the danger of the water becoming polluted in an open reservoir would, under anything but the most careless management, be so small as to be negligible. The roof would prevent the growth of algæ in the water, but as these growths are harmless from a sanitary viewpoint, and as they can be cheaply prevented by other means, it did not seem that the heavy expense of covering the reservoir would be justified.

Circular Buttressed Wall vs. Hooped Wall

A gravity wall seemed to involve prohibitive expense. Computations of the steel required for a reinforced-concrete wall in which the steel should resist the water pressures in the same manner as do the hoops of a barrel, showed not only that the amount of steel would be excessive, but also that this type of wall would not be an economical one for this location, because it would not permit advantage to be taken of the elevation of the higher portions of the rock; that is to say, the steel reinforcement in those parts of the reservoir where the rock was highest would have to be just as heavy and be carried down just as far in order to give continuity to the bars, as would be the case if the surface of the rock were level and were all as low as its lowest point.

Various types of sloping walls, or of walls a part of which was vertical and a part built on a slope, were also considered, but here again the desirability of taking advantage of the elevation of the higher portion of the rock, the undesirability of having any portion of the structure resting upon rock while another portion was supported by the earth, and the fact that the width of the lot left no room to spare, combined to eliminate all types of wall of which any part would be built on a slope.

The wall finally selected was one which availed itself to the fullest possible extent of the inequalities of the rock surface, being thin and practically without horizontal reinforcement wherever it was built against the solid rock. All of the stresses in the wall above the rock were transmitted to the solid rock by means of buttresses, the height of these buttresses being adjusted to the actual elevation of the rock surface. The wall between the buttresses was reinforced as a slab continuous over its supports. This permitted the horizontal reinforcing bars near the outer edge of the wall to be laid to a circle around the reservoir with proper provisions for laps at convenient points. Negative moment bars were also inserted near the inner surface of the wall opposite each buttress.

The general design of wall and buttresses was such as would simplify the construction of forms and reduce their cost. The lower portions of the buttresses were poured without other form than the earth excavation, while the wall forms were used over and over again as the wall was carried up.

As originally planned, there were four typical sections of wall and four typical sizes of buttress, depending on the elevation of the rock. After the overlying soil had been removed from the rock surface, however, it was found that in a number of instances float rock had been struck by the test borings, and that the solid rock actually lay deeper than these borings had indicated. In order to carry all buttresses down to the solid rock it was therefore necessary to eliminate the two shallower types.

The accompanying drawing shows in cross-section the type B wall and, in vertical elevation, the type B buttress. The vertical reinforcing bars in the type B wall were of various lengths and were placed near the inner face of this wall, extending from the bottom upwards. They served as anchors for the wall and contributed to the economy of the design, for without them the buttresses would have had to be larger and more numerous to resist the overturning moments due to the internal water pressures.

The specifications prohibited the use of chutes for conveying the concrete unless the concrete should be thoroughly remixed just before it reached its place in the work. In order to give an opportunity for proper spading and tamping in the forms it was specified that the wall should be built in sections only 4 ft. deep. To minimize the danger of leakage at the joints between sections, ⅛ x 8-in. steel dams were provided, extending continuously around the wall. They were bolted to the vertical steel channels and facilitated the erection of these channels by spacing them properly and holding them firmly in their places until the reinforcing bars could be fastened to them.

OVERFLOW SUBMERGED BELOW WAVE AGITATION

Experience with the Sioux City reservoirs, and with other reservoirs located on wind-swept hills, had shown that a hard gale would produce in a reservoir of this size waves of surprising height. In order to prevent the overflowing of large quantities of water in stormy weather when the reservoir was nearly full, the 12-in. overflow pipe, instead of terminating with an open end 1 ft. below the top of the wall, was fitted with two elbows so as to form a return bend, the lower end of which was carried down 13½ ft. below the top of the wall, or 12½ ft. below the flow line, at which depth there could be very little agitation of the water. To prevent water from being siphoned out of the reservoir the plans called for holes to be drilled in the top of each elbow so that the vacuum would be broken at these points and siphon action could not take place.

PROVISION FOR CIRCULATION

Water enters and leaves the reservoir through the same 24-in. cast-iron pipe, which is bolted to the branch of a flanged tee set in the sump just inside the reservoir wall. A check valve on one end of the run of this tee opens into the reservoir and a check valve on the other end opens out of the reservoir. Incoming water is thus projected around the reservoir in a clockwise direction, tending to produce about as much stirring action as could be obtained without baffles or other artificial means. The water in the center does not, of course, receive as much agitation from the incoming stream as that nearer to the circumference, but whenever water is flowing out of the reservoir the stream lines run from all parts of the water toward the outlet check valve. It is believed that with the frequent alterations of filling and discharging this arrangement of the check valves should in the long run give adequate circulation at the minimum of cost.

BIDS RECEIVED

The contract included, in addition to the construction of the reservoir and appurtenances, the laying of 2150 ft. of 24-in. cast-iron main to connect with the 20-in. main crossing Third Street at the alley between Main and Locust Streets. All cast-iron pipe, specials and fittings, and all gate valves and check valves were to be furnished by the city, the contractor to furnish everything else.

The estimated quantities were as follows: Earth, 22,100 cu. yd.; rock, 2200 cu. yd.; steel, 97 tons. The ten bids received ranged all the way from $62,000 to $106,790. The two lowest bids were rejected because of vital informalities, and the contract was awarded on Aug. 11, 1914, to the Mid-West Construction Company of Kansas City, Mo., on its bid of $66,000. The writer's estimate of the cost of the work, not including the cost of lands, the cost of putting in a 20-in. tee and three 20-in. gate valves to connect the reservoir branch to the distribution system, nor the cost of fencing the reservoir and turfing the lot, was $87,340. As nearly as can be ascertained at this writing, the total cost of the work covered by the above estimate, including all extras, engineering, inspections, tests and other expenses, was less than $82,000, or more than $5,000 below the original estimate.

INJUNCTION DELAYS WORK

Work was begun on Aug. 13, 1914. It was stopped on account of weather by order of the resident engineer for eight days at different times during the fall and winter. The work was further greatly delayed after Oct. 2 by restricting the use of the steam shovel from 7 a. m. to 10 p. m. as the result of an injunction obtained by a neighboring property holder, who complained that the noise of the steam shovel constituted a nuisance. It had been the intention of the contractor to work day and night, so as to have this wall built before freezing weather came, in the hope that he might thus avoid delay and danger from the caving of the earth during the spring thaws. The injunction prevented this and by throwing the work into bad weather so delayed it that the construction operations must unquestionably have proved far more of a nuisance to the neighbors in the long run than if the contractor had been allowed to proceed without interruption.

The stripping was done with slip scrapers. Wheel scrapers then moved some 1500 cu. yd., and as the excavation grew deeper a steam shovel was put to work loading the earth on small cars which were hauled up a narrow-gage incline track. Practically all of the rock after it had been broken by blasting was also handled by the steam shovel. Other difficulties encountered by the contractor resulted from the caving of the earth bank on several occasions and from the fact that the rock proved to be much harder and more difficult to deal with than he had anticipated.

TEST WALL LEAKAGE

After the forms were removed the reservoir was filled. A test made to determine the total amount of leakage showed that in 7½ hours the water level fell ⅝ in., corresponding to a rate of loss of 32,000 gal. in 24 hours, a small portion of this loss being due, of course, to evaporation.

The reservoir was drained and, with the space between the outer surface of the wall and the surrounding earth filled with water, quite a number of wet spots showed on the inner surface of the wall, and there were also three or four places in which very small streams spurted out. One of these places was at the lowest construction joint, the surface of which had been covered with clay from the caving bank. This leak was doubtless due to the fact that the contractor had not succeeded in removing all of the clay before pouring the next lot of concrete. There were practically no other leaks at the 4-ft. construction joints, the remaining leaks or damp spots occurring where stone showed on the inner face of the wall, indicating that at these points the spading had not been as efficient as it should have been. These rough spots were less in number than is usually the case in work of such magnitude, and the quality of the concrete work generally was well above the average.

All of the spots where there was any indication of leakage, however small, were marked, and the contractor promptly set about filling the spots with a mixture of pulverized iron and cement. This was successfully done, and it is believed that the reservoir is now as nearly absolutely watertight as it is possible to make such a structure.

Ralph P. Melendy, then engineer for the water department, was resident engineer in charge of the construction work. Under his supervision the Mid-West Construction Company fulfilled its contract obligations in a very creditable manner.

Materials for the reservoir were inspected and tested by Robert W. Hunt & Company.

Texas Conducts Sanitary Campaign

As a result of the agitation for incinerators waged by the state sanitary engineering department of Texas, records show that during the past six months approximately $250,000 has been expended for incinerators by 26 Texas towns.

Letters to the Editor

Comment on matters of interest to engineers and contractors will be welcomed

Justice to the Contractor

SIR:—With reference to the editorial on page 502 of the Engineering Record for April 15 concerning the usual custom of making a chief engineer sole judge of his own specifications, it seems that if the engineer is an honest one, no contractor could find fault with this clause in the specifications. Before a man has reached the position of chief engineer he has come in contact with a great many contractors who have become acquainted with his methods. These contractors, consequently, will make a high bid if they are dealing with an engineer who is inclined to be unfair, and a correspondingly low bid to the engineer whose decisions are fair. Clients soon find this out. Thus the engineer who will not deal fairly will be eliminated finally.

A. O. CUNNINGHAM,
Chief Engineer, the Wabash Railroad.
St. Louis, Mo.

[The process of elimination referred to by Mr. Cunningham is undoubtedly going on to some extent, but it alone should not be relied on to correct the abuses referred to in the editorial mentioned. It seems to the Engineering Record that a process of education, which would teach engineers, contractors and clients alike how to draw and administer contracts to secure a higher grade of results, would be distinctly preferable.—EDITOR.]

SIR:—I heartily agree with the editorial found on page 502 of the Engineering Record of April 15, and am willing to support a movement to place engineering and contracting on the highest planes possible. I have said that such clauses as "in the judgment of the engineer," "in the opinion of the engineer," and "at the discretion of the engineer" should never be permitted in a specification, because the engineer should occupy the position of a judge, or an interpreter of the specification, but not be permitted to make specifications or rulings that would change the meaning and intent of the specification. Specifications should be clearly written and the thought well defined, so that no misunderstanding or misinterpretation need be possible. Specifications should be full and complete, and no engineer should be permitted to make specifications who does not have a thorough knowledge of the work he proposes to do. Both the engineer and the contractor should enter into the work with a sincerity of purpose, and neither should expect to take unfair or undue advantages of the other. Especially should the engineer be fair to the contractor, as well as to the county, because of the responsibility and the grave-ness of the position he occupies.

A. D. WILLIAMS,
Chief Road Engineer, State Road Bureau of West Virginia.
Morgantown, W. Va.

SIR:—With reference to your editorial, "Justice to the Contractor," I am very much interested in the subject of correct engineering specifications and the correct engineering administration of public works. There is no question but that the courts will, on proper presentation, give the contractor justice as against the biased engineer, but it is the duty of engineering publications and of engineering schools to educate the next generation of engineers to the knowledge of the fact that, legally, the power of the engineer is limited to the authority given in the contract, and that the courts are not inclined to sustain a contract in which the engineer is the sole arbitrator. In other words, the courts do not recognize the right of parties to decide upon the arbitration of a dispute that has not yet arisen.

Anything that I can do to aid in a movement to correct the conditions you refer to will be cheerfully done.

H. E. RIGGS,
Professor of Civil Engineering, University of Michigan.
Ann Arbor, Mich.

SIR: Regarding the editorial entitled "Justice to the Contractor," published in the Engineering Record, April 15, I am quite in accord with your suggestion that there is a necessity for improvement in the method of compiling specifications. I fail to see, however, how a properly drawn standard specification would correct the narrowmindedness of the inferior and ill-equipped engineers, since they will probably consider that the specifications which they draw will be far superior to those drawn by any engineering society.

Nevertheless, there is certainly room for improvement, and your suggestion that the American Society of Civil Engineers should do extensive work along these lines is a good one. I think a committee for such work should include not only engineers, or contractors, but contractors' engineers.

I am optimistic, however, about the general situation, feeling that the engineering profession as a whole is growing to the realization of the value of a fair deal, whether the fair deal is included in the specifications or not.

I find in many instances, that complaints from contractors are met with more than fair treatment by engineers in charge of work, and I find also a disposition on the part of contractors to be less selfish and narrowminded than they are ordinarily considered to be.

C. J. BENNETT,
State Highway Commissioner.
Hartford, Conn.

SIR: I have read with some interest the editorial "Justice for the Contractor," in the Engineering Record for April 15, especially as I happen to be a member of a committee appointed by the Canadian Society of Civil Engineers at the annual meeting in January, 1914, to consider the question of "Uniform General Clauses for Specifications," the chairman of which is Henry Holgate, M. Am. Soc. C. E.

This committee has had a number of meetings, and at the 1915 annual meeting of the society presented a report embodying draft clauses for the purpose. These clauses provoked a great deal of discussion pro and con, and resulted in the report being referred back to the committee, and certain additions being made to the committee's membership. During 1915-1916 not much was accomplished, owing to wartime conditions in Canada, but it is hoped to present a revised report to the society at the 1917 meeting.

There is no doubt in my mind but that a set of fair and usable general clauses can be drawn up, not necessarily all to be used in any one contract, but from which the engineer may make a selection of such as may fit the case at hand. If the American Society of Civil Engineers can be induced to appoint a committee such as that referred to, on which both engineers and contractors shall be well represented, the results of its labors should be of great value.

Very truly yours,
R. DEL. FRENCH,
Assoc. M. Am. Soc. C. E.
McGill University, Montreal, Que.

Architect vs. Engineer

SIRS Allow me to commend most heartily the editorial entitled "Architect vs. Engineer," which appeared in your issue of March 25, page 406. It ought to be read by every engineer and architect in the country. Fortunately, the deservedly wide circulation of your paper may be expected to bring it to the notice of many of them.

I feel so strongly the force and the propriety of one paragraph of the editorial that I quote it here, as follows:

"Without a doubt the best plan would be to secure co-operation with the American Institute of Architects to the end that both engineers' and architects' licensing laws be kept off the statute books, and be repealed where now in force. As this journal has long held, such licenses do not make for the safety and welfare of the public. That can only be provided for by examining the work of the engineer and the architect, and not the individual."

The Illinois architects' license law makes it illegal for anyone but a licensed architect to design any building or part of building, and it defines a building as any "structure having foundations, walls and roof, with or without other parts." It was, therefore, illegal for an electrical engineer to design a power plant, a sub-station, or even a conduit or a manhole for light, power, or telephone cables. The railway engineer could not design a tunnel or a covered bridge. The municipal engineer could not design a sewer or even a sewer manhole. The waterworks engineer could not design a pumping station, a filtration plant, a covered reservoir, or a gate house on a reservoir or dam, or even an ordinary gate box. Each of these structures has "foundations, walls and roof, with or without other parts."

The architects' law was passed about twenty years ago, when structural steel and reinforced concrete first came into use for buildings. Both of these materials called for a knowledge of structural design, with which the engineer, generally speaking, was better equipped than the architect. The engineers were asleep and did not oppose the bill; and it is doubtless true that most of the architects themselves did not then fully realize its far-reaching effects. For a long time the architects made no attempt to enforce its provisions, but within the last few years they have been exceedingly active along this line. In view of the announced policy of officers of the local Association of Architects, it became necessary for engineers in Illinois to secure some protection if they wished to continue to practice their profession. The result was the passage in Illinois of the structural engineers' license law, prepared by the legislative committee of the Western Society of Engineers, of which the writer was a member during the last year of its existence.

Both laws should be repealed. Both are, in effect, class legislation masquerading in the guise of measures for the protection of the public. In this, of course, the architects' law is the worst offender, because it was passed first, and because the fact that it was in force made it absolutely necessary for engineers to secure similar legislation. Furthermore, with the architects' law in force, the engineers' law was actually in the interest of public safety, for it restored to the public its right to employ the class of men best qualified to design all structures safely.

Apart from the fact that the engineers' law now gives an engineer the legal right to practice his profession in the state of Illinois, a right of which he was formerly deprived in large measure by the architects' law, neither law is of any real benefit to either profession.

It would be folly to expect that any board of examiners, whether for architects or for engineers, could, by the mere issuance of a license, insure the public against unsafe plans. If it be necessary to protect the public by law against unsightly structures, art commissions could accomplish much; if against unsafe plans, suitable building codes would seem to offer the best solution. In both cases it would be the work which would be judged, and not the man.

Should this deplorable controversy between the two professions continue to spread, the engineers, if they will only bestir themselves—not to secure further class legislation, but simply to prevent architects from doing so—need not fear the ultimate outcome. A committee of the American Society of Civil Engineers has already, as you say, studied the situation, and sounded a warning which all engineers should heed. It seems probable that the American Society of Civil Engineers will soon join with the other engineering organizations in occupancy of the Engineering Societies Building in New York. The writer, for one, sincerely hopes that it will do so. That building will then be the official headquarters of more than thirty thousand engineers from all over the United States, and the power of these men in a just cause ought easily to outweigh the strength of such architects as could be induced knowingly to sanction the promotion of further class legislation.

But it seems too bad that two honorable professions should quarrel over laws so fundamentally wrong. The writer is unwilling to believe that the highest class of men in either profession would, if they thoroughly understood the situation, desire to perpetuate these laws. Neither profession could, of course, repeal its law with safety to itself, unless the other law was repealed at the same time. The only proper thing to do, therefore, would be, as you suggest, for the architects and engineers to join in repealing both laws.

DABNEY H. MAURY,
Consulting Engineer.

Chicago.

Service of Engineering Societies

SIR: "A society exists to render service to its members." This phrase from the editorial on "Service of Engineering Societies" in the Engineering Record of April 1 should be framed and hung in the meeting room of each society and be printed on its letterheads to keep constantly in mind a fact which too often has been overlooked, but which has now come to be appreciated as never before.

With the recent rapid growth of the national societies with headquarters in New York there has been a tendency to forget this simple fact and to point with pride to mere numbers of membership, apparently overlooking the fact that the larger the membership the larger the responsibility and the duties to the members, and the greater liability to diffusion of effort and lack of efficiency.

Some of the older members of our engineering societies, and particularly the officers, appear to regard the society as an institution almost sacred in itself and as the sum and substance of desirable human effort. They appear to forget that it is simply a means to an end and not the end itself. The accumulation of wealth and a substantial building, and library, may properly be questioned as a desirable achievement if, in the process of adding to the wealth and membership, the society has sacrificed the end for which it was created. Concerning every dollar of membership dues which has been laid aside there may be a proper question as to whether it has been used rightfully, as to whether in being held in reserve it has not resulted in delaying the accomplishment of the purpose for which the society was organized. The possession of a surplus over running expenses, while indicative of good management financially, may be in itself an arraignment of good faith of the management of the society which has taken the membership dues and may not have used them in the best way for the good of the members and through these of the general public.

During the past few years I have had unusual opportunities of meeting engineers of all kinds and in addressing engineering organizations, East and West, North and South. The impression derived is that the smaller, struggling societies, many of them barely avoiding debt, are the ones which are accomplishing the largest results for their members and for the profession in general. This is particularly true of those which bring together the members, representing all branches of engineering, for monthly or semi-monthly meetings, partly social in character and in part devoted to the discussion of technical subjects. These are the ones which may be considered as rendering 100 per cent efficiency for the time and money invested. In striking contrast to these are the larger organizations with greater wealth and with corresponding self-satisfaction. Here the funds are often expended in conducting routine work which, while good in itself, represents only 30 or 40 per cent of possible efficiency.

The question may be asked, "Why do men continue to join these large associations if there is a recognition of this lack of efficiency?" The answer lies in the fact that there has been built up a tradition or sentiment to the effect that it is incumbent, upon the younger men especially, to join a big society and to demonstrate their fitness by being accepted as members. It is frequently urged that their opportunities for securing employment or public recognition will be increased by their being able to wear the badge of the society. Thus arises a certain moral coercion; a man joins and continues to pay annual dues year after year simply because it is considered a proper thing to do and for fear that if he does not do so his business may suffer therefrom.

As a matter of fact, the value of the privilege of wearing the pin of any engineering society is greatly exaggerated. Employers and men of influence in every-day life care practically nothing about it. Personally, I have employed scores of engineers and have been associated in business and otherwise with many others. I have not been able to find that membership in any society, big or little, really counts for, say, more than 1 or 2 per cent in the factors that contribute to success. Wide acquaintance within various societies and without leads to a conviction that the ability to pass the committee on admission is not a very satisfactory test; equally good men are found outside of the societies as well as in, and vice versa. Nevertheless, as before stated, there is a sentiment, which has been carefully fostered, leading men to apply for membership and to continue to pay annual dues, even though they are vaguely conscious that the money which they have contributed is not being used effectively either for the public good or for their own.

The ideals of service necessarily vary in the different organizations, and in many, especially the larger societies, they are extremely vague. The time is coming, however, with the increase in number of engineering societies and with the larger demand for engineers to take part in civic affairs, when every engineer will ask whether the association to which he belongs is not merely holding a high ideal, but is actually working toward it in an effective manner. We may state in general terms that every association of engineers does accomplish some good, but good is a relative term. It means little unless we define it quantitatively. On examination it may be found that the "good" resulting to individuals from membership in one society may be 30 per cent and in another 100 per cent on the investment.

As stated in your editorial, "a satisfied and enthusiastic membership is one which is being adequately served." There is nothing which is more important at the present time than for each and every thinking man to ask the question as to whether he is being adequately served. If not, what is the reason? Is the society too big? Are its headquarters too remote? Does it discourage local option or initiative? Has it fallen into extravagant habits or dropped into a rut? None of us should accept without question the established order nor cease to continually inquire into the efficiency of the organization to which he contributes his annual dues.

The greatest developments of recent years in practical affairs have been those which have resulted from efficiency studies, from elimination of useless details, from the use of high-speed machinery and more effective men. The engineering societies may well profit by the lesson and turn to the benefit of their own members some of the lessons learned by the transportation and manufacturing organizations.

F. H. NEWELL.

Urbana, Ill.

HINTS FOR THE CONTRACTOR

Details Which Save Time and Labor on Construction Work

Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

[*Contributions to this section are solicited, and if found available will be paid for. They must be* SHORT, *and should be accompanied, if possible, by photographs or sketches.*—EDITOR.]

Types of Rock Drills for Tunnel Work in Chicago Compared

IN DRIVING the Wilson Avenue 8-mile waterworks tunnel, Chicago, described in detail last week, the rock drill question was given considerable study. The results obtained were given by Henry W. Clausen in a paper presented recently before the Western Society of Engineers. After securing all available information both as to what had been done in Chicago and what had been accomplished in other parts of the country since the last rock tunnel was completed in Chicago, the decision was reached that the best way to determine which is the most efficient type and make of drill for any particular rock formation was to equip each shaft with a distinct type of rock drill. Accordingly the old piston type of drill, the water-piston type and the water-hammer type, were used on the work. The results found up to Jan. 1, 1916, were that the most economical type of drill from the standpoint of repair parts is the piston. The fastest drill is the water-hammer drill, but the difference between the drills is not marked in either comparison. The hammer drill, however, uses less air than the piston drill. The specifications called for drills with not less than 2⅝-in. cylinder diameter and a capacity of 10-ft. holes. The cost of the better grade of piston drill of this size is $193, of the water-piston drill, $229.60, and of the water-hammer drill, $280; all equipped complete with a 50-ft. length of hose.

Both the column and heading-bar methods of mounting the drills at the face were tried, and the advantage thus far seems to rest with the column method. Bench holes were drilled from the column or bar as much as possible.

After the tunnel work had advanced for some time it was found advisable to install a No. 5 Ingersoll-Rand Leyner drill sharpener with the necessary dies, dollies, etc. This machine, which is operated by compressed air, holds and forges the steel. The cost of the machine with all appliances was $1,379.55. It is operated by one man and easily performs the work of four blacksmiths and does the work better, said Mr. Clausen.

This work is under the direction of John Ericson, city engineer, with Mr. Clausen, engineer of waterworks construction, in direct charge.

Paving Mixer Rolls Subgrade While Waiting for Stone

BY SLIPPING 24-in. wide butt-welded tires of ½-in. thick steel over the regular wheels of a paving mixer, made by the Chain Belt Company, a contractor for road construction in Glenwood, Iowa, converted the mixer into a road roller at a cost of $75. The outer half of each new tire was filled with 1 to 2 mixture of sand and cement. Samuel Friedman, the contractor, states that the converted mixer rolled the subgrade with very satisfactory results, although there were several backfilled trenches in the road. Owing to the fact that shipments of coarse aggregate for the concrete were delayed on this work, it was possible to roll the entire subgrade without using a regular roller on the job. The contractor figures that the converted tool will perform several years of good service as a mixer and roller.

MIXER AS ROAD ROLLER

What Is Best Way to Cut Blocks from Concrete Pier?

SIR: Will you please tell me how to cut out a piece of concrete from the corner of a pier in one lump so as to make a neat job and not injure the rest of the work? Although I have been in construction work all my life this is the first time I have come across a piece of work of this kind. I used plugs and feathers, spacing the drill holes on 4-in. centers, but it made a poor job.

WILLIAM J. STRATTON,
U. S. Reclamation Service.
Gilman, Mont.

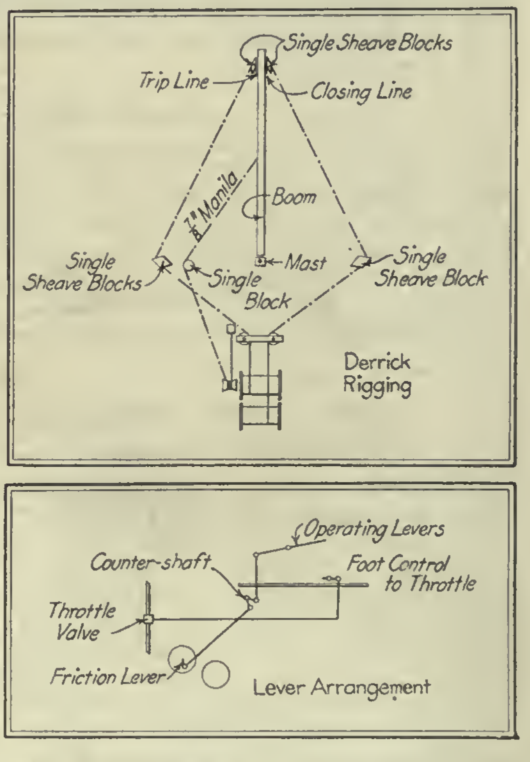
[Perhaps some reader of the Engineering Record can suggest a good method of doing this work. An inclosed sketch indicates that the pieces to be cut from the pier, which is 4 ft. thick, are at the upper corners, are 3 ft. 3 in. high and 3 ft. deep, and extend through the pier from side to side. Perhaps the work could be done by using small steels, drilling a row of holes as close together as possible downward from the top of the pier and another row inward horizontally from the 4-ft. face, and cutting out the walls between the holes as far as possible with a chisel steel used in the drill. As there is stated to be no reinforcement in the pier, it should be possible by careful drilling to take the block out very neatly. The horizontal holes would be drilled and the walls between them cut, of course, before the vertical holes are started.—EDITOR.]

Quick-Operating Rig for Grab Buckets Uses Two-Drum Hoist

By WILLIAM G. BROADHURST
F. R. Long-W. G. Broadhurst Company,
Hackensack, N. J.

FOR HANDLING material with a grab bucket from one point to another where the elevation of the boom does not have to be changed, as in unloading material from barges at a water-front plant, a rig arranged as indicated in the accompanying sketch and operated with a two-drum hoist is much more rapid and efficient than the average clamshell derrick swung with a bull wheel.

The closing line is run from the bucket through a swivel-hook, single-sheave block hung at the end of the boom on the right side, then through a loose-hook, single-sheave block well off to the right side at the level of the foot of the boom, then through a guide sheave fixed so as to lead the line to the upper drum of the hoist. The trip line is run from the bucket in the same way, but on the left side of the boom. The operator stands on a platform set so that he can see the whole operation of the bucket. The brakes are removed from the engine and the drums are operated and controlled only by the frictions. There are two oper



DERRICK HANDLES GRAB BUCKET WITHOUT BULL WHEEL OR THIRD DRUM ating levers placed parallel about 30 in. apart at such an elevation that the operator can stand between them and raise and lower them one with each hand to control the friction levers of the drums. The throttle is controlled by a foot treadle directly in front of the operator.

To operate the rig, beginning at the point of loading, the throttle is opened with the foot control, the right-hand lever pushed down and the bucket closed, loaded and raised clear. At the same time the left-hand lever is held down just enough to take up the slack on the trip line on the lower drum. The bucket swings to the right with the boom, which is pulled around by the side lead of the closing line. Enough tension is kept on the trip line to keep the boom from swinging too fast. When the bucket reaches the dumping point the closing line is slacked and the trip line held, opening the bucket. The trip line is then wound in, reversing the operation and pulling the boom back to the loading point.

If the empty bucket is not heavy enough to furnish the tension in the trip line required to swing the boom back at a rapid rate, a tag line, rigged as indicated in the sketch, may be used to help. A manila line is attached about half way up the boom, rove through a single block at about the elevation of the winch head, given several turns around the winch head and then rove through a set of double-sheave blocks hung from some point on the derrick. To the lower block of this set of falls is hung a weight of about 50 lb. The weight and the number of turns on the winch head are adjusted so that there is just enough pull in the line to start the boom swinging back from the dumping position. The weight of the loaded bucket will furnish enough tension in the closing line to overcome the pull on the manila line when the boom is swinging with a load.

With practice an operator can learn to handle this rig with great speed. With a 1-yd. clamshell bucket 500 to 600 cu. yd. of ashes or similar material may be unloaded from a scow in 9 hr.

[The rig described operates on the same principle as the 5-yd. orangepeel dredge boats common about Eastern harbors. Such a rig, which is rarely seen away from the Atlantic seaboard, might be used profitably in many places on construction work. It might be added that the dredge boats are usually rigged with chains instead of wire rope, and that usually a tag line is not needed with the heavy buckets.—EDITOR.]

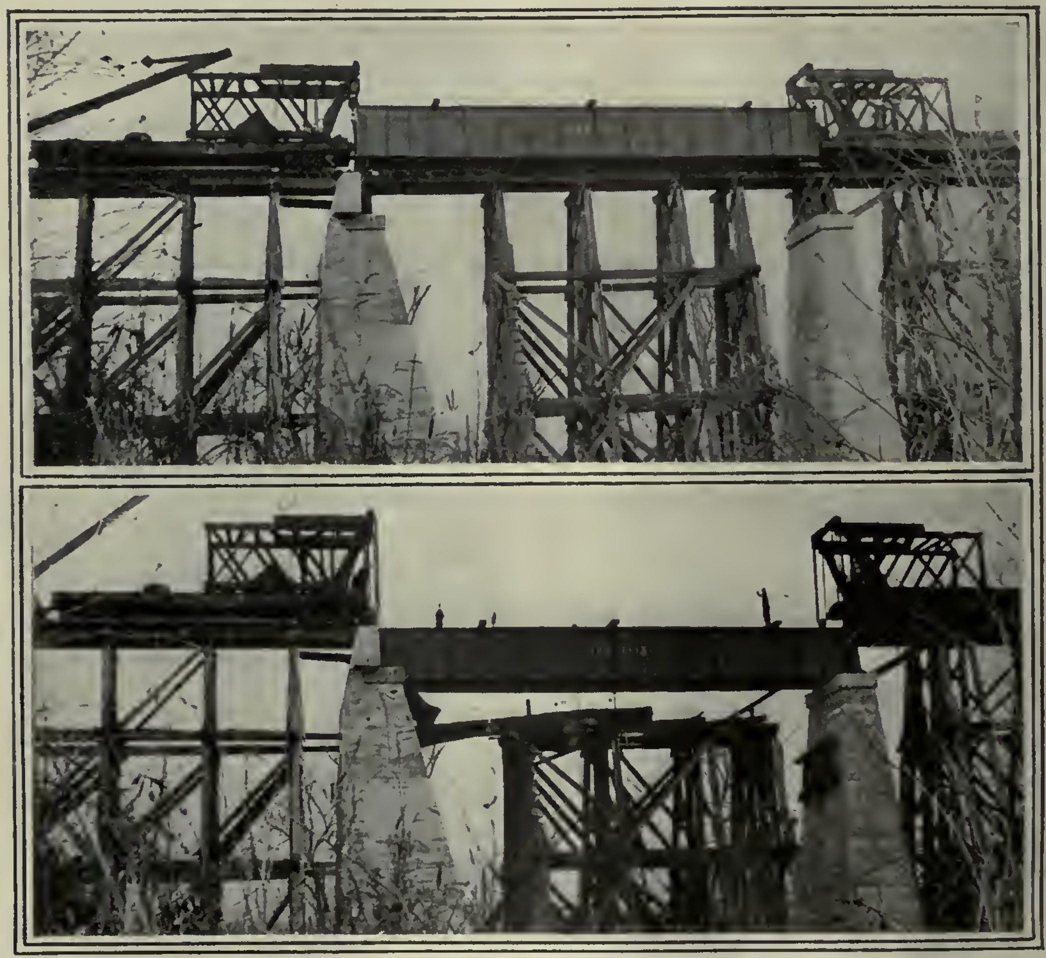
Use Gasoline Engine Successfully in Chicago Tunnel

FIVE-TON gasoline locomotives with the exhaust gases thrown off through a water box to remove the smoke and unburned gasoline operate the trains of muck cars in the Wilson Avenue tunnel, Chicago, described in the Engineering Record of April 29, 1916, page 568. The small quantities of CO and CO_2 remaining are ordinarily sufficiently diluted to be unobjectionable, according to Henry L. Clausen, engineer of waterworks construction, in a paper recently presented to the Western Society of Engineers. The four-wheel type locomotives are driven by 40-hp. four-cycle, four-cylinder engines running at 800 r.p.m., and can attain a speed of 8 miles per hour, at which they can develop a drawbar pull of 900 lb. They were furnished from special city specifications by the Baldwin Locomotive Works. In the Wilson Avenue tunnel they usually pull trains of twenty to twenty-five loaded 1-yd. cars, and in an emergency as many as fifty-seven loaded cars.

Frames on Flat Cars Erect Railroad Girder Bridges

By C. L. KETCHAM
Pleasanton, Kan.

THE CARRIER cars, shown in the accompanying photographs in the act of placing a 70-ft. deck plate girder span, are in use by the St. Louis & San Francisco Railroad for setting girders up to 100 ft. long in replacing lighter bridges and trestles. The two frames shown were erected on standard flat cars at a cost of $150 without injuring the cars for future service. Ordinarily no hoisting equipment is used.



SET IN THIRTY MINUTES, THESE GIRDERS WERE HANDLED WITHOUT HOISTING EQUIPMENT

For this replacement work the girders are nearly always delivered a few days before the time to set them. They are unloaded from the flat cars at a convenient point near the bridge onto cribbing the same height as the floor of the car. When a span is to be set, one of the carrier cars is spotted at each end of it, and cribbing built on the track between these cars. The girder span is then slid over into place between the cars. Next, manilla rope lowering tackles hung from the frame on each car are attached to the ends of the girder span. The span is then raised on jacks, the cribbing on the track removed and the span lowered a little way on the jacks till the tackles are taut. The lead lines from these tackles are snubbed around lengths of 5-in. gas pipe secured to the upright members of the frames.

When the weight of the span is on the cars, the whole train is pushed out into place to set the new span by a locomotive. When the cars have to be pulled they must be held together by a wire-rope line. It is for this purpose that the derrick car shown in the accompanying photographs had been used. When the cars are pushed no coupling is necessary, as the advanced car can be stopped accurately with the hand brake.

The rails over the bridge or section of trestle to be replaced are cut beforehand, and short lengths put in. This makes it easy to take out the old trestle or span in a short time. It is then only a matter of a few minutes to lower the new span into place with the supporting tackles. With spans shorter than 70 ft. the new deck is usually placed on the girders before leaving the side track with them.

The time consumed in placing the girders shown in the accompanying photographs was only 30 minutes after the carrier cars were spotted. The entire process of cutting the old rails, setting the girders and replacing the track was done on one occasion in 50 minutes between trains on a busy section of the main line. The girders set in this instance were also 70 ft. long. Girders have been set in this way at a cost of 50 cents a ton or less.

The writer is in the service of the St. Louis & San Francisco Railroad as superintendent and inspector of steel bridges.

Status of American Ship Building

According to returns made by builders to the Bureau of Navigation, Department of Commerce, there were building or under contract on March 1, 1916, in American shipyards 244 steel merchant vessels, having a gross tonnage of 945,798.

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

Will Dedicate New Technology Buildings June 12

Elaborate Ceremony Planned to Mark Removal of Institute from Boston Site to Cambridge—Prominent Educators Will Attend

With elaborate ceremonies, including a pageant and masque delineating man's progress in conquering the forces of nature, the transfer of its archives from Boston across the Charles River in a lavishly decorated Venetian barge, a water carnival, alumni reunions, and formal exercises in which distinguished educators, statesmen and men of affairs will participate, the Massachusetts Institute of Technology, on June 12, 13 and 14, will celebrate its fiftieth anniversary and dedicate its imposing group of new buildings on the banks of the Charles River in Cambridge, Mass. For the three-day celebration, separate programs have been arranged for the alumni, the undergraduates, and guests from other institutions of learning, but the activities of these three groups will intermingle, to some extent, so that while the units will enjoy themselves in their own ways the whole great mass of people will be together at times when the interests of the occasion are common to all.

The formal exercises of dedication will be held on Wednesday, June 14. The arrangements are in the hands of committees of which Franklin W. Hobbs, Jasper Whiting and Frederick P. Fish are chairmen. Two hours in the morning are to be devoted to an inspection of the new buildings. At 2:30 p. m. the academic procession will start its march to the Court of Honor, where the exercises will be held. Dr. William T. Sedgwick will act as chief marshal. At 3 p. m. President Richard C. Maclaurin will welcome the visitors and delegates, Governor McCall of Massachusetts and President Lowell of Harvard will make brief addresses, while the orator of the afternoon will be Senator Henry Cabot Lodge. Delegates from colleges throughout the United States and Europe will be present, together with presidents or other representatives of a hundred scientific and literary associations.

Spectacular Pageant Planned

Tuesday, June 13, will be alumni day. Thousands of Tech men are planning to be in Cambridge to do honor to their alma mater and will witness, in the evening, a masque and pageant on a stupendous scale. The spectacle will illustrate "The Conquest of Chaos by Technology," and will be staged in the Court of Honor at the new Technology. The arena will be filled with thousands of elements—students and other participants—in chaos and confusion. Primordial man will be represented by a group of the huskiest of Tech students selected for their physical prowess. Again and again savage man enters the circle and is flung out by the forces that do not know his bidding. Growing more and more intelligent and calling to his aid great principles working with Reason, Will and Skill, symbolical characters which come to his aid, man subdues Chaos and order and civilization are established. This is a bare outline of the subject which originated in the imagination of Prof. R. A. Cram, senior professor in the department of architecture.

Transfer of Archives

One of the most important spectacular features of the celebration will be the water festival on Monday afternoon, June 12 in Charles River basin. On the following afternoon, as an introduction to the masque and pageant, there will be the formal transfer of the archives of the Institute from the Rogers Building in Boston, their home for fifty years, to the new site in Cambridge. Following an old Venetian custom the corporation and faculty members will embark in an elaborately decorated barge, 100 ft. long, designed especially for this occasion by Professor Cram, with sculptured decorations by Hugh Cairns. This vessel will carry the dignitaries across the Charles River basin to the new Technology.

Alumni Will Celebrate

Many alumni celebrations are planned for Monday, June 12. Delegations will reach Cambridge from all parts of the country and a round of festivities for their entertainment has been provided.

The new buildings for the Massachusetts Institute of Technology have been described in a number of articles in the Engineering Record and the construction methods were given in detail in the issue of Nov. 28, 1914, page 578. The financing of the edifices for this great institutional plant, involving gifts aggregating about $9,000,000, has been in the hands of President Richard C. Maclaurin who, at the same time, has carried forward the educational program of the Institute.

TO THESE NEW BUILDINGS ON THE BANKS OF THE CHARLES RIVER IN CAMBRIDGE, MASS., THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY IS NOW READY TO MOVE FROM ITS SITE IN BOSTON

Engineers Hold Exhibit

The Scranton and Northeastern Pennsylvania corps of engineers recently held a recruiting exhibit at Scranton. Working models and pictures of military bridges and war equipment were shown, with the result that forty recruits were enrolled.

Two Closely Allied Conferences Held at Washington

One in Connection with American Institute of Electrical Engineers—Other a Part of American Electrochemical Society Meeting

Two closely allied conferences were held last week in Washington, D. C., one under the auspices of the committee on development of water-power and the Washington (D. C.) section of the American Institute of Electrical Engineers and the other as part of the general meeting of the American Electrochemical Society.

Wednesday's meeting dealt with the engineering and economic question of water-power development as related to national industrial efficiency and preparedness. The Thursday afternoon session was devoted to discussion of Niagara Falls power and American industries. A. P. Davis, chief engineer of the U. S. Reclamation Service, gave an illustrated lecture on the federal water-power projects.

In a paper entitled "Electrochemical Industries and Their Interest in the Development of Water Powers," Lawrence Addicks pointed out that those industries offer nearly ideal loads of considerable magnitude for central stations. He also said that electrical energy must be obtainable at even less cost than at Niagara Falls before it will be in marked demand for electrochemical purposes. While the available energy must be near the electrochemical market and source of supply for raw materials, the nature of the industry determines whether energy, transportation charges or labor cost is the ruling factor in the location of the plant. In variance with expressed opinions electrochemical plants can seldom be operated on off-peak power, declared the speaker. These industries, so far, have not found it economical to develop their own power singly, but, in time, may co-operate to develop energy as a group. In view of the foregoing considerations, a liberal water-power policy on the part of the government would be a step toward making inexpensive energy available for this extensive industry.

Water Power and Transportation

Some of the conditions which determined the value of water-power in relation to transportation, and how it may change with progress and changes in interest rates demanded for capital, were outlined in a paper by Lewis B. Stillwell, entitled "Relation of Water Power to Transportation."

Estimates were given on the approximate economic limits to investments in hydroelectric plants when coal can be obtained for steam plant operation in the vicinity at $1 to $5 and when the capital charges are 9, 12 and 15 per cent. It was pointed out that if water power has to be supplemented by steam reserve equipment, the amount that can be economically invested in a hydroelectric plant is reduced by the cost of the steam plant. Attention was also called to the fact that the decreased cost of steam-power plants and increased fuel economies obtained in recent years, have considerably reduced the limits to economical investment in water-power plants.

Discussion

In the discussion which followed, Dr. Leo Baekeland, of New York City, told of the power famine confronting electrochemists and how the industry cannot go forward without cheap and abundant power. He complained of the wasteful methods of financing in this country. He stated that a development is saddled with investment charges of 9 per cent before operations begin, while in Europe the money costs about 4 per cent. Fertilizers, he said, cannot be made where a plant has such fixed charges for capital because energy must be extremely cheap. No plant having to pay $9 yearly on a $100 investment can make energy cheaply enough for the fixation of nitrogen.

J. J. Carty blamed the government for the high rates which prevail. If it would remove the uncertainties about the tenure of the grant, bankers would be content to recommend the investment at lower costs. Give the investment stability and money would be cheaper. Everything, he said, should be done to conserve the coal of the country, and this can best be done by developing the water-powers.

Hard to Procure Capital

Certain aspects of investors' attitude toward water-power developments were presented in a paper by Gano Dunn, entitled "The Water-Power Situation, Including Its Financial Aspects." It was pointed out that actual and threatened laws, popular prejudices and some cases of unprofitable developments have retarded water-power developments. Physical and natural difficulties also handicap hydroelectric plants, as compared with steam plants, making it essential that a reasonable profit be offered to induce investment of capital.

On account of the increasing cost of labor and materials, increasing taxation, and the fact that the efficiency of converting water-power to electric power has practically reached a maximum, the cost of generating hydroelectric power is increasing and will continue to do so. On the other hand, steam-electric energy is decreasing in cost because continual improvements in converting heat energy into electrical energy have been made and may be expected.

At the meeting of the American Electrochemical Society, Thursday afternoon, four papers were presented by I. R. Edwards, F. J. Tone, A. H. Hooker and W. S. Landis. The discussions were on water-power development at Niagara Falls, electric furnace products, electrochemical processes and nitrogen fixation processes. H. J. Pierce lectured that evening on American and foreign water-powers and electrochemical industries.

American Society Board Changes Rules Governing Admissions

Several revisions in the rules adopted by the board of direction of the American Society of Civil Engineers last January were made at a meeting of the board held on April 18. Rule 1 (see page 35 of the year book), stating that the qualifications for admission to any grade must clearly exceed the minimum requirements of the constitution, now states that the qualifications must be shown to clearly equal the requirements of the constitution. Rule 2, regarding references, is practically unchanged. Rule 3, requiring markedly superior professional experience for admission of applicants engaged on work for which engineering education is not essential, has been omitted. Rule 4 has been modified as Rule 3 to the following form: "In considering the requirements for the grade of member, the words 'responsible charge of work' shall be interpreted to refer to work of considerable magnitude for which rule-of-thumb methods are not sufficient." Rule 5, stating that a candidate shall be admitted as member only by transfer from the grade of associate member unless eminently qualified, has been omitted.

Shields Bill Endorsed by Conservation Congress

After a bitter fight in which the so-called conservationists, headed by Gifford Pinchot, made the usual charges of convention-packing by the power interests, the National Conservation Congress in session in Washington, D. C., May 3, adopted a resolution endorsing the Shields bill. The vote was 116 to 39. The Shields bill would permit the granting of franchises, irrevocable for 50 years, for the construction of power plants on navigable streams. The Pinchot following contended that sufficient degree of control was not retained by the government to protect the interests of the public.

The merits of the bill were discussed editorially in the Engineering Record of April 8, 1916, page 469.

Pennsylvania Will Build Large Hotel in New York

Plans have been made public by the Pennsylvania Railroad regarding the large hotel to be built by its subsidiary, the Pennsylvania Terminal Real Estate Company, across Seventh Avenue from the Pennsylvania Station in New York. The Hotel Pennsylvania will occupy the property fronting 200 ft. on Seventh Avenue and 400 ft. on Thirty-second and Thirty-third Streets. At present it will have a three-story section twenty stories high on Seventh Avenue, with a three-story section in the rear, and will contain 1000 bedrooms. The low section will be designed, however, to be carried up when necessary to the full height of twenty stories, thus giving 1200 additional rooms. Large rooms will also be provided for conventions.

The architects and the contractor will be the same as for the Pennsylvania Station opposite—McKim, Mead & White and the George A. Fuller Company respectively. The hotel is to be opened in 1917.

Concrete Dam of C. P. R. at Moose Jaw Slides on Base

Gravity Type Water Supply Structure 300 Feet Long Moves About 15 Feet Downstream When River Rises

While the water is still too high for a verification of the cause of the accident, it is probable that the failure of the Canadian Pacific Railway's concrete dam at Moose Jaw, which occurred on the morning of April 24, was due to the sliding of the structure upon its foundation. The dam across the Moose Jaw River is of the gravity type, about 300 ft. long, divided by buttresses into eighteen sections, nine of which are provided with stop gates. The downstream face had no concrete apron but was protected by stone riprap. The stop logs were all removed at the time of failure.

It is believed that the dam did not break but slid forward about 15 ft. on its foundation, due to the washing away of the riprap protection. It is not possible, at this writing, to verify this conclusion.

According to old residents in Moose Jaw this year's spring run-off has been equaled only once during the past thirty years, in 1905. In both years of high water the low lying and built-up portions of the city were flooded about 2 ft. deep.

Moose Jaw is the general divisional headquarters for the Canadian Pacific Railway's system in the Province of Saskatchewan and is the site of large repair shops. The railway company is partly dependent on the impounding reservoir formed by the Moose Jaw dam for its water supply for operating purposes.

Pennsylvania Railroad Reorganizes Operating Department

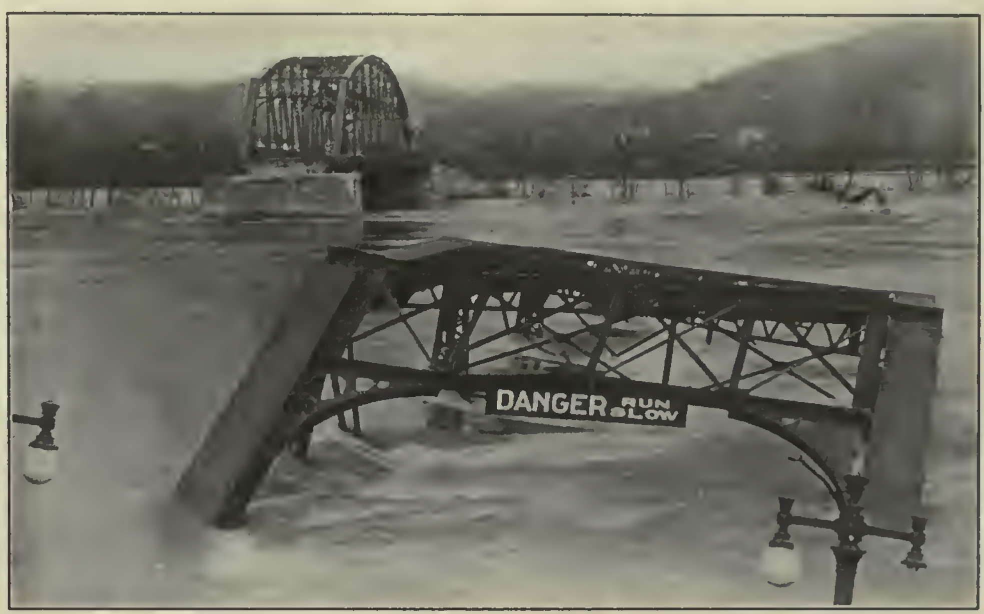
The operating department of the Pennsylvania Railroad was radically reorganized, and two new positions created, at the directors' meeting in Philadelphia, April 26. The two new offices are those of assistant general manager and resident assistant in New York, to the vice-president in charge of operation.

The Baltimore division south of Wago, including the York branch and the York, Hanover & Frederick Railroad and the north end of Bay View yard, comprise a new Baltimore division which is attached to the Philadelphia, Baltimore & Washington Railroad. The Baltimore division north of Wago has been attached to the Eastern Pennsylvania division. Rockville, Pa., is the southern terminus of the Central division. The Media division has been consolidated with the Maryland division of the Philadelphia, Baltimore & Washington.

Students at Johns Hopkins University Practice Military Engineering

THIS MILITARY BRIDGE WAS ERECTED BY 28 STUDENTS AT JOHN HOPKINS UNIVERSITY IN ABOUT A DAY'S TIME. THE PRINCIPAL PART OF THE WORK, CONSISTING OF LASHING THE BENTS TOGETHER, WAS DONE IN LESS THAN 6 HOURS. COST OF CONSTRUCTION WAS APPROXIMATELY $70, FOR ROPE, PLUS THE LABOR OF CUTTING THE TIMBER. THE SAWN LUMBER WAS ON HAND. THE STRUCTURE WAS TAKEN DOWN IN TWO HOURS. THE MILITARY ENGINEERING PRACTICE IS THE RESULT OF A SUGGESTION BY C. J. TILDEN, PROFESSOR OF CIVIL ENGINEERING. THE DESIGN IS THAT USED BY THE WAR DEPARTMENT.

The changes made May 1 include the following: C. S. Krick, formerly acting general superintendent of the New Jersey division, has been appointed general superintendent. Elisha Lee has been promoted from the position of general superintendent of the Philadelphia, Baltimore & Washington Railroad to assistant general manager. R. V. Massey, formerly superintendent of the Manhattan division has been appointed to a similar position on the New York division, formed by consolidating the New York and Manhattan divisions. F. W. Smith has been promoted from the position of division engineer of the New York division to become assistant superintendent of that division. J. H. Harris, formerly division engineer of the Manhattan division, now holds a similar position on the New York division. G. R. Sinnickson has been promoted from superintendent of the Schuylkill division to a similar position on the Baltimore division. He is succeeded by J. J. Rhoads, formerly superintendent of the Media division. J. H. Gumbes, formerly superintendent of the Renovo division, is superintendent of the Philadelphia Terminal division.



Athens Bridge Washed Out by Underscoring of Intermediate Pier

AS DESCRIBED IN THE EDITORIAL ON PAGE 534 OF THE ENGINEERING RECORD OF APRIL 22, TWO RECENTLY COMPLETED BRIDGE SPANS OVER THE SUSQUEHANNA RIVER, AT ATHENS, PA., FAILED DUE TO FALSE ECONOMY IN USING OLD TIMBER CRIB PIERS BUILT IN 1840. THE CENTER SPAN TURNED COMPLETELY OVER AND CAN BE SEEN ABOVE WATER IN THE DISTANCE. THE NEAR SPAN (ATHENS END) SETTLED WITHOUT SHOCK, AS EVIDENCED BY THE UNBROKEN LIGHT GLOBES IN THE FOREGROUND OF THE ILLUSTRATION

Nominate Officers for Testing Materials Society

Last week the nominating committee of the American Society for Testing Materials announced the following nominations to be voted on previous to the coming annual meeting to be held June 27:

For president, A. A. Stevenson; for vice-president, S. S. Voorhees; for members of executive committee, W. H. Bassett, John Brunner, G. W. Thompson and F. E. Turneaure.

The executive committee announces that the total membership on April 20, 1916, was 1963 members, a net increase of 121 since June 15, 1915. The largest net gain in membership for the yearly period between annual meetings was 155, reported last year, but during that year the net gain from the date of the annual meeting of 1914 to April 20, 1915, was only 71 as compared with 121 this year. It is confidently anticipated by the committee, therefore, that the total membership at the time of the approaching annual meeting will be substantially above 2000.

As announced elsewhere in these columns, the annual meeting this year will consume only four days, the Saturday morning session, customary in the past, being eliminated.

The Best of Footings None too Good for New York Subway

We are down to Solid rock I can smell Sulphur in the cracks.
All right, we will finish off the bottom. Here Comes the Manicure now.
What is all that blasted noise I hear? There has been a terrible smell of fresh air down here lately

Seamy rock was found in excavating the column footings for New York City's new Lexington Avenue subway station opposite the Grand Central Terminal. As these columns are on private property and will have to support a heavy building, the engineers of the Public Service Commission had all excavations carried down to solid rock and well cleaned up to make sure that no stray fissures remained undetected. The cleaning was carried out with the nicety, so it is said, of manicure operations. The extra excavation was done under Article XII of the contract. Robert A. Shailer, tunnel engineer for the contractors, the Rapid Transit Subway Construction Company, on learning one morning that the extra excavation would hold up the work of concreting the footings for another week, is rumored to have consigned Article XII to the lower regions with some heat. Less than an hour afterward our informant, who had been down "in the bottom" in the meantime, rushed up to the office with a huge chunk of sulphur crystals, mined from the depths, and the greeting "we're almost there with Article XII, Mr. Shailer."

The cartoon is from the pen of George Perrine, Mr. Shailer's assistant.

Engineers Protest Against Engineer's Removal from Office

The removal of Leon H. Nishkian from his position in the building department of San Francisco was the subject of discussion at a recent meeting of the San Francisco Association of Members of the American Society of Civil Engineers. Political reasons are said to have been the cause of the removal.

The following resolution was adopted at a recent meeting of the association:

"Resolved, that the San Francisco Association of Members of the American Society of Civil Engineers expresses its confidence in the impartial, trustworthy, fearless and competent way and manner in which Leon H. Nishkian has conducted the work in his office as structural engineer to the building permit department, and our regrets as to the removal from his position."

Copies were sent to the Mayor, Civil Service Commission, and various publications.

American Society for Testing Materials Will Meet June 27

The nineteenth annual meeting of the American Society for Testing Materials will be held in the Hotel Traymore, at Atlantic City, June 27 to 30. The first day will be devoted to miscellaneous reports and papers on heat-treatment of steel. Reports on steel and iron, and on tests and testing will be presented the second day, while the last two days will be devoted to reports on cement and concrete, ceramics and road materials, non-ferrous metals, cast-iron and miscellaneous material.

1700 Engineers Apply for Admission to Military Lectures

Invitations from the Engineers' Society of Western Pennsylvania to engineers to attend a series of military engineering lectures at Pittsburgh, brought favorable replies from nearly 1700 technical men. The first lecture was delivered May 3 by Lieut.-Col. F. R. Shunk. The next meeting will be held May 10, in Carnegie Music Hall, at which Major P. S. Bond will discuss military reconnaissance, sketching and surveying, and military demolitions.

Atlanta Must Pay for Its Garbage Plant, Court Rules

Upholding the claims of the Destructor Company, of New York, Judge W. T. Newman, in the federal court last month, settled the long-standing controversy over payment for the garbage disposal plant at Atlanta, Ga., by a decision calling upon the city to pay the company $135,000 due on the plant and other expenses to be determined at a later date. The court's opinion took the form of a denial of the city's bill of exceptions to the report of Frank E. Callaway, the special master. That report upheld the company's claims in practically every important detail.

In closing its opinion, the court said:

"I may add to all that has been said that the manner in which the plant has destroyed the refuse of the city during the past one and a quarter years seems to show clearly that the city must necessarily take it and pay for it, the only real question being what it should pay for the extra cost of operation from the time stated.

"The trifling amount of refuse not completely destroyed, as has been discussed, is not sufficient to justify any serious objection to the working of the plant, and the steam product being satisfactory, although not used at all now, there is nothing left as to which there ought to be any reasonable discussion. As soon as the amount the company is entitled to recover, if anything, for the excess cost of running the plant and for usual and ordinary repairs, as indicated herein, is determined, a decree may be entered in accordance with it."

Heavy Storm Does $125,000 Damage at Louisville

A sudden rain and hail storm in the center of Louisville, Ky., April 20, caused damage to buildings amounting to nearly $125,000. The first indication of danger was a black funnel-shaped cloud which swooped down, ran only a few blocks and then lifted.

The J. B. Wathen distilling buildings were unroofed and a large smokestack blown down, resulting in about $50,000 damage. The loss at the Glencoe distillery amounted to $30,000, and at the Sunny Brook plant two large stacks were destroyed, damage amounting to $25,000.

National Fire Protection Association Will Meet May 9

The twentieth annual meeting of the National Fire Protection Association will be held May 9-11, in the Insurance Exchange Building, Chicago. Reports will be presented on automatic sprinklers, standardization of pipe and pipe fittings, automobile fire apparatus, protection of openings in walls and partitions, standpipe systems, fire pumps and hose, fire-resistive construction, uses of wood in building construction and explosives and combustibles.

Nine Counties Represented in Flood Control Association

Nine counties were represented in the Southern Counties Flood Control Association recently organized in Los Angeles for the purpose of inaugurating a campaign to meet flood control needs in that district. The association adopted a resolution urging an appropriation by Congress, at this session, "in as large amounts as those recommended by the Secretaries of Agriculture, Interior, Commerce and War, for immediate use in flood control in Southern California and the Colorado River."

$200,000 Fire in Raleigh

Fire in the business section of Raleigh, N. C., May 2, destroyed seven buildings, with an estimated loss of $200,000.

Engineering Society Activities

The Canadian Society of Civil Engineers heard George H. Montgomery give a lecture on "The Law and the Engineer," April 27, at Montreal.

The American Association of Engineers will hold its first annual convention May 9 and 10 in the rooms of the Western Society of Engineers at Chicago.

The Western Society of Engineers will hear Gaylord Cummin, city manager of Jackson, Mich., talk on "Opportunities for Engineers in City Management" May 15.

The American Society of Civil Engineers, at a meeting May 3, enjoyed a paper by H. H. Wolff, entitled "Design of a Drift Barrier Across White River, Near Auburn, Wash."

The Oregon Society of Engineers heard Dr. W. J. Kerr, president of the Oregon Agricultural College, discuss the engineering work of the college and its relation to that work of the state, at the April 28 meeting, in Portland.

The Seattle Association of Members of the American Society of Civil Engineers, at a recent meeting in that city, voted favorably on the affiliation of the society with the United Engineering Society as an additional founder society.

The Illinois Section of Members of the American Society of Civil Engineers discussed the change of headquarters of the society at the April 24 meeting. The majority of those who spoke, including Onward Bates, president of the section, favored the move to Thirty-ninth Street.

The Utah Society of Engineers at the annual election and banquet held April 19 at the Hotel Utah, in Salt Lake City, elected Guy Sterling, civil and mining engineer of that city, president of the society. C. J. Ullrich, assistant state engineer, was elected first vice-president; W. A. Wilson, second vice-president; L. H. Krebs, treasurer; Hugh C. Lewis, secretary, and R. B. Ketchum, member of the executive committee.

What Engineers and Contractors Are Doing

Theodore Speiden, Jr., formerly superintendent of the Nashville and Chattanooga divisions of the Nashville, Chattanooga & St. Louis Railway, has been promoted to the position of assistant general manager, with headquarters at Nashville.

Clyde Potts, consulting engineer, of New York City, has been retained to design a sewage-disposal works for the city of Oneonta, N. Y. Frank M. Gurney is city engineer.

Herbert C. Keith, consulting engineer, of New York City, has removed his office to 154 Nassau Street.

Arthur M. Field, formerly in the consulting engineering business in Rochester, N. Y., has been appointed city manager of Winchester, Va.

Francis T. Crowe, who has been employed on drainage work on the Boise project of the U. S. Reclamation Service during the winter, has returned to Jackson Lake, Wyo., to work on the enlargement of the dam there.

James H. Graham, Jr., was recently appointed to the position of state building inspector for the Pennsylvania department of labor and industry, with headquarters at Harrisburg, Pa. He was formerly connected with the firm of Chester & Fleming, consulting engineers, of Pittsburgh, where he was engaged in valuation of public utilities.

William F. Cocke has been appointed road commissioner for the state of Florida.

W. A. McTighe, formerly assistant city engineer of Memphis, Tenn., has become a member of the engineering firm of Baum & Haynes, of Texarkana, Ark.-Tex. The new firm will be known as Baum, Haynes & McTighe.

Thomas S. McAllister, formerly recorder in the valuation department of the Boston & Albany Railroad, has resigned from that position to accept an appointment as assistant in the chief engineer's office of the Rutland Railroad, at Rutland, Vt.

J. M. LeGrand, formerly assistant engineer for the United Verde Copper Company, of Clarkdale, Ariz., has become associated with the engineering department of the Canadian Copper Company at Copper Cliff, Ontario.

William J. Gilbert has been promoted from the position of transitman for the Pennsylvania Railroad to that of assistant supervisor at East Greensburg, Pa.

William N. Hall, in the employ of the U. S. Drainage Service, has been transferred from Salt Lake City to Chillicothe, Mo.

Elisha Lee, formerly general superintendent of the Philadelphia, Baltimore & Washington Railroad, has been promoted to the newly created position of assistant general manager of the Pennsylvania Railroad. Mr. Lee was born at Chicago in 1870. He was graduated from the Massachusetts Institute of Technology in 1892 and later in that year joined the office of the assistant engineer of the Tyrone division of the Pennsylvania Railroad. He was promoted to the position of assistant supervisor in 1899 and in 1901 was made supervisor. 1903 found him in the position of division engineer and three years later he was appointed engineer of the Philadelphia Terminal division. Mr. Lee was made principal assistant engineer of the Philadelphia, Baltimore & Washington Railroad in April, 1907, and, two years later, was promoted to the position of superintendent of the New York, Philadelphia & Norfolk Railroad. In 1911 he was made assistant to the general manager of the Pennsylvania and later was appointed general superintendent of the Philadelphia, Baltimore & Washington.

C. S. Krick has been advanced from the position of acting general superintendent of the New Jersey division of the Pennsylvania Railroad to that of general superintendent of that division. Mr. Krick was graduated from Lafayette College in 1887 and immediately entered the engineering department of the Pennsylvania. His recent promotion comes after 29 years' continuous service with that road.

R. V. Massey, formerly superintendent of the Manhattan division of the Pennsylvania Railroad, has been appointed superintendent of the New York division, formed by a consolidation of the Manhattan and New York divisions. Mr. Massey was graduated from Sheffield Scientific School in 1892, after which he entered the construction department of the Pennsylvania. He has been in the employ of that road since graduation.

F. W. Smith, Jr., until recently division engineer of the New York division of the Pennsylvania Railroad, was appointed assistant superintendent of that division, May 1.

J. H. Harris has been appointed division engineer of the New York division of the Pennsylvania Railroad, the duties of which office combine those of the division engineer of the old New York division and those of the engineer of the Manhattan division, which latter office was formerly held by Mr. Harris. He entered the engineering department of the Norfolk & Western Railway and later went to the Pennsylvania in 1894. He has been with that road ever since, rising to the position of engineer of the Delaware division in 1909, after which his promotion to engineer of the Manhattan division followed shortly.

Fred Kellam has recently become connected with the Cadillac Engineering Company, of Cadillac, Mich.

J. E. Moreland, formerly resident engineer for G. B. Howard & Company, engineers, of Nashville, has been appointed county engineer for Marion County, Tenn., where it is expected that $100,000 will be expended for road building.

J. J. Rhoades, formerly superintendent of the Media division, has been appointed to a similar position on the Schuylkill division of the Pennsylvania Railroad. He has been in the employ of that road since 1889, during which he has been successively supervisor, assistant engineer and division engineer. He was appointed superintendent of the central division in 1913.

J. H. Gumbes, superintendent of the Renovo division of the Pennsylvania Railroad since 1913, has been made superintendent of the Philadelphia Terminal division of that road. Mr. Gumbes was graduated from the University of Pennsylvania in 1888 and immediately thereafter entered the employ of the Pennsylvania. He rose to the position of assistant superintendent of the Pittsburgh division in 1911.

G. R. Sinnickson has been transferred from the position of superintendent of the Schuylkill division of the Pennsylvania Railroad to fill a similar office on the Baltimore division. Mr. Sinnickson has been in that road's employ since his graduation from Princeton University in 1897.

R. M. Patterson has been advanced from the position of superintendent of freight transportation of the Pennsylvania Railroad to that of special agent in the general manager's department. Mr. Patterson was educated at the University of Pennsylvania and entered the engineering department of the Northern Pacific Railroad in 1870. Three years later he became connected with the Pennsylvania as assistant engineer. He engaged in private business from 1878 until his return to railroad work in 1882 as division superintendent of the Buffalo, New York & Philadelphia Railroad. He returned to the Pennsylvania in 1885, where his work in the transportation department brought him promotion to his new position.

William H. Cushman, hydraulic engineer, of Syracuse, N. Y., has become chief engineer of the Hydraulic Construction Company of Watertown, N. Y. Mr. Cushman has been engaged in engineering work since 1886, when he began as helper on a hydrographic survey of Duxbury Harbor, Mass. He steadily worked his way up and in 1892 supervised the construction of a gravity waterworks systems for Lancaster, N. H. Later he built a 3,000,000-gal. reservoir for that city. He was also district superintendent in the street cleaning department of New York City from 1895 to 1896, during which time he prepared a report which led to the construction of the Barren Island reduction plant. Mr. Cushman has been actively engaged in hydraulic engineering work and included in his achievements are such works as a $5,000,000 canal and power plant at Massena, N. Y., and the design and construction of a $1,300,000 dam and power house at Morgan Falls, Ga. He also has been connected with the New York State Barge Canal as resident engineer at Oswego, and was chief engineer for the Juniata Hydro-Electric Company.

David R. Shearer, consulting engineer, of Knoxville, Tenn., is making preliminary investigations for the development of a 600-hp. hydroelectric plant for the Whiting Lumber Company, at Boone, N. C.

Howard R. Perrin has been transferred from the Aberthaw Construction Company's work at New Haven, Conn., to a big construction job undertaken by that concern at Buffalo, N. Y. Mr. Perrin's title will be efficiency engineer.

J. Ellingston has been promoted from the position of city engineer to that of city manager of Sherman, Tex.

H. G. Shirley, chief engineer, Maryland State Road Commission, Arthur H. Blanchard, consulting engineer, of New York City, and G. W. Tillson, consulting engineer, Brooklyn, recently submitted a report on the administration, construction and maintenance of highways under the jurisdiction of the Levy Court of New Castle county, Del.

Charles H. Hughes, naval architect and engineer, of New York City, has removed his office to 27 William Street.

H. K. Morgans has resigned from his position as designing engineer for the state engineer of New Mexico, to become superintendent of construction for F. P. Davey, builder and contractor, of Detroit.

E. H. Welles, formerly with the New York highway department, has become a member of the firm of Sherman, Welsh & Welles, general contractors, of Lakeville, Conn.

H. S. Bell has been promoted to the position of chief engineer of the new plant of the Vacuum Oil Company, at Paulsboro, N. J.

Charles S. Grace has resigned from his position as junior resident engineer for the California highway commission to become connected with the Los Angeles Flood Control District as junior engineer. The plan to be prepared is said to involve an expenditure of $3,600,000.

James H. Van Wagenen, for several years in charge of field parties engaged on the survey of the boundary line between the United States and Canada, has been appointed engineer for the International Boundary Commissions, in charge of the direction of all field and office work of the United States section of the commissions. Beginning May 15, work will be conducted in Maine, New Hampshire and Minnesota. It is estimated that the cost of this year's surveys will be about $110,000. Mr. Van Wagenen was graduated from the University of Missouri in 1908. Previous to his engagement with the boundary commissions he was with the U. S. Geological Survey on topographic surveys in North Dakota, and later was an assistant engineer with the Illinois Highway Commission.

J. R. Wilbanks has been appointed chief engineer for the Ferrocarril Samana y Santiago, with headquarters at Sanchez, Santo Domingo.

C. C. Cunningham, of the Chicago, Rock Island & Pacific Railway, has been appointed roadmaster, with headquarters at Liberal, Kan.

J. W. Lee, Jr., publicity agent of the Pennsylvania Railroad at Philadelphia, has resigned, effective May 15, to become associated in business with Ivy L. Lee. George B. Harley, assistant in his office, will succeed him.

J. Allen Warren, engineer with the public road office at Washington, D. C., recently visited Sacramento, Cal., to advise in a consulting capacity with the Sacramento county highway commission relative to the report of roads proposed to be constructed under a bond issue.

Robert Goodwin, city engineer of Hayward, Cal., since 1878, tendered his resignation to the city trustees April 20. His successor has not as yet been named.

Jacob S. Langthorn, formerly division engineer for the board of water supply of New York City, was appointed deputy water commissioner of the Borough of Brooklyn, April 28. Mr. Langthorn has been in the employ of the city for several years, and was in charge of a section of the Ashokan dam. He was also associated with the engineering department of the Brooklyn, Queens County & Suburban Railroad.

J. M. Estep, formerly employed in the department of public works of Cleveland, has resigned to engage in the practice of consulting engineering. He has opened offices in the Marshall Building in that city. Mr. Estep was connected with the city engineering department from 1889 until his recent resignation, at which time he was assistant chief engineer. He was graduated from Rensselaer Polytechnic Institute in 1889. In 1894 he went to South America to investigate the possibilities of a proposed electric railway and water power development. Mr. Estep had charge of the expenditure of nearly $1,000,000 a year for sewer work for Cleveland at the time of his resignation.

R. A. Burns, civil engineer and surveyor, recently opened an office at 825 Ninth Avenue, Lewiston, Idaho. Mr. Burns has had wide experience in the Northwest in railroad, irrigation and wagon road work. Previous to coming to Lewiston, he was chief engineer for the Great Northern Railway Company's coal mines, near Great Falls, Mont.

Allan Purvis, formerly superintendent of the Ontario division of the Canadian Pacific Railway, with headquarters at London, has just been appointed general superintendent of the Eastern division, with headquarters at Montreal. Mr. Purvis was previously general manager of the Vancouver Electric Lines, with headquarters at Vancouver, B. C. He goes to Montreal to take the place of A. E. Stevens, who has been transferred to Moosejaw.

Thomas Collins, formerly superintendent of the Canadian Pacific Railway Terminals at Toronto, has been transferred to London, on the Ontario division.

Frank Boney was elected street commissioner of Punxsutawney, Pa., at a special meeting of the borough council April 24.

Frank H. Zouck, assistant chairman of the Maryland roads commission, has been appointed chairman of that commission, effective May 1.

E. V. Rinehart, engineer in charge of the construction and maintenance division of the water department of Baltimore, Md., has resigned.

E. A. Fretz, who has been structural designer for the engineering department of Houston, Tex., for the past two years, has resigned to become engineer for Horton & Horton, general contractors, of that city.

Obituary Notes

J. W. Eddy, who was active in the construction of the Angel's Flight Inclined Railway, in Los Angeles, died at Eagle Rock, Cal., recently.

Thomas J. Keane, superintendent of asphaltic construction in the Pennsylvania highway department and assistant in that department's testing laboratory, died at Harrisburg, Pa., April 25. He had been connected with the department since July, 1912.

Frank E. Skagerlind, an inspector in the engineering department of the city of Seattle, was instantly killed under the wheels of a Seattle, Renton & Southern street car, April 24. He had been in the employ of the engineering department since January, 1912, and was 55 years old.

Colin McLean, a well-known contractor of Baltimore, died at his home in that city on April 29, at the age of 72. He was a native of Nova Scotia and head of the McLean Contracting Company.

Col. John Waters, contractor and builder, who is said to have been instrumental in securing electric power for Baltimore, Md., died April 26 at his home in that city, at the age of 75.

Electric Hoist Run Continuously Drives Piles with Drop Hammer

The electric hoist shown in the accompanying photograph has been used to drive piles with a drop hammer with satisfactory results, according to Arthur Looff, of Santa Monica, Cal. Mr. Looff had to drive a large number of piles for an amusement pier in a residential section where smoke and noise were highly objectionable. An electric hoist equipped with a 30-hp. Westinghouse three-phase motor, using current at 440 volts, was therefore tried. At first the rope speed was too slow, but with the substitution of new gearing it was possible to lift the hammer at a speed of 200 ft. per minute. A drop of 40 ft. was used.

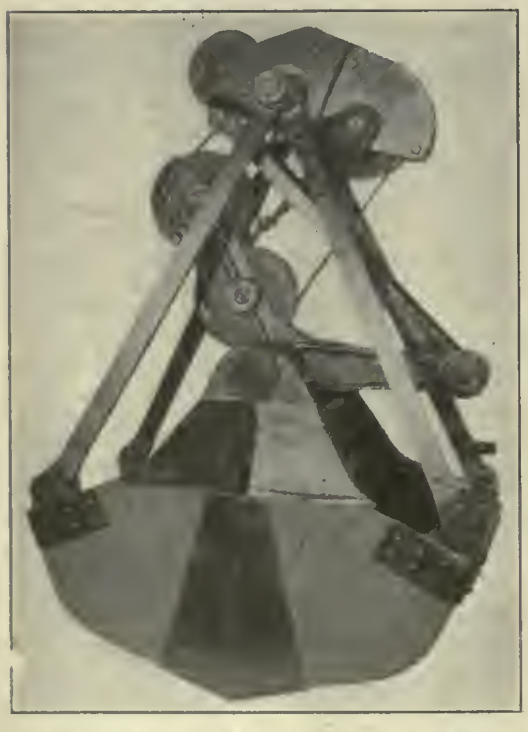
ELECTRIC HOIST ON PILE DRIVER

While the driver is in operation the motor is kept running constantly, the friction being thrown in and out to raise or release the hammer. Running the motor without load is declared to use only a trifling amount of current.

New Bucket Is Said to Be Very Rapid Digger

A new clamshell bucket placed on the market by the Ruddock Bucket Company, of Cleveland, Ohio, is said to be a remarkably good digger due to the auxiliary arm which causes both carbon steel lips to travel at the same speed, resulting in cutting by both edges of the bucket.

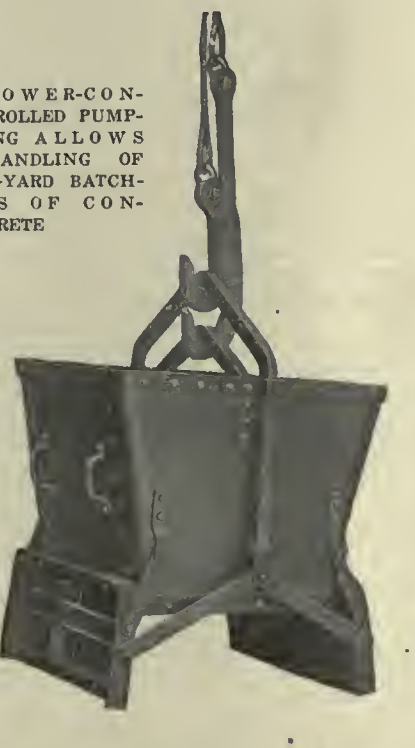
The steel sheaves are of extra large diameter and bronze bushed, the pins are hammered steel and the scoops are said to be constructed to obtain rigidity. Every casting in the Ruddock is guaranteed against defects in workmanship and material for one year.


BOTH LIPS OF THIS BUCKET CUT AT THE SAME SPEED

The officers and directors of the recently incorporated Ruddock Bucket Company are: President, Wm. Ruddock; vice-president, C. E. Forsyth and E. F. Simon, Christ Koblitzer and William Olenburg.

New Concrete Bucket Is Dumped by Hoist Runner

The principle of the double-line under-water concrete bucket has been applied to the new concrete bucket being manufactured by the Union Iron Works to put the dumping operation in direct control of the hoisting engineer. The operation of this type of bucket will be familiar to many contractors who have placed concrete under water, but the advantages of using the same bucket for open-air work are just being appreciated. Among those claimed for this bucket are much quicker dumping, the elimination of the men usually necessary on top of the form to turn and dump the bucket, and the possibility of handling concrete in 4-yd. batches and controlling the dumping, to prevent sudden strain on the forms, as readily as this can be done by hand with a ½-yd. bucket. The type of bucket adapts itself to simple mechanical design. It has no springs, catches or locks, and there are no castings used in its construction. The bucket, on account of its controlled dump feature, may be used to load dirt into wagons without the use of dumping boards. It may be rigged by using a counterweight drum for the trip line, or by tripping the bucket with a line handled by a man on the bull wheel of the derrick.


POWER-CONTROLLED PUMPING ALLOWS HANDLING OF 4-YARD BATCHES OF CONCRETE

This bucket, manufactured under the name "Unionlock," is furnished in ½, ¾, 1, 1½, 2, 3 and 4 cu. yd. sizes.

Business Notes

The Platt Iron Works of Dayton, Ohio, has removed its Chicago office to the Monadnock Block.

Rensselaer Valve Company of Troy, N. Y., has removed its New York office to 50 Church Street.

The Foundation Company of Pittsburgh has removed its district branch from Wheeling to Pittsburgh.

MacArthur Concrete Pile & Foundation Company of New York City has removed its offices to 120 Broadway.

The Universal Concrete Products Company of Chicago has removed its offices to the Continental & Commercial Bank Building.

The Independent Pneumatic Tool Company's Atlanta (Ga.) branch was moved recently to the Jefferson County Bank Building, Birmingham, Ala.

R. T. Stull, ceramic engineer of the Dunn Wire-Cut Lug Brick Company of Conneaut, Ohio, was elected an honorary member of the Paving Brick Institute at the recent meeting at Portsmouth, Ohio.

A. L. Feenaughty, who recently resigned from his position as sales manager for the Whalen Form Company of Syracuse, N. Y., is located in Denver, Col., where he is recuperating from an operation. Mr. Feenaughty is at present selling the Edwards road graders and drags.

The George Oldham & Son Company of Philadelphia recently purchased a complete equipment for a new power installation. In addition, the upper floor of this company's present building is being utilized and a new equipment installed. This will greatly increase the capacity of the plant.

The Indiana Paving Brick & Block Company of Brazil, Ind., is the latest addition to the family of licensees of the Dunn Wire-Cut Lug Brick Company. This company has not purchased the Brazil company's plant, as was stated last week; it has merely granted them a license to make Dunn wire-cut lug brick.

Trade Publications

Pittsburgh-Des Moines Steel Company, Pittsburgh, Pa., booklet, 16 pages, illustrated. Brief discussion on railway service tanks setting forth advantages of standardization, uniformity of design and permanence of construction.

National Tube Company, Pittsburgh, Pa., "National" Bulletin 26, 11 x 8½ in., 52 pages, illustrated. Presents advantages of autogenous welding of pipe and describes methods employed. Contains several engineering tables and a cross index.

The Goulds Manufacturing Company, Seneca Falls, N. Y., bulletin 120, 10 x 7¾ in., 20 pages, illustrated. First of this company's bulletins on their multi-stage centrifugal pumps, describing various sizes and adaptations of each. Also contains several cross-sections, and charts and diagrams.

Raymond Brothers Impact Pulverizer Company, Chicago, catalog 12, 64 pages, illustrated. Describes grinding, pulverizing and air separating machinery for any material to be reduced to powdered form. Contains drawings of model installations and partial list of materials handled by the Raymond system. Indexed.

Stark Rolling Mill Company, Canton, Ohio. Booklet 5½ x 8½ in., 98 pages, illustrated. Compiled in two sections, the first of which contains a treatise on the civilization of Ferris sheet metal, and the second, descriptions, reports and tables on comparative service tests of Toncan metal and a few typical installations. The treatise is an interestingly written brief history of iron and its fabrication, and the problem of corrosion.

Deming Company, Salem, Ohio, catalog 25, 6½ x 9½ in.; 358 pages, cloth bound. Illustrated descriptions of Deming hand and power pumps. The entire book, from arrangement of the pages, well selected illustrations and fine quality of paper. to the substantial cover, is worthy of commendation and shows an effort on the part of the manufacturer to present his products so that the customer will have little trouble in selecting the equipment he needs. In the back of the book are convenient technical tables, a good index and several protographs of Deming installations.

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Check Dams

MR. OLMSTED'S article, on page 636 of this issue, recounts observations on a combination flood-control and water-conservation scheme being tried out in the mountains near Los Angeles. Check dams are not new in engineering practice, though they have not, so far as is known, been applied heretofore in the United States. In central Europe—Switzerland and Austria—their merits have long been known. Two objects are aimed at in their construction—the impeding of the flow, thus cutting down erosion, and the forcing of flood waters into underground storage so that they will become available in the dry season. So far, observations on the system of check dams near Los Angeles have been most encouraging. Should records of future years substantiate present promise they may take a very important position in the water-conservation and flood-protection practice in those parts of our country where mountain slopes are steep and reservoir sites not available.

Trainmen's Demands

IT HAS BEEN repeatedly pointed out that since the Interstate Commerce Commission controls the income of railroads it should have something to say about the outgo. The thought is particularly pertinent at the present time when the trainmen are making demands for a 25-per cent wage increase. If granted, these demands would add about $330,000,000 a year to the railroad wage bill. If the controversy should be arbitrated as in the past, by a body independent of the Interstate Commerce Commission, some advance may be given the trainmen, without any consideration of the sources from which the necessary funds will come. Seeing the logic of the situation, the Chamber of Commerce of the United States has proposed that the Interstate Commerce Commission be directed to make an investigation of the controversy. Such a proposal is hard on the Interstate Commerce Commission; it certainly has enough work without taking up this angle of railroad affairs. Nevertheless, the logic of the proposal is irresistible. The big question is whether or not Congress can be made to see it.

Convenient Code Arrangement

NEW YORK CITY has just issued in the form of a booklet the revised building code containing all revisions passed by the Board of Aldermen up to Dec. 14, 1915. Conforming with one of the principles in the revision laid down by Rudolph P. Miller, consulting engineer to the committee, the new code is exceptionally well arranged. Furthermore, it is clearly and completely indexed. In the form just compiled and indexed by Robert B. Insley, assistant superintendent of the bureau of buildings, Borough of Manhattan, any desired regulation on any detail of construction can be instantly located. Aside from the many improvements accomplished in the revision, both in content and in technical form and quality, already commented upon in an editorial on page 35 of the issue of Jan. 8, the new code marks a great advance in the publication of building regulations as practised by cities in this country. That the great waste of time experienced in the past in locating regulations on any given detail of construction is entirely unnecessary and can be completely eliminated is clearly demonstrated by the present form of New York's code.

Commissions and Maximum Rates

THAT the New York Public Service Commission need not be hampered in rate regulation by the maximum rates fixed by the general railroad law has now been established by a decision of the Court of Appeals in the Ulster & Delaware case. Readers of the Engineering Record will recall that last year (see the issue of August 21, 1915, page 226) W. J. Wilgus, consulting engineer, presented abundant proof to the commission that the 2-cent mileage rate which the Ulster & Delaware Railroad was compelled to make meant passenger service at less than cost; but that the commission, while admitting the force of the argument, ruled that it was not empowered to allow a rate higher than the 2 cents per mile prescribed by statute for mileage tickets. In February of this year the Appellate Division of the state Supreme Court overruled this decision. Now the Court of Appeals sustains the Appellate Division, and the commission has responded by authorizing the railroad to increase its mileage rate from 2 to 2.9 cents per mile, only a tenth less than the 3-cent rate asked for by the railroad. The decision proves that in New York State, at least, the purpose of the regulatory body is to regulate rates either upward or downward as justice demands, and not merely to scale them down to the lowest possible figure.

Anti-Mosquito Entente

AN ANTI-MOSQUITO ENTENTE has been formed by health authorities in New Jersey, Connecticut, Long Island and Westchester County, N. Y. A week has been set aside for the opening of the campaign, during which there will be carried on vigorous educational as well as actual work. Arrangements have been made for widespread draining and oiling of salt marshes, pools, swamps and other mosquito-breeding places. In connection with the campaign, literature is being furnished to the daily newspapers throughout the sections affected, and excellent work is thus being done in distributing information as to ways of killing the wrigglers from which the mosquitoes develop. The entente is necessary for effective anti-mosquito work. It is of little value to have one county drain its marsh lands and oil its pools, if the adjacent counties do nothing. Only by combination of all of the forces in a badly affected district can success be attained. For years the communities around New York have been carrying on their own extermination work. The results have been fair. There is now reason to believe that, through the effective combination of all of the mosquito-fighting forces, the metropolitan district may be entirely freed of the pest.

Water Pipe and Street Grades

IF AN engineer engaged in municipal work fails to look well into the future in planning his construction he or his successor will meet with many unforeseen difficulties. A case in point, which should appeal particularly to waterworks men, is cited by H. P. Bohmann in the latest annual report of the Milwaukee waterworks. The distribution division in this city has been put to considerable expense during the past year on account of the necessity of lowering water pipe and service connections in streets where the pipe and services had been laid before the grade of the street was established. Evidently this pipe was laid without any regard to a future grade. In one instance the water pipe was left on top of the street after the street was cut down to the established elevation. No water pipe should be laid unless the grade is established, or a tentative grade is fixed by the city engineer. It should not be necessary to lower the water pipe if the street is brought to grade. With this in view some of the new pipe laid in Milwaukee during the past year where the grade was not yet established was placed with from 8 to 12 ft. of covering. This is an instance of how municipal departments can co-operate and save money for the taxpayers.

Posed Construction Pictures

WITH the approach of summer comes the open season for picture-taking. Engineers in greater numbers than ever before are equipping themselves with hand cameras to record the progress of their work and interesting details of construction which it would often take a page or two of text to describe. Many of these views, however, are spoiled, pictorially, by having the working force "pose" while the shutter is being snapped. Take the case, for example, of laborers placing concrete in forms. When a picture is suggested there appears to be an overpowering desire on the part of the inexperienced camera operator to line these men up in front of their work and summon as many extra members as can be accommodated on the film. Then when the members of the group, on dress parade, have assumed the usual self-conscious facial expressions, the exposure is made. The finished picture gives no idea of the distribution of the force under actual working conditions and the posed line of men often completely eclipses some interesting plant detail. Then, too, there is an atmosphere of artificiality about such a photograph which robs it of its interest. Don't have a construction gang pose for a picture. Snap them in action.

Winter Heaving of Pavements

MUNICIPAL engineers who are responsible for the condition of paved streets will profit by a study of the experiences of Seattle and other Pacific Coast cities, as recited by J. Thomas Dovey on page 640. An unusually long period of cold weather early this year, coupled with the presence of water below the street surface, is given as the primary cause of the damage. An examination of conditions in a number of cities indicated that the trouble was not confined to pavements of any one type. Brick, asphalt and wood block all showed the effects of frost action. One point which the investigations revealed was that the heaving occurred only on streets which carried street-railway tracks and that the damage was greatest adjacent to the rails. Mr. Dovey believes that the remedy is proper drainage and a filler which forms a tight bond between the rails and the paving material. If water is allowed to enter a joint at this place an ice filler is formed, causing a movement upward of the paving blocks, due to the expansion of the water in freezing. The consequences are more serious than the mere production of a rough and unsightly street surface. One case is mentioned in which the heaving amounted to as much as 5 in., sufficient to block the passage of street cars. In another case a long section of blocks adjacent to the rails had to be removed to give the cars proper clearance. Where the blocks were not taken out their tops were pounded and broken. The bond between the rails and the paving blocks appears to be the key to the situation. It would be interesting to hear how engineers in other cities have dealt with this problem. A discussion would be of great value.

Sunday for Contractors, Too

SUNDAY work does not meet the approval of H. P. Converse & Company and of G. M. Follett, their superintendent on the Hanover Street bridge. They recognize the fact that a man is capable of doing just so much in a given length of time, and that if he is worked continuously the amount will be cut down. As a result a long contract, described on another page of this issue, is reaching an end with everybody fresh and doing his share. Although unusual difficulties arose to try the patience of superintendent, foreman and workman alike, there are no malcontents. The organization, in fact, is completing its third large contract with scarcely a change of personnel. There is work, such as pneumatic caisson construction, where to stop even a day is costly and attended with possibility of disaster. Nevertheless, without any increase in the total labor cost, enough men can be employed in such work to give each a chance to lay off a day at intervals and renew his energy. With men in authority this is harder to arrange, but even still more important. At the end of months of ceaseless effort to keep work going smoothly even an able man reaches a state of exhaustion where mistakes are to be expected. Because of his responsible position, such mistakes will always be costly. Usually they would more than pay for the assistance needed to relieve the strain which caused them. Many contractors have already found that seven days a week for every man on the job pays no extra dividends and breaks no progress records.

Ton-Miles or Maximum Loads

ON PAGE 639 Paul M. LaBach makes an interesting contribution to the meager literature on the allocation of railroad maintenance expenses to passenger and freight service. His main ideas are that maximum loads, which determine the design of railroad structures, should have more bearing than actual ton-miles on the items affected by traffic; that the items not affected by traffic constitute a large percentage of the total, and that these are likely to be overlooked in the determining of fair return.

As to the latter two contentions, the Engineering Record believes with Mr. LaBach that there is danger that in the alternate revision downward of freight and passenger rates items not directly dependent on traffic may be overlooked. One may doubt, however, whether $K - A$, as defined by Mr. LaBach, should be divided into two equal parts as he proposes, rather than according to the traffic; and whether a uniform figure of $800 should be used for $K - A$ for all of the roads in Table 2—in other words, whether the prosperity factor B, and perhaps to some extent the factors C and D, should not vary according to the percentage of passenger traffic.

Regarding the use of maximum loads instead of ton-miles in the subdividing of Mr. LaBach's $fx + py$, there is a chance for debate, and perhaps a combination of the two theories might be the ultimate solution. Surely there is force in his argument as applied to bridges, which are designed for maximum equipment and impact, and are not affected as to deterioration by the frequency of loads well under the elastic limit. But the theory does not seem to fit track so well. Until the special committee on stresses in track makes a full report, this journal cannot subscribe to Mr. LaBach's statement that track is designed to carry its maximum loads. It appears rather that trial is the main guide in the design of track, and that nobody can yet say positively whether the greatest stresses therein are produced by maximum loads, excessive speeds or flat wheels. Certainly defective equipment affects maintenance, and multiplies with traffic. The subject is a complex one, however, and the Engineering Record would gladly throw its columns open to discussions of the problem by those who have given it thought.

High Stresses in Flat Slabs

CONVINCING evidence that the factor of safety of the flat-slab floor construction of the Seattle port warehouse is exceedingly low is found in the high local stresses in both steel and concrete obtained in the test made for the Seattle building department. As reported by Mr. Hooker in the article on page 647 of this issue, dangerously high unit stresses correspond to the extensometer strains measured under a final test load only 1.1 times the sum of the dead and design live loads, or 1.4 times the design live load. The words "dangerously high" are fully justified. Under this relatively low test load—the Chicago code requires a test load sufficient to double the total design load—steel rods of 50,000-lb. elastic limit were stressed nearly to that limit, and stresses were obtained in the concrete exceeding the average ultimate strength of test cylinders of the same age. Numerous cracks in many directions in both top and bottom of slabs and continued deformation and deflection under the final load, which was left in place for 84 hr., together with large permanent sets and deflections after the load was entirely removed, were observed. The maximum deflection of 0.8 in. was 1/300 of the span—the Chicago code limit is only 1/800.

This evidence throws light upon the flat-slab controversy waged between the proponents of this system and the more conservative engineers. No theory of least work or long mathematical dissertations leading to an adoption of an arbitrary value of 0.5 for Poisson's ratio for reinforced concrete can refute the facts presented, provided the tests were accurate, and Dean Fuller's standing vouched for this.

This test demonstrates anew the advantage of actual strain measurements, made at carefully selected points on floors and columns, over simple load and deflection tests. The ability to locate and measure the overstressed parts by this method of field investigation is of the greatest help in reaching an understanding of stress distribution and in suggesting improvements in design. In this case the possibility of a more economical distribution of the reinforcing steel is indicated; the compression in the outer ring over column 19 and the cracks in the concrete over the direct bands between columns point to weakness due to improper proportions of steel in the diagonal and direct bands or to improper spacing. The loading of the two wall panels only, a type of test advocated by many engineers, showed strikingly the relatively high stresses possible for this case. It is stated that the stresses in portions of these panels under full live load would probably be as great as those produced by one-and-one-half live load over the entire floor.

The concrete engineer who has consistently kept to conservative practice in the design of flat slabs, neglecting the tensile value of the concrete and recognizing no excess "bond-shear" strength element, will find that the results of this test confirm the view that safe and permanent construction must be based upon the standard bending-moment formulas which the majority of engineers has advocated.

Cleveland's Sewage Report

THE DEGREE to which sanitary engineers are adapting the design of sewage-treatment plants to local conditions is well illustrated by the case of Cleveland, Ohio, where three separate works, each differing from the others in the details of disposal methods, were recommended in a joint report by Robert Hoffman, chief engineer, R. Winthrop Pratt, consulting engineer, and Harry B. Hommon, chief chemist. The conclusions are particularly valuable, for they are based upon about two years' operating results obtained at a testing station where various devices and processes were studied. Although the report has just been issued in printed form its recommendations have, in part, been put into effect, and one of the Cleveland plants was described in the Engineering Record of March 25, page 408.

In the design of sewage-treatment plants two basic factors must be given equal consideration—the composition of the raw sewage and the character of the body of water which is to receive the effluent. The Cleveland report reflects the careful study which has been given to both subjects. About half of the city's liquid wastes is discharged into Lake Erie, while the remainder enters the Cuyahoga River. In the case of the largest of the three installations—the easterly works for the Lake Erie effluent—the plant recommended includes grit chambers, two-story settling tanks, disinfection apparatus and a dispersing outlet. Here the principle governing the design was the desire to secure only clarification of the sewage, together with provision for disinfection and dispersion of the effluent.

At the southerly plant, which will discharge into the Cuyahoga River, a non-putrescible effluent was demanded, as the flow of the river is not sufficient, at all times, to oxidize a large quantity of tank-treated sewage. At the southerly works, therefore, the process used at the easterly plant is altered by the addition of coarse-grained slag filters and the omission of the disinfecting feature.

At the westerly works the important factor was that land ultimately available for sewage treatment purposes is quite limited and that the sewage in this locality is fresher than that discharging at the easterly works. These conditions made the clarification of the sewage by fine screening appear more suitable than tank treatment.

It is apparent from this brief outline of the report that no "standard" sewage plant could have been applied, economically, to the solution of Cleveland's problem. Similar conditions are presented at Philadelphia, where a number of plants have been designed with particular reference to local requirements and conditions.

An interesting feature of the report is the suggestion of inclosed sludge-drying beds at Cleveland. This type of bed, the report states, can be operated through the entire year, provided a heating system is installed to prevent freezing during winter. In summer the period of drying is approximately the same as, or possibly a little longer than, with open beds. Eliminating the three winter months of operation it is possible to operate beds of this type so that 1 sq. yd. of surface will dry 0.8 cu. yd. of sludge per year.

From what has been said the value of the report as a contribution to sewage-treatment literature is evident.

The Waste at Niagara

TWO WEEKS AGO at its meeting in Washington the American Electrochemical Society devoted a session to a symposium on Niagara Falls and the industries there dependent on hydroelectric power. The situation depicted is of national import. Briefly the situation is that the electrochemical industries are unable to get the power needed for their continued expansion. The restrictions placed both by treaty and by government rulings, unless modified, are certain to force these industries to move to Canada or even to Europe for their further power needs. In a word, there is danger that industries which their promoters are anxious to develop to large proportions on American soil will be expatriated and the strength which they might add to the national wealth and national resources be lost. In fact, American capital, unable to secure development rights in this country on a sound business basis, is now employed on the Canadian side of the Niagara frontier, and some of it is even working in the Scandinavian peninsula. There is but one alternative to further migration of capital for electrochemical activity—the enactment of favorable water power laws and the granting of further withdrawals of water at Niagara.

The treaty between the United States and Great Britain covering the Niagara situation, which went into effect in May, 1910, allows the diversion of 56,000 sec. ft., 26 per cent of the average flow of the river. Of this quantity, 20,000 sec. ft. is for American and 36,000 for Canadian use. The United States Government, however, has persistently refused to grant permits for more than 15,600 sec. ft. (part of this goes to the Erie Canal), so that every second 4400 cu. ft. of water, capable of generating 80,000 hp., goes to waste. The power actually developed on the American side is about 215,000 hp.

In Canada 29,000 sec. ft. (including that for the Welland Canal) is used, and 360,000 hp. is developed. Of this amount 175,000 hp. is transmitted to the United States, which is nearly up to the limit permitted by Canadian law.

The variety of plants at Niagara dependent upon electrical power are little appreciated except by those in touch with the chemical and metallurgical industries. Up to the present time the total domestic production of ferro-silicon, employed as the chief deoxidizing agent in the production of finished steel, has been made from Niagara power. The commercial development of aluminum was first made possible at Niagara, and, in fact, the Falls district was for many years the only seat of the industry. Five plants there are engaged in the making of electric-furnace abrasives—carborundum and aluminum—while calcium carbide, artificial graphite, chlorine, caustic soda, caustic potash, metallic sodium and phosphorus are also produced in large volume. It requires but a small acquaintance with the chemical, metallurgical and engineering arts to understand the wide influence upon our industries of these products.

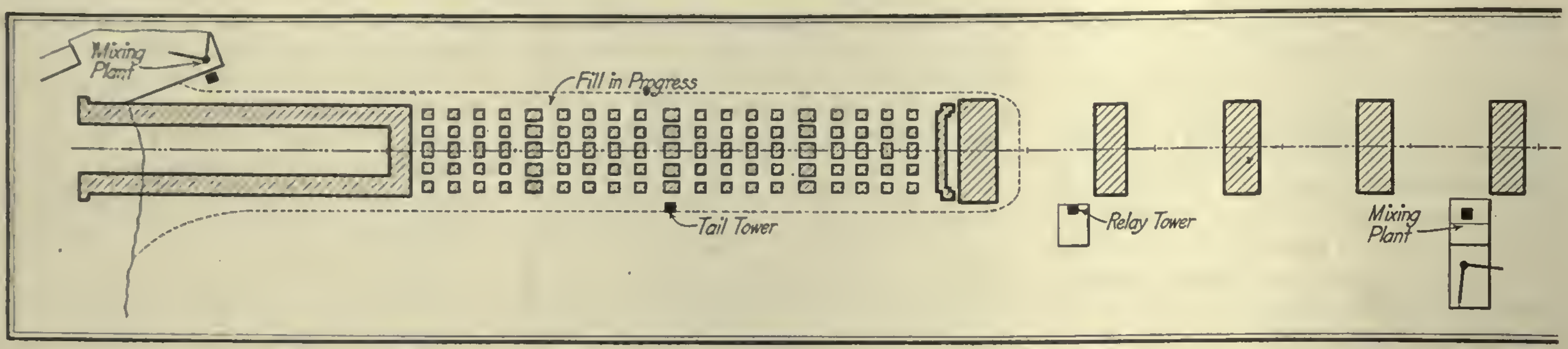
The European War has taught us more clearly than ever before how serious it is to have a one-sided industrial development, and to depend upon foreign nations for materials of great, even if not of vital, importance to the nation's life. There may be products, of course, in which the economics of the situation are such as to warrant only limited development in this country, but all of those mentioned as being produced at Niagara Falls can readily be made here on a sound economic basis. It is the part of folly, then, for the nation for the sake of a fetish—scenic preservation—to force to other lands industries that can be economically developed here and whose promoters prefer to remain on American soil.

Condemnation of those who favor increased withdrawals of water from Niagara have been common. "Nature robbers," "gross materialists" and similar hard names have been applied to them. If Niagara Falls were the only spot in the United States where its people could enjoy the beauties of nature, there might be some warrant for the characterization. When, however, nature has been most lavish in the quantity and disposition of her treasures it is a mawkish sentimentality that allows over 3,000,000 hp. to go to waste, at a cost, it has been carefully estimated, of something like $100 per look for each visitor to the Falls.

No one will deny that the spectacle is sublime, most impressive, but certainly ways can be devised to allow the full flow to go over the precipice at intervals. Certain Sundays might be set apart, for example, or all of the industries might take a two week's vacation in the summer, turning the full flow into its natural channels.

This journal does not doubt in the least that the time will come when economic pressure will be so great that it will be impossible to let Niagara go unused. But why should the waste be allowed to go on now and for many years hence, when the argument is overwhelmingly in favor of the use of the cataract?

Engineers are expected to think soundly on such matters. Is it not time that their national societies took up the matter actively and presented it to the people of the United States, to the end that Niagara would be the servant and not merely the entertainer of mankind?



Well-Balanced Mixing Plants Pour Dense Concrete from High Towers on Long Highway Bridge

Carpenter Work Sets Pace on Baltimore Structure Where Pier Sites Were Excavated and Piles Driven and Cut Off Before Steel Coffers Were Built—40,000 Yards of Concrete Require 2485 Tons of Reinforcing Steel

WITH MORE than half the total force working in carpenter gangs to keep ahead of spouting plants so well balanced that one of them with a 22-cu. ft. mixer can place 350 yd. in 9 hours, a concrete highway bridge 2300 ft. long, one of the largest in the country, is now being finished at Baltimore. The mud harbor bottom, underlaid with a hard bed of iron ore and gravel, made profitable an unusual order of construction in building the fifteen main river piers. The site of each was dredged and the 65-ft. piles driven and cut off below water before setting the cofferdam. The steel sheet piles not only required no driving, but had to be supported to keep their tops in sight. A concrete seal was placed before the bracing was put in. Water transportation was available for all the material, including the structural steel reinforcement, and was a big factor in the construction layout.

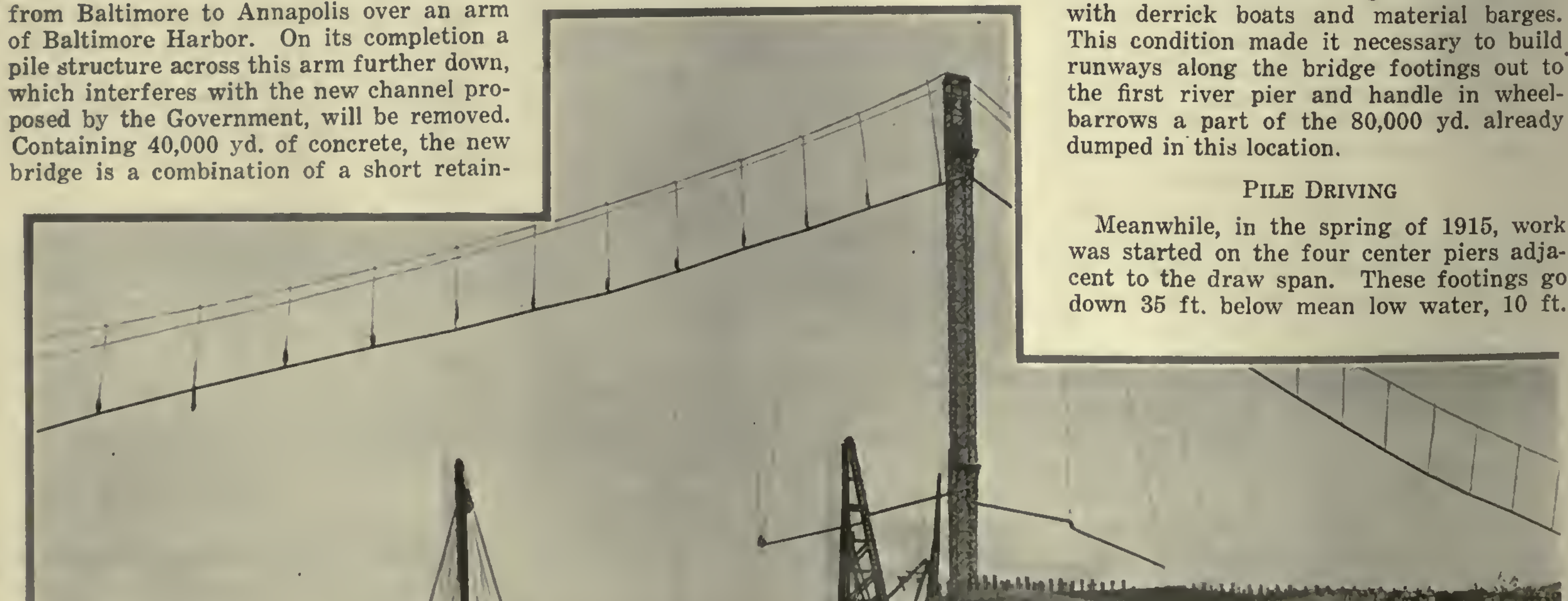
BRIDGE OF UMBRELLA TYPE

The bridge is at the foot of Hanover Street, and will carry the state highway from Baltimore to Annapolis over an arm of Baltimore Harbor. On its completion a pile structure across this arm further down, which interferes with the new channel proposed by the Government, will be removed. Containing 40,000 yd. of concrete, the new bridge is a combination of a short retaining wall approach, a viaduct section, twelve main cantilever spans and a 150-ft. double-leaf bascule draw span. Each pier supports half of each adjoining span on ten ribs, reinforced with structural steel, of which 1685 tons were required. There is an expansion joint in the center of each span. The entire structure, except the south abutment, is supported on 5600 yellow pine piles 40 to 65 ft. long. The south abutment rests on approximately 130 short concrete piles. The bridge will be paved with sheet asphalt and wood blocks and will carry two trolley tracks. In addition to the structural steel reinforcing 800 tons of bar reinforcement were required.

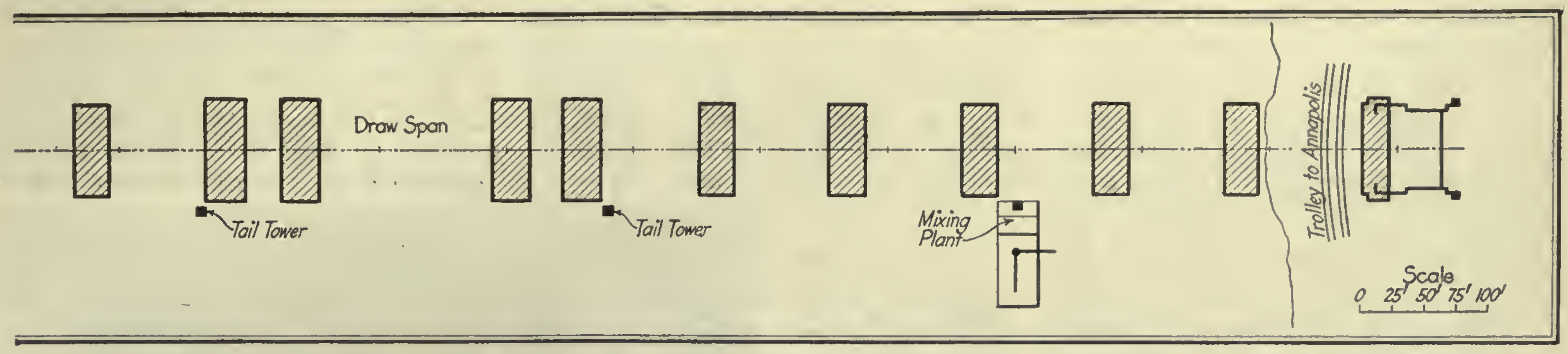
For placing this concrete yardage over a stretch of nearly half a mile a mixer boat was considered, but was estimated to cost, with an additional derrick boat which would be tied up to feed it, more than the tower and chute layout shown in the accompanying illustrations, especially as about 100 ft. of bridge at the south end and about 250 ft. at the north end could not have been reached by mixer boat in any case. With two mixing plants on the main channel, one tower north of them to re-elevate concrete and another mixing plant on the north shore dock, the entire structure was covered. As there was a long delay in securing piles of sufficient length and in determining by means of driving tests how far the hard stratum below the harbor could be penetrated without injuring the piles, the concrete plant on the north shore was the first placed in service. Here the retaining wall approach and 250 ft. of the viaduct were finished in the period from the start of the job, in September, 1914, to May, 1915. At this point work on the viaduct was halted pending the completion of a fill which will be carried out and around the north river pier. Though it was known that the harbor mud would flow out under this fill and require many times the 10,000 yd. that would have been needed if the fill had been on solid ground, it was scarcely expected that the bottom would heave up far out in the bay on both sides of the bridge so that the contractor could not get near the site with derrick boats and material barges. This condition made it necessary to build runways along the bridge footings out to the first river pier and handle in wheelbarrows a part of the 80,000 yd. already dumped in this location.

PILE DRIVING

Meanwhile, in the spring of 1915, work was started on the four center piers adjacent to the draw span. These footings go down 35 ft. below mean low water, 10 ft.



EXCEPT FOR CENTER PIERS BEGUN EARLY TO HASTEN ERECTION OF DRAW, AND SECTION OF VIADUCT WAITING ON COMPLETION



THREE CONCRETE PLANTS AND ONE RELAY TOWER ARRANGED TO COVER STRUCTURE AND UTILIZE WATER DELIVERY OF MATERIALS

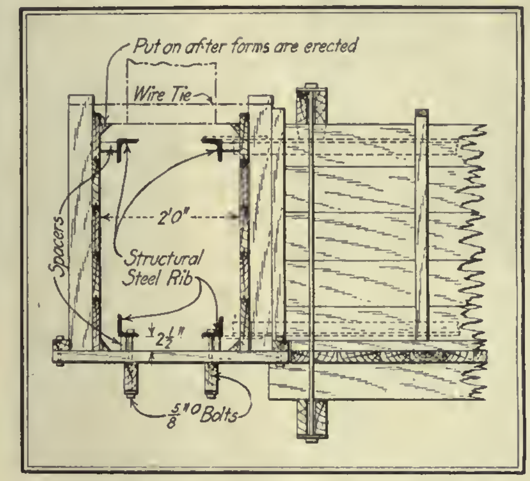
deeper than the other channel piers. They were started first to make the erection of the steel draw possible at an early date. Except for them, the piers were built in regular order from north to south. First the site of each pier was dredged about 4 ft. below grade. The piles were then driven, three floating drivers being used in addition to the two land drivers on the north approach. The outer two rows of piles under each pier are battered. One machine had a pivoted pair of leads with extension leads inside them, while the other two were weighted on one edge of the scow to tip them for driving batter piles. Steam hammers were hardly in order for this work, though one was used throughout the job. The piles went low enough to put the follower on almost at the start, then struck the hard stratum in a few blows, and thereafter could hardly be driven with anything. The engineers arranged with the contractor to drive each pile to much higher resistance than was at first specified, to secure maximum penetration into the hard stratum. Driving in this way, each machine made about twenty-two piles a shift. Driving only to a resistance of 16 tons per pile, one machine put in more than fifty in a shift.

SEAL PLACED BEFORE BRACING

When the piles for a pier were driven one driver, equipped with a circular saw on a vertical shaft supported in the extension leads, cut them off to grade, 22 and 32 ft. below mean low water. The piles were yellow pine, and had to be handled on barges because many of them would not float. It would not do to let the butts fall down in the footing, and each was speared with a long pike pole and pulled to the surface as it was cut off.

The sheeting was next set to an outside template resting on round piles, to which it had to be bolted every few feet to keep it above water. Splined wood sheeting was used for three of the shallow piers and Jones & Laughlin steel sheeting for the rest. This sheeting was pulled for the most part with a single whip by the driver boats, though some of it came so hard as to strip out the pulling holes.

Before the bracing was set in each cofferdam a 2-ft. seal of concrete was placed with double-line bottom dump buckets filled from the tower spouts and handled by one of the three derrick boats. This seal came a foot below the cutoff of the piles. As the piles were driven before setting the sheeting there was no danger of the mud swelling above grade. In fact, gravel had to be used to bring all of the bottoms up to grade before concreting them.



RIB FORMS SUPPORTED FROM STEEL

The bracing was then framed a course at a time, sinking of its own weight. It was framed a few inches small. Posts as well as wales and braces were bolted, making a rigid structure. This entire method was made possible because of the accuracy with which the sheeting could be set in the soft mud.

An 8-in. centrifugal pump unwatered most of the dams, though no banking and but a single row of sheeting was used. One, however, in almost 30 ft. of water, required two such pumps and several smaller ones. It was noted in every case that the only difficulty was in getting a start. After the first 2 ft. had been made, the unbalanced head clamped the sheeting against the bracing, reducing slightly its perimeter and jamming all the interlocks tight. After the cofferdams were pumped out a 3-in. pump kept the most of them dry. A sump was dug in the seal and the water pushed to it as the first lift was concreted. The sump was boxed in as the concrete reached it and later filled. After the frustrum of a pyramid, full size at the bottom, which formed the base of each pier shaft, was concreted, the pump suctions were hung outside the forms.

A CARPENTER'S JOB

Even the pier shafts required much form work, as for architectural effect, the portion above water is larger than was actually needed to carry the load. The lower part of the shaft was therefore made for each pier with a longitudinal wall above the base, supported by cross walls. Indeed, to have the draw piers in scale with the bascule leaves, curtain walls were used, hung at the two sides by means of reinforcing rods and supported at the rear by piles. When it came to the superstructure, the bottom chord ribs, the spandrels and the deck had to be formed and poured in three successive operations. It is not surprising, therefore, that of the 250 men employed daily about 135 are in the carpenter gangs. Three full sets of wood forms were provided for every operation at the start of the job. They have required little maintenance.

The rib forms are supported entirely on their bottom sections, which are bolted to the flanges of the structural steel ribs. These bolts were screwed out, leaving the nuts embedded. When the bolts were given a quarter turn while the concrete was green,

OF FILL, MAIN RIVER STRUCTURE WAS BUILT FROM RIGHT TO LEFT—TOWER AT LEFT MARKS RIGHT MIXING PLANT IN PLAN ABOVE they usually came right out. Less than 5 per cent of them had to be cut off.

NO FIELD RIVETING ON STEEL RIBS

The fact that the steel ribs were fabricated at a water front plant made field riveting unnecessary. Though these ribs, before being tied together with cross struts and concreted, were somewhat flimsy to handle, ten pair of them—enough for one pier—would be loaded standing on their bases on a large barge and towed to the site. A cradle was of course built at each end of the barge to support them. The ribs are tied by heavy rods across the top of a central tower, making each pair a complete unit which could be picked by the top pins in the tower by a derrick boat and set on the anchor bolts on the pier. The cross struts were handled on hand lines. As they were incased in concrete, it was only necessary to bolt them.

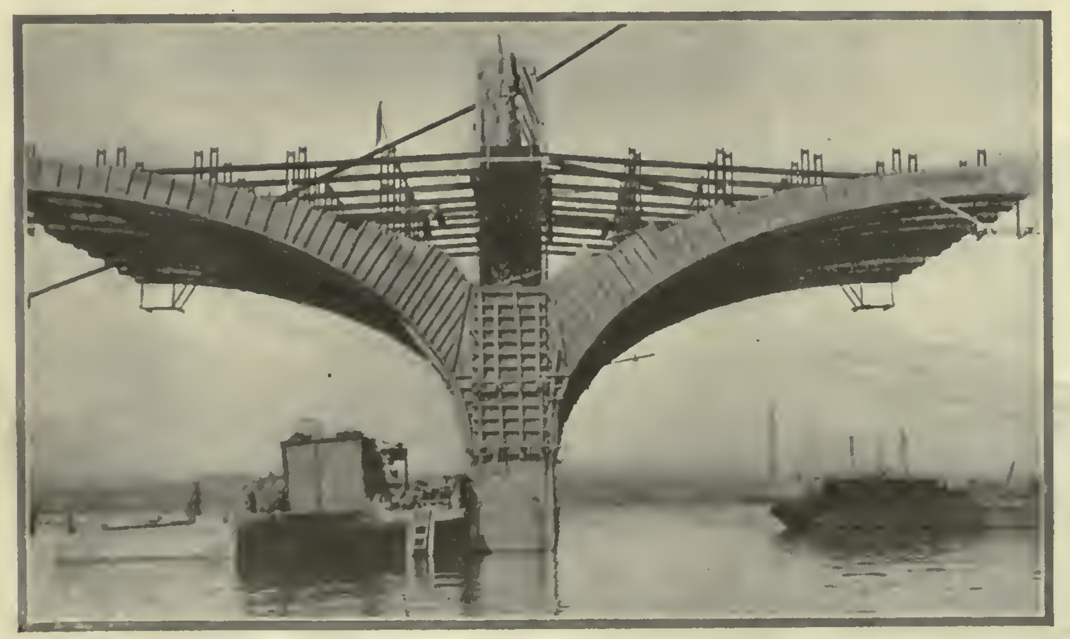
SPOUTING PLANTS BALANCED

Each tower concrete plant was designed to place concrete at the same speed at which it was made and to supply materials as fast as the mixer could take them. In this way a steady stream of concrete was kept pouring through the chutes, greatly improving its quality and at the same time avoiding all blocking and spilling. Moreover, no part of the plant had to be overloaded, and smooth operation at full capacity was secured. As the mixer was capable of a batch every 40 sec., and as the towers were close to 200 ft. high, a rope speed of 600 ft. per min. was provided for the hoists. This volume of concrete just maintained a good stream in the spouts employed. Small hoppers, 20 ft. square and 8 ft. deep, divided into 1/3 for sand and 2/3 for gravel, were fed with 40 cu. ft. clamshell buckets from barges. The barges made up the storage, as it would have been expensive to build large bins because of the poor foundation available. The mixers, fed by gravity, were near the water level and cement was carried to them from a cement storage boat of 600 bbl. capacity. Water was supplied from the north shore through a 3-in. line laid on the harbor bottom.

The concrete placed left an unusually clean finish against the forms. That in the piers was ready for bush hammering and that in the rest of the structure for rubbing with cement bricks with very little plastering. A manhole in one of the draw piers was filled with fresh water for boiler use by the foreman in charge of erecting the draw span. He stated that this water stood eight days with a subsidence of only 3 in. No attempt was made to waterproof any part of the structure.

→ FORMS FOR SUPERSTRUCTURE BUILT AND POURED IN THREE SUCCESSIVE SECTIONS

← BRACING BUILT AND SUNK AS UNIT—COFFER FOR PIER NUMBER SEVEN


FORMS WERE ERECTED, STRIPPED AND MOVED WITH AID OF CARPENTER BARGE

The Hanover Street bridge is being built by H. P. Converse & Company of Boston, Mass., for the Maryland State Roads Commission, of which H. G. Shirley is chief engineer, E. H. Wroe, district engineer in charge of the work and J. E. Greiner consulting engineer. The Raymond Concrete Pile Company was sub-contractor for the piles under the south abutment and the Strobel Steel Construction Company furnished and placed the bascule span.

[*In next week's issue the design of the Hanover Street Bridge at Baltimore will be described.*—EDITOR.]

Pullmans to House Traveling Railroad Gangs

Bessemer & Lake Erie Fits Up Six of These to Replace the Box Cars Ordinarily Used by Bridge Men and the Like

EMULATING the Division of Valuation of the Interstate Commerce Commission in providing quarters for its field men, or perhaps working along independent lines, the Bessemer & Lake Erie Railroad has acquired and is fitting up six old Pullman cars for the use of its traveling bridge gangs, engineers and other groups that can reasonably be depended upon to appreciate and take care of such quarters. Two of these cars have already been put into service, and have to date given complete satisfaction. They replaced the well-known box cars.

The cars are of the twelve-section type, with a single stateroom at one end. They are wooden cars, of course, built in the day of rather elaborate moldings and other interior decorations. In adapting them to their new use, care was taken not to destroy or disrupt these decorations ruthlessly, but to retain them to the fullest degree. The stateroom and the eight sections adjoining have been left untouched. From the remainig four sections the seats have been removed, and replaced by a longitudinal dining table and sofa along one side of the car. These conform to the rest of the woodwork. The smoking room has been converted into a kitchen fitted out with a first-class range and a full complement of cupboards, shelves and kitchen utensils. A Baker heater supplies heat and hot water.

The cars were remodeled under the direction of H. T. Porter, chief engineer of the Bessemer & Lake Erie Railroad.

Electric Drive Replaces Steam for Drainage Pumps

To Realize Maximum Efficiency Two Speeds Are Provided for by New Motors and Chain Belts at Illinois Plant

By E. J. HEGERTY
Of the Westinghouse Electric & Manufacturing Company

BY the substitution of an electric for a steam drive at the pumping plant of the Spring Lake Drainage and Levee District in Tazewell County, Illinois, along the Illinois River, difficulties in obtaining coal, in securing and holding good engineers and operators, and in making emergency repairs—all of which were encountered when the pumping engines were operated on steam—were eliminated. Power from the new motors is transmitted to the old centrifugal pumps by chain belts. By selecting two separate motor sprockets, to be fitted to the shaft as the head against which the pump must work changes, it is possible to operate the pumps at two different speeds, the lower speed being used when the pump is operating against low heads and the higher speed when the lift is near the maximum. For average heads both pumps are operated at a very good efficiency, one on high speed and one on low speed. This arrangement allows the pumps and the motors to operate at high efficiencies at all times.

← MOTOR, STEAM ENGINES AND PUMPS; MOTOR-DRIVEN COMPRESSOR, USED AS VACUUM PUMP FOR PRIMING, WITH ITS STARTING PANEL IN THE BACKGROUND

Pumping Load not Constant

The lands comprising the drainage districts of the Illinois and Mississippi rivers are considerably below the levels of the streams the greater part of the year. Hence the only practicable method of bringing these lands under cultivation was to construct a levee system, dig ditches and canals, and install a pumping plant to remove the water to a level that would permit the land to be farmed. Most of the pumping stations in use in this district are steam-driven, the engines being either belted or directly connected to centrifugal pumps. Usually these stations have two pumps, the relative capacities of which are one-third and two-thirds the rating of the station. This difference in size is advisable because heavy pumping is required for only about three months of the year, as from 65 to 75 per cent of the total yearly work of the station is done from March 15 to June 15, while the remaining work is distributed about evenly through the other nine months of the year.

There have been two systems in use to operate these plants most economically. The first, allowing the water to back up in the ditches, starting the pumps only when a sufficient amount has been stored up to justify running the plant, and the second, operating the pumps on alternate days and banking the fires between these periods. The objection to the first method is that it is opposed to the principle of the drainage system, for the water should always be kept at about the same level in the main canal, while the second scheme was undesirable in that about half as much coal is required to bank the fire as to actually operate the pumps.

The Spring Lake Drainage and Levee District extends from a point about 5 miles below Peking, Ill., to 3 miles below the Coperas Creek locks. This district, which contains approximately 12,500 acres, is about 18 miles in length, the width varying from ½ to 3 miles, depending on the distance from the river to the bluffs.

Original Plant Steam-Driven

The pumping station is at the extreme lower end of the district along the river and is about 15 miles from Canton. The original equipment of the plant installed in 1909 consisted of two 48-in. pumps driven by two cross-compound Russell engines, direct-connected and operating at speeds of from 170 to 215 r.p.m., and one 24-in. pump direct-connected to a single cylinder Russell engine, driven at 250 r.p.m. The pumps were primed by means of steam ejectors, and current for lighting the station was furnished by a small vertical engine direct-connected to a direct-current generator. The boiler plant consisted of two 300-hp. water-tube boilers with hand-fired grates, the necessary draft being obtained from a steam-driven induced draft outfit.

→ METHOD BY WHICH MOTOR AND PUMP ARE CONNECTED — MOTOR USED REGULARLY BUT ENGINE READY FOR EMERGENCY SERVICE

In 1914 the commissioners of the district advertised for electric motors with controllers and chain drive for operating the pumps. Some of the main reasons given for changing from steam to electric drive were the difficulty in obtaining coal, in securing and holding good engineers and operators, and in making repairs in case of emergency. In addition, the foundations of the engines and pumps were on poor soil and weak piling, so that it was impossible to maintain the proper alignment of engines and pumps, which resulted in a high maintenance cost. The contract for the work was awarded to Hoppin & Rich, engineers, of Peoria, Ill., who made a thorough investigation of the proposed change and the method of making alterations necessary for the Canton Gas & Electric Company in supplying the current.

13,000-Volt Transmission Line

Energy is supplied over a three-phase, sixty-cycle, 13,000-volt transmission line. The substation at the pumping plant consists of four 25-ft. poles placed one on each corner of a concrete foundation 5 ft. wide and 15 ft. long. On these are mounted the lightning arresters, disconnecting switches, choke coils and fuses. The transformers, which are each 200 kva, 13,000 to 460 volts, are mounted on the concrete base. There is no building or roof over this substation, a picket fence inclosing the whole apparatus.

Electrical Equipment

The electrical equipment of the pumping plant consists of two 300-hp. and one 100-hp. Westinghouse 440-volt induction motors, with starting equipment consisting of auto transformers and switchboard type oil circuit-breakers. The larger motors are connected to the 48-in. pumps by two 25-in. silent chain belts, and the 24-in. pump is driven by a 10-in. chain belt. The sprockets on the pump shafts were placed in the position occupied by the flywheel and eccentrics when the plant was steam driven.

The purchaser's specifications required the pumps to be operated at two speeds, as explained in the first paragraph. A compressor, used as a vacuum pump, replaces the steam jets which were used for priming the pumps when the steam plant was in use. The installation of the motors and changes in piping to allow for the new priming and water level maintaining system was made without interfering with the operation of the steam plant. The cost of making the change was small, and as no structural changes were made in the plant to accommodate the electric drive, the present steam plant is intact and can be put into service in a very short time at small expense.

The station does not operate continuously at its full capacity, nor does it operate every day. The pumping depends largely on the season of the year and the amount of rainfall. The usual load on the plant is about 250 kw., and during a part of the year this load is on the lines about 10 or 12 hours per day, but none of the motors is operated during the period of the day in which the company carries its peak load. During the heavy pumping season the motors are sometimes operated 18 to 24 hours per day, and in extremely wet periods all of the pumps taking practically 600 kw. have been operated for a few hours at a time.

The cost of operation has compared very

SECTION 1

Applying to districts draining not more than 2500 acres

	Per kw.-hr.
First kw.-hr. per acre per month of total acreage drained	$0.045
Second kw.-hr. per acre per month of total acreage drained	.036
Third kw.-hr. per acre per month of total acreage drained	.028
Remaining kw.-hr. per acre per month of total acreage drained	.022

SECTION 2

Applying to districts draining more than 2500 acres, but less than 7500 acres

	Per kw.-hr.
First kw.-hr. per acre per month of total acreage drained	$0.04
Second kw.-hr. per acre per month of total acreage drained	.03
Third kw.-hr. per acre per month of total acreage drained	.025
Remaining kw.-hr. per acre per month of total acreage drained	.02

SECTION 3

Applying to districts draining more than 7500 acres

	Per kw.-hr.
First kw.-hr. per acre per month of total acreage drained	$0.03
Second kw.-hr. per acre per month of total acreage drained	.0225
Remaining kw.-hr. per acre per month of total acreage drained	.015

favorably with steam operation, and the certainty and freedom from interruption have made the service very satisfactory to the commissioners.

POWER RATES

The schedule of power rates in effect in Canton, Ill., and vicinity, applying to drainage and pumping, was devised by the firm of Hoppin & Rich after a study of the existing rates and the cost of power at the company's switchboard. The power is sold at a certain rate per kilowatt-hour per acre per month, the rate depending on the amount of land served and the amount of power used.

The rates devised by the engineers of the Canton Electric Company are shown in the accompanying table.

A cash discount of 5 per cent and an off-peak discount of 5 per cent are allowed from above rates. The minimum charge is $10 to $20 per horsepower per year.

Anthracite Production in Pennsylvania Falls Off Slightly

The production of anthracite coal in Pennsylvania in 1915 was about 2 per cent less than in 1914, according to a bulletin of the U. S. Geological Survey. The figures in gross tons were respectively 79,459,876 and 81,090,631, and the values at the mines were $184,653,498 and $188,181,399, the average value per ton at the mines being practically $2.32 each year.

Small Check Dams, in Series, Lessen Flood Velocities in California Ravines—Part I

Experiments Prove Value of Obstructions in Channels Where Floods Originate—Water Robbed of Debris Carrying Power

By **HARRY F. OLMSTED**

Of Buck & Olmsted, Conservation Engineers, Los Angeles

WITHIN the mountain areas of Los Angeles County, California, there has been conducted, during the past twelve months, a series of experiments which was instituted to show conclusively the effect of unit obstructions upon stream flow. The flood problem in the United States is such an important one, and engineering methods employed in remedy have proven so futile, that these experiments carried out along lines entirely new to American practice have attracted wide attention. In brief, the experiment has consisted in adapting the Swiss system of flood prevention to ravines and canyons which comprise the upper watersheds of certain torrential streams in southern California. This system consists of placing in the upper channels, where floods originate, many small and inexpensive cross structures or miniature dams, which materially reduce the flood velocities, rob the waters of their debris carrying power, and make for greatly increased absorption in the gravels.

→ DAM AT EXPERIMENT STATION EQUIPPED FOR INSTANT RELEASE OF 1000 SECOND-FEET OF WATER

← CHECK DAMS WERE CONSTRUCTED WHICH SUCCESSFULLY WITHSTOOD THE IMPACT OF THESE GREAT ARTIFICIAL FLOOD FLOWS

CHARACTER OF STREAMS

The streams of Los Angeles County are not rivers, or even brooks, in the dry season, at which time the major portions of their great lower channels are devoid of surface flow. The largest stream in the county, the San Gabriel River, which drains a mountain area of 222 sq. mi., has had a minimum flow of 2 sec.-ft. at its mouth as against a maximum flow of 45,000 sec.-ft. The rainfall that is largely responsible for these changes falls between Nov. 1 and May 31, and the flood producing precipitation may be expected in the months of January, February and March.

The only other large stream in the county is the Los Angeles River, which, during floods in past years, has had a runoff of at least 40,000 sec.-ft., and perhaps more.

The significant characteristic of these immense flood flows discharging from watersheds whose minimum flows are so small, is the great amount of debris, sand and silt which they carry from the upper reaches of the streams to the valleys below. The comparatively short distance from the mountain crest line to the sea, 40 miles, and the pronounced drop, 6000 ft., with a constantly diminishing gradient, causes flood waters to transport great masses of detritus from the upper reaches and to deposit them in the lower channels. This building up process has caused a greater and greater area to be menaced and has resulted in the failure of every lower channel in southern California to carry the floods, excepting that of the Los Angeles River through the city of Los Angeles. Major floods occur in southern California on an average of every seven years, although there have been periods of as high as 29 years between these visitations. During the flood of 1914 Los Angeles County experienced a financial loss of over $10,000,000. This was undoubtedly the greatest loss by flood in the history of the county, for, although the flood was by no means the most severe, the improvements menaced and wrecked were the greatest of any flood year. Future floods of equal violence will cause without question even greater losses.

BOARD INVESTIGATES FLOOD PROBLEM

The board of engineers for flood control, appointed by the Los Angeles County supervisors in April, 1914, reported over one year later that a fund of $16,500,000 would be required to carry out measures for flood protection, which could be depended upon to relieve the situation in Los Angeles County. There was some diversity of opinion among the engineers constituting the board as to the relative importance of certain types of work recommended in the report. For instance, it was recommended by the committee on conservation that $4,130,838 be appropriated to provide for impeding dams in the mountain ravines, rock-fill dams in the canyons, masonry dams where reservoir sites exist, spreading devices whereby the canyon waters could be made to cover debris cones to obtain the maximum absorption, and for the reforestation of denuded areas. The sum included in the $16,500,000 total to provide for these measures was only $2,800,000. The difference was occasioned because the majority of the board believed that the restraining dam method had not been sufficiently tested in America. This belief, together with the fact that there was no way to ascertain mathematically what degree of efficiency this class of construction might attain, influenced the board in recommending the smaller sum.

The committee recommending the large appropriation took this position:

1. Any comprehensive flood control plan for Los Angeles County must not alone provide for a quick and safe delivery of flood waters into the sea, but must also look to the reduction of these wastes by utilizing all surface storage sites.
2. Any engineering means that would check the velocities of flood water in the mountain region and thus prevent the great disgorging of debris into the lower channels and upon the lower lands, should certainly be adopted, providing the cost was not prohibitive.
3. The great cones of gravel deposits at the canyon mouths should be utilized to the greatest possible extent as absorption grounds for the clarified flood flows.
4. The cost and character of the lower channel rectification must necessarily be influenced by the diminution of flood crests by means of the upper work.

CHECK DAMS PROPOSED

That there is some relief to be afforded from the retarding works in the mountain regions no one will deny. It is also an indisputable fact that there will always be need for lower channels. The proportion of any given appropriation that should be devoted to each, and the order in which the expenditures should be made, were, therefore, the questions confronting the board of engineers.

A LITTLE THE WORSE FOR WEAR—AN APRON OR SPILLBREAK SAVED THIS STRUCTURE. ANNUAL MAINTENANCE WILL BE SMALL BUT ABSOLUTELY ESSENTIAL IN THE CORRECTED CANYON

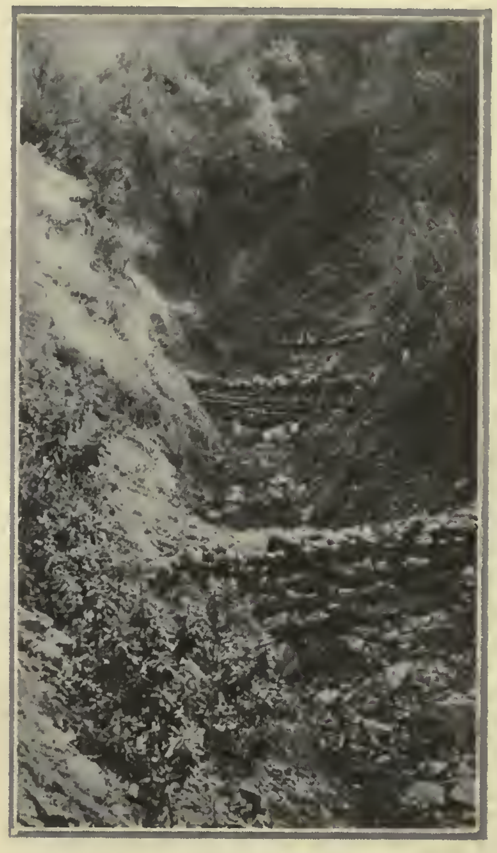
Frank H. Olmsted, the writer's father, the chairman of that committee of the board which investigated the subject of water conservation in its relation to flood crests, was responsible for the introduction to the board of engineers of the idea of the check dam method. He argued that, without the mountain control, channel expenditures in the lower reaches would be wasted in the future as they have proved to be in the past and that until such mountain works were constructed it would be impossible for any one to approximate with any degree of accuracy the amount of relief to be afforded by this system.

Reports concerning the control of certain Swiss and Austrian rivers by means of check dams, forestry, etc., stated that for many years no real success had attended the efforts of foreign engineers to control the torrents in the Rhine Valley by means of channel work in the lower rivers. Channel rectification, bank protection, and levee work were all recognized failures until the erosion in the upper reaches had been prevented by the check dam system and by the terracing and planting of barren and badly eroded slopes.

Mr. Olmsted became convinced that the Swiss system could be admirably adapted to the Southern California mountain region, where it would be a powerful factor in the reduction of flood flows by conservation. He pointed out that while the European engineers had a much more adaptable material in slate with which to build their retarding structures, the granite formation of the Southern California mountains afforded fair building material and an added advantage in the highly porous character of the mountain slopes, the lower channel bottoms, and the debris cones.

$23,000 FOR EXPERIMENTS

At the earnest solicitation of Mr. Olmsted, the board of supervisors acquiesced in the expenditure of $23,000 for experimental work to test out the Swiss system. About $13,000 of this amount was expended on an experiment station in Clear Creek, a small tributary of Tujunga River. This experiment station consisted in the first instance of a rock fill dam with masonry core. This dam was made 24 ft. high and was equipped with collapsible gates which would instantly release 1000 sec.-ft. when the reservoir was filled. The canyon was a short one, well brushed, very crooked in alignment, and somewhat typical of the flood producing ravines of Los Angeles County. Observations were taken at various points below the dam, when as much as 700 sec.-ft. were instantly released. This caused a great wave of water to rush down the canyon. There were several experiments of this nature taken to note the initial velocity of flow and its observed retardation, both in the clear channel and after the structures were installed. Check dams were built in the streamway in two sets of ten each, and observations of flow were taken at the completion of each set.



THESE STRUCTURES ARE OF DRY RUBBLE MASONRY AND IMPOUND LITTLE OR NO WATER BEHIND THEM. EACH DAM ACTS AS A PROTECTOR FOR THE ONE BELOW IT. THUS IT IS ESSENTIAL THAT THE UPPER REACHES BE TREATED FIRST

From these experiments certain types of structures required to withstand the sudden impact of varying quantities of water have been evolved, and quantitative values for the retarding effects of natural obstructions and the unit structures have been determined. In brief, the results of this portion of the experiments furnished convincing evidence that this system could be applied at a reasonable cost to the Southern California ravines with beneficial results, and that the structures themselves were stable under flows approximating cloudburst conditions. For example, when 210,000 gal. of water was instantaneously released, the initial velocity measured 19.5 ft. per second. In the clear and unobstructed channel 1100 ft. distant, the natural velocity had dropped to 7.8 ft. per second. This same amount of water instantly released over the same reach with ten cross structures installed, showed a velocity of 4.8 ft. per second at the lower station, or a 38.5 per cent velocity reduction. In other words, these ten check dams

DATA ON DISCHARGE AND VELOCITY AS AFFECTED BY CHECK DAMS, CLEAR CREEK EXPERIMENT STATION

Head, ft.	Storage, gal.	Disc., cu. ft. per sec.	Initial vel., ft. per sec.	Vel. at 1100 ft. clear channel	Vel. at 1100 ft., 10 dams, av. ht. 4.22 ft.	Vel. at 1100 ft., 20 dams, av. ht. 3.95 ft.	Reduction of debris-carrying power at 1100 ft., 10 dams, per cent	Reduction of debris-carrying power at 1100 ft., 20 dams, per cent.
11	210,000	700	19.5	7.8	4.8	2.9	95	99.6
9	112,500	468	15.0	6.6	3.2	1.6	96.5	99.8

had reduced the transporting power of this flood flow 94.5 per cent in 1100 ft. The same quantity of water released over the same reach with twenty cross structures showed a velocity of 2.9 ft. per second at the lower station, or 63 per cent of velocity reduction with a corresponding reduction of 99.6 per cent in the transporting power.

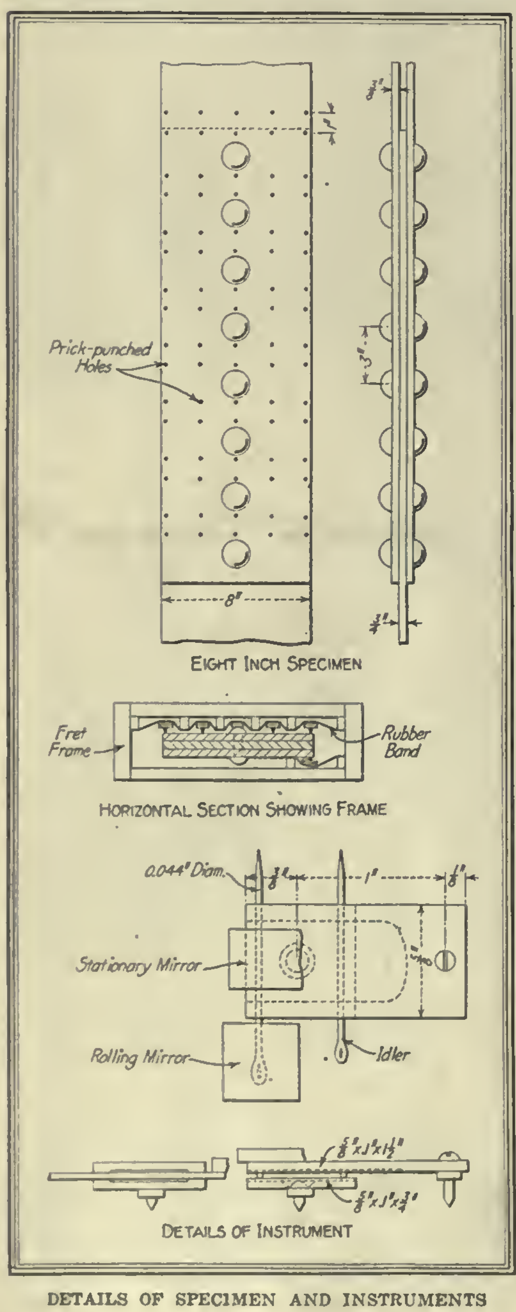
With 112,500 gal. storage, which would probably more nearly represent the maximum flow of a cloudburst in this canyon, the showing was even better, as indicated by the accompanying table.

(To be concluded)

Riveted Joints Being Tested by Series of Simple and Accurate Mirror Extensometers

New Method of Applying Strain Apparatus to the Determination of Rivet Slip and the Distribution of Stress in Riveted Joints Explained

SEVERAL ASSUMPTIONS almost universally made in the design of riveted joints have never been fully justified by extensive and exact scientific tests. For example, it is assumed in the design of a typical joint that the given total stress in the main members is distributed equally among all the rivets in that member, and that the unit stresses in the rivets shall be based upon shear or bearing values obtained by tests for ultimate strength, regardless of the effects of rivet slip and of the initial rivet stresses, shrinkage and frictional grip. Tests are being made at Purdue University by the use of a new device consisting of a series of mirror extensometers distributed along the test piece between the rivets, and designed to make possible the accurate determination of (a) the unit stress on the rivets at which the first slip occurs; (b) how the total stress is proportioned among the various rivets in a connection, and (c) how this distribution of stress is affected by the proportions and areas of the connected pieces.



DETAILS OF SPECIMEN AND INSTRUMENTS

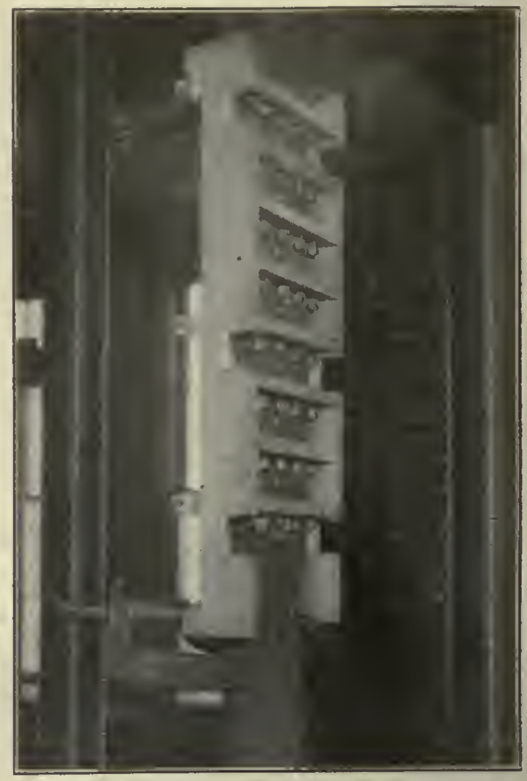
These tests will supplement those already made and reported by the American Railway Engineering Association in March, 1905, and by the University of Illinois in Bulletin 49, which indicate small slips at low unit stresses. While the results of the present series are not yet available, the general method being used and the details of the instruments have been furnished by Albert Smith, professor of structural engineering at Purdue University.

The accompanying diagrams indicate the manner of constructing the mirror extensometers and the supporting frame and applying them to an 8-in. specimen with a single row of eight rivets. For this case the instrument consists of a series of rows of small mirror extensometers, five in each row, which indicate the strains in 1 in. for these rows between the rivets, as shown.

These small extensometers are constructed of two plates supported by pins in prick-punched holes in the specimen. Two small steel rollers, or needles, to one of which a thin plate-glass mirror is attached by plaster of paris, separate these plates, as shown in the diagram, and each plate is ground so as to leave a narrow track on the edges in contact with the rollers. The rows of instruments are held in place by a wooden frame and a rubber band stretched across frets. The tension of this band holds the instrument points firmly in the prick-punched holes on the specimen and keeps the rollers in position between the two plates. A fixed mirror attached to the outside of the longer plate is designed to give corrections to be applied to the readings of the roller mirrors to eliminate errors from bending or vertical displacement of the specimen.

At a convenient distance from the specimen a telescope is set up, which looks in the mirror and back into a vertical scale at the desired distance from the mirror. It has been found desirable to make the line of sight as nearly horizontal as possible, and this involves cutting a hole in the scale to receive the barrel of the telescope.

MAKING OBSERVATIONS



FRAME ATTACHED TO SPECIMEN

When the specimen is subjected to tension the deformation causes the distance between the prick-punched holes to increase, and results in a relative motion of the two plates equal to the unit deformation, since the holes are 1 in. apart. The needles revolve through a vertical angle α (equal to the deformation divided by the diameter of the needle), causing the line of sight between the mirror and scale to move through the vertical angle 2α. For a scale distance of 100 in. the reading thus equals 200α. It has been found possible to read hundredths of an inch at this distance with a probable error of one hundredth. The smallest stress which can be observed is thus about 60 lb. per square inch.

DETERMINING SLIP POINTS

The row of instruments above the first rivet of the joint should show the fiber stress due to the total load. The instrument between the first and second rivet should show a fiber stress diminished by the stress carried by the rivet to the middle plate. So long as the difference between the readings of the first and second rows of instruments is large and constant, the first rivet is carrying its proper load. When for a 1000-lb. increment this difference disappears or becomes negative, the first rivet has slipped. Then as the stress is increased the increments of the second row of instruments again increases until the first rivet slips again. Similar observations show the point at which the second rivet slips.

The average fiber stress across any section multiplied by the area gives the stress at that section, and this stress subtracted from a stress similarly obtained for the section above gives the stress carried by the rivet between.

In the last test made upon a four-rivet specimen, after the load had been carried up to the design load for ¾-in. rivets, the load was dropped to 20,000 lb. and then brought up to 25,000 lb., and the mirrors were read. Twice again the load was dropped and raised, and readings were taken. Each mirror thus had three return readings, and for thirty-one of the thirty-two instruments the check was remarkably good, being within 0.01 in. on the scale for a total movement of 0.80 in. One reading for one instrument showed a large difference, probably due to an error, as the others agreed.

This work is being conducted in the testing laboratory of Purdue University, of which W. K. Hatt is director, by Prof. Albert Smith and H. H. Schofield.

Is the Ton-Mile the Proper Basis for Allocating Railroad Operating Costs?

Are Not Maximum Loads More Pertinent Than Total Tonnages, and Should Not More Weight Be Given to Deterioration Independent of Traffic?

By PAUL M. LA BACH
Assistant Engineer, Chicago, Rock Island & Pacific Railway, Chicago, Ill.

IS EITHER the ton-mile or the train-mile the proper basis for allocating railroad operating costs between passenger and freight service? Are not maximum loads and stresses, for which railroad structures are designed, more pertinent than total tonnages, and should not more weight also be given to the fact that a large percentage of deterioration is independent of traffic?

The Interstate Commerce Commission and various state commissions having decided that freight and passenger business must each be self-supporting, it has been the duty of various judicial and administrative bodies to find out how this shall be brought about. Up to the present no two of these bodies have agreed, which is not at all surprising when we consider the fact that the hypothesis from which a start is made has little to support it. This assumption is that present accounting systems can be utilized for the purpose.

PRESENT ACCOUNTING SYSTEM

It is a primary principle in cost accounting that the different items must be charged out at the point of origin. Little can be expected from a system which attempts to do this backwards by subdividing the sum total into its constituent elements. This applies particularly to the items which are simply collective. If a factory should charge out all items for axles, for instance, without reference to the kind, little would be known about the cost of any particular one. In addition to this the requirement that a subdivision must be made for freight and passenger costs means that the origin of each cost must be ascertained. This adds a complication which has no very satisfactory solution particularly with reference to maintenance of way and structures.

In a good deal of the discussion of the subject there seems to be a tendency for the proponents of one method or another to describe other methods as "too theoretical." All are practically in the same boat insofar as theory is concerned, but some theories are apparently simpler than others. Recourse must be had in all these discussions to published authentic accounts, and for that purpose the Interstate Commerce Commission published statistics are the only ones now available for comparative purposes. They subdivide the maintenance of way and structures accounts as follows: (1) superintendence; (2) ballast; (3) ties; (4) rails; (5) other track material; (6) roadway and track; (7) removal of snow, sand and ice; (8) tunnels; (9) bridges, trestles and culverts; (10) over and under crossings; (11) grade crossings, fences, cattle guards and signs; (12) snow and sand fences and snowsheds; (13) signals and interlocking plants; (14) telegraph and telephone lines; (15) electric power transmission lines; (16) buildings, fixtures and grounds; (17) docks and wharves; (18) roadway, tools and supplies; (19) injuries to persons; (20) stationery and printing; (21) other expenses; (22) maintenance joint tracks, etc., Dr.; (23) maintenance joint tracks, etc., Cr.

It will be seen that these are collective accounts without reference to cause of expense except in one or two instances. Broadly speaking, all necessary expense is due to one of three causes: (a) Legal or community requirements; (b) destructive forces of nature; (c) destructive mechanical forces originating in the conduct of transportation.

Under the heading (a) are a large number of items not found in the classification above. Some may be partly included in (1), but others are found by name, such as fencing, cattleguards, signs, under and overgrade crossings. They have nothing to do, as a rule, with the relative amounts of the different kinds of traffic, as they are primarily intended to protect abutting property owners, pedestrians, etc. Undergrade crossings might be considered to have some relation to the differences in traffic, but that relation is very slight.

Under the heading (b) is included what is sometimes called weather stress. Erosion, decay, oxidation or similar manifestations may destroy or decrease the efficiency of the track structure. It is used here in the sense of destruction which would take place if no trains were run. The process is hardly perceptible at times, but the maintenance of a railroad constantly calls for the flushing of embankments, digging of ditches, repairing of snow fences, cleaning of culverts, replacing of bridges and embankments after washouts. Also, rails rust and ties decay, but we take little note of it. A great deal of track work, such as surfacing, is due partly to the presence of water and not altogether to the movement of trains. Two years ago $10,000,000 was lost through floods in one state, and it is not unusual for a large system to lose $1,000,000 in a season through floods.

Under the heading (c) we have the element which has been most discussed and frequently used as the criterion for the division of all expenses. That the movement of trains does cause destruction goes without saying, but it frequently causes less than half the annual maintenance expense.

The foregoing only includes *necessary* expenses. Anything not utilitarian is assumed to be omitted. However, business is not done that way, and lines having extensive passenger traffic indulge in ornamentation, landscape gardening and various other expenses to please the eye of the traveling public. This has been called a prosperity factor and should be chargeable to passenger expense, as it makes little difference to the freight service if things do not look spick and span.

EQUATION FOR MAINTENANCE EXPENSES

The equation for total maintenance of way and structures operating expense will then be

$$A + B + C + D + fx + py = Q$$

where A = amount (buildings, yards, etc.) which can be charged to either freight or passenger traffic by reason of exclusive occupancy or usage; B, a prosperity factor which causes a prosperous railroad to indulge in landscape gardening and other methods of pleasing the eye of passengers; C, legal requirements for the safety of persons or property of neighbors (the cost usually varies with the density of population; the items are fences, cattleguards, signs, grade crossings, etc.); D, amount necessary to overcome the destructive effects of erosion, corrosion, snow, ice and floods; f, amount needed to overcome the destructive effect of a unit of freight traffic; x, total number of units of freight traffic per year; p, amount needed to overcome the destructive effect of a unit of passenger traffic; y, total number of units of passenger traffic per year, and Q, total expenditure.

TABLE 1—ITEMS FOR A CERTAIN RAILROAD THAT DO NOT ORIGINATE IN MECHANICAL WEAR OF TRACK USED JOINTLY BY BOTH FREIGHT AND PASSENGER EQUIPMENT

A ($36 passenger; $64 freight)		$100
B		0
C		25
D		
Rail—cost $6,000 (90-lb); length of life, 50 years	$120	
Ties—creosoted—cost $3,200; length of life, 20 years	160	
Ballast—cost, $5,600; length of life, 20 years	180	
Ditching and restoring cross-section	100	
Widening banks to original cross-section	75	
Replacements due to floods, washouts, cleaning culverts	100	
Cutting grass and weeds	25	
Removal of snow and ice	30	
		$790
Total *K*		$915

For the sake of brevity, $A + B + C + D$ may be represented by K, which thus represents all those items which do not originate in the mechanical wear of track used jointly by both freight and passenger equipment. The formula thus becomes:

$$K + fx + py = Q$$

Table 1 is an estimate of the value of K on a railroad in the Mississippi valley. The unit is one mile of main track.

The foregoing, of course, has no general application, but the road in question averaged about $1,400 per track mile for total maintenance of way and structures, the item $fx + py$ being only $485, or about 34 per cent of the total. A, B, and C can

TABLE 2—MAINTENANCE COSTS PER 1000 CAR-MILES OF RAILROADS WITH VARIOUS RATIOS OF PASSENGER AND FREIGHT TRACKS

Railroad	Miles of main track	Cost of maintenance of way and structures per mile of main track	Passenger-car mileage being 1.00 freight-car-mls. are as below	Maintenance cost per 1000 car-miles per mile of track	*K* — *A* assumed as $800 per track-mile	Cost of maintenance per 1000-car-miles per track-mile for *fx* + *py*
Long Island	602	$2,028	0.39	$35.20	$800	$21.5
Atlantic City	248	1,638	0.62	41.43	800	21.2
West Jersey & Seashore	526	1,639	0.69	38.11	800	19.5
New York, New Haven & Hartford	3121	2,414	2.64	25.50	800	17.1
Philadelphia, Baltimore & Washington	1083	2,680	2.96	20.83	800	13.1
Boston & Maine	2903	1,945	3.94	19.45	800	11.4
Delaware, Lackawanna & Western	1595	2,849	6.17	15.04	800	10.8
Pennsylvania	6504	3,117	7.43	14.29	800	10.6
Northern Central	679	2,194	7.88	13.77	800	8.7
Philadelphia & Reading	759	2,646	10.32	13.34	800	8.3
Lehigh Valley	2183	1,813	13.63	11.07	800	6.2
Norfolk & Western	2531	1,879	20.20	9.15	800	5.2
Virginian	508	1,573	24.45	10.96	800	5.4

usually be ascertained wih little difficulty by the usual appraisal methods.

How Subdivide $fx + py$

The sum $fx+py$ may fluctuate from 20 to 60 per cent of the total, depending on the density of traffic, but even in extreme cases there does not seem to be good reason for attempting to allocate all expenses by the use of a traffic unit. How then shall $fx + py$ be subdivided?

The most logical method is by comparing the stresses produced by each style of locomotive when running at its maximum allowable speed. These stresses have been measured in the rail by use of the stremmatograph. A thousand pounds static load will be 1250 lb. for a Mikado at 35 miles per hour and 1390 lb. for an Atlantic type at 60 miles per hour if the effect on stresses is condensed. This is an increase of 11 per cent for the passenger. The ton-miles of the passenger locomotive (minus tender) multiplied by 1.11 would form a ratio with the locomotive ton-miles of the freight locomotive multiplied by 1.00. In the foregoing case the division of $fx + py$ would be $230 for freight and $255 for passenger.

A railroad track, like other structures, is designed to carry its maximum loads. Average loads have little bearing on the first cost. The same is true to a certain extent of maintenance. The greatest damage is done by those loads which create stresses near the elastic limits of the material employed. Loads which are well within these limits may be repeated many millions of times without any apparent effect. As the stresses created by the high-speed locomotives are very near the elastic limit of steel it would seem only fair to use these locomotives as a criterion rather than a traffic unit which may have little bearing on the history of the subject.

Reverting again to the problem, we have from *A*, Table 1, $64 for freight and $36 for passenger. These, added to their respective values of $fx + py$ ($230 and $255), give us, as final figures, $294 per mile for freight, $291 per mile for passenger and $815 which is not affected by the question, as it would not increase or decrease if all trains were passenger or all freight, unless it was found in the latter case, as would undoubtedly be true, that a less expensive track could be used.

Expenses Not Affected By Traffic

How this $815 should be divided would be a good subject for argumentation. In an ordinary business it would probably be divided in the ratio of the net profits of the two classes of business. The calculations, however, are used in rate cases in which the profit is necessarily a point of issue, and so some other method will have to be selected. As railroads generally are required to perform two distinct classes of service without reference to the profitableness of either, it would appear to be equitable to divide all these expenses, which do not originate in the class of service, into two equal parts. In the above case, if the amount was divided equally, $815 would be charged out as $407 freight and $408 passenger. These figures added to $294 and $291 give us as the final answer, freight, $701, and passenger, $699.

The published statistics unfortunately do not have a common unit of weight for freight and passenger equipment which can be used in statistical arguments. For that reason the car-mile, as it is the smallest common unit, may be used. No claim is made from an engineering point of view that the effect of a freight car and a passenger car are the same. The fact that passenger traffic cannot be compared with freight traffic on either a ton-mile or a train-mile basis can, however, be shown by this unit.

Figures For Various Railroads

The roads in Table 2 have, with the exception of two, been money makers for a long term of years and have little deferred maintenance. The table shows that when the number of passenger-car-miles exceeds the number of freight-car-miles the cost per mile of main track increases for the 1000 car-miles per mile of track. The hypothetical problem which has been worked out would probably not apply except on granger roads having a car-mile ratio of about 4.5:1.

In this Table 2 accounts 15, 16 and 17 have been subtracted from total maintenance of way and structures. It will be noted that after taking them out and then subtracting a constant of $800 per track-mile that the roads doing the greater passenger business still have the greater unit costs. This does not bear out the contention that the two classes of business are comparable on a ton-mile basis. It is probable, however, that the constant is too small in some cases, as a survey or actual experience in the engineering department of each road would be needed to get it accurately. The roads at the head of the list also run trains faster than the 60 miles per hour assumed at the beginning.

The writer makes no claim for anything in the foregoing except the method of analysis. That some similar method must be used in rate cases in order to obtain correct results seems obvious. The revision downward of first freight and then passenger rates without reference to each other or to the business as a whole is apt to result in the omission of items which are common to both, and thus deny the railroad a fair return on the investment.

Discharge Into Draft Tube Increases Power Output

That the water conducted by sluices from a pond upstream during the flood season at the Barton plant of the Eastern Michigan Edison Company, and discharged into the draft tube, increases the power output of the turbines and compensates in a large measure for the decreased output due to the rise of the tail-water level has been proved by actual tests.

During the construction of the plant the sluices were used to carry the low-water flow of the river, and in the completed structure have been used for lowering the pond. During the flood season they are used to assist in regulating the pond level, with the result that the water discharged into the draft tube effects an increase in the power output.

In a test the quantity of water discharged by the sluices was measured and the effect on one of the units determined while it was running at 6-10 gate. The power was increased about 9 per cent, and the effect of an 18-in. rise of water can be compensated for.

The Barton plant was designed, and its erection supervised by Gardner S. Williams, consulting engineer, Ann Arbor, Mich.

Pavement Near Car Lines Heaves During Cold Spell

Freezing Water Between Rails and Blocks Damages Streets in Seattle and Other Pacific Coast Cities

By J. THOMAS DOVEY
President, Seattle Engineering Company

HEAVED upward by frost action to heights of several inches in the vicinity of street railway tracks, the pavements in Seattle and other cities in the western sections of the North Pacific States suffered severe damage during January of this year, a month marked by the longest duration of low temperatures recorded in the last ten years. Although examinations were made on streets surfaced with brick, brick block, sand stone block, creosoted wood block and asphalt, no particular type of pavement appeared to be immune from the effects of the cold, but the one fact made clear by these investigations was that only those streets which carried street railway tracks exhibited any evidences of deterioration. It is apparent that the heaving was caused by the freezing of water which collected between the rails and the paving material adjacent thereto, a result attributable to improper facilities for drainage or lack of a proper filler between the rails and the paving blocks.

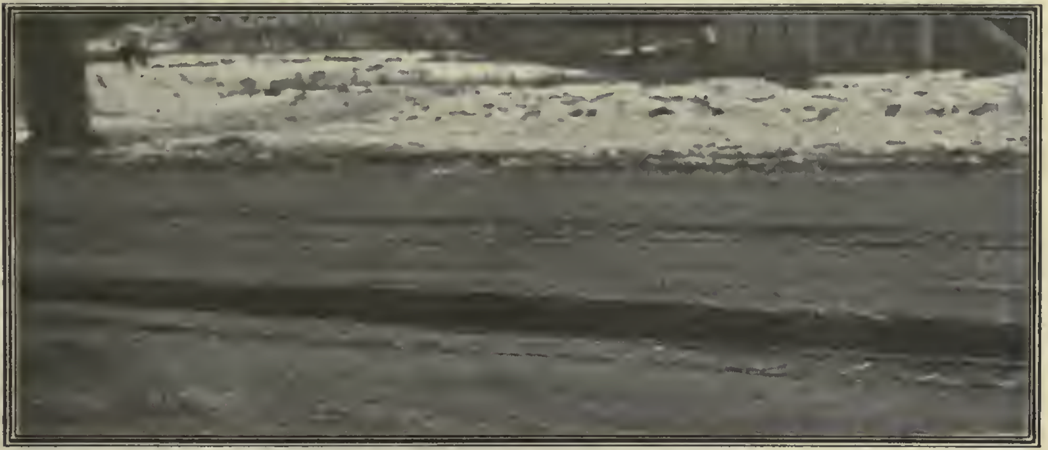
Winter Temperatures

As the greater number of the investigations made were in Seattle and vicinity and as the temperature conditions in the other cities closely approximated those of Seattle and do, as a general rule, follow them quite closely, temperature figures are given for Seattle only. The average winter temperatures of the North Pacific Coast cities are comparatively high and very equable, that of Seattle for the months of November, December, January and February for the past five years being 42.35 deg. Fahr. For the past ten years the average for the same months was 42.33 deg., the maximum range of average monthly temperature for these months during the entire ten years being only 15 deg. The lowest temperature recorded during the last ten years was on Jan. 15, 1907, when the mercury reached 11 deg. above zero. The greatest duration of low temperature, with the exception of January, 1915, was in the same month of the same year when there were 20 days whose minimum temperature was under 30 deg. These days, however, were not of consecutive duration.

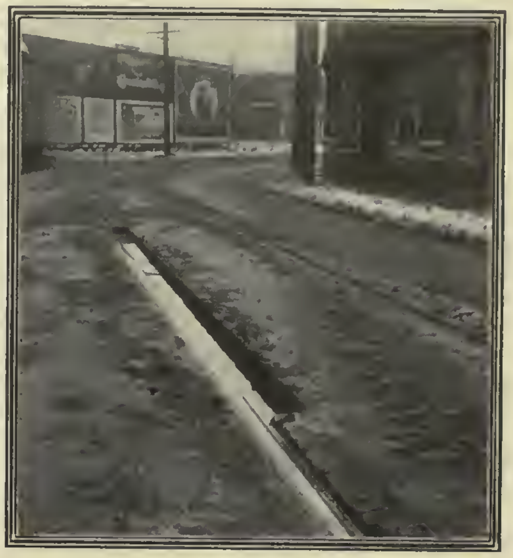
Between the dates of Dec. 29, 1915, and Feb. 1, 1916, there were 27 days whose minimum temperature was less than 30 deg., the average mean temperature being 31 deg., so that this is the longest duration of low temperature that has visited Seattle during the past ten years. Corresponding conditions were felt in other coast cities. There was a light snow fall at intervals during the month of January which had the effect of continuing the refrigeration during the few days when the minimum temperature was above freezing, but there was never at any time during that month over a few inches of snow on the ground at one time.

Streets examined were paved with brick, brick block, sandstone block, creosoted wood block and asphalt and no frost action was noticeable upon any streets examined except those on which car lines were laid.

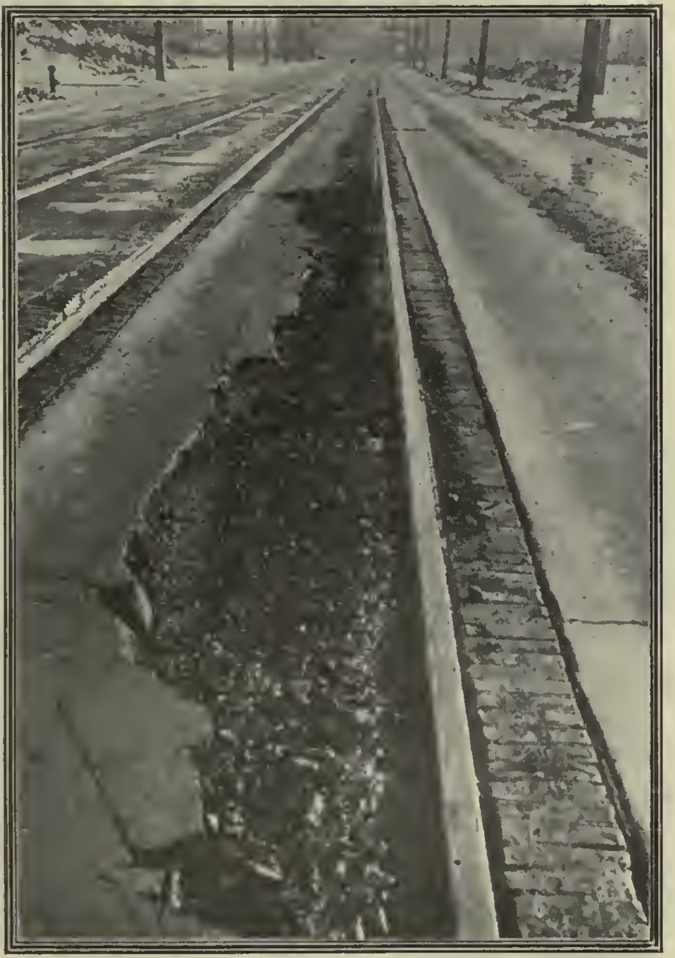
How Cold Weather Damaged Pavement Surfaces in Seattle by Heaving



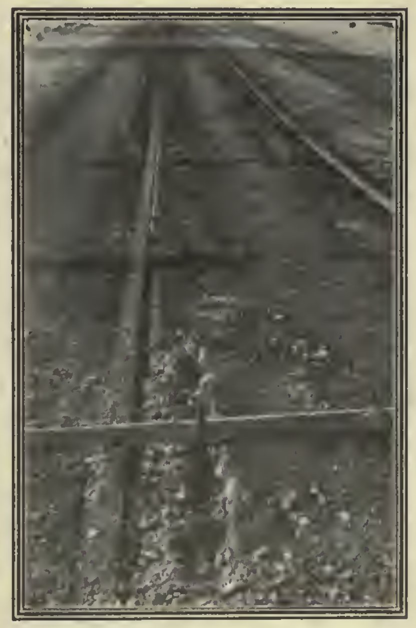
1—AN ASPHALT PAVED STREET IN WHICH THE TOP OF THE BRICK ALONG THE STREET CAR RAILS HAS BEEN HEAVED 2½ INCHES



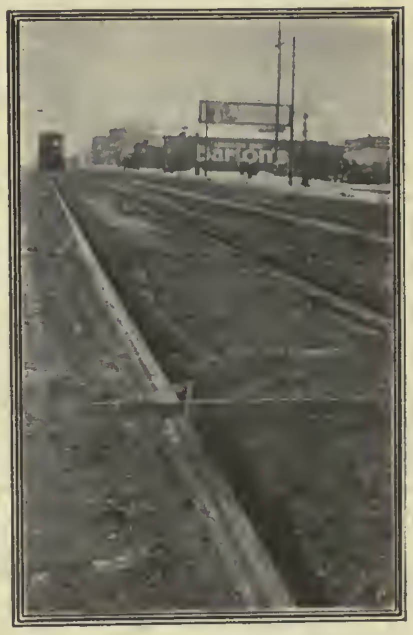
3—IN SOME PLACES STREET CARS COULD NOT PASS UNTIL HEAVED BRICK HAD BEEN REMOVED



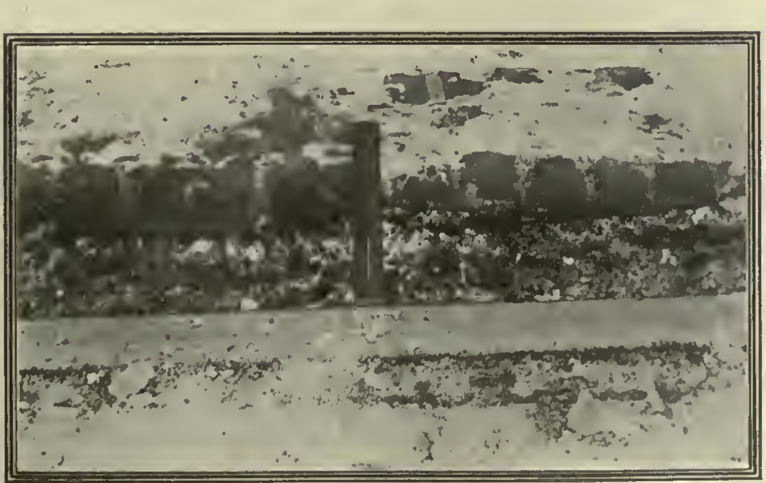
2—HOW SEATTLE STREETS BETWEEN CAR TRACKS HAVE BEEN DAMAGED BY FROST ACTION—THE BREAKING OF THE ASPHALT CONTINUED AT INTERVALS FOR A NUMBER OF BLOCKS



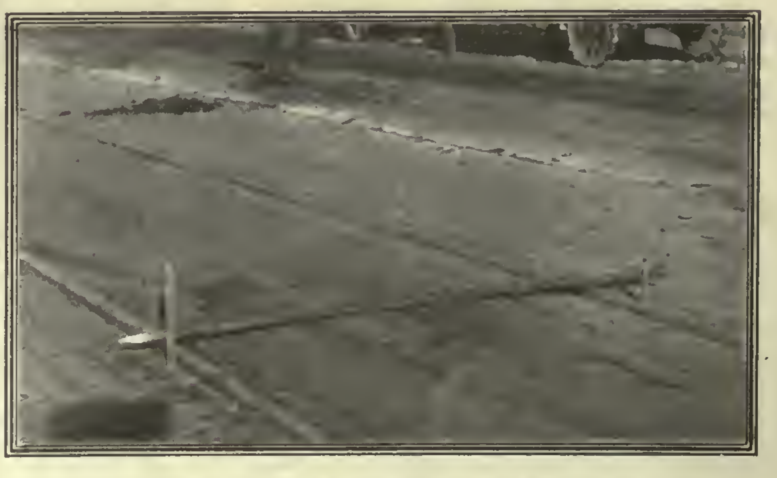
4—HOW THE STREET CARS HAVE POUNDED DOWN PROJECTING TOPS OF PAVING BRICK



5—STRAIGHT EDGE AND RULER INDICATE RISE OF TOP OF BRICK ABOVE TRACK RAIL



6—A BRICK PAVED STREET WHICH WAS HEAVED 5 INCHES ABOVE THE RAIL, BLOCKING CAR SURFACE



7—THE HEAVING OF THIS WOOD BLOCK PAVEMENT OCCURRED, GENERALLY, ONLY BETWEEN THE CAR TRACKS

All the damage to the paving was contiguous to the car tracks. The streets were of various widths and grades varying from 24 to 60-ft. roadways and from 0 to 7 per cent grades, in light, medium and heavy traffic districts, but the results noted did not seem to be affected by any of these conditions.

Extent of Damage

The results of the examinations of the pavements are shown by the accompanying photographs. No. 1 shows the general condition of heave of the paving brick along an asphalt section. The brick in all cases was originally laid so that their tops were coincident in elevation with the top of the rail. In photo 1 the top of the brick is approximately 2½ in. above the top of the rail and this condition existed at this location for a distance of about 100 ft. in each case, the brick gradually receding to an elevation of about ¼ in. above the normal for the balance of the block. The brick next to the track is a bull-nosed pattern, as may be seen in photo 2, which shows the brick removed on the same street a few blocks away. This street is in a residence district and supports a medium residence traffic of light vehicles, principally automobiles, and has been in service since 1908 and 1909. The bricks were originally laid on a sand cushion with cement grout. A filler of the same material was run between the brick and the track, but this has long since been broken away by the street car and other traffic and has left practically no filler between the brick and the rail.

Photo 2 shows the same street at another location and the frost action upon the brick and asphalt between the tracks. It will be noted that the bricks here shown have been raised both on the outside and inside (on the left-hand track) of the rail. The breaking of the asphalt continued at intervals over a number of blocks in more or less degree. This part of the street was paved in 1908, the roadway is 40 ft. in width. The gradient is less than 1 per cent.

Photo 3 shows a street paved entirely with vitrified paving brick, 8½ x 4 x 2¾ in., the exposed edges of which are rounded to a radius of ¼ in. The paving was laid in 1909 and sustains a heavier traffic than the previous streets noted, but could not be termed a heavy traffic thoroughfare. The width of roadway is 60 ft. and the gradients vary from 5 to 0.05 per cent. This street showed a consistent raising of the brick on both the inside and outside of the car tracks and only at intervals were large heaves noted.

Levels Taken

As it was desired to show an average condition of this type of paving direct levels were taken over approximately 1000 lin. ft. of street (inside and outside of both rails) which gave the following results:

Length, approximately 2000 ft.; average elevation of top of brick inside and outside rail, above top of rail, taken at 5-ft. intervals, 0.0533 ft. Length 250 ft., showing highest elevation of brick above top of rail, 0.124 ft. Highest average of any two readings taken, 0.1693 ft. Maximum reading 0.1732 ft.

About 55 lin. ft. of brick between the tracks had been removed contiguous to where the readings were taken, as the raise of the brick in that portion had been high enough to interfere with street car traffic. Numerous instances, particularly at cross streets, showed the effect of the impact of traffic on the paving material that had been forced above the grade of the tracks. In more cases of this kind the material was either forced out or reduced to small pieces, as shown in photo 4, which is a portion of the same street shown in photo 3, some blocks distant. The gradient at this point is 2 per cent and the width of roadway 44 ft.

Blocks Heaved 5 Inches

Photo 5 shows a pavement of brick laid 5 years ago, where the brick along the car tracks has been removed because of its interference with traffic. The grades on these streets are light and the traffic of medium character. The tracks shown had in most cases been cleaned and been kept clear of snow by the car traffic. In photo 6 is shown a track in a small town in northern Oregon which had not had the advantage of constant traffic and cleaning. Here the brick, laid in 1912, raised a full 5 in. above the rail and temporarily precluded the use of the track for car service.

All of the brick paving examined was of practically the same construction and showed that either cement grout or small brick fillers had been used between the track and the paving material, but that the fillers had in all cases broken up so as to cease to fulfill their function.

The heave in a wood block pavement is shown in photo 7. This pavement was laid in 1909 and sustains a fairly heavy downtown traffic. It is laid on a 3.93 per cent grade with a 60-ft. roadway. The photograph does not indicate graphically the actual extent of the damage caused by the heaving. This pavement showed a greater height of heave than any of the brick or asphalt pavements examined, the heave measuring from 3 to 3½ in. The heaving appeared, generally, in the center of the car tracks and at no point on the outside of the tracks was any noticeable heave cause by frost action.

Ice Filler Along Rails

As in the case of the brick paving the wood block paving did not have a close bond to the rail, a chamfered block next the rail being used with no filler. This allowed the formation of an ice filler between the block and the rail. That it was the expansion of the ice formed between the rail and the block that caused the heaving of the material was later demonstrated when wood blocks, frozen in the laboratory, showed an actual contraction in size in the freezing tests. It was noted that at each rail joint, where the opportunity for the admission of water and snow was made easier, by reason of the larger opening, that the heaving was greatest at these points. These blocks are of creosoted Douglas fir, 3¾ x 3½ x 6 in., and were laid upon a sand and cement cushion which was found to have held its place much better than the sand cushion in the portion of streets outside the tracks, which had been laid without mixing with cement.

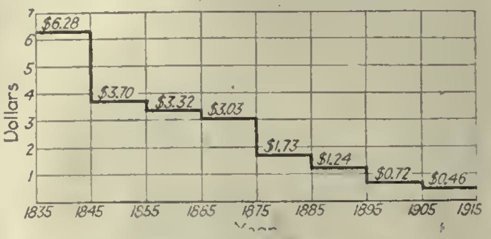
All the heaving investigated was due to the lack of or improper drainage, which allowed the water to stand against the rail till it became frozen, or to the lack of proper fillers between the material and the rail, which allowed the snow and ice to become driven into the space by the action of the car wheel and other vehicles and there to expand when the temperature lowered.

In all cases, in four different cities, the paving that was affected was in and around car tracks which were laid with T rail. Both brick and wood block that were laid against girder rails, which permitted a close bond and did not allow the formation of ice against the tracks, showed no heaving as the results of the low temperatures.

Streets paved with all three materials, upon which car lines were not laid, showed no action caused by frost or freezing.

Fire Losses Show Striking Decrease

Evidence of the effect of careful selection of risks and of the great increase in the number of fire-resistive buildings and in the use of sprinkler systems is seen in the striking reduction in fire losses reported by the Manufacturers Mutual Fire Insurance Company. As shown in the accompanying diagram, the average fire loss in dollars per thousand dollars of insurance has decreased from $6.28 in the decade 1835-1845 to $0.46 in 1905-1915.



FIRE LOSSES AVERAGED BY DECADES IN DOLLARS PER THOUSAND DOLLARS OF INSURANCE

Since 1902 the water damage due to sprinkler accidents is included with the fire losses, and since 1913 the damage by windstorm has also been included. As this is a mutual company, in which the fire losses are assessed pro rata upon all policy holders, the records show clearly the direct benefits to all insurers as a result of the strict limitations of risk and the use of sprinkler systems.

Vehicle Loads Now Limited in Ontario

A LAW limiting the load of vehicles operating on the highways of the Province of Ontario, Canada, has just been enacted. While a number of the states of the union, as well as European countries, have adopted similar measures, Ontario is the first of the Canadian provinces to have such a law.

The provisions of the bill are briefly as follows:

1. No vehicle shall carry a load, including the vehicle itself, greater than 12 tons or more than 4½ tons on any one wheel.
2. No vehicle shall be operated on the highways which has any flange, rib, clamp or other device attached to its wheels which would injure the highways.
3. No vehicle shall carry a load, including the vehicle itself, which will impose a greater weight than 650 lb. per inch of tire.
4. Under certain conditions permit may be granted for moving a heavier load, but even when such a permit has been secured the operator or owner shall be responsible for all damages which may be caused.
5. No vehicle shall have a greater width than 90 in., except traction engines, which are limited to 110 in.

The measure was enacted into law through the energy of its introducer, George S. Henry, member of the Legislative Assembly of Ontario for East York.

Patrol System Improves Condition of Dirt Roads 50 Per Cent at Low Cost

System Started in Clayton County, Iowa, Three Years Ago Has Proved Its Value in Efficiency and Economy in Maintenance Work

By E. B. TOURTELLOT
County Engineer, Clayton County, Iowa

THREE years ago Clayton County, Iowa, started a patrol system for the maintenance of its dirt roads. To-day the condition of the roads in the county is 50 per cent better than it was then. They are better drained, better dragged and have easier grades. This is attributed to the fact that experienced road men are on the job at the right time.

Use Drag at Right Time

To drag a road at the right time is acknowledged to be the secret of a well-kept road. The right time to drag roads is usually a matter of judgment with the individual, or, perhaps, a lack of judgment, since little attention is paid to the character of the soil and the season of the year. The result is that many dirt roads are dragged either too early or too late. There must be organization to give good results and that organization must have a head in order to operate in an efficient manner. Realizing the lack of system in the old methods of road maintenance, the writer conceived the idea of organizing the labor on Clayton County roads into a patrol system, the head of which was to be the board of supervisors and the engineer. The system was intended not merely for road dragging purpose, but also for repair and permanent work.

The county is located in the northeastern part of Iowa, and borders on the Mississippi River. It comprises about 810 sq. miles of area and is cut by two fair-sized rivers.

Its elevations range from 600 to 1250 ft. above sea level. All the streams in the county are cutting rapidly. The surface over the larger part of the country is made up of a light clay, which washes very readily, and, at the same time, drains rapidly. This permits early dragging.

There are over 1350 miles of roads in the county, the county system totaling about 226 miles. The towns, with the exception of three, are situated in the valley at an elevation of from 555 to 600 ft. above sea level, or about 400 to 500 ft. below the surrounding ridges. This requires a limiting grade for the road somewhat in excess of the average requirements.

Roads Need More Than Average Amount of Repairs

The roads of Clayton County need more than the ordinary amount of care if they are to be kept passable. Gulleys of from 8 to 10 ft. deep form within a few days along the center of hill roads, where proper care had been lacking in turning the water from the ruts.

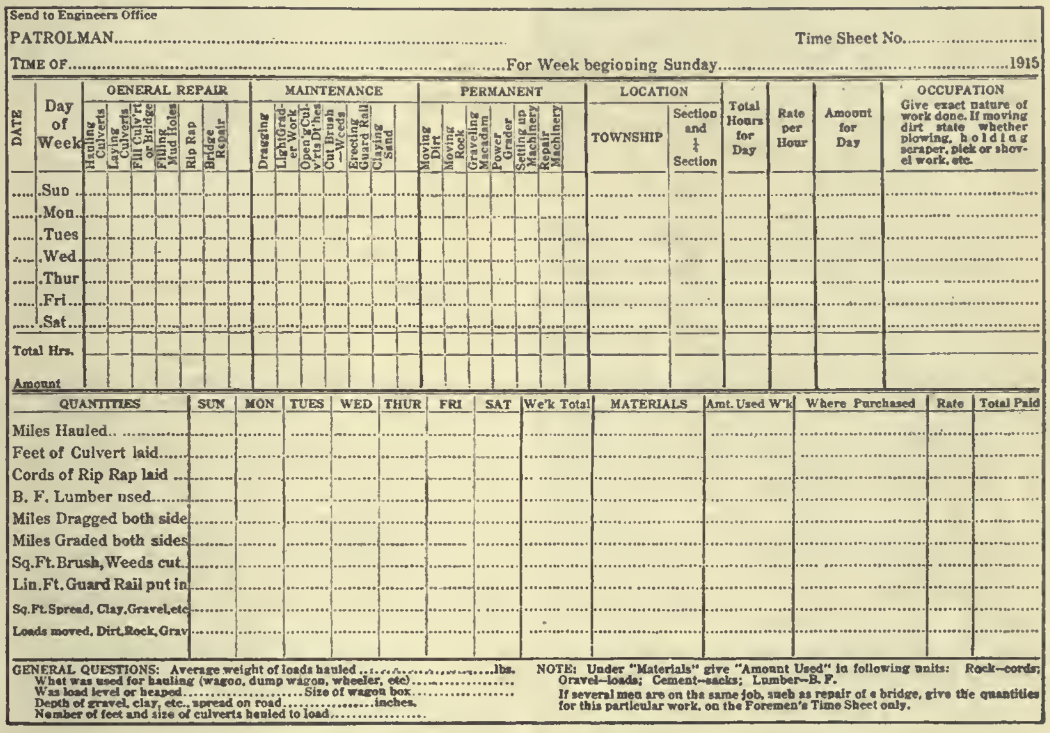
The patrol system used covers the entire mileage of the county roads, the average length of each patrol being 10 miles. This length was reduced during the past season to about 7 miles in parts of the county.

Supervisors Select Patrolmen

The selection of patrolmen rests with the supervisors, each attending to the covering of the road in his district. Men of experience in road work, and capable of handling a gang, if necessary, are the type selected as a rule, although it is sometimes difficult to get the right man.

Patrolmen Under Contract

The patrolmen are under a written contract to work for the county at the time and place designated by the board of supervisors or the engineer. In the past they were required to give a bond to insure the care and return of tools. This year this requirement was struck out, as it had not been found necessary. The average price paid to patrolmen throughout the county is 27½ cents per man per hour. A man and team is paid 47½ cents per hour, and 10 cents per hour is paid for each extra horse. Extra help is paid for at the rate of 25 cents per man per hour and for a man and team at 45 cents per hour. The patrolman is authorized to hire assistants for dragging.



Send to Engineers Office

PATROLMAN.. Time Sheet No..........................

TIME OF..For Week begioning Sunday..1915

DATE	Day of Week	GENERAL REPAIR							MAINTENANCE							PERMANENT							LOCATION		Total Hours for Day	Rate per Hour	Amount for Day	OCCUPATION Give exact nature of work done. If moving dirt state whether plowing, holding scraper, pick or shovel work, etc.
		Hauling Culverts	Laying Culverts	Fill Culv'rt or Bridge	Filling Mud Holes	Rip Rap	Bridge Repair		Dragging	LightGrader Work	Open'g Culv'rts Dt'hes	Cut Brush —Weeds	Erecting Guard Rail	Claying Sand		Moving Dirt	Moving Rock	Graveling Macadam	Power Grader	Setting up Machinery	Repair Machinery		TOWNSHIP	Section and ¼ Section				
......	Sun																											
......	Mon																											
......	Tues																											
......	Wed																											
......	Thur																											
......	Fri																											
......	Sat																											
Total Hrs.																												
Amount																												

QUANTITIES	SUN	MON	TUES	WED	THUR	FRI	SAT	We'k Total	MATERIALS	Amt. Used W'k	Where Purchased	Rate	Total Paid
Miles Hauled..													
Feet of Culvert laid													
Cords of Rip Rap laid													
B. F. Lumber used													
Miles Dragged both side													
Miles Graded both sides													
Sq.Ft. Brush, Weeds cut													
Lin.Ft. Guard Rail put in													
Sq.Ft. Spread, Clay, Gravel, etc													
Loads moved, Dirt, Rock, Grav													

GENERAL QUESTIONS: Average weight of loads hauled ....lbs.
What was used for hauling (wagon, dump wagon, wheeler, etc)........................
Was load level or heaped......................Size of wagon box.....................
Depth of gravel, clay, etc., spread on road.................inches.
Number of feet and size of culverts hauled to load.................

NOTE: Under "Materials" give "Amount Used" in following units: Rock—cords; Gravel—loads; Cement—sacks; Lumber—B. F.
If several men are on the same job, such as repair of a bridge, give the quantities for this particular work, on the Foremen's Time Sheet only.

PATROLMAN'S TIME SHEET PROVIDES BASIS OF COST DATA COMPILATIONS

All road tools are supplied by the county with the understanding that the patrolmen will take reasonable care of them. At the close of the season an inventory of all tools, supplies and road material is made and sent to the engineer.

Primary Object of System

The primary object of the patrol system is to keep the road in passable condition. In addition to maintenance the patrolman has charge of any permanent work outside of blade grader work, which is done on his patrol. If advisable, one or more patrolmen are called to the assistance of another on any work of considerable size, the patrolman of the district in which the work is done being in charge. In no case, though, is dragging or emergency repair work neglected for this purpose. The patrolman is also used on bridge or other repairs on township roads in the vicinity of his patrol.

Not all of the patrolmen depend on road work for a living, although several were employed throughout the season. They are, however, under obligation to report for the county at any time the board of supervisors or engineer demand their services.

All maintenance work on the patrol system is under the inspection of the supervisor or engineer. At the beginning of the season a trip is usually made by the supervisor of the district, or by the engineer, in company with the patrolmen, and the work of the season is outlined. All permanent work is indicated by the engineer, who superintends the construction.

Sheets Used for Time-Keeping

At the end of every week each patrolman sums up his time. He sends the time sheet to the engineer, who checks it, and, if any mistake is found, returns it for correction. Claim sheets are filed at the end of the month and the time shown must check with the time sheets. All time sheets are retained in the engineer's office. A space is reserved on the sheet for quantities of work done.

Requisition books are supplied each patrolmen, and no claim is allowed any dealer unless a duplicate requisition is attached. When the patrolman pays cash for the supplies or tools a receipt from the dealer must be attached to his claim.

Cost of Dragging Lessened

The total cost of dragging on the county system for 1915 was 56½ cents per mile per round trip, as compared with an average cost of 71 3/10 cents per mile per round trip for all the counties of the State.

The average rate paid throughout the State per hour for a man and a team during the past season was 47½ cents per hour, the same as paid Clayton County's patrolmen. The time required to drag one mile of road per round trip is about one hour. The average number of horses used to each drag last season was three, which means a cost of 47½ cents plus 10 cents or 57½ cents per mile per round trip. This checks within a cent of the average cost shown above. If a mile can be double-dragged in one hour with three horses in Clayton County it surely should be done in any other county in the State where the average rate is shown to be 71.3 cents. In other words, the average county in the State is paying the price of 1¼ miles for the dragging of one mile of road.

Why the Patrol System Pays

The patrol system pays because it is more efficient. Results have shown that the county roads in Clayton County are today fully 50 per cent better than they were three years ago. They are better drained, better dragged, have better grades and are better for passing. This is because experienced road men are on the job when they should be. They have easier and wider roadways because men are working constantly to eliminate the heavy grades and to widen the narrow places.

It is the economical system. Figures show that for 1915 Clayton County paid less per mile for the dragging of a county road than the average county in the State. Furthermore, when roads are dragged at the right time, the surface is left in better condition than when dragged too early or too late, and the cost of maintenance is diminished in proportion.

Geodetic Survey Doing Valuable Work in Field of Terrestrial Magnetism

Because of its extensive compilations of data relating to the change of the compass direction from time to time, the U. S. Coast and Geodetic Survey is able to furnish promptly information of priceless value in the adjudication of disputed land boundaries, the bearings of which were referred to the compass direction when originally laid out, 100 to 150 years or more ago. Meridian lines for the use of surveyors have been established at many county seats throughout the country, magnetic data at sea have been accumulated on cruises of the coast survey vessels, and five magnetic observatories, where the countless fluctuations of the earth's magnetism are continuously being recorded, are at present in operation under the direction of the Survey. At the present time in the New England States, the north end of the compass is moving west at the rate of about 6 min. per annum. Thus, instead of a change of 1 deg. in 20 years, as is frequently assumed, there may be a change of 1 deg. in 10 years or even in 5 years or less, depending entirely upon geographic location.

Portable Telephone for Forest Service Control

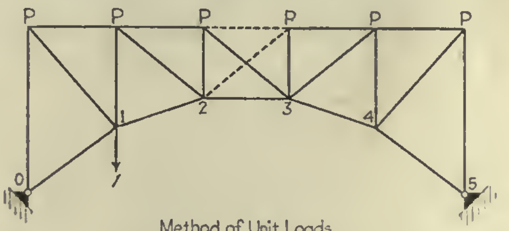
District rangers and field men of the forest service during the coming season will use a portable telephone, made of aluminum and weighing 2½ lb. This instrument, which is to replace the 10-lb. telephone set now in use, is provided with a few yards of light emergency wire and a short piece of heavy wire to make the ground connection. When it is to be connected for use, one end of the emergency wire is thrown over the telephone line and the two ends are connected to the portable instrument which, in turn, is connected to the ground wire. At the receiving station the call from the portable instruments comes in as a screeching sound from a small megaphone-shaped apparatus specially provided. The equipment was invented by R. B. Adams, a Forest Service employee at Missoula, Mont.

Truss Deflections Accurately Determined by Angle Changes and Elastic Weights

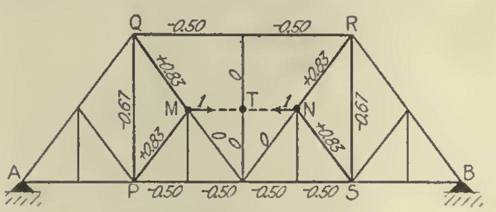
Different Methods Explained and Compared—Practical Formulas and Diagrams, Designed to Save Time, Are Illustrated by Examples—Part 1

By D. B. STEINMAN
Special Assistant to Gustav Lindenthal, Consulting Engineer, New York City

RECOGNIZING the necessity for accuracy in the determination of elastic deflections of truss bridges, particularly for long-span and indeterminate higher structures, there is here developed a treatment of truss deflections including some new formulas and diagrams, designed to save time in the accurate analysis of such problems. Four general methods which can be used in the solution of these problems are explained and compared. The method of unit loads, the method of angle changes and the method of elastic weights are described in detail and applied to examples illustrating the advantages of each method —examples including the two-hinged arch and various simple truss problems. The relations between influence lines for stresses or reactions and deflection diagrams are also considered.



Method of Unit Loads Applied to a Two-Hinged Arch
FIG. 1



To Find the Change of Distance Between Two Points of a Truss
FIG. 2

Applications and First Step

In the planning and execution of any important bridge project a number of problems arise which involve a determination of the elastic deflections of the structure. In a previous article ("The Elastic Curve Applied to the Design of the Sciotoville Bridge" in the Engineering Record of Aug. 28, 1915, page 258) the writer showed how a curve of deflections is used as the basis for the design of indeterminate structures. Other purposes for which deflection studies are necessary are: Comparing the maximum deflections in different designs for a given project; making provision for camber in long spans; laying out or checking a cambered truss in shop or yard when assembled for reaming; fixing the elevations for falsework or centering; checking the elevations of a truss or arch after it is swung free from the falsework; checking the elevations of a cantilever, or of a truss erected by the cantilever method, at different stages of the erection; planning or controlling jacking operations or other adjustments during erection; designing latching details at the ends of a drawbridge; designing expansion details and determining the movement to be provided for at rocker or roller bearings; and making estimates of the secondary stresses resulting from the deformations of the structure.

The first step in determining the deformations of a truss under any loading is to calculate the elastic strain (elongation or compression) produced by that loading in each member of the structure. This strain is given by the familiar formula

$$\Delta s = \frac{S.s}{E\,A} \qquad (1)$$

where S is the stress (tension or compression) in the member, determined by any of the usual methods of stress analysis, s is the length of the member and A its area of cross-section. In investigating the deformations due to temperature, the above formula is replaced by

$$\Delta s = e.t.s \qquad (2)$$

where t is the change in the temperature of one or more points of the structure. The the member and e is the coefficient of expansion. The sign of Δs is taken + or — according as it represents an increase or decrease in the length of the member.

General Problem—Methods of Solution

The general problem of truss deflections may be thus stated: Given the elongations or compressions Δs in all the members of a truss, calculated by eq. (1) or (2), it is required to find the resulting deflection δ of problem thus stated is a purely kinematic one; its solution is independent of the loading and depends only upon the geometry of the structure. There are four different methods of solving this problem:

1. Graphically—By the Williot Diagram.
2. Analytically—By the Method of Unit Loads.
3. By the Method of Angle Changes.
4. By the Method of Elastic Weights.

As will appear later, each of these methods has its peculiar merits and, as there are different investigations or problems for which each is best adapted, the bridge engineer will find it advantageous to have all four methods at his disposal. In general, each example is selected to illustrate the advantages of the particular method applied.

1—The Williot Diagram

This method is too well known to require explanatory description here. The Williot diagram is simply a graphic expression of the geometric relations between the given strains, the resulting angular rotations of the members and the desired panel point deflections. The strains are plotted as vectors, and the resulting deflections of the panel points are scaled directly from the diagram.

The advantage of this method is the completeness of its information. It gives, in a single construction, both the horizontal and vertical displacement of every point in the structure. However, in common with all graphic methods, the Williot diagram possesses the disadvantage of lack of precision when compared with analytical procedures; a slight inaccuracy in a single line, instead of being confined in its effect to the immediate panel point, will introduce errors, usually increasing in magnitude, in the positions of all the succeeding points in the diagram.

2—The Method of Unit Loads

When the deflection of a single point or of a small number of points is desired, the method of unit loads is best, being superior to the Williot diagram in speed as well as precision. It consists in applying a load of unity at the panel point whose deflection is sought, acting in the direction of the desired deflection, and finding the resulting stresses in all the members of the structure; when these stresses S_1 are multiplied by the given strains Δs in the respective members, the algebraic sum of the products will give the desired deflections δ; thus,

$$\delta = \Sigma S_1.\Delta s \qquad (3)$$

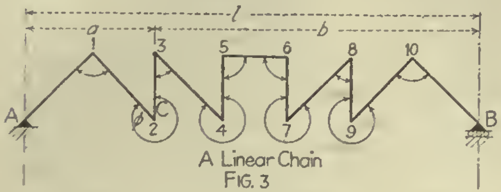
For a simple proof of this formula, consider any member and any panel point of a truss. Let S_1 be the stress in the member produced by a load 1 at the panel point, and let δ be the deflection of the panel point produced by any elongation Δs in the member. Then S_1 and 1 are a pair of forces in equilibrium and Δs and δ are a pair of mutually consistent displacements of their points of application. By the principle of "virtual velocities," or the fundamental law of machines, the ratio of two forces in equilibrium is equal to the inverse ratio of any small, simultaneous displacements of their points of application in the directions of the forces. Consequently we have the proportion

$$S_1 : 1 = \delta : \Delta s$$

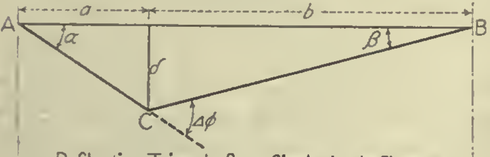
Hence

$$\delta = S_1.\Delta s \qquad (3a)$$

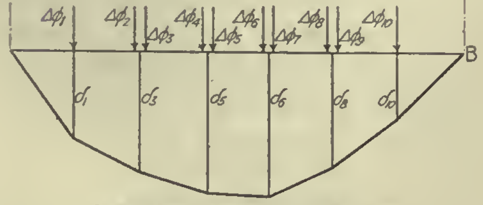
This represents the contribution of a single member to the deflection of any panel point.



A Linear Chain
FIG. 3



Deflection Triangle for a Single Angle Change
FIG. 4



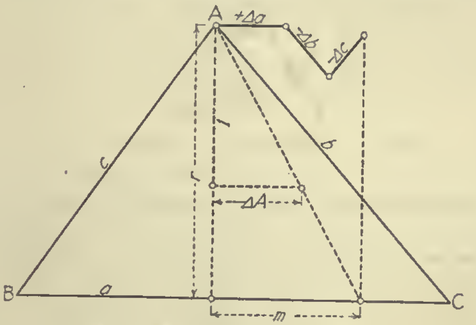
Deflection Diagram for all the Angle Changes in Linear Chain
FIG. 5

Adding such expressions for all the members of a structure, we obtain the total deflection of the panel point as given above in (3).

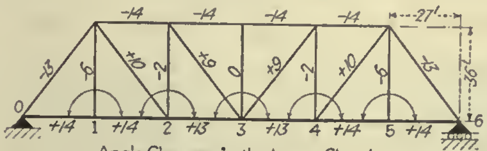
It should be noted that the values of Δs are those due to the given loading, while the values of S_1 are independent of that loading but depend only upon the location of the panel point under investigation and the relative dimensions of the structure.

Example 1—To Find the Deflections of a Two-Hinged Arch

In the two-hinged spandrel-braced arch represented in Fig. 1, it is required to find the vertical deflection of each of the lower panel points 1, 2, 3, 4, caused by the loading ΣP. The stresses S due to this loading and the resulting values of Δs are determined for all the members. A unit load is then applied at panel point 1, and the stresses S_1 calculated with the arch rendered statically determinate by removing the redundant members shown by dotted lines. This simplification corresponds to neglecting a system of stresses comprising the stresses S_1 in the redundant members and the stresses which these would produce in the rest of the members, and is justified because this system of stresses is in internal equilibrium without the aid of any external forces, and would therefore yield a zero contribution to the value of $\Sigma S_1.\Delta s$. With the values of S_1 thus determined, the deflection of panel point 1 is given by $\delta = \Sigma S_1.\Delta s$. As the structure and given loading are symmetrical, panel point 4 will have the same deflection. The unit load is then applied at panel point 2 in order to find the deflections at points 2 and 3.



Graphic Method for Angle Changes
FIG. 6



Angle Changes in the Lower Chord
FIG. 7

The above device of omitting the redundant members is a valuable time-saver in finding deflections in indeterminate structures. For example, in finding the deflections in any span of a continuous truss, after the values of Δs have been determined, the span is severed from the adjoining spans by omitting the top-chord member over each pier before finding the values of S_1.

Example 2—To Find the Change of Distance Between Two Points of a Truss

In the web system shown in Fig. 2, M N represents a longitudinal strut provided for bracing the vertical post at T. It is assumed that the strains Δs in all the members produced by maximum loading are known, and it is required to find the resulting change in the distance M N so that suitable provision may be made for such expansion.

For this purpose a unit force is considered applied as shown at the points M and N, and the resulting stresses S_1 are marked in the figure. It will be observed that these stresses are confined to the members indicated by heavy lines. Multiplying these values of S_1 by the known values of the strains Δs in the same members, the sum $\delta = \Sigma S_1.\Delta s$ will give the change in the distance M N. Since the unit force was assumed to act in such direction as to draw M and N together, a plus result for δ represents a shortening and a minus result an increase of the distance M N.

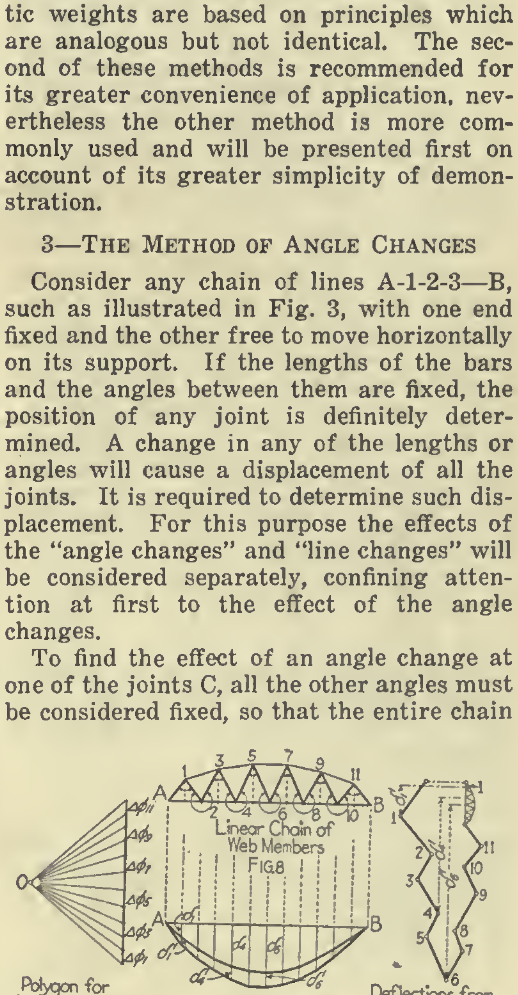
For finding the deflections of one or more isolated points, as in the above examples, the method of unit loads is evidently the most expeditious. As the number of points is increased, however, it loses its advantage over other methods as it requires a new stress analysis of the entire truss for each deflection desired. When the vertical deflections of a large number of points in a structure are desired, the third or fourth of the above methods becomes most advantageous; these are both more precise than the Williot diagram and more expeditious than the method of unit loads. They are particularly adapted for plotting truss deflection diagrams, influence lines for deflections, and "elastic curves" for the design of indeterminate structures.

The methods of angle changes and of elastic weights are based on principles which are analogous but not identical. The second of these methods is recommended for its greater convenience of application, nevertheless the other method is more commonly used and will be presented first on account of its greater simplicity of demonstration.

3—The Method of Angle Changes

Consider any chain of lines A-1-2-3—B, such as illustrated in Fig. 3, with one end fixed and the other free to move horizontally on its support. If the lengths of the bars and the angles between them are fixed, the position of any joint is definitely determined. A change in any of the lengths or angles will cause a displacement of all the joints. It is required to determine such displacement. For this purpose the effects of the "angle changes" and "line changes" will be considered separately, confining attention at first to the effect of the angle changes.

To find the effect of an angle change at one of the joints C, all the other angles must be considered fixed, so that the entire chain may be conceived as composed of two rigid segments (AC, BC) hinged together at the given joint. If the angle φ at this joint is increased by any amount $\Delta\,\varphi$, the two segments will rotate downward through respective angles α and β governed by the relation (from the triangle, Fig. 4)



Linear Chain of Web Members
FIG. 8

Polygon for Angle Changes
FIG. 9

Deflection Diagram
FIG. 10

Deflections from Line Changes
FIG. 11

$$\alpha + \beta = \Delta\,\varphi \qquad (a)$$

The resulting deflection of the hinge point C, common to both segments will be

$$\delta = a{\cdot}\alpha = b{\cdot}\beta \qquad (b)$$

From equations (a) and (b)

$$\delta = \frac{a{\cdot}b}{l}\Delta\,\varphi \qquad (c)$$

as the expression for the maximum ordinate of the deflection triangle ACB, Fig. 4.

Comparing eq. (c) with the expression for the corresponding ordinate of the moment triangle for a "weight" $\Delta\,\varphi$ applied at C, the two triangles prove to be identical. In other words, the deflection triangle for any angle change is identical with the moment triangle for a weight equal to the angle change and applied at the same point. To find the combined effect of all the angle changes, we could add the superimposed ordinates of the several moment triangles; but this is equivalent to constructing directly the moment diagram (funicular polygon) for all the angle changes applied as weights at the respective joints. The ordinates of this deflection diagram, Fig. 5, multiplied by the pole distance used in its construction, will represent the total deflections caused by the angle changes.

It is evident that a chain of lines, such as treated above, may be formed from the members of a truss, selecting those which connect the panel points whose deflections are desired. We have thus proved the general principle of the method of angle changes, which may be stated as follows:

> The deflection diagram of a chain of truss members, if the line changes are neglected, is identical with the moment diagram obtained by applying as a weight at each joint the angle change at that joint.

It will now be shown how the angle changes in such a chain of truss members may be determined.

DETERMINATION OF THE ANGLE CHANGES

When the strains Δs in three members forming a triangle are known, the resulting changes in the angles of the triangle, Fig. 6, may be determined either analytically or graphically. If a, b, c, denote the lengths of the three sides; Δa, Δb, Δc, their respective elongations (negative if compression); and A, B, C, the opposite angles, respectively, then the change in any angle A is given by the formula

$$\Delta A=\left(\frac{\Delta a}{a}-\frac{\Delta b}{b}\right)\cot C+\left(\frac{\Delta a}{a}-\frac{\Delta c}{c}\right)\cot B \tag{4}$$

If the strains Δs have not yet been calculated, a short-cut may be applied by using the intensities of stress or unit stresses u defined by

$$u=\frac{S}{A}$$

If u_1, u_2, u_3, are the unit stresses in the three members, a, b and c respectively, the above formula (4) may be written in the following form:

$$E.\,\Delta A = (u_1 - u_2) \cot C + (u_1 - u_3) \cot B \tag{5}$$

The angle changes may be found graphically by the construction shown in Fig. 6. Using any convenient scale, the vector summation of the three strains is constructed as a chain of lines (Δa, Δb, Δc), all elongations being plotted in the direction of the cyclical succession of the sides of the triangle ABC and all compressions being plotted in the reverse direction. To find the change in any angle, this chain of lines is projected upon the opposite side of the triangle. This projection m, measured to the linear scale of the plotted strains and divided by the corresponding altitude r, will give the actual change in the angle in radians. Instead of performing this division, the angle change may be obtained directly as the intercept ΔA drawn parallel to m at a unit distance from the vertex. The direct analytical equivalent of this method is represented by the formula

$$\Delta A=\frac{\Delta a - \Delta b.\cos C - \Delta c.\cos B}{r} \tag{6}$$

To find the total change of angle $\Delta\varphi$ between two chord members the three component angle changes may be found separately from the respective triangles by eq. (4), (5) or (6).

EXAMPLES—METHOD OF ANGLE CHANGES

Example 3—To find the deflections of the lower chord of a simple truss by the method of angle changes.

Fig. 7 gives the unit stresses u (in thousands of pounds per square inch) in all the members of a truss under the action of a symmetrical load. Treating the lower chord as a chain of lines, the angle changes at the joints are calculated by eq. (5). Thus,

$$E.\Delta\varphi_1 = (-13-14)\ 0.75 + (-13+6)\ 1.33 + (10+6)\ 1.33 + (10-14)\ 0.75 = -11.25$$

$$E.\Delta\varphi_2 = 0.75\ (-14-10+9-13) + 1.33\ (-6-10+9+2) = -27.65$$

$$E.\Delta\varphi_3 = 2\ [0.75\ (-14-9) + 1.33\ (-2-9)] = -63.80$$

Applying these angle changes as weights at the respective panel points, the resulting shears and bending moments are obtained successively by summation as follows:

Panel Point	E × Angle Change $E.\Delta\phi$	Shear	Moment M	Deflection δ In.
0			0	0
		70.80		
1	11.25		70.80	0.76
		59.55		
2	27.65		130.35	1.41
		31.90		
3	63.80		162.25	1.75

In the above table, the values of $E.\Delta\varphi$ were used instead of the angle changes, and the panel length was assumed as unity in figuring the moments (M). Consequently the values obtained for M must be multiplied by the panel length and divided by E (= 30,000) to obtain the deflections, which are listed in the last column.

The results for δ in this case require no correction for the line changes of the members in the chain, as all these members are horizontal and consequently their line changes can have no effect on the vertical deflections.

Example 4—To find the deflections of the upper chord panel points of a truss.

In a truss with verticals, like that of Fig. 7, the lower chord deflection may first be found as explained above; the deflections of the upper panel points are then equal to those of the lower panel points augmented (or diminished) by the compressions (or elongations) of the respective posts (or hangers). This rule can be expressed by the formula

$$\delta_l = \delta_u + \Delta v \tag{7}$$

The deflections of the upper panel points may also be found directly by treating the upper chord as the chain of lines and applying the method of angle changes just as in the preceding example. In this case, however, the results obtained for the deflections δ must be corrected for the effect of the line changes in the members of the chain. If the loading is symmetrical and the top chord straight, the correction is simply made by adding the vertical component of the compression in the end posts.

Example 5—To find the deflections of a truss by means of a chain of web members.

Instead of using the top or bottom chord, the linear chain may be formed of the web members of a truss (Fig. 8; see also Fig. 3). This procedure is sometimes used because it appears more expeditious than the others; the angle changes are more easily computed, each being derived from a single triangle; and the solution gives the deflections of all the panel points instead of those of a single chord. The disadvantage of this method, however, lies in the necessity of making a special correction for the line changes in the web members, unless it is decided to neglect such correction.

The angle changes determined for the truss in Fig. 8 are plotted in a force polygon, Fig. 9, and the corresponding funicular polygon, drawn below the truss, represents the desired deflection diagram (Fig. 10).

CORRECTION FOR LINE CHANGES

The above method gives the deflections caused by the angular deformations (angle changes) between the members of the chain. To these deflections must be added those produced by the pure elongations (line changes) of the members in the chain. In Fig. 7 the effect of the line changes upon the vertical deflections is zero, as all of the members are horizontal. In the systems of Fig. 8, however, the effect of the linear deformations is considerable and a special correction must therefore be applied to the results of the above procedure. This is a point which has been overlooked by some writers, although the resulting error in the deflections may amount to 15 per cent.

The correction may be made graphically as follows: A simple Williot diagram, Fig. 11, is constructed by the vector addition of the elongations of the members, but with the resulting rotations omitted since these are already included in the effect of the angle changes. To this diagram is attached a small reproduction of the structure to provide for the rotation of the system back to its horizontally constraining abutment, a correction which is not required when the strains are symmetrical. The vertical deflections of the different panel points are then scaled from the resulting diagram and added to the values of the deflections determined from the angle changes. This correction is shown graphically in Fig. 10.

If the line changes are symmetrical, the correction to the deflection at any panel point is given analytically by

$$\delta' = \Sigma\,\Delta s.\sin\alpha = \frac{1}{E}\Sigma\,u.v \tag{8}$$

where u is the intensity of stress and v is the vertical projection of each member, and where the summation extends from either end of the span to the panel point. If the line changes are not symmetrical, eq. (8) will give a different result for each segment of the span; the true value will lie between these and may be obtained by interpolation in the inverse ratio of the lengths of the segments.

(*To be concluded*)

United States Begins to Produce Potash

Potash salts were produced in the United States in 1915 to the value of $342,000, according to the U. S. Geological Survey. Though this figure is of interest as showing a small beginning in the domestic potash industry, it is of little importance if the total need to the country is considered, for it represents a quantity consumed in less than a week under normal conditions. Experimental work on the production of potash salts was active during the year, and, in places, the activity has been succeeded by the construction of plants. Manufacturers of Portland cement, having had their attention directed to a possible revenue from by-product potash, are investigating their raw materials.

Test of Mushroom Flat Slab in Seattle Warehouse Shows High Local Stresses

Official Investigation of Building by Extensometer Measurements Under Live Loads Carried to 1.1 Times the Design Load

By D. E. HOOKER
Assistant Superintendent of Buildings, City of Seattle

RESULTS of extensometer measurements of the strains in steel and concrete of a mushroom flat-slab floor recently reported to the building department of Seattle, Wash., show high local stresses near the columns in both steel and concrete, with many cracks in the latter at a maximum test load equal to 1.1 times the design loading. Permanent sets were indicated by the measurements, and the final deflection after the removal of all load was a large percentage of the maximum deflection under load.

In August, 1913, the present Seattle building ordinance became effective. It is stated in the ordinance that the regulations pertaining to reinforced-concrete work "are based upon tests of the ordinary monolithic types of reinforced concrete, consisting of slabs, beams, girders and columns. But it is not intended to exclude other types of reinforced-concrete construction which meet the requirements of safety contained in this code, subject to the approval of the superintendent of buildings." It is provided that the superintendent of buildings may require tests to determinne the sufficiency of any proposed system or type of construction.

In view of the foregoing provisions of the ordinance, C. A. P. Turner, in the latter part of 1914, applied to the building department for approval of the mushroom system of construction. Before a decision in the matter had been reached, the Port of Seattle Commission filed an application for a permit to construct a large warehouse and office building of mushroom flat-slab construction. After considerable delay the superintendent of buildings, T. Josenhans, consented to issue the permit, with the understanding that an extensometer test of the building would be made to determine "the strength and sufficiency of the mushroom slab for the purpose of enabling the building department to secure its own data for the treatment of subsequent applications for mushroom constructions."

The test subsequently made after completion of the building was conducted for the building department by Dean Almon H. Fuller and Prof. Charles C. More of the college of engineering of the University of Washington. The data hereinafter set forth are taken from their report to the superintendent of buildings.

Location of Test Panels

The building, ordinarily referred to as the Bell Street Warehouse, is approximately 80 x 435 ft., 60 ft. high. The warm storage portion, in which the test area was selected, consists of four stories. The test area comprised four contiguous panels on the third floor, including two wall panels.

The floor was designed for a live load of 500 lb. per square foot, and a dead load of 144 lb. per square foot, including the ¾-in. top finish. The mean actual thickness of the rough slab measured on approximately 5-ft. sections was 10.98 in., the design thickness being 10¾ in.

The location and construction of the tested panels and the position of the load are shown on Figs. 1 and 2. The loading material was sheet tin in wooden boxes. Three sets of measurements were taken, after average uniform loadings of 265, 470 and 700 lb. per square foot had been applied in three increments.

Tapered Plugs Used

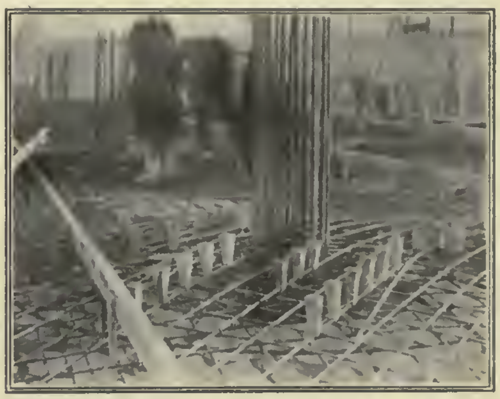
After the reinforcing steel of the slab had been placed and made ready for the pouring of the concrete, tapered wooden plugs were fastened to the steel, to be removed after pouring, leaving holes by which access to the steel could be had without undue chipping of the slab. An accompanying photograph shows some of these inserts in place.

The gage-line holes were drilled with a No. 54 drill. For the concrete gage lines little steel plugs were set into the concrete with plaster of paris, and the holes drilled in these plugs. The readings on these were more erratic than were those on the reinforcing rods; some of the plugs, in fact, became loosened and had to be discarded. Readings were taken with Berry strain gages, the lengths of all gage lines being 8 in.

SLAB AT COLUMN 79 BEFORE TESTING

Measured Stresses

The position of the gage lines, with the stresses at each due to the three increments of live load, as computed from the observed deformations according to the assumptions hereafter set forth, are shown on Figs. 1 and 2, in which compression in steel and tension in concrete are shown as negative quantities. The stresses shown were computed from the averages of deformations measured in most cases by three observers. The first quantity shown at each gage line is the stress occasioned by the first average live load of 265 lb. per square foot, the second quantity is that occasioned by the average load of 470 lb., and the third is the initial stress caused by the final test load of 700 lb. It should be borne in mind that the stresses and deformations herein mentioned or shown, unless otherwise noted, are those occasioned by the live load alone.



WOODEN INSERTS USED AT STEEL RODS

The slab was poured Dec. 16, 1914, in a temperature just about at freezing. The water used in mixing the concrete was heated. For several days after the slab was poured the temperature hovered around the freezing point, although there is no evidence that the concrete was touched by frost.

Placing the Test Loads

The first increment of the test load was placed on April 8, 1915, when the slab was 113 days old. The first, second and third increments of load were placed at intervals of 24 hr. Readings were taken just after the placing of each increment; also 24 hr. and again 84 hr. after the third increment was placed. After this the third increment was removed from the two wall panels and all three increments from the two interior panels, the removal occupying some three days. Readings were then taken with the 470-lb. load only in place on the two wall panels, the two interior panels being empty. The remaining load was then removed, after which two sets of readings were taken, 48 hr. apart.

The maximum stresses shown in Figs. 1 and 2 were computed from the deformations observed in the first series of readings taken after the placing of the last increment of the test load. Almost without exception the deformations at all points increased during the 84 hr. that the total load remained in place. The average increase was about 18 per cent.

Permanent Sets

After all the load was removed from the interior panels, and the third increment from the wall panels, the slab of the two inside panels recovered materially, the deformations decreasing an average of about 53 per cent of the maxima. The decrease in the deformations for the wall panels averaged about 14 per cent. The last readings taken, two days or more after removal of all load, showed an average decrease from the maximum deformations of about 58 per cent for both the wall panels and the interior panels.

Deflection readings were taken with an engineer's level; also by direct measurements between the loaded slab and the one below it, and the results are shown graphically on Fig. 3. They show a maximum deflection of 0.8 in. in the center of the north wall panel, and a permanent set at this point of 0.38 in.

The concrete of the slabs and columns was a 1:2:4 mix, the coarse aggregate being gravel. A number of 8-in. test cylinders from 12 to 16 in. long were cast during the pouring of several of the slabs and allowed to cure in and about the building. Tests of these and of several specimens cut out of the tested floor slab after removal of the load showed an ultimate strength of from 1730 to 3470 lb. per square inch. The average strength of five cylinders and two slab specimens was 2230 lb. per square inch.

TEST VALUES FOR MODULI OF ELASTICITY ARE USED

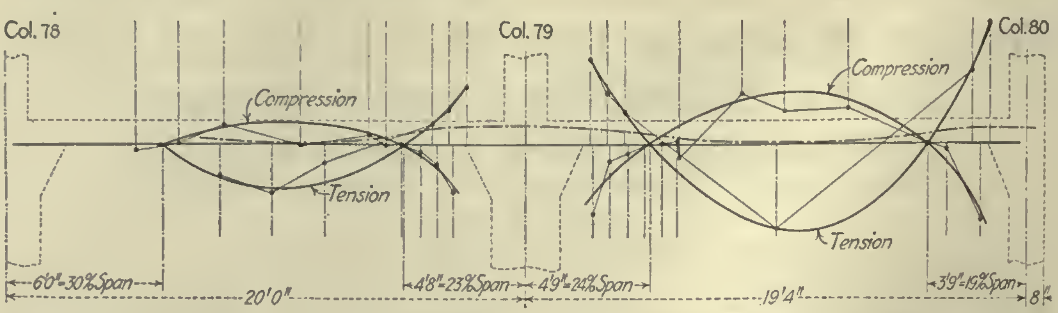


FIG. 4—APPROXIMATE STRESS CURVES ON LINE BETWEEN COLUMNS 78, 79, 80

Measurements of deformation of two cylinders and one slab specimen, under load applied at a similar time rate as the test load, led to the conclusion that the modulus of elasticity of the concrete could fairly, for the purpose of computing stresses from the initial deformations observed after the placing of each increment of load, be assumed to be 2,500,000 lb. per square inch. This modulus has been used in computing the stresses shown in Figs. 1 and 2. On this assumption a deformation of one dial unit of 0.0002 is equivalent to a stress of 62.5 lb. per square inch.

Experiments were made as quickly as possible after completion of the test to determine the moisture content, absorption and specific gravity of the concrete. These showed that the concrete specimens cut out of the slab had a moisture content of about 7.5 per cent, as compared with 5 per cent for the test cylinders; a saturation of 9.5 per cent as compared with 7.6 per cent for the cylinders, and a specific gravity of 2.13 as compared with 2.23 for the cylinders.

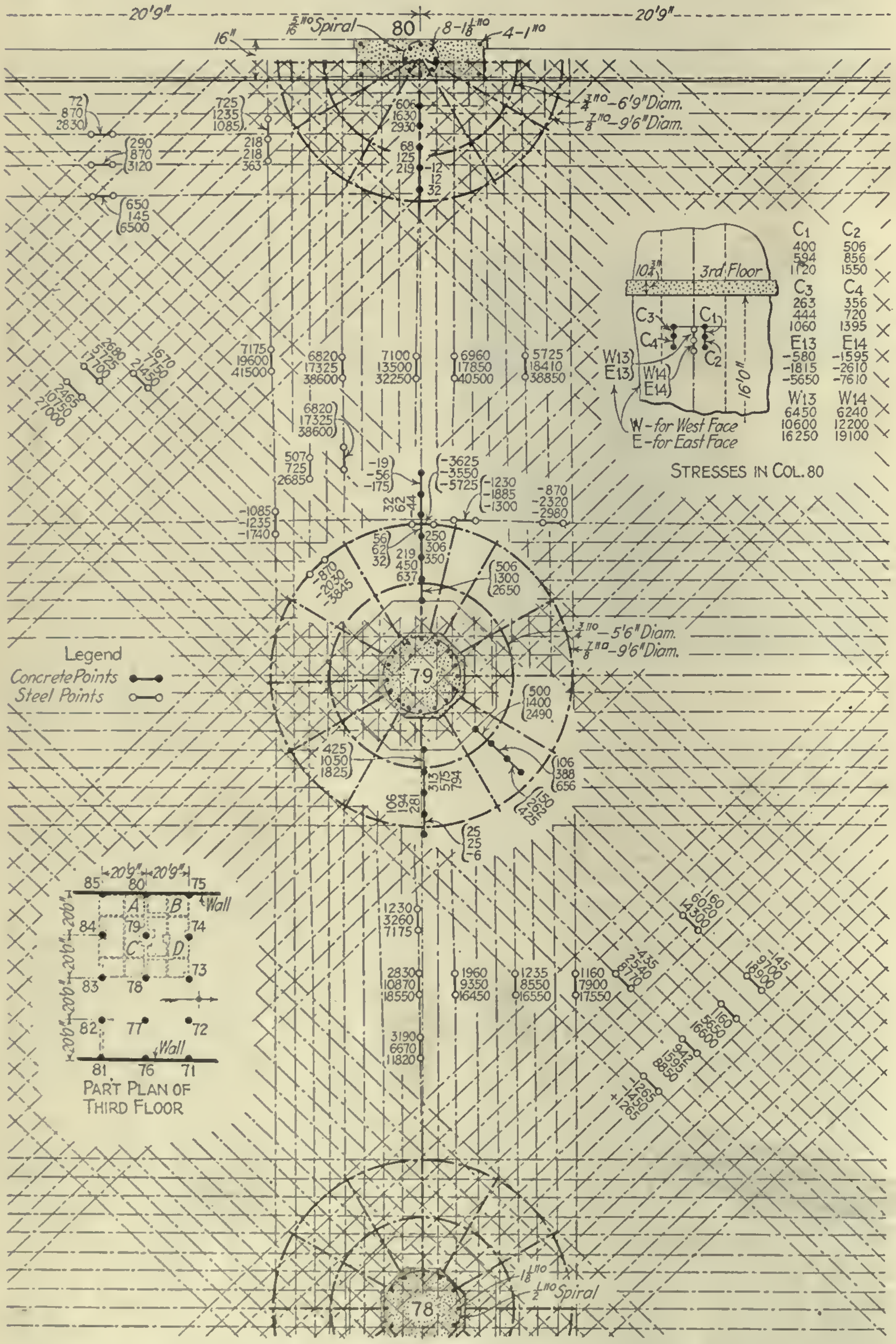


FIG. 1—STRESSES IN UNDERSIDE OF SLAB AND IN WALL COLUMN 80

Note the high concrete stresses near the column heads.

The steel used was of hard, re-rolled grade, plain round rods, with an ultimate strength of about 90,000 lb. per square inch and an elastic limit of about 50,000. The modulus of elasticity assumed from test results was 29,000,000 lb. per square inch. Hence a dial unit of deformation is equivalent to a stress of 725 lb. per square inch.

INTERPRETATION OF RESULTS

Certain outstanding features are pointed out in the official report of the test substantially as given in the following paragraphs:

The greatest deformation observed in the steel was for the point near wall column 80 on the center rod between columns 79 and 80. This, for the third day of the third increment, was 0.0140 in. This indicates a stress of 50800 lb. per square inch in the upper fibers of the rod. It is barely possible, though not probable, that the elastic limit had been reached and the actual stress was somewhat less. But it must have been in the neighborhood of 50,000 lb. per square inch.

(It should be noted that the foregoing stress was induced by the live load alone, which amounted to 1.1 times the combined design live and dead load. The foregoing live-load stress would indicate that the total stress in the rod, due to dead and live loads combined, approached 61,000 lb. per square inch.)

UNIFORM STRESSES IN STEEL BANDS

It is interesting to note the fairly uniform distribution of stress, exceeding 44,000 lb. per square inch, in points across the band of steel in the wall panel between columns 79 and 80, and to compare it with the 21,000 lb. as an average of the stresses at points across the same band in the interior panel between columns 78 and 79. There is further interest in noting that under the second increment of load (slightly less than the design live load) the comparative figures are approximately 18,000 and 9,000. The distribution in both places is more nearly uniform under the greater loads.

The center rod carries a greater stress than the others in the interior panel and a lesser one in the wall panel. As this rod was directly under an aisle, it seems natural that it should be somewhat relieved. The survey of the steel shows this rod to be misplaced in the wall panel and over column 79. This may account in part for the apparent discrepancy, and also possibly

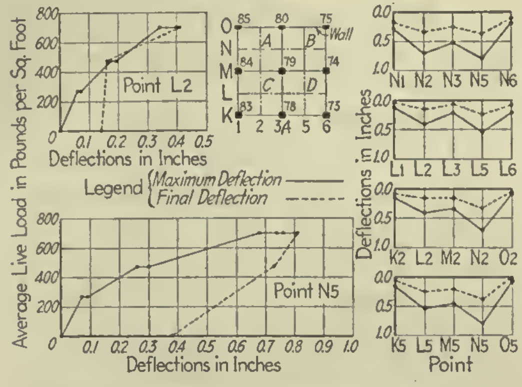


FIG. 3—INITIAL AND FINAL DEFLECTIONS

for a portion of the excessive stress at the point near wall column 80.

PROBABLE POINTS OF CONTRAFLEXURE

On Fig. 4 are plotted the stresses found at those gage lines on the center line through columns 78, 79 and 80, locating the probable points of contraflexure. These stresses are computed from the initial deformations observed after placing the third increment of load.

Lower steel deformations show the maximum stress in the northeast-southwest diagonal bands to be about the same as in the east-west bands in the interior panels. The stress in the diagonal bands was less than in the east-west bands in the wall panel; the stress in these bands, however, is greater in the wall than in the interior panels. The deformations are small in the rods parallel to the wall.

STRESSES IN THE RADIAL AND RING RODS

The upper fibers of the radial rods were subjected to tensile stresses from 16,000 to 22,000 and the inner ring rods to tensile stresses from 16,000 to 19,000 lb. per square inch. The outer ring rods were found to be in compression by about 5000 to 6000 lb. per square inch.

STRESSES IN WALL COLUMN 80

Steel deformations on the east and the west sides of wall column 80 were the most difficult to read and the results are, perhaps, the least precise of any. However, there is a tendency that is unquestionable for a good, strong, live-load tension of approximately 20,000 lb. per square inch in the west or outside rods, and a live-load compression on the inside rods of perhaps one-third as great. In both cases the stresses in the upper points, directly below the bracket, were smaller than in the ones immediately below. Concrete deformations directly below the bracket were measured, and the two lower points again showed the greater stresses—probably 1300 and 1200 lb. per square inch respectively. The upper points were doubtless stressed at least 1100 lb. per square inch.

LOAD ON WALL PANELS ONLY

It may be noted that the stresses in the wall panel and in wall column 80 are very nearly equal for the uniform load of 470 lb. on the wall panels only, and for the full load of 700 lb. on the four panels under test, and that they are far greater than for the 470-lb. load on the four panels. The precision in the above statement is not as great as the deformations would indicate, on account of the continued deformations under load and the set in the concrete.

It seems probable that the matter of unloading; that is, removing the third increment from the wall panels first, favored the wall panels somewhat, and that a full live load on wall panels would produce stresses in portions of those panels very nearly as great as one-and-a-half live load uniformly distributed over the entire floor.

CONCRETE CRACKS

A number of hair cracks were visible under the second increment of load. These were: (1) Several on the underside of the wall panels parallel to the wall; (2) one on the top of the slab near the wall and parallel to it, one around column 79 at approximately the outside of the bracket, and one along the center line of columns 78, 79 and 80 for the greater portion of the distance; (3) across the outside of wall column 80 at about the elevation of the bottom of the bracket.

The third increment of load enlarged the ones on top of floor and on wall column and developed another for a portion of the distance from columns 74, 79 and 84 and others around columns 79 and 80. This increment greatly increased the number on the lower side of the slab and extended the distribution.

A few cracks developed perpendicular to the wall through the greater portion of the central third of panel *C* and extending to about the center of panel *A*. Likewise through panel *D* and into *B*. No cracks were discovered through the interior panels *C* and *D* parallel to the wall.

The building was designed for the Port of Seattle Commission by Capt. A. O. Powell of Seattle, and C. A. P. Turner of Minneapolis. It was constructed by the Pearson Construction Company of Seattle under the superintendence of the engineering department of the Port Commission.

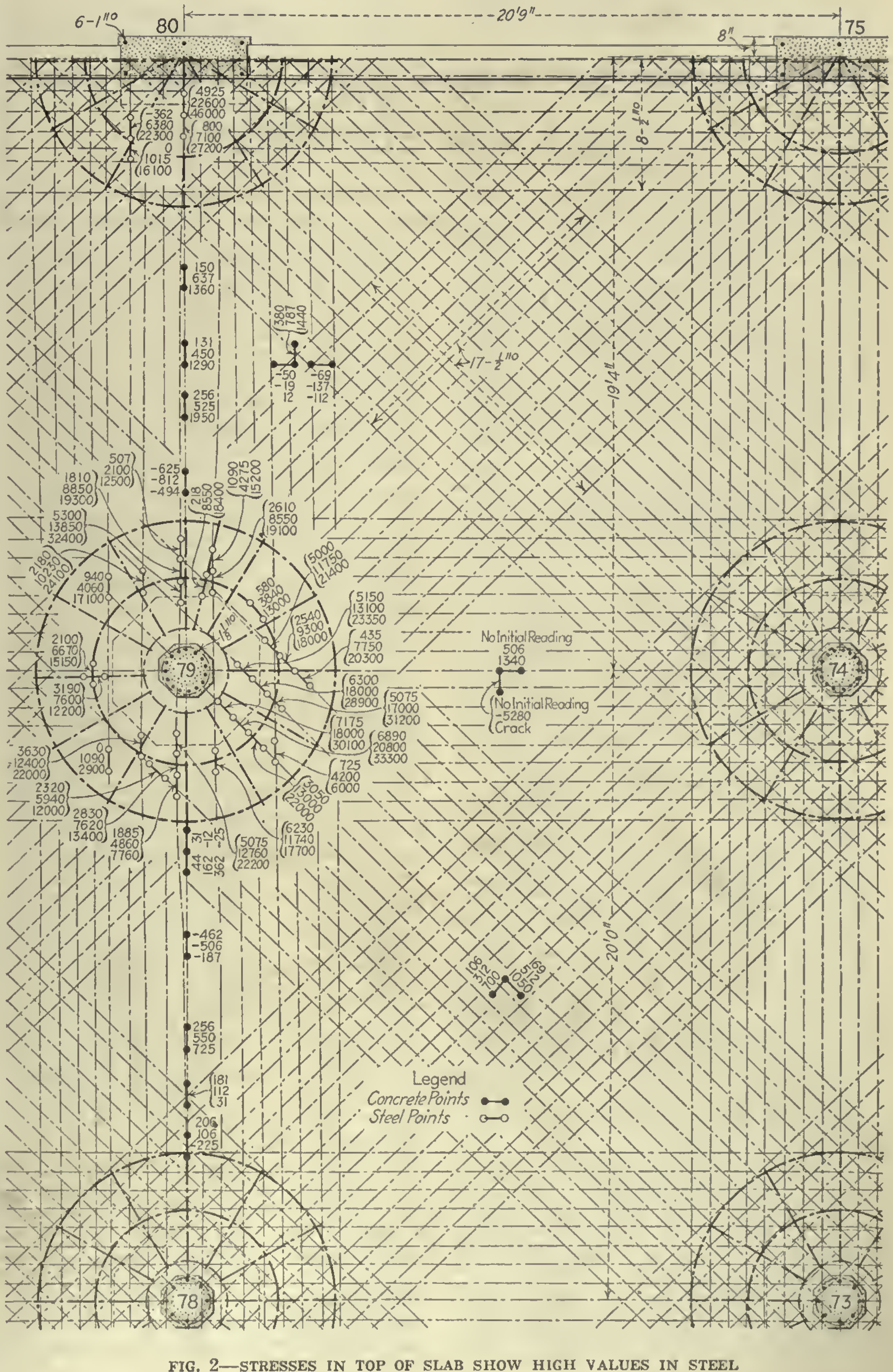


FIG. 2—STRESSES IN TOP OF SLAB SHOW HIGH VALUES IN STEEL

Literature

For the Civil Engineer and Contractor

New Publications

Building Code—City of New York. Paper, 4½ x 7½ in.; 278 pages. New York, Bureau of Buildings, Municipal Building.

The Practical Design of Steel-Framed Sheds. By Albert S. Spencer. Cloth, 6 x 10 in.; 163 pages; illustrated. New York, D. Van Nostrand Company. $3.50 net.

Journal of the Western Society of Engineers, Vol. 20, No. 10. Index to Volumes 1-20. Paper, 6 x 9 in.; 89 pages. Chicago, published by the Society, 1735 Monadnock Block.

Power Possibilities on the Raquette River. Report of New York State Conservation Commission. Paper, 6 x 9 in.; 112 pages; illustrated. Albany, State of New York Conservation Commission.

Irrigation Management. By Frederick Haynes Newell, professor of civil engineering, University of Illinois. Cloth, 5 x 7½ in.; 306 pages; illustrated. New York and London, D. Appleton & Company. $2 net.

Masonry Dam Design. By Charles E. Morrison, C. E., Ph.D., and Orrin L. Brodie, C. E. Second edition, revised and enlarged. Cloth, 6 x 9 in.; 276 pages; illustrated. New York, John Wiley & Sons, Inc. $2.50 net.

Military Preparedness and the Engineer. By Ernest F. Robinson, Captain, Corps of Engineers, National Guard of New York. Cloth, 4¼ x 6¾ in.; 224 pages; illustrated. New York, Clark Book Company, Inc. $1.50 net.

Design of Intakes, Scroll Cases and Turbine Draft Tubes for Single-Runner Turbines. By A. G. Hillberg, hydraulic engineer. Paper, 11 x 14 in.; 11 pages, illustrated. Reprinted from the Engineering Record. Copies may be obtained from the author, Park Row Building, New York.

Relation of Mineral Composition and Rock Structure to the Physical Properties of Road Materials. By E. C. E. Lord, petrographer. Bulletin 348, U. S. Department of Agriculture, Office of Public Roads. Paper, 6 x 9 in.; 26 pages; illustrated. Washington, Government Printing Office.

Road Dust Preventives—References to Books and Magazine Articles. Paper, 6 x 9 in.; 39 pages. Pittsburgh, Carnegie Library.

List representing part of the more recent literature on this subject, including general biography, non-bituminous and bituminous materials, hygienic aspects and American and foreign practice.

Street-Name Signs. By Roland S. Wallis. Bulletin 20, Engineering Extension Department Technical Service, Iowa State College. Paper, 6 x 9 in.; 47 pages; illustrated. Ames, Iowa, Iowa State College.

A profusely illustrated booklet giving many examples of good and bad methods of designating streets at street intersections. General requirements, legibility, size and style of lettering, color combinations, number and location of signs, illuminated signs, durability and cost are all treated concisely, and details of supporting devices shown.

Parks and Park Engineering. By William T. Lyle, professor of municipal engineering, Lafayette College. Cloth, 6 x 9 in.; 130 pages; illustrated. New York, John Wiley & Sons, Inc. $1.25 net.

The first book to deal with engineering features of park construction. While many of the problems which relate to park engineering, such as road construction, underdrainage and sewers are treated in various books, this text treats them in their specific relations to park construction. The chapter on labor and contracts should be especially useful to city officials.

Theory of Errors and Least Squares. A textbook for college students and research workers. By LeRoy D. Weld, M. S.; professor of physics in Coe College. Cloth, 5 x 7½ in.; 190 pages; illustrated. New York, Macmillan Company. $1.25 net.

This book is written with a special purpose—to make so clear through simple and concise treatment the subjects of precision and the distribution of errors by the theory of least squares that not only students but any research worker may quickly become master of the methods presented. Examples are given, illustrating applications to various branches of science, including surveying and astronomy.

Invar and Related Nickel Steels. Circular 58, U. S. Bureau of Standards. Paper, 7 x 10 in.; 68 pages; illustrated. Washington, Government Printing Office.

Describes some of the more important properties of nickel steels in general, with particular reference to invar, and consists largely of a compilation of results obtained by various investigators during the last twenty-five years. Treats reversible and irreversible nickel steels magnetic properties, electrical properties, thermal expansion, constancy of dimensions of invar, density, mechanical properties, resistance to corrosion, applications and sources of supply. Much of the treatment is from the metallurgical point of view.

Books Reviewed

The Strength of Materials

Author, Ewart S. Andrews, lecturer in the engineering department of the Goldsmiths' College, New Cross, and at the Westminster Technical Institute. Cloth, 5½ x 8½ in.; 604 pages, 264 illustrations. New York, D. Van Nostrand Company. $4 net.

Reviewed by Melvin L. Enger

Assistant Professor of Mechanics and Hydraulics, University of Illinois

This is an advanced book on the mechanics of materials written for students preparing to take examinations for associate member of the Institution of Civil Engineers in Great Britain, and for the university degree in engineering.

The text begins with a chapter on stress, strain and elasticity containing an unusually clear presentation of the effects of combined loadings. Then follows a chapter on the behavior of materials under test in which the Rankine, St. Venant, Guest and Navier theories for conditions causing failure are developed and discussed. Then follow discussions of reptition of stress, working stresses, riveted joints and thin pipes.

In the treatment of beams both analytical and graphical methods are given, with considerable attention devoted to concrete and reinforced concrete. In the discussion of columns the author uses the "buckling factor," which is defined as the length of the equivalent pin-ended column divided by the least radius of gyration, instead of the slenderness ratio. The treatment of concrete columns cannot be considered complete.

The usual treatment of torsion of shafts is given, and St. Venant's approximate formulas for non-circular shafts are stated. The subject of springs is unusually well presented. There are two chapters on the testing of materials, in which various types of testing machines and extensometers are described and illustrated. Flat plates and slabs are treated by the Bach and by the Grashof-Rankine theories, and the results of the Grashof theory for circular plates are given in tabular form.

Thick pipes are treated by Lamé's theory, and formulas for the required thickness are deduced on the maximum-stress theory and on the maximum-strain theory. Excellent chapters on curved beams and on rotating drums, disks and shafts complete the text. A good set of problems, with answers, is included, and the properties of the British standard sections, together with some mathematical tables, are given in the appendix.

The long ton is generally used as the unit of force. The mechanical make-up of the book is excellent, although the lettering in some of the figures is poorly done. Many tables, curves and charts have been included for the use of designers, and their use is made clear by the solutions of illustrative problems. The book will take a high rank in the literature of the mechanics of materials.

Pole and Tower Lines

Author, R. D. Coombs. Cloth, 6 x 9 in.; 272 pages, 162 illustrations and diagrams. New York, McGraw-Hill Book Company. $2.50.

Reviewed by A. G. Hillberg

Civil and Hydraulic Engineer, New York City

The author of this book should be complimented upon his work. Electric transmission of power is one of the most important branches of engineering. It has a direct bearing on the industrial development and, consequently, the prosperity of a nation. However, so far only the electrical problems entering into such construction have received careful attention, and while several good books are available, not until the publishing of this book has the purely structural side received due attention. Generally the supports of transmission wires have been spaced in an offhand fashion, and thus in many cases so closely that neither they nor the conductors have been loaded up to their permissible unit stresses.

The subject has been divided into fourteen chapters, namely: Types of Construction; Loading; Wires and Cables; Design; Wooden Poles; Steel Poles and Towers; Special Structures; Concrete Poles; Foundations; Protective Coatings; Line Material; Erection and Costs; Protection, and Specifications.

In these chapters the various phases of the problem have been discussed clearly, and where necessary diagrams and tables have been inserted. The illustrations, of which the majority is halftones, show both American and foreign practice. Of special value are the chapter dealing with erection and costs, and the specifications contained in the last chapter and elsewhere in the text.

Industrial Leadership

Author, H. L. Gantt. Cloth, 5 x 7½ in.; 128 pages. New Haven, Yale University Press. $1 net.

This little volume is composed of addresses delivered in the Page Lecture Series, during 1915, before the Senior class of the Sheffield Scientific School, Yale University. The first of the addresses, bearing the same title as that of the volume itself, is most inspiring and will repay reading again and again. Mr. Gantt contends that to bring the United States to the position it should occupy in the industrial life of the world we must develop great leaders. Throughout the addresses are found pregnant thoughts such as these:

"The authority to issue an order involves the responsibility to see that it is properly executed."

"In a civilized country we are all buying and selling service. The bread we eat, and the coal we burn are available to us through the service of many people. Likewise our value to the community is measured by the service we render, and in the long run our reward is apt to be in proportion to that service."

"People learn but little from what they are told, but they readily imitate what appeals to them. If, therefore, a man would be a leader he must know thoroughly the people whom he would lead and be able to shape his actions in such a manner that they will not only be understood but thoroughly appreciated by his followers."

The remaining chapters are on the training of workmen, principles of task work, results of task work, and on production and sales. In these chapters there is much that has been gone over at various times since the scientific management movement gathered force. Mr. Gantt's statement, however, is lucid and brief and will interest those who have not closely followed this important subject. The chapter on production and sales contains some unusually interesting sale-price curves.

City Planning

Author, Charles Mulford Robinson. Cloth, 6 x 9 in.; 344 pages, 64 illustrations. New York, G. P. Putnam's Sons. $2.50.

REVIEWED BY MORRIS KNOWLES
Consulting Engineer, Pittsburgh, Pa.

In this volume the author has elaborated and made additions to his book, "The Width and Arrangement of Streets," published in 1911, and has thus produced a book of much usefulness to beginners in the subjects of engineering, economics and sociology, all of which enter into the study of city planning. While he devotes his attention entirely to thoroughfares and street areas, the author properly points out that they constitute the skeleton of the city, comprise from 25 to 45 per cent of its total area, and thus contribute a substantial part of the total investment and maintenance cost. The book, which is descriptive of what has been done and what can be done, does not assume or demand a technical knowledge of any of the fundamental sciences underlying the subject, but in a general way shows the scope and general trend of town planning, and of municipal development along the lines of logical arrangement, rather than unregulated or arbitrary allotments.

The author shows briefly the need of town planning by explaining how growth and development have demanded regulation and then how regulation has led to standardization—an illogical, arbitrary, extravagant and inconvenient system. Having shown the defects of standardization, both from the social and economic points of view, he offers functional or logical plotting, which the reader is by that time quite prepared to accept. The author has made his strongest appeal for this an economic one, doubtless because American judgment is usually most easily appealed to in terms of dollars and cents. At the same time the ends for which he is striving are more social than economic, and town planning is shown to be desirable that people may live more comfortably and healthfully, and travel more conveniently.

The main plotting of the arterial system, which must be laid out to take care of traffic, is in itself more a matter of convenience than of economy. Such a system must be designed not only to care for traffic, but also to be adjacent to and easily accessible from the residential sections, which must be carefully located and planned with regard to the health, convenience and comfort of the community.

In residential sections, economy by the use of narrow streets and by avoiding cuts and fills through following the contours is most effectively urged. But here, too, such saving is really most desirable because of its effect on rents in the poorer sections, and because in the higher-class sections it attains at the same time increased beauty, individuality and comfort. Many of the departures from standardization which are offered are extremely useful, and most of them have been successfully applied in almost every city. Scarcely a city with natural topographical features can be found that has not made use, at least in isolated cases, of some of these suggestions, such as grading sidewalk and road to different levels, omitting sidewalks on one or both sides of the street, two-level streets, and use of narrow lanes or walks where no driveway is essential.

A prima facie case is made out for foresight in planning for open spaces and reservations for schools, public buildings and playgrounds, and every engineer or business man, accustomed to plan for future development, will readily acquiesce in the author's condemnation of the extravagant expenditures so often required in this country to provide public buildings, park spaces and schools at later periods in the history of a city.

The author summarizes in the last section the development of legislation, ordinances and by-laws relating to town planning, and in his appendix gives examples of model laws for carrying out town-planning schemes. The index is ample, the illustrations are plentiful, and the mechanical arrangement of the book is convenient for reference.

Unless a word of caution be said, there is danger that so excellent a book may mislead city-planning bodies into the error of supposing that they can, with its aid, work out all the problems that come before them. It is unfortunate, therefore, that the author, although stating that "the book is presented with no illusion as to its providing a panacea," has not laid more stress upon the fact that town planning is, in the last analysis, the work of the expert. It is for the student, the trained town-planning engineer, to work out these problems of plotting and arrangement, and grievous mistakes will be made by commissions, no matter how sincere and public-spirited they may be, unless they have the benefit of expert advice based upon broad experience and adequate investigation and study.

Letters to the Editor

Comment on matters of interest to engineers and contractors will be welcomed

Shall the American Society of Civil Engineers Move Its Headquarters?

SIR: The discussions of the proposed change of the headquarters of the American Society of Civil Engineers to the Engineering Societies' Building on Thirty-ninth Street show a strong sentiment in favor of the "get together" movement, but there seems to be some apprehension lest the society should lose its individuality.

With the present income of the American Society of Civil Engineers and the prospect of still future large increase, would it not be practicable for it to finance a new building of its own on Fortieth Street—next door to the Engineers' Club—and by a proper connection to the Engineering Societies' Building form a suitable entrance facing Bryant Park, on Fortieth Street, for the entire joint building?

This seems very much needed.

New York. HENRY B. SEAMAN.

Architect vs. Engineer

SIR: The undersigned, as a member of the New York State Board for Registration of Architects and also as one of the directors of the American Institute of Architects, was much interested in an article which appeared in the Engineering Record of March 25, page 406.

I am pleased to see the suggestion of co-operation as between engineers and architects. Surely nothing but a misunderstanding could cause a breach between the professions, and there is every reason for friendly relations. It will be my pleasure to bring before the Board of Directors of the Institute at our next meeting the suggestion that a committee be authorized to confer with some corresponding committee of engineers on this subject.

Will you permit me in the meantime to call the attention of engineers not already informed that the New York law for the registration of architects does not interfere with the right of an engineer or a builder to design or supervise or erect any building? The law is designed to raise the standard of education of architects and is expected to accomplish its purpose in the course of years by requiring all who wish to use the title "architect" to comply with certain requirements as to education, ability and experience.

It is presumable as a premise that the engineering profession does not approve of any person without training or experience arbitrarily taking to himself the title of "engineer," and thereby helping to lower the profession in the respect of the public.

The architectural profession feels very keenly our need of higher average standards of qualifications. Surely our two professions should co-operate to attain greater usefulness which will be a legitimate benefit to the profession so long as it also operates to prevent imposition upon the public.

D. EVERETT WAID,
President State Board of Registration of Architects.
Albany, N. Y.

Keeps an Up-to-Date and Convenient Scrap Book

SIR: At first I used to save and bind all of the numbers of the Record and index the articles that were especially interesting to me with a card system. The heavy bound volumes became bothersome and I found that I was not referring to them at all. I stopped saving and binding the Engineering Record and for a while depended altogether on the nearest public library for my reference to it. This did not meet with my needs satisfactorily and then I started the following system, which I have kept up for ten years:

I cut out the pages, close to the binding, which contain any article which I feel I would want to save and put these pages in a certain drawer of my desk. If the article is the first one of a series you usually indicate it by a special design on the cover so I save that number and bind in it all of the following articles of the series. I cut out all of the pages not used in this number for the article, cutting on the margine line so as to leave a lot of stubs. Then I paste the cut pages with the other articles to these stubs in the order of their issue, giving me a number of books, all of one size, containing only certain information and always easy to haul out and look over.

I have the series of articles on the first Quebec Bridge; another on the Blackwells Island Bridge; one on various viaduct bridges; a story about Arch Bridges; another on the microscope and concrete, by Nathan Johnson, and I am starting one now on National Defense. I have in mind saving most of the articles you publish on bridge erection, dividing them up into groups of cantilever, suspension, and ordinary.

This system requires no indexing and only a little time now and then with a paste pot and a knife. And I dare say the entire lot of articles I have saved do not pile up higher than three inches, and I look them over often.

WALTER J. PARSONS.

Flushing, L. I.

What Causes Peculiar Refraction on Arizona Desert?

SIR: In answer to a letter on Arizona desert refraction from Thomas A. Hayden in the Engineering Record of March 25, page 427, I beg to say a few words. While the writer is not personally acquainted with the special conditions existing in Arizona, and therefore cannot give an answer to the question "What causes the peculiar refraction on Arizona deserts?" he knows of a method to eliminate the influence of refraction in stadia measurements. This method, which gave accurate results under all meteorological conditions occurring during a year, would be worth a trial in Arizona.

It is a well-known fact that refraction affects the accuracy of stadia measurements by changing the length of the rod intercept. The effect of refraction is much greater near the ground than it is a few feet above. The lower line of sight passing through the layer near the ground is refracted differently from the upper line of sight traversing the upper strata. This causes the rod reading to differ from what it would have been had the air been homogeneous. If both lines of sight should traverse the same strata there would most likely be no effect from refraction.

The writer, while connected with the Royal Technische Hochschule at Danzig, Germany, carried out a one year's test of the influence of this "differential refraction" on the accuracy of stadia measurements. In the course of these studies he also used a horizontal rod instead of a vertical rod for taking rod readings. The rod was brought perpendicular to the line of sight by means of a diopter, a special rod support being provided. Even on days when the influence of refraction was very noticeable with a vertical rod, measurements taken with the horizontal rod gave accurate results. For surveying with the horizontal rod the diaphragm carrying the stadia hairs has to be turned 90 deg.

Though the influence of differential refraction is naturally less in localities with moderate climate and covered with vegetation than in the desert region of Arizona, the application of the horizontal rod will most likely permit the use of the stadia method with good results. This would outweigh the little inconvenience which the use of the horizontal rod involves.

DR. KARL G. HABERMEHL.

Hoboken, N. J.

Measuring Flow in Concrete

SIR: I note your editorial in the issue of March 4, page 310, on the flow of concrete and the conclusions to be drawn from extensometer measurements in tests. To one who has had a fairly comprehensive experience with construction, it is astounding to observe how many engineers and embryo investigators from our universities are firmly convinced that 60 to 90 days in cool, chilly weather thoroughly hardens the concrete and that at the end of so many days they can actually determine the stresses in a floor which is half cured by measuring the deformation of the concrete and reducing this deformation to stress on the basis of instantaneous, or nearly instantaneous, measurements on cylindrical specimens of the same mix, but cured in a manner which enables them to dry out and be two or three times as rigid as the material in the floor on which measurements were taken.

Extensometer tests should add greatly to the sum of engineering knowledge. But this requires the exercise of thought and care on the part of those who conduct such tests, otherwise much misinformation will be extracted therefrom.

The time to take measurements on the concrete in testing a floor to determine the concrete stress is evidently during the removal and not during the application of the load. When a floor is cast, shrinkage of the concrete occurs during hardening in the air. Consequently, before initial loading the floor is in condition of internal strain due to shrinkage during hardening and the deformation under the initial load is the sum of these internal stresses and those produced by the load and not the result of the application of the load alone. The stress, if it exists, will manifest itself in the recovery of the slab while the load is being removed, and if the deformations are measured during this period of the test, *i. e.*, taking the condition as zero when the load is fully applied and noting the change in deformation until the load is half removed, we then have a basis on which we can determine the stress with errors largely eliminated.

This is a matter which should be called to the attention of those building inspectors who insist on considering that deformations of the concrete under initial loading are a real criterion of the state of stress. Many times they are 100 per cent in error through taking this illogical position. That is, they consider the stress to be 100 per cent more than that which really exists.

For example, if we consider the tests of Messrs. Fuller and More (see page 279 of the issue of Feb. 26), in some cases it would appear that recovery was about 0.4 of the total deformation. To assume that the deformation where there is less than 40 per cent recovery can be translated into elastic stress without considering the permanent set and lack of recovery represents the absurd position taken by many. No one would be willing to assume where there is no further recovery after application of the load and the material is free to recover that there is any material elastic stress operating in that direction.

C. A. P. TURNER,
Consulting Engineer.

Minneapolis.

[Because of his extensive experience in testing concrete by such strain measurements as are here discussed, a copy of Mr. Turner's letter was sent to Prof. Herbert F. Moore, of the University of Illinois, and he was asked to comment upon it. His reply follows.—Editor.]

Sir: With the second paragraph of Mr. Turner's communication, "Extensometer tests should add. . . . Otherwise much misinformation will be extracted therefrom," I am in thorough agreement. It is a general statement, but one which should be frequently made and emphasized.

I am not of the opinion that determinations of elastic stress in a material like concrete should be made wholly from readings during the release of load on a test slab or building floor. Frequently in applying load very small cracks open in the concrete, on the release of the load the jagged edges of these microscopic cracks do not close perfectly, and there are left in the concrete stresses which are not shown by readings during release of load alone. It seems to me that extensometer readings should be taken both during application of load and during release of load, and both sets of readings considered in estimating stresses.

It has been my observation that in estimating stresses in a test floor or slab that much more confidence is placed (and rightly placed) on stress determination in steel reinforcement than on stress determination in concrete, and I believe that there are few building inspectors who "insist on considering that deformations of the concrete under initial loading are a real criterion of the state of stress." In estimating the stresses in the steel, reliance on readings obtained during release of load alone would render practically impossible the observation of any stress in the steel beyond the yield point. Of course, such stress should not exist in a well-designed floor under working load, but tests should be of such a nature as to detect such a state if it does exist.

In strain readings on steel, as in strain readings on concrete, I am of the opinion that readings should be taken both during application of load and during release of load, together with an examination of the surface of the test floor or slab for cracks, and that all phases of the test should be considered in estimating stresses and in passing opinion on the safety of the structure.

H. F. MOORE,
Assistant Professor of Theoretic and Applied Mechanics, University of Illinois,
Urbana, Ill.

Topographic Survey of Rough Wooded Area

SIR: Having read with much interest the article in the Engineering Record of March 4, page 316, entitled "Unusual Methods Simplify Topographic Survey of Rough Wooded Area," and the "challenge" of the same appearing in the issue of April 1, page 459, I wish to enter my dissent from certain statements in the "challenge." The writer thereof states that the location of contours directly with a wye level and recording with a plane table, is a *most unusual* method. To this I can only say that my limited experience tells me the contrary. As to his assertion that work done in that way can only be done "at unusually high unit costs," I would offer the following:

Within the past few years I have completed two topographic surveys, each of which was done by plane table, using the wye level to locate contours. The first job was in a wild section of New England, a precipitous, winding river forming the nucleus of the map, and the banks now rising abruptly from the water's edge, and then following tributary valleys back sometimes for two miles. Most of the country was wooded, not with heavy trees, but with New England "second-growth" mixed with underbrush. The scale of the maps was 200 ft. to 1 in., and the contour interval 5 ft. The second was a similar river survey, but this time the river fell more gradually and the banks were not so high. Also, there was a slightly larger proportion of cleared fields and meadows, although the added thickness of the underbrush in the wooded areas largely offset that advantage. The scale and contour interval were the same as in the first case.

In each survey a meandering base line was run by azimuths on each bank of the river and bench marks frequently established. These lines were checked with each other frequently. From each of these lines meandering lines, wtih levels, were run back from the river, following the tops of the banks, extending up the ravines and valleys, and generally establishing all points needed for plane-table occupancy, returning to and closing on the main line on the river bank. In this way an absolute check on the accuracy was maintained at all times. The party for such work consisted of an engineer in charge, transitman, leveler, two tapemen, rodman and one extra efficient axeman. The points thus established were later occupied by one or the other of two plane-table parties, each consisting of a plane-table operator, leveler and two rodmen. One base line and two plane-table parties were used continuously.

The cost of the field work on the first survey cited was 37.7 cents per acre for base line and 46.2 cents per acre for plane tabling; on the second job, 25.8 cents per acre for base line and 20.9 cents for plane tabling. Office work added 7.5 cents per acre to the cost of the first work and 5.6 cents for the second, making totals respectively of 91.4 and 52.3 cents. Rainy days cost 5.7 cents on the first and 5.8 cents on the second, which the reader may add if he desires.

In order to give full meaning to the above figures I should emphasize that they are *costs of work* and not the total cost of the surveys. In each case the work was in a remote region, several miles from a railroad or source of supplies. The men were brought to the scene from a distance and a camp was maintained for their accommodation, board and lodging being furnished in addition to their wages. Supplies were bought at distant wholesale houses, shipped by rail and teamed to the camp. The total costs per acre for railroad fares, camp maintenance, cost and depreciation of camp equipment and surveying instruments, in fact for everything charged to the job at the main office, was $2368 on the first job and $1769 on the second.

FRED J. WOOD.

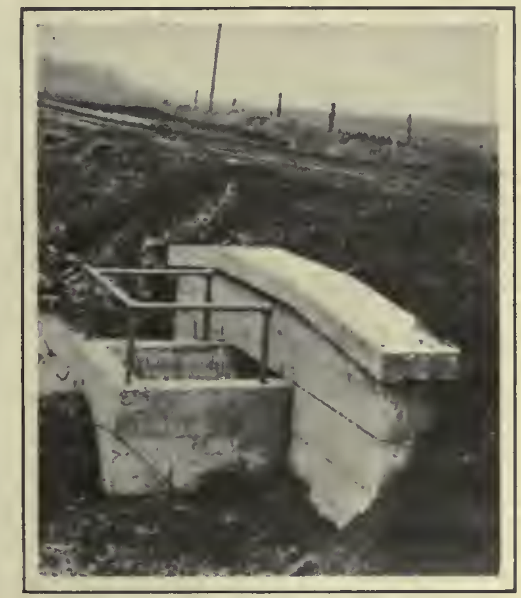
Brookline, Mass.

Wing-Wall Weirs to Prevent Soil Erosion

SIR: In the Feb. 26 issue of the Engineering Record, page 289, I note an article pertaining to the construction of a wing-wall weir in California, which was used to prevent soil erosion.

Construction producing similar results has been used for some time in this state in the design of small highway culverts, as illustrated by the accompanying photograph. The culvert in this instance is a small box culvert provided with a rectangular box at the upper end, which allows the water to run off and the sediment to deposit at the upper end of the culvert.

A great many culverts constructed in this manner have been built in the state in the past few years. This particular one is in Cedar County, and was built in 1914.



RECTANGULAR BOX STOPS SEDIMENT

IOWA HIGHWAY COMMISSION,
By J. H. Ames, Bridge Engineer.
Ames, Iowa.

What Is an Engineer?

SIR: The recent canvass among practising engineers to determine the consensus of opinion as to the relative value of certain characteristics leading to success in the engineering profession has brought to light some interesting facts. These findings, though preliminary to some extent, have been criticised by a few. This is to be expected, especially from those directly interested in teaching technical students, for the factors given most prominence in schools of engineering show a small percentage in the tabulated report based on the data secured in the canvass. However, as the data secured in this manner represent a general opinion, there must be considerable truth in the points made and it is to be expected that some of the schools will modify their curriculum to approach more nearly the desired conditions.

It appears to the writer that there are three causes operating to the detriment of engineering schools in general and also to that of the young graduate engineer.

First—Too many teachers of the branches of engineering have been advanced to their positions with no opportunity to engage sufficiently in practical every-day work. An educator in engineering should by all means have had many years of successful practical work and thus have developed many of those attributes which mean so much toward success.

Second—The student is, in many cases, led to believe that when he graduates he will become at once a full-fledged engineer and so naturally expects many things which do not materialize. He thinks that he can at once take his place in the engineering world and acquit himself with credit to himself and his alma mater. This view is sometimes a serious handicap to a promising young man and not infrequently lowers the estimation his employer places upon him.

Third—The engineering student is hampered by the same lockstep system which is so detrimental to the efficiency of our common graded-school system. By this statement I mean that a certain definite time is taken for each study or branch of learning, and this time is much too long for the more brilliant students in that line and too short for those who have no aptitude for that particular study. Thus the best students are held back and the slower ones rushed forward. Practically every student is brilliant in some branches and slow in others, and should be allowed to progress just as rapidly as he is individually able. Surely some method can be evolved which is at least a compromise between class instruction and purely individual teaching.

If these three troubles could be obviated engineering education would be placed at once on a much more satisfactory plane, and students could be graduated with a much better chance of rapid success in their chosen profession.

Boone, N. C. D. R. SHEARER.

Who Must Pay for the Transit?

SIR: I had a transit knocked over and damaged by a man driving against it. It was in use running the center line of a street for the city. There was plenty of roadway and several teams had passed. Can I compel the party to pay damages for knocking over the instrument?

SURVEYOR.

Pennsylvania.

Meters Read by Mail

HOW the Kansas City (Mo.) water department secures meter readings by mail when its representatives find nobody at home during their round of calls at consumers' houses is told in last year's annual report by D. L. Wheelock, superintendent of the meter division. When the meter reader cannot enter the building he leaves a postal card, marking the license number, premises and date he called. On this card is a fac-simile of a regular meter dial, with the hands blank. The consumer is instructed to take the card and mark the location of the hands. The card is then mailed to the office, where the reading is compared and put in the route book. The department receives on an average of 600 cards each month and finds only about 5 per cent in error.

The results from this system are said to be very beneficial. It gives the consumer the idea that the department needs his cooperation. The consumer learns to read his meter and, most important of all, the system saves making up an estimated bill, which, no matter how estimated, causes a great deal of trouble and complaint from the consumer. It thus saves the men in the collection division much time.

HINTS FOR THE CONTRACTOR

Details Which Save Time and Labor on Construction Work

Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

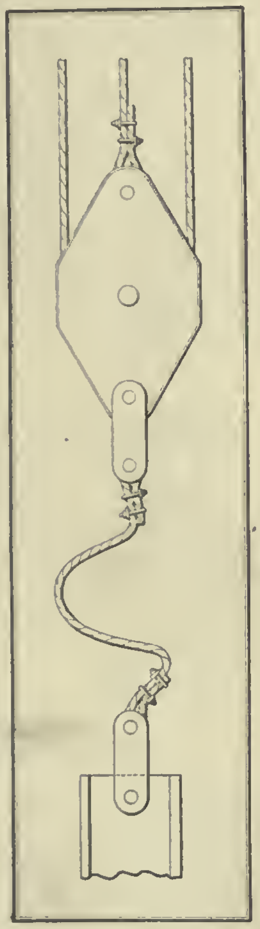
[*Contributions to this section are solicited, and if found available will be paid for. They must be* SHORT, *and should be accompanied, if possible, by photographs or sketches.*—EDITOR.]

Jerking with Weighted Block Pulls Sheet Piles Easily

By H. S. CARPENTER

Cobleskill, N. Y.

BADLY-BENT steel sheet piles have been pulled by the writer with the rigging shown in the accompanying drawing. A weight block, or an ordinary block with some heavy weight tied closely to it, is shackled to a piece of cable about 10 ft. long, the lower end of which is secured to the pile. The fall line is slacked off and taken up with a run by the hoisting engineer, the momentum of the heavy block, in addition to the strain on the hoisting line, producing something like a sharp upward blow when the lower cable comes taut. The writer has never come across a sheet pile stuck so tightly that it could not be pulled in this way by a skillful hoisting engineer. A derrick or any other hoisting rig handy, of a few tons capacity, can be used. It is not desirable to reave up a heavy set of falls, as it is the jerk of the weighted block that does most of the actual work.



Ends of Paper Casing Pull Out After Form Rods Are Removed

By D. P. LANE

Assistant Chief Engineer, Unit Construction Company, St. Louis, Mo.

SECTIONAL paper tubes, similar to mailing tubes but dipped in paraffine, were used recently to permit the removal of long tie rods in taking down the forms for a heavy concrete wall. By catching a sharp hook in the end of the tube, it was easy to unwind and pull out a few inches of the paper at each end when the tie-rod holes were plugged.

The work involved a concrete wall 385 ft. long, 34 ft. high and tapering from 25 ft. wide at the base to 3 ft. at the top. The writer suggested for the $\frac{3}{4}$-in., $\frac{5}{8}$-in. and $\frac{1}{4}$-in. rods used to tie the wall forms the use of these paraffined paper tube casings, which were ordered from the St. Louis Paper Can & Tube Company. They were the ordinary spiral-wound mailing tube dipped in a bath of hot paraffine. They were furnished in 3 and 4-ft. lengths, and each length was provided with a 3-in. sleeve at one end for covering the joints between sections. The inside diameter of the tubes was $\frac{1}{8}$ in. larger than that of the rods.

After the concrete had set the rods were removed without the least difficulty, and the ends of the paper tubes were unwound as described with a hook and removed to a depth of 4 in. before plugging the holes. These tubes were the first order for this purpose that the manufacturer had ever filled. The cost, delivered on the job, was about $1\frac{1}{4}$ cents per lin. ft. of tube.

Cofferdam Bracing Removed Economically at Baltimore Bridge

PRACTICALLY all of the cofferdam bracing in the piers for the Hanover Street bridge at Baltimore, the construction of which is described on page 632 of this issue, was removed without being cut. Roughly outlined, the method was as follows:

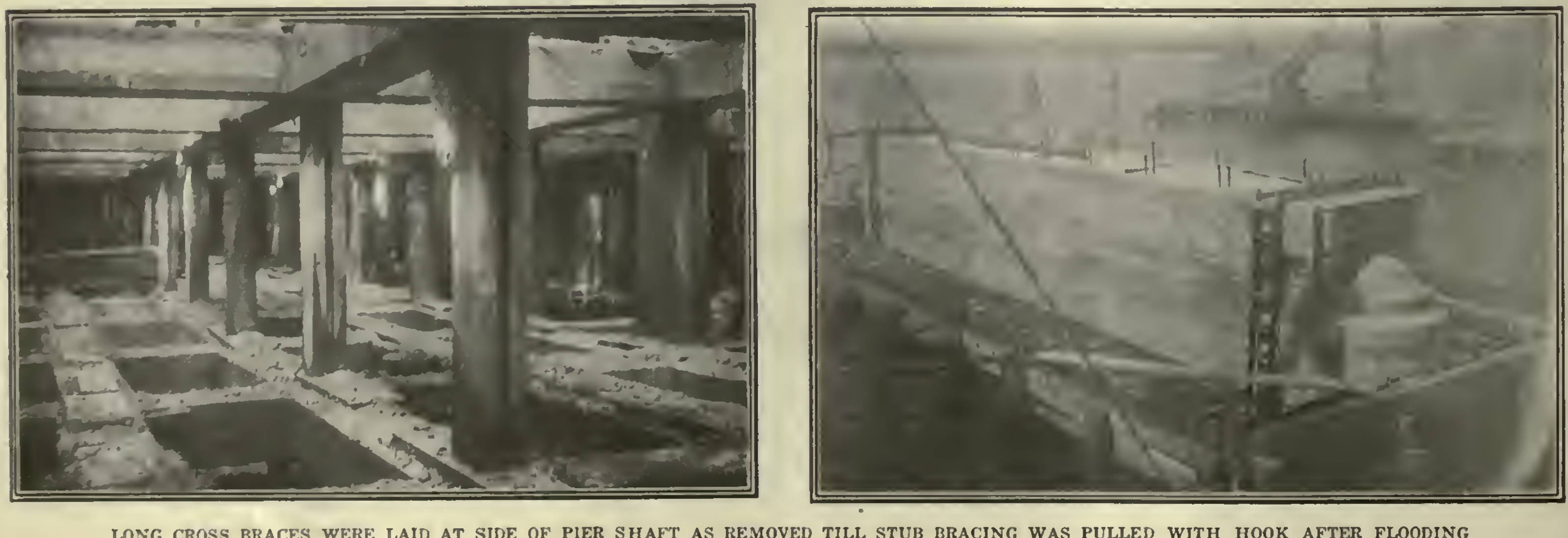
As the concrete of the pier shaft reached a layer of bracing the ranger course below that layer was blocked to the pier shaft and the layer itself removed. This left the cofferdam temporarily unsupported for two vertical spans. So far the usual method was followed. Instead, however, of sawing the bracing out inside the form, it was taken out in whole sticks. The longitudinal braces, which were in short lengths, spanning between the cross braces, were at once removed from the cofferdam. The cross braces, being single sticks reaching clear across the coffer, were too long to be tilted enough to take them out through the pockets. Rather than cut them, they were turned parallel to the long side of the coffer and laid on the blocking from the ranger below to the pier.

As the concrete came up the forms were stripped and the water allowed to rise. It did not have to be pumped down again. A tool shaped like one-half of a pair of timber hooks, but with a horizontal leg long enough to pass clean under a timber, was lowered through the water by one of the derrick boats and used to jerk out the blocking between the rangers and the pier shaft. The pulling was easy, as there was no outside head on the coffer. This procedure at once allowed the long cross braces to float to the top. All that remained to be removed was then the rangers themselves and the posts between them. This was accomplished with comparatively little breakage by swinging the hook against the sheeting and pulling it up.

By this method extra pumping charges were saved, only a small crew was required, no one had to work down below while the bracing was being pulled, and a large salvage, it is said, was realized on the timber. The bridge is being built by H. P. Converse & Company.

Quarantine to Save Timber

The first lumber quarantine on record was put into effect recently. The U. S. Department of Agriculture has asked Eastern nurserymen to aid in fighting white-pine blister rust by shipping west of the Dakotas, Nebraska, Kansas, Oklahoma and Texas no white-pine nursery stock or currant and gooseberry bushes which carry the rust.



LONG CROSS BRACES WERE LAID AT SIDE OF PIER SHAFT AS REMOVED TILL STUB BRACING WAS PULLED WITH HOOK AFTER FLOODING

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

Recommend Sedimentation and Disinfection of Detroit's Sewage

The report on the disposal of sewage at Detroit, Mich., on which Clarence W. Hubbell has been working for the past year and a half, recommends that treatment works be located at Fort Wayne and Fairview, on the river front, and a plant be provided on Connors Creek for future use. The recommended treatment is by means of Imhoff tanks combined with disinfection. The first cost of complete installation is estimated at $6,091,000.

The plants, it is estimated, will take care of the sewage from a population of 950,000. Each plant is to have its own system of collecting sewers. Sludge is to be disposed of by filling low lands, incineration or sold as fertilizer. The total annual charge, including interest at 4½ per cent, amortization, operating cost and maintenance, is given as $517,430.

U. S. Senate Passes $85,000,000 Good Roads Bill

The Senate, on May 8, passed the Bankhead good roads bill. $85,000,000 will be spent by 1921 for road construction, contingent on an equal expediture by the states. For roads in national forests $10,000,000 is provided. For the year ending June 30, 1917, $5,000,000 is appropriated with increasing expenditures until 1921. The money is to be apportioned by the secretary of agriculture, on a basis of one-third in the ratio of the area to which the states bear to the total area of the country, one-third in the ratio of population, and one-third in the ratio which the mileage of rural delivery routes bears to the total mileage in the country.

The measure is a substitute for the Shackleford bill, which passed the House, and provided that not more than $25,000,000 should be appropriated annually by the government.

Candidates Nominated for American Waterworks Election

The nominating committee of the American Waterworks Association has selected the following candidates for office to be balloted on prior to the association's thirty-sixth annual convention in New York City, June 5 to 9:

For president, Leonard Metcalf, consulting engineer, Boston, Mass.; for vice-president, Theodore A. Leisen, general superintendent, Board of Water Commissioners, Detroit, Mich.; for treasurer, James M. Caird, consulting engineer, Troy, New York; for trustees, F. W. Capplen, city engineer, Minneapolis and M. L. Worrell, general manager of waterworks Meridian, Miss.

Vessel Smashes Two Head Gates on Welland Canal

Two headgates at lock No. 8, at St. Catherines on the Welland Canal, were smashed April 30, by the steamer W. J. Averell. The accident was attributed to the steel hawser getting caught in the vessel's compressor and not being placed on the post on the lock wall to check the vessel's speed. The damage is estimated at approximately $3,000.

The rush of water from lock 8 carried the vessel and towpath gate out into the lower reach. The ship was not damaged and there was no overflow, due to the fact that the lock below No. 8 is about 1¼ miles long, while the one above is short. Traffic was resumed with a short delay for replacing the gates.

For a Summary of the Labor Situation As It Affects Construction Work See Contracting News Section

"Paper Mobilization" Proposed by Captain Park

An essential feature of plans for preparing the engineers of the country for military duty, as discussed at a recent joint meeting of engineers, in San Francisco, should be the compilation and maintenance of a record of the names and addresses of technical men. "A paper mobilization" is the scheme proposed by Capt. Richard Park. One salaried secretary could be established in the engineering center of each state, to compile and maintain a card index showing names, addresses and experience of engineers, skilled laborers and mechanics. The cost would be small and the information almost invaluable in event of war.

Portland Engineers Make Investigation of Trunk Sewer

Owing to charges that the Montavilla trunk sewer in Portland, Ore., was unsatisfactory, the Portland association of members of the American Society of Civil Engineers appointed a committee to investigate the matter. The committee was composed of George C. Mason, J. P. Newell and J. L. Stannard.

The committee after a careful examination of the structure reports that it is entirely satisfactory, thus vindicating the city engineer and others against whom the charges were made. For the good of the service and of the engineering profession the committee rcommends the discharge of those employees of the city who aided in spreading false and malicious reports regarding the condition of the sewer.

G. A. Kyle, who reported independently on behalf of the residents of Montavilla, reached the same conclusion as the committee.

Engineering Society Comes to Aid of Canadian City Engineer

G. W. Craig, city engineer of Calgary, Alberta, Canada, who was recently criticized for the failure of a reinforced-concrete arch bridge over the Bow River, has been absolved from all blame.

The city council of Calgary ordered an investigation to ascertain whether Mr. Craig was guilty of adopting an unsafe design and using unsuitable material. The Calgary branch of the Canadian Society of Engineers immediately offered the services of its members in settling the technical questions involved. Investigation by the engineers showed that Mr. Craig had used every precaution in the design and erection of the structure. The city council has adopted a motion to that effect.

Break Ground on $3,000,000 Nave

Work was started May 8 on the $3,000,000 nave of the new Protestant Episcopal Cathedral of St. John the Divine, in New York City. As noted in previous issues, this will be the largest church in the western hemisphere.

Will Construct $6,000,000 Reservoir Near Wanaque, N. J.

Governor Fielder, of New Jersey, appointed George G. Wright, of Paterson; E. E. Hincke, of Montclair; Mr. Ramsey, of Perth Amboy, and Laurent Tonnelle, of Bayonne, members of the New Jersey Water Commission, May 5. This commission will construct a reservoir in the vicinity of Wanaque, N. J., to supply the cities and towns of northern New Jersey with drinking water. The commission will organize soon and it is rumored that Morris R. Sherrerd, chief engineer of the board of street and water commission, of Newark, will be appointed chief engineer for the commission. The cost of the reservoir, dam and pipe lines is estimated at $6,000,000.

Rebuild Tracks of First Western Railway for Monument

A monument to early American railroading will be dedicated by the College of Mechanical and Electrical Engineering of the State University of Kentucky, at Lexington, in connection with the celebration of the university's silver jubilee. The monument will consist of the restoration of a portion of the original track of the Lexington & Ohio Railroad (now the Louisville & Nashville), the first railway west of the Allegheny Mountains.

The original track consisted of stone "sills" upon which were placed ½ x 3-in. wrought-iron rails 14 ft. long. The ends of the rails were miter-jointed and fastened by spikes driven into lead-filled holes in the stone. About 25 ft. of this original track will be set in a concrete base on the university campus in front of Mechanical Hall. Efforts are being made to secure a locomotive of the 1835 period to place on the track.

New Filtration Plant May Be Built at East Chicago

The public service commission of Indiana has announced that it will immediately order the East Chicago and Indiana Harbor Water Company, of East Chicago, to file plans and specifications for a filtration plant within sixty days. The cost of the complete new filtration system is estimated to be $150,000. John C. Diggs, water chemist of the State board of health, said the water now obtained from Lake Michigan was polluted by sewage from the East Chicago ship canal and from other sources. The state board of health of Indiana condemned the supply.

Electrical Engineers Hold Annual Meeting by Telephone

The national meeting of the American Institute of Electrical Engineers will be held May 16 in San Francisco, Chicago, Atlanta, Philadelphia, New York and Boston. The various meeting halls will be connected by long-distance telephone. Every seat will be equipped with a receiver so that each member will hear the proceedings at the gatherings in the other cities.

Error Action by Anti-Conservancy Counties Overruled

Every ground on which the anti-conservancy counties of Ohio endeavored to have the organization of the conservancy court declared illegal was completely overruled May 6, by the court of appeals of the fifth district. This is another victory added to the successes which the conservancy law has met in the courts.

Bridge Erected by Chinese Contractor

THE PICTURE SHOWS A NEARLY COMPLETED BRIDGE ON THE CANTON-HANKOW RAILWAY, IN SHA HU, CHINA. THE DECK SPANS ARE EACH 40-FT. THE ENTIRE WORK WAS DONE BY CHINESE CONTRACTORS UNDER THE DIRECTION OF R. A. WHITE, FROM WHOM THE INFORMATION AND PHOTOGRAPH WERE SECURED.

Offer Business Men's Course of Training in Export Business

A course of training for business men for work in the export business has been prepared by Dr. Edward E. Pratt, chief of the bureau of foreign and domestic commerce, in co-operation with other prominent men, including O. P. Austin, of the National City Bank of New York; E. N. Vose, editor of Dun's International Review; E. A. De Lima, president of the Battery Park National Bank of New York; Prof. Emory R. Johnson and Dr. G. G. Huebner, of the University of Pennsylvania.

The course is designed to aid manufacturers, bankers and commercial houses in developing men to handle foreign business. The course is under the management of the Business Training Corporation, 185 Madison Avenue, New York City, of which W. H. Lough is president.

Illinois Architects Want Branded Structural Timbers

Standard specifications for southern yellow pine structural timbers were adopted by the Illinois Society of Architects, April 25. When maximum durability and strength are required, the specifications call for longleaf southern yellow pine "of select structural material," in accordance with the definition of "dense southern yellow pine" as adopted by the American Society for Testing Materials (August, 1915), and the Southern Pine Association (Density Rule Book, March 15, 1916). The brand shall be in accordance with the official requirements of the association.

When strength is required without special reference to durability, the specification calls for southern yellow pine of "structural material" as defined above. The word "longleaf" is omitted.

No. 1 common southern yellow pine timbers of "dense" grade, as defined in the density rule book of the association, are to be called for when the lumber is to be used without reference to durability or maximum strength.

No. 1 common southern yellow pine as defined in the density rule book, is to be used for joists, studs, etc., in ordinary or minor structures without reference to durability or maximum strength. (Note the word "dense" is omitted.)

For heavy factory and laminated flooring, when durability and strength are required, "dense" southern yellow pine of "merchantable grade" is to be used. When strength only is wanted, southern yellow pine of "No. 1 common timbers" will answer.

In lieu of branding, the contractor may have the material inspected by the inspection department of the Southern Pine Association, but he must then furnish, to the architect, a certificate showing that all material complies with the architect's specifications.

An Argument Against Hard Roads

Many have been the stories embodying fanciful objections to hard roads. The following incident, vouched for by the engineers of the Du Pont road, is worth adding to the list:

Shortly after the construction of one of the sections of concrete road there was an "experience meeting" in the nearest country store. Judging by the encomiums, opponents of concrete were few in that neighborhood. Finally a new customer overhearing the conversation broke up the harmony by declaring that he would never use the road again, nor would any of his family. Pressed for his reason, he replied:

Well, I was driving to town with eggs, and as soon as I hit that concrete road the wagon ran up on the horse and frightened him. He started to kick and broke every last egg in the rig. I ain't going to try no such road again."

Blame Faulty Construction for Fires in Wooden Buildings

The lumbermen of the United States will ask the government to make a comprehensive census of the nation's fires. From the data they hope to show that the susceptibility of wooden structures to fire has been over-estimated and that the real cause of fires is improper construction. Local investigations, according to reports from the National Lumber Manufacturers' Association, have shown that fires in several cities were caused by faulty placing of joists in chimneys and improper flue linings, the fires starting through careless exposure and violation of building regulations.

Will Do Small Part of Aurora Track Elevation This Year

Authority has been granted by Board of Directors of the Chicago, Burlington & Quincy Railroad to proceed with the track-elevation work at Aurora, Ill. The total estimated cost of the improvement is $4,000,000. The work to be done this year is confined to bridge work on the new alignment, where there will be no interference with present tracks and operation.

The project as a whole involves track elevation of the main line from east of Farnsworth Street to a point a mile west of Rathbone Avenue. Some sixteen grade crossings will be eliminated and a sag in the present profile will be materially lessened. The main tracks will be swung to the south to a new location a maximum of 250 ft. from the present tracks from Wood Street to the Aurora station, thereby reducing the main-line curvature and providing ground for the expansion of the yard at this point.

Beginning at South Broadway, there will be a cut-off a mile long to a point near the Elgin, Joliet & Eastern Railway crossing. This cut-off will eliminate considerable curvature. It will cross the Fox River on an island, involving two short arch bridges instead of the single bridge now in use. It will also involve a relocation of the junction with the Savanna Branch to a point just west of the westerly river crossings. The old line will be retained for industrial purposes.

The work to be done this year will be confined to this cut-off. The details of the bridges are not yet fully worked out. It is settled, however, that all bridges on the improvement, including those over the two arms of the Fox River, will be of reinforced-concrete; with steel fascia girders at one or two of the most complex skew crossings.

The work is being carried out under the direction of the engineering department of the Chicago, Burlington & Quincy Railroad, of which T. E. Calvert is chief engineer, and C. H. Cartlidge, bridge engineer.

Attorney Explains Pennsylvania Highway Laws

According to a recent interpretation of the state laws by William H. Keller, first deputy attorney general, the state highway department is not permitted to construct or improve, as a state-aid highway, any section of a state highway route within the limits of a borough. This opinion upsets the plan under which the state highway department has been acting in the past, whereby state-aid money has been used for construction work on state highways. As a result, many of the boroughs wherein the state highway department had planned to do work during the coming season, on a state-aid basis, will be deprived of this improvement.

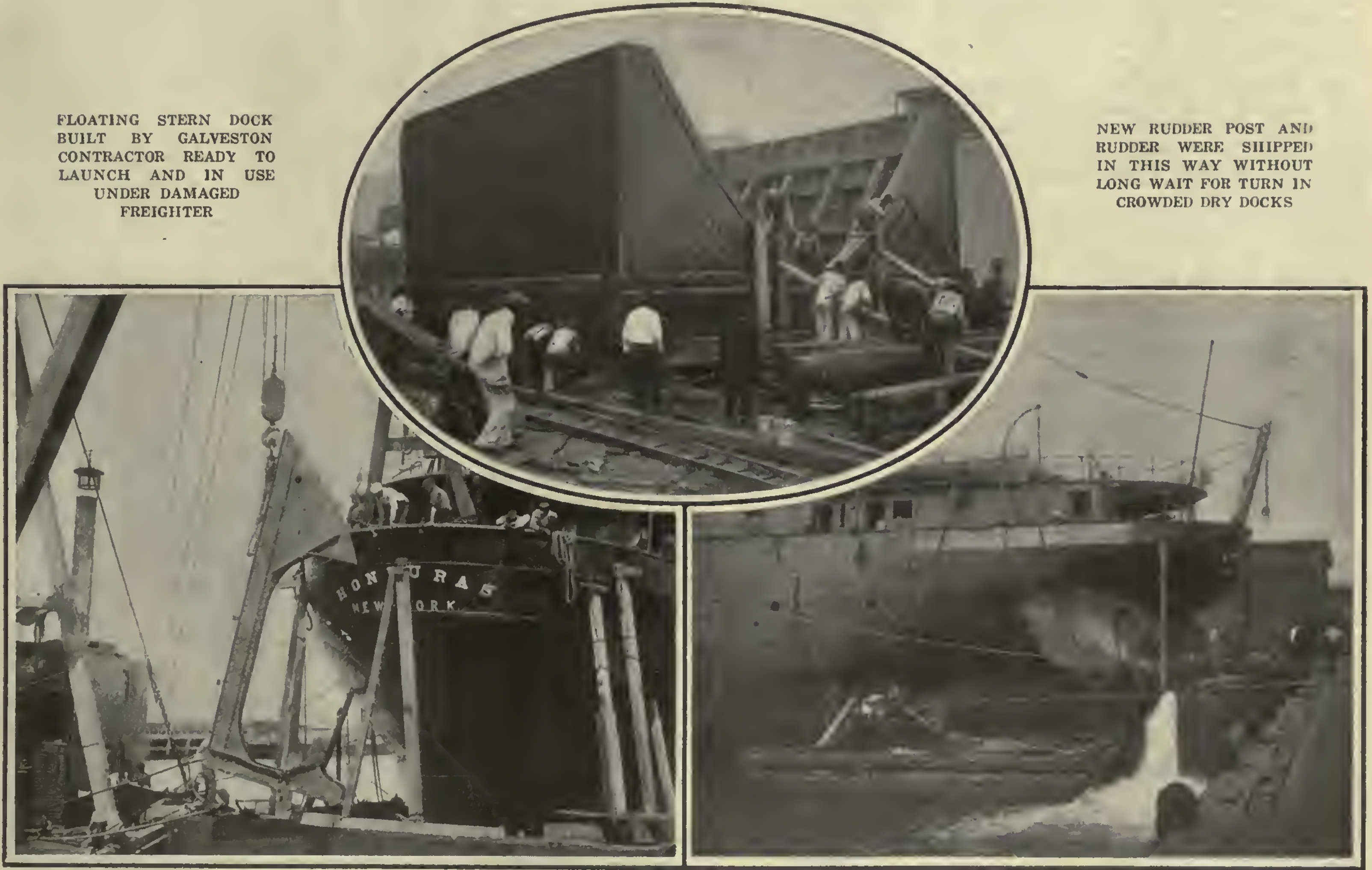
The deputy attorney general also stated that if a street has been reconstructed with permanent pavement material, the maintenance cost thenceforth is at the expense of the borough, but if it has been constructed or improved with any type of construction not coming within the term "permanent paving" material, the state highway department must pay 50 per cent of the cost of maintenance, this money to come out of the state highway funds.

An opinion was also given to the state highway department to the effect that existing legislation does not authorize the highway commissioner to build state-aid highways in townships on state highway routes; that townships and counties may, under the Act of 1913, contribute to the cost of reconstruction and improvement of state highways in townships in the same manner as provided for state-aid highways; that the entire cost of maintenance and repair of such state highways reconstructed by the aid of townships and counties must be paid by the state and that the state's share of such reconstruction and maintenance must be paid out of state highway as distinguished from state-aid highway funds.

Contractor Builds Stern Dock to Put Rudder Post on Steamer

By unwatering the stern of the large ocean freighter Honduras in a floating timber stern dock, which a Galveston contractor built in five days, a new rudder post and rudder were set on the steamer without the long delay of waiting for one of the Gulf Coast drydocks to be vacant. As shipping is at a premium and all the yards within reach were busy, this novel method of making repairs was resorted to.

The vessel was towed into Galveston harbor with her stern frame completely broken off, and steamed out 24 days later, in perfect condition, to load sulphur at Freeport, Tex. Within that time the stern dock was built and placed, measurements taken and a new stern frame and rudder designed, fabricated and permanently erected. The dock was built by R. F. Koeppe, a general contractor of Galveston. The repairs were carried out by the McDonough Iron Works of the same city, while the Texas Carnegie Steel Company fabricated the repair parts.


FLOATING STERN DOCK BUILT BY GALVESTON CONTRACTOR READY TO LAUNCH AND IN USE UNDER DAMAGED FREIGHTER

NEW RUDDER POST AND RUDDER WERE SHIPPED IN THIS WAY WITHOUT LONG WAIT FOR TURN IN CROWDED DRY DOCKS

Offer Two Weeks' Business Course

A short course in factory organization, cost accounting and scientific management is offered by Pennsylvania State College. Registration day is Aug. 7 ,and the course ends Aug. 19. The course is under the direction of Prof. Hugo Diemer.

Augusta Adopts Rigid Building Code After Big Fire

At a recent meeting of the city council of Augusta, Ga., the official code of the National Board of Fire Underwriters was adopted.

Ask Engineers' Support for du Pont's Presidential Nomination

Coleman du Pont, until recently president of the E. I. du Pont de Nemours Powder Company and at present in control of the Equitable Life Assurance Society, is a candidate for the Republican nomination for President of the United States. He is a graduate of Massachusetts Institute of Technology, and appeals to the engineers of the country for their support.

While Mr. du Pont is primarily a business man, his engineering education at Massachusetts Institute of Technology led to a position as engineer for the Central Coal & Iron Company, of Central City, Ky., from which he rose to become managing head of the company. He left Central City in 1893 to become general manager of the Johnson Company, of Johnstown, Pa., only to return three years later to engage in business for himself. He was soon made president of several Kentucky coal and iron companies, and was also interested in railway and street car systems. In 1900 he was made president of the E. I. du Pont de Nemours Powder Company and in fifteen years of service increased the company's assets from $15,000,000 to $80,000,000. He resigned from that position in 1915, and since then he has devoted his time to the Equitable Life Assurance Society, in which he holds the controlling interest.

New York City Needs Press Agent

That many important measures affecting the city are threatened and killed because the public does not understand or take interest in them is the belief of Mayor Mitchel, of New York City, as expressed by him in a recent address to the members of the Advertising Club, of New York City. According to the mayor, the power of the Senate or Assembly is almost worthless if the interest of the general public is not aroused to a point of enthusiastic support or emphatic opposition.

The present methods of giving publicity to public affairs by means of interviews with and statements by officials, are, according to Mayor Mitchel, far from satisfactory. He solicited, and was promised, the help of the advertising men present in solving the problem of how best to arouse public interest.

Engineering Societies Are Doing Good Work, Says C. E. Drayer

At a meeting of the Nashville section of the Engineering Association of the South, C. E. Drayer, secretary of the Cleveland (Ohio) Engineering Society, pointed out how engineering associations throughout the country are bringing citizens and government officials to a better appreciation of the importance of the engineer.

The engineers of Nashville became so enthused by Mr. Drayer's words that a committee was appointed to co-operate with the central health committee in a campaign for sewer extension and sanitary improvement. The committee consists of C. P. Connell, assistant city engineer; Prof. W. H. Schuerman, of Vanderbilt University; F. E. Freeland, county bridge engineer; J. H. Allen, secretary engineer, and Wilbut Nelson, geologist.

Engineering Corporation Opens Sugar-Engineering Department

After several years of investigation of problems to be met in sugar manufacture, the J. G. White Engineering Corporation of New York City has organized a sugar-engineering department. The new division offers advice in the efficient production of cane and in the design, construction and operation of sugar-manufacturing plants.. The J. G. White corporation is not affiliated with any company engaged in the manufacture of machinery or supplies used in the production of sugar.

Build 1000 Farms for Soldiers

One thousand completely equipped farms entailing an expenditure of about $3,500,000 are being rushed to completion by the Canadian Pacific Railway for the use of soldiers who have served in the European war. The funds for this patriotic memorial came through the department of natural resources of the Canadian Pacific and the plans involve the construction of 1000 houses and barns, 1200 miles of fence, and digging of 1000 wells.

Want 3000 Recruits by June 1

A campaign is being conducted by the National Guard of New York to secure 3000 recruits during May. Lieut.-Col. E. W. Van C. Lucas, Corps of Engineers, N. G., N. Y., at 216 Fort Washington Avenue, New York City, urges the engineers of New York state to enlist.

Engineering Society Activities

The Engineers' Club of Philadelphia will hold its annual meeting May 16, at which officers will be elected.

The Engineers' Society of Pennsylvania at the May 5 meeting heard John E. Lathrop of the American City Bureau, New York City, lecture on "City Planning."

The Engineers' Club of St. Louis held a joint meeting with the local section of the American Institute of Electrical Engineers May 10, at which Terrell Croft, consulting engineer, presented a paper on "Protection of Buildings Against Lightning."

The Engineers' Club of Trenton held a meeting May 11, at which "National Preparedness" was the topic of discussion. Congressman Martin B. Madden of Chicago and Frederick B. Chase, field secretary of the American Defense Society, spoke.

The Baltimore Association of Members of the American Society of Civil Engineers elected the following officers at a recent meeting: President, Harry D. Bush; vice-presidents, R. K. Compton and Col. John Biddle; secretary and treasurer, C. J. Tilden.

The Engineering Society of Buffalo at the final meeting of the season re-elected the following officers: President, John Younger; vice-presidents, W. A. James and J. G. Melendy; treasurer, William Dollar; secretary, W. J. Gamble. Over 200 members attended.

The Engineers' Society of Western Pennsylvania will hold the third of a series of military preparedness lectures May 17. Capt. C. L. Sturdevant, Corps of Engineers, U. S. A., will outline the subject of field fortifications, methods of trench warfare and siege operations.

The Colorado Association of Members of the American Society of Civil Engineers will meet this evening to hear Andrew Weiss, project manager of the U. S. Reclamation Service, discuss the drainage of irrigation projects, with special reference to the North Platte project.

The Brooklyn Engineers' Club met May 11 to witness the presentation of a paper by A. H. Rhett, formerly engineer of structures for the New York, Westchester & Boston Railway, on the waterproofing of structures subject to stress from moving loads and temperature variations.

The Georgia Drainage Association met May 4 and 5 at Monroe, Ga. Officers were elected as follows: President, A. R. Lawton, Savannah; vice-presidents, T. A. Pate, Grayson; Dr. J. A. Pirkle, Monroe; E. A. Copelan, Greensboro, and L. R. Akin, Brunswick; secretary and treasurer, S. W. McCallie, Atlanta.

A joint meeting on Military Preparedness, invitations to which were sent to all San Francisco members of the American institutes of electrical and mining engineers and the American societies of civil, mechanical and chemical engineers, was held in San Francisco May 2. The speakers were: Capt. Richard Park, Corps of Engineers, U. S. A.; Capt. John Murphy, Coast Artillery, U. S. A., and A. H. Babcock, member of the Naval Consulting Board. A resolution was adopted requesting the local officers of each of the five societies to appoint a committee to facilitate co-operation among engineers in military preparedness matters, and to represent the engineering profession in military matters in the state of California.

What Engineers and Contractors Are Doing

C. Chauncey Smith, architectural engineer, formerly with Aaron H. Gould, architect, of Portland, will assume charge of a new office opened by the Gould Engineering & Contracting Company in the Fulton-Dement Building, Astoria, Ore.

Virgil G. Bogue, consulting engineer, of New York City, has removed his office to 26 Cortlandt Street.

Charles Harding, erecting engineer for the New York Continental Jewell Filtration Company, formerly engaged at Reading, Pa., is now installing a 4,000,000-gal. filtration plant at New Albany, Ind.

Henry Jensen, general contractor, of Glasgow, Mont., has opened a permanent office in the Patterson Building. In connection with his general contracting business, Mr. Jensen will handle a line of cement.

J. D. McLeod was recently appointed city engineer of Helena, Mont.

John R. Sexton has been appointed division engineer of the Meadville division of the Erie Railroad, succeeding C. Bucholtz, promoted.

M. F. Rather, who recently resigned from his position with the engineering staff of the Wisconsin Railroad Commission, has accepted an appointment with the Johnson Service Company, of Milwaukee, Wis. Mr. Rather was connected with the commission for three years in the water-power and the land and building departments. His work for the Johnson Service Company will be in the sales division, with headquarters at Dallas, Tex.

Calvin W. Hendrick, chief engineer of Baltimore, Md., has been appointed chairman of a committee to standardize all materials and supplies purchased by the municipal government.

Walter Lee, water engineer for Baltimore, Md., is a member of the committee to standardize all materials purchased by that city.

J. H. Merriam has been transferred from Kansas City, Mo., where he was resident engineer for the Chicago, Burlington & Quincy Railroad's bridge over the Missouri River, to Yutan, Neb., where he will have charge of a 75-ft. bridge for that railroad over the Platte River.

Walter Rowland, who has been associated with the Isthmian Canal Commission and the Panama Canal since 1907, has terminated his services with the government. He has under advisement an offer from the Chile Exploration Company, in connection with its intended developments in Chuquicamata. Mr. Rowland was in charge of design of the docks and piers of the new Pacific terminals of the canal, amounting in value to $3,400,000 and comprising over 7600 lineal feet of steel and reinforced-concrete dock construction. Mr. Rowland was graduated from the civil engineering department of the University of Vienna in 1896, where he remained as an assistant until 1898. From the latter date until 1905 he was actively engaged in engineering work in Europe. He was engaged by the Twin City Rapid Transit Company, of Minneapolis, for a short time and was later associated with A. W. Hunking, consulting engineer, of St. Croix, Wis. He became connected with the Isthmian Canal Commission in 1907.

Edwin Corr, lawyer, of Bloomington, was recently appointed a member of the public service commission of Indiana. He has been a member of the legislature and deputy attorney general of that state.

R. K. Brown was promoted from the position of division engineer to that of engineer, maintenance-of-way, for the San Pedro, Los Angeles & Salt Lake Railroad, May 1, with headquarters at Los Angeles. Mr. Brown obtained his first railroad experience with the Pennsylvania at the age of 16. He later attended Rensselaer Polytechnic Institute, returning to the Pennsylvania after graduation. After ten years with that road, he went to the San Pedro, Los Angeles & Salt Lake Railroad in 1902 as division engineer.

E. F. Mitchell was appointed engineer of the western group of the presidents' conference committee on federal valuation of railroads, May 1, with headquarters at Chicago. Mr. Mitchell entered railway service in 1864 in the construction department of the Pennsylvania. He left that road in 1887 to become division engineer, maintenance-of-way, for the Norfolk & Western. From 1890 until 1892 he was assistant engineer in charge of surveys and track construction for the Denver & Rio Grande Railroad, which position he left to engage in private engineering practice until 1900, when he returned to the Denver & Rio Grande. He remained in the employ of that road for a year and then became chief engineer for the San Luis Valley Land & Mining Company. In 1905 he again took up railway work, going to the Missouri Pacific as engineer of construction and chief engineer. He left that position to engage in the practice of consulting engineering, to which he had been devoting his time until his recent appointment.

W. G. Stromquist, formerly assistant engineer for the Sanitary District of Chicago, has received an appointment as sanitary engineer with the U. S. Public Health Service, at Cincinnati. He will be active in the Ohio River investigation. Mr. Stromquist was graduated from the University of Illinois in 1910, after which he spent several months with the Champaign & Urbana Water Company at an experimental iron removal plant. For one year he was assistant engineer of Excelsior Springs, Mo. He then spent one and one-half years with the Illinois State Water Survey. In the position he is leaving he had immediate charge of the sewage-testing stations under Langdon Pearse.

H. A. Strauss, consulting engineer, of Chicago, has been retained by the Salt Lake & Los Angeles Railway to design the electrification and extension of that 15-mile steam line from Salt Lake to Saltair. The extension is to be a 4-mile stretch to Garfield.

William F. Cocke, whose appointment to the position of state road commissioner of Florida was announced in last week's issue, was born in Powhatan county, Va., in 1875. He started engineering work as chairman of the Richmond, Fredericksburg & Potomac Railway, between Richmond and Washington, and was engaged in railroad work in Virginia, West Virginia and Georgia until the panic in the fall of 1907. Shortly after returning to Virginia he secured a position as resident engineer with the Virginia highway commission. In the fall of 1910 he was promoted to the position of division engineer, from which he resigned in April, 1911, to accept the position of county engineer of Wise county. Late in 1912 he resumed the work of division engineer with the Virginia highway commission and continued in charge of the Northern division until Jan. 1, 1916, when he was promoted to the position of engineer of maintenance. He recently accepted the newly created position of state road commissioner for the state of Florida.

W. M. Stieve, formerly junior engineer for the Public Service Commission, first district, has resigned to become connected with the U. S. navy department, at Washington, D. C.

M. F. Comer, contractor, of Toledo, has been awarded the contracts for two reinforced-concrete bridges with bascule spans across the Miami River, at Miami, Fla.

John V. Stark has left the employ of the engineering department of the New York Central Railroad to engage in private business.

Frank Strong has been promoted to the position of assistant engineer of the Salt Lake division of the San Pedro, Los Angeles and Salt Lake Railroad, succeeding R. K. Brown. Mr. Strong was connected with the engineering department of the Pennsylvania Railroad from 1904 until 1912. He went to the Salt Lake route in the latter year.

D. P. Dale has resigned from his position as assistant county engineer for Sac county, Iowa, to become associated with A. H. Cunningham, engineer, in charge of about thirty drainage districts in Buena Vista and adjacent Iowa counties.

Yates & Yates, consulting engineers, New York City, have been engaged by New London county, Conn., to design and supervise the construction of a 600-ft. highway bridge across the Niantic River.

George B. Walbridge, formerly vice-president of George A. Fuller Company, has formed the Walbridge, Aldinger Company, with offices in the Penobscot Building, Detroit. The new concern will engage in building construction and engineering.

Carl E. Huffstetter, who has been connected with the U. S. engineer's office at Memphis, Tenn., for the past 3½ years, has accepted a position with the Eastville road district, at Eastville, Va. His work will consist of completing the survey of fifty miles of road now being built.

Charles S. Carpenter has resigned from his position as assistant city engineer for Angola, Ind., to become connected with the Des Moines Bridge & Iron Works.

F. Wakeman Sharpe, formerly engineer in charge of construction with the Afton-Windsor Light, Heat & Power Company, is now field engineer with the New York state highway department, at Sanitaria Springs.

Frank A. Ernest has been appointed engineer of construction at the new plant to be erected at Warners, N. J., by the Ammo-Phos Corporation, of 200 Fifth Avenue, New York City.

Albert Freitag, engaged on the head water diversion channel of the Little River drainage district, has been transferred from Whitewater to Advance, Mo.

O. P. M. Goss, consulting engineer for the West Coast Lumbermen's Association and the Association of Creosoting Companies of the Pacific Coast, has been temporarily transferred to Canadian territory to work in conjunction with the forestry department of British Columbia and of the Dominion of Canada. He will acquaint city engineers in Western Canada with the possibilities of creosoted Douglas fir for street paving and other municipal improvement purposes.

C. P. Hill is now employed on the construction of a new reinforced-concrete building at Ocean Park, Cal., as steel foreman.

The Turner Construction Company, of New York City, has been awarded contract for the erection of a seven-story reinforced-concrete factory building for the Pathé Frères Phonograph Company, in Brooklyn.

T. J. Blair, Jr., has accepted a position in the engineering department of the Baltimore & Ohio Railroad. He was formerly resident engineer for Kanawha county, W. Va.

Edgar B. Thomas, who recently resigned from his position in the engineering department of Cleveland, has opened consulting engineering offices in the Leader-News Building, in that city. Mr. Thomas received his education at Franklin College and the Case School of Applied Science. He has been in the employ of the city engineering department of Cleveland for the past fifteen years, nine of which were spent in municipal engineering design and construction and six in charge of river and harbor work.

R. V. Orbison and T. D. Allin, city engineer and engineer of public works respectively, of Pasadena, Cal., have started on a six-weeks' tour of inspection of sewage-disposal plants in numerous cities throughout the United States to secure information that may be useful in the construction of the proposed plant near Ramona Acres, for the joint use of Pasadena, Alhambra and South Pasadena.

John MacMillan, who has been city engineer of South Pasadena for several years, tendered his resignation at a special meeting May 1. Under Mr. MacMillan's supervision the sewer system has been installed and many important street improvements have been made. He has been a member of the tri-city sewer committee, which is considering the purchase of a new sewer farm for the use of the cities of Pasadena, South Pasadena and Alhambra. His resignation has not yet been accepted.

William Mulholland, chief engineer of the bureau of waterworks and supply at Los Angeles, is being urged to go to Dayton, Ohio, to advise with the authorities there in working out plans for flood control. Mr. Mulholland was asked to act as consulting engineer several weeks ago, but felt that his duties in Los Angeles were such that he could not take on any further obligations. However, when a second appeal came from the same source, the Los Angeles Public Service Commission, feeling it was a call for aid from one municipality to another, asked Mr. Mulholland to accept a twenty-day leave of absence for the purpose of complying with the request.

L. C. Scott has recently been appointed to a position on the field party of the bridge department of the Kansas City Terminal Railway, at Kansas City, Mo. Mr. Scott has been county surveyor and highway engineer for Camden county, Mo.; chief engineer for the inter-county seat road commission of that county and was recently engaged in consulting engineering practice, advising on developments involving expenditure of $7,000,000.

Obituary Notes

William F. Heath, a retired contractor, formerly of Minneapolis, died in Tacoma, Wash., May 1, at the age of 83.

Theodore H. McKenzie, consulting engineer, of Hartford, Conn., died May 3, in that city. Mr. McKenzie was born in 1847. His first engineering work was in the employ of the New York, New Haven & Hartford Railroad. After two years with that road, he accepted a position as assistant engineer for the New Haven & Northampton Railroad, which he left two years later to become division engineer for the Connecticut Valley Railroad. He spent several years with various New England railroads and served Meriden, Conn., as city engineer for three years and as street commissioner for one year. He was secretary of the Peck, Stow & Wilcox Company, at Southington, for ten years, after which he resigned to engage in the practice of consulting engineering. Since 1906 he has been engaged on appraisal of water-power, mills and machinery on the new Catskill water supply and was for five years engaged on similar work for the New York State Barge Canal.

Charles Long, who had been in the engineering department of the Grand Trunk Railway for thirty years, died May 1 at Niagara Falls.

John G. McLean, railroad contractor, of Seattle, died recently at Spokane, at the age of 66.

Frederick C. Kunz, consulting engineer, of New York City, died in that city, May 3, at the age of 52. Mr. Kunz was born in Austria and completed his technical studies at the Polytechnical School in Prague, in 1886. He was for several years on the engineering staff of the Austrian Northern (Emperor Ferdinand) Railroad. He came to the United States in the summer of 1891 and found employment with the Pencoyd Bridge Works, in Philadelphia. When this company was absorbed by the American Bridge Company, he became assistant to the vice-president in charge of engineering, with whom he remained until 1903. His most important work while with the Pencoyd Bridge Works was erection of the Niagara and Clifton arch bridges over the Niagara River. Mr. Kunz was at one time consulting engineer of New York City's bridge department, where he was active in preparing specifications and plans for the Manhattan and the Queensborough bridges. Early in 1904 he became chief engineer of the bridge department of the Pennsylvania Steel Company at Steelton, Pa., where he remained for several years. Later he engaged in the practice of consulting engineering, devoting a large part of his time to the writing of his work on "Design of Steel Bridges." Among his last construction work was the steel arch bridge at St. Johns, N. B., over the St. Johns River.

Enos M. Barton, former president of the Western Electric Company, died recently at the age of 74, at Biloxi, Miss.

Joseph J. Duffy, contractor, of Chicago, died May 3 in that city at the age of 56. Twenty-five years ago Mr. Duffy took over the contracting business started by his father. A section of the Northwest Land waterworks tunnel was built by him in 1895. At the time of his death he was engaged in a $12,000,000 lawsuit against the Sanitary District of Chicago, claiming that he was unjustly deprived of a contract for the construction of the canal extension from Lockport to Joliet.

Henry Floy, electrical engineer and valuation expert, died in New York City, May 5. Mr. Floy, who had figured in many important public utility cases during the past twenty years, was graduated from Cornell University in 1891. He was connected with the Westinghouse company for several years and, in 1898, began the practice of consulting engineering in New York City. He installed the 25,000-volt underground transmission line at St. Paul, Minn., in 1900 and had served in many big appraisal cases in various cities in the United States.

Civil Service Examinations

New York.—Examinations for state, county and village service are announced for June 3, applications for which must be received in Albany by May 24. One examination is for assistant electrical engineer, Public Service Commission, First District, salary $1,801 to $2,400. Applicants must have had six years' experience in construction or operation of power stations and heavy traction systems. Applicants for the position of junior assistant engineer, salary $901 to $1,200, must be over 20 years of age. Both examinations are open to non-residents.

Examinations Previously Announced

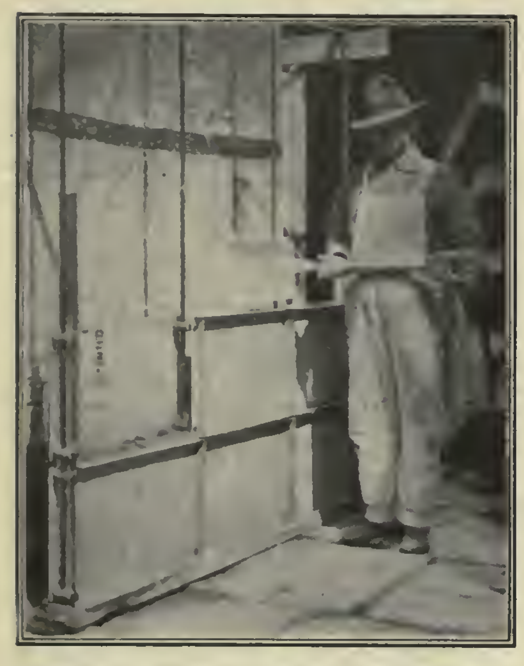
Date		See Eng. Record
Aug. 21-25	Second lieutenant, civilian candidates	April 1

Bridge Company Opens Plant

The new plant of the Anthracite Bridge Company, of Scranton, Pa., was put into operation this week. The concern specializes in structural steel for coal breakers. The officers are: President, Boyd A. Musser; vice-president, N. K. Osborne; secretary-treasurer, Warren Acker. H. E. Detwiller is chief engineer and manager.

Adjustable Metal Forms Simplify Building Problem

The construction of reinforced-concrete walls by the use of metal forms adjustable to the exact thickness of the partition has been introduced by the Pyramid Fireproofing Company, 52 Vanderbilt Avenue, New York City. Vertical steel rods or pipe are placed 2 ft. apart, along the center of the proposed wall. Screws are inserted in steel spacers, previously attached to the rods, and adjusted to the required thickness. The form plates are placed against the hub of the adjusting screws and held in place by a nut threaded on the outer end of the screws. The concrete is then placed.



SHOWING REINFORCING RODS AND METHOD OF ATTACHING FORM PLATES

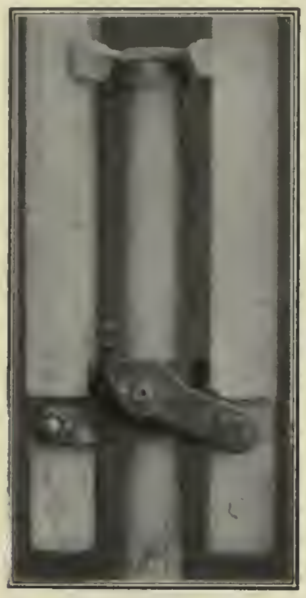
The steel rods, while they hold the plates in position, also serve as reinforcing material. This internal fastening arrangement automatically spaces the forms laterally and prevents any outward collapse. It also permits adjustment of the form plates for thickness and plumb, and makes possible building in successive courses instead of erecting the forms to the full height before placing concrete.

The form plates, being attached by screws, may be removed as soon as the concrete has set. The adjusting screws are said to make possible so nice an adjustment that only a small amount of plaster is required to finish the wall.

Compact Trench Pump Worm Gear Driven by Gasoline Engine

A competent diaphragm trench pump direct-connected by worm gear to a gasoline engine and specially designed to pump muddy and gritty water, is being made by the C. H. & E. Manufacturing Company of Milwaukee, Wis. The pump is mounted either on skids or trucks and the worm gear connects with the engine through a flexible coupling enclosed in a dust-proof housing. Both the 3-in. and 4-in. suction sizes are driven by 2-hp. water-cooled, 4-cycle engines and weigh about 500 lb. each. The 3-in. size has a capacity of 50 gal. per minute, and the 4-in 100 gal. per minute.

Shore Can Be Quickly Adjusted to Fraction of an Inch



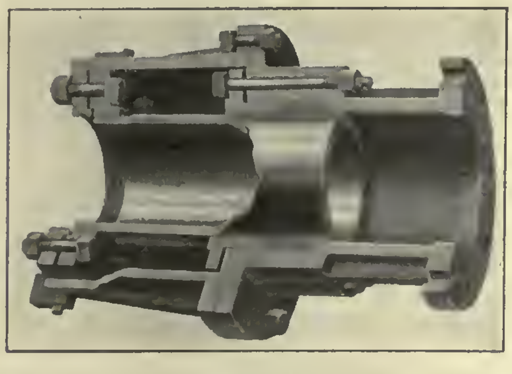
DEVICE IS LIGHT YET STRONG

A self-locking adjustable shore, consisting of a lower member of 1½-in. pipe and an extension member of two legs of two-by-fours, has been perfected by Roos Brothers, engineers and contractors, of Cincinnati, Ohio. The extension member is lifted to the desired height and fine adjustments are made by means of the Roos jacking device (not shown). A thumb screw lock prevents release through jarring and the heavier the load, the tighter the grip. The shore has great strength for its light weight.

Expansion Joint Eliminates Stresses in Pipe

The crosshead-guided expansion joint, shown in the illustration, eliminates all stresses in pipe due to expansion and contraction and is claimed to be adapted to all service for which pipe lines are designed.

These Ross joints are offered with two lengths of sleeves, having a total free travel of 4 and 8 in. respectively. They are said to be sensitive to the slightest variation in length. The larger diameter of the joint is but slightly larger than the ordinary pipe flange; hence the joint takes up but little more space than the straight line itself, and can be covered with the ordinary insulating materials.



EXPANSION JOINT USES STEAM ENGINE PRINCIPLE

This joint is manufactured by the Ross Heater & Manufacturing Company, Inc., Buffalo, N. Y., for all pressures up to 200 lb. per square inch, and for all standard sizes of pipes up to and including 24 in.

Vibrator on Wooden Mats Compacts Concrete in Pavement

In order to imbed the stone, and make a more compact mass, an engine-driven vibrator is used by the Vibrolithic Construction Company of Dallas, Texas, in laying the foundations for "Vibrolithic" pavements. Immediately after the 6-in. concrete slab is raked and smoothed to grade, 1 or 2 in. of trap rock is spread on the surface. Narrow, flexible wooden platforms on mats are then placed on the stone and a vibrator is rolled over the platforms until their bottom edges are brought to grade, resulting in a denser mixture. A coal-tar preparation is later applied to the concrete for a wearing surface.

The accompanying photograph shows the vibrator being used to surface the foundation course on a paving job in Dallas. A Foote boom and bucket mixer is used by the Vibrolithic Company to supply the concrete.

VIBRATORS ARE PLACED ON MATS

Business Notes

Platt Iron Works have removed their Chicago office to the Monadnock Block.

Ford Pulley & Hardware Company of New York City has removed to 432 Fourth Avenue.

J. A. Garber has been transferred to the Chicago office of the Ball Engine Company of Erie, Pa., to handle the sale of Erie steam shovels.

Michigan Scale & Supply Company, 82 Woodbridge Street, Detroit, now represents the Standard Scale & Supply Company of Chicago in Detroit and vicinity.

F. A. Percy has been appointed general sales manager for L. R. Kollock & Company, Railway Exchange Building, Portland. The firm deals in building materials and specialties.

The Southern Clay Manufacturing Company, Chattanooga, Tenn., has purchased the Graves paving brick plant at North Binghamton, Ala., and will begin making wire-cut lug brick at that plant.

Trade Publications

The folowing companies have recently issued trade literature:

Way-Cleanse Company, Sandusky, Ohio. Bulletin 10, 6 x 9 in.; 16 pages. Devoted to Way-Cleanse suction street sweepers.

Edson Manufacturing Company, 255 Atlantic Avenue, Boston, four-page folder describing air-cooled gasoline engine and diaphragm pump mounted on wooden skid. The engine is mounted directly over the pump, making a light and compact outfit.

The Kilbourne & Jacobs Manufacturing Company, Columbus, Ohio, catalog 41, 6 x 9 in., 30 pages, illustrated. Describes standardized line of wheelbarrows and scrapers. Contains several tables and an index.

The Goulds Manufacturing Company, Seneca Falls, N. Y., bulletin 120, 10 x 7¾ in., 20 pages, illustrated. First of this company's bulletins on its line of multi-stage centrifugal pumps. Contains descriptions of various sizes and the adaptation of each. Several cross-sections and charts and diagrams.

Raymond Brothers Impact Pulverizer Company, Chicago, catalog 12, 64 pages, illustrated. Describes grinding, pulverizing and air-separating machinery for any material to be reduced to powdered form. Contains drawings of model installations and partial list of materials handled by the Raymond system.

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Elmer Lawrence Corthell

IN THE DEATH of Elmer Lawrence Corthell the engineering profession has lost a distinguished member whose professional career was closely linked with three continents. Associated in his younger days with men whose names are indelibly blazoned on American engineering annals—Eads and Morison—he left the United States to gain a distinguished position in Europe and South America, and to return in sufficient season to allow his professional brethren here to show that they, no less than his South American and European confreres, appreciated his sterling character and his singular ability. It was characteristic of Dr. Corthell that on his return to America he should throw himself into the broader professional life with extraordinary energy. Rapidly he picked up the threads of progress here, and with equal rapidity sensed the depth of the movement for giving the engineer his proper place in public life. In such a movement he could not but take an enthusiastic part. His professional work had given him a mastery of financial affairs and brought him into close contact with the leaders of nations. He knew, therefore, the opportunities, and the need, for participation by engineers in public movements. Through his initiative the American Institute of Consulting Engineers became a member of the Chamber of Commerce of the United States and Dr. Corthell devoted much time to the committee work which ensued. He saw in it a great opportunity for public service. He was one of the leaders—if not *the* leader—in the movement to establish a civilian reserve corps of engineers. Closer relations between engineering societies appealed to him as most desirable; in fact, more than twenty years ago he advocated the formation of an engineering society of international scope. The success of the proposal to move the headquarters of the American Society of Civil Engineers to the Engineering Societies' Building was close to his heart. In a word, no subject that meant the advancement of the profession, the improvement of its status before the public, failed to find in him an enthusiastic supporter. Withal, his enthusiasm was tempered by the experience born of the handling of big affairs, while his executive ability never failed to find quickly a plan by which the proposals of which he approved could be made effective. Happily for him, and for the profession, his last years were spent in his own country. By electing him president of the American Society of Civil Engineers and of the American Institute of Consulting Engineers his professional brethren showed that though long separated from him they had followed with pride and interest his distinguished triumphs in foreign fields. "He died in the fullness of years and honors."

N. F. P. A. Takes Significant Action

SIGNIFICANT action by the committee on fire-resistive construction of the National Fire Protection Association was reported and approved at the recent annual convention in Chicago, as noted elsewhere in this issue. The previously adopted terms "full," "partial" and "temporary" protection, as applied to buildings of various classes, are to be applied in the future only to the structural materials and types of construction, and not to the completed structures. Instead, the detailed specifications now to be prepared by the committee for different classes of buildings will recognize three grades in each class—Grade A, Grade B and Grade C. The purpose is stated to be to secure for Grade A the highest practical type of fire resistance, and to have Grades B and C allow for permissible modifications. The practical wisdom of this change in principle, which will permit the future work of the committee to proceed along the lines of best economy for a completed structure, allowing the use of minor structural parts just sufficient in fire-resistive quality for their purpose, is quite evident. On the other hand, it is of vital importance that careful discrimination and judgment be exercised by the committee in permitting and limiting the use of substandard construction in minor parts.

The Typhoid Toll

ENGINEERS who have been unsuccessful in convincing local municipal authorities of the wisdom of an investment in a filtered water supply will find a quantity of valuable ammunition in the paper, "The Typhoid Toll," by George A. Johnson, consulting engineer, of New York, which will appear in the June number of the *Journal* of the American Waterworks Association. Effective use can be made of this material in justifying appropriations for much-needed public-water-supply improvements. City officials, unfamiliar with the recent progress in sanitary engineering, are likely to regard a high typhoid-fever death rate as a necessary evil. They should ponder the New York State Department of Health's motto, "Public Health Is Purchasable," and then weigh carefully Mr. Johnson's statistics. He claims, in effect, that 3000 lives could be saved annually by supplying the urban population of the United States with filtered water or water of equal purity. This figure is based upon the assumption that the typhoid fever death rate could be reduced from 20 per 100,000 population, the figure for 1913, to 14. According to Mr. Johnson's calculations, this reduction represents an amount of vital capital equal to $22,500,000 annually, or, at 6 per cent, the interest on an investment of $375,000,000. Of the 50,000,000 people representing the urban population of the United States 20,000,000 are now supplied with filtered water. To build filtration works having a total daily capacity of 4000 million gallons daily, sufficient to provide for the remaining 30,000,000 people, would not cost $100,000,000. To operate these works and pay all charges, including interest and sinking fund, would cost not more than $12,000,000, or about one-half the present annual loss in vital capital. The remaining $10,500,000 per year in saved vital capital would make a substantial nucleus for a public-health fund to be expended in general disease-prevention work. It would represent 21 cents per capita per year for the entire urban population of the United States and, if expended solely for typhoid prevention, would aid in eliminating this plague.

Engineers in Preparedness Parade

NEW YORK CITY on May 13 witnessed the largest civilian parade in American history. Approximately 125,000 people were in line, and all except about 10,000 were civilians. The demonstration was New York's way of telling how strongly its business and professional men, its employers and employees, desire that the nation be prepared in a military way. Very significant of the depth of feeling was the participation of the professions, and of these engineering easily made the best showing. Upward of 6000 men marched behind the standards of the engineering division, in nine sections—the Engineers' Club, the engineers' training battalion, one section each for the civil, mining, mechanical, electrical, chemical and automobile engineers, and a final section for miscellaneous engineering societies and organizations. The showing was impressive—so much so that the "New York Times" commented especially upon the personnel and appearance of the division. The response of the members of the profession to the invitation of the parade committee, following so closely after the success of the military lectures for engineers, is fitting notice to the military authorities of the country that engineers can be counted on to do their duty when the country needs their services. It is understood that preparedness parades are being planned in other cities—in Chicago, in Boston, in Baltimore, in Buffalo and possibly in other places. These parades will give the engineers of these communities an opportunity to show their fellow citizens where they stand on the subject of preparedness. Judging by the interest displayed in the military engineering lectures from coast to coast, the Engineering Record feels certain that the profession's response elsewhere will be fully equal to the showing at New York.

An Essential in Steel Column Tests

IN THE planning and execution of a series of full-size column tests, there is one essential too often given less attention than its importance demands. In order that the profession may obtain maximum benefit from expensive experiments of this nature, and avoid the future necessity of repeating such tests, both the physical and chemical properties of the component parts of the column section should be accurately determined. It should be possible when a section has been thoroughly investigated to predict within close limits the yield point, provided the compressive yield points of all its component parts are accurately known. By component parts is meant not simply the angles, plates, Z-bars or channels of which the columns are made, but the roots and edges of the angles, the roots, webs and flanges of the channels, and, especially, outstanding portions subject to bending as well as to direct compressive stress.

The theory of column failure, remembering that for all practical purposes failure occurs with the first marked yielding or flow of material under stress, in testing commonly designated as the yield point, indicates that there must be a direct relation between the crippling load, obtained by repeated applications of stress as suggested in the editorial in this journal of May 8, 1915, page 574, and the yield points of the material. The latter yield points should be obtained by compressive tests, for, although theoretically the elastic limit in compression is the same as in tension, the ratio between yield point and elastic limit is not constant, nor is it known just what effects the lack of perfect homogeneity of material and of inaccuracies in testing methods may have on these values.

While recognizing the complexity of the problem of determining the influence of form of section and length of column, the results of any scientific series of tests should make it possible to develop equations in terms of the yield point of the component material which would give closely the relation between this yield point and the strength of any column of given proportions built of that material.

The valuable results now being obtained in the extensive series of full-size column tests being made at the U. S. Bureau of Standards for the American Society of Civil Engineers and the American Railway Engineering Association should furnish sufficient data of this kind to make it possible to test the many varieties of theoretical formulas which have been proposed and to fix finally that formula which will give the most reliable values.

A Great Problem of Cheap Power

AT A RECENT MEETING of the American Institute of Electrical Engineers Lawrence Addicks brought to the front for consideration what is perhaps the most colossal problem in the field of power utilization. This is the provision of cheap energy for the fixation of atmospheric nitrogen. Even in times of peace innumerable industries require the use of nitric acid or its derivatives, of which the ordinary source is the niter dug from the earth. In war time, when the need of nitric acid is enormously increased on account of its necessary use in the making of explosives, the question of adequate supply becomes of prodigious importance. Germany is to-day depending, perhaps exclusively, on artificial nitrates for keeping up the ammunition supply, and without plants at home and those accessible in Scandanavia would fare badly. Since the Chilian nitrate beds, our chief source, might easily be cut off in case of war, the importance of securing the artificial nitrates is plain. In peace we need nitrates badly enough both for fertilizers and for a wide range of chemical industries. In war their possession is necessary to national life.

From the standpoint of the engineer the furnishing of power for this particular purpose is a very grave problem, much more serious than any ordinary question of electricity supply. To make the fixation-of-nitrogen industry self-supporting in times when the natural niter can be obtained, it is necessary to furnish electrical power at a price very much below that which is ordinarily possible. Mr. Addicks states that at even $15 per kilowatt per year, which comes pretty near the minimum of present practice, even in cheap water powers, commercial success is not possible unless the industry furnishes profitable byproducts. Even at half this low price success could only be attained on a large scale, running the works at full load. Improvements are being made in the technique of the processes, but at present it would take half a million kilowatts furnished day and night to make enough nitric acid for a war supply. Such an amount of power cannot possibly be secured as a by-product or spare power. It must be deliberately provided for. It is a task for the engineer, then, to look to means for the production of power on a huge scale and at very low prices, not only for the uses which are here referred to but for the widely varied metallurgical processes which are all-important in giving us materials of construction.

The available sources of power are two; the first, water power which can be developed very cheaply and which is within striking distance by electrical transmission of suitable shipping facilities for getting the product on the market. Scandinavia is rich in such powers, the United States singularly poor. The constructing engineer who sets before himself the problem of buying the power rights and designing a water-power plant which will turn out energy that can be sold at a profit for $7 or $8 per kilowatt-year transmitted to a convenient shipping point has tackled a most difficult job. If the Government can select and aid in developing water-power sites which will give the remotest chance of meeting the conditions, it can find no better use for a few million dollars than in aiding in this development.

The other possible source, by generating very cheap power by steam, is one which should appeal with particular force to the inventive genius of the engineer. If one could work at the very mouth of a cheap coal mine on the basis of producing a steady output of 100,000 kw. or more, some very remarkable figures in economy of power production might be realized. This is a far more practical and reasonable proposition than the general distribution of power from coal mines, which has, however, in a few instances made a moderate success. In the fixation of nitrogen the processes can be made practically continuous, so that a plant delivering power for this task would be able to run at very nearly 100 per cent load factor all the time. It might be possible to combine the power service with a coking plant from which valuable by-products, to be further worked up, might be derived. One of the great English engineers a year or two ago called attention to the great economies which might be introduced by the distillation of coal at comparatively low temperatures with the idea of saving the valuable material and burning the solid carbon refuse, and perhaps the otherwise unneeded gas. The possibilities are inviting.

The situation presented is far too important to let rest as one of the unsolved problems of the future. It is a tremendously big problem. It stands quite by itself, apart from the ordinary requirements of power supply.

Latest Report on Pollution of International Boundary Waters

ONCE more the work of the International Joint Commission is brought to the attention of sanitary engineers. In a report just published suggestions are made as to definite measures for abating the pollution of boundary waters between the United States and Canada and a limit for effective dilution of untreated sewage is fixed. The report, a 159-page document, is by the commission's consulting sanitary engineer, Prof. Earle B. Phelps; an abstract of it appears on page 667. The procedure adopted by the commission in dealing with this problem is as unique in the history of state control of stream pollution as the organization and powers of the commission itself are novel and epoch-marking in the history of the settlement of international disputes.

The treaty of Jan. 11, 1909, between the United States and Great Britain had for its objects, as set forth in the preamble, "to prevent disputes regarding the use of boundary waters and to settle all questions which are now pending between the United States and the Dominion of Canada involving the rights, obligations, or interests of either in relation to the other or to the inhabitants of the other, along their common frontier, and to make provision for the adjustment and settlement of all such questions as may hereafter arise."

To accomplish this purpose in the most direct manner possible the high contracting parties agreed "to establish and maintain an International Joint Commission of the United States and Canada, composed of six commissioners, three on the part of the United States appointed by the President thereof, and three on the part of the United Kingdom appointed by His Majesty on the recommendation of the Governor in Council of the Dominion of Canada."

This commission was organized Jan. 10, 1912. In certain matters dealing with the uses, obstructions and diversions of the boundary waters, the commission has final jurisdiction and may render decisions from which there is no appeal. In these matters, therefore, it sits as an international court of arbitration. In addition, the high contracting parties agreed to refer to the commission from time to time, for examination and report upon the facts and circumstances, together with such conclusions and recommendations as may be appropriate, any other questions or matters of difference arising between them involving the rights, obligations or interests of either in relation to the other, or to the inhabitants of the other along the common frontier. Under this article the commission renders reports and recommendations which are not binding upon the two governments, although the obligation to so refer all matters of dispute is apparently made binding by the wording of the treaty.

Since its organization the commission has been actively engaged in the settlement of disputes that existed prior to that time and that have arisen in the meantime. In a statement before a congressional committee, James A. Tawney, a member, and at that time chairman of the American section, said: "An examination of the record of the work of the commission will disclose the fact that since its organization three years ago the commission has finally settled and adjusted more controversies between the people of Canada and the United States and between the two governments than were previously settled and adjusted through the diplomatic agencies of Great Britain and the United States since the beginning of our government."

The work of the commission has dealt largely with matters of water diversion, lake levels and obstructions to navigation. In August, 1912, however, there were referred to the commission for examination and report with appropriate recommendations, the following questions:

"1. To what extent and by what causes and in what localities have the boundary waters between the United States and Canada been polluted so as to be injurious to the public health and unfit for domestic or other uses?

"2. In what way or manner, whether by the construction and operation of suitable drainage canals or plants at convenient points or otherwise, is it possible and advisable to remedy or prevent the pollution of these waters, and by what means or arrangement can the proper construction or operation of remedial or preventive works, or a system or method of rendering these waters sanitary and suitable for domestic and other uses, be best secured and maintained in order to secure the adequate protection and development of all interests involved on both sides of the boundary, and to fulfil the obligations undertaken in Article IV of the Waterways Treaty of January 11th, 1909?"

The commission immediately organized, under the leadership of Dr. Allan J. McLaughlin, U. S. Public Health Service, the necessary personnel and equipment for a thorough investigation of the first branch of this reference. Dr. McLaughlin had the co-operation in this work of Dr. J. W. S. McCullough, chief officer of health of Ontario, and of F. A. Dallyn, provincial sanitary engineer, and Dr. John A. Amyot, professor of hygiene, University of Toronto. The results of the investigation which was made were reported in detail in a progress report of the International Joint Commission on the pollution of boundary waters issued Jan. 16, 1914. This report probably represents the largest single piece of work of this character which has ever been undertaken. Seventeen field laboratories were utilized and more than 19,000 samples were examined. The total cost of the investigation was about $42,000. The boundary waters from the Rainy River in the northwest to the St. John River between Maine and New Brunswick were included in this study. The report of the sanitary experts in charge of this work established in a conclusive manner the location and extent of pollution which exists in contravention of the terms of the treaty.

Immediately upon the completion of this work and publication of the results steps were taken toward answering the second branch of the reference and the formulation of the final recommendations of the commission. For this purpose a board of consulting engineers, comprising three sanitary engineers of each country, was called together at New York City in May, 1914. Those consulted were George W. Fuller, New York; Prof. George C. Whipple, New York; Prof. Earle B. Phelps, Washington; Fred A. Dallyn, Toronto; W. S. Lea, Montreal, and Theodore Lafrenier, Montreal. The testimony of these engineers was taken in great detail and was later summarized in the form of a résumé, which, in fourteen paragraphs, laid down a set of principles which, in the opinion of the engineers, should guide the commission in its further procedures.

The terms of the reference seemed to place upon the commission the burden of establishing the feasibility and desirability of any recommendations which it might make, and to this end it was decided that a complete preliminary engineering survey of the entire situation was necessary before definite recommendations of remedial measures would be justified. The organization and conduct of this phase of the studies were placed in the hands of Professor Phelps of the U. S. Public Health Service as consulting sanitary engineer. Engineering offices were established at Detroit, Mich., and at Buffalo, N. Y., in charge of Henry C. McRae and Frank C. Tolles, district engineers. These offices were properly organized for the work in hand and immediately proceeded to the preparation of drainage plans, the selection of suitable sites for purification works and the design and cost estimates of purification plants of various types. The Detroit office covered the St. Clair River and Detroit River districts and the Buffalo office the Niagara River district, and plans and estimates were prepared for all communities on both sides of these three rivers.

The work was continued over a period of nine months, and three months' additional time was utilized in the preparation of the final reports of the district engineers and the consulting sanitary engineer. The cost of this investigation was approximately $20,000. This report (see page 667) was presented to the commission at a meeting held in Washington March 8 to 10, 1916, and was accepted and ordered printed in the form of advance sheets. The report of the engineers, therefore, does not constitute the report of the commission upon these matters and it is the purpose, after allowing the cities and towns a suitable time for a study of the results obtained, to hold public hearings at various convenient points at which hearings the federal, state and provincial authorities and the cities interested may have full opportunity to present facts and opinions before the commission. The final conclusions and recommendations of the commission will presumably be based upon a full consideration of the engineers' report and material presented at these hearings.

While the final word still remains to be spoken, the present report carries with it suggestions which, it is reasonable to assume, will govern the commission along three broad principles of policy. In the first place, a definite standard has been proposed to aid in determining whether or not the disposal of raw sewage by mere dilution in a large body of water is permissible. The fixing of 4 sec.-ft. of diluting water per capita of contributing population as a minimum requirement is a matter of considerable economic importance, for upon it hinges the question of the construction or omission of treatment works. Secondly, the recommendation of coarse screening, Imhoff tanks in preference to fine screens, and chemical disinfection indicates what degree of purification the commission considers adequate and what financial burdens the municipalities in the Detroit and Buffalo districts may be called upon to bear. The third significant feature of the report concerns the administration of the remedial works proposed. The jurisdiction of whatever administrative body may be appointed to take charge of this work—and it will be one of considerable size—should be coextensive with the entire system of boundary waters. Then, too, a real solution of the stream pollution problem must be based upon laws so carefully drawn as regards their reasonableness and their consideration of common-law rights as to stand the test of the courts.

Professor Phelps' latest report marks the second important stage of the boundary water question. The first was signalized by the 1914 report, stating the facts in the case. The third will be the actual construction of sewage treatment works.

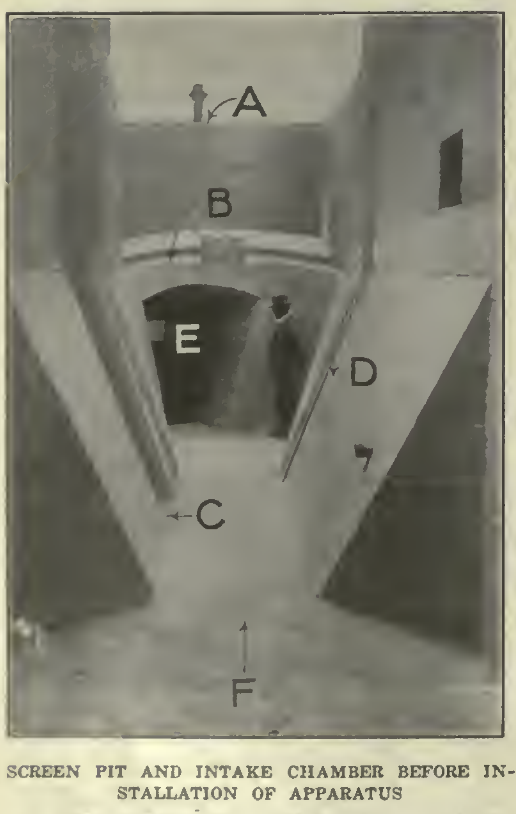
Sewage Screening and Sludge Burning Plant Prevent Sea Shore Nuisances

At Long Beach, Cal., Sewage Passes Revolving Screen—Effluent Discharged into Ocean and Sludge Reduced in Incinerator

In May, 1913, the construction of a sewerage system for the city of Long Beach, Cal., was authorized, and under a bond issue of $340,000 work was commenced on a system involving 12 miles of mains and laterals terminating in a 48-in. outfall. Machine-made concrete pipe was used for the small diameters, and reinforced concrete for diameters of 33 in. and over. The present population of Long Beach is 35,000; the outfall was designed with sufficient capacity for 125,000 to 150,000. After a careful study of various methods of sewage treatment the engineers retained for this work decided that the use of fine screens would be most advisable. This decision was based on four considerations: Sufficient suspended matter would be removed to render the passage of effluent into the ocean unobjectionable; the cost of Imhoff tanks would be excessive because of the high ground-water level and quicksand along the sewer outfall; a screening plant would occupy but small space and could be housed in an attractive building which would not suggest sewage disposal works; and screenings from the sewage could be completely destroyed by incineration. No attempt at purification of the effluent was made because, after passing the fine screen, it is discharged into the ocean 1100 ft. from shore in 15 ft. of water.

Screen of Revolving Type

The sewage enters the disposal plant through a 48-in. outfall pipe, passes through a Riensch-Wurl screen, then over a weir and into a pump sump. A by-pass is provided so that in case screen repairs are necessary the sewage can be temporarily by-passed direct into the sump. A grizzly, or bar screen, of ½ x 3-in. wrought-iron bars, spaced 2½ in. on centers, is placed in the 48-in. main just above the screen so that all extraneous matter can be removed and taken directly to the incinerator without interfering with the screening process. The screen openings are 1/32 in. in diameter so that only the finest particles will appear in the effluent. These will be readily oxidized and are expected to cause no nuisance in the sea water or along the shore.



SCREEN PIT AND INTAKE CHAMBER BEFORE INSTALLATION OF APPARATUS

A—Wall of screening discharge room. B—Screen setting. C—By-pass. D—Stop-plank grooves. E—Outlet. F—Inlet channel.

In order to obtain a gravity flow for practically the entire city it was necessary to have the water level at the screen at approximately half tide. Under this condition it is necessary to pump the sewage for about one-third of the time while the tide is above this level. Gravity discharge is obtained for about two-thirds of the time during the low tide period. The sludge collected on the screens is consumed in an oil-burning incinerator for which draft is furnished for a 65-ft. chimney. The outfall beyond the screening plant is a 36-in. iron pipe laid along the ocean bottom and anchored with three concrete piles driven to a 20-ft. penetration every 12 ft.

Part of Sewage Pumped

When the sewage is to be pumped it is handled by two motor-driven, vertical, centrifugal pumps, each rated at 1000 gal. per minute. These pumps are automatically started and stopped by a float in a 12-in. cast-iron pipe connected with the outfall beyond the sump. When the tide water rises above a fixed level this float starts the pumps and later cuts off the current when the tide recedes to the same level. In addition to the pump mechanism, an electric motor operating the 36-in. pipe valve through which outlet from the sump is provided is actuated by the same float arrangement, its function being to prevent the backing up of the tide waters through the low pipe outlet channel. The differential installed for this purpose consists of a set of adjustable, renewable contacts on a marble panel connected between two sliding contactors, one on each side, actuated by the float chains. This mechanism is interlocking with the automatic pump starters in such a manner that while the pipe valve is open the pumps are automatically rendered inoperative, without, however, affecting the manual pump control.

The plant is designed for an approximate population of 50,000 with an estimated normal daily flow of 3,750,000 gal. The consumption is designed to handle a maximum daily flow of 5,500,000 gal.

Removing Screenings from Disk

The screen proper consists of a circular plate set on an incline and with its lower part dipping into the sewage as this circular disk is revolved. A device for removing the solid deposits sweeps over the upper exposed part of the disk and transfers the solids to a receptacle in which they are conveyed to the incinerator. The disk is made of rolled manganese bronze plates, ⅛ in. thick, carrying rectangular perforations 1/32 in. wide by 2 in. long, and which widen on the under, or downstream, side. These perforations are so arranged that in the operation of the screening mechanism they will have their long axes parallel to the travel of the cleaning brushes. All of the plates which make up the screen disk are readily removable and each plate fits exactly, so there are no spaces in which solid matter might accumulate. The perforations are machine cut, so that both sides of the plate are free from burrs. The clearance between the screen periphery and the screen chamber is carefully made consistent for the full distance of the screen perimeter and the specifications require this space to be not greater than 1/32 in.

UNDER SIDE OF SCREEN FRAME

R—Screened sewage chamber. S—Screen pit. T—Lower edge of screen. U—Cone frame

The solid matter is removed from the upper part of the screen by brushes sweeping across the screen disk in a direction opposite to that in which the disk is traveling. At the same time that these brushes revolve around their common center they rotate in such a direction that in passing over the screen they do not force the screenings down through the perforations but rather lift them off the disk and roll them along ahead of the brush. At the center of the screen disk its axis is incased in a conical section of screening surface and this is also cleaned by a revolving brush which sweeps the screen in a vertical direction.

The screening disk is so arranged that as the sewage flows against it in the incline position, the effluent passes on through the screen into the outfall while all solid matter is held back and, as the screen rotates, is cleanly removed by the brushes before that portion of the screen again dips below the sewage level.

Movement of Screen

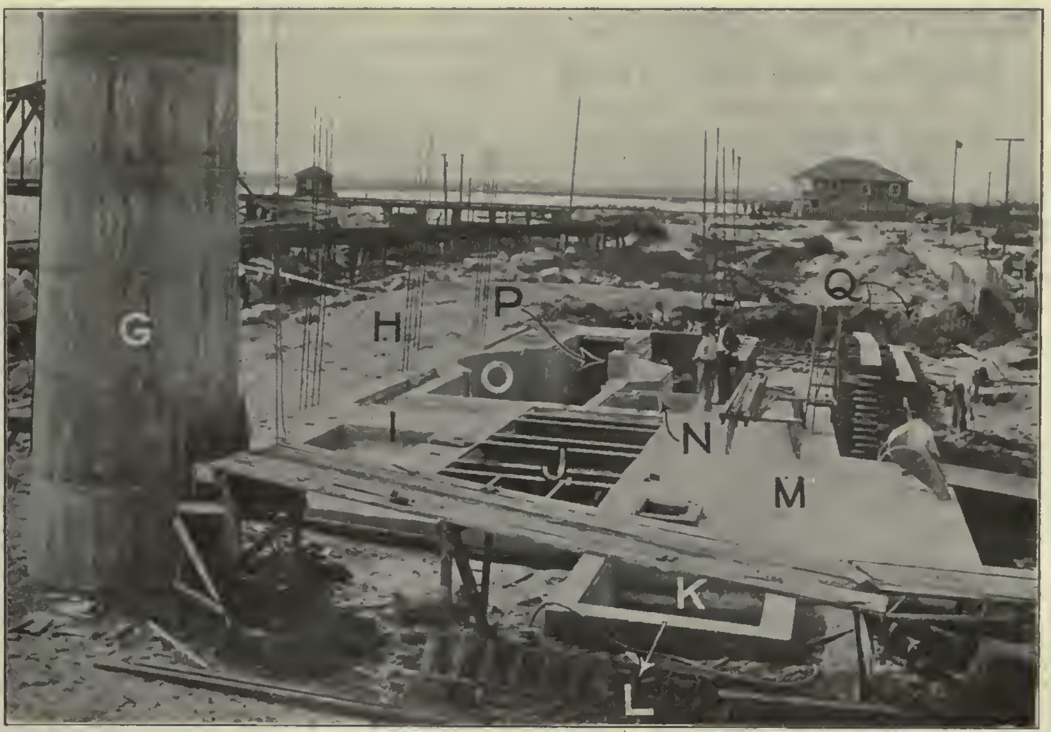
The screen is revolved at the rate of ½ r.p.m. by a three-phase variable speed mtor which has impregnated moisture-proof windings for both rotor and stator, this impregnation being suitable to withstand salt air. The lubricating system for the moving parts of the screen mechanism is fed and regulated from a central point as far as practicable. Borings lubricated by grease are packed and sealed and when near or below the sewage level are equipped with stuffing boxes.

As the solids are swept from the face of the screening disk they pass through a chute into a sludge can standing on a turntable. As the can is filled the turntable is revolved so that an empty can is brought under the chute and the other can be emptied. From this turntable the sludge cans are hoisted to an overhead monorail along which they travel to a position over the charging hole in the top of the incinerator. The cans are 24 in. in dameter, 36 in. high and are equipped with tightly fitting lid and handles for lifting. The plant equipment includes six cans.

INCINERATOR

The incinerator is of the high pressure oil-burning type, designed for the destruction of 1300 lb. per hour of sludge as delivered from the screen containing approximately 80 per cent of moisture. On the basis of 8 hr. continuous operation, its capacity is rated at 10,400 lb. of sludge, equivalent to 150 cu. ft. of sludge on the basis of 69 lb. per cubic foot. The exterior walls of the incinerator are of hard burnt red brick laid in cement mortar and separated by a 2-in. air space of interior lining of 9-in. firebrick. The roof is arched and consists of fireclay blocks grouted to fit the exact interior dimensions of the furnace. The incinerator is set in concrete foundations and is braced by three sets of double 6-in. channels, 9½ ft. long and with tie rods across the top. The four corners have 6-in. angles with tie rods, and 6-in. and 4-in. angles are used for bracing on all four sides.

Passing through the charging hole into the interior of the incinerator the wet sludge strikes an inclined upper drying hearth of special fireclay blocks with 1-in. openings between, through which free liquid passes into the lower section. This is raised at the sides to provide for retention of material without flowing through stoking doors and slightly inclined from front to rear to allow free water to pass through into the concave bottom of the furnace. Between the upper hearth and the concave bottom which serves as an evaporating pan a layer of dry hearth is placed so as to direct the return of the flames and heat. The combustion chamber at one end of the furnace is equipped with a series of baffles of heavy 9-in. fireclay blocks with 6-in. openings, staggered to permit the passing of gases. These baffles become incandescent and are intended to destroy all smoke and combustion gases from the fuel and the burning material. The oil burners are placed in the front end of the furnace in such a manner as to direct the flames first over the material on the drying hearth. From the final combustion chamber the gases pass upon the concrete chimney which is lined with fire brick. The chimney is supported on a concrete piling foundation by a block of reinforced 1:2:5 concrete.



LONG BEACH SCREENING AND DISPOSAL PLANT UNDER CONSTRUCTION

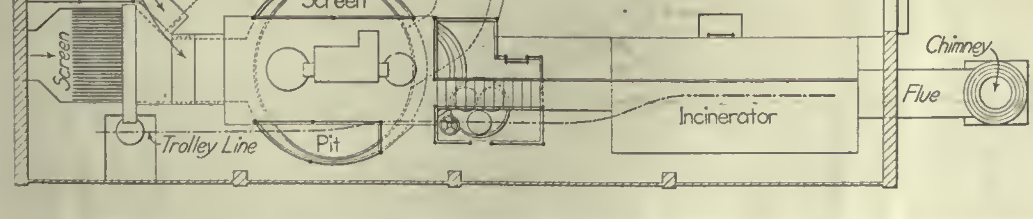
G—Incinerator stack. H—Column reinforcement. I—Incinerator foundations. J—Pump pit. K—Hatch over outlet. L—To outfall pipe. M—Sump roof. N—Screened sewage channel. O—Screen chamber. P—Screen chamber by-pass. Q—Trench for inlet pipe.

Under this reduction process the only residue which has to be removed from the plant is the ash from the incinerator. Since the plant has been in operation handling sewage from a population of about 35,000, the quantity of ash has been about 2 cu. yd. per month. Tests of the sewage which have been made from time to time by the city bacteriologist show that it runs from 87.1 to 88.4 per cent of water. An analysis of the sewage effluent gave the following volumetric results:

Volume of effluent used	350 cu. cm.
Weight of suspended matter (residue on filtration)	0.0953 grams
Weight of suspended matter in grams per liter	0.272 grams
Weight of suspended matter in ounces per 100,000 gal	3636.3 ounces

The average amount of wet sludge consumed, according to Charles B. Murphy, superintendent of sewers, is 100,000 lb. per month. The burning of this has required 1815 bbl. of fuel oil costing 90 cents per barrel. The total cost of operation, including fuel oil and electric power and two operators at $90 per month, has been found to be $250. This figure represents operation when handling an average daily sewage flow of 2,000,000 gal.

Olmsted & Gillelen, of Los Angeles, Cal., were retained by the city of Long Beach, first in a consulting capacity and later to supervise the construction of the sewerage system and treatment works. Bent Brothers, of Los Angeles, held the contract for the manufacture and placing of the pipe and the construction of the building for housing the screens and incinerator. The screens and incinerator were furnished by the Sanitation Corporation of New York.



SEWAGE MAY BE BY-PASSED AROUND REVOLVING SCREEN TO SUMP

Instructs Road Patrolmen Regarding Their Duties

TO impress upon road patrolmen the duties which they are expected to perform, D. H. Winslow, U. S. superintendent of road construction at Durham, N. C., has prepared the following general instructions:

Inspect your road, its entire section, during a rainy day and locate all pond holes.

Use the road drag immediately after a rain.

Fill all depressions with good material.

On no account use worn-out material, sod or sand from ditches.

Remove all glass, tin cans, nails, old iron, etc., from the roadbed.

Renew all defective plank at culverts when necessary.

Should your road surface be very rough, a spike toothed harrow used while the road is wet will improve an earth, sand-clay, topsoil or gravel surface.

Cut the weeds both sides of the road. Use a mowing machine for this purpose if practical.

Cut all brush at inside of the curves and at railway crossings and culverts.

Remove the ridge between the wheel rut and the gutter by using the one-horse cultivator and then use the drag to push the material toward the ditch.

See that all culverts are clear, with outlets and inlets in good order.

Paint all guard rails at culverts and bridges, etc.

Renew all signboards, mile-posts, etc., when necessary and give the traveling public all the advice in regard to the routes within your power.

See that all labor and teams in your employ render full and satisfactory service.

Receive all information and criticism from the general public in a courteous manner.

Rail Weights Reduced to Lengths, and Vice Versa

Tables Compiled for Converting Linear Feet of Eighteen Sections into Tonnages, and Tonnages into Track Miles

By JAMES G. WISHART
Office Engineer, Chicago, Rock Island & Pacific Railway, Chicago, Ill.

THE ACCOMPANYING tables for figuring tonnages and lengths of rail will be found very convenient not only in the engineering departments of the railroads but also in the valuation and auditing departments. Table 1 is especially valuable in the division engineer's office or other offices where estimates for spur tracks are made, and is also a time saver for the valuation department in arriving at the tonnage in existing tracks. Table 2 is useful where the tonnage of rail available is fixed and the length of track it will lay is to be found. This occurs frequently when programs are being compiled for laying rail.

Table 1 gives the weight in gross tons per linear foot for any section of rail from 35 to 120 lb. per yard, inclusive. From this table the total tonnage of any given length of rail can be quickly and accurately ascertained by the addition of two or more quantities. The following example will illustrate the method of using the table: Given 4237 lin. ft. of 80-lb. rail, to find the total tonnage. From the column headed 80 lb. take from opposite 4000 in the first column the amount 47.6190; from opposite 200 the amount 2.3810; from opposite 30 the amount 0.3571 and from opposite 7 the amount 0.0833. The sum of these four quantities equals 50.4404 tons, the weight of the given amount of rail.

Table 2 gives the amount of single track that can be laid with any amount of rail, given in gross tons, for any section of rail from 35 to 120 lb. per yard inclusive. Example: Given 2652 tons of 90-lb. rail, to find the miles of single track which it will lay. From the column headed 90 lb. take from opposite 2000 in the first column the amount 14.1414; from opposite 600, 4.2424; from opposite 50, 0.3535, and from opposite 2, 0.0141. The sum of these four quantities equals 18.7514 miles, the amount of single

TABLE I—WEIGHTS OF RAIL OF VARIOUS SECTIONS IN GROSS TONS PER ANY LENGTH IN FEET (SINGLE RAIL)

Length of Rail	WEIGHT IN TONS																		Length of Rail
	120-lb.	110-lb.	105-lb.	100-lb.	95-lb.	90-lb.	85-lb.	80-lb.	75-lb	70-lb.	67-lb.	65-lb.	60-lb.	56-lb.	50-lb.	45-lb.	40-lb.	35-lb.	
1	0.0179	0.0164	0.0156	0.0149	0.0141	0.0134	0.0126	0.0119	0.0112	0.0104	0.0100	0.0097	0.0089	0.0083	0.0074	0.0067	0.0060	0.0052	1
2	0.0357	0.0327	0.0313	0.0298	0.0283	0 0268	0.0253	0.0238	0.0223	0.0208	0.0199	0.0193	0.0179	0.0167	0.0149	0.0134	0.0119	0.0104	2
3	0.0536	0.0491	0.0469	0.0446	0.0424	0.0402	0.0379	0.0357	0.0335	0.0313	0.0299	0.0290	0.0268	0.0250	00.223	0.0201	0.0179	0.0156	3
4	0.0714	0.0655	0.0625	0.0595	0.0565	0.0536	0.0506	0.0476	0.0446	0.0417	0.0399	0.0387	0.0357	0.0333	0.0298	0.0268	0.0238	0.0208	4
5	0.0893	0.0818	0.0781	0.0744	0 0707	0.0670	0.0632	0.0595	0.0558	0.0521	0.0499	0.0484	0.0446	0.0417	0.0372	0.0335	0.0298	0.0260	5
6	0.1071	0.0982	0.0938	0.0893	0.0848	0.0804	0.0759	0.0714	0.0670	0.0625	0.0598	0.0580	0.0536	0.0500	0.0446	0.0402	0.0357	0.0313	6
7	0.1250	0.1146	0.1094	0.1042	0.0990	0.0938	0.0885	0.0833	0.0781	0.0729	0.0698	0.0677	0.0625	0.0583	0.0521	0.0469	0.0417	0.0365	7
8	0 1429	0.1310	0.1250	0.1190	0.1131	0.1071	0.1012	0.0952	0.0893	0.0833	0.0798	0.0774	0.0714	0.0667	0.0595	0.0536	0.0476	0.0417	8
9	0.1607	0.1473	0.1406	0.1339	0.1272	0.1205	0.1138	0.1071	0.1004	0.0938	0.0897	0.0871	0.0804	0.0750	0.0670	0.0603	0.0536	0.0469	9
10	0.1786	0.1637	0.1563	0.1488	0.1414	0.1339	0.1265	0.1190	0.1116	0.1042	0.0997	0.0967	0.0893	0.0833	0.0744	0.0670	0.0595	0.0521	10
20	0.3571	0.3274	0.3125	0.2976	0.2827	0.2679	0 2530	0.2381	0.2232	0.2083	0.1994	0.1935	0.1786	0.1667	0.1488	0.1339	0.1190	0.1042	20
30	0.5357	0.4911	0.4688	0.4464	0.4241	0.4018	0.3795	0.3571	0.3348	0.3125	0.2991	0.2902	0.2679	0.2500	0.2232	0.2009	0.1786	0.1563	30
40	0.7143	0.6548	0.6250	0.5952	0.5655	0.5357	0.5060	0.4762	0.4464	0.4167	0.3988	0.3869	0.3571	0.3333	0.2976	0.2679	0.2381	0.2083	40
50	0.8929	0.8184	0.7813	0.7440	0.7068	0.6696	0.6324	0.5952	0.5580	0.5208	0.4985	0.4836	0.4464	0.4167	0.3720	0.3348	0.2976	0.2604	50
60	1.0714	0.9821	0.9375	0.8929	0.8482	0.8036	0.7589	0.7143	0.6696	0.6250	0.5982	0.5804	0.5357	0.5000	0.4464	0.4018	0.3571	0.3125	60
70	1.2500	1.1458	1.0938	1.0417	0.9896	0.9375	0.8854	0.8333	0.7813	0.7292	0.6979	0.6771	0.6250	0.5833	0.5208	0.4688	0.4167	0.3646	70
80	1.4286	1.3095	1.2500	1.1905	1.1310	1.0714	1.0119	0.9524	0.8929	0.8333	0.7976	0.7738	0.7143	0.6667	0.5952	0.5357	0 4762	0.4167	80
90	1.6071	1.4732	1.4063	1.3393	1.2723	1.2054	1.1384	1.0714	1.0045	0.9375	0.8973	0.8705	0.8036	0.7500	0.6696	0.6027	0.5357	0.4688	90
100	1.7857	1.6369	1.5625	1.4881	1.4137	1.3393	1.2649	1.1905	1.1161	1.0417	0.9970	0.9673	0.8929	0.8333	0.7440	0.6696	0.5952	0.5208	100
200	3.5714	2.2738	3.1250	2.9762	2.8274	2.6786	2.5298	2.3810	2.2321	2.0833	1.9940	1.9345	1.7857	1.6667	1.4881	1.3393	1.1905	1.0417	200
300	5.3571	4 9106	4 6875	4.4643	4.2411	4.0179	3.7946	3.5714	3.3482	3.1250	2.9911	2.9018	2.0786	2.5000	2.2321	2.0089	1.7857	1.5625	300
400	7.1429	6.5475	6.2500	5.9524	5.6548	5.3571	5.0595	4.7619	4.4643	4.1667	3.9881	3.8690	3.5714	3.3333	2.9762	2.6786	2.3810	2.0833	400
500	8.9286	8.1844	7.8125	7.4405	7.0685	6.6964	6.3244	5.9524	5.5804	5.2083	4.9851	4.8363	4.4643	4.1667	3.7202	3.3482	2.9762	2.6042	500
600	10.7143	9.8213	9.3750	8.9286	8.4821	8.0357	7.5893	7.1429	6.6964	6.2500	5.9821	5.8036	5.3571	5.0000	4.4643	4.0179	3.5714	3.1250	600
700	12.5000	11.4581	10.9375	10.4167	9.8958	9.3750	8.8542	8.3333	7.8125	7.2917	6.9792	6.7708	6.2500	5.8333	5.2083	4.6875	4.1667	3.6458	700
800	14.2857	13.0950	12.5000	11.9048	11.3095	10.7143	10.1190	9.5238	8.9286	8.3333	7.9762	7.7381	7.1429	6.6667	5.9524	5.3571	4.7619	4.1667	800
900	16.0714	14.7319	14 0625	13.3929	12.7232	12.0536	11.3839	10.7143	10.0446	9.3750	8.9732	8.7054	8.0357	7.5000	6.6964	6.0268	5.3571	4.6875	900
1000	17.8571	16.3688	15.6250	14.8810	14.1369	13.3929	12.6488	11.9048	11.1607	10.4167	9.9702	9.6726	8.9286	8.3333	7.4405	6.6964	5.9524	5.2083	1000
2000	35.7143	32.7375	31 2500	29.7619	28.2738	26.7857	25.2976	23.8095	22.3214	20.8333	19.9405	19.3452	17.8571	16.6667	14.8810	13.3929	11.9048	10.4167	2000
3000	53.5714	49.1063	46.8750	44.6429	42.4107	40.1786	37.9464	35.7143	33.4821	31.2500	29.9107	29.0179	26.7857	25.0000	22.3214	20.0893	17.8571	15.6250	3000
4000	71.4286	65.4750	62.5000	59.5238	56.5476	53.5714	50.5952	47.6190	44.6429	41.6667	39.8810	38.6905	35.7143	33.3333	29.7619	26.7857	23.8095	20.8333	4000
5000	89.2857	81.8438	78.1250	74.4048	70.6845	66.9643	63.2440	59.5238	55.8036	52.0833	49.8512	48.3631	44.6429	41.6667	37.2024	33.4821	29.7619	26.0417	5000
6000	107.1428	98.2125	93.7500	89.2857	84.8214	80.3571	75.8929	71.4286	66.9643	62.5000	59.8214	58.0357	53.5714	50.0000	44.6429	40.1786	35.7143	31.2500	6000
7000	125.0001	114.5813	109.3750	104.1667	98.9583	93.7500	88.5417	83.3333	78.1250	72.9167	69.7917	67.7083	62.5000	58.3333	52.0833	46.8750	41.6667	36.4583	7000
8000	142.8571	130.9500	125.0000	119.0476	113.0952	107.1429	101.1905	95.2381	89.2857	83.3333	79.7619	77.3810	71.4286	66.6667	59.5238	53.5714	47.6190	41.6667	8000
9000	160.7143	147.3168	140.6250	133.9286	127.2321	120.5357	113.8393	107.1429	100.4464	93.7500	89.7321	87.0536	80.3571	75.0000	66.9643	60.2679	53.5714	46.8750	9000
10000	178.5714	163.6875	158.2500	148.8095	141.3690	133.9286	126.4881	119 0476	111.6071	104.1667	99.7024	96.7262	89.2857	83.3333	74.4048	66.9643	59.5238	52.0833	10000
1 mile	94.2857	86.4271	82.5000	78.5714	74.6429	70.7143	66.7857	62.8571	58.9286	55.0000	62.6429	51.0714	47.1429	44.0000	39.2857	35.3571	31.4286	27.5000	1 mile
2 miles	188.5714	172.8542	165.0000	157.1429	149.2858	141.4286	133.5714	125.7143	117.8571	110.0000	105.2857	102.1429	94.2857	88.0000	78.5714	70.7143	62.8571	55.0000	2 miles

TABLE 2—LENGTHS OF RAIL OF VARIOUS SECTIONS IN TRACK MILES PER ANY WEIGHT IN GHOSS TONS

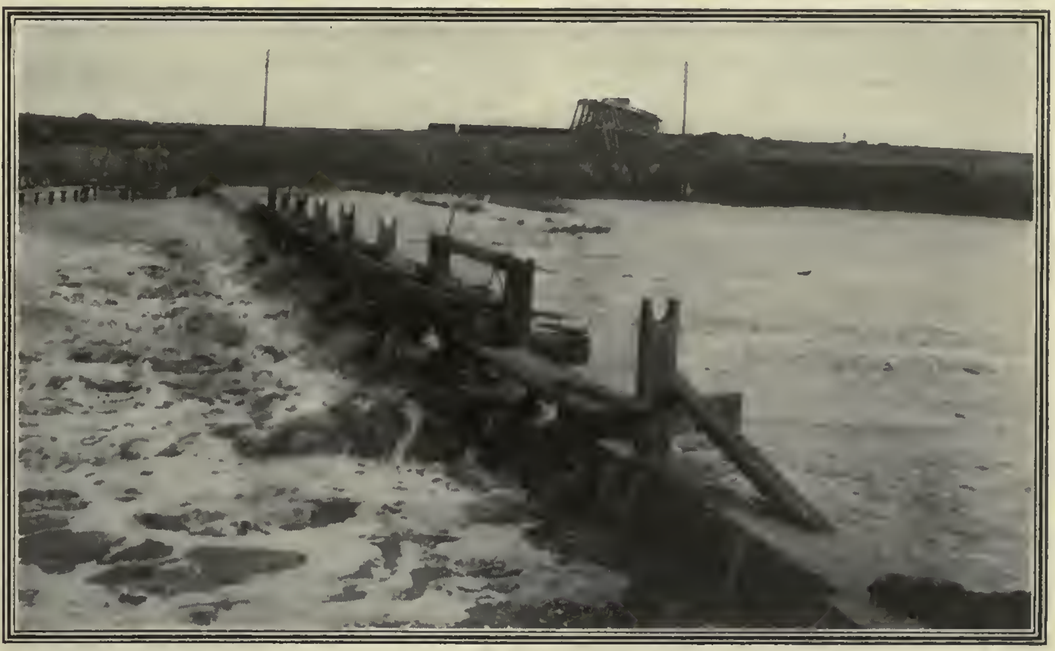
Tons of Rail	LENGTH IN MILES																		Tons of Rail
	120-lb.	110-lb.	105-lb.	100-lb.	95-lb.	90-lb.	85-lb.	80-lb.	75-lb.	70-lb.	67-lb.	65-lb.	60-lb.	56-lb.	50-lb.	45-lb.	40-lb.	35-lb.	
1	0.0053	0.0057	0.0061	0.0064	0.0067	0.0071	0.0075	0.0080	0.0085	0.0091	0.0095	0.0098	0.0106	0.0114	0.0127	0.0141	0.0159	0.0182	1
2	0.0106	0.0116	0.0121	0.0127	0.0134	0.0141	0.0150	0.0159	0.0170	0.0182	0.0190	0.0196	0.0212	0.0227	0.0254	0.0283	0.0318	0.0364	2
3	0.0159	0.0174	0.0182	0.0191	0.0201	0.0212	0.0225	0.0239	0.0254	0.0273	0.0285	0.0294	0.0318	0.0341	0.0382	0.0424	0.0477	0.0545	3
4	0.0212	0.0231	0.0242	0.0254	0.0268	0.0283	0.0299	0.0318	0.0339	0.0364	0.0380	0.0392	0.0424	0.0454	0.0509	0.0566	0.0636	0.0727	4
5	0.0265	0.0289	0.0303	0.0318	0.0335	0.0353	0.0374	0.0398	0.0424	0.0454	0.0475	0.0490	0.0530	0.0568	0.0636	0.0707	0.0795	0.0909	5
6	0.0318	0.0347	0.0364	0.0382	0.0402	0.0424	0.0449	0.0477	0.0509	0.0545	0.0570	0.0587	0.0636	0.0682	0.0764	0.0848	0.0955	0.1091	6
7	0.0371	0.0405	0.0424	0.0445	0.0469	0.0494	0.0524	0.0557	0.0594	0.0636	0.0665	0.0685	0.0742	0.0795	0.0891	0.0990	0.1114	0.1273	7
8	0.0424	0.0463	0.0485	0.0509	0.0536	0.0566	0.0599	0.0636	0.0679	0.0727	0.0760	0.0783	0.0848	0.0909	0.1018	0.1131	0.1273	0.1454	8
9	0.0477	0.0521	0.0545	0.0573	0.0603	0.0636	0.0674	0.0716	0.0764	0.0818	0.0855	0.0881	0.0954	0.1023	0.1145	0.1273	0.1432	0.1636	9
10	0 0530	0.0579	0 0606	0.0636	0.0670	0.0707	0.0749	0.0795	0.0848	0.0909	0.0950	0.0979	0.1061	0.1136	0.1273	0.1414	0.1591	0.1818	10
20	0.1061	0.1157	0.1212	0.1273	0.1340	0.1414	0.1497	0.1591	0.1697	0.1818	0.1900	0.1958	0.2121	0.2273	0.2545	0.2828	0.3182	0.3636	20
30	0.1591	0.1736	0.1818	0.1909	0.2010	0.2121	0.2246	0.2386	0.2545	0.2727	0.2849	0.2937	0.3182	0.3409	0.3818	0.4242	0.4772	0.5454	30
40	0.2121	0.2314	0.2424	0.2545	0.2679	0.2828	0.2995	0.3182	0.3394	0.3636	0.3799	0.3916	0.4242	0.4545	0.5091	0.5657	0.6364	0.7273	40
50	0.2652	0.2893	0.3030	0.3182	0.3349	0.3535	0.3743	0.3977	0.4242	0.4545	0.4749	0.4895	0.5303	0.5682	0.6364	0.7071	0.7995	0.9091	50
60	0.3182	0.3471	0.3636	0.3818	0.4019	0.4242	0.4492	0.4773	0.5091	0.5454	0.5699	0.5874	0.6364	0.6818	0.7636	0.8485	0.9545	1.0909	60
70	0.3712	0.4050	0.4242	0.4454	0.4689	0.4949	0.5241	0.5568	0.5939	0.6364	0.6649	0.6853	0.7424	0.7954	0.8009	0.9899	1.1136	1.2727	70
80	0.4242	0.4628	0.4848	0.5091	0.5359	0.5657	0.5989	0.6364	0.6788	0.7273	0.7598	0.7832	0.8485	0.9091	1.0182	1.1313	1.2727	1.4545	80
90	0.4773	0.5207	0.5455	0.5727	0.6029	0.6364	0.6738	0.7159	0.7636	0.8182	0.8548	0.8811	0.9545	1.0227	1.1454	1.2727	1.4318	1.6364	90
100	0.5303	0.5785	0.6061	0.6364	0.6699	0.7071	0.7486	0.7954	0.8484	0.0091	0.9498	0.9790	1.0606	1.3644	1.2727	1.4141	1.5909	1.8182	100
200	1 0606	1.1570	1.2121	1.2727	1.3397	1.4141	1.4973	1.5909	1.6970	1.8182	1.8996	1.9580	2.1212	2.2727	2.5454	2.8283	3.1818	3.6364	200
300	1.5909	1.7355	1.8182	1.9091	2.0096	2.1212	2.2460	2.3864	2.5454	2.7273	2.8494	2.9371	3.1818	3.4091	3.8182	4.2424	4.7727	5.4545	300
400	2.1212	2.3140	2.4242	2.5454	2.6794	2.8283	2.9946	3.1818	3.3939	3.6364	3.7992	3.9161	4.2424	4.5454	5.0909	5.6566	6.3636	7.2727	400
500	2.6515	2.8926	3.0303	3.1818	3.3493	3.5353	3.7433	3.9773	4.2424	4.5454	4.7490	4.8951	5.3030	5.6818	6.3636	7.0707	7.9546	9.0909	500
600	3.1818	3.4711	3.6364	3.8182	4.0191	4.2424	4 4920	4.7727	5.0909	5.4545	5.6988	5.8741	6.3636	6.8182	7.6364	8.4849	9.5455	10.9091	600
700	3.7121	4.0496	4.2424	4.4545	4.6890	4.9494	5.2406	5.5682	5.9394	6.3636	6.6486	6.8531	7.4242	7.9545	8.9091	9.8990	11.1364	12.7273	700
800	4.2424	4.6281	4.8485	5.0909	5.3589	5.6566	5.9893	6.3636	6.7879	7.2727	7.5984	7.8322	8.4848	9.0909	10.1818	11.3132	12.7273	14.5454	800
900	4.7727	5.2066	5.4545	5.7273	6.0287	6.3636	6.7380	7.1591	7.6364	8.1818	8.5482	8.8112	9.5454	10.2273	11.4545	12.7273	14.3182	16.3636	900
1000	5.3030	5.7851	6.0606	6.3636	6.6986	7.0707	7.4866	7.9545	8.4848	9 0909	9.4980	9.7902	10.6061	11.3636	12.7273	14.1414	15.9091	18.1818	1000
2000	10.6061	11.5702	12.1212	12.7273	13.3071	14.1414	14.9733	15.9091	16.9697	18.1818	18.9959	19.5804	21.2121	22.7273	25.4545	28.2820	31.8182	36.3636	2000
3000	15.9091	17.3554	18.1818	19.0909	20.0957	21.2121	22.4599	23.8636	25.4545	27.2727	28.4939	29.3706	31.8182	34.0009	38.1818	42.4243	47.7273	54.5454	3000
4000	21.2121	23.1405	24.2424	25.4545	26.7943	28.2828	29.9465	31.8182	33.9394	36.3636	37.9919	39.1608	42.4242	45.4545	50.9091	56.5657	63.6364	72.7273	4000
5000	26.5152	28.9256	30.3030	31.8182	33.4928	35.3535	37.4332	39.7727	42.4242	45.4545	47.4898	48.9510	53.0303	56.8182	63.6364	70.7071	79.5455	90.9091	5000
6000	31.8182	34.7107	36.3636	38.1818	40.1914	42.4242	44.9198	47.7273	50.9091	54.5454	56.9878	58.7413	63.6364	68.1818	76.3636	84.8486	95.4546	109.0909	6000
7000	37.1212	40.4958	42.4242	44.5454	46 8899	49.4949	52.4064	55.6818	59.3939	63.6364	66.4858	68.6314	74.2424	79.5454	89.0909	98.9900	111.3637	127.2727	7000
8000	42.4242	46.2810	48.4848	50.9091	53.6885	56.5657	59.8930	63.6364	67.8788	72 7273	75.9837	78.3217	84.8485	90.9091	101.8182	113.1318	127.2728	145.4545	8000
9000	47.7273	52.0661	54.5455	57.2727	60.2871	63.6361	67.3797	71.5909	76.3636	81.8182	85.4817	88.1119	95.4545	102.2727	114.5454	127.2728	143.1819	163.6364	9000
10,000	53.0303	57.8512	60.6061	63.6364	66.9854	70.7071	74.8663	79.5454	84.8484	90.0091	94.9796	97.9021	106.0606	113.6364	127.2727	141.4143	159.0910	181.8182	10,000
50,000	265.1515	289.2562	303.0303	318.1818	334.9282	353.5354	374.3316	397.7273	424.2424	454.5454	474.8982	489.5105	530.3030	568.1818	636.3636	707.0713	795.4551	909.0909	50,009
100,000	530.3030	578.5124	606.0606	636.3636	669.8564	707.0707	748.8631	795.4545	848.4848	909.0909	949.7965	979.0210	1060.6061	1136.3636	1272.7273	1414.1425	1500.9102	1818.1818	100,000

track that can be laid with the tonnage of rail given.

The use of these tables will save many minutes for the estimator, and will give the most accurate results. The fact that the quantities are figured to the fourth decimal place practically eliminates any cumulative error which ordinarily might creep in through the addition of several quantities.

Moose Jaw Dam Failure Followed Sudden River Rise

Washing Away of Downstream Rip-Rap Caused Canadian Pacific Structure to Slide 15 Feet on Its Base



MOOSE JAW DAM WAS GRAVITY TYPE CONCRETE STRUCTURE 300 FEET LONG

THE accompanying pictures show the damage to the Canadian Pacific Railway Company's dam at Moose Jaw, Canada, which slid on its base 15 ft. downstream when overtopped by a 6-ft. head of water on April 24, as reported in the news section of the Engineering Record, May 6, page 624.

The dam extended across the Moose Jaw River inside the city limits. It was a gravity type concrete structure 300 ft. long, resting upon a clay foundation, divided by buttresses into eighteen sections. Eight of these sections were used as flood sluiceways, being provided with stop logs to hold water up to the flow line after the floods were over. The dam had no concrete spillways with aprons, but was protected on the downstream face by stone rip-rap.

EIGHT SECTIONS OF THE DAM WERE USED AS FLOOD SLUICEWAYS

Moose Jaw River flows only from early in March until about October, being frozen up during the winter months. The drainage area is about 1800 sq. miles, and is almost entirely devoid of tree growth. This lack of timber growth, and the clayey surface-cover of the basin, tend to the rapid collection and delivery of storm water to the main channel. The flow of the river is, therefore, subject to sudden rises during the melting of the snow in the spring, or periods of abundant rainfall.

AFTER THE FAILURE THE WATER LEVEL IN THE RESERVOIR DROPPED 5 FEET

The reservoir is about 4½ miles long, 700 ft. in width, and about 18 ft. in the deepest portion. After the failure the water level dropped nearly 5 ft.

The spring freshet started April 11 and the water rose until over 6 ft. head of water was flowing over the dam. The stop logs had all been removed before the freshet started.

The failure was due, it is believed, to the rip-rap protection being washed away, which allowed the dam to slide forward on its foundations 15 ft.

Plans Outlined for Abating Boundary Water Pollution

Earle B. Phelps Reports to International Joint Commission on Minimum Standard and Type of Sewage Plants Recommended for Detroit and Buffalo Districts

TO remedy present conditions of pollution of the boundary waters between the United States and Canada Prof. Earle B. Phelps, consulting sanitary engineer, in a 159-page report just issued, has recommended to the International Joint Commission a general type of sewage treatment, with suitable local modifications, comprising coarse screening for the removal of large floating material, sedimentation in Imhoff tanks and chemical disinfection with chloride of lime. The necessary auxiliary plant, sludge-drying beds, chemical mixing tanks, etc., are also provided. The report also prescribes a minimum requirement for the treatment of sewage and fixes 4 sec.-ft. per capita of contributing population as the minimum for effective dilution of untreated sewage with water into which it is discharged. This dilution standard assumes that the pollution of boundary waters cannot be permitted to exceed that which will give 500 B. coli per 100 cu. cm. as a mean cross sectional value. In brief, the engineering studies which have been carried out under Professor Phelp's direction, with the assistance of Henry C. McRae and Frank C. Tolles as division engineers, have developed feasible plans of collection and disposal at all important points on the three most seriously polluted connecting rivers—the St. Clair, Detroit and Niagara—and have determined the upper limits of cost of these improvements. This report, dealing entirely with remedies for sewage pollution, is the second one issued by the International Joint Commission. The first one, issued two years ago, dealt with the extent and causes of pollution injurious to public health.

ADMINISTRATIVE CONTROL

The administrative control of boundary water pollution, the report states, is obviously a federal, rather than a state or provincial, matter. It is recommended that the federal health authorities of the United States and Canadian governments would naturally and logically constitute, or nominate, a joint administrative body for the direct inforcement of a continuing policy of stream protection. In the matter of cost of the improvements proposed it is assumed that the burden of responsibility is individual and to be borne equally by all concerned. This will place a heavier burden upon American cities than upon Canadian.

The report is specific in stating that the oxidizing capacity of streams shall be taken advantage of and that careful attention must be given to the matter of outfall works design.

The report discusses the alternatives of fine screening and sedimentation as the preferred method of treatment and decides in favor of the latter, although it is pointed out that this decision is not necessarily final. No studies were made of the possibility of treating sewage by aeration.

POLICY ADOPTED

In outlining principles to control the pollution of the boundary waters the report states:

"The limit of permissible bacterial pollution shall be deemed to have been exceeded when the effective dilution, as hereinafter defined, shall be less than 4 cu. ft. per second per capita of contributing population, based upon mean river stages during the season May to September inclusive.

"The effective dilution shall be taken as the quotient of the actual physical dilution divided by the residual fraction of the total bacteria remaining after treatment, provided that in the case of the St. Lawrence and other rivers, where the time element is such as to permit some degree of self-purification between points of successive pollution, this factor shall be considered as an element of treatment entering the determination of effective dilution at the lower point.

"In all cases where the actual stream flow below any point of pollution is less than 4 cu. ft. per second per capita of contributing population, or where the net effect of successive pollution with proper allowance for self-purification in the intermediate stretches exceeds the equivalent of one contributing person per 4 cu. ft. per second of stream flow, sewage treatment shall be employed to reduce the net bacterial pollution to a basis of an effective dilution of 4 sec.-ft. per capita, as defined.

"Sewage treatment, while based primarily upon bacterial pollution, shall also include the removal of suspended solids capable of settling to approximately the same degree as is called for in the case of bacteria; provided that this requirement shall not be extended to an unreasonable degree in the light of good engineering practice; and provided, further, that in the case of combined sewer systems, ordinary mineral detritus shall be excluded in computing the degree of removal.

"In all cases where sewage treatment to a specified degree is demanded the entire contributory population shall be dealt with upon the same basis of relative improvement required, so that the net residual pollution from each community shall be proportional to its population."

Tests Show Strength of Corrugated Culvert Pipe

Formula for Working Pressure Developed from Results of Crushing Pipe by External Hydrostatic Pressure

By GEORGE L. FOWLER
Consulting Mechanical Engineer, New York

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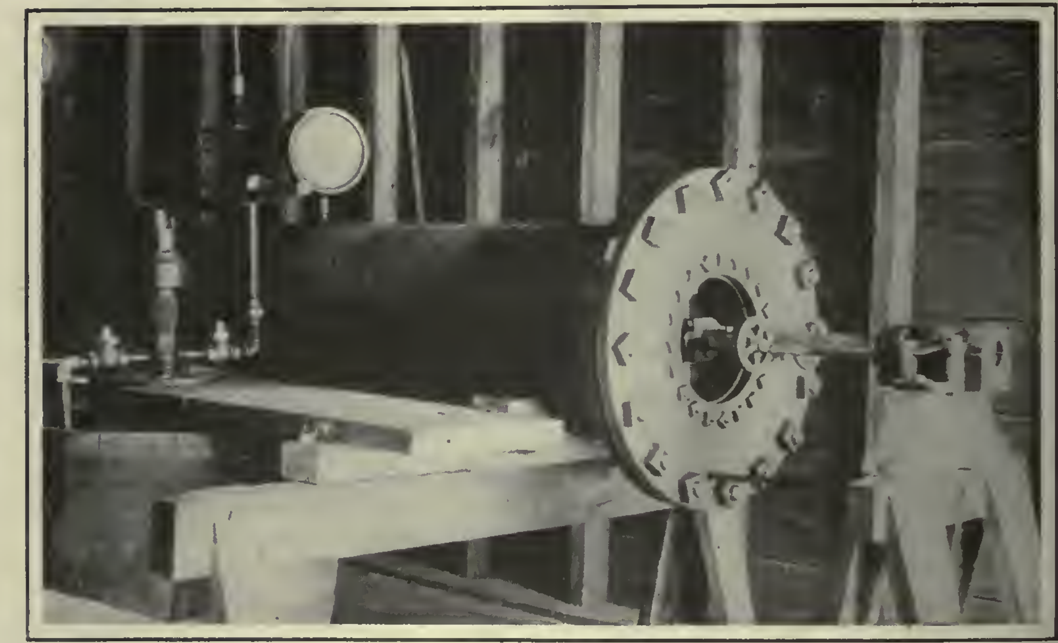
AN investigation has recently been completed looking to the determination of the collapsing strength of corrugated culverts as made of Armco (American ingot) iron. For the hydrostatic tests the pipe tested was placed in a closed cylinder and subjected to an external hydrostatic pressure until it collapsed.



APPARATUS FOR APPLYING EXTERNAL HYDROSTATIC PRESSURE TO CULVERT PIPE AND MEASURING DEFORMATIONS

The pipe investigated was of three internal diameters, 12, 24 and 48 in., and had two depths of corrugation, ½ and ¾ in., with a uniform pitch of 2 2/3 in. The pipe were double riveted on the longitudinal and single on the circumferential seams, with a longitudinal pitch of 2 2/3 in. and a circumferential of about 8 in. The sheets and rivets of all pipe were galvanized. For each diameter of pipe the strength with two depths of corrugation was tested, and for each depth of corrugation the work was done with four thicknesses of metal, namely 16 gage (0.0625 in.), 14 gage (0.078 in), 12 gage (0.109 in.) and 10 gage (0.141 in.).

TESTING APPARATUS

The first tests were made with pipe 12 in. in diameter and 8 ft. long. It was assumed that a total length of eight diameters would be sufficient to avoid all influence of end bracing and support, and this was found to be the case. Each piece of pipe tested was fitted at each end with an internally projecting flange made of angles and riveted to the inside of the pipe. These flanges were faced off parallel to each other and at a distance of 8 ft. apart. They were further drilled for ½-in. bolts to match the head of the casing in which they were tested. A caliper was provided by which any diameter could be measured to within 0.02 in. It was characteristic of all of these pipe that they collapsed suddenly upon the attainment of the maximum pressure.

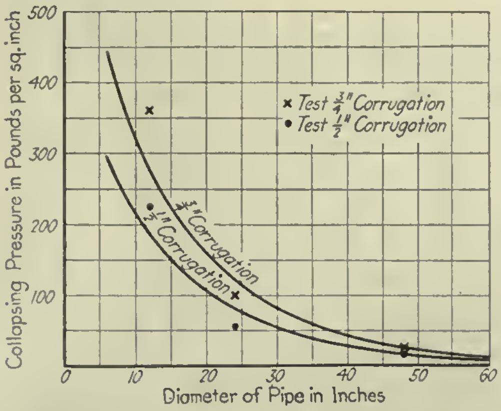
As it is understood that it is safe to conclude that the end support does not influence the strength of the pipe for more than 1¾ diameters on an average, it was considered safe to adopt a length of 12 ft. of pipe of 24-in. and 48-in. diameters that were to be tested, and this was done. Tests were also made, for the sake of comparison, of a set of smooth pipe 12 in. in diameter.

EFFECT OF CORRUGATIONS

On tabulating the collapsing pressures of all of the pipe tested it was found that a ½-in. depth of corrugation increased the strength about 3½ times with 10 gage metal, 5¼ times with 12 gage, 7 times with 14 gage, and 6 times with 16 gage. The ratio must be increased by 50 per cent if a comparison is to be made with pipe having a ¾-in. depth of corrugation.

As the object of the tests was to develop a formula by which the probable strength of other diameters of pipe, made of various thicknesses of metal, could be calculated, that phase of the subject will now be considered. Such a formula, however, can be considered only on the basis of a probability, and not as having been demonstrated as proved. There were three diameters tested for each depth of corrugation and thickness of metal to supply three points on the curve developed from a formula, but the objection arises that the three points may not represent true averages. The pipe was made up in the ordinary course of manufacture and was subject to all of the variations due to that method of treatment.

With this statement of the limitations imposed it will be well to review the results of tabulating collapsing pressures of



COMPARISON OF PRESSURES AT FAILURE

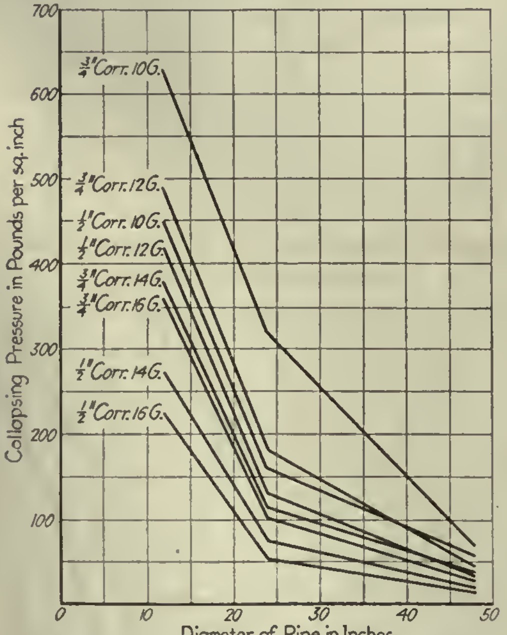
the several pipe tested, as given in the table.

Hydrostatic Collapsing Pressure of Corrugated Culvert Pipe

Diam. of pipe, inches	Gage of metal	Depth of corrugation, inch	Collapsing press., lb. per sq. in.
12	16	½	225
12	14	½	275
12	12	½	420
12	10	½	450
12	16	¾	360
12	14	¾	380
12	12	¾	490
12	10	¾	630
24	16	½	52
24	14	½	75
24	12	½	130
24	10	½	160
24	16	¾	100
24	14	¾	100(125)
24	12	¾	180
24	10	¾	320
48	16	½	15
48	14	½	20
48	12	½	33
48	10	½	58
48	16	¾	29
48	14	¾	39
48	12	¾	45
48	10	¾	70

These results are plotted in the accompanying diagram. The lines connecting the several points of failure show that the pressures do not vary inversely as the diameters, as might have been expected and as they are formulated in the rules of Lloyds and the United States for the working pressures allowed on corrugated furnaces.

As between the 12-in. and 24-in. pipe, this ratio holds for the heaviest metal (10 gage) on the smallest pipe. As the thickness of metal decreases the ratio of the collapsing pressure of the 24-in. pipe to that of the 12-in. increases, until with 16 gage and ½-in. depth of corrugation, the ratio becomes about 4½ to 1. While the ratio between the 48 and 24-in. pipe is never less than 1.75 and runs from that to 4½.



COLLAPSING STRENGTH OF 10 TO 16 GAGE CORRUGATED CULVERT PIPE

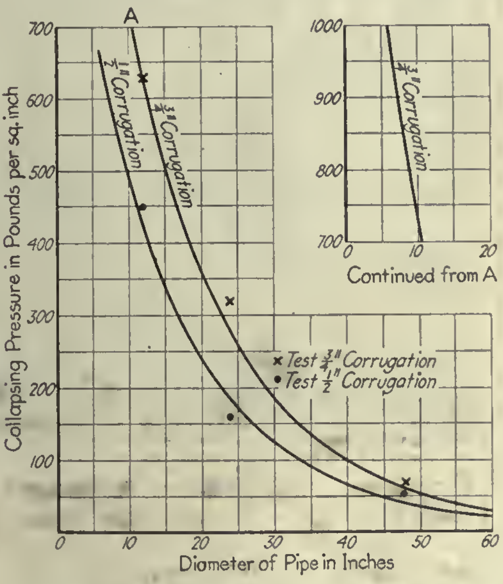
Formula Developed

Considering the three variables—the diameter of the pipe, the thickness of the metal and the depth of the corrugations—the following formula was developed:

$$P = \frac{5960 \times C \times T}{2^{\left(\frac{D-12}{12}\right)}} \times \left(1 - 0.4 \log \frac{D}{12}\right)$$

In which P = collapsing pressure in pounds per square inch; C = depth of corrugation in inches; T = thickness of metal in inches; D = inside diameter in inches.

In the accompanying diagrams of collapsing strength the actual collapsing strength of the several diameters of pipe and for the two thicknesses of No. 10 and No. 16 gage are plotted and lines are drawn.



COLLAPSING STRENGTH OF 16 GAGE CORRUGATED CULVERT PIPE

From this formula it is possible to evolve a simpler approximate formula for the allowable working pressures to which culverts may safely be subjected, assuming that through the narrow range of sizes from about 10 to 24 in., the collapsing pressure varies inversely as the diameter. If, then, we work within this narrow range of sizes, and for a working pressure that bears a ratio of 1 to 2 of the collapsing pressure, the calculation for such a working pressure may be expressed by the formula:

$$P_w = \frac{34{,}000 \times C \times T}{D}$$

in which P_w is the working pressure; the other symbols have the same meaning as before. We thus have a formula identical with that used for calculating the pressure of corrugated furnaces and equally as accurate.

Should it be desired to work to a larger factor of safety, it is merely necessary to make a corresponding reduction in the constant factor of the formula.

The foregoing tests, as also some tests under sand beds, which will be described in another article, were undertaken with a view to securing information preliminary to the planning of tests under sand beds in which conditions of culvert installations in railway practice should be duplicated just as closely as possible.

The succeeding article will describe the methods employed and the results obtained in these practical tests. These results are, of course, those which are applicable to the actual questions arising with regard to railroad and highway culvert installations.

Asphalt Flush Coat Seals Porous Road Surface

Preponderance of Large Particles in Aggregate of Asphalt—Broken Stone Mixture Left Surface Porous to Inch Depth

To seal the surface of a resurfaced road in South Hadley, Mass., which was porous after rolling to a depth of an inch, a flush coat was applied after an unsuccessful attempt was made to make it water-tight by using a finer aggregate. The work was described in detail by E. H. Townsend at the March convention of the Massachusetts Highway Commission. The results, he reports, were excellent.

Large Particles Cause Porosity

Though 18 gal. of asphalt per cubic yard coated the aggregate thoroughly, the surface was porous after rolling. This was apparently due to a preponderance of large particles in the aggregate. It became apparent that one of the chief problems would be the attainment of a dense surface, which would seal over during the rolling process.

Subsequent experiments showed that a finer aggregate required more asphalt, the amount being increased first to 20 and then to 21 gal. The resulting pavement was denser than the first, and showed a greater tendency to seal over under rolling. The surface, however, was still porous, and the top particles protruded from the denser part of the pavement from 0.25 to 0.5 in.

No other way of obtaining a more dense pavement with the available aggregate was apparent, and the introduction of more asphalt was found to be impossible. The aggregate was supplied with as much as it would carry, and additional asphalt ran out of the mass and was lost in transit.

Coat Wiped Down by Squeegee

The specifications made no allowance for the introduction of a finer material by adding to the aggregate a sand or fine crusher product. The use of a flush coat to seal over the surface and obtain a watertight pavement was therefore determined upon. The same kind of asphalt was used as in the mixture. It was applied from pouring pots, and wiped down to a uniform thickness with a squeegee, pouring and carrying the strokes lengthwise to the road. About 0.6 gal, of asphalt per square yard was used for sealing, the best results being obtained at not less than 375 deg. Fahr.

Immediately after application the seal coat was covered with clean ¼-in. grit spread at the rate of about 20 lb. per square yard. The flush coat was applied as soon as possible after spreading the mixture, thus placing the coat on a clean, warm surface. No penetration of the stone was required.

At the time of applying, the flush coat was scarcely 1/16 in. thick. The action of traffic gradually pressed the covering of grit into it until it became embodied in the wearing surface, with the result that the coat increased in thickness to about ⅜ in. The resulting surface has a smooth, rubbery appearance similar to asphalt surfaces, and is said to have given excellent service during the seven months of its use.

Queensboro Bridge Floor Strengthened by Adding Stiffeners to Buckle Plates

New 3-Inch Block Flooring with Thicker Concrete of Richer Mix to Replace Old Floor—Tested Satisfactorily on Trial Sections

After many years of trouble for the New York City Department of Bridges and great inconvenience to the traveling public using the Queensboro Bridge crossing the East River in New York City, the plans for reconstruction of the pavement for the roadway have been finally approved, and the necessary fund of $144,000 for proceeding with the work voted by the Board of Estimate and the Board of Aldermen. When the investigation into the reasons for the upheaval and failure of the wood-block paving on the bridge, which occurred in 1911, about 2½ years after the bridge was opened for traffic, was made by the bridge commissioner, the principal cause of the difficulty was found to be the excessive deflection of the steel buckle plates under the old concrete base, causing the latter to break.

The method of remedying this difficulty has gradually developed since the first scheme proposed in the annual report of the Department of Bridges for 1913, and includes the use of stiffener angles to be riveted to the flat parts of the buckle plates, as illustrated in the accompanying drawing. Trial sections, some of which have been in place for three seasons, have shown the proposed method to be satisfactory. The paving will be relaid from the Manhattan anchor pier to Ely Avenue, a distance of 5960 ft., or a total of 33,000 sq. yd. One-half of the roadway will be kept in condition for use at all times. The trolley tracks are to be removed from the roadway between the trusses and carried on the outside brackets, in order to furnish an unrestricted roadway for vehicular traffic, which has increased from a daily average of 2110 in 1910 to 9505 in 1915.

Causes of Floor Failure

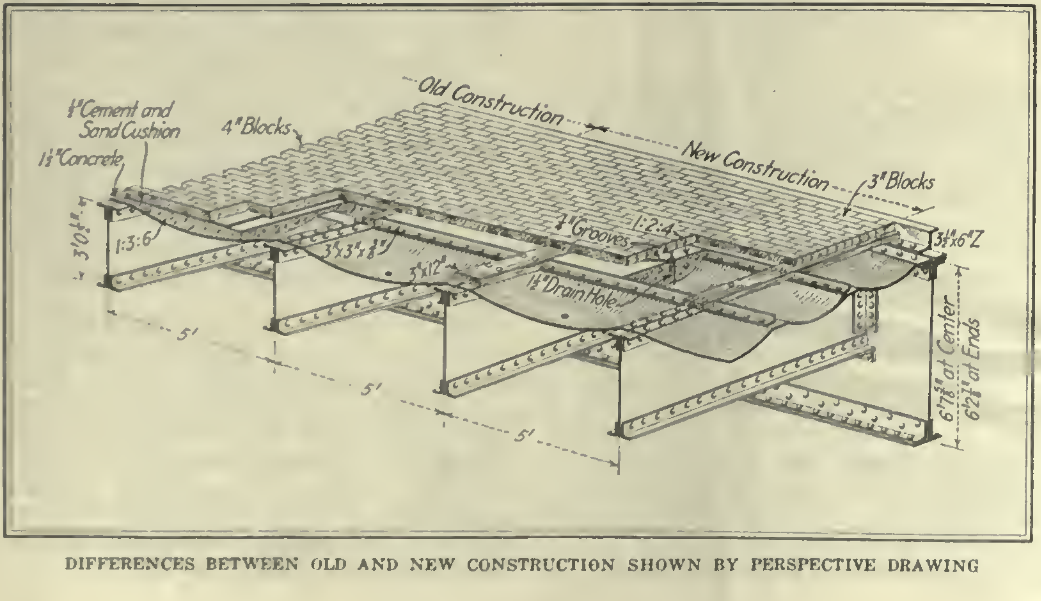
An investigation to ascertain the amount of deflection of the buckle plates was made by using a horizontal timber joist under the flat plate of the buckle plates with nails partly driven to just touch the plate. After allowing traffic to pass for some hours, the nails were found to be driven further into the joints by as much as ⅛ to ⅜ in. under the heavy impact of loads crossing the bridge. These deflecting buckle plates continually developed cracks in the concrete, and the sand and cement cushion on which the blocks were laid, for lack of proper drainage, permitted moisture to collect and caused disintegration of the concrete and consequent great unevenness in the roadway.

A special board of engineers was appointed by the mayor in February, 1916, to report on the plans for the reconstruction of the pavement. This board agreed with the conclusions reached by the Bridge Department as to why the pavement failed, and it also approved the Bridge Department's plan for reconstructing the pavement.

LAYING AN EXPERIMENTAL STRIP OF THE NEW PAVING ON THE QUEENS APPROACH

It will be remembered that the consulting engineers, Boller & Hodge and William H. Burr, who examined the strength of the main trusses in 1908, recommended that the dead weight of the bridge should be decreased before full live-load traffic would be permissible. The repairs to the roadway, therefore, had to be made by using a design which would keep the dead load down to an absolute minimum.

This has been accomplished by adopting thinner wood blocks, a thicker and richer concrete base, with grooves to the weep holes in the center of each buckle plate, and timbers over the stringers as seen in the illustration. The experience of the New York Bridge Department indicates that wood block on a plank floor forms the most satisfactory light bridge flooring. But in this case the buckle plates and concrete act as solid beams to transfer shear due to wind and lateral forces, and it was found that the cost of thick plank over the buckle plates would be greater than the cost of repairing as proposed by the Bridge Department.



DIFFERENCES BETWEEN OLD AND NEW CONSTRUCTION SHOWN BY PERSPECTIVE DRAWING

Several sections laid with this proposed flooring, as illustrated, have given excellent service; three sections completed late in 1913 and one in August, 1915, have all given good results. Steel angles are riveted to the flat parts of the plate, those on the Queens approach being turned upward, while those on the main spans are turned downward. The 3 x 12-in. timber plank over the stringers not only lighten the construction but also act as forms for the concrete, which is easily given a smooth finish. Galvanized iron thimbles are placed in the drain holes, and the concrete is poured around them.

The work will be done under the supervision of Edward A. Byrne, chief engineer of the Bridge Department, New York City, who designed the proposed method of repairing the bridge floor. The commissioner of bridges, F. J. H. Kracke, has been authorized by the Board of Estimate to have the work done by departmental labor—a very unusual method for work of this character and magnitude.

Railway Revenues for February Show Continued Increase

Gross operating revenues for February on the large steam railroads of the United States, according to a bulletin issued by the Bureau of Railway Economics, were $1140 per mile, showing an increase of $240 or 26.8 per cent as compared with February, 1915. Operating expenses were $800, an increase of $120 or 17.7 per cent. Net operating revenue, therefore, was $340—an increase of $120 or 54.8 per cent, and operating income was $287—an increase of $116 or 67.8 per cent. The operating ratio was 70.1 per cent, as compared with 75.5 per cent in February, 1915, and 81.6 per cent in February, 1914.

Proposed Co-operation in Muscle Shoals Project Unjustly Criticised

Characterization of Plan of Private and Government Development as a "Notorious Scheme" Not Warranted by Facts

By H. BURGESS
Major, Corps of Engineers, U. S. A., Nashville, Tenn.

IN VIEW of the inaccurate statements which have been made in public speeches and newspapers in connection with the proposed power development at the Muscle Shoals, Tennessee River, it is believed to be desirable to describe to the engineering profession what has been proposed in connection with this work. This project has been referred to in print and elsewhere as "the notorious Muscle Shoals scheme," and it may be impossible to correct this impression when held by partisan newspapers or those who have some object in attacking this conservation measure. A statement of the facts, however, should be sufficient to convince all disinterested persons that the proposed Muscle Shoals power development has in it no notoriety except that due to there remaining unanswered attacks made upon it by irresponsible or uninformed persons.

The Muscle Shoals section covers the 36.5 miles of the river just above the town of Florence, Ala., and here the Tennessee River is a wide and shallow stream with a fall at low water of 131 ft. In its natural condition the section was impassable for steamboat traffic, and therefore divided the river into two disconnected navigable parts—the lower of 256 miles and the upper of 360 miles. Prior to the Civil War the state of Alabama undertook an improvement of this section, but the resulting benefit to navigation was nothing. In 1870 there was begun an improvement by the United States which contemplated the construction of a lateral canal surmounting these shoals. Inadequate appropriations caused a change in the project, which contemplated that the canal be extended only past the most serious obstructions, and the remainder of the shoals be improved by open channel work in such manner as to make the entire section navigable for as long a period per year as were other obstructions on the river. The slow rate at which money was appropriated caused the completion of this work to be delayed, and it was not opened to traffic until 1891.

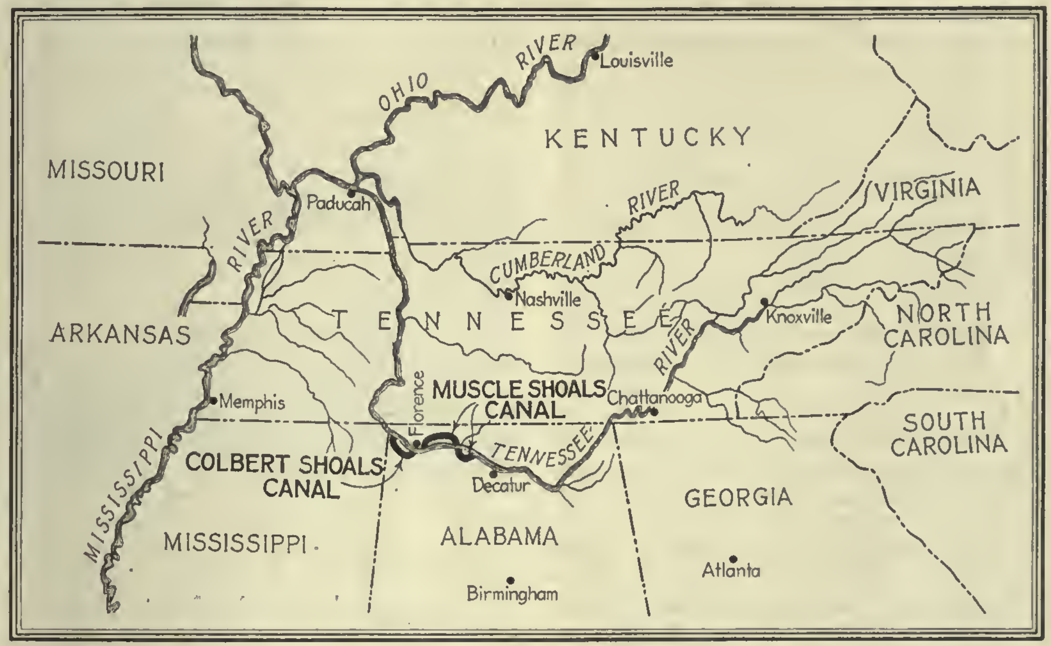
River Traffic Formerly Heavy

In the early years following the Civil War an important traffic existed on the Tennessee River, in spite of an interruption by low water of from four to six months per year, but by the time the Muscle Shoals canal was completed transportation conditions had so changed that a river subject to the handicap of interruption for practically half the year lost tonnage to the improved railway systems. The canal, therefore, has carried since its completion a very unimportant tonnage.

In 1912 Congress adopted for the Tennessee River a plan of improvement which contemplates making Chattanooga the head of continuous barge navigation, but as there was then under investigation a proposed power development at the Muscle Shoals, that section was omitted from the adopted plan. It is obvious, however, that the work of improvement proposed to be done above the Muscle Shoals would be of practically no value unless the barrier to through navigation formed by the Muscle Shoals be removed by a suitable improvement in that section.

Large Potential Power Suggests Co-operation

The large potential power due to the 131-ft. fall and a low-water discharge nearly always of 10,000 sec.-ft. or more attracted the attention of power companies, and in 1908 and 1909 offers were made to the United States which contemplated co-operation between the companies and the United States in the combined improvement. These offers were not favorably considered by the Engineer Department, because of the fact that the extent of the financial co-operation proposed by the companies was entirely insufficient. Undoubtedly the great cost of the long dams and of the locks, and the lack of a satisfactory market for the power, were responsible for the poor offers made.



MUSCLE SHOALS SECTION DIVIDES RIVER INTO TWO DISCONNECTED NAVIGABLE PARTS

The Engineer Department again in 1911, under instructions from the Rivers and Harbors Committee of the House of Representatives, made an investigation for a plan to combine power development with the improvement of navigation facilities. The instructions of the committee directed that advertisement be made and that bids be received from power companies interested in co-operating in this combined improvement. The plans prepared by a special board of engineer officers were sufficiently advanced to permit advertisement March 24, 1913. The advertisement invited bids for co-operation in the development, and requested that separate proposals be made for lease periods of 20, 50 and 100 years.

The bids were opened June 24, 1913, but only two were received. Neither was entirely satisfactory from the financial standpoint, and neither considered any but the long-term franchise. On this account the board made further investigation and revised its plan so as to eliminate one of the dams and power houses by an increase in height of the other two. The revised plans also included a navigable improvement of the 46 miles of river above the Muscle Shoals section, with the addition of 9 ft. to the total power head. Advertisement inviting bids was again made Aug. 28, 1913, and the opening was fixed for Dec. 11, 1913. One of the June bidders repeated his offer, but made no change because of the increased power head. The other made an offer which appeared to be satisfactory, and it is the one described below.

Government Expenditure Limited to $8,575,000

In each of the investigations made by the Engineer Department the boards of officers laid down as an essential condition that the portion of the total cost to be paid by the United States must not exceed the estimated cost of providing satisfactory navigation facilities through the Muscle Shoals section. A plan of improvement for the 82.5 miles of river considering only navigation facilities was prepared, and it was estimated that the cost would be $8,575,000. With such an improvement, power development would be impracticable, as the plan contemplated an extension and improvement of the present canal system.

The plan under which the advertisement of August was made provided for locks, dams, substructures of power houses, and tailraces, and the cost was estimated at $18,701,000. Under the above stated condition, therefore, no offer could be considered favorable unless it provided for a payment by the power company of at least $10,126,000.

One of the offers proposed a cash payment at the beginning of the lease period of $6,250,000. The other bid was from the Muscle Shoals Hydro-Electric Power Company, a subsidiary organization of the Alabama Power Company, and, as explained below, the final cost to the United States under this offer would be very much less than $8,575,000. The offer submitted was discussed by representatives of the power company with the board, and the final agreement proposed that the franchise should be awarded to the power company upon the following terms:

1. The United States to construct locks, dams and substructures of power houses, and to excavate the tailraces; the power company to construct superstructures of power houses and make all installations connected with the power development.

2. The power company to furnish detail plans for the substructures of the power houses, such plans providing structures not more costly than those estimated on by the board, or all extra cost to be borne by the power company.

3. The power company to have a 100-year lease of the power developable at the two dams, the lease to begin upon completion of the first dam.

4. The power company to pay $3,000,000 cash upon completion of the first dam.

5. The power company to make the following payments to the United States:

At the end of the first year following the completion of the second dam..........	$75,000
At the end of the second year..............	125,000
At the end of the third year...............	150,000
At the end of the fourth year...............	175,000
At the end of the fifth year................	200,000
At the end of the sixth year, and at the end of each year thereafter until the close of the lease period.........................	240,000

6. The power company to pay in cash to the United States at the end of each year an amount equivalent to 35 cents per year per horsepower of installed capacity, as measured at the switchboards of the power houses, such payments to begin at the end of the first year after the installed capacity reached 200,000 hp., but in any event not later than the end of 20 years from the beginning of the lease.

7. The power company to furnish to the United States, free of charge, delivered at the locks, electric current sufficient for operating the locks and the government shops and boat yard—not exceeding 200 hp.

8. The power company to maintain and operate the dams and to maintain power houses and equipment in first-class condition throughout the lease period.

9. The United States to control the regulation of river flow during the period of the lease, in order to prevent interference with navigation in the open channels of the river below Florence.

10. The United States to be the owner from the beginning of the locks, dams, substructures of power houses, and lands, and to become the owner of the power houses and such transformer houses as might be located on the land belonging to the United States at the end of the lease period, and the power company to remain the owner of all installations connected with power development.

Termination or Renewal of Lease

11. The following provisions for the termination or renewal of the lease: At any reasonable time prior to the expiration of the lease, and upon the invitation of either party, the United States and the power company shall discuss, and, if practicable, agree upon terms for the renewal of the lease. If agreement on such terms is reached, the lease shall be renewed under the conditions agreed on; but if the contracting parties fail to agree on terms for such renewal, the lease shall be terminated at the end of the 100-year period, and the United States shall take possession of all property of the power company used for the development and transmission of electric power, and shall pay to the power company a price which may have previously been agreed upon between the contracting parties, or, in the event of failure to so agree, shall pay to the power company for the property so taken a fair value to be determined by condemnation proceedings usual in the states wherein the property is located, and the United States shall, upon so taking possession, assume all contract obligations of the power company to deliver electric power which comply with the terms of condition 12.

12. In connection with contracts to be made by the power company for delivery of power, the following provision: All contracts for the delivery of electric power extending beyond the end of the 100-year lease period shall be submitted by the power company to the United States for approval; and in the event that such contracts are approved, or in the event that they are not disapproved within a period of three months from the time of receipt by the United States, they shall be binding on the United States as provided in condition 11. No contract disapproved by the United States, nor any contract not submitted for approval in accordance with the requirements of this condition, shall be binding on the United States in case the latter takes over the property of the power company.

13. The United States to be allowed at any time after the end of 50 years to terminate the 100-year lease and take possession of all property used for the generation and distribution of power, upon payment to the power company of its value as a going concern—a condition recommended by the Board for Rivers and Harbors, which reviews the reports of all subordinate boards.

14. The power company to execute a bond with approved securities for an amount not less than $1,500,000, to be prescribed by the Secretary of War, the period of the bond to extend until the cash payment of $3,000,000 be made.

Under the conditions stated, the amount to be appropriated by the United States for the structures and for flowage damages would be $15,701,000, the remaining part of the estimated cost, $3,000,000, being furnished by the power company.

Final Cost to United States

In order to determine what the final cost to the United States would be, all annual payments are reduced to "present worth" at the beginning of the lease period. The fixed payments, not dependent upon installation, at 3 per cent compound interest, have a "present worth" of $7,128,000. Payments upon installation depend so much on the success of the company in marketing power that nothing more than estimates can be given. Three suppositions have been made, which may be designated as "success poor," "success good" and "success excellent." The first assumes that 200,000-hp. installation will not be reached until the end of the 20th year, and that for each decade thereafter there is added an installation of only 20,000 hp. Upon the basis of this installation, using the 3-per cent compound interest rate, the present worth of the payments is, at the beginning of the lease period, $1,413,000. The second supposition is that the installation for the first decade is 200,000 and increased as follows: For the second decade, 250,000; for the third, 300,000; for the fourth, 400,000; for the fifth, 500,000; for the sixth, 600,000, and for the last 40 years the full proposed installation of 680,000 hp. The present worth of the payments for this assumed installation is, at the beginning of the lease period, $3,940,000. The third supposition (which is somewhat less than that stated by the power company as the expected installation) assumes 200,000 hp. for the first five years; 250,000 for the second five; 300,000 from the 10th to the 15th year; 400,000 from the 15th to the 20th; 500,000 from the 20th to the 25th; 600,000 from the 25th to the 30th, and for the last 70 years the full installation of 680,000 hp. Upon this assumed installation the present worth at the beginning of the lease period is $5,674,000.

The "present worths" of the fixed payments and of the payments upon installations are to be deducted from the amount to be appropriated by the United States to give the final cost to the United States for the navigation improvement of the 82.5 miles of river. Under the first supposition this final cost would be $7,189,000, under the second $4,662,000 and under the third $2,928,000. The difference between these figures and the $15,701,000 to be appropriated by the United States represents a loan to the power company.

Government Ultimately Gets $20,700,000 Worth

Under the conditions agreed upon, the power company is to construct, at its own expense, the superstructures of power houses and the transformer stations, but these are to become the property of the United States at the end of the lease. The estimate for these structures, as prepared by the power company, is something over $2,000,000, and the property which the United States will own at the end of the lease period will be that which cost a little more than $20,700,000. In comparison, therefore, with the navigation improvement, costing $8,575,000, the gain in property value to the United States by reason of entering into the co-operative plan of improvement will be $12,125,000. The "present worth" of $12,125,000 at the beginning of the lease period, at the 3-per cent compound rate, is $630,000. Properly speaking this amount also should be deducted, in order to make a true comparison with the cost of the combined and the independent improvements. The power company will have paid from two-thirds to five-sixths of the total cost of property which, at the end of the lease period, will be owned exclusively by the United States.

There must be considered, in connection with the question of to what extent the Alabama Power Company has been favored, that the special board advertised on two occasions, for an aggregate period of more than six months, and received bids from only two parties interested in this development. Not only was the advertisement made in leading technical journals, but circulars of information were sent to all hydroelectric power companies, so far as known, whether or not they made application for information. In spite of the wide publicity only two offers were received, and this is a clear indication of a general lack of interest by hydroelectric companies. The Alabama Power Company has absolutely no control of the situation, and owns only a very small percentage of the lands affected by the proposed dams. There is little doubt that the ability of this company to make a satisfactory offer was due entirely to the proximity of this undeveloped power to the territory in which that company is now distributing electric power.

FUTILITY OF DELAY

It may be questioned whether or not a delay of several years in the development of the power at Muscle Shoals might result in the securing of a better offer than that now under consideration. If development of the power is delayed for such a purpose, the same reason would justify still further delay in the future, and the logical application of such an argument would result in the power forever remaining undeveloped. The special advantage of accepting the offer of the power company is in the opportunity now to combine this run-of-the-river plant with large storage projects controlled by the power company in northern Alabama, a combination which permits a more complete utilization of the potential power at Muscle Shoals than is possible in any other way. However, even though it be assumed that an equally good combination could be effected ten or more years from now, the delay would postpone to a large extent the industrial development of this section of the country, would cause industries to be established in foreign countries which, with cheap power at the Muscle Shoals, would be located there, and would cause a permanent loss in the coal supply of the country of more than 1,500,000 tons per year.

It is not true conservation of natural resources which forbids their development on the plea that the state or general government is not obtaining full value for the grant of privileges. There is little doubt that franchises for power development should be for limited periods, so that the people may again take over their property and provide for its future operation under conditions suitable to the time when the limited franchise has ended. It is equally certain that the interests of the people demand the regulation of rates to the consumer, so that the company which has been granted the franchise for operating the property belonging to the people may not obtain an undue benefit at the expense of the owners. Assuming such regulation, it is unimportant whether or not any payment is required to be made to the state or general government, or what the size of such payments shall be. In any event, under the assumed regulation of rates, whatever amount is charged to the power company is paid by the consumer, and the collection of such amount is merely an exercise of the taxing power of the government. It seems not unreasonable, therefore, to assume that the present plan, which contemplates navigation improvement of this section of the river and a more complete utilization of the potential power than seems practicable by any other combination of plants, and which can be secured under fair and reasonable terms and at less cost than any other navigation improvement, ought to be adopted, rather than to have this power continue to be wasted for many years and have through navigation remain obstructed by the shoals section, on the ground that delay may result in securing somewhat better terms from some other power company proposing to co-operate.

Shallow Brick Roads

The New York State Highway Department will lay some brick roads this year, using 3 and 3½-in. brick. Both depths will be laid on cement-sand cushions.

Aprons Reduce Flood Damage to Road Shoulders

High Water in Livingston County Teaches Lesson in Protecting Highways in Low-Lying Country

By GEORGE E. SCHAEFER
County Superintendent of Highways,
Geneseo, N. Y.

THE recent high water of the Genesee River in Livingston County, N. Y., inundating the major portion of the lowlands and materially damaging some of the newly constructed state and county highways, has caused grave concern among road officials regarding the proper type of construction to be used in such locations, and apparently has shown the necessity of providing additional shoulder protection for roads designated for future improvement. Four state and county improved highways in this county cross the river flats from east to west, and while it is somewhat difficult for a comparison of their original characters of construction in connection with the resultant flood damage they have been analyzed individually as follows:

SHOULDERS ON DOWNSTREAM SIDE OF GENESEO-PIFFARD HIGHWAY, WHERE NOT PROTECTED BY CONCRETE APRONS, WERE WASHED AWAY

The Avon-Caledonia state highway No. 5273, a part of route 6, was completed in 1913. The construction was concrete-bituminous, 6 in. thick, metal 16 ft. wide and roadway 32 ft. between ditches. The crown of the road is about 5 ft. above the flatlands. Since completion there have been but two floods that covered the roadway, damaging only the shoulders on the downstream side. It must be borne in mind, however, that this road is out of the worst run of the current.

The Geneseo-Piffard county highway No. 718, concrete-bituminous construction, 6 in. thick, metal 14 ft. wide, 28 ft. between ditches, was completed in 1913. The average height of the road above the adjoining fields is about 2 ft. Since completion the road has been covered with water six times, the greatest depth above the crown being 4.2 ft. The current, as closely as one could figure, was from 6 to 8 miles per hour. Concrete aprons of the same thickness as the metal section, about 4 ft. wide and sloping with the shoulders, were constructed in the worst known places on the downstream side and on the upstream side where depressions formed a natural channel at time of flood water. Results on the road were that the shoulders on the downstream side, where not protected by the concrete aprons, were washed away entirely, and in some cases holes extended back under the metal. Where protected there was a little wash but it did not jeopardize the pavement. The concrete guard railing was bent over and broken. The bituminous cover was practically all carried away.

The Moscow-Geneseo county highway No. 1247 was constructed of waterbound limestone 3 in. thick on a 5-in. gravel bottom course. The macadam is 16 ft. wide, width of roadway between ditches 32 ft., and date of completion the fall of 1915. Aprons of concrete were built along the shoulders where deemed essential for the preservation of the road. It has been flooded twice since completion, the recent overflow during the latter part of March causing damage estimated at more than $1,000. The top course was almost entirely destroyed, and in a number of locations the whole roadway was washed away to a depth of from 3 to 4 ft. The shoulders were also badly damaged, but more particularly on the downstream side. Again, in this synopsis, it must be seriously considered that this was a newly completed road. Final settlement of the earth had not yet taken place, and there was no growth to speak of on the shoulders.

MT. MORRIS-GENESEO HIGHWAY

The Mt. Morris-Geneseo county highway No. 622 was completed in 1910 of waterbound macadam 6 in. thick, 14 ft. of limestone pavement and 32 ft. of roadway. The surface of this road is very little higher than the surrounding territory. The road is above the junction of the river and the Canaseraga Creek and, consequently, less susceptible to floods. Damage from high water took place only on the shoulders and was most serious on the downstream side. Soil in the valley is mostly a mixture of clay, treacherous sandy loam and silt. Foundation conditions are poor, the ground being unstable to a depth of more than 40 ft. Large quantities of debris come down the river annually on the crest of the flood and, to a certain extent, form one of the factors causing subsequent damage and deterioration. To build the roads entirely above maximum high water mark would entail an exorbitant expenditure per mile, with a correspondingly greater impediment to a quick runoff and an increased possibility of wash.

It would, therefore, appear that, profiting by past experiences on these highways, with due regard to location, existing conditions and the life of the road, the situation may be summed up in the following manner: Aprons of concrete for the protection of the metal, constructed on the shoulders at the same slope therewith, have conclusively proved their worth, but should be at least 5 ft. wide. The downstream side always sustains the worst damage and should have a suitably adequate and careful design. The grades should be kept at zero, or as nearly zero as possible, in order to allow the water to go over the road uniformly and not in greater volume at some points than others. What are known as evener culverts, where there is no natural channel, have not proved satisfactory. A waterbound type of construction is not fully acceptable. Finally, the surface elevation should be as low as, if not lower than, the adjoining lands, and should not in any way form an obstruction to the natural flow of the flood water.

Small Check Dams, in Series, Lessen Flood Velocities in California Ravines—Part II

Test Results Lead to Prediction That Unit Obstructions Will Be Big Factor in Future Flood Control Plans

By HARRY F. OLMSTED
Of Buck & Olmsted, Conservation Engineers, Los Angeles

[In the first part of this article, published last week, Mr. Olmsted discusses Southern California flood flows and the history of investigations to prevent them. Check dams were proposed as a remedy and experiments were carried out to test their efficiency. In this week's issue the actual results of placing unit obstructions in ravines are given in detail.—Editor.]

THE experiment station with its 24-ft. dam on Clear Creek, described last week, was under the direct personal supervision of B. R. Metcalf, who is preparing an elaborate analysis of the results achieved. His curves will make it possible to determine approximately the character and number of the structures in any given watershed, after controlling grades and drainage areas are known.

400 CHECK DAMS BUILT

The remaining $10,000 of the $23,000 appropriated for experimental work was spent in constructing about 400 check dams in Haines Canyon, a small torrential stream discharging into the Tujunga River. This canyon was chosen for the following reasons: First, the watershed had been entirely denuded by fire in the summer of 1913, and its barren slopes promised a convincing test of the Swiss system. Second, measurements taken after the disastrous flood of 1914 indicated that the 712 sec.-ft. per square mile of area discharged from Haines Canyon was the maximum unit flow ever recorded in Southern California. Third, inasmuch as two separate communities and much valuable acreage were menaced by this torrent, any beneficial results attained by the experimental work in this canyon would have the added value of giving practical relief to this district. Fourth, any object lesson observed as a result of treating the 1000-acre Haines watershed could be taken as a safe working basis for similar operations throughout Southern California.

The first expenditure in the Haines watershed was made under the direct supervision of C. C. Buck, an experienced superintendent of construction, who has built similar structures in Alaska to protect sluicing operations. This work was done in December, 1914, and consisted in building six retarding dams in a dry ravine called Western Empire Canyon, which discharges into Haines Canyon, 2 miles above its mouth. The materials used in this construction were granite boulders and oak logs which were found on the hillsides directly above each dam.

RUNOFF CONDITIONS ON THREE MOUNTAIN WATERSHEDS, SHOWING EFFECT OF CHECK DAMS

Mountain Watershed	Sq. miles area	Max. disch., Jan., 1916, sec.-ft.	Max. disch. per sq. mile, sec.-ft.	Surface flow at mouth of canyon, Feb. 20, '16, sec.-ft.	Surface flow at mouth of canyon per sq. mile, sec.-ft.	Per cent of column 4 of average of 3	Per cent of column 6 of average of 3
1.	2.	3.	4.	5.	6.	7.	8.
Haines	1.45	164.5	113.4	1.008	0.696	42.3	113.9
Cook's	.50	269.5	539.0	0.24	0.480	201.1	78.5
Little Tujunga	18.70	2,835.0	151.60	12.3	0.658	56.6	107.6

POOLS FORMED BY CHECK DAMS INDUCE GROWTH OF VEGETATION

FIRST TEST BY STORM

The first test given these structures was in the major storm of January, 1915. A rain gage situated in the valley 3 miles below showed 9 in. for the storm, and during a certain 1½ hr. the precipitation measured 1 in.

The writer was in Haines Canyon during the height of this storm, observing run-off condition. While all little side gullies and ravines were pouring out their flood of turbid water, the treated ravine above referred to had no surface flow escaping into Haines Canyon over the face of the detrital cone. Within the treated canyon the water was flowing clear and was being entirely absorbed in the gravels at the mouth. This condition was maintained during each storm throughout the winter. During the following summer Western Empire Canyon was observed to have undergone a radical change. Instead of a perfectly dry and barren gash in the burnt-over mountain face, the bed of the gully was filled with moisture. Willows were springing up everywhere and in one place the writer measured 1/6 in. of water flowing. These conditions had been attained in a gulch where neither summer flow nor willow growth had ever been seen. E. J. Mehren, editor of the Engineering Record, inspected the work in September, 1915. He noted with surprise the abundant vegetation springing up in the bed of the ravine within the zone of moisture.

The work was carried rapidly forward in Haines Canyon until the fall of 1915, at which time it was discontinued by the board of engineers, who considered that enough had been done to determine what degree of efficiency this class of construction might accomplish. At the beginning of the rainy season Haines Canyon became the central point of interest for those in Southern California who were concerned with flood problems.

RAINFALL RECORDS

No storms of any importance for the season were recorded in Southern California before Jan. 1, 1916. On that date, however, rainfall started, and with the exception of Jan. 3, 7, 11 and 12, more or less rain fell during each 24 hr. until Jan. 19. In this 16 days' rainfall the Pasadena gage situated at the foot of the San Gabriel Mountains showed 12.96 in. with 7.90 in. concentrated on Jan. 17, 18 and 19. The greatest rainfall for any 24-hr. period was between 6 p. m., Jan. 16, and 6 p. m., Jan. 17, when 4.68 in. fell. The greatest hourly intensities occurred between the hours of 3 a. m. and 6 a. m. on Jan. 17, during which time 2.01 in. fell.

The precipitation for the 24 hr., Jan. 16 and 17, was 5.71 in. in Haines Canyon against 4.16 in. in Los Angeles, and 5.31 in. in Pasadena. Equating the ratio of hourly intensities to total precipitation in Haines Canyon to that of Pasadena and Los Angeles in turn we obtain two sets of values for the hourly intensities in Haines Canyon. Averaging these it would appear that 68.2 per cent of the rainfall for the 24 hr. fell in eight consecutive hours, and that 41.5 per cent fell in three consecutive hours, and that 16.8 per cent fell in one hour. At the end of

RAINFALL, IN INCHES, DURING STORM, JAN. 17, 1916

Time, A. M.

Gage	12-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-11	11-12
Los Angeles	.17	.30	.56	.83	.60	.19	.11	.16	.08	.01	.02	T
Pasadena	.15	.29	.49	.73	.65	.66	.23	.34	.61	.04	.02	.03
Probable Haines Canyon: Prec. Basis L. A. Gage	.23	.41	.77	1.14	.83	.26	.15	.22	.11	.01	.03	T
Probable Haines Canyon: Prec. Basis Pasa. Gage	.16	.31	.53	.78	.70	.71	.25	.36	.12	.04	.02	.03
Haines Canyon Average	.19	.36	.65	.96	.76	.48	.20	.29	.12	.03	.02	.02

Time, P. M.

Gage	12-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-11	11-12	Total for 24 hr.
Los Angeles	.12	.09	.02	.03	.08	.11	.10	.06	.09	.17	.16	.10	4.16
Pasadena	.07	.03	.01	.07	.10	.17	.22	.10	.09	.20	.21	.32	5.33
Probable Haines Canyon: Prec. Basis L. A. Gage	.16	.12	.03	.04	.11	.15	.14	.08	.12	.23	.22	.14	5.71
Probable Haines Canyon: Prec. Basis Pasa. Gage	.08	.03	.01	.08	.11	.18	.24	.11	.10	.21	.22	.34	5.71
Haines Canyon Average	.12	.07	.02	.06	.11	.17	.19	.10	.11	.22	.22	.24	5.71

this eight hours of intense rainfall there were 15 cu. ft. per second being discharged from Haines Canyon at 7.30 p. m., and there was no evidence that more than 25 cu. ft. per second had passed at any time. Furthermore the velocities of flow during the peak of flood discharge were so low that the succulent young growth with which the stream bed was filled was not harmed to the slightest extent.

CHECK DAMS PROVE VALUE

At 11 p. m., Jan. 17, the writer, with others, inspected the Sunland wash or Lower Haines Channel, where it is crossed by Walnut Avenue, Sunland. It was at this point that the water left the debris-filled channel in 1914, and practically ruined seven acres of fine land, belonging to Secretary Wells of the Sunland Chamber of Commerce. The channel at this point was without surface flow and the writer estimated from water marks that the maximum flow during the night had not exceeded 10 sec.-ft. Mr. Wells said, "In my five years' residence here I have seen but one worse storm, that of February, 1914. At least once every year, and sometimes twice a year, it would have been foolhardy to attempt to cross the Sunland Wash with an automobile. This year any agile person could have jumped over it in its highest stage."

Mr. Rowley, who has resided in Sunland for thirty-three years, said, "I arose at 2 a. m., Jan. 17, because I expected trouble as a result of the intense rainfall at this time. A small creek discharging through the town of Sunland was carrying a large quantity of water and was doing more damage than ever before. The Sunland Wash, which drains Haines Canyon, was barely running, and despite the fact that the heavy rainfall continued for over three hours, a man could have crossed the wash on foot anywhere."

At 12 o'clock noon Haines Canyon was discharging 5.05 sec.-ft. at its mouth. This water was perfectly clear and had a velocity of 2 ft. per second. At 12.30 p. m., Fall Canyon, Laurel Canyon and Upper Haines Canyon, the three principal tributaries of Haines Canyon, were discharging 1.6 sec.-ft., 0.75 sec.-ft. and 0.60 sec.-ft., respectively, and excepting Fall Canyon which had run probably 15 sec.-ft., they were at the maximum discharge for the storm.

HAINES CANYON WAS DENUDED BY FIRE IN 1913 AND THERE WAS LITTLE VEGETATION LEFT TO RETARD THE WATERS IN THEIR WILD SWEEP TO THE MONTE VISTA VALLEY

CHECK DAMS HAVE PREVENTED FLOW FROM PASSING OVER THIS LARGE CONE OF DEPOSIT AT MOUTH OF WESTERN EMPIRE RAVINE

It must be borne in mind for the sake of comparison that at 12 o'clock noon, Jan. 17, the principal streams of Los Angeles County were in full flood flow. They had passed the danger point and were tearing out bridge approaches, carving new channels, etc. The Tujunga River, into which Haines Canyon discharges, had just ruined a Los Angeles County protection levee that had been constructed at great cost less than a year before. It also had broken through the Southern Pacific Railroad Company's levee north of the San Fernando Boulevard and was menacing hundreds of acres of valuable property.

VERY SMALL AMOUNTS OF SILT ARE CARRIED INTO THE BAYS BEHIND THE AVERAGE CHECK DAM

COMPARISON OF FLOW CURVES

A comparison of the flow curves of Haines Canyon, Cook's Canyon, and Little Tujunga River, practically adjacent watersheds, is indicative of what may be accomplished by check dams. It is indeed gratifying to see that Haines Canyon, which, in 1914, discharged the maximum unit flow ever recorded in Southern California, is to-day showing a flatter curve than either of its two neighboring streams.

From experiments in Clear Creek and from one season's test of the main Haines Canyon and a two years' test of Western Empire Ravine, we are in possession of the following data:

Twenty structures at the experiment station in Clear Creek reduced the velocity of flood flow as much as 71 per cent, demonstrating the stability of inexpensive structures when checking high flood velocities.

That the flood flows in Haines Canyon have been changed from much the worst of any in the immediate neighborhood to by far the best, is indicated by the first test given these structures.

That out of Western Empire Ravine, with a large cone of deposit at its mouth, there has been for two seasons no surface flow into Haines Canyon, and a constant summer stream in this canyon has been developed where none had ever been observed before.

These facts are of sufficient weight, I believe, to warrant the engineering opinion that check dam construction is valuable as a flood preventive measure, and that it will come to be recognized as one of the important factors in controlling floods, not alone in Southern California, but in the headwaters of the Ohio, Mississippi and Colorado River systems.

Expense Limits, Pennsylvania Highway Department

FOR some time, states William R. Main, auditor of the Pennsylvania State Highway Department, in the "Pennsylvania Highway News," the department hesitated to place arbitrary restrictions on the amount allowed a man for subsistence in the field, each account being scrutinized carefully on the basis of its individual merit, the fact being taken into consideration that rates for the same service varied widely in different parts of the state. The general rule was that an individual should incur no greater expense in connection with state highway department work than if he were traveling on his own account. It became apparent, however, that the temptation was toward extravagance and due care was not taken to get service at the most reasonable rates possible.

As an offset, therefore, arbitrary rules were established and are now in force, limiting the charge to engineers, superintendents and corps men for single meals to 50 cents and the combined charge for one day's board and lodging to $2. No Pullman charges are allowed except sleeping car service and this only when accompanied by letter of explanation. The chief of party is held responsible for making arrangements in advance for his corps at farmhouses and boarding houses in preference to having the men avail themselves of hotels in adjacent towns at a greatly increased expense. At no time is a man permitted expense outside his own district unless so ordered by the chief engineer.

Railroad Bridge Piers Built Both Ways from Central Plant on Island

Four-Rail Trestle at Milton, Pa., Accommodates Cranes on Center Track and Concrete Trains on Outside Tracks—Two Sets of Forms Build Twelve Piers

USING a central construction plant on an island and transporting concrete and materials both ways on a trestle upstream from the work, the twelve concrete piers and four abutments for the new Philadelphia & Reading Railway bridge over the Susquehanna River at Milton, Pa., have been practically completed since a contract for them was let last July. The work was carried on through a severe winter, as a climax to which the flood on which the winter ice went out early in April carried away the entire construction trestle across the east channel and destroyed the partly built steel cofferdam for pier 3. The trestles used were unusual in providing three tracks with four rails—one for locomotive cranes and two for concrete—while the work was handled so that all three tracks were used at once.

GRADE CROSSINGS TO BE ELIMINATED

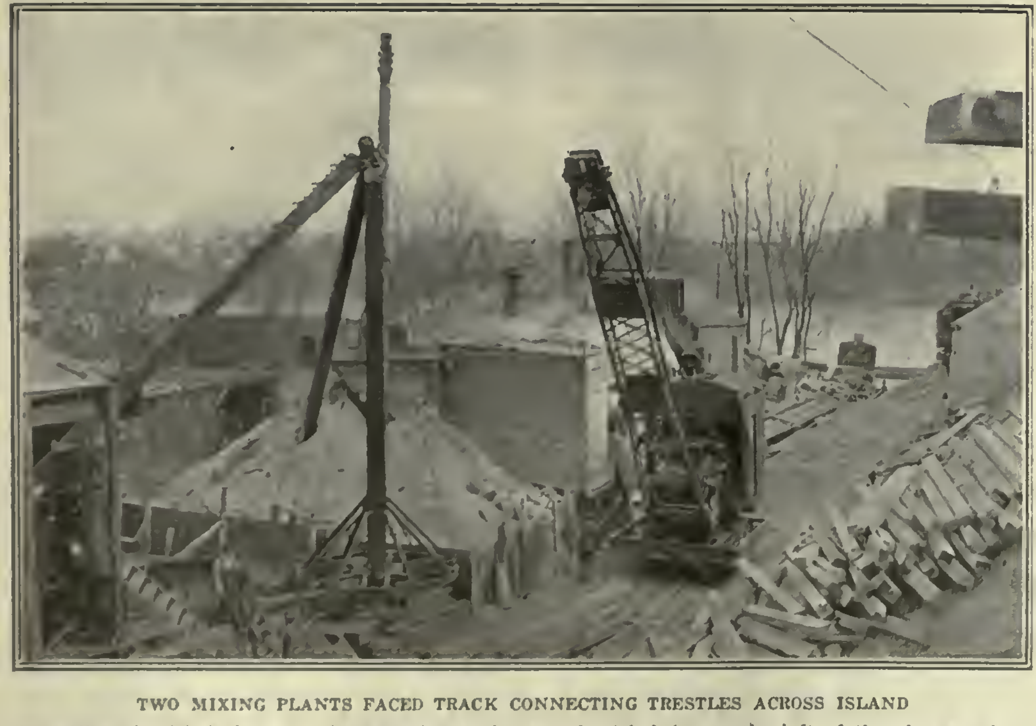
The new bridge, immediately upstream from and 5 ft. higher than the old, will make possible the elimination of street grade crossings in Milton. This work is now going forward under a separate contract, and the line will be raised when it is finished so that it will not be difficult later to eliminate the grade crossing at the Pennsylvania Railroad east of the present improvement work.

The river has a shale bottom from 10 to 16 ft. below low water, covered with from a few inches to 8 ft. of silt and gravel. Piers were therefore easily built. By using through girder spans and raising the elevation of the track, it was possible to provide the same waterway that existed with the old bridge, to keep the steelwork above the highest flood level and to lower the cost of construction as compared with longer spans. The crossing is for the Catawissa branch of the Philadelphia & Reading Railway, which joins the main line just west of the bridge, and both the old and new bridges are single track.

Both old and new bridges are made up of two independent bridges across the east and west channels connected by a short fill across the island. A turnout on trestle work from the old line was built on this island for delivering material. Bottom-dump sand and gravel railway cars were dumped from it to a storage pile below and upstream from the trestle. At the foot of this pile was the track extension of the two construction trestles, north of which in turn were two mixers mounted under separate hoppers. One was fed by a guy derrick and the other by a stiffleg derrick. The cement was also handled by these derricks in skips. Crossovers on either side of the mixers between the narrow-gage tracks, which were the outside ones, allowed all the switching to be done at the mixers. The crane when dumping concrete was thus always busy, being supplied by two tracks. Gasoline mine locomotives did the hauling, and are preferred by the contractor to steam dinkies.

FORCE OF ICE JAM BENT 18-INCH BEAMS

END FORMS TIED ON WITH WIRE ROPE


TWO MIXING PLANTS FACED TRACK CONNECTING TRESTLES ACROSS ISLAND

The stiffleg derrick is between the two plants, the guy derrick being to the left of the photograph and unloading trestle and material piles to the right.

SINGLE-WALL STEEL COFFERDAMS

The steel coffers, about 20 by 40 ft. with round ends, were set between inside and outside frames. The sheeting was driven through the mud and slightly into the shale, which is soft enough to pick, to shut off leaks at the bottom. An 8-in. pump, set in the upstream end, unwatered each dam. As the water was lowered two or three sets of bracing were put in and the mud removed by hand digging with buckets and dumped around the piers. A sump was cut in the rock in each case and shallow side ditches picked out to drain the rock surface inside the footing form.

TWO SETS OF FORMS REQUIRED

The work was started at the island and carried across the west channel first. The advance locomotive crane drove the trestle, which consisted of 18-in. I-beam stringers on capped bents of five piles each, and also set, drove and excavated the coffers. The second crane followed it up with the concrete work. Two sets of pier forms of four build-ups each kept three piers going at a time. By the time the first pier was ready for the last lift the second pier would be above water, and the bottom forms would be stripped from the first pier and set up at the third. These forms were of 1-in. tongue-and-groove lumber on vertical studs, lined with sheet steel plates. The side forms were tied through with rods and the curved end forms held on by $\frac{3}{8}$-in. cables with turnbuckles, passing entirely around the pier.

Enough steel sheeting, from 20 to 28 ft. long, was required to build one abutment and four pier cofferdams at the same time.

MORTAR FACE USED

The piers and abutments were faced with "granolithic" inside the form, using vertical steel plates which overlapped and extended all around the form. These were raised as concreting progressed. Molding strips, tacked on through nail holes in the steel form plates, were used to make band courses around the piers. The "granolithic" mixture was made at the pier being concreted either by hand or in a small wheeled mixer set on a plank platform on the trestle. Sand and cement were sent out to it on cars in the concrete trains.

On the completion of work in the west channel that in the east channel was started and handled in the same way, except for the

WORK IN WEST CHANNEL FINISHED FIRST

interference from floods mentioned, and except that a mixer and derrick were set up on the east shore to build the abutment on that site. This was wanted in advance to allow the track fill to be made against it. At the time of the April flood the coffer for the fourth pier from the island had been partly stood up but not driven. It collapsed in the ice jam, which was under such pressure as to curl several of the trestle stringers around the pier noses as if they had been old rails. The trestle was replaced as rapidly as possible to the fifth pier from the island, which was built in advance of the fourth while the contractor was waiting for a lower stage of water to remove the wrecked cofferdam.

PIER 2 WITH FORMS REMOVED — CONCRETE TO BE RUBBED

The old piers will be removed but the old abutments have been capped with concrete and will serve as downstream wing walls for the new ones.

The pier work was done for the Philadelphia & Reading Railway by the Robert Grace Contracting Company, for which F. P. Kemon was superintendent under B. R. Hundley, manager of the contractor's work in the Eastern territory. S. T. Wagner is chief engineer and Clark Dillenbeck engineer of bridges and buildings of the Philadelphia & Reading Railway, while the field work was in the immediate charge of J. S. Ward and E. F. Gorman, successively resident engineer.

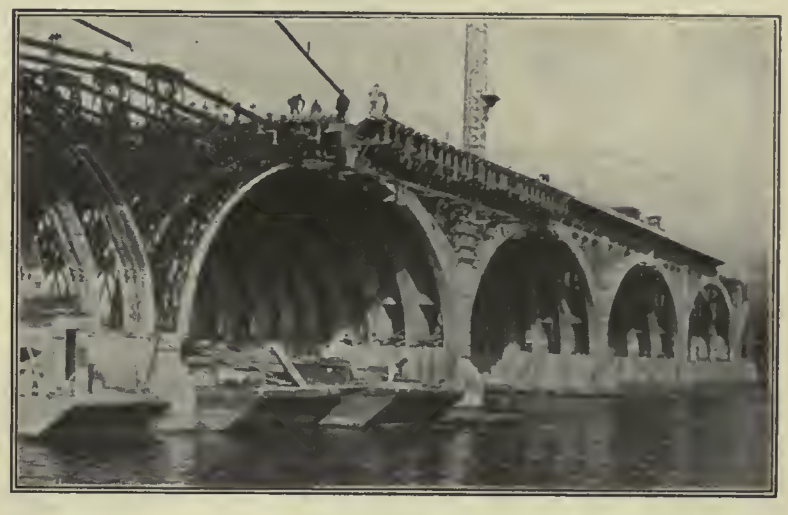
Eliminating Grade Crossings

Of the thirty-six grade crossings on a 210-mile stretch of the California state highway near the Oregon line, thirty have recently been eliminated by relocating the highways.

Steel Cantilever Ribs Balanced Over Main Piers to Form Arched Concrete Spans

Hanover Street Bridge Over Middle Branch of Patapsco River, Baltimore, Designed to Avoid the Use of Falsework—Unusual Pier and Abutment Details Adopted

UTILIZING the cantilever principle in the design of the structural steel ribs in the main arched spans, in order to facilitate the erection by placing the fabricated units over the piers and using them for the support of the concrete forms, the necessity for expensive falsework or centering in the construction of the long highway bridge at Hanover Street, Baltimore, Md., described in last week's issue, page 632, was entirely avoided. Arch action in the arched steel ribs of the main spans is eliminated, since the only connection between the adjacent cantilevers at the crown is a 3-in. pin placed longitudinally to transfer any unbalanced live load for conditions causing unequal deflection.

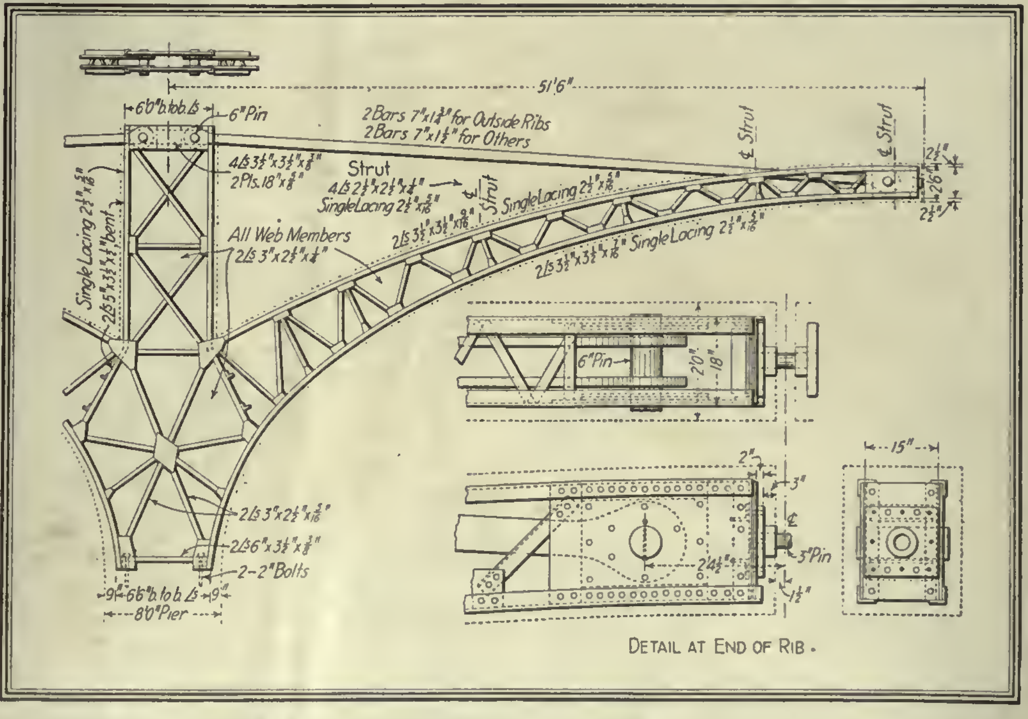


VARIOUS STAGES IN THE CONSTRUCTION OF MAIN SPANS

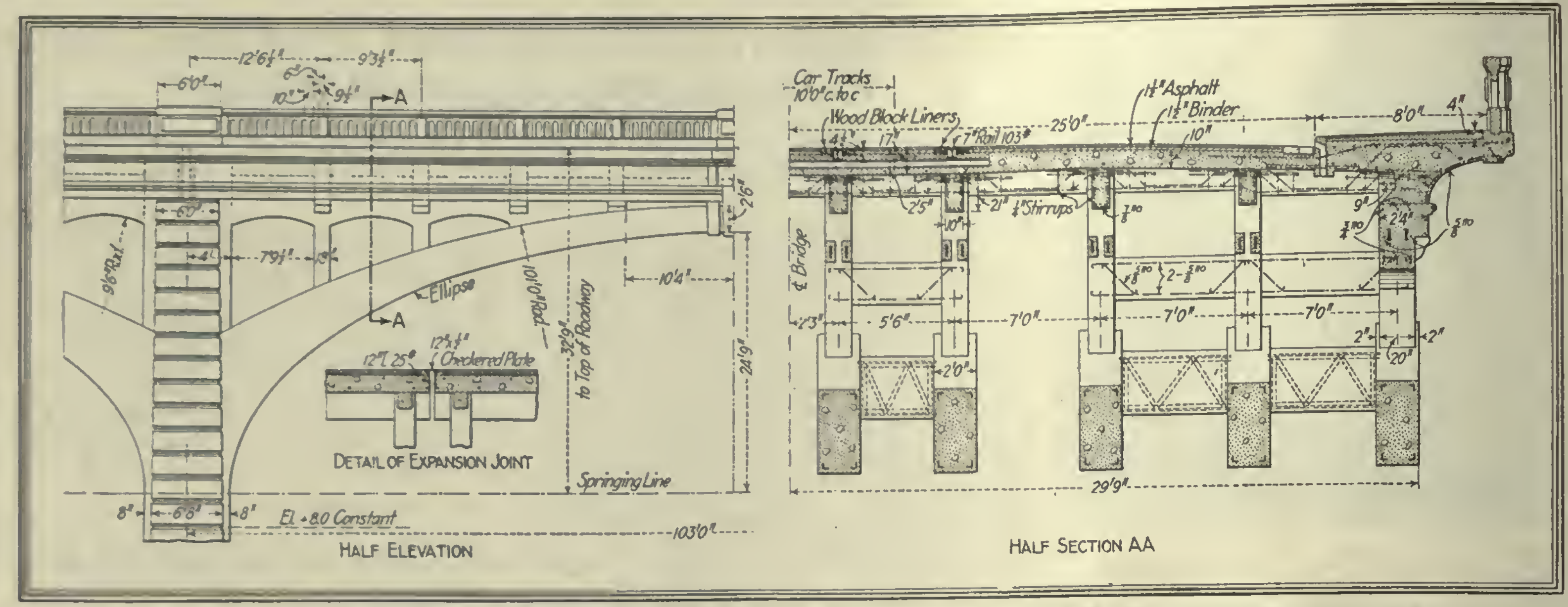
The main piers were designed with vertical reinforced-concrete cross walls, so that the amount of concrete used was considerably reduced. Another special construction is the south abutment, formed of curtain walls offset and paneled on the outside, hiding the cantilever ribs extended backward symmetrically to balance the cantilever arm of the south main span. Similar construction exists at the pier joining the arcade section and the main arched section, and also at the bascule piers, except that the cantilever arms are not symmetrical.

GENERAL DESIGN FEATURES

The Hanover Street bridge, now under construction for the Maryland State Roads Commission, is to replace the existing Light Street timber viaduct crossing the Patapsco River between Baltimore and the village of Brooklyn in Anne Arundel County, Md. The new bridge, however, is located on an entirely different line. It crosses the middle branch of the river nearly perpendicularly by the main arched spans here described, passes over the point of land in Baltimore County by a deep cut for a distance of 1900 ft. and thence by a fill in shallow water for 1400 ft. to a bridge consisting of sixteen 30-ft. and one 32-ft. continuous reinforced-



STEEL RIB DETAILS—CROWN JOINT PIN TRANSFERS UNBALANCED LOADING TO ADJACENT CANTILEVERS

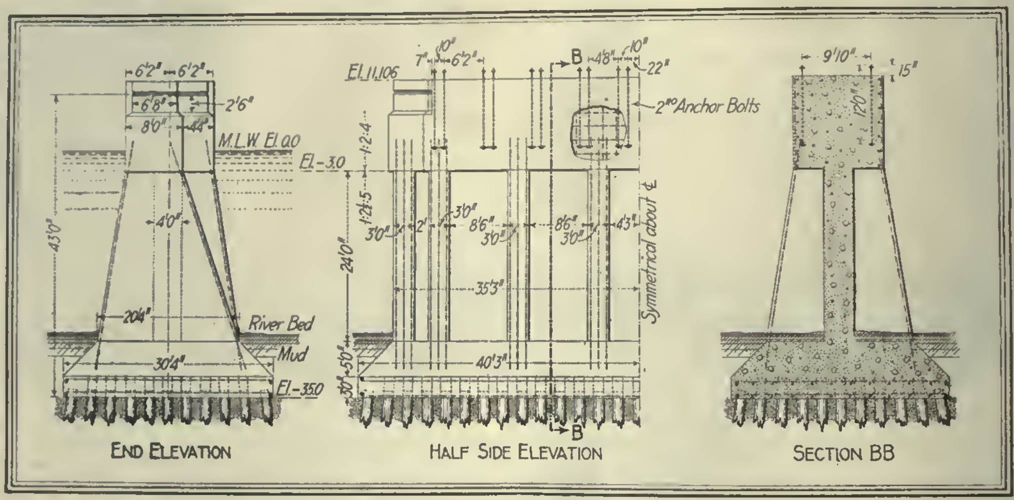


HALF ELEVATION AND SECTION OF TYPICAL SPAN WITH ELLIPTICAL INTRADOS FOR CONCRETE RIBS TO IMPROVE APPEARANCE

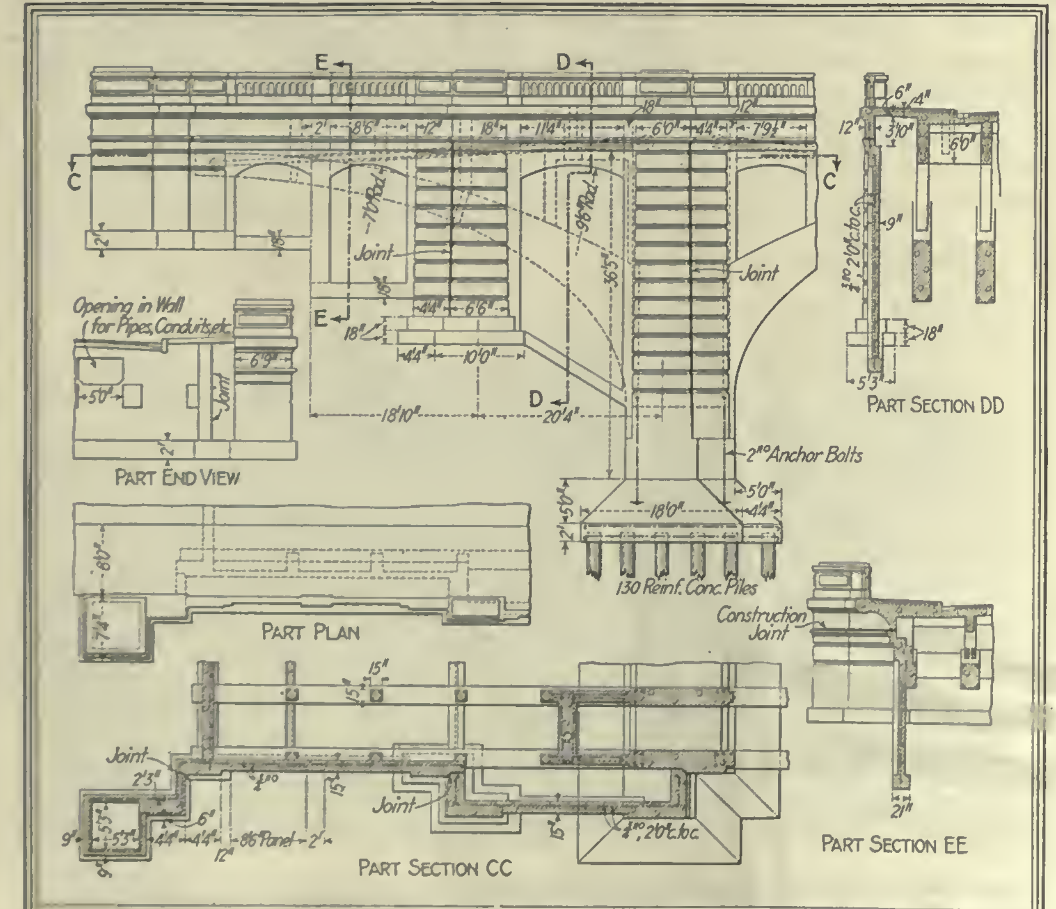
concrete spans, then by 1600 ft. of shallow fill to a bridge of seven 15-ft. continuous spans to Brooklyn.

The principal crossing, nearly 2300 ft. long, consists of twelve main arched spans of 103 ft. between centers of piers, with a rise of 25 ft., a double-leaf bascule span of the Rall type, 150 ft. clear, with two adjacent 55-ft. spans masked with curtain walls and supporting the operating house, 460 ft. of small arched-beam construction called the arcade, with curved longitudinal and transverse outlines, and 210 ft. of counterforted retaining wall connected with ties on the north approach leading from Hanover Street. The main span lengths and clearances were fixed by the government requirements for allowing small boats to pass without the necessity for lifting the bascule span. The new grade is some 30 ft. above that of the old viaduct.

The accompanying drawing shows the typical construction of the main arched spans. The floor is a concrete slab reinforced in both directions, using ⅝-in. round rods on 5-in. centers transversely and 8-in. centers longitudinally, with the spacing increased toward the supports and alternate rods bent up over the supporting beams. Rods 5 ft. long are added at the top flanges over the beams to aid in resisting negative bending moments. An expansion joint is placed at the center of each main span, with details as shown in the drawing herewith. Similar joints are placed about 106 ft. apart on the arcade approach section of the bridge.



MAIN PIERS DESIGNED WITH CAP AND BASE CONNECTED BY VERTICAL WALLS



SOUTH ABUTMENT IS OF MASSIVE APPEARANCE—INTERIOR RIBS BALANCE CANTILEVER ARMS

DESIGN OF MAIN RIBS

The cantilever steel framework shown in an accompanying drawing, consisting of eye-bar top chords, a vertical tower and arched girder lower chords, ten over each main pier, was designed to carry the wet concrete as it was poured and the forms necessary to support this concrete, assuming that the two cantilever ends would be poured nearly symmetrically. Then the reinforced concrete arms were analyzed for full and unbalanced live load, assuming that an initial stress had been developed in the steel by the forms of green concrete. The method of least work was used to analyze the stresses in the cantilever arms to obtain the shear transferred to the adjacent arm by the crown pin. For the live lead analysis the strengthening effect of the inclosing concrete in resisting compression was included by finding a pressure line and treating the entire rib as a reinforced concrete arch ring, the value of concrete being taken as 650 lb. per square inch. Only a slight unbalanced dead load was provided for in the design of the vertical steel tower and its anchorage to the pier.

The live loading used in the design consisted of two 50-ton electric cars, coupled together, on each railway track, a 24-ton truck on any part of the roadway, and 80 lb. per square foot on the sidewalk. To provide for impact effects, the live load stresses due to moving wheel loads were increased 15 per cent. The lateral forces prescribed were 30 lb. per square foot on one and one-half times the area of the vertical projection and 10 per cent of the specified live load on one track. The longitudinal forces were specified at 20 per cent of the live load for one line of traffic.

The vertical spandrel columns supporting the roadway floorbeams were first designed as reinforced-concrete columns with vertical round rod reinforcement. At the request of the fabricating company an alternate design, using four angles 2 x 2 x ¼ in. with tie plates, inclosed in concrete, was adopted in order to make the units complete for erection purposes, to give stiff connections between the main lower rib and the columns and to furnish support for the eyebars.

MAIN PIERS AND SOUTH ABUTMENT

As indicated by an accompanying drawing, the main piers are designed to economize in the amount of concrete by the use of vertical cross walls, which resemble a reinforced-concrete counterfort type of construction. The steel rods are all placed near the outside of the 3-ft. cross walls where they are most effective in developing the required fixing moment for unbalanced loading on the cantilever arms.

The apparently massive construction at the south abutment pier 1 and at the bascule piers is attained by the use of reinforced-concrete facing walls, with deep panels and wide offsets, masking the balancing ribs which extend into them. The end retaining wall at the south abutment is simply a connecting transverse wall joining the outer walls and the ribs, and made deep enough to reach a secure foundation, widened with a footing. The cross walls at pier 1 and at the bascule piers act as counterweights necessitated by the short ends of the hidden cantilevers.

The structure is being built under the supervision of H. G. Shirley, chief engineer of the Maryland State Roads Commission. J. E. Greiner of Baltimore, is consulting engineer, and E. H. Wroe, district engineer. The general contractor is H. P. Converse & Company of Boston, Mass. The steel framework for the main structure was fabricated by the Maryland Steel Company, and the Strobel Steel Construction Company designed and erected the bascule span.

Consistency Test for Concrete

The structural materials testing laboratory of Lewis Institute, Chicago, under Prof. D. A. Abrams, is conducting some tests for the committee on aggregates of the American Society for Testing Materials on a method of standardizing the consistency of mix of concrete. Cylindrical forms 8 in. in diameter and either 12 or 16 in. high are used. The concrete is poured in them and puddled with a bar. The form is removed at once. If the mixture stands without change it is considered too dry. If it slumps more than a ¼ in. it is too wet. If the slump is only ¼ in. it is considered correct. Final conclusions have not been reached regarding the test.

Products Depending on Hydroelectric Energy

Affect Greater Number of Industries Than Is Generally Appreciated—Lawrence Addicks Gives, Also, Unit Power Consumption

BRIEF reference was made in this journal last week in the editorial entitled "The Waste at Niagara," to the industries dependent on electrically-produced products. This subject was enlarged upon by Lawrence Addicks, past president of the American Electro-chemical Society, in an address on April 26 before the American Institute of Electrical Engineers. Mr. Addicks also discussed cost of power in relation to electrochemical processes. This phase of the subject is discussed editorially in this issue, but the present extract from the paper refers only to the materials produced and the unit power consumptions.

The electric current, Mr. Addicks said, may be used for its chemical effect, giving oxidation products at the anode and reduction products at the cathode in an electrolytic cell; or it may be used for its heat effect in an electric furnace, where high temperatures and a controlled atmosphere are desirable; or both effects may be utilized, as in the electrolysis of fused salts. Finally, we have the effects of electric discharges through gases.

A small beginning in electro-plating two generations ago has developed until the great majority of the copper output of the world is electrolytically refined; silver is thus parted from gold and gold from the platinum metals, bismuth-bearing lead can be successfully treated, electrolytic nickel is well known, and zinc and tin so refined are appearing in the market. In general, electrolytic refining not only increases the purity of the metal but makes possible the recovery of the impurities as byproducts, thus greatly cheapening the cost of some of the less common elements.

The electrolysis of common salt is the basis of the electrolytic alkali industry, the products of which are caustic soda, the starting point for various chemical industries, and used in very large quantities in soap making, mercerizing cotton, etc.; metallic sodium, also used as a foundation for other products, such as the cyanide so largely used in the metallurgy of silver and gold; chlorates, used in the manufacture of matches, certain explosives, etc.; hypochlorites, of value for bleaching; chlorine, employed as a sterilizing and chloridizing agent and for the formation of bleach.

ELECTRIC FURNACE

The electric furnace has created a host of new industries. Very briefly, the chief products consist of abrasives, such as carborundum, alundum, aloxite, etc.; graphite; silicon; ferro-alloys, such as ferro-silicon, -manganese, -chrome, -tungsten, -vanadium and others, which are used in the steel industry for producing sound ingots, hardening, making special steels, high-speed tool steel, armor plate, etc.; refined steel of crucible grade; phosphorous by distillation; calcium carbide, used in the generation of acetylene and in the manufacture of cyanimid; and so on. It is also being tried out experimentally as a competitor of the combustion furnace in the metallurgy of many metals. Used as an electrolytic furnace, we have the very important application to the production of aluminum.

The industrial use of electric discharges through gases is still in its infancy, but we have ozone and nitric acid among the products, the former used for sterilization and the latter as a base for fertilizers and explosives.

Every one of these industries consumes large quantities of energy. Starting at the bottom, we have the refining of lead at 120 kw.-hr. per ton. and of copper at 300 kw.-hr. per ton. Where diaphragms are used, as in nickel refining, the power rises to about 3000 kw.-hr. per ton. Where insoluble anodes are used for the recovery of a metal from solution, the power will range from 700 to 4000 kw.hr. per ton, depending upon the metal, the amount of depolarization at the anode, and of course the current density.

Turning now to electric furnaces, an ordinary melting operation, such as casting an alloy or refined steel, generall requires from 600 to 1000 kw.-hr. per ton. In the production of ferro-alloys, which is really a smelting operation, a large amount of energy is consumed by the endothermic reaction, and the power used runs from 3000 to 8000 kw.-hr. per ton of product, depending upon the grade of alloy made. The aluminum furnace requires 25,000 kw.-hr. per ton of product. The electrolytic refining, alkali and aluminum industries require direct current; the graphite, carborundum, melting and ferro-alloy furnaces use alternating current. In general low voltage and high amperage is employed. In the case of alternating current this is readily obtained by the use of suitable transforming units; in the direct-current processes it is customary to connect a sufficient number of cells or furnaces together to obtain a reasonable line voltage. Individual industries in plants of modern commercial size require blocks of energy ranging from 5000 to 50,000 kw.-hr. and it is self-evident that the charge for energy in such quantities is a vital item.

Hydroelectric Power in Spain

ACCORDING to recently compiled statistics, U. S. Consul General Hurst, at Barcelona, reports the hydraulic power available in Spain is estimated at over 5,000,000 hp. There are 110 large hydroelectric plants exploiting a total power of 281,490 hp. and a large number of small plants, so that the whole amount of power in use may be reasonably estimated at 300,000 hp. This total will probably be increased to 500,000 during 1916, when important installations are expected to be completed. The total horsepower controlled by the 110 large enterprises referred to is 1,020,790, and consequently 739,300 of their total power remains to be developed.

Independent of this amount numerous paper, spinning, and flour mills, and other manufacturing plants are run by water power not transformed into electricity. In Catalonia, northeastern Spain, the textile industries alone use some 200,000 hp., about one-half of which is natural water power. The estimated power of the streams of the Pyrenees running through Catalonia amounts to 1,135,000 hp., and concessions have been granted for the exploitation of only 800,000 hp.

The water power of the rivers of Spain has been estimated as capable of producing horsepower as follows: Ebro and affluents, 1,300,000; Duero, 900,000; Guadalquiver, 750,000; Tajo, 700,000; Guadiana, 370,000; Miño, 250,000; Jucar, 190,000; Segura and affluents, 100,000; and others, 600,000, making a total of 5,160,000 hp.

Truss Deflections Accurately Determined by Angle Changes and Elastic Weights

Different Methods Explained and Compared—Practical Formulas and Diagrams Designed to Save Time Are Illustrated by Examples—Part 2

By D. B. STEINMAN

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CONTINUING the discussion of the method of angle changes and its applications, as presented in Part 1 in last week's issue, page 644, the example of change in length of an arch chord will now be considered. The method of elastic weights will then be presented in full detail and followed by examples of its application.

EXAMPLE 6—TO FIND THE CHANGE IN LENGTH OF AN ARCH CHORD

In this case the "weights" $\Delta\varphi$, instead of being applied vertically, are considered acting in the direction of the desired deflection; that is, parallel to the arch chord *AB*, Fig. 12. The deflection due to the angle changes will be the sum of the moments of the angle changes about *AB*.

$$\Delta l = \Sigma y \cdot \Delta\varphi \qquad (9)$$

where y is the perpendicular distance of each angle change from the chord *AB*. To correct for the line changes, the formula becomes

$$\Delta l = \Sigma y \cdot \Delta\varphi + \Sigma \Delta s \cdot \cos \alpha \qquad (10)$$

where Δs is the elongation of each member of the linear chain and α is its inclination to the chord. If the panel length p is constant, this formula may be written

$$\Delta l = \Sigma y \cdot \Delta\varphi + \frac{p}{E} \Sigma u \qquad (10a)$$

where u is the unit stress in each member.

The value of Δl thus found for any given loading, divided by the value of Δl for a horizontal unit load applied at *B*, will give the horizontal reaction *H* at the ends of the arch if the displacement is prevented. In a three-hinged arch the value of Δl given by equation (10) or (10a) divided by the arch rise will give the angle change at the crown hinge. Formula (10) may also be applied to find the change in distance between any two points of a curved chord of an arch or truss.

DEFLECTION DIAGRAMS FOR HIGHER STRUCTURES

To find the vertical deflections of the arch represented in Fig. 12, the moment diagram of the angle changes is constructed as for a simple span *AB*. In other words, after the strains Δs are found, the indeterminateness of the structure does not affect the calculation of the deflections. Similarly, in continuous trusses, the angle changes are calculated from the strains in the actual structure, and then each span is treated as a simple span in the construction of the deflection diagram.

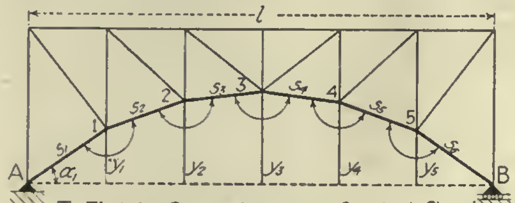
For a cantilever truss, Fig. 13, the deflection of the free end is given by the formula

$$\delta = \Sigma x \cdot \Delta\varphi \qquad (11)$$

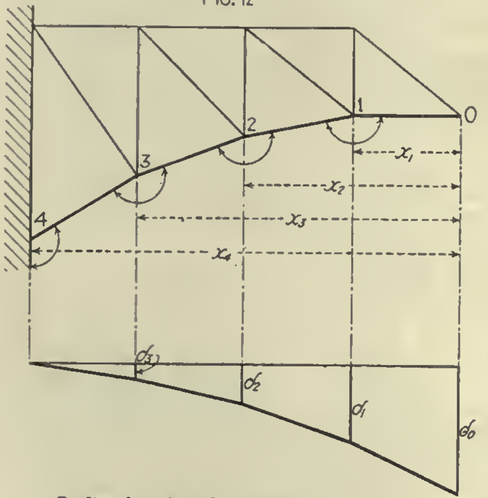
where x is the horizontal distance of each angle change from the free end. In other words the cantilever is treated as fixed at the free end and free at the fixed end when the angle changes are applied as weights. Extending the above principles to a cantilever bridge, we obtain the deflection diagram represented in Fig. 14.

In order to dispense with the necessity of making a separate correction for the effect of the line changes upon the deflections, the method of elastic weights is used. This method, in common with the preceding method, makes use of the angle changes in a truss, but differs from the preceding method in requiring the angle changes to be determined and applied at the center of moments for each member instead of at the contiguous panel points.

The kinematic basis for this procedure lies in the fact that the pole, or center of relative rotation, of two parts of a truss held together by any member coincides with the center of moments for that member. Thus, in Fig. 15, any strain in the chord member 3-5 produces relative rotation of the two segments of the truss with the center of moment *C* acting as a hinge or pole.



To Find the Change in Length of an Arch Chord
FIG. 12



Deflections in a Cantilever Truss
FIG. 13

Similarly, in Fig. 16, any strain in the diagonal 3-4 produces relative rotation of the two segments of the truss (shown shaded), with the pole, or virtual hinge, at the intersection of the connecting links 2-4 and 3-5; that is, at the center of moments *C*. In both cases the amount of relative rotation or angle change, measured in radians, is given by the formula

$$\Delta\varphi = \Delta s / r \qquad (12)$$

where Δs is the strain (elongation) in the member and r is its lever arm from the center of moments.

If the angle change $\Delta\varphi$ is applied at any point other than the true pole, a correction remains to be made for a translatory effect not covered by the rotation. But if the angle change is applied at the true pole—that is, at the center of moments *C*—the effect of each strain Δs becomes completely represented by a pure rotation, so that no correction is necessary for any additional effect of translation such as that of the line changes in the preceding method.

The method of elastic weights then consists in finding the angle change $\Delta\varphi$, defined by equation (12), for each member, and applying it as a weight at the corresponding center of moment; the resulting moment polygon constitutes the deflection diagram of the structure.

GENERAL PROOF

The following is a general proof of this principle: In the method of unit loads the stress S_1 in any member is equal to the bending moment M_1 at the center of moments *C* divided by the lever arm r. Consequently equation (3) for the deflection of any panel point *X* may be written, using equation (12),

$$\delta = S_1 \cdot \Delta s = \frac{M_1}{r} \cdot \Delta s = M_1 \cdot \Delta\varphi \qquad (13)$$

in which M_1 is the bending moment at *C* produced by a unit load applied at *X*. But, by virtue of the reciprocal relation for single loads between the bending moments at any two points of a span, M_1 also represents the bending moment at *X* producible by a unit load applied at *C*; and $\Delta\varphi \cdot M_1$ is therefore the bending moment at *X* producible by a load of $\Delta\varphi$ applied at *C*. Consequently equation (13) states that the deflections δ, due to the strain in any member, are equal to the bending moments produced by a weight $\Delta\varphi$ applied at the center of moments *C*. The total deflection diagram of a framed structure is therefore identical with the moment diagram of all the angle changes applied as weights at the respective centers of moments, which was to be proved.

For the effect of the chord members on truss deflections the method of elastic weights is identical in procedure with the preceding method (Fig. 8, Part 1). It is only in the method of including effect of web members that the two procedures differ.

APPLICATION TO CASE OF DIAGONAL

Fig. 16 shows the application of this method to the finding of the deflections produced by the elongation of a diagonal. In this case the pole or center of moments *C* is located outside of the span. As this is not a panel point of the truss, we cannot apply $\Delta\varphi$ as a weight directly at *C*. Instead we replace $\Delta\varphi$ by two other weights which will produce the same effect. These are the vertical components *P* and *Q* applied at the ends of the diagonal under consideration. If a and b are the respective horizontal distances of these two points from the pole *C*, and if p ($= b - a$) is the distance between them, the general expression for *P* and *Q* may be written

$$P = \Delta\varphi \cdot \frac{b}{p} \text{ and } Q = -\Delta\varphi \cdot \frac{a}{p} \qquad (14)$$

P, being the component nearer to $\Delta\varphi$, always has the same sign as $\Delta\varphi$, and is larger than the other component *Q*. With these two weights acting on the truss, the resulting moment diagram *AMNB* is constructed, and the ordinates of this diagram give the deflections of the different panel points due to the elongation of the diagonal d.

To find the deflections due to a vertical member (Fig. 17), the component weights *P* and *Q* are considered applied at the panel points of the loaded chord on either side of the section taken through the web member; these values of *P* and *Q* are also given by equation (14).

To find the total deflections of a truss, find the weights $\Delta\varphi$ for all the chord members by equation (12), and the weights *P* and *Q* for all the web members by equation (14), and then take the algebraic sum of all the weights at each panel point. These sums, which are to be applied as loads at the respective panel points, are called "elastic weights," and are represented by the symbol w. The moment diagram of the elastic weights constitutes the deflection diagram of the structure.

The above is the general procedure of the method of elastic weights. The work may be expedited, however, by transforming the above formulas into more convenient expressions.

If Δc is the elongation of any chord member and $\Delta' c$ is the same strain multiplied by the secant of its inclination to the horizontal, the contribution to the elastic weight, given by equation (12), reduces to

$$\Delta\varphi = \pm \Delta' c/h \qquad (15)$$

where h (Figs. 15, 18) is the height of the truss at the point of application of $\Delta\varphi$.

If h_1 and h_2 (Fig. 16) are the heights of the truss at P and Q respectively, and if r_1 and r_2 are the perpendiculars from the ends of h_1 and h_2 to the diagonal d, then P and Q are given by any of the following formulas:

$$P = \pm \frac{\Delta d}{r_1}, \qquad Q = \mp \frac{\Delta d}{r_2} \qquad (16)$$

$$P = \pm \frac{\Delta' d}{h_1}, \qquad Q = \mp \frac{\Delta' d}{h_2} \qquad (17)$$

where $\Delta' d$ represents the elongation of the diagonal multipled by the secant of its inclination to the horizontal. If θ is the angle of this inclination, the component P or Q which acts at the upper end of the diagonal is given by the formula

$$P \text{ or } Q = -\Delta d/p \sin\theta \qquad (18)$$

For a vertical web member, v (Fig. 17), if P or Q is the component coinciding with v, the other is given by the simple formula

$$Q \text{ or } P = -\Delta v/p \qquad (19)$$

For any web member, if either P or Q is known, the other can be found from $P + Q = \Delta\varphi$, or from the ratio

$$P/Q = -b/a = -h_2/h_1 \qquad (20)$$

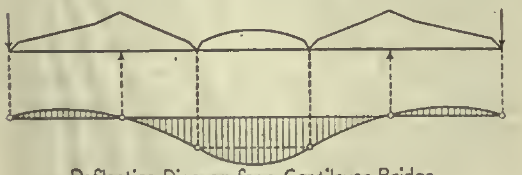
If the truss has parallel chords, or if the two chords cut by the section through the web member are parallel, $P = -Q$.

COMBINATION FORMULAS

Instead of applying a formula separately for each member of the truss, combination formulas may be used. Thus, in a truss of the Warren type (no verticals) the elastic weight to be applied at each panel point is obtained by combining equations (15) and (17)

$$w = \pm(\Delta' c - \Delta' d_1 - \Delta' d_2)/h \qquad (21)$$

where h is the vertical altitude of the triangle formed by the members, c, d_1 and d_2 (Figs. 15, 18). The + sign is used for the upper panel points and the — sign for the lower panel points. An example of the application of this formula to the determination of a deflection diagram is given in the previously cited article in the Engineering Record of Aug. 28, 1915, page 259. This formula must not be confused with equation (6) of the method of angle changes; the one is an actual angle change, the other an elastic weight representing the resultant effect of three angle changes; the difference between the two expressions represents the correction for the line changes in the web members.



Deflection Diagram for a Cantilever Bridge
FIG. 14

Another combination formula for the elastic weights in a Warren truss is

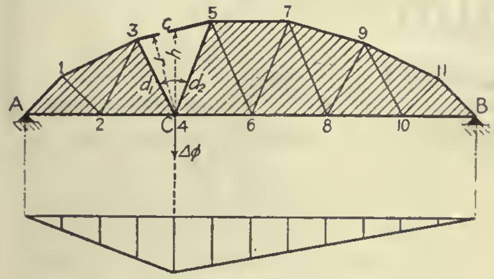
$$\pm w = \Delta' c/h - \Delta d_1/r_1 - \Delta d_2/r_2 \qquad (22)$$

where r_1 and r_2 are the perpendiculars from the foot of h to the two diagonals d_1 and d_2, Fig. 18.

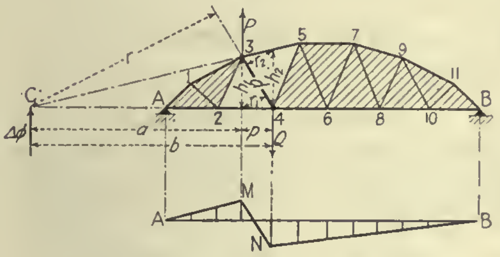
In a Pratt truss with parallel chords and vertical posts, Fig. 19, the elastic weight to be applied at each panel point of the lower chord is given by a combination of equations (15), (16) and (19):

$$w = \frac{\Delta c_2 - \Delta c_1}{h} + \frac{\Delta d_1 - \Delta d_2}{r_1} + \frac{\Delta v_2 - \Delta v_1}{p} \qquad (23)$$

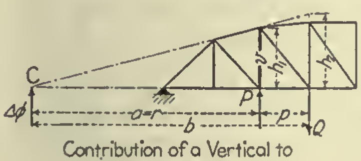
The sign of any elastic weight $\Delta\varphi$, P or Q, is always taken as plus if it tends to produce downward deflection of its point of application. Thus for chord members in a truss span $\Delta\varphi$ is plus (downward) for compression in a top-chord member or tension in a bottom-chord member. For a diagonal the components P and Q have opposite signs, and are assumed to be directed toward each other or away, according as the diagonal is in compression or tension. For a vertical the component P or Q at the foot of the member is taken as plus (downward) if the member is in tension.



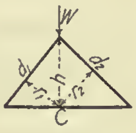
Contribution of a Chord Member to Truss Deflections
FIG. 15



Contribution of a Diagonal to Truss Deflections
FIG. 16



Contribution of a Vertical to Truss Deflections
FIG. 17

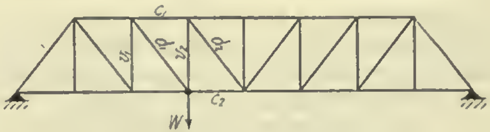


Elastic Weight at a Panel Point of a Warren Truss
FIG. 18

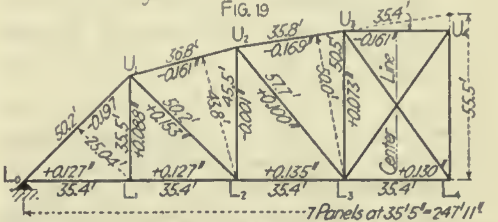
In the case of vertical hangers or posts whose strains affect the deflections of but a single panel point, it is best to disregard their strains until the deflection diagram is constructed; the correction is then made by equation (7), simply adding their strains to the ordinates of the deflection diagram. In the case of a truss having vertical web members the deflection diagram represents the displacements of the lower panel points only; the deflections of the upper chord may be obtained by correcting as above.

EXAMPLE 7—TO FIND THE DEFLECTIONS OF A TRUSS BY THE METHOD OF ELASTIC WEIGHTS

Fig. 20 represents a seven-panel Pratt truss with dimensions as indicated. The elastic strains (in inches) produced by the dead load plus a full live load of 6000 lb. per linear foot of truss are marked on the members in parentheses. The elastic weights are computed by equations (12), (17), (19) and (20) as in the accompanying table.



Elastic Weight at a Panel Point of a Pratt Truss
FIG. 19



Method of Elastic Weights Applied to an Inclined Chord Truss
FIG. 20

In the above evaluation of the elastic weights the diagonals U_3L_4 and U_4L_3 and the post U_2L_2 are omitted, as their strains are zero or negligible. The presence of two diagonals in the center panel is taken into account by using only one-half of the strains in the affected members (U_3U_4, L_3L_4, U_3L_4 and U_4L_4) in conjunction with each diagonal. Combining all the elastic weights at each panel point, and applying the method of successive summations, we obtain the deflections as follows:

Point	Elastic weight	Shear	Moment	Deflection, In.	
		0.0265			
L_1	0.0090		0.0265	0.94	(+ 0.09 = 1.03)
		0.0175			
L_2	0.0079		0.0440	1.56	
		0.0096			
L_3	0.0096		0.0536	1.90	

The moments in the above table are obtained by summation of the shears, assuming the length of panel as unity; consequently the values in the last column are obtained by multiplying the moments by the panel length, 35.4 ft. To the deflection of L_1 is added the correction for the elongation of the hanger which was previously omitted.

The above determination of the deflections is more expeditious than that of any other analytical method and more precise than that of the Williot diagram.

INFLUENCE LINES AND DEFLECTION DIAGRAMS

Referring back to Figs. 15 and 16, it may be noted that the deflection polygon in each case, besides being a deflection diagram for Δs and a moment polygon for the elastic weights, is also the influence line for the stress in the given member. This is an example of a general relation between influence lines and deflections, which may be deduced from equation (3a), $\delta = S_1 \cdot \Delta s$. If

ELASTIC WEIGHTS COMPUTED—EXAMPLE 7

Member	Strain (Δs)	Divisor	Elastic Weight ($\Delta\phi$)	Panel Point
L_0U_1	0.197	25.0	+ 0.0079	L_1
L_0L_2	0.254	35.5	0.0072	L_1
U_1U_2	0.161	43.8	0.0037	L_2
L_2L_3	0.135	45.5	0.0030	L_2
U_2U_3	0.169	50.0	0.0034	L_3
L_3L_4	0.065	50.5	0.0013	L_3
U_2U_4	0.080	50.5	0.0016	L_3
		Multiplier	P and Q	
U_1L_2	0.153	$\frac{-50.2}{35.4 \times 35.5}$	P, — 0.0061	L_1
		*35.6/45.5	Q, + 0.0048	L_2
U_2L_3	0.100	$\frac{-57.7}{35.4 \times 45.5}$	P, — 0.0036	L_2
		*45.6/50.5	Q, + 0.0032	L_3
U_3L_3	0.036	1/35.4	P, + 0.0010	L_3
		*— 50.5/55.5	Q, — 0.0009	L_3

*Multiplied by P.

we make $\Delta s = 1$, then $\delta = S_1$; that is, the deflections δ will be equal to the stress S_1 produced in the member by a unit load moving over the span. In other words:

> The influence line for the stress in any member is identical with the deflection diagram produced by increasing the length of that member by unity ($\Delta s = 1$).

The same relation between influence lines and deflections is also applied in the design of indeterminate structures in the form of the following principle:

> The influence line for any external reaction is the deflection diagram produced by a unit displacement of the point of application of that reaction.

Another useful relation which may be deduced from equation (3) is Maxwell's principle. If S_m and S_n are the stresses produced by a unit load at panel points m and n respectively, the deflection of m due to a unit load at n and the deflection at n due to a unit load at m are both given by the same expression from equations (1) and (3),

$$\delta = \Sigma S_m \cdot S_n \cdot s/EA \qquad (24)$$

Hence the two deflections are equal, which constitutes Maxwell's principle. From this principle we derive this relation:

> The deflection diagram for a unit load at any panel point is also the influence line for the deflections of that panel point.

By applying the above principles, the methods of angle changes and elastic weights may be used to construct influence lines for stresses, reactions and deflections as well as deflection diagrams.

Literature

For the Civil Engineer and Contractor

New Publications

Value for Rate-Making. By Henry Floy, A.B., M.A., M.E., consulting engineer. Cloth, 6 x 9 in.; 322 pages; illustrated. New York, McGraw-Hill Book Company, Inc. $4 net.

Five-Figure Mathematical Tables. Compiled by E. Chappell, B.Sc. Cloth, 6 x 9 in.; 320 pages. New York, D. Van Nostrand Company; London, W. & R. Chambers, Ltd. $2 net.

Hydraulics.—By R. L. Daugherty, A.B., M.E., assistant professor of hydraulics, Cornell University. Cloth, 6 x 9 in.; 267 pages; illustrated. New York, McGraw-Hill Book Company, Inc. $2.50 net.

Earth Pressure, Retaining Walls and Bins. By William Cain, professor of mathematics, University of Carolina. Cloth, 6 x 9 in.; 287 pages; illustrated. New York, John Wiley & Sons, Inc. $2.50 net.

Ground Water in San Joaquin Valley, California. By W. C. Mendenhall, R. B. Dole and Herman Stabler. Water-Supply Paper 398. Paper, 6 x 9 in.; 310 pages; illustrated. Washington, Government Printing Office.

Metric System in Export Trade. Report by S. W. Stratton, director, U. S. Bureau of Standards, to the International High Commission. Paper, 6 x 9 in.; 80 pages; illustrated. Washington, Government Printing Office, Senate Document 241.

Proceedings of the City Managers' Association, 1915. Paper, 6 x 9 in.; 144 pages; illustrated. Niagara Falls, N. Y., published by the association, O. E. Carr, secretary.

Second annual report giving the proceedings at the meeting in Dayton, Ohio, Nov. 15-17, 1915.

The American Road. A Non-Engineering Manual for Practical Road Builders. By James I. Tucker, professor of civil engineering, University of Oklahoma, and consulting state engineer, Oklahoma Department of Highways. Cloth, 5 x 7½ in.; 235 pages; illustrated. Norman, Okla., The American Road. $1.08 net.

The Spirit of Caution. Monthly periodical started by the Conference Board on Safety and Sanitation. Paper, 5 x 8 in.; 12 pages; illustrated. West Lynn, Mass.; Magnus W. Alexander, executive secretary.

Prepared primarily for the use and guidance of managers, superintendents and foremen in manufacturing plants.

General Specifications for Concrete Bridges. Third edition. By Wilbur J. Watson. Paper, 8 x 11 in.; 70 pages; illustrated.

This third edition brings up to date the matter issued in the previous editions, the first in 1908 and the second in 1910, by some radical changes, especially in the section on quality of materials. The sections on waterproofing and surface finish have been entirely rewritten.

The Panama Canal.—A Series of Papers Covering in Full Detail the Technical Problems Involved in the Construction of the Canal. Prepared under the direction of George W. Goethals, major general, U. S. Army, and Governor of the Canal Zone, by engineers and other specialists in charge of various branches of the work and presented at the International Engineering Congress, 1915. Two volumes, 25 papers. Cloth, 6 x 9 in.; 527 and 483 pages respectively; illustrated. New York, McGraw-Hill Book Company, Inc. $7.50 net per set.

Oregon's Opportunity in National Preparedness. Bulletin No. 5, Office of the State Engineer, Salem, Ore. By John H. Lewis, state engineer, L. F. Harza of Portland, Garfield Stubblefield and E. J. McCaustland. Paper, 5¾ x 8½ in.; 120 pages; illustrated.

A presentation of tentative plans and estimates of cost for the construction of certain large water power projects estimated to be capable of developing 2,400,000 hp., discussing possibilities for marketing some of this power, and pointing out the direct and indirect benefits which will come through the early development of the water power resources of Oregon.

Books Reviewed

Geodetic Surveying

Author, Edward R. Cary, professor of railroad engineering and geodesy, Rensselaer Polytechnic Institute. Cloth, 8 x 5½ in.; 272 pages, 98 illustrations, 21 tables. New York, John Wiley & Sons, Inc. $2.50 net.

Reviewed by A. F. Comstock

Associate in Railroad Engineering, University of Illinois, Urbana

Those who have followed the recent advances in methods and instruments of precise measurement will appreciate the need of a text setting forth in usable form the principles and modern aspects of geodetic surveying. Such a book is the one under review. A brief description of the book might well read as follows: "A concise, well-balanced textbook embodying the essentials of geodetic surveying, including geodetic astronomy and the method of least squares." Geodetic surveying proper is confined to the eight chapters which form the main part (three-fourths) of the book, while the appendices are restricted to astronomical considerations and least squares. Many of the methods presented are those of the U. S. Coast and Geodetic Survey. The author comments most favorably upon the results achieved by this organization.

Starting with a short introduction and an equally short chapter on reconnaissance, there follows a 30-page chapter on base lines. Chapters 3 to 7, inclusive, take up horizontal angles; adjustment of the horizontal angles; computation of geodetic latitudes, longitudes and azimuths; map projections, and trigonometric leveling. In general these chapters are brief—they average but fifteen pages each—but brevity has clearly been achieved by studious and legitimate condensation. Chapter 8 on precise leveling is a 40-page discussion taken principally from the reports and instructions of the U. S. Coast and Geodetic Survey. Throughout these eight chapters the numerous mathematical derivations and formulas involved have been presented with facility. A dozen typical problems are worked out at intervals to illustrate difficult applications, and a fair sprinkling of halftones and tables adds to the completeness of the several chapters. The measure and standards of precision have been duly emphasized.

The two appendices constitute one-fourth of the book. Appendix 1 treats of time, longitude, latitude and azimuth, and Appendix 2 takes up the method of least squares. Both are compact and to the point; they summarize these two related subjects in a judicious way, while numerous problems are worked out to supplement the text. Following the appendices is a list of some thirty references to the literature of the subject. The book impresses one as being a first-class, usable text.

Good Roads Year Book

Good Roads Year Book for 1916 (Fifth Edition). Cloth, 6 x 9 in., 440 pages. Washington, D. C., Colorado Building, American Highway Association, $1.

This, the fifth edition of the Good Roads Year Book, fully maintains the valuable place which its predecessors have made for this annual publication. The work is invaluable to libraries, associations, corporations and individuals requiring reference to highway laws, practices and statistics.

The main divisions of the work follow those of the last volume, but the arrangement has been improved, so that the book is better adapted for reference than its predecessors. The index in the front has been better displayed—dividing the book into three principal parts—while a detailed index at the end leads one directly to the subject sought.

Part 1 gives information regarding road improvements under federal, state, territorial and local control, together with a digest of the laws under which the work is executed. Here also are given the names of officials responsible for highway work.

Part 2 contains historical notes, technical details of road construction and maintenance, and a summary of road practice in European countries.

Part 3 is a miscellaneous section, containing discussions of highway bond issues, a bibliography, and lists of manufacturers, of highway and allied associations, and of road materials and road machinery.

While the value of each particular part of the book will depend upon the field in which the user is working, it is worth while calling especial attention to the digest of state highway specifications. It is a most valuable comparative summary of practice in different parts of the country.

Sewerage

Author, A. Prescott Folwell, past-president, American Society of Municipal Improvements. Cloth, 6 x 9 in.; 540 pages, 46 illustrations, 31 tables. New York, John Wiley & Sons, Inc., $3 net.

Reviewed by Charles E. Gregory

Engineer in Charge of Sewers, Department of Public Works, Borough of Manhattan, New York City

The seventh edition of "Sewerage," by A. Prescott Folwell, directs attention again to one of the older and most used text-books on sewerage. This work did not originally assume to treat at length the subject of sewage disposal, but recent developments in the art of sewage treatment and a more universal belief in the need for treatment has caused the author to revise and add to Part 4 of his work.

The older portion of the work may be very briefly reviewed with profit. Chapter 1 concisely defines various sewerage systems and methods and shows the water-carriage system the only one worthy of consideration under usual conditions. Chapter 2 gives the usual assumptions for determining quantity of sewage to provide for.

Chapters 3, 4 and 5 are devoted to rather elementary discussions of flow, flushing and collecting data. Chapters 6, 7 and 8 cover in a little more than 100 pages the preparation of drawings and specifications for sewer work, not including treatment plants.

Part 2 includes about 100 pages on construction. In twenty pages of Part 3 the usual maintenance practice is described.

Part 4 covers the field of sewage disposal in 155 pages devoting considerable space to dilution, composition of sewage and general principles of pollution and treatment. The significance of the quantity of dissolved oxygen in a polluted body of water as a measure of the pollution and an indication of the approach of malodorous conditions is not brought out.

Under "Methods of Treatment" the various devices for treating sewage are concisely described.

Under the head of of "Straining" various coarse and fine screens are described and data are quoted from Kenneth Allen's recent paper read before the American Society of Civil Engineers.

The various tank treatments, including chemical precipitation, are very lucidly covered. Examples of plants and tables of results are given. This chapter is especially meritorious.

A special article is devoted to oxidation, and very properly emphasizes the importance of oxidation in any complete purification of sewage, and quotes Dr. Rideal as to these processes. There is also described the design and maintenance of intermittent filters, and George W. Fuller in the report of the Massachusetts State Board of Health for 1893 is quoted.

Contact beds and sprinkling filters are described and much valuable advice is given as to their design and operation. Details are given of the modern types of sewage sprinkling nozzles, and Prof. Earl B. Phelps' method of expressing efficiency of sprinkling filters is described.

The article on the "Disinfection of Sewage" includes considerable data on costs, as well as upon the methods employed and results obtained.

While the space given to "activated" sludge is small, it gives the experience gained at Milwaukee in general terms. It does not go into details or show designs of works or devices. The author is wise in this, because this method of treatment has not yet reached a stage of practical development which warrants a permanent text-book description of details.

In describing the "Electrolytic Treatment" great weight is given to a report by three experts, including Prof. W. P. Mason, on the electro-chemical process which was carried out at Elmhurst, Borough of Queens, and not in Brooklyn, N. Y., as stated. Many of the results given in this report were not verified by other investigators of the same plant. While a satisfactory effluent was obtained the sewage which actually entered the electrolytic machine was abnormally weak, and its strength fluctuated between wide limits within short periods of time, thus making the results obtained open to doubt. Other investigations seem to indicate that the passage of the low-tension direct-electrical current through the liquid had very little beneficial effect. Both the sludge and the effluent became putrescible in two days after the alkalinity had been neutralized. Comparison of effluent between sewage treated with the electrical current and that treated in the same machine and plant with the electrical current turned off showed very slight difference in result, except in the one case quoted by the report of the experts above referred to.

The cost of this process as reported by Professor Mason and his colleagues was $30.19 per million gallons for a 1,000,000-gal. unit, and $22.28 for a 3,000,000-gal. unit. These costs do not include pumping, which would usually be necessary, nor the fixed charges to cover the cost of the electrolytic apparatus, sedimentation tanks, pump well, grit chambers, land, fine screening, sludge pressing and disposal machinery, which would probably very nearly double the actual cost of treatment by this method.

A brief description is given of rapid sand filters and of the Kessel siphon tank. The article on "Disposal of Sludge" briefly describes the composition of sludge, states its manurial value.

The work as a whole is clearly and concisely written, is free from conflicting data, and is admirably adapted for text-book uses and for reference library work.

Letters to the Editor

Comment on matters of interest to engineers and contractors will be welcomed

New York Central West Side Improvement in New York

SIR: In connection with your editorial in relation to the proposed New York Central West Side improvement, in your issue of May 6, page 599, permit us to add somewhat to your statement. As engineers for the conference committee of the various civic organizations who are and have been for some years vitally interested in securing a proper solution of this problem, we prepared the "citizens' plan," for a tunnel route, as the railroad and some of the city officials had assumed that the only possible solution of the problem was the railroad plan advanced in 1913.

That the labors of these civic organizations were not in vain is shown by the plan at present under consideration, which is a distinct and decided improvement on any of its predecessors, from both railroad and civic point of view, though far from being entirely complete or satisfactory.

The chief expenditure by the railroad will be made to secure improved terminal and track facilities, fully worth their expense, which afford a practical monopoly of the freight facilities of Manhattan. The railroad is further to gain an opportunity for the relief of its passenger traffic by running its express trains, at no far distant date, along the west side, and so relieving the congestion on its Park Avenue line.

The cost of covering over the tracks in Riverside Park, Fort Washington Park and Inwood Hill seems to be more than compensated for by the $6,000,000 difference in realty values involved in the proposed exchange of lands between the railroad and the city.

As to those who desire to reserve to the city the right to roof over the 129th Street freight yard at some future time, and at the city's expense, permit us to say that from their point of view as real-estate owners and taxpayers, they are not idealists but rather very practical people. In spite of electric operation, a freight yard is not likely to enhance but rather to depreciate the value of any property that may adjoin it.

As to future marginal terminal improvements, all that is now asked for is the right of the city to go over or under the proposed downtown structures of the New York Central should it be desired at some future time to provide terminal facilities for the roads now terminating on the Jersey shore. If this is not done, our progressive neighbors in New Jersey may eclipse the port facilities of New York by newer and better conditions in New Jersey, and New York City will retain only such freight from these roads as is intended for its own use, while the export freights will be diverted to the New Jersey terminals and docks.

The civic organizations are all in accord in desiring that the railroad should have all necessary facilities for its present business and future development, but they ask that this be done with due regard to the rights of the public and the reasonable interests of real estate affected. Their suggestions and criticisms have been recognized as helpful by the city authorities, and the railroad plans have gained somewhat by them. The operation is so large a matter that it would be very unfortunate if every detail and contingency is not thoroughly worked out in advance.

The amount which the railroad asserts it is going to spend upon the project, the extent of which is a mere assertion on its part, should not be allowed to affect the careful investigation of the details.

The railroad's future interests in some respects do not appear to be as well provided for, in this plan, as by the "citizens' plan."

THE R. P. BOLTON COMPANY,
Reginald Pelham Bolton, President.
New York City.

[Mr. Bolton's fears regarding the possibility of the New York Central securing a permanent monopoly south of Thirtieth Street should be allayed by the second report of the port and terminal committee of the Board of Estimate, made public early this week. The committee points out that this section of the line will cross thirty-six streets, and at thirty-four of these the city reserves the right to cross over, under or at grade.

Mr. Bolton's statement that the railroad is making its chief expenditure for improved terminal and track facilities does not seem quite fair. Surely $15,000,000 for park treatment is not to be scorned. Obviously the railroad, in justice to its stockholders and the ratepaying public, could not offer to spend $50,000,000 or more without expecting compensating advantages of some sort. Nevertheless the city will gain much at little expense to itself, and even in the exchange of land, whatever the comparative values of individual parcels, the city seems to be the gainer when the whole project is considered.

The port and terminal committee says regarding the covering of the Manhattanville yard, that there are foundation difficulties making it practically impossible. The Engineering Record cannot see any great likelihood of a serious nuisance in an electrically operated yard from 30 to 45 ft. below the parapet of a broad level strip of park.

The Engineering Record agrees with Mr. Bolton that so far-reaching an improvement should be studied out in detail before adoption. Apparently, however, the studying has been done; certainly it cannot go on forever. And it appears to this journal that the main obstacles have been overcome, and that the importance of carrying out the project as a whole as soon as possible far transcends the sum total of all of the objections that have been raised to it in detail.—Editor.]

Surveys and Bench Marks—More Permanence Needed

Sir: I would like to suggest a more general use of sea-level datum and reference ties to public land lines for all surveys, the lack of which will generally be found to be weak points in many surveys. The too frequent practice of using assumed bench marks, such as spikes in trees, or tops of curbs, should be discontinued wherever practicable. Reference points, such as stakes and marks opposite center of structures, are often used instead of township and section lines. It is only a question of a few years before assumed bench marks and reference points will be destroyed, and the surveys will be practically valueless for future use.

Recently I desired records of high-water marks along a certain strip of land to use in establishing a high-water plane. Several dozen surveys, which had been made for permanent bridge work and which contained high-water records, were obtained from the files. As is often the case, the surveys had been made from assumed bench marks. The connecting links were missing and the surveys were valueless for my purpose.

One finds many maps, profiles, and topographical surveys on file in engineering offices bearing practically no direct relation to each other. Engineers have had occasion in valuation work, and in lawsuits involving surveys, to handle maps and profiles the value of which would have been intrinsic if only some relation between the maps and the profiles could have been established. The engineering departments of both small and large corporations are more or less at fault in the matter of allowing surveys to be made and filed which are of practically no future value.

The federal government has established sea-level bench marks and permanent land lines in many parts of this country, and their use should become more general in surveys of all kinds. The more general use of sea-level datum and land-line ties for surveys will aid greatly in reducing the duplication of field surveys, and will tend toward inaugurating a more permanent and economical policy in the making and filing of surveys.

F. D. Yeaton.

Oak Park, Ill.

Justice to the Contractor

Sir: I heartily indorse your editorial suggestion "Justice to the Contractor" on page 502 of the Engineering Record for April 15.

The American Society of Civil Engineers could very properly draft general clauses and specifications including the general principles which should govern the preparation of detailed specifications. To encourage the adoption of these standard specifications at the earliest time possible it would seem advisable to include a brief statement of the advantages of the form of specifications proposed and explain how these specifications would eliminate the many present abuses. These statements and explanations should be written in plain, popular language so the layman could grasp and understand them readily.

Before much improvement can be made along these lines public officials and the public in general must know the difference between blue prints and specifications. They must also know the essential things the plans and specifications should contain to properly safeguard both parties to the contract. The attitude of many public officials is at present to require the specifications to be made as rigid as possible, for they feel that the contractor will get more than is coming to him in spite of all they can do in any case. Under such specifications the bids are generally made on what the contractors know about the officials and their engineer instead of on the specifications.

Education on the sound business principles of handling public business and the realization of the necessity of employing competent engineers and paying them well for directing this work will overcome many of these unsatisfactory conditions.

In order to overcome the objection to making the county engineer sole judge of the contract, plans and specifications I propose to use the following clause in my standard specifications for county highway bridge work.

"It is hereby agreed by both parties to this contract that the engineer shall act as referee in all questions and disputes arising under the terms of this contract between the parties thereto, and that the decision of the engineer in all such cases shall be final and binding upon both parties alike, unless an appeal is made from such decision, in which case both parties hereby agree that before any action shall be started in any court the question or questions at issue under this contract shall be referred to an arbitrator selected jointly by the contracting parties. The arbitrator shall be a graduate civil engineer who has had not less than ten years' experience in highway bridge work and who is not connected or interested in any way with any bridge contractor. The party losing the decision shall pay the fees of the arbitrator and all the expenses incurred by him in making the investigations and preparing and submitting reports."

Such a provision would probably be some restraint on the engineer, and it would have a tendency to discourage claims that could not and should not be sustained, and it seems only fair that the party who erred in his judgment as to the reasonable and proper interpretation of the contract should pay the expense of the arbitration.

I should be very glad to support a movement to correct the abuses referred to.

W. S. Gearhart,
State Engineer.

Manhattan, Kan.

Sir: I have read your editorial entitled, "Justice to the Contractor." There is merit and justice in your attitude in this editorial. However, it would be well not to lose sight of the fact that many contractors are so accustomed to "putting things over," to use an everyday vernacular, that when they do work that is run on the level they are constantly kicking and fighting with the engineer either to intimidate him into letting them do inferior work or slip something by when he is not looking.

It is my opinion that there are many good contractors who are eminently fair; men who have reputations to sustain and who do sustain them by ofttimes doing much more than the formal provisions of the contract provide for, and it is to this class of men that we should give protection against unjust tactics on the part of men not qualified to judge as to what is equitable and fair.

I am very much interested in this question as it is a live one with us all the time, and I would gladly help in any movement to correct these conditions. It has been suggested in your editorial that the American Society of Civil Engineers is best qualified to do this work. That suggestion is a good one and it would seem as though the Society could appoint a committee of engineers and contractors, for there are many contractors in the Society who are engineers, to take up this problem and report to the Society as a whole with suggestions. I think if it is done in that manner that it will give the whole thing more weight than could be achieved in any other manner. But, of course, it would be necessary to have the help of the engineering press in bringing about a change in conditions, for many men who are not members of the Society would be slow to take up any change of this nature unless it had been strongly advocated by the engineering press.

Yours very truly,
H. E. Breed,
First Deputy Commissioner of Highways,
State of New York.
Albany, N. Y.

Stream-Flow Measurements

Since 1888, according to a bulletin of the U. S. Geological Survey, measurements of stream-flow have been made by the Survey at about 3000 points in the United States. In addition, measurements have been made at many points in small areas in the Seward Peninsula and the Yukon-Tanana region, Alaska, and in the Hawaiian Islands. In this work many private and state organizations have co-operated, either by furnishing data or by providing financial assistance in collecting the data. In July, 1913, about 1380 stations were maintained by the Survey and the co-operating organizations, and many measurements of discharge were made at other points.

HINTS FOR THE CONTRACTOR

Details Which Save Time and Labor on Construction Work

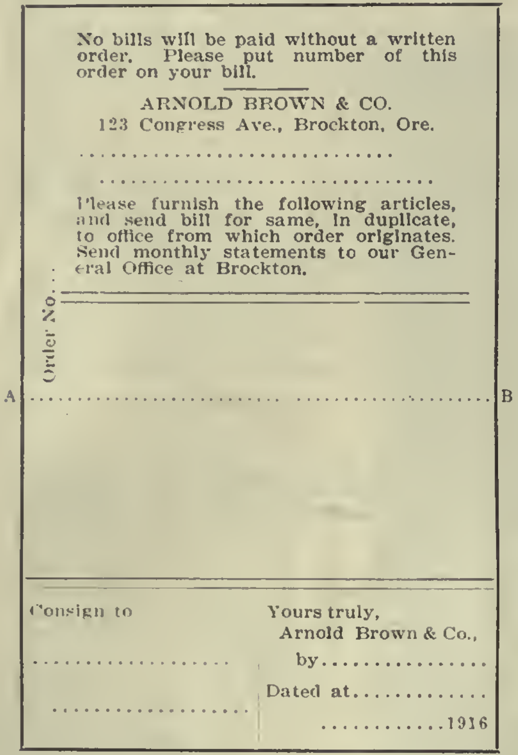
Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

[*Contributions to this section are solicited, and if found available will be paid for. They must be* SHORT, *and should be accompanied, if possible, by photographs or sketches.*—EDITOR.]

Accounting for the Contractor—Order Blanks

By **BENJAMIN L. LATHROP**
Lathrop, Shea & Henwood Company, Scranton, Pa.

THESE suggestions are offered especially to the small contractor, whose system of accounting is often started along wrong lines. Such a system may seem adequate for his needs, but if his business expands he finds it necessary to install new methods from time to time, involving considerable experimental accounting before he learns just what is needed to meet the demands of a growing business. It is just as easy to start right, and save the confusion incident to repeated changes. First the order blank will be considered.



No bills will be paid without a written order. Please put number of this order on your bill.

ARNOLD BROWN & CO.
123 Congress Ave., Brockton, Ore.

....

....

Please furnish the following articles, and send bill for same, in duplicate, to office from which order originates. Send monthly statements to our General Office at Brockton.

Order No. . . .

A .... B

Consign to

....

....

Yours truly,
Arnold Brown & Co.,
by..............
Dated at............
............1916

Even when an order for goods is given by a personal interview or over the telephone, it should be confirmed by a written order. A carbon copy should be kept on file for ready reference. The form illustrated herewith should be printed on paper cut to measure 8½ in. from left to right and 9 in. from top to bottom. This, when folded once, makes just the right size to fit into a standard document file, the most convenient device for filing order blanks, estimate sheets, invoices, etc. If the enterprise is a new one and it is felt that the outlay for filing equipment is not justified at first, this form can be kept in bundles secured by elastic bands, or placed in pasteboard boxes of convenient size. The important thing is to have the blanks of standard size and form, so that when the time comes to install a filing cabinet the papers can be transferred to it without inconvenience.

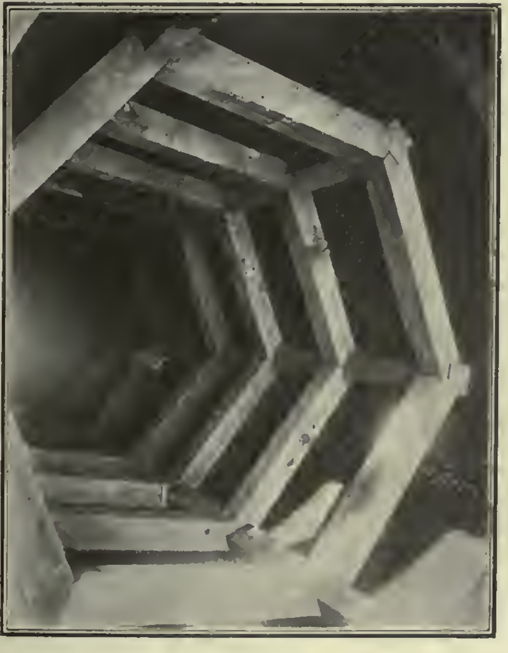
Orders should be written in duplicate or triplicate according to the requirements of the business, the original to be delivered to the consignor and one or two copies held for the office file. The form shown herewith is a modification of one that has proved satisfactory in actual use. The dotted line *A-B*, of course, does not appear on the form. It is shown to indicate the fold. The duplicate should be folded back along this line and placed in the document file with the order number at the top.

If the expense of order blanks is thought unnecessary until the business is more thoroughly established, an ordinary 8½ by 11-in. letter sheet may be used by folding under the lower margin of the duplicate 2 in., then folding the sheet back 4½ in. from the top and placing the order number in the left-hand margin, as indicated.

[This article is the first of a series by Mr. Lathrop on office and accounting methods for contractors. These articles will undoubtedly prove suggestive not merely to those starting in business, but also to the accounting forces of many established firms.—EDITOR.]

Sink Thin Steel Shaft Lining Outside of Hexagonal Bracing

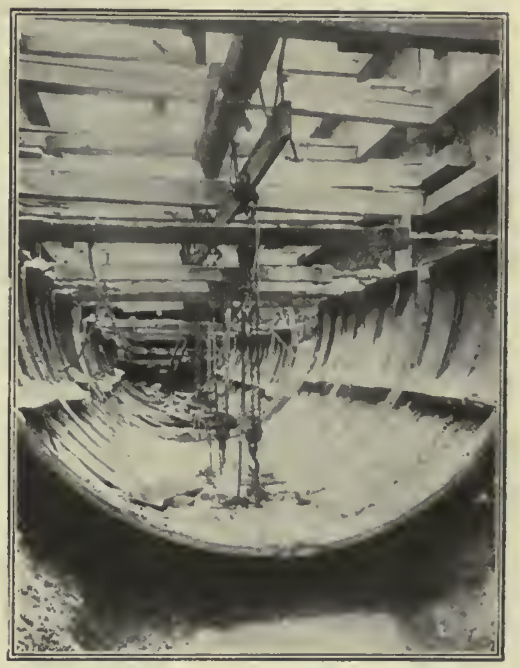
THE SHORE shaft of the Wilson Avenue water tunnel, Chicago, is driven for the first 20 ft. through water-bearing sand. To exclude the water a ⅜-in. steel shell was sunk to a seal in the stiff underlying clay outside of a hexagonal set of bracing, as shown in the accompanying photograph. The excavation was started, according to H. L. Clausen, engineer of waterworks construction, in a recent paper presented to the Western Society of Engineers, with an 18-ft. square set of bracing and sheeting inside of which the steel shell was started. The latter is 13½ ft. in diameter and was brought on the job in five 6-ft. sections, 30 ft. in all, and riveted and caulked section by section. It was sunk into place by digging in the center and loading the shell with 140 tons of pig iron. Below the shell wood lagging with standard caisson rings was used to the rock surface, from which the shaft was lined with concrete to the top.



HEXAGONAL BRACING KEEPS THIN SHEET LINING IN PLACE

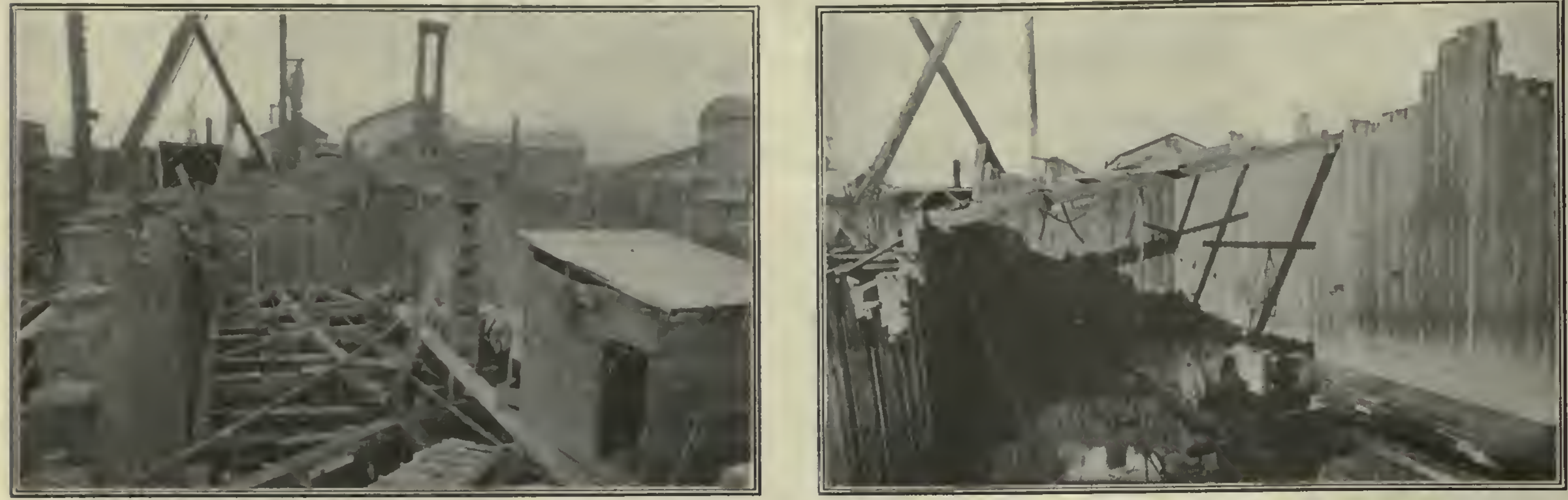
Sewer Forms Hung from Channel Trolley on Chain Blocks

THE SCHEME illustrated herewith of hanging steel sewer invert forms on chain blocks from a channel trolley track has been used successfully in building trench sections of the south side storm sewer in Columbus, Ohio, by J. C. Carland & Company, the contractors. The section of the sewer for which this method was devised is 10 ft. 3 in. in diameter. A section of the Blaw invert forms is lifted by three chain blocks, each hung from a three-wheel trolley running on a 7-in. channel which is suspended by chains from the trench bracing overhead. The forms are raised clear, run ahead on the trolley and lowered on cement blocks which are set to grade to support the forms in the trench ahead of the last section concreted. Three trolleys carrying a set of forms are easily pulled ahead by three men with a single rope pulley. The two 20-ft. sections can be moved, set and braced in from two to three hours by five men. The arch forms are pulled ahead on rollers on a track of doubled 2-in. plank. It also takes about three hours for five men to move ahead and set 60 ft. of the arch forms.



SEWER FORM CARRIED AHEAD ON TROLLEY

The south side storm sewer, the main trunk of which is more than a mile long, is being built for the city of Columbus, which is represented on the work by R. C. Chaney, assistant engineer under W. J. Weaver, engineer in charge of sewer con-



SHEETING IN RIGHT VIEW SHOWN AT LEFT AFTER IT HAD BEEN JETTED THROUGH HARDPAN WITH HELP OF 400 POUNDS WATER PRESSURE

struction, and Henry Maetzel, chief of the city engineering department. Charles E. Cannell is manager and H. R. De Lorme secretary of the contracting firm.

Wood Sheet Piles Jetted Into Hard Pan with 400 Pounds Pressure

By K. D. MacLEAN
Seattle, Wash.

A WATER jet under 400 to 450-lb. pressure has recently been successfully employed by the writer in driving wood sheet piles through hard pan which was so tough that it could scarcely be penetrated with a pick. This was done in driving the cofferdams for the north side piers of the city bridge over the Lake Washington Canal at Fifteenth Avenue, N. W., Seattle. The footings for the north side piers were built in two excavations each surrounded by a single row of the sheet piling shown in the accompanying photographs, and both entirely surrounded by an outside row of sheeting. The space between the outside sheeting and the two inclosed cofferdams was filled with clay puddle.

The borings showed about 1 ft. of sand, 4 ft. of blue clay, 8 ft. of hardpan, another thin seam of sand and then more hardpan. The foundation work had been sublet, and, contrary to the original intention, the subcontractors started to drive the cofferdams without doing any preliminary dredging. When the hardpan was encountered it was found impossible to drive the piling any further. In the south side piers a trench was dug around the inside of the sheeting and filled with sacks of earth, nearly 5000 of which were required for one pier. These were taken out in short sections at a time, the trench excavated and the material dug out from beneath the piles so they could be driven down. This proved so expensive and difficult that the general contractor had to take over the south side piers and complete them.

Those on the north side were again sublet in the condition in which they were left by the previous sub-contractor, that is with the piles driven to hardpan. The writer then undertook to put the piling to grade.

The only equipment retained on the work was a stiffleg derrick with a set of swinging leads and a drop hammer. A Blake duplex pump with a 5-in. intake and 4-in. discharge and 12 x 14-in. cylinders was set up and the 4-in. line carried about 50 ft. to a point between the two inside cofferdams, from where a 50-ft. hose reached all points of both. Considerable trouble was experienced in securing a hose that would withstand such high pressure, and the largest one obtainable was only 1½ in. in diameter, rubber hose wire wrapped, which, however, proved satisfactory. To this was attached a 30-ft. jet pipe, 2-in. diameter, double strength, with the nozzle drawn down to ¼ x 1¼ in. and case hardened. The pump was run by a 100-hp. boiler carrying 160 lb. steam pressure, and a working pressure of between 400 and 450 lb. at the pump was maintained.

The piling had to be driven 36 ft. below extreme high tide, 32 ft. below the top set of timbers and from 20 to 24 ft. below the ground line. The water was kept pumped down in the cofferdams so that this depth could be reached by the jet. The jet pipe was hung from the derrick from behind the leads, and was handled by three men. It was started down the front of the pile with a slight angle outward. When the hardpan was encountered all three men put their weight on the pipe by standing on a pair of handles clasped around it. In order to keep as straight a line as possible and prevent unnecessary strain on the splines, each pile was driven 5 or 6 ft. at a time working around the wall until all had reached a penetration of about 1 ft. below the grade of the bottom of the pier.

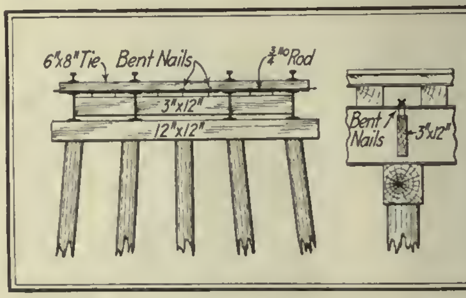
The greatest difficulty was found to be in driving through a stratum of gravel encountered in one corner of pier No. 1, which was coarse, closing in around the jet after it had been displaced, making the jet hard to remove and leaving no opening for the pile. Here the point of the jet had to be kept just below the tip of the pile, which often resulted in the jet being caught by the pile and having to be pulled with the derrick. This, however, did not result in any injuries to the pipe. Care had to be taken to work slowly through the blue clay, as the closing of the nozzle by plunging the jet into this clay would sometimes raise the pressure in the line to 600 lb. or more. Three times during the process of the work the pressure line was torn to pieces as though it were paper.

Jetting through the hardpan presented no difficulties other than the high pressure required to penetrate it. When the jet was removed the hole remained open and the pile was driven into it with an average penetration of 6 in. per blow, using a 5-ft. drop. A hole was required under each pile and in a few cases two were necessary, showing that the action of the water did not affect the ground at any distance from the tip of the nozzle.

The "Labor Map" in the Contracting News Section Shows Conditions in the Territory That Interests You

I-Beam Trestle Stringers Made Secure Without Punching Holes

THE SEPARATORS shown in the accompanying sketch are used by the Robert Grace Contracting Company to brace 18-in. I-beam trestle stringers securely without punching the beams for any connections. As the beams are lapped by over the caps of the trestle bents, they are not injured in any way by using them for stringers. A trestle construction with high salvage value, able to support 5-ton locomotive cranes and heavy concrete trains, is made in this way with long spans which reduce pile driving to the minimum required to carry the load. The spans in the trestle of this type used on the bridge at Milton, Pa., described on page 676 of this issue, averaged 18 ft. in length. The work is in charge of F. P. Kemon for the contractor.



PLANK SEPARATORS HUNG FROM ROD

Sand-Lime Brick Industry Firmly Established

In a report on sand-lime brick recently issued by the U. S. Geological Survey it is stated that the sand-lime brick industry, after experiencing the ups and downs of a new industry, has become firmly established. The sales of the product in 1915 attained a value $1,135,104, an increase of over $75,000 over the value in 1914. Michigan marketed more than any other state. Minnesota ranked second and New York third.

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

E. L. Corthell, President of American Society of Civil Engineers, Is Dead

Engineer of International Reputation Succumbs to Stomach Disease at Hospital in Albany, N. Y., This Week—Had Unusually Varied Experience on Large Projects

Elmer Lawrence Corthell, Dr. Sc., president of the American Society of Civil Engineers, consulting engineer with a reputation that extended to three continents, bridge and railway builder, Civil War veteran, river and harbor expert and member of a score of scientific societies in this country and abroad, died in a hospital at Albany, N. Y., Tuesday afternoon from a disease of the stomach. Dr. Corthell occupied a unique position in American practice. In these days of specialization the tendency of engineers is to confine their professional work to a single field, but Dr. Corthell's activities covered a remarkably wide range of operations—bridges, railroads and terminals, river channel rectification, harbors, canals, waterworks, protection of sandy coasts from sea erosion—involving responsible charge of projects calling for an aggregate expenditure well in excess of $200,000,000. But even amid the press of his many professional engagements he found time to participate actively in the affairs of the engineer, particularly as they related to matters of public policy. He was always prominent at international congresses of engineers, where his European and South American experience made him an invaluable member of committees having in charge the organization and administration of such meetings. Early this year he achieved the highest distinction which it is possible for civil engineers to confer upon a member of their profession—the presidency of the American Society of Civil Engineers.

President of American Society of Civil Engineers and Consulting Engineer of International Reputation, Who Died This Week

DR. ELMER LAWRENCE CORTHELL

Enlisted in Civil War

Elmer Lawrence Corthell was born at South Abington, Mass., in 1840 and had been at Brown University two years when the Civil War broke out. He enlisted as a private in the First Regiment, Rhode Island Light Artillery, and in his service of four and one-quarter years, nearly all of the time in Virginia and North Carolina, he was advanced to the grade of captain. After the war he re-entered Brown University and received the degrees of B.A. and M.A. Later, in recognition of his professinal achievements, his alma mater conferred on him the honorary degree of Doctor of Science.

Upon leaving the university he entered a general engineering office in Providence and engaged in railroad, hydraulic and municipal work, resigning in 1868 to devote his entire attention to railroad work in the Middle West. After two years he became assistant engineer in charge of constructing the bridge over the Mississippi River at Hannibal, Mo., and from 1871 to 1874 served as chief engineer of the Sny Island levee, 51 miles in length, on the east bank of the Mississippi River in Illinois.

Dr. Corthell's name is closely linked with the history of the control of the Mississippi River and in 1875 he was engaged by James B. Eads to take charge of the engineering and construction of the jetties at the mouth of the river. These jetties vastly increased the ocean commerce of the Port of New Orleans, and also the railroad commerce of that city, developing the Mississippi Valley route. Dr. Corthell also served as chief engineer of the bridge over the Mississippi River at Louisiana, having a 444-ft. draw span, the longest in the world at that time.

Associated with Mr. Eads, Dr. Corthell, in 1880, went to the Isthmus of Tehuantepec, Mexico, to make surveys for the inter-oceanic ship railway and harbor. Returning to the United States in 1881, he devoted his time for three years to railroad construction, but from 1886 to 1887 he worked upon the project for the inter-oceanic route in Mexico, making an address before the commerce committee of the House of Representatives, U. S. Congress, which had before it the bill to charter the ship railway.

Built Many Bridges

Forming a partnership with George S. Morison, Dr. Corthell, from 1887 to 1888, engaged in the design and construction of railroads, bridges, harbors and waterworks. During this partnership many famous structures were completed—the Cairo bridge over the Ohio River for the Illinois Central Railroad, at that time the longest steel bridge in the world; the Nebraska City bridge over the Missouri River; the Sioux City bridge over the same river and two bridges in Oregon. About this time Dr. Corthell made several expert examinations of railroad properties for bankers in London and New York.

From 1889 to 1890 he was chief engineer of the St. Louis Merchants Bridge over the Mississippi River and chief engineer of the improvements at the mouth of the Brazes River in Texas, consisting of jetties built into the Gulf of Mexico, which increased the depth of water from 5 to 20 ft.

Reverting to railway work in 1890, he served for three years as consulting engineer for the Illinois Central and the Atchison, Topeka & Santa Fé Railway.

Improved Tampico Harbor

One of Dr. Corthell's biggest projects was the improvement of the harbor of Tampico, Mexico, for the Mexican Central Railroad, a work which he began in 1889. In 1885 he wrote a descriptive paper of these works for the Institution of Civil Engineers, London, for which he was awarded the Telford premium and the Watt medal. The striking feature of this work was that a deep channel was produced by the works constructed, without resort to dredging. In connection with his work at Tampico Dr. Corthell visited Europe in 1891 and examined 26 harbors to get special information for use on the Mexican project. On this trip also he was selected by the University of Chicago to examine leading universities and technical schools of Europe and to bring back data upon which to base the establishment of the University's School of Engineering and Architecture.

The Mexican government enlisted his services in 1892 to complete the National Railroad of Tehuantepec. He had charge of the surveys, plans and estimates for the harbors for this route and made a report to the Mexican government.

Retained by Argentine Government

In 1899 the Argentine government applied to the authorities at Washington for an engineer of broad experience to act in a consulting capacity in connection with its river and harbor improvements. Dr. Corthell was recommended and early the following year began an engagement which kept him in South America or engaged upon Argentine work until May, 1903. Thirty-six different subjects were referred to him for investigation and report. Dr. Corthell's work was held in such high regard that he was selected to represent the Argentine government as a delegate to the International Navigation Cogress held at Dusseldorf in 1902.

Upon his return to the United States he was engaged for eleven years as engineer for the Boston, Cape Cod & New York Ship canal, which is now in operation.

The Governor of New York State in 1904 appointed him upon the advisory board of consulting engineers to build the state Barge Canal, a position from which he resigned to give all his time to Brazilian work. During 1904-05 he was engaged on extensive commercial works in Brazil, at Para, in St. Catharina and Rio Grande do Sul.

Active at Congresses

The various international engineering congresses have always found Dr. Corthell an active participant either in person or by important papers. At a meeting in Brussels, where all but six of the seventy-one papers were in other languages than English, he prepared for the Department of State, which had selected him as a delegate, a résumé of the entire proceedings, which formed a volume of 245 pages. The International Engineering Congress held during the Columbian exposition was suggested by him and its success was largely due to his work as chairman of the executive committee having charge of that affair. When the recent Pan-American Scientific Congress in Washington, D. C., was contemplated the Department of State again called upon Dr. Corthell to aid in the organization of the meeting, and he rendered valuable assistance in making this affair a success.

A prolific writer upon engineering subjects, his printed papers fill many volumes. He was a member of many engineering and scientific societies, both in this country and abroad, and was twice president of the American Institute of Consulting Engineers. Largely through his efforts this organization became a member of the Chamber of Commerce of the United States. Another of his activities concerned the establishment of a civilian reserve corps of engineers and he was one of the leaders, if not *the* leader in this project. Since his election to the presidency of the American Society of Civil Engineers Dr. Corthell had taken an active part in the proposal to have the society join the three other national engineering organizations in the Engineering Societies Building in New York.

To readers of the Engineering Record Dr. Corthell's name is already familiar. His most recent important contribution to this journal appeared in the issue of April 11, 1914, page 408, and was entitled "The War Against the Waves." It summarizes his many years of experience in protecting sea coasts from erosion by waves and is generally regarded as a classic in this field.

At the time of his death Dr. Corthell was seventy-six years old. His life was an eventful one and to a greater extent, perhaps, than any engineer living to-day did he come into close contact with important men and projects of national magnitude.

Appreciations of Dr. Corthell

Eminent Engineers Tell of His Work and Ability and Express Their Sorrow at His Departure

The Engineering Record has asked a number of those who knew Dr. Corthell well for appreciations of him as an engineer and as a man. They represent but a few of the expressions of sorrow and esteem that this journal has heard in the two days following his death.

Clemens Herschel

Vice-President, American Society of Civil Engineers, (now ranking officer of the Society)

Seldom has a life been lived that was fuller of duty performed and a striving for well doing than that of Elmer Lawrence Corthell, dead at the age of 76, while president of the American Society of Civil Engineers and of the American Institute of Consulting Engineers.

The writer is glad to be allowed to say a few words in leave taking of a friend of more than 40 years.

Of a rather frail physique, unsparing of himself, it is a wonder that he endured as long as he did. Never was there a man more ardent in the pursuit of all that came within his compass; never a one more devoted to the manifold causes he took up.

To him was applicable Emerson's description of the volunteer laborer:

> "So nigh is grandeur to our dust,
> So near is God to man,
> When Duty whispers low, Thou must,
> The youth replies, I can!"

He was one of the few American civil engineers whose name was known among the engineers of many nations, and he will be sincerely mourned abroad no less than at home.

So farewell, brave heart, and as the ancients had it, "May the sod rest lightly upon thee."

William Barclay Parsons

Consulting Engineer, New York

In the death of Dr. Corthell the engineering profession has lost one of its ornaments, and many individual members have lost a valued friend. Corthell stood, as few others did, for high professional ideals. His experience was perhaps unique in the variety of his work and its widely scattered nature and location, but his views were equally broad. He had the ability to see and properly estimate the practical or commercial aspects of engineering problems as well as the scientific aspect. To others, and especially to younger men, he was always considerate and helpful and for this his death will be most keenly felt.

Percival Farquhar

Consulting Engineer and Brazilian Railway Builder

It was my privilege to be actively associated with Dr. Corthell in various enterprises dating from early in 1906 until the latter part of 1912.

Dr. Corthell conceived the idea of deepening the channel into the Port of Rio Grande do Sul, Brazil, by the construction of jetties similar in principle to those by which the Mississippi and Tampico were deepened, and by the construction of a port there. The plans for this work and its initiation were carried out under his direction.

He was also for some years chief engineer in the construction of the Port of Para, at the mouth of the Amazon, afterward acting as consulting engineer.

His death comes as a great sorrow to me, and he is a man whom it will be difficult to replace.

F. A. Molitor

Secretary, American Institute of Consulting Engineers

One of the most appealing things to my mind in Dr. Corthell's life and character was the broad way in which he approached his professional undertakings. He ever sought the public good. The constructive works that stand as monuments to his genius have accomplished much for the people of many countries, and many of these works were his own creation. Instead of being the agent of capital, he made capital his agent. I was deeply impressed with this when, over a year ago, I visited Rio Grande do Sul in Brazil, where improvements of the harbor were being completed under his plans. It is here, his last constructive work, that he "utilized one of the forces of nature to the usefulness of mankind" and opened to commerce a broad and fertile country. His unselfish devotion to this project, the personal hardships and obstacles encountered had much to do with the breaking down of his health. Through all the earlier negotiations and sometimes disappointments his unfailing energy, wonderful tact and the human qualities of his nataure overcame all the obstacles.

The last years of Dr. Corthell's life were devoted to the cause of creating a better understanding between the profession and the general public. His activities in this field were endless. Had he been spared a few years longer his growing influence would have finally impressed the public with the usefulness of the profession. This great human quality of his was exemplified also by his broad acquaintance, and his ever ready and unselfish response to public duty, as well as his remembrance and care for his subordinates and associates. A member of the younger generation who has worked for him and gained some of his inspiration and spirit may always be sure of preferment by saying, "I am one of Dr. Corthell's boys."

Onward Bates

Past President of the American Society of Civil Engineers

I was never directly associated with Mr. Corthell, but I have watched his career since my own boyhood. He was a man of high ideals, enterprising and courageous in advocating them. For half a century he has been a leader in the civil engineering profession, growing with it and contributing to its advancement. The record of his life will be helpful and inspiring to future engineers, and I trust it will be made accessible to them.

Julio F. Sorzano

President, The Pan-American Chamber of Commerce

With the death of Elmer L. Corthell this country has lost not only one of its eminent engineers, but the one who has done more than any other man to make the American engineer known and respected in Latin-America.

During his long and important connections with large undertakings in Mexico, Brazil, Argentina and also with foreign governments as a consulting engineer, Corthell, by his sterling qualities, his broad and liberal mind, his inexhaustible generosity of character and, above all, by his lovable qualities as a man and as a friend, endeared himself to everyone with whom he came in contact.

It is fitting that such a man should have died while president of the American Society of Civil Engineers and president of the American Institute of Consulting Engineers.

He was a charter member of the Institution of Civil Engineers of Great Britain, an honorary member of the French Society of Civil Engineers and a founder of the Pan-American Chamber of Commerce. In every one of these institutions his loss will be deeply felt.

The Pan-American Chamber of Commerce loses in him a most devoted member, and I a beloved friend.

Dr. Romulo S. Naon

AMBASSADOR OF THE ARGENTINE REPUBLIC TO THE UNITED STATES

In the death of Dr. Corthell Latin America is deprived of the services of one of the most brilliant hydraulic engineers—one of the greatest in the world. Every project he undertook was worked out in a manner that showed Dr. Corthell's genius. The projects he has finished will stand as monuments to his memory as long as Latin America endures.

Dr. Domicio da Gama

AMBASSADOR OF BRAZIL TO THE UNITED STATES

South America has lost one of its most brilliant engineers in the death of Dr. Corthell. Probably his greatest achievement in connection with Brazil was his planning and completion of the harbor and improvements of Rio Grande do Sul. The work was undertaken by a French company, but they failed to accomplish the task. Dr. Corthell was the author of the present plans and the work has given the Brazilian Government entire satisfaction. Most of Latin America's great men have been patriots who shed their life's blood for their country. Dr. Corthell's work was of a different character, but just as helpful.

George F. Swain

PAST-PRESIDENT, AMERICAN SOCIETY OF CIVIL ENGINEERS

Mr. Corthell's energy and enthusiasm seemed without limit, and his devotion to the interests of his profession has placed all engineers under a heavy debt of gratitude to him. His ideals were of the highest, but never impracticable or visionary. He was always clear-headed and combined in rare degree the highest professional knowledge with sturdy common sense. He was a most delightful companion, intensely loyal to his friends and always ready to help others.

He will be greatly missed in the ranks of the profession and in the hearts of those who knew him well. His death will leave a void which only time and tender memories can partly heal. To his devoted wife, whose tender and unwearied care was such a support to him in his later years, the hearts of all who knew him will go out in deepest sympathy. He has passed into the great hereafter, but he has not only left material works to remind us of him, but an example that will be an inspiration to younger men.

In deference to Dr. Corthell the regular semi-monthly meeting of the American Society of Civil Engineers May 17 at the society house in New York City was adjourned immediately after the announcement of the death of Dr. Corthell, and the reading of a telegram of appreciation from Arthur P. Davis in behalf of the Washington Association of members of the society.

Attractive Routes Planned for Delegates to Waterworks Convention

Boat Trips on Hudson River and Atlantic Ocean May Be Included at Small Extra Expense by Delegates from the West

F. J. Bradley, 1223 Wabash Avenue, Chicago representative of the transportation committee, has arranged several routes to and from the annual convention of the American Water Works Association to be held June 5 to 9 in New York City. The Chicago party will leave the Twelfth Street station on the "Wolverine" of the Michigan Central Railroad, at 9.05 a.m., June 4.

For those who wish to return via the same route the round-trip fare will be $35. The return trip may be made on the Baltimore & Ohio, via Washington at an additional cost of $1.20 for the round trip, and on the Pennsylvania, at $38 for the round trip. Those wishing to include a boat trip may return via the Old Dominion Steamship Line to Norfolk, thence, via boat, to Washington and by the Baltimore & Ohio or Pennsylvania to Chicago. The trip via this route will cost $38, including berth and meals on steamer.

Boat Trips Planned

The return trip may also be made by either Sound or outside-line steamer to Boston, thence by rail to Montreal, and from there to Chicago via the Canadian Pacific or the Grand Trunk Railway. The cost of the round trip is $38.50. The return trip via Boston and Montreal can be made by rail for $39.75.

Those desiring to leave the train at Albany and complete the trip to New York by boat may check their baggage through to New York, by rail, without extra charge. The $5 extra fare will be refunded and railroad tickets exchanged at Albany to those wishing to make the river trip.

The transportation arrangements for delegates from Pittsburgh and the vicinity are in the hands of T. C. Clifford of the Pittsburgh Meter Company, East Pittsburgh. L. S. Barnard of the Hersey Manufacturing Company, Buffalo, is making transportation arrangements from that city. H. M. Lofton of the Columbian Iron Works, Chattanooga, is handling the arrangements for delegates from that section.

Elephant Butte Dam Completed

Work on the Elephant Butte dam at Elephant Butte, N. M., 120 miles north of El Paso, was completed May 13. The structure, on which work was started five years ago, forms a reservoir for the waters of the Rio Grande River, which will feed an irrigation system extending over 185,000 acres of New Mexican, Texas and Mexican land. This, the fifth of the government's big irrigation projects, will store the entire flow of the Rio Grande—enough water, it is estimated, to cover the State of Delaware to a depth of 2 ft.

President Wilson and Secretary of the Interior Lane wired their congratulations to the employees of the U. S. Reclamation Service engaged on the construction of the world's largest reservoir, which stores 856 billion gallons of water.

A description of the Elephant Butte project appeared in the Engineering Record of Oct. 4, 1914, page 368.

Pass Law Governing Contractors Operating in Maryland

A law relating to contractors doing a business of more than $5,000 a year in that state was recently passed by the Maryland Legislature, to become effective June 1. The measure compels a construction company with its chief office outside of the state, doing business in Maryland, to take out a license. The fee is $50 if the firm operates in the city of Baltimore and a like amount for each county of Maryland in which said firm may be operating. Resident firms operating in Maryland must take out a license at an annual cost of $10 for working in the city of Baltimore, and $10 additional for each county in which work is carried on.

Governor Signs New York Plant and Structures Bill

Governor Whitman, on May 12, signed the bill passed by the New York Legislature authorizing the change of the Department of Bridges of New York City to the Department of Plant and Structures. The new department will have the control of the construction and maintenance of buildings and structures previously under the jurisdiction of eight city departments. The present commissioner of bridges, F. J. H. Kracke, becomes commissioner of plant and structures. The forty-two bridges now controlled by the Department of Bridges will pass to the new department, but structures under the jurisdiction of the borough presidents, the Department of Water Supply, Gas and Electricity and the Department of Docks and Ferries, remain under the same control.

As stated on page 527 of the April 15 issue of the Engineering Record, the bill eliminates duplication of labor and equipment and authorizes the construction of a central repair shop at an expenditure of $1,500,000. The saving to be effected under the new organization is estimated at $1,000,000 a year.

Chicagoans to March for Preparedness June 10

A military preparedness parade will be held June 10 in Chicago, similar to the one held in New York City last Saturday.

National Fire Protection Association Holds Meeting at Chicago

Highest Grade of Fire-Resistive Construction Defined—Long Turn Elbows Recommended —All Officers Re-elected

Fire-resistive construction for office buildings was defined in a report by a committee of the National Fire Protection Association, May 9, 10 and 11, in Chicago. Ira H. Woolson is chairman of the committee and R. L. Humphrey presided at the session at which the report was presented.

The terms "full," "partial" and "temporary protection" are still to apply to structural materials and types of construction, but they are discontinued as applied to completed structures. Three grades of building in each class are to be recognized hereafter. The purpose is to secure, in grade A, the highest practical type of fire resistance. Grades B and C provide for permissible modifications. The committee report was accepted and referred to the executive committee with power to act.

A report on uses of wood in building construction was anticipated, but only a brief verbal progress report was submitted by Julius Franke, chairman, of New York.

Various changes in specifications for indicator posts were suggested by H. O. Lacount, chairman of the committee on hydrants and valves. The aim is to raise the standard of workmanship, to improve the present type of post by standardizing the target mechanism and to outline a new design for rising-stem indicator post which overcomes some of the criticisms of the target mechanism.

Long Turn Elbows Recommended

W. O. Teague, chairman of the committee on standardization of pipe and pipe fitting, brought in a progress report giving the results of an investigation by the Factory Mutual Laboratories on friction lost in screw and elbows of 2½, 4 and 6-in. diameter. In view of the conclusion that the friction loss of standard elbows is 50 to 100 per cent greater than that of long-turn elbows, the committee recommended the use of the latter.

More or less criticism was expressed in regard to the practice of permitting reports to be presented and passed without full previous consideration. It was explained that specifications may thus be promulgated which are not representative. The matter was placed in the hands of the executive committee to formulate a policy requiring all reports to be prepared well in advance so that they might represent mature consideration. This would remove possibility of criticism that insurance interests were trying to foist on the public anything to which they were not entitled.

All the officers were re-elected: Charles E. Meek, president; Louis Wiederhold and D. Everett Waid, vice-presidents; Franklin Wentworth, secretary-treasurer.

Amended Lockwood-Ellenbogen Bill Passes Legislature

The Lockwood-Ellenbogen bill providing for unified inspection of buildings in New York City, which was defeated by the state Legislature last year, has been revised and amended and was finally passed this year and signed by Governor Whitman, May 11. It consolidates, in a board of standards and appeals, the power to make and amend rules and regulations for the construction, alteration and structural changes in and rèmoval of buildings in New York City. These matters were formerly handled by the superintendents of buildings of the five boroughs, the fire commissioner and the state commissioner of labor. Control of waterfront property of the city and the jurisdiction of the tenement-house department are not, however, to be infringed upon.

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More Than 125,000 March in New York City's Preparedness Parade May 13—Engineers Number 6660

A PART OF THE CIVIL ENGINEERS' DIVISION OF THE MILITARY PARADE HELD IN NEW YORK CITY, MAY 13, IS SHOWN IN THE PICTURE. MORE THAN 125,000 EARNEST CITIZENS OF ALL OCCUPATIONS TOOK PART. THE ENGINEERS' DIVISION, WHICH WAS DIVIDED INTO EIGHT SECTIONS, TOTALED OVER 6660 TECHNICAL MEN AND, IN ADDITION, BOASTED EIGHT BANDS COMPOSED OF 384 MUSICIANS. THE MARCHING WAS CONTINUOUS FROM 9.35 A. M. UNTIL 9.40 P. M. THE ESTIMATED TIME FOR ONE LINE TO COVER THE ROUTE FROM THE CITY HALL TO FIFTH AVENUE AND FIFTY-SEVENTH STREET WAS ONE HOUR AND FIVE MINUTES. MILITARY OFFICERS WHO REVIEWED THE PARADE SAID THAT THE UNTRAINED CITIZENS MARCHED WITH UNEXPECTEDLY GOOD PRECISION. LIEUT.-COL. MERRITT H. SMITH WAS MARSHAL OF THE ENGINEERS' DIVISION; CAPT. GEORGE PERRINE, COL. E. W. VAN C. LUCAS AND COMMANDER EDWARD C. FITZGERALD LED THE FIRST, SECOND AND THIRD ENGINEERS' DIVISIONS RESPECTIVELY. J. WALDO SMITH AND GANO DUNN, CHAIRMEN, J. S. LANGTHORN, SECRETARY, J. P. HOGAN, ASSISTANT SECRETARY, WILLIAM BARCLAY PARSONS, AND ARTHUR S. DWIGHT, OF THE MILITARY LECTURE COMMITTEE, MARCHED JUST AHEAD OF THE FIRST DIVISION OF ENGINEERS.

The board of standards and appeals is to consist of the fire commissioner, the superintendents of buildings, the chief of the fire department and six other members appointed by the mayor. Of these six appointed members the mayor designates a chairman, who shall be an architect or structural engineer of at least fifteen years' experience and shall devote his whole time to the work. The mayor also appoints a secretary. Of the other appointed members there must, at all times, be one architect, one structural engineer and one builder, each with at least ten years' practical experience. The mayor has power to remove and to fill vacancies among the appointed members of the board.

The rules of the new board will not take effect until Oct. 1, 1916.

$30,000,000 Building Project Proposed on Long Island

An American Versailles is to be built on the north side of Long Island, New York, at an estimated cost of $30,000,000. According to Penrhyn Stanlaws, president of the organization, ground will be broken about July 15. About 180 acres of land have been purchased and plans are being completed by Carrère & Hastings, architects, 52 Vanderbilt Avenue, New York City.

Building Collapses at Akron

The Beacon-Journal Building at Akron, Ohio, collapsed May 15. Ten people are reported killed and twenty-five seriously injured. The accident is said to have been caused by dynamiting in an adjoining excavation.

Dinner to George S. Bartlett

During the meeting of the Portland Cement Association in Chicago last week friends of George S. Bartlett, one of the best known men in the cement industry, joined in tendering him a testimonial dinner at the Hotel Blackstone. W. S. Mallory, president of the Edison Portland Cement Company, was toastmaster, and among the speakers were the following officers of cement companies: John B. Lober, Vulcanite; A. Y. Gowen, Lehigh; B. F. Affleck, Universal; Richard Hardy, Dixie; L. T. Sunderland, Ash Grove, and T. G. Dickinson, Marquette. Edward N. Hines and Robert W. Lesley also spoke.

In the foreword to the souvenir menu are found these words:

"A company of men is here assembled, because of the admiration, yes, the love, we bear for one man. Through years we have worked with him in close association. And now and then we have fought him in the changing fortunes of the business war. But whether our interests were his interests, or otherwise, as we have known him better we have loved him more."

While Mr. Bartlett's acquaintance in the cement industry is very large, he also numbers a great host of engineers among his friends. He has been constantly engaged in the cement and building-supply business since he started in it in Milwaukee some thirty years ago. For some years past, as a member of the promotional department of the Universal Portland Cement Company, with headquarters in Chicago, and as vice-president of the Edison Portland Cement Company, with offices in New York, he has been engaged in the promotion of concrete roads.

Wreck Bridge at Manchester to Get Skeleton of Dinosaur

A $10,000 bridge will be torn down at Manchester, Conn., to secure the skeleton of a dinosaur embedded in the sandstone piers and abutments. The structure was erected more than thirty years ago, at which time the presence of the bones was mentioned. The Peabody Museum of Yale University will pay for wrecking the old bridge and constructing a new one.

Col. John Biddle Made Superintendent of West Point Academy

Col. John Biddle, Corps of Engineers, U. S. A., will be transferred from Baltimore, Md., to become superintendent of the U. S. miliary academy at West Point, effective July 1. Colonel Biddle, as engineer of the Eastern Division, was in charge of the works for defense of Baltimore and of many improvements of the harbor at Baltimore. He has just completed a survey and plans for the improvement of the channel approaches to that harbor.

Colonel Biddle was graduated from West Point in 1881 and was commissioned in the Corps of Engineers that same year. In 1902 he was made captain. During the Spanish war he was chief engineer of the U. S. volunteers. He has also served in the Philippines, Porto Rico and Cuba. In 1907 he was detailed in charge of works in the Sacramento and San Joaquin rivers, in California. He was appointed military observer to Austria in 1914 and succeeded Major Horton W. Stickle in charge of river and harbor works at Baltimore in 1915.

Ask Government to List Engineers' Qualifications

A set of resolutions passed May 9 by the American Association of Engineers at its annual convention requests the U. S. War Department to furnish blanks for recording engineers' qualifications and other useful information. The report of the secretary showed that the membership has reached 700 and approximately $12,000 has been saved by the securing of positions for engineers through the service clearing house instead of through employment agencies. W. J. Mauer was appointed member of the board of directors to replace the retiring president, W. D. Wilcox. Garrison Babcock was elected president.

What Engineers and Contractors Are Doing

Frederic C. Dunlap, who resigned as chief engineer of the Bureau of Water, Department of Public Works, Philadelphia, in 1912, has again been engaged by the department, in an advisory capacity, in connection with sewage-disposal work. Mr. Dunlap was born in 1869 at Mullica Hill, N. J. He was educated at the Pennsylvania Polytechnic School and began engineering work in 1888. In 1890 he engaged in the practice of consulting engineering and from 1894 to 1896 served as engineer for the Union Hydraulic Works, of Philadelphia. From the latter year until 1900 he was engaged in various hydroelectric and water-supply developments until he joined the Philadelphia engineering department as assistant engineer on designs for water-supply improvement. He was later placed in charge of the Torresdale filters and, still later, made chief of the Bureau of Water, in charge of the city's water purification plants, pumping stations and distribution system.

W. C. Coles was recently made pilot engineer of the Baltimore & Ohio Railroad, with headquarters at Wheeling, W. Va.

C. E. Painter has resigned as assistant city engineer of Newton, Kan., to become connected with Black & Veatch, consulting engineers, of Kansas City, Mo.

R. E. Kennedy was recently appointed pilot engineer for the Baltimore & Ohio Railroad, at Relay, Md.

Charles Wilson, of the firm of Kirk & Wilson, has been appointed a member of the engineering staff of Youngstown, Ohio.

William C. Campbell has resigned as superintendent of public works for Columbus, Ga., to engage in the contracting business at Charlotte, N. C. Mr. Campbell was graduated from the Georgia School of Technology in 1904 and has been connected with the engineering department of Columbus ever since.

Schley Gordy has been promoted to the position of superintendent of public works for Columbus, Ga. He has been in the city's employ for six years as assistant to W. C. Campbell, whom he succeeds.

Edmund M. Blake, for several years in charge of the Neponset River improvement for the Massachusetts Department of Health, has been made engineer for the Holbrook, Cabot & Rollins Corporation. He will work on the construction of the new drydock at Boston. Mr. Blake was recently engineer on the Arrowrock dam, at Boise, Idaho.

J. E. Gillespie, state-aid highway engineer, has been transferred from Grand Rapids, Mich., to Milwaukee, Wis.

Montague Ferry, consulting engineer, of Chicago, has removed his office to 20 South La Salle Street.

H. W. Ker, formerly shop superintendent for the Snyder Electric Furnace Company, of Chicago, is now connected with the Wapakoneta Machine Company, of Wapakoneta, Ohio.

Edward R. Stapley has resigned as instructor in civil engineering at Cornell University to assume the duties of resident engineer for the town of Wilson, N. C. Improvements costing nearly $500,000 are under construction.

Charles Cottingham, consulting engineer, of Danville, Ill., has removed his office to the Daniel Building.

Bartlett & Ranney, consulting engineers, of San Antonio, Tex., have been retained to prepare plans for a 500-kw. steam turbo-generator for the Landa Industries, at New Braunfels, Tex. The firm will also investigate and report on improvements of the water supply at Terrell, Tex., and sewage disposal at Dallas.

W. H. Coverdale & Company, consulting engineers, of New York City, will hereafter practise under the firm name of Coverdale & Colpitts.

H. J. Fairbanks, formerly recorder of a field party on the Long Island Railroad, is now office computer with the Interstate Commerce Commission at Washington.

Samuel E. Flexer has left the employ of the Lehigh Portland Cement Company to become connected with the Clinchfield Portland Cement Corporation, at Kingsport, Tenn.

Stephen L. Selden has resigned from his position as vice-president of J. G. White & Company to practise law.

A. M. Truesdell has left the employ of the bridge department of the Oregon Short Line Railroad to accept a position with the American Bridge Company, at Gary, Ind.

E. W. Blodgett, formerly with the Aberthaw Construction Company, of Boston, is now connected with the Gilbert & Banker Manufacturing Company, of Springfield, Mass.

Dr. W. C. Huntington will leave his position as head of the Chicago office of the Bureau of Foreign and Domestic Commerce to become commercial attaché at Petrograd, May 31. Dr. Huntington brings to the position a technical training acquired at Columbia University and at the Königliche Technische Hochschule at Aix-la-Chappelle. He has had five years' experience with two of the largest engineering firms in the United States.

C. D. Flanders, for the past three years superintendent of construction for Busk & Wind, contractors, of Omaha, has been appointed general foreman of construction for James Stewart & Company. Mr. Flanders was at one time connected with F. P. Gould & Son, and was also previously with his present employers as general foreman on the U. S. National Bank Building at Omaha. In his present position Mr. Flanders has charge of the construction of new bulkheads and piers for the Norfolk & Western Railway at Norfolk, Va.

L. W. Swett has been made superintendent for the Brooks Construction Company, of Fort Wayne, Ind. He has also been made a member of the Joint Committee on Military Engineering.

Frank Sheets has been promoted to the position of assistant maintenance engineer with the Illinois highway commission. Besides having supervision of the maintenance of state-aid roads, he is required to lecture on road building and maintenance.

J. M. Heffelfinger is assistant resident engineer with J. J. Morgan, consulting engineer, of Columbus, Ohio. He is at present on construction work at the Columbus sewage-disposal plant.

R. B. Siler is now employed on government railway valuation work with the Interstate Commerce Commission, with headquarters at Chattanooga, Tenn.

R. D. Brown has resigned as transitman with the U. S. Department of Agriculture to become associated with Francis W. Wilson, consulting engineer, of Hanover, Mass.

E. H. Miller is now engineer in charge of paving of streets and construction of two reinforced-concrete bridges at Berkeley Springs, W. Va.

Carl W. Bucholtz, formerly division engineer on the Meadville division of the Erie Railroad, has been made trainmaster of the Marion division.

C. E. Lesher has accepted a position with the engineering department of Jackson, Mich.

A. C. Cornelison, who recently returned from Panama to accept an appointment as superintendent of the Mexia Quarry Company, is now connected with the Honolulu Construction Company, of Honolulu, T. H.

Frederic Bass, consulting engineer, of Minneapolis, has been retained to make preliminary investigations for an improvement of the waterworks at Minot, N. D.

Edward A. Collins has been elected permanent secretary of the Builders' and Traders' Exchange of Pawtucket, R. I.

Henry Hornbostel and George Wild have been appointed consulting city planner and associate city planner respectively by the city-planning commission of Johnstown, Pa.

Albert Buchanan, chief engineer and draftsman of the London Street Railway, London, Ont., was the first to enlist in the Western University Stationary Hospital when recruiting started May 13. He is a graduate of the Royal Technical College, Glasgow, Scotland.

Eric G. Kingwell, formerly city engineer of Kamloops, B. C., has joined the Kootenay pioneer overseas battalion as lieutenant.

I. E. Goodnier, of Goldfield, Nev., was appointed engineer of the Paradise irrigation district, Butte County, California, at a meeting of the board of directors May 3.

H. Moseley has been re-elected city engineer of Dallas, Tex.

J. D. Wardle, formerly chief engineer of the Iowa Railway & Light Company, has been engaged to improve the Mount Vernon

(Iowa) sewerage and sewage-disposal systems. Mr. Wardle was for some time city engineer of Cedar Rapids, Iowa.

Raymond Hunt has been made consulting engineer for the Tidewater Power Company, at Wilmington, N. C.

W. W. Randolph was recently appointed development engineer for the Tidewater Power Company, at Wilmington, N. C.

E. D. Stapp has been appointed assistant city engineer of Davenport, Iowa.

Thomas K. Myler, formerly with the T. A. Gillespie Company on the construction of the East Liverpool (Ohio) filtration plant, has entered the engineering department of the American Bridge Company, at Gary, Ind. Mr. Myler was graduated from the University of Pittsburgh in 1911. He was then employed by the engineering department of the Pennsylvania Railroad and later by the Chicago, Milwaukee & St. Paul. In 1913 he became construction engineer for the Clinton Gas & Electric Company, of Clinton, Iowa, and later was made assistant city engineer of that city. He has been with the Gillespie Company since 1915.

William McCrabb was recently appointed general foreman on the Pennsylvania Railroad reinforced-concrete viaduct across the Susquehanna River, at Harrisburg, Pa., for which the Robert Grace Construction Company has the contract. Mr. McCrabb was engaged on the construction of the viaduct in Baltimore over Jones Falls and was general foreman at lock 1 on the Welland canal. He has also been connected with the J. G. White Engineering Corporation on two water-power developments in Tennessee.

E. S. Hathaway has been appointed city engineer of Missoula, Mont.

L. A. Nicholson, engaged in consulting engineering practice for the past twenty-six years, has been appointed city engineer of Tacoma, Wash.

Monty Hulse has been appointed city engineer of the town of Sumner, near Tacoma, Wash.

F. R. Marsh, city engineer of Great Falls, Mont., has been reappointed for two years.

C. R. Moore, of Hamilton, Ont., has been appointed assistant to H. G. Kelley, chief engineer and vice-president of the Grand Trunk Railway.

George D. Mackie, city engineer of Moose Jaw, Sask., has been appointed a member of a Royal Commission which will investigate the work of the provincial highways department.

L. G. Ireland, general manager of the Brantford Municipal Railway and the Brantford electrical commission, has tendered his resignation. He will take complete charge of the Ontario hydro commission and of the new Eastern Ontario hydro power development project, on which the government plans to expend many millions. Mr. Ireland was with the hydro commission for five years before going to Brantford.

Elisha Lee, assistant general manager of the Pennsylvania Railroad at New York; W. L. Seddon, vice-president of the Seaboard Air Line Railway, and L. W. Baldwin, general manager of the Central of Georgia Railway, are three—the three who have risen through the engineering departments—of the seventeen railroad officials appointed to represent the railroads in the negotiations regarding the demands of the trainmen for a basic eight-hour day. A series of conferences with representatives of the brotherhoods will begin in New York City June 1.

Oscar D. Chrisman has been appointed city engineer of Springfield, Mo. His first work with that city was as field engineer. He acted as draftsman of the public works department and later was appointed assistant engineer, which position he has held since 1912.

Col. Harry Taylor, Corps of Engineers, U. S. A., principal assistant to the chief of engineers at Washington, D. C., will be transferred to New York City, June 1, to become division engineer of the Eastern Division.

Col. Henry C. Newcomer, Corps of Engineers, U. S. A., resident member of the board of engineers for rivers and harbors, Washington, D. C., will succeed Col. Harry Taylor as principal assistant to the chief of engineers, at Washington.

Lieut.-Col. Francis R. Shunk will be made resident member of the engineer river and harbor board, at Washington, June 1. He is now in charge of river and harbor work in the vicinity of Pittsburgh.

Lieut.-Col. Edgar Jadwin, assistant to the chief of engineers, Washington, D. C., will soon assume charge of river and harbor work in the vicinity of Pittsburgh.

Halford Erickson, whose resignation from the Railroad Commission of Wisconsin was noted in the April 29 issue, has formed a partnership with William Hagenah, and opened offices in the First National Bank Building, at Chicago. The firm of Hagenah & Erickson will conduct railroad, public utility and financial investigations, embracing appraisals, cost analyses and rate studies. Mr. Hagenah was chairman of the board of arbitration which conducted an investigation into Chicago's gas rates. Mr. Erickson had served on the Railroad Commission of Wisconsin since its creation in 1905, and the enviable reputation which this commission has gained is attributed in large measure to Mr. Erickson's efforts and ability. He was born and educated in Sweden, and came to the United States in 1884. He continued his education in Minneapolis and entered the service of the Chicago, St. Paul, Minneapolis & Omaha Railroad in 1890. After serving in various capacities with that company, he was appointed a labor commissioner of Wisconsin in 1896. He continued in that office until 1905, when he was appointed a member of the original Railroad Commission of Wisconsin.

T. M. Vinton, formerly of the firm of Tucker & Vinton, engineers and constructors, New York, has joined the New York office of the Trussed Concrete Steel Company.

Obituary Notes

John L. Kief, railroad contractor, of Mountain Home, Idaho, died recently. Mr. Kief was born at Wilmington, Del., in 1859. His first experience was gained in the employ of various railroads. He soon entered the contracting business and did a great deal of work for the Union Pacific and Atchison, Topeka & Santa Fé railways. He also assisted in the construction of storage reservoirs, diversion dams and canals for the Pecos Irrigation & Improvement Company of New Mexico.

Henry Rohwer, consulting engineer, of St. Louis, died May 5 in that city. He was born in the province of Holstein, Germany, in 1847 and was graduated from the Royal Polytechnic High School in 1869. He came to the United States that year and entered railway service as topographer for the Burlington & Missouri River Railway. He had risen to the position of chief draftsman and engineer in charge of location and construction in 1873, when he became resident engineer for the Omaha & Southwestern Railroad. In 1874 he began the practice of consulting engineering at Omaha and was made city engineer in 1877. He left the employ of Omaha in 1881 to become assistant engineer of the Union Pacific Railway. He went to the Oregon Short Line in 1883 and remained with that road until his appointment with the Omaha Belt Railway when that road became part of the Missouri Pacific Railway in 1887. He was made chief engineer of that road in 1901 and resigned in 1905 to engage in private practice.

Charles W. Fenn, consulting engineer, of Portland, Me., died recently in that city. Mr. Fenn was born in Jersey City, N. J., in 1854 and was graduated from Yale University in 1876. His first work was in the engineering department of the Chicago, Burlington & Quincy Railroad. He later opened offices in Portland as consulting engineer, and when the Portland water district was formed he was put in charge of construction. He has also been associated with the construction of several of Portland's large buildings.

Patrick Walsh, chief engineer of the Quindare station of the Kansas City (Mo.) water department, died May 9, at the age of 65.

Richard Gentry, general manager and president of the Kansas City, Nevada & Fort Smith Railway, died recently at Kansas City. He was also chief engineer on the construction of that road, which is now a part of the Kansas City Southern.

Cloud Clifford Conkling, engineer for the Lackawanna Steel Company, died May 8 at Buffalo. He was born in Rensselaerville, N. Y., in 1862 and was educated in the public schools of Scranton, Pa. He studied civil and mining engineering while employed as rodman on the Erie & Wyoming Railroad and during 1882, while on a water-supply survey of Ramapo Valley, N. Y. He took a special course of study at Williston Seminary during 1882 and 1883 and was draftsman and transitman at Scranton, Pa., under J. H. Rittenhouse, in 1884 and 1885. Mr. Conkling served for 12 years in the National Guard, State of Pennsylvania, and was sergeant-major of the Thirteenth Regiment at the time of his retirement. He entered the department of civil and mining engineering of the Lackawanna Iron & Steel Company in 1886 as rodman. He was successively transitman, assistant engineer and chief of the engineering department. He had charge of the design and construction of all civil engineering work for the company, including the construction of the company's plant at Buffalo, N. Y., and the design and construction of railroad yards, sewers, villages, canals, harbor work, the South Buffalo Railroad and foundations of all kinds. He was chief engineer of the South Buffalo Railroad and chief civil engineer of the Lackawanna Steel Company until 1904, when he left the direct employ of the company to practise consulting civil engineering at Buffalo. Mr. Conkling designed and patented modifications of the original design of Lackawanna steel sheet piling and was instrumental in bringing to a successful completion the designs and sections of Lackawanna steel sheet piling now rolled by that company. In October, 1913, he returned to the Lackawanna Steel Company as chief engineer in the steel sheet piling engineering department, which position he held until the time of his death.

Civil Service Examinations

United States.—The Civil Service Commission announces an open competitive examination for aid in the Coast and Geodetic Survey, June 7 and 8, salary $900 at time of appointment. Applicants must be between 18 and 25 years of age. Apply for Form 1312 at any of the usual civil service branches.

Examinations Previously Announced

Date		See Eng. Record
June 3	Assistant electrical engineer, New York State	May 13
Aug. 21-25	Second lieutenant, civilian candidates	April 1

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New York for Defense

SINCE engineers and contractors have entered so heartily into the spirit of the military preparedness movement, it will be of general interest to the readers of the Engineering Record to know that the Governor of New York has signed four measures, passed in the recent session of the Legislature, aiming to make the citizens of the state of maximum effectiveness in military defense. The bill provides the necessary power, first, for compulsory physical training for all public and private school pupils more than eight years old; for compulsory military training of all boys between sixteen and nineteen, except those regularly employed as a means of livelihood; for the enrollment of all male citizens between eighteen and forty-five years of age, from which list drafts may be made at any time, in peace or in war, in order to bring the National Guard up to full strength, and finally for such changes in the military law as are needed to increase the number and efficiency of the defense forces of the state.

Longleaf Pine and Durability

WHY MATERIAL INTERESTS wait for the consumers to force them into better specification-writing is not always clear. Many attempts have been made to square the uses of wood to the classifications the sellers felt disposed to make, and sometimes the changes have been made so often that the buyers could not keep up with them. The southern pine specifications have been passing through a series of evolutions, and the latest word is the adoption last month by the Illinois Society of Architects of the official grading of the Southern Pine Association, except in the highest specification where both strength and durability are required. The modification simply adds the word "longleaf" to the density specification. This was deemed necessary because the "select structural grade" is based on density, which takes care of the strength but not necessarily of the durability—a quality dependent upon the amount of heart. Since from the practical standpoint it requires longleaf to meet the necessary heart requirement, the architects did well to put in that word rather than to attempt to describe the requirement and lead many people to believe that some other species might be satisfactory.

Specification for an Engineer

IT IS NOT unusual for reports on projected engineering enterprises to recommend that the work be placed in charge of a "competent" engineer. While the intention is most commendable, the result is not always what is desired, since the interpretation of the word "competent" is generally left in the hands of non-technical men—a county court, a city council, a board of commissioners. In a recent engineering report the general recommendation as to competence was replaced by a much better and very definite specification of qualities which the proposed incumbent should have. In their report to the Levy Court of New Castle County, Del., George W. Tillson, Henry G. Shirley and Arthur H. Blanchard recommended that the highway work of New Castle County be placed in charge of a civil engineer who has had at least four years' experience in the supervision of highway construction and maintenance and who is a full member or an associate member of the American Society of Civil Engineers or has the requirements for the grade of associate member. The recommendation was made complete by a quotation from the constitution of the society giving the qualifications for associate membership. This method of specifying the type of engineer might well be copied by others in making similar reports.

Experience for Teachers

ONE OF THE striking facts brought out during the discussion in this journal of the causes for the decline in the number of civil engineering students was the growth of the engineering school at the University of Michigan since its reorganization in 1911. The causes of this growth, in the face of a general decline elsewhere, warrant the consideration of all engineering educators. The chief reason is believed to be the policy of selecting as professors and instructors engineers with practical training. When professors have had from 10 to 25 years and instructors at least 5 years of experience outside of college, as is the case at Michigan, results should follow. The attendance results, at least, seem to indicate that such is the case at Michigan. Most engineering schools have developed a system of "inbreeding" which, while deplored on theoretical grounds, is considered necessary because of limited funds. Young graduates are brought back to teach after little or no practical experience, are advanced to instructorships, and finally reach professorial rank. The influence on standards and the tendency to stagnate and drop into deeper ruts of educational inefficiency have been vividly portrayed by Professor Swain in the recent discussion in this journal. Are not the low academic standards and the absence of common sense which he deplores largely due to teachers who have never had to work under business standards of accomplishment?

Investments for Engineers

THE LETTER on engineers' savings, on page 716, carries a suggestion that may well be pondered by employing engineers. Mr. Berg suggests that these men advise their young assistants on savings investments. Few men with extensive experience in handling funds will care for the duty that Mr. Berg wishes on them, yet have they not an opportunity for service that should not be lightly thrust aside? Even if they cannot bring themselves to the positive action of suggesting definite investments, they can act negatively in warning their young men against speculative enterprises, against buying Wall Street "cats and dogs" that exalt the manipulators to golden thrones but bring heartaches, and even ruin and despair, to the outsiders. Many engineers are assisting their young men. This journal knows of a score of cases where the advice is not merely negative but decidedly positive. And the men, young and old, in these organizations are bound to the "chief" by "hoops of steel." Contentment reigns in these offices, the serenity that comes with financial security, the concentration on the work in hand that is possible only when the mind is free from hounding world-cares. Mr. Berg's thought is well worth pondering.

Field of the Technical Journal

MR. BERG'S letter also affords opportunity to comment on the scope of the technical journal. He suggests that occasional discussions of investment opportunities would be in order. While such discussions might be invaluable, their advisability must be judged on the basis of the ideal that the technical journal has set for itself. That ideal, as formulated for the Engineering Record, may be briefly expressed by these words: "To render the maximum possible technical service to the civil engineer and the contractor." Every bit of white space available in each issue is at a high premium. The supply of technical articles and notes which meet the professional and business needs of the readers is double or treble each week the space available. Consequently what is not included in the journal's professed scope must be ruthlessly held out. There are many non-engineering factors that play an important part in the success of the engineer and the contractor—his morals and his health, for example—yet they cannot properly be given place in an engineering journal. There are other agencies and other mediums that take care of these matters. However, there is a twilight zone in which technical and general subjects overlap. In it are such topics as engineering ethics, engineering education, engineering publicity, engineering participation in public affairs, engineering and military preparedness. Just how far each of these subjects shall be pursued and be given space requires a fine discrimination. The Engineering Record, particularly in its editorial pages, has treated them at length, believing that a fairly thorough discussion has a decidedly broadening influence. That policy has received a strong indorsement of the readers. The editors feel certain, however, that they cannot go farther afield, that no matter how important the subject it must not be treated unless it has a decided technical bearing.

Prospective Development and the Value of a Railroad

POSSIBLY readers of Mr. Shepard's article, on page 704, relative to the value of a railroad will think that this journal in printing such a discussion is violating its own editorial advice of April 29 to steer a straight course in valuation and ignore "mushroom" theories. Certainly Mr. Shepard's theory of capitalizing future prospects is outside of the beaten path. Nevertheless he has carefully developed it, and the Engineering Record believes it is well worth consideration.

To this journal it appears that the author's reasoning is based on the same fallacy as the official railroad view of the "other elements of value," that is, that these items are all plus. Mr. Shepard doubtless recognizes that neither his nor any other exact process of valuation would make it possible to separate the rates of any railroad of size from the general rate structure and remodel them in strict accordance with the computed value. As the Engineering Record understands it and has repeatedly pointed out, the only use as regards rates to which the valuation of the railroads can be put is in determining the general level of rates from the sum total of the values of all of the railroads in the country, or at best from the totals of large districts. Rates cannot be made high enough to make every road profitable, and on the other hand, in fairness to the average road, cannot be made low enough to prevent a few from making more than the theoretical fair profit. There are those who contend that it is proper to add, to the above-mentioned sum total for all roads, figures representing prospective growth of business of the successful roads, on the ground that the builders or buyers of these roads exercised foresight which should be rewarded. Even these would hardly hold that anything should be added to the present reproduction cost or capital equivalent of the unprofitable road merely because the prospects are that in the next decade the road will be called upon to handle a larger volume of business—at a loss as heretofore.

The Engineering Record has inferred in the foregoing that practically every road of any importance would have ascending trend lines, regardless of its financial condition. It might be, however, that a railroad that was doing little in the way of expansion would be improving its condition by reducing its operating expenses. In that case the trend line of earnings required under Mr. Shepard's theory would seemingly be horizontal and the road would be penalized for its improving efficiency. Conversely, a road that was decreasing in efficiency would be rewarded for so doing. This seems to indicate another serious defect in the method.

Nevertheless the Engineering Record believes that the matter of trend is an important one and worthy of serious consideration. Perhaps careful calculation of trend for a number of representative roads would give some illuminating information. In any event the Engineering Record would be glad to have the subject discussed in its columns.

Professional and True Conservation of Natural Resources

FOR over seven years—since the memorable congress called by President Roosevelt in the White House in 1908—"conservation" has been a term with which to conjure. Impressed by the necessity of curtailing waste in the use of our natural resources, newspaper editors since then—save, possibly, in the Far West—have been ever ready to accept without analysis anything from a simon-pure "conservationist." Particularly has this been true when the advocate has combined with his plea for economy in the use of natural resources the bugaboo of a grasping monopoly seeking by any and every means to rob the people of their birthright.

Has this not gone far enough? The water-power situation is a pertinent instance of the abuse of the word "conservation." As every schoolboy knows there are millions of water horsepower running to waste in the United States every year. Time and again efforts have been made to get through Congress legislation which would encourage capital to develop these powers. They have failed, sometimes because of pressure of congressional work, but always the conservationist of the professional type has had a large part in preventing the adoption of the measure. Manifestly conservation is accomplished by putting powers to work, not by letting them run to waste—and the professional conservationists are chiefly responsible for the present waste.

In 1913 the National Conservation Congress, meeting in Washington, adopted a set of "unanimous recommendations" in regard to water power. This set of recommendations has been the basis of many, if not all, the water-power measures introduced since then in Congress. The Shields bill, passed by the Senate, includes every stipulation of these "unanimous recommendations," save that which provides that the Government should receive an annual recompense for the power used. As pointed out editorially in this journal in April 8, however, this omission is offset by the provision that the rate shall be governed by the state public service commissions or by the Interstate Commerce Commission. Despite the fact that the bill thus embodies the stipulations which even the professional conservationists assented to in 1913, these same men, headed by Gifford Pinchot, are waging a strong fight against the Shields bill. They lost, however, in the meeting of the National Conservation Congress in Washington May 3. Their contention there was that the bill does not really give the Government an opportunity to recapture the power site, despite the fact that the bill states explicitly that the franchise shall be revocable after fifty years.

On what basis their contention that "the fifty-year limitation as proposed is nothing more than a mere fiction" is based this journal does not understand. The Senate after a very lengthy debate concluded that the provisions were sufficient to protect the interests of the United States and Secretary Lane has endorsed the measure.

There is an indication, judging by the editorial and news items examined by this journal within the last month, that the newspapers are beginning to see that true conservation rests in the development of our water powers and not in the continuance of the opposition of the professional conservationists. In most of the items the opposition is referred to as coming from the "Pinchot element." The terms conservation and conservationist are avoided. In other words, a distinction is being made between the true conservationist and the adherents of the Pinchot fold. Mr. Pinchot is undoubtedly a conservationist in theory; in practice, so far as water power is concerned, he is the most prodigal man in the United States.

The Increasing Efficiency of Large Steam Turbines

TO MANY engineers it seems but a short time since a thermal efficiency of 15 to 18 per cent represented a truly marvelous standard of operating success in steam-driven prime movers. A plant capable of turning out a kilowatt-hour on 2.5 lb. of coal was looked upon not long ago as a pace-setter in economy, and so it was in its day. But new conceptions of efficiency came into being with the development of the steam turbine, and with increasing sizes the advance in economy attained by this extraordinarily interesting equipment drove everything before it in large work, threatening even hydroelectric generation except under conditions of unusually low development cost and favorable load-factors.

A thermal efficiency of 24.81 per cent was reported last week at a meeting of the American Society of Mechanical Engineers in New York in a paper upon "Efficiency Tests of a 30,000-KW. Cross-Compound Steam Turbine," by H. G. Stott and W. S. Finlay, Jr. This exceedingly high point in economy, corresponding to a water rate of only 11.258 lb. per kilowatt-hour, was attained at a load of 26,740 kw., the steam pressure at the throttle being 224 lb. per square inch, and the superheat 108.5 deg.

Fahr. The vacuum was 28.862 in. and the Rankine-cycle efficiency under these conditions was 75.84 per cent. A result like this hints at still further good things to come through the adoption of higher pressures and superheat, larger units and plants designed *de novo* for what might be called super-economical service. Turning aside from this for the moment, however, it is interesting to contrast the performance of the 30,000-kw. unit as set forth by Messrs. Stott and Finlay with that of the engine-driven unit which was its predecessor.

The test was made upon one of the three turbo-generating units of the 30,000-kw. size installed in the Seventy-fourth Street station of the Interborough Rapid Transit Company at New York City. In 1900 this plant was equipped with eight reciprocating engines of 5000-kw. rating and a maximum capacity of 7500 kw. In a space no greater than any one of these units required, a 30,000-kw. turbo-set now stands, operated from the same boilers, now run at higher pressure, with mechanical stokers of the underfeed type and superheaters designed to supply 200 degrees of superheat when the boilers are delivering three times their rated output. The water rate of the engine units was 17 lb. per kilowatt-hour, compared with about 11.4 lb. for the turbines when operating under similar conditions. Here is a concentration of generating capacity in the ratio of more than 4 to 1 on a maximum comparison, the turbines being capable of delivering over 32,000 kw. per unit, and here, too, is a gain in efficiency which puts the reciprocating engine out of consideration for heavy work, although heavy work has been its best field since the economies of much smaller turbo-units were manifested.

The authors did not mention the labor requirements of these large units in their paper, but brought out the fact in the discussion that the first cost of such a unit, including generator and condenser, was only about $9 per kilowatt, compared with approximately $40 in the case of the former engine, generator and condenser unit. In other words, an investment of $1,600,000 in eight engine units with an aggregate maximum capacity of 60,000 kw. compares with an outlay of $540,000 for two turbo-generator sets with a maximum capacity of about 65,000 kw. Such a reduction in investment, too, must be considered in connection with the economy in operation represented by the difference between 2.5 and 1.5 lb. of coal per kilowatt-hour. Furthermore, full weight should be given to the ability of the steam turbine to operate at high efficiency through a wide range of load. In the Interborough case the water rate increased only some 5 per cent at loads approximating half the rating of the unit, and momentary swings of even 30 per cent in the average load cut no appreciable figure in economy.

In a sense, the 30,000-kw. turbo-unit has become commonplace to the designers and purchasers of high-powered equipment, and the publication of results like those above simply whets the appetite of the engineer for similar food seasoned with even bigger outputs. Great things are afoot in the field of boiler design, and pressures running two or three times those of to-day are likely to be used in the near future. It would be hazardous to predict where the size of turbo-generators will stop, and machines of 60,000-kw. rating and even above, are coming into their own. Given the combination of a 60,000-kw. unit, already in process of manufacture, with a boiler group designed for operation at 600 lb. per square inch, which seems to be in early prospect, further substantial gains in efficiency may be confidently expected. A manufacturing cost of 2 mills per kilowatt-hour is not as far away as it used to be, and in the light of high-pressure possibilities and the increasing size of generating units, the day of 1.5 mills per unit of energy delivered at the bus seems almost within reach.

Standard Contract Forms for Engineering Work

WOULD not standard contract forms furnish the average engineer with a better guide than he has now for drawing and administering contracts? Would not such forms lower the cost of engineering construction by reducing the risk which the contractor faces with engineers he does not know?

Reference is made to contract standards that might be drawn by the American Society of Civil Engineers, in collaboration with representative contracting interests, and with the aid of competent legal advice. The Engineering Record, in what is said here and in the article on page 699 of this issue, recognizes that none of the provisions cited as unfair are actually so under competent administration, and that many of those quoted do not reflect the wishes of the engineers, having been framed by the attorneys of the owners or of the cities involved. It is contended, however, that the average engineer often lacks the force, the backing and the ability to compel an equitable enforcement of poorly drawn contracts copied after the forms used on large work; and, further, that carefully prepared standard forms would greatly raise the average of contract administration. Furthermore, if such forms, sponsored by the American Society of Civil Engineers and by men of high standing in contracting and in the legal profession, existed, the average engineer would be much better able to face down the legal adviser who seeks to insert provisions that are not equitable and that will raise the cost of the work.

The American Institute of Architects long ago recognized that standard forms, on which individual contracts could be based, constitute a real remedy for conditions similar to those that now obtain on much engineering work. Such forms are far more potent for correcting errors than the commendable practice of certain individuals or the too-often disregarded teachings of technical schools.

There are two sides to every bargain, and both parties receive most for their money when both are treated alike and fairly. The "standard documents" of the American Institute of Architects plainly show that this truth was well considered in drawing them. On the other hand, despite the advanced position taken by Waddell and Wait and reflected by a few writers and teachers, it can be well maintained that engineering contracts have so far been developed mainly from one side. They protect the engineer and his employer. They do not protect the contractor in any specific language. When the engineer is protected against his own faulty work by such clauses as those disclaiming the very information on which bids are asked, and allowing the engineer to make good his own errors or omissions at the contractor's expense, an element of uncertainty comes in which results in high bids. This uncertainty is further increased by the usual provision allowing the engineer or owner to change plans at will, without first adjusting the matter with the contractor, and binding the latter to take whatever sum the engineer thinks the changes are worth. It is further augmented by the common practice of making the engineer the final judge of all disputes. When such a clause is included there is never any guarantee to the contractor, even if he bids on plans prepared by an engineer of enviable reputation, that this man will continue in charge of the work or that minor losses will not be forced on him by the engineer's associates or subordinates.

Moreover, men of enviable reputation are not so numerous as they might be if better standards were in force. The strong temptation to save their reputations by misusing authority vested in them by contract provisions has caused many engineers to forsake the straight and narrow path. As they err, the cost of work to their clients mounts. These members of the profession should be protected against such temptation by standard contract forms. If such forms were in existence the unjust or incompetent engineer who is pulling down professional standards could no longer hide his inefficiency by throwing its cost first on contractors and finally on his clients. In the face of publicly-known standard contract forms he would no longer dare draw inequitable documents. Furthermore, he could not follow these forms because they would guarantee to the contractor that the engineering work had been and would be competently handled, and he could not so handle it. The result is that incompetents would be forced out of the consulting ranks.

On the question of patent infringement, it is neither good business nor economy to make the contractor pay in all cases. Standards can also improve this detail.

In drawing such a set of standards, contractors, contractors' engineers and lawyers of high standing must be consulted. The work of the American Institute of Architects was conceived in the proper spirit. Even though the resulting documents are not a direct model for engineers, even though they may not be perfect, the methods by which they were produced, and recently revised, should be carefully considered. There is need for study of the subject. The American Society of Civil Engineers is best equipped to do it.

Stop Slides by Releasing Accumulated Water at Bulls Bridge Hydroelectric Plant

Leakage from Pond, a Break in the Canal Bank and Landslides Occur at Small Plant in Connecticut After It Had Been in Service Several Years

By CHARLES RUFUS HARTE,
Construction Engineer, Connecticut Company, New Haven, Conn.

SERIOUS LEAKAGE from a storage pond, landslides that threatened the security of the intake canal, and a break in the canal bank are a few of the developments which occurred, and had to be dealt with, in the Bulls Bridge hydroelectric plant in Connecticut, after it had been in service some years. The leakage was dealt with for the time being by inserting pipes into the points of heaviest flow. The interruption to operations, due to the break in the canal embankment, was remedied temporarily by the construction of a flue, and, later, permanently by the construction of a concrete wall. The slides were effectually and economically stopped by digging drainage ditches and driving drifts to relieve the pressure of the accumulated waters that caused them.

PERMANENT WALL AT EMBANKMENT BREAK

Other features of the rehabilitation work that was necessary at the plant included increasing the stability of the forebay dam, the construction of a standpipe foundation in the tailrace and the repair of a penstock, broken through a sudden draft.

The Bulls Bridge plant is located in Connecticut, in the vicinity of Waterbury, New Britain and Cheshire. Its canal pierces the gorge wall of the river on the east side and comes out on the bank, where it follows its level along a hillside to a total length of nearly 2 miles, to a forebay from which penstocks supply the turbines in the power station on the river bank below.

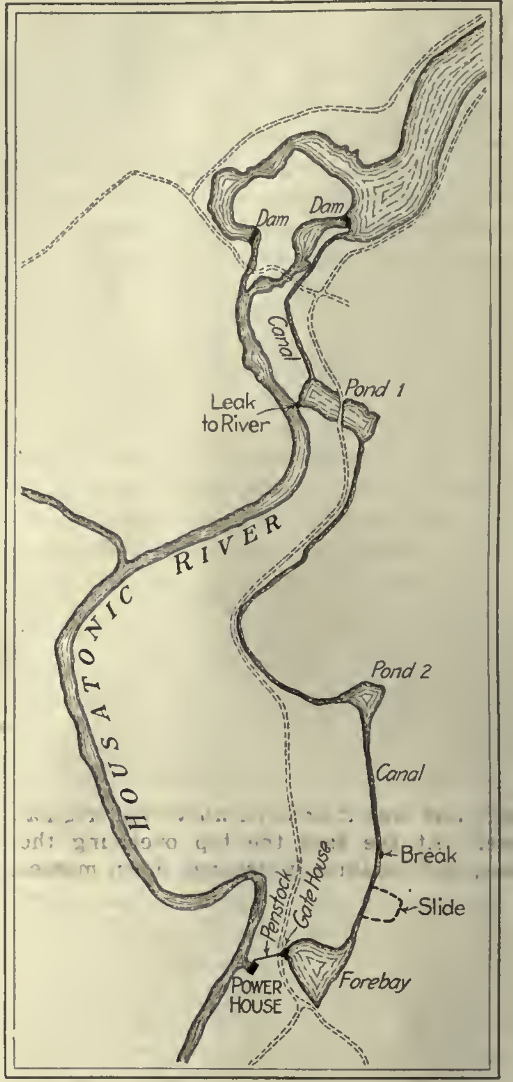
About 2000 ft. below the headgate the canal crosses a natural depression. This area was closed in by a bank at the lower end, forming a pool some 8 acres in area, but too far from the forebay to be of any help for storage purposes except against a long sustained peak draft. This pond, known as pond 1, lies against the river bank, which is a porous limestone ledge at this point and through which there was a very heavy leakage from the time the canal was first built.

To stop the loss the spot of heaviest flow was opened up, and an 8-in. wrought-iron pipe, threaded for a cap, was pushed well back and securely anchored in concrete. The other leaks were then dug out and the cavities refilled with dry cement faced with mortar. As soon as this had set the pipes were capped. After an unsuccessful effort to stop the new leaks, which developed as fast as the old ones were closed, a smaller pipe was inserted in a second center of leakage and both pipes were allowed to run free. By this means, and other methods commonly employed to prevent seepage through the bottom, the leakage was considerably reduced. The only completely satisfactory treatment, however, would have been the construction of a dike cutting off the leakage area, a procedure which would have cost more than would have been warranted unless the rate of leakage had very materially increased.

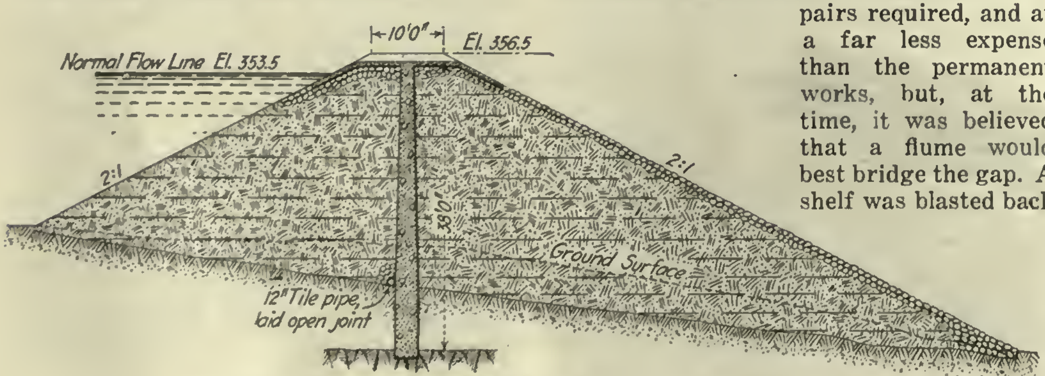
BREAK IN CANAL BANK

From pond 1 to a point near the forebay, the canal follows a sidehill, the easterly side in cut and the westerly side in fill. In order to cut down the cost the first part was in many cases left low. In 1906, due to negligence on the part of the operating force, the gates were not closed as the load fell off at the station. As a result at a point about 2000 ft. from the forebay the bank was topped and, an hour later, carried out.

Immediate steps were taken to restore service. The earth banks could have been replaced in less time than the temporary repairs required, and at a far less expense than the permanent works, but, at the time, it was believed that a flume would best bridge the gap. A shelf was blasted back 25 ft. in the solid ledge of the hill, and on this was set, on 3-ft. centers, four rows of 10 x 10-in. posts, carrying 10 x 10-in. stringers. The flume was 200 ft. long, and was made up of a series of rings 4 ft. apart, inside of which were two layers of yellow pine, each 2½ in. thick, laid to break joints, the inner one of matched stock, with a layer of tar paper between the two. The rings were 12 ft. 4 in. wide in the clear, and of a height increasing from 7 ft. 7 in. to 8 ft. 7 in. Each end of the flume was secured in a plank bulkhead, closing off the canal. Sand bags were used to prevent undermining, and a plank apron was extended from the southerly bulkhead downstream. The banks below were riprapped for 30 or 40 ft. These, however, showed such effects of the flume discharge that a further shutdown was made, when the inside face of the westerly bank was riprapped in cement for a distance of 160 ft. below the bulkhead, and a timber wing was built 80 ft. long, cutting off the water from this length of bank.



CANAL FOLLOWS HILLSIDE FROM POND 1 TO POND 2



TILE DRAIN DROPS FROM EACH END TO CENTER OF EARTH DAM

CONCRETE FLOOR AND WALL

In the meantime a contract had been let for the construction of a permanent concrete floor and reinforced-concrete wall to replace the lost section.

The removal of the flume proved quite difficult. It being out of the question to do the work during the short Sunday shutdown, which was all that could be allowed, the space between the flume and wall was allowed to fill with the canal in service, but the inertia of the moving water kept the flume from floating. An effort to break it by pulling it sideways was also unavailing. Finally the southerly bulkhead was re-

IN THE BIG SLIDE AN AREA OF 7 ACRES DROPPED ABOUT 4 FEET VERTICALLY

moved and, the flume being free, it was possible to break it up. Booms at several points kept the fragments out of the forebay.

As the posts proved very difficult to remove, some were sawed off, and others chopped off, either plan leaving stubs, which it was feared would start silting; but, while on two or three occasions the bottom was filled nearly to the tops of the stubs, it subsequently scoured out again.

LANDSLIDES

At the point where the bank failure occurred an abrupt hill sweeps east and south, leaving a steeply sloping pasture from a marsh some 20 ft. below the flow line of the canal. The toe of the west bank of the canal falls at the toe of this slope, while the east bank rises at the point some 10 ft. above the water to meet the old surface. In 1907 an area about 100 ft. wide, extending 200 ft. up the hill, pulled forward several feet in as many hours, opening, at the top, a crack 3 or 4 in. wide, while the surface dropped nearly a foot.

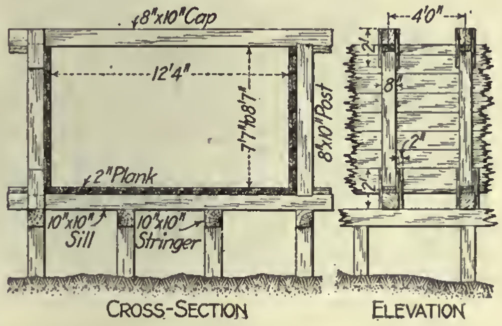
The entire affected area showed cracks parallel to the canal, far apart at the top but closer together toward the lower end, where the ground looked like a plowed field, and was 2 or 3 ft. above its original level. At the face the top overhung the base, and continually dropped down masses of a cubic yard or so. Under the direction of E. H. McHenry, then engineering vice-president of the properties, the slide was attacked from the front. The material, a hardpan with streaks of greasy clay of various colors, was so saturated that when touched it melted and flowed, but in a very short time the face was sufficiently drained to act as an abutment. The ditches were then pushed to the end of the movement, which had apparently extended 10 or 12 ft. below the surface, and no further trouble was experienced.

Four years later an area of 7 acres immediately south of the first slide dropped about 4 ft. vertically, and moved forward, opening up a main crack about a foot wide and 30 ft. deep at the upper edge, 300 ft. from the canal. A series of smaller cracks appeared between, while the base, some 20 to 40 ft. high at the point, became saturated, bulged outward and dropped considerable material on the berm, which was between it and the water.

FACE BLED BY DITCHES DRIVEN INTO IT

Following the same general plan as in the case of the first slide, the face was bled by a series of ditches driven into it, a cut-off ditch was dug outside the limits of the movement to trap off all surface water, and, at the point of maximum disturbance, an exploration shaft was sunk some 25 ft., where a sliding plane of 3 ft. of clay was found. On this a drift was pushed 25 ft. up the hill to rock and 100 ft. down the hill to the base of the canal bank.

A second drift was started at the bank face, 100 ft. north of the first, and a little above the canal level. This was driven in a northwesterly direction 80 ft. to the rock, and had a rising grade from the bank of about 2 per cent. Thirty feet from the mouth a lateral was run nearly to the exploration shaft, and from near the end of the main drift another lateral was run northwesterly 240 ft., with two short branches eastward to rock.



FLUME BUILT TO CARRY CANAL ACROSS BREAK

Comparatively little water was intercepted, but the behavior of the slide indicated that the small quantity found was the cause of the trouble. Apparently it had accumulated along the rock until the head was sufficient to start the mass, but this movement largely increased the size of the cavity, and some little time elapsed before the head was again sufficient to cause a succession of moves.

DRIFTS TIMBERED

The drifts were timbered with local chestnut, at least 8 in. in diameter for the sets, and 3-in. plank for the sides and roof. A bulkhead was maintained at the face throughout, and frequently the work was stopped for a day or so to drain off an unusually wet section. The advances were made by driving the roof and top side plank, removing the top board of the bulkhead, excavating to the ends of the roof and side boards just driven, and setting the top of the next bulkhead.

It was expected that the drifts would have to explore the entire line of the break, and future developments may necessitate such a course, but so far it would appear that the work already done has been entirely successful in anchoring the area, although less than half has been explored. There is evidently a series of planes of sliding, but, between the surface drains and the drifts, enough water has been intercepted to protect the planes below.

STRENGTHENING THE FOREBAY DAM

The canal originally terminated in a forebay so little larger than the canal itself as to be negligible in regulation, and, at peaks, the latter would be drawn down several feet. Immediately south of the forebay was a swale which, by the construction of a dam several hundred feet long, gave a forebay 7 acres in extent.

The construction of the earth dam required, with its concrete corewall, offered little difficulty except in the search for solid rock, which, following the general surface contour at about a 20-ft. depth, dropped unexpectedly at one point 45 ft. below, a closely packed mass of boulders completely masking this fact in the preliminary borings.

The corewall was securely notched into bedrock, and, along its upstream side, in broken stones with open joints, a 12-in. tile

SLIDE AREA SHOWN—EFFECT OF LITTLE SLIDE AT LEFT OF VIEW AND MAIN CRACK AT CENTER

NEW STANDPIPE AND SMALLER PENSTOCK BUILT ABOVE LARGE PENSTOCK

drain was laid, which dropped from each end to the center, where it was carried through the corewall to a free discharge beyond the downstream toe. This procedure was at the suggestion of Mr. McHenry, to prevent saturation of the upstream earth. The pipe discharges about ½ gal. per minute the year around.

PENSTOCK RUPTURED

The larger penstock reduces 15 in. in diameter after each successive turbine tap, coming at the end to a diameter of 5 ft., where it is turned up into a standpipe 98 ft. high. This handled small surges and shocks fairly well, but, in 1912, a boy threw a piece of wire across two phases of the line and the automatic switches opened a load of 4000 kw. The standpipe could not relieve the shock to the extent of preventing a break in the penstock. Temporary provision was made against a similar contingency, and, as a permanent protection it was decided to install an 8-ft. penstock for which a thimble had been placed when the headwall was built, which, together with an 8-ft. standpipe, would be connected to both penstocks. The 13-ft. penstock location necessitated carrying the 8-ft. penstock on top of it, and so required for the standpipe a foundation in the tailrace with supports to go either side of, and above, the big penstock. The draft tubes were so close together that it was decided to pierce the foundation across the line of discharge as well as with it, making a four-legged structure.

BUILDING STANDPIPE SUPPORT

The original plan was to shut down the plant long enough to pump out the tailrace, and the cribs for the cofferdam had all been set when an accident in the steam plant not only prevented shutting down at all, but made it imperative that no interference should occur to any unit. To build the pedestal legs the smooth rock bottom had to be cleaned of a layer of cobblestones in 16 ft. of water, with a current in front of an operating draft tube which swept the diver off his feet. The penstock close overhead, and the swift current below the surface, prevented constructing the necessary cribs on shore and floating them to the site, either on the surface or partly submerged.

The posts for the cribs were therefore set up in place and held with bottoms at the water surface; the bottom ring was then framed, bolted to the posts and loaded with old rails, and the posts were slacked down 2 ft. for the attachment of the next ring.

PEDESTAL FOR STANDPIPE IN TAILRACE

When nearly down the diver, at times of light load when the adjacent units could be shut down for a little while, cleared off the bottom, and, as soon as the cribs were in place, sealed it as tightly as possible to the power-house wall at the end, and to the rock at the bottom. It was then lined with 3-in. splined sheeting, which was spiked to a depth of 6 or 8 ft. below the surface. Within the shelter of this the diver could work if the unit on his side was at rest, even though the next one was in service. Panels of ⅞-in. matched sheeting were then set to form the legs. The concrete was placed in the quiet inclosed water thus obtained, a dump bucket being used which was lowered upon the material already poured, and opened.

The arches under the penstock spring from a level 2 ft. below the water surface, those parallel to it from 7 ft. higher up. To pour these and complete the saddle in which the big penstock rests, and on the sides of which are the supports on which the standpipe is carried, was straightaway work.

Economics of Crossties Reduced to Figures

Baltimore & Ohio Issues Circular Giving Life Lengths and Annual Costs of All Classes Under Various Conditions

MUCH INFORMATION on the length of life, first cost and annual cost of railroad crossties of various classes under various conditions is contained in a circular and key of instructions on the use of crossties recently issued by the Baltimore & Ohio Railroad. The April-June issue of *Wood-Preserving,* from which these notes are taken, devotes three pages to the circular. The circular is based on an extended investigation, in which the experiences and opinions of both engineers and trackmen were utilized. The instructions were prepared, it is stated, to define the most economical tie for every condition of track and traffic, and to assist in the most economical distribution of ties.

The circular divides ties into five classes according to kind of wood. Class A embraces white, burr and chestnut or rock oak, cherry, mulberry, black walnut and locust (except honey locust). Class B includes chestnut only. Class C includes red, black, scarlet, Spanish, pin and shingle or laurel oak, also honey locust, beech and hard or sugar maple. Silver, soft or white maple, red, soft or swamp maple, red or river birch, sweet or black birch and white, rock and red elm make up class D, while pines—short leaf, loblolly and sap long leaf—form class E. Classes A and B are used without, classes C, D and E with preservative treatment.

As to size, class A has three grades, 7 or 6 x 8 in., 6 x 7 or 6 x 6. The other classes

TABLE I—ESTIMATED LIFE OF TIES IN YEARS UNDER VARYING CONDITIONS OF TRAFFIC

		UNTREATED																				TREATED			
		CLASS A—8½ FT.						CLASS A—8 FT.						CLASS B—8½ FT.				CLASS B—8 FT.				CLASS C		CLASSES D AND E	
		*Yes	†No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	Yes	Yes	Yes
		1	1	2	2	3	3	1	1	2	2	3	3	1	1	2	2	1	1	2	2	1	2	1	2
Kind of track	Weight of Power and Traffic	7x8		6x7		6x6		6x8		6x7		6x6		7x8		6x7		6x8		6x7		7x8	6x7	‡7x8	§6x7
Main line	Heavy power, dense traffic	8	5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	11	..	9	..
	Moderate weight, power and traffic	9	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	14	..	12	..
	Light power and traffic	9	7	..	..	..	..	8	6	..	..	..	..	..	..	..	..	..	..	..	..	15	..	13	..
Branch line	Heavy power and traffic	9	6	8	5	..	..	8	5	7	4	..	..	..	..	..	..	..	..	..	..	14	12	11	10
	Moderate weight, power and traffic	9	7	8	6	..	..	9	6	7	5	..	..	9	5	..	..	7	4	..	..	15	13	12	11
	Light power and traffic	9	8	9	8	8	7	9	8	9	8	8	7	9	7	..	..	8	5	..	..	..	14	..	12
Lead and passing	Heavy power and traffic	9	7	8	6	..	..	8	6	7	5	..	..	8	5	..	..	7	4	..	..	..	14	..	12
	Moderate weight, power and traffic	..	..	9	7	..	..	9	7	8	6	..	..	9	7	..	..	8	5	..	..	..	15	..	13
	Light power and traffic	..	..	9	8	8	7	9	8	9	8	7	6	11	7	..	..	10	6	..	..	..	15	..	14
Yard and industrial	Heavy power and traffic	..	..	9	7	8	6	..	..	8	6	7	5	10	7	9	6	9	6	8	5	..	15	..	13
	Moderate weight, power and traffic	..	..	9	8	8	7	..	..	9	8	8	7	11	8	10	7	10	7	9	6	..	15	..	14
	Light power and traffic	..	..	9	9	9	9	..	..	9	9	8	8	12	10	12	10	12	9	11	8	..	16	..	15
Repair, temporary and storage		..	..	9	9	9	9	..	..	9	9	8	8	..	..	12	10	12	10	12	10	..	16	..	15

*Tieplated. †Not tieplated. ‡7x9 for class E. §7x8 for class E.

have two grades only, 7 or 6 x 8 and 6 x 7. (Class E ties are respectively 7 x 9 and 7 x 8.) Attention has also been given to length, as this has an important bearing.

Table 1 gives estimated life lengths for all classes, grades and lengths under various conditions of traffic. It also shows where these classes and grades are and are not used. It will be noted that the use of tieplates adds materially to the life length. The instructions stipulate that all treated ties should be tieplated.

Table 2 gives the detailed first cost to the Baltimore & Ohio for the various classes of ties, and derived therefrom, the annual costs, with interest figured at 6 per cent.

TABLE 2—COMPARATIVE FIRST AND ANNUAL COSTS OF DIFFERENT CLASSES AND GRADES OF TIES WITH DIFFERENT LENGTHS OF LIFE

	CLASS A, 8½ FT., GRADE						CLASS A, 8 FT., GRADE						CLASS B, 8½ FT., GRADE				CLASS B, 8 FT., GRADE				CLASS C—8½ FT., GRADE		CLASSES D AND E, 8½ FT., GRADE	
	1		2		3		1		2		3		1 . .		2		1		2		1	2	1	2
	*Yes	†No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No.	Yes	No	Yes	No	Yes	No	Yes	No	Yes	Yes	Yes	Yes
1. Purchase price	$ .800	$ .800	$ .680	$ .680	$ .250	$ .250	$ .700	$ .700	$ .580	$ .580	$ .250	$ .250	$ .500	$ .500	$ .350	$ .350	$ .400	$ .400	$ .250	$ .250	$ .610	$ .510	$ .570	$ .470
2. Inspection	.010	.010	.010	.010	.010	.010	.010	.010	.010	.010	.010	.010	.010	.010	.010	.010	.010	.010	.010	.010	.010	.010	.010	.010
3. Treatment	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	.220	.200	.220	.200
4. Freight—																								
80 mi. for non treatment	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
380 mi. for treated	.018	.018	.018	.018	.018	.018	.018	.018	.018	.018	.018	.018	.018	.018	.018	.018	.018	.018	.018	.018	.090	.070	.090	.070
5. Work train service	.010	.010	.010	.010	.010	.010	.010	.010	.010	.010	.010	.010	.010	.010	.010	.010	.010	.010	.010	.010	.010	.010	.010	.010
(a)	$ .838	$ .838	$ .718	$ .718	$ .288	$ .288	$ .738	$ .738	$ .618	$ .618	$ .288	$ .288	$ .538	$ .638	$ .388	$ .388	$ .438	$ .438	$ .288	$ .288	$ .940	$ .800	$ .900	$ .760
6. Handling and installing	.190	.190	.160	.160	.160	.160	.190	.190	.160	.160	.160	.160	.160	.160	.160	.160	.160	.160	.160	.160	.190	.160	.190	.160
7. Two tieplates	.240	.....	.120	.....	.120	.....	.240	.....	.120	.....	.120	.....	.120	.....	.120	.....	.120	.....	.120	.....	.240	.120	.240	.120
8. Interest on (a)— 6 months on untreated, 12 months on treated	$ .025	.025	$ .022	.022	$ .009	.009	$ .022	.022	$ .019	.019	$ .009	.009	$ .016	.016	$ .012	.012	$ .013	.013	$ .009	.009	$ .056	$ .048	$ .054	$ .046
9. Supervision	.066	.043	.066	.043	.066	.043	.066	.043	.066	.043	.066	.043	.066	.043	.066	.043	.066	.043	.066	.043	.066	.066	.066	.066
(b)	$1.359	$1.096	$1.086	$ .943	$ .643	$ .500	$1.256	$ .993	$ .983	$ .840	$ .643	$ .500	$ .900	$ .757	$ .746	$ .603	$ .797	$ .654	$ .643	$ .500	$ .492	$1.194	$1.450	$1.152
10. Credit salvage, one-third value tieplate	.080	....	.040	....	.040	....	.080	....	.040	....	.040	....	.040	....	.040	....	.040	....	.040	....	.080	.010	.080	.040
Total net cost	$1.279	$1.096	$1.046	$ .943	$ .603	$ .500	$1.176	$ .993	$ .943	$ .840	$ .603	$ .500	$ .860	$ .757	$ .706	$ .603	$ .757	$ .654	$ .603	$ .500	$1.412	$1.154	$1.370	$1.112
Annual cost per tie with annual life of..																								
4 years..	$ .400	$ .340	$ .320	$ .290	$ .180	$ .150	$ .360	$ .310	$ .290	$ .260	$ .190	$ .150	$ .270	$ .234	$ .220	$ .187	$ .230	$ .203	$ .190	$ .155	$ .440	$ .360	$ .420	$ .350
5 years..	.330	.280	.270	.240	.160	.130	.310	.260	.250	.220	.160	.130	.220	.197	.180	.157	.200	.170	.160	.130	.370	.300	.360	.290
6 years..	.290	.250	.240	.210	.140	.110	.270	.230	.210	.190	.140	.110	.190	.171	.160	.137	.170	.148	.140	.113	.320	.260	.310	.250
7 years..	.260	.220	.210	.190	.120	.100	.240	.200	.190	170	.120	.100	.170	.153	.140	.122	.150	.133	.120	.101	.280	.230	.280	.230
8 years..	.240	.200	.190	.170	.110	.090	.220	.180	.170	.150	.110	.090	.160	.140	.130	.110	.140	.121	.110	.092	.260	.210	.250	.210
9 years..	.220	.190	.180	.170	.100	.090	.200	.170	.160	.140	.100	.090	.140	.129	.120	.103	.130	.112	.100	.086	.240	.200	.230	.190
6 per cent interest added 10 years..	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.140	.121	.110	.096	.120	.104	.100	.080	.230	.180	.220	.180
11 years..	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.130	.114	.110	.091	.110	.099	.090	.075	.210	.170	.210	.170
12 years..	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.120	.108	.100	.086	.100	.004	.090	.072	.200	.160	.200	.160
13 years..	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.120	.103	.100	.082	.100	.089	.080	.068	.190	.160	.190	.150
14 years..	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.110	099	.090	.079	.100	.086	.080	.066	.190	.150	.180	.150
15 years..	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.180	.150	.170	.140
16 years..	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.170	.140	.170	.140

*Tieplated.
†Not tieplated.

Small Town Streets Paved Too Wide

In the report of the committee on street paving of the League of Minnesota Municipalities it is stated that data received in regard to the width of streets indicates that many of the smaller towns are paving wider than large cities. Such towns frequently pave much wider than is necessary, due to lack of experience with paved streets. On many residential streets the width of 20 ft. between curbs is ample. This will permit a fire team on the run to pass an auto truck with safety. On more frequented streets an additional width of 8 ft. will permit an automobile in addition to the fire team and auto truck, which in most cases would be sufficient except for the business streets, where many vehicles are necessarily standing at the curb. A liberal grass space between the curb and sidewalk adds much to the cleanliness and appearance of a street, and at the same time reduces the cost of maintenance and construction materially.

Topographic Surveys Not So Costly

Typographical errors made the costs of the topographic surveys described by Fred J. Wood in the issue of May 13, page 653, $2,368 and $1,769 per acre respectively. The figures should have been $2.368 and $1.769.

Do Engineers Need Standard Contract Forms Backed by National Societies?

"Standard Documents" of American Institute of Architects Contrasted with Current Engineering Practice in Writing Contracts

THE AMERICAN Institute of Architects has had, ever since 1887, standard forms for contract documents. In the construction of the first of these documents contractors—the American Association of Builders—were consulted. The documents have been brought up to date by two recent revisions, in both of which a contractors' association—the National Association of Builders' Exchanges—has been concerned. In addition, the latest set of these Standard Documents, issued in April, 1915, is approved by the National Association of Master Plumbers, the National Association of Master Steam and Hot Water Fitters, the National Association of Sheet Metal Contractors of the United States, the National Electrical Contractors' Association of the United States, and the National Association of Marble Dealers. Framed with the assistance of the best legal advice, it is the evident purpose of these documents to be equally fair to contractor, architect and client. It is thought that the documents, as distinguished from textbooks, create a direct presumption in favor of the drawing of uniform and equitable contracts on the part of every member of the institute, and furnish both the owner and contractor with a directly accessible and public yardstick by which to measure the efficiency in this respect of every architect with whom they come in contact. Do engineers need something of the same sort?

The answer of the Engineering Record to this question will be found in the editorial pages of this issue. Below, in order that every reader may judge for himself, are placed side by side contrasting classes from these Standard Documents, and from current contracts for engineering construction. These contracts have not been selected after a long search for bad examples, but on the contrary, of those picked out at random not one was found but had some provision which, if pushed to a decision in court, would be held illegal. In fact, several unusually bad examples of contract writing recently called to the attention of this journal have purposely not been quoted. In order that readers may appreciate how slight is the effect of textbooks in comparison with current practice on the mind of the young engineer, the provisions covering these points suggested by several well known authorities in standard works on engineering specifications are also quoted.

ARCHITECT RESPONSIBLE—ENGINEER IS NOT

In the "general conditions of the contract" of the Standard Documents are found from these words (Article 2):

"The intention of the documents is to include all labor and materials reasonably necessary for the proper execution of the work. It is not intended, however, that materials or work not covered by or properly inferable from any heading, branch, class or trade of the specifications shall be supplied unless distinctly so noted on the drawings."

Further on this subject it is stated in Article 3:

"All ——— drawings and instructions shall be consistent with the contract documents, true developments thereof, and reasonably inferable therefrom. The work shall be executed in conformity therewith and the contractor shall do no work without proper drawings and instructions."

This position is supported by John C. Wait, who, on page 133 of the Appendix to "Specifications and Contracts" by himself and J. A. L. Waddell, points out that a contractor may refuse to carry out working drawings which vary materially from the original plans and specifications, and may recover for the work done. This opinion also has an important bearing on changes in the work after letting contracts, which will be discussed in another paragraph.

Richard S. Kirby, however, in his "Elements of Specification Writing" includes the clause:

"In case by inadvertence or otherwise the plans or specifications omit to require all material necessary for that purpose, the contractor shall, nevertheless, be required to provide the same so that the work may be completed according to the true intent and purpose of the plans and specifications."

It will be noted that this clause, while apparently similar to that quoted from the Standard Documents, is capable of being construed to cover material changes, and that these changes may be made arbitrarily by the engineer, of his own motion or at the behest of the owner, under most of the contracts in which such a clause is inserted.

Recent specifications for engineering contracts cover this point in the following language:

"And should any work or material be required which is not denoted in the specifications or plans, either directly or indirectly, but which is nevertheless necessary for the proper carrying out of the intent thereof, the contractor is to understand the same to be implied and required, and shall perform all such work and furnish any such material as fully as if they were particularly delineated or described."—Uniform general contract forms, American Railway Engineering Association.

"Any correction of errors or omissions in the drawings and specifications may be made by the engineer when such correction is necessary for the proper fulfilment of their intention as construed by him."—Board of Water Supply, City of New York, contract for Wallkill pressure tunnel.

"The contractor will not be allowed to take advantage of any error or omission in the specifications."—Contract for levee system, Knox County, Indiana, February, 1916.

"All work shall be done and completed in a thorough, workmanlike manner, notwithstanding any omission from these specifications or drawings."—U. S. Reclamation Service, Flathead project, Montana, March, 1916.

"The contractor ...... agrees to furnish everything necessary ...... notwithstanding any errors or omission in the drawings and specifications."—Contract for bridge at Lawrence, Kan., August, 1915.

It will be noted that while it is possible for an able man to administer a contract fairly under any of these clauses, all of them make it far too easy for the inefficient engineer to slight his own work, carelessly or otherwise, and saddle the cost on the contractor, or, ultimately, on his own clients.

THE FINAL JUDGE

The status of the architect under the contract is defined by the Standard Documents as follows:

The architect "is not the agent of the owner, except as provided in the contract documents and when in special instances he is authorized by the owner so to act, and in such instances he shall, upon request, show the contractor written authority." (Article 9.)

"Except as may be otherwise expressly provided in or appended to these general conditions or as particularly set forth in the specifications, all the architect's decisions are subject to arbitration." (Article 10.)

The position that the engineer should not be the final judge of all matters relating to the execution of the contract is supported by James Irwin Tucker in his "Contracts in Engineering," paragraphs 439 to 487. Waddell in the work cited above also provides that the engineer's decision shall be subject to arbitration (page 78). The clause recommended by Kirby in the work quoted above also provides for arbitration in certain cases.

These precedents were evidently not considered in drawing the contracts from which the following provisions are quoted:

"All questions or controversies which may arise between the contractor and company, under or in reference to this contract, shall be subject to the decision of the chief engineer, and his decision shall be final and conclusive upon both parties."—Uniform general contract forms, American Railway Engineering Association.

"To prevent disputes and litigations the engineer shall ...... determine all questions in relation to said work and the construction thereof, and shall in all cases decide every question which may arise relative to the fulfilment of this contract on the part of the contractor. His estimate and decision shall be final and conclusive upon said contractor, and in case any question shall arise between the parties hereto, touching this contract, such estimate and decision shall be made a condition precedent to the right of the contractor to receive any money under this contract."—Board of Water Supply, city of New York, contract for Wallkill pressure tunnel.

"It is further mutually agreed that should dispute arise, and in all matters under the contract and specifications, the decision of the city engineer shall be final and conclusive to all parties."—Specifications for street paving, Lynchburg, Va., 1916.

"On all questions concerning the acceptability of material, or machinery, the classifications of material, *the execution of the work*, conflicting interests of contractors performing related work, and the determination of costs, the decision of the chief engineer shall be final, and binding upon both parties."—U. S. Reclamation Service, Grand Valley, Col., May, 1916. (The italics are the editor's.)

"It is thoroughly understood and agreed that the contractor, on signing this contract, agrees that the interpretation of the plans and specifications by the engineer shall at all times be final and conclusive."—Contract for bridge at Phoenixville, Pa., 1915.

"Should any disagreement or difference arise as to the true meaning of the drawings or specifications on any point, or concerning the character of the work, the decision of the engineer shall be final and conclusive, and binding on all parties to the contract."—Specifications for waterworks, Ironton, Ohio, 1916.

"The decision of the engineer shall govern on all matters pertaining to the specifications and the accompanying plans, and to the interpretation thereof, or to any questions arising under this contract."—Contract for bridge at Lawrence, Kan., August, 1915.

The Standard Documents provide that all changes in the work must be ordered in writing by the owner, and that an equitable adjustment of their cost must be made with the contractor (Article 24). In other words, the architect cannot order changes and also determine, single-handed, their value.

The clause recommended by Kirby conforms closely to the provisions of the Standard Documents, and Waddell states that "powers of an engineer to make changes should be limited to the details of construction and of materials." The impression gathered from Mr. Waddell's work is that he refers here only to minor details. On the other hand, Tucker states that while the owners should reserve the right to make changes, alterations and additions, "the power to determine the value of alterations may be vested in the engineer."

J. B. Johnson, in his book, "Engineering Contracts and Specifications," quotes with approval on this point the following provision from specifications of Emil Kuichling:

"And it is also agreed by said contractor that said board may, at any time, make any changes in the location, form, dimensions, grades and alignments, and may make any variation in the quantity of work to be done .... and may entirely exclude any items of work .... without altering or invalidating any of the prices herein made, or this contract in any other respect; .... should such action be taken after the commencement of any particular piece of work, and result thereby in extra cost to said contractor, said chief engineer shall certify to said board the amount to be allowed therefore, ... and his decision, when approved by said board*, shall be final and conclusive."

*"This decision of the engineer is usually made final and conclusive without approval by his principal."—Foot note by Johnson.

Actual contracts have to say on this point:

"The company shall have the right to make any changes that may be hereafter determined upon, in the nature or dimensions of the work, either before or after its commencement, and such changes shall in no way affect or void the obligations of this contract. If such changes make any change in the cost of the work, an equitable adjustment shall be made by the chief engineer to cover the same."—Uniform general contract forms, American Railway Engineering Association.

"The engineer may .... make changes (a) in the design or materials of machinery; (b) in the plans for installation or construction; (c) in the quantities or character of the work or material required. The changes in plans for installation or construction may also include: (a) modifications of shapes and dimensions of canals, dams and other structures; (b) the shifting of locations to suit conditions disclosed as work progresses. If such changes result in an increase or decrease of cost to the contractor the engineer will make such additions or deductions on account thereof as he may deem reasonable and proper, and his action thereon shall be final."—U. S. Reclamation Service, Flathead project, Montana, March, 1916.

"The engineers shall have the right to make such minor changes in construction as they may see fit, ... the amount of any .... extra compensation will be determined by the engineers."—Contract for bridge at Lawrence, Kan., August, 1915.

"The city reserves the right to increase or decrease the quantity of work, or any part thereof, to the amount found necessary. No allowance will be made in case of increase for any sum above the rate of price bid, nor in case of decrease for any real or supposed damage or loss of profit occasioned by such diminution. The city also reserves the right to change or modify the plans or specifications for any portion of the work, or change the location of water mains, or any other structure or structures, etc., ... and the contractor shall make no claim for damages .... by reason of such changes. If the changes increase the amount of work or material the contractor will be paid in proportion to the increase."—Specifications for waterworks, Ironton, Ohio, 1916.

"And it is also agreed by the contractor that the engineer may, at any time, make any changes in the location, form, dimensions, grades and alignments of the work or any part thereof, and may make any variations in the quantity of work .... and may entirely exclude any items of work .... without thereby altering or invalidating any of the prices named herein."—Specifications for paving work, Lynchburg, Va.

"Standard Documents" Two-Sided

The Standard Documents of the American Institute of Architects provide that under certain conditions the contractor may abandon the work and recover full damages from the owner. The owner is not able to assign the contract without his written assent. The architect must have plans ready to a schedule approved by the contractor. Clauses of this kind cannot be cited for comparison from the contracts quoted, as they are not to be found in them. The textbooks quoted also have very little to say on the subject of safeguarding the contractor against losses through acts of the owner or engineer.

With regard to local laws which may conflict with the provisions of the general contract conditions, the Standard Documents provide that local laws shall govern arbitration and supersede conflicting articles.

The Patent Question

The Standard Documents place the responsibility for patent infringement on the contractor. Of the textbooks mentioned, those by Johnson and Kirby both include this same provision. Waddell does not mention the subject of patents, and no conspicuous reference to it is to be found in Tucker. Of the contracts mentioned above, those of the Board of Water Supply, New York City, of the U. S. Reclamation Service, for the bridge at Lawrence, Kan., and for the paving work at Lynchburg, Va., all provide that the contractor shall be liable for any patent infringements in connection with the work.

Construction Plant Controls Minimum Drainage Ditch and Levee Sections

Little River Drainage District Engineers Specify Minimum Base and Berm Widths and Curvatures, Which Are Fixed by Dredges Required

EQUALLY as important as the hydraulic properties of a drainage canal is the knowledge of the plant by which it is to be excavated. In the recent extension of the Little River Drainage District of Missouri, to take in areas in Stoddard and Bollinger counties at the west end of the headwater diversion system by which water from the hill country having a quick run-off is diverted directly into the Mississippi River, as described in the Engineering Record of July 14, 1914, page 67, advantage was taken of the experience gained with the 372 miles of canals and levees constructed to date in the original district.

For the larger channel areas in the diversion system the flood of 1915 on Castor River gave data indicating that an ample factor of safety had been provided. It gave a maximum run-off of 78 per cent for the day of maximum rainfall, equivalent to 76 sec.-ft. per square mile, and the channels were designed to carry about twice as much. The Chezy formula was used and n in the Kutter formula was taken at 0.030. For small ditches these assumptions give channel areas in which a floating dipper dredge, the plant which is used for the larger ditch, cannot operate. Therefore the type and size of dredge is the controlling factor.

→ SPREAD OF THE SPUD PLATFORM DETERMINES THE WIDTH OF BERM

← YEAR-OLD DITCH DUG BY ENGINEER'S METHOD DETERIORATES LITTLE

Base Widths 8 Feet

First, the dimensions of the barge govern the minimum base width. One of the contracts requires a $1\frac{1}{2}$-yd. dipper, 45-ft. boom, a 22 x 75 x 6-ft. barge and a 55-ft. spread of spud platforms. The second contract requires the same sized dipper on a 55-ft. boom. The barge is 24 x 85 x $6\frac{1}{2}$ ft., and the spread of the spud platforms is 66 ft. Practically within the original district the minimum base excavated by such machines has been 8 ft., even though specified as 4 ft. To call for 4-ft. bases adds to the price of the work, conflicts with the clearing and results in insufficient right-of-way. It is found best then to call for what will be obtained anyway—a bottom width of 8 ft.

Spread of Spud Platforms Controls

Berms and maximum curvatures are also dependent on the dredge, as the normal operation of the plant with bank spuds requires that the material be wasted beyond the spud platforms. It follows, then, that the berm width is controlled by the spread of the spud platforms. In the above cases the minimum distances from berm to berm are 55 and 66 ft. respectively.

The limiting curvature is that of a curve whose tangent deflection will permit, with a given length of boom, the proper wasting of material at the required berm line. This has been found to be more a matter of experiment than of computation. For boom lengths of 45 ft. 16 deg. is the sharpest curve that can be negotiated.

Right-of-way required also depends on the dredge, for a well-constructed canal needs wide berms and banks sloping 1:1. Slopes of $1\frac{1}{2}$:1 are better for the efficiency of the canal, but such a slope seems impossible of development by the dipper dredge. This is due more to the obstinacy of human nature, say the engineers, than to any known mechanical reason. For each of the above dredges minimum widths of right-of-way of 100 ft. were chosen.

Deterioration 10 Per Cent

Studies are now under way to determine what the relation is between the areas and cross-sections of the ditches as actually dug, as called for theoretically and as they are after they have reached their permanent regimen. This phase of canal design has been grossly neglected, and the engineers have already measured up 75 miles of canal constructed from two to three years ago, canals that have been flooded and unwatered several times and canals in several kinds of soil. While not conclusive, present evidence indicates that the mean loss is about 10 per cent in canals having a slope of 1:1. Seemingly the loss is in the mean hydraulic radius. In the Stoddard and Bollinger County canals the controlling minimum sections were determined with the mean hydraulic radius taken as 90 per cent of that given for the theoretical section. The area is considered constant.

On ditch 42, which was designed for n

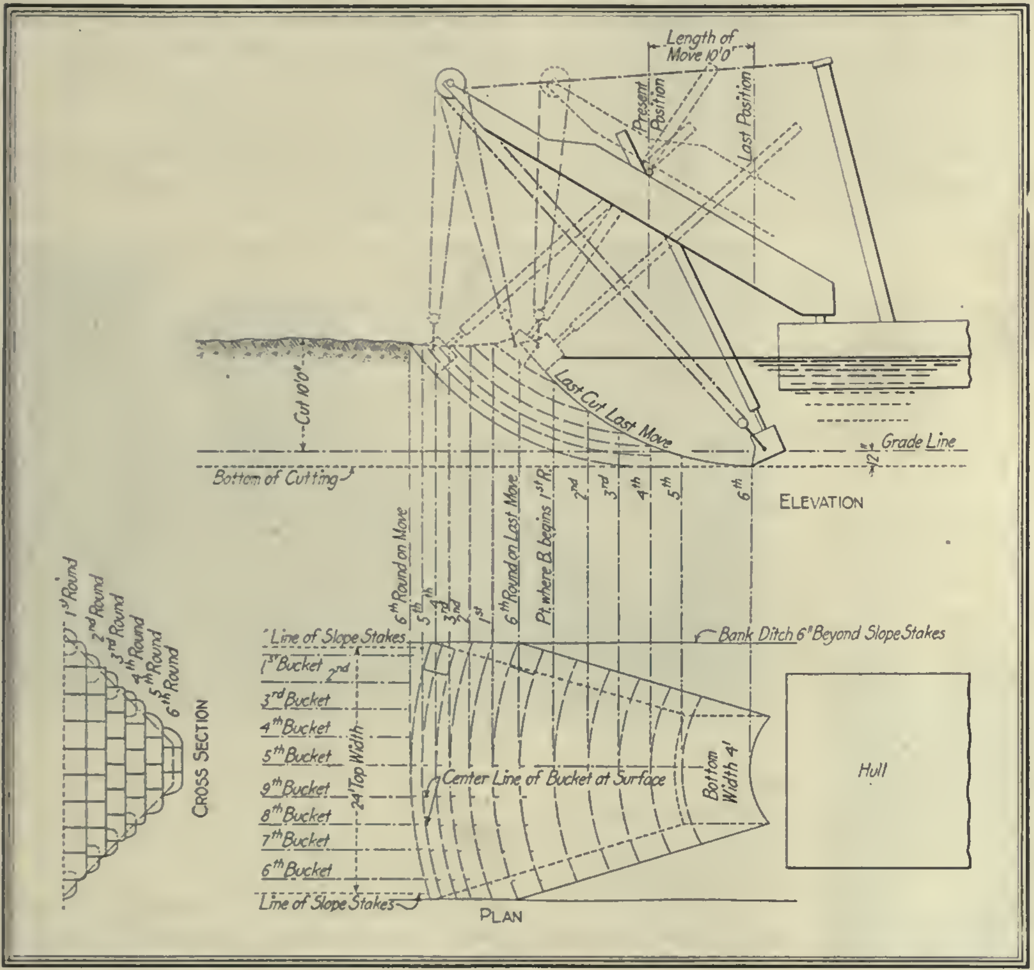
$= 0.025$ and $s = 0.00025$, and was through material described as "gumbo and clay—little sand," the efficiency of the ditch as excavated was as a maximum 94 per cent, minimum 65 per cent and average 75 per cent. In per cent of the theoretical ditch it was 161, 121 and 133 per cent respectively. Sixty-six cubic yards filled in per station, but it would require 33 cu. yd. more to fill in the ditch to the theoretical section.

On a second section of ditch 42, which had a fall of water of 0.00025—the first section had no fall on account of backwater—and in which 45 cu. yd. per station had been washed out, requiring 13 cu. yd. to bring it to the theoretical prism, the relative maximum, minimum and average percentages as excavated were 160, 88 and 115 per cent. Compared with the theoretical section the percentages were 172, 133 and 151 respectively.

Ditch 41 had a fall of water of 0.0003. Nearly 40 cu. yd. per station had been washed out, and the relative efficiencies in per cent of ditch as excavated were 130, 91 and 114. In per cent of ditch of theoretical section the maximum was 196 per cent, minimum 118 per cent and average 155 per cent.

Magnitude of Project

The Little River Drainage District's work, consisting of 627 miles of canals, 41 miles of levees, 9 miles of floodway, 32 miles of diversion channel and 23 square miles of detention basins in the headwater diversion system, involving the handling of 50,000,000 cu. yd. of earth, is about 37 per cent completed. It is being handled under the direction of William A. O'Brien, chief engineer. Isham Randolph is consulting engineer.



ENGINEERS HAVE WORKED OUT METHOD BY WHICH NARROW-BASE DITCHES CAN BE DUG

Prism is cut by digging corners first. They must be cut light. The roll from the berm is cleaned on completion of the fifth round regardless of bottom width.

How to Make Concrete Resist Action of Sea Water

W. Watters Pagon Makes Exhaustive Search of Available Data—Experiments Show Proper Materials, Maximum Density and Mortar Face Necessary

Conclusions reached after an exhaustive search of the available technical literature on the subject of the destructive action of sea water on concrete, and a scientific analysis of a particular case by experimental study to determine the effect of various elements in the problem, are given in a report by W. Watters Pagon submitted to J. E. Greiner, consulting engineer, of Baltimore, in the *Journal* of the Engineers' Club of Baltimore. These conclusions are summarized in the statements: Use materials that cannot be attacked by the sea-water salts. Mix these so as to obtain the maximum density. Have no stones near the surface of the concrete, but use a mortar face 3 in. thick.

A more complete summary of the conclusions of this study of the requirements for making concrete that will have the greatest resistive power against the action of sea water (and also probably of alkali waters) is given in the following paragraphs:

Requirements for Resisting Sea Water

1. The addition of puzzolan in some form is widely practised in Europe, and appears to be theoretically correct. It has not been tried in America, to the author's knowledge, but is worth an exhaustive test. The amount should not be over one part for each part of cement, nor less than one-half part.

2. Waterproofing with substances that combine chemically with the free lime ought to be successful, and is well worth testing.

3. Between extreme high and low tides the concrete surfaces should be faced continuously, without joints, with about 3 in. of 1:1½ or 1:2 mortar, made with sand as specified below, well cured before coming in contact with the sea water. The facing must be placed simultaneously with the backing.

4. The cement should be low in lime and alumina and contain as little gypsum as possible.

Requirements for Sand

5. Sand must be silicious, uniformly graded from fine to coarse, with not less than 50 per cent nor more than 70 per cent passing through a No. 20 sieve, and not more than 3 per cent passing a No. 100 sieve, and must have no organic matter coating the grains. It must be free from roots and easily disintegrated grains, such as feldspar, shells, limestone, mica, etc. It should be washed free from clay, and should show a tensile strength for 1:3 specimens not less than 85, 90, 95 and 100 per cent of the strength of standard Ottawa sand of the same consistency, using the brand of cement that is to be used on the work, at ages of 1, 3, 7 and 28 days respectively.

6. Where concrete must be exposed to sea water without mortar facing, gravel should not be used. Broken stone should be hard, durable, trap, granite or other dense, hard, insoluble stone. It should not exceed ¾ in. in size, and should be free from crusher dust, sand, dirt, organic matter or other foreign substances. The mixture should be 1:1½:3 or 1:2:4, or should be proportioned for maximum density.

Fresh Water Should Be Used

7. Pure, fresh water should be used in sufficient quantity to permit the materials to be well puddled and spaded, so that no later surface treatment or patching will be required, but not sufficiently to materially retard the setting of the cement. Care must be exercised, however, to prevent the formation of laitance or pockets of neat cement or very rich mortar.

8. Forms should be tight to prevent leakage of cement or, where concrete must be submerged immediately, to prevent contact with the sea water.

9. Facing should be reinforced with steel, well covered with mortar and securely anchored to the backing.

10. No surface treatment should be given.

11. The work should be allowed to harden two weeks, if possible, before coming in contact with sea water. Two months is better.

Avoid Low Temperatures

12. Sea water work should never be done in cold weather, with temperature below 40 deg. Fahr.

13. Where possible precast, mortar-faced blocks cured in damp sand for at least one month should be used. The facing should extend back at the joints to prevent saturation of the backing. The joints should be pointed with 1:1 mortar of coarse sand.

14. The most durable surface will be obtained if granite or other dense stone be used as facing. This should not be less than 6 in. thick, anchored back with wrought iron clamps, and pointed with 1:1 mortar of coarse sand and cement as noted above.

15. On mortar or concrete surfaces the growth of barnacles, moss, etc., will frequently afford protection.

Concrete Paving a Remedy for Unsightly Alleys

Costs Given for Work Done by Day Labor Force Which Laid 3578 Square Yards Last Year

By JOHN C. HITESHEW
City Engineer, Carlisle, Pa.

CONCRETE PAVING MAKES VAST IMPROVEMENT IN APPEARANCE OF ALLEYS

EVEN in a town with well-paved main streets alleys in the rear of residences of the cheaper class are likely to be eyesores. At Carlisle, Pa., however, it was decided to make the alleys sanitary and reduce their maintenance cost by paving to the full width with concrete, thus solving at the same time the sidewalk problem in these thoroughfares. Last season the street department, with a day-labor force under the writer's direction, began this improvement and paved 3578 sq. yd. Work was begun on two of the heaviest traffic alleys in town, with livery stables, and warehouses fronting on them. The first job consisted of paving around the Court House and Church Avenue; the second included the sections around the Presbyterian church and Dickinson Avenue. Around the Court House the avenue averages 22 ft. in width. In order to do away with two gutters and at the same time not have an inverted crown in front of offices and stores, the surface was made to slope toward a single gutter. In other places an inverted crown was used.

The original idea was to have all public service poles set inside the building line, but as the alleys are used by pedestrians we realized that, by retaining their position on the curb line the poles really defined an imaginary curb that would protect the pedestrians in case of careless driving. Then, too, a great amount of time would have been required to secure rights-of-way for the location of the poles on the private property abutting on the work, and to compel the public service companies to change the locations of poles.

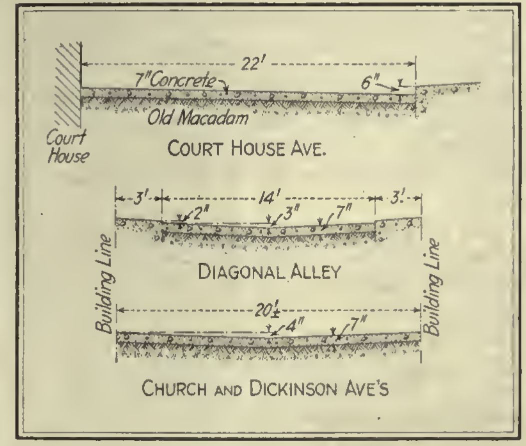
COST OF PAVING COURT HOUSE AND CHURCH AVENUES

Concrete paving begun July 30, finished Aug. 27. Proportions 1:2:3. Depth 7 in. Square yards, 1836.77. Cubic yards, 355.10. Cost per cubic yard, $4.96.

			Totals	Per Sq. Yd.
Grading:				
Foreman	111 hrs.	@ $0.20	$22.20	
Labor	871 hrs.	@ .15	130.65	
Cart	256 hrs.	@ .25	64.00	
Team	3 hrs.	@ .15	.45	
Team	4 hrs.	@ .10	.40	
Roller eng.	12 hrs.	@ .25	3.00	
½ ton coal			2.00	
			$226.40	$0.1232
Mixing concrete:				
Labor	90 hrs.	@ $0.15	$13.50	
Labor	90 hrs.	@ .25	22.50	
Mixer	90 hrs.	@ .30	27.00	
14 gal. gasoline		@ .15	2.10	
			$65.10	0.0354
Concreting materials:				
193 bbl. cement		@ $1.35	$260.55	
44½ bbl. cement		@ 1.15	51.18	
275¾ bbl. cement		@ 1.05	289.54	
			$601.27	
220.91 tons sand		@ $1.50	$331.36	
277 cu. yd. stone		@ .75	207.75	
Loading and hauling stone:				
Team	183 hrs.	@ $0.15	$27.45	
Cart	62 hrs.	@ .25	15.50	
Labor	13 hrs.	@ .15	1.95	
			$1,185.28	0.6452
Wheeling to mixer:				
Labor	293 hrs	@ $0.15	$43.95	0.0239
Wheeling from mixer:				
Labor	380 hrs.	@ $0.15	$57.00	0.0310
Placing concrete:				
Foreman	90 hrs.	@ $0.20	$18.00	
Labor	187 hrs.	@ .15	28.05	
			$46.05	0.0250
Floating:				
Labor	223 hrs.	@ $0.15	$23.45	0.0182
Covering with sand and sprinkling:				
Labor	11 hrs.	@ $0.15	$1.65	
Labor	22 hrs.	@ .10	2.20	
Five tons sand.		@ 1.50	7.50	
			$11.35	0.0060
Miscellaneous:				
Foreman	10 hrs.	@ $0.20	$2.00	
Labor	53 hrs.	@ .15	7.95	
Labor	38 hrs.	@ .10	3.80	
Cart	6 hrs.	@ .25	1.50	
Changing manhole tops:				
Mason	13 hrs.	@ $0.35	$4.55	
Labor	13 hrs.	@ .15	1.95	
Form—2 x 4's			10.00	
			$31.75	0.0172
Expansion joint:				
1252.4 lin. ft. ½ in. x 6 in. @ $4.02 per 100 ft.			$50.34	
608 lin. ft. ¼ in. x 6 in. @ $2.00 per 100 ft.			12.16	
			$62.50	0.0340

Recapitulation

	Totals	Per Sq. Yd.
Grading	$226.40	$0.1232
Mixing concrete	65.10	0.0354
Concreting materials	1,185.28	0.6452
Wheeling to mixer	43.95	0.0239
Wheeling from mixer	57.00	0.0310
Placing concrete	46.05	0.0250
Floating	23.45	0.0182
Covering with sand and sprinkling	11.35	0.0060
Miscellaneous	31.75	0.0172
Expansion joint	62.50	0.0340
Grand total	$1.762.83	$0.9591



BOTH SLOPING SURFACE AND INVERTED CROWN SECTIONS WERE USED

CONSTRUCTION METHODS

The section on the north side of the Presbyterian church was not paved at the same time as Dickinson Avenue, owing to building operations, but was constructed as a separate job. Its small size and the fact that work was done during cold weather account for the slightly increased cost of the job. The details and costs on each job are about the same, with the exception of the grading, which cost more on Dickinson Avenue than on Court House and Church Avenues.

The old macadam was spiked with 13-ton roller, graded, and well rolled with same roller. Concrete was mixed with Wonder No. 10 mixer, with power charger and automatic water tank, owned by the city. The mixer was charged to the job at 30 cents per hour. The gang consisted of one man on mixer, cement man, one sand man, and two stone men. An average of 204 sq. yd. were mixed per day. Cement was contracted for early last spring at $1.05 per barrel net, and delivered on the job when needed. Bids were also received on sand and a contract let at $1.50 per ton of 2000 lb. Limestone was quarried and crushed by the street department at 75 cents per cubic yard, and hauled to the job with fire teams, one at 10 cents and one at 15 cents per hour.

Four men were required to wheel concrete from the mixer; in placing concrete two men were screeding, one shoveling, and one tamping. Stakes were placed in the center and at 16-ft. intervals along the sides of the alley to mark the top of the concrete; 2 x 6's were placed between stakes and screeded with a 2 x 4-in. straight edge.

One-course construction was used throughout. Proportions were 1 part cement, 2 parts sand, and 3 parts stone. The depth was 7 in. Floating was begun as soon as practicable and continued until the entire yardage laid on any day had been completed; the floaters had to work in the evenings until 10 or 11 o'clock. Wood floats were used. A wooden bridge spanning one-half of the alley was used in floating.

EXPANSION JOINTS

One-half inch Elastite expansion joints were placed longitudinally along alley except along fences. One-quarter inch transverse joints were placed every 30 ft. The edges of the concrete at joints were rounded in order that the expansion joint pounding down under traffic would cover both edges of concrete and protect them.

As soon as the concrete had set sufficiently a 1-in. depth of sand was spread uniformly and sprinkled several times a day for ten days.

Traffic was kept off of alleys fourteen days, after which time the sand was scraped up and carted away to be used on small jobs, such as crossings, gutters, etc.

The city pays one-third and intersections and abutting owners pay the remaining two-thirds of the cost.

The accompanying cost figures on the largest section of the work, 1837 sq. yd., show the expenditures in detail.

Prospective Development and Earnings Affect the Value of a Railroad

To Reach Correct Figure It Is Believed Trend of Expenses and Revenues Must Be Developed from Past and Projected into Future

By R. B. SHEPARD, JR.
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THE FIRST provision of the Valuation Act is "that the commission shall, as hereinafter provided, investigate, ascertain and report the value of all the property owned or used by every common carrier subject to the provisions of this act." The act then goes on to specify certain cost figures which shall be ascertained and reported, and to provide that "The commission shall in like manner ascertain and report separately other values, and elements of value, if any, of the property of such common carrier . . ." It is further provided that "All final valuations by the commission and the classification thereof shall be published and shall be prima facie evidence of the value of the property in all proceedings under the act to regulate commerce as of the date of the fixing thereof . . ." It is the almost general understanding that the Interstate Commerce Commission is charged by the language of this act and by its intent, as evidenced in the tenor of the discussions and "hearings" during the time of its framing, with the duty of ascertaining and reporting to Congress the final or ultimate value of the utilities engaged in interstate commerce, though there be some who hold that the obligations imposed by the act shall have been met when the Interstate Commerce Commission has reported to Congress the several "cost" figures. In any event, the ultimate or final value must be determined and the question which now looms largest is: What is this value? On what is it to be based and how ascertained? The writer believes it must take into account prospective development and earnings.

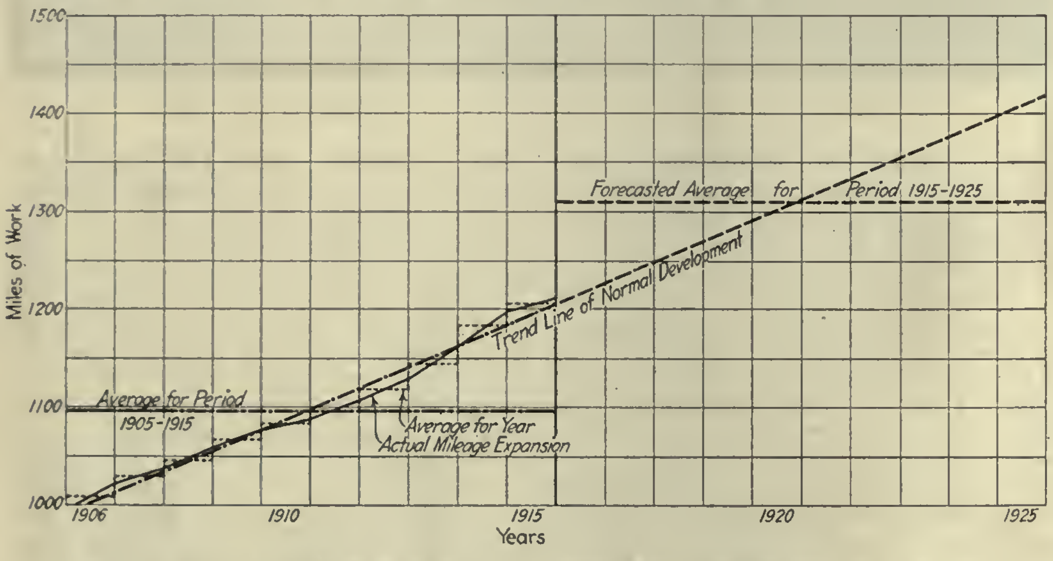


FIG. 1—TREND OF MILEAGE EXPANSION, AND FORECASTED AVERAGE FOR NEXT DECADE

"OTHER ELEMENTS" IMPORTANT

There has been a feeling that the cost of reproduction should be determined and to this added the sum of the "other values and elements of value" to produce the final result, but the enumeration and analysis of these "other values and elements of value" present a problem which is not susceptible of satisfactory solution, nor is it at all certain that the combination would produce a correct statement of value. The cost of reproduction represents the equivalent of the capital held in the property as of the date of valuation, and has no necessary relation to true value in the case of a business free to respond to natural economic laws. The general conception of "other values and elements of value" is synonymous with that of "intangible values," embracing good will, special franchises, going concern, etc., and if this conception be correct, it is entirely on "other values and elements of value" that reliance should naturally be placed for the ascertainment of true value. The cost of reproduction, or capital engaged, is more truly related to cost of service than to value.

Let us picture a railroad which has been in operation for a considerable period and has demonstrated both the economic need of its existence and its ability to expand with the increasing demands of its patrons. Let us further suppose that the tributary country has shown a healthy growth in population, industry and business, and that the limits of its possibilities are not yet in sight. Then the final value of the railroad is expressed in terms of present and prospective earnings and is that sum of money which, if now invested at compound interest, would yield at the expiration of a certain number of years an additional sum equal to that which would result from similar yearly investments of the net earnings of the railroad. For the operation of the railroad to be successful the minimum requirement would be earnings at least sufficient to meet all costs of doing business, including interest on the capital, and in addition provide a reasonable profit; and the value calculated on the basis of such earnings represents the minimum to be respected by artificial regulating agencies.

As an example of the suggested method of calculating value, let us find the value of our hypothetical railroad, supposing the results of its operation and development during the past ten years to be shown in Table 1.

TREND DEVELOPED AND PROJECTED INTO THE FUTURE

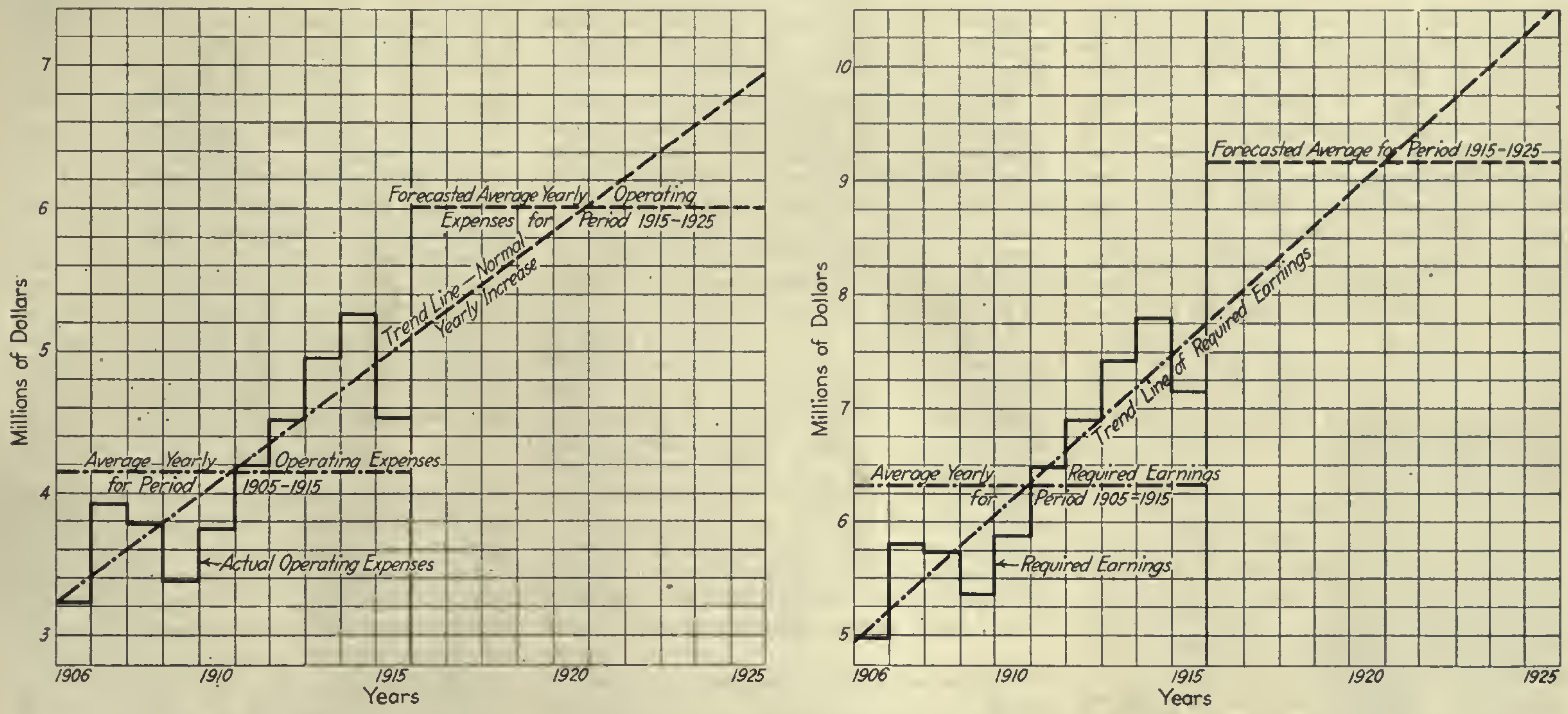
If the differences for each of the columns above and below the average for that column be treated as forces acting in opposite directions, a moment will result which can be regarded as indicating the tendency of the "average line" to tilt, revealing the trend or tendency of the units toward increase or decrease with respect to time, and this tendency can be projected into the future, forecasting "normal" values for each year, or better, the average for the period or decade following the one for which the data are compiled.

To bring this out more clearly, let the figures in the column for average mileage for the several years be plotted, as in Fig. 1. The areas above and below the average line and their respective centers of gravity are shown in Table 2, and the moments are calculated, from which the "slope" of the "trend" line, or normal yearly increase in mileage, is determined. The moment is $260\ (8.58 - 1.77) = 1771$. The "extreme fiber stress" or the bases of the triangles which would produce the same moment are $1771 \div (10^2/6) = 106$. In other words, the irregular figure resulting from plotting the yearly mileage can be transformed into a trapezoid having an equivalent area, the inclined side of which trapezoid represents the average "trend" line of normal values. The average yearly increase in mileage is $106 \div 5 = 21.2$ miles. The ratio of this average yearly increase to the average for the period 1905-15 is 1.94 per cent.

From these data the probable average mileage to be in service during the next ensuing decade can be determined, provided the economic conditions affecting the development of country and railroad remain undisturbed, and provided also that the limit of development is not near. On

TABLE 1—OPERATION AND DEVELOPMENT OF AN IMAGINARY RAILROAD DURING THE LAST TEN YEARS

Year Ended June 30	Mileage		Capital		Service Rendered, Thousand Ton-Miles	Operating Expenses	Taxes	Interest at 5 per Cent on Capital	Total Cost of Service	Gross Earnings to Yield 5 per Cent Profit
	June 30	Average for Year	June 30	Average for Year						
1905	995	......	$26,950,000							
1906	1012	1,004	27,750,000	$27,350,000	268,500	$3,215,000	$161,900	$1,367,500	$4,744,400	$4,981,620
1907	1028	1,020	29,100,000	28,425,000	298,500	3,915,000	171,000	1,421,250	5,507,250	5,782,613
1908	1062	1,045	29,250,000	29,175,000	286,500	3,790,000	214,100	1,458,750	5,462,850	5,735,992
1909	1075	1,068	30,600,000	29,925,000	291,000	3,385,000	223,900	1,496,250	5,105,150	5,360,408
1910	1082	1,079	32,850,000	31,725,000	327,000	3,720,000	242,000	1,586,250	5,548,250	5,825,663
1911	1105	1,093	34,850,000	33,850,000	355,000	4,190,000	256,000	1,692,500	6,138,500	6,445,425
1912	1125	1,115	35,700,000	35,275,000	365,500	4,500,000	280,000	1,763,750	6,543,750	6,870,937
1913	1160	1,143	36,950,000	36,325,000	407,000	4,930,000	290,000	1,816,250	7,036,250	7,388,063
1914	1196	1,178	37,590,000	37,270,000	408,000	5,240,000	312,100	1,863,500	7,415,600	7,786,380
1915	1212	1,204	38,100,000	37,890,000	351,500	4,575,000	318,000	1,894,500	6,787,500	7,126,875
Total...	......	10,949	....	$327,210,000	3,359,400	$41,460,000	$2,469,000	$16,360,500	$60,289,500	$63,303,976
Average.	......	1,095	....	$32,721,000	335,940	$4,146,000	$246,900	$1,636,050	$6,028,950	$6,330,398



FIGS. 2 AND 3—TREND AND FORECASTED AVERAGES OF OPERATING EXPENSES, AND OF REQUIRED EARNINGS TO YIELD 5 PER CENT

this showing the average mileage to be expected for the decade 1915 to 1925 would be $1095 + 10 \times 21.2 = 1307$ miles. It is to be noted that while the trend line indicates normal values for individual years, no attempt is made to forecast actual values for those years, but all forecasts have reference to average values for the decade.

OPERATING EXPENSES AND GROSS EARNINGS

By forecasting the items in the remaining columns in the same way it can be shown that the curve of "service rendered" reveals an increasing demand for the product of the railroad; and that a continuation of that demand is indicated, asuring the success of the business if allowed to realize its economic possibilities. For the purposes of this discussion, however, it is necessary to analyze only operating expenses and necessary gross earnings.

The indicated operating expenses are determined from Table 3 and Fig. 2. The moment is

$$2{,}705{,}000\ (8.06 - 2.32) = 15{,}515{,}000.$$

The base of the triangle is

$$15{,}515{,}000 \div (10^2/6) = \$930{,}900.$$

The slope, or normal yearly increase, is $\$930{,}900 \div 5 = \$186{,}180$. The ratio of yearly increase to the average for the period 1905-15 is 4.5 per cent. The indicated average expenses for the period 1915-25 are

$$\$4{,}146{,}000 + 10 \times \$186{,}180 = \$6{,}007{,}800$$

per year, and the total for the decade are \$60,078,000.

Similarly, the indicated gross earnings required to yield 5 per cent profit are determined from Table 4 and Fig. 3. The moment is

$$3{,}965{,}692\ (8.08 - 2.18) = 23{,}372{,}686.$$

The base of the triangle is

$$23{,}372{,}686 \div (10^2/6) = \$1{,}402{,}361.$$

The slope, or normal yearly increase, is

$$\$1{,}402{,}361 \div 5 = \$280{,}472.20.$$

The ratio of this yearly increase to the average for the period 1905-15 is 4.44 per cent. The indicated average yearly earnings required to yield a profit of 5 per cent during the period 1915-25 is

$$\$6{,}330{,}398 + 10 \times \$280{,}472.2 = \$9{,}135{,}120.$$

(Note that the indicated cost of service, $\$8{,}700{,}114 \times 1.05$, is \$9,135,120, showing that existing relationships are not impaired in the process of determining or projecting trend.)

VALUE OF NET EARNINGS

From the foregoing it is seen that the indicated gross earnings for the period 1915-25 are \$91,351,200, and as the indicated operating expenses were shown to be \$60,078,000, the indicated net earnings are \$31,273,200. To determine the value of the net earnings as of June 30, 1925, they should be extended at compound interest, but as an attempt to do this would involve assumptions as to the actual earnings for each year, it is regarded as more conservative to consider the yearly earnings uniform and apply simple interest. The value thus obtained falls between that which would result from the use of compound interest and that based truly on simple interest.

The value of the net earnings June 30, 1925, at 5 per cent is $\$31{,}273{,}000 \times 1.25 = \$39{,}091{,}500$, which, from the formula $p = r/[(1+r)^n - 1]$, is equivalent to an annuity for ten years at 5 per cent compound interest of \$3,107,774, which in turn is the interest at 5 per cent on \$62,155,480, the indicated minimum present worth of the railroad. This does not, of course, mean the net value to the owners of the property, but does mean the reasonable economic value of the wealth-producing machine, conditioned on the fulfilment to it of all obligations, including provision of requisite capital for expansion. The machine has the right to expect to be allowed to realize its economic possibilities, and any arbitrary acts, by whomsoever performed, which obstruct its development do actually destroy value and create a liability on the part of the responsible agencies.

This value is that to be respected by the regulators in establishing or passing upon rates, not in the sense of calculating returns upon it, but in refraining from enforcing rates which would cause it to be less, as to reduce it would be destruction, or in the case of rates, confiscation. It represents the assets side of the balance sheet, while on the liability side must be shown all obligations of the business, including the present worth of required new capital. The balance represents the market value of all of the stocks, or the price which would have to be paid in the event of condemnation if liabilities were assumed by the state.

PART PLAYED BY REPRODUCTION COST

In the foregoing calculations the book cost of the railroad was assumed; when the figures are available, the cost to reproduce should be used, since it will represent the capital equivalent in the property. This has reference to determination of cost of serv-

TABLE 2—"MOMENTS" OF MILEAGES FOR TEN YEARS

Year	Mileage for Year	Below Average	Time to Center of Gravity, Years	Above Average	Time to Center of Gravity, Years
1906.....	1,004	90	1.77		
1907.....	1,020	75			
1908.....	1,045	50			
1909.....	1,068	27			
1910.....	1,079	16			
1911.....	1,092	2			
1912.....	1,115			20	8.58
1913.....	1,143			48	
1914.....	1,178			83	
1915.....	1,204			109	
Total....	10,949	260		260	
Average..	1,095				

TABLE 3—"MOMENTS" OF OPERATING EXPENSES

Year	Operating Expenses	Below Average	Time to Center of Gravity, Years	Above Average	Time to Center of Gravity, Years
1906....	\$3,215,000	\$931,000	2.32		
1907....	3,915,000	231,000			
1908....	3,790,000	356,000			
1909....	3,385,000	761,000			
1910....	3,720,000	426,000			
1911....	4,190,000			\$44,000	8.06
1912....	4,500,000			354,000	
1913....	4,930,000			784,000	
1914....	5,240,000			1,094,000	
1915....	4,575,000			429,000	
Total...	\$41,460,000	\$2,705,000		\$2,705,000	
Average.	\$4,146,000				

TABLE 4—"MOMENTS" OF GROSS EARNINGS REQUIRED TO YIELD 5 PER CENT PROFIT

Year	Earnings Required	Below Average	Time to Center of Gravity, Years	Above Average	Time to Center of Gravity, Years
1906....	\$4,981,620	\$1,348,778	2.18		
1907....	5,782,613	547,785			
1908....	5,735,992	594,405			
1909....	5,360,408	969,990			
1910....	5,825,663	504,734			
1911....	6,445,425			\$115,027	8.08
1912....	6,870,937			540,540	
1913....	7,388,063			1,057,665	
1914....	7,786,380			1,455,983	
1915....	7,126,875			796,477	
Total...	\$63,303,976	\$3,965,692		\$3,965,692	

ice on which minimum value is based. If the railroads were free to respond to the pressure of economic laws, then the question of cost need not enter into the determination of value; but, as it is, the operation of these laws having been suspended and the question being as to the limit beyond which value cannot be depressed, the answer is that the business must be allowed to be profitable, and the minimum requirement for profitableness is that cost of service plus a profit must be realized from the plant.

In calculating the value, taxes are supposed to be based on value, and cannot affect it. They do form a part of the cost of service, however, and are included in its determination.

CONCLUSION

In conclusion, it is urged that any true determination of value must take into account the element of prospective development and earnings. It is wholly illogical to base a valuation entirely on present conditions. There is scarcely a transaction of any nature whatever that is not based on expectancy, and certainly we have the right to look forward to continuous, though possibly fluctuating, development of our country, and to expect that our industries will keep pace. Any statement of value at all is based on the principle of forecast, although in some cases the prediction is merely that the exact present status will be maintained —a proposition which the most cursory inspection of statistics will refute.

Corrugated Culvert Pipes Tested Under a Sandbed

Box with Movable Sides and 100-Ton Jacks Employed—Arching Effect of Sand Discussed

By GEORGE L. FOWLER
Consulting Engineer, New York, N. Y.

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AFTER the completion of the hydrostatic tests of Armco iron corrugated culvert pipe, described in the Engineering Record last week, page 668, it was decided to make tests of the same range under a bed of kiln-dried sand. Preliminary laboratory tests showed that, on a slightly yielding bottom like the top of a corrugated culvert, the sand arches and the bottom is relieved of the load. Further, when the sand is confined the lateral thrust does not increase, but the vertical load is carried by the frictional resistance of the sand against the sides of the confining structure.

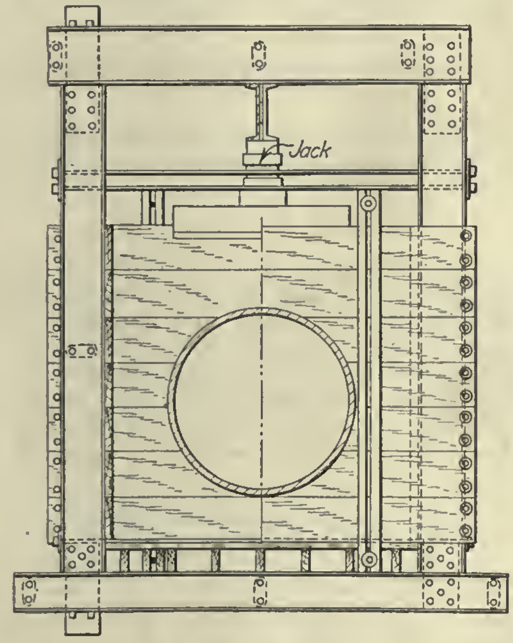
TESTING BOX BUILT

With the data obtained from the preliminary tests, a box like that shown in the accompanying illustration was built of heavy planks supported in a structural steel frame. One side was made movable so that any desired width up to 7 ft. could be obtained, and the box had a height sufficient to take in a pipe 8 ft. long and 48 in. in diameter, and to allow for 2 ft. of sand above it and 1 ft. below it. Three jacks, each of 100 tons capacity, were provided for imposing the load on the sand, which was done by means of three platens 25 in. wide and reaching the full length of the box. Floating planks, 12 in. wide and 30 in. long, carried on ball bearings, were inserted in the fixed side of the box and held in place by levers resembling those of a platform scale, as shown in the drawing. Diaphragm dynamometers were connected with the floating planks to indicate the magnitudes of the forces acting upon them.

The movable side of the box was so adjusted that when the pipe under test was in place there would be 1 ft. of sand between it and each side of the box. Sand was then put into the box and tamped down to a depth of 1 ft. The pipe was then put in place and the sand was rammed about and beneath it and was carried up above the top of the corrugation to a depth of 14 in.

After the pipe had been put in place it was calipered at each corrugation on both vertical and horizontal diameters. The pressures were then applied in varying increments until the vertical diameter had been shortened by 1 in. The floating-plank dynamometers were read to determine the arching properties of the sand.

Tests were also made of smooth pipe 12 in. in diameter, and these showed that, under the conditions of the tests, the pipe with ½-in. depth of corrugation was about twice as strong as the smooth pipe, and that one with ¾-in. depth of corrugation was about three times as strong.



SAND BOX FOR USE IN TESTING CORRUGATED CULVERT PIPE

In measuring the pressure on the top of the pipe under a bed of sand from 12 to 14 in. thick it was found that on the 12-in. pipe the pressure was higher than the average pressure exerted by the platens on the sand. With the 24-in. pipe it was also slightly higher, but with the 48-in. pipe it was very much lower. This was due to the relative diameter of pipe and width of platen.

These tests, while exhibiting the general features of the conveyance and distribution of sand pressures, were not extensive enough to warrant the development of a formula for calculating the pressures exerted under beds of sand. It has been shown that the amount of pressure put upon buried surfaces with a given load depends upon the depth of sand above them, as this pressure decreases with an increase in the depth of sand. As to what may be the proportional effect of depth of sand on the increase or decrease of pressure, there are not sufficient data to determine. The lateral pressures, when measured in pounds per square inch, were low as compared with the vertical pressures, but no definite ratio could be determined.

When the 24-in. pipe was being tested the lower floating plank was a little more than 2 ft. below the surface of the sand and the top of the upper plank was about 4 in. below the surface. The pressures on the top of the sand and on the two planks averaged as follows: Surface, 38½ lb. per square inch; upper floating plank, 3.74 lb., and lower floating plank, 8.2 lb. When the 48-in. pipe was being tested, the top of the lower plank was about 4 ft. below the surface of the sand and the top of the upper floating plank was about 2 ft. below the surface. The average pressures on the three points were: Surface, 10.09 lb. per square inch; upper floating plank, 3.66 lb., and lower floating plank, 2.42 lb.

MEEM'S RESULTS CHECKED

J. C. Meem found that in an excavation the lateral pressure increased very rapidly from the top down, reaching a maximum at a point dependent upon the angle of repose of the material and then decreasing. This, together with what has preceded, seems to show that after a certain, as yet undetermined, depth has been reached there can be no further load, but upon a culvert pipe by an increase in the depth of cover, and that such an increase of depth serves directly to protect the pipe against an increase of burden due to an increase of surface loading.

While this condition seems to be pretty thoroughly demonstrated, it was felt that there might be a question in the mind of some engineers as to the action of the culverts under a loading similar to that applied in railway service. There it is applied through ties of limited width and separated by intervals in which no load is applied to the material. Accordingly the principal tests were made to determine this point. For these three pipes of 24 in., 36 in. and 48 in. diameter respectively were taken, each having ½ in. depth of corrugation. The 24-in. pipe was of No. 14 gage iron and the others of No. 12 gage. The load was applied through 8-in. ties spaced 22 in. between centers, and by means of jacks bearing on the centers of rails laid to a gage of 4 ft. 8½ in. across the ties. It was assumed that a normal covering was a thickness of sand equal to the diameter of pipe. As this was the condition in the case of the earlier 12-in. pipe tests, it was considered unnecessary to duplicate these. Under the wooden platen and 1 ft. of sand the 12-in. pipe of No. 16 gage metal had carried a load of 262,125 lb. before showing a deflection of approximately 1 in. The depth of sand over the pipes was about equal to the diameter for the 24-in. and 36-in. sizes, and 3½ ft. for the 48-in. size, the latter being necessitated by the size of the frame.

PIPE DISTORTION SLIGHT

With the load applied through broad platens the increase in loading was stopped when the pipes had been deflected approximately 1 in. The increase was stopped automatically in the later tests by the ties sinking into the sand and thus refusing to carry more load. The result was that the distortion of the pipes under the greatest pressure obtainable was very slight. This pressure, however, was considerably more than that applied through the platens, being, in the case of the 24-in. pipe, 237,800 lb. Had this load been applied on the platens with 12 in. of cover over the pipe, the latter would probably have been very seriously crushed, but under a cover of 24 in. it is also probable that the crushing would not have exceeded that obtained under the ties, because of the arching properties of the sand already discussed.

On comparing the loads applied with those of actual railroad service it will be noted that the maximum locomotive wheel load is about 70,000 lb. for a pair of driving wheels or about the same as that of the first increment of load used. If this were considered to be increased by running conditions to 1000,000 lb. there might result a maximum deflection of the pipe of about 0.45 in. This is a probable maximum, since, in the tests under discussion, a further increase of the loading served to distribute the strain so as actually to decrease the deflection at the one point of greatest yield under the intermediate loading.

The measurements of the pipe showed that, even after the application of a load of 237,800 lb. with an average deflection of the pipe of 0.14 in. the recovery of the pipe against the burden of sand above it was fully up to its original shape and that it had sprung back to an average shape more nearly round than when first measured.

The point to be emphasized here is that under the heaviest load that can be applied to the ties of a railway track by the wheels of any existing locomotive or car, a 24-in. corrugated culvert pipe having the depth of corrugation and thickness of metal of the one tested, and buried under a cover of 24 in. of dry sand, cannot be deflected beyond its elastic properties of complete recovery of shape when the load is removed. The results of the tests of the 36-in. and 48-in. pipe corresponded very closely with those of the 24-in. pipe. On the 36-in. 12-gage pipe under 3 ft. of sand, a pressure of 165,900 lb. produced a deflection of approximately 0.60 in., and the original form was recovered to a great extent after release. On the 48-in. 12-gage pipe, under 3½ ft. of sand, a pressure of 124,000 lb. caused a deflection of approximately 0.66 in., much of this also being recovered on release of the jacks. It seems reasonable to conclude that, under existing railroad loading, corrugated culverts of 36-in. and 48-in. diameter are uncrushable when under a cover equal to their own diameter.

INCIDENTAL FACTS

Some incidental facts that have been developed by these tests show that a given area will support a greater weight on a bed of sand if concentrated in one whole than if divided into smaller units. For example, in the preliminary tests the load was applied to platens measuring 2 ft. x 7 ft. 6 in. With any load that was applied there was no pushing of the platens down into the sand other than that due to the compacting of the sand, and in no case was there any real upward flow. The sand was elastic under the platens, and when the load was released it would spring back nearly to its original bulk. When the load was applied on three ties with the same total bearing surface as before, the division of the surface had the very marked effect of materially reducing the sustaining capacity of the sand. A limit was soon reached beyond which the ties were simply pushed down into the sand and without the development of any increase of resistance.

On the basis of the data afforded by these tests, and also of practical experience, it is evident that unusual depth of a ditch in which a corrugated culvert is installed does not involve any especially severe conditions. Indeed, such an installation is better protected from superimposed loads than one with a shallower cover. But it should be remembered that the weight of a cover consisting of a wide loose fill or embankment is not so well supported laterally as in a narrow ditch, and that thus extremely high embankments may bring about conditions of unusual severity which should be provided for by the use of heavier gages.

CONCLUSIONS

The conclusions that seem warranted by the investigation described above are as follows:

The full collapsing strength of corrugated culverts, as determined by the hydrostatic test, described in last week's issue, can probably not be fully realized under an earth covering because of the impossibility of securing an even pressure upon all sides of the pipe. Under ordinary conditions of loading under a bank or fill, the maximum pressure will be exerted vertically, and the pipe will be distorted by a shortening of the vertical and a lengthening of the horizontal diameter.

The value of end support extends farther from the end of the pipe under an earth load than under a hydrostatic pressure. How much farther was not determined.

The greater the depth to which a pipe is buried, the less is the variation in the loads to which it will be subjected.

The maximum pressure upon a pipe is reached under a certain depth of cover which was not determined.

At depths greater than the maximum above referred to, the pressures due to surface loading decrease. This and the above conclusion apply also to lateral pressures.

The 12-in. pipe of No. 10 gage would be practically uncrushable under a cover of dry sand 3 ft. deep. This probably holds for all other granular materials.

It is estimated that a depth of cover equal to three times the diameter of a pipe will suffice to protect it from any increase of pressure due to surface loading.

There are no data as to the depth of penetration of concentrated surface loads, but it is safe to calculate that the intensity is dissipated as the depth increases.

This Rod Speaks for Itself

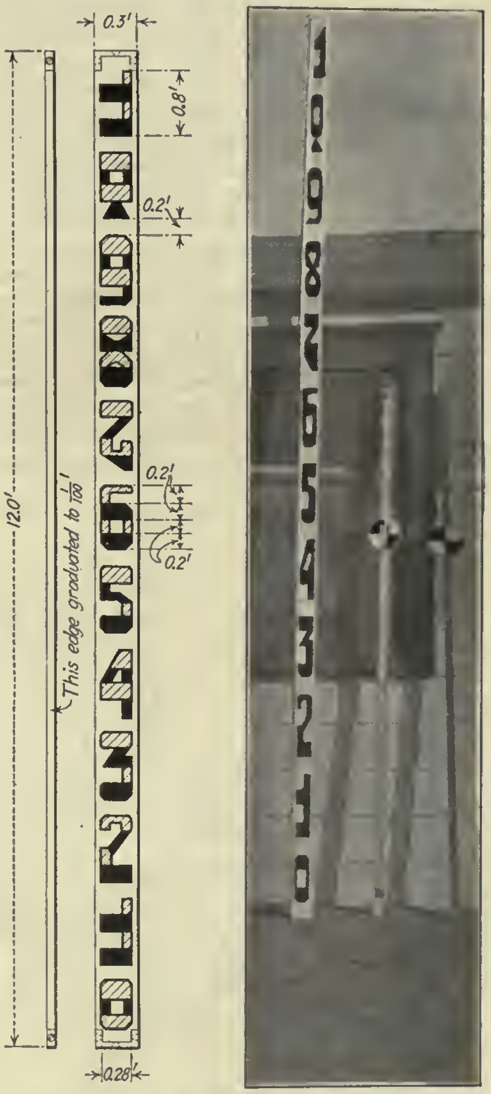
Figures 0.8 Feet High, with Alternation of Colors Every 0.2 Feet, Make Rod Self-Reading with Hand Level at 100 Feet

By JOHN H. SAWKINS, C. E.
Baltimore, Maryland

THE ACCOMPANYING illustrations show a level rod, which I have called the "Roosevelt self-speaking rod," which I believe to be an innovation in level rods to be used in connection with the Locke hand level. The photograph shows the comparative advantages of this type over the Philadelphia or New York rod. At a distance of 25 ft. the graduations of the New York rod cannot be seen with the naked eye, while at 100 ft. distance the graduations of only the Roosevelt rod are discernible with the unaided eye.

The principal advantage of the rod in question lies in the fact that there is little or no chance for the levelman to make an error in reading the correct foot, as the figures are so made that in reading the tenths of a foot it is necessary for the observer to note that figure which is cut by the horizontal wire of the instrument. Every two-tenths of a foot is as readily read by the naked eye as the large figure itself, which is 0.8 ft. high. The bottom of each large figure is a foot graduation, except the zero, the bottom of which is 0.2 ft. above the botton of the rod. The rod can be easily and quickly read to the nearest tenth of a foot. If it is desired to read more accurately than this, for use on stadia work, either edge of the rod may be graduated to hundredths of a foot and the rod held in such position on the point over which it is desired to take a reading that both the large figures on the flat face of the rod and the hundredths on the edge may be seen simultaneously.

The exact dimensions of the rod are given in the accompanying sketch. I have found that the most advantageous coloring scheme for the rod is to make a white background with the two-tenths divisions painted red and black alternately. This is shown in the sketch by the alternate solid black and cross-hatching of the large figures. It will be seen that a specially designed figure for the 10-ft. mark has been used, but the writer believes this offers no disadvantage, since with very little practice the user becomes readily accustomed to the construction of the figures, and reads them quickly and with very little chance for error.



DIMENSIONS OF ROD AND COMPARISON WITH OTHER RODS

The writer has used this rod successfully for Locke measurements of earth embankment for the Mexican Petroleum Corporation's plant now in the course of construction at Carteret, Township of Roosevelt, New Jersey, for which work Henry Steers, Inc., New York City, is the contractor. The name, Roosevelt self-speaking rod, was chosen because the rod was first used in the township of Roosevelt, and not for any other reason that might suggest itself.

Two-Story Shed for New York's Forty-sixth Street Pier Will Be 969 Feet Long

Steel Structure on 1000-Foot Pier Will Have Interior Columns on 40-Foot Centers and I-Beam Grillages in Column Foundations

By CHARLES W. STANIFORD
Chief Engineer, Department of Docks and Ferries, New York City

THE TWO-STORY steel shed to be built on the 150 x 1000-ft. pier near the foot of West Forty-sixth Street on the North River, New York City, is intended to serve the longest transatlantic steamers, now docking at the Chelsea piers, or at Hoboken, about a mile farther down. These steamships now project beyond the established pierhead line in the Chelsea district, and dock at present by special permit from the U. S. War Department, given on condition that adequate docking facilities would be provided elsewhere. To provide these facilities the city has chosen the section north of West Forty-second Street, and the two-story shed shown herewith is the first to be built under that agreement.

The details of the steel frame and concrete construction, which provides a depressed center aisle on the second floor to provide for future elevated railway trains, and of the changed design for column foundations, will be described.

The two-story part, from the inner facade of granite, terra cotta and brick to the outer end, is 921 ft. long. A one-story extension forming an outside promenade of 48 ft. makes an over-all distance of 969 ft. There are four columns in the typical cross-section, with center columns spaced 32 ft. 4 in. apart, a distance which was deemed sufficient for a central driveway, and leaving maximum unobstructed areas along the sides of the shed. For about 400 ft. at the inner end the shed has central columns on 40-ft. centers, while all side columns are spaced on 20-ft. centers.

The 40-ft. spacing could be used inshore because sufficient foundation resistance was developed. If practicable it would have been followed throughout, not only on account of the reduced cost of foundation work, but mainly on account of the desire for maximum unobstructed floor space, increasing the handling capacity of trucks when intermingled with cargo.

The pier shed is fire-resistive throughout; the doors are of steel frames covered with galvanized steel, thus eliminating even this woodwork which obtains in most pier doors.

The live loads assumed were: 50 lb. per square foot for the roof, 300 lb. for the second floor, 500 lb. for the main deck, 6000 lb. uniform load per linear foot of the track, and two 5-ton loads on each cargo girder, applied 5 ft. from the supports, with 100 per cent added for impact.

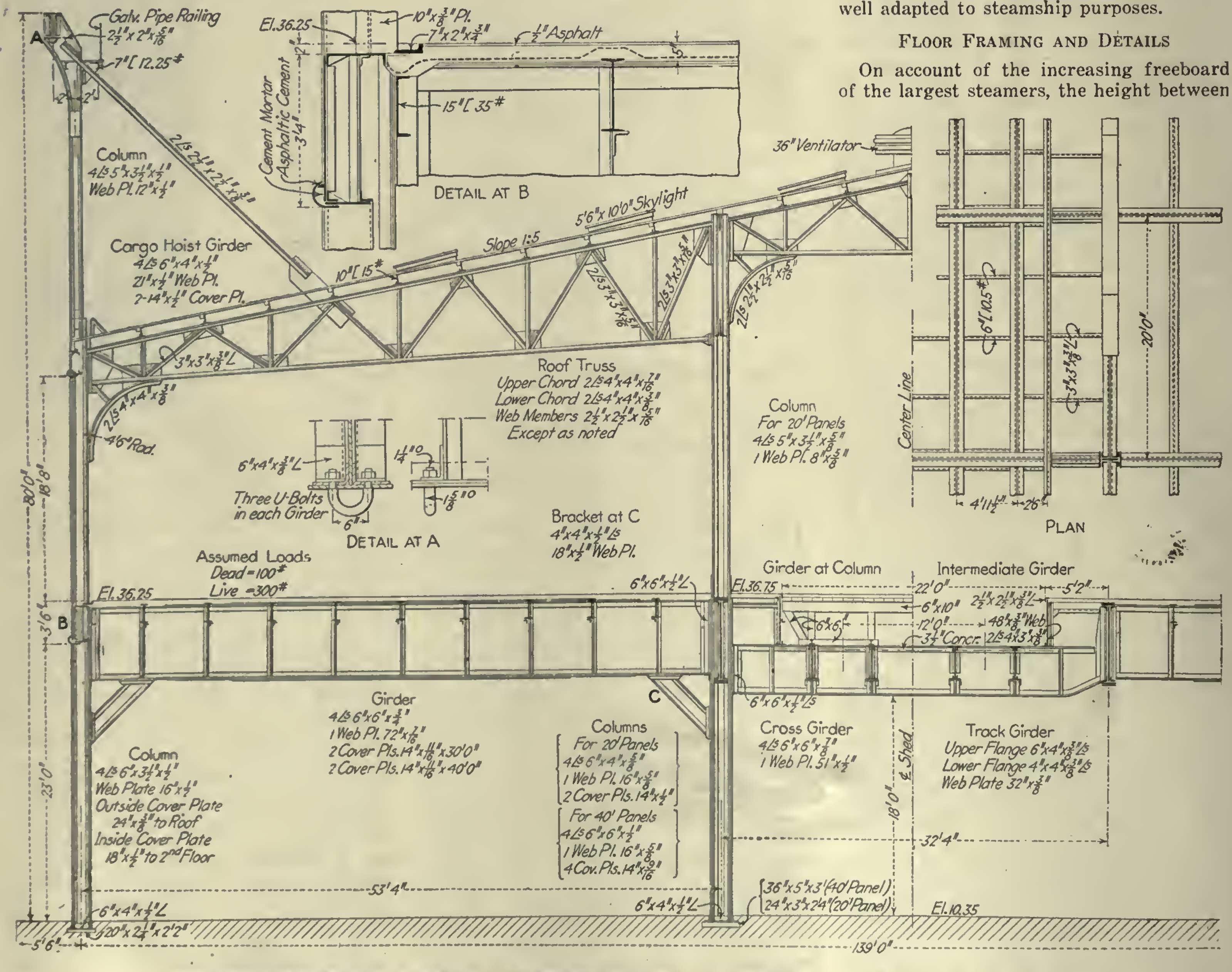
COLUMN FOUNDATIONS CHANGED

The original design for the column foundations was described in a general article on the substructure in the Engineering Record of Aug. 1, 1914, page 120, and contemplated the use of reinforced concrete supported on timber platforms on piles. This detail has been changed to I-beam grillages embedded in concrete. The reason for this change was the fear of injury to the concrete from floating ice or floating logs and consequent deterioration of the foundation from the exposure of the concrete to salt water, exposing the small rods near the surface in the original design. This danger is now prevented by the use of a beam grillage in the center of the foundation with an outside protection of concrete.

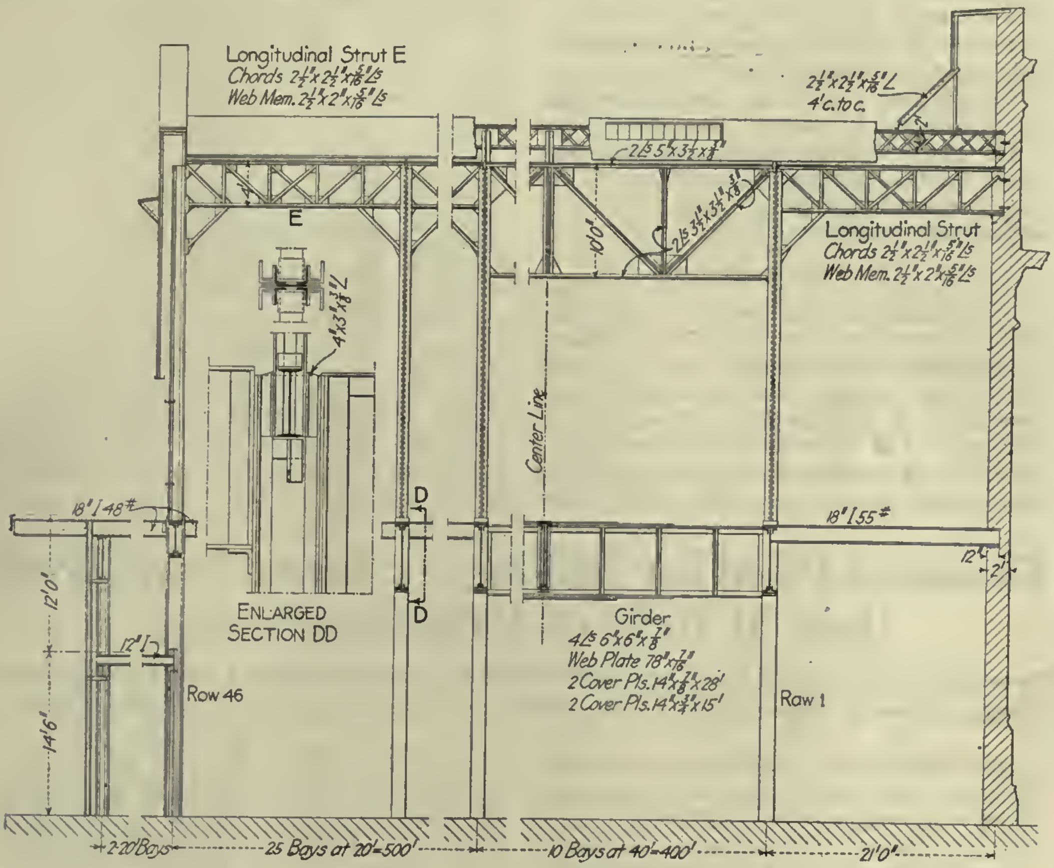
The standard pile-bent spacing of the Department of Docks and Ferries is 10 ft. with shed column centers at the sides of 20 ft., insuring a uniformity in the details of side doors, cargo-hoist girders, roof trusses and framing. This unit of 20 ft. is also well adapted to steamship purposes.

FLOOR FRAMING AND DETAILS

On account of the increasing freeboard of the largest steamers, the height between



PART TRANSVERSE SECTION SHOWS DETAILS OF STEEL FRAMING AND TEMPORARY TIMBER FLOOR IN CENTER PANEL



PART LONGITUDINAL SECTION AND TYPICAL BAYS WITH 40-FOOT GIRDER AND TRUSS

floors is 26 ft. 6 in. and the height of the cargo masts is 80 ft., 5 ft. higher than the present Chelsea piers.

The second floor of the pier shed is a typical reinforced-concrete slab on longitudinal steel I-beams, framed into transverse plate girders. As indicated in the half section, the center bay is depressed sufficiently to provide track stringers at such level that future track rails supported on the top flanges will allow the cars on the proposed elevated railway on the marginal street to enter with their platforms on a level with the pier floor.

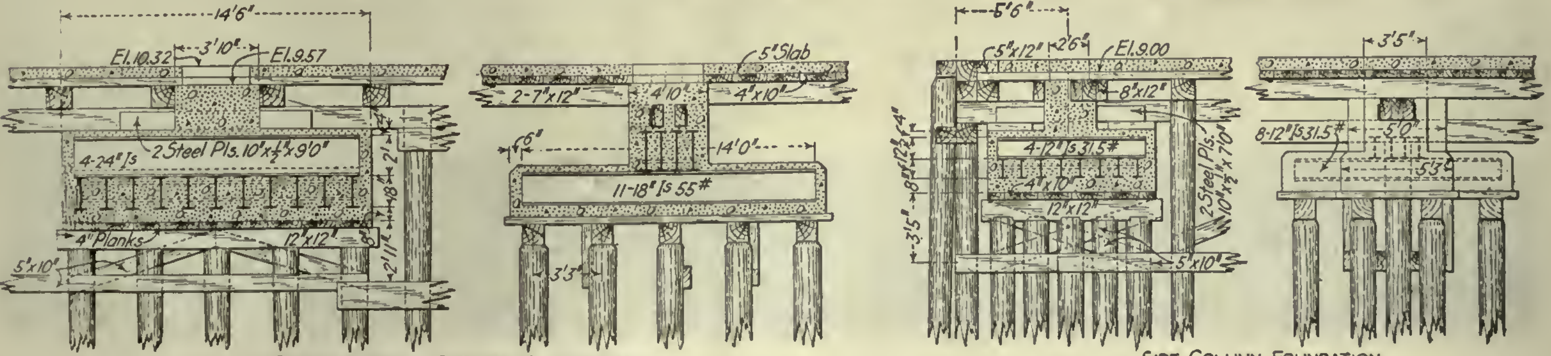
To support the temporary timber floor in the center panel small timber bents of the simple construction shown are spaced 6 ft. apart, supported on the track stringers. A reinforced-concrete floor at the level of the upper flanges of these track stringers is supported on transverse channels, and side girders are used to close the depressed area.

CARGO-HOIST GIRDERS

The type of cargo-handling equipment provided in this design differs from the suspension-cable type used in many of the New York piers, and described in the article on the Thirty-fifth Street pier, Brooklyn (Engineering Record, Sept. 18, 1915, page 753). Instead of 60-ft. spacing of columns with steel cables stretched between, this pier shed has built-up cargo girders on 20-ft. spans. The U-bolts (shown in the large-scale drawing) are attached at 5-ft. intervals to the lower flanges of these girders, which are designed to carry both vertical and lateral loads applied by the cargo hoists. A runway with hand railing, reached by ladders at each end, gives access to the hooks.

The shed is being constructed by the Department of Docks and Ferries, of which R. A. C. Smith is commissioner, and R. C. Harrison deputy commissioner. The detailed plans and specifications were prepared by the Bureau of Engineering, under the writer, chief engineer, and T. F. Keller, assistant engineer.

The contract was awarded to the low bidder, Post & McCord, of New York City, for $573,450.



COLUMN FOUNDATIONS ON PILES—ORIGINAL DESIGN HAD REINFORCING RODS

Drying Yellow Pine in Less Time

Members of the Forest Products Laboratory at Madison, Wis., are now doing commercial experimental work at Winfield, La., for the Fremont Lumber Company on a new method of drying yellow pine. This follows experiments made at the laboratory wherein the period of drying was cut from 48 hours, the old time, to 39 hours. If this can be done in practice, it will mean a 20-per-cent saving in the operation of the kilns.

Favors Mill-Bent Angle-Iron as Concrete Road Screed

Massachusetts Engineer Styles It Best Form for the Purpose, and Offers Several Other Road-Building Suggestions

THE best form of screed for concrete road construction is an angle-iron, bent at the mill to conform to the desired cross-section of the road, and equipped with handles at each end, according to Samuel Hobbs, of the Massachusetts Highway Commission, in a paper presented at the March convention of that commission. That the furnishing and placing of materials for a given piece of work is an ever-changing problem, was conceded, but the organization of a force for mixing, placing and finishing the surface itself is definite, in his opinion, and seldom need be changed. The following suggestions have been extracted from Mr. Hobbs' paper:

WATER NECESSARY

A rather wet mixture, in view of the absorbing powers of the sub-grade, is considered best. With a dry mix it is practically impossible to obtain an even surface under the screed, and a dry concrete must be thoroughly tamped to secure uniform conditions throughout the mass. This is costly in labor.

If the concrete is mixed just wet enough so that the mass, when placed, will appear homogeneous without tamping, will move quite readily as the screed advances, and the screed is dry enough so that the water pockets are not left behind and the surface holds its shape well without appearing watery, the consistency is about right for good progress.

In placing concrete two men are needed at all times, one to level the surface with a rake ahead of the template, always keeping the concrete higher than the true surface of the road, and the other to look after the spading of the edges, keep the material, running from the mixer into the bucket, well mixed and wet down the sub-grade whenever necessary. The spreaders should be picked men, trained to do the work as the engineer wants it done, and not shifted about by the contractor on slight pretext.

PROPER LENGTH OF TEMPLATE

The best form of screed is an angle-iron, bent at the mill to conform to the desired cross-section of the road, and with handles at each end. The template should be about 18 in. longer than the width of the roadway, so that it may rest upon the side forms as it is being pulled along to cut down the surface. A 3 by 4-in. angle should be sufficiently heavy to shape down the surface.

Two well-trained finishers are needed all the times to keep the work well in hand.

Under ordinary conditions, the floating should be in progress about 10 or 15 ft. behind the screed, or when the concrete has dried just enough so that water will not be flushed over the surface by the wooden float.

The edging should be started about 1 to 1½ hours after the concrete is placed, by forcing a spade down against the form to a depth of 3 or 4 in., thus opening a space to insert the edging tool. A small amount of concrete should then be scraped out with a trowel, so that the edger will have no surplus material to shape in rolling the edge to a 3-in. circle, or to whatever form may be required. The correct amount of material to remove can be determined only by trial.

Broom in Straight Lines

Brooming is generally done about 3 hours after the concrete is placed, depending upon weather conditions. In brooming it is desirable that the workman should place the bridge at right angles with the side forms and run his broom against its side, to insure straight lines. It is usually necessary to run the broom forward and back, going over all portions twice.

The placing of transverse joints 30 ft. apart in concrete roads gives rise to two problems. First, it has been very noticeable on roads so far built that spalling and peeling take place near the joint oftener than at any other point in the slab. Second, a difference in elevation has often been found after cutting a joint between corresponding points on adjacent slabs, sometimes enough to cause vehicle jolting.

Spalling and peeling under travel appear most probable in that portion of the mass which is lacking in the stone or gravel constituent—though rich, perhaps, in mortar—and lacking therefore in resistance to abrasion. This composition often occurs near the joint at the end of the slab, where the screed has brought forward the surplus material from the surface. The following remedy is suggested: Set the joint and joint plate firmly in place and fill out the section as usual, running the template to the end of the slab to leave the requisite amount of concrete to fill the section. Then set the screed back 2 or 3 ft. and shovel into the space thus formed, fresh concrete of the right proportions to displace the fluid portion which is too rich in mortar and thus force it to flow over the side forms. When the concrete in the space becomes of such a constituency that a spade will show the presence of stone close to the surface at all points, the concrete should be better able to resist wear.

An intelligent workman, who is allowed ample time to do his work well, is the best remedy for the common unevenness of joints. In Massachusetts a cross-float is used at each joint shortly after the screed has removed all surplus material. This is composed of two thin, smooth boards, nailed securely at right angles, and sawed to leave a notch in one board high and wide enough to pass over the joint, the two sides of the other board forming surfaces in the same plane for floating the adjacent ends of the two slabs. If properly used, this float should leave the joints even.

Gang Organization

The furnishing and placing of materials for a given piece of work is an ever-changing problem, but the organization of a force for mixing, placing and finishing the surface itself is definite and seldom need be changed. The following table shows in condensed form the organization of a force for laying concrete surfacing which should meet almost any requirements, provided that the materials and sub-grade are in readiness:

	Min.	Max.
Superintendent	1	1
Loading:		
Sand	1	1
Cement and Lime	3	4
Stone	4	6
Mixing and placing:		
Engineer	1	1
Fireman	1	1
Spading and spreading	2	2
Placing and removing forms	2	2
Finishing:		
Floating, brooming and edging	2	2
Curing:		
Covering and uncovering	1	4
Watering	1	3
Totals	19	27

The average number of men would be about 25. Exclusive of the variable item of curing, a gang of nineteen good men can handle the work about the mixer.

Canadian Plant for Making Acids and Explosives Built at Rate of $300,000 a Month

Seventy-five Scattered Buildings, Railroad Yard and Filtration Plant Completed in Twenty Weeks with Simple Plant, Well-Knit Organization and 2,300 Workmen

SCATTERED over a U-shaped area a mile long, covering 460 acres, a great powder plant, costing upward of $1,500,000, was recently completed in five months at Drummondville, Que., by an American firm of engineers and constructors. Two acid-making plants added to the original contract have since been built at an additional cost of $500,000. No unit of the plant was difficult of construction, but the work as a whole required extensive clearing and grading, the construction of seventy-five concrete, brick and timber buildings and a railroad yard, the installation of heavy machinery and the fitting of an extraordinary quantity of pipe.

The plant will be operated by the Aetna Chemical Company of Canada for the manufacture of guncotton and smokeless powder. It is located near the French-Canadian village of Drummondville, Que., which has a population of only 3000, and which could neither furnish nor house the 2000 workmen required to push the plant to rapid completion. The powder works will draw water from its own filter plant on the St. Francis River. It is located near a branch of the Canadian Pacific Railway, from which a permanent siding and yard had to be built for the plant.

Plans Made Quickly

The site was selected at the time of the signing of the contract. A preliminary survey was at once made and a general layout established so that construction was actually started within two weeks. The general layout of the plant, which is U-shaped, places the sulphuric-acid plant, nitric-acid plant, cotton stores and cotton dry house in the order named from south to north along the east side. The remainder of the guncotton plant and the press houses of the smokeless powder plant are located on the main east-and-west axis, and the balance of the smokeless plant on the west side.

All the buildings except the pump house, power house and magazines were constructed of timber. The power house is combination brick and timber. The magazines were built with tile walls and reinforced-concrete roofs. All important foundation work is of concrete. The steam, air and alcohol piping has been carried above ground, the high-pressure hydraulic lines at the surface in boxes and the water piping in trenches at least 6 ft. deep to provide against frost.

Materials Assembled Rapidly

The first task of the constructors on being ordered, July 20, 1915, to proceed with the work, was to assemble at the site the plant and the large quantities of material needed. The plant was loaded immediately at Montreal and reached the site in two days. Having kept in the closest touch with the market, the firm was in a position to place the main orders for material to good advantage at short notice. The capacity of a good-sized lumber mill at Drummondville was investigated, and its entire output was at once contracted for in small-dimension sizes. The large timber was bought at once from Montreal dealers. The entire output of a brick kiln at Mitchell Station, near the work, was bought up. Arrangements were made at

PLANT OF THE AETNA CHEMICAL COMPANY IN WILDERNESS NEAR DRUMMONDSVILLE, QUEBEC, HAS BEEN CREATED SINCE JULY 20

Drummondville for the exclusive use of its rock-crushing plant, which, when pushed to capacity, could just supply the job with aggregate, and contracts were made with the local farmers for delivering boulders to be crushed. Good sand in large quantities was found at the site.

KEY STRUCTURES ATTACKED FIRST

The detailed design of the plant and the supervision of the construction were carried out by the constructors under the guidance of the Aetna Company's engineers, with the result that the work was harmoniously planned and executed. There was little waiting by the construction forces for plans to be delivered, and all details were worked out in time to have the necessary material at the site when it was needed. Two main features were at once recognized as the keys to the rapid completion of the plant. The first was the railroad yard, which the constructors needed to get in materials and plant, and the second was the power house—a heavy piece of construction which was started at once and finished within 104 days. The grading required was in sand and was not heavy. It and the clearing had to be done immediately, and both were started July 20 with local labor, teams and scrapers. This work was practically completed by Sept. 1. As rapidly as possible a large, well built camp was constructed on the site to care for 2000 men sent up from Montreal. This was made a permanent camp for the use of the operating forces by the addition of a club house and separate cottages. Meanwhile the railroad yard was partly graded, and the entire three miles of trackage was laid and in use by Aug. 15. Two weeks later the yard had been completely graded and the tracks put in permanent shape.

DIFFICULTIES WITH WATER

As soon as possible the foundation work was started. The site was elevated, and it was not expected that water would be found in the excavation for the foundations and the numerous pipe trenches. However, water was encountered in all of this work about 2 ft. below the surface. Pumps were at once secured, and the difficulty was met with hardly the expense of a day's delay. Following the excavating crews were five gangs with portable mixers, supplied by teams, putting in concrete foundations. After them came the crews erecting the timber frames. A very limited use was made of steel in the construction. The future contents of the buildings made fireproofing somewhat superfluous, and the lighter, cheaper construction adopted is considered more economical in the long run. The buildings are spaced widely, and under these conditions are amply protected from fire.

All the buildings are linked by an industrial railway along which the materials are transported in the course of manufacture from the acid plants at one end to the finished smokeless powder at the other. A locomotive crane spotted the cars carrying the equipment of presses, tanks and other heavy apparatus and unloaded them on runways on which the machinery was moved into various buildings before the completion of the outside walls. Wagons were used for transporting all other materials on the job. Only one motor truck was employed, because road conditions were poor. This truck hauled small plant and rush supplies from the Intercolonial Railway, over which a fast express service from Montreal was available.

Mixers, pumps, hoisting equipment, etc., were independent steam units. About 100 hp. in electric current—all the local company could supply—was used for lighting, and for temporary operation of the permanent pumping station.

STRONG OVERHEAD ORGANIZATION

To secure efficiency from a maximum of 2300 men drawing wages of $45,000 weekly a strong organization was necessary. At its head the engineer in charge was responsible, with the help of the main office, for having all designs ready, all materials on hand, all work laid out and orders issued in accordance with the construction schedule. Under him the general superintendent had entire charge of the actual work of creating the plant. His force comprised not less than ten general foremen under whom in turn were foremen in charge of each of a large number of scattered crews. The classes of labor requiring general foremen were the excavating and concrete forces, with two general men; the timber-framing and erection crews, the brick layers, the men engaged in installing the machinery and the pipe fitters. In addition the construction of the yard, power plant, acid plants, and filtration plant were each treated as separate units and put in charge of a general foreman with a complete organization. This system worked well, as the units which were important time factors were in charge from start to finish of one man who was responsible for their completion to schedule, while the main force for the large number of smaller units was kept mobile so that it could be thrown where needed for the greatest economy and speed.

ACID PLANTS DELAY COMPLETION

During the construction it became evident from the growing scarcity of nitric and sulphuric acid that the Aetna Company would have to build its own acid plants. But for this the guncotton end of the plant could have been put in operation Nov. 15, sixteen weeks after the contract was signed, and smokeless powder could have been manufactured by Dec. 15, a month later. The nitric-acid plant, first decided on, was completed early this year, and the sulphuric-acid plant is now being built. The total outlay for the completed plant represents $2,500,000, of which cost the construction work comprised four-fifths. The work was carried out under the direction of the engineering and construction forces of the Aetna Explosives Company by Westinghouse, Church, Kerr & Company, whose representatives were J. H. O'Brien, managing engineer, F. E. Caldwell, engineer in charge, and John Lydon, construction superintendent.

Mentor System Used at University of Michigan

Given as One of Three Causes for Growth of the Engineering College Since the Reorganization in 1911—Details of Faculty-Advisory System

THE GROWTH of the college of engineering at the University of Michigan since its reorganization in 1911 (see diagrams in the Engineering Record Dec. 18, 1915, page 766, and Jan. 15, 1916, page 88), in view of the general downward tendency at other institutions during the same period, suggested inquiry whether any definite causes could be assigned to this apparently exceptional condition. In reply to a communication, Prof. H. E. Riggs, of the civil engineering department, states that in all probability there were three effective factors in this growth: the popularity of the group system of electives adopted in 1911, the prestige resulting from the appointment of teachers having many years of practical engineering experience, and the unusually efficient use of the mentor-and-assembly, or faculty-advisor system.

OBJECT OF MENTOR SYSTEM

By the mentor system the freshman students are divided into groups of five and a member of the faculty appointed to act as mentor, or special advisor, for each group. Each mentor has a similar group in the sophomore, the junior and the senior classes. Reports give each mentor a record of the work done by each member of his groups. The mentor does not merely advise the student with respect to his studies, but takes the place of an elder brother to whom the student may go and talk over freely any phase of college life. It is the mentor's duty to see that every man in his group gets the largest possible benefit from the time spent in college.

Every week all freshmen in the college of engineering are brought together in the freshman assembly. Here they listen to a talk by the dean, or some other speaker, and

LAST BY STRONG ORGANIZATION IN CONTROL OF THE DESIGN, THE ASSEMBLY OF MATERIALS AND THE ERECTION FORCE OF 2300 MEN have their class meeting. The sophomore, the junior and the senior assemblies, each meet four times a semester, and are regarded as invaluable not only to the mentor system, but for purposes of class organization For the upper-class assemblies special effort is made to secure practising engineers of such prominence that the students appreciate the opportunity of hearing them.

MENTOR AND STUDENT

When a student enters the college he is at once assigned a mentor, and continues with the same mentor throughout his college course. Early in the college year each mentor calls his group together not merely to allow the students to ask questions, but to get acquainted with them and to make each student in his group feel sure that his particular mentor is genuinely desirous of helping him in any way that he can.

The mentor receives his first report on the student's work about six weeks after the beginning of each semester, and if this report shows a student below passing grade in more than one subject the mentor and student talk matters over frankly. Perhaps the student should drop one subject so that he can do good work in the others. Perhaps he is doing too much outside work. In all cases the students are strongly urged to work for a "margin of safety"—to keep their grades well above the passing mark.

MENTOR AND INSTRUCTOR

The mentor and instructor are of distinct service to each other. In special cases where the mentor is in doubt, a talk with the student's instructors may give him just the information he needs. Special reports to the mentor are made to help him in bringing his man's work up to the standard.

Mentor and teacher also work together in helping to develop a feeling that in addition to the necessity of obtaining passing grades, there are to be developed qualities of heart and mind, which in after life may prove even more important than knowledge in the conduct of practical affairs. In particular, the student should understand that from the freshman to the senior year the qualities of thoroughness and dependability should mark his college work just as clearly as they should mark his work after graduation.

As each mentor is also an instructor, this continuous looking after the welfare of a group of students can not do otherwise than increase his teaching efficiency. It brings him in closer personal contact with the students and makes him understand their difficulties, the very difficulties which he as a teacher must help his own students to overcome. It is, in fact, the general opinion of those in charge of the administration of the college of engineering that the mentor system has greatly increased the teaching efficiency of the whole staff.

MENTOR AND PARENTS

In general, it will be advisable for the mentor to talk matters over with the student before writing to parents. A letter to the principal of the student's preparatory school will often bring valuable suggestions. If a student's work is not what it should be, there may be reasons for it which the parents do not understand and which the mentor may make clear so that the students may receive fairer judgment at home. Then, too, there may be reasons which the mentor does not know, but by knowing which he may help the student more intelligently.

In case a student fails to pass in so large a proportion of his studies that the committee on delinquent students puts him on the warned list, the probation list, or the home list, the mentor sees both the student and the committee. He presents to the committee anything he knows in the student's favor which might in fairness to the student and without lowering the standards of the department induce the committee to lighten or remove the discipline.

This system was inaugurated in 1911 for freshmen, and in 1914 for sophomores and juniors. It is under the personal supervision of Prof. M. E. Cooley, dean of the college of engineering. Dr. W. D. Moriarty is in charge of the freshman assembly.

Steel Skeleton of Bell Parkway Building Contains Heavy Portal Framing

Architectural Features of New Philadelphia Building Particularly Effective—Loads and Provisions for Wind Stresses Determine Design

IN ADDITION to its effective architectural treatment and its excellent layout planned to accommodate the special requirements for the heavy wire distributing frames and the switchboards on the lower floors and the suites of offices, recreation and lunch rooms and large open spaces on the upper floors, the new Parkway central office building of the Bell Telephone Company in Philadelphia contains unusual engineering details. The horizontal wind diagonal bracing in the upper floors, the heavy triple portal girders and wide main columns designed for large bending stresses due to wind, with the slotted cover plates at the connections, and the exceptionally heavy steel slabs and built girders in the column bases and foundation grillages, which contain a large percentage of the total of 4140 tons of steel in the building, are special features. The details of the foundation girders and of the reinforced-concrete struts will be treated in a later article.

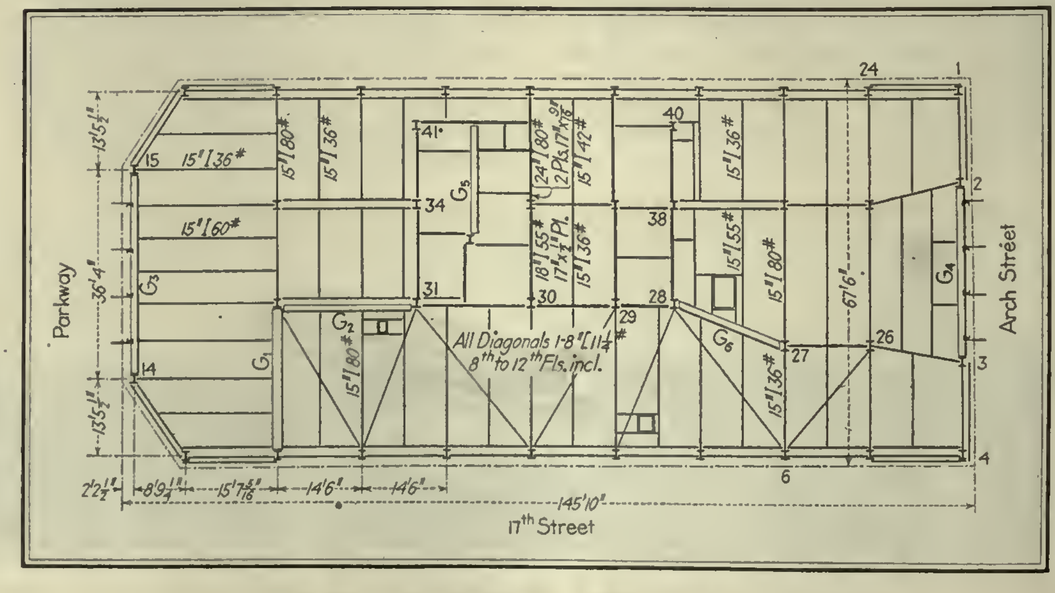
PORTAL GIRDERS AND WIDE COLUMNS AT END OF BUILDING ERECTED

GENERAL DIMENSIONS AND LAYOUT

The building is located at the intersection of Seventeenth and Arch Streets, and occupies about 68 x 146 ft. in plan, extending to the new Parkway being cut through diagonally from the City Hall to Fairmount Park. It is practically rectangular, 243 ft. high from first floor to top of roof beams. The accompanying plan view of typical upper floors shows the layout of the columns, accommodating five passenger elevator shafts grouped near the center of the building.

Adjacent to the elevators are two smokeproof towers isolated by fire-resistive walls. with stairs of reinforced concrete. Entrance to these towers through outside balconies is facilitated by a self-releasing fire-exit latch controlled by a long bar on the outside of the self-closing steel-covered doors. The building is of fire-resistive construction throughout, with metal window and door frames and wire-glass on all floors except the first.

The floor space amounts to more than 106,000 sq. ft., while the total cubical contents exceed 2,900,000 cu. ft. . The lower floors and partitions were designed to accommodate the unusual requirements for the switchboards and the wire-distribution racks. The specified floor loads per square per flows shows the layout of the columns,



TYPICAL PLAN FOR FLOORS ABOVE THE FIFTH SHOWING WIND BRACING and seventh floors, 125 lb. on the fourth to the thirteenth inclusive (except the seventh), 100 lb. on all the floors above and the elevator lobbies throughout; and 30 lb. on the penthouse roof. The floors are of 16-in. terra cotta tile arches between steel I-beams, with the bottom of the tile 3 in. below the steel and a cinder-concrete fill and cement finish above. In some floors the total thickness is 29¼ in., providing sufficient space for concealing all the necessary conduits for wiring.

WIND LOADS AND BRACING

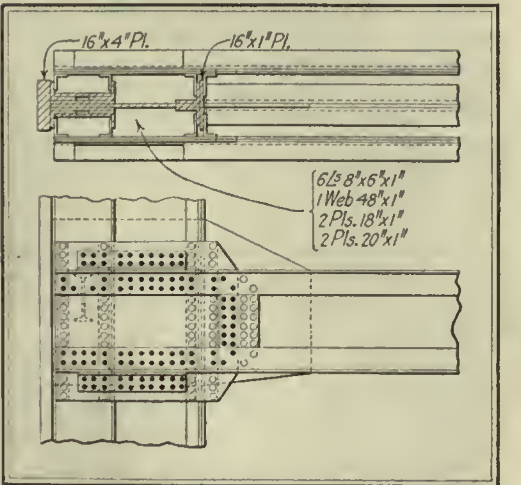
The wind loads specified by the Philadelphia building code are 25 lb. per square foot at the tenth story, with 2.5 lb. less at each succeeding lower story and 2.5 lb. additional at each succeeding upper story to a maximum of 35 lb. at the fourteenth story and above. These wind pressures were transmitted to the foundations by complete diagonal systems of vertical bracing, placed in the walls surrounding the elevator wells, between columns 28-29-30-31 to the loft floor and between columns 31-34-41 and 28-38-40 to the thirteenth floor.

The diagonal channels used in the floor, as shown on the plan, occur only from the eighth to the twelfth floors inclusive. This bracing was required to carry the wind pressures to the vertical systems. It was specified in the design of the structure that there should be no knee braces or large gussets projecting below ceilings, and that flush ceilings must be used throughout. The wind pressures above the thirteenth floor are carried down to the thirteenth floor by bending stresses in the columns of each bay, and the separate loads at each floor below the eighth are carried down to the foundation in like manner.

PORTAL CONNECTIONS AT FOURTH FLOOR

At both ends of the building the architectural requirements made it impossible to use any intermediate spandrel beams or bracing between the first and the fourth floors. To transfer the heavy wind pressures (on 26 lin. ft.) to the foundation required heavy triple portal girders at the fourth-floor level, combined with wide columns of special section shown in the accompanying drawing of a typical connection between the triple girder and column 14 in the rear of the building.

The connection of the interior girder is made by a heavy 1-in. gusset plate milled to bear on the main web plates of the columns, and passing through slotted holes in the 16-in, cover plates, as seen. An unusually heavy outside cover plate (16 x 4 in.) is used. An accompanying photograph shows the columns 14 and 15 with the portal girder during erection.



CONNECTION OF TRIPLE GIRDER TO COLUMN 14 AT FOURTH FLOOR

COLUMN DESIGN AND GENERAL FINISH

The steel columns, of built-up I-sections, are fireproofed throughout by reinforced concrete, although no part of the latter is considered to carry load. In determining the allowable unit stresses in the columns, however, the radius of gyration was computed for a rectangle whose least side corresponds to the outside dimension of the concrete. The columns are supported on heavy steel slabs, the largest of which (for column 15) is 36 x 11½ in. and 6 ft. long, resting on three girders 6 ft. deep extending below columns 33 and 15, and resting in turn on grillage beams.

The finish of the building is granite, limestone, brick and terra cotta, the largest piece of granite, under the main Arch Street windows, weighing 11 tons. The ornamental Corinthian columns at the front and rear extend to the fourth floor and are finished with 6-ton carved stone caps. The banded effects in the main walls above result from buff-colored and light brown bricks, with terra cotta panels. The terra cotta finish of the upper stories is light gray, designed to correspond with the limestone trimmings below, using an Ionic colonnade extending for two stories, capped by the heavy main cornice and frieze.

EFFECTIVE ARCHITECTURAL TREATMENT

In accordance with the policy of the Bell Company, an attractive sun parlor for the employees is provided on the roof just west of the penthouse.

The building was designed under the direction of Nathan Hayward, engineer, J. L. Kilpatrick and C. Reutlinger successively holding the position of engineer of buildings and equipment, and T. L. Griest, assistant engineer, of the Bell Telephone Company. The architect was J. T. Windrim, Philadelphia, whose structural engineer was F. N. Kneas. The total cost, including office equipment and furnishings, exceeded $2,000,000. The construction was completed in about fourteen months by Cramp & Company, of Philadelphia.

SEARCHLIGHTS AND INDIRECT LIGHTING SYSTEM ILLUMINATE BUILDING AT NIGHT

Operation of Columbus Sewage Plant Hindered by Construction

The total suspended matter removed from the sewage coming to the treatment works at Columbus, Ohio, averaged only 46 per cent during 1915, because of interference due to the reconstruction of the septic tanks into Imhoff tanks, and to the fact that much larger volumes were treated than ever before. The detention period was necessarily shortened, the average being 3.2 hr., according to the annual report of C. B. Hoover, chemist in charge. Greater volumes of poorly clarified liquor were applied to the sprinkling filters. Much trouble was experienced in the clogging of the nozzles and in passing the material. It was necessary at times to remove some of the nozzles in order to increase the capacity of the filters. These factors combined to reduce the efficiency of the sprinkling treatment. Toward the close of the year a modification of the type of nozzle was worked out and given a trial. With the original it was impossible to remove balls of fat, or other particles, which were too large to pass the orifice except by removing the entire nozzle. This operation was usually very difficult because of rusted threads and the frequent removal contributed to serious thread stripping. The modification of the method of attachment is such that rust and stripped threads are eliminated and nozzle detachment and replacement can be done easily and quickly.

Letters to the Editor

Comment on matters of interest to engineers and contractors will be welcomed

Intermittent Diversion Would Save Waste at Niagara Falls

SIR: I was very much interested in reading your excellent editorial, "The Waste at Niagara," appearing on page 631 of the issue of May 13. During my last visit to Niagara Falls, in November, I had occasion to study the industrial conditions there and was surprised to find that one of the large companies had already arranged to start up a plant in Norway, for the manufacture of its products, because it was found possible to obtain power at rates much lower and in larger quantities than could be obtained at Niagara Falls. Others were seriously considering similar steps.

In my paper before the Second Pan-American Scientific Congress at Washington, on Dec. 29, 1915, I emphasized the very matters to which you call attention in your editorial. Every effort should be made to bring this serious condition to the attention of the entire public, as it is a most important element of Preparedness in this country. Dr. Thomas H. Norton of the Department of Commerce has consulted me on several occasions during the past year, and I suggested to him several methods by which an increase in the output of power from Niagara Falls could be obtained without the destruction of the scenic attractiveness of the Falls. Some of these are recommended in the latter part of my paper.

One of these methods contemplates the construction of a low diversion dam extending out from the upper end of Goat Island to the international boundary line. This would permit of the diversion to the American Falls of a considerable amount of water which now flows over the Canadian Horseshoe Falls. This would be an equitable diversion, particularly when it is considered that 60 per cent of the total watershed feeding the Niagara River is on American soil, while less than 5 per cent of the total discharge passes over the American Falls.

A dam might be constructed across the Niagara River about ¾ mile above Goat Island without causing any detrimental effects upon the present power houses. By a system of regulation the diversion of water from the river might be limited to certain periods, as for example, at night when their view is less attractive to visitors than during the daytime. The spectacle of the regeneration of the Falls when the diversion of the water is stopped at a certain hour in the morning would be an unique attraction. Such diversion might be limited to every day except Saturday, Sunday or holidays. Such a plan of intermittent diversion would be particularly feasible and practicable in its application to refrigerating and cold-storage industries, where the brine at extremely low temperatures obtained during the operation of the turbines at night would be of sufficient effectiveness to be used for circulation during the rest of the day, when the flow of water over the Falls is not diverted.

A committee of the New York State Legislature has recently been appointed to consider the question of further diversion of water from the Niagara River. I thoroughly agree with you that all of the engineering societies should consider this a matter of sufficient importance to the entire country to take the matter up actively with the various legislative bodies.

MAURICE DEUTSCH,
Consulting Engineer.
New York.

High Stresses in Flat Slabs

SIR: Your editorial in the issue of May 13, page 630, on the test of the Bell Street warehouse in Seattle, is most timely. There is feverish anxiety and haste among patent owners and licensees to set up a standard for the design of flat slabs that will allow the "skinniest" thing that it is possible to put over on the engineering profession. An example was published the same week you published the account of the Seattle test. Strangely enough, the Seattle building fits that standard exactly. I refer to the ruling of John A. Ferguson applied when he was engineer for the Bureau of Building Inspection of Pittsburgh, and which he hopes will be adopted in this city's new code. It touches the lowest mark of all the standards yet proposed.

So Pittsburgh may have some more buildings that are apt to have 44,000 lb. per square inch in the steel and 2930 lb. per square inch in the concrete under a trifle more than the "safe" load, or worse than this if the owner is so unreasonable as to put the "safe" load on the outside bays without balancing it by load on the interior panels. One of these buildings I checked and condemned. It was built over my protest.

It takes many years sometimes for one to see vindication of plain truth; but sometimes it comes more quickly!

It is significant to point out that the Pittsburgh building code makes it mandatory on designers of systems other than the beam-and-slab type to present evidence of tests to destruction, or to make tests that will show a factor of safety of four. It would seem to be mandatory on the Bureau of Building Inspection to require such tests. No such tests were ever made on a typical flat-slab floor. In fact this Seattle test is the first disinterested test on a flat-slab floor of which I have any knowledge. Generally the tests are very carefully guarded and made on particularly strong spots, such as the first or second floor, where the columns are enormous in size, or if on exterior panels, only on those where there is a deep girder in the wall.

It is instructive to compare Mr. Ferguson's ruling with the requirements for beam-and-slab design in the Pittsburgh building code. For the positive moment Mr. Ferguson gives 0.0625 *W L* in a square surrounding the column head. Half of the rods cut are at 45 deg. and therefore good for seven-tenths of their area; total 85 per cent or 0.0531 *W L*.

The code requires that ordinary beams and slabs be designed for 0.083 *W L*. In the square surrounding a column head the girder would be cut twice and the slab would be cut twice, making the total moment-resisting value in the selection 4 × 0.083 *W L* or 0.333 *W L*. The beam-and-slab design must thus be more than six times as strong as the flat-slab design, in the matter of steel reinforcement. Tension in the concrete has to do the rest.

Of course, if people want this let them have it. But they have a right to know that it means failure—possibly some tremendous disasters.

Pittsburgh. EDWARD GODFREY.

High Velocity in Large Hydraulic Dredges

SIR: In the Engineering Record of April 15, 1916, page 517, appears a description of the dredges Cyclone and Tornado, belonging to the Canadian Stewart Company, Ltd., and in use in Toronto harbor. These dredges have shown very large outputs, and in the article referred to much of the credit for this result is assigned to the high velocity maintained in the pipe line. Some of the principal features enumerated are given in Table 1.

TABLE 1—FEATURES OF TORONTO DREDGES

Diameter of discharge pipe	24 in.
Velocity in discharge pipe	15 to 18 ft.
Discharge pressure, 85 lb	196 ft.
Suction head, 22 to 25 in. of mercury, or	25 to 28 ft.
Power of main pumping engine, i.hp	1750
Speed of main pumping engine, r.p.m	210 to 225
Diameter of impeller of main pump	100 in.
Weight of impeller of main pump	5 tons
Weight of main pump	45 tons
Diameter of solids that can pass the pump (by inference)	12 in.

Improvements in dredges should be accomplished by copying the good features of existing machines and by correcting the bad features. In what follows an effort will be made to show that the hydraulic features of the dredges in question are far from perfect.

An examination of such dredging data as the undersigned has been able to find (see *Professional Memoirs*, March-April, 1915), has led to the conclusion that a velocity of 10 ft. per second in a 20-in. pipe line will be sufficient to deliver fully 500 cu. yd. per hour of sand. The same velocity will deliver occasional boulders of the largest size that can pass the pump. The sea-going dredges operating in New York harbor have picked up steel projectiles weighing 60 lb. and delivered them to the bins through a 20-in. pipe in which the velocity did not in all probability exceed 11 ft. per second. For pipes 6 in. in diameter or less sand mixtures will flow well with velocities of 5 ft. per sec. (American Civil Engineers Pocket Book, page 935, 1912 edition.) As the diameter of the pipe is increased the velocities must be increased. The barge tests on the Mississippi River dredges indicate that a high percentage of sand can be delivered through pipe lines from 30 to 34 in. in diameter, with velocities not exceeding 12 ft. per sec.

To maintain a high velocity in a small pipe involves heavy frictional losses, the use of high pressures and an excessive expenditure of power. The figures in Table 2 for dredge pipes will illustrate:

The outputs corresponding to a 16-ft. velocity in a 24-in. pipe and a 14-ft. velocity in a 27-in. pipe are 50 and 56 sec.-ft. respectively. There can be little doubt that a 14-ft. velocity in a 27-in. pipe line is ample. Based on a length of 4000 ft., we should, by using a 27-in. line, accomplish a

TABLE 2—VELOCITIES, LOSSES OF HEAD AND POWER CONSUMPTION FOR PIPES OF VARIOUS SIZES

Diameter of pipe	20-in.			24-in.			27-in.		
Velocity, ft. per sec....	12	14	16	12	14	16	12	14	16
Loss of head per 1000 ft.	37	47	57	31	40	48	29	36	43
Power consumption per 1000 ft.....	120	160	230	140	200	280	160	220	320

saving of 240 water-hp., as compared with a 16-ft. velocity in a 24-in. pipe. At the same time the head against which the pump must work would be reduced by 48 ft., which will greatly simplify the problem of pump design and maintenance.

No data in regard to the combined efficiency of the pump and engine are given, but the statements in regard to power, pipeline velocity and operating head would indicate a combined efficiency far in excess of any published results known to the writer for comparable conditions.

The writer has been surprised to note the tendency during the past few years toward higher power in the pipe lines without an increase in diameter. On the Cyclone and Tornado we have 1750 hp. with a 24-in. discharge pipe. Several years ago the Atlantic, Gulf & Pacific Company, as a result of actual experience, converted a 24-in. dredge into a 27-in. dredge in spite of the fact that the main pumping engine developed only about 1000 ihp.

High velocities in the pipe line resulted in excessive expenditures of power and in excessively high operating heads. The latter necessitate high peripheral speeds and increase the wear on the pump. For slow-speed pumps designed to pass large solids, high heads generally result in lowered pump efficiencies.

The writer is also an advocate of pumps of higher speed than those in use on the Cyclone and Tornado. The 45 tons of steel in the pumps described is costly when first purchased, is costly when it must be moved to take down the pump, and it takes a costly engine to drive it.

E. J. DENT,
Major, Corps of Engineers, U. S. Army.
Little Rock, Ark.

[This letter was referred to Charles F. Franson, vice-president of the contracting firm which designed and is using the dredges. His reply is given below.—EDITOR.]

SIR: I acknowledge receipt of your letter, together with the comments of Major Dent on the general description of the dredges Cyclone and Tornado, which appeared in your issue of April 15, 1916.

Twenty-four-inch high-power dredges were decided upon after consideration of all the probable conditions under which these dredges would have to work in the execution of this contract. Many other conditions besides the hydraulic feature had to be taken into account, such as the character of the material to be dredged; the distance of discharge, which would vary from about 2500 ft. to a possible 7500 ft.; the question of how often booster pumps could be used to advantage on the long pipe lines, which would depend on how frequently the pipe lines would have to be changed in length and location; and also first cost of the pumps, boosters and pipe lines, as well as the handling and replacing of same when worn out. This latter item is quite important, for about 25,000 lin. ft. of pipe line had to be provided for the original installation.

The figures given in the article referred to are maximum results obtained, and do not represent the average running conditions.

The weight of the pump includes the pump unit complete with impeller, shaft, main bearings and supports, and does not represent the weight of the renewable parts only.

CHARLES F. FRANSON,
Vice-President, Canadian Stewart Company, Ltd.
New York City.

Several Kinds of Depreciation in Two Small Tanks

SIR: The accompanying photograph shows twin reservoirs located on Fortification Hill in North Chattanooga. One of these was erected in 1911 at a cost to the company of $840. At present it would cost $1,500 to duplicate it. It has therefore appreciated $660.

In 1912 the other was built, as the first had outgrown its usefulness or was inadequate for the required service. The joint capacity of the two tanks is 94,200 gal., and the reproduction cost of identical structures is $3,000, whereas a single tank of equal capacity could be built for $2,600. Hence there has been a depreciation for inadequacy of $400.

WHAT IS PRESENT WORTH OF THESE TANKS?

These tanks have now been in service, say, five years, and if the metal has depreciated physically from decrepitude 2.1 per cent per year, the present worth is $2,685, showing a depreciation of $315.

Moreover, if the company was called upon to build them anew, it is more than probable that for the shorter lived steel tanks, a concrete-lined reservoir would be substituted. This indicates a depreciation from obsolescence, not to be determined exactly without additional factors.

This is merely an illustration of some of the elements and complexities of depreciation.

JAMES NISBET HAZLEHURST,
Consulting Engineer.
Chattanooga, Tenn.

Present-Day College Education

SIR: The subject of college education, to which Professors Mead and Swain have so ably contributed in the Engineering Record of May 16, page 607, is one of fascinating interest and great practical importance. Almost any observer will agree, at least in modified form, with the tenets expressed by both of the contributors. This is due to the fact that their discussions relate to tendencies and not to measurable qualities. It is largely on this account that Professor Swain, in his later communication, is able to show apparent unanimity on almost every count of his original indictment. But as a matter of fact their viewpoints are entirely different, the one is attacking college education for the harm it does—the other, while not denying altogether the harm, is defending it for the good. Neither viewpoint alone is tenable; both must be considered.

It is the belief of the writer that the good influences of college education can be enhanced and the bad lessened by vocational selection and individual training; that is, training in small groups of uniform mental capacity. The instructor's duty will not end with the mere covering of his subject in a uniform fashion before a heterogeneous assemblage of students; but rather the students will be assigned to courses suited to their natural aptitudes, and carefully graded into classes according to their mental capacities.

This method of education will throw large responsibilities on the educators in thus standing sponsors for the selection of a man's vocation, but it is a responsibility they must measure up to if they are to realize their highest potentialities and contribute to the elimination of the great number of misfits in life that trace their failure to their college walls. The remedy proposed is dynamic, and if men are thus classified and placed in an environment in harmony with their natural aptitudes, if curricula are made more elastic, degrees less formal and more vital, the writer believes the ill effects of college education will largely disappear and the good effects will be realized in the greatest possible measure.

HENRY B. SMITH.
Chattanooga, Tenn.

Architect vs. Engineer, and a Sound View on Licensing

SIR: The writer has frequently read with interest the discussions arising between architects and engineers regarding the restrictions and scope of their respective professions. It appears that the architects feel that the engineering profession is encroaching upon their province in the designing or erection of certain types of buildings, and on the other hand the engineers feel the same way, to some extent, when architects design and superintend the installation of mechanical equipment and other features considered as belonging to some branch of engineering.

Some writers on the subject take the stand that architecture, from its very name, embraces all the features of building from the design of the shell and room arrangement to the final completion of the entire equipment. Others appear to hold that architecture in its modern sense covers only the æsthetical appearance, the harmony of detail or, in other words, the form and symmetry of the structure as it appeals to the eye, leaving to the engineer the design and installation of the mechanical equipment together with the calculations involving certain details of mechanical strength and the means of securing the results aimed at by the architect.

There is no doubt that in the past when the building shell was in itself the chief consideration the architect did cover every field pertaining to the design and completion of a building in all details. So also did engineering once cover all the branches of mechanical art. However, so rapidly did the profession of engineering grow and broaden that specialization grew up and the calling was divided into many correlated branches until at present we have engineering in many forms. This is a direct outgrowth of the fact that no one man can master the multitudinous details of the science in its broad or general sense.

The architect, however, in many instances, appears to attempt the design of all features of construction entering into a building structure in spite of the fact that this also has improved and broadened until it covers many branches really belonging to engineering. In fact, the mechanical details of a modern structure require more labor and painstaking calculation than the shell of the building.

The writer has attempted many times to secure or complete contracts on the engineering features as designed by the architect, who, as a usual thing, also furnishes the specifications, and in practically every case has had trouble of some kind. This is to be expected when we remember that no architect, however broad-minded and experienced, can keep abreast of the progress in several branches of engineering and at the same time give due attention to the artistry and æsthetic appeal of his building on both exterior and interior. The usual specifications as formulated by the architect on heating, ventilation, electric lighting, power equipment, water supply, vacuum cleaning, elevators and such features, are very incomplete, loosely worded and altogether inadequate. Such specifications court disaster by giving the unscrupulous contractor an opening to slight material and workmanship and by preventing the careful and conscientious contractor from bidding as low as he might for fear of extra demands from time to time. Of course, this criticism does not apply to the larger architectural firms who restrict themselves to the structural features and employ engineers to prepare the plans and specifications covering the work in their respective engineering lines.

In view of these facts it would seem advisable for more of the architects to follow in the lead of those mentioned and devote themselves exclusively to the exterior and interior structural features pertaining to the building shell and to the artistic effect, general convenience and harmony only of the engineering details, leaving the questions of mechanical and electrical equipment to men more conversant with this branch of knowledge.

No doubt under such conditions the word architecture would come to have a slightly different meaning from that which now obtains, but such is the case with many words which change in meaning with the growth of our language.

With reference to the licensing of architects and engineers it appears to the writer that this is putting the cart before the horse. Assuming that legislative supervision of this class of work is desirable, why not examine the concrete result of an architect or engineer's work rather than the man himself; that is, his plans and specifications for a given structure? It is possible for a man able to pass the required examination to make a serious error in his plan and thereby endanger life. It is also possible for one to design a building perfectly safe and suitable for the ends in view and yet be unable to pass the licensing board.

Why not have boards of engineering and architectural approval under legislative control and require all plans and specifications to be examined and approved by this board, especially in regard to those features which have a bearing on the life and safety of humanity, and without consideration of the designer. It is the proposed work and not the builder which may prove unsafe. Then, if the engineer is able to make adequate building plans, or the architect to draw engineering specifications, it is the same to the examining board and a safe structure is assured. The building, and not the man, should conform to recognized principles.

D. R. Shearer,
Consulting Engineer.

Boone, N. C.

Investment of Savings for Engineers

Sir: Seldom has a paper and an accompanying editorial comment been followed by such a flood of interesting letters to the editor as have the paper and your editorial suggestions on the causes for the decrease in registration of civil-engineering students.

Throughout this discussion there is evident an undercurrent of thought to the effect that civil engineers are overworked and underpaid, and especially underpaid. Would your correspondents have us believe that no engineering assistants are underworked and overpaid, and especially overpaid? Undoubtedly there are a few such! But the conscientious engineering employee, especially if he is technically trained and likes his work, will certainly earn more for his employer if he does get more than a living salary.

If a young engineer is true to his profession his mind will crave to know something about what other engineers are doing, and learning, and writing about. The craving for this knowledge is not satiated without the outlay of some funds, whether this be for current technical literature, for the latest books in his particular field, or for membership fees and incidental dues in technical societies and engineering clubs. The engineering quack, more indifferent than indigent, has few such wants, is satisfied with the lighter amusements, has no college debts to pay, and can afford to work for less money than the man who has spent a small fortune in laying a proper foundation for acquiring intelligent proficiency in his chosen profession.

A summary of the information to date does not seem to support the premise or justify the fear that the supply of civil engineers may soon be insufficient for the demand, although it might be well if this were the fact, not only for those who are struggling along in part-time employment, but for those who have been forced out of a profession for which they had spent time and money in thorough preparation even to the extent of taking full collegiate and, not infrequently, graduate courses. Whatever affects the supply of men will eventually affect their average salary, and what affects the salary will in turn affect the capacity for permanent investment of savings from salary.

The appalling statistics on poverty and pauperism should compel the conscientious, continuous and persistent practice of economic thrift on the part of every man in good health who is intelligent enough to have become an engineer. Successful financiers tell us that every man should save something out of his salary "for a rainy day," no matter what that salary is, and engineers as the conservators of Nature's resources certainly ought not to lag behind the average citizen in this respect. But how many know how to invest their savings funds? Only within the last few weeks again have I listened to an engineer relate his personal experience with investment of his savings, and how he had lost $500 in unwise investment. This is by no means an uncommon experience.

We hear a good deal these days about the efficiency of co-operation—co-operation between engineering societies and other world organizations, inter-society co-operation and co-operation between individuals of the same society. Except for the humanizing efforts of some of the larger corporations, we hear little about any propaganda of the engineering employer looking towards the economic independence of the employee. This is not always decided by the size of his salary check, but rather by the ability to save something out of his salary check and to invest this amount wisely. Right at this juncture the benefit of the employer's experience might be worth more than a 50-per cent increase in salary. But the employee is not going to ask his employer's advice, nor will the average employer volunteer any expert information on investments. The result is that the employee rests on his own resources, but, for lack of experience or proper counsel, becomes the sorry victim of merciless exploitation of the salesman who has graduated in the art of selling things that we ought not to buy. We spend four to six years at college learning mathematics, languages, and the fundamentals of engineering science; we put theory into practice that we may acquire familiarity, thoroughness, speed and accuracy; we do this to become efficient, responsible and resourceful employees; but we have little opportunity for learning how to conserve the estate of "Number One."

By reason of its unique position in the field of technical literature, I believe that the Engineering Record can do its younger readers no greater service than to open its columns for occasional discussions on suitable investments for small savings. Indeed, if such a department were made a regular feature I believe it would not only be a justifiable diversion from its purely technical features but would meet with instant approval and might be the means of saving many inexperienced investors from financial embarrassment.

Chicago, Ill. John Berg.

[Comment on several phases of this letter will be found in the editorial pages of this issue.—Editor.]

Model Shows Process of Cement Manufacture

In connection with its educational exhibition work the division of mineral technology of the National Museum at Washington has completed a model of a Portland cement plant. This is a miniature of a real plant and covers 80 sq. ft., its design and layout being such as to enable the visitor to follow successively the various steps of the process.

HINTS FOR THE CONTRACTOR

Details Which Save Time and Labor on Construction Work

Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

[*Contributions to this section are solicited, and if found available will be paid for. They must be* SHORT, *and should be accompanied, if possible, by photographs or sketches.*—EDITOR.]

Pipe Handle Makes Air Bucker Easy to Use Inside Chord Members

By A. M. TRUESDELL
Gary, Ind.

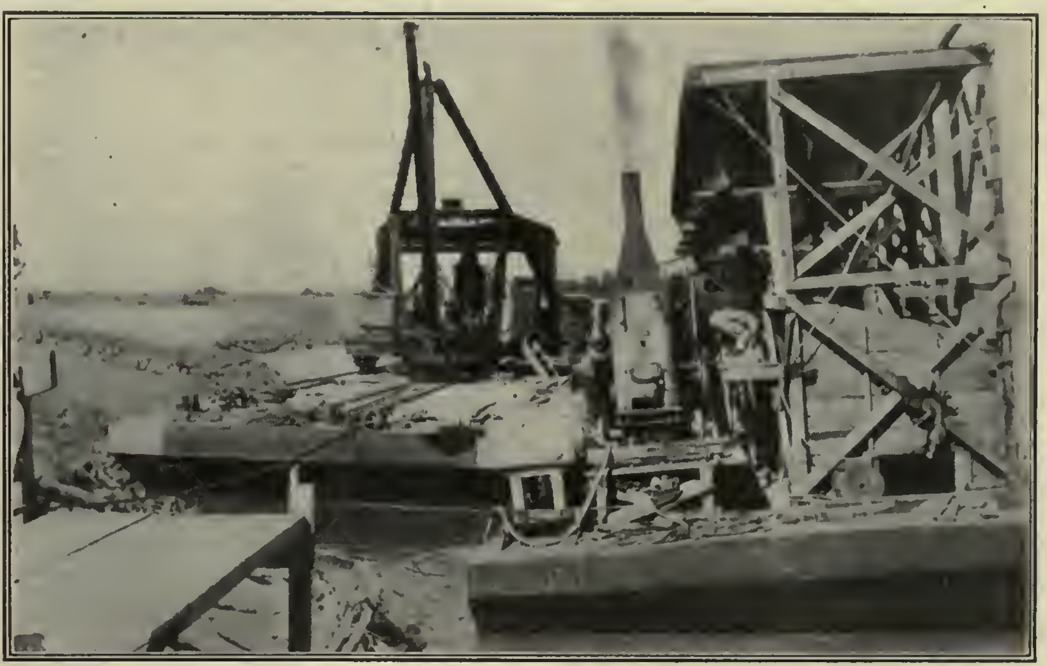
THE OREGON Short Line had in use in some recent bridge erection a number of air dollies for bucking up rivets which were very handy in accessible places, but could not be used in the hips of bridges and similar riveting. These tools, which were made by the Chicago Pneumatic Tool Company, have a straight cylinder and piston, with the hose coming in on the side. One of the men suggested screwing a pipe about 3 ft. long into the dolly and attaching the hose and valve to the pipe. This furnished a long handle so that the dolly could be reached way in between gusset plates where it could not otherwise be used. Besides increasing the speed of the riveting, this enabled the bucker-up to sit up instead of lying down to hold the dolly. Working in this position is much easier, and makes it possible for the man handling the dolly to keep scale out of his eyes.

Battery of Bins and Traveling Mixer Save Extra Derrick Barge

By A. J. RIFE
Junior Engineer, Corps of Engineers,
U. S. Army

USING only one derrick barge to feed the bins and place the concrete, Mississippi River concrete revetment work near Vicksburg is being placed by the War Department engineers from long decked barges on which are located five 30-yd. aggregate bins feeding a mounted mixer which in turn discharges into buckets on cars running on a track parallel to the mixer track. The barge is 120 ft. long, 30 ft. wide and 6 ft. deep, and the bins are arranged on one side so that plenty of room is left for a ¾-yd. Foote mixer to operate back and forth and still leave room for moving ¾-yd. Steubner bottom dump buckets carried from end to end of the barge on two small cars. The bins are so elevated that the sand and gravel are discharged by gravity into the mixer hopper. The mixer track is raised 3½ ft. above the barge deck to permit dumping the concrete directly into the buckets. The bucket is then pushed along the track until it is within reach of a 70-ft. boom derrick mounted on a second barge alongside the first and placed between the concrete plant and the bank.

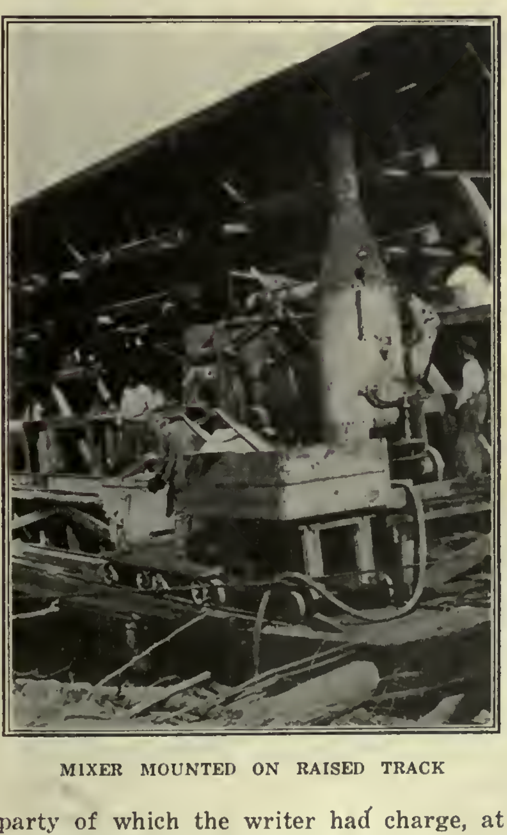
Sand and gravel are delivered by barge and the bins filled by the derrick operating a ¾-yd. clam shell bucket. The bins will hold enough for a day's work, and from 50 to 60 tons of cement is stored in small houses built underneath each of the bins in a convenient position for feeding into the mixer when it is placed opposite the bin in question.



DERRICK, BUCKET CAR AND MIXER TRAVEL THE LENGTH OF THE BARGES

As the derrick is mounted on a track and has a travel of 70 ft. from one end of the barge to the other, 70 ft. of bank paving is laid before it is necessary to drop the plant downstream to a new position. The gravel barge is placed just ahead of the derrick barge when unloading the latter.

During the 1915 season 1375 cu. yd. of concrete was placed on the slope by the party of which the writer had charge, at an average field cost of $2 per cubic yard. From 80 to 100 cu. yd. was placed in 10 hr. A delay of about 4 hr. to refill the bins was necessary after each 10-hr. run.



MIXER MOUNTED ON RAISED TRACK

No form work of any consequence was necessary on the slope. The concrete was dressed to the required thickness of 4 in. with hoes and shovels. The concrete is placed on a slope of about 3 horizontal to 1 vertical, and is tamped with one-man tampers in order to make a compact mass and smooth surface. The concrete is mixed in the proportions of 1 part cement to 10 parts of river-run gravel in which the proportions of sand to gravel approximate 1 to 2. The cost of the gravel is 36 cents per yard and of the cement $1.18 per barrel, both delivered.

The plant was designed and is being operated under the direction of Major J. R. Slattery, Corps of Engineers, U. S. Army, in charge of the Third Mississippi River District.

Accounting for the Contractor—Taking Care of Invoices

By BENJAMIN L. LATHROP
Lathrop, Shea & Henwood Company,
Scranton, Pa.

PROVIDING instructions on the order blank, which was described on page 685 of the Engineering Record last week, have been followed by the shipper, the field office will receive two copies of the invoice. The foreman, timekeeper or office agent, depending on the size of contract, who receives these invoices should verify deliveries, be responsible for checking up goods invoiced, prove extensions and additions, and note the distribution of the charges represented by the invoice. He should be provided with a rubber stamp, or a gummed flap to attach to each invoice, similar to the form shown herewith. Both original and duplicate invoices should carry this form, which enables the agent to

Job........................
Approved by..............
Excavation.......$
Foundation.......
Sheeting..........
Superstructure....
Repairs...........
Office............
....
....
....
....
Total...........$
Forwarded to General Office
..............191..

.............................191...

Messrs. Arnold Brown & Co.,
Brockton, Ore.
Gentlemen:—
Enclosed please find the following invoices chargeable to Contract........

Date	Invoice of		

.......................Agent

FORM ACCOMPANIES INVOICES TO MAIN OFFICE

make a systematic, compace distribution of the items. Aside from the information thus conveyed to the general office, the agent will find these distributions valuable in making up his cost sheets, which will be described in a later article under field office accounting.

While a simple letter of advice may accompany the invoices forwarded to the general office, it is better to use for that purpose the form illustrated herewith.

Probably more time and energy is wasted in the main office of some companies over the simple matter of entering invoices than over any other detail. The writer knows one contractor who used to compel his bookkeeper to copy every invoice into a "bill book." Others insist on having every invoice pasted into a book for future reference. Both of these methods are antiquated and very wasteful of time, space and effort. After the bills are thus disposed of an elaborate system of numbering and indexing is necessary if the information is to be made at all accessible. Invoices can be much better taken care of by using the form shown herewith.

Suppose, for example, half a dozen bills from one company for supplies furnished to several jobs are on hand at once. By using this form they may all be covered in one entry. Pin or clip the invoices to the form, fold on the dotted line and carry the totals of the distribution to the outside of the folder, which is also shown herewith. When folded this form is just the right size for a vertical document file, if printed on an 8½ x 9-in. sheet.

The whole batch of bills is now ready for entry in the journal, or the journal may be dispensed with and the items posted direct to the ledger. In the latter case substitute for the words "journal page" on the outside of the last form the words "posting number." The folders themselves, with the invoices inside, should be filed in alphabetical order.

[This is the second of a series of short articles on up-to-date accounting methods for the contractor. Others will appear in succeeding issues.—EDITOR.]

—8½″—

ARNOLD BROWN & CO.

Date 1915		Invoice		Distribution					
				Leeds	Corfu	Br. No. 4	N. H. Arch	St. Road	General
12	1	7 50		6 00	1 50				
12	7	10 00			4 00		6 00		
12	9	4 00			1 00			3 00	
12	12	12 00		12 00					
12	15	40 00				40 00			
12	28	36 00					18 00		18 00
Totals		109 50		18 00	6 50	40 00	24 00	3 00	18 00

—9″—

FORM FOR LISTING AND DISTRIBUTING INVOICES SIMPLIFIES ENTRIES ON THE BOOKS

ARNOLD BROWN & CO.
To Calvin & Co., Dr.
Month............Dec...................1915
Journal Page......

Distribution	
Leeds...........................	18 00
Corfu...........................	6 50
Bridge No. 4....................	40 00
North Hill Arch.................	24 00
State Road......................	3 00
General Expense.................	18 00
Total...........................	109 50

REVERSE OF FORM FOR GROUPING INVOICES

Pumps Handle Hardpan Broken Up With High-Pressure Jet

By K. D. MacLEAN
Seattle, Wash.

CENTRIFUGAL pumps were used to excavate the north side piers for the bridge over Lake Washington Canal at Fifteenth Avenue, N. W., Seattle, after breaking up the hardpan of which the excavation consisted and washing it to the pump suctions with a jet under 250 lb. pressure. The work of driving sheet piles through this hardpan with a high-pressure water jet was described on page 686 of the Engineering Record for May 20, 1916.

After the sheeting was driven, an 8-in. and a 10-in. centrifugal sand pump was used to excavate each pit. One was placed above high tide, to be used only in case the lower one was drowned. Both pumps were driven from the same 75-hp. motor placed on the timbers above high tide. A high-pressure fire hose, unwrapped so as to give greater flexibility, was connected with the pressure pump used to jet the piles into place. This hose was fitted with a ¾-in. round nozzle, and a pressure of about 250 lb. was used to dig up the bottom and wash the dirt to the sump. A couple of men with picks helped this process at times. The dirt was discharged by the pumps into the puddle wall around the inside cofferdams. A sluice box at low tide elevation, fitted with a gate, furnished the water needed by the pumps to raise this material.

Testing Hemlock Timber for Strength

Many joists and large stringers of hemlock are being tested in the U. S. Forest Products Laboratory at Madison, to furnish a basis for recommending proper fiber stresses. This is in line with the technical investigation of relative strength preliminary to the formulation of the density rules for Southern pine. The laboratory is also working on similar tests for Douglas fir.

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

New York Engineers Will Be Reviewed by General Wood

Naval Consulting Board and Military Lectures Committee Also to See Battalion of 500 Formed from Men Attending Lecture Course, and Trained by Officers of New York National Guard

Since the organization of the military engineering lectures for the benefit of engineers residing in New York City, under the direction of a committee including the presidents and secretaries of the national engineering societies, a battalion of 500 men has been formed from those who attended the lecture course which has been receiving regular instruction twice a week in infantry drill. This battalion will be reviewed on Thursday evening, June 1, at 8.30 p. m. by Major-General Wood, commanding the eastern department, U. S. Army, and by the Military Engineering Lectures Committee. Guests at the review will include the Naval Consulting Board, high officers of the U. S. Army and of the New York National Guard, and several city officials. Captain Walter A. De Lamater, company K, Seventy-first Regiment, New York National Guard, will command the battalion for the review.

The progress of the battalion in learning the infantry drill, which has been in charge of Captain George Perrine of the Seventy-first Infantry, New York National Guard, and Captain R. S. Thomas, of the twenty-second Engineers, New York National Guard, is said to have excited favorable comment from military men who witnessed the citizens' preparedness parade on May 13, in which the battalion followed the Naval Consulting Board at the head of the engineers' division.

The membership of the battalion is indicative of the interest in this movement which has been taken by New York engineers. It includes not only a number of young men who could be made available for active field service, but also many civil, mining, electrical and mechanical engineers of national reputation, who are anxious not only to lend their support to the movement, but to increase their personal usefulness in case they should have an opportunity to render patriotic service in an emergency.

More than half of the membership of the organization will attend the military training camp at Plattsburg and, as the officers who have been giving their time to the battalion will be unusually busy this summer with the encampments and work of their own organizations, the battalion will not resume training as an organization until fall. Many members unable to go to Plattsburg will continue training under the direction of U. S. Army officers at Fort Totten, L. I. The executive organization formed to relieve the Military Engineering Lectures Committee of the work of providing instruction, rifle practice and outdoor drills for the battalion, which was noted on page 560 of the Engineering Record for April 22, will continue in office. Tickets of admission to the review on June 1 are being distributed from the office of the secretary of this committee, C. R. Hulsart, 250 West Fifty-fourth Street, New York City.

The Committee on Military Engineering Lectures which was organized in New York City last January, at a meeting Monday, effected a permanent organization under the name of the Military Engineering Committee of New York, and expects to resume next fall on more definite lines the military education of engineers. The following names have been added to the committee: Clemens Herschel, E. W. Van C. Lucas, Kingsley L. Martin, Ralph D. Mershon, D. L. Turner and Pope Yeatman.

The executive committee of the former organization—Gano Dunn, chairman; D. S. Jacobus, John W. Lieb, Charles F. Rand and J. Waldo Smith—was continued, and an additional committee on plan and scope was appointed, consisting of Charles F. Rand, chairman; Gano Dunn, Arthur S. Dwight and J. S. Langthorn. The latter committee will study in consultation with the army officers the question of further work, particularly with reference to fitting engineers for qualification in the new Reserve Corps, and will report in the fall.

Convention of American Waterworks Association Next Week

Final arrangements for the convention of the American Waterworks Association, to be held June 5 to 9 at the Hotel Astor, New York City, have been completed. In addition to a program of technical papers and committee reports, there will be a trip to the Kensico dam of the Catskill aqueduct and an excursion to Coney Island.

Governor Signs Bill Regulating Flow of New York Rivers

Governor Whitman of New York has signed the bill relative to the regulation of rivers by means of storage reservoirs. The measure authorizes the division of the state into districts for the purpose of maintaining a steady supply of water in the upper parts of the rivers. Under this bill the excess of water in the spring will be avoided by a series of dams which will also prevent drouth later in the season.

City of Erie, Pa., Approves $1,445,000 Bond Issue

A $950,000 bond issue was approved May 16 by the city of Erie, Pa., for the construction of the flood-prevention works outlined in the report presented last fall by Farley Gannett, consulting engineer, of Harrisburg, Pa. The city also approved bond issues totaling $495,000 for the elimination of grade crossings, the protection of Garrison Run from floods and the construction of storm sewers. Plans are now being prepared by Mr. Gannett.

Heavy Bridge Span's Hazardous Boat Ride Ends Safely

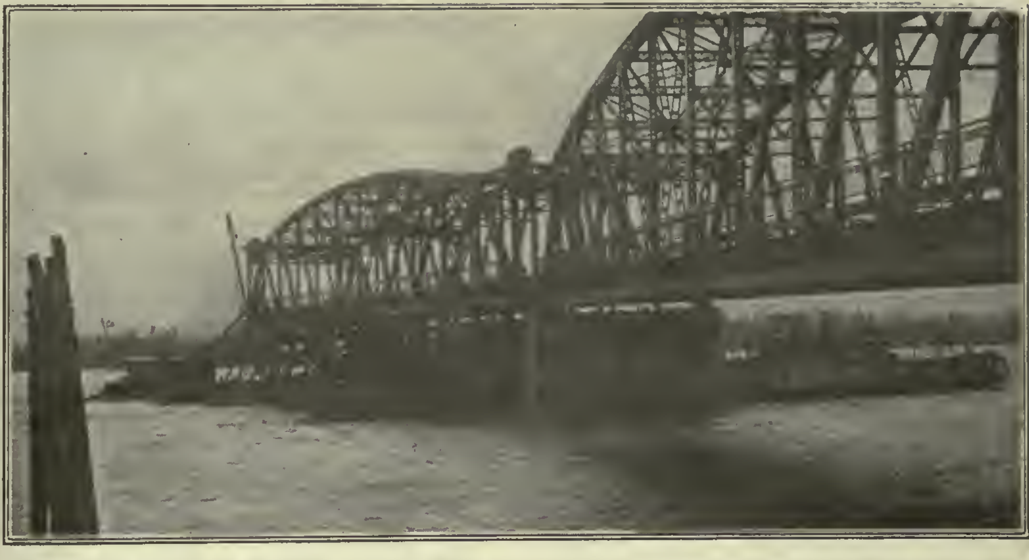
Windstorm Comes Up Just as Span of Interstate Highway Bridge Across Columbia River Is Being Floated to Position—Accident Is Narrowly Averted

The spans of the interstate highway bridge across the Columbia River, at Portland, Ore., are being erected on shore and floated to place on barges. During the eight days prior to May 2 five of the spans were placed by this method in addition to three spans placed previously. The work progressed smoothly until the large lift span, 272 ft. in length and weighing about 580 tons, was en route from shore to piers, April 26.

The span was to have been moved into place early in the afternoon, but on account of a light wind, which came up after the span had been lifted on the barges, the start was postponed. At 4.30 o'clock the wind had died down and it was decided to place the span that day. The stern-wheel steamers Paloma and Hustler, assisted by the tug Stimson, accordingly took the span out on the river.

The bridge was almost in position when a sudden wind and rainstorm sprang up. It is estimated that the wind blew about forty miles an hour for nearly five minutes. As there had not been time to make the lines taut before the squall broke, the span began moving upstream, gaining enough momentum to break all the lines. The squall swung one boat around crosswise to the current, breaking her starboard towline. The post on the barge, to which the starboard line of the other boat was made fast, gave way. Both boats were temporarily out of commission so far as holding the span against the brisk wind was concerned.

The north end of the span jammed against the one already in position. At the south end the span caught the boom of a derrick which was tied to a dolphin just above the south pier, and swung the derrick barge around until it jammed between the dolphin and the scow under the south end of the span. New lines were quickly thrown out from the tow boats and from the span to the piers. After the wind died down the span was moved back over the piers and landed without mishap.



THE NORTH END OF FLOATING SPAN JAMMED AGAINST THE NORTH SPAN ALREADY PLACED; THE SOUTH END CAUGHT THE BOOM OF A DERRICK

Dr. Corthell Buried at Whitman, Massachusetts

With rites of exceeding simplicity the body of Dr. E. L. Corthell, late president of the American Society of Civil Engineers and of the American Institute of Consulting Engineers, was laid to rest in the town of his birth, Whitman, Mass., May 19. As befitted the memory of one who had fought valiantly for the Union, the coffin was covered with the American colors. About forty engineers, most of them from Boston, attended the funeral. A little group went over from New York, while William B. Landreth, deputy state engineer of New York, representing the New York state engineer, and Joseph Ripley, fellow member of Dr. Corthell on the board of consulting engineers of the New York State Barge Canal, came from Albany. F. P. Stearns and George F. Swain, past presidents; Lincoln Bush, treasurer, and T. J. McMinn, assistant secretary, represented the American Society of Civil Engineers. The secretary, Charles Warren Hunt, is in California. F. A. Molitor, secretary, and Henry W. Hodge, member of the council, represented the American Institute of Consulting Engineers.

The honorary pall bearers were Messrs. Stearns, Swain, Bush, Molitor, McMinn and Professor Hill, the last mentioned representing Brown University, Dr. Corthell's alma mater. The active pall bearers were Harrison P. Eddy, Richard A. Hale, Frederick H. Fay, S. E. Tinkham, F. W. Hodgdon and James Kendall.

Automobiles Driven on Inspection Trip of New Subway

Automobiles were driven under the Harlem River for the first time in the history of New York City when an inspection of the new Lexington Avenue subway was made May 17. The smaller picture was taken under the middle of the Harlem River, 50 ft. below the surface. The construction of the center wall on the right is straight, whereas the outside wall is curved. The other picture was snapped at the portal at River Avenue and 157th Street. The men can be identified as follows: 1, Commissioner H. W. Hodge; 2, T. P. Shonts, president Interborough Rapid Transit; 3, Commissioner William Hayward; 4, Alfred Craven, chief engineer, Public Service Commission; 5, R. H. Jacobs, senior assistant division engineer; 6, Commissioner T. H. Whitney; 7, Chairman Oscar S. Straus; 8, Frank Hedley, vice-president and general manager, Interborough Rapid Transit; 9, C. W. Wilder, electrical engineer, Public Service Commission; 10, Robert Ridgway, engineer of subway construction; 11, George Keegan, of the Interborough Rapid Transit; 12, G. H. Pegram, chief engineer, Interborough Rapid Transit; 13, D. L. Turner, deputy engineer of subway construction; 14, I. V. Werbin, assistant division engineer; 15, J. B. Walker, secretary, Public Service Commission; 16, R. S. Bennett, junior engineer; 17, Edward Leimann, assistant engineer; 18, J. P. Locke, assistant division engineer; 19, F. N. Robinson, secretary.

Make Investigation of Silt Carried by Irrigation Canals

A concerted effort will be made to solve the problem of eliminating injuries caused by silt in the irrigation canals from the lower end of the Colorado River. J. C. Allison, formerly chief engineer of the California Development Company, and Dr. Fortnier, of the public roads and rural engineering bureau of the U. S. Department of Agriculture, will conduct the research work. They hope to discover means of preventing accumulation of silt in canals, of transferring these deposits to the lands under irrigation and of eliminating certain qualities from the silt.

The volume of silt carried in different locations, cross-sections, grades and discharges of canals will be secured for the purpose of making comparisons. Where the velocity of the water is low, deposits 5 or 6 ft. deep have accumulated during the last ten years. About $8,000 has been appropriated to carry on the work.

Chicago Engineers Co-operate for Preparedness Parade

Engineers of Chicago are to march as a separate section in the Chicago preparedness parade planned for June 3, not June 10, as noted in these columns last week. Sections are required to have at least 2000 individuals. To obtain this number in the short time available a voluntary committee, composed of presidents and other officials of fifteen technical societies, has the plans in charge. Edmund T. Perkins, chairman of the engineers' section of the Chicago Association of Commerce, is chairman; Wharton Clay, chairman Joint Committee on Military Engineering, is vice-chairman and marshal; E. N. Layfield, secretary Western Society of Engineers, is treasurer; B. F. Affleck, president Chicago Engineers' Club, is chairman of the finance committee. All engineers, whether affiliated with any society or not, are being urged to participate.

Protests Against Letting Public Work Contracts

At a meeting of the Central Trades and Labor Union, May 15, at St. Louis, a protest was made against letting contracts for public work. The legislation committee declared that the system is injurious to the taxpayers and wage-earners. The Mill Creek relief sewer was cited as an example. The committee also declared that the labor, most of which was imported, was paid a low wage and, according to their information, a profit of $900,000 was made on a $3,500,000 job. The committee urged the elimination of the contract system. The city charter provides that residents shall perform the public work of the city, which is declared to be impossible under the contract system.

District Court Decides Against Louisville Bridge Company

Judge Walter Evans, of the United States District Court at Louisville, Ky., handed down a decision May 12 in favor of the U. S. Government in its suit against the Louisville Bridge Company for failure to comply with the orders issued by the Secretary of War, Dec. 12, 1914. These orders were based upon the decision of the secretary that the Ohio Falls bridge of this company at Louisville is an unreasonable obstruction to free navigation of the Ohio River. They require the company within three years to change the main channel span to provide a 600-ft. clear opening over the "Indiana Chute" and to change the existing swing span over the Louisville and Portland Canal to a lift span with horizontal clearance of 200 ft. and vertical clearance, when open, of 78 ft. above pool level.

The bridge company refused to obey these orders and stated on Nov. 26, 1915, that it intended to continue the renewal of its superstructure on the existing masonry without changing the lengths of existing spans (380 and 352 ft.). The court also now grants an injunction restraining the bridge company from proceeding with the construction of the spans in question.

It is understood that the case will be appealed to the Supreme Court in an effort to have the government pay compensation to the bridge company for the expense of making the required changes.

Dam at Plattsburg Wrecked

About one-third of the new concrete dam on the West Brook, at Plattsburg, N. Y., known as storage dam 3, was carried away May 15. The water rushed to storage dams 1 and 2, inundating the state road for a few miles west of Plattsburg. The structure was erected at a cost of about $65,000 and has been in use less than two years.

French Waterway Opened

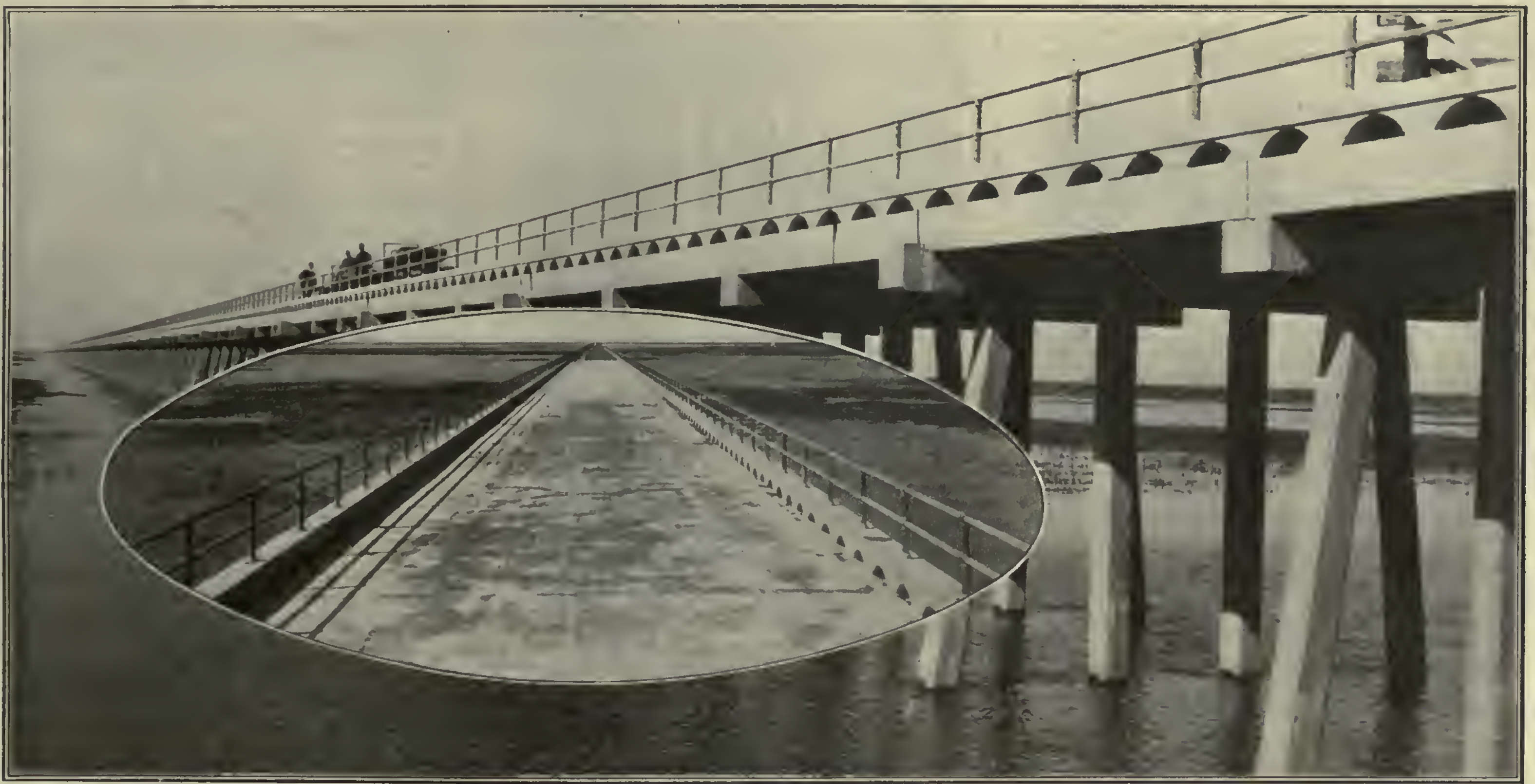
The sixty-mile canal connecting the city of Marseilles, France, with the River Rhone was officially opened May 7.

14,000-Ft. Yolo Causeway in California Opened to Traffic

A four-day carnival celebrated the recent opening of the Yolo causeway near Sacramento, Cal. The structure provides a direct connection between the east and west sides of the Sacramento valley and cuts 30 miles off the distance between the state capitol and San Francisco. The causeway, described in the Engineering Record of Aug. 28, 1915, page 248, is not entirely finished, as the dredger canal is to be spanned by a bascule bridge, which will not be in service until late this summer. Meanwhile a temporary wooden trestle by-pass has been built around this section.

The ceremonies included an automobile parade across the causeway, led by Governor Johnson and other state officials. Addresses were made by the Governor and by Charles D. Blaney, highway commissioner. It was pointed out that a highly satisfactory structure had been built by the engineering department of the State Highway Commission for less than $400,000. The cost of the usual type of construction built under conditions such as exist in the Sacramento valley would have exceeded $1,000,000.

The causeway provides the one trans-valley highway route beyond the reach of extreme floods. For the entire length of the structure its roadway is carried 18 ft. above a natural depression resembling an old river channel. This channel is the by-pass into which floods from the 35,000-sq. mile interior drainage basin are to be turned when the spring high waters threaten the reclaimed lowlands of the lower Sacramento and San Joaquin rivers. At present the waters which annually flood the Yolo basin are merely backwater from the lower reaches of the river. Upon completion of the long spillway now under construction farther up the river, this channel will be opened and used as an overflow route.


THE RECENTLY COMPLETED 14,000-FOOT YOLO CAUSEWAY, BUILT AT A COST OF $400,000, PROVIDES AN 18-FOOT HIGHWAY BEYOND REACH OF FLOODS. THE ROAD IS SHOWN IN THE INSERT

Blasts Too Near Foundation Caused Akron Building Collapse

The recent collapse of the Beacon-Journal Building at Akron, Ohio, noted in last week's issue, was due to the setting off of dynamite blasts within 6 ft. of that structure. Excavation in the lot adjoining the wrecked building had weakened the walls, and when blasting was done only 6 ft. away the building collapsed. Nine people were killed and twenty-eight injured. That structural weakness did not cause the accident is shown by the fact that nearly 100 persons climbed to the roof only a few days ago to view a parade.

Storm Wrecks Kemp City, Okla.

Twelve business houses, a two-story hotel and sixty residences in Kemp City, Okla., were destroyed May 20 by a tornado. The little town of 300 was almost completely destroyed and it is said that no efforts will be made to rebuild.

Look Through Your File of Pictures

We want to publish several pages of pictures of unusual concrete-plant layouts. The unusual features may be in the setting of the mixer, the arrangement of the bins, the source and control of the water supply, the methods of handling material and concrete cars —anything, in fact, that will help other men solve their mixing-plant problems.

Look through your file of photographs and send us your prints. We will carefully examine all you send. Tell us where the plant was located and add a sentence or two of explanation.

Two dollars will be paid for each print used. The others will be returned promptly.

Here is an opportunity to pass your good ideas along to the other fellow and to learn what he has done under similar conditions.

Address your prints to
THE EDITOR
Engineering Record
239 West 39th Street
New York City

Court Says General Superintendent Can Recover Damages

A new construction was recently put on the Arizona Employers' Liability law by the state Supreme Court, which held that a general superintendent or manager of a company has a right to recover damages for personal injuries received in hazardous occupations. The decision was rendered in the case of A. E. Deyo vs. Arizona Grading & Construction Company, of Tucson. A tunnel was being driven on which Mr. Deyo was employed as superintendent in charge of operations. An accident took place in which he was injured. The lower court held that Mr. Deyo had failed to establish his status as a workman. The Supreme Court reversed that judgment, ruling that the word "workman," as used in the act, means employee.

Students of University of Michigan Hold Spring Exhibit

The students of the college of engineering and architecture and the departments of natural science of the University of Michigan held an exhibition May 18 and 19. The affair was conducted by the students to foster a spirit of mutual understanding by demonstrating the work they are doing and the tools they use.

The civil-engineering branch was represented by five departments. The hydraulic engineers showed a working model of a modern power development and irrigation project; the roads department tested and explained various road materials, structures and tools; the structural students displayed bridge, culvert and building models; the railway students exhibited railroad devices and the sanitary engineering department showed a working model of an Imhoff tank.

$45,000,000 Flood Control Bill Passes House—Goes to Senate

The flood-control bill, authorizing the expenditure of $45,000,000 for flood control and general improvement of the Mississippi River, was passed by the U. S. House of Representatives May 17. The vote was 180 to 53. The bill now goes to the Senate.

Town Fathers Work Nights to Remove Undesirable Railway

For more than twenty years the Houston & Texas Central Railroad operated, without a franchise, a switching track in Bryan, Tex., which connected its tracks with those of the International & Great Northern Railroad. This track, which was the subject of much discussion by Bryan's business men, passed within 15 ft. of the best hotel, and sparks from the engines threatened to cause fires in adjacent cotton sheds.

No arrangement could be made for the track's removal. The mayor of Bryan was in the undesirable position of having to serve his people and, at the same time, hold his position as towerman with the Houston & Texas Central Railroad. The city council, however, met May 6, without the mayor, and voted to pave the street intersected by the switching track and to remove any obstructions which might interfere. A contract was immediately made with a contractor, and at 6.30 p. m. the same day laborers started tearing up the switching track which constituted the "obstruction." At 2 a. m. the next morning the concrete paving had been laid. The solution to the nice problem in diplomacy confronting the mayor has not yet come to hand.

Grand Rapids Has Gas Explosion

Vapor from gasoline in the sewers of Grand Rapids, Mich., entering electric cable conduits of the Consumers' Power Company, is considered the cause of two explosions in the business section of the city near Campau and Pearl Streets, May 17. The first explosion blew off a few manhole covers. The second one, a few minutes later, wrecked the brick pavement laid in cement as shown and broke window glass in the vicinity. A fire started, but was put out by pouring water into the conduits.

EXPLOSION WRECKS BRICK PAVEMENT

Cincinnati Will Have Unofficial City Planning Commission

An unofficial city-planning commission of five members is soon to be appointed by the Mayor of Cincinnati. The city council recently refused to authorize the appointment of a permanent body under the present law requiring a two-thirds majority of the council to overrule acts of the commission.

Instruct Chicago Engineers in Military Bridge Building

A practical demonstration of military bridge building was given a week ago by the Joint Committee on Military Engineering, Chicago. Capt. L. S. Marsh of the engineer company of the Illinois National Guard supervised the exhibition in Grant Park.

Now that the lecture course is half over the committee is considering what to do to conserve the interest shown. Since engineers must have at least some rudimentary military training, evening drills are to be started. Advantage may also be taken of the offer of a suburban wooded area on which engineering tactics may be carried out.

Major H. B. Ferguson, Corps of Engineers, U. S. A., Milwaukee, spoke May 11 on "Service of Reconnaissance and Castramentation." Major P. S. Bond, Corps of Engineers, U. S. A., Cleveland, author of the series of military engineering articles which appeared in recent issues of the Engineering Record, addressed the committee May 18 on "Communications and Stream Crossings," illustrated with slides and moving pictures. Capt. H. B. Sauerman, organizer of the National Guard engineer company in Chicago, gave a lecture May 25 on "Fortifications."

Elevator Tower Is 30 Feet Square and 180 Feet High

THIS CONCRETE SHAFT WAS RECENTLY COMPLETED FOR THE CHICAGO, MILWAUKEE & ST. PAUL RAILWAY AT KANSAS CITY, MO., BY JAMES T. STEWART & COMPANY, INC., ENGINEERS AND CONTRACTORS, OF CHICAGO.

Minnesota Highway Commission Starts Publication of Journal

Beginning this month the Minnesota State Highway Commission begins the publication of an official medium known as the *Minnesota Highway Journal.* The object is to spread information regarding the commission's work. It will be sent not only to assistant engineers, but to others interested in the betterment of roads and bridges of the state. Copies will be mailed to county engineers, superintendents of highways, county auditors and members of county boards. Others interested can receive copies upon application. The office of the commission is in the Shubert Building, St. Paul.

Engineering Society Activities

The Harvard Engineering Society of New York will hold its annual field day at the Short Hills (N. J.) Club to-day. Baseball, tennis and other sports have been arranged, together with a dinner in the evening.

The Engineers' Club of Seattle, on May 18, entertained as its guest at the regular noon luncheon Thomas Riggs, Jr., of the Alaska Engineering Commission. He discussed the new government railroad in Alaska.

The Engineers' Society of Northeastern Pennsylvania held a meeting May 18 at which Herbert Axford, of the coal-mining department of the Delaware, Lackawanna & Western Railroad, discussed the design and operation of pumps.

The Engineers' Club of Trenton held its last spring meeting May 25, at which W. L. D'Olier, of the D'Olier Centrifugal Pump & Machine Company, presented an illustrated paper entitled "Progress and Development of the Art of Sewage Treatment."

The Associated Engineering Societies of St. Louis was addressed May 24 by William A. O'Brien, chief engineer of the Little River Drainage District, of Missouri, who discussed the work of the district. The meeting was held at the Engineers' Club under the auspices of the St. Louis Association of Members of the American Society of Civil Engineers.

The Engineers' Society of Western Pennsylvania recently held the fourth of a series of military engineering lectures, at which Major J. C. Oakes, Corps of Engineers, U. S. A., gave a lecture on "Military Roads, Bridges, Fords and Ferries." At the May 16 meeting Sanford E. Thompson, consulting engineer, of Boston, discussed scientific methods in construction.

The Texas Association of Members of the American Society of Civil Engineers held a meeting at Galveston, May 19 and 20. The following papers were presented: "Relative Strengths of Concrete Due to Varying Proportions of Cement," by Prof. F. E. Giesecke, University of Texas; "Features of Engineering Interest and the City of Galveston," by W. M. Blackburn, Galveston, and "Industrial Preparedness," by John B. Hawley, of Fort Worth. Election of officers will take place at the meeting next October at Dallas.

The American Society of Civil Engineers held on May 24 the regular semi-monthly meeting adjourned from May 17 on account of the death of Dr. Elmer L. Corthell. H. de B. Parsons presented an illustrated paper on "Engineering Fallacies." A letter from Col. E. W. Van C. Lucas of the Twenty-second Regiment of Engineers, N. Y. National Guard, stated that it was desired to get 3000 men to join the National Guard during the month of May. Capt. E. F. Robinson then made a short address urging the engineers to join, pointing out both the desirability of individual preparedness for military purposes and the value of the training for every-day civil life.

What Engineers and Contractors Are Doing

MORGAN CILLEY, formerly assistant mechanical engineer in the office of public roads, U. S. Department of Agriculture, was recently appointed estimator and computer in the supervising architect's office of the treasury department, at Washington, D. C. Mr. Cilley was graduated from the Cooper Union school in New York City in 1907, which he attended while working in that city. His first employment was with the Brackett Bridge Company, of Cincinnati, as computer and draftsman in 1900. He spent 1901 and 1902 with the De Dion, Bouton Motorette Company, of Brooklyn, after which he was employed by Purdy & Henderson, consulting engineers, of New York City. He later went to the Empire Bridge Company, of Brooklyn, and then became connected with Westinghouse Church Kerr & Company, of New York. In 1905 he was engaged on tunnel work by the Pennsylvania, New York & Long Island Railroad. He was made building inspector and assistant engineer to the building superintendent of the Brooklyn Rapid Transit Company in 1906, but resigned the next year to become associated with Charles W. Leavitt, landscape engineer, of New York City. From 1908 to 1911 he was in the employ of the U. S. government in the Philippine Islands as assistant engineer and later as district engineer in the Bureau of Public Works. The Troy Wagon Works Company, of Troy, Ohio, made him special representative in eastern Canada in 1911. He was later consulting engineer and assistant factory superintendent for that company. He became connected with the U. S. Department of Agriculture in 1914.

FERRIS LEROY FRANCISCO, consulting engineer, of New York City, has been appointed a member of the board of supervising engineers of Chicago. Mr. Francisco's first engineering work was with the Newark (N. J.) Electric & Power Company. He spent two years with that company, after which he was engaged by various Eastern electric railways on nearly every kind of engineering work. In 1902 he was made engineer for the Continental and American tobacco companies, at Louisville, Ky., and in 1905 rose to the position of chief engineer for the American Tobacco Company and all its subsidiaries. While in that position he supervised buildings in various cities costing more than $3,000,000. Four years ago he became a member of the firm of Francisco & Jacobus, engineers and architects, New York City. Mr. Francisco will retain his connection with his firm, with offices in New York and Chicago.

W. A. MCINTYRE has resigned as chief highway engineer for the Association of American Portland Cement Manufacturers to become assistant manager of the Hy-Rib, lath and highway department of the Trussed Concrete Steel Company, with headquarters at Youngstown, Ohio. Mr. McIntyre was graduated from the civil-engineering department of the University of Pennsylvania in 1904. For two years prior to entering college and also during each summer and until the end of 1906, he was with the firms of Chester E. Albright and Albright & Mebus, of Philadelphia, on land development and sewer and trolley construction. He was later with the government on suction-dredge work in the Delaware River and New York harbor, after which he was superintendent of construction for W. Gordon Smith, of Hammond, Ind. Mr. McIntyre spent 1908 and 1909 with the city of Philadelphia in the bureau of surveys. He was engineer and superintendent of highways of Lower Merion Township, Pennsylvania, during 1910 and 1911. He became connected with the Association of American Portland Cement Manufacturers in 1912.

CHARLES G. THORNBURG has resigned as assistant engineer in the Bureau of Water of Philadelphia to become resident engineer for Frank C. Roberts & Company on the construction of an ore dock at Port Henry, N. Y., for the Lake Champlain & Moriah Railroad. Mr. Thornburg was recently in charge of the construction of the sedimentation basin at the Torresdale filters, at Philadelphia.

OLAF LAURGAARD, consulting engineer, of Portland, Ore., is a candidate for one of the twelve Republican nominations for state representative from Multnomah County. Mr. Laurgaard was the engineer in charge of the construction of the Tumalo irrigation project in central Oregon, built by the state in 1913. He is thirty-six years of age, a graduate of the University of Wisconsin and has lived in Portland since 1910. He was also assistant engineer on the Okanogan (Wash.) government irrigation project and engineer in charge of the construction of the Conconnully dam of that project. He is at present consulting engineer on the Suttle's Lake, Paisley and Brewster projects.

A. F. MACCALLUM has resigned as city engineer of Hamilton, Ont., to fill a similar position at Ottawa.

M. T. CANTELL was recently made municipal engineer of St. Vital, Man.

WILLIAM E. FOSS, who has been acting chief engineer of the Metropolitan Water and Sewerage Board of Massachusetts since August, 1915, has been made chief engineer of the board. Mr. Foss began his engineering career in 1885 as rodman in the city surveyor's office at Boston. He was made transitman a year later and in 1889 was appointed engineer for the West Kearney Improvement Company, of Kearney, Neb. He returned to Boston later in that year to become assistant engineer for the western division of the waterworks. After six years' service he was made division engineer of the Metropolitan waterworks of Boston, in charge of designs, estimates and construction. Mr. Foss has acted as consulting engineer for various cities and corporations.

A. F. MCMAHON will have charge of the bitulithic paving at Grinnell, Iowa, the contract for which was recently awarded to William Horrabin, of Iowa City. Mr. McMahon has had entire charge of 200,000 sq. yd. of bitulithic paving in Grinnell during the past seven years.

HOWARD E. HYDE, formerly acting city engineer of Manila, and for many years principal assistant engineer of the sewerage system and street paving work at Havana, Cuba, has resigned from his position in connection with the new waterworks for Providence, R. I. After June 1 he will become associated with Young & Hyde, Inc., contracting engineers, of New York City, with which company he has been indirectly connected for the past four or five years.

WILLIAM BOWIE, on the recommendation of the superintendent of the U. S. Coast and Geodetic Survey, and the secretary of commerce, has just been appointed the member from the United States of the Permanent Commission of the International Geodetic Association. Since 1909 Mr. Bowie has been chief of the division of geodesy of the coast and geodetic survey. In 1912 he was one of the delegates from the United States to the convention of the International Goedetic Association, which met in Hamburg, Germany. This association was organized more than fifty years ago for the purpose of securing the co-operation the European nations in undertaking certain geodetic problems which were international in scope.

HENRY W. DUN has resigned as assistant engineer in the office of the city engineer of Albany, N. Y., to accept a position in the engineering department of the Atchison, Topeka and Santa Fe Railway.

G. A. HARWOOD, chief engineer of electric zone improvements of the New York Central Railroad, has been appointed engineering assistant to the vice-president of operation, with headquarters at New York City. Mr. Harwood was born in Waltham, Mass., in 1875, and was graduated from Tufts College in 1898. During his college course he did summer work with the Fitchburg Railroad (now part of the Boston & Maine), and after graduation he returned to this road, remaining until 1900. In 1900 he came to the New York Central as draftsman. The following year he was made special assistant to the designing engineer, and from May, 1904, to February, 1905, was engineer of grade crossing elimination for the entire line east of Buffalo. In the latter month he was transferred to the electric-zone improvement work in and near New York City as assistant terminal engineer on the new Grand Central Terminal. A year later he was made terminal engineer, and late in the same year (November, 1906) was appointed chief engineer of electric-zone improvements. Besides carrying through to completion the new Grand Central Terminal and the electrification of the terminal zone he has, with H. D. Jouett, designing engineer of West Side improvements, handled for the railroad the preparation of plans for the reconstruction of the freight line on the west side of Manhattan (see the Engineering Record of May 6, page 614) and has also been a member of a committee negotiating with the city of Buffalo relative to a new union station at that point. Mr. Harwood is a director of the American Society of Civil Engineers and a member of the committee on electricity of the American Railway Engineering Association. For the present it is understood that he will retain his former duties with the railroad, and no successor is announced.

Obituary Notes

DAVID WEST CUNNINGHAM, member of the American Society of Civil Engineers since 1873, died at Montrose, Cal., May 10, at the age of eighty-seven. Mr. Cunningham constructed many water systems throughout the New England states, among them being the systems at Charlestown and Lowell, Mass., and the Boston waterworks. He spent six years in the service of the Chilean government, during which time he constructed the Tarkio Valley Railroad, said to be the first across the Andes Mountains. Mr. Cunningham, who was a graduate of Harvard University, retired from active engineering practice about twenty years ago.

JAMES M. MACK, head of the Mack Paving Company, of Philadelphia, died May 18 at his home in that city. He had been in the contracting business in Philadelphia since 1900.

HUGH BROWN, who was connected with the early construction of the Grand Trunk Railway in Canada, died in Detroit, May 19, at the age of 87.

ERNEST GAY, consulting engineer, of Windsor, Ont., died in that city, May 21, at the age of 53.

CHARLES W. APPLEBY, who resigned as city engineer of Albany, N. Y., three years ago, died in that city May 20. Since leaving the employ of the city Mr. Appleby had been engaged in general contracting.

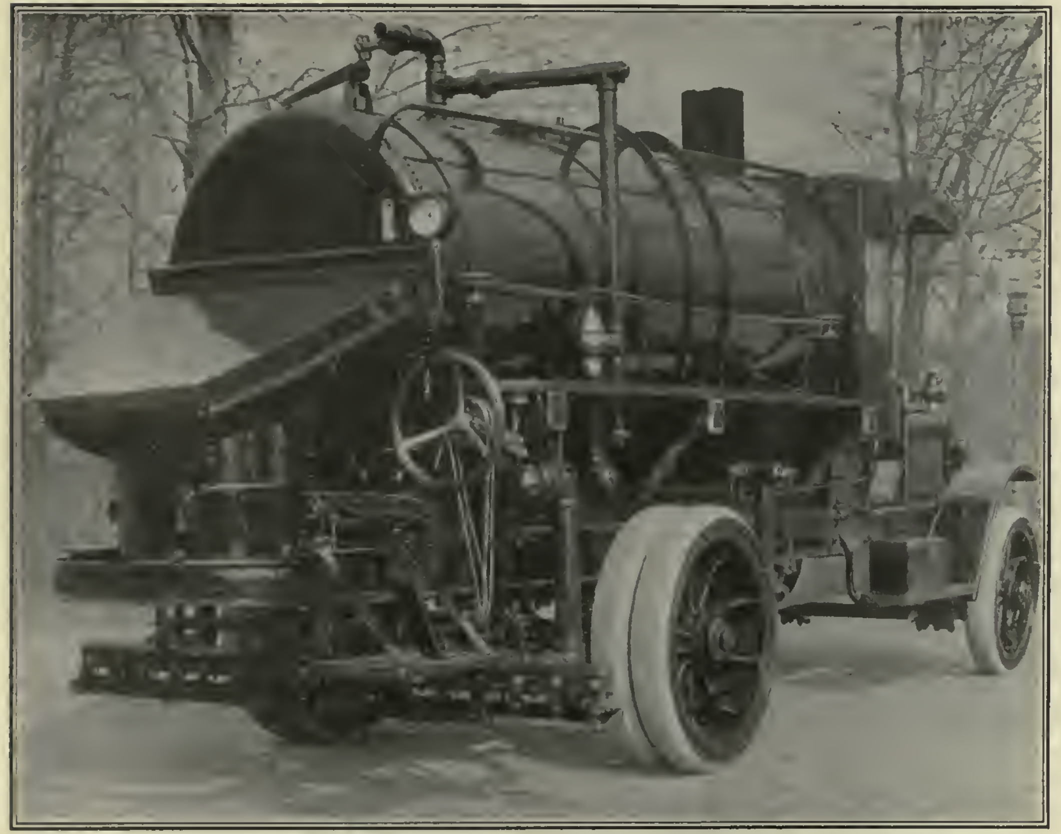
FREDERICK H. MEYERS, assistant engineer in the drafting division of the headquarters department of the Board of Water Supply, New York City, died May 21. He entered the service on the Catskill Aqeduct in 1906 as topographical draftsman at Poughkeepsie. He was made assistant engineer in 1911 and was transferred to New York City in 1914.

New Road Machine Has Rotary Displacement Pump

A combination road-maintenance and construction truck has just been introduced by the White Company, of Cleveland. The machine has facilities for sprinkling and flushing streets, applying heavy or light oils to roads and spreading hot asphaltic oils to road surfaces under a penetrating pressure. The iron tank which holds the liquids can be detached and the truck used with an ordinary body for general hauling.

Two of the chief features of the truck are the rotary displacement pump and the special White heating system. The temperature of a tank full of material can be raised at the rate of 1 deg. a minute and maintained at 350 deg.

The pump is driven by a lay shaft from the rear of the transmission case. It can be used to fill the tank with oil or water by means of an intake pipe at the front, or to load direct from freight cars. As the pump has a lift of 13 ft., the truck need not be on a lower level than the cars. While the liquid is being heated the pump keeps it in constant circulation, preventing the heavy oils from settling at the bottom of the tank. Oil is delivered to a set of sixteen nozzles on the rear of the truck and spread uniformly over a strip of road 8½ ft. wide. The 80-lb. pressure drives the liquid into the crevices of the road surface and binds it firmly. After the oil has been turned off the pump carries the quantity remaining in the pipes back into the tank. An automatic drip trough prevents leakage.



AUTOMATIC DRIP TROUGH PREVENTS LEAKAGE AFTER OIL HAS BEEN TURNED OFF

The heater is located on the rear of the tank. It consists of a gasoline burner which uniformly distributes heat to the boiler flues in the lower section of the tank. Danger of igniting the liquid in the tank is said to be eliminated.

The tank can be cleaned by using the pump pressure to circulate kerosene. A small tank of this cleaning fluid is attached to the left side of the tank.

Issues 20-Year Guaranty Bond

Experience has convinced the Barrett Company that with the workmanship properly safeguarded a Barrett specification roof will last for a minimum period of twenty years without repairs. To give the benefit of this experience to architects, engineers and owners of Barrett specification roofs, a twenty-year surety bond guaranty will be given, without charge, on all Barrett specification roofs of 50 squares or more in the United States and Canada, in towns of 25,000 or over, and in smaller centers where Barrett inspection service is available. The roof must be laid by a roofing contractor in strict accordance with the Barrett specification dated May 1, 1916, and subject to the inspection and approval of the Barrett Company.

New Line of Jaw Crushers Demonstrated at Columbus

Tests and demonstrations of the new line of jaw crushers being placed on the market by the Jeffrey Manufacturing Company, of Columbus, Ohio, were recently made at the Jeffrey plant before a number of engineers and contractors' supply dealers. The new crushers, which embody distinctive features of design, are said to have received the enthusiastic approval of those present. The Jeffrey pulverizers and loading machines were also demonstrated.

In the evening the party was entertained at a banquet at the Athletic Club of Columbus. Officers of the company were present to pledge their support to the agents who will sell the new line. L. A. Kling, manager of the new department, presided.

Concrete Mixer Operated by Inmates of Insane Asylum

The Chain Belt Company, of Milwaukee, claims that the term "fool proof" may well be applied to its concrete mixers. In substantiation of this assertion, the mixer owned by the Michigan State Hospital for the Insane, at Kalamazoo, and operated by the inmates, is a "Chain Belt." According to the foreman in charge, the inmates do good work, although they have to be handled carefully.

Foreign Products Exhibited

A comprehensive collection of foreign-made articles was on exhibition at the annual meeting of the National Association of Manufacturers held in New York City, May 15 to 17. Four large collections of hardware, cotton and woolen goods, paper and stationery, together with reports from the Bureau of Foreign and Domestic Commerce covering foreign market conditions, offered an unusual opportunity for the American manufacturer to acquaint himself with existing conditions in foreign countries.

Dealers and Manufacturers Meet

A joint convention was held May 10 to 12 at Pittsburgh, composed of members of the Southern Supply and Machinery Dealers, National Supply and Machinery Dealers and American Supply and Machinery Manufacturers associations.

The morning of Monday, May 10, was devoted to a joint open session at which addresses of welcome were made by H. P. Bope, of the Carnegie Steel Company, Robert Garland, of the Garland Nut & Rivet Company and F. J. Lanahan, of the Fort Pitt Malleable Iron Company. The associations met in their respective halls Monday afternoon and continued with their respective separate programs.

Business Notes

The Parker Supply Company of New York City has removed its offices to 785 East 135th Street.

David Lupton's Sons Company has opened a direct sales office in the Oliver Building, Boston, with Harry Wolf as sales engineer.

Bruno Grosche & Company, of New York City, will hereafter be known as the S. P. F. Wood Preserving Company. The offices remain at 90 Wall Street.

O. E. Thomas has been appointed district manager for the Terry Steam Turbine Company of Hartford, Conn. Mr. Thomas will have headquarters in the Washington Building, Los Angeles, and handle sales in Arizona and parts of California and Nevada.

The International Filter Company of Chicago has appointed Wilbur S. Wilding Eastern representative, with headquarters in the Woolworth Building, New York City. A few years ago Mr. Wilding took charge of the San Francisco office of this company.

The Standard Brick Company, of Crawfordsville, Ind., has taken a license from the Dunn Wire-Cut-Lug Brick Company for the manufacture of wire-cut-lug paving brick. This makes thirty companies operating forty-eight plants now engaged in the manufacture of wire-cut-lug brick.

D. A. Casey, who has been connected with the Westinghouse Electric & Manufacturing Company for the past six years as machinery salesman through the Pittsburgh territory, resigned May 15. He has organized the Service Supply & Equipment Company, with offices in the Fulton Building, Pittsburgh, Pa.

Trade Publications

The following companies have recently issued trade literature:

Blaw Steel Construction Company, Pittsburgh, folder, illustrated, describing Blaw Adjustable Rectangular Culvert Form.

Zelnicker Supply Company, St. Louis, catalog, 8½ x 3¾ in., 10 pages. A list of special bargains in second-hand equipment for contractors.

Link Belt Company, Chicago. Booklet 267, "Moving Material Indian File," 3½ x 6½ in., 24 pages, illustrated. Describes a variety of belt and other conveyors.

James Leffel & Company, Springfield, Ohio. Bulletin 54; 6 x 9 in., 32 pages, devoted to Leffel turbine waterwheels. Describes methods of measuring stream flow. By referring to tables horsepower and other data regarding installation of turbines are available. Installations of every kind of turbine are well shown in four-color illustrations.

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Waterworks Number

FOLLOWING the custom of former years, this issue of the Engineering Record, preceding the annual convention of the American Waterworks Association, which meets in New York next week, is devoted largely to waterworks articles. It contains a fund of information as diverse as it is valuable. Chief engineer, superintendent, chemist and bacteriologist, assistant engineer and construction man will all find something in the following pages directly applicable to his work. Asked for criticism of this journal's former waterworks numbers an engineer of wide experience said: "I have found your articles excellent, but the tendency is to give most of your space to the problems of the big, costly projects with which the small town engineer never has to deal. From the newspaper point of view this policy is, perhaps, justifiable, but it neglects a large class of men who want information on the small-scale undertakings—the jobs that are the day's work for them." In planning the contents of this issue this criticism proved decidedly helpful and an examination of the pages which follow will demonstrate that this year's waterworks number is essentially for the man in charge of small-town activities. It is not possible here to give a complete outline of the contents, but attention is invited to the articles on the new filtered gravity water supply for the village of Le Roy, N. Y.; the meter maintenance and repair system in operation at East Orange, N. J.; the saving of water in a 100-per cent metered city—Oak Park, Ill.; Diesel-engine pumping at Appleton, Wis., and comparative costs of sterilizing water with hypochlorite and liquid chlorine. These articles treat of work which is not out of the ordinary because of size, cost or special conditions. They are practical—for practical men.

Unjust Accusations

THAT the Thompson committee of the New York Legislature, which has for some time been attempting to discredit the Public Service Commission for the First District, in charge of the construction of New York City's new transit system, has outlived any usefulness it may have had, and has lately been reflecting more on its own ability than on that of the commission it is supposed to be discrediting, is admitted on all hands. However, when the committee persists, by means of statements and insinuations without foundation in fact, in attempting to misrepresent reputable members of the engineering profession, no matter how far below contempt the committee has brought itself, it is due to the engineers attacked to state publicly to the profession that the charges made and implied against them are baseless and without justification. Anyone who has read the public letter from Alfred Craven to the chairman of this committee, called forth by the insinuations of the committee's counsel while Mr. Craven was testifying before it, can appreciate the disagreeable situation in which, unfortunately, unscrupulous politicians have the power to place any man whom they attack. The attacks on Mr. Craven were entirely uncalled for. His life's record as an engineer, including his service with the commission, is a complete refutation of the slurs cast upon him.

Selling Water Efficiently

WHEN the taking of a bath is a recorded event—recorded on the meter chart of the main supply to a city of 31,000—water pipes are pretty tight. Even with such a record the officials of the water department of Oak Park, Ill., are still looking for leaks and do not profess to have reached the ideal. Incidentally there are no free services, so that consumers actually pay for the water wasted through leaky fixtures. In less than two years the night consumption has been reduced from 800,000 to 400,000 gal., and the bathtub story is not fiction. The superintendent has another halving of the night rate in mind as his goal.

The key to the method of administering the department, as outlined in the account on page 738 is the absolute control which the department officials have over the system. In the matter of "high-bill" complaints, no leniency is shown where charges are proved to be just, because it has been found that leniency encourages waste. Oak Park is a high-class residential suburb, and therefore it is comparatively easy to educate the citizens to the necessity of keeping fixtures in repair. In fact, they are educated to such an extent that they are coming to demand a better grade of work from the plumbers.

Another vital point in the water department's success is the backing given by the administration, which is, in effect, that of the city-manager form of government. Oak Park still adheres to the town system and the municipality is run as would be a business. The voters recently rejected the council-and-mayor form of government.

The contrast, in the matter of water consumption, between Oak Park and unmetered suburbs near Chicago is striking. But Oak Park has just as beautiful lawns and its citizens use just as much water legitimately as those of communities where the consumption is several times as great. Oak Park's record is a shining example of what can be done when the selling of water is put on a strictly commercial basis.

Architecture for Engineers

ENGINEERS who have occasion to design ornamental bridges or buildings must often realize their lack of preparation in even the simplest fundamentals of architectural design. Due to the prevailing tendency in engineering schools toward crowded curricula, containing highly specialized and differentiated technical courses, our educators have not provided broadening and helpful general courses in closely allied fields. One of the difficulties has been that the desired condensed courses are not offered by outside departments. For example, a course dealing with elementary principles and illustrated by interest-arousing examples taken from the student's own special field is requested from the department of architecture by the civil engineering department. Instead of such a course being created, the engineering students are often offered a piece of dead wood cut from a more extended course given to architectural students. The same is sometimes true of the courses given by the various departments of engineering to the students from other departments. Changes in engineering courses are of perennial interest and the advisability of providing a short course in architectural design for civil engineering students warrants the careful consideration of those responsible for curricula.

James J. Hill, Empire Builder

AS an empire builder, as a railroad operator and not as a "railroad magnate," as the Wall Street variety of railroad men are styled, the memory of James J. Hill will go down in American transportation history. With him the intrinsic worth of his properties and the prosperity of the communities they served were always of first importance. In this he stands out in striking contrast to those who consider railroads as pawns in the Wall Street game and to whose everlasting disgrace stand such wrecks as the New Haven, the Rock Island, the Frisco. A financial power undoubtedly he was—he had to be to care properly for his enormous interests. Primarily, however, he was a railroad man. The country generally well realized his worth—his contribution to the upbuilding of the "Hill" country. The Northwest, with good reason, revered him. Fortunately he has left behind him not only an example that will continue to inspire those who elect a railroad career but a generation of younger railroad men trained under him and in his methods, inspired by his ideals. His influence on American railroading will not soon wane.

The Subway Grating Again

LOUDNESS of protest and persistence of the protesters have scored a partial victory over the subway grating in New York City. On a recent decision of Commissioner Henry W. Hodge the Public Service Commission for the First District has decided not to build sidewalk ventilator gratings in front of the premises of lucky complainants on the uncompleted sections of the new dual system between Twenty-ninth and Thirty-fifth Streets and between Thirty-ninth and Forty-sixth Streets. From the announcement made by the commission it appears that forced mechanical draught and ventilator openings in parkways will be employed to change the air in these sections. It was found impossible to eliminate the gratings between Thirty-fifth and Thirty-ninth Streets. Although the plans for the change have not yet been made public, it is taken for granted that the changes contemplated maintenance costs to be borne by the entire city for the benefit of these property owners. Commissioner Hodge has stated that he does not believe that completed work should be ripped up merely for the purpose of removing the sidewalk gratings, and the only sections affected by the decision are those where gratings have not yet been constructed. A report, after a thorough investigation by an engineering commission of the entire question of ventilating the subways; which was abstracted on page 382 and discussed on page 376 of the Engineering Record for March 18, 1916, is upheld in the main by this decision. As was to be expected, the decision proved most unsatisfactory to the press of New York City, which is behind the property owners whose vault space has been encroached upon by the despised ventilator openings.

Catskill Aqueduct Progress

IN its annual report for the year 1915, soon to be published, the Board of Water Supply of the city of New York presents progress figures which support the prediction, made a year ago, that the great Catskill aqueduct system would be ready for actual service this year. The 1914 report, noted in an editorial in this journal July 17, 1915, page 65, recorded the fact that only two links in the 126-mile line between the Ashokan reservoir in the Catskills and the terminal reservoir at Silver Lake, Staten Island, remained unfinished—the Moodna supplementary tunnel and the Narrows submarine siphon. Of these the first is now completed, and at the end of 1915 only 250 ft. of the 10,620 ft. of 36-in. flexible joint submarine pipe across the Narrows remained to be laid. The best indication of the present status of the project, however, is the fact that in 1915 Catskill water was delivered from the Ashokan reservoir to points within the city limits for use in testing the north half of the city tunnel. As for the four reervoirs of the project—the Ashokan, Kensico, Hill View and Silver Lake—work was so far advanced at the beginning of this year that two were partially filled and one entirely filled with Catskill water. Construction on the Silver Lake reservoir was three-fourths finished. Hydrostatic tests of the city tunnel have shown a high degree of watertightness, although a few hundred feet of the line, where the rock backing was fissured, developed cracks, which are now being repaired. The total cash disbursements on the project at the end of 1915 amounted to $129,800,000, as against $123,000,000 reported for the previous year, while the force in the engineering bureau at the end of last year was reduced to 637. Among the important developments in 1915 was the securing of legislation governing the sanitary control of the Ashokan watershed and the selection of a definite site for the Schoharie dam, which will develop the second installment of 250,000,000 gal. of water daily. Added to the yield of the Esopus drainage area, which is now ready for delivery, this will bring the supply up to the aqueduct's capacity of 500,000,000 gal. daily.

Operating Cost of Motor Vehicles in Waterworks Service

TO THE ENGINEER who is contemplating the use of motor vehicles on work under his direction the all-important question is, "How much does it cost to operate an automobile?" Upon the answer much depends, for technical men appreciate that the automobile has a wider field of usefulness than mere pleasure riding. For road building supervision, for example, it is now conceded to be indispensable. In the case of a waterworks department it has not yet attained the same popularity, but the light, cheap car is demonstrating its value for such work as meter inspection and repair, collections, supervision of city pipe line construction and, in fact, all work which requires periodic visits by a department head or his deputies to distant points.

For data upon which to base his decision as to whether or not an automobile is a profitable investment the engineer has had to depend largely on the manufacturer's statement regarding the cost per mile for such items as gasoline, oil and tires. The automobile salesman, naturally, presents his case in its most favorable light, and while his figures may be entirely accurate, they may apply to performances under particularly favorable conditions. What the engineer wants is an unprejudiced summary of results actually secured under every-day conditions, and this he will find in Burt A. Heinly's article on page 728, telling of the performance of sixty-five motor vehicles in the service of the Los Angeles Water Department.

The data are valuable for they deal with a sufficient number of cars to give a dependable average and, what is equally important, they go into details. In studying these records, however, engineers in other cities should keep in mind, besides the usual local variations, two important points—that California's climate permits the use of motors the year round, and that the cost figures are based on the records of 1915, before the price of gasoline had soared to its present level. To arrive at reliable costs for present conditions elsewhere an allowance for these factors must be made.

Decolorization of Water

AT WILMINGTON, N. C., George F. Catlett, chemist in charge of the filtration plant, has recently put into successful practice some of the theories that have been discussed academically by sanitarians for several years. In particular he has done this by considering coagulation as a colloidal phenomenon. The water supply of Wilmington is taken from near the junction of two streams, one carrying colored water, one turbid water, and both of them tidal. The situation results in an extremely variable load on the filter from hour to hour, with a range of color in the raw water from about 130 to 200, and a range of turbidity from 0 to 50. This varying load coupled with a low alkalinity made the water a difficult one to decolorize. A coagulation basin of insufficient size increased the difficulty.

To obtain a good effluent and at the same time preserve a sufficient alkalinity to prevent rusty hot water in the city, soda was used with alum, and large quantities of both chemicals were applied. Present practice has been conducted on the theory that an excess of alkalinity should be maintained, but after some experimental studies Mr. Catlett found that a better decolorization, with smaller amounts of chemicals, was obtained by first overdosing the water with alum and afterward adding lime. This was a corroboration of the idea advanced by Prof. George C. Whipple many years ago in a discussion before the American Society of Civil Engineers, although the idea was worked out anew by Mr. Catlett.

A second coagulation basin constructed at Wilmington some time ago made it possible to put the idea into practice. The water in the first basin was kept acid, that is, was made to contain an excess of alum, and the alkalinity was restored as it entered the second basin. The result was a saving of 50 to 70 per cent in chemicals, and a filtered water clear and uniformly low in color. An incidental result of the overdosing with alum should be the prevention of algæ growths in the slightly acid water of the first basin. Detailed results will be found in the article on page 741.

Mr. Catlett's theory is that the coloring matter of water is a colloid charged with positive electricity, and that this charge is best neutralized by adding soda ash and alum together, with the latter in slight excess. The theory raises some interesting questions. The colloidal character of coloring matter may be regarded as established. But all coloring matter in water is not alike either in its appearance or in its re-action with chemicals. It is possible that not all of it is positively charged. Perhaps some coloring matter may be charged negatively. It is not certain, therefore, that the Wilmington method will work satisfactorily with all waters, but it is a method which should be studied experimentally wherever deeply stained water is being decolorized.

Mr. Catlett also advances the idea that carbonic acid acts negatively to the colloidal coloring matter and offers this as an explanation of the better keeping qualities of swamp water in casks on shipboard, the increased carbonic acid resulting from the decomposition of organic matter being an element in the subsequent clarification of the water.

If decolorization results from a neutralization of the positive electricity of colored colloids, one cannot help looking forward to some physical process which may perhaps accomplish this result without the use of alum, some process which will do for the colloidal coloring matter of water what the activated sludge process is doing for the colloidal matter of sewage. Defend it as we may, the use of alum for the decolorization of soft colored water has not been an unmixed blessing. Sometimes it of doubtful expediency. The Wilmington experiments point in a new direction and should be carefully studied.

Determination of Net Strains in Reinforced Concrete

ALTHOUGH there have been hundreds of strain measurements, on laboratory specimens and on actual concrete structures, for determining the stresses in reinforcing steel, generally with results that are consistent and apparently, therefore, reliable, there are two factors which are often neglected in the interpretation of these results. In the first place, shrinkage in the concrete has an influence on the deformation measured in that material, and the time element, as pointed out in the letters on page 652 of the issue of May 13, thus becomes of vital importance. Shall the strain measurements be made as the load is being applied or as it is being removed? What is the net strain which is the result of stress, and what value of the co-efficient of elasticity of the concrete should be used to translate strain into stress? These questions are pressing for answer, and the tests recently reported (see the Engineering Record of Feb. 26, pages 179 and 282, and of March 4, page 329) show that the subject is a live one and requires further exact experimentation.

In the second place, there must exist in the steel reinforcement an initial compression of unknown intensity, due to the shrinkage of concrete in setting. Although it is realized that there are practical difficulties, this journal suggests that in future measurements of strain the reinforcing rods be drilled with test holes before they are placed in the concrete. Accurate measurements and records of the unstrained lengths could thus be made and the amount of strain due to the effect of concrete shrinkage be determined. The presence of initial compression in reinforcement is, of course, advantageous for the tension steel in beams, but in columns it is an element of danger.

In any case, the exact determination of this factor would be a great aid in the attainment of a closer approximation to the true value of the internal stress in the material—which is the ultimate object of all such strain measurements.

Flaws in Road Bond Issues

THE FINANCING of road-building projects is bringing into the bond market an oversupply of county bond issues. There has been up to this time no marked reluctance to absorb these securities, but there are so many of them that the bankers are in a position to pick and choose as between those that are rated as being merely passable and those that are entirely acceptable. It cannot be expected that the supply of such issues can increase at the present rate without leading to a glut of the market and failure before the season is half over of many issues to find any market whatever.

State road bond issues are not here in question; there is little difficulty in ascertaining whether they are good or bad from an investment banker's point of view, whatever may be said from other viewpoints. Many miles of road for which a promise to pay in fifty years is outstanding, and on which interest must be paid for that length of time, have already worn out. The county bonds, of which so many are now coming on the investment market, are in a different category. As a rule, they run for twenty years, the security is ample and the credit of the communities that issue them is unquestionable.

Most of these issues, however, are the offspring of laws which authorize counties to bond themselves for all or a portion of the cost of highways, toward which the state or the abutting property owners or both may also contribute. The prescribed "legislation" leading up to the issuance of such bonds is often intricate. Its execution is left in the hands of county boards having the best of intentions but no experience in such matters and only a faint conception of how carefully a banker's attorneys will scrutinize the proceedings under which bonds are issued.

A middle western state, for example, has a law under which county road-building may be initiated upon petition of the property owners along the line of the proposed improvement. A certain proportion of the owners must sign the petition; then notice in certain form must be given of the date for a hearing, at which remonstrance against the movement may be made. Proceedings in the courts are authorized in certain instances to enable the commissioners to proceed in spite of remonstrances. If the project goes through, the state awards certain amounts per mile, depending on the classification of the road; the property owners pay 25 per cent of the remainder by installment assessments, and the county may issue bonds for the other 75 per cent.

If an insufficient number of property owners signed in the first instance, if there were unauthorized signatures on the petition, if there was any imperfection in the notice given of the proceedings of the county commissioners, or any flaw in carrying out any part of the page after page of detailed proceedings, the bonds may be declared invalid. Knowing this bankers are likely to regard such issues with suspicion without in any way questioning the credit of the county issuing the bonds. In many states entirely too much latitude has been allowed to counties in the matter of road-bond issues; or perhaps it would be more exact to say that they have put upon county boards duties and responsibilities which they are not equipped to perform. The casual assistance of a county attorney is often all the professional aid they have in carrying out proceedings quite as intricate and complicated as those for which the most competent legal talent would be employed if the case were, for example, that of a corporation making an issue of mortgage bonds. In such a case what will satisfy the banker's attorneys is ever in mind; while in the case of a county road-bond issue, that is not likely to be thought of until the banker refuses to consider the county's bond.

So far as the security back of county road bonds is concerned, the case is rare where the security is not much more than ample, even when, as should be done, no provision is made for retirement of the bonds in installments. There are few prosperous agricultural counties that are more than very lightly taxed in proportion to their wealth and ability to pay. Furthermore, when the cost of carrying a bond issue of say $1,000,000 is distributed per acre over the productive area of an average county the burden per acre or per farm is a mere feather weight. Such a computation made with respect of two Illinois counties showed that the interest and amortization charge per year on $1,000,000 of twenty-year bonds was less than 5 cents per acre. Not only is the charge light but the increase of property values is so substantial, and the saving in marketing so immediate, that the beneficiary of improved roads can pay for them out of a small share of what he derives from the investment.

This the bond buyer is usually willing to admit, but he nevertheless insists that the securities he buys must be entirely free from legal flaws. From this aspect the county road bond is likely to be weak. It is on this side, at least, that it needs strengthening in the opinion of the investment market. And, as pointed out in the beginning, the banker's requirements are likely to become more stringent and his scrutiny more severe as county road-bond issues multiply. This severity will become all the more marked as these securities get farther from home—out of the range of vision of the local banker—as they must, because no local market can absorb them in the quantities in which they are now coming forth.

Operating Cost Records Show Comparative Economy of 65 Motor Vehicles in Los Angeles Water Department

Analysis of Data Made for Machines Employed on General Administration, Meter Inspection, Collections and Pipe Line Construction and Repair—Blank Forms Developed and Maintenance Routine Systematized

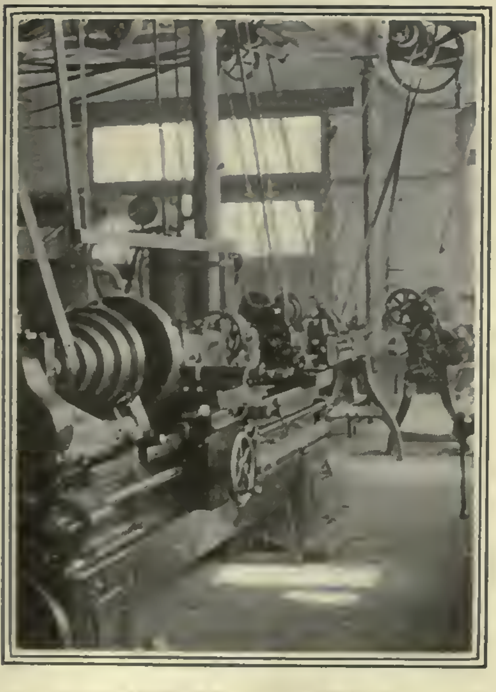
By BURT A. HEINLY
Bureau of Waterworks and Supply, Los Angeles, Cal.

BEGINNING with a five-passenger steam automobile in 1904, the Los Angeles City Water Department is now operating 80 self-propelled vehicles and has developed a system of operation and cost-keeping on standardized forms by means of which the performance of each machine may be accurately appraised. The methods employed are as simple, concise and lacking in red tape as it is possible to make them. The writer believes they are as applicable to the operation of 4 machines as 400. No delays, confusion or opposition of the force has been met with, and the cost is represented only by a small printer's bill and about one-half the time of one of the representatives of the purchasing department, who is known as the auto cost accountant.

In no other section of the United States are the conditions so nearly perfect for the use and development of the auto vehicle as in Southern California. This is due to the fact that in Los Angeles and adjoining counties a gentle climate makes the motor equally serviceable in all four seasons; the cities' streets are well paved and county roads, instead of following section lines, follow as a rule the trails of mission days, which pursue easy contour gradients. Improvement of the latter by state and county bond issues was begun seven years ago, and they are to-day among the best in the country.

Yard Operation

All cars are housed at the waterworks yards, centrally located. Room is here at a premium. To economize space, to make every car easily accessible and to procure a fireproof garage at a minimum cost, a 12-ft. brick wall was built along the boundary line of the property. This provides the side of the storage shed. Sheet steel roofing supported on steel posts completes the building, a part of which is shown in the illustration. In a less kindly climate a frontage of lift or sliding doors would be required.



MACHINE SHOP FOR AUTO REPAIRS AT LOS ANGELES IS COMPLETELY EQUIPPED

Each car is given and is known by a number and has its assigned place in the shed. The gates of the yard close at sundown and every car, with the exception of three or four for the use of executives who are subject to night call, must be reported in before closing time. Reporting-in consists of driving up to the filling stand where the keeper reads the speedometer and fills the machine with oil and gas. This information is set down on form C, which the driver endorses; it is then dropped into a locked mail box to which there is only one key—that of the cost accountant. Filling at night prevents any delay in getting away from the yards promptly on time in the morning and the method of accounting for gas and lubricant and checking against the filling of the garage tanks, as well as the speedometer readings, guards against the use of these commodities on private or any other vehicles than those of the department.

Two washers, one at $3 per day and one at $2.50 per day, are on an 8-hr. shift at night for cleaning the cars. If any car needs repairs it is laid out for the repair shop and an extra is made ready and is used until the regular car is again ready for the road.

All regular cars are driven by their users with the exception of the chief electrical engineer and the chief water engineer, who have drivers at $85 per month. All work cars are driven by the gang foreman. Truck drivers on light hauling do their own unloading, but on heavy trucking they are given helpers.

Garage Machine Shop

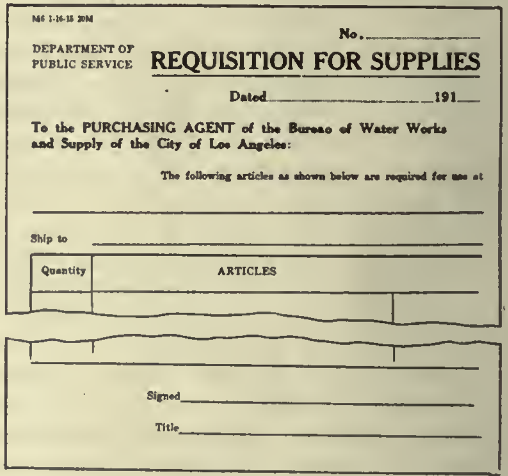
For the maintenance of equipment the two-story brick stables in 1912 were converted into a garage, the lower floor being given over to completely equipped machine and blacksmith shops; what was the haymow now serves for a paint and woodworking shop. An oxy-acetylene cutting and welding outfit, recently installed, is one of the largest time and money savers with which the shop is supplied. The force comprises a foreman at $5 per day and four assistants at $4 per day, with an emergency chauffeur at $90 per month who does about one-half shop time.

The shop in equipment is prepared to assemble completely any car, do all necessary woodworking and smithy work and all but the finer grades of painting. In addition, it serves as the mechanical aid of all outside construction camps and does all the mechanical and repair work for a distribution waterworks system of over 1000 miles. Hours of labor in the shop are from 7.30 a. m. to 4:30 p. m., the machines getting away from 7.30 to 8.00 a. m.

On entering the shop in the morning each mechanic receives his day's shop work card, form B, on which he keeps the record of his time and the material used. These on the morning following are collected by the auto cost accountant. The payroll is made up from this form, so that the cost keeper's record in both material and labor is checked. The form is simple and self-explanatory. All tire labor goes on form B and the tire data are recorded on form C. This has become a very important item for watchfulness, and great care is urged that no tire changes, whether on the road or in the shop, shall be made without a full record being taken. All auto equipment and the mechanical force are under the personal direction of the assistant superintendent, whose office is at the yards and whose hours are such that he is at his point of duty when the cars leave in the morning and when they return at night.

Purchases

All machines except Fords, which are purchased by simple resolution of the Board of Commissioners, are bought under sealed bids. This is required by law and is not entirely satisfactory. It results too often in acceptance of the lowest responsible bid, as is also by law required. To-day prices of machines are stabilized and matters of public knowledge. To purchase by make, disregarding in a measure the first price and giving consideration to operating costs, would tend to better the system. The specifications are drawn as broadly as possible in order that bids on almost any make of vehicle may be submitted. In these, two requirements are of merit: One is that the car must be of a model and make of common use in the city, with a bona fide agency where repair parts are kept on hand, and the other that the bidder shall furnish as a part of his bid a complete list of parts with prices. All trucks are purchased without bodies. These are manufactured in the department's shop along lines best adapted to waterworks use and at a cost of about 40



M6 1-16-15 20M

No.__________

DEPARTMENT OF
PUBLIC SERVICE

REQUISITION FOR SUPPLIES

Dated________________191__

To the PURCHASING AGENT of the Bureau of Water Works and Supply of the City of Los Angeles:

The following articles as shown below are required for use at ________________

Ship to ________________

Quantity	ARTICLES	

Signed________________

Title________________

FORM A—REQUISITION FOR SUPPLIES

per cent less than they can be purchased for elsewhere.

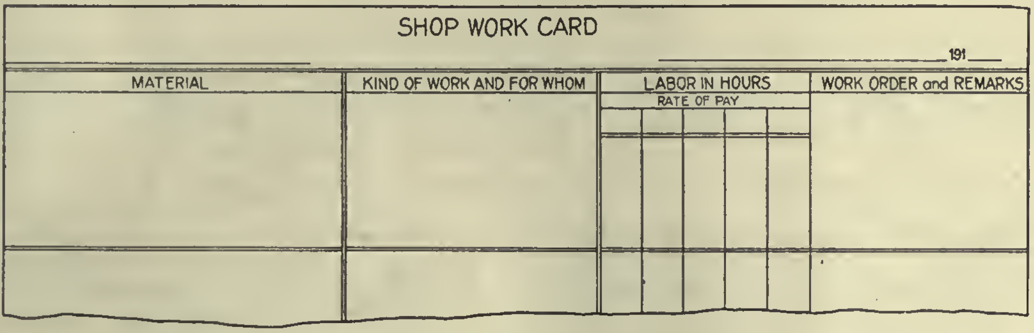
All equipment, such as parts, tires, etc., are purchased through the purchasing department, of which the auto cost accountant is a member. He handles the larger part of auto purchases and is greatly assisted in this by his first-hand knowledge of the quality and durability of the materials he buys. The shop foreman in making his orders uses form A—requisition for supplies. Where possible repair parts and supplies are purchased in quantities, the department having agreements with most of the dealers by which it receives regular dealer rates. A requisition in quadruplicate is then made out, one copy being retained by the purchasing department, one going to the auditor, one to the seller and one to the shop foreman. Payment is refused on goods obtained by any other than this method.

OFFICE RECORDS

Once each day the daily auto service report (form C) and the shopwork cards (form B) are collected by the auto cost accountant. From these the day's data for each machine are placed on the daily automobile record (form 1), which is spaced and dated to show the complete performance of a car for one month. The capitulation of form 1 goes onto the monthly automobile record (form 3), which contains spaces to show the complete equipment of the car and the capitulation of which gives the total cost of the machine to the department for the year.

Tire mileage record (form 2) gives the complete history of every tire owned by the department from the time purchased until it is worn out or replaced for inferiority. The three forms outlined above and here illustrated are of such simplicity that no further explanation is required. It is only needful to add that forms 1, 2 and 3 are cut for a loose-leaf ledger so that they form a single volume which is filed at the end of the year.

Some criticism may be made that the records are not as complete as should be necessary. To this answer can be made that the department has found the records sufficiently complete for all practical purposes. Eighteen months ago it was decided that neither the department's forms nor its tabulated records were of sufficient detail. It therefore assigned the auto cost accountant, on leave of absence, to make a study of the methods employed by all the larger private enterprises of this section that were using auto equipment. He found much more elaborate and involved systems than that here shown, but they brought complaint from drivers and much clerical work in tabulation. From his study and the department's needs the old system was revised, improved and adopted as here shown. It has thus far developed no serious defects and we begin our second year under it without any change.



SHOP WORK CARD

191__

MATERIAL	KIND OF WORK AND FOR WHOM	LABOR IN HOURS RATE OF PAY	WORK ORDER and REMARKS

FORM B—SHOP WORK CARD COLLECTED DAILY BY AUTO COST ACCOUNTANT

BECAUSE OF MILD CLIMATE THE STORAGE SHEDS FOR THE LOS ANGELES WATER DEPARTMENT AUTOMOBILES DID NOT REQUIRE OUTER WALLS

Costs for the 65 vehicles during 1915 were kept by one man, the auto cost accountant, who devotes approximately one-half his time to this work, the remainder being taken up with his regular duties in the purchasing department.

TIRE RECORDS

Outside of the value of knowing just what the equipment and each driver of a machine is doing, the cost-keeping for autos has produced a saving sufficient to defray about one-half the cost accountant's salary in the matter of tires alone. Before a careful record was kept there was no means of knowing what the tires were doing. All tires are under a guaranty of 3500 miles, with replacement at cost proportional to the mileage run. Many times, under the old system, no demand on the tire agent was ever made; there was nothing to rely upon but the driver's memory and it was much easier for the foreman to slip on a new tire at regular cost than to waste time in trying to fight it out with the agent for a replacement. To-day a defective tire goes back to the agent with its slip showing the whole record of its use and failure and there is no discussion over a refund. Moreover, it appears that nearly all makes of tires are subject at some time or other to periods of poor material or manufacture. The tire records show whenever and wherever this period arrives. With reports on tires of one make in use on three or four cars showing a falling off in mileage as compared with previous records or with records of other makes, the brand is discontinued and purchases are not resumed until information is obtained from other users that it has returned to its original standard. Where purchases in a year aggregate $6500 this is an item that will bear watching.

At the end of the year a sheet giving the year's run of each car, as shown in the table, but less perfect in form, is made up and each driver is furnished with a copy. The writer believes that much good could be accomplished by doing this monthly, thus creating a spirit of rivalry in securing the largest mileage at the least operating cost. The attention of drivers has been called at various times to the high mileage costs they were running up and warnings have been given, but the system has never extended beyond this point.

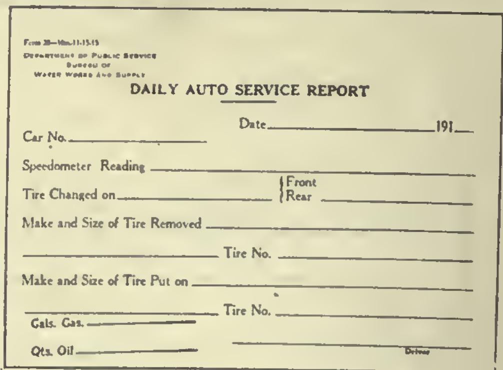
Consulting the table, original costs of cars and accessories will be found higher than in the Eastern states, owing to the addition of freight rates. Gasoline, however, is cheaper because Los Angeles is in the producing field. For this item the city purchases for all departments under an annual contract which is let in July. For the first six months of 1915 the contract price was 12 cents per gallon; during the last six months the price was 9½ cents per gallon, although on Jan. 1, 1916, garage prices had raised to 18 cents per gallon. The department's consumption of this commodity is about 300 gallons per day.

For its choice of lubricants the department, two years ago, conducted a durability test, resulting in the selection of a lubricant of standard make. This is purchased of a medium grade in 50-bbl. lots, delivered as needed, at 45 cents per gallon, less 10 per cent when the whole order has been completed. The quantity of oil used is about 1 bbl. per week.

For truck tires, the department has practically standardized on Goodyear S. V. Pressed-on. Where heavy loads are carried, the rear tires used are 5-in. dual solid and on small trucks 5-in. single solid.

WHAT THE TABULATION TELLS

The figures as presented by the table comprise a frank, unvarnished statement

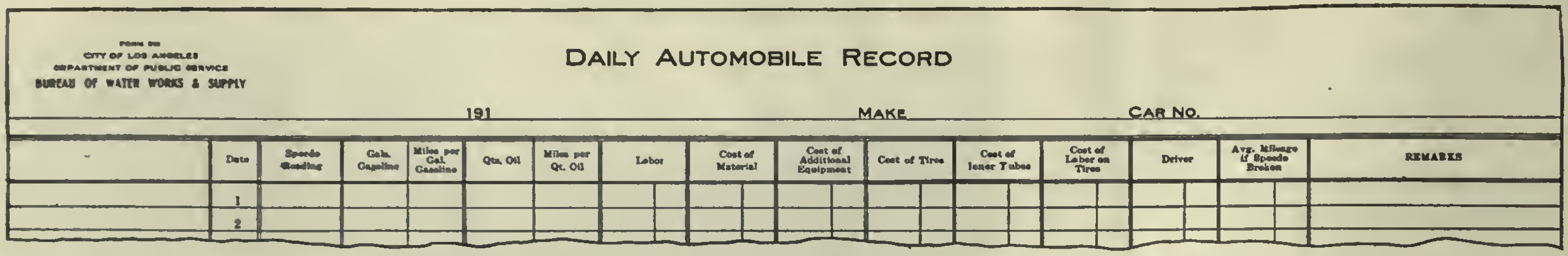


Form 20—[illegible]-11-15-15
Department of Public Service
Bureau of
Water Works and Supply

DAILY AUTO SERVICE REPORT

Date__________191__
Car No.__________
Speedometer Reading__________
Tire Changed on__________ {Front / Rear __________
Make and Size of Tire Removed__________
__________ Tire No.__________
Make and Size of Tire Put on__________
__________ Tire No.__________
Gals. Gas.__________
Qts. Oil__________ __________ Driver

FORM C—DAILY AUTO SERVICE REPORT


FORM [illegible]
CITY OF LOS ANGELES
DEPARTMENT OF PUBLIC SERVICE
BUREAU OF WATER WORKS & SUPPLY

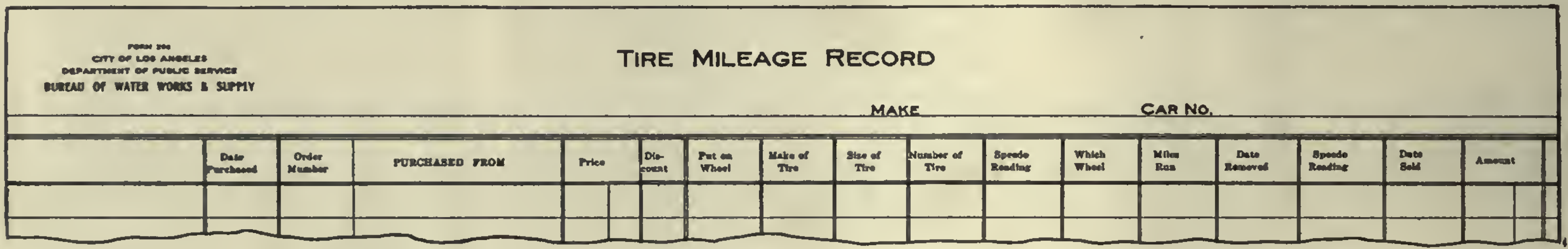
DAILY AUTOMOBILE RECORD

191 MAKE CAR NO.

	Date	Speedo Reading	Gals. Gasoline	Miles per Gal. Gasoline	Qts. Oil	Miles per Qt. Oil	Labor	Cost of Material	Cost of Additional Equipment	Cost of Tires	Cost of Inner Tubes	Cost of Labor on Tires	Driver	Avg. Mileage if Speedo Broken	REMARKS
	1														
	2														

FORM 1—THE DAY'S INFORMATION FOR EACH MACHINE IS ENTERED UNDER THESE HEADINGS

of operating costs, carefully compiled and with nothing omitted except interest on investment and depreciation charges, of which more later. Whether these costs are high or low as compared with the operation of equipment by the public service departments of other cities the writer has not been able to ascertain, as he has been unable to find published data with which a comparison could be made. With data printed as advertisement for several factories the Los Angeles mileage costs, it is freely admitted, will show high, but the writer can only believe that these records were not made so inclusive as his own, or else they were under ideal, and not practical, working conditions. In any event the mileage costs as shown in the table are about the average of what the department will continue to pay, as the operation of the equipment is now on a thoroughly organized basis.


FORM [illegible]
CITY OF LOS ANGELES
DEPARTMENT OF PUBLIC SERVICE
BUREAU OF WATER WORKS & SUPPLY

TIRE MILEAGE RECORD

MAKE CAR NO.

	Date Purchased	Order Number	PURCHASED FROM	Price	Discount	Put on Wheel	Make of Tire	Size of Tire	Number of Tire	Speedo Reading	Which Wheel	Miles Run	Date Removed	Speedo Reading	Date Sold	Amount	

FORM 2—A DETAILED RECORD IS KEPT OF THE SERVICE OF TIRES OF VARIOUS MAKES ON ALL MACHINES

From the standpoint of the tables one thing is certain—the operation of an auto vehicle by a public utility or a private business is only comparatively cheap. In the question of cost there can no longer be ground for comparison between it and the horse, for the horse is to-day in limbo.

SERVICE CLASSIFICATIONS

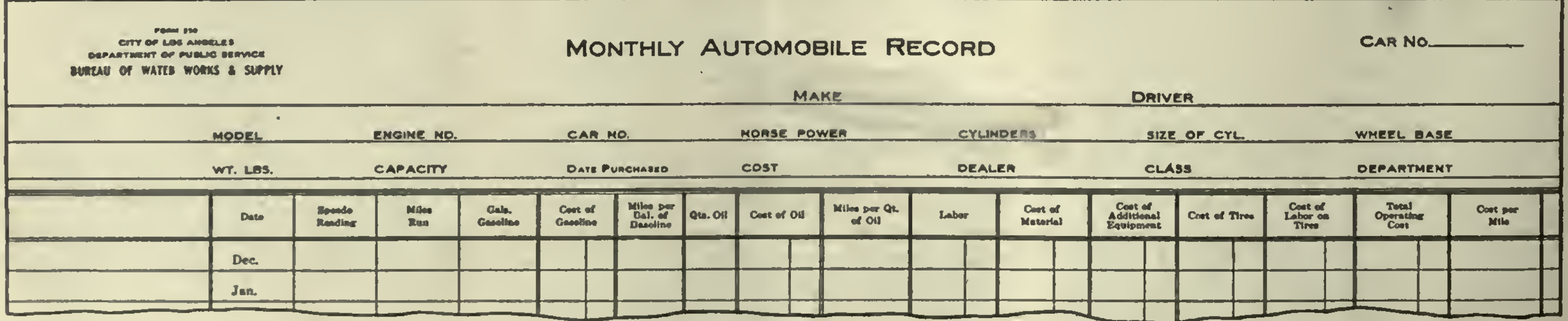
To arrive at costs of different classifications of service the cars were arranged under four different heads. For administration the average cost per car per day amounted to $1.44. As there are 21 cars so listed, the transportation cost for this item (which includes cars not particularly for administration but difficult to list under any other head) amounted to $30.32 per day. Cars for collections cost 66 cents per day for each machine, or $3.96 per day for the 6 in service. For the meter department the cost was $1.10 per car per day or $22 per day for the 20 machines this branch of the service requires. For the pipe-laying department the cost per vehicle was $1.346 per day or $24.23 as a total daily cost for the 18 machines required. Motorcycles for linemen on the Los Angeles aqueduct telephone patrol cost a total of 75 cents per day or 37½ cents for each machine. This makes a grand total expense to the department of $81.26 per day for the movement of its men and supplies. Comparing this sum, however, with the cost of horse equipment as used to the same end, it is safe to say that the latter could only be operated, and with much less efficiency, at two or three times the amount.

Low daily mileage may cause comment. This must be expected in a public service utility where the auto is used largely for hauling the men and light material to the work or for carrying the gang quickly from one job to another. The largest daily average mileage shown is that under administration at 31.26 miles per day. Here the auto is a money saver in an unexpected way. By enabling a chief executive to visit four or five important works at least once and often two or three times each day it has conspired against the engineer of only average ability. For him has been substituted the day foreman who is thoroughly capable provided he is not called upon for initiative and can be constantly observed and his efforts properly directed. The auto in this way has undoubtedly enlarged the field of the chief executive engineer and narrowed the scope of the engineer of lesser ability who, with collegiate training, reluctantly, if at all, accepts the foreman position and the foreman pay. There is, of course, the further saving alluded to by other writers in the centralization at one point under one executive head of all men and equipment.

In the compilation a depreciation charge has not been added to the operating cost, nor are any overhead charges accounted for. In figuring depreciation no hard and fast rules can be followed. It will vary with each car, depending upon the carefulness of the driver, the whole number of cars and the judgment of the man setting the depreciation rate. The time of service for a machine can therefore give no adequate basis for the actual working value of the car. As an instance of this, a Buick, 1914 model, driven by the farm superintendent, has deteriorated more than 60 per cent in less than two years because of hard usage, whereas a Kissel-Kar, model 1913, bought October, 1912, but driven by a mechanic who understands his machine, has gone a great many more thousand miles, and, as far as working parts are concerned, is in practically as good condition as when it was purchased. Placed on sale, however, it might not bring 50 per cent because it is an old model. To the department it still has the value of a machine almost new. Moreover, with the simplification and improvement of the modern car of to-day, particularly the motor truck, and in a business where style or appearance is of very little importance, the serviceable life of a machine is still a very debatable question. We are little interested, therefore, in figuring depreciation costs, but we are interested in figuring what cars make the miles with the least expenditure of tires, oil and gas.

The advent at the opening of 1915 of a moderately priced light truck worm-driven and with the engine under the hood has met with much satisfaction. It has long been the belief of Assistant Superintendent Brooks that this would be the final form evolved for trucks of this character.

The department has standardized on no special make of car. One reason for this, as referred to under "purchases," is that


FORM [illegible]
CITY OF LOS ANGELES
DEPARTMENT OF PUBLIC SERVICE
BUREAU OF WATER WORKS & SUPPLY

MONTHLY AUTOMOBILE RECORD

CAR NO.______

MAKE DRIVER

MODEL ENGINE NO. CAR NO. HORSE POWER CYLINDERS SIZE OF CYL. WHEEL BASE

WT. LBS. CAPACITY DATE PURCHASED COST DEALER CLASS DEPARTMENT

	Date	Speedo Reading	Miles Run	Gals. Gasoline	Cost of Gasoline	Miles per Gal. of Gasoline	Qts. Oil	Cost of Oil	Miles per Qt. of Oil	Labor	Cost of Material	Cost of Additional Equipment	Cost of Tires	Cost of Labor on Tires	Total Operating Cost	Cost per Mile	
	Dec.																
	Jan.																

FORM 3—MONTHLY AUTOMOBILE RECORD WHICH IS A CAPITULATION OF DATA ON FORM 1

the city charter requires the acceptance of the lowest responsible bid and this has resulted in an array of cars of different makes. The efficiency of the department's auto service makes it desirable to a dealer, from his selling standpoint, to say that the department has his make in its service and in order to place his car he is willing to make reductions to insure his being low bidder. As this is written the department is purchasing four 2½-ton trucks for $8,800, this price being 18 per cent under the bidder's established rate for the trucks in question. Even so, his was not the low bid, and the low bidder threatened injunction pro-

OPERATION AND MAINTENANCE COST OF MOTOR VEHICLE EQUIPMENT, LOS ANGELES WATER WORKS, IN 1915

Car Number and Make	Model	A.L.A.M. Rating	Date Purchased	Cost	Use	Miles Run	Gallons Gasoline	Cost Gasoline	Quarts Oil	Cost Oil	Labor	Cost Material	Cost Added Equipment	Cost Tires	Labor on Tires	Total Operating Expense	Miles per Gallon Gasoline	Miles per Quart Oil	Total Cost per Mile	No. Months Run	Weight
I. *Administration*																					
5 P. Alco	1912	60.0	3-29-12	$3500	Chief El. Eng.	11,688	1240	$149.03	393	$46.68	$125.55	$285.30	......	$522.13	$9.30	$1137.99	9.425	29.740	$0.0973	12	4500
5 P. Ford	1915	22.5	2-16-15	*525	Owens River Work	10,352	669	116.13	130.5	18.88	50.45	127.18	......	160.24	.50	473.38	15.473	79.325	.0457	11	1475
5 P. Ford	1915	22.5	2-24-15	*525	Supt. of small system	6,965	509	56.64	86.5	9.75	79.15	94.34	......	73.28	2.05	315.21	13.683	80.520	.0452	11	1475
5 P. Ford	1915	22.5	4-15-15	565	Surveys	10,428	708	73.12	78	8.84	30.15	55.58	......	55.25	2.70	225.64	14.728	133.690	.0216	9	1475
5 P. Ford	1915	22.5	9- 8-15	493	Asst. El. Eng.	3,656	286	27.39	43	4.66	44.40	90.59	81.50	34.30	.75	283.59	12.761	85.020	.0776	4	1475
5 P. Olds	1915	30.0	8-25-15	1225	Asst. El. Eng.	3,957	285	28.61	15.5	1.73	2.15	30.11	......	23.45	.....	86.05	13.884	255.290	.0218	5	2700
5 P. Kissel Kar	1913	28.9	10-20-12	3150	Asst. Supt.	15,983	1439	153.96	408.5	46.69	128.40	271.27	......	228.17	5.45	833.94	11.110	39.126	.0522	12	3150
5 P. Kissel Kar	1913	28.9	10-20-12	3150	Chief. Mech. Eng.	12,805	1033	111.15	392	44.52	127.70	208.49	......	190.77	2.40	685.03	12.395	32.666	.0535	12	3150
5 P. Ford	1913	22.5	10- 7-13	675	Field Eng.	16,575	1069	114.16	272.5	31.17	147.80	314.08	......	144.69	1.80	753.90	15.505	60.286	.0455	12	....
2 P. Ford	1913	22.5	10- 7-13	575	Timekeeper	15,140	865	92.41	114.5	12.97	83.57	91.10	......	86.58	2.55	369.18	17.503	132.227	.0244	12	1475
5 P. Pierce Arrow	1912	38.4	10-16-13	2500	Chief Eng.	16,402	1837	204.64	162.5	19.05	83.60	247.76	......	400.63	.80	956.38	8.694	100.935	.0583	12	3770
5 P. Pope-Hartford	1913	36.1	10-16-13	1400	Aq. Supt.	13,509	1067	160.31	208	32.06	337.20	533.34	......	444.59	4.50	1,512.00	12.666	64.899	.1119	12	4650
3 P. Mitchell	1910	28.9	......	......	Chief Mech. Con.	3,024	231	27.72	55	6.60	10.10	3.20	......	37.75	.65	86.02	13.091	54.981	.0218	4	2725
2 P. Olde	1915	30	5-25-15	1285	Chief Mech. Con.	12,210	682	70.15	60	6.92	25.70	17.01	......	62.43	3.23	185.44	17.916	201.818	.0152	8	2600
5 P. Franklin	1912	38.4	......	......	Extra Car	13,313	1330	166.19	147	18.83	256.45	261.30	......	317.43	1.30	1,021.50	10.013	90.874	.0767	12	3475
2 P. Buick	1914	22.5	4-22-14	1060	Farm Supt.	9,985	717	153.61	260	37.65	130.00	199.01	......	162.40	5.50	688.17	13.926	38.403	.0689	12	2155
5 P. Dodge	1915	25	5- 2-15	975	Asst. Aud.	9,871	631	67.17	136	15.17	29.30	35.13	......	71.10	2.35	220.82	15.655	72.531	.0224	8	....
5 P. Ford	1915	22.5	5-15-15	525	Bacteriologist	7,593	565	59.37	62	7.06	19.90	40.58	......	37.45	.50	164.86	13.427	122.468	.0217	8	....
2 P. Ford	1915	22.5	9-18-15	525	Gager	3,456	234	36.55	35	4.68	21.85	9.15	19.72	27.50	.....	119.45	14.737	98.743	.0346	4	1475
2 P. Dodge	1915	25	11-27-15	895	Meter Supt.	852	62	5.95	5	.50	4.85	14.15	......	12.69	.25	38.39	13.632	170.400	.0451	1	....
2 P. Mitchell	1909	25.6	12-15-08	1900	Meter Supt.	3,826	232	25.24	68	7.98	47.35	29.53	......	42.72	1.00	153.82	16.491	56.264	.0402	11	2550
Total	..	..	......	$25,448	....	201,590	15741	$1899.50	3132.5	$382.90	$1785.62	$2958.20	$101.22	$3135.65	$47.58	$10310.76	286.715	2000.256	$1.0016	..	....
Av. for 21 cars	..	..	......	1339.31	....	9,599	749.5	90.52	149.6	18.23	85.03	140.86	4.82	149.31	2.08	443.36	12.806	64.3	.0477	..	....
Av. cost per day, 307 days	..	..	......	......	....	31.26	2.44	.295	.48	.059	.276	.458	0.15	.487	.006	1.444	.....	......	.....	..	....
II. *Collections*																					
2 P. Ford	1911	22.5	7-1 11	$575	Collector	12,951	818	$89.80	151	$17.80	$117.55	$102.64	......	$99.77	$3.20	$430.76	15.842	85.768	.0333	12	....
2 P. Ford	1915	22.5	6-28-15	443	Collector	3,012	232	22.42	37	4.16	7.56	2.90	......	....	.....	37.04	12.954	85.405	.0122	5	....
2 P. Ford	1913	22.5	6-28-13	575	Collector	6,034	434	41.56	50	5.55	8.60	18.18	......	20.50	.....	94.39	13.919	121.899	.0156	7	....
2 P. Ford	1915	22.5	9- 1-15	443	Collector	2,235	164	15.58	34	3.61	40.17	20.25	8.57	....	.75	88.95	13.628	64.782	.0398	4	....
2 P. Ford	1915	22.5	8-28-15	443	Collector	2,082	158	14.96	15	1.68	12.85	5.25	9.90	....	.....	44.64	13.219	138.800	.0215	5	....
2 P. Ford	1915	22.5	11- 1-15	443	Collector	1,498	119	11.26	15	1.60	3.00	3.84	11.21	....	.....	30.81	12.641	99.866	.0206	2	....
Total	..	..	......	$2922	....	27,812	1925	$195.58	302	$34.30	$189.73	$153.06	$29.70	$120.27	$3.95	$1157.35	82.203	596.520	.1130	..	....
Av. for 6 cars	..	..	......	487	....	4,635	321	32.59	50	5.71	31.62	25.61	4.95	20.04	.66	192.89	14.45	.92	.0238	..	....
Av. cost per day, 307 days	..	..	......	......	....	10.09	1.04	.106	.16	.132	.103	.084	.016	.66	.002	.635	.....	......	.....	..	....
III. *Meter and Service Trucks and Work Cars*																					
Ford Work Car	1915	22.5	7- 7-15	443	Leaks	6,553	489	$46.42	43.5	$4.67	$21.88	$11.37	$8.65	$48.52	.....	$141.51	13.373	150.184	$.0216	6	1450
Ford Work Car	1915	22.5	5-28-15	443	Extra	4,908	281	27.85	33.5	3.75	20.75	13.17	7.81	....	......	73.33	17.466	146.507	.0149	7	1450
1½ Ton Autocar	1911	18	9-12-10	2350	Leaks	10,781	1320	143.12	338.6	39.45	230.08	307.63	......	93.43	3.70	817.41	8.167	31.849	.0758	12	4300
1½ Ton Autocar	1911	18	5-25-11	2350	Leaks	9,756	1336	145.47	279.5	32.33	138.65	189.59	......	71.23	1.25	678.52	7.302	34.901	.0593	12	4300
1½ Ton Autocar	1911	18	7- 8-11	2350	Services	7,842	926	99.68	161	18.50	70.65	145.68	......	171.67	1.65	507.83	8.473	48.708	.0648	12	4300
1½ Ton Autocar	1911	18	8-29-11	2350	Cement	6,737	1219	132.09	257	29.71	86.55	93.09	......	119.21	2.20	462.85	5.526	26.214	.0687	12	4300
1½ Ton Autocar	1912	18	6-25-12	2300	Services	6,804	928	99.00	265	32.74	91.05	141.47	......	56.20	1.70	422.16	7.332	25.679	.0620	12	4300
1½ Ton Autocar	1915	18	5- 8-15	1750	Leaks	7,311	975	99.30	200	22.16	77.13	16.54	36.01	....	.....	251.14	7.494	36.555	.0344	8	4300
1½ Ton Autocar	1915	18	7-17-15	1745	Services	4,242	525	49.99	123	13.24	92.88	11.00	92.70	62.05	.....	321.86	8.072	34.488	.0759	5	4300
1½ Ton Autocar	1915	18	7-22-15	1745	Leaks	7,593	816	77.49	164	17.56	119.93	28.92	122.97	....	.....	366.87	9.299	46.298	.0483	6	4300
1½ Ton Autocar	1915	18	8-25-15	1745	Services	2,288	350	34.09	35	3.70	55.65	21.67	23.20	37.50	.....	175.81	6.537	65.371	.0768	5	4300
1½ Ton Federal	1915	18	2-19-15	2000	Meter and Serv.	4,344	796	85.64	93.5	10.83	288.70	459.52	46.01	31.60	.50	922.80	5.461	46.459	.2103	10	4500
2 Ton Kissel Kar	1913	32.4	9-23-13	2325	Meter and Serv.	7,528	1306	139.60	306	35.74	31.90	89.84	......	69.36	.....	366.44	5.762	24.601	.0485	12	6226
Ford Work Car	1914	22.5	7-27-14	575	Meter Insp.	12,512	644	68.04	133	15.80	24.25	46.72	......	71.63	1.70	228.14	19.429	90.666	.0182	12	1450
Ford Work Car	1914	22.5	7-27-14	575	Meter Insp.	13,133	876	95.66	125	14.31	52.55	86.86	......	93.58	3.00	345.96	15.001	105.888	.0263	12	1450
Ford Work Car	1915	22.5	3-15-15	443	Meter Insp.	10,903	817	85.56	82	9.53	41.75	21.14	7.01	63.99	.....	288.98	13.337	132.158	.0210	10	1450
Ford Work Car	1915	22.5	3-15-15	443	Meter Insp.	10,788	759	79.34	81	9.26	45.08	23.54	7.01	74.52	.25	239.00	14.204	133.185	.0222	10	1450
Ford Work Car	1915	22.5	9- 7-15	443	Meter Insp.	4,640	377	35.78	27	2.83	17.70	8.45	14.31	6.50	.....	85.57	12.324	175.094	.0184	4	1450
Ford Work Car	1915	22.5	10-19-15	443	Meter Insp.	2,808	208	19.86	35	3.50	14.90	5.10	13.93	....	.....	57.29	13.467	80.229	.0204	3	1450
Ford Work Car	1911	22.5	8-21-11	590	Shop Car	3,249	269	29.02	21	2.40	21.15	32.69	......	9.60	.....	94.86	12.100	154.714	.0292	12	1450
Total	..	..	......	$27408	....	144,720	15,127	$1593.00	2808.50	$322.01	$1543.18	$1753.99	$379.61	$1080.59	$15.95	$6748.33	210.126	1589.748	$1.0170	.	....
Av. cost for 20 cars	..	..	......	1370.40	....	7,236	761	79.65	140.4	16.10	77.15	87.69	18.98	54.02	.79	337.41	9.51	51.05	.0508	..	....
Av. cost per day, 307 days	..	..	......	......	....	23.56	2.47	.227	.45	.05	.25	.285	.0616	.176	.002	1.10	.....	......	.....	..	....
IV. *Pipe Laying, Heavy and Work Trucks*																					
1½ Ton Autocar	1911	18	5-25-11	$2350	Extra	8,001	1051	$114.89	189	$21.58	$63.45	$160.55	......	$102.91	$1.70	$465.08	7.609	42.333	$.0581	12	2350
1½ Ton Autocar	1912	18	6-25-12	2300	Extra	7,008	947	102.23	209	26.24	65.50	67.73	......	125.04	.50	387.24	7.404	33.531	.0553	12	2350
1½ Ton Autocar*	1913	18	2- 4-13	2300	Pipe Const.	10,433	1434	156.25	289	33.44	98.00	106.58	......	129.24	.....	523.51	7.275	36.100	.0502	12	2350
1½ Ton Signal	1915	20	4-20-15	1710	Pipe Const.	6,513	1289	129.22	88	9.92	72.60	17.64	......	46.01	.....	275.39	5.051	74.011	.0423	8	....
1½ Ton Federal	1916	18	7-31-15	2000	Pipe Const.	3,163	424	40.21	21	2.26	62.59	16.39	94.28	....	.....	215.73	7.460	150.619	.0682	5	....
3 Ton Packard	1912	32.4	11-15-11	3600	Hauling Pipe	11,863	2178	231.32	727	83.20	61.00	131.98	......	354.74	.95	863.19	5.448	16.329	.0728	12	8175
2 Ton Moore	1912	32.4	4-19-12	2670	Pipe Const.	6,637	1177	126.35	236	27.04	155.25	62.27	......	120.04	2.80	493.75	5.641	28.122	.0744	12	7350
2 Ton Moore	1914	32.4	4-24-14	2351	Pipe Const.	6,389	1291	139.35	196	23.15	108.81	115.79	......	201.95	.....	589.05	4.946	32.514	.0919	12	7335
2 Ton Moreland	1913	27.2	6-30-13	2343	Pipe Const.	6,817	935	101.55	203	23.56	88.15	78.06	......	175.62	1.25	469.19	7.294	33.581	.0688	12	6160
3 Ton Mack	1913	48.4	6-25-12	3250	Hauling Pipe	12,755	3044	330.31	1169	135.24	160.49	96.61	......	240.08	5.30	976.03	4.190	10.911	.0765	12	9100
½ Ton Regal	1900	25.6	7-17-09	2300	Pipe Const.	5,099	620	68.31	257	29.82	43.75	51.83	......	61.24	1.85	256.80	8.231	19.840	.0504	12	1350
½ Ton Stoddard Dayt'n	1908	27.2	2-23-10	600	Gate Insp.	11,557	1116	120.08	140	15.62	79.30	68.47	......	132.90	.90	417.27	10.355	82.550	.0361	12	3240
¾ Ton Kissel Kar	1912	28.9	4- 9-12	1459	Pipe Const.	7,933	1000	108.40	331	40.28	75.87	110.74	......	135.65	2.10	473.04	7.953	23.966	.0596	12	3650
¾ Ton Kissel Kar	1912	28.9	6-25-12	1650	....	7,913	1044	115.00	380	44.28	93.75	120.04	......	120.20	2.45	495.72	7.580	20.323	.0626	12	3650
½ Ton Mitchell	1910	28.9	6- 1-13	700	Gate Rep.	9,006	907	96.92	418	47.41	97.53	55.35	......	125.03	1.60	423.84	9.9229	21.519	.0491	12	3150
½ Ton Stoddard Dayton	1908	28.9	7-17-15	*	Gate Rep.	.....	66	6.27	18	2.08	2.80	16.26	......	27.41	.....	....	.....	......	.....	..	....
Ford Work Car	1915	22.5	3-15-15	443	Pipe Const.	3,987	381	39.11	67	7.60	21.87	13.58	7.01	14.54	.50	104.21	10.228	58.164	.0267	10	2350
Ford Work Truck	1915	22.5	7-17-15	443	General	5,660	351	33.55	45	4.96	21.23	12.83	8.12	23.95	.25	104.69	16.125	125.777	.0185	6	....
Ford Work Truck	1915	22.5	4-26-15	443	Irrigation	14,802	952	103.12	183	20.32	51.15	41.84	7.01	91.90	1.85	317.19	15.548	80.805	.0214	9	....
Total	..	..	......	$32912	....	145,536	20207	$2162.44	5166	$598.00	$1432.09	$1344.54	$116.92	$2228.45	24.00	$7850.92	148.261	891.995	$.9809	..	....
Av. cost for 18 cars	..	..	......	1732.21	....	7,660	1063	113.81	272	31.47	75.37	70.76	6.15	117.28	1.26	413.20	7.2	28.11	.0516	..	....
Av. cost per day	..	..	......	......	....	24.9	3.46	.37	.88	.102	.245	.23	.02	.382	.004	1.346	.....	......	.....	..	....
V. *Motorcycles*																					
Merkel	1913	..	9-24-13	......	Telep. Line Rider	2,440	66	$7.15	28	$3.18	$8.40	$43.10	......	$12.09	.....	$74.73	37.880	87.142	$.0304	12	....
Merkel	1914	..	6-24-14	......	Telep. Line Rider	10,223	158	19.03	60	6.92	27.50	88.97	......	13.02	.....	155.44	64.933	170.383	.0152	12	....
Total	..	..	......	......	....	12,663	224	$26.18	88	$10.10	$35.90	$132.07	......	$25.11	.....	$230.17	102.813	257.525	$.0456	..	....
Av. cost per car	..	..	......	......	....	6,331	112	13.09	44	5.05	17.95	66.03	......	12.55	.....	115.08	56.53	144.0	.0228	..	....
Av. cost per day	..	..	......	......	....	20.6	.36	.423	.14	.016	.584	.218	......	.04	.....	.374	(51.4)	(128.76)	.....	..	....
Grand Total																					
Total	..	..	......	$88790	....	532,319	63314	5876.70	11497	1347.40	4986.52	6341.86	626.95	6590.07	91.48	26297.53	829.281	5335.544	3.1881	..	....
Av. cost per vehicle	..	..	......	1409*	....	7,945	796	87.71	171.5	20.11	74.42	94.65	9.35	98.36	1.36	392.50	9.98	79.63	.0476	..	....
Av. cost per day	..	..	......	......	....	25.88	2.59	.285	.55	.065	.242	.308	.03	.32	.004	1.278	112.377	......	.....	..	....

*Av. for 63 cars.

ceedings to force the purchase of his car. In this instance the table here illustrated was brought forward and the respective merits of not only the equipment but the operating costs set forth.

The refusal to standardize, however, has had certain advantages, one being that it maintains competition not only on initial costs of machines but also on parts. Be this as it may, the department has come to look upon two machines as almost standard. The writer has no fear of being accused of publicity work in mentioning the Ford. Unquestionably it is by all odds the car best adapted to department service under the three main heads of initial cost, cheapness of maintenance and cost of operation. The department has 26 in use. If out of service they are easily repaired at low cost of parts and little time is required in the shop for parts replacement. The operating costs in the table speak for themselves. On collection service, where they are the only machines employed, the operation in 1915 ranged from 1½ to 3 1-3 cents per mile (downtown streets, with traffic stops and low gear frequent), while the average daily cost was only 63½ cents, or less than half the daily maintenance of a one-horse rig.

On Ford light work-cars, which the department does not hesitate to load to 1000 lb., the turtle-back end of the roadster is removed and is replaced by a light truck body built at the shop at a cost of from $7.50 to $8 each. Several such trucks have been in use since 1911 and they are still "running strong."

One Truck Partly Standardized

Consulting the table, the reader will be able to denominate the truck that has been partially selected as standard. This is for the reason that, like the Ford, its factory has standardized the model, many of the parts are interchangeable and these are sold at a reasonable price. If not overloaded it is of good value in waterworks service. In very hilly regions, on account of its small horsepower, the machine might not prove serviceable, but here, with comparatively gentle gradients, the engine is of large enough size to do the work assigned to it, is of sufficient speed and the truck is not torn to pieces by too much engine.

The department does all its own hauling with the exception of cast-iron pipe from cars to trench. This is let by annual contract and comprises usually the disposition at one time of several thousand tons arriving in quantities which the department could not handle without disrupting its regular auto service, and then with heavy railroad demurrage.

In the hauling of gates, hydrants and stock pipe no effort has been made in the tables to arrive at ton-mile costs. The needs of the different gangs are so variable, with small and diminishing loads so frequent, that cost data would be of little value.

While the table is of large value for a single year and gives fair averages from which deductions may be drawn, the tabulation does not and cannot tell the full story. To be fully comprehensive it should include two, three or, better still, five years. With two years, complete tire changes would show (in a year's schedule a tire change in December would not be listed in the following year's costs), and with three or five years' records the full maintenance and replacement costs would be brought out. Such a plan the department has in mind as based on the system explained in this article.

Pumping Costs with Diesel Engines Given in Detail

Installation in Duplicate at Appleton, Wis., Serves 18,000 Population and Operates Against 185-Foot Head

By H. W. GOCHNAUER
Sanitary Engineer, Department of Water, Appleton, Wis.

DIESEL oil engines, operated for the year ended April 1, 1916, furnished power for the municipal water supply of Appleton, Wis., a city of 18,000 inhabitants, at an average fuel cost of $2.82 per million gallons of water pumped against a head of 185 ft. The installation consists of two 225-brake horsepower, three-cylinder, four-stroke cycle Busch-Sulzer Bros.-Diesel oil engines, located opposite and parallel to each other in such a manner that their air compressors can be belted to either unit. Each engine is directly connected to two Deane double-acting triplex pumps of 2,000,000 gal. capacity each, located one on each end of the engine shaft. The total capacity of one unit, 4,000,000 gal., is sufficient for the city's fire protection. By running the two units alternately, one each week, one unit is always in reserve.

DUPLICATE DIESEL ENGINES PUMP WATER SUPPLY OF APPLETON, WIS., AT COST OF $11.64 PER MILLION GALLONS AGAINST HEAD OF 185 FEET

Lighting Bill Saved

Soon after the plant was put into operation it was found that the cost of current from the local lighting company for lighting the filtration and power plants was about $60 a month, or about half of the entire cost of the fuel consumed in supplying the city with water. To save this expense it was decided to discontinue the purchase of current and install two Allis-Chalmers 15-k.w. 110-volt direct-current generators connected by Link-Belt silent chains, one to each engine. This eliminated the cost of lighting completely, as the generator load on the engines did not sensibly increase the fuel oil consumption over previous months.

Until early in 1915 the station supplied water to the city without stand-pipe or distributing reservoirs, the water being pumped directly into the mains. Due to the fluctuation in the consumption it was necessary to run two pumps continuously, controlling the pressure by means of a Ross regulating valve that by-passed the surplus water to the suction line. This procedure caused a considerable waste of power and was the main cause for the erection of an elevated tank or distributing reservoir of 500,000 gal. capacity, located in the heart of the city.

For the past year, by utilizing the elevated tank, the station has been operating on an average of but 16.2 hr. per day. After the tank is filled one pump holds it full and supplies the consumption demands over night. The shut-down occurs in the morning during the low consumption period of the day, when the demand is met solely by the contents of a full tank.

It was calculated that it would be most economical to shut down at night, when the consumption is at a minimum. However, on trying this out it was surprising to find that during this short shut-down period the cost of lighting the two buildings amounted to approximately $30 a month, which was more than the cost of the fuel oil required to run the one pump and the generator in service during this period. That is to say, it was found that the station could pump water for a period of time equal to the shut-down period, generating its own lighting current, for less than the cost of outside lighting service.

Fire Pressure Regulated

Fire pressure is supplied by pumping directly into the city mains at a pressure of 110 lb. per square inch. This is accomplished by closing off the elevated tank by means of an electro-hydraulic control operated from the power house. The fire pressure is controlled by the Ross regulating valve. Tests have proved this operation can be accomplished 32 sec. after the fire alarm is received. If the alarm is received while the plant is shut down it is easily and quickly put into operation, the high pressure required being supplied in 3 min.

During the winter, in order to supply the engines and air compressors, a volume of air equal to three times the air displacement of the building must enter through the ventilator in the roof every 24 hours. Consequently, the heating coils were placed on the lower chord of the roof trusses, successfully heating the air as it is drawn into the building. The heating plant, comprising a Spencer boiler, is located in the basement of the adoining filtration plant.

COST OF OPERATION

The operating labor consists of a chief engineer and three assistants, who work in two two-man shifts. Because of the delicacy with which the fire pressure must be controlled, due to the condition of the mains, it is not at all desirable to depend upon a one-man shift.

The accompanying tables, compiled by Chief Engineer Otradov, are self-explanatory and cover the operating data for the year quite completely.

TABLE 1—PUMPAGE AND FUEL OIL CONSUMPTION

Month 1915-16	Total hr. run	Total amount fuel oil	Total pumpage, mil. gal.
April	577	4,562	60.380
May	553	4,310	59.180
June	522	3,814	50.080
July	551	3,972	52.800
Aug.	558	4,156	52.910
Sept.	524	3,660	44.630
Oct.	454	3,458	43.950
Nov.	494	3,466	39.710
Dec.	441	3,310	39.990
Jan.	429	3,378	43.020
Feb.	425	3,226	40.040
March	420	3,298	42.740
Total	5,948	44.610	569.430

TABLE 2—LUBRICATING OIL USED

Month, 1915-16	Lubricating oils used per month (gal.)			
	Cylinder oil	Air comp. oil	Engine oil	Kerosene oil
April	33.00	2.00	8.50	3.00
May	30.75	3.25	8.25	6.30
June	39.25	4.62	11.00	4.87
July	45.00	3.50	10.37	5.37
Aug.	76.00	4.00	18.62	11.25
Sept.	39.25	2.75	12.12	6.50
Oct.	69.00	3.00	7.87	6.50
Nov.	50.25	2.25	6.87	6.75
Dec.	39.75	2.25	8.25	7.25
Jan.	45.25	1.12	6.37	7.62
Feb.	42.00	2.12	6.87	7.62
March	50.00	2.37	4.37	7.50
Total	559.50	33.23	109.46	80.53

TABLE 3—AVERAGE PUMPAGE AND FUEL OIL CONSUMPTION

Month, 1915-16	Av. hr. run per day	Av. amt. fuel oil per day	Av. pumpage, mil. gal. per day	Av. fuel oil per mil. gal. water pumped
April	19.0	152.0	2.012	75.5
May	17.9	139.0	1.909	72.8
June	17.4	127.1	1.666	76.1
July	17.7	128.0	1.703	75.2
Aug.	18.0	133.8	1.706	78.5
Sept.	17.4	112.0	1.487	80.6
Oct.	14.6	111.5	1.416	78.6
Nov.	16.4	115.5	1.280	87.2
Dec.	14.1	106.7	1.287	82.7
Jan.	13.8	108.9	1.387	78.5
Feb.	14.6	111.2	1.380	80.5
March	13.5	106.3	1.377	77.1
Average	16.2	121.0	1.550	78.6

TABLE 4—COST OF OPERATION, APPLETON PUMPING STATION, APRIL 1, 1915, TO APRIL 1, 1916

		Total cost	Cost per million gallons
Fuel oil:			
44,610 gal. at 3.6c. per gal		$1,605.96	$2.82
Lubricating oil:			
Cylinder, 559.50 gal. at 30c	$167.85		
Air compress, 33.23 gal. at 30c	9.97		
Engine, 109.46 gal. at 20c	21.89		
Kerosene, 80.53 gal. at 8c	6.44		
		206.15	.36
Labor:			
Chief Engineer	$1,350.00		
Three assistant engineers	2,340.00		
		3,690.00	6.48
Materials:			
Miscellaneous supplies and expenses (heating, telephone, stationery, printing, packing, etc)	887.95		
Maintenance of engines (repair exhaust pipe)	22.64		
Maintenance of pumps	215.95		
		1,126.54	1.98
Total operating cost		$6,628.65	$11.64

NOTE.—A break in the strainer system of the filter plant caused sand to be admitted into the cylinders of the pumps. One cylinder was so badly cut that it was necessary to reline it. The cost of this repair and the expressage on same constitute the pump maintenance.

Meter Maintenance and Repair Systematized in East Orange, N. J., Water Department

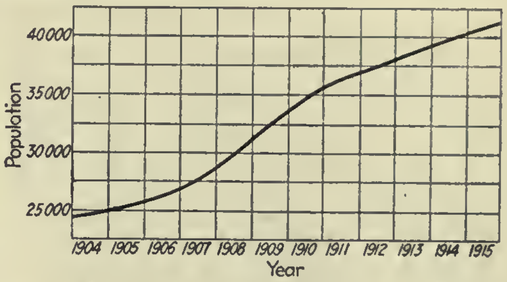
All New Meters Tested at Three Rates—Individual "History Cards" Kept—Per Capita Consumption Reduced to 67 Gal. Daily Last Year

TO supply a population of 42,000 in East Orange, N. J., in 1915 required 175,000,000 gal. less water than was needed in 1910 for only 35,000 people. For this surprising economy meters are accountable. Five years ago the sale of water was based almost exclusively upon a system of flat rates. In 1911 a program of meter installation was begun, and to-day the flow through about 75 per cent of the city's 8100 services is registered and paid for according to a schedule of the amount of water actually used. Reduced to definite terms, the saving effected by the 6000 meters now in service is that resulting from the lowering of the average daily per capita pumpage from 92 gal. in 1910 to 67 gal. in 1915. It is planned to have a 100 per cent metered city by December, 1917, when still further economies are anticipated.

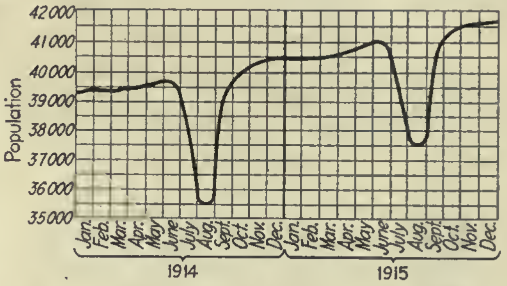
INVESTMENT OF $54,500 IN METERS

The administration of the East Orange water department, however, has not been content with the mere installation of water meters. It is held that the maintenance element is just as important in the water meter problem as in that of good roads, and under the direction of A. A. Reimer, the department's chief engineer, a meter maintenance and repair division has been organized on a systematic basis to safeguard a present investment of $54,500 in water registering devices. This meter division occupies a portion of the department's storage yard building and is charged with the responsibility of keeping the present total of 6000 meters in working order, testing all new meters and maintaining individual records on cards of every meter set or removed. Simplicity is the keynote of the organization and methods. The prime object of the department is to install and repair meters quickly at a minimum cost, and with this idea in mind bicycles, instead of motor cars, are considered entirely satisfactory for the use of the inspection and repair gang, and the card index system is such that a clerk with no qualifications as a cost account expert can operate it.

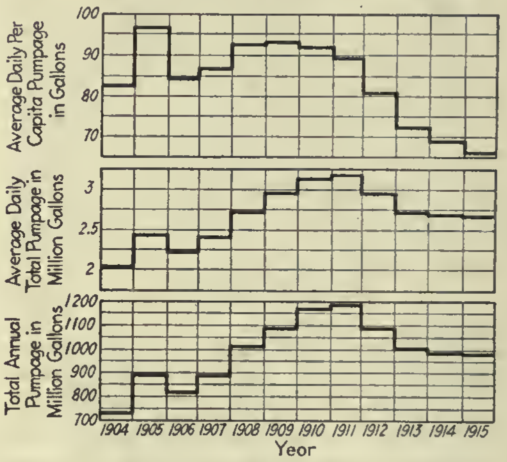
The department's policy has been to purchase and set all meters and bear the expense of normal wear and tear. In case of palpable neglect or the freezing of a meter the property owner is held to account. Every new service connection, for domestic or other purposes, is equipped with a meter, and all charges for water through such services are based upon the established meter rates. The Board of Water Commissioners has authority to install a meter on any service pipe not so equipped, and to determine the size of meter required. Meters are the property of the water department, and are at all times under its control.



EAST ORANGE'S POPULATION GROWTH



MANY PEOPLE LEAVE TOWN IN SUMMER



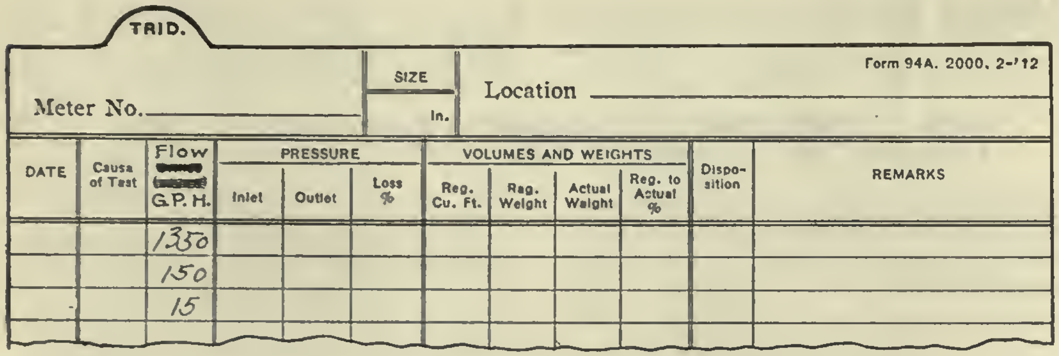
THESE CURVES SHOW HOW WATER CONSUMPTION WAS REDUCED FOLLOWING INSTALLATION OF METERS IN 1911

REQUIRED ACCURACY

East Orange is a residential city, and very little water is used for other than domestic purposes. The prevailing size of meter is ⅝ in., and the disk type predominates. Each new meter, when received from the manufacturers, is tested at three rates of flow before it is placed in service, and must meet the following requirements for accuracy:

Test No.	Rate, gal., per hour	Required accuracy, per cent
1	1350	99-100
2	150	98-102
3	15	90-100

The testing apparatus consists of connections with the city supply, a water tank mounted on scales and a long bench upon



TRID.

Form 94A. 2000. 2-'12

Meter No.______ SIZE ___ In. Location ______

DATE	Cause of Test	Flow [redacted] G.P.H.	PRESSURE			VOLUMES AND WEIGHTS				Dispo-sition	REMARKS
			Inlet	Outlet	Loss %	Reg. Cu. Ft.	Reg. Weight	Actual Weight	Reg. to Actual %		
		1350									
		150									
		15									

ACCURACY TEST RESULTS ARE REPORTED ON "HISTORY CARD"

which it is possible to connect fifty meters and test them simultaneously on the two low rate flow tests, thus effecting a marked economy in the use of water as compared with a scheme of individual tests. The water, after passing through the meters, is weighed and its volume accurately computed. If the meter meets the requirements it is placed upon a shelf ready for installation when needed. If the registration is inaccurate the meter is returned to the manufacturers or adjusted in the city's shop.

REPAIRING OLD METERS

The following is the procedure in the case of an old meter which is found to be defective: The meter reader, during his periodic rounds of residences, reports to the main office, for example, that a meter is stuck. Within a few hours another member of the force, on a bicycle with a wire-cage carrying attachment behind for tools and supplies, proceeds to the premises. If the damage appears to be serious the practice is not to wait for the repair and replacement of the old meter, but to put in a new meter. At the shop the defective meter, to which a location tag is attached, goes on the shelf for repair. If clogged by sand it is merely cleaned, tested and replaced, but if new parts are needed it is carefully repaired and then placed upon the shelf assigned to meters available for service. It is, of course, tested for accuracy before being sent out. The four kinds of repair which experience has shown to be most often necessary are freezing of a meter, meter stuck by hot water, leaking stuffing box or gear defects. In East Orange the majority of the meters are of the Trident, Hersey and Empire make and a sufficient supply of spare parts is always kept on hand so that repairs can be made quickly.

CHARGES FOR REPAIRS

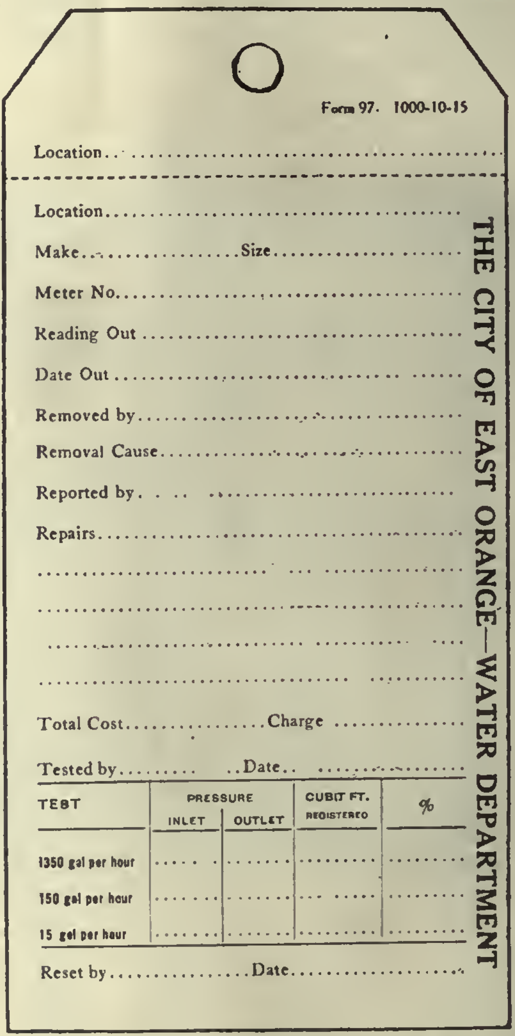
As to charges for repairs, the department bears these except where damage is due to gross carelessness or neglect of the property owner. In the case of a frozen meter or a meter stuck by hot water the consumer pays the repair bill. Stuffing box leaks are, of course, field repairs, and are chargeable to the department, as are also repairs necessitated by worn gearing.

The meter maintenance and testing force is under the general direction of a foreman and includes about 6 or 8 men, depending upon the activities of the department in setting new meters. The testing of a new meter is classified as a general expense, but after a meter has once been placed in service all expenditures are charged to maintenance. There are two meter readers employed at present who spend about two-thirds of their time upon the duties indicated by their titles and the remainder in inspecting plumbing in unmetered houses. It is the custom to set the meters inside the houses, but if a curb setting is required the cost is charged to the property owner. In ordinary settings, if the work is simple, no charge is made, but if the department's men are required to tear up flooring, or if the pipes are buried under coal bins and otherwise difficult to reach, a bill for this extra labor is forwarded to the house owner. Including the time of the men, wagon and material, the cost of setting a new meter averages $1.25.

While bicycle transportation is generally resorted to for meter maintenance and repair work, a horse and wagon have been found useful in the operations of setting new meters. The city occupies an area of only 4 sq. miles, so that the matter of transportation from one point to another is never very serious.

METER "HISTORY CARDS"

It was not until the year 1911 that a big campaign of metering was begun. Sufficient time has not elapsed, therefore, to secure conclusive figures on the life of a meter and its maintenance cost. This matter, however, is not being neglected, and Mr. Reimer has devised a system of "history cards" by which a complete record of the meter is kept. On these cards, of which a sample is shown, are reported the results of the first accuracy test and any subsequent tests, together with the reasons for taking a meter out after it has once been placed in service. The daily report of the meter foreman also is standardized, and the accompanying blank form gives an idea of the kind of information he supplies. Each history card has a tab upon which the brand of the meter is printed, and for each brand a distinctive color is employed.



Form 97. 1000-10-15

Location..............................

Location..............................

Make..................Size..................

Meter No..............................

Reading Out..............................

Date Out..............................

Removed by..............................

Removal Cause..............................

Reported by..............................

Repairs..............................

Total Cost..................Charge..................

Tested by..........Date..................

TEST	PRESSURE		CUBIC FT. REGISTERED	%
	INLET	OUTLET		
1350 gal per hour	......	......	......	......
150 gal per hour	......	......	......	......
15 gal per hour	......	......	......	......

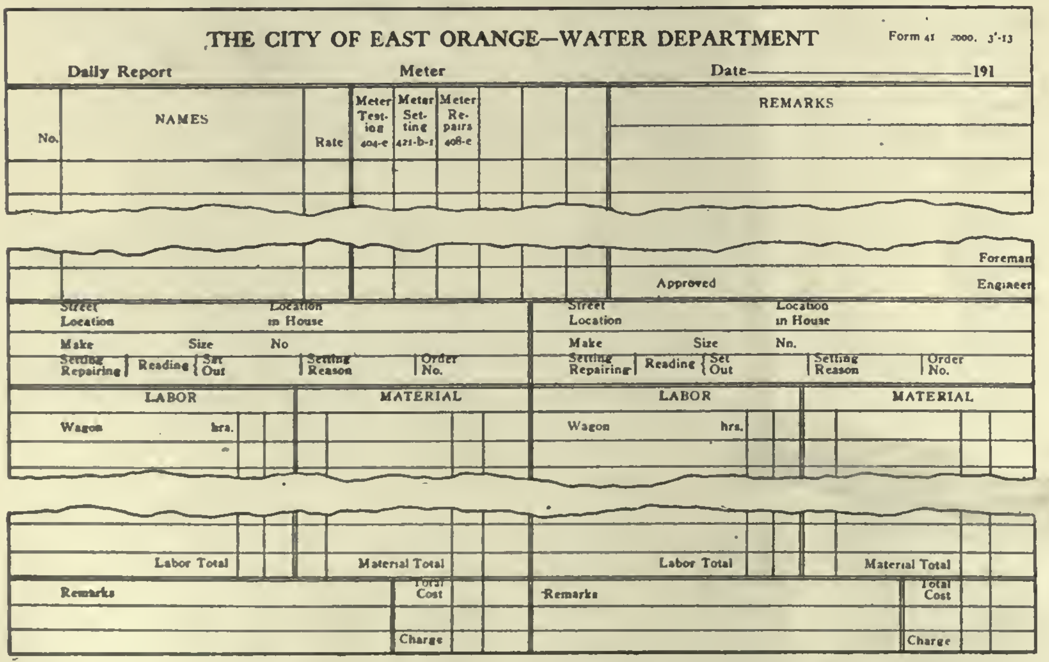
Reset by..................Date..................

THE CITY OF EAST ORANGE—WATER DEPARTMENT

THIS IDENTIFICATION TAG IS ATTACHED TO OLD METERS JUST BEFORE THEY ARE TAKEN OUT FOR REPAIRS

As has been pointed out in a preceding paragraph, no attempt at an elaborate system of records or costs was attempted. The advantages of the system now in force are that it is workable and requires very little time for its upkeep.

Nicholas S. Hill, Jr., present president of the American Waterworks Association, is president of the Board of Water Commissioners of East Orange, the other members being T. F. Macksey and H. D. Reed.



THE CITY OF EAST ORANGE—WATER DEPARTMENT Form 41 2000. 3-'13

Daily Report Meter Date——————191

No.	NAMES	Rate	Meter Testing 404-e	Meter Setting 421-b-1	Meter Repairs 408-e				REMARKS
									Foreman
									Approved Engineer

Street Location Location in House

Make Size No

Setting Repairing Reading {Set Out Setting Reason Order No.

LABOR			MATERIAL		
Wagon hrs.					
Labor Total			Material Total		
Remarks			Total Cost		
			Charge		

Street Location Location in House

Make Size No.

Setting Repairing Reading {Set Out Setting Reason Order No.

LABOR			MATERIAL		
Wagon hrs.					
Labor Total			Material Total		
Remarks			Total Cost		
			Charge		

ON THIS FORM THE FOREMAN OF THE METER DIVISION REPORTS THE KIND OF WORK DONE BY HIS FORCE AND THE LOCATION OF METERS REMOVED OR SET

New Water Supply for Small Town Involves Earth Dam, Filters and Pipe Line

Hard and Impure Well Water at Le Roy, N. Y., Abandoned in Favor of Gravity System Recently Placed in Service

By JAMES P. WELLS
Consulting Engineer, Rochester, N. Y.

AFTER suffering for 20 years from an inadequate supply of impure, hard well water, the village of Le Roy, N. Y., two months ago placed in service its new gravity system, comprising an earth dam 500 ft. long and 32 ft. high, a 1,000,000-gal. per-day mechanical filtration plant and a 14-in. cast-iron pipe line 5 miles long, laid in record time. Before the new system was placed in operation the consumption of water in Le Roy averaged only 200,000 gal. per day. As the old supply, on account of its hardness, was used very little for washing and factory purposes, it was estimated that with the new supply of soft water the consumption would reach 400,000 gal. per day, or about 100 gal. per capita. From data as to past growth it is estimated that in 35 years the population would increase to 7000 and that a supply of 700,000 gal. per day would be sufficient. Estimates were made and an appropriation of $105,000 was made for the construction of the new system, with $15,000 for extensions and improvements to the distribution system. Work was started in September, 1915, and in the fore part of April, 1916, the water was turned into the mains.

AT THE SITE OF THE DAM CLAY SOIL IS UNDERLAID BY SHALE ROCK

The reservoir has a capacity of about 175,000,000 gal. Eighty-three per cent of this amount, 145,000,000 gal., is in the upper 14 ft. and is available for use. The reservoir was formed by the construction of two earthen dikes and an earthen dam with a concrete core, and has an area of 55 acres when full.

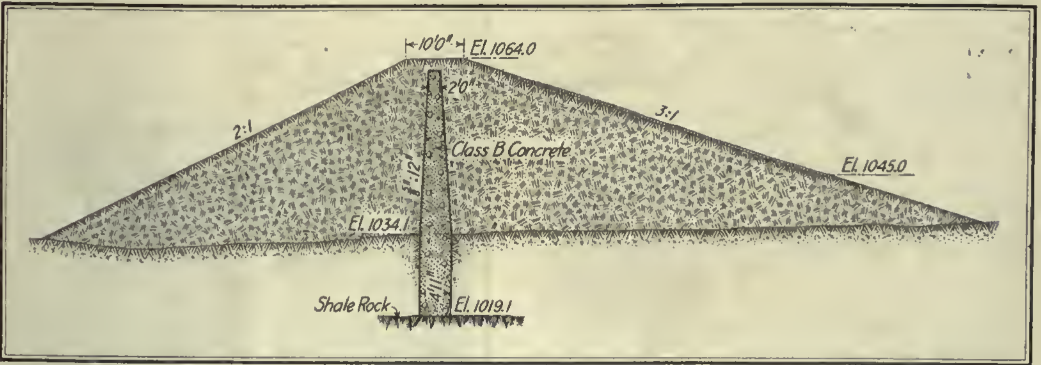
Minimum Run-off Estimated

Mad Creek, the stream upon which the dam has been constructed, has a drainage area slightly in excess of 1½ sq. m. From records of adjacent streams it was estimated that in an extreme low year the average daily run-off for the entire year would be at least 900,000 gal. per day. The run-off during the early part of the year is sufficient to keep the reservoir filled until the latter part of May or June. As there is occasionally a year when the run-off is very slight during the last six months it was considered advisable, even though there is always some run-off, to construct a reservoir of sufficient capacity to furnish 700,000 gal. per day for six months without its being replenished by any inflow. This amount of water is equivalent to 126,000,000 gal. The reservoir was accordingly designed to have a capacity of 145,000,000 gal., a liberal amount being allowed for evaporation and seepage. At the time of writing the reservoir is full and overflowing and enough water has wasted over the spillway to refill it.

Earth Dam and Dikes

Test pits at the site of the dam indicated that an earth structure with a concrete core would be much cheaper than either a concrete masonry or a reinforced concrete dam of the Ambursen type. The bed of the reservoir is composed of a heavy, clayey soil. This is underlaid by shale rock. At the central portion of the dam this rock is 16 ft. below the surface. At both ends of the structure no sheeting was necessary for the core wall trench as the material was stiff clay and hardpan. At the center of the dam considerable water was encountered. The material was sandy clay and great difficulty was experienced in deepening the trench, it being necessary to work day and night. The core was carried to the rock for the entire central portion of the dam.

The greater part of the material for the earth fill was excavated by an elevating grader loading directly into dump wagons from a borrow pit just east of the reservoir. The remainder was placed by wheel scrapers. On the upstream portion of the structure fine, clayey material was deposited in 6-in. layers. This was then watered and rolled with a 2-ton, grooved roller. The coarser and more porous material was used on the downstream side. The width of the dam is 10 ft. at the top with an upstream slope of 3 to 1 and a downstream slope of 2 to 1. Severe winter weather set in before the work was completed so that it was necessary to leave the work when the embankment had been carried to the top of the core, 3 ft. above the crest of the spillway. Although the wetting and rolling of the embankment was materially aided by considerable rainfall during the construction there was some settlement when the water reached its full height. The accompanying photograph shows the cracks formed along the core due to this settlement. Riprap, 1 ft. thick, was placed on the upstream face of the dam to a depth of 14 ft. below the spillway crest, the point of lowest draft. The earth dikes in no case exceeded a height of 9 ft., and as their crest is 5 ft. above the normal water level they were made 5 ft. wide at the top with 2 to 1 slopes on each side.



THE EARTH DAM IS 500 FT. LONG, 32 FT. IN MAXIMUM HEIGHT AND HAS A CONCRETE CORE WALL

Spillway

The concrete spillway was designed with a width of 60 ft. at the point of overflow. Its crest is 5 ft. below the surface of the dam. For the size of the stream a spillway width of 60 ft. is perhaps somewhat greater than is ordinarily allowed, especially with a reservoir area of 55 acres, which will temporarily store a large amount of water and greatly decrease the intensity of a flood. However, in the light of the recent flood at Erie, where the flood rate was about 900 sec.-ft. per square mile from a stream with a drainage area ten times the size of Mad Creek, it is evident that such a spillway width is not too great.

Concrete

The concrete in the core was of the proportion 1:3:6; that in the spillway, 1:2½:5. The gravel was obtained from a pit ¾ mile east of the works. The location of the spillway, core wall and filter plant was such that considerable economy could be effected in the placing of the concrete. An 18-cu.-ft. Koehring mixer was placed at each end of the core wall. Practically all the concrete, not only in the core wall but in the spillway and filter plant, was poured from these mixers through open chutes without changing their position.

Filtration Plant

Water passes from the reservoir into the filter plant through a 16-in. cast-iron pipe. Before entering the sedimentation basin it is aerated by a fountain in a small building attached to the filter house. After aeration the water descends through a Venturi tube into the sedimentation basin. The Venturi tube was installed to automatically regulate the flow of chemicals. Up to the present time it has been found necessary to use only sulphate of alumina. There are two beds in the plant, each with a normal capacity of 500,000 gal.

Leading from the clear well of the filter plant is a 14-in. cast-iron pipe which carries the water to Le Roy. Remarkable progress was made in its construction. With the exception of 100 ft. of hard limestone rock in the lower portion of the trench the entire 24,500 ft. was excavated with an Austin trenching machine. Of this amount 500 ft. extended through shale rock, 3 ft. of which occurred in the bottom of the trench. There were also 700 ft. of woods. The first 22,000 ft. of the line, which included the sections of rock and woods, was completed, including the backfill, in 35 days, an average of 750 ft. per day. The greatest amount of trench excavated during any one day was slightly over 1000 ft. and the record for laying pipe was eighty-five 12-ft. lengths. This record is not often excelled and it was made possible by the efficient manner in which the contractor handled the work.

In order to increase the supply of water available at Le Roy for fire protection purposes an elevated tank with a capacity, when full, of 130,000 gal. has been constructed, in addition to the old stand pipe.

THIS METHOD OF BACK-FILLING THE PIPE LINE TRENCH DID NOT PROVE VERY SATISFACTORY

There is sufficient pressure from the new system to raise the water above the top of the old stand pipe, but in case of a large fire there would be considerable head lost in friction from the reservoir to Le Roy. For this reason it was considered advisable to have more water available directly at the distribution system. In addition to this several dead ends will be connected, which will greatly improve the fire protection in the factory district.

It is often the case that many a meritorious engineering project has not been approved by the public simply because the public did not understand it. In this instance all the details of the proposition were presented in a way which the people could easily understand by E. M. Perkins, editor of the local paper. As the plan involved the construction of a storage reservoir on a stream which sometimes goes dry in summer there was naturally much apprehension. While engineers are satisfied that water filtration is an effective means of purifying water, it is not always an easy matter to convince the general public. Now that the plant is in operation the citizens are more than satisfied with the results, for in addition to having water in abundance, analysis of the new supply shows the presence of no B. coli and gives a bacterial count equal to about 3 per cent of that of the old supply. The water is also sufficiently soft so that it may be used for all purposes.

CONCRETE FOR THE CORE WALL WAS POURED TO PLACE THROUGH OPEN CHUTES

PERSONNEL

The dam and the concrete work on the filter plant were built by Morrison & Quinn, of Rochester, N. Y. The Norwood Engineering Company, of Florence, Mass., designed and built the filter plant. The cast-iron pipe was furnished by the United States Cast Iron Pipe & Foundry Company and the line was laid by Charles Shepard, of Niagara Falls. The writer prepared the plans and supervised the construction of the work and also engaged Walter McCulloh, of Niagara Falls, N. Y., to act as consulting engineer. O. S. Hart was assistant engineer.

Exports to South America Doubled

Exports from the United States to South American countries were more than doubled during the past year, according to data collected by the Bureau of Foreign and Domestic Commerce.

SETTLEMENT CAUSED CRACKS IN THE EMBANKMENT ABOVE THE CORE WALL

Twin-Tube Venturi Meter Aids Water Waste Detection

Apparatus Developed at St. Johns Is Sensitive for Wide Range of Flow and Is Simple to Operate

By FRANCIS F. LONGLEY
Of the Firm of Hazen, Whipple & Fuller, Consulting Engineers, New York

WITH a new type of Venturi meter apparatus, designed especially to record wide ranges of flow with extreme sensitiveness, it has been possible, in an investigation of water waste at St. Johns, Newfoundland, to detect leakages as small as ½ gal. per minute. This result has been accomplished by the use of two meter tubes of different diameters, assembled in a single, portable unit which has proved its usefulness on the waste detection work which the writer's firm has been conducting. At first various temporary expedients, devised from materials ready at hand, were used in order to get a general and approximate idea of the waste from different sections, and finally the desire to secure more accurate information resulted in the design of the equipment described below.

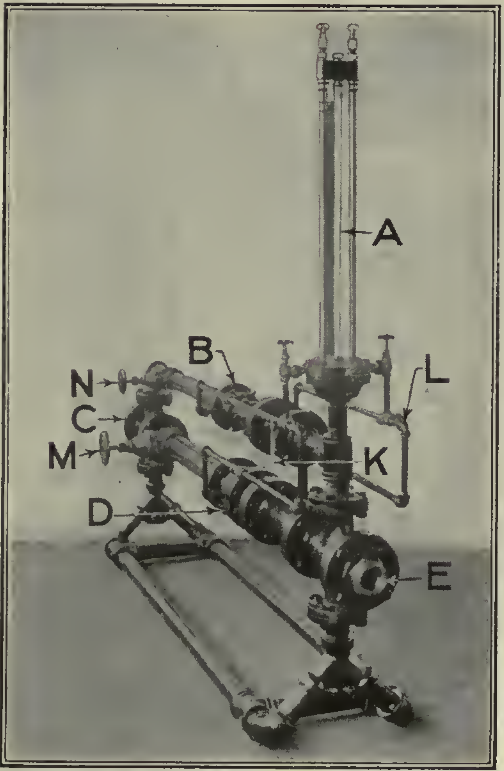
TWIN-TUBE APPARATUS DEVELOPED

The methods that were being used in St. Johns involved the isolation of districts of the distribution system and the supplying of the isolated district through a line of fire hose connecting a hydrant within with a hydrant outside of the district. The problem then resolved itself into the design of an apparatus by means of which small changes in rate of flow through this hose could be readily and accurately observed. A Venturi meter tube with its indicator, at once simple, sensitive and accurate, seemed to offer many advantages for this purpose, but a single meter tube has not range enough in capacity to cover all the possible rates of flow that might be encountered in such a study as this. A logical development of the Venturi meter idea, then, required the use of two or more meter tubes so arranged that the flow could be diverted through that one whose capacity most nearly met the immediate requirements.

The writer thereupon submitted to the Builders Iron Foundry a sketch showing the general requirements for this apparatus, and that firm perfected a design in which two meter tubes were erected, one above the other, on a light but rigid framework of wrought-iron pipe. A single manometer tube of the barometric type was provided with two scales, one for each of the meter tubes, and the manometer was suitably connected to the mouth and throat of the two meters through three-way cocks in such a manner as to insure connection with the right tube.

The apparatus, as assembled in one unit, is shown on the accompanying photograph. The two Venturi meter tubes used for the St. Johns equipment were a 3-in. tube with 1½-in. throat and a 2-in. tube with ⅝-in. throat. The 2-in. tube is in a by-pass line around the 3-in. and water can be passed through either meter tube from the common inlet by properly manipulating the gate valves *M* and *N*, which have a common outlet as shown. The three-way cocks, marked *K* and *L*, transmit respectively the inlet and throat pressures from the 3-in. and 2-in. meter tubes to the manometer and they are so arranged that the pressure from but one meter tube can be turned into the manometer at one time. The hose connections are made at the inlet and outlet ends shown in the photograph and these are, therefore, provided with hose thread couplings.

The range of capacity of a Venturi meter of any size is approximately 1 to 13—that is, the minimum reliable reading is about one-thirteenth of the reading corresponding to the maximum allowable throat velocity. The lower part of the scale of the manometer is less sensitive than the upper part. A change in the level of the manometer mercury column at a point a quarter of the way up from the bottom of the scale corresponds to a change in rate four or five times as great as an equal change in level at the highest point of the scale. It was, therefore, desirable to have the ranges of the scales overlap somewhat in order to avoid the necessity at any time of using the extreme low portions of the scale. Making allowance for this overlapping of capacity, the equipment provides a measuring range of approximately 3 to 200 U. S. gal. per minute. The size of the isolated district can in general be adjusted to conform to some convenient portion of this range.



TWIN-TUBE VENTURI EQUIPMENT IS SENSITIVE FOR WIDE RANGE OF FLOW

A, manometer; *B*, 2-in. meter tube; *C*, inlet; *D*, 3-in. meter tube; *E*, outlet; *K* and *L*, three-way cocks; *M* and *N*, gate valves.

The statement that the minimum point of the capacity range is 3 gal. per minute does not mean that that is the limit of sensitiveness for observing changes in rate. While 3 gal. a minute is about the smallest total quantity that can be measured with dependable accuracy with these meter tubes, variations in rate of flow very much smaller than that can be readily observed. On the 3-in. meter tube, for instance, a change in the height of the mercury column of ¼ in. at or near the top of the scale corresponds to a change in rate of flow of about 1½ gal. per minute. For the 2-in. meter tube a change of ¼ in. in the height of the mercury column when it stands at or near the top of the scale corresponds to a change in rate of flow through the meter of only about ¼ gal. per minute, and even at the lower part of the scale the 2-in. meter tube still shows sensitiveness enough for all practical purposes, for a change in height of the mercury column of ¼ in. at one-quarter of the height of the manometer scale corresponds to a change in rate of flow through the meter of somewhat less than 1 gal. per minute.

EQUIPMENT SENSITIVE

It is readily seen, therefore, that the sensitiveness of the apparatus is great enough so that the cutting off of even so moderate a leakage as 1 gal. per minute, or even ½ gal. per minute, when a house service is shut off, may be readily detected. The equipment is easily transported from place to place and easily handled; is simple and requires a minimum of expert knowledge and attendance; is flexible and covers a large range of rate; and in every way is convenient and well suited to waste investigation work.

To make its use effective, its service should, of course, be well organized and energetically and efficiently managed, and the co-ordinate labors of house inspection and other follow-up methods must be vigorously pressed. This equipment has actually been tried out by the writer and seems bound to form a useful tool in the hands of progressive waterworks men.

Efficiency of 59 Per Cent Obtained with Air Lift

Results of Pumping Test at Camden (N. J.) Waterworks Given for 120-Foot Well

WHAT is cited by the designers of the equipment as a remarkable performance was achieved during a test for the Camden, N. J., Water Department, when an air-lift well-pumping installation developed an over-all efficiency of 59 per cent, measured between the steam end of the compressor and the point of delivery of the water. From the Standard Supply & Equipment Company, of Philadelphia, which furnished the air-lift outfit, the following information regarding the test has been received. The figures have been submitted to and checked by James H. Long, chief engineer of the Camden Water Department.

RESULTS OF TEST OF 8-INCH WELL AT CAMDEN

1. Total depth, 120 ft.
2. Diameter, 8 in.
3. Depth to foot piece, 106 ft.
4. Foot-piece to umbrella, 115.5 ft.
5. Water eduction pipe, 5 in.
6. Air pipe, 1¼ in.

Cu. ft. free air per min.	Gal. per min.	Shut in pres.	Well press	Cu. ft. air per gal.	Submergence, per cent	Lift, ft.	Water horsepower	Air horsepower	Efficiency
50	300	31.5	35.3	0.166	63	42.8	3.22	5.40	59.6
60	322	31.0	35.5	0.186	62	43.9	3.56	6.54	54.2
100	392	27.5	37.5	0.255	55	52.0	4.55	11.30	40.2

WELL 120 FEET DEEP

The well was 120 ft. deep and 8 in. in diameter. The water eduction pipe was 5 in. and the air pipe 1¼ in. in diameter. The depth to the foot-piece was 106 ft. and from the foot-piece umbrella 115.5 ft. The air-lift was of the Talbot type. In installing this apparatus the practice is to consider each well as an individual problem and adapt the pumping rigs to the local conditions encountered. When once the pumping conditions are known the whole apparatus, from foot-piece to point of discharge of the water, is designed to fit those conditions exactly, as regards both size and general construction.

The most important conclusion to be drawn from these tests, it is stated, is the fact that much greater economy is obtained by pumping two wells moderately than by attempting to pump one to its limit. It follows that wells of large diameter are preferable to small wells since more water can be obtained from them without forcing.

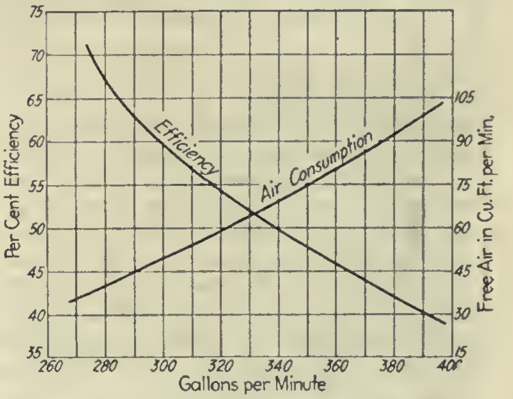
The accompanying table shows the comparative amounts of air used and water obtained under the old and new systems in one of the wells. It will be noted that 299 gal. per min. was the greatest amount of water that could be obtained with the best of the old lifts. This was by turning all the available pressure on full.

COMPARISON OF AIR USED AND WATER RAISED

Old System		New System	
Cu. ft. air per min.	Gal. per min.	Cu. ft. air per min.	Gal. per min.
80	277	50	300 (271)*
100	293	60	322 (293)*
104	299	100	392 (379)*
104	299	122	405
104	299	136	423

*Figures obtained during second test.

Curves were plotted from the data obtained. The air volumes were measured with a General Electric air flow meter and the water was measured by pumping into a large iron tank for an interval of time taken by stop watches. An umbrella deflector was used at the top of the water eduction pipe, and the water was caught in a small wood tank surrounding the latter. This tank was fitted with a 6-in. outflow pipe about 4 ft. long, having an ell and short nipple on the outer end. By turning the ell, which was left loose on the horizontal pipe, the water could be directed into the measuring tank or out on the ground at will.



CURVES OF EFFICIENCY AND AIR CONSUMPTION

The curve of efficiency shows a steady falling off as the pressure is increased and more water pumped. This is to be expected for two reasons: First, because of the lower submergence when pumping the larger quantity; second, because of the greatly increased friction of water and consequent slippage of air at the higher velocities of discharge. This friction and slip, it is held, is the greatest contributing cause of the inefficiency of most air-lift systems. Careful design of the apparatus in the present case so as to reduce this factor to a minimum is claimed to be the chief reason for the results obtained.

Water Saved in 100-Per Cent Metered City

How a Well-Managed Suburban City of 30,000 Handles the Waste Problem—Reasons for Repairs to Meters Analyzed

SYSTEMATIC repairs to meters and rigid inspections to stop leaks saved Oak Park, Ill., $4,577 in 1915. Lake water at the low rate of 65 gallons per capita is purchased from Chicago by meter, re-pumped and sold to the 31,000 ultimate consumers only by meter. The metered services also include watering troughs, drinking fountains and hydrants when used for other than fire purposes. Water used for building purposes is sold through meters buried in the parkway and contractors are arrested for taking water from hydrants without a meter. Even the water used for meter testing is measured by meter and accounted for, while the municipality pays for water used by all its departments. In fact, there is absolutely no free water.

NIGHT FLOW REDUCED

In 1914 the night rate, representing the daily waste, was 800,000 gal. and in 1915 it was reduced to 600,000 gal., which is 30 per cent of the average daily consumption and 15 per cent of the average maximum draft. About one-half of the waste is paid for, but the remainder is lost through under-registration of meters and underground leaks. Still further reductions are expected and the superintendent states that at present the night flow is about 400,000 gal. per day during the period from 1 to 5 a. m. It is so small that the drawing of water for an extra bath deflects the recording needle of the meter chart, and an experiment proved that a 2-inch pipe can supply the flow during this period at 40 lb. per square inch.

Systematic inspection was started in 1915 of all meters which had not been inspected for accuracy within the past five years, and all meters on the system purchased from the Public Service Company in 1912. The work will be concluded in 1916. The thorough inspection of all services and hydrants to locate underground leakages reduced the waste so materially that the use of water due to 660 added services (making 7000 in all) was not noticeable.

In 1915 there was an actual increase in the daily consumption of 40,600 gal. per day, and if there had been no reduction in waste the average daily consumption (based upon the per capita consumption of 1914) would have been at least 2,232,600 gal.—that is to say, 200,000 gal. above what it actually was. Of this latter quantity 70,000 gal. a day was underground leakage, while the remaining 130,000 gal. was saved by the reduction in fixture leakage and had previously been paid for by consumers.

All complaints concerning high water bills are investigated and a comprehensive written report is made to the consumer. Absolutely no reductions in bills are made for excessive water used due clearly to leakage. Some leniency in terms as to date of payment is occasionally entered into, but in general the rules are rigidly observed. A campaign was conducted to educate the consumer in the prevention of needless waste and in methods of detecting leaky fixtures.

Whenever a complaint is made concerning a high bill the consumer is given the benefit of the doubt from the first. The nature of the complaint is written upon a card provided for that purpose and is given to an inspector who makes a specialty of investigating high bills. He first checks the reading of the meter and then listens on the water pipe with an aquaphone. If he hears the slightest sound of running water after making sure that none is being drawn he examines every fixture, locating leaky toilets by sound rather than by sight, as in a number of types of toilets the leaks cannot be seen. It has been found that leaks from faucets are rare, due to the fact that they can be seen by the water taker.

From consumption tables prepared for Oak Park conditions the inspector can determine whether or not he has found the cause of the high bill. If the leaks found are not sufficient in size or number, or no leaks or signs of waste are found, the occupants are questioned as to the number of people in the household during the period covered by the high bill, number of automatic devices depending upon water pressure, such as thermostats, hydraulic pumps, etc., and whether or not a plumber has done some work in the house. This latter information is generally withheld by the complainant himself. The inspector then turns in the reading of the meter to the office with all the facts he has been able to obtain.

WHAT YOUR SMALL LEAKS COST YOU

Size stream	Gal. per day	Cost per quarter
1/8	3000	$48.60
1/16	700	11.70
1/32	175	2.84
1/64	44	.71
Steady Drop, Drop	24	.39

WATCH YOUR FIXTURES

Do not neglect leaking toilets—for a small leak will waste from $10 to $50 worth of water a year. This leak may occur without being visible, but it can be detected by listening on the pipe leading from the tank or on the tank itself.

Do not suspect the meter if your water bills are too high. It registers **all** of the water consumed whether used or merely wasted—but no more. When a water meter is worn or defective it either allows water to pass through without registering the flow at all, or else under-registers.

All water passing through a meter will be charged for whether used or wasted—and no reductions will be made on account of leaks.

Meters will be tested by the Water Department upon the request of the consumer—but if the test shall establish the accuracy of the meter within two per cent, the customer will be required to pay two dollars ($2) for the expense of making the test.

The table at the left is not based upon mere theory, but the various openings were tested in Oak Park at the average pressure of 45 pounds per square inch.

THESE EDUCATIONAL ADMONITIONS APPEAR ON BACKS OF QUARTERLY BILLS

In case leakage is found the complaint clerk writes a formal letter to the complainant giving the result of the investigation, together with information regarding the effect of leaks upon water bills.

If no leaks have been found, and the cause of the excess consumption cannot be determined, a second reading of the meter is taken a week after the first inspection. This gives the "present rate of consumption," and shows whether or not the conditions have changed. If the consumption has dropped to "normal," it is assumed that the causes of the excess consumption were removed by the complainant just before he applied for the investigation, or perhaps just before the inspector made the first trip. The water department therefore reports that the conditions which caused the high bill have been removed, and gives the present quarterly rate.

Although the consumer invariably accuses the meter, unless he has had previous experience with the complaint department, no meter which has been tested within five years is tested upon request until the consumer agrees to pay $2 for the expense of making the test should the meter prove to be accurate within 2 per cent. Consumers rarely take advantage of this offer.

If a complainant is dissatisfied even after a second inspection he is sometimes allowed to hold the payment of the bill until the next quarterly statement, when he will see for himself the result of stopping small leaks. If, however, a consumer refuses to pay a bill and a rebate is still expected or sought a final notice of "shut off for non-payment" is issued; and the water is shut off in spite of protests and threats of litigation. During the past year this has been necessary only in half a dozen instances, 90 per cent of the cases being settled with the first report, 9 per cent after two investigations and 1 per cent are not satisfactory to the complainant. Payment of excessive bills, however, is not enforced until a complete investigation has been made and the charge is proved to be a just one. It has been found that leniency encourages waste.

Some plumbers who fail to appreciate small leaks often mislead the water takers, but the latter are becoming educated and the plumber has to make good.

In the distribution of the consumption 80 per cent was accounted for by consumers' meters, 4 per cent was used for construction, street sprinkling, flooding of skating rinks and fires, 3 per cent for sewer flushing, hydrant flushing, emptying of pipes for repairs, etc., and 13 per cent was unaccounted for, including loss from leakage, stoppage of meters, etc.

The apportionment to various uses is as follows: Domestic—residences and apartments, 65.2 per cent; commercial use—dairies, laundries and stores, 5 per cent; public use—schools, public buildings, hospitals, fires and streets, 7.9 per cent; industrial use—public service corporations, 8.9 per cent; unaccounted for—underground waste and under-registration of meters, 13 per cent.

WHY METERS ARE REPAIRED

Of the 1153 meters (16.5 per cent of the total number in service) sent to the shops for repair during the year, 15.4 per cent had been damaged by heat and 5 per cent by frost; 17.7 per cent were stopped by dirt or by a broken disk; 21.5 per cent were old water-piston meters replaced by new disk meters; 31 per cent were tests of meters on the system purchased from the Public Service Company, and 9.4 per cent were leaking or damaged externally, stopping the flow of water.

The number of calls of inspectors, 3532, was 50 per cent of the number of accounts. Of these inspection calls 17.9 per cent were to investigate the reason for high bills and only 6.5 per cent were made to shut off the water for non-payment of bills.

Oak Park is one of the largest municipalities to cling to the town system of government. In an election last spring the voters overwhelmingly defeated a proposition to change to a city with a council form of government. At present the affairs are handled on a business basis with W. F. Sargent, commissioner of public works, exercising practically the same powers as a city manager. Reporting to him is H. P. T. Matte, superintendent of the water department.

The following are samples of rubber stamps used when the occasion requires:

Oak Park, Ill..............191..
M.......................
....
Oak Park, Ill.

Our meter reader reports that meter at the above address registers......................gallons from ....to............amounting to $........ He finds this higher than the usual consumption and thinks it may be caused by waste in some form, such as defective plumbing, leakage or carelessness. Unless you can account for same it would be advisable for you to investigate in order to avoid future large water bills.

WATER DEPARTMENT.
....

.......................,

Your complaint will be given immediate attention and result of investigation will be reported to you by inspector or by mail.

OAK PARK WATER DEPARTMENT.

One-Third of Los Angeles Water Supply Now Furnished by Aqueduct

Approximately one-third of the water supply of Los Angeles is now furnished by the aqueduct, according to information recently given to the Los Angeles Public Service Commission by William Mulholland. It was also stated that the operation of pumps in the southern part of the city had been discontinued, thus effecting a saving of about $65,000 annually.

Old Pipe Relaid for Galveston's Submerged Line

To Guard Against Storm Damage to Causeway Line a Second Main Is Laid on Bottom of Bay

By E. B. VAN DE GREYN
Consulting Engineer, Houston, Tex.

THE water supply for Galveston, Tex., which was interrupted by the breaking of the main supply pipe during the great storm last year, is now brought through the repaired 30-in. pipe line on the causeway. The restoration of the water supply was described in the Engineering Record of Oct. 23, 1915, page 500. In order to provide against a repetition of a water shortage the city is laying a submerged pipe line 30 in. in diameter approximately 10 ft. below the bottom of the bay, connecting at the mainland and at the island with the present 30-in. main. Plans called for the use of all good and serviceable pipe taken from the old line which was laid originally on the bottom of the bay and which was broken at several points during the storm. No flexible joint pipe are used. The city let the contract to Isaac Heffron of Galveston.

DREDGE AND SCOW—GALVESTON CAUSEWAY AT LEFT

SEQUENCE OF OPERATIONS

Work was started at a point about 1500 ft. from the mainland, where the water is of sufficient depth to float the suction dredge which digs the trench for the new pipe line. Next comes a derrick barge which picks up the old submerged line. It is followed by a barge from which is laid the new submerged pipe. In the deep part of the bay the new line is about 18 ft. below water surface. At the shore end, where the water is too shallow to float the dredge, open cofferdams will be used.

The suction dredge excavates a trench approximately 10 ft. below the bottom of the bay. Below the mud hard material is encountered which makes dredging slower. This hard material will furnish a firm bed for the pipe and it is unlikely that it will be scoured out, especially when the causeway approaches are reconstructed with arches giving much additional waterway.

In taking up the old pipe line a diver makes a hitch around the end of the pipe and a hitch just back of the first bell from the end. The pipe is then raised and lowered a little until a joint breaks loose, when the sections broken loose are lifted onto the barge. From one to three or four, but generally two or three, sections are brought up at a time. Only good pipe are used for the new main, cracked or broken pipe are discarded. Lead is removed from joints by melting with oxy-acetylene flame.

Both ends of the barge are equipped with derricks. One of them has pile driver leads suspended at the end of the boom and is used to drive piles on both sides of the barge to hold it in position. The other derrick handles the pipe, cradle, etc. An air compressor on the barge furnishes pressure for calking pipe joints.

PIPE-LAYING CRADLE

The pipe-laying cradle is made entirely of steel. The general plan for the cradle was supplied by the contractor and his assistants; the detailing and building were done by the Texas Carnegie Steel Company, of Galveston. On the line of its bottom chord the cradle is 108 ft. long, made up of nine panels of 12 ft. each. The cradle is curved by making deflection of 6 in. in each 12-ft. panel. The 30-in. pipe rests and slides on three channels.

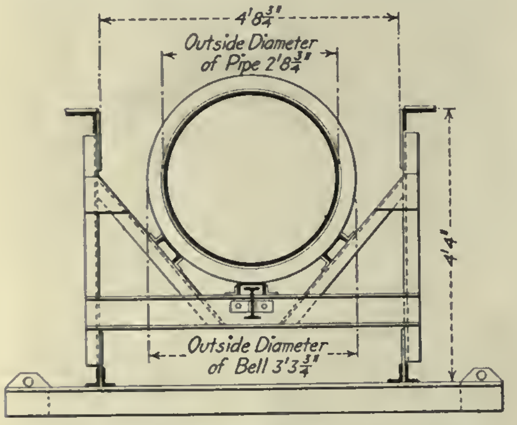
One end of the cradle rests on and is secured to the end of the barge. The other end rests on the bottom of the trench excavated by the suction dredge. The curved form of the cradle allows the pipe to reach its position in the trench without shock. As the barge moves forward it drags the cradle with it, the cradle sliding out from under the pipe.

As soon as a joint is poured the barge is moved forward one pipe length, dragging cradle with it. While the next section of pipe is being placed in the cradle the lead joint is trimmed and calked. To move the barge forward each time the boom is lowered, a hitch taken about the upper end of the pipe, and strain put on load line, this being equivalent to pushing against the end of pipe line. Barge and cradle then move forward. The use of an air compressor in calking joints facilitates the pipe laying work. On an average, twelve sections or 144 ft. of pipe is laid per 9-hr. day. On one day about 50 per cent more than this amount was laid. The use of the cradle

CALKED PIPE SECTION AT TOP OF CRADLE READY TO SLIDE WHEN BARGE IS MOVED

LOOKING DOWN ALONG THE STEEL LAUNCHING CRADLE

and the driving of piles on both sides of the barge put the laying of the submerged line under good control. If it becomes necessary on account of storm to remove the barge the piles can be cross timbered and braced and the cradle and pipe lashed to the bent. These piles are pulled and used again as the barge moves forward.


4'8¾"
Outside Diameter of Pipe 2'8¾"
4'4"
Outside Diameter of Bell 3'3¾"

HOW PIPE IS SUPPORTED BY CHANNELS ON CRADLE

The pipe line is to be tested under 40 lb. pressure. Any leaks developed will be calked by a diver.

[The cradle described is similar to the one used in laying the Narrows siphon flexible joint pipe line for the New York Board of Water Supply.—Editor.]

Blueprint Clogs Air Filter System

For safekeeping an over-careful foreman put a 3 x 4-ft. blueprint in the intake box of the air compressor supplying the filters of the Bubbly Creek plant of the Union Stock Yard & Transit Company, Chicago. The night attendant washed two or three filters the same night. Business of hunting everywhere for the blueprint next day by the foreman and final confession as to his safety deposit vault. The 40-mesh seive over the intake valve was found torn sufficiently to let the folded blueprint enter. Fragments were found throughout the whole system, as the valves acted as a shredder. The wet, macerated paper stock clogged the small holes in the air system to such an extent, according to C. A. Jennings, superintendent, that the filter media must be removed and each lateral cleaned.

Chlorine Gas Reduced Water Sterilizing Costs

Operating Records of Two Types of Plant, Compared, Show Hypochlorite Treatment Involves Greater Expense

By C. O. JOHNSTON
Johnstown (Pa.) Water Company

BY substituting chlorine gas for a solution of hydrochlorite of lime as the sterilizing agent for the water supply of Johnstown, Pa., a saving of 300 per cent in operating costs will be realized. This estimate is based upon the recent advance in the cost of hypochlorite from $1.60 to $12.50 per hundredweight. Comparative costs of the two methods of treatment are given in the accompanying tables.

SUPPLY FROM SEVERAL SOURCES

A brief description of the Johnstown Water Company's system is necessary to enable the reader to appreciate fully the cost of treating the water. Johnstown lies in the foothills of the Allegheny Mountains at El. 1165 to 1800, and on account of the topography the largest watershed contains 10 sq. miles, while the smallest contains only 4.85 sq. miles. The population of Johnstown and suburban districts is approximately 90,000, of which 70,000 are supplied by the Johnstown Water Company, which derives its supply from a number of sources.

The water from the St. Clair reservoir was first treated in 1910 by erecting a hypo plant directly over the bulkhead. The solution was fed into the main through a 1-in. pipe perforated at the bottom. The water from Laurel Run, Red Run and Wild Cat was also treated, at first, with hypochlorite by erecting a plant and feeding a sufficient amount of the solution into the Red Run supply main to treat the water of Laurel Run and Wild Cat. The Benscreek hypo plant treats the combined supply of Mill Creek 1 and 2, Dalton Run and at times North Fork.

At the Benscreek plant the hypochlorite is weighed, 50 lb. at a time, and put into the emulsion or mixing tank and allowed to dissolve for approximately 12 hr., after which the remaining lumps are thoroughly broken up and mixed by water the pressure of which is 100 lb. The water flows through holes drilled in a 1-in. pipe forming a grid in the bottom of the tank. We use a ½-per cent solution (50 lb. hypo and 1200 gal. water), as we have found through a series of tests that the treatment is more efficient by using more of the weaker solution than less of a stronger solution. The solution flows from the emulsion tank into any one of three storage tanks and is again thoroughly mixed by revolving paddle agitators for 2 hr., after which the solution is allowed to settle before being fed into the orifice tanks.

This plant has been in constant operation 24 hr. a day and 364 days a year since 1911, with the exception of one day each year to make slight repairs to piping and to grind tank valves. The operating cost has averaged $2.155 per million gallons treated, including labor, general expense and chemicals.

Our main objections to hypochlorite treatment are, first, the actual and imaginary taste of the treated water at different periods of the year; and, second, the high cost of plant and its operation.

On the completion of our Saltlick reservoir it was decided to use chlorine gas, and after a careful study we chose the Wallace & Tiernan direct-feed machine. This machine was installed in the effluent tower, and a ½-in. galvanized pipe was run down the inside and connected to the 20 and 30-in. supply mains at two different elevations in order to reduce the amount of head the machine would have to work against (i.e., top elevation is used when reservoir is full, while the lower elevation is used when the water in the reservoir drops 25 ft.).

After four months of careful study we found that chlorine gas sterilization overcame all our objections to hypochlorite and we decided to change the St. Clair and Laurel Run plants by using the same kind of machine. At the present writing we are abandoning the Benscreek hypochlorite plant by installing three additional Wallace & Tiernan machines. Mill Creek water and Dalton Run water will be treated by installing a direct-feed type A machine in the valve house at the foot of the reservoir, while the water from North Fork will receive its treatment by using a type A machine the diffuser of which will be placed in the mouth of a 24-in. main, under 3-ft. head of water.

The actual labor required to operate a chlorine plant is approximately 1 hr. per day, as the attendant at the reservoir is only required to read the gages, get the scale weight and change empty for full cylinders, when necessary, fix his fires morning and evening and make his report to the office each morning. The general care of the plants and clerical work is in charge of another man, who makes weekly inspections to insure constant operation of these machines. The general expense is for a portion of telephone charges, fuel and any repairs necessary. With the installation of the last three chlorine plants we will effect a saving of over 300 per cent, based on the cost of hypochlorite.

COSTS OF TREATMENT WITH CHLORINE GAS

	Mil. gal. treated per month	Lb. of chl. gas per mil. gal.	Avail. chlorine p.p.m.	Cost per mil. gal. treated		
				Gas	Labor and gen. exp.	Total
St. Clair Plant (Oct., 1915-April, 1916—Total of 96.889 mil. gal. treated)						
*Max.	17.942	4.58	0.56	$0.424	$1.991	.....
Min.	12.658	1.74	0.22	0.161	1.098	.....
Av.	.....	3.09	0.38	0.277	1.527	$1.804
Laurel Run Plant (Oct., 1915-April, 1916—Total of 512.63 mil. gal. treated)						
*Max.	92.96	2.17	0.26	$0.196	$0.282	.....
Min.	76.42	1.79	0.22	0.161	0.208	.....
Av.	....	1.99	0.24	0.179	0.257	$0.436
Saltlick Gas Plant (June, 1915-April, 1916—Total of 981.34 mil. gal. treated)						
Max.	129.67	2.45	0.29	$0.221	$0.589	.....
Min.	72.56	1.25	0.14	0.113	0.257	.....
Av.	....	1.76	0.21	0.158	0.342	$0.501

*Based on monthly averages.

COSTS OF TREATMENT WITH HYPOCHLORITE

	Mil. gal. treated per month	Lb. of hypo. per mil. gal.	Avail. chlorine p.p.m.	Cost per mil. gal. treated		
				Hypo.	Labor and gen. exp.	Total
St. Clair plant (Nov., 1914-Oct., 1915—Total of 136.7 mil. gal. treated)						
*Max.	15.337	12.69	0.48	$0.208	$14.090	.....
Min.	9.284	7.40	0.31	0.122	8.184	.....
Av.	.....	9.64	0.36	0.158	11.795	$11.953
Laurel Run Plant (Nov., 1914-Oct., 1915—Total of 801.57 mil. gal. treated)						
*Max.	86.970	13.52	0.50	$0.222	$6.677	.....
Min.	17.480	5.54	0.21	0.091	1.609	.....
Av.	.....	7.83	0.29	0.128	1.950	$2.078

*Based on monthly averages.

Colloidal Theories, Applied to Colored Water, Reduce Cost of Chemicals

Saving of 50 to 70 Per Cent Effected at Wilmington, N. C., in Treating Mixed Water of High Color and Turbidity

By GEORGE F. CATLETT
Chemist and Bacteriologist, Board of Health, Wilmington, N. C.

IN recent studies conducted for the improvement of the water supply at Wilmington, N. C., results have been obtained bearing upon the physical chemistry of coagulation. The laws relating to the chemistry of the colloids have been made use of with marked increase in efficiency and economy.

The raw water at Wilmington is pumped from the Cape Fear River, which forks just opposite the upper part of the town, the main river going in a northwesterly direction away from Wilmington, and the tributary, known as Northeast River, flowing northeasterly along the city front. The main river extends for a considerable distance into the interior of the state, and has a drainage area of 8400 sq. miles. It brings down a water high in turbidity and low in color, very similar to the Mississippi and its tributaries. The Northeast River, on the other hand, has a drainage area of only 1330 sq. miles, consisting of low ground, meadows and cypress swamps, which give to its water a very high color (150 to 300), with practically no turbidity.

CHARACTER OF RAW WATER

The water plant is situated just above the city, and just above the fork of the river, on the Northeast branch. The unusual and unique nature of the raw water is due to the fact that there is a mixture of both the high colored water and the high turbidity water, the one or the other predominating according to the tide changes four times a day or to freshets in either branch. Under usual conditions a high turbidity water cannot contain much color, as the turbidity will remove the color to a great extent if given time. In the present case the water is treated shortly after the mixture is made, and we have to deal with high color and high turbidity in the same water.

The river receives the sewage from Wilmington below the water intake, but has no polluting courses above. The high dilution makes the sewage pollution no great load for a filtration plant to take care of.

The filtration plant is of the ordinary mechanical type, consisting of eight units of 500,000 gal. each, with a reserve provision for four more units. Two coagulating basins are provided, giving a combined basin time of about 5 hr. When the plant was completed in 1911 these basins were independent of each other and only one could be operated at a time; with this arrangement only about 2½ to 3 hr. time was available. Besides, the most convenient basin had no baffling and, through "short cutting," much less than the theoretical basin time was obtained.

The chemicals used are 22 per cent alum, soda ash, and, recently, lime, the low alkalinity of the raw water requiring the addition of the latter. This alkalinity runs from 8 to 5 parts per million.

It may be seen that this was a "standard" plant, designed for an average water, and that no attempt was made to provide for the unusual demands of the Wilmington.

The results obtained were very unsatisfactory. The plant gave very satisfactory bacterial removal, but very poor removal of color and turbidity, and in addition it was impossible to prevent the coagulant from separating out in the mains from a colloidal state that would pass the filters. From 3 to 4 grains per gallon of alum were used, as better results were obtained than when using a smaller amount. The resulting carbon dioxide and bisulphate caused, with such a soft water, corrosion of plumbing, "red water" trouble and boiler action. This all caused great dissatisfaction among the water users, and the usual prejudice following the introduction of an alum-treated river water was augmented so that its effect will be felt for many years.

All of the usual remedies were tried. The alum was increased and decreased as high as 5 grains per gallon. The soda was decreased to a very slight excess, and the sand was thoroughly investigated, using various sizes. The washing was carefully studied to insure a proper film, and, finally, the basins were connected in tandem to increase the basin time.

SAME WATER (HIGH COLOR) TREATED WITH THE SAME AMOUNT OF ALUM

The jar on the left has dosage of alkalinity so as to leave alum slightly in excess. The other vessel has about 1 gr. per gallon excess alkalinity. Picture taken after 2 hours' standing. Note complete sedimentation in former, and very little in the latter.

COLOR AND TURBIDITY

Turbidity consists of fine sand, silt and clay, a part of which is large in size and settles out without treatment, and a part of such finely divided material as to produce a colloidal suspensoid. It has been demonstrated that this is a negatively charged colloid.

The coloring matter in the water is chiefly tannates, gallates, etc., which are colloids or semi-colloids following the same laws. This is positively charged and is similar to aluminum hydrate in this respect.

In the treatment commonly used to remove these materials we introduce the sulphate of aluminum or of iron, and therefore have to consider these in studying the reactions taking place. These are soluble in water, are crystalloids, and have relation to the colloids only as electrolytes and colloid precipitants. When this material is introduced into the water containing alkali, they are immediately thrown out as aluminum or iron hydrate. This is precipitated in very finely divided particles, and these should be made to pass more or less rapidly by agglomeration through gradually decreasing degrees of dispersity until they have passed the colloidal stage and settle out readily from suspension. A most important feature of basin action is to prevent this material from remaining in the colloidal stage. When the precipitated materials settle down in a compact mass in water they partake of the nature of a gel.

SAME WATER (HIGH TURBIDITY)—NO COAGULANT ADDED

Vessel on left had sulphuric acid slightly in excess. On the right there is added hydrated lime to slight pink, on addition of phenolphthalein. After standing 48 hours.

In order to secure a full precipitation of these insoluble hydrates it is necessary to have in the water sufficient precipitating alkali to react with the aluminum and iron sulphates. This is found naturally in water in the form of the carbonates of lime and soda. Both the carbonate and bicarbonate of sodium are soluble, but the carbonate of lime is only very slightly soluble, and there must be sufficient carbon dioxide in the water to convert this into the bicarbonate before it will exist in solution. Some waters do not have sufficient natural alkalinity, and it is necessary to add additional alkali in the form of the carbonate of soda and lime hydrate. The added sodium carbonate, in reacting with the aluminum or iron sulphate, sets free carbon dioxide in the water. The lime hydrate, on the other hand, takes up the free carbon dioxide in the water and the half-bound carbon dioxide already in the water, so that the bicarbonate of lime already in the water is thrown down as carbonate together with the added lime.

The carbon dioxide derived from the soda reaction and that existing free in the water act as a negatively charged material on the colloids, and are important for this reason.

PRINCIPLES OF COLLOIDAL REACTIONS

Colloids are mixtures of two substances which partake very strongly of the properties and actions of solutions, but, unlike true solutions, still preserve a distinct heterogeneity. Ordinary sand mixed with water does not result in a change of the properties of either the sand or the water. If, however, the sand be increased in the dispersity of its particles, we finally reach a stage where the sand and water mixture differs in important properties from the sand and the water. The high degree of dispersity increases the specific surface proportionately, so that the surface tension equalizes the force of gravity and keeps the sand particles in suspension in the water. These particles act in some respects like the ions of true solutions. Colloids are commonly formed of liquids and solids (suspensoids), and of two liquids (emulsoids). A liquid mobile colloid is known as a sol; a jellylike colloid, a gel.

The properties and actions of these colloids form a complex subject, and cannot be outlined even briefly in a discussion of this nature.

Colloids may be precipitated by (1) soluble crystalloids, or (2) mutual precipitation with other colloids. A positively charged colloid is thrown down in the presence of an anion—e. g., aluminum hydrate suspensoid is thrown down quickly if a few drops of sulphuric or hydrochloric acid are added. Certain salts also accomplish this precipitation, as in the case of sodium sulphate acting on aluminum hydrate suspensoid. The precipitating strength is proportional to the chemical valency, i. e., the valency of the ion group (anion against negative colloids, and cation against positive colloids) concerned.

The second interesting action is due to the mutual precipitation of two colloids of opposite electric charge; negatively charged clay particles and positively charged coloring matter react mutually.

The reverse of these actions is also true. Crystalloids, acids and bases, and other colloids of the same electrical charge act to support the colloidal state.

EXPERIMENTAL APPLICATION

A sample of the high colored, clear, Northeast River water, if kept for some time, will coagulate and deposit the coloring matter to a considerable extent. If the water is made slightly acid, this action is hastened. Before sewage pollution made it necessary to discontinue the practice, vessels before leaving the port of Wilmington to cross the Atlantic filled their water casks from this Northeast River. They reported that, after some time at sea, the color settled and the water was particularly good. There must have occurred a formation of carbon dioxide from the organic matter.

Large glass battery jars were filled with definite amounts of the high colored water (180-200), and aluminum sulphate and soda were added in such proportions that the aluminum sulphate was in slight and in large excess respectively on the one hand, and the soda in slight excess and in excess of 10 parts per million respectively on the other. Where the alum was in excess (slight) the efficiency of the flocculation and precipitation was markedly increased, and color removal effected in less time with considerably less alum. Where it was necessary to use 3½ grains of alum with the alkali in the ordinary excess of 10 parts per million, two grains accomplished the result even more satisfactorily, when the alkali added was only sufficient to allow the alum to be slightly in excess.

Similar jars were filled with a high turbidity water (160 turbidity—60 color). To one jar was added a small amount of lime. To another lime was added in excess (to complete neutralization of CO_2), and finally one with water just as it came from the river. The test with excess lime gave almost complete precipitation of the clay in a few hours, while the untreated water settled very slowly, and the acid test showed little change after several days.

When these tests were made on a higher colored water the coloring matter interfered with the action.

A deep well water with a high content of bicarbonate of lime (125 parts per million alkalinity) was also placed in the jars, and the laboratory turbidity standard suspension added to produce a turbidity of 200 parts per million. This also showed a marked precipitation of the turbidity when lime was added in excess. These were even better than the river water tests, as there was no color to interfere. The precipitating lime also aids the reaction.

PLANT APPLICATIONS

At the time these principles were applied to the Cape Fear River water the water was running with a color of 180 to 200 and with practically no turbidity on low tide. On high tide the color was 130 to 160, and the turbidity was 30 to 50. The alum used was 4 grains to the gallon and the soda was added to make an excess alkalinity of 10 parts per million. All of it was applied to the intake suction and the water pumped to the first basin, which was on a higher elevation than the other one. From there it flowed to the lower basin and thence to the filters. Results from the treatment, as previously stated, were highly unsatisfactory. Color and turbidity were incompletely removed, and colloidal coagulant passed through the filters and was precipitated out in the mains. All of the ordinary causes for this were thoroughly investigated.

The treatment was changed so that all alum was still applied to the pump suction, but just so much soda to allow an excess of alum of ¼ grain. The result was that the reaction in the first basin took place in the presence of excess alum, which has an opposite electrical charge to the aluminum hydrate, as well as in the presence of sodium sulphate and bisulphate. There is no appreciable absorption and loss of alum in this way by actual test. The water finally flowed to the second basin where it received additional soda to throw out the remaining alum, and to leave an excess alkalinity of 10 parts per million.

This arrangement showed just as good results as the laboratory tests indicated. It has been continued since March, 1915, with splendid improvement in the water and economy in treatment. Where previously the filtered water had a color (due to color and turbidity) of 40 to 100 parts per million, we now have a color of 0 to 5, with an infrequent maximum of 10 or 15. In addition, the amount of chemicals has been cut 50 to 70 per cent. The improvement has also been due to a later substitution of lime for part of the soda, thus reducing the carbon dioxide in the lower basin. A return to the old method in cleaning the basins always brings the former bad water.

OTHER TESTS MADE

Tests were also made, where the raw water happened to be low in color and high in turbidity, when all alkali was added in the form of lime to the upper basin and the alum put in the lower basin. Enough turbidity was removed in the upper basin to demonstrate the soundness of the principles involved, but there is always too much color to permit of good results. If a third basin were added, as is now being considered, it will be possible to effect the color removal in the first two basins as described, and remove the turbidity remaining by rational treatment in the third basin.

These principles have been applied only to the particular case of the Cape Fear River water, but they are applicable to this type of water which is prevalent on the Atlantic seaboard. It will be possible to obtain similar results on other types of water. Fortunately the work done on the Wilmington water is not the only exposition of the soundness of these principles in practice.

In the Engineering Record of Sept. 4, 1915, page 292, is a description of some results on the Neosho River water at Burlington, Kan. This is described as a high turbidity, low colored water. Trouble had been experienced from colloidal clay and from the coagulant persisting in colloidal suspension. The alum was applied in a quantity of more than 4 grains per gallon. This water was high in carbon dioxide and bicarbonate alkalinity, but by getting rid of the free CO_2 by whipping and churning the water and by neutralizing the half-bound CO_2 with lime hydrate, excellent results were obtained with much less alum. The results reported here are particularly interesting in respect to the good effect secured by treating the water with an excess of lime before any alum is added. This is in close harmony with the Wilmington results.

Elbert E. Lochridge, in *American Journal of Public Health* for November, 1914, describes a treatment of the high colored, low turbidity water at Springfield, Mass. Splendid results in improvement of the water, and reduction of the alum required, were obtained by adding the alum in excess to a basin partly filled with water, and then adding raw water to get the required excess alkalinity. This is interesting in illustrating how the excess alum treatment can be applied even though the alkalinity in the raw water is in excess of what is required.

CONCLUSION

The experiences at Wilmington are given in the hope that they will contribute toward more clearly establishing the fact that the chemistry of the colloids is the true foundation upon which all water clarification design should be based. One reason that the chemistry of the colloids has not received more attention in water purification is because only recently has the true action of these complex bodies been clearly understood. Until the appearance in 1915 of the book by W. W. Taylor, the "Chemistry of the Colloids," there was no work in English comprehensively treating the subject.

The large cities are able to employ the most eminent men in the profession, and study at considerable cost the peculiar needs of their particular water. In the case of the small plant we have ample illustration that the practice of "designing" a "standard" outfit, consisting of filter units furnished by the filter manufacturers, is altogether too common. Basins are calculated to give 3 to 6 hr. contact, with a few baffles put in with a vague idea of what actions they are meant to bring about. Chemicals are introduced in a haphazard manner. There is always a tendency by the "business man" councilman to judge that the small priced man is the proper one for a small plant, independent of the obstacles to be overcome.

It is on account of this that it would seem desirable to establish and define the principles involved in water purification on a rational basis. In this way only can the plant be designed so that the proper chemical reactions will be applied, and the equipment so arranged as to best perform this work.

Surveying Government Timber

A reconnaissance of all standing timber in the national forests of Oregon and Washington, involving about 25,000,000 acres, has recently been completed by the United States Forest Service. The examination has been classed as an "extensive" reconnaissance in contradistinction to the intensive surveys used where extremely accurate results are desired.

Brush and Riprap Buffer Will Protect Bulkhead

Creosoted Timber Wall Being Built at Stone Harbor, N. J., to Resist Heavy Seas, Will Be Supplemented by Crib Jetties

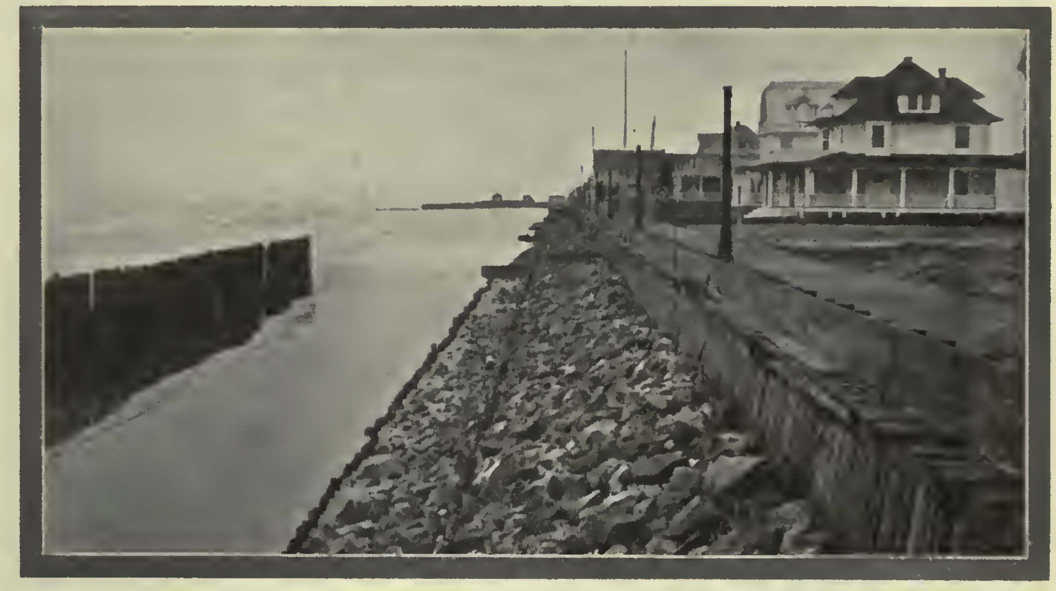
By HARRY E. WEIR
City Engineer, Wildwood, N. J.

A CREOSOTED bulkhead with a buffer in front of brush topped with riprap and held by a row of piles, and an overhanging lip to turn the waves outward, will form the backbone of the beach protection works being built at Stone Harbor, N. J. To help build up the beach jetties filled with brush and stone will be placed where deemed necessary. The form of construction is being patterned after one that withstood severe storms when surrounding works failed.

In December, 1914, several violent storms swept the entire south coast of New Jersey, doing severe damage at a number of points. At Ventnor a concrete wall was practically destroyed, and at Stone Harbor, which had no protection, the beach was lowered to a depth of 3 ft. and several houses on the front were destroyed. At Wildwood Crest the construction shown in the accompanying photograph, taken the day after one of the storms, suffered almost no damage. Consequently the borough council of Stone Harbor decided to build a similar wall, and the writer, who had charge of the construction of the wall at Wildwood Crest in 1908, was engaged to prepare plans and specifications for the protection works at Stone Harbor. The bulkhead wall will be supplemented by a series of jetties.

The wall when completed will be 8250 ft. long. The form of construction is indicated in one of the drawings. For the main structure piles are driven as shown, forming an A-truss construction with a double course sheathing on the water side of 4-in. planks. Twelve feet in front of the bulkhead is placed a row of toe piling, and between this piling and the bulkhead is an apron of tightly bound brush in bundles from 12 to 14 ft. long, on which is placed one-man and two-man stone. The amount of stone used is 1¼ tons per 10 ft. Meadow sod is placed back of the bulkhead to keep the sand from leaking through.

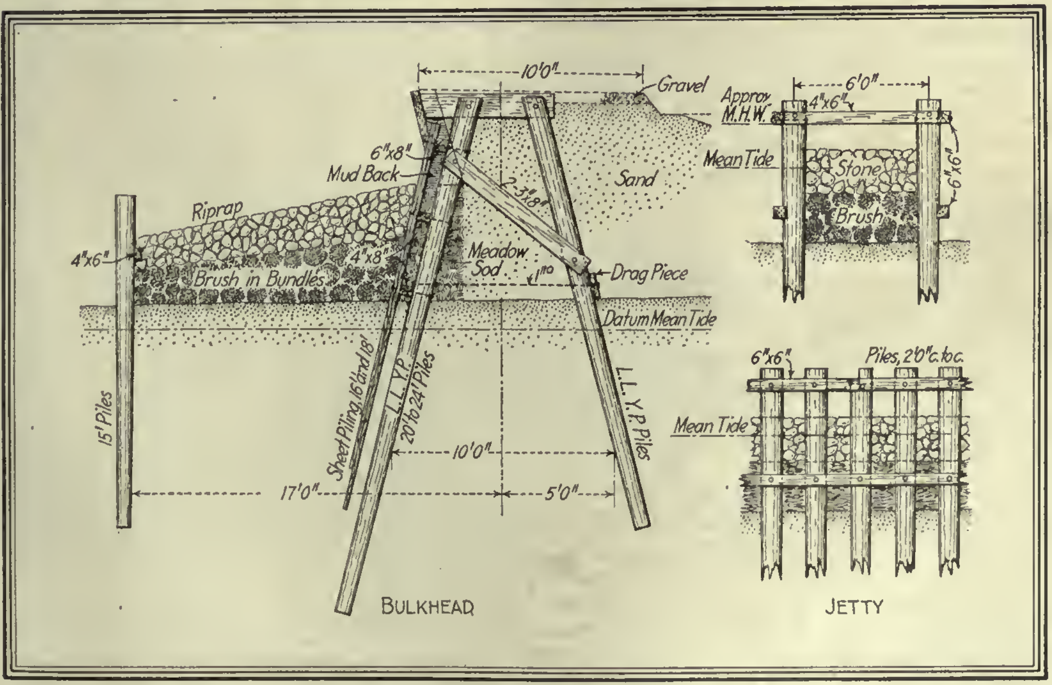
A feature of the bulkhead is the lip sheathing at the top, placed with a slight overhang so that the waves that break over the toe piling will be deflected outward, and will not fall behind the bulkhead and cause erosion. This is a very important detail of the construction.



THIS WALL AT WILDWOOD CREST HAS WITHSTOOD STORMS SINCE 1908

There will be nine jetties, varying in length from 300 to 400 ft. Their form of construction is shown. In profile the tops of the piles at the outer ends will be 3 ft. above mean tide, or about 1 ft. above mean high water, for a distance of about 150 ft., after which they will be on an ascending grade to the elevation of the toe piling of the bulkhead, which is 5 ft. above mean high water. The purpose of the jetties is to help build up the beach and also to break up the waves.

The contractor for this work is the Hill Dredging Company. The approximate price per foot of bulkhead and apron is $15 per linear foot. The cost of the bulkhead wall at Wildwood Crest was approximately $8 per foot. The difference in cost is due to the fact that all the material at Stone Harbor is creosoted in order to withstand the teredo, and because the new wall is of much heavier construction than the old, using fifty per cent more lumber.



DETAILS OF BULKHEAD, AND SECTIONS AND PART ELEVATION OF JETTY
Note overhanging lip at top of bulkhead.

Rolling Important for Asphalt-Gravel Roads

A. P. Rice Indicates Requirements for Satisfactory Job on This Class of Road and Describes Construction Methods

THAT skillful rolling is an important feature of asphalt-gravel road surfacing was strongly emphasized by A. P. Rice in a paper presented at the March convention of the Massachusetts Highway Commission. Others in attendance concurred with Mr. Rice's view and offered many suggestions for carrying on that part of the work. Other conclusions reached were that the money spent on asphalt gravel surfaces is absolutely wasted unless the subgrade is thoroughly drained and approximately true to section; that less trouble from crawling of the surfacing material, which results during rolling, is experienced where enough dust or sand is used for binding to keep the larger stone in place; that running the mixer too long is apt to result in the formation of balls in the finer part of the aggregate, and that the stone base offers the least difficulty in attaining proper grades and cheaper sections.

ROLLING

As a rule for determining when the heat of the surface is suitable for rolling it was stated that the temperature was proper if the mixture was not too hot for the hand to be rested on for half a minute. During the rolling the end of each strip should be staggered, and the direction of the roller should be reversed as rapidly as possible, but without jerking. Each day's work should be thoroughly cross-rolled.

Better joints result if the work is ended and started transversely, and if the joint is ironed out with one wheel of the roller as soon as possible.

HANDLING THE MATERIAL

Normally 3 min. should be sufficient to mix gravel and asphalt, the latter being heated to 200 to 300 deg. Fahr. No material should be spread on a wet subgrade. The use of a horse-drawn roller was favored in connection with a steam-driven outfit in handling material just spread. If depressions are overlooked until the mixture is cold, the old material should be cut out in the immediate locality, the edges of the cut painted with hot oil and the new mixture rammed in and rolled to a true surface.

It has been found that the stone base is the least difficult to bring to proper grade and cheaper section. Less trouble from the crawling of surfacing material, which results in cracks during rolling, is experienced where there is enough dust used for binding to keep the larger stones in place, all the binding material being slightly below the surface of the stone. In taking up pieces of surfacing that had crawled and cracked a layer of dust on the surface of the stone, which seemed to act like flour on a bread-board, was found. Brooming the surface of the broken stone base just ahead of the asphalt is advisable and incurs little extra expense to the contractor.

Unless the subgrade is thoroughly drained and approximately true to section the cost of putting on a gravel asphalt surface is wasted. In view of the traffic which passes over the roads during its construction it had not been found possible to put a broken-stone foundation in place and keep it there without the use of water. All irregularities of surface must be corrected in the base, otherwise a smooth surface of asphalt cannot be laid. In later contracts for this class of work in Massachusetts, payments have been made on the basis of materials used and not by the area laid.

Railroad Revenues Continue Favorable Showing in March

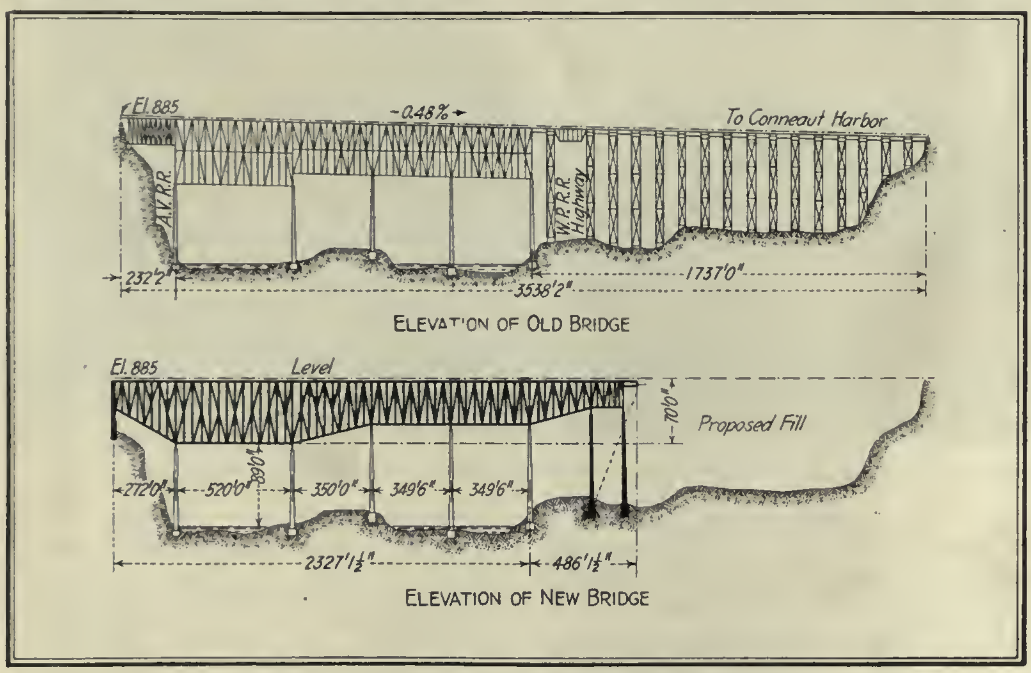
Gross operating revenues for March on the large steam railroads of the United States, according to a bulletin issued by the Bureau of Railway Economics, were $1,260 per mile, showing an increase of $245, or 24.1 per cent, as compared with March, 1915. Operating expenses were $844, an increase of $122, or 16.8 per cent. Net operating revenue, therefore, was $416—an increase of $123, or 41.9 per cent, and operating income was $362—an increase of $118, or 48.4 per cent. The operating ratio was 67.0 per cent, as compared with 71.7 per cent in March, 1915, and 73.4 per cent in March, 1914. Considering the three main districts, the respective ratios for March, 1916, and March, 1915, were as follows: Eastern, 70.0 and 74.4; Southern, 64.5 and 70.2; Western, 64.5 and 68.2.

Begins Reconstruction of Allegheny River Bridge

In Double-Tracking High Crossing Bessemer & Lake Erie Will Put in New Level Spans and Fill Long Viaduct Approach

WORK has been started on the replacing of the single-track bridge of the Bessemeh & Lake Erie Railroad over the Allegheny River 14 miles north of Pittsburgh by a double-track structure. The provement was authorized Feb. 1, and the contracts, both for the substructural work and for the steel work and its erection, have awarded.

The accompanying drawing shows on a distorted scale the elevations of the old bridge and the new. The bridge crosses the river proper on four main spans, aggregating 1569 ft. in length. On the south bank of the river, which is steep, is the Allegheny Valley Railroad, and on the north bank is the West Penn Railroad and a highway, beyond which is a 1500-ft. steel viaduct across the flat. The bridge descends on a 0.48-per cent grade. The height of the bridge above low water is about 160 ft., and the height of the trestle approach is about 120 ft.



DISTORTED ELEVATIONS OF THE NEW BRIDGE AND THE OLD

The new bridge will be brought up to level, the south end being at the same elevation as the old, but the north end of what is now the viaduct approach being 17 ft. higher. The masonry piers, the foundations for which were laid for two tracks when the bridge was built, will be brought on up, the extensions to the west being about 35 ft. Two new piers and an abutment will be required as shown. The new double-track superstructure will be erected on the new masonry without interfering with the present bridge, after which the present bridge will be removed and the new superstructure centered on the piers.

NORTH APPROACH TO BE FILLED

The entire viaduct approach north of the West Penn Railroad and the highway will be filled with steel-mill refuse, which the Bessemer & Lake Erie uses for all of its large embankments, having from 100 to 150 cars of this material to dispose of daily when the steel mills are in full operation. The embankment will take about 1,200,000 cu. yd. To place it without interfering with the heavy traffic on the present single-track bridge a steel viaduct 1545 ft. long and 155 ft. high across Bull Creek, 9 miles to the north, which has been put out of use by a grade revision, is being taken down and will be re-erected alongside the present viaduct approach. The transplanted viaduct will be buried in the embankment.

The work is being done under the direction of the Bessemer & Lake Erie Railroad, of which H. T. Porter is chief engineer, and W. H. Slifer, resident engineer. The Arthur McMullen Company of New York City, has the contract for the masonry, and the American Bridge Company will furnish the steel and erect it. The latter company is also taking down the Bull Creek viaduct and will re-erect it at the Allegheny bridge site.

Waterbound Macadam Tar-Surfaced Stands Heavy Traffic

Bronx Borough, New York City, Keeps Street Under City Traffic in Excellent Condition for 2 3/5 Cents Per Square Yard

THAT waterbound macadam if properly surfaced—which can be done economically—will stand up well under heavy motor traffic is proved by the experience of the Borough of the Bronx, New York City, which maintains 1,800,000 sq. yd. of such pavement at a cost as low as 2 3/5 cents per square yard in one heavy-traffic street and 3 1/5 cents per square yard in other streets.

GRAND CONCOURSE

The most striking example is the Grand Concourse and Boulevard. This pavement, which is 4½ miles long, has two 35-ft. roadways and contains 192,000 sq. yd. of surface. According to an informal count it has carried as many as 1200 vehicles an hour. It is a main driveway, leading to the parkways and suburban counties to the north, and carries regularly a heavy, and, at times, high-speed traffic. Heavy trucks frequent it. Though the proportion of this class of traffic is not large as compared to other streets in the Bronx, it does amount to more than the average hard-surfaced country road has to carry.

The original surface treatment of the Concourse consisted of a ¼-in. thickness of Tarvia A and grit. The tar treatment was applied hot in the proportion of 1/3 gal. to the square yard by a squegee, though the highway officials state that if they had to do it over again they would use a pressure distributor. The cost of the first application was 8 cents per square yard, due to the fact that it was thoroughly cleaned and the dust film entirely removed before the bituminous material was applied. The extreme thoroughness of the cleaning was considered justified in order to secure a satisfactory bond between the metal of the road and the bituminous surface.

Every spring a gang goes over the roadway and using tar makes whatever patches may be required. When the warm weather comes a paint coat of Tarvia B and grit is applied. This is the only maintenance on the road throughout the year. The aim is to keep the top surface thin.

MAINTENANCE ON OTHER STREETS

The maintenance on other waterbound streets in the borough is similar to that on the Concourse. Some of them do not require repairs annually, but are sometimes allowed to go over until the next spring. Those on a grade appear to require less repair than those under similar traffic on level stretches. The quantity of bituminous material applied varies from 1/6 to ¼ of a gallon per square yard, according as the appearance of the road indicates the need of a greater or less quantity.

John P. Binzen, engineer of maintenance, highways and sewers of the borough, is in direct charge of all repair work. J. Stewart Wilson is superintendent of highways and R. H. Gillespie is chief engineer of highways and sewers.

How Steel Prices Affect Cost of Minnesota Bridge Work

THE ADVANCE during the year ended March 30 last of 1.4 cents per pound in the price of structural and reinforcing steel has, according to the Minnesota State Highway Commission, resulted in increasing the cost of various types of bridge superstructure used in that state, as follows:

Steel Bridges with Concrete Floors	
15-ft. beam span	$62.16
18-ft. beam span	78.90
23-ft. beam span	112.46
30-ft. beam span	180.84
40-ft. low truss	275.46
55-ft. low truss	412.56
80-ft. low truss	723.06
120-ft. high truss	1,195.11
160-ft. high truss	1,910.21
Reinforced-Concrete Bridges	
15-ft. slab span	$22.96
18-ft. slab span	30.83
23-ft. slab span	50.98
30-ft. deck girder	82.93
40-ft. deck girder	134.05
55-ft. deck girder	206.64

In addition to these increases the same advance in price makes the average cost $50 greater for reinforced-concrete abutments used with I-beam spans and reinforced-concrete slab spans. The average abutments used with truss and concrete girder bridges are higher than those used with the shorter spans and contain approximately twice the amount of reinforcing steel, so that the advance in cost would be about $100 for each abutment.

These increases mean that a 40-ft. truss costs 32 per cent more this year than last, and that a 40-ft. deck-girder reinforced-concrete superstructure costs 15 per cent more.

The commission points out that the average cost of new concrete-floored bridges built on its plans has been approximately $1 per foot per year, and that, as the cost only of replanking the floor of an old bridge is about the same amount, it is not a good investment to put extensive repairs on old bridges even with the present increased cost of new construction.

Rising Gate Guides Reduce Span Length

Intermediate Submerged Piers Support Movable Gate Posts Giving 52-Foot Clear Span for Passage of Debris and Ice

WIDE spillway openings free from any lifting equipment which would impede the passage of driftwood or ice during flood flows, are obtained at Merrill, Wis., by movable guides which are pulled up after the gates have been raised. The dam is opposite the city and close to the business center, but the Merrill Railway & Light Company, owner of the dam, desired to keep the pond level at as high a stage as possible. When let down the built-up structural steel guides fit into steel-lined slots in the submerged concrete piers, thereby cutting the unsupported length of the gate into four equal parts of 11 ft. 7 in. each.

HOME-MADE CARS DISTRIBUTED CONCRETE

The piers are 2 ft. wide and rise 5 ft. high above the old crib dam, which was filled in with concrete. The gates raise the water 7 ft.; that is, 2 ft. above the tops of the piers. Both upstream and downstream slopes of these small piers are 1.84:1. To take the shock of floating débris the face of the slope is reinforced with a 10-in. I-beam embedded flat and anchored to the concrete with ⅝ x 18-in. bolts.

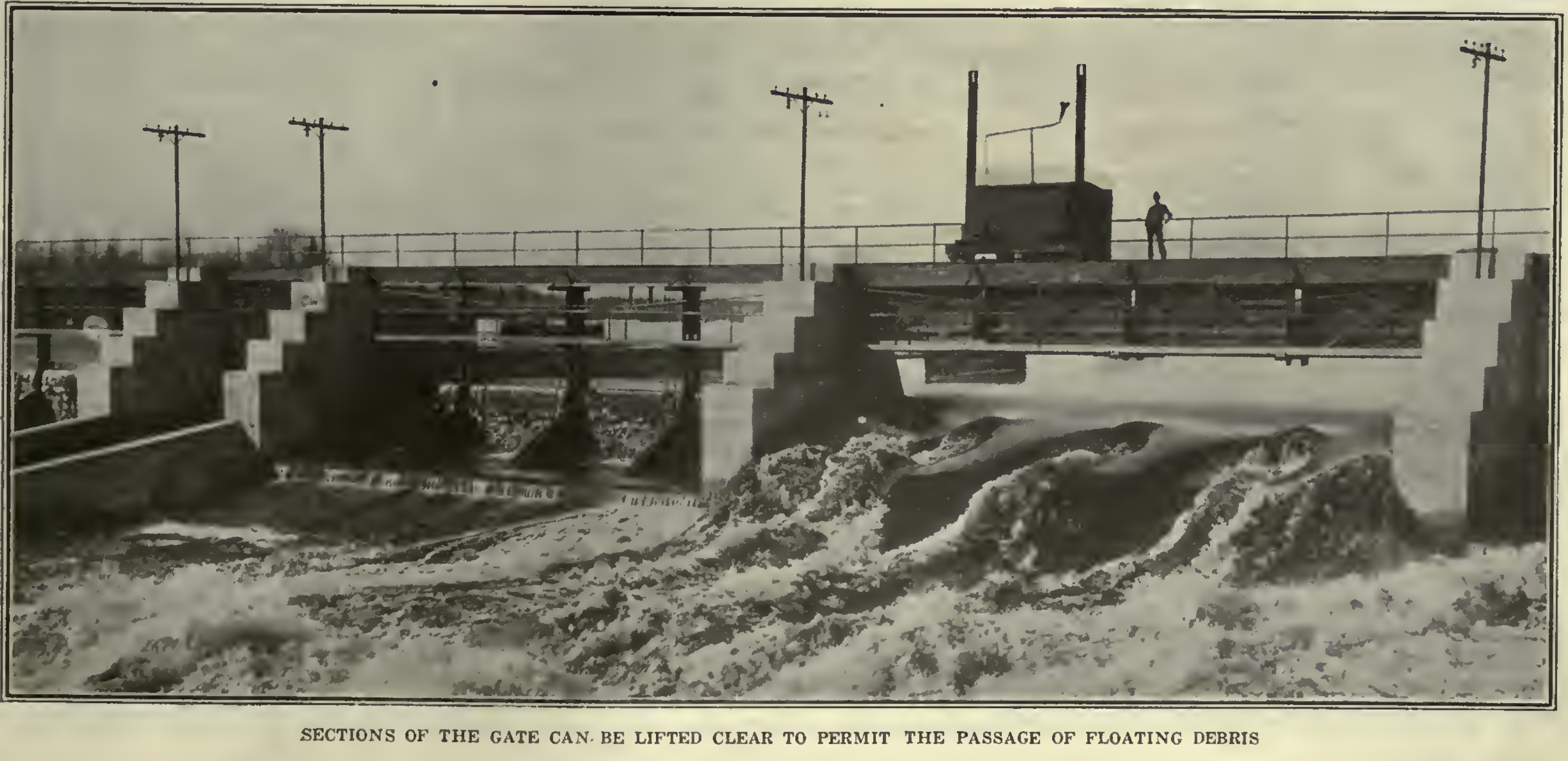
At the intermediate piers the steel gates slide in a movable 10-in. channel which in turn slides against a plate with out-turned angles, making a second guide. The plate extends only to the top of the pier, the upper end of the channel sliding in a similar guide suspended from an overhead trussed bridge of 24-in. I-beams. The electric gate hoist operates over this bridge, which is paralleled by concrete sidewalks on each side; one on the upstream side at the level of the top of the I-beams supported on the end piers and on brackets, and the other on the downstream side suspended from brackets 5 ft. below the bottom of the 24-in. I-beams, and from the hanger guide.

CRIBS ON ROCK SUPPORTED COFFERDAM

The work was carried out by company forces under the direction of H. L. Lange, construction engineer for the Merrill Railway & Lighting Company, for whom E. S. King is secretary.

A Billion Feet of Lumber from California

A total of more than a billion feet of lumber was sawed by California mills during 1915, according to statistics compiled by the U. S. Forest Service. The report includes figures from 136 mills, thirty-five of which had cut 90 per cent of the total. Of thirteen kinds of wood sawn, redwood led with a total of 418,824,000 ft. b.m. With the exception of about 1,000,000 ft. b.m., it was all California timber.


SECTIONS OF THE GATE CAN BE LIFTED CLEAR TO PERMIT THE PASSAGE OF FLOATING DEBRIS

Attain Artistic Effects in Chicago Park Buildings

In New Field Houses the South Park Commissioners Use a Dry Concrete of Small Aggregate Tamped Into Molded Forms

REMARKABLY artistic effects have been attained in two groups of park recreation buildings of concrete now near completion in Chicago. The unique feature of their construction is the rough surface in which fluted pilasters and a wide ornamental cornice of classic Doric design have been cast without showing the impressions of the forms. This gives the entire exterior walls a monolithic effect of pleasing and harmonious appearance. The horizontal markings shown in the photograph are not form marks, but are due to the method of laying the concrete entirely around the building in thin layers. In fact, the form boards were laid vertically. This type of concrete construction was first introduced in Chicago park work ten years ago by D. H. Burnham, architect.

BUILDINGS UNUSUALLY COMPLETE IN EQUIPMENT

These groups of buildings are located in what are designated as parks 15 and 16, each designed as a recreation and social center for a community of the city. Park 15 is bounded by Seventy-sixth and Seventy-eighth Streets, and Dobson and Ingleside Avenues; it contains 10.16 acres and has been named Grand Crossing Park. Park 16 lies between 103rd and 105th Streets and Oglesby and Bensely Avenues, and contains 18.52 acres, but at present is known only by the number. The two groups of structures in the two parks are of the same general dimensions and design, and a description of the buildings in Grand Crossing Park will therefore present the construction features of interest in both.

The main group of buildings is of cruciform shape, the length of which, not counting a cement platform, is 310 ft. The width of the central portion is 146 ft. 6 in. The buildings are more complete in equipment than has previously been attempted in city park structures. They are two-story and contain gymnasium and apparatus rooms for men and women, and an assembly hall. The roof is carried by open construction, steel trusses supporting wood purlins and rafters, the entire structure being roofed with green Spanish tile.

SWIMMING POOL

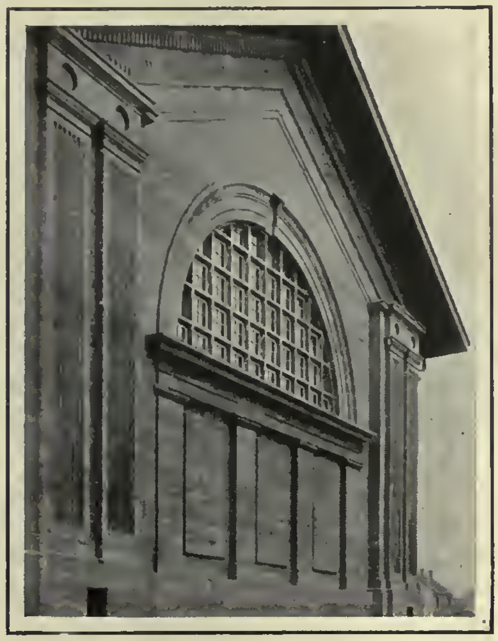
At the end of the main group of buildings in the rear of the men's gymnasium are a large open-air swimming pool, a power house and a service yard. The pool is surrounded by an ornamental brick and concrete walk with long concrete benches, and is connected with the lockers and dressing-rooms in the main group of buildings by asphalt walks on both sides. The pool is 130 ft. long by 60 ft. wide and is divided into two sections. The shallow end is 60 x 80 ft. and is designed for a water depth of 2 ft. at one end and 4½ ft. at the other. The deep end of the pool is designed for a uniform water depth of 8 ft. The walls and entire floor of the pool are faced with white enameled tile.

The power house is 52 x 65 ft. and is of the same rough surface ornamental concrete design as the other buildings. A feature of the power house is a chimney 115 ft. high with the same surface finish as the buildings, this being the first use of this construction in a chimney.

HOW CONCRETE EFFECTS WERE OBTAINED

The standard thickness of the walls of these buildings, not considering pilasters and cornice, is 18 in. This is composed of a 4-in. tile center with 7 in. of dry-mixed concrete on the outside and 7 in. of wet-mixed concrete on the inside. The dry-mixed concrete is composed of 2 parts cement, 3 parts torpedo sand and 9 parts ½ to ¼-in. stone. The interior side of the wall is composed of ordinary wet-mixed 1:3:6 concrete.

The walls were built in 8-in. layers, the tile being laid first, then the surface concrete, and lastly the wet-mixed concrete on the inside of the wall. In the placing of the surface concrete it was tamped very hard for a width of about 5 in. next to the tile and very little at the front. By the use of very small stone of nearly uniform size and a dry mix tamped in this manner it was possible to crowd the concrete forward into the molded design of the forms, bringing out every detail of the design and presenting a uniform rough exterior finish. In mixing the concrete for the surface only about one-third as much water was used as for the wet-mixed interior part of the wall.



MOLD MONOLITHIC CONCRETE INTO DORIC DESIGNS

STONE MUST BE SMALL AND UNIFORM

The inspectors of the South Park Commissioners say that the artistic results obtained by placing concrete in this manner require a uniform small size of stone, great care in securing evenly mixed concrete of uniform moisture and skill in tamping to crowd the concrete forward into the molded design of the forms. All concrete used in this group of buildings was mixed in a Standard low-charging mixer placed on the ground level about the center, close to the side of the main group of buildings. Most of the concrete was delivered in barrows from this position.

These buildings were designed and their erection supervised entirely by the engineering department of the South Park Commissioners under the direction of Linn White, chief engineer. J. D. Barber, assistant engineer, was in immediate charge of the work. The general contract was handled by the John Brittain Company, Chicago.

Highway Bridge Floor Is Light and Durable

Original Plank Floors Being Replaced by 2 x 4-Inch Joist on Recommendation of New York State Commission of Highways

By EMERY E. BRANDOW
First Assistant Engineer, New York Commission of Highways, Albany, N. Y.

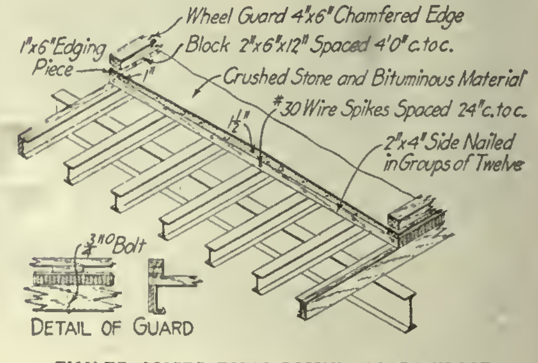
THE TOWNS of the state of New York have many light truss bridges which were originally designed for plank floors. The cost of upkeep on these floors is very great, and the danger caused by broken planks must always be considered. The live load which they are called upon to withstand at the present time is larger than ever before, due to the great number of motor trucks and road rollers now so common. The metal of the bridge has not always had proper attention, and the result is that in the majority of cases there is not sufficient metal to carry the present live loads and at the same time permit the use of a concrete slab floor.

As a money saver, and also as a means of causing less inconvenience to the traveling public, the Bureau of Town Highways of the State Commission of Highways is recommending the use of 2 x 4-in. joists in place of ordinary plank. The drawing herewith shows the method of placing this solid flooring, and the surface finish. Creosoted joists, of course, furnish the most ideal floors, and these are used in some cases, a treatment similar to that given wood blocks being applied. The state is required to maintain the floors of bridges in Indian reservations, where many thousands of feet of this lumber are used.

TIMBER TREATED WHILE LAYING

In order to lower the cost and at the same time keep the money for labor and supplies at home, many of the towns are providing their own treatment while actually laying the floor. Ordinary 2 x 4-in. stock is used, and is dipped in hot tar or asphalt and then allowed to drain before placing. If the wood contains much moisture or sap no treatment is given the bottom, this surface being left free for the escape of moisture or sap, which is believed to prevent rot. The joists are spiked together in blocks of ten or twelve and those blocks are toe-nailed at their ends. This is to facilitate the removal of any joint when necessary, as only a small number of the adjoining joists have to be disturbed.

Over the top surface is placed a heavy coat of hot tar or asphalt, and on this as a blotter is spread some crusher screenings or sand and gravel; some provide a thicker coat, using crushed stone, but this adds largely to the dead load. This makes a wearing surface and at the same time waterproofs the floor. This surface should be


Wheel Guard 4"x6" Chamfered Edge
1"x6" Edging Piece
Block 2"x6"x12" Spaced 4'0" c.to c.
1"
Crushed Stone and Bituminous Material
#30 Wire Spikes Spaced 24" c.to c.
1½"
2"x4" Side Nailed in Groups of Twelve
¾" ⌀ Bolt
DETAIL OF GUARD

TIMBER JOISTS FORM LIGHT BRIDGE FLOOR

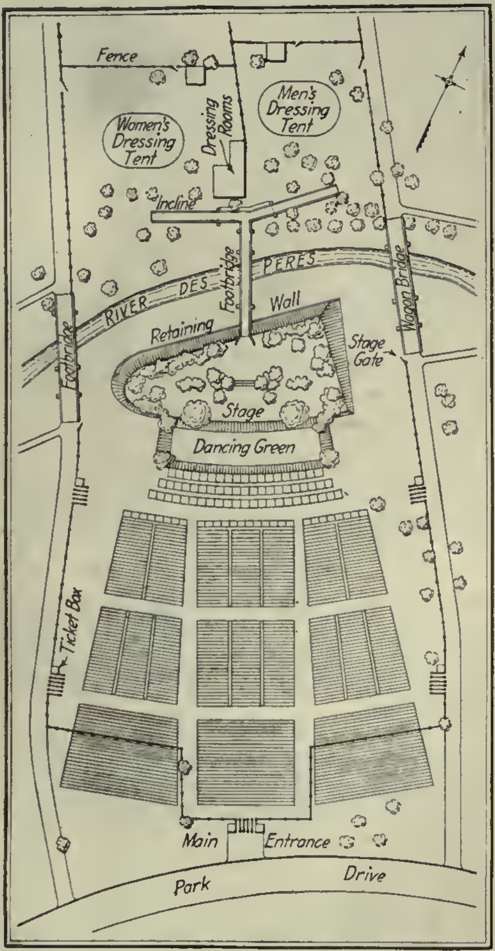
carefully preserved, but its cost of upkeep is very small.

Some of these floors have been in use for five seasons. One in particular, which is on the state highway leading down the Mohawk River just outside of the city of Utica, is heavily traveled, and yet to-day, after five seasons, is in first-class condition. On this same bridge, before providing this type of floor, the oak plank had to be entirely renewed every year, in addition to some extra attention from time to time. All of the results obtained to date favor this type of floor for light truss designs.

Small-Scale Structures Built for St. Louis Pageant

Temporary Stage Constructed on a 10-Foot Fill—Seats for 10,000 People Provided by Relatively Small Amount of Grading

NEW FIELDS for engineering work on a relatively small scale are seen in the increasing number of outdoor pageants in various large cities of the country. The community production of "As You Like It" to be given in St. Louis on June 5 to 11 on a temporary stage erected in the center of Forest Park furnishes examples of the kind of engineering work involved. A relatively small amount of grading on a natural hillside has provided seats for 10,000 people. Three timber bridges have been constructed across the River Des Peres and a timber retaining wall has been erected for the fill under the stage.



PLAN SHOWS THREE NEW BRIDGES, RETAINING WALL, STAGE AND SEATING CAPACITY

GENERAL LAYOUT

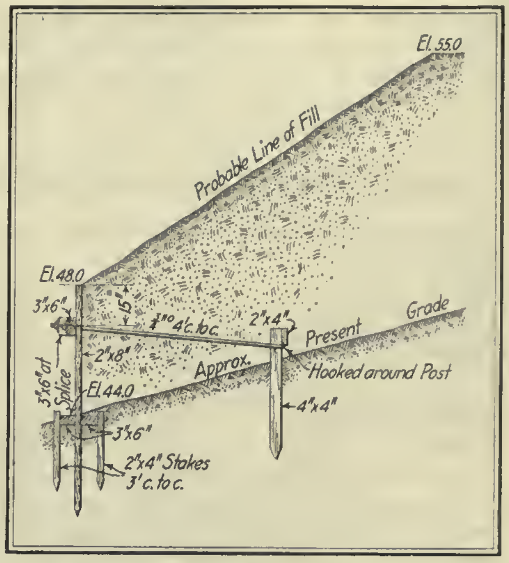
The hillside selected furnished natural advantages in a gradual slope and the presence of two large trees, to form the proscenium of the open-air theater, as shown in the picture. Between and behind these trees the stage was built on an 8 or 10-ft. fill alongside the River Des Peres. Three bridges over this river had to be constructed, one 6 ft. wide between the dressing rooms and the stage, and two 12 ft. wide each and west of the stage to accommodate foot and wagon traffic, as seen in the accompanying plan. In front of the stage is a slope of about 4 ft. down to a dancing green which will accommodate about 250 people.

The 4-ft. timber retaining wall is anchored back by steel rods hooked around short posts, as shown in one of the drawings herewith. The fill retained by this wall supports the stage, which is more than 60 ft. deep at the center line and footbridge, and more than 150 ft. wide near the center, although only about 70 ft. wide in front between the two large trees.

SITE OF STAGE FOR PAGEANT DRAMA

TIMBER BRIDGES

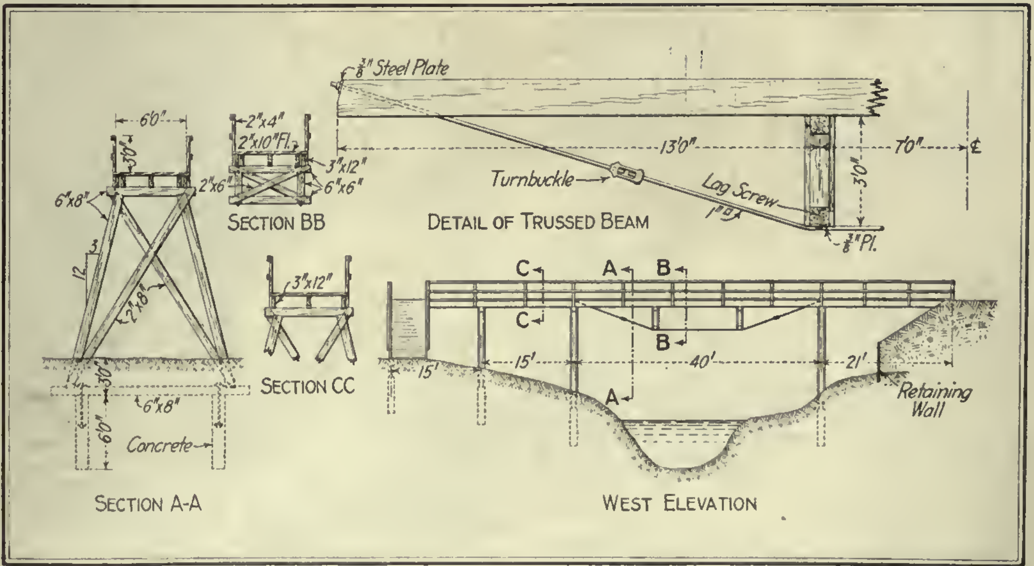
Trussed timber beam bridges of 40-ft. span are used for each of the three crossings provided over the river, with timber beam bents and approaches, and inclines at one end of the footbridge 6 ft. wide on the center line of the stage. Typical details of this construction are indicated by the accompanying drawings of this bridge. The other two are similar except in the use of three trussed beams in each case instead of two, with wider timber bents of similar standard construction, and 1¼-in. truss rods for the wagon bridge.



DETAILS OF TIMBER RETAINING WALL

Concrete pedestals, four under each timber bent for the 12-ft. bridges and two as shown for the 6-ft. bridges, are 6 ft. high in all cases.

The work was done under the supervision of Nelson Cunliff, commissioner of parks and recreation, City of St. Louis.



ELEVATION OF FOOTBRIDGE LEADING TO STAGE—DETAILS OF TRUSSED BEAM

Gives Cost of Concrete Lining Laterals on Average Job

TWENTY-TWO miles of laterals on the Orland project in California in sections ranging from a few feet to 8800 ft. in length have been lined with 1½ in. of 1:3:5 concrete. The work has no unusual conditions, so that the costs are representative average figures. Bottom widths varied from 2 to 8 ft. and slopes from 1:1 to 2:1. Not all laterals received lining, but in general it was placed in all fills; within highway boundaries to increase carrying capacity and to reduce maintenance; in sections of excessive seepage; as a protection over culverts and on curves, and also at forks of laterals where the number of structures made cleaning difficult.

For the longer stretches of work a portable 4-ft. mixer was used, but for the shorter laterals hand-mixing was employed. Bank-run gravel was obtained at a round-trip haul of 5 miles, cement at 6 miles, while water sufficient for the concrete work followed the lining crew down the lateral. According to a statement by A. N. Burch, project manager, in the *Reclamation Record*, there was little difference in cost between hand-mixed and machine-mixed concrete, but the machine-mixed product was better in quality. He has estimated the expense of the work, a typical example of its kind, as in the accompanying table.

COST IN CENTS PER SQUARE YARD FOR LINING LATERALS

Cement delivered on work	9.57
Gravel delivered on work	4.08
Mixing concrete	3.14
Placing concrete	2.94
Sprinkling and protecting	0.46
Preparing section for lining	6.97
Field superintendence and engineering	0.10
Maintenance of equipment	0.22
Plant arbitrary	0.43
Total labor and material	27.91
General expense	6.39
Total cost	34.30

Foremen and finishers were paid $3.20 per day, laborers $2.50, and teamsters with teams $4.50 to $5 per day. Cement cost $2 per barrel and gravel $1 per cubic yard. The total area of the lateral lining was 191,400 sq. yd.

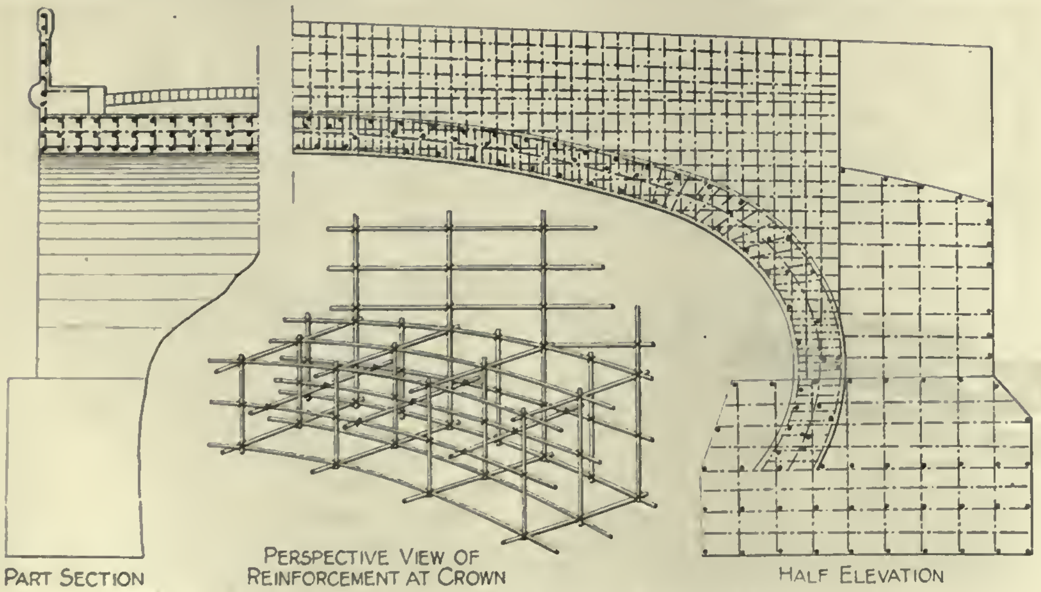
Double Reinforcement in Monier Arch Patent

Statement Made in Previous Article in Reference to Single Layer of Wire Netting at Intrados Was in Error

ATTENTION has been called to certain misleading statements regarding the Monier system of arch reinforcement which occur in the short historical sketch of arch patents printed in the Engineering Record of Feb. 26, page 274. It was there stated that "the genuine Monier system had only one wire netting at the intrados of the arch, and no sample has been found of two complete wire nettings used in the Monier bridges."

The Monier arch patent issued in 1873, as is indicated by the accompanying sketch taken from the original illustration, did cover the use of two or more layers of reinforcing steel rods for bridges. The description accompanying the supplementary patent of 1873 distinctly states that for small arches two rows of the reinforcing grillage would be used in the arch, while for larger arches carrying heavy loads, three or four rows would be used, such as shown in the drawing reproduced herewith.

The statement often made, and quoted in the article above mentioned, to the effect that the Monier system consists of reinforcement with wire mesh too small to be used with concrete is quite evidently not the case, when judged by the intent of the patent as shown by the drawing. The Monier patent as issued in France covers construction using either cement mortar or concrete.



MONIER PATENT FOR ARCH REINFORCEMENT PLACED IN MORE THAN ONE ROW

Rustic Guard Rail Protects Highways in Washington

IN THE mountainous highway construction necessary in King County, Washington, it is deemed advisable to use a guard rail on all curves and grades. The standard type shown in the picture has therefore been adopted, involving the use of fresh cut timber which can always be found in that county adjacent to the line if not actually on the right-of-way.

GUARD RAIL BUILT FROM TIMBER ON OR NEAR RIGHT-OF-WAY

The specifications for this construction call for 6-ft. posts, preferably cedar, 10 in. in diameter at one end and not less than 6 in. in diameter at the other end. They are set on 8-ft. centers, 3½ ft. in the ground, leaving a 30-in. projection. The guard rails proper are to be not less than 16 ft. long and from 10 to 14 in. in diameter. The rails are drifted to the posts with ¾-in. bolts, 20 in. long. It has been found that this construction costs between 20 and 25 cents per linear foot in place.

The work shown in the illustration was done under the direction of A. P. Denton, county engineer, King County, Washington.

Test Douglas-Fir Ties for Holding Force of Spikes

THE GREATEST holding power of common spikes driven into untreated Douglas-fir ties was obtained when the spike was driven into a ⅜-in. hole. Under this condition an average force of 4627 lb. was required for removal. The holding power of common spikes driven into treated specimens reached the maximum average of 4474 lb. when the spikes were driven into ½-in. holes bored before the ties were subjected to the creosoting process. Screw spikes driven into ⅝-in. holes were removed from treated ties by an average force of 10,182 lb., which was 1215 lb. greater than that required for the pulling of screw spikes from the natural wood.

These conclusions are some of the results obtained from the tests of eighteen commercial-grade Douglas-fir ties recently conducted by the U. S. Forest Service, and published by the Association of Creosoting Companies of the Pacific Coast, to determine the holding force of spikes under various conditions in natural and creosoted timber. The specimens were cut in halves and various size holes were bored, after which half of each original specimen was subjected to a creosoting process involving boiling under vacuum, and the comparative holding values of spikes were accurately determined.

For common spikes driven into natural wood, the average holding force was found to be 4555 lb., while a force of 4160 lb. was the average required for the removal of the spikes from the treated specimens. The average force required to pull common spikes from the untreated specimens was found to be 4507 lbs. when the spike was driven into a 7/16-in. hole, 4115 lb. for a ½-in. hole and 3646 lb. for a 9/16-in. hole, while, for the treated ties, the average holding force of the common spikes was 4298 lb. when driven into a ⅜-in. hole, 4352 lb. for a 7/16-in. hole and 3778 lb. for a 9/16-in. hole.

The tests indicate that if the holes are not too large and the spikes follow the holes closely the resistance to withdrawal will usually be increased. Spikes driven close to but not in the holes have a comparatively low resistance. As would be expected, driving spikes in holes reduces the splitting and fiber-breaking to a considerable degree.

HINTS FOR THE CONTRACTOR

Details Which Save Time and Labor on Construction Work

Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

[*Contributions to this section are solicited, and if found available will be paid for. They must be* SHORT, *and should be accompanied, if possible, by photographs or sketches.*—EDITOR.]

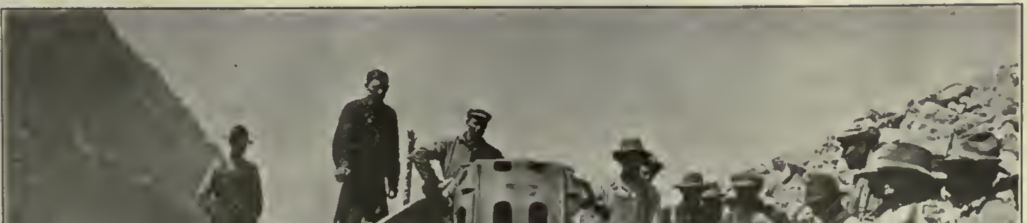
Special Skids Take 7-Ton Generators Down Side of Gorge

By F. N. BIERSACH
Erection Superintendent, Allis-Chalmers Company, Milwaukee, Wis.

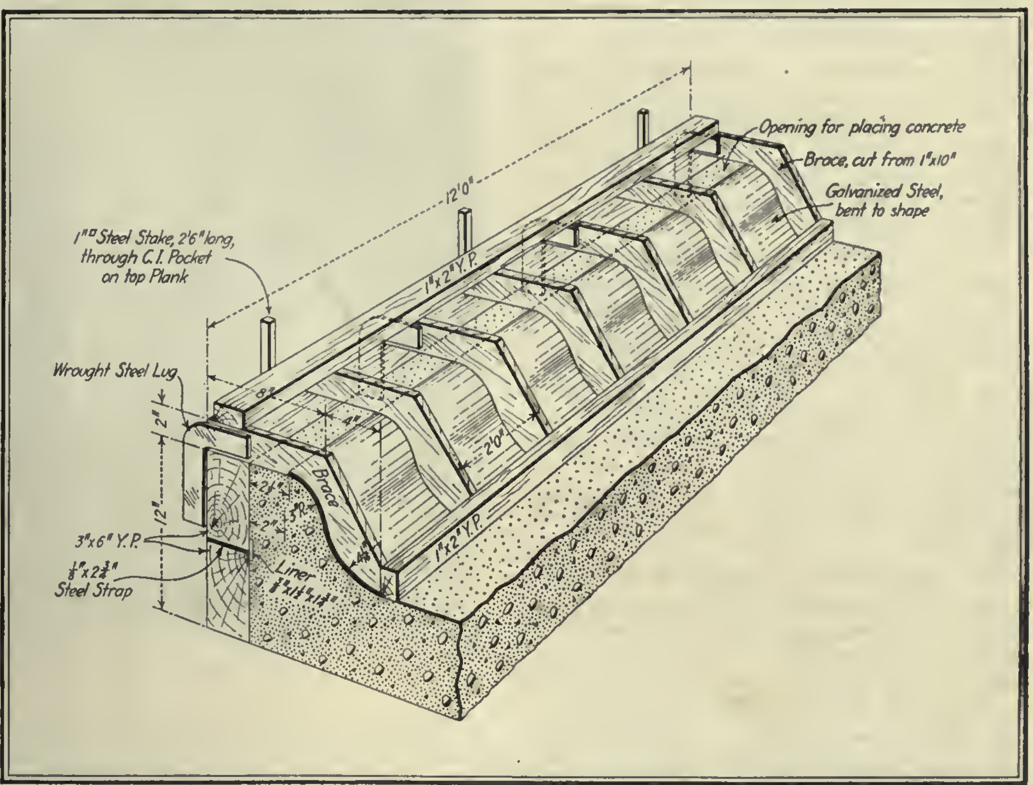
BY MEANS of the long skids shown in the accompanying photographs two 7-ton generators were successfully lowered a long distance down the side of a steep gorge and installed in the power house of Glacier Park Hotel Company, in Glacier National Park, Montana. The generators were hauled by road to a point just above the power plant, and then unloaded and mounted on the skids. Needless to say, after the descent was started no rollers were necessary. There were several ledges in the path, and the skids had to be made long enough to pass over these in safety. Careful snubbing was necessary, but the heavy loads were lowered without accident and in a short time. The turbines were lowered in the same way.

DOWN THE SIDE OF A STEEP GORGE

The two units were erected by the writer for the Allis-Chalmers Manufacturing Company.



SEVEN-TON GENERATOR MOUNTED ON LONG SKIDS FOR ROUGH TRIP DOWN STEEP MOUNTAIN



SIMPLE BUT RIGID FORM INSURES GOOD ALIGNMENT OF INTEGRAL CONCRETE CURB

Simple Integral Curb Form Built with Bent Steel Plates

More than $2.60 per capita was saved to the taxpayers of East Milwaukee, Wis., last year by the use of integral curb on the 80,000 sq. yd. of concrete pavement laid. One of the contractors, the Dean Construction Company, has developed a curb form, an isometric view of which is shown herewith, that worked so well the village engineer has specified its use in the paving to be done this year.

As soon as the pavement is struck off the form is set in place and filled. Any tendency for it to lift when the concrete is poured behind it is overcome by applying convenient weights.

Most of the work in East Milwaukee is of two courses with a base course of 1:2½:4 mixture and a top course of 1:1½:2 granite mixture. That portion of the integral curb extending above the pavement is made of the same mixture as the top course of the pavement. All pavements more than 20 ft. in width are reinforced.

The work is being carried out under the direction of F. W. Ullius, Jr., engineer for the village, which has employed him since 1913.

Time Study Eliminates Costly Details of Design

By DAN PATCH
Aberthaw Construction Company, Boston

TIME STUDY has been applied by the writer in the new use of eliminating unnecessary work by determining features of the plans that entail useless effort and correcting trouble in the office. The average person considers time study as one of the tools of scientific management by which the human machine is to be speeded up. Hence, on the part of workmen, there has grown to be a great distrust of any man in the overhead organization if he pulls a watch from his pocket.

No argument is needed to prove that the average workman, if given proper conditions, will give as honest return for the investment made in him as the average man behind the desk. Both, however, should be interested in the elimination of useless tasks, and in this field time study should find its most fruitful application.

The following application to a simple problem in construction may illustrate the point. Costs were being obtained on the laying of maple floors. These floors were laid on a tar base, all supported by a reinforced-concrete slab. The building was of a modified mushroom type with square columns, the corners of which were chamfered to prevent the breaking down of the columns under fire stresses.

It was noted by the cost department that after a floor had the full quantity reported a considerable amount of time was charged. This was due to the fitting of edge strips along the walls and around the columns. In investigating this item the cost man noted that much time was spent in filling the triangular spaces at the corners of the columns. A time study was made to determine the influence of this on the cost of the floor as a whole. The work of filling these corners was being done as follows:

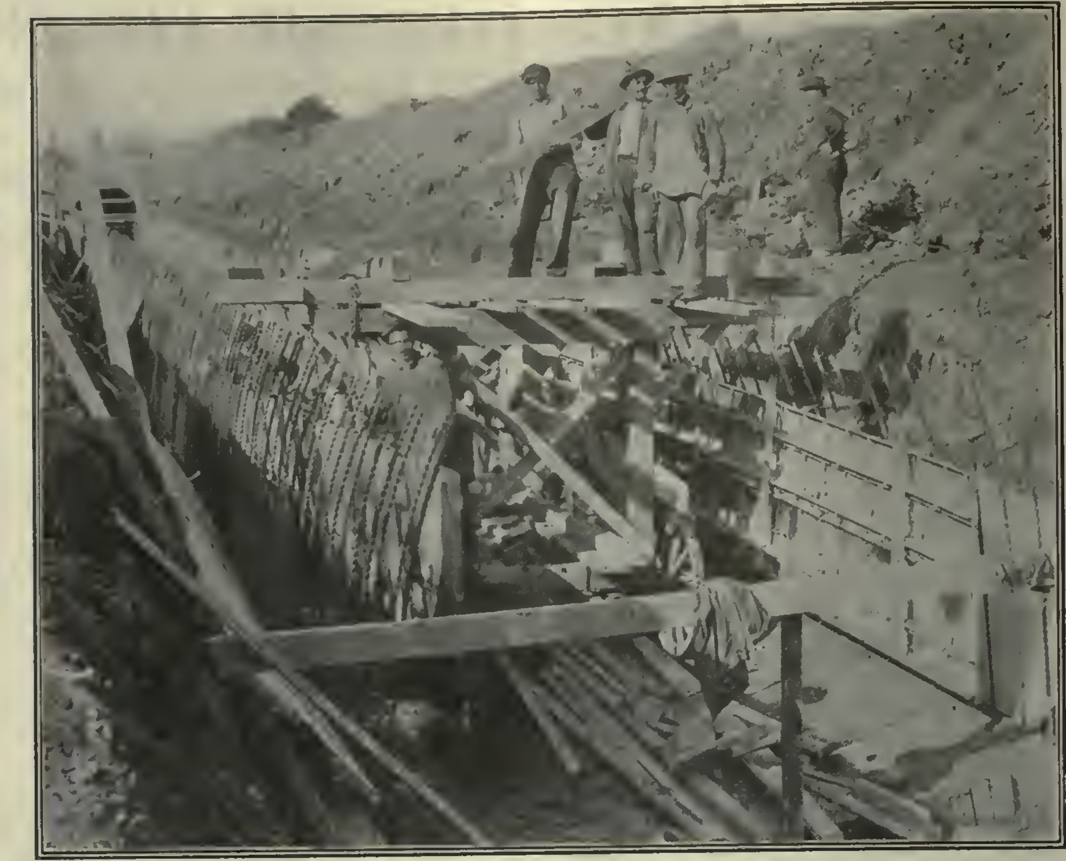
The carpenter would make his measurements of the opening, for each one was enough different to preclude the use of a standard or jig filling piece, and then lay this triangle out on a piece of scrap maple flooring. He would then saw the piece out, try it in the opening and with his knife make any necessary alterations to complete a fit. This study developed the fact that about 20 cents per square of the floor laid was due to the operations attendant on filling these corners. Instead, however, of trying to speed up the men and reduce the cost, a study was made of the possibility of eliminating the process and hence the item of cost. Two methods presented themselves, one of which reduced the cost by about a half and one of which eliminated the cost. The first was to fill the openings with concrete after the edge strips were laid. The second was more complete and involved the forms.

When the column forms were made a fillet was placed on the forms to give the desired chamfer. By cutting this fillet off at a 45-deg. angle about 2 in. above the grade of the edge strips the bottom of the column was poured with square corners. This eliminated not only the cost of fitting corner pieces but saved the operations of sawing the 2-in. spruce plank and maple flooring to fit around the chamfered corners. This may seem a slight item but in the construction of a good-sized factory is well worth saving.

The point is, however, that while there may be justification for antagonism to time study for speeding purposes, there should be none to its use for eliminating unnecessary processes in construction and manufacture.

Wagon, Used as Carriage for Sewer Forms, Rolls on Invert

IN BUILDING the Columbus, Ohio, sewer, the handling of the invert forms on a section of which was described on page 685 of the Engineering Record for May 20, 1916, a special carriage made with wagon wheels was used on the open cut sections to raise and carry the sidewall forms. The wheels of an old wagon were set on 6 x 6-in. axles with 8-ft. gage, and on the axles was built a frame with which 30 ft. of inside or outside forms could be handled. The forms on each side were raised by means of the levers on top of the frame shown in the accompanying photograph, until they cleared the finished walls. The wagon was then pushed ahead by four men. These four men were able to move and set 60 ft. of either inside or outside form in about 3 hours. The arch forms for this part of the work were pulled ahead on a track built on posts resting on the invert. This track was built in sections of 60 ft. each.


RIG MOVES AND SETS SIXTY FEET OF SIDEWALL FORMS FOR SEWER IN THREE HOURS

The method described was used on the south side storm sewer, which is being built by J. C. Carland & Company, of which Charles E. Cannell is manager and H. R. De Lorme secretary, for the city of Columbus, which is represented on the work by R. C. Chaney, assistant engineer, under W. J. Weaver, engineer in charge of sewer construction, and Henry Maetzel, chief of the city engineering department.

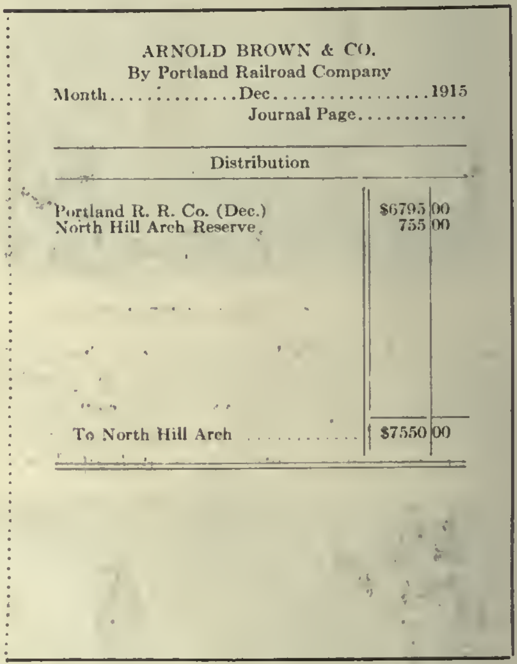
Accounting for the Contractor—Credit Memoranda, Estimates

By BENJAMIN L. LATHROP

Lathrop, Shea & Henwood Company, Scranton, Pa.

CREDIT memoranda should be handled before posting in the journal or ledger by the same method as that described in the second article of the series (page 717, Engineering Record for May 27, 1916) for taking care of invoices, except that the folder to which they are attached should be of different colored paper from those used for invoices, so that the credit memoranda will be readily distinguishable in the files. The form for listing and distributing invoices should be changed to convert it into a form for credit memoranda by substituting "credit" for "invoice" and "by" for "to."

The estimate sheets showing the amount of work allowed for during the month, the percentage retained until completion, etc., which usually accompany monthly payments from the owner to the contractor, should be attached to a credit folder. In this case no entry is necessary on the inside of the folder, but the outside should be filled in as indicated on the accompanying form.


ARNOLD BROWN & CO.
By Portland Railroad Company
Month..........Dec..................1915
Journal Page............

Distribution

Portland R. R. Co. (Dec.)	$6795	00
North Hill Arch Reserve	755	00
To North Hill Arch	$7550	00

CREDIT FOLDER LISTING ESTIMATE PAYMENTS

It is a good practice to keep a ledger account with the reserve, or retained percentage, on each job, thus giving the contract full credit for the gross earnings. While this reserve is a nominal or deferred asset, it has a proper place on the ledger and in the balance sheet.

[This is the third of a series of short articles on good accounting methods for contractors. Others will appear in succeeding issues.—Editor.]

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

Corrosion Causes Failure of South Street Bridge, Philadelphia

End Diagonal Eyebars Break Under Carload of Stone, but I-Beam Chords Prevent More Than 18-In. Sag in Truss

An iron truss 100-ft. span of the bridge carrying South Street, Philadelphia, over the property of the Pennsylvania Railroad near the Schuylkill River failed May 26 due to the breaking of end diagonal eyebars weakened by corrosion. The reserve strength of the I-beam top chords prevented serious consequences and no damage resulted except to the bridge structure, one panel point (L_1) dropping about 18 in. The information which follows has been furnished by Jonathan Jones, assistant engineer of bridges, city of Philadelphia.

This portion of South Street bridge comprises three spans of about 75, 100 and 75 ft. respectively. The central or longest span, the one which failed, does not at the present time span railroad tracks, though there were tracks under it when it was built in 1878. Locomotive gases thus had a share in promoting corrosion, and the pocket formed under the wooden floor at the panel point where failure occurred no doubt held water for considerable periods.

Carried Heavy Traffic

The bridge is 52 ft. wide, the two lines of trusses being 36 ft. center to center. Transverse floorbeams of rolled I-beams trussed with rods support wooden longitudinal stringers and a timber floor. The bridge has been carrying two lines of the heaviest type of electric car in Philadelphia and also heavy trucking traffic, though it is seldom that more than two heavy vehicles are on the same span at one time.

The trusses are of the Pratt type, with counters in all except the two end panels. The top and bottom chords each consist of four I-beams. The web diagonals are eyebars and the posts are of the old Phoenix type. The end top chord I-beams rest on top of the vertical end post, which rests on the end of the bottom chord I-beams, and these on the supporting bent.

Eyebars Rusted Away

The end diagonal eyebars rusted away inside of the bottom chord joint L_1, to a degree which caused them to break under a heavy carload of paving materials. This threw the shear to the two chords, acting as girders, and the bottom chord I-beam L_0L_1, also badly corroded, failed in bending adjacent to L_1. The top chord I-beams, having a greater margin, took the load and though deflecting about 18 in. continued to support the truss and floor.

Traffic was at once diverted and the failed panel point braced and jacked up on a bent of 12 x 12-in. timber. The floor was removed and relaid. Both trusses were then supported by timber bents at all panel points, and it is intended to similarly brace the two 75-ft. spans. Where the railroad tracks beneath interfere with the placing of bents, old girders above deck will be used to relieve the trusses.

With these temporary precautions, traffic will be resumed and the city councils will be asked to appropriate funds for a new bridge to be built during 1917. The old masonry piers and abutments are in excellent shape. A new superstructure will cost about $60,000.

The temporary repairs are being directed by John H. Neeson, assistant engineer, Bureau of Highways, city of Philadelphia, in charge of the maintenance of bridges and sewers.

Naval Board to Head Chicago Engineers' Preparedness Parade

Members of the Naval Consulting Board of Illinois will act as the honorary committee of the engineers' division of the Chicago preparedness parade to-day. The Illinois members of the board are S. K. Copeland, chairman; Dr. W. F. M. Goss, William Hoskins, Robert W. Hunt and Peter Junkersfeld. Bion J. Arnold, member of the National Naval Consulting Board, will also be one of the honorary committee. The volunteer engineers' committee has extended invitations to all companies employing technical men to join the parade.

Invitations have also been extended to all engineering colleges and universities within convenient distances of Chicago and it is expected that delegations from the universities of Illinois, Wisconsin, Michigan and Northwestern and Armour and Lewis institutes will march with the engineers' division.

Among the societies co-operating with the volunteer committee are: Western Society of Engineers, Joint Committee on Military Engineering, American Society of Civil Engineers, Chicago Engineers' Club, Illinois Society of Engineers, Illinois Association of Structural Engineers, American Association of Engineers and Associated Technical Men.

$150,000 Maceo Monument Built by Cuban Engineers in 1½ Months

Largest Work of the Kind Ever Undertaken in Cuba Will Be Exposed to Unbroken Force of Tropical Hurricanes

After 1½ months of night and day work, Cuban engineers completed, unaided by outside advice, the construction of the $150,000 Maceo monument. It is the largest work of its kind ever undertaken on the island. The official unveiling took place on the country's independence day, May 20. The approximately 600-ton monument rests on a concrete foundation carried down to solid rock and each piece is tied in and anchored by bronze or steel.

Foundation 40 Ft. in Diameter

For the foundation earth was excavated to a depth of about 12 ft. to solid rock in a circle 40 ft. in diameter. This hole was filled with concrete mixed in the proportion of 1:2:3, using native cement and ¾-in. reinforcing bars. After the concrete had set 12 days the building of the monument was started.

For the erection a girder crane was set up on timber towers on each side and running longitudinally along them. A trolley along this provided for transverse movements. The heaviest piece set weighed 9 tons.

MACEO MONUMENT IS LARGEST WORK OF ITS KIND UNDERTAKEN IN CUBA

The base consists of an American granite facing with solid concrete filling. The shaft was built of Carrara granite also filled in with concrete. Each piece of granite is securely anchored with bronze tie-bolts.

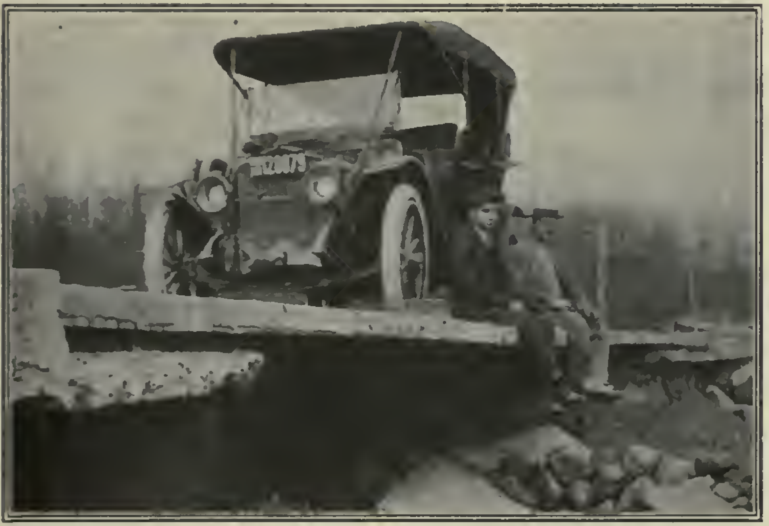
As the monument stands on the seafront, entirely exposed to the hurricanes to which the locality is liable, and the figure on the top is fastened only by the hind legs of the horse, steel rods 2½ in. square were imbedded in each leg and run through the bronze base several inches into the marble slab beneath.

The total cost of the monument, including construction was $150,000. The erection was executed by the National Department of Public Works, of which Col. Jose R. Villalon is secretary, under the immediate direction of Leopoldo G. Abreu. The statue is the work of Dominico Boni, sculptor, of Carrara, Italy.

Brick Pavement Undermined, Yet Upholds Heavy Load

Paving a short distance west of Wooster, Ohio, where the road skirts Killbuck Creek, was undermined this spring and the road inundated for many hours. When the water receded it was found that the embankment supporting the road had been gouged away for several hundred feet by the swift current. For a distance of 60 ft. the concrete base of the pavement was swept away, leaving the brick surface intact.

A strip of the under side of the brick 60 ft. long and 6 ft. wide was scoured clean, yet a good-sized automobile and its passenger were able to rest on the edge. In preparing to refill the wrecked embankment large boulders were dumped upon the pavement and rolled over the protruding edge. This was accomplished without disturbing a single brick. The road will be rebuilt up to the pavement, reversing the customary procedure.



UNDERMINED BRICK PAVEMENT SUPPORTS AUTOMOBILE AND PASSENGERS

The information and photograph were furnished by the National Brick Manufacturers' Association.

8,000,000 Tons of Rain Falls at Rochester First Part of May

According to reports from Rochester, N. Y., the rainfall during the first twenty-three days in May was 4.2 in. Rochester covers nearly 16,000 acres. Hence the amount of water which has fallen on this area during the stated period is approximately 8,000,000 tons.

St. Louis Engineers Will March To-day for Preparedness

Great enthusiasm among the St. Louis engineers has been aroused by Col. J. A. Ockerson and his assistants for the preparedness parade in that city to-day. Every effort has been made to get every engineer in St. Louis to participate.

Leaking Basin at Bellaire, Ohio, Is Repaired with Sheet Rubber Strips

Simple Expedient Proves Successful After Attempts for Eleven Years Fail to Make Reservoir on Unstable Foundation Tight

Rubber strips placed over cracks and boxed in with mud made the reservoir walls of a filter plant at Bellaire, Ohio, watertight and enabled it to be put into successful operation for the first time in eleven years. Built in 1905, at a time when funds available for construction were limited, the plant, because of lack of certain necessary equipment, could not be operated for the first six years. Since that time the source of trouble has been the sedimentation basin, whose insufficient foundation allowed it to settle and crack, defying all attempts to make it watertight until it was recently repaired with rubber sheeting.

An attempt was made to repair the sedimentation basin in 1911. After this work was completed the basin was filled with water, but because it was not built on proper ground it settled still more, and such large cracks appeared that it was again found impossible to operate the plant. In 1913 $4,500 was spent in placing concrete piers 23 ft. below the bottom of the basin and extending them to so-called bedrock. Tie rods were placed diagonally across the basin to support the wall. The bottom of the basin was thoroughly cemented and the interior of the walls was plastered with neat cement mortar. When tested Dec. 29, 1913, the coagulation basin was filled to a point about 4 ft. below the flow line before any deflection or leak occurred. At this point, however, a settlement took place in one corner of the basin, causing cracks in the walls and across the roof. The leakage from the basin was sufficient to erode the bank of the river adjoining the plant, and the water in the basin did not reach a sufficient elevation to provide for the passage of water to the filters. The city officials were discouraged in their attempts to make the plant a success, and the people were thoroughly disgusted. Owing to the poor location and the apparent impossibility of repairing the plant the chief engineer of the State Board of Health reported that it should be abandoned and a new one built in a more favorable location.

Method of Repair

However, in October, 1914, E. J. Lewis, a resident of Bellaire, offered to make the sedimentation tank watertight. Failing to do so he was to receive no pay. His proposition was accepted, and with the expenditure of a very small sum he succeeded in the following manner:

A strip of rubber sheeting 30 ft. long by 3 ft. wide by ⅛ in. thick was placed in the corner of the basin covering the crack. A box was then built around this rubber covering and filled with soft mud. A large crack in the bottom of the basin was also covered with a strip of rubber and was held in place by a cement covering. The basin was then filled with water and it was found that although the crack in the wall opened still further 1/16 in., there was absolutely no leakage.

Under the direction of C. P. Hoover, consulting chemist of Columbus, Ohio, some changes were made in the method of applying the chemicals to the water, and the plant is now in continuous operation. The water is treated with enough lime to absorb the free and half-bound carbon dioxide and from 1 to 1½ gr. of alum per gallon. Mr. Hoover reports that the results have been satisfactory, giving a clear, colorless water free from intestinal bacteria.

Livingston County (N. Y.) Floods Cause Nearly $250,000 Damage

According to estimates made by the superintendent of Livingston County, New York, nearly $250,000 damage has been done in that county by recent floods. Bridges have been wrecked, roads washed out and sluices destroyed.

Two bridges were washed out at Geneseo. Bridges in the town of York will have to be repaired at an estimated cost of $15,000. Nearly forty bridges and sluices as well as many of the roads in the town of Groveland were damaged. Ten bridges were washed out and thirty sluices destroyed at Nunda. Ossian and Portage also suffered considerable damage.

Thirty bridges and sluices at Conesus will have to be rebuilt, while six bridges were badly damaged and several roads washed out at Mount Morris. The Geneseo-Moscow road will be in commission only after an expenditure of several thousands of dollars. Considerable bridge repair and reconstruction will also be necessary at West Sparta, Avon, Livonia, Lima, Springwater and Dansville.

Rebuilding Wrecked Cities Taught by French Government

"The Reconstructed City" is the name of an exposition in Paris, France, which began May 15 and will last four months. The purpose is to instruct the people in the reconstruction of cities destroyed during the war. According to the National Lumber Manufacturers' Association, it is a French exposition entirely. America's lumber manufacturers have, however, sent an exhibit to show the possibilities of American timber in the work of reconstruction.

Different parts of the exposition are devoted to road-building, city planning, city residence construction, city industrial buildings and rural work. In some cases the city-planning department will work for an entire reconstruction, on entirely new lines, of the cities which have been wrecked. In other cases building construction along the old streets only will be required. The road work will be important, as shells have raised havoc with the famous highways of northern France.

Army Engineers to Study Utilization of Great Falls Power

Col. Henry C. Newcomer, Lieut.-Col. C. A. F. Flagler and Lieut.-Col. W. W. Harts comprise the board of engineer officers recently appointed to study and report on the question of utilizing the power of the Great Falls of the Potomac River.

The investigation is being made to determine the adequacy of a power plant at that location to furnish current to meet the growing demands of the federal and district governments. The information will supplement that contained in the Langfitt report.

Bureau of Commerce Reports Latest Foreign Tariff Changes

A report on the latest changes and developments in foreign tariffs has just been issued by the U. S. Bureau of Foreign and Domestic Commerce at Washington. In addition to the usual notices of recent changes, actual and proposed, in import and export duties, customs regulations and internal taxes of foreign countries, the publication contains the more important embargo and contraband provisions, a summary of the regulations affecting commercial travelers in Central America and articles on a number of other subjects more or less intimately connected with foreign tariffs. There is included an article on the probable revival of German commercial influence in Russia after the war. The report is designated "Foreign Tariff Notes, 19," and may be had by application to the Bureau of Foreign and Domestic Commerce or to any of its district offices.

Engineering Society Comes to Aid of Canadian City Engineer

The report under this heading in the issue of May 13 stated that G. W. Craig, city engineer of Calgary, Alberta, had been absolved from all blame for the failure of a reinforced-concrete arch bridge over Bow River. The bridge referred to is now under construction. No failure has occurred and the structure is said to be perfectly safe.

The charges against Mr. Craig concerned the use and testing of re-rolled steel, alleged neglect in not carrying certain foundations deep enough and several minor matters. The committee of members of the Canadian Society of Civil Engineers who made the investigation are of the opinion that the cost of testing the re-rolled steel was not extravagant; that economy warranted the use of such steel in certain parts of the structure, and that the foundations in question had been carried to a sufficient depth. A detailed account will be published in the Engineering Record for next week.

Conservation Congress Indorses Preparedness for Engineers

The Sixth National Conservation Congress recently passed a resolution indorsing and pledging its support to the patriotic work of the engineers and the Committee on Industrial Preparedness of the Naval Consulting Board, and commending their able and patriotic work.

Sprinkler System in Baltimore in Operation

THE IMMENSE SPRINKLING FILTER SHOWN IN THE PICTURE IS A PART OF THE SEWAGE-DISPOSAL SYSTEM INSTALLED AT BALTIMORE. SOME IDEA OF THE VAST AREA DEVOTED TO THIS FILTER MAY BE GAINED FROM THE ILLUSTRATION.

Offer Short Course in Concrete

A practical course in the use of concrete is being offered by the extension division of the Portland Cement Association. The instruction will be given at Lewis Institute, Chicago, June 26 to July 1. It will be conducted by engineers and teachers of national reputation in the cement industry assisted by a force of laboratory experts and artisans. An exhibit of drawings, notebooks, report blanks, course outlines, photographs, tools, forms, equipment and concrete work from various schools will be shown.

The course is for the benefit of manual training and vocational teachers.

"Jail Might Stop Them—We Can't"

The above is the somewhat startling inscription on one of four luridly colored posters that the Long Island Railroad is distributing in its campaign to educate the public to the danger of disregarding signs, bells and gates at grade crossings. In the poster in question an automobile is racing with a train for a crossing. In a second poster another auto has smashed through lowered gates and is about to meet its fate. A third depicts a horse with a sleeping driver, while the fourth shows a stream of men, women and children "ducking" under the gates.

Must Take Signs Off Bridges

Signs with which country merchants adorn bridges on rural roads in attempts at advertising are under the ban of the state highway commission of Minnesota. State aid will be withheld from all counties failing to cause removal of signs.

May Resume Work on Presidential Palace Abandoned Three Years Ago

WORK ON THE PRESIDENTIAL PALACE AT HAVANA, CUBA, WAS ABANDONED THREE YEARS AGO, DUE, IT IS SAID, TO THE DISCOVERY THAT THE INNER ROOMS WOULD BE WITHOUT LIGHT AND VENTILATION. THE GOVERNMENT IS CONSIDERING AN APPROPRIATION TO REBUILD AND COMPLETE THE STRUCTURE.

Contractors Form Association

The Astoria Builders' Exchange was recently organized in Astoria, Ore. The officers elected are: J. E. Simons, president; J. H. Hansen, vice-president; A. B. Thorsnes, secretary; C. G. Palmberg, treasurer. The organization was formed in the interest of general contractors, builders, etc. Fifty members have already been enrolled.

Engineering Society Activities

The Municipal Engineers of the City of New York have chartered the steamer Mandalay for a dance and moonlight sail up the Hudson River on the evening of June 15.

The Engineers' Society of Western Pennsylvania at the June 6 meeting will hear Thomas P. Roberts, of the U. S. engineer office at Pittsburgh, present a paper on the glacial epoch.

The Southwestern Concrete Association completed its organization at a meeting held May 26 at Kansas City, Mo. A constitution and by-laws were adopted and the following officers, all from that city, were elected: President, G. B. Appo, publisher of *Portland Cement;* vice-presidents, Martin Carroll, general contractor, and W. F. Fague, of the Sunflower Portland Cement Company; secretary, H. H. Peters, manager, *Western Contractor;* treasurer, Charles A. Stevenson, Kansas City manager of the Lansing Company.

What Engineers and Contractors Are Doing

BERNARD J. SWEENEY, superintendent for Morrison & Quinn, engineers and contractors, of Rochester, N. Y., will have charge of the construction of a sewerage system at Oriskany, N. Y. Mr. Sweeney recently had charge of construction of the reservoir and dam at Le Roy, N. Y. He was also in charge of the construction of storm sewers and the regulation of the flow of Dry River at Watervliet, N. Y., at which time he was connected with the firm of Leary & Morrison. The work at Watervliet was described in the Engineering Record of Nov. 21, 1914, page 571. Two years ago Mr. Sweeney had charge of the Densmore Creek storm sewers at Rochester.

H. A. STRINGFELLOW, consulting engineer, of Rochester, has been made consulting engineer for the Sedgwick Machine Works, of New York City. He will work on the design and construction of elevators and hoisting machinery.

R. M. BURKHALTER was recently appointed resident engineer in charge of the construction of one of the East River tunnels of New York City's dual subway system. Mr. Burkhalter was employed on the construction of the Pennsylvania Railroad East River tunnels, the Washington Street tunnel at Chicago and the Yonkers (N. Y.) pressure tunnel of the Catskill aqueduct. He resigned as superintendent of the Alabama Power Company to accept his recent appointment with the Public Service Commission.

Frank R. Fisher, who was employed on the construction of the Market Street subway in Philadelphia, has been made engineer in charge of construction of the section of the Broad Street subway beneath the City Hall in that city. Mr. Fisher, who is a graduate of Lehigh University, has been active in engineering work in Philadelphia for a number of years.

William von Phul will succeed Charles N. Blake as vice-president of the United Railways of San Francisco. Mr. von Phul was graduated from Tulane University in 1892. He has since been actively engaged in many power-plant constructions and from 1907 until 1912 was engineer in charge of operation and construction for several Southern light and power companies and electric lines. He is also vice-president of the American Cities Company.

J. L. Jacobs, consulting engineer, of Chicago, formerly with the efficiency division of the Chicago Civil Service Commission, has been employed by the City Liquor Commission to analyze statistics collected by the police on the material and moral sides of the saloon problem.

Walter J. Parsons, who has been assistant engineer on the erection of the Hell Gate bridge for the American Bridge Company for the past 3½ years, has been made assistant manager of the Pittsburgh office of the Foundation Company.

Thomas Fraher has resigned as superintendent of construction for the Pittsford Power Company at Chittenden, Vt., to become engineer for the Long Leaf Pine Company, of New York City. Mr. Fraher was recently connected with Jacobs & Davies, consulting engineers, of New York City, on the North River tunnel of the Pennsylvania Railroad. Previous to that he worked on the Astoria gas tunnel, and the Mexican Light & Power Company's hydraulic development at Necaxa, Mexico.

Frank Adams, formerly connected with the U. S. Department of Agriculture, has been made professor of irrigation investigations at the University of California.

Howard S. Morse, formerly director of the Cincinnati Bureau of Municipal Research, has been placed in charge of the public works department of the newly organized Detroit Bureau of Governmental Research. The Detroit bureau is a private organization intended to conduct municipal investigations in Detroit and research studies of state and national problems. Mr. Morse was graduated from the Massachusetts Institute of Technology in 1903. He entered the U. S. Reclamation Service in 1904 and was engaged on the Lower Yellowstone irrigation project until 1908, when he became connected with the commissioners of sewerage of Louisville, Ky. In 1912 he was made engineer in charge of the division of sewerage investigation of Cincinnati. Two years later he was made engineer for the Ohio State Institute for Public Efficiency and in 1915 he was elected a director of the Cincinnati Bureau of Municipal Research.

Harold J. M. Baker, junior engineer in the U. S. engineer's office at Seattle, left May 22 for Dry Strait, Alaska, to make a survey of that channel with the object of making it navigable.

Alexander P. Crary, formerly junior engineer for the Isthmian Canal Commission, has been made resident engineer for the Cleveland Dock Engineering Company, of Cleveland. He is now engaged on the construction of a reinforced-concrete wharf and pier at Baltimore. Mr. Crary was graduated from Rensselaer Polytechnic Institute in 1901, after which he entered the employ of the Pittsburgh Railways Company as rodman. In 1902 he became connected with the Wilson & Baillie Manufacturing Company. While with that organization he was engaged on subway work in Brooklyn for the Long Island Railroad. He resigned in 1905 to work for Charles Cranford on depression and elevation of tracks of the Brighton Beach Railroad in Brooklyn. He was made draftsman for the Degnon Construction Company, of New York City, in 1906 and later became associated with Baillie & Dumary, of Guild, Tenn. He was made a junior engineer for the Isthmian Canal Commission in 1908.

D. L. Sommerville, formerly superintendent of the Adirondack division of the New York Central Railroad, has been made superintendent of the St. Lawrence division at Watertown, N. Y. Mr. Sommerville has been in the employ of the New York Central since 1899, when he was made supervisor of bridges and buildings on the Pennsylvania division. He was successively engineer of the Rome, Watertown & Ogdensburg, the Pennsylvania and the Western divisions. He was made superintendent of the Adirondack division in 1912.

M. J. Coffey, general superintendent of the T. A. Gillespie Company, will have charge of the pipe job at Rochester for which his company recently secured the contract. Mr. Coffey has been with the Gillespie company for many years and had charge of the work that company did on the New York State Barge Canal and the New York City aqueduct.

Frank A. Walton has left the employ of the Mississippi River Commission to become connected with the Michigan highway department, with headquarters at Lansing.

John J. Lydon, who has been connected with Westinghouse Church Kerr & Company for twenty-five years, will have charge of the work to be done for the Chicago, Burlington & Quincy Railroad at West Burlington, Iowa. Mr. Lydon recently handled the work for the Aetna Explosives Company at Drummondville, Canada, and for the Taylor-Wharton Iron & Steel Company at Easton, Pa.

William V. Murray recently resigned as superintendent of construction for the State of Montana to become superintendent of construction for James Stewart & Company, of New York City, with headquarters at Bridgeport, Conn.

James T. Clark, vice-president in charge of the operation and construction departments of the Chicago, St. Paul, Minneapolis & Omaha Railway, has been made president, succeeding William A. Gardner, deceased.

Edmund M. Blake, whose appointment as engineer for the Holbrook, Cabot & Rollins Corporation was noted in these columns in the issue of May 20, was educated at Amherst College and Harvard University. He was assistant engineer for the New York Rapid Transit Commission from 1900 to 1902. In the latter year he was made principal assistant to Percy M. Blake, consulting engineer, of Newton, Mass. He resigned four years later and for two years he and H. A. Symonds practised consulting engineering in Boston. In 1908 Mr. Blake became manager of the Idaho Irrigation Company, but again took up private practice in 1909 at Boise, Idaho. He came East in 1911 to take charge of the improvement of the Neponset River for the Massachusetts Department of Health, where he was employed at the time of his recent change. Mr. Blake was president of the Westford (Mass.) Water Company in 1907 and 1908 and was honorary commissioner to Italy for the U. S. Department of Agriculture in 1905, when a report was prepared on drainage and irrigation southwest of Venice.

Ernest L. Merrill has resigned as engineer in the U. S. Department of Agriculture to become engineer for the Maine highway department.

Theodore C. Rogers has won the undergraduate Fuertes medal at Cornell University. The presentation will take place at commencement.

Clement E. Chase, a graduate of Cornell University, class of 1910, was awarded the graduate Fuertes medal for his paper on the Cherry Street bridge at Toledo.

C. B. Brady, formerly junior civil engineer in the roadway department of the Interstate Commerce Commission, has been made deputy collector of United States internal revenue at Austin, Tex.

R. M. Hosea, consulting engineer, of Pueblo, Col., is now engaged on coal-mine valuation work at Denver. Mr. Hosea resigned in 1915 as chief engineer of the Colorado Fuel & Iron Company, the Colorado & Wyoming Refining Company and the Crystal River Railroad. He has since acted as consulting engineer for these companies in addition to his other practice.

J. L. Jacks, Southern manager for James Stewart & Company, is now located at Norfolk, Va., where he is erecting two large warehouse piers and 10,000 ft. of bulkhead, as well as directing dredging amounting to 1,500,000 cu. yd. The work is being done for the Norfolk & Western Railway.

J. B. Ferguson has been elected chief engineer of the Hagerstown (Md.) sewerage committee to prepare plans for a new sewerage system.

Richard H. Aishton, vice-president of the Chicago & North Western Railway, was elected president of that road May 23. He began his railroad career in the engineering department in 1878 as axman. He was consecutively rodman, levelman, assistant engineer, superintendent of bridges and buildings and division engineer. He was made division superintendent in 1897 and general superintendent two years later. In 1902 he became general manager and was made vice-president in 1910.

J. E. Hammond has been transferred from the Marietta division of the Pennsylvania lines west of Pittsburgh to a more responsible position on the Toledo division.

J. C. Mitchell, who is now employed on construction at Dallas, Tex., for the Lock Joint Pipe Company, of New York City, will have charge of the Lake Worth conduit job at Fort Worth, Tex., for which his company was recently awarded the contract.

George H. Reussner has resigned from the U. S. Reclamation Service to become construction engineer for the Bethlehem Steel Company, at South Bethlehem, Pa. Mr. Reussner was graduated from Lehigh University in 1911, after which he spent a year in the bridge department of the Lehigh Valley Railroad. He joined the U. S. Reclamation Service in 1912 and was made junior engineer on the Milk River project in 1913, where he was engaged at the time of his resignation.

Karl C. Kastberg has severed his connection with the engineering and water departments of Boone, Iowa, to become city engineer of Des Moines.

Robert McCormick succeeds Karl C. Kastberg as city engineer of Boone, Iowa.

E. S. Walker is engaged in making a topographic survey of a military reservation near Cordova, Alaska, for the U. S. Coast and Geodetic Survey.

E. B. RHINE, formerly connected with the California Highway Commission, has been made junior civil engineer for the Interstate Commerce Commission, Division of Valuation, at San Francisco. Mr. Rhine was engaged as rodman on maintenance-of-way for the Chicago & North Western Railway at Boone, Iowa, from 1909 to 1911. He was later made instrumentman on construction at Sparta, Wis. In 1912 he was appointed resident engineer for the California Highway Commission, at San Francisco. He resigned in 1913 to take charge of highway and bridge construction for San Mateo county, California. He returned to the California Highway Commission in 1914, where he remained until his recent appointment.

E. C. OATES has resigned as manager for the Jackson-Vreeland Investment Company, of Kansas City, to become chief engineer and land commissioner for the Mardez Lumber Company, with headquarters at Benford, Tex.

H. O. KELLEY has been promoted from the position of assistant engineer for the Evansville & Indianapolis Railroad to that of division engineer, with headquarters at Terre Haute, Ind. Mr. Kelley will have jurisdiction over the location and construction of track, buildings and bridges.

T. HICKEY, formerly roadmaster for the Michigan Central Railroad, at St. Thomas, Ark., has been made superintendent of track, in charge of maintenance, with headquarters at Detroit.

PHILLIP D. LAIRD, who resigned from the Maryland Public Service Commission about a year ago, will again become a member of that commission June 1.

ALBERT L. SOLLEDER has left the employ of the U. S. government at Wheeling W. Va., where he has been stationed for the past three years, to become connected with the Dravo Contracting Company, of Pittsburgh.

THOMAS R. TETLEY, JR., consulting engineer, of Brooklyn, has been appointed resident engineer in charge of construction of the Seneca Power Corporation's power plant at Seneca Falls, N. Y.

HARRY W. COLE, a recent graduate of Dartmouth College, has entered the employ of the estimating department of the Petroleum Iron Works Company at Sharon, Pa.

RALPH ST. LAWRENCE PEVERLEY, consulting and constructing engineer, of San Juan, P. R., has given up his practice to engage in commercial business in New York City.

EMIL DIEBITSCH, engineer and contractor, of New York City, was recently elected mayor of the town of Nutley, N. J. Mr. Diebitsch accepted the nomination because of a petition signed by more than 400 citizens, who expressed the opinion that his experience as an engineer and constructor would be of great value to the town. Mr. Diebitsch is a graduate of Lehigh University and ex-president of the General Contractors' Association. During the past twenty-five years he has been connected with many large construction operations, which include a timber drydock at Port Royal, S. C., and a similar structure of granite at Portsmouth, N. H., as well as many of New York's largest buildings.

J. C. ALLISON, formerly chief engineer and assistant general manager of the California Development Company, will open offices for general engineering practice in the Anderson Building, Calexico, Cal., June 1. Mr. Allison will specialize in irrigation, drainage, silt investigation, municipal engineering and valuations. As noted in a previous issue, Mr. Allison has been engaged to make investigations of silt carried by canals from the lower Colorado River with the object of eliminating injuries caused by the silt.

O. A. GEIRLICH has been appointed city engineer of El Monte, Cal., to succeed Robert L. Wood, who resigned recently.

S. H. FINLEY has been appointed city engineer of Seal Beach, Cal. For a number of years Mr. Finley was highway engineer of Orange County, California, at Santa Ana.

G. E. HILL, who has been deputy city engineer of South Pasadena, Cal., for the last few years, has been made city engineer.

W. C. WATTLES has been appointed city engineer of Tropico, Cal.

HAROLD BARGEMAN, county engineer of Maricopa County, Arizona, has been elected secretary and treasurer of the Arizona Association of Highway Engineers, succeeding W. H. Carruthers, resigned. The annual meeting of the association will be held in Phoenix next December.

H. L. CORY was recently made city engineer of Baker, Mont.

J. E. CARMICHAEL, formerly construction foreman for the Montague-O'Reilly Company, of Portland, Ore., has become connected with A. Guthrie & Company, of Portland, in a similar capacity. He will be engaged on the lining of the tunnel of the Oregon-Washington Railroad & Navigation Company at Portland.

HAROLD T. BURGESS has resigned from his position in the engineering department of the city of Meriden, Conn., to become connected with the C. W. Blakeslee Company, contractors, of New Haven. Mr. Burgess is a graduate of Tufts College.

C. C. FLETCHER has been appointed commissioner of waterworks and sewerage at Aberdeen, S. D.

ROBERT BATHMAN, employed by the New York highway department, has been transferred to Elmira.

J. A. LEICHTER will have charge of the construction of a sewage-disposal works on Westerlo Island, near Albany, N. Y., the contract for which was recently secured by the Peter Keeler Building Company of Albany Mr. Leichter has been associated with various construction work, including the foundations and intake for the Riverside power plant, Albany, and work at various institutions.

CLYDE POTTS, consulting engineer, of New York City, has been retained to design a sewerage system for Monroe, N. Y.

ZANE HOFFMAN, formery registrar in the survey bureau of Philadelphia, has been promoted to the position of special inspector.

WILLIAM W. HILL succeeds Z. Hoffman as registrar in the survey bureau of Philadelphia.

JOHN E. ALLEN was recently made assistant engineer of sewer design for Philadelphia, succeeding Charles Frommer, promoted.

CHARLES FROMMER, formerly engineer of sewer design for the city of Philadelphia, has been made assistant to the chief engineer.

GUSTAV J. REQUARDT, division engineer of the Baltimore Sewerage Commission, has been appointed head of the department of franchises and privileges of that city. He will make a complete survey for the purpose of listing all the franchises and privileges with the object of increasing the city's revenue. Mr. Requardt has been connected wtih the sewerage commission since 1909.

LAURENT TONNELLE, of Bayonne, N. J., has been made president of the North Jersey Water Supply Commission. This body, as noted in the May 13 issue, will have charge of the construction of the reservoir at Wanaque, N. J.

JOHN W. HERBERT, of Helmetta, has been elected president of the commission named by Governor Fielder, of New Jersey, to investigate road conditions in that state. The next meeting will be held in Trenton, June 1.

Obituary Notes

JAMES J. HILL, ex-chairman of the Great Northern Railway and one of the most prominent railroad men in the country, died at his home in St. Paul May 29. Mr. Hill leaves many thousands of miles of railroad as his monument. He was born in 1838 in the County of Wellington, Ontario. His first work was in steamboat offices in St. Paul from 1856 to 1865. He later established and became head of the transportation company known as Hill, Griggs & Company. He entered railway service in 1866 as local agent for the St. Paul & Pacific Railroad. That road was reorganized about 1881 and made a part of the St. Paul, Minneapolis & Manitoba Railway, of which Mr. Hill was made vice-president and general manager. He was elected president of that road in 1883, in which position he remained until 1891. He became president of the Great Northern Railway in 1889 and was made chairman of the board of directors in 1907. He resigned as chairman of the board of directors of the Great Northern in 1912, but retained his membership in the board.

JAMES V. ROCKWELL, civil engineer at the U. S. Navy aeronautic station at Pensacola, Fla., was killed May 24 when the aeroplane in which he was flying failed. Mr. Rockwell was previously in the navy service from 1898 to 1899. He resigned to enter the engineering department of the Chicago & North Western Railway, where he remained until 1903. He again joined the U. S. Navy Department in 1903, since which time he had been active in engineering work at San Juan, P. R. He was also in charge of about $2,000,000 worth of work at the Mare Island (Cal.) navy yard. He was recently transferred to Pensacola, Fla.

JOHN PLATZ, contractor, who for more than half a century had been connected with the architectural advancement of South Bend, Ind., recently died in that city. He was born in New Berlin, Pa., in 1827. Mr. Platz came to South Bend in 1851. He erected two paper mills in that city and several of the buildings of the Studebaker and Singer corporations.

HAMILTON FLOOD, civil engineer and contractor, of Quincy, Mass., died May 23 in that city. He was born there forty-six years ago and served as city engineer from 1902 to 1908. Since the latter date he had been in private practice.

FRED T. PERRIS, retired railroad construction engineer of Southern California, died recently at his home in San Bernardino at the age of 79. Mr. Perris was active in the construction of the first lines of the Atchison, Topeka & Santa Fé Railway in southern California. Prior to his connection with the Santa Fé he was in charge of the engineering department of the old California Southern Railway on the construction of its lines out of Los Angeles and San Bernardino. He ran the line and supervised the construction of the San Bernardino-Barstow section. At one time he was county surveyor of San Bernardino County.

Civil Service Examinations

United States: The U. S. Civil Service Commission announces an examination for assistant sanitary engineer to be held July 5 at the regular places. Salary $1,600. Apply for form 1312.

Examinations Previously Announced

Date		See Eng. Record
June 3.	Assistant electrical engineer, New York State..........	May 13
June 7.	Aid in U. S. Coast and Geodetic Survey	May 20
Aug. 21-25.	Second lieutenant, civilian candidates	April 1

146 Road Rollers Bought by Russian Government

What is said to be the largest single order for road rollers was recently placed by the Russian Government with the Austin Manufacturing Company, of Chicago. One hundred and forty-six Austin motor road rollers were purchased.

American-Made Mastic Takes Place of Imported Product

For a long time many tons of rock mastic were imported from Germany, and in lesser quantities from Switzerland and Italy. When importations suddenly ceased it was discovered that in the Trinidad lake asphalt, which is the bitumen used in American-made mastic, nature has supplied the fine material content, or filler, required.

Thus the war, according to the Barber Asphalt Paving Company, has developed an important specialized industry that not only gives employment to many but is keeping at home a great deal of money that formerly went to foreign producers.

Western Engineer Designs New Rapid Computer

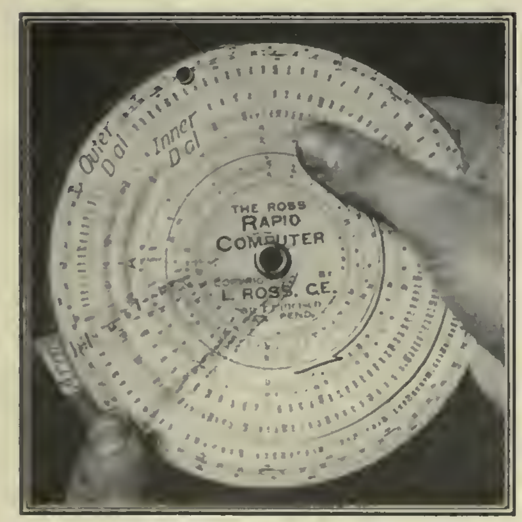
A rapid computer devised to handle a wider range of problems than the ordinary slide-rule has been patented by Louis Ross, civil engineer, of San Francisco, Cal.

Beginning with the outermost, the scales on the outside dial are:

1. Degrees, 0 to 360 deg., for measuring angles.
2. Radians, 0 to 6.283, for circular measure.
3. A scale of equal parts, 0 to 1000, to read logarithms.
4. Scale N, for setting the first number and reading the answer.

The scales on the inner dial are:

5. Scale M, like scale N, but numbered in the reverse direction, to set multiplier.
6. Scale D, like scale N, to set divisor.
7. Sines and cosecants, 6 to 90 deg.; cosines and secants, 0 to 84 deg.
8. Sines and cosecants, tangents and cotangents, 37 min. to 6 deg. Cosines and secants, tangents and cotangents, 84 deg. to 89 deg. 23 min.
9. Tangents and cotangents, 6 to 84 deg.



COMPUTER SAID TO BE QUICKER THAN SLIDE-RULE

10. A scale of squares.
11. A scale of cubes.

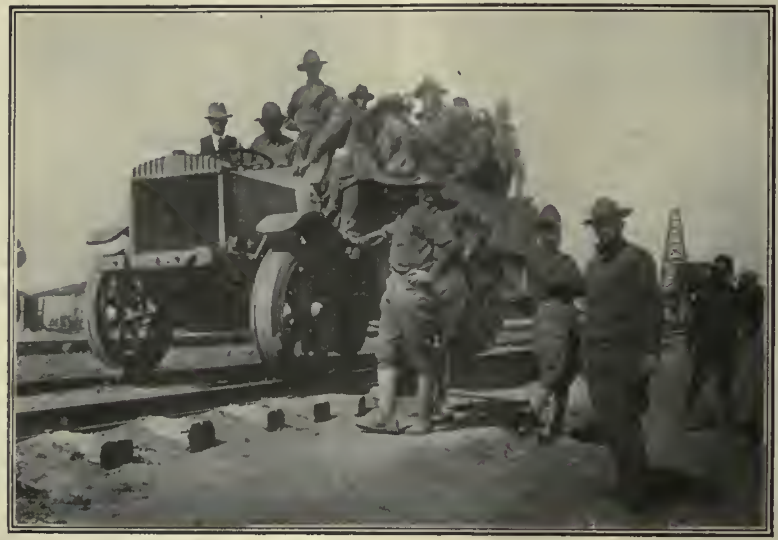
The circular form of the computer is said to reduce the number of movements, simplify the operation, prove the answers and afford a full set of reciprocals and equivalent ratios without ever running off the scale. The answer is shown by a big pointer so marked. A smaller auxiliary arrow proves the answer. The conventional method of graduations has been dropped and a simple system of three and four-figure numbers adopted.

Numbers can be read to three or four places. The trigonometric scales are claimed to be as complete as a printed table, and can be used directly for figuring areas, volumes, traverses and for railroad curves. The device is sold by the Computer Manufacturing Company, 24 California Street, San Francisco.

30 Trucks Sent to U. S. Troops on Mexican Border

An order for thirty 3-ton Riker trucks was recently placed with the Locomobile Company of America by the U. S. government. The order was placed on a Monday morning, and completely filled Tuesday afternoon. The trucks, accompanied by forty-one mechanics and drivers, were loaded on a special train in the Erie Railroad yards at Jersey City, N. J., and shipped to San Antonio, Tex. The Riker motor truck, in a recent demonstration, ran from Columbus, N. M., to El Paso, Tex., a distance of 93 miles, over the rails of the El Paso & Southwestern system at an average speed of 19 miles per hour. The truck carried twenty soldiers with their complete equipment. On arrival at El Paso it was derailed and driven up the main street, where General Scott inspected it.

FLANGED RIM DEVICE PERMITS TRAVEL ON TRACK OR ROAD



Business Notes

The Des Moines Refining Company has opened a sales office in Des Moines, Iowa, to handle the distribution of its water-softening apparatus.

Theo. Raun, Seattle representative for the Automatic Concrete Mixer Company, has removed his office to the Stuart Building. The firm is now known as the Raun Engineering & Equipment Company.

The Cement Products Exhibition Company recently held an annual meeting at which the following officers were elected: President, B. F. Affleck; vice-president, A. Y. Gowen; secretary, Blaine S. Smith; treasurer, J. U. C. McDaniel.

The Central Foundry Company, of New York City, announces that C. C. Todd, who for many years has represented the company in the West and was elected a vice-president of the company about a year ago, will open a Chicago office July 1.

C. T. Anderson, who has been in charge of the sale of rail bonds and third-rail insulators for the Ohio Brass Company, of Mansfield, Ohio, has resigned to become vice-president and sales manager of the Hartman Electrical Manufacturing Company, of the same city.

Fairbanks, Morse & Company, of Chicago, held the annual meeting of the directors May 17. The following officers were elected: Chairman of the board, C. H. Morse, Sr.; president, C. H. Morse, Jr.; vice-presidents, W. E. Miller, H. C. McClary and H. J. Fuller; secretary and treasurer, F. M. Boughey; assistant treasurer, B. E. Cremerius; assistant secretary, C. A. Meyer.

Stanley H. Rose, until recently in charge of the New York office of the Bureau of Foreign and Domestic Commerce, has been engaged by the Barber Asphalt Paving Company to direct its foreign trade department. Prior to his appointment as commercial agent of the bureau Mr. Rose had an extensive business experience in Europe, Australia, New Zealand, India and Egypt. He has also held important posts with American and European firms engaged in foreign trade. As special agent of the Bureau of Foreign and Domestic Commerce Mr. Rose has just completed a tour of more than fifty cities of the Middle West, South and Southwest, acquainting manufacturers with foreign trade opportunities and advising commercial organizations as to the best methods of promoting export trade. Mr. Rose was educated in London, Berlin, Paris and Brussels and speaks most of the modern languages. The Barber company's export trade in paving materials, roofing and other asphaltic products will hereafter be in Mr. Rose's charge, with headquarters in Philadelphia and New York.

Charles L. D. Conklin, until recently president of the Digger Machinery Company, has severed his connection with that concern and is now with the John F. Allen Company, of New York City, as superintendent of the contractors' machinery department.

G. S. Kelley, formerly with the Digger Machinery Company, has recently been appointed sales representative of the John F. Allen Company, of New York City, in connection with the new department established for the manufacture of coal-handling and hoisting machinery.

Trade Publications

The following companies have recently issued trade publications:

Spray Engineering Company, Boston. Booklet, 6 x 4 in., 16 pages. A list of this company's cooling-pond and air-washer installations, completed or in progress March, 1916. Includes thirty-five cooling-pond installations in numerous states and in Canada, Mexico, Cuba and South Africa. Air-washer installations in twenty-one states are described.

Insley Manufacturing Company, Indianapolis. Catalog 41, 6 x 9 in., 64 pages, illustrated. Describes the Insley gravity plant for concrete distribution and the buckets, cars, skips, and other equipment manufactured by this company.

O. K. Clutch & Machinery Company, Columbia, Pa. Catalog 12, 6 x 9 in., 16 pages, illustrated. Presents a complete line of O. K. hoisting apparatus adapted for operation with gasoline, oil and steam engines or with electric power.

Engineering Record

A Weekly Journal Devoted to Civil Engineering and Contracting

PUBLISHED BY McGRAW PUBLISHING COMPANY, INC.

Volume 73 NEW YORK, SATURDAY, JUNE 10, 1916 Number 24

Cuban Opportunity

AS WAS prophesied in this journal last November the season just ended has proved one of unprecedented prosperity to the Cuban sugar plantations. As a result, the construction of new mills, with their miles of railways, bridges, and, often, wharves, is going on at a record rate. Money for the construction is plentiful and investors are eager. The only limiting factor is, seemingly, the inability of manufacturers to furnish the required machinery and materials within a reasonable period. With raw sugar selling at present top prices, time is at a premium. To supervise the construction ahead many engineers will be required, and in this feverish activity the American engineer—particularly the younger member of the profession—should find many opportunities; especially since a large part of the capital invested in Cuban sugar plantations comes from this country.

Day Labor Again

AS this journal has pointed out before, if a city is to compete with contractors in doing work by day labor it must have as efficient a construction organization as is possessed by the average contractor. Moreover, a city cannot economically compete with contract work on construction requiring expensive machinery unless that construction is of such a nature that the city is engaged in it more or less continuously. Both these conditions have been fulfilled at Flint, Mich., the successful experiment of whose engineers in the day-labor field is described on page 767 of this issue. Students of the economic side of the day-labor question will also recognize that in laying pavements a city has an important advantage over contractors. The city is assured of its own work, and can handle as one large construction problem the paving of many streets from which no one contractor could expect to get anything but shorter and relatively more expensive contracts.

Fire-Resistive Dwelling Houses

REALIZING the large annual losses sustained by thousands of home-owners through construction which tends to spread fires instead of retarding them, the committee on construction of buildings of the National Board of Fire Underwriters has issued a booklet of 115 pages on methods of increasing the fire-resistive qualities of dwellings. Builders everywhere, especially in localities outside the control of building ordinances (and by far the majority of ordinary dwellings are built in such localities), will find valuable information in this presentation of methods for making houses reasonably safe from fire. Particularly important, not only for builders but for owners and the general public, are the sections devoted to floor and roof construction; chimneys, flues, smokepipes and fireplaces; fire-stopping, and general precautions for fire protection. Generally-recognized dangers from such old offenders as shingle roofs, unlined chimneys, unprotected stairways and shafts are strikingly illustrated, and many simple and effective, while relatively inexpensive, devices in construction which retard the spread of fire are clearly explained. Every potential house-owner will find it profitable to become familiar with these building precautions, which may prevent loss of life as well as of property. Engineers, through their positions in building departments and their participation as plain citizens in civic associations, chambers of commerce and similar organizations, can let it be known that ordinary dwellings can readily be improved as to their fire-resistive qualities, and can direct interested parties to the proper source of information.

Limitations in Flat-Slab Testing

INTERPRETATION of results in the testing of floor slabs in buildings can never be definitely conclusive. This fact should be kept in mind, especially during the current discussion of the results of the tests of buildings in Seattle. In this connection, the comments made by Professors A. N. Talbot and W. A. Slater in bulletin 84 of the Engineering Experiment Station, University of Illinois (just issued), describing tests of several types of flat-slab structures, are particularly valuable. It is stated that the unknown amount of the distribution of the resistance to adjacent unloaded parts of the structure (a point strongly emphasized by Mr. Hooker as a result of strain measurements in adjacent panels of the King County Court House test reported on another page) and the effect of the tensile strength of the concrete greatly modify the action of the structure. These factors, together with the physical conditions unfavorable to securing exactness, make definite and uniform quantitative results impossible. When, furthermore, the extreme variations in the actual construction of different buildings as a whole, together with errors in placing steel and effects of varying age and conditions of curing, are considered, it is evident that exact and definite general conclusions from such tests are impracticable.

Their recommendations of a series of tests on flat-slab structures, designed solely for the purpose of testing and systematically planned to bring out the fundamental differences between various types of design and the effect of varying certain elements, should be adopted, either by our national societies or by the U. S. Bureau of Standards, or by them jointly. Possibly financial assistance for such a program of tests could be obtained from those commercially interested. In any case, considering the wide diversity of practice in flat-slab design, such a scientific series of tests is a necessity, and would well repay the outlay.

Timing Waterworks Purchases

WHILE purely technical considerations should claim a substantial part of the waterworks engineer's time, he should not be unmindful of the business side of his work. There are big opportunities for him to demonstrate his usefulness by looking ahead and timing his purchases of materials and supplies so as to secure the benefit of attractive prices. A case in point is that of a New Jersey town which is now making extensive alterations to its water-distribution system. When the improvements were under consideration many months ago the engineer in charge foresaw an advance in the price of pig lead, lead-service connections and brass fittings. Accordingly he purchased a large quantity of these materials when the prices were low. To-day, with his work under way, he gets considerable satisfaction from exhibiting his well-stocked storage yard, representing, at present prices, a big saving to the taxpayers. Of course, in the case of a private corporation there would be nothing remarkable in this instance of business acumen. In municipal administration, however, it is all too uncommon.

Biaxial Loading Tests

MILD steel tubes tested by Prof. Albert J. Becker, as reported in bulletin 85 of the Engineering Experiment Station, University of Illinois, using combined axial loads and internal pressure and measuring external strains by a Berry strain gage, have given results for yield-point strength showing that two laws govern strength under such combined stresses, instead of one law, as hitherto assumed. The maximum-strain theory versus the maximum-shear theory, long a subject for experimentation, has apparently been definitely settled in the results attained by Professor Becker by a new and more satisfactory method of testing. Using Johnson's tangent method for fixing yield points, the only variable being the ratio of circumferential stress to axial stress, the yield-point strength is shown to vary according to the maximum-strain theory until the value of the shearing stress reaches the shearing yield point, after which the shearing stress controls according to the maximum-shear theory. For such ductile materials, therefore, the ratio of the shearing yield point to the tensile yield point for simple stress is important. Further experimentation along these lines should be actively pursued. After confirmatory results have been obtained, the effects upon the practical design of material under such combined stress conditions can be definitely formulated.

Co-operation in the Collection of Municipal Data

DUE to the widespread character of our education most men above average intelligence are anxious to learn of the experiences of others when important tasks are in hand. True it is that they generally act without advising with others. As their matters grow in importance, however, they are more and more inclined to seek through books and magazines, technical, professional and trade organizations and direct inquiry information as to the solutions used by others under similar circumstances.

This applies as well to municipal undertakings as to other lines of activity. One finds cities, large and small, spending considerable time and energy in correspondence and travel in order to profit by the work of their neighbors, while careful search through printed matter is part of the regular procedure. If matters of recent development are under consideration, travel, if the observer be competent, will give the best results. It has the disadvantage of being costly. Moreover, as the competence of the observer decreases, its efficiency drops off at a rapid rate.

Realizing how great the need was for a data-collecting and distributing bureau the New York State Conference of Mayors last year established a bureau of municipal information, under the direction of a council of five mayors, elected by the conference. The council, in turn, elected as director and active head William P. Capes. The first report of the bureau was made to the seventh annual meeting of the conference in Syracuse last week.

An examination of the report to the Syracuse convention indicates that the director of the bureau fully understood not only the needs but also the methods by which the desired end could be attained. At the outset the bureau adopted three principles—a move which subsequent experience indicates to have been very wise. Not to advocate anything was the first principle; not to recommend any person, firm or thing, the second, and the third, to give as much information as possible on both sides of a controversial subject.

The first step was to establish relationship with the New York State Library, an arrangement furthered by the location of the bureau's headquarters at the state capital. The immense reservoir of information and the services of the staff of researchers maintained by the state are therefore at the disposal of the bureau. But the arrangement is truly co-operative. All printed matter received by the bureau, except the annual and special reports of the cities of the state, is sent to the library to be indexed and filed. By means of this relation the bureau is able to do work at a minimum cost, while the library is helped by the addition of the data and publications which the bureau collects. Furthermore, the bureau has established co-operative relationship with each municipal league in the thirty-five cities which now have them, and with many public and private agencies gathering and studying statistics and data about cities.

Effective use is made of a clipping service which supplies the bureau with all newspaper articles about municipal work in every city of the state. When one of these items indicates that a new charter, ordinance, budget or code has been adopted, or an amendment to any of these, the bureau requests immediately that a copy be furnished to it. In this way its information as to the latest municipal practice in the state is kept up-to-date.

But the clippings serve another end. They frequently enable the bureau to anticipate the needs of the municipalities it is designed to serve. When a clipping indicates, for example, that a city is contemplating the passage of an ordinance of a given type or is studying a certain situation the bureau makes it its business, without waiting for an application, to furnish the city with data on the subject.

One of the very interesting developments in the bureau's activities is its endeavor to make known to the cities of the state new ideas and plans that promise advantage to the communities, or that seem worth while trying. In pursuance of this idea reports regarding new and successful municipal activities have been secured, not only from cities in the state but from other towns, and sent to the mayors. Auxiliary activities consist in keeping the member cities informed as to proposed state legislation which would affect them in settling difficulties between state departments and particular cities, and in issuing a semi-monthly bulletin containing general municipal information, announcements of the activities of the conference and the bureau and a list of subjects researched during the previous two weeks.

In all, since its establishment somewhat over eight months ago, 148 reports have been prepared. These affect almost every phase of municipal information, and quite naturally a large number of them are on engineering subjects.

The cities of the state appreciate the service, for all cities in the state of the first and second classes contribute to the support of the bureau, and of those of the third class only eleven are not participating. Cities of the first class appropriate $500 annually; those of the second, $300, and those of the third, $150 each. That a great deal can be done at small cost is indicated by the budget of the bureau; in the first eight months the expenditures were only $4,789 and the total for the year are expected not to exceed $7,500.

The testimony of city officials in places both large and small indicates that having once availed themselves of the service they could not, without detriment to their administrations, be without it. The plan should certainly commend itself to bodies of municipal officials in other states. Such organizations exist in thirty-five states. Some of them are making attempts at work of this sort. Most of them, however, confine their activities to an annual convention. For greater effectiveness they might well plan to embark on the work which the New York State conference has so well begun.

The Auto-Truck Highway—A New Factor in Back-Country Transportation

SINCE the advent of the railway there have been two modes, and only two, of developing new country—the highway and the railroad. Where the traffic was very small or the country difficult the highway was the only practicable solution of the transportation problem. With "easier" country and a goodly volume of traffic the railroads became possible, though how precarious was the venture in many cases the history of our pioneer roads plainly shows. There was no system of transportation intermediate between the highway and the railroad. The volume of traffic might have been greater than could be satisfactorily handled over the highway with the horse-drawn vehicles of former days, yet be insufficient to support a railroad. Nevertheless, the advantages of rail transportation—the greater speed and comfort, the lower ton-mile operating cost and the possibility of extensive developments coming in the wake of the railroad—spurred optimists to make investments. If the developments lagged behind what was hoped for, receiverships and forced sales with heavy losses ensued.

Is there not to-day some intermediary that will bridge the gap, in the matter of transportation economics, between the ordinary highway and the poorly built, possibly narrow-gage, railroad? Indications are that there is—that the "automobile highway," or better the "auto-truck highway." may fill the need. Such a transportation system could go up grades and around curves prohibitive for the steam railroad, or operate in units smaller than the railroad could operate profitably, and still it would utilize the economies of the motor truck as compared with the horse.

Let it not be understood that by this term is meant merely the placing of automobiles and trucks on existing highways, whether in well settled or sparsely settled sections. The term here signifies a road specially built for truck traffic and equipped with trucks and large-capacity passenger cars to furnish transportation between points not now connected, unless by ordinary wagon roads. The term should be considered to convey the idea, too, of a method of transporation used in lieu of a railroad either temporarily or permanently. In other words the auto-truck highway is here taken to be a transportation system—not merely a road or an independent stream of trucks—having a well defined place in transportation economics between the ordinary highway and the railroad.

Of course there may be various approximations of this idea. In this country there are many fleets of trucks operating over public roads, even when not adapted to their use, but this could not be considered an approximation of the "auto-truck highway." It would be an approximation if a municipal or governmental body spent considerable sums on the reconstruction, according to truck-road standards, of the sole highway connecting with the outer world. A still closer approximation would be afforded if a private company were given a franchise to rebuild the roads and allowed the exclusive commercial transportation rights over it, while not excluding cars and wagons used solely in the service of individuals.

The type of highway referred to, it should be noted, is not still in the realm of theory, though one may not be warranted in stating that it is beyond the experimental stage. Manifestly, in a development of this sort, so many conditions will enter that success to any particular enterprise cannot be unerringly predicted. In tropical countries, for example, road building is attended by unusual difficulties, while unforeseen problems may arise in connection with the transportation unit on account of climatic conditions. Nevertheless, the experience with both of these essential factors—the road and the truck—is such that there can be no permanent difficulty to prevent the ultimate development of the auto-truck highway. What transportation engineers will need is abundant information regarding the actual operation of such projects—the correct ton-mile costs, including both overhead and operating charges. There are data of this sort in existence. They are, however, the property of individuals and are closely guarded. When a given project is in hand, however, the truck manufacturers will give the data in their possession. In fact such is their confidence in the performance of their equipment that at least one of them has proposed to equip a highway and under a forfeiture of a bond to guarantee the minimum operating cost, including repairs, and also a maximum life of the unit.

A number of highways of the type referred to are in operation. In Bolivia, tin block is being hauled long distances over a plateau 14,000 ft. above sea level. In Central America a 90-mile truck road connects the capital of Honduras with the coast, while in Maine all the materials for a large construction job are going by trucks over a specially built highway 40 miles long. In one of the South American republics a road is projected to connect with the outer world an important city now lacking communication. A franchise exists for the building of a narrow-gage railroad, but remains inoperative because of the improbability of getting sufficient traffic to justify an $11,000,000 investment. On the other hand the auto-truck highway fully equipped would, it is estimated, cost only $4,000,000, and for this capitalization the prospective traffic, hauled by auto trucks, promises a handsome profit. Without a doubt the auto-truck highways referred to are but a pioneer of a considerable development. There must exist many cases where similar auto-truck projects offer the only hope for transportation speedier and cheaper than can be given by the ordinary highway.

Undoubtedly many problems will arise that are new. Certainly the conditions plainly indicate many respects in which the highway standard, for example, will have to be altered. Unusual attention will need to be given to drainage, to the structures, to the surfacing of the road itself. High speeds and heavy loads must be supported, and construction standards quite different from those considered sufficient under ordinary automobile traffic must be provided for. None of the conditions, however, so far as they now can be foreseen, are insuperable, and the problem, therefore, warrants the careful attention of those concerned with transportation matters.

The Daylight-Saving Problem

THE TIME has come when one must take the daylight-saving movement seriously. With its adoption in Germany, Austria-Hungary, Denmark, Holland and England it reaches international significance, especially since France, Norway and Sweden are very likely to follow the example of their neighbors. Some Canadian towns are already trying it, a few of our own cities are moving toward it and now the metropolis is discussing its advisability.

As a starting point in a fair discussion of the matter one must admit at once that people certainly are far from making the most of daylight. In summer the sun has been up an hour or two ere mankind begins to waken. The early rising propaganda, carried on chiefly by strenuous elderly folk who cannot sleep in the morning, has been a dead failure.

Yet there is little doubt that the early morning hours are hours of exceptional efficiency. The present daylight-saving scheme differs from the former efforts to promote early rising merely in its psychology. It proceeds on the plausible theory that mankind is a slave of the clock and will gladly arise an hour ahead of the usual time if the mendacious hands of his timepiece deceive him. Those who would feel themselves scandalously wronged if the "boss" called on them to report at seven-thirty after May 1, would turn up smiling if the clocks still pointed to eight-thirty by virtue of having been shoved forward an hour in the night. The experience already gathered in the countries which have adopted the plan seems to show that the psychological theory is right, for everywhere the change has been made it has been quite easy and simple, although not yet long tried.

Granted this, what special good is going to be accomplished? The hours of labor will be neither lengthened nor shortened. The only difference is that there would be more daylight left after the day's work is done, just as if one had moved into a higher latitude for the summer season. This is very agreeable on the whole, yet the actual saving in artificial light, one of the reasons, if not the chief, urged abroad, is rather illusory, since, in fact, people at the end of a warm day are more than likely to sit gladly in the growing dusk and only turn on the lights near bedtime. Places of amusement which depend on artificial light night or day will use it to exactly the same extent as before; public lighting will have to be used the same number of hours per day as now. On the whole, the saving in artificial light will be small, perhaps quite negligible.

From May 1 until September 1 the plan of setting the clock ahead an hour would work pretty well, but to rather dubious economy. If it could be tried in our country on a modest scale it would be a most interesting experiment, but unhappily it is necessary to work it over the whole country or not at all in order to avoid utterly hopeless confusion in time tables and the means of intercommunication generally.

Besides, it must be remembered that we are now working on a standard time system, established after some difficulties, which is based on belts 15 deg. of longitude wide, or one hour in time. The standard time for the belt is that of the central meridian 75 deg. west for Eastern time. Now noon is not a conventional but an astronomical fact—the passage of the mean sun over the meridian of the place. Hence when it is 12 m. Eastern time, true noon has passed by half an hour on the eastern border of the belt and will come half an hour later on the western border. Suppose the clocks in the belt are all shoved forward an hour. Then the variation of nominal time from sun time, instead of being half an hour each way, will be a half hour in error at one edge and an hour and a half at the other. And to have the clock time an hour and a half ahead is serious in the matter of sunrise as the days begin to shorten. In fact, unless the period of daylight-saving were considerably shortened over the present proposals the use of artificial light would gain at one end of the day only to lose at the other. The fact is that with standard time belts 15 deg. wide even the half-hour error has proved by no means negligible, and some places near the edges of the belts have retained local time even after more than thirty years.

Therefore, in this country with its four belts of standard time it is a rather serious business to put the clocks an hour ahead. It is far more likely to make trouble than in England, for instance, where the time is Greenwich throughout and the variation from sun time nowhere great. The logical method of daylight-saving is frankly to shift the customary business and working hours in summer without fooling with the clocks. Difference in hours of work between summer and winter is not unusual, and if carried out systematically would gain everything to be accomplished by "daylight-saving" without the inconveniences resulting from mixing up the time tables or great discrepancies between nominal and sun time.

Despite the good arguments to the contrary, however, it would not be surprising to find communities here and there putting their clocks forward. "Psychology" is stronger than logic, and the "other fellow," meaning chiefly the traveler, will probably get little consideration for his protest against the confusion.

Pressed-Steel Floor Forms Left in Place on Two-Mile Bridge Eliminate Carpenters

City Engineers on St. Louis Municipal Bridge, Which Is Being Completed by Day-Labor System, Develop Short Cuts in Building of Walls, Piers and Floors

LABOR scarcity and its high price have forced the builders of the approaches to the St. Louis municipal bridge to take as many short cuts and use as much labor-saving equipment as possible. Thin pressed-steel domes fitted snugly between the I-beam stringers for the 2-mile roadway are the forms to be left in place. Electrically welded mats of reinforcing bars save time in assembling small rods over the enormous area. Steel forms for the retaining walls and for the piers have reduced the carpenter force to a minimum.

For three years the three immense center spans over the main channel of the Mississippi River have stood unused while two bond issues providing funds for building the approaches and putting the bridge into commission were defeated by those who were opposed to the privilege that would result of entrance into the city without payment of the present "arbitrary" fee of $3 per car. The third issue was successful, but it provided that the work on the approaches should be done under city supervision by union labor—restricted to the citizenry of St. Louis. This required the installation of all the labor-saving schemes that the engineers could devise in order to bring the costs within the limits of the appropriation. Numerous jurisdictional labor strikes have added to the complications.

The work necessary to complete the bridge involves laying the floor slab over the whole roadway; building on the Illinois side 457 concrete pedestal piers; four open caisson piers 22 ft. square and 45 to 50 ft. deep and extending 40 ft. above low-water level; six pneumatic caisson piers required for truss spans over the Mobile & Ohio River Railroad Company, Southern Railway Company and East St. Louis Connecting Railway Company railroad tracks, and six pneumatic caisson piers for the first viaduct tower of the combined approach east of the main channel spans; 24,000 tons of structural steel; 40,000 cu. yd. of concrete in piers, pedestals, abutment and retaining walls aggregating 17,000 ft. in length; 30,000 sq. yd. of concrete floor slab for the creosoted wood block over the whole roadway, and 12,000 sq. yd. of concrete floor slab for new and old sidewalks.

A LAND CONNECTION WILL SOON END 3-YEARS' ISOLATION OF MUNICIPAL BRIDGE

Work on the approach substructure was started in the spring of 1915 and on June 1 was 60 per cent completed. Only the pile work was let by contract and this was finished on May 15, 1916.

STEEL FORMS FOR TAPERED PIERS

The typical pier has two octagonal bases and a square pedestal, varying from 8 to 18 ft. high. The lower base is 3 ft. thick and has an inscribed diameter of 12½ ft. The upper one is 2 ft. thick and has a diameter of 11½ ft., with four upturned rods embedded in it. The pedestals vary from 4 to 5 ft. 9 in. square at the top and have a batter of 1¼ in. per foot. The thirty Blaw forms used are erected and handled by structural iron workers. The variation in size was to be allowed for originally by wooden extensions at two corners. However, the construction engineers found that this did not work out well and various sizes of bent-steel corner pieces with angles to fit against the regular vertical angles on the original forms are used. These specials are applied to corners diagonally opposite each other only. On account of upward pressure of the concrete, due to the batter, four ¾-in. bolts are embedded in the base blocks to anchor the forms.

Two concrete mixers, a ½-yd. Smith and 2/3-yd. Ransome, are building the piers. One of them is served by an Orton & Steinbrenner locomotive crane and the other by a derrick car.

Spur tracks were laid to all parts of the work at one side of the line of piers to bring the concrete materials to the mixers and for handling the steel work with two Industrial cranes to the erectors. Usually the aggregate is unloaded to the ground by the locomotive crane and is then wheeled to the mixer-charging hopper, which is provided with a track extending to the ground

TIPPING BUCKETS ARE MOUNTED ON LORRY CARS

SIDEWALK MATS COME IN 16-FOOT LENGTHS

surface. Cement is stored on the mixer car. The crane raises the concrete in bottom-dump buckets to the top of the pedestal forms, but in some cases where the distance to the far line of piers is too great for the boom a wood chute is used to convey the concrete from a platform on the nearest pier.

ERECT WALL FORMS AT LOW COST

For building the walls a ¾-yd. Ransome mixer is mounted on a flat car at one end of which is a 50-ft. Lakewood tower resting on two 12 x 12-in. timbers cantilevered out from the end of the car, but provided with hinged struts to give stability during operation. The charger drops to the ground level as with the other outfits, but is fed by three 1-yd. Koppel dump cars running on a narrow-gage track to standard-gage cars, which are brought in only as fast as the material is used. Three 1-yd. hoppers, one on the sand and two on the stone cars, hung to the side of the cars, facilitate the operation.

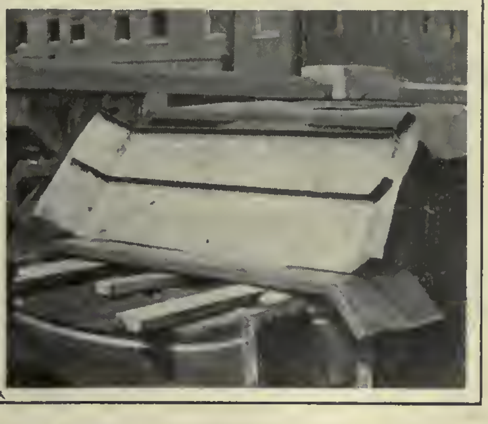
Standard Hydraulic Pressed Steel Company wall forms are being used on the retaining walls and the abutment on the railway approach. Carpenters and laborers are putting these forms in place and, with the union carpenters' scale of 62½ cents per hour and the union laborers' scale of 35 cents per hour, the unit cost of building forms for the walls has been so much reduced that a large saving has been made over the use of wooden forms, such as were used on the retaining walls and abutment on the highway approach.

The walls vary in height from 8 to 25 ft., and enough ribs are supplied so that they may be left in place and the plates used on succeeding sections. In this way the plates can be taken out in 12 to 16 hours and still leave sufficient support for the green concrete by the ribs, which are tied together and support the wall until the concrete has thoroughly set. The ribs are taken out the second day and the operation is repeated. A certain capacity is guaranteed by the manufacturer and enough forms, ribs, plates and wedges are supplied to maintain this capacity. The engineers for the city state that the forms have worked out satisfactorily in every respect.

MATS ARE PUSHED UNDER INNER RAIL

FORMS FOR FLOOR SLABS STAY IN

Specially designed thin pressed-steel domes set between the I-beam stringers and left there solved the problem of forms for the enormous floor-slab area. Wood forms of any kind would have to be suspended and a special falsework built to get them out. No underhung traveler was practical on account of the numerous cross bracing and towers on the approaches. The steel domes are pressed from 22-gage steel sheets laying 22 in. wide. They have two deep longitudinal corrugations to stiffen them and are guaranteed to support 90 lb. per square foot. The rise from the flat portion resting on the lower I-beam flange is 12⅞ in., with a curve nearly an ellipse made up of a short and a long radius curve. A man's weight deforms them somewhat, but he does not go through. When the reinforcing is in place the weight of the concrete is distributed sufficiently to prevent any deformation.



SPOT-WELDED ANGLES STIFFEN SIDEWALK FORMS

Note the small space taken up by the corrugated forms in the power pile.

There are two street-car tracks in the roadway and a sidewalk on each side. The stringer spacing requires different lengths of domes—three, 4 ft. 6½ in. long, for the devil strip; one each, 4 ft. 11⅛ in. for the tracks; one each, 3½ ft., for spaces between outer rails and curb, and one each, 5 ft 9 in., for the sidewalks. For the last named the space was too great for the corrugation to answer and two pressed-steel angles, ¾ x 1½ x ⅛ in., are spot-welded to reinforce the sheet, which is flat on top and has the ends bent down at an angle of 45 deg. to meet the lower I-beam flanges. In the central portion the welds were spotted about 4 in. apart and on the bent portion about 2 in. Six structural steel men have laid as high as 3000 sq. ft. of the domes in 8 hours.

STEEL MATS REDUCE LAYING COST

The enormous area over which to lay reinforcement in the 9802-ft. length of the bridge presented another problem, since it was necessary to pay the skilled labor rates. It was impossible to change the design and use small arches, as the steel work had been figured for a reinforced slab and not to take any side thrust.

Electrically welded mats made up of seven ½-in. deformed bars spaced on 4-in. centers are used for the transverse reinforcing, and American Steel & Wire Company woven wire of special width and section for the longitudinal reinforcing. The welded mats, furnished by the Electric Welding Company, are spot-welded only at the ends to a ⅜-in. bar. At three places in the mats, 16 ft. 8 in. long, are Efficiency bar spacers which rest on the top of the domes. The long mats for the devil strip are pushed under the inner rails between the rail chairs and extend 18 in. into the gage space. Short mats extend from the curb under the rail for 18 in. and loose bars are lapped over the ends of the two mats for the slab in the gage space, both support and spacing being provided. The central mats could not be made long enough to extend under both rails of the same track because the rail chairs are not opposite each other. For the sidewalks the mats are made up with wire clips to secure the bars. The ⅜-in. bars are spaced on 6-in. centers transversely, and the ¼-in. bars in 16-ft. lengths are spaced on 9-in. centers longitudinally. The distribution and placing of the steel by the structural iron workers at 67½ cents per hour have been done at a remarkably low figure.

MINE LOCOMOTIVE DISTRIBUTES FLOOR MATERIALS

For handling the concrete over such a long stretch advantage is taken of the street railway tracks already laid. The west approach was completed originally and a concrete plant has been erected on an elevated platform at the point of diversion between the roadway and railroad. Storage space for 200 yd. of stone and 100 yd. of sand is provided on the ground below the trestle so that bottom-dump railroad cars can discharge directly into the bins. Two Link-Belt conveyors elevate the materials to the respective sand and stone bins of 4 and 8-yd. capacity over the ¾-yd. Ransome mixer. There is little space for a cement storage house, so that demurrage is charged off to that account. A platform holding 150 bags only for temporary supply is all that can be obtained. Cement is handled directly from the cars to the platform, where enough for a batch is emptied from the sacks into a narrow-gage car

MOUNTED MIXER IS ATTENDED BY CRANE

pulled up an incline to the mixer hopper.

For distributing the forms, reinforcing steel and the concrete two 5-ton standard-gage Whitcomb gasoline mine engines are provided, having a drawbar pull of 2000 lb. They were bought to start a load of 7½ tons on a 4-per cent grade and to attain a speed of 8 miles per hour. This will deliver the concrete at the farthest point in about 10 minutes. A temporary crossover permits the use of both tracks for distribution of concrete forms and reinforcing.

On account of the standard gage it was impossible to buy standard equipment in concrete dump cars. Eight Fairbanks-Morse hand-push cars used by section men were purchased and on six of them were mounted 1-yd. Koppel dump buckets. The buckets are on a swivel, so that the concrete can be dumped to each side and into the track space. With this outfit about 100 cu. yd. per day, equivalent to 100 lin. ft., can be placed with ten men.

The completion of the bridge is under the direct charge of Clinton H. Fisk, chief engineer of the Board of Public Service, of which E. B. Kinsey is president. W. S. Collar is superintendent of the bridge construction work. Brenneke & Fay are resident engineers and Boller & Hodge are the consulting engineers.

Baltimore & Ohio Adds Second Dynamometer to Car

Diaphragm-Type Instrument Indicates Both Pulling and Buffing Forces, and Is Sensitive to Small Variations

A NEW diaphragm-type dynamometer, arranged to indicate both pulling and buffing forces, has been added to the equipment of dynamometer car 930 of the Baltimore & Ohio Railroad, which was put in service three years ago. The new dynamometer has a capacity of 1,000,000 lb. in buff and 250,000 lb. in pull, the corresponding fluid pressures being 2000 and 1000 lb. per square inch respectively. The dynamometer has proved to be both accurate and sensitive to small variations in drawbar pull.

As originally built the car was 50 ft. 9 in. long over end sills, with a platform at one end only. At the opposite end was a direct pull cylinder type dynamometer mounted below the car floor, together with a recording table. In the center of the car were two staterooms, toilets and a kitchen, while at the platform end was a dining room. The dynamometer had a capacity of 200,000 lb. It has been entirely satisfactory for the purpose for which it was intended, but in order to get more precise readings the second, more delicately adjusted, machine has been installed at the platform end, under the dining table, as was originally planned. At the same time the platform has been inclosed and the space added to the dining room.

The lever of the new dynamometer, which is direct connected to the coupler, has the ratio of the arms so arranged in relation to the area of the diaphragm dynamometer plunger that for equal tension on the drawbars at either end of the car the fluid pressure in the two dynamometers is equal. The pressure pipes from the pull chambers of the two dynamometers are connected to the same indicator cylinder on the recording machine, so that the drawbar-pull record to a uniform scale may be obtained from either dynamometer.

The cylindrical pistons, which have a clearance of 1/64 in., are supported on knife edges and backed up with a reinforced lug on which the knife edges of the lever rest, thus giving accurate adjustments and enabling the instrument to register very slight pulls and buffs.

A half mixture of glycerine and alcohol is the liquid used in the new dynamometer, instead of the red engine oil used in the old one. An electric bell in the operating room warns the operator in case the liquid becomes so low that the lever travels more than ¼ in. off center.

The piping is cross connected, so that the pull on the new dynamometer can also be taken on the buff cylinder pen on the table, should occasion require, while the pull of the new dynamometer can be shown on the gage of the old, thus making the arrangement flexible and affording a check of one machine against the other.

Compares Results of Tests on Three Types of Reinforced-Concrete Building Floors

D. E. Hooker Reports Extensometer Measurements Showing Relatively High Strength for Joist-and-Tile as Compared with Flat-Slab Floors

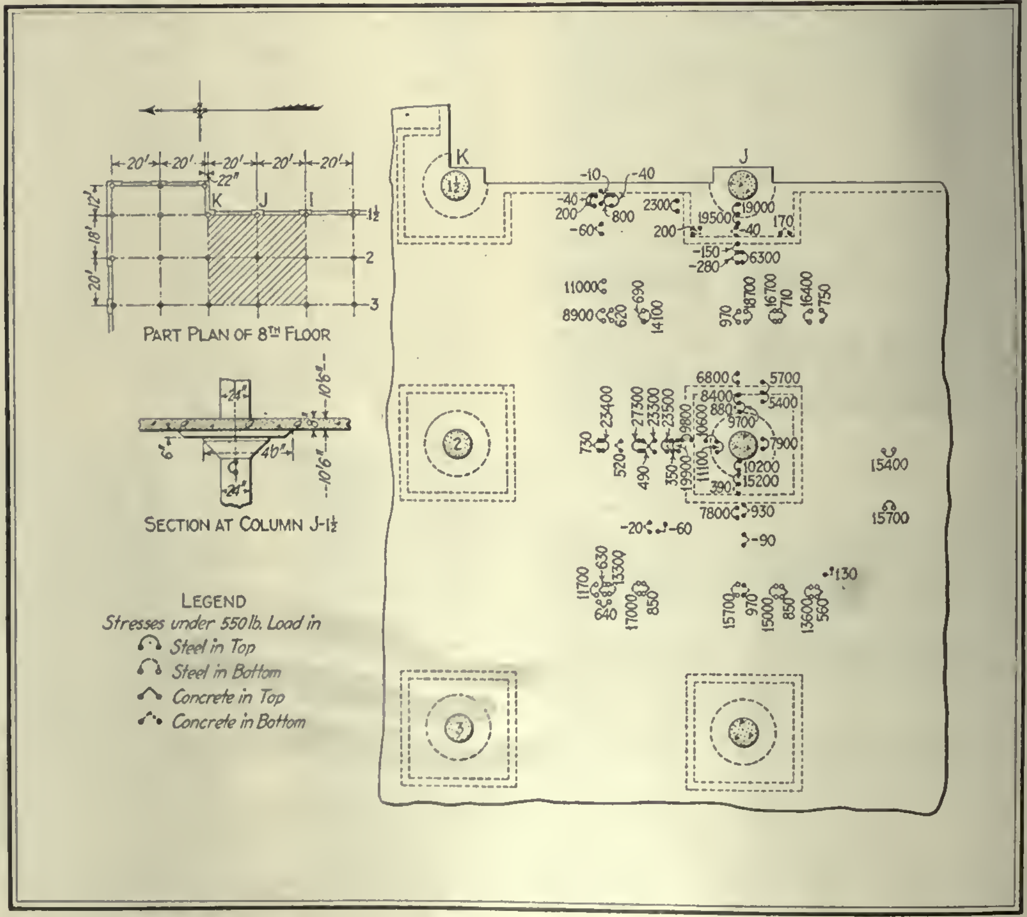
RESULTS of load tests and stress determination by extensometer readings on the floors of three types of reinforced-concrete building floors—the three-way system and the two-way system of flat-slab design and a hollow-tile and joist design—are cited by D. E. Hooker, assistant superintendent of buildings for the city of Seattle, in a paper published recently in the *Proceedings* of the Pacific Northwest Society of Engineers. The high stresses obtained for the three-way system in the Bell Street Warehouse, Seattle, were published in the Engineering Record of May 13, page 647. It is brought out in the discussion by the designer of this building, Captain A. O. Powell, that possible contributing causes for these high stresses are the uncured condition of the concrete and the misplacement of the reinforcing steel over column 80, the inner ring rod averaging 3 in. too low. See letters in this issue, page 778.

Included in the following abstract of the paper by Mr. Hooker describing the tests of the Sears-Roebuck Building and the King County court house in Seattle is a table showing the relative deformation of the three buildings at corresponding points which strikingly illustrates the differences in stresses under loads similarly related to the design loads.

SEARS-ROEBUCK BUILDING

The Sears-Roebuck Building, nine stories high and occupying a tract 240 x 330 ft., has the largest floor area of any building in Seattle, and probably in the Northwest. It was designed by the Condron Company, of Chicago, and follows rather closely the standard Akme two-way flat-ceiling design of that company, except that the depressed panels at columns are 0.4 instead of 0.25 of the span.

The test area selected consisted of four contiguous panels near the northwest corner of the eighth floor, two interior panels 20 ft. square and two wall panels 18 x 20 ft. These slabs were poured April 17, 1915, and the test load was placed June 9, so that the concrete was about 52 days old, compared with 113 days for the Bell Street



STRESSES IN STEEL AND CONCRETE AT MAXIMUM LOAD—SEARS-ROEBUCK BUILDING

Warehouse test. The test load, consisting of piles of brick, was applied in three increments, twenty-four hours apart, the successive loads being 201, 402 and 550 lb. total per square foot. The last load plus the 100-lb. dead load brought the total live and dead load up to just twice the design load of 325 lb.; that is, 200 lb. live load plus 125 lb. dead load, including the cinder fill and wood-floor finish.

RESULTS OF TEST

Using the same moduli of elasticity for steel and concrete as used for the Bell Street building, 29,000,000 and 2,500,000 lb. respectively, the stresses shown in an accompanying drawing were obtained from the measured strains. The greatest steel stress of 27,300 lb. per square inch, was obtained in a rod at the top of the slab over the main band between columns J2 and K2. These stresses were produced by the maximum load, equivalent to 1.7 times the design load.

In general the steel and concrete stresses are relatively small. The stresses for the various critical sections are fairly uniform, except in the secondary band running east and west where it passed up over the main band between columns J2 and K2. These stresses are relatively high, as above noted.

The stresses obtained at two gage lines on column J1½ demonstrated the remarkable effect of such eccentric loading on the wall column. Before the full load was applied sufficient tension developed in the outside of the column to crack the concrete in several places, including a crack between the gage points which nullified future readings. This bending effect for wall columns, Mr. Hooker pointed out, should always be taken into consideration in flat-slab design.

The maximum deflection was 0.48 in., practically the same for the centers of three panels. At some points of small deflection the recovery was 100 per cent, but in others of greater deflection it was as low as 54 per cent. However, the recovery readings were taken only a few hours after the load had been removed, and it is probable that the ultimate recovery was much greater, if not complete.

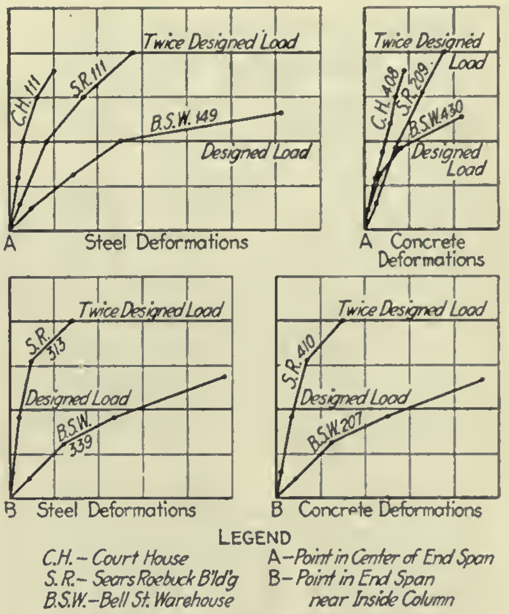
KING COUNTY COURT HOUSE

The floors of the King County court house are of reinforced concrete with 12 x 12-in. terra-cotta tile forming the joists, as shown by an accompanying drawing. The design was taken exception to by the building department because there was too much steel in the joists to give adequate bond and permit puddling of the concrete (in fact, difficulties in placing concrete were met, and large voids in the bottom of the joists did occur in the construction afterward) and because it was feared that there would be excessive deflection in the long 31-ft. side spans, which were so shallow as to require compressive reinforcement. Furthermore, a comparatively small amount of steel was placed over the supports, and the three adjacent panels were designed as non-continuous beams. The contractor was therefore required to make a load test of a typical portion of the floor.

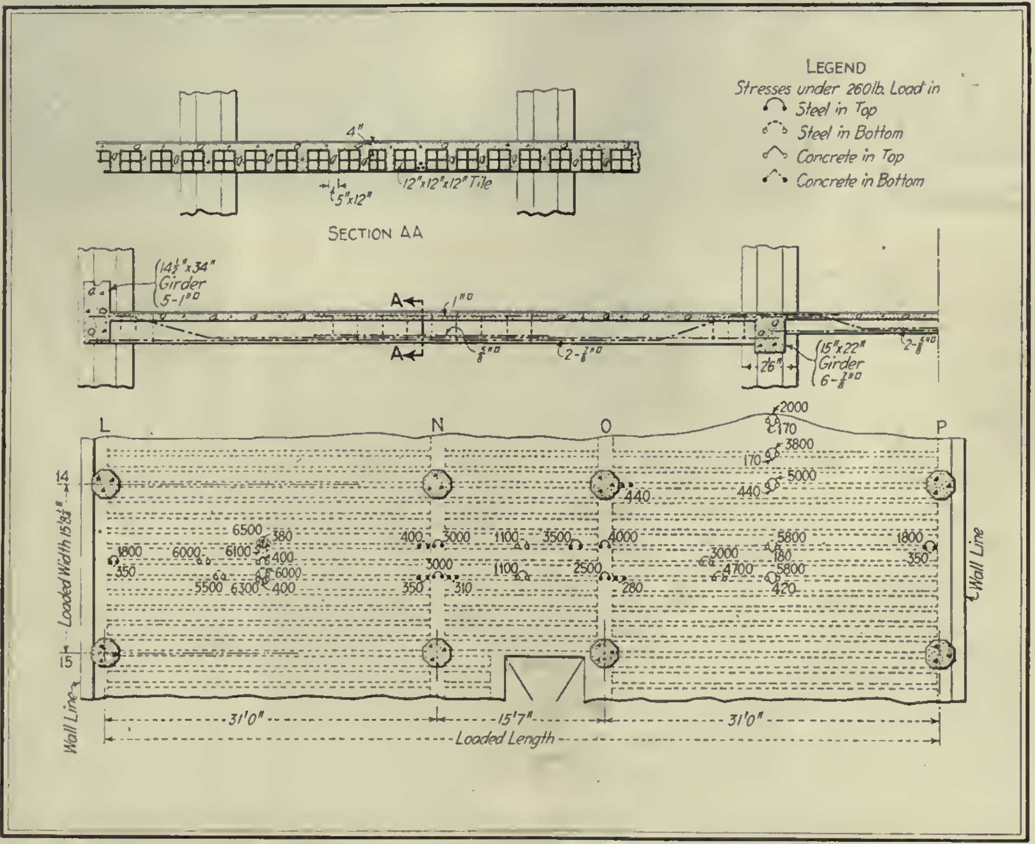
A test area one panel (15 ft. 8¼ in.) wide extending from wall to wall over the three panels shown on the fourth floor was selected. Deformations in steel and concrete were measured. The slab was poured Feb. 17, 1915, and tested June 25, at the age of 128 days, the whole area being loaded by cement in sacks in four increments—65, 130, 190 and 260 lb. total per square foot. This floor was designed for a live load of 75 lb. per square foot; the final load amounted to 1.2 times the design dead and live load of 215 lb.

RESULTS OF TEST

Remarkably small deflections and stresses were found. The maximum deflection was 0.3 in. at the center of one 31-ft. span (only 1/1240 of the span length). The greatest observed stress was about 6000 lb. per square inch in the steel and 450 lb. per square inch in the concrete under the maximum load. Over the interior girders the stresses were very low, as noted in an accompanying plan view.



COMPARISON OF DEFORMATIONS IN THREE TYPES OF BUILDINGS



STRESSES IN STEEL AND CONCRETE AT MAXIMUM LOAD—KING COUNTY COURT HOUSE

[These approximate stresses were computed from the strain diagrams of the Engineering Record—EDITOR.]

[The strains under maximum load have been transformed into approximate stresses by the same moduli as for the other cases, using the small-scale diagrams.—EDITOR.]

One fact stands out distinctly, Mr. Hooker pointed out. Strain measurements in adjacent panels showed considerable stress, and investigation of this lateral distribution of the load showed that the maximum steel stresses would probably have been about 9000 lb. per square inch and the concrete stresses about 600 lb. per square inch if this distribution had not occurred. In other words, the stresses were reduced about one-third by the assistance of adjacent unloaded panels.

COMPARISON OF THREE TYPES

On an accompanying diagram is shown a comparison of the deformations at two gage lines selected as nearly as possible in the same relative positions in the different slabs. Each curve has been extended as a dotted line to the point of no load in order to form a proper comparison. The scales are varied to give the results in terms of design load.

The assistance of H. E. Fowler, of the Seattle Building Department, in helping to plan the tests, in taking readings and working up the computations, and appreciation of the kindness of Professors Fuller and More of the University of Washington in lending their instruments for these two tests is acknowledged by Mr. Hooker, who conducted them for this department.

Valuable Potash May Be Found By Casual Drillers

Drilling contractors in regions where salt beds occur are liable at any time to discover deposits of potash, which is very valuable, according to the U. S. Geological Survey. So far potash has only been found in the United States at Searles Lake, Cal. The foreign supply of potash for this country has been practically cut off by the war, and the price of the salts has risen from $40 to $400 per ton. The potash beds of Germany and Spain were laid down in formations that include beds of salt, gypsum, anhydrite and such minerals, and it is unreasonable to suppose that potash does not occur in many similar formations in this country.

Should Separate Manhood and Technical Qualities

Dean Anson Marston, Discussing Engineering Education, Suggests Two Classes of Tests, Each Rated on Basis of 100

SEPARATION of the qualifications for engineers into two classes, general and technical, in each of which 100 per cent represents perfect, is more exact and logical than the grouping of all qualities in one class, as has been done by Prof. C. R. Mann in stating the results of his investigation of engineering education (see the Engineering Record, Jan. 22, page 126; Jan. 29, page 134; March 4, page 329, and March 11, page 342). This is the opinion of Dean Anson Marston of the college of engineering, Iowa State College, as expressed in an address before the alumni of that institution at Chicago. He believes that Professor Mann's classification leads to absurd results when the attempt is made to use it as a guide in selecting men to fill engineering positions.

Dean Marston suggested that the institutions can improve engineering education by employing instructors with practical experience and ability to inspire the students professionally and culturally, by putting the colleges on a schedule comparable to business life and by requiring one or more years of engineering work between the sophomore and junior years.

The following summary gives the chief ideas brought out by Dean Marston:

MODERN EDUCATIONAL PROBLEM

The present problem in engineering education is how to educate our engineers better in the fundamentals of successful manhood without sacrificing the quality of their technical education. Neither of these can be sacrificed for the other. The engineer must pass a double test, and not fail in either. The investigation by Prof. C. R. Mann, based on the fundamental idea that engineers should themselves define the kind of graduates they desire from the colleges, has led to a proposed score card in which values are assigned on the scale of 100 to each of six qualifications, of which 87 per cent are general, and only 13 per cent technical.

On account of failure to recognize that there are two separate essential sets of qualifications of an engineer, the proposed score card leads to absurd results when used as an actual guide in the selection of the best men to fill engineering positions. In actual application (shown by a table comparing three engineers with three business men rated according to Professor Mann's percentages) any first-class business man would receive preference for appointment to engineering positions over any engineer of merely fair general qualifications, no matter how high the engineer's technical skill.

DOUBLE TEST NECESSARY

In reality there should be a double test for the engineer. First, the engineer should have satisfactory engineering skill; second, he should also have satisfactory fundamental manhood qualifications. Every criterion for testing engineers should have a separate detailed technical requirement which might include the following items: (1) Knowledge of the sciences underlying engineering, (2) knowledge of engineering, (3) engineering experience, (4) commercial training, (5) professional standing, including membership in engineering societies, contributions to engineering literature and professional honors.

The fundamental manhood qualifications should include: (1) character, including integrity, responsibility, resourcefulness and initiative; (2) health, including present health and freedom from injurious habits and from inherited weaknesses; (3) judgment, including common sense, scientific attitude and perspective; (4) efficiency, including thoroughness, accuracy, industry and discipline; (5) understanding of men and executive ability; (6) temperament, including evenness of temper, sympathy with others and ability to make friends without yielding principles; (7) culture and general education. No person should be ranked as an engineer who does not possess the above qualifications in a satisfactory degree, and this requirement should be separate from, and in addition to, satisfactory technical qualifications.

The engineering schools may properly be held accountable for the thoroughness of the instruction in mathematics and the other sciences underlying engineering; in English, including public speaking; in political economy; in commercial subjects, and in technical subjects. The development of the qualities of understanding of men, executive ability, resourcefulness, initiative and perspective is to be carried on in college as far as possible, but their most effective and extensive development will occur in actual work after graduation.

THREE GREAT IMPROVEMENTS POSSIBLE

Improvements seem possible in three directions:

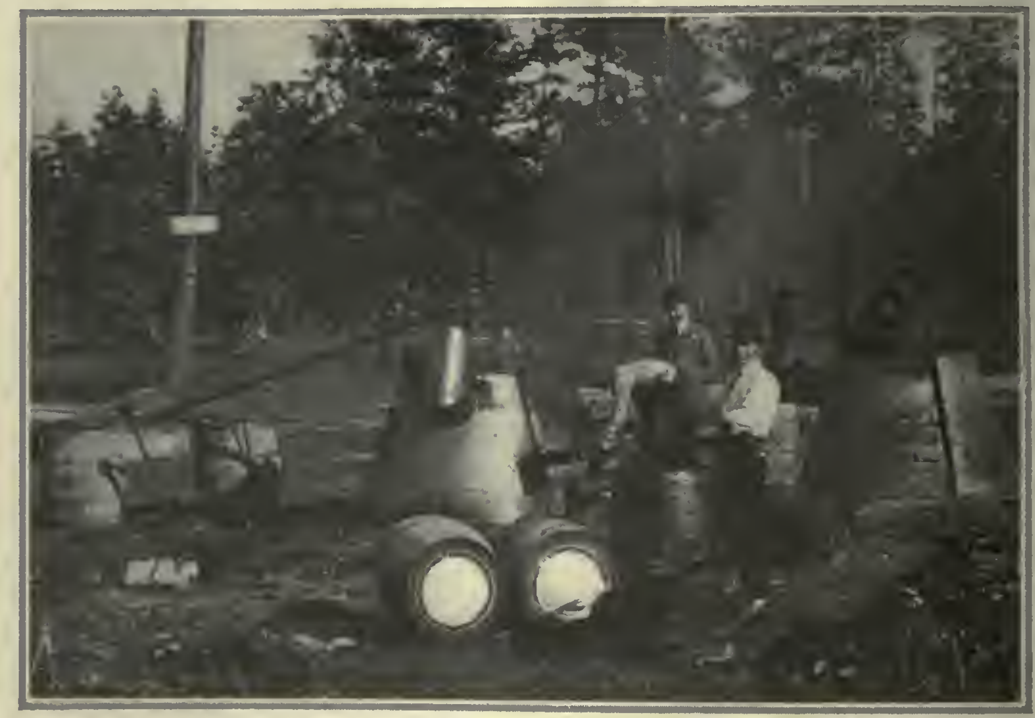
First, by organized, direct, personal acquaintanceship, instruction and inspiration by a faculty of strong, able and experienced engineers, outside of regular class lessons.

Second, by the reorganization of the colleges on the basis of business life. An engineering professor has three months' vacation per year, instead of two weeks, and is regularly scheduled for from two to three classes per day instead of eight hours of regular work. College students are not held to the strict accountability to which men and women in actual life are subjected. We ought to inquire seriously into the question of the possibility and advisability of reorganizing college work on a business basis, with 48 weeks of school per year. Daily schedules should be provided for faculty and students.

Third, by requiring one year or more of actual engineering work outside of college immediately following the sophomore year. Nothing will do more to make men of students than to set them to work with men under the strict discipline of actual business regulations.

Timber Owners Make Stumps Pay

"UTILIZING the squeal" has long been the standard joke around a stockyards. Stumps in a timber country are not usually considered an asset, but Eastman, Gardiner & Company of Laurel, Miss., owners of much long leaf pine timber land, have found a way to distill various pine oils direct from the stump. From an ordinary good-sized stump about 25 gal. of distillate are obtained by the hood-shaped apparatus shown in the accompanying photograph. After removing the water there remain about 17 gal. of heavy pine oil. The stump is converted into a fine grade of charcoal, very much like coke. It is destroyed far enough underground to permit plowing over it without further work. There is a cylinder inside the conical cover, and the intervening space is filled with pine knots for fuel. About four hours are required to destroy a stump, so the distillers handle two stumps per day.



TWO STUMPS PER DAY ARE "DISTILLED" AND DISPOSED OF BY THIS METHOD

Apply Bituminous Covering After Concrete Road Has Been in Service

The Maryland State Roads Commission does not apply the bituminous cover to its concrete roads until they have been in service for four or five years, as it has been found that the coat adheres much better after the concrete surface has been worn than if it had been applied when the road was completed.

New Railroad Terminal in New Orleans Now Open

Pretentious Station of Trans-Mississippi Terminal Accommodates Texas & Pacific and St. Louis, Iron Mountain & Southern

IN ITS recently opened passenger terminal in New Orleans the Trans-Mississippi Terminal Railroad Company has provided its tenant railroads, the Texas & Pacific and St. Louis, Iron Mountain & Southern, with as pretentious a station as is to be found anywhere in the South. The terminal is on Annunciation Street, in the heart of the business district, land having been acquired for a short connecting line between the river and the new terminal. The plant includes a freight layout with separate outbound and inbound freight houses, also on Annunciation Street.

NEWEST, LARGEST AND MOST ATTRACTIVE RAILROAD STATION IN NEW ORLEANS

The Trans-Mississippi Terminal Railroad Company was incorporated in 1912 for the purpose of providing adequate passenger and freight facilities in the city of New Orleans for the Texas & Pacific and St. Louis, Iron Mountain & Southern Railways. Up to this time the railroads used the Union Station, owned by the Illinois Central, with which they effected a junction by crossing the Mississippi River at Avondale, about 11 miles above New Orleans; while freight came in by the present route to Gouldsboro, on the south side of the river, the New Orleans side being reached by ferry. The terminal company acquired an area equal to about thirty city blocks, fronting on the river and extending into the business district. The passenger and freight terminals have been built at the inland end of this tract, at a distance of about ½ mile from the river, and a short connecting railroad reaches the ferry from the terminals.

The terminal buildings consist of an inbound freight house, an outbound freight house and the passenger station. Views are shown of the station, and also of the two-story inbound freight house, which, with its reinforced-concrete frame and brick paneling, presents a pleasing appearance.

STATION BUILDING

The station is laid out with the main waiting room, 100 x 65 ft., in the central section. In the left-hand wing is the lunch room and the ladies' waiting room. In the ladies' retiring room special arrangements have been provided for the care of children, these including iron cribs and an infant's bath—facilities that have already proved very acceptable to families required to wait several hours between trains. In the right-hand wing is the colored waiting room, with ticket office and check room between the two waiting rooms at once serving both and separating them. Behind the station proper is a concourse 234 x 60 ft., running the full length of the building and serving the stub tracks, of which there are five at present, with space provided for five more. The baggage, mail and express building shows in the photograph behind the left wing.

The interior treatment of the waiting rooms for whites consists of light gray marble floors, English vein Italian marble wainscot 10 ft. high, with verde antique bases, and above this point ornamental plaster treatments so as to carry out a complete interior decorative scheme. The colored waiting room is treated with light meadow gray Tennessee marble wainscot 6 ft. high, and above this with Caen stone plaster. All floors throughout are of light gray Tennessee marble. All woodwork in the principal room is of selected mahogany, and all grilles are of bronze.

A feature of the station layout is the use of short tracks. This is due to the fact that the trains are pulled out in lengths of three cars to go on the ferryboat, and are made up into full-length trains at Gouldsboro; and vice versa, trains coming in from the West or North are broken up at Gouldsboro into short trains and brought across the river and into the new terminal in that manner. This eliminates switching on the New Orleans side at the ferry, and makes it possible to spot baggage and mail cars alongside the baggage building, thus keeping trucks off the passenger platform.

The inbound and outbound freight houses are respectively 70 x 594 and 40 x 818 ft. They are of standard fire-resistant construction, and are heated by steam from the same power plant that serves the station. The two houses are 130 ft. apart, and each is served by four tracks on 12½-ft. centers, thus leaving space for a 12-ft. transfer platform to be built at some later date between the two groups of tracks. Each house has an 8-ft. platform along the track side. Both houses were built on a grade of 0.3 per cent to conform to the natural ground slope.

In the rear of the inbound house is a large concrete platform with a ramp to the street to facilitate the handling of automobiles.

RECUT PAVING BLOCKS USED

In the granite-block pavements running the entire length of the two freight houses and along the team tracks between the outbound house and the passenger station small blocks 6 x 8 x 7 in. were used, cut by hand on the ground from large blocks from 12 x 14 to 18 x 24 in., taken up in connection with the street changes. This afforded sufficient blocks to do all the necessary paving about the freight houses, which approximated 12,000 sq. yd., and a great saving was thus effected.

In order to eliminate numerous grade crossings and re-route street cars so as to furnish better street car service to the terminals the tracks of the street railway company were relocated, and in this connection Annunciation Street, on which the passenger station and freight houses front, was widened 10 ft., and a neutral ground was provided in the center for street railway tracks.

Large granite paving stones, about 12 x 14 in. in cross-section, and from 20 to 24 in. long, were set in concrete on edge flush with the walls of the freight houses, with the tops 10 in. above the surface of the pavement, to serve as wheel guards in place of the wood waling timbers generally used.

CONCRETE TRIM WITH BRICK PANELING GIVES FREIGHT HOUSE PLEASING APPEARANCE

The contractor for this work was J. W. Thompson, of St. Louis and New Orleans. A. F. Barclay was in direct charge of the construction, and with the aid of C. H. Chamberlin, chief engineer of the Texas & Pacific, and J. L. Lancaster, assistant to the first vice-president of the Texas & Pacific and vice-president of the Trans-Mississippi Terminal Company, designed the freight houses and track layout. The passenger station was designed by Favrot & Livaudais, Ltd., architects, of New Orleans.

Service of Society to Its Members Is Urged

In His Presidential Address Before the American Waterworks Association This Week President Nicholas S. Hill, Jr., Offers Constructive Measures

SERVICE of the engineering society to and from its members was the keynote of the presidential address delivered by Nicholas S. Hill, Jr., at the opening session, this week, of the thirty-sixth annual convention of the American Waterworks Association in New York City. He emphasized the need for co-ordination of the local sections and the parent body, better committee work and the appropriation of certain funds to secure this end, and the desirability of improving the general character of the papers and printed proceedings of the association. One of his suggestions embodied the separation of the duties of secretary and editor and the appointment of an experienced man for the latter post to secure the best material for publication and eliminate the commonplace and uninteresting in the papers used. This division of work would leave the secretary free to attend to the larger phases of the society's work. Mr. Hill also answered certain criticisms which had been made about the society's present condition and prospective development. Extracts from his address follow:

"At the present time there are 6000 waterworks in villages, towns and cities of the United States. Of this number only 500 are represented by active or corporate members in the American Waterworks Association. In other words, only 8 per cent of the waterworks men of the country receive the benefits which may be derived from this association. We will never exert the influence which we should until we reach a greater number of those interested in water supply matters. Our field of usefulness must be expanded if we are to take a proper place among the technical associations of this country. The formation of sections brings added financial responsibility, and in order to render proper service to our members our revenues must be increased. The only feasible method of increasing our revenues is by increased membership.

NEED OF COMMITTEE WORK

"Equally as important as increase of membership is committee work. In no other way can we meet the needs of our members so well as by thorough investigations along special lines, followed by carefully considered reports thereon. Our committees suffer from two handicaps. The first of these is the wide separation of members and the difficulty of convening for conference and consultation. This widely scattered assignment of committee membership is, I believe, largely the outgrowth of the demand for distributing appointments to different sections of the country so as to preclude the possibility of predominance in a given section. If this consideration is to hold, a better distribution would be to divide the committees as a whole among the various sections, so that the members of a given committee could meet with reasonable facility and without unnecessary cost in time and money.

"The second handicap to our present committee work is the absolute lack of funds for its purposes. It is not just to ask busy men to expend their time and energies on investigations and reports without compensation and expect them to go into their own pockets to pay the cost of such investigations as well. I know of no way in which our funds may be expended to better advantage than in appropriations to assist these committees to work out the problems allotted to them.

PAPERS SHOULD BE EDITED

"I can foresee that one of the most serious problems which the association may have to face in the future will be the added cost of publications resulting from the formation of sections. One of our most urgent needs, therefore, is a careful scrutiny of all papers presented at the section meetings, with a view to eliminating matter of doubtful value, needless repetition of similar topics, and long and wordy papers replete with superfluous detail. Proper editing will accomplish the same result that the meter does in the average water works, namely, reduce waste without restricting needful use.

"The last suggestion brings the increasing demands upon the time of the secretary-editor forcibly to the front. Owing to the growth of the association, the development of sections, the resulting expansion of the publications and the number of papers to be edited, the advisability of separating the office of secretary and editor must be seriously considered. It is doubtful if any one person can attend to the duties of both secretary and editor with a proper regard for each.

"We have reached a stage where it would be well worth while to employ a trained editor for the purpose of securing the very best for publication. This association is largely judged by the character of the proceedings and the quality of the papers which it publishes. One man will be well and completely occupied if he spends the proper amount of time in seeking subjects for new papers which will be appropriate and useful, in finding the best authors for their presentation, in reviewing those papers which have been gratuitously offered and in editing them and putting them in proper shape for publication. The editor should report directly to the Publication Committee, so that the final selection of papers will not rest entirely with an individual. The Publication Committee should be appointed with a view to having the editor in close touch with this committee, so that all matters relating to publications may be efficiently and expeditiously handled.

"The secretary should be free to devote his time to the general correspondence of the association, to attending meetings of the local sections and stimulating their activity, to the accretion of membership, to promoting committee work and the proper relationship between this association and allied societies, to the arrangements for conventions and the numerous other duties which devolve upon the executive officer of an association of this size.

NATIONALIZATION POSSIBLE

"Finally, I disagree with the statement that the complete nationalization of this association is beyond the realms of possibility. I do not believe that we can be overambitious in our attempts at expansion. The issue of a single, country-wide association was raised by my predecessor, and everyone who has a disinterested regard for the welfare of the waterworks fraternity should weigh its merits and disadvantages carefully.

"When a national association is mentioned some say that its size will destroy the intimate personal relation which has been one of the most valuable assets of the smaller organizations. It is at this point that the sections become useful. It must be remembered that under our present system the larger organization is composed of smaller units, each holding its own meetings at regular intervals. These sections offer an adequate means for close contact among members and insure acquaintanceship for the member who attends the national convention.

"It is pertinent to ask what should be the ideal of this association? My answer is, service—service of the individual to the association; service by the association to the individual and to the country at large.

"What is needed primarily is individual service, as the corporate service of the association is nothing more than the composite service of the individual. What we need, therefore, is servants, irrespective of calling or profession, servants who are willing to do and to help achieve the best results for the association."

Pipe Laid During Civil War Still on Duty Under Pressure

THE accompanying photograph is that of a section of 6-in. pipe cut in April from the water distribution system of Chattanooga, Tenn., in service at the time under 70-lb. pressure. The pipe was cut from some three miles of cast-iron main laid under the direction of Gen. U. S. Grant during the occupation of Chattanooga by the federal troops during the Civil War.

At the time of occupation (1864) there was a small pumping plant located on the banks of the Tennessee River, pumping into three small wooden tanks on the side of Cameron Hill. This outfit was taken over by the Government, and later the original owner, undertaking to secure possession of the pumps, evidently found some difficulty in this effort, since according to the chancellor the property "was seized by the U. S. government as property abandoned by rebels in aid of the rebellion."

CAST-IRON PIPE LAID DURING CIVIL WAR WITHSTANDS 70 POUNDS PRESSURE

The foregoing information, together with the photograph, was furnished by James Nisbet Hazlehurst, consulting engineer, who is representing the city of Chattanooga in the appraisal of the city water company's property.

City Makes Money by Purchasing Plant and Laying Its Own Asphalt Paving

Flint, Mich., Saved $43,000 Last Year Under Contractors' Estimates by Forming an Efficient Day-Labor Organization

By CLARENCE E. RIDLEY
Cost and Progress Engineer, Flint, Mich.

THE City of Flint, Mich., in the spring of 1915 received bids on approximately 100,000 sq. yd. of pavement, and in spite of the fact that they were the lowest tendered at the time anywhere in this part of the country, they were rejected by the Common Council, and the work was carried out by day labor under the supervision of the city engineer, Ezra C. Shoecraft. Up to that time practically all municipal construction work had been done by contractors. It was therefore necessary to form an efficient construction organization and buy the requisite equipment to carry on the work. The most important purchases were a Hetherington & Berner direct-heating asphalt plant and the necessary street equipment for laying asphalt pavement.

With this organization and with the equipment acquired work amounting to $322,920.08 was done with a total saving to the city under the prices bid by contractors of $43,936.11, or 13½ per cent.

CLOSE TRACK KEPT OF WORK

The progress of the work is followed in the office by a progress chart, illustrated herewith. The chart, as filled in for production, shows, for instance, at a glance that Avon Street is finished except 60 per cent of the surface; that the foundation on Broad Street is about 10 per cent complete, and that the excavation on Cornelia Street is 90 per cent complete. This chart is made on tracing cloth and is brought up to date every other day, and a print is taken from it each week on which the date is stamped. These prints serve as a permanent record for the office, showing the stage of the work at all times for each street paved during the year.

This chart keeps the office force in close touch with the field work and enables it to order material intelligently as well as to make sure that the work is progressing according to schedule.

The 4 x 6 in. cards illustrated are used to keep track of the cost as the work progresses. A report card is made out in the office for all foremen for each pay period of two weeks, showing the jobs worked on and the unit cost. These cards summarize the report cards which the foremen are obliged to send into the office each day. By means of them the cost of similar work done by different foremen is compared, bringing out the strong and weak points of the organization. This comparison, being known to the organization, furnishes a strong incentive to efficient work.

The progress cost cards, shown herewith, which are made out for each job, are kept in the same file. On them are entered the amounts of labor cost, under the correct heading of the kind of work, the foremen doing the work and the date of the payroll. Under this system the foremen's report cards may be referred to at any time to trace out the unit cost of any particular job. For example, the $672.48 entered for excavation against Broad Street was done by foreman No. 3, J. H. Brown, and the unit cost for it was 42 cents per cubic yard, as shown by his report card for the July 5 payroll. This method of following the cost of the work is readily referred to and is used daily to ascertain if any part of the work is exceeding the estimate. If such is the case, with no apparent excuse, a remedy is applied before it is too late. It is an accepted fact on large construction operations that some such system of keeping track of cost and progress is a necessity. It was considered all the more desirable for the city because of the scattered nature of the work.

QUANTITY OF WORK COMPLETED

The total amount of pavement built by the city during the 1915 season was 90,031.8 sq. yd., of which 73,799.6 sq. yd. was sheet asphalt. In addition the city also constructed sewers, sidewalks, bridges and other work, bringing the total cost to $322,920.08. At the same time there was spent on contract work $135,320.42, thus making the total cost of improvements for the fiscal year ended Feb. 29 last $458,240.50.

The overhead engineering on all of the foregoing work amounted to $7,095.76, or 1.5 per cent of the value of the work done.

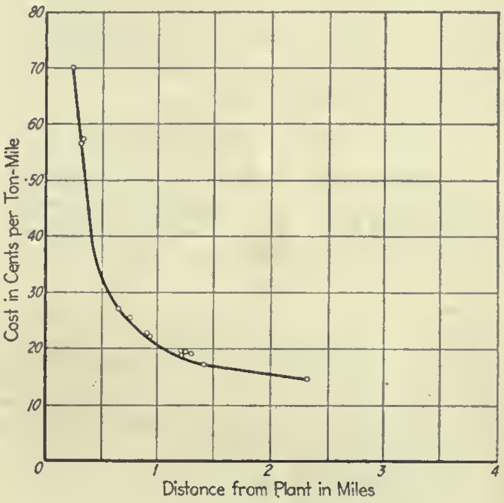
COSTS IN DETAIL

In order to afford a comparison of the figures on unit costs there are given in Table 1 the cost of materials and labor used in the construction of pavements, all the material prices being f.o.b. Flint, except that for cement, which is the price delivered on the line of work.

TABLE 1—UNIT COSTS OF ROAD WORK

Asphalt, per ton:	
Bermudez	$29.36
Standard	13.91
Trinidad	21.37
Texaco	14.11
Fluxing oil, per ton	8.85
Binder stone, per ton	1.28
Limestone dust, per ton	4.10
Asphalt sand, per cu. yd	1.09
Concrete gravel, per ton	0.83
Paving brick, per sq. yd	0.88
Cement, per bbl	1.29
Laborers, per hr. for 10-hr. day	0.25
Teams, per hr. for 10-hr. day	0.55

As the total excavation for paving was more than 50,000 cu. yd., and as but one steam shovel was available, it was necessary to use hand labor on about two-thirds of the work. In the selection of streets the hand labor was favored at all times, which makes the saving shown by the steam shovel even larger than is indicated by the figures in Table 2. In addition to the excavation it was, of course, necessary to have a hand crew working ahead of the steam roller putting the subgrade in condition for concrete. It will also be noted that the cost of this finished grading on work done by the steam shovel is one-third less than on the streets excavated by hand.



COST OF DELIVERING ASPHALT

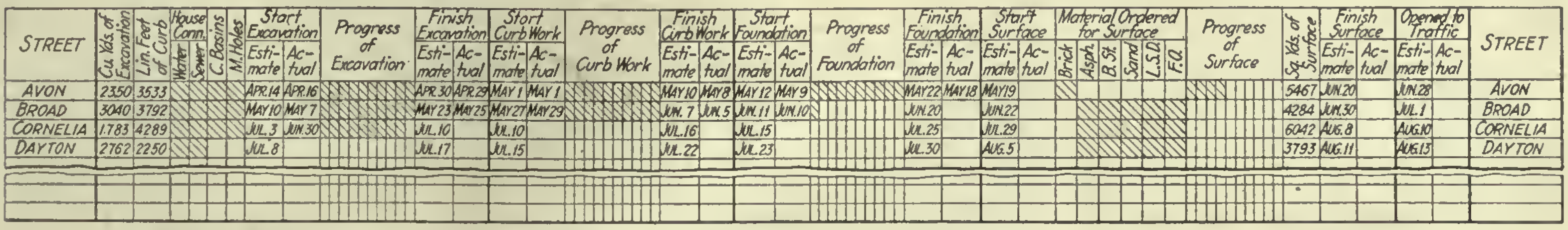
These costs show that had all the excavation been done by steam shovel a saving in cents of 17.3 times 34,464.5 would have been made, which amounts to $5,962.36. Thus, if a new machine had been bought, its cost would have been saved in a single season.

TABLE 2—COMPARATIVE COSTS OF STEAM-SHOVEL AND HAND EXCAVATION

Steam-Shovel Excavation	
Total cubic yards	16,838.9
Labor cost	$4,965.01
Average cost per cu. yd	0.295
Average cost per sq. yd., finish grading	0.042
Total average labor cost per cu. yd	0.377
Average cost of fuels, oils, etc., per cu. yd.	0.015
Reimbursement of equipment fund for depreciation and repairs	0.033
Total average cost of excavation per cu. yd.	0.425
Hand Excavation	
Total cubic yards	34,464.5
Labor cost	$15,913.43
Average cost per cu. yd	0.46
Average cost per sq. yd., finish grading	0.063
Total average labor cost per cu. yd	0.570
Reimbursement of equipment fund for depreciation and repairs	0.028
Total average cost of excavation per cu. yd.	0.598

COST OF CURB WORK

With the exception of six streets on which brick pavement and stone curbing were used, and two others having straight concrete curbs, a combined curb and gutter was used. Two gangs of fifteen men each were working on this feature of the paving almost all season. By having a finisher on either side of the street the graders could



STREET	Cu. Yds. of Excavation	Lin. Feet of Curb	House Conn.		C. Basins	M. Holes	Start Excavation		Progress of Excavation	Finish Excavation		Start Curb Work		Progress of Curb Work	Finish Curb Work		Start Foundation		Progress of Foundation	Finish Foundation		Start Surface		Material Ordered for Surface						Progress of Surface	Sq. Yds. of Surface	Finish Surface		Opened to Traffic		STREET
			Water	Sewer			Estimate	Actual		Estimate	Actual	Estimate	Actual		Estimate	Actual	Estimate	Actual		Estimate	Actual	Estimate	Actual	Brick	Asph.	B. St.	Sand	L.S.D.	F.Q.			Estimate	Actual	Estimate	Actual	
AVON	2350	3533	▨	▨	▨	▨	APR. 14	APR. 16	▨	APR. 30	APR. 29	MAY 1	MAY 1	▨	MAY 10	MAY 8	MAY 12	MAY 9	▨	MAY 22	MAY 18	MAY 19		▨						▨	5467	JUN. 20		JUN. 28		AVON
BROAD	3040	3792	▨	▨	▨	▨	MAY 10	MAY 7	▨	MAY 23	MAY 25	MAY 27	MAY 29	▨	JUN. 7	JUN. 5	JUN. 11	JUN. 10	▨	JUN. 20		JUN. 22			▨	▨	▨	▨	▨		4284	JUN. 30		JUL. 1		BROAD
CORNELIA	1783	4289	▨	▨	▨	▨	JUL. 3	JUN. 30	▨	JUL. 10		JUL. 10			JUL. 16		JUL. 15			JUL. 25		JUL. 29			▨	▨	▨	▨	▨		6042	AUG. 8		AUG. 10		CORNELIA
DAYTON	2762	2250	▨	▨			JUL. 8			JUL. 17		JUL. 15			JUL. 22		JUL. 23			JUL. 30		AUG. 5			▨	▨	▨	▨	▨		3793	AUG. 11		AUG. 13		DAYTON

BLUE PRINTS OF PROGRESS CHART MADE AND DATED EACH WEEK GIVE ACCURATE RECORD OF PROGRESS OF WORK ON EACH STREET

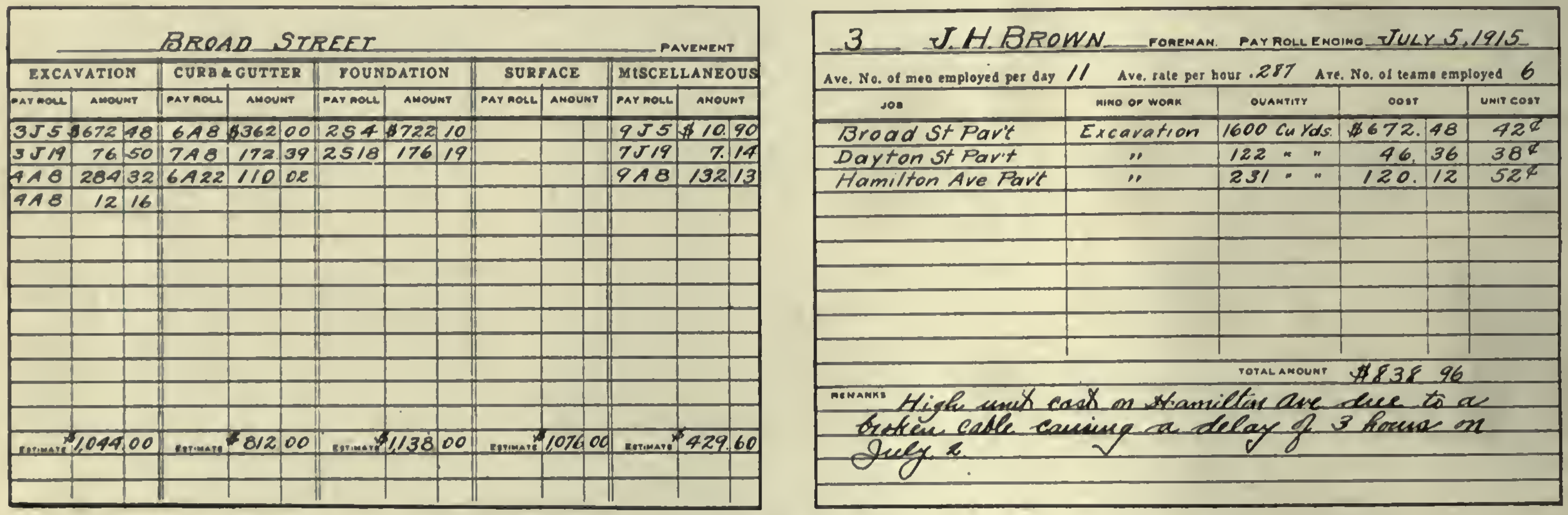
TABLE 3—COST OF COMBINED CURB AND GUTTER

Total lin. ft. curb and gutter	47,967
Total number of wagon loads (1½ cu. yd.) gravel	2,371
Average cost gravel per load at pit	$0.93
Average cost of delivery on job per load	0.93
Average length in ft. built per load of gravel	20
Average cost of gravel per ft	$0.0924
Average length in ft. of curb and gutter per bbl. of cement	10.7
Average cost of cement per ft	$0.1206
Average cost of labor	0.1300
Reimbursement of equipment fund for depreciation and repairs	0.0214
Total average cost of curb and gutter per ft.	$0.3644

follow the curb gangs very closely. An average of 400 ft. per day was placed. The unit cost of labor and material for this work is as shown in Table 3.

COST OF CONCRETE FOUNDATIONS

A 6-in. concrete base of 1:3:6 mixture was placed on all the streets. The gravel was unloaded from cars and delivered on the line of the work by teams and wagons. The average length of haul was 0.47 miles, and the average cost per ton-mile was 39.6 cents. It will be noted that for this length of haul the cost falls very close to the ton-mileage curve plotted for hauling asphalt. Table 4 gives the cost of the concrete work for the year.



BROAD STREET PAVEMENT

EXCAVATION		CURB & GUTTER		FOUNDATION		SURFACE		MISCELLANEOUS	
PAY ROLL	AMOUNT	PAY ROLL	AMOUNT	PAY ROLL	AMOUNT	PAY ROLL	AMOUNT	PAY ROLL	AMOUNT
3J5	$672 48	6A8	$362 00	2S4	$722 10			9J5	$10 90
3J19	76 50	7A8	172 39	2S18	176 19			7J19	7 14
4A8	284 32	6A22	110 02					9A8	132 13
9A8	12 16								
ESTIMATE	$1,044 00	ESTIMATE	$812 00	ESTIMATE	$1,138 00	ESTIMATE	$1,076 00	ESTIMATE	$429 60

3 J. H. BROWN FOREMAN. PAY ROLL ENDING JULY 5, 1915

Ave. No. of men employed per day 11 Ave. rate per hour .287 Ave. No. of teams employed 6

JOB	KIND OF WORK	QUANTITY	COST	UNIT COST
Broad St Pav't	Excavation	1600 Cu Yds.	$672.48	42¢
Dayton St Pav't	"	122 " "	46.36	38¢
Hamilton Ave Pav't	"	231 " "	120.12	52¢

TOTAL AMOUNT $838 96

REMARKS High unit cost on Hamilton Ave due to a broken cable causing a delay of 3 hours on July 2.

PROGRESS COSTS FOR EACH JOB ARE TRACED TO FOREMEN'S REPORT CARDS (AT RIGHT) IF EXCESSIVE COSTS APPEAR

TABLE 4—COST OF CONCRETE FOUNDATIONS

Total number sq. yd. foundation	90,031.8
Total number carloads gravel	554.0
Total weight of gravel, in tons	26,420.0
Average weight of gravel per car, in lb.	95,300.0
Average cost of gravel on tracks per car	$39.55
Average cost of unloading cars:	
(1) Shovelers (hand)	4.50
(2) Teaming	9.00
Total number wagon loads (1½ cu. yd.) gravel	10,819.0
Average number wagon loads per car	19.5
Average weight of wagon load, in lb.	4,880.0
Average cost per wagon load on track	$2.03
Average cost per wagon for delivery on job	0.69
Cost of gravel on tracks per ton	0.83
Average cost of unloading gravel per ton	0.091
Average cost of hauling gravel per ton	0.182
Amount of gravel per sq. yd. foundation, in lb.	587.0
Cost of gravel per sq. yd. on track	$0.244
Cost of unloading and delivering on street per sq. yd	0.08
Total average cost of gravel per sq. yd.	0.3240
Cost of water per sq. yd	0.0075
Number of sq. yd. foundation per bbl. cement	5.47
Average cost of cement per sq. yd	$0.2350
Amount of depreciation on equipment	0.0007
Average cost of labor per sq. yd	0.0850
Total average cost of foundation per sq. yd.	$0.6522

TABLE 5—COST OF BRICK SURFACING

Brick, f.o.b. Flint	$0.88
Delivering brick on line of work	0.08
Cement	0.03
Cushion sand	0.04
Slushing sand	0.01
Fixing sand bed, laying, rolling and slushing brick	0.16
Total average cost of brick surface	$1.20

BRICK SURFACING

It has already been stated that but 16,232.2 sq. yd. of brick pavement was laid. As this amounted to only about 18 per cent of the total paving and was made up of comparatively small jobs, its cost is not as low for this class of work as the main surfacing costs are for asphalt paving work. The average cost of brick paving, with a stone curb and 6-in. foundation, excluding the cost of excavation, was $2.128 per square yard. The amount of material per square yard of surface was 40 brick, 1/40 bbl. of cement, 1/25 load of cushion sand and 1/200 load of slushing sand. The cost of material and labor for these items per square yard is shown in Table 5.

LARGEST SAVING ON SHEET ASPHALT

The greatest saving was made on sheet-asphalt surface. Enough money was made on this work alone to more than pay for the plant and equipment twice over. Exclusive of grading, the average cost of asphalt paving was $1.51 per square yard. All of the sheet-asphalt pavements were laid in residence districts with widths of 24 and 26 ft. Texaco asphalt was generally used in the binder with an average penetration for the season of 75.5. Mexican asphalt mixed half and half with either Bermudez or Trinidad was chiefly used in the top with an average penetration of 65.3. An average of 24.9 per cent of the sand used passed an eighty-mesh screen, and 29.3 per cent of the total aggregate used passed this screen.

The percentage of bitumen for the season averaged 10.9. The total cost of the plant and equipment is listed in Table 6.

TABLE 6—COST OF ASPHALT PLANT

Original cost of plant erected	$9,245.00	
Cost of foundation	380.76	
Kettle shed	493.92	
Buildings (office, engine room and limestone dust shed)	742.88	
Flux oil tank	302.89	
Miscellaneous equipment for plant and street	638.14	
Total cost of plant and equipment		$11,803.59
Cost of five asphalt wagons	$824.76	
Cost of asphalt roller	2,350.00	
Total cost of street equipment		3,174.76
Grand total		$14,978.35

Of the above items of plant, the equipment, asphalt plant, wagons and roller were allowed a depreciation of 20 per cent, and the rest a depreciation of 10 per cent, amounting in all to $2,803.63. The asphalt plant is located on the Pere Marquette Railroad, as near the center of the city as possible. The average hauling distance during the past season was 0.96 miles, but one haul of more than 2 miles and one of less than ¼ mile occurred. The average cost of delivering the asphalt during the year amounted to 23.7 cents per ton-mile. The asphalt surfaces placed consisted of 1½ in. of binder and a 1-in. top. The average amounts of material used and cost per square yard of surface are given in Table 7.

The total yardage of sheet asphalt, 73,799.6, times the difference in the contract price offered for the work and the actual cost, 38 cents per square yard, equals $28,043.85. Less $2,803.63 depreciation, this amounts to $25,240.22 saved on the asphalt surfacing alone.

EXTENSIVE WORK CONTEMPLATED FOR THIS YEAR

Petitions have already been presented to the Council for more than 120,000 sq. yd. of additional sheet-asphalt pavement to be built during the coming season. In addition to this plans are complete for constructing

TABLE 7—AVERAGE AMOUNTS OF MATERIAL USED, AND TOTAL COST PER SQUARE YARD

Binder Material	Amount per sq. yd.	Cost per lb.	Cost per sq. yd.	
Texaco asphalt	5.47 lb.	$0.007055	$0.03859	
Fluxing oil	.15 lb.	0.004425	0.00066	
Sand	16.35 lb.	0.000425	0.00695	
Binder stone	89.70 lb.	0.000640	0.05740	
Cost of material in binder				$0.1036
Top				
One-half Trinidad and one-half Mexican	18.50 lb.	0.008820	0.16317	
Fluxing oil	2.20 lb.	0.004425	0.00973	
Sand	147.15 lb.	0.000425	0.06254	
Limestone dust	15.20 lb.	0.002050	0.03116	
Material in top				$0.2666
Coal, electric power and water				0.0200
Labor at plant				0.0844
Labor on street				0.0668
Teaming				0.0330
Salary of expert, engineer in charge and assistants				0.0300
Total average cost of asphalt pavement per square yard				$0.6044

sanitary and storm sewers on a much larger scale than during the past year, when more than 21 miles of sewers were completed. The new equipment purchased to prosecute this work includes a sewer excavator, another steam shovel and a crane for unloading gravel. It is expected that practically all of this work will be done by day labor, and the engineering department is ambitious to make at least as good a record as that of the past season.

Double-End Motor Trucks Clean Los Angeles Streets

FIVE auto trucks carrying 1200-gal. tanks have recently been put in service by the street-cleaning department of the City of Los Angeles. The trucks are equipped with both front and rear nozzles; those in front for flushing and those behind for sprinkling. The nozzles are so constructed that there is no overlapping of the streams, and the spread is such that one trip covers the 50-ft. streets from curb to curb. Water is delivered at a pressure of 60 lb., supplied by a centrifugal pump direct-connected to the truck engine. The trucks are being operated two eight-hour shifts per day, covering a distance of 30 miles in each shift, and are said to be making a very creditable cost account showing. The trucks are of the Moreland make.

DOUBLE-END TRUCKS CLEAN 50-FT. STREET FROM CURB TO CURB IN ONE TRIP

Sawed Lumber Piling

Sawed lumber instead of bare poles for piling in the prevention of levee breaks along the Mississippi River, first tried at New Orleans, has proved so successful, according to the National Lumber Manufacturers' Association, that the use of wooden interlocking piling is said to be spreading rapidly. An advantage claimed for the wooden interlocking piling is that it does not buckle and bend when driven. These piles have also been used in caisson work, sewerage and waterworks excavations.

Are Rock-Fill Dams Safely Designed?—What Failure of Lower Otay Dam Teaches

Study of Disaster Indicates That Downstream Surface Must Be Able to Withstand Heavy Overpour for Short Period Without Gorging of Fill

By GEORGE S. BINCKLEY
Consulting Hydraulic Engineer, Los Angeles

THE MORE disastrous a failure is, the more valuable are its lessions. In engineering especially, much is learned from failure—little from success. The construction and continued existence in service of the Lower Otay dam taught nothing. The margin of safety that held it together under a head of water 15 ft. below the spillway level in 1907 is unknown, and can never be known.

But the failure of this recklessly conceived and crudely constructed example of lay engineering has a value of its own. So long as it stood up, no matter how fearfully narrow the margin by which it stood, the fact that it *did* stand was to the layman sufficient and triumphant proof of its safety. Even well qualified engineers were mild in their criticism, for to question the safety of this dam was to invite a demand for mathematical proof of its weakness—something not easy to furnish with a desirable degree of finality. The fact that the nature of the stresses and the elements of resistance in a pile of loosely dumped rock are not susceptible of mathematical determination probably accounts for a great deal of the freedom from drastic criticism to which this dam would otherwise have been subjected.

Now the Lower Otay dam is gone, and criticism may rest on the safe basis of disastrous fact. So we find that, quite aside from descriptive or historical articles, this failure has brought out a number of others of a critical or analytical character, and there can be little doubt that the dissection of this unpleasing corpse will be profitable to the engineering profession.

Where a type of engineering construction, even though it be approved by ripe judgment and established by experience, lacks a firm and rational mathematical basis, it is wholesome that from time to time it should be subjected to severe question. Of all types of engineering structures bridge design would seem to be that most completely susceptible of treatment by rigid mathematical processes. Yet the failure of the greatest bridge ever attempted demonstrated unsuspected imperfections and taught great lessons. In the design and construction of dams judgment far more than mathematics must control. Upon a mathematical skeleton must be built up a structure that must not merely stand but stand safely.

Those elements in the design of a dam that are calculable are few and comparatively simple; the many that must be determined by the judgment and experience of the engineer are of equal or even superior importance. So in the design of a rock-fill dam the wise engineer will trust his mathematics only so far as he must. At best his results will be suggestive, and not finally controlling. He knows, or should know, that an embankment of rock so steep that its surface represents the natural angle of repose of the material is, at its surface, in a condition approaching unstable equilibrium. Hence he will make the slope of the lower angle, not upon the basis of a mathematical determination, but in accordance with his personal judgment and experience. He will contemplate the dangers that may threaten his structure, and in the light of his own knowledge and with proper regard for established practice he will provide safeguards.

CONDITION AT LOWER OTAY DAM

In considering the rock-fill dam as a distinct type of construction, it will be helpful to analyze briefly the general conditions that existed at the Lower Otay dam at the time that it failed. Certain of these conditions are not open to question, while others must be deduced from evidence.

In the first place, full hydrostatic pressure existed all over the upstream surface of the steel diaphragm or the thin enclosing walls of concrete on the axis of the dam. Hence the only resistance offered to this pressure is found in the mass of rock on the downstream side of the diaphragm. But in adition to this hydrostatic pressure there existed an additional pressure against the diaphragm due to the weight of the upstream rock fill. Although it is difficult or perhaps impossible to state with mathematical certainty just how much this additional pressure amounted to, a rough investigation by Bligh's method indicates that the aggregate of this pressure and the hydrostatic component would be nearly or quite double that of the hydrostatic alone, although the direction of the resultant of these two forces would fall below the horizontal.

It is hardly too much to say that the resistance that a large mass of loose rock will oppose to horizontal displacement is wholly unknown. The recorded failures of rock-fill dams illuminate this phase of the problem but little, as they always seem to have been complicated by conditions of erosion or overpour. Hence we have here a condition on the upstream side of the dam defined by fairly determinate forces, opposed on the downstream side by a mass having qualities of resistance of which nothing definite is known.

Rapid Change When Dam Was Overtopped

So much for the conditions existing with a full reservoir. The dam may sustain its load, but with what margin of safety cannot be known. The Lower Otay dam did actually withstand the pressure of a full reservoir. But when it was overtopped a rapid and profound change in the conditions controlling its stability—probably slight enough to begin with—took place. The voids in the loose rock fill on the downstream side filled with water which, against the resistance of the tortuous channels through the voids, forced its way out of the mass downstream.

The excellent evidence obtained from eyewitnesses and graphically arranged in the three diagrammatic sketches in the Engineering Record of Feb. 12, 1916, page 225, proves that the earthen dike which was built on top of the dam to a height of about 5 ft. above the top of the steel and concrete core was first overtopped by from 4 to 6 in. of water, and was then carried out near the center and probably down to the top of the steel diaphragm. The flow through this rapidly widening break in the dike was sufficient to gorge quickly the already partly saturated rock fill and break through the lower face with sufficient force to displace large rock from the steep slope. As this slope was built on the natural angle of repose, taking material from the toe naturally tended to put into motion everything on the slope above, and the sudden reduction in the effective weight of the rock fill due to its partial submergence, aggravated by the disruptive force of the hydrostatic pressure within the mass itself, made destruction swift and inevitable. As a matter of fact there was an interval of twenty minutes between the time the first serious break occurred in the earth like on top of the dam and the moment of failure of the structure itself—a period quite long enough for the downstream portion of the rock fill to become disastrously gorged.

Considerable stress has been laid by other writers upon the fact that this rock fill contained a great deal of fine material, and the writer is inclined to agree that this was an element of weakness in reducing the volume of the voids and retarding the escape of water from the fill. But he does not believe that the destruction of this or any other rock-fill dam can be ascribed to the actual erosive effect of the overpour, either by the displacement of material on the surface or the washing of it out from within the fill. All evidence is against such a hypothesis. But that the gorging of such a mass with water reduces its effective weight and consequently its resistance to displacement, and that under such conditions there must exist a disruptive force within the mass itself due to hydrostatic pressure, there can be no question. Hence in view of the fact that the Lower Otay dam actually resisted the static pressure due to a full reservoir, but failed when overtopped, the writer believes that to the existence of the conditions described above must be attributed the failure of this dam.

How Would Morena Dam Have Behaved?

The question naturally arises: Would the Morena dam have survived the same conditions that destroyed the Lower Otay dam? As engineering works the two structures are not to be compared. Yet it is pertinent to examine the dangers that threatened the Morena dam at the time of the recent floods.

In the first place, for some reason not apparent, racks of railroad iron, spaced 1 ft. apart, were placed in front of the spillway, which in turn was provided with radial gates by which it could be closed completely. It is plain that it was intended to make possible the utilization of storage to within a few feet of the top of the dam—in fact it actually rose to within 18 in. of the top of the parapet. Leaving aside what would appear to be the very doubtful propriety of such an arrangement, the fact is that the large amount of floating débris brought down the reservoir by the rapidly rising water promptly stopped the flow through the spillway so completely that with a head of 3 ft. of water above the spillway level and all the radial gates wide open the depth of water on the floor of the spillway was but 3 in. With the spillway entirely useless, a few hours more of heavy rain would have produced an enormous overpour.

It is, the writer believes, extremely unlikely that the Morena dam would have sustained such a condition for more than the short period that would have been required for the gorging of the fill. While the lower angle of its downstream slope provided a stability superior to that of the Lower Otay dam, the greater distance which the water from the overpour would have to traverse before escaping at the toe of the fill would increase the extent of the gorging and aggravate the loss of effective weight of the mass and the disruptive force of the hydrostatic pressure within the mass itself. Actual erosion of the surface of the fill by the flow of water over it would probably not be a factor at all, but displacement of material from the surface of the slope by the escape of water from within would probably be an important or even vital element in the final catastrophe.

The destruction of the Lower Otay dam carries one kind of lesson. But the narrow escape of the great Morena rock fill carries another and perhaps more valuable warning. The Otay dam cannot be considered as an example of engineering design or even good construction. But the Morena dam is the work of an engineer of standing and experience, and is therefore more properly subject to engineering criticism where weakness or error in design has been developed. The lesson in both cases is plain. From the Lower Otay we again have tragically emphasized the folly of intrusting engineering works to untrained or reckless hands. And from the narrow escape of the great Morena rock fill few engineers will fail to realize with the shock of sudden remembrance the grim hazards of an obstructed or insufficient spillway.

What Rock-Fill Dams Require for Safety

The writer believes it proper to conclude that a rock-fill dam that is at all likely to be overtopped must, for even reasonable safety, be provided with a downstream surface that will carry a heavy overpour for a short period without leakage through into the mass below sufficient even partly to gorge the fill, and that to secure a reasonable stability the angle of the downstream slope should be considerably lower than the natural angle of repose of the material of which it is constructed.

And finally, in view of the fact that no failure of an arched masonry dam has ever been recorded—even though this principle has been ignorantly and recklessly applied—it seems very likely indeed that where the conditions are favorable a well-designed arch of concrete or masonry will prove not only a better and safer structure but actually cheaper than a rock-fill dam designed and constructed with due reference to safety and watertightness.

Engineers Investigate Charges Against City Engineer

Show That Official Directed Work Efficiently and Safely—Accusations Not Based on Actual Facts or Engineering Knowledge

A precedent has been established by the Canadian Society of Civil Engineers in coming to the aid of an unjustly accused member of the profession. G. W. Craig, city engineer of Calgary, was recently accused by one of that city's officials of neglect in certain details of the construction of a bridge. A committee of engineers, after making a thorough investigation, declared the charges against the city engineer and his associates to be without justification.

For nearly a year there had been public criticism of the Calgary engineering department by one of the aldermen. He had at one time been waterworks engineer, but was dismissed when that office was abolished for economical reasons and the waterworks department placed under the direction of the city engineer. He was later elected an alderman and also opened an office for the practice of consulting engineering. The work of the city engineering department was greatly handicapped by his continual fault-finding.

Finally the alderman's criticism focused itself upon the construction of a reinforced concrete arch bridge being built by the city over the Bow River at Center Street. Charges made to the city council by this alderman reflected upon the ability and good judgment of the city engineer and his associates. G. W. Craig, city engineer, is an associate member of the American Society of Civil Engineers. The local members of that organization took the matter up with him, as it was evident that if the facts were as Mr. Craig presented them his reputation as an engineer was being attacked largely for political reasons.

Engineers Offer Free Service

As this was a matter between engineers it was thought that it should be settled within the profession. The executive board of the Calgary branch of the Canadian Society of Civil Engineers offered to investigate the matter without charge. Accordingly, the Calgary city council requested the alderman to draft his charges and the city engineer to answer them in writing. Three members of the Calgary branch of the Canadian Society of Civil Engineers were selected as an investigating committee. The alderman's charges were presented in writing, together with the city engineer's reply.

Public meetings were held, at which the alderman preferring the charges refused to appear for examination. On the other hand, the city engineer, the engineer in charge of design and construction of the bridge and the city chemist who had charge of the city testing laboratory submitted willingly to a fair examination on the points at issue.

The charges involved the use of unsuitable re-rolled steel in the structure and extravagance in the testing; neglect or carelessness in not carrying the foundations of the north retaining wall to rock and failure on the part of the engineering department to submit the design to a consulting engineer for indorsement.

CHARGES DECLARED FALSE

After reviewing the evidence the committee of engineers decided that the cost of testing will be reasonable, and in all probability will be less than the cost of a similar service performed by an inspection company. The engineers also decided that the use of re-rolled steel in certain parts of the structure was warranted on the ground of economy, and that in view of the relatively high grade of the material the integrity of the structure had not suffered.

Failure of the north abutment from the causes outlined by the alderman was found to be only a remote possibility. The committee was also of the opinion that the additional cost of carrying the foundation in question to rock would not be justified by any extra security so obtained. The committee was unable to find that employing a consulting engineer had ever been suggested nor was such a course thought necessary.

After carefully reviewing both the engineer's reports and the charges against him, as well as all of the evidence, the committee of engineers could find no basis for the charges and decided that the engineers had directed the work in a creditable manner. Information about the work had not been withheld nor had any legal or engineering requirement been overlooked.

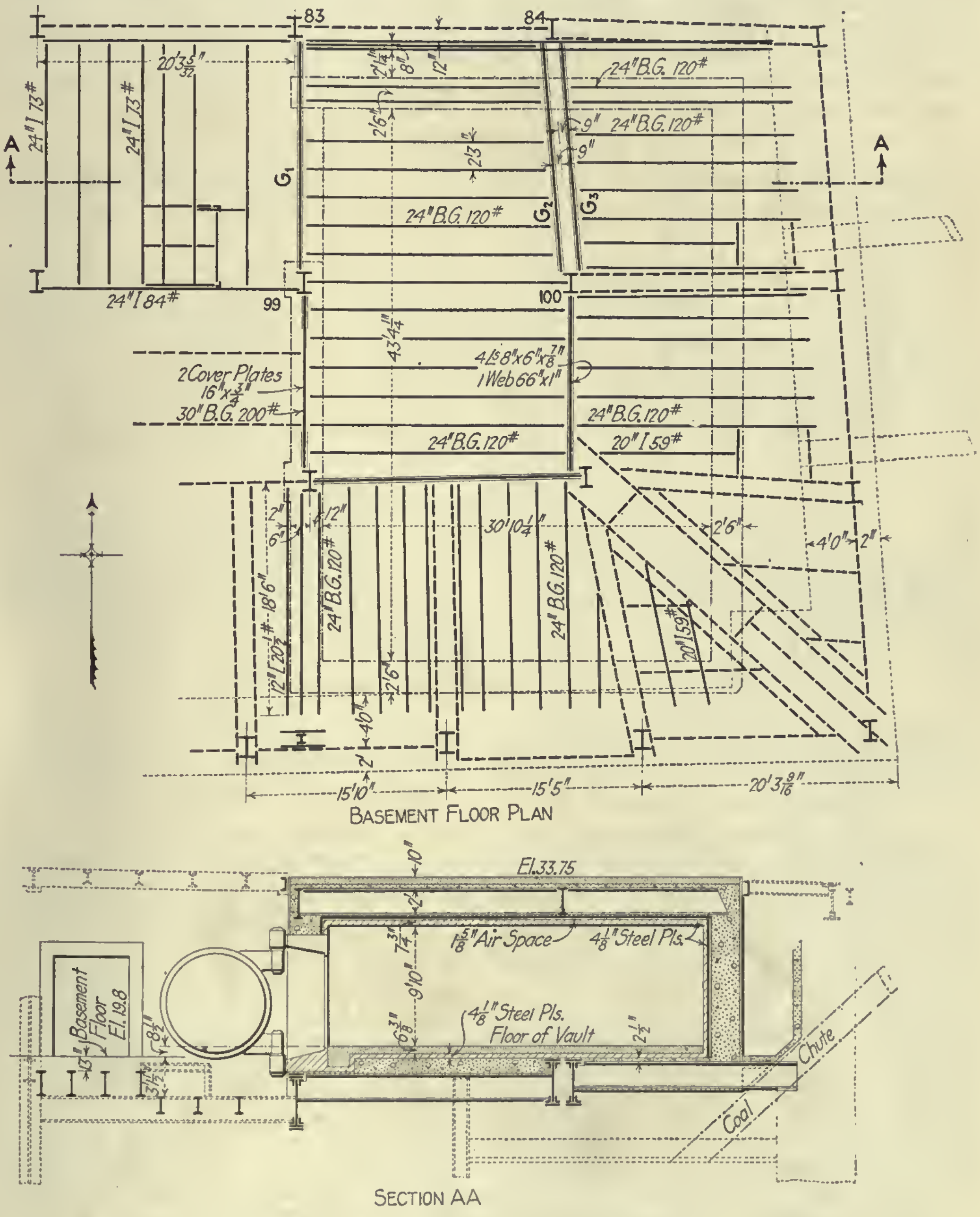
Liner Plates Used in Sewer Tunnel

Although the ground encountered in driving the tunnels for the intercepting sewer in Broadway and North Water Streets, Milwaukee, is hard clay which is practically self-supporting, the contractor is using steel liner plates. While these plates are expensive in first cost their use has proved economical in labor, according to the annual report of T. Chalkley Hatton, chief engineer of the Milwaukee Sewerage Commission. From gratuitous information given to the contractor before the beginning of the work by those who had done underground work in the city the contractor became convinced that these tunnels would prove troublesome and expensive. He therefore provided full air equipment and steel liner plates. The air equipment has never been used. The bore is lined with steel plates throughout, furnished and placed at the contractor's expense. These plates will be left in, and the concrete shell forming the sewer will be built inside of them. They permit of the removal of the minimum amount of excavation, are easily handled and put in place by one or two unskilled men, require no braces, thus leaving the bore free for operating material cars and placing the concrete, and have many other advantages over timber lining.

Heavy Vault Floor Framed into Existing Columns in Basement of Equitable Building

Difficult Details Encountered for Connections of Steel Girders to Old Columns—Load of 3,000 Pounds Per Square Foot Specified

ESPECIALLY difficult, both in the general design and in the practical detailing of connections to the existing columns, are the problems encountered in the installation of a heavy steel-frame vault to be used by the Federal Reserve Bank for the storage of gold specie and valuables in the basement of the Equitable Building, New York City. These problems were intensified by the extremely heavy load of 3000 lb. per square foot prescribed in order to allow for excessive concentrated loading and for the possible large uniform live loading on the floor of the vault. After outlining the determining requirements for work of this type, there is here given a typical detail of a connection between the new floor girders and the existing columns.



BASEMENT FLOOR PLAN

SECTION AA

PLAN AT BASEMENT FLOOR AND SECTION THROUGH NEW VAULT FRAMING

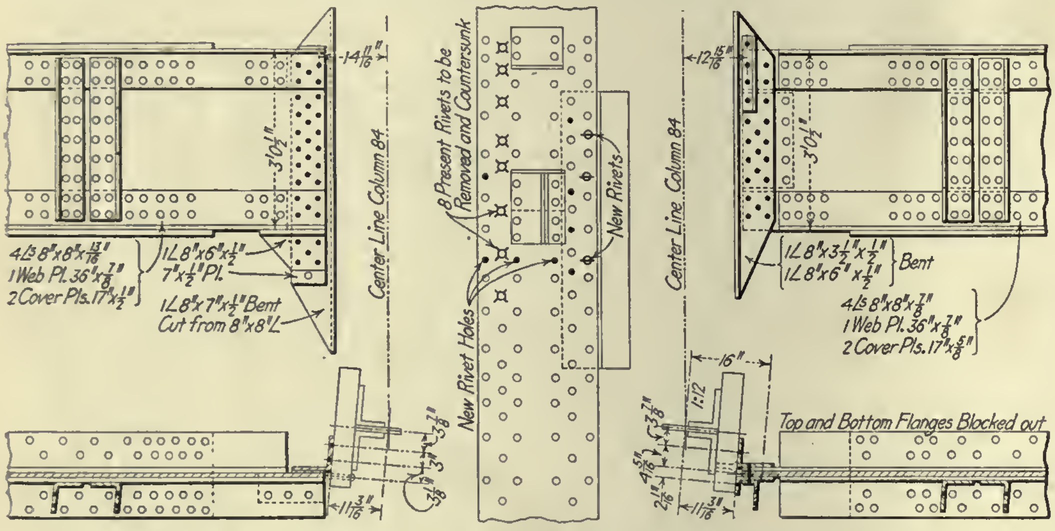
NEW FRAMING IN BASEMENT

As indicated by the accompanying plan view, the new vault is to be placed in the southeast corner of the basement of the Equitable Building. The floor is supported on I-beams carried on the south and east sides by the 6-ft. foundation-wall caissons of the building, and by interior girders framing into the existing columns. The direction of the beams was selected to transfer the load to the foundations by the most direct path. Between columns 84 and 100 two plate girders spaced 18 in. apart on centers were necessary in order to make the connections to the columns practicable and keep the weight of single pieces to be handled within the capacity of the erection rigging.

The first-floor framing plan forming the ceiling for the vault is simple. It consists of 24-in. 73-lb. I-beams spaced 2 ft. 3 in. on centers, all running east and west and framing into 24-in. 140-lb. girder beams, as seen in the section AA. The east ends of these beams rest on the concrete wall of the vault, which is lined throughout on the inside with 4⅛-in. steel plates.

The assumed dead load for the vault floor was 600 lb. per square foot and the assumed live load 3000 lb. per square foot for the beams and girders and 1500 lb. per square foot for the columns. The girder G_1 between columns 83 and 99 carries a huge steel door and frame weighing 96½ tons, the door alone weighing 50 tons. No reinforcement for the main columns, which are of the built-up I-section type, was required to carry the relatively small additional loads, because the slenderness ratio Z/r was decreased by the new framing, and because the revised New York building code allows slightly higher values (for these slenderness ratios) than were permitted when the building was designed in 1912.

The determining requirements in making the connections to existing columns were two-fold. In the first place, the details of the connections between new steel and old columns had to be devised in such a manner as to avoid weakening the main columns. Thus, in some cases, rivets must be added before the existing rivets connecting the cover plates with the main angles are removed. In the second place many difficult problems in devising practicable rivet connections had to be solved. Regular schedules of the successive operations for doing the work are drawn up, with drawings stating what new rivets must be inserted, what rivets cut out, where countersinking is necessary and what new holes are to be drilled.



GIRDER G_3 SOUTH FACE OF COLUMN 84 GIRDER G_2

DETAILS OF RIVETED CONNECTIONS BETWEEN GIRDERS AND COLUMN 84

TYPICAL JOINT DETAILS

The accompanying detail drawing showing the connection between girders G_2 and G_3 and column 84 is reproduced to illustrate one of the problems encountered. In this case it was found impracticable to use a single girder between columns 84 and 100 and make the end connections. It was therefore necessary to frame into the column by a detail which required the eccentric and complicated end connections shown. To avoid interference with rivet heads by the girder G_2, one row of the 1⅛-in. rivets in the column must be cut out and new countersunk rivets driven. In preventing bulging of the cover plates on the columns three new rivets are added on the east side where the eccentric connection for girder G_3, using a single heavy connection angle, requires the removal of both rows of existing rivets on that side of the column.

These details and the design of the framing were worked out under the personal supervision of George Simpson, chief engineer for the contractors, the Thompson-Starrett Company of New York City. The steel is furnished by the Hay Foundry & Iron Works of Newark, N. J.

John Nolen Says City Planning Is for Small Cities as Well as for Large Ones

Holds That Younger Towns Have Opportunity to Avoid Established Mistakes of Older Ones, Not to Be Corrected Now Except at Great Expense

CHALLENGING the common belief that city planning is for large cities only, John Nolen of Cambridge, Mass., fellow of the American Society of Landscape Architects, averred in a paper read at the Eighth National Conference on City Planning at Cleveland this week that the best opportunities are rather in the smaller places. This, he stated, is because the larger places have already grown up wrong, and only the gravest mistakes can be corrected except at great expense, while almost any change is feasible in the small city. He thinks there should be an advisory state planning board, but concedes that even with such a board much would depend upon the local community. He would urge the community not only to adopt safeguarding regulations as to streets, parks, building restrictions and the like, but also to employ experts to prepare a comprehensive city plan at the earliest possible date.

Extracts from his paper follow.

LARGE CITIES AND SMALL

A notion prevails that comprehensive plans are needed only for large cities. The reverse of this is nearer the truth. In large cities the conditions are comparatively fixed and unyielding. Comprehensive planning, especially with our present legal limitations, can occupy only a limited field in larger places, relieving only the worst physical conditions. But with the smaller cities the opportunity is different. Comprehensive planning may be to them of far-reaching and permanent service, for there is scarcely anything in them that may not be modified or changed. Streets can be widened, transit systems properly outlined, building districts defined, park and recreation areas selected, public buildings grouped and a scheme of planning adopted which will have unity and character. We have expended too much of our time and money in almost futile consideration of the ills that afflict our great cities, instead of providing against an unnecessary repetition of those self-same ills in cities that are to-day small, but in which there are clear indications of steady growth.

Two forms of town and city planning have required attention in the past, and will continue to require attention in the future. The first is concerned with villages and towns planned in advance of a settlement of population; the second with existing towns and cities which must be replanned or remodeled to meet new and insistent requirements. Planning a town or village before its settlement has great advantages, but the opportunity is only occasionally possible. The complex influences which determine the selection of the sites for towns and villages and future cities and the locations of the first streets and buildings must usually be left to work out their results by natural forces.

When, however, a small population has been attracted to a village or town by natural causes and there are indications that because of strategic situation, climate, natural resources, the inevitable trend of trade and commerce, the wealth and energy of citizens, or other forces a city of some importance is to be established, then if action is taken soon enough it is entirely practicable and certainly economical to replan the existing town so as to provide more satisfactorily for its present and its future needs.

The planning and replanning of the smaller cities take on added importance when we consider how great is their number, the population affected and their relative rates of increase. Of the total population of the United States, according to the census of 1910, 54.7 per cent is still rural; only 46.3 per cent is urban. Of this 46 per cent more than one-half, or 25.5 per cent of the total population, is included in towns and smaller cities with a population ranging from 2500 to 125,000. Moreover, the relative increase of population is greater in the smaller cities.

NEED OF ADVISORY STATE PLANNING BOARD

Progress in planning for small places under our present form of civic organization is apt to be slow unless cities can have the advice and service of qualified men. Two things would seem to be necessary. In the first place, a state planning board or department of municipal affairs; and in the second, the early adoption by cities, towns and even villages and rural districts of safeguarding regulations and the preparation of surveys and general plans. Like many state boards of health, the proposed state planning board or commission could be largely advisory. The one exception might be in dealing with those matters which concern two or more communities.

Such a planning board would be organized to secure:

1. The identification of the administration of public health, housing, highways and other matters with broad city-planning projects.
2. The employment of technically qualified men in dealing with the physical, sanitary, social and financial problems of cities.
3. The proper regulation of local finance, local expenditures and local indebtedness.

4. The adjustment of public franchises directly connected with city planning.

5. The application of fair and right principles in regard to the extension of municipal boundaries or the co-operation between adjacent communities.

The purpose of such a state board is not to check or limit local government, but to offer it aid and help it to be efficient and economical. It should be recognized that even with such a board good city planning would still depend largely upon the efficiency of the city government and the successful organization and utilization of the best forces of the community, both public and private.

SAFEGUARDING REGULATIONS FOR TOWNS AND CITIES

The safeguarding regulations which should be considered and, if approved, adopted by the various local authorities themselves are as follows:

1. The minimum width for main thoroughfares and the public reservation of land necessary for the same.
2. Provision for narrow streets and roadways of short length in many residential areas.
3. The establishment of building districts defining zones for factories, dwellings, etc., with regard to use, and also the bulk (height and area) of buildings allowable.
4. Provision for some systematic setting aside of recreation open spaces for public use in connection with the extension of the town or city, just as streets are now usually set aside.
5. The laying out or approval of land subdivisions by local public authorities.

In connection with these safeguarding regulations it should be established that property would not be deemed to be injuriously affected by reason of provisions which prescribe the minimum space necessary around buildings, their height, area or character, or which limit the number of buildings to be erected in a given area. There should also be public power to purchase or expropriate land necessary for these wider public purposes, including, when desirable, land within 200 ft. of the boundary lines of any street, park or other public property.

The town or city should have all the power necessary to make systematic local surveys, and to provide a general town or city plan, including the appropriation of the necessary funds, which, in view of the fact that such surveys are largely for the benefit of future generations, might, if it were deemed advisable, be provided for by bond issues. In order that the regulations already referred to shall be wisely placed, a general plan based upon a local survey should be prepared as early as practicable.

PRINCIPAL CITY-PLANNING FAILURES OF LARGE CITIES

Some of the principal shortcomings of large cities from the city-planning point of view are the following:

1. Inadequate systems of arterial streets, including with them a proper consideration of transit problems.
2. Neglect of the regulation of city building according to districts, defining the use of various areas, with the regulation of height of buildings, percentage of lot to be covered, etc.
3. Postponement until it is too late of the reservation of ample lands for park systems and local recreation grounds.
4. Failure to recognize early the advantages, from many points of view, of an orderly grouping of public buildings, conveniently and appropriately located.
5. Neglect of that kind of city planning which would give unity and character to the city as a whole, and enable it better to discharge its functions.

CONCLUSION

City planning can learn much from a study of the history, method and recent success, to say nothing of the rich promise for the future, of preventive medicine. Formerly medical practice was largely a negative program, a program of "don'ts." Now it is mainly positive and constructive. So it must be with town and city planning. The merely corrective and therefore negative program must be displaced by one that is more positive and constructive. Misconceptions, false traditions and hollow superstitions must be put aside. Most persistent of all errors, and in some respects most difficult to combat, is the idea that the beauty of a city consists of mere adornment, that it is on the surface of things, and that beauty in a city is somehow different from beauty in a ship, an engine, a schoolhouse or a factory, and that it is not mainly functional perfection.

In broader matters, in phases which concern many physical aspects combined in one, the notion is widespread that it is too much to expect unity, character and distinctiveness in a city; or if not, that it must be left to come by chance and not by art. Not only in physical phases, however, but in law and expert services and costs, new ideas must, for example, displace such old ones as that laws and constitutions cannot be changed, and that judicial decisions must always be a generation behind the times; that anyone can plan a city, and that trained men have nothing to contribute to the solution of technical problems. Finally, the idea must pass that city planning is a new way of spending money, and not a new way of saving money, and making the most of what we have.

The Automobile and the City Plan

Nelson P. Lewis Discusses the Growth of and Present Tendencies in Motor Vehicular Transportation, and Suggests How They Should Be Met

A FACTOR of rapidly growing importance in city planning is the motor vehicle. The problems introduced and how to meet them were discussed at length at the Sixth Annual Conference on City Planning in Cleveland this week by Nelson P. Lewis, chief engineer of the Board of Estimate and Apportionment, New York City. Mr. Lewis presented much statistical matter pertaining to American and European cities, as well as abstracts of replies received from motor-truck manufacturers to circular questions asked by him. In his conclusions he insisted that the manufacturers must adapt themselves to existing conditions rather than attempt to force changes in those conditions.

"The problem of the motor vehicle in its relation to the city plan," said Mr. Lewis, "is the avoidance of congestion due to concentration of traffic on certain streets and the congestion and confusion which will result from mixed traffic or the presence on the same street of vehicles of different sizes and speeds. The tendency toward centralization has presented a number of serious problems. The garden-city movement and the efforts to control the height, arrangement and use of buildings are protests against this tendency and will, if successful, do much to solve the problem of traffic congestion, more particularly the trouble due to mixed traffic. A mere statement of the number of vehicles passing through a given street does not give an adequate idea of the resulting congestion. Some offer far more obstruction to traffic than others, depending upon their size, speed and flexibility, while the roadway capacity may be such as to cause or prevent congestion."

For purposes of comparison an attempt has been made at standardization in London, and the results were presented in tabular form by Mr. Lewis. The degrees of obstruction assigned to different vehicles range from ½ for cycles to 10 for slow two-horse trucks and the same for electric trams. In general the motor vehicle is rated only about half as obstructive as the horse vehicle, and the fast outfit only half as bad as the slow.

SPECIAL PROBLEMS OF HEAVY TRUCKS

Mr. Lewis's attention was directed primarily, however, to heavy commercial vehicles. "So far as the obstruction of traffic is concerned," said he, "the small commercial vehicles present the same problems as do those designed for pleasure traffic, but in the case of the truck of large capacity an entirely different set of problems is presented, these being (1) damage to pavements by reason of excessive wheel loads, (2) obstruction to traffic by reason of low speeds and (3) occupation of an undue proportion of the street owing to their constantly increasing dimensions."

Feeling that it would be impossible to plan intelligently for the future unless the future demands as to both space and sustaining power to be made upon the city streets could be known, Mr. Lewis has attempted to secure from some of the principal manufacturers and organizations concerned in the design and sale of motor trucks information as to the present practice and expressions of opinion as to the economical limits of size, weight, speed and loads. Of 221 manufacturers in this country producing commercial vehicles at the beginning of the present year, only 88 are offering trucks of more than 3 tons capacity. Fifty-eight have made no change in their models for 1916, twelve have increased their maximum capacity, six have decreased it and twelve are newcomers in the field. Mr. Lewis has found the popularity of 3½-ton and the 5-ton trucks quite noticeable.

PROBABLE MAXIMUM WEIGHTS AND LOADS

Six of the largest makers of trucks, one organization dealing with their design and one devoting itself to the promotion of their use have expressed their opinions as to the probable economic limits of weight, load capacity and load on rear axle. The maximum weight of car is estimated at from 10,000 to 12,000 lb., the load capacity at from 10,000 to 16,000 lb. and the load carried on the rear axle at from 16,750 to 24,000 lb. The load per inch width of tire is estimated at from 600 to 800 lb.—a limit that Mr. Lewis has noted appears to have been fixed by the inability of rubber tires to sustain a heavier load, and not by any consideration of the effect of concentrated loads on street pavements. Mr. Lewis thinks there is a very rational basis for the prediction that the maximum limit of weight will be about 6 tons. "A careful analysis," said he, "of the ton-mile cost of moving material by motor trucks indicates that this cost reaches a minimum in the case of a 5-ton truck at a speed of 9 miles an hour, or a 6-ton truck at 8 miles an hour, the estimated cost being 6.88 cents per ton-mile in the former and 6.87 cents in the latter case. The operating cost of a 1-ton truck at 15 miles an hour is estimated to be 11.33 cents, and that of a 10-ton truck at 5 miles an hour to be 7.40 cents per ton-mile. All these estimates are predicated upon 5 hours of actual running during the day." . . .

"Perhaps the most important consideration from the city-planning point of view," continued Mr. Lewis, "is the size of the vehicle, more particularly its width and its flexibility. The manufacturers and others have indicated that the wheel base varies from 12 ft. 6 in. to 17 ft. 4 in., the over-all length from 22 to 28 ft., the gage between centers of tires from 5 ft. 10 in. to 6 ft. 3 in. and the over-all width from 7 ft. 4 in. to 8 ft., the opinion also being expressed that these will be the probable limiting dimensions. . . .

EFFECT OF WIDE TRUCKS

"If a roadway in which there are no railroad tracks is designed to accommodate four lines of traffic, allowing 8 ft. for each line, which would permit 2 ft. of free space between the great majority of vehicles, and if trucks measuring 8 ft. over all are permitted on public streets this width of 8 ft. for a line of moving vehicles will be insufficient. The roadway capacity will be actually reduced to three lines of traffic, and that means that the street capacity for accommodating vehicles will be reduced almost one-half by reason of the fact that the third or middle strip must accommodate vehicles moving in both directions and the interference will be so great that the capacity of this middle strip will be very small."

Mr. Lewis then quoted several opinions from the motor-truck people to the effect that the city streets must adapt themselves to the development of the motor truck instead of the truck adapting itself to the street. One of them said: "The city street of the future must be wide—very wide—to allow for a line of stationary vehicles near the sidewalk, a line of slow moving vehicles next and a line of fast moving vehicles in the center." Mr. Lewis pointed out, however, that street widenings are very costly, prohibitively so in many cases—even though it is often possible to increase the width of the roadway at the expense of the sidewalk, to eliminate unsightly strips of dirt between the sidewalk and the roadway, or to remove encroachments on the sidewalk. The greatest traffic congestion, he pointed out, commonly occurs on streets where there are costly buildings and where widening is out of the question. For certain points he suggests detours or by-passes, made attractive by means of better pavements and easier grades.

An examination was made by Mr. Lewis into the question of the ability of large trucks to turn corners without fouling traffic in the opposite direction. His conclusion is that the necessity for setting back curb corners has been somewhat overestimated

His inquiries embraced the question of trailers, and some of the responses indicated belief that three trailers might be used, with a total length, including the truck, of 50 ft. It was pointed out that with a suitable coupling trailers would follow the tractor and turn corners without difficulty. Mr. Lewis believes, however, that the number of trailers which may be used in city streets should be limited so that the total length of train should not exceed say, 50 ft., and that special permits should be required for trains as long as this.

Conclusions

In conclusion Mr. Lewis summarized his views as follows:

1. The effect of the motor vehicle upon the city plan of the future will be beneficial in that it will aid in bringing about some of the most important results that city planners are striving to attain, such as:

(a) The discouragement of further centralization by reason of the fact that distances can more readily be overcome and less time will be consumed by men and women going to and from their work.

(b) The diffusion of land values. While they will be increased in the aggregate, sensational increases in some places and stagnation in others will be less likely, and real estate will be put on a more stable basis.

(c) Insistence upon a better class of street and road improvements, they in turn stimulating better improvement of the abutting property.

(d) A better knowledge on the part of the citizen of his city and its environs, through the more general use of the motor car. He will thus acquire a greater interest in the improvement of both and a more widespread interest in city-wide planning will be developed.

GREATER SPEED AND FLEXIBILITY OF MOTOR VEHICLE

2. While the amount of traffic on important thoroughfares will be greatly increased, the greater speed and flexibility of the motor vehicle will permit a much greater volume of traffic to be accommodated with safety in the same street, provided:

(a) That the speed and movement of all vehicles are controlled by intelligent police regulations so that the safety of riders and pedestrians shall be protected. This means regulation of pedestrian as well as vehicular movement and the education of both in the principle of "Safety First."

(b) That the width of commercial vehicles is so regulated that the number of lines of traffic which a street can accommodate will not be reduced and the capacity of the roadway thereby seriously curtailed. This might be accomplished by the imposition of a tax or license fee which would be uniform for all vehicles having an over-all width of 7 ft. or less, with an additional tax increasing in geometrical ratio for each inch of width over 7 ft.

(c) That the wheel loads are so restricted that the sustaining power of street pavement and foundation is not exceeded. The most rational way to do this would be to prohibit wheel loads in excess of 700 lb. per inch width of tire, and these only on rubber tires, the maximum loads on steel tires to be less, or say 600 lb. per inch of width.

3. The greatest congestion, delay and danger will be found where the traffic is most mixed. The traffic problem will, therefore, be simplified if heavy manufacturing, business and residences are confined as far as possible to certain well-defined districts. Regulations having this end in view are becoming more generally recognized as an essential part of good city planning.

4. Horse-drawn traffic requires relatively light grades. Motor cars and trucks can overcome much steeper grades and considerable expense can, therefore, be saved in regulating streets, as they can conform more closely to the topography. The greater speed of the motor vehicle will also justify longer detours to avoid excessive grades, and little time will be lost thereby.

MOTOR VEHICLES MUST ADAPT THEMSELVES TO STREET CONDITIONS

5. While street corners and junctions should be improved wherever possible, manufacturers of motor vehicles should understand that they must adapt their vehicles to street conditions wherever possible, and that they should not be satisfied with present practice and expect the city streets to be adapted to such practice. The mobility of such vehicles, the short turning radius for the heaviest motor trucks, and the ingenuity which has been displayed in the design of trailers which will follow the tractor without the cutting of corners give promise that such adaptation to existing conditions is possible. Every effort should be made to conform with the existing conditions before demands are made for modifications of street details at great cost.

6. With decreasing cost of light motor cars and with the likelihood of cheaper fuel the number of such cars will doubtless continue to increase. The problem of their accommodation in public streets will solve itself with the improvement of the character of road surfaces, although a serious problem will be presented in providing for the accommodation of standing cars. This will undoubtedly require the widening of roadways where possible at the expense of the sidewalks, and the provision at frequent intervals of parking spaces where cars may be left and cared for at a moderate charge.

Pennsylvania Orders 130-Pound Rail

An order for more than 100,000 tons of 130-lb. rail has been placed by the Pennsylvania Railroad. The only difference between the new section and the 125-lb. standard adopted by this road some time ago is in the addition of 1/8 in. of metal on the top of the head and 1/32 in. in the thickness of the web. This makes a total height of 6 5/8 in., base width of 5 1/2 in., width of head of 3 in., depth of head of 2 in. and web thickness of 11/16 in., as compared with the corresponding figures of 6 3/4, 6, 2 15/16, 1 27/32 and 21/32 in. for the 130-lb. section of the American Railway Engineering Association. In this connection it may be stated that the web thickness of the Pennsylvania's 125-lb. rail, given as 23/32 in. in the table on page 221 of the Engineering Record of Feb. 12, where the new 136-lb. rail of the Lehigh Valley Railroad was compared with other heavy rails, should have read 21/32 in.

Levee System Is Expected to Protect Memphis Against Future Floods

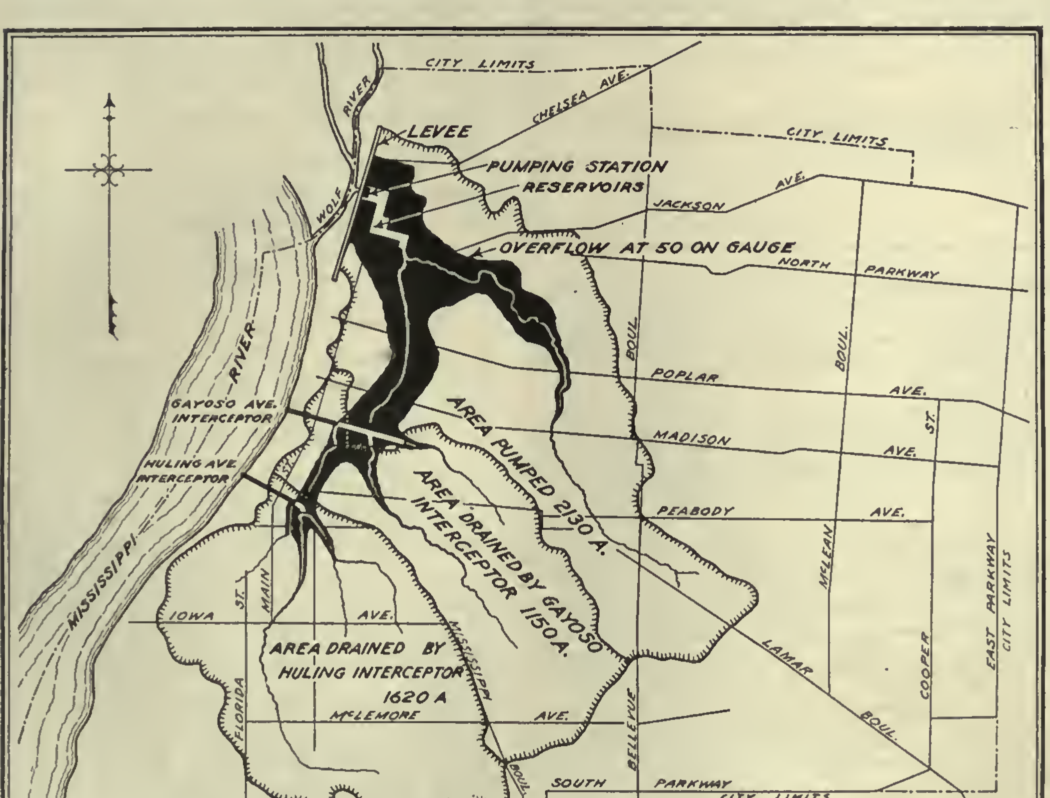
Pumping Plant and Two Interceptors Leading Through Bluff to River Will Take Care of City's Sewage and Storm Water of Bayou Gayoso

By J. H. WEATHERFORD
City Engineer, Memphis, Tenn.

A LEVEE protecting the city of Memphis against the flood waters of the Mississippi River and its tributary, the Wolf River, which joins the "Father of Waters" at the north city line; a pumping station for disposing of the storm water of Bayou Gayoso—a creek flowing north through the city to the Wolf River—and also the sanitary sewage of the city, and the diversion of such parts of the storm water of the bayou as could be carried at all times by gravity into the river—these are the essential features of what is known as the North Memphis levee system, designed to protect Memphis against floods. The work is planned for a stage several feet higher than that reached in 1913.

TOPOGRAPHY OF MEMPHIS

Memphis occupies what is known as the Chickasaw Bluffs on the east bank of the Mississippi River, which bluffs are the western terminus of a ridge of land lying between Wolf River on the north and Nonconnah Creek on the south, that part of the ridge occupied by the city proper being largely from 150 to 200 ft. above low water of the Mississippi River, the crest of the ridge being near the south city limit. A small creek known as Bayou Gayoso traverses the city from south to north along the eastern edge of the main business district, emptying into Wolf River near the north city limits, the banks of this bayou near its mouth being about 35 ft. above low water, or 35 ft. on the gage.



FLOOD AREA ALONG BAYOU GAYOSO PARALLELS THE MISSISSIPPI RIVER

Prior to 1900 the river bed spread over low ground west of the city and did not reach above this stage; about this time, however, as levees were being constructed on the opposite, or Arkansas, side of the river above Memphis, it became increasingly evident that the water confined in the river would reach a higher stage than had ever been reached before. In 1904 a levee system was constructed to confine Bayou Gayoso between banks from its mouth at Front Street and Wolf River east and south along the bayou as far as Poplar Avenue, together with a storm drain for draining the low property back of this levee. This system was satisfactory up to a stage of 41 ft., but early in the spring of 1912 a stage of 45½ ft. was reached, and the water overflowed this low territory.

It was evident then that any plan for leveeing the bayou against such stages was absolutely futile. Steps were therefore taken to prepare a plan which would give protection against a 48-ft. stage on the river. After due consideration it was decided that a 50-ft. stage would probably be reached at some future time and should be provided for, with provision for further additions to protect against even higher stages. The wisdom of this was shown when the floods of 1913 reached 46½ ft. and showed that any year the city might be called on to hold the amount of water which had been figured on in 1912.

THREE PLANS CONSIDERED

Under direction of the Board of Commissioners the writer, as city engineer, was instructed to prepare plans and make recommendation in regard to same. The general plans considered embraced a number of different methods of handling the work. The first method considered was the raising of all streets to a grade equal to 50 ft. on the Memphis gage. The second was the building of a complete system of storm sewers, including a pressure system, through the entire city, with a pump to handle only such parts of the water as actually fell below a 50-ft. stage, and levees along the east side of Wolf River to keep out the flood water from the Mississippi River. The third was the building of a levee, as in the second plan, the diversion of such part of Bayou Gayoso as could be diverted, and the pumping of such water as could not be diverted.

The first of these plans was abandoned after careful study had been made of the expense of raising the streets and adjoining property, and the expense to individual owners in the low-lying territory. The second plan was also abandoned because of the great cost. The third plan was given very serious consideration and after study extending over a number of months the present plan, designated the North Memphis Levee System, and outlined in the first paragraph, was adopted.

The accompanying map shows the location of the levee and pumping station, the territory which would have been flooded during heavy rains at 50 ft. on the gage and the respective areas the drainage from which is to be pumped and which drains through the two intercepting storm sewers into the river.

LEVEE BUILT FOR 52-FOOT STAGE

The levee occupies the right-of-way of the Illinois Central Railroad parallel to and about 200 ft. west of Front Street (600 ft. west of Main Street) and is approximately 6000 ft. long from grade point to grade point, with its top at an elevation of 52 ft. on the gage.

The United States gage used for river elevations is situated practically 1½ miles downstream from the levee site, the normal river slope being practically 0.6 ft. in this distance. The floods of 1912, however, showed a slope of 1.35 ft., and allowance of 1.5 ft. for this slope was used in all calculations. In 1913 the actual slope was 0.95 ft., so that the levee level as established was 52.5 ft. on the 1913 flood records.

Borings along the levee site developed that the entire area was covered by from 3 to 15 ft. of cinders, bark and slabs, and that under this were strata of soft blue river fill, quicksand, yellow clay, yellow sand and blue sand, all resting on an extremely hard blue clay. The levee site was first stripped clear of the cinders, bark, etc., and a line of 35-lb. United States steel sheet piling driven into the underlying blue clay as a cut-off sheeting.

Concrete retaining walls of the counterfort type were built with center of the wall resting on steel piling where it was necessary to prevent the levee from encroaching on private property. These walls varied in height from 14 to 26 ft. Where it was possible to build slopes on the land side a pile every 9 ft. was left extending up to 46 ft. on the gage (6 ft. below levee grade) and a reinforced slab or core wall 12 in. thick built up on these as a frame, there being 540 lin. ft. of this core wall.

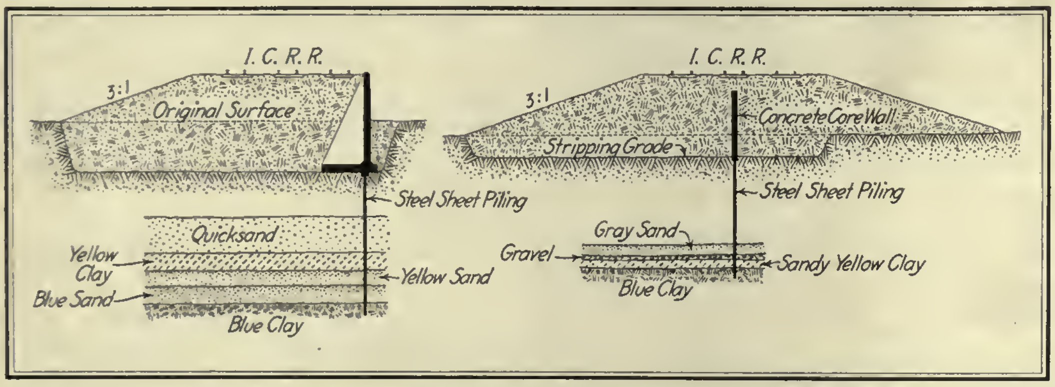
All stripping, sheet piling and concrete walls was done by the city at an expense of $125,000. All earth filling, amounting to 200,000 cu. yd., was placed by the Illinois

Central Railroad, which will occupy the top of the levee with its tracks. The earth levee has a 40-ft. minimum crown, with 3:1 slopes.

PUMPING PLANT DRAINS 2130 ACRES

The total city area which originally drained through Bayou Gayoso and emptied into Wolf River where the pumping station is now located is 4900 acres. Of this it was feasible to drain 2770 acres directly into the river through two intercepting sewers, known as the Gayoso and the Huling interceptors, leaving an area of 2130 acres draining directly to the pumping station.

A study of rainfall curves showed the run-off from this area to 4160 sec.-ft., equivalent to 2 in. of rain per hour, all running off. This, however, occurs after ordinary periods of high water, so that during high-water periods it is necessary to take care of 1½ in. or approximately 3200 sec.-ft. There were available, however, certain low-lying areas along the bayou which were purchased for use as reservoirs. Taking advantage of these the capacity of the main pumps for the station was fixed at 1200 sec.-ft., which with the reservoir storage should be ample even in the severest storm.



TYPICAL CROSS-SECTIONS OF LEVEE WITH AND WITHOUT RETAINING WALL

In order that the pumping lift might be held as low as possible the old bayou levees were retained, thus making it unnecessary to pump until a stage of 40 ft. is reached, and at the same time reducing the pumping lift, since with these levees and the reservoirs it is not necessary to hold the bayou below 35 ft.

The low territory behind these levees is drained by a storm sewer known as the West Side storm sewer, which leads to the pumping station.

The larger part of the sanitary sewage of the city is handled by a 48-in. main which backs out in this low territory at 34 ft. on the gage. The West Side storm sewer crosses under this sewer at Auction Avenue and Front Street, and a by-pass with a sluice gate has been constructed at that point so that the sanitary sewer may be diverted through the storm sewer to the pumping station. A flood gate has also been constructed to cut the sanitary sewer off from the river.

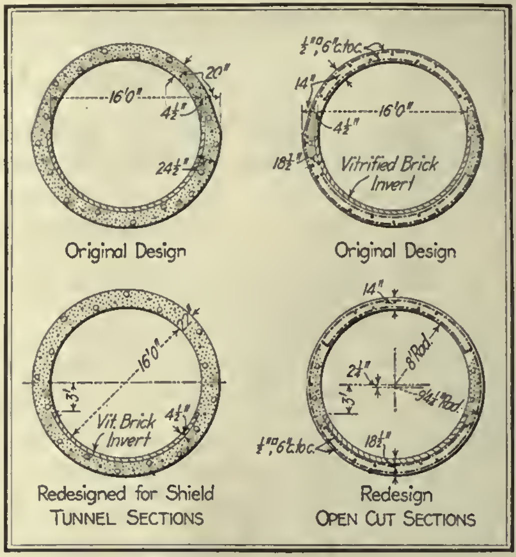
A low-level pumping plant has been provided under the same roof to take care of this water, the capacity of this plant being 160 sec.-ft.

PUMPING STATION DETAILS

The pumping station is a reinforced-concrete structure, 60 ft. wide, 160 ft. long and 100 ft. high from foundation to top of roof, about half of the structure being below ground. The foundation mat or sump floor is of mass concrete 3½ ft. thick with its top at 6½ ft. on the gage, and rests on 1200 creosoted yellow-pine piles driven to blue clay. The west wall, which forms a part of the levee, is 5 ft. thick at the base, 30 in. thick at floor level and 24 in. at 52 ft. on the gage. Under this wall interlocking steel piles, weighing 35 lb. to the square foot, were driven to blue clay. This wall is pierced by four openings in the main part of the building, each 7½ x 10 ft. These openings are closed during periods of high water by rectangular sluice gates of the same size, which gates are opened during low water to permit the bayou to discharge by gravity.

One of the drawings shows a cross-section of the pumping station, together with the twin box culverts under the levee to Wolf River and the semicircular culvert under Front Street.

The pumping station houses two pumping plants, one of 1200 sec.-ft. capacity, operated at stages of 40 ft. or over, and one of 160 sec.-ft. capacity, operated at stages of 34 ft. or over. The main plant operates under a normal head of 15 ft.; the low-level station under a head of 25 ft. (against a 50-ft. stage), which latter head would have been necessary for the entire station but for the low-level system.



INTERCEPTORS IN TUNNEL AND IN OPEN CUT

The main pumping plant consists of four 72-in. double-suction horizontal-shaft centrifugal pumps—each pump having a normal capacity of 300 sec.-ft. against a head of 15 ft. and each pump driven by a 750-hp. three-phase, 60-cycle, 6250-volt induction motor, with a normal speed of 116 r.p.m.

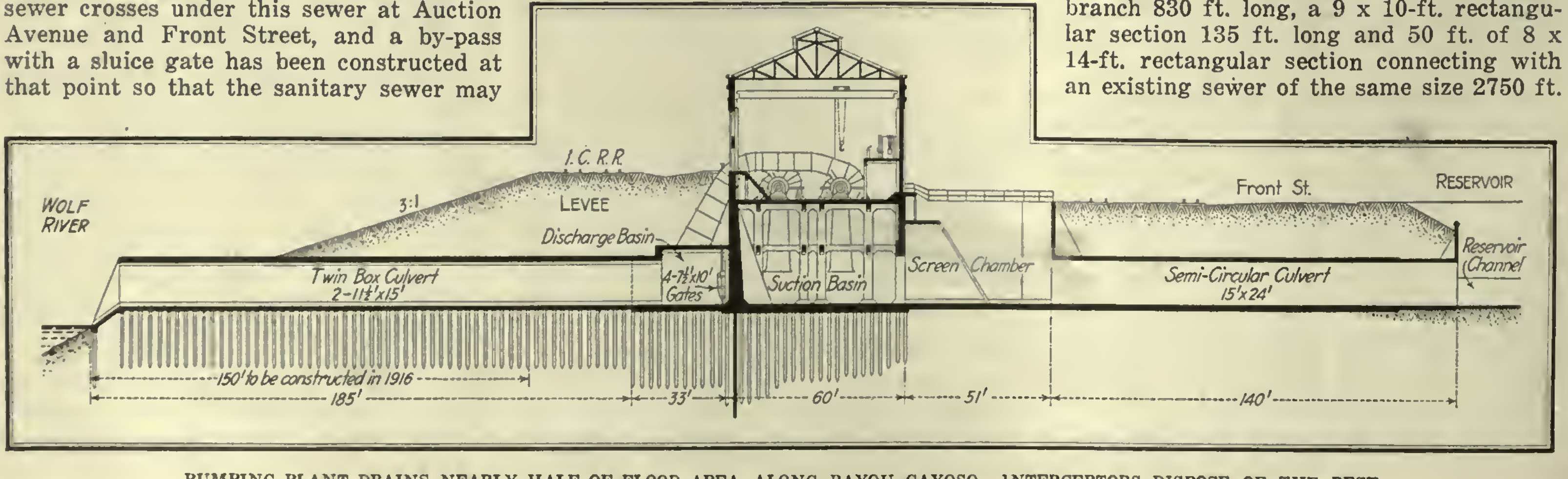
The low-level or West Side storm sewer pumps are in the south end of the buildings, and consist of two 36-in. vertical-shaft centrifugal pumps each of 80 sec.-ft. capacity, and each driven by a 300-hp. induction motor with a speed of 165 r.p.m. controlled from the same platform as the larger pumps.

The pumps and motors were built and installed by the Allis-Chalmers Manufacturing Company, of Milwaukee. The building was erected by the James Alexander Construction Company, local contractors.

DIVERSION SEWERS OR INTERCEPTORS

Reference to the map will show that the river flows south, whereas Bayou Gayoso flows north almost parallel to the river. It was thus possible to divert the bayou directly through the bluffs into the river where ground levels were sufficiently above high water to permit, and two points were selected for this, each being at the confluence of two or more branch bayous—the interceptors being designated by the names of the streets under which they lie as the Huling interceptor and the Gayoso interceptor.

The Huling interceptor drains 1620 acres and is a circular sewer 16 ft. in diameter extending eastward from the river 1925 ft. along Huling Avenue with an outlet apron or spillway 125 ft. long, an 8-ft. circular branch 830 ft. long, a 9 x 10-ft. rectangular section 135 ft. long and 50 ft. of 8 x 14-ft. rectangular section connecting with an existing sewer of the same size 2750 ft.



PUMPING PLANT DRAINS NEARLY HALF OF FLOOD AREA ALONG BAYOU GAYOSO—INTERCEPTORS DISPOSE OF THE REST long. Cross-sections are shown of the 16-ft. section, part of which was built in tunnel and part in open cut.

TUNNEL UNDER SEWER

The construction difficulties of this interceptor were increased by reason of a 36-in. sanitary sewer occupying both Second Street and Huling Avenue and crossing from one side to the other of each street. In the laying of grades for the interceptor this was borne in mind, and along Huling Avenue the top grade was put 5 ft. below the flow line of the sanitary sewer. Fortunately the line along Huling Avenue was of cast-iron pipe and stood the test; had it not been of this material no attempt would have been made to use this street.

Work was started at the river end with a shield 20 ft. in diameter and 9 ft. long driven by sixteen hydraulic jacks 6 in. in diameter. Wood cants 4 ft. long of 6 x 8-in. oak, with the outside cut to a 21-ft. circle, were put in to line the excavation and push against. The shield proved too light and was rebuilt, being heavily reinforced, after moving about 100 ft. Construction was again started, but progress was still slow, and after a total of 692 ft. of tunnel had been driven the shield again failed and was abandoned.

During this construction an air pressure of from 5 to 9 lb. was maintained, all excavation being locked out and materials locked in. Serious troubles, however, were encountered with ground water, and the sand in the bottom 3 ft. proved practically a quicksand, the upper part of the excavation, however, proving quite hard. It was therefore decided to attempt to drive the top half of the tunnel by a cap-and-leg method and to concrete the top half. This method proved fairly satisfactory, although some settlement developed owing to the method of timbering, and the balance of the tunnel was thus driven. Two lines of 1-in. square bars were carried continuously in the bottom of the arch walls to strengthen them during the construction of the invert. The bottom half was then constructed without serious trouble.

Grout pumps were used to force grout into all crevices left by the excavation, and in some cases this grout was forced through to the street surface.

The contractor was the Southern Asphalt & Construction Company.

The Gayoso interceptor drains 1150 acres. It is a circular sewer which extends from zero on the Memphis gage east under the center of Gayoso Avenue and through private property to a point 400 ft. east of Wellington Street. It has 275 ft. of special outlet section, 2805 ft. of 15-ft. circular section, and 1155 ft. of 8-ft. circular section with two branches, a 6-ft. rectangular branch built in tunnel and extending south 570 ft., and an 11½ ft. circular section extending south 420 ft. The contractor was the Thomas-Harmon & Hickey Brothers Company.

This sewer extends through territory that is practically at an elevation of 50 ft. on the gage at two points, and all open-cut work was reinforced against internal as well as external pressure. No openings were made into the tunnel below 55 ft. on the gage, and the ends of all sections were carried into territory that was above that grade. The 15-ft. section is of monolithic concrete 20-in. thick in tunnel and of reinforced concrete 12 in. thick in open cut, all with the bottom third brick lined.

Approximately 1900 ft. was built in tunnel by the shield method under an air pressure of about 5 lb. The shield used was 19 ft. 8 in. in diameter and 9 ft. long and was driven by fourteen Watson Stillman hydraulic jacks. Oak cants 6 x 8 in., 4 ft. long, cut to 9 ft. 10 in. radius outside were used for timbering and to jack against. The balance of the 15-ft. section and the 8-ft. and 11½-ft. sections were built in open cut, a Potter trench machine being used on the 8-ft. section and a traveling stiffleg derrick and clamshell bucket on the other sections.

CONCRETING OF INTERCEPTORS

All concrete on both interceptors was made of Mississippi River "river run" sand and gravel, monolithic concrete being mixed in the proportion of 5 sacks of cement to 1 yd. of sand and gravel and reinforced concrete in the proportion of 6 sacks of cement to 1 yd. of sand and gravel. Vitrified shale brick pavers was used for the brick lining. The open-cut concrete was machine mixed and deposited through chutes, either directly from the mixer or from barrows. The tunnel concrete was placed by the pneumatic method with a mixer made by the Concrete Mixing & Paving Company, of Chicago, the concrete being satisfactorily blown through an 8-in. pipe for a distance of 600 ft. from the mixer. When this distance was reached the mixer was moved up in the completed tunnel and a 10-in. shaft sunk from the surface into the tunnel. The materials were proportioned on the surface of the street and dropped through a door into a lock; the bottom door was then opened and the materials were dropped through the shaft into the mixer. Water was then added and the mix blown by compressed air through an 8-in. pipe directly into the forms and there spread by hand. Blaw steel forms were used almost exclusively on the work.

All plans and specifications for the work were prepared under the direct supervision of the writer and approved by George W. Fuller, consulting engineer, of New York City, with the exception of the plans for the pumps and motors, on which A. B. Wood, of New Orleans, was consulting engineer. The work was carried out under the direction of the writer, with W. A. McTighe, assistant engineer, in charge of construction. The operation of the pumping station will be in charge of Roy Johnson, electrician.

Literature

For the Civil Engineer and Contractor

New Publications

DWELLING HOUSES—A CODE OF SUGGESTIONS FOR CONSTRUCTION AND FIRE PROTECTION. Recommended by the National Board of Fire Underwriters. Paper, 6 x 9 in.; 115 pages; illustrated. New York, the National Board of Fire Underwriters, Ira H. Woolson, consulting engineer, 76 William Street.

RULES FOR CONDUCTING PERFORMANCE TESTS OF POWER PLANT APPARATUS. Report of Power Test Committee, American Society of Mechanical Engineers. Paper, 6 x 9 in.; 215 pages; illustrated. New York, American Society of Mechanical Engineers, 29 West Thirty-ninth Street.

SOME FOREIGN SPECIFICATIONS FOR RAILWAY MATERIALS: RAILS, WHEELS, AXLES AND TIRES. By G. K. Burgess, physicist, and P. D. Merica, associate physicist, U. S. Bureau of Standards. Technologic Paper No. 61. Paper, 7 x 10 in.; 132 pages, illustrated.

Part of program relating to the determination of the causes of failure of railway materials. Discusses and compares the several types of foreign specification and tests of rails, wheels, axles and tires, treated by subjects. Some accident statistics are included.

HYDRATED LIME—HISTORY, MANUFACTURE, AND USES IN PLASTER, MORTAR AND CONCRETE. By E. W. Lazell, Ph. D. Paper, 6 x 9 in.; 95 pages; illustrated. Pittsburgh, Hydrated Lime Bureau of the National Lime Manufacturers Association, Arrott Building. 30 cents.

EXPERIMENTS ON THE ECONOMICAL USE OF IRRIGATION WATER IN IDAHO. By Don H. Bark, irrigation engineer, Division of Irrigation Investigations. Bulletin 339, U. S. Department of Agriculture, Office of Public Roads and Rural Engineering. Paper, 6 x 9 in.; 57 pages; illustrated. Washington; Government Printing Office.

SHINGLE ROOFS AS CONFLAGRATION SPREADERS. An appeal to the Civil Authorities and Civic and Commercial Bodies. Paper, 6 x 9 in.; 21 pages; illustrated. New York, National Board of Fire Underwriters, Committee on Fire Prevention, 76 William Street.

PROGRESS IN RECLAMATION OF ARID LANDS IN THE WESTERN UNITED STATES. By J. B. Beadle, U. S. Reclamation Service. From the Smithsonian Report for 1915. Paper, 6 x 9 in.; 21 pages; illustrated. Washington, Government Printing Office.

REPORT OF PROCEEDINGS, TWELFTH ANNUAL MEETING AMERICAN WOOD PRESERVERS' ASSOCIATION, 1916. Paper, 6 x 9 in.; 432 pages; illustrated. Baltimore, F. J. Angier, secretary-treasurer, Mount Royal Station.

REGULATIONS GOVERNING COAL-LAND LEASES IN THE TERRITORY OF ALASKA. Approved May 18, 1916. U. S. Department of the Interior. Paper, 6 x 9 in.; 86 pages; illustrated. Washington, Government Printing Office.

CONCRETE CONSTRUCTION FOR RURAL COMMUNITIES. By Roy A. Seaton, M. S., professor of applied mechanics and machine design, and superintendent of construction, Kansas State Agricultural College. Cloth, 6 x 8 in.; 223 pages; illustrated. New York, McGraw-Hill Book Company, Inc. $2 net.

IRRIGATION DISTRICTS IN CALIFORNIA, 1887-1915. Bulletin No. 2, State of California, Department of Engineering. By Frank Adams. Based on data gathered under co-operative agreement between the Office of Public Roads and Rural Engineering of the United States Department of Agriculture and the California State Department of Engineering. Paper, 5¾ x 8 11/16 in.; 151 pages; illustrated, and contains several sketch maps. California, State Printing Office.

The fifty-seven irrigation districts in California are described as to location, date of organization, area, value and financial status. The pamphlet also includes a review of the Wright irrigation act and its several amendments, with comment on other legal phases of irrigation district organization.

REPORT OF THE CHIEF ENGINEER OF THE BOARD OF ESTIMATE AND APPORTIONMENT, CITY OF NEW YORK, 1914. Paper, 7 x 10 in.; 235 pages; illustrated. New York, Chief Engineer, Board of Estimate, Municipal Building.

Books Reviewed

Hydraulic Tables

Author, Joseph H. Harper, formerly of Harper, MacDonald & Company, Butte, Mont. Leather, 4 x 6½ in.; 192 pages; 17 illustrations. New York, D. Van Nostrand Company. $2 net.

REVIEWED BY A. G. HILLBERG

Civil and Hydraulic Engineer, New York City

About three-fourths of this book is devoted to tables giving the flow of water in differently shaped channels under various conditions, calculated by means of formulas generally accepted by engineers as giving the best results. The author has divided the book into seven parts and an appendix. Part 1 is introductory, discussing formulas, coefficients of roughness, methods of interpolating in the tables, and the like. Parts 2 to 5 consist of tables for the flow of water in circular pipes, when running full or under pressure; in rectangular open channels or timber flumes; in open trapezoidal channels, ditches and canals; and in egg-shaped conduits, when running full, two-thirds full and one-third full. These tables cover an unusually large range of values, and by straight-line interpolation any desired intermediate values can be obtained.

In Part 6 the author has grouped miscellaneous information and reference tables. The hydraulic units, acre foot and miner's inch have been explained and conversion tables given. The other subjects dealt with are weight or static pressure in fluids, buoyancy, discharge through orifices, measurement of water and the various types of weirs used, tables giving heads and corresponding discharges, and limiting velocities in various kinds of conduits. Part 7 contains discussions of the various formulas, and the appendix consists of tables and charts comparing the various formulas used.

The author has succeeded in compiling a very useful little handbook that will be welcomed not only by office engineers engaged in designing but also by field engineers called upon to determine quickly the quantity of water carried in conduits or discharged over weirs.

The Panama Canal

A Series of Papers Covering in Full Detail the Technical Problems Involved in the Construction of the Canal. Prepared by engineers and other specialists in charge of various branches of the work and presented at the International Engineering Congress, 1915, under the direction of George W. Goethals, major general, U. S. Army, Governor of the Canal Zone. 2 volumes, 25 Papers. Cloth, 6 x 9 in.; 527 and 483 pages respectively; illustrated. New York, McGraw-Hill Book Company, Inc. $7.50 net per set.

This exhaustive treatise is the most authoritative and exact technical exposition of the many correlated tasks accomplished in the monumental work of digging the Panama Canal which is now available. The wide general interest and scope of these tasks is suggested by the fact that, in addition to the more specialized papers covering the engineering work involved, there is also included a general historical and statistical introduction by the present Governor of the Canal Zone, Major-General George W. Goethals, under whose direction these papers were prepared; the commercial and trade aspects of the canal, by Emory R. Johnson; an outline of Canal Zone geology, by Donald F. McDonald; sanitation in the Canal Zone, by Charles F. Mason; preliminary municipal engineering at Panama, by Henry Welles Durham; municipal engineering and domestic water supply in the Canal Zone, by George M. Wells; the working force, by R. E. Wood; the purchase of supplies, by F. C. Boggs; climatology and hydrology of the canal, by F. D. Willson; terminal works, dry docks and wharves, by H. H. Rousseau; coaling plants and floating cranes, by F. H. Cooke, and aids to navigation for the canal, by Walter F. Beyer.

The papers treating the details of the actual work of constructing the canal were written by men in charge, and cover the whole range of engineering problems involved from dry excavation, by Major-General Goethals himself, to the reconstruction of the Panama Railroad,' by Frederick Mears. Among the technically more important of these papers may be mentioned the construction of the Gatun locks, dam and spillway, by W. L. Sibert; dredging the canal, by W. G. Comber; the general design of the locks, dams and regulating works, by H. F. Hodges; the design of the spillways, by Edward C. Sherman; the design of the lock walls and valves, by L. D. Cornish; lock gates, chain fenders and lock entrance caissons, by Henry Goldmark, and the emergency dams above the locks, by T. B. Mönniche.

The work of the publishers is uniformly excellent, both volumes containing a wealth of illustrations reproduced from photographs and drawings. Such books as these should be in the library of every engineer who has a real interest in the monumental achievements of his profession.

Letters to the Editor

Comment on matters of interest to engineers and contractors will be welcomed

Who Must Pay for the Transit?

Sir:—The inquiry of the Pennsylvania engineer in your issue of May 13, page 653, as to whether he could compel payment for damage to a transit knocked over in a city street by a man driving against it, reminds me of a similar experience in the city of St. Albans, Vt., where we, when making surveys for a city sewer system, had a transit upset by a team driven by an intoxicated citizen. It cost upward of $40 to repair the instrument, and acting on the advice of the mayor of the city we placed the claim in the hands of the city solicitor for collection. This public official settled with the person doing the damage for $30 and retained $15 of this amount for his services in effecting the settlement.

Arthur W. Dudley.

Manchester, N. H.

Final Report of Construction of Los Angeles Aqueduct

Sir: For nearly two years the Los Angeles Board of Public Service Commissioners has had in the course of preparation the "Final Report of the Construction of the Los Angeles Aqueduct," which is now complete and the contract for the printing of which has been let.

It is not possible within this short space to enumerate the different subjects which the volume discusses, but it is sufficient to say that we believe the book will not only serve almost as a text to students but will be an invaluable book of reference to every engineer, contractor or other person having to do with large construction enterprises. What commends the volume is that it contains nothing of theory but is an exposition of the methods adopted by practical engineers in the working out of many problems for which, at the time the work was started, few data were available. There are chapters on municipal tufa cement manufacture, dam building, conduit excavation and lining, tunnel boring in hard rock and in shale, the bonus system as applied to tunnels, steel pipe fabrication, sanitation of water supply, cost keeping, etc., and scattered frequently throughout the book are cost data on all the various classes of work.

The size of the book will be 8½x11. It will comprise about 350 pages, in stout library binding, and will be illustrated by sixty-two full-page and twenty-four half-page halftones and thirty-four line cuts of engineering designs. It will be apparent that entirely aside from the collection and placing in manuscript form of the material, the cost of paper and printer's ink would forbid free distribution. We believe, however, that there will be a large demand for this volume and that it will contribute largely to the benefit of the engineering profession. To this end the board has set a price at which it can be obtained of $1.95 delivered. This price is, exclusive of postage and packing on a weight of 5 lb., under the cost of printing. The board of Public Service Commissioners is not in the publishing business. Instead of deriving a profit it compounds a loss by the sale of the volume. Its interest in the book's distribution extends no further than as above stated.

The only requirement insisted upon will be that the sum stated must accompany the order and the order must be mailed immediately, as only the number of copies will be ordered printed for which orders have been received at the time of going to press. Checks should be made payable to the Los Angeles Department of Public Service, 645 South Olive Street, Los Angeles, Cal.

R. F. Del Valle,
President, Board of Public Service Commissioners.
Los Angeles.

Test of Mushroom Flat Slab

Sir: There appeared on page 647 of the Engineering Record of May 13 an article by D. E. Hooker on "Test of Mushroom Flat Slab in Seattle Warehouse," with editorial comment on page 630 of the same issue.

I was not astonished at the contents, or rather the lack of contents, in the article, because the author's attitude toward the building is familiar to me, but the editorial was a surprise until I reflected that the profession of Mr. Hooker and the public position he occupies justified the editor in assuming that the essential facts had been fully stated.

The two chief facts either not emphasized or not supplied by Mr. Hooker, and concerning which there is no dispute, are: (1) The designers had nothing to do with the erection of the building; (2) the reinforcing steel in the slabs was not placed in accordance with the design. A third point, which will not be designated a fact, although I believe it to be such, is the uncured state of the concrete at the time of the test. The concrete was 116 days old, but because of adverse weather conditions had not reached, in the judgment of the designers, its normal strength. Some fair-minded engineers do not concede that the concrete was not in first-class condition and hence no effort will be made herein to accentuate this phase of the controversy, especially as time has eliminated the defect and it will not be a factor in the second test which the superintendent of buildings has repeatedly promised to make, but does not make.

That there is foundation for the contention that the concrete had not attained the strength ordinarily expected at the end of 116 days is proved by the subsequent behavior of the floor slabs. The floor carried a live load of from 420 to 430 lb. per square foot all last winter, and notwithstanding the misplacement of the steel reinforcement there was not the slightest indication, by cracks or otherwise, of undue stresses.

REINFORCING STEEL MISPLACED

The misplacement of the steel, where it has occurred, cannot be corrected and will be a vital factor in interpreting the results of future tests of the building. When the floor-slab tests of April, 1915, were being conducted it became apparent that there was something wrong with the wall panels; a few rough measurements disclosed the misplacement of the steel. A survey was requested, but the men in charge of the test refused on the plea that they were not interested in anything but deformation measurements. Mr. Turner then employed a disinterested local engineer, Climie E. Hill, to make a survey of the steel, and subsequently the owner made one. The two surveys are in substantial agreement; the determinations by the owner indicate a slightly greater misplacement.

The Hill measurements will be cited in this letter. The reinforcing steel over column 79 was found to be within 9/16 in. of the correct position, but the inner ring rod, column 80, which fixed the position of *all* the belt rods running to that column, was greatly out of place, both horizontally and vertically; the top of the rod was designed to be 8 in. above the bottom of the slab; its average height was found to be only 5 1/16 in.—an error in construction of 37 per cent. The position of the steel over the other columns is unknown. Is it remarkable that the two wall panels showed weakness, and is it not eminently unfair in an engineer to write upon the results of the test without specifically calling attention to the degree of misplacement of the steel?

The official report of the test by Professors Fuller and More did not contain a suitable reference to the actual position of the steel reinforcement; it was a report by technical men upon the strength of a structural member without stating the actual dimensions of that member. The professors in a revision of the report for a paper read before the Pacific Northwest Society of Engineers Feb. 9, 1916, did incorporate this paragraph: "Attention is called to the location of the inner ring rod near column 80, the designed position of which is 8 in. from top of rod to bottom of slab. The actual distances are as follows: North end about 4½ in.; at center line between columns, about 5¾ in.; south end, about 4⅝ in. At the center line between columns the rod is about 2 ft. 3 in. from the inside of the wall, where the plans show it about 3 ft. 0 in."

Mr. Hooker has persistently avoided stating the whole truth except when forced to categorically answer yes or no. A fair sample of his dodging of the issue is shown in the paragraph at the bottom of the third column, page 648, which contains the only reference to the misplacement of steel, reading as follows: "The center rod carries a greater stress than the others in the interior panel and a lesser one in the wall panel. As this rod was directly under an aisle, it seems natural that it should be somewhat relieved. The survey of the steel shows this rod to be misplaced in the wall panels and over column 79. This may account in part for the apparent discrepancy, and—also possibly for a portion of the excessive stress at the point near wall column 80."

When the tapered plugs were set no precautions were taken regarding the steel. The only defense made for the omission is the assertion that the placing of steel for the mushroom system is more difficult in the wall columns than in the interior ones, also the dogmatic proposition that a design must shoulder the responsibility of errors in construction!

There is an opportunity for a legitimate difference of opinion regarding the relative merits of the various flat-slab systems. As engineers we should be concerned in ascertaining the real truth, but definite conclusions never will be reached unless investigators in reporting the results of tests rise above prejudice and are precise in the statement of all the facts.

A. O. POWELL,
Consulting Civil Engineer.
Seattle.

SIR: In the discussion of the test of the Bell Street Warehouse, Seattle, presented by Captain A. O. Powell and by Mr. Fixen in the *Proceedings* of the Pacific Northwest Society of Engineers, Vol. 14, No. 1, are given statements of facts as to the uncured condition of the concrete, in conjunction with the misplacement of the steel, quite sufficient to account for the wide divergence between the results of this premature test at Seattle, and the uniform results of scores of others made on well-cured floors of the same design, a divergence which amounts to 100 per cent or more.

In the light of this accumulation of concurrent test data and experience the reported results cannot be seriously considered as any indication whatever as to what the deportment of this same floor would be in its present cured state. The only legitimate conclusion to be drawn from the test is the inexperience and incompetence of those in charge of the test in face of the protest that the slab was in an uncured condition as reported on after investigation by Mr. Fixen, the personal representative of the writer.

The writer feels that he has been unfairly treated by those who made this test, and that a second test of this floor will clearly bring out this fact and make patent the pseudo-scientific character of the published investigation.

This test was paid for by the writer under a rigid stipulation and a written promise or guarantee of the department of buildings that it should be made only when the concrete was thoroughly cured and dried out. This stipulation was not adhered to, and the labored effort to give publicity to a comparison of a test on partly cured work with results on cured concrete are not fair to the designer, Captain Powell, nor to the writer, who reported on Captain Powell's design.

Having contributed more than $1,000 under an agreement that the test made should be made on thoroughly cured work, and since by reason of the inexperience of the investigators this condition was not given business-like consideration, and since the second test has not been made as promised, in order to test the good faith of the parties concerned I will make the following proposition:

I will agree to put up a guarantee of a second $1,000 under condition that a second test on the now cured work be executed in a business-like manner and the conclusions I have condemned as false or erroneous be either substantiated or refuted. If the published results are refuted no money is to be paid over.

C. A. P. TURNER,
Consulting Engineer.
Minneapolis.

[Captain Powell's letter was referred to Mr. Hooker, whose reply follows.—EDITOR.]

Sir: Mr. Powell's comment on my article pertaining to the test of the Seattle Port Commission warehouse would, I am sure, have been considerably different had all of the article been printed as submitted. Judging alone by the article as it appeared, Mr. Powell would be justified in alleging that I was unfair in reporting the results of the test, for the account as printed did not contain all the essential facts pertaining thereto.

However, the manuscript of the article as submitted did contain all the essential data included in the official report made by Professors Fuller and More to the Seattle building department. In my letter to you with which I transmitted the manuscript of the article in question, I made this specific statement:

"Because this account emanates from an official source, it has been confined to a mere statement of facts taken from the official Seattle building department records, and does not contain any personal views or conclusions of the author."

In order to avoid being accused of the very thing Mr. Powell seems to think me guilty of, I studiously avoided the inclusion of any personal views, conclusions or amplifications whatsoever, and confined myself absolutely to a mere statement of all essential data contained in the official report of the test.

As to the position of the steel reinforcement, I wish to state that the manuscript contained a table giving the exact position of the reinforcing rods at each gage line where deformation measurements were taken. Furthermore, the manuscript included the structural details of the slab, including those of the wall column, which latter accounted for and made possible the misplacement of the slab rods. These details of construction also gave the designed position of the reinforcement.

The paragraph which Mr. Powell cites as being a fair sample of my "dodging of the issue" is, as a matter of fact, a verbatim quotation from the official report of the test and is, therefore, not my language.

A fact which should have been mentioned in my article, and which was omitted unintentionally, is that the Seattle building department has promised Messrs. Turner and Powell that a second test of the building will be made if loading material and necessary funds can be obtained.

I will esteem it a favor if you will kindly corroborate the statements made above relative to my manuscript as submitted.

D. E. HOOKER,
Assistant Superintendent, Seattle Building Department.
Seattle.

[Practical limitations in reproducing drawings for Mr. Hooker's article made it necessary to omit the gage numbers and the table giving position of steel which was included in the manuscript. Editorial comment will be found on another page—EDITOR.]

Service of Engineering Societies

Sir: I read with great interest the letter by Prof. F. H. Newell in the Engineering Record of May 6, page 620. The opening phrase, "A society exists to render service to its members," certainly is a valuable one, and I agree that it might be wise to display this on the walls of meeting rooms of every society, but I do not think that it goes far enough. Accompanying such a phrase should be another: "As a member of this society I must assist in rendering service to its members."

The larger a society becomes the more unwieldy it is certain to be. There is no reason why the answer to this problem cannot be taken from commercial life. How does any large business organization similar to the packing companies care for its widespread interests? Is there any reason why the engineering society cannot apply similar business methods to its problems?

In trying to solve the economic problems of the engineering profession a newly formed engineering organization has undertaken its work on this basis, and it contemplates the adoption of those business methods in its work which have proved successful in the commercial world, just as quickly as its membership in any community is sufficiently large to warrant the undertaking of the work. There are ideas of common interest to all classes of engineers which one organization can no doubt take care of with greater economy than if the organization of each class of engineers attempts to perform this service for its specific class of engineers. While the three older societies at present have an established overhead and have branches in many cities, neither of them is equipped to care for the work of any of the others.

It has been asserted that the American Society of Civil Engineers, the American Society of Mechanical Engineers and the American Institute of Electrical Engineers could appoint committees from each to form a co-operative committee to carry on the work which is common to them, but to do so would call for the establishment of an entirely new set of overhead. As a matter of fact it is not clear to the writer how such a committee could be formed without its becoming the equivalent to the new society, the American Association of Engineers. Furthermore, if such a co-operative committee were formed it could do no more work in securing new members without considerable confusion, and one of the great needs of the engineering profession would not be met—that of interesting the "non-joining" type of engineer in co-operative work. At present there are three of this type to every two who have allied themselves to engineering associations, and it is believed that no lasting benefits can be derived through associations until a very large percentage of all engineers have been interested in studying the social and business problems of present-day engineering.

One plan of action was suggested at the meeting of the committee on co-operation held in Chicago April 13 and 14 which might be worthy of the consideration of all engineering societies. It is that all engineering societies co-operate to evolve a plan whereby certain work is assigned to certain societies and all work on subjects of common interest to all engineers be referred to one society, which might thus become a binder of all engineering societies to care for those matters of common interest. The expense of such action might be prorated between the various societies according to the work to be done by each.

The rapid growth of the new association and the ease with which it has convinced engineers of both the employing and employee type of its soundness and fairness, and the acquisition of a large percentage of engineers hitherto not affiliated indicates clearly that this association has found a field of labor which is distinctively different from that of any other engineering society in the field at present.

Arthur Kneisel.

Chicago.

Present-Day College Education

Sir: The writer was very much interested in the discussion between Professors Mead and Swain as to whether the present-day college education produces accuracy and thoroughness which appeared in your issue of May 6, 1916, page 607, and his experience with the young technical graduate leads him to agree completely with Professor Swain's summation. A recent incident, which is not infrequent, but which fairly well illustrates the lack of thoroughness and accuracy in the average finished product of our technical schools, appears to fit in very well with this argument.

At a recent civil service examination for paving inspectors taken by some young men about to graduate from the university with which Professor Mead is connected the examiner desired to test the applicants' ability to interpret specifications in a common sense and accurate manner. Not having a set of specifications at hand he picked out a paragraph in the daily paper concerning the trouble on the Mexican border, in which the word "pacificist" occurred. Upon being asked to define verbally the meaning of the word "pacificist" one of the four near graduates unhesitatingly replied that it referred to a certain type of people living along the Pacific Coast. When asked to name the border states another near graduate named North Dakota, Montana, Missouri and Texas, and this question was asked in connection with the paragraph alluded to.

Certainly these young men had not attained that thoroughness and accuracy in their college education which fitted them to fill satisfactorily the simplest engineering position. They were not taught to think straight.

The writer has recently engaged some twenty young graduates from the three leading universities in this vicinity. Before doing so he received letters of application from many times that number. A careful perusal of these letters substantiates Professor Mead's assertion that the teaching of English is neglected; that the writer passed by those applicants whose letters showed a deficiency in English further substantiates the professor's statement that English is an essential necessary to professional preferment.

The writer is aware that an engineer cannot be turned out of the universities in four years, but he is quite sure that after fourteen years of efficient training the English language should be fairly well learned by the average lad, who begins it at the age of ten and continues it through his entire scholastic life. Is it possible that the entrance examinations for the university are deficient in English, and that the instructors attach to it too little importance? If so they have the wrong viewpoint as to the attitude an employer of engineering services takes toward an applicant who can neither speak nor write English reasonably well.

A graduate engineer is expected to write his thesis either before or soon after his graduation. The writer believes he should be required to write one upon some subject every week of his four years' term, and that particular care should be taken by his instructors in marking his composition and his ability to express himself logically.

The much dreaded weekly composition of ancient days should be revived and carried to the end of the senior year. The declamation would be quite as useful a requirement to the engineer as to the law student. These two arts would do more than abstract mathematics to bring the engineering profession to the place in the public's esteem which it deserves.

T. Chalkley Hatton,
Chief Engineer, Milwaukee Sewerage Commission.
Milwaukee.

Medieval Revival in Warfare

Sir: I have just been reading, in the *Literary Digest*, a review of your editorial on "Medieval Revival in Warfare." (See the Engineering Record of April 15, page 503.) In it you are quoted as saying that the bow has not been used in the present European war. It will interest you, I think, to learn that this weapon has been used to a considerable extent.

When the war first started and the British forces began to dig trenches that were less than 150 yd. (a bow shot) from the enemy, I mentioned, in a letter to James Izzard of the firm of Thomas Aldred, of London, that arrows could be made with little bombs fastened to their ends for use in the trenches. Some time later I received a letter from Mr. Izzard in which he said that he had made two dozen arrows of that sort, to which dynamite bombs about an inch in diameter were to be fastened by means of two wires, and that he had sent them to a British officer of his acquaintance who was an archer. What use was made of this "artillery" (in the original meaning of that word) I do not know.

It is definitely known, however, that bows and arrows were used in Flanders for shooting messages across the border. In fact James Duff, of Jersey City, president of the National Archery Association, says that one of these arrows accidentally pierced a man's neck. The Flemish workmen are nearly all enthusiastic archers. I have talked to many of them, have seen them shoot, and have shot with their bows, which are usually of exquisite workmanship.

I do not agree with you in your conjecture that the bow could be successfully used in repelling a night attack. The trouble is that an arrow has so little shocking force that a man could be hit in a non-vital part and yet pull the shaft out and keep on coming. Furthermore, the bow takes rather long to load and fire, especially in the dark.

Robert P. Elmer,
Champion Archer of the United States.
Wayne, Pa.

HINTS FOR THE CONTRACTOR

Details Which Save Time and Labor on Construction Work

Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

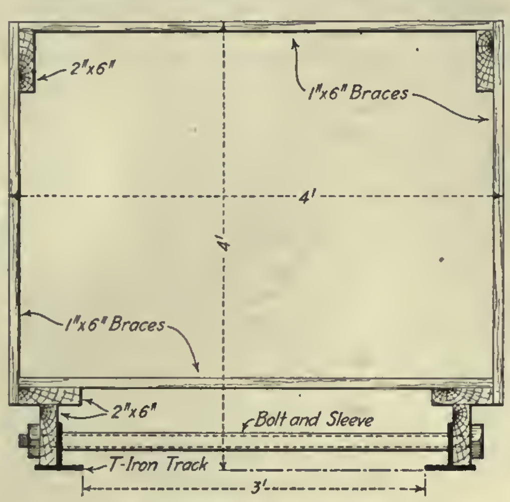
[*Contributions to this section are solicited, and if found available will be paid for. They must be* SHORT, *and should be accompanied, if possible, by photographs or sketches.*—EDITOR.]

Portable Towers Save Large Spouting Installation on Viaduct

By R. C. HARDMAN
Colorado Springs, Col.

SMALL, light towers which were easily erected, dismantled and moved, were used recently on a viaduct 750 ft. long, of light construction and with a comparatively small yardage of concrete, where the expenditure necessary for a central mixing and distributing plant was not warranted. The cost of a central distributing plant, exclusive of the tower, was found to amount to 50 cents per cu. yd. of concrete.

Four suitable locations along the viaduct were selected from which almost the entire structure could be reached with 55-ft. towers. These towers, two of which were provided, were moved by being torn down and re-erected, as the configuration of the ground made it impossible to use a tower that could be moved erect. A cross-section of the tower is shown in the accompanying sketch. As the Wallace-Lindesmith hoist, which runs on a track outside of the tower, was used, it was only necessary to make the framework 4 ft. square. The bolts and spacers between the T-beam rails for the buckets were spaced 3 to 4 ft. apart. Guys were attached to the headframe at the top, which carried two sheaves.



LIGHT TOWER EASILY MOVED

By having two towers, and having one ready in the next location before the one in use was through work, only one hoist, with headframe, track and bucket, was needed. This part of the equipment could be moved in a very short time. Although the towers were used twice in each of the four locations, each removal cost only $25 to $30, and the small amount of lumber required kept the total cost below what would have been necessary for a high central tower. The cost of chutes was reduced to one-fortieth of the cost for a central plant. The total cost of the plant came to about one-fourth of the quotations made for furnishing a central distributing system, exclusive of tower. Neither, in the opinion of the writer, was the cost of placing the concrete increased by this method.

Suggestions for Economical Road Construction

THE USE of an industrial railway in road construction is an economy only under certain conditions in rough grading or in hauling material. In most cases it is economy to complete all culverts as far in advance as possible, and it is of vital importance that material and labor be on hand when the excavation for the culvert is complete. A slight relocation of culverts for small flows is a decided advantage and can be frequently made. The concrete can be put in place rapidly and successfully without the expense of diverting the water. In subgrading contractors often do not trim their rough grading sufficiently close to avoid an excessive cost for cutting the subgrade. Bids ranging from 2 to 5 cents for subgrade are common, with an actual cost of from 5 to 10 cents.

These points were brought out in an address made by Dr. L. I. Hewes, engineer of the federal office of public roads, at this year's Good Roads Week at Cornell University. Dr. Hewes also suggested that the item of hauling and placing of road material be studied carefully before a job is commenced. Such matters may often decide the question of profit or loss on a highway job. It has been found in many cases that while motor trucks and tractor trains are of advantage where good roads prevail, the expense for repairs and lost time under adverse conditions cancels the advantages of speed and capacity.

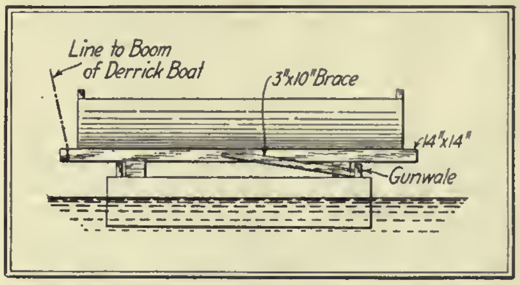
Contractors will find it economical in many cases to deliver stone in piles along the roadbed in advance of the construction of the surface. There exist sufficient data for determining in advance the tonnage of stones of various kinds, spread to various depths, per 100 ft. of road, but because this part of the job is left to guesswork, loss and confusion have often resulted on road contracts. It is an advantage to avoid hauling second-coat material over gravel or macadam foundation.

Machinery should be adapted to the work required. Crushers, for instance, are often used which have a daily output in excess of the roller capacity, and crushers are sometimes purchased which require more power than the engines already owned can develop.

Derrick Boat Hulls Built Afloat and Launched from Barge

By GEORGE W. MacALPIN
Junior Engineer, Ohio River Dam No. 35, New Richmond, Ohio

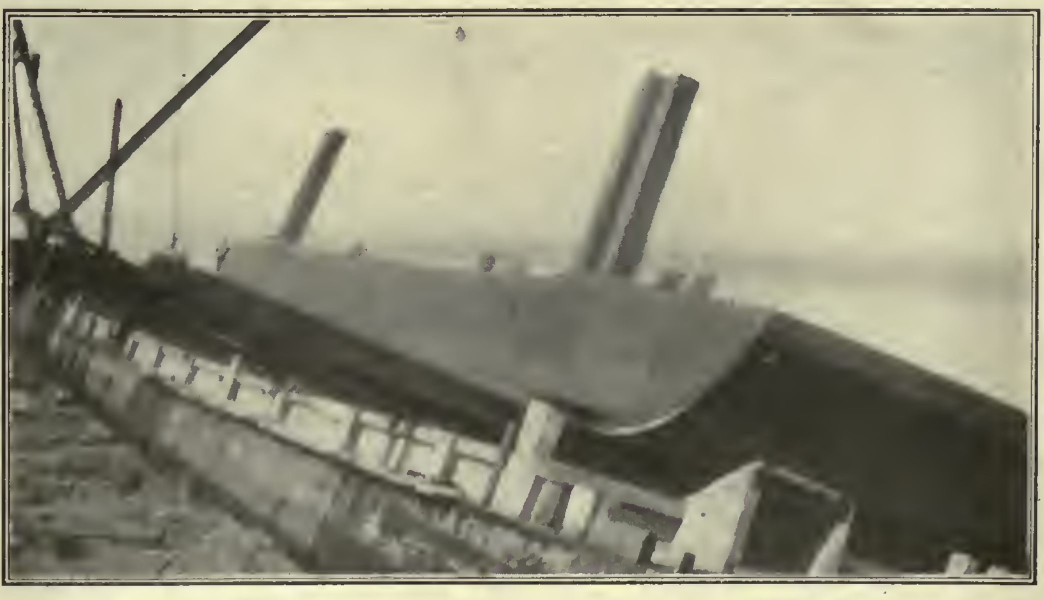
THREE NEW derrick boat hulls were constructed resting upon barges and launched from these into the river during April of this year at dam No. 35 on the Ohio River. This process greatly simplified the construction of the hulls, as the material was brought to the site loaded on barges and placed by two derrick boats stationed alongside.



LAUNCHWAYS BRACED TO GUNWALE

A deck barge, 26 x 80 ft., was used for the purpose. Three 14 x 14-in. 35-ft. timbers were placed across it and blocked up to keep them above the gunwales. The new hulls were built in turn resting directly on these timbers. They measured 32 x 72 ft., 62 in. deep, and were finished complete, except for the decking, before launching.

When a hull was ready to launch the cross timbers under it were braced to the gunwale of the barge to prevent their slipping and given a thick layer of grease.



DERRICK BOAT HULL SLID EASILY INTO RIVER BY TIPPING BARGE UNDERNEATH

Water was then pumped into the barge with two siphons until the deck came within 2 ft. of the surface of the river. Each of the two derrick boats then took hold of the inner end of one of the runway timbers. By taking a strain on these lines the barge was tipped, allowing the water in the hold to rush to one side. Increasing this strain, the barge and runways were tipped to an angle of about 30 deg., at which point the derrick boat hull slid off into the river. So easily was this done that although the hulls were not decked no water was shipped during the launchings.

The derrick boat hulls were built by the contractors, the National Contract Company, for use in constructing the dam.

Accounting for the Contractor—The Columnar Journal

By BENJAMIN L. LATHROP
Lathrop, Shea & Henwood Company,
Scranton, Pa.

AS SUGGESTED in an earlier article, small concerns may dispense with a journal; but assuming that the business shows a normal, healthy growth, it will doubtless be found expedient to adopt a journal, a book which serves as a sort of miniature clearing house for the many and various items which will come into the general office for entry and distribution. The journal serves to index the invoice file, may be utilized to carry information that would otherwise have to be entered in a day-book, and minimizes the number of entries to be carried into the ledger. An ordinary journal contains but two columns for dollars and cents—one for debits, the other for credits. A much more serviceable book for the contractor is the columnar journal. This should contain at least ten columns for figures. Most first-class office stationers carry such a book in stock, or it may pay you to have one made to order, with special rulings to meet the requirements of your business. Consider the time saved in posting to the ledger. A condensed specimen page, starting with the entry of Calvin & Co.'s bills mentioned in the article on invoices published in this section on May 27, is shown herewith. Only seven columns are shown, to save space.

Normally, of course, the entries for a month would occupy several pages, the totals being carried forward from the foot of each page to the top of the next; but the matter is condensed here in order to show the method of closing the journal at the end of the month. Note that the only items requiring daily posting are those that appear in the sundries columns. All the others are posted "in a lump" at the end of the month. The economy of time is much more evident in actual practice than would appear from this abbreviated example, in which an attempt is made to show a comparatively wide variety of entries.

Note the implied suggestion that a ledger account be kept with each monthly payroll. It will be seen that in the foregoing there is an apparent balance of $475.50 due on the "Leeds December payroll." It is assumed that this balance will be covered under an entry from the cash book or check register.

		Dr.						Cr.
1916		Leeds	Corfu	Br. No. 4	N. H. Arch	St. Rd.	Sundries	Sundries
Jan. 2	Sundries	$18.00	$6.50	$40.00	$24.00	$3.00	....	....
	General expense	....	....	....	....	....	$18.00	....
	To Calvin & Co., Dec.	....	....	....	....	....	....	$109.50
4	Sundries	....	4.00	4.00	....	....	....	....
	To Edward F. Fraser, Dec.	....	....	....	....	....	....	$8.00
6	General office expense	....	....	....	....	....	10.00	....
	To G. H. Ingersoll, Nov.	....	....	....	....	....	....	10.00
18	Sundries	3.00	4.20	....	....	....	....	....
	To Jones, Kipp & Lane, Dec.	....	....	....	....	....	....	7.20
20	Leeds Dec. payroll	....	....	....	....	....	325.00	....
	To M. Perri, Dec. (comissary)	....	....	....	....	....	....	102.00
	To R. Sanders, agent (cash advanced)	....	....	....	....	....	....	203.00
	To Leeds shanty (rent)	....	....	....	....	....	....	20.00
	Leeds	800.50	....	....	....	....	....	....
	To Leeds Dec. payroll	....	....	....	....	....	....	800.50
23	Leeds Mfg. Co., Dec.	....	....	....	....	....	1,080.00	....
	Leeds reserve	....	....	....	....	....	120.00	....
	To Leeds (estimate)	....	....	....	....	....	....	1,200.00
28	Leeds	250.00	....	....	....	....	....	....
	To Portland R. R. Co. (freight)	....	....	....	....	....	....	250.00
31	Leeds	$1,071.50	....	....	....	....	1,071.50	....
	Corfu		$14.70	....	....	....	14.70	....
	Bridge No. 4			$44.00	....	....	44.00	....
	North Hill Arch				$24.00	....	24.00	....
	State Road					$3.00	3.00	....
							$2,710.20	$2,710.20

TILE STRUNG ON REINFORCING RODS PROTECTS HOIST HOUSE FROM "TAR KETTLES"

Tile Strung on Reinforcing Rods "Fireproofs" Hoist House

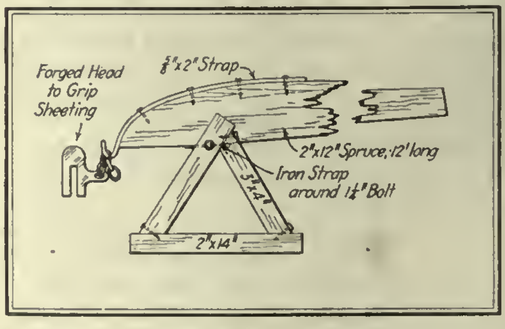
VITRIFIED tile strung on reinforcing rods has been furnishing an economical protection against scorching to the back of the hoist house on the new Seventh Avenue subway just below Forty-first Street in New York City. While waterproofing the subway structure at this point it was found desirable to set the three large tar kettles needed to melt the waterproofing against the back of this house. To protect it from being scorched and possibly catching fire some of the vitrified tile blocks, which are being used on this section of the new subway to back the waterproofing instead of the 4-in. of outside concrete usually employed, were threaded on reinforcing rods. The rods were then stood up against the hoist house at the right intervals and nailed to the eaves. Both the rods and the tile will go into the subway structure later.

This section of the Seventh Avenue subway is being built for the Public Service Commission, Robert Ridgway, engineer of subway construction, by the Rapid Transit Subway Construction Company.

Three-Man Puller Removes Trench Sheeting Quickly

By H. S. CARPENTER
Cobleskill, N. Y.

THE PULLER shown in the accompanying sketch was used to extract trench sheeting at Dunellen, N. J. Made from a few feet of lumber and fittings that can be forged by any blacksmith, it weighed less than 75 lb. and was very easily handled.



PULLER WORKS RAPIDLY

Where the puller could not be set on the side of the ditch, a few planks were put across for a foundation. All that was necessary was to fit the jaw over the edge of a piece of sheeting and pump the lever. Three men were used, one to see that the jaw did not slip off the sheeting and two to pump. It was the fastest puller the writer has ever seen in operation.

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

Charles Sooysmith, Noted Tunnel Engineer, Died June 1

Brought Freezing Method of Excavation to This Country—Built Foundations for Many Big Bridges and Buildings

Charles Sooysmith, prominent consulting civil engineer and contractor, died at his home in New York City June 1. He was the son of the late Gen. William Sooysmith, the eminent civil engineer, of Chicago. Charles Sooysmith was born at Buffalo, N. Y., in 1856. As a boy, on work conducted by his father, he acquired an intimate knowledge of men and of construction methods. Before he was twenty he was graduated from the civil engineering department of Rensselaer Polytechnic Institute, after which he studied abroad for two years.

In 1879 he was made assistant superintendent of the department of track, bridges and buildings of the Atchison, Topeka & Santa Fé Railway. He left that position in 1881 to join his father in the firm of Wm. Sooysmith & Son, engineers and contractors. In 1887 he organized the firm of Sooysmith & Company, contracting engineers, of which he was president. From 1887 to 1897 he constructed, among other things, the foundations of many important bridges, including those over the Mississippi River at Fort Madison and at Keithsburg, Iowa, and over the Missouri River at Kansas City and at Sibley, Mo., East Omaha, Neb., and Sioux City, Iowa. He also directed part of the building of the bridge over the Schuylkill River at Philadelphia for the Baltimore & Ohio Railroad and of the Central bridge over the Harlem River, New York City.

Among other important original work in this line Mr. Sooysmith introduced the pneumatic-caisson method of building foundations for high buildings. He was closely associated with the construction of the Manhattan Life, American Surety, Empire and Washington Life buildings in New York City.

Mr. Sooysmith also introduced into the United States and improved and developed the freezing method for making excavations. He recently perfected plans for the application of that process to the construction of subaqueous tunnels. Mr. Sooysmith's tastes were those of a student rather than of an active man of affairs and, while constantly engaged in some difficult work of the most practical nature, he was able to devote much time to the study of modern languages and literature.

Since 1898 Mr. Sooysmith has practised consulting engineering in New York City. He was employed as an expert on New York's subway construction and was also, at one time, a member of the Metropolitan Sewerage Commission. He was a member of the American Society of Civil Engineers, of which he was a director from 1895 to 1897. He was also a member of the American Institute of Consulting Engineers and many other societies.

Establish Massachusetts Land and Waterways Commission

Governor McCall of Massachusetts has signed an act abolishing the Board of Harbor and Land Commissioners and the Directors of the Port of Boston. In their stead a new body has been created under the title of the Massachusetts Commission on Waterways and Public Lands. All powers and duties of the old boards are to be transferred to the new one, which will consist of a chairman and two commissioners. They will serve terms of one, two and three years from July 1, 1916. Appointments are to be made by the Governor and confirmed by the council. Subsequent terms are to be of three years each. Any member may be removed by the Governor and council. The commission is to appoint and fix the salaries of a superintendent of commerce and a superintendent of engineering. An annual report is required and headquarters for the board and its staff will be in the state house.

George D. Marshall Will Assist Texas Highway Department

As a step toward the perfection of the road system of Texas and a means toward construction of more durable highways, George D. Marshall, superintendent of road construction of the Office of Public Roads and Rural Engineering at Washington, has been assigned by the federal government to the highway department of Texas to act as an advisory officer. The request for the appointment of Mr. Marshall came at the instigation of Gov. James E. Ferguson.

Prominent Consulting Engineer and Tunnel Expert, Died June 1

CHARLES SOOYSMITH

By this arrangement a government road expert becomes available to every county in Texas desiring information as to the best system of road construction, administration and maintenance. The services of the expert to county officials is secured free of charge upon approval of the Governor. The scope of this service will also include bridge and culvert work.

An office has been assigned in the state capitol and a road exhibit is being installed which will include pictures of roads before and after improvement; road models illustrating various methods of construction and maintenance and an exhibit emphasizing the value of physical tests for road materials to determine their adaptability.

City Planners Discuss Effect of Automobile on Street Traffic

First Session of Eighth National Conference on City Planning in Cleveland Centers on Paper by Nelson P. Lewis

The automobile and its effect on street traffic, and so on the city plan, was the topic for discussion at the first conference session of the Eighth National Conference on City Planning, held in Cleveland this week. There was general agreement with the views (abstracted on page 773 of this issue) presented by Nelson P. Lewis, chief engineer of the Board of Estimate and Apportionment, New York City. The main doubt expressed was whether the growing use of the passenger automobile would not increase rather than decrease the congestion in the business districts.

The conference was held in the Statler Hotel, June 5-7. Monday morning was devoted to registration and was followed by a luncheon with short talks. Following addresses of welcome at the beginning of the afternoon session Mr. Lewis read his paper, "The Automobile and the City Plan." George A. Walters presented a paper on street traffic by John H. Gillespie, commissioner of police, Detroit. He spoke of the advantages of one-way traffic on streets.

Effect on Centralization

C. M. Talbert, director of streets and sewers, St. Louis, agreed in the main with Mr. Lewis, but thought the automobile would "discourage further centralization" only in residential and outlying districts, having the opposite effect in central and congested business districts, because of the increased facility for getting into these centers. E. P. Goodrich, consulting engineer, New York City, voiced the same opinion. He suggested as a remedy diffusion of population by the encouraging of suburban development and the laying of smooth pavements to attract autos to various routes.

W. I. Prince, mayor of Duluth, Minn., said that city had solved the problem of extra cost of handling heavy traffic by levying a wheel tax for both horse and motor vehicles proportionate to the number of horses or the horsepower. J. P. Fox, New York City, argued for better regulation of street traffic by a mechanical signal system. W. P. Blair, secretary of the National Brick Makers' Association, urged a systematic survey and the compilation of data with a view to constructing streets to conform to the traffic requirements.

At the evening session Frederick Law Olmstead, president of the conference, spoke of Cleveland's two crying city-planning needs, a coherent and complete system of radial streets and a county park system. Arnold W. Brunner also discussed Cleveland's needs. Lawson Purdy, of New York City, compared the methods of taxation of Cleveland and New York.

An account of the remainder of the conference will appear in next week's issue.

Cement Association Changes Name and Opens New York Office

An amendment to the constitution of the Association of American Portland Cement Manufacturers was recently passed changing the name of that organization to the Portland Cement Association. The association recently opened a New York office at 101 Park Avenue, in charge of Lewis R. Ferguson.

Boston's First Dorchester Tunnel Completed

First of 3200-Foot Tubes Completed by Unusual Methods in Less Than Year, and Second to Be Finished by Aug. 1

Finished considerably ahead of time, the inbound tunnel of the Dorchester tubes under Fort Point Channel in Boston was connected to the finished work of the adjoining section under Summer Street in front of the South Station, June 3. The work was done in just twelve days less than one year after tunnel driving was first started on the contract. It is expected that the outbound tube will be completed by Aug. 1.

It will be remembered from the descriptions of this work on page 218 of the Engineering Record of Aug. 21, 1915, and page 136 of the issue of Jan. 29, 1916, that unusual speed was expected, due to combining light, easily-placed wood block lining and belt conveyors for handling muck from the face to cars behind the head of the concrete lining with pneumatic shield tunneling methods. The progress is said to have come up to expectations, amounting in this tunnel to more than 9 ft. per day for every elapsed day since June 15, 1915. The soil pentrated, it will be remembered from the articles referred to, is for the most part so stiff as to require considerable physical labor in its excavation. Where sandy it was found to contain boulders, which necessitated blasting.

The tunnels have been driven entirely from the construction shaft on West First Street near the southern limit of the contract, as there was no opportunity to erect a shaft plant at the Summer Street end of the work.

Will Hear Speakers at Tech Jubilee in Thirty-Five Cities

By an arrangement of telephone connections between the Massachusetts Institute of Technology and thirty-five cities, the speakers at the institute's golden jubilee celebration this month will be heard over practically the whole United States. Each of the speakers will talk into the telephone and thousands of watch-case receivers have been provided for the audiences. Two main lines of the telephone company will be devoted to the celebration for more than two hours. Connections will be made with most of the big Eastern cities and with many of importance in the West and South.

$2,000,000 Authorized for Roads and Bridges in Porto Rico

Bonds amounting to $2,000,000 have recently been authorized for the construction of roads and bridges in Porto Rico by the Legislature of that island. The principal and interest are to be paid from the proceeds of a special tax on all real and personal property not exempt from taxation. Various roads and bridges are specified for improvement, but the economy commission of the government is instructed to determine a plan prescribing the order of precedence in which the work will be undertaken. The construction is to be carried on simultaneously in the seven election districts of the island so far as is practical.

Make Survey of St. Louis Smoke

The engineering department of Washington University has just completed a smoke survey of St. Louis under the direction of Prof. E. L. Ohle. The report states that the air of St. Louis, despite its smoke, is free from acidity and therefore not harmful to human life, iron or stonework; that anthracite coal may be burned in furnaces without smoke; in large furnaces bituminous coal may be burned without smoke if the overdraft is used. Use of up-to-date stoking appliances and the latest boilers is recommended.

Minnesota Engineers Form Board for Closer Co-operation

The engineers of Minnesota, believing that through the co-operation of the various engineering societies they can be more useful to their communities, are forming the Minnesota Joint Engineering Board. The societies represented are the Northwestern Association of Members of the American Society of Civil Engineers, the Minnesota sections of the national societies of mechanical and electrical engineers, the Minnesota Surveyors' and Engineers' Society, the Engineers' Club of Minneapolis and the Civil Engineers' Society of St. Paul.

It is hoped that through the joint organization the activities of the engineers of Minnesota may be more closely correlated and more accomplished for the public welfare. George W. Pathjens, of St. Paul, is secretary of the board.

Will Prepare Plans for New Haven Sewage-Disposal Plant

The committee on sewage disposal at New Haven has appointed a special committee to prepare preliminary plans for the proposed experiment station. The city has voted a fund for the work of the committee. Frederick L. Ford, city engineer, and Henry J. Kellogg, assistant city engineer, will assist the committee. The government will also co-operate in the undertaking and Dr. Hugh Cummings, as government representative, will help the committee.

Albert B. Hill, consulting engineer, of New Haven, has made a study of the needs of the city and reported to the committee. It is expected that the screen system and submerged outlets will be adopted. Work may be started in about two years.

Motor Trucks Demonstrate Ability to Turn in Narrow Limits

The motor truck is effectively demonstrating its ability to turn in narrow limits in the building of the Twin Peaks tunnel in San Francisco. The accompanying illustration shows a 5-ton White truck being loaded and gives an idea of the difficulties presented in reaching the point of charging.

Engineer Investigates Floods in Northern Minnesota

Prof. Adolph F. Meyer, of the College of Engineering, University of Minnesota, and consulting engineer for the International Joint Commission, has just returned from the northern part of Minnesota, where he was called to investigate flood conditions on the Lake of the Woods watershed. Damage from high water has been serious and the waters are still rising. Professor Meyer stated that if such regulation of these waters as the International Joint Commission will soon recommend to the governments of the United States and Canada had been in force, most, if not all, of the damage could have been prevented.

Postpone Ohio Conservancy Hearing

A majority of the members of the Miami Conservancy Court, at the May 31 meeting, voted to postpone the hearing from June 19 to Oct. 3. Objections to the official plan for flood prevention will be presented at that time.

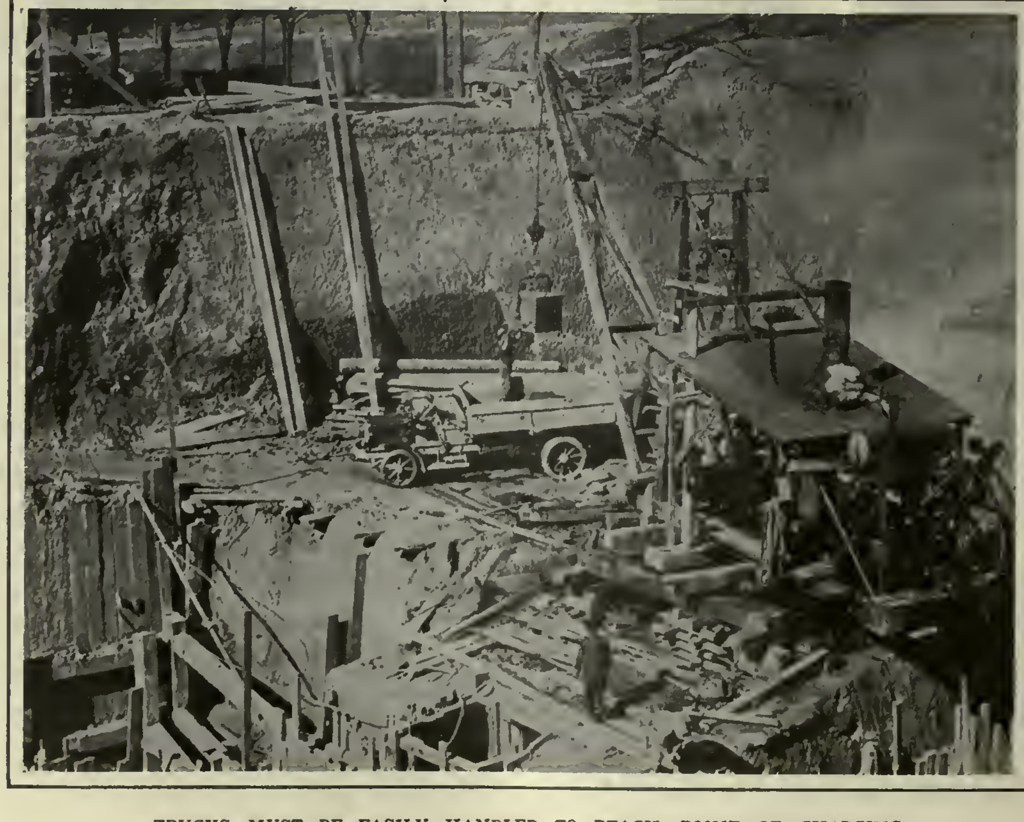
Public Utilities Association Will Hold Convention July 12

The Public Utilities Association of West Virginia will hold its convention at the Chancellor Hotel, Parkersburg, W. Va., July 12 to 14. Representatives of electric light, power, traction and water companies of that state will attend.

Engineering Society Activities

The Engineers of Charleston, S. C., are forming an engineering society in that city. The second meeting was held June 5 in the Chamber of Commerce Building. Thirty engineers attended the first meeting, which was in May.

The Engineers' Society of Western Pennsylvania, at the May 31 meeting, heard A. L. Humphrey, vice-president and general manager of the Westinghouse Airbrake Company, deliver the last of a series of free lectures on military engineering. Mr. Humphrey's address



TRUCKS MUST BE EASILY HANDLED TO REACH POINT OF CHARGING was on the mobilization of materials and industrial resources. An unusually large audience was on hand.

The Edmonton Branch of the Canadian Society of Civil Engineers recently elected L. B. Elliot chairman and C. A. Robb secretary and treasurer.

The Engineers' Club of Baltimore has elected the following new officers: Alfred H. Hartman, president; Henry G. Shirley, vice-president; William D. Janney, secretary-treasurer. Thomas D. Pitts, Edward F. Ruggles and Richard K. Meade were made directors for the next two years.

The Technical Society of Waterloo, Iowa, is working to secure a rigid building code for that city. The society was organized last September and the present membership includes fifty engineers and contractors. Meetings are held the last Friday of each month.

Los Angeles members of five national technical societies held the second annual joint meeting in that city June 1. All topics on the program were allied with preparedness. Dean George A. Damon of Throop College of Technology served as toastmaster and introduced a number of noted engineers, each of whom briefly discussed some phase of the subject or suggested how engineers could participate in the movement. A unanimous vote was cast authorizing the forwarding to the U. S. Senate and House of Representatives of resolutions expressing a desire for preparedness.

The Engineers' Club of Seattle, at the regular weekly meeting June 1, heard C. E. Bogardus, assayer, chemist, testing and inspecting engineer, of Seattle, speak on "Salted Mines."

The National Lumber Manufacturers' Association held its annual meeting in Chicago May 31 and June 1. Most of the addresses referred to purely business problems, such as trade extension, advertising and selling. Of special interest to engineers were papers by Frank D. Chase, consulting engineer, Chicago, on "Why Architects and Engineers Want Branded Timber," and by Dr. Hermann von Schrenk on "Tests of Fire-Resistant Paints."

The Colorado Association of Members of the American Society of Engineers was addressed June 10 by J. B. Lippincott, consulting engineer, of Los Angeles, on "The Construction and Operation of the Los Angeles Aqueduct." L. R. Hinman, the secretary, stated that the regular meetings during July and August will be omitted, but the Wednesday luncheon will be continued.

The Western Society of Engineers was addressed June 5 by J. L. Jacobs, consulting engineer, of Chicago, on "Public Service Opportunity and Preparedness."

What Engineers and Contractors Are Doing

FRANK S. HARRIS has been appointed efficiency engineer of the Oakland (Cal.) municipal government by the Oakland civil service board, succeeding W. P. Smith, resigned. Mr. Harris was formerly in the office of Galloway & Markwart, consulting engineers, of San Francisco. He was also connected with the engineering department of the Panama-Pacific International Exposition.

WILLIAM E. IRVING, of the engineering department of the Pennsylvania Railroad, has been transferred to Parnassus, Pa., to work on the construction of a branch line of that road in Westmoreland County.

ALFRED C. GREGORY, engineer of sewers and water of Trenton, N. J., has been appointed chief aid for Mercer County in carrying out the program of industrial preparedness outlined by the Naval Consulting Board of the United States.

W. H. SCALES was recently made chief engineer and secretary of the Blackhawk Construction Company, of Waterloo, Iowa.

FRED GONYOU, chief engineer of the Dominion Sugar Company, has been sent to Chatham, Ont., where a new million dollar plant is being erected by his company.

CHARLES PRATT has resigned as city engineer of Chanute, Kan., to take a similar position at Erie, Kan.

G. N. WOOD, formerly in the engineering department of Douglas, Ariz., has been made city engineer of Chanute, Kan.

C. J. DONALDSON, whose appointment as county surveyor for Montrail County, North Dakota, was noted in the Engineering Record of May 22, 1915, has resigned to become associated with Swearingen & McCulloh, consulting engineers, of Great Falls, Mont. Mr. Donaldson has had nearly twelve years' experience in municipal engineering. The firm with which he now becomes associated specializes in the design of municipal utilities.

B. L. FIELD, assistant superintendent for Robert G. Lassiter & Company, engineers and contractors, of Oxford, N. C., has been transferred to Wilson, N. C., to start work on a paving job of 100,000 sq. yd. in that city.

FRANK C. SMITH is now employed by the engineering department of the Central of Georgia Railway at Savannah, Ga. He was previously engaged in general engineering work in Florida.

A. N. JOHNSON, for many years Illinois state highway engineer and now consulting highway engineer for the Portland Cement Association, has been appointed chairman of a subcommittee of Committee D-4 of the American Society for Testing Materials to investigate and report on tests for concrete aggregates in concrete roads. Mr. Johnson's committee will make its first report at the Atlantic City meeting of the American Society for Testing Materials, June 29.

NEIL MCDONALD, general contractor, of Seattle, has removed his office to larger quarters in the Joshua Green Building.

J. M. SUTTON, foreman for the Foundation Company, has been transferred to Wellsburg, W. Va., to take charge of placing reinforcing for a steam power plant being built for the American Gas & Electric Company. Mr. Sutton has been foreman for the Foundation Company on jobs in Washington, British Columbia, Michigan, Missouri and New York.

RICHARD LAMB, consulting engineer, of New York City, has removed his offices to 90 West Street.

G. J. REQUARDT, whose appointment as head of the department of franchises and privileges of Baltimore was noted in last week's issue, has resigned to become connected with Norton Bird and Whitman, engineers, of Chicago and Baltimore. Mr. Requardt is at present located in the Baltimore office.

EDGAR E. CALVIN was elected president of the Union Pacific Railroad May 31. He was previously vice-president and general manager of the Oregon Short Line.

C. R. BUDD, of Gloucester County, New Jersey, has been made a member of the Delaware River Bridge and Tunnel Commission, succeeding the late Elwood Usinger.

W. H. KNAUS has resigned as engineer for the Alton-Slater Water Company, of Slater, Mo., to become engineer for the Anderson Land Company, of Cedar Rapids, Iowa.

E. WILLIAM KOHL, JR., has resigned as chief engineer of the Spanish-American Iron Company to open an office as consulting engineer and contractor at Central Borjita, Dos Caminos, Oriente, Cuba. He held his recent position for seven years. Mr. Kohl began engineering work with the Philadelphia & Reading Railway in 1902. He assisted in the installation of a sewer system in the borough of Norristown in 1905 and 1906, after which he entered the engineering department of the Pennsylvania Railroad. He became connected with the Spanish-American Iron Company in 1909 at Daiquire, Cuba.

BARTLETT & RANNEY, consulting engineers, of San Antonio and Dallas, Tex., have been engaged by the city of Austin to inspect the Austin dam on the Colorado River. It was rebuilt and recently completed by the contractors when a controversy arose over certain changes in the plans and methods of construction. A comparison will be made of the structure as it now is with the original design.

PELLISSIER & DIBBLE, engineers and architects, of Springfield, Mass., have removed their offices to the Third National Bank Building.

J. W. ELLMS, consulting engineer, of Cincinnati, has been retained by the city of Cleveland to take charge of its Division Avenue filter plant, which is expected to be in operation July 1.

JOHN E. GEORGE has been appointed assistant to Frank H. Zouck, chairman of the Maryland Road Commission.

J. WIGHTMAN CLEAVELAND, formerly assistant engineer of the sewerage commission of Baltimore, has resigned to become supervisor for the E. I. du Pont de Nemours Powder Company.

CALVIN W. HENDRICK, city engineer of Baltimore, has been made chairman of a commission to revise the building code of that city.

ERNEST WILLIAM MOIR, director of S. Pearson & Son, Ltd., of London, and representative of the British Ministry of Munitions in the United States, was recently made a baronet. Mr. Moir is an engineer of world-wide repute. He studied at the West of Scotland Technical College and at University College, London, England, after which he joined the staff of Sir William Arroll on the construction of Forth bridge. He had charge of the caisson work, using caissons over 70 ft. in diameter. He superintended the driving of the Hudson tunnel at New York in 1888, but the work was stopped after 2000 ft. had been completed. In 1891 he was engaged by S. Pearson & Son, Ltd., to construct the Blackwell tunnel. Since then he has completed the national harbor works at Dover costing more than $20,000,000; constructed the largest tube railroad in London for the Great Northern & City Railway and completed the East River Tunnel at New York City for the Pennsylvania Railroad. Mr. Moir has been a director of S. Pearson, Ltd., since 1899.

Obituary Notes

ELWOOD USINGER, member of the Gloucester County (N. J.) Board of Freeholders and one of the leading road and bridge builders of New Jersey, died May 31 at the age of 68. He was a member of the Delaware River Bridge and Tunnel Commission.

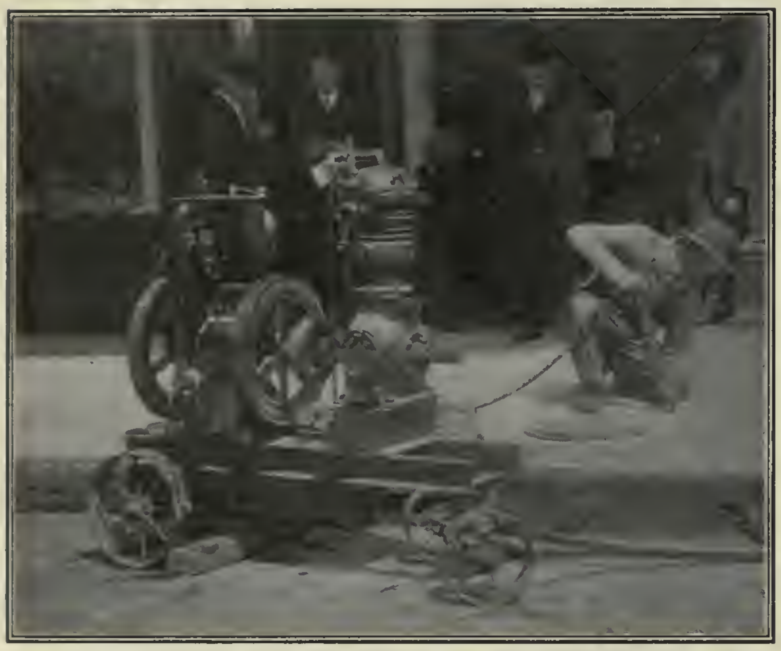
ARMORY COFFIN, consulting engineer, of Phoenixville, Pa., died at his home in that city June 5 at the age of 75. Mr. Coffin was connected with the design and construction of many important buildings and was for many years chief engineer of the Phoenixville Iron Company. He also served in the Civil War. His membership in the American Society of Civil Engineers dated back to 1875.

FREDERICK SEWALL BROWN, railroad contractor and engineer, died May 31 at Evanston, Ill., at the age of 62. He was born in Bangor, Me., and had been engaged in the contracting business for twenty-eight years. He was a member of the Western Society of Engineers.

New Stone-Roughing Outfit Perfected by Illinois Company

The Gardner Governor Company, of Quincy, Ill., offers to engineers and contractors the first outfit ever constructed for roughing stone. It has been tested by the Brinkoetter Monumental Company, of Quincy, and the first machine is said to have operated successfully in that city and vicinity.

The outfit consists of an air-cooled air compressor driven by a gasoline engine mounted on a light steel truck. An air receiver is held under the truck. The compressor is a Gardner-Rix vertical, air cooled, oil-splash lubricated machine connected to the engine by a coupling. The compressor valves are of thin flexible sheet steel and cannot be drawn into the cylinder.



NEW PORTABLE MACHINE FOR ROUGHING STONE IS OPERATED BY AIR COMPRESSOR DRIVEN BY GASOLINE ENGINE

The tool is an ordinary plug drill fitted with a case-hardened steel block with sixteen sharpened raised points. The block has a wire handle which helps to guide the tool. In chipping around cracks and posts set into the sidewalk a trimming tool is used. An unloading device regulates the air pressure for the most efficient work.

Ring Around Piles Repels Borers

A device was recently put on the market in California to protect piles from marine borers. Constant friction and blows are given the pile by a metal ring suspended 16 in. below the surface of the water and surrounding the pile. The ring fits the pile loosely and is raised and lowered automatically by blocks of wood which are secured to the ring by chains. Waves and the tide raise and lower the ring and revolve the floats constantly, rubbing against and delivering sharp blows on the side of the pile. Borers enter or attack the pile from the exterior about 2 ft. below low tide up to the high-tide line. After attachment they take several days to enter. To live they must maintain their connection with the original point of entrance.

The idea of the device is that blows of the floats and rings will kill the animal by force and injure the siphons maintained at the surface. The inventor, Alva L. Reynolds, who controls it, asserts that his protector will prevent attacks on new piles, save the sound portions of old piling and clean piling of any type of marine life, barnacles, mussels, moss or seaweed. Six hundred piles supporting Neptune Pier, at Long Beach, under observation for sixteen months for abrasion, are said to have shown no attacks and no appreciable wear.

The device is controlled by the Common Sense Pile Protector Company, Long Beach, Cal. Protection service per year, and not the device, is sold.

Pipe Company Leases Big Mills at Columbia, Pa.

The A. M. Byers Company, of Pittsburgh, has leased the plant of the Susquehanna Iron Company, at Columbia, Pa. The works consist of the Columbia and the Susquehanna plant. The Susquehanna works consist of a puddle mill with thirty-two single furnaces and equipment of squeezers and muck bar mill. It will make puddled iron for the Columbia mill. The pipe mill at Columbia contains one buttweld and one lapweld furnace.

D. F. Manice of the Pittsburgh mills has been appointed manager of the Columbia works; L. M. Johnston will be general manager. At the South Side mills the company is adding a 750-kw. turbo generator unit furnished by the Kerr Turbine Company, of Wellsville, N. Y.

New Construction Eliminates Broken Sidewalk Lights

By setting square sidewalk lights in a metal holder with waterproof expanding material and embedding the holder in cement, breakage due to unequal expansion of glass and conduit is reduced to a minimum. Steel V-shaped angles placed with the point down support the holders and shut off a minimum amount of light. Another advantage claimed is the ease of replacements, as no chipping of the cement is necessary. The lights are made by the Bayley Structural Iron Company, of Milwaukee.

Introduce Imported Tracing Cloth

A new brand of imported tracing cloth has recently been put on the market by the Defiance Manufacturing Company, of New York City. Its transparent and erasing qualities are said to have exceptional merit. The brand is known as Stirling. Branch offices of the Defiance company are in Boston, Philadelphia and Chicago.

Chicago Steel Company Buys Plant at New Castle, Del.

The American Manganese Steel Company, of Chicago, has purchased the plant of the Brylgon Steel Casting Company, at New Castle, Del., having a monthly capacity of approximately 400 tons of steel castings. The company now has two plants at New Castle and one at Chicago Heights, Ill. The newly acquired plant is rapidly being converted into a manganese steel foundry of the latest and most efficient type. Actual production is expected to start July 15.

Business Notes

The Traylor Engineering & Manufacturing Company, of Allentown, Pa., has acquired control of the Cement Gun Company and elected officers as follows: President, S. W. Traylor; vice-president, W. J. Roberts; secretary, F. R. Crispen; treasurer, H. Battersby; general manager, B. C. Collier.

Edward T. Terry has formed the Edward T. Terry Manufacturing Company, Grand Central Terminal, New York City, to carry on the business of manufacturing cranes, derricks and structural steel formerly handled by the Terry & Tench Company, Inc. The business of the Terry & Tench Company, with the exception of the above departments, will be carried on as usual and the offices of both companies will be continued at the address given.

Trade Publications

The following companies have recently issued trade literature:

John A. Roebling's Sons Company, Trenton, N. J. A new 9½ x 6½ in., 16-page publication for users of wire rope.

Wallace & Tiernan Company, Inc., New York. Booklet 8½ x 4 in., 11 pages, "The Cost—Hypochlorite vs. Liquid Chlorine."

Ingersoll-Rand Company, New York. Booklet 9 x 6 in., 44 pages, illustrated. Construction and advantages of Leyner-Ingersoll water drills.

Municipal Engineering & Contracting Company, Chicago. Catalog, 8 x 9 in., 32 pages, illustrated. Austin cube concrete mixer is described and use illustrated.

Heltzel Steel Form & Iron Works, Warren, Ohio. Two booklets, 11 x 8 in., 14 pages, illustrated. One on steel road forms, the other on steel curb and gutter forms.

American Abrasive Metals Company, New York City. Booklets describing uses of "Feralun" insert strips for stairways and sidewalks to prevent slipping of pedestrians.

Zelnicker Supply Company, St. Louis, catalog, 8½ x 3¾ in., 10 pages. A list of special bargains in second-hand equipment for contractors.

Biehl Iron Works, Reading, Pa. Catalog F, 9 x 6 in., 48 pages, illustrated. Contractors' equipment. Contains several tables and is accompanied by circular describing this company's improved car loader.

Osgood Company, Marion, Ohio. Circular 14, 8½ x 11 in., 12 pages, illustrated. Describes the "Osgood 18" ¾-yd. traction steam shovel for sewer-trench excavating. Contains several cross-sections.

Turner Construction Company, New York. Booklet, 8½ x 11 in., 14 pages, illustrated. Contains photographs of buildings erected by this company and outlines its policy in handling contracts.

National Transit Pump & Machine Company, Oil City, Pa. "Transit" bulletin 302, 9 x 6 in., 16 pages, illustrated. Shows improvements effected in this company's new vertical triplex, single-acting power pumps.

Trussed Concrete Steel Company, Youngstown, Ohio. Booklet, "Kahn Pressed Steel Construction," 8½ x 11 in.; 23 pages; illustrated. Fire-resistive floor construction by use of pressed-steel beams, Hy-Rib, pressed-steel joists with either reinforced-concrete beams or steel I-beams is fully illustrated, with tables for safe loads and general specifications.

National Tube Company, Pittsburgh, Pa. Bulletin 5, 8½ x 11 in., 88 pages, illustrated. Specifications and useful tables. Mechanical properties of solid and tubular beams, safety factors and safe working fiber stresses, flow of streams and synopsis of contents. Numerous photographs of buildings in all parts of the country in which National pipe has been installed.

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"Without Yielding Principles"

IN LAST WEEK'S issue the Engineering Record published part of Dean Marston's address on the qualifications of the engineer. In abstracting the paper it was necessary to omit a paragraph containing an epigrammatic expression that the young men coming out of college—and all young men—may well grave deeply on their memories. Speaking of the fundamentals of successful manhood, Dean Marston emphasized the importance of the "ability to make friends without yielding principles." *The ability to make friends without yielding principles* —what an epitome of the philosophy of true success! But the clause really expresses far more by indirection than the words themselves signify. What trials of moral strength, what pictures of careers hanging on a single decision does it bring us! The thought might well furnish food for much reflection. Suffice it, however, to point out that the friends, or supposed friends, who are lost by adherence to one's principles are not those whose loss should be bemoaned. The friendships that are really worth while are not jeopardized by staunch adherence to the truth. That should not deter one, however, from trying to cultivate those qualities which will enable one to continue friendships, to expand one's circle and at the same time cling fast to those principles without which there is no true success.

Water Analysis Not Black Magic

ONE of the big problems of the state health department, as cited by L. H. Van Buskirk at last week's convention of the American Waterworks Association, is to convince the public that the water analyst cannot be expected to pass judgment upon samples by means of black magic. He needs more than a pill bottle full of water to reach reliable conclusions as to whether or not the supply is fit for domestic consumption. The sample is of little value for analytical purposes unless it is accompanied by a specific explanation as to the conditions under which it was obtained, and, if possible, general information regarding sanitary conditions on the watershed. In fact, there developed at the meeting of the association's chemical and bacteriological section a strong tendency to attach more significance to the results of a sanitary survey than to the analysis of water samples indiscriminately collected. As John W. Alvord pointed out, the public has grown to expect from engineers answers correct to several decimal places, even though the data upon which such results are based are incomplete. This impression has been allowed to exist long enough. If an engineer is properly to exercise his judicial functions he must have all of the evidence at hand. Obviously this consideration applies to other fields of engineering than those which demand the service of the sanitary expert.

A. S. M. E. Power Test Code

CODES of practice are subject to limitations when their universal application is attempted, but it is difficult even for the trained worker in the field of power production to find anything fundamental lacking in the "Rules for Conducting Performance Tests of Power Plant Apparatus," recently published by the American Society of Mechanical Engineers. These rules represent a vast amount of unselfish labor on the part of the society's committee, and of the engineers, both inside and outside the organization, who discussed the preliminary report. Occupying a volume of 215 pages, the rules are nevertheless put forth in a form easily carried, compact in arrangement, with excellent cross-references and a completeness of detail which challenges admiration. It is not too much to say that the committee and its advisers have produced a classic handbook of practice in the field of prime-mover testing. The committee has done well to edit the code in such a way that its various sections can be utilized in the minimum time. A virtual standard of test procedure has been adopted, following these lines of thought: Object and preparations, apparatus and instruments, operating conditions, duration of tests, starting, stopping and records. In its wealth of detailed information about accepted units and standards of operation; its complete sample log-sheet forms; its examples of how various intricate problems associated with plant investigation are calculated from observed data; its treatment of tests of separate items of equipment, from gas producers to waterwheels, the code affords a valuable addition to the analytical resources of power engineers.

Engineering and the Dollar

IN the efficient operation of waterworks pumping plants attention is generally focused upon the engineering problems—the purchase of coal upon a heat-unit basis, the covering of steam lines to prevent loss by radiation, water evaporation per pound of coal, etc. In fact, these fields are so rich in opportunity for profitable study that the engineer is apt to forget that the pumping station involves a human, as well as a mechanical, problem. Some sound advice on this subject was given at the recent convention of the American Waterworks Association by Captain H. G. H. Tarr in his discussion of J. N. Chester's paper dealing with test duty and operating results. "Hitch up engineering with the dollar" has been the slogan which Captain Tarr has preached to all of the young men who have served on his staff. Applying this principle to the small waterworks pumping station, Captain Tarr made a plea for giving to the firemen some incentive for better work. He advocated, in effect, that a bonus be paid, based upon a specified scale of coal consumption. Such practice has a precedent in the operation of transatlantic liners, where the conservation of coal obviously is a factor of far greater importance than it is on land. Here the bonus system has worked with excellent results, for it takes into consideration the human problem and rewards a man in proportion to the care and intelligence he exercises in the operation of his boilers. It is safe to assume that none of the remarkable tunneling records would have been accomplished without the bonus system. There is food for thought in the application of the bonus system to pumping-plant operation. Certainly the scheme has demonstrated its value in other fields. There is no apparent reason why its success would not be equally well assured if its use became more general at waterworks pumping plants.

Are Better Contracts Coming?

IN a widely discussed paper read in March before the Engineers' Society of Western Pennsylvania J. W. Rollins called attention to the evils of present practice in contract writing for which Engineering Record proposed a remedy in an editorial in the issue of May 27. His paper, which ably presented the losses occasioned by these shortcomings, with favorable and pointed discussions by J. A. L. Waddell, C. L. McKenzie, Samuel E. Duff, G. W. Snyder and other men of authority, has recently been issued in the March *Proceedings* of the society. This statement not only proves that reform is needed, if further proof were required, but brings out the point that the wasteful clauses attacked do not even deserve the defense that they enable the engineer to control dishonest contractors. This defense is not justifiable on any consideration. If an engineer is not convinced that a contractor means to do the work to the best of his ability, he has no more right to countenance an award to that contractor than has a government quartermaster officer to place an order for food with a concern that is known to deal in spoiled provisions. In every line of business the crooked firms have been eliminated by the refusal of honest people to deal with them. No other method, it is safe to say, has ever met with conspicuous success. If honest engineers will continue to permit owners to deal with dishonest contractors, no quantity of stringent verbiage in the contract documents will ever eliminate the latter from the field. As long as the man of questionable methods gets work, he will continue to "get away with it."

At present it is not possible for many engineers to take this stand. As has been pointed out by this journal, a large amount of educational work must be done by engineers before owners—especially public officials—can be expected to see the subject in its true proportions. What is needed is for the engineering organizations, especially the American Society of Civil Engineers, to take a decisive stand, and back up the individual engineer with all their influence. The best way to do this is to have the whole matter of contract documents thoroughly studied by a competent committee, and standards recommended which will command respect from owners, lawyers and engineers alike.

Why do not the men who have so ably discussed this subject before the society referred to, and other engineers who have shown a lively interest in this question, get together and urge action? If they will, it is safe to say that their efforts will be attended with immediate and practical results such as will never be accomplished merely by further discussion.

Double Test for Engineers

CLAIMING that the method of classification adopted by Professor Mann, in stating the results of his investigation of engineering education, leads to absurd conclusions in testing the fitness of candidates for engineering work, Dean Anson Marston advocates the use of a double, instead of a single, standard of comparison. He shows convincingly the necessity for two tests—one of engineering skill and the other of general manhood qualities—in each of which 100 per cent represents perfection. In his address to the alumni of Iowa State College, abstracted on page 764 of last week's issue, Dean Marston proposed certain subdivisions for estimating the qualifications separately. Such qualifications can be determined by the teachers. The information should not only lead to a proper estimate for recommendation to prospective employers, but should stimulate the whole teaching staff to more intelligent handling of the students.

Dean Marston also suggests three improvements in engineering education which are worthy of earnest consideration. His plea for experienced teachers, engaged on the basis of business hours and business standards, is directly in line with what Engineering Record has already advocated. The third suggestion, which requires practical engineering work by the students between the sophomore and the junior years, would immeasurably improve the quality of the last two years of college work. Experienced teachers agree that the most earnest and productive of their students are those who have had outside experience or are working their way through college.

One other idea suggested by Dean Marston should be strongly emphasized. Today, when overspecialization in engineering courses is being criticised and deplored, it is well to remember that technical subjects properly taught may be made broadly cultural through the personality and breadth of experience of the teacher. This is not done, however, by recounting the details of big projects with which the professor has been connected, but through thoroughness of understanding and a comprehensive view of the relations of the engineer's particular problems to human problems and activities. Furthermore, highly specialized subjects, in addition to thorough theoretical training, should be taught by the use of practical problems solved by the best methods developed in engineering offices. Broadening of engineering curricula must not mean less exact training in technical details, but less time devoted to following special lines to extreme limits. Thesis work and graduate work offer the necessary outlets for advanced specialization, which should not be made a general requirement for all undergraduates.

The postponement of specialized details will make room in the curriculum for the general courses so much desired. To be effective, however, the courses giving a broadening outlook must be made to appeal strongly to the students by showing them the relation of these general subjects to the life and work of the engineer.

Following Cincinnati's Lead

DOUBT, and in some quarters a quiet scorn, greeted the announcement not so many years ago of the establishment at the University of Cincinnati of the co-operative courses in engineering. The fundamental principle underlying the new system—that engineering education should be planned with reference to the requirements of practice—was not disputed. In fact it was, or should have been, recognized that Dean Schneider's plan was a revival of the apprenticeship system, supplemented by the broadening influence of a theoretical training far more thorough than was possible under the old system. Despite the sound historical and theoretical bases, however, it was not believed that the plan would prove successful. The co-ordination of the classroom work with that of the shop and the enlistment of the aid of industries seemed to offer insurmountable obstacles. They would have been insuperable, too, had the execution of the plan been intrusted to anyone less determined than its author, and with less faith in its soundness and in the ultimate results.

Results count, and to-day the co-operative system at Cincinnati stands not only as a success, but as a pattern of similar curricula and the inspiration of related plans elsewhere. The co-operative system at the University of Akron is a direct offshoot of the Cincinnati work, while the courses at Marquette University and Detroit College, comparatively new engineering schools, were patterned after the Schneider plan. Probably, too, the directors of the co-operative course in mechanical engineering at Lafayette College drew their inspiration from the Ohio school. At least one technical high school is fashioned on the same lines.

But these are not the only evidences of the influence of the Cincinnati idea. These have followed the plan in its fulness; others have gone part way. In some quarters, co-operative measures and industrial school co-ordination have not been adopted, but their indorsement by prominent educators indicates no less than positive action how wide the influence has been. For instance, in the controversy between Professors Mead and Swain, the latter said (see Engineering Record, May 6, 1916, page 609): "I am inclined to look upon the work which is being done by Dean Schneider at the University of Cincinnati as one of the most promising developments in modern technical education." Again, Dean Marston, in the address abstracted on page 764 of the Engineering Record of June 10, proposed that present curricula be modified by requiring one year or more of actual engineering work outside the college, immediately following the sophomore year.

Practical applications of related ideas are found in the schemes just announced for the school of chemical-engineering practice at the Massachusetts Institute of Technology. The Yale plan has been worked out in co-operation with the alumni; the engineering courses at Sheffield are five years in length, two years of undergraduate work being completed after the award of the first degree. The corporations co-operating select, with the aid of the faculty, a student who has received his first degree and whose fitness and liking for the business in question have been made the subject of careful inquiry. The student is employed at a nominal figure. After becoming familiar in a general way with his employer's business, the student is given some engineering problem, varying from the perfection of a machine or process to some question of management. Half his time is devoted to this problem, the solution of which constitutes his thesis. The summer between his fourth and fifth years is spent in the works of the corporation. At the completion of his course it is the expectation that he will enter permanently the business of the corporation which has helped to educate him. The advantages on either side are obvious.

The plan announced by the Massachusetts Institute of Technology is declared, in the institute circular, to be "the greatest forward step in technical education since William Barton Rogers established the institute, and it is an extension of the practice of Rogers, whose ideal was 'to teach young men by making them do things.'" The plan outlines a five-year course in chemical engineering, leading to a master's degree. The first three and a half years are spent at the institute, obtaining a knowledge of the fundamentals of chemistry and engineering, the next nine months in five or six industrial plants, and the last nine again at the institute. The main feature of the plan is the emphasis on the nine months spent in direct contact with industry. The institute will maintain a professor and a well-equipped laboratory in each of the five or six stations. The students will be divided into as many groups as there are stations and will pass around the circle, spending about six weeks in each plant. The stations have been selected not merely because of the importance of the industries with which they are connected, but because those particular plants well illustrate certain fundamental processes which the chemical engineer must thoroughly understand.

Needless to say, the Engineering Record's hearty indorsement of the Cincinnati plan must extend, though in a modified degree, to the Sheffield and Massachusetts Institute schemes. The last two are still to be worked out. As planned, they impress one favorably. Whether the results will be as good as those obtained at Cincinnati remains to be seen. They have the disadvantage of bringing the student into contact with industry rather late in his course, when it is difficult to correct the erroneous trends that may have been caused by the first three or four years of his theoretical training. At Cincinnati, from the start, the student is tested against the conditions which will surround him throughout his professional career. Tendencies in a wrong direction are nipped in the bud and cannot become confirmed mental attitudes or habits.

Certainly, the movements here noted are very strong indorsements of the co-operative idea carried out in its fulness at Cincinnati. While some of those concerned with the formulation of the later plans may not be willing to confess their indebtedness to the Cincinnati example, from the standpoint of the outsider, viewing educational movements at a distance, the Cincinnati influence seems very apparent.

Awakening of the American Waterworks Association

At its thirty-sixth annual convention, held in New York City last week, the American Waterworks Association showed signs of awakening to a realization of broader opportunities for service. With its membership increased to more than 1300, prospects bright for the acquisition of several new local sections and finances in a sound condition, the organization possesses latent power which, neglected in the past, is now ready to be developed along intensive lines. In his presidential address, an abstract of which was published in last week's issue, page 766, the retiring chief executive, Nicholas S. Hill, Jr., offered a number of constructive recommendations pertaining to the general administration of the society's affairs. With a man of the caliber of the new president, Leonard Metcalf, in office, it is safe to predict that the coming year will mark a new era of progress in the association's history.

It is time now for the association to realize that its administrative machinery, which may have been adequate for a membership of a few hundred a decade ago, has become obsolete when applied to a roster of the present size. One of the most important changes advocated by Mr. Hill is the separation of the duties of the secretary and editor. The demands upon the secretary's time have increased enormously since the movement for local sections throughout the country gained impetus, and any secretary, with his own private interests to attend to, will have his hands more than full in transacting the society's routine business and co-ordinating the work of the local sections with that of the parent body. Just as soon as the finances of the organization permit, the office of editor should be established.

The American Waterworks Association is not, primarily, a social organization, although the opportunity for personal contact at its conventions and section meetings is highly important. Its usefulness must be gaged, in large measure, by the kind of technical information it supplies to its members, either in printed form or at its conventions in the shape of papers or reports on technical subjects. Of course, there are other possibilities of service for the association, as Mr. Hill suggests, but no better beginning could be made than in the improvement of the printed proceedings and the arrangement of the convention program.

In this work the Engineering Record sees a much broader field of usefulness than is indicated by Mr. Hill's remarks. The editor's duties must not be confined merely to the preparation of copy and the reading of proofs. They must go even beyond the effort to determine what subjects are of most timely interest and who are the best men to discuss them. Granting that these matters are essential, the duties of the editor should include the effective use of papers and committee reports after they have once been secured. The association needs a man who can show its wares to the outside world as well as to the members themselves, for often the vital feature of a paper or report is so buried in a mass of inconsequential detail that it is passed by without having its full significance brought out.

If a salaried editor is to be appointed, let him be not merely a good engineer, but also a good journalist—a man with a quick appreciation of news value. Let this man, who can "see the story," have the leading part in the arrangement of the convention program. On such occasions he should be a sort of stage manager, who will sense the really important features of the convention, give them the choice places on the program and insist that they be presented according to schedule. In this way only will their full effect be realized and the association receive the maximum benefit therefrom. On this score of publicity for its activities the association has shown a pitiful ignorance—an ignorance which, if allowed to continue, will be a serious check upon the growth of the association in the esteem of its own members and of the outside world.

Now to get down to specific cases: Last week's convention offers a conspicuous example of lost opportunity. Without any doubt the big feature of the five-day session was George A. Johnson's paper "The Typhoid Toll." Not since Allen Hazen, years ago, propounded his theorem dealing with the reduction of the death rate by pure water has the case for filtration been put so forcefully. Full publicity for Mr. Johnson's paper among the members, and particularly in the daily press of the country, would have been one of the greatest educational achievements which the American Waterworks Association could have sponsored. What is more, the dissemination of the facts which Mr. Johnson enunciated would have meant money in the pockets of waterworks men. Before a city can build a filtration plant it must have the support of public opinion. Any steps that can be taken to foster public sentiment in favor of pure water should not be neglected. With the people realizing that typhoid fever is a water-borne disease and is preventable, it will not be long before there is a general demand for filters. The result, of course, will be more work for the waterworks engineer.

What happened at the convention last week? The ammunition, in the form of Mr. Johnson's paper on typhoid prevention by water filtration, was fired blindly, so far as its full effect on the members of the association and the general public is concerned. The paper was scheduled for presentation Wednesday evening, following the vote on the selection of a city for the next convention. With the convention hall packed, speaker after speaker was permitted to dilate upon the claims of his home town as the next convention city. A limit of five minutes had been set for each of these speakers and was promptly disregarded. At last a vote was taken, and when the ballots were counted the whole farce had to be repeated, as there was no majority on the first count. When this buffoonery was concluded it was too late for the feature paper of the convention. It found no place on the program next day, but Mr. Johnson had the satisfaction of being called upon at the very close of the final session at noon Friday, when everyone was ready for a recess. At this late hour there was no time for the written discussions, in spite of the fact that communications had been received from such national figures as Dr. Harvey W. Wiley and Surgeon-General Rupert Blue.

A great opportunity for educational work was wasted, and the whole affair was particularly lamentable, because, if the paper had been given a place of prominence on the program, it would undoubtedly have been reported by such influential metropolitan dailies as the New York *Times*, which gave about half a column to each of the first two days' sessions and then, apparently, decided that the important papers had been delivered and that the remaining sessions would be given over to discussions of no interest to the lay reader. As the paper on typhoid and filtered water was being discussed there were perhaps from 50 to 75 men in attendance, whereas, if it had been properly scheduled, it would have had an audience of several hundred, to say nothing of the value of the publicity in the daily press.

This instance demonstrates the need, in the arrangement of convention programs, of a man with perspective, who can sense the big things and give them the display their importance warrants. If the association secures a man of the proper caliber to handle such matters it will not be long before it will make its influence felt beyond the confines of its convention halls.

Regulation of Weight, Size and Speed of Vehicles Has Become an All-Important Problem

Development of Motor Truck to Extra Widths and Very Heavy Wheel Loads Calls for Legislation to Make It Pay Its Fair Share of Added Costs of Street Construction and Maintenance

By H. C. HUTCHINS
Assistant Engineer, Department of Public Works, Borough of Manhattan, New York City

DURING the past ten years the advent of the motor truck has introduced new problems to those in charge of street and highway management. There have been large and special types of horse-drawn vehicles in existence for many years, such as trucks for hauling steel girders and columns, printing presses, boilers and other heavy materials through the streets. Steam traction engines have also existed for many years, and are occasionally to be met with on country highways. These heavy vehicles, however, are not very numerous and their affect upon the pavements is not very great, owing to the slow speed at which they are driven and the care taken by their owners and drivers not to cause unnecessary damage.

The advent of the motor truck has introduced new features into the problem, however, as there has been a marked tendency on the part of the manufacturers of these vehicles to increase their loading capacity and speed. It is self-evident that the cost of hauling can be greatly reduced if the size of the vehicle is increased, since the cost per ton hauled for fuel, wages and other items is reduced. The proposition from the standpoint of the manufacturer and the owner of motor trucks is of course to get the greatest return in hauling capacity for the investment and cost of operation and maintenance.

WEAR AND TEAR ON PAVEMENTS

The cost to a city, town, state or county for increased wear and tear on pavements should also enter into the problem. It is easy to say, for instance, that a city should lay pavements strong enough to withstand the shock and wear and tear caused by the heaviest type of truck, or that a state or county should have roads that will stand the wear and tear due to the passage of heavy automobiles or trucks at a high rate of speed. The immediate replacement, however, of all the pavements in a city is no small matter.

The borough of Manhattan, comprising the central part of New York City, has approximately 450 mi. of pavements. If we assume that they have an average width of 30 ft. of roadway that would have to be paved by the city, the total area would be 7,920,000 sq. yd. If all these streets had to be resurfaced with a better type of pavement costing $2.50 per sq. yd., the total cost to the borough of Manhattan alone would be $18,800,000. If it were found necessary to add 1 in. extra thickness of concrete to the pavement foundation as a provision to take care of the heavier traffic, there would be 220,000 cu. yd. of concrete required, which at $5 a cu. yd. would cost $1,100,000. This extra cost would have to be borne by the taxpayers. Among these are the owners of the vehicles themselves, but they would pay only an infinitesimal part of the extra costs of paving and maintenance of old paving, while the majority would derive no benefit at all.

FIFTH AVENUE, NEW YORK, READILY CARRIES SIX LINES OF ORDINARY VEHICLES, BUT EXTRA-WIDE TRUCKS MIGHT CROWD OUT TWO OF THE SIX

While it may not be advisable to reduce vehicle sizes now in existence, certain principles of design of these vehicles could be followed which would reduce the wear and tear on pavements. One would be the limitation of the allowable load per inch of width of tire. A sliding scale of license fees could be made so that wheels above a certain loading, such as 750 lb. per in. width of tire, would be taxed at a gradually rising rate, with a consequent tendency on the part of owners and manufacturers to reduce the unit-width load to a minimum at which the lowest rate could be obtained, and thereby reduce the wear and tear on pavements by reducing the unit pressure on them. In an ordinance prepared for New York City in 1913 it was proposed to tax the loading per inch width of tire as per Table 1.

TABLE 1—PROPOSED LICENSE SCHEDULE BASED ON LOAD PER INCH WIDTH OF TIRE

(a) Vehicles carrying or intending to carry a total gross load of 6000 lb. or less upon any wheel shall be charged the following annual license:

Loads in Pounds per Inch Width of Tire	License Fee for Each Vehicle
750 or less	$1
751-800	3
801-850	6
851-900	12
901-950	25
951-1000 (max.)	50

This would tend to prevent the operation of vehicles having narrow tires which are so heavily loaded as to cut into the macadam and asphalt pavements now laid on many city streets.

VERY HEAVY LOADS

Certain types of vehicles now in operation are too heavily loaded for any pavement to support. At the present time pavements in New York City are laid with a 6-in. foundation of concrete, which will support a very heavy load. But if it becomes necessary to lay pavements to provide for some of the excessive loads now seen in the streets, and to provide in addition for probable increases in such loads in the future, the cost of street construction will be greatly increased for the benefit of a few vehicle owners, causing a greatly increased tax upon the city at large. A pavement foundation is a thing that is not renewed every year. This burden would be more equitably borne by imposing a tax upon vehicles of excessive weight, and accordingly a schedule was prepared for additional fees upon the basis of Table 2.

EFFECT OF EXCESSIVE SIZES OF TRUCKS

In addition to the foregoing problems a further problem has been found in many large cities due to excessive traffic on certain streets. If all vehicles were of a uniform width and length, the problem of proper street widths and congestion of traffic might be easily solved. There has been a tendency, however, to construct vehicles of very great width and length, thereby producing greater carrying capacity, such as moving vans, coal wagons, trucks for hauling dirt and stone and the like. These vehicles occupy more space in the roadway than do the average vehicles, often destroying the balance of traffic by preventing the movement of two lines of vehicles on congested streets such as Fifth Avenue, where six lines of vehicles of ordinary width can be operated.

If a street has a capacity for two or more lines of vehicles of an average width of 6 ft. 9 in. in each direction, two large trucks occupying 8 or 9 ft. in width will block off one line of traffic in each direction and cause a 50 per cent reduction in the traffic capacity of that street. Many streets in New York City have been widened in the past few

TABLE 2—ADDITIONAL FEES FOR LOADS OF FROM 6000 TO 10,000 POUNDS PER WHEEL

(b) In addition to the fees provided for in subdivision (a), further fees shall be charged for loads greater than 6000 lb., but not exceeding 10,000 lb. upon any wheel as follows:

Weight in Pounds per Wheel	License Fee for Each Vehicle
6,001- 6,500	$75
6,501- 7,000	110
7,001- 7,500	150
7,501- 8,000	200
8,001- 8,500	300
8,501- 9,000	500
9,001- 9,500	750
9,501-10,000	1,000

For loads greater than 10,000 lb. per wheel, license fees shall be charged for each vehicle at the additional rate of $500 for each 1000 lb. increase in weight, or portion thereof, per wheel; provided, however, that no load greater than 1000 lb. per inch width of wheel shall in any case be permitted, except as specified in subdivision (d).

In lieu of the fees hereinabove provided for in subdivisions (a) and (b) for loads of 6000 lb. or more on any wheel, special permits may be issued for single trips and fees charged therefor at the rate of 10 per cent of the fees therein provided, except that no single fee shall be less than $25; and in lieu of the fees provided in subdivision (c) for excess width of vehicle, special permits for single trips may be granted upon payment of a single fee of not less than $10.

years at considerable expense both to the city for extra pavement, changes in sewer basins, etc., and to property owners for the removal of encroachments and the reconstruction of vault space necessary on account of widened roadways. If this widened space is to be monopolized by vehicles of unusual size, proper fees should be paid by the owners of the vehicles to offset the expense of the widening of streets.

The ordinance proposed in 1913 had charges for extra widths of vehicles as per Table 3.

In order to enforce the ordinance properly it provided for license plates, to be attached to each side of the vehicle, stating the weight of the empty vehicle, the maximum load capacity per inch width of tire and most heavily loaded wheel, and the width over all of the vehicle. These plates were to be furnished by the city upon payment of the license fees and were to be attached in a conspicuous place as directed by the chief of the Bureau of Licenses.

Weighing stations were to be established in various parts of the city at which all vehicles should be weighed whenever required by a duly authorized representative of the Bureau of Licenses.

If the ordinance were violated, the owner of the vehicle was liable to a revocation of his license and should be deemed guilty of a misdemeanor, and if convicted, could be fined not less than $100 nor more than $500, or not more than ten days in jail.

TWO TYPES OF EXTRA LARGE AND HEAVY MOTOR TRUCKS—CONTRACTOR'S OUTFIT ON RIGHT HAS CAPACITY OF 18,000 LB., TOTAL LENGTH OF 32 FT. 3 IN. AND WIDTH OF 8 FT. 7 IN.—REAR (STEEL) TIRES ARE 8½ IN. WIDE

The question of speed of traffic has long been a subject of regulation by all cities, but this has been due to the desire to protect lives and to prevent accidents rather than from any effect upon pavements. It is self-evident, however, that the same principles of impact that have to be taken care of in the design of bridges will apply in the design of pavements, and that the increased speed due to the advent of motor vehicles must give an increased load due to the impact of heavy wheels moving at higher rates of speed than with horse-drawn vehicles. Even the argument that motor vehicles have rubber tires does not fully offset this, as the tires and springs of the vehicle do not reduce very much the blows that the pavement receives. There is also a tendency on the part of large trucks to use steel-tired wheels to carry the greatest load, which give very heavy shocks to the pavement when moving at speeds of from 10 to 15 mi. per hour. The horse-drawn vehicles which these trucks supplant did not go more than 3 or 4 mi. an hour.

In New York City complaints have been received by the authorities from property owners of excessive vibration felt, and actually measured by recording instruments, due to the rapid movement of heavy motor buses and trucks through the street. In one case complaint was made that the excessive vibration had broken off the gaspipe connection in a private house past which there was a constant movement of heavy trucks carrying earth and rock for a subway contractor. The vibration of the house could be plainly felt even in a rear room on the second floor at the time an investigation was made. If the vibration is so plainly felt in houses, there certainly must be a very bad effect on pavements, as they bear all the direct blows from the heavy truck wheels.

The Highway Commission of the State of New York limits the maximum weight of vehicles on the highways to 14 tons, with a further limitation of 9 tons on any one axle. The load per inch width of tire is limited to 800 lb., and the total width of any vehicle is limited to 7 ft. 6 in., with the exception of traction engines, which may be 9 ft. 2 in. wide. The speed is limited to 15 mi. per hour for vehicles weighing from 4 to 6 tons, and 6 mi. per hour for vehicles with iron or steel tires, and to 12 mi. per hour with rubber tires or other similar substance. Special permission for vehicles weighing more than 14 tons must be obtained from the commission.

TABLE 3—PROPOSED CHARGES FOR EXTRA WIDTHS OF VEHICLES

(c) Vehicles 6 ft. 6 in. or more in width over all shall be charged, in addition to the fees specified in subdivisions (a) and (b), the following annual fees:

Width of Vehicles	License Fee for Each Inch in Width in Excess of 6 Ft. 6 In.
More than 6 ft. 6 in., but not to exceed 7 ft. 0 in.	$5
More than 7 ft. 0 in., but not to exceed 7 ft. 6 in.	10
More than 7 ft. 6 in., but not to exceed 8 ft. 0 in.	15
More than 8 ft. 0 in., but not to exceed 8 ft. 6 in.	20
More than 8 ft. 6 in., but not to exceed 9 ft. 6 in.	25

In determining this fee any width which is greater than 6 ft. 6 in. by a fraction of an inch, or by a distance which contains a fraction of an inch, shall be reckoned as if it were the next greater even inch.

(d) No loads, harness or other appurtenances shall in any case be allowed to extend beyond the outside limits of any vehicle except as specified in subdivision (c).

Chicago has an ordinance requiring that all motor trucks shall have rubber tires or some material of equal resiliency. The maximum load per inch width of tire is limited to 1000 lb. The maximum load and weight of the vehicle shall not exceed 15 tons and the maximum axle load shall not exceed 12 tons. The maximum width permitted is 8 ft. 6 in. and the maximum length 40 ft. The speed of motor trucks is limited to that of the Motor Vehicle Law of the State of Illinois and the rate of speed is limited to 4 mi. per hour when there is a defective tire which tends to cause additional injury to the pavement or additional noise. The operation of tractors and trailers not exceeding 100 ft. in length is permitted between 8 p. m. and 5 a. m. at a rate of speed not to exceed 8 mi. per hour upon routes designated in a permit. Special permits are necessary for transporting loads exceeding 12 tons per axle, and a bond of $10,000 is required to pay for any damage that may be caused to city structures.

Boston has street-traffic regulation which limits the width of vehicles to 10 ft. except by special permit from the Board of Street Commissioners. The extreme length of trucks and drays is limited to 24 ft. 6 in., and motor vehicles are limited to 26 ft. The maximum load that a vehicle may carry is limited to 6 tons except by special permit.

London limits the width of motor cars to 7 ft. 2 in. Special widths of tires are prescribed for motor cars of different weights, except when pneumatic or other elastic tires are used. The maximum axle weight allowed is 8 tons, and the total weight on all axles shall not exceed 12 tons.

LARGE AND SMALL WHEELS

The regulations also provide for the difference in effect upon the pavement of large and small wheels, as they permit 750 lb. per inch width or tire for a wheel 3 ft. 0 in. in diameter, with an increase of 100 lb. per inch width of the tire for each 12 in. increase in wheel diameter, and a deduction of 100 lb. per inch width in tire for every 6 in. reduction in diameter, with proportional increases or decreases in loading for amounts less or greater than the increments specified.

The speed of heavy motor cars must not exceed 8 mi. per hour if the unloaded weight of the vehicle does not exceed 3 tons, or if the maximum axle weight registered exceeds 6 tons. If the motor car draws a trailer the speed shall not exceed 5 mi. per hour, while 12 mi. per hour is allowed if pneumatic or elastic tires are used for cars not exceeding axle weights of 6 tons or less, and 8 mi. an hour for axle weights exceeding 6 tons. The minimum size of wheels allowed on heavy motor cars is 24 in.

In the state of Pennsylvania the load per inch width of tire is limited to 750 lb., and the maximum weights of a motor vehicle or trailer shall not exceed 12 tons. The width of vehicles must not exceed 7 ft. 6 in., except that motor buses within city limits may be 8 ft. 4 in. wide.

Many other states have special regulations regarding widths of tires. In Washington special regulations allowing greater unit loads per inch width of tire are permitted as the width of the tire increases, and increases are also allowed for increased diameter of wheels. This latter increase is an excellent one, as the greater diameter of wheel increases the bearing surface and renders less heavy the blow on any slight irregularity or defect in the pavement.

It is evident that there are many points to be studied in order to produce a satisfactory ordinance, and that much could be done to improve existing laws and regulations.

Pour Filler Over Blocks in Granite Pavement

Special Filler in Use in Baltimore Two Years Gives Excellent Results—Remains Firm in Summer and Resilient in Winter

FOR the past two years the City of Baltimore has used a special filler for its granite block pavements, which has given excellent service and is seemingly free from brittleness in winter and softness in summer. The filler is applied to the top of the joints and is poured over the blocks, and, combined with gravel, gives the pavement an asphalt-like appearance.

VARIOUS TARS AND ASPHALTIC FILLERS USED

In Baltimore a number of tars and asphaltic fillers have been used with varying success. Some were too brittle, others had no ductility and would not adhere to the blocks, thus allowing water to seep through the joints, to displace the sand cushion or cause freezing in winter weather. The filler finally adopted and at present in use is refined from Mexican crude oil and has the following characteristics:

Bitumen soluble in CS_2	= 99.80%
Bitumen soluble in CCl_4	= 99.80
Specific gravity at 60 deg. Fahr.	= 1.042
Penetration at 32 deg. Fahr.	= 17
Penetration at 77 deg. Fahr.	= 45
Penetration at 115 deg. Fahr.	= 160
Ductility at 77 deg. Fahr.	= 60 cm.
Loss at 325 deg. Fahr.; 5 hours; 20 grams	= none
Penetration at 77 deg. Fahr. after loss test	= 32
Per cent hardened	= 28.8
Melting point, cube method	= 155 deg. Fahr.

In using the filler the granite blocks are laid with joints of not over ½-in. width, on a bed consisting of one part Portland cement to four parts of clean, sharp sand and having a depth of 1 in. The surface of the pavement is covered with hot torpedo gravel, which is swept into the joints to a depth of about 1 in. The blocks are then rammed, after which the joints are poured half full of the filler. They are then filled to within ½ in. of the top of the joints with torpedo gravel and again poured with the filler, which flows over the blocks and covers the entire surface of the pavement. Hot gravel is then spread over the surface, and, in a few hours, the road can be opened to traffic. It has been found by experience that the action of horses' feet and wagon wheels tends to pound the material into the joints.

Care should be taken to have the filler at a temperature between 375 deg. and 425 deg. Fahr., as it will not penetrate and fill all the voids if poured at a lower temperature. It is also imperative that the blocks be perfectly dry and free from dust, as the filler will not adhere to a wet or dusty surface.

At the intersections where the filler has been in service for two years the mat is still on top of the block, though spalled off in places, but not to any great extent. The appearance of the street is very much like that of sheet asphalt. In places where the mat has spalled off it has left a full flush coating of filler in the joints, giving an even surface to the granite block and fully protecting the edges. The filler was developed by Bruce Aldrich, chief asphalt inspector of the Paving Commission of the city. R. Keith Compton is chairman of the Paving Commission and consulting engineer.

Conservation of Operating Head Controls Design of Oaklyn (N. J.) Sewage Plant

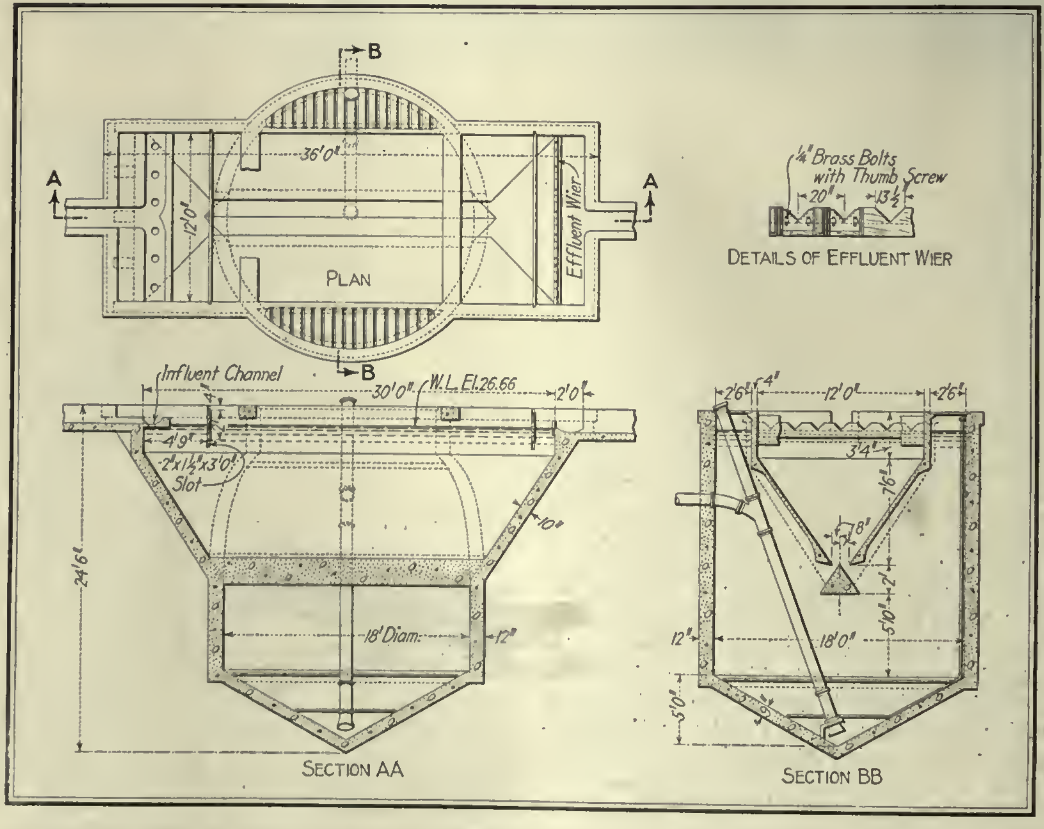
Gravity Installation, Consisting of Two-Story Tank, Sprinkling Filters and Secondary Settling Basin, Designed for 12½-Ft. Drop

By W. DE WITT VOSBURY
Of Remington & Vosbury, Consulting Engineers, Camden, N. J.

IN designing the sanitary sewer system recently constructed in the Borough of Oaklyn, N. J., it was found impossible to obtain, at the site selected for the disposal plant, a head greater than 12.5 ft. It was desirable, for various reasons, to construct a disposal plant consisting of a primary clarification tank, sprinkling filter and secondary settling basin, within the limitations imposed. A satisfactory design for a gravity plant of this type necessarily called for considerable study. As finally decided upon the drop was partitioned as follows: Flow line of primary settling tank to discharge level of water in dosing tank, 5 in.; to elevation of sprinkling nozzles, 4 ft. 3 in.; to flow line of secondary settling tank, 7 ft. 10 in. The total loss of head, therefore, was 12.5 ft. To keep within the head available for each portion of the plant it was necessary to conserve the drop in every possible way. Channels and troughs with circular inverts were adopted throughout and special care was given to the design of the dosing siphon and system of distribution piping to reduce the loss of head by friction.

As shown in the accompanying drawing, the primary settling tank is of the two story, horizontal flow type. It has a capacity of 170,000 gal. per 24 hr. with a 2-hr. detention period and consists of a hopper bottom, rectangular settling basin 12 ft. wide by 30 ft. long, which intersects a cylindrical chamber 18 ft. in diameter by 24 ft. in depth to the center of the conical bottom.

The segments lying outside of the partition walls of the settling compartments furnish the scum area. There are two 8-in. slots or openings betwen the upper and lower compartments of the tank. They are located at a depth of 9 ft. 6 in. below the water surface and extend across the cylinder parallel to the longitudinal axis of the tank. Protection against the gases from the sludge compartment entering the settling chamber is afforded by a concrete beam having a tri-



CYLINDRICAL FORM OF BODY OF TANK WAS DESIGNED TO AID CONSTRUCTION IN SATURATED GROUND.

angular cross-section, the bottom face of which overlaps the edges of the slots above by a distance of 9 in. The sludge chamber is designed to retain the accumulated solids from a population of 2500 for a period of six months.

The cylindrical form of the body of the tank was adopted to facilitate construction. Many indications pointed to the presence of running sand and ground water in large quantities and to avoid the heavy expense incidental to sheathing and shoring at the depth required, as well as to reduce materially the amount of excavation and pumping necessary, it was the intention first to construct the cylinder complete at the surface of the ground and then sink it to place by excavating from the interior. Fortunately, however, during construction, subsoil conditions were encountered which made it unnecessary to follow the above procedure.

Distribution of the sewage as it enters the tank is secured by means of a transverse, circular-bottom, concrete trough overhanging and extending across the end of the settling chamber. In the bottom of the trough there are six openings each 6 in. in diameter, through which the sewage drops into the sedimentation chamber. Regulation of the flow through each opening is had by means of an adjustable, galvanized iron shutter, secured by bronze guides to the under side of the trough. This method of distribution has proven quite satisfactory as not only is an equal division of the influent throughout the cross-section of the tank readily obtained, but the trough is practically self-cleansing. Experience has shown that solids do not collect in it even under a greatly diminished volume of flow. At the effluent end of the tank the settled sewage is withdrawn through seven V-shaped weirs, made of No. 14 galvanized iron. The latter are slotted so that they may be accurately adjusted to position by means of thumb screws projecting from a notched cypress plank fronting the effluent trough.

DOSING TANK

From the settling tank the sewage is conveyed by a short circular-bottom channel to the dosing tank. The latter has an effective capacity of 1140 gal., equivalent to a depth of ½ in. of liquid on the surface of the filter bed. To attain as nearly as possible an even distribution of sewage during each dosing cycle, the bottom of the tank is tapered to conform to a theoretical curve, corrected to meet actual working conditions, representing the relation existing between the volume of sewage discharged and the area covered by the spray under the variable head. A 14-in. automatic siphon, operating under a 3-ft. draft, discharged the contents of the tank to the filter bed.

FILTER BED

In deciding upon the shape of the filter bed the make and type of nozzle to be used was first selected. The Taylor circular spray nozzle with a ⅞-in. orifice was used. With the characteristics of the nozzle and the working head known, the correct spacing was determined. The required effective area of the bed based upon a rate of filtration of 2,000,000 gal. per acre was 3646 sq. ft. The spacing of the nozzles, when located at the apices of a triangle with their maximum effective sprayed circles just touching, was 8 ft. 3 in. center to center in each row, with 7 ft. 2 in. between rows. By using nine rows with six whole and one half-nozzle to each row at alternate ends the dimensions of the sprayed surface of the bed became 66 ft. 10 in. wide by 54 ft. 10 in. long, or an effective area of 3660 sq. ft.

THE SPRINKLING FILTER BED HAS AN AREA OF 3660 SQUARE FEET

TO MINIMIZE FRICTION LOSSES ALL CHANNELS HAVE CIRCULAR INVERTS

The piping system which distributes the sewage from the dosing tank to the nozzles was designed to eliminate, as far as possible, all losses by friction. Y-branches with ⅛-bends were employed in place of tees at the points where the lateral distributers branch from the main header. Universal cast-iron pipe, varying in size from 4 to 12 in., was used. Within the bed it was laid directly upon the filtering material without other foundation.

The filtering medium has a depth of 7 ft. and consists of 6 ft. of 1½ to 2½-in. crushed slag overlying a 12-in. layer of 4 to 6-in. slag covering the underdrains. For the latter, half-round 8-in. special perforated tile was used. The floor of the filter bed slopes uniformly, from both sides to the circular collecting channel at the center. The tile is laid in parallel rows, on the floor, 15 in. center to center, and as it extends from the above channel to the outside face of the vertical dry wall inclosing the bed, circulation of air is freely permitted. The central channel which collects the drainage from the bed and conveys it to the final settling basin is covered with concrete slabs resting on continuous concrete supports cast over and around the ends of the tile on either side of the channel.

The secondary sedimentation basin, which performs the function of collecting the settleable solids that pass from the filter bed, is 16 ft. wide, 30 ft. long by 3 ft. in depth, and was designed for a period of detention of 1 hr. A central concrete partition wall, which extends from the end nearest the filter bed to within 6 ft. of the opposite end, doubles the length of the flow line. The sewage enters the tank at the left of the division wall and after traveling to the opposite end returns on the right to the effluent weir. Distribution at the influent end is effected by a longitudinal cypress baffle extending nearly to the bottom of the tank.

A series of horizontal slots in the baffle diffuse the flow over the cross-sectional area at about mid-depth and the effect of a weir is thereby obtained. At the end of the partition wall on the right hand side of the tank a second baffle similar to the one already described re-distributes the flow after the sewage has made the turn. The sewage leaves the tank over a carefully constructed weir of green, glazed tile and enters the collecting trough alongside.

DISINFECTION

As the effluent from the plant is discharged into a small lake used for recreation purposes it was considered advisable to install further means of protection against possible contamination. Provision has, therefore, been made for chemical disinfection and a liquid chlorine apparatus was installed in a small brick chemical house located between the filter bed and secondary settling tank. As the apparatus is manually controlled, means for determining the rate of flow through the plant were necessary so that, when used, the chlorine might be fed in proportion to the sewage dosed. Neither the minimum flow nor available head was sufficient to warrant the use of a Venturi meter. A V-notched weir was, therefore, placed at the end of the collecting trough of the secondary settling tank and a 2-in. pipe used to connect the former with a float well in the chemical house. A 12-in. copper float and brass rod, to which a pointer is attached at the top, constitutes the recording apparatus. The rate of flow in gallons per day is indicated by the pointer against a scale graduated to correspond with the amount of water discharged by the weir at various depths.

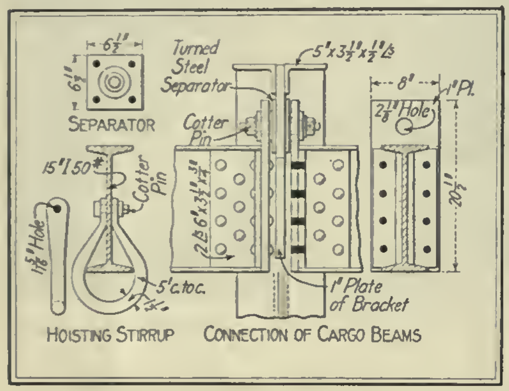
While the plant is constructed as symmetrically and compactly as possible, the design is sufficiently flexible to permit an increase in capacity when required. Attention was also given to general appearance and the place was made as attractive as possible, as a factor in gaining public confidence.

The plant described was constructed by the Kelley-McFeeley Company, of Camden, N. J., at a cost of approximately $11,000. Remington & Vosbury were the engineers.

Swinging Cargo Hoist Beams for New Pier Shed

I-Beams with Pin Connections Used Instead of Built-Up Girders in the New West Fifty-Seventh Street Pier in New York City

BY DESIGNING the end connections with pin details to allow the beams to swing into a position resulting in applied loads parallel to the webs only, it was found possible to use I-beams instead of built-up plate girders for the cargo hoist girders in the new West Fifty-seventh Street municipal pier to be built in New York City. This pier shed has the standard 20-ft. panels used in New York dock construction, is of the two-story type, with high 70-ft. cargo columns at each bay, similar to the construction used in the Forty-sixth Street pier described in the Engineering Record of May 27, page 708. The Fifty-seventh Street pier shed will be 700 ft. long and 110 ft. wide.



DETAILS OF SWINGING CARGO HOIST BEAM

The accompanying drawing indicates the details used in making the swinging connection to the bracket carried by the top of the column. A 2-in. pin placed above the ends of the beams passes through the 1-in. plate of the column bracket and through 1-in. plates riveted to the ends of the beams. The hoisting stirrups placed on 5-ft. centers are also a new design, looping around the lower flange of the I-beams as shown.

This design has been worked out under the supervision of Charles W. Staniford, chief engineer of the Department of Docks and Ferries, New York City, of which R. A. C. Smith is commissioner, and R. C. Harrison is deputy commissioner.

Denver and Philadelphia Typhoid Rates Similar for Years

Comparative data on typhoid death rates in two cities of such different characteristics as Denver and Philadelphia show a remarkable similarity for the last dozen years. This is even more marked since 1908. Philadelphia has been sterilizing the water since September, 1909, and Denver since July, 1911, every year showing a reduction in the rate for the latter city since 1910. For 1915 the Denver typhoid death rate per 100,000 was 6.7 and for Philadelphia 6.6.

As the Government Interprets Railroad Depreciation

Engineering Board, Division of Valuation, Ordinarily Bases Condition Per Cent on Ratio of Remaining to Total Service Life

THE views of the Engineering Board, Division of Valuation, Interstate Commerce Commission, regarding depreciation as submitted to Director Prouty last November, have recently been published in a statement issued by Thomas W. Hulme, general secretary of the Presidents' Conference Committee. The board believes that ordinary service condition per cent should be the ratio between remaining and total service life, and that mortality tables should be used on the straight-line basis. The general principles enunciated by the board are as follows:

1. Depreciation is the lessening in worth of physical property due to use or other causes.
2. Labor depreciates with the items of property of which it is a part.
3. Service condition per cent is the ratio between remaining capacity for service and total capacity for service in each cycle of use.
4. Depreciation shall be determined by a consideration of observations of actual conditions of the property and mortality statistics of similar property in like use applied where practicable on the straight-line basis.
5. Salvage is the net value which an article possesses for carrier purposes other than that for which the article was originally used.
6. Scrap is the net market value which an article possesses after its service for carrier purposes has been exhausted.
7. Normal life shall be the estimated average total service life under ordinary conditions.

GENERAL RULES

When depreciating property under the several accounts, the following general rules shall apply:

1. Ordinarily, service condition per cent shall be the ratio between the remaining service life and the total service life. When the depreciation of an item of property is based upon the weighted average of the parts, the service condition of each part shall be determined by this ratio.
2. When a normal life for a particular item of property has been prescribed for use in determining appreciation, that life must not be departed from unless an investigation of the records of the carrier or actual inspection in the field, or the two combined, warrant such departure. In no case shall a remaining service life of an item of property be taken at more than the prescribed normal life.
3. When no normal life is prescribed, the total service life and remaining service life shall be determined from observation of actual conditions and the examination of records and data from reliable sources.
4. Salvage and scrap will be allowed in cases where such values actually exist. Whether allowance shall be made in a given case for salvage or scrap shall be left to the discretion of the member of the Engineering Board. If an allowance is made this fact shall in all cases be stated upon the pricing sheet even though at the time the amount of the allowance cannot be given.
5. The service condition per cent as stated in the field record by the field man shall be subject to revision and final fixing by the member of the Engineering Board or his staff subordinates. The service condition per cent fixed in the field is assumed to be simply the statement of a fact.

HOW TO TREAT INDIVIDUAL ACCOUNTS

The board recommends that some of the accounts be treated as follows:

Engineering.—A small portion of the expenditure for engineering is connected with property which depreciates. In view of the fact that the larger portion is expended on location surveys, grading and other property which does not depreciate, and that the accounting records have been so kept in the past as to make it impracticable to segregate that portion of the expenditure which depreciates, the service condition per cent of the account shall be considered at 100.

Grading.—No allowance shall be made for appreciation or depreciation, as such, to excavation and embankment pay quantities of grading. Other property, such as breakwaters, bulkheading, retaining walls and similar items constructed of perishable materials shall be depreciated.

Tunnels and Subways.—The excavation of tunnels and subways including back-filling shall not be depreciated. Concrete and other masonry shall be given a normal life of 100 years.

Bridges, Trestles and Culverts.—(*a*) Metal bridges shall be given a normal service life of seventy years provided that the loads for which they were designed are not now being exceeded.

(*b*) Masonry culverts shall be given a normal service life of 100 years.

(*c*) Cast-iron culvert pipe shall be given a normal service life of eighty years, and other iron or steel pipe a normal service life of thirty years.

(*d*) Vitrified and concrete culvert pipe shall be given a normal service life of fifty years.

(*e*) Masonry piers and abutments shall be given a normal service life of 100 years.

Ties.—Where track has reached such a condition that the tie renewals are uniform in quantity and quality from year to year, the service condition shall be considered as 50 per cent. The average life of ties shall be determined by a study of the carrier records of tie renewals supplemented by a consideration of field observations.

TWO CYCLES FOR RAILS

Rails.—Rails shall be considered as having two cycles of life; viz., new to relay and relay to scrap. Each cycle shall be considered separately and have a range of service condition per cent of 100. The first cycle for a particular carrier shall be determined by a study of its rail renewals and the rail renewals of other carriers in the vicinity having similar traffic conditions. This cycle may vary upon different divisions of the same carrier where traffic conditions are different. A net salvage value shall be allowed for rails at the end of the first cycle equal to the price of relay rail at carrier's nearest material yard, less cost of bringing same from point where removed.

The second cycle shall be considered as having a normal life of fifty years.

When in depreciating relay rail the date relaid cannot be ascertained from records, the same shall be estimated from the best available data. Where rail was laid new in side tracks and will be used in this service until it becomes scrap, it shall be given a normal life of seventy-five years. Where the annual rail renewals in yards have become uniform in quantity and quality, a service condition of 50 per cent may be used.

A net price shall be assigned to scrap rail based upon the price of scrap at the carrier's nearest material yard, less the cost of bringing same from point where removed. The weight of relay and scrap rail shall be assumed to be the same as that of new rail.

Other Track Material.—(*a*) Splice bars shall be depreciated in cycles on the same basis as the rail with which they are used.

(*b*) Bolts shall be depreciated from new to scrap during each cycle of the rail with which they are used.

(*c*) Spikes shall be depreciated on the same basis as the ties with which they are used.

(*d*) Where average annual renewals of frogs and switches are uniform and conditions warrant, they may be depreciated on a 50-per cent basis.

(*e*) All other track material for this account shall be depreciated from new to scrap during each cycle of the rail.

Station and Office Buildings.—Timber structures shall be given a normal service life of sixty years and masonry structures 100 years, suitably modified where observation shows principal parts are new or in need of renewal.

EQUIPMENT

Steam Locomotives.—Steam locomotives shall be depreciated according to the general rules. The percentage finally established as representing the present service condition of each locomotive shall be the weighted average of the assigned condition per cent of the following principal parts: Engine—(*a*) boiler, (*b*) underframe, (*c*) running gear; tender—(*a*) trucks, (*b*) underframe, (*c*) tank. (The same rules are to be used for other locomotives.)

Freight-Train Cars.—Freight-train cars shall be depreciated according to the general rules. A service condition shall be established for each series of cars which shall be the weighted average of those cars of the series actually inspected. Not less than 10 per cent of the cars of each series shall be inspected for condition, and a larger percentage where a series contains a small number of cars, or if the cars in a series vary greatly.

The service condition per cent established for each car inspected shall be the weighted average of the service condition per cent assigned to the following principal parts of the car: (*a*) Body, (*b*) underframe, (*c*) trucks.

Passenger-Train Cars.—Passenger-train cars shall be depreciated according to the general rules. Each passenger-train car shall be separately inspected to determine service condition, following the same general rules set forth in Account 53 (freight-train cars).

Tracklaying and surfacing, the recommendations state, should be depreciated with the material composing the track, the depreciation to be determined on the basis of the depreciation weighted according to the labor costs assignable to the materials of the several accounts. Iron wire for telegraph and telephone lines should be given a normal service life of 50 years and copper wire one of 100 years. Property coming under all other accounts should be depreciated under the general rules.

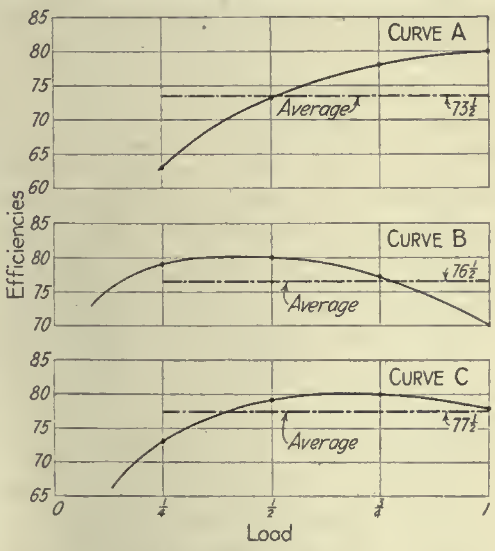
Average Efficiency of Waterwheel Influenced by Size of Bucket

Quotient Derived by Dividing the Pitch Diameter by the Jet Diameter Conveys Good Idea of Performance of Impulse Wheel

By JOHN S. CARPENTER
Hydraulic Engineer, Pelton Water Wheel Company

By plotting a curve, using as the ordinates the specific speeds of waterwheels of the impulse type and as abscissæ the ratio of the pitch diameter to the jet diameter, it will be noticed that it will assume the form $ab = c$, the last being a constant. Thus it is shown that, by dividing a constant by the ratio of the pitch diameter to the jet diameter, the specific speed may be obtained and vice versa. But, while the specific speed conveys in a general way to the designer whether the resulting runner will be of high or slow speed, a quantity having for its value the quotient of the pitch diameter divided by the jet diameter conveys at once a good idea of the finished wheel, the number of buckets necessary and whether the buckets will be crowded or relatively wider spaced.

By use of the following notations the formulæ for obtaining specific speed relations may be derived either in English or metric terms.



SIZE OF BUCKET SHOULD BE PROPORTIONAL TO THAT OF JET

H = effective head in feet; h = the same in meters.

N = horsepower, n = revolutions per minute.

D = diameter in inches of runner on pitch circle; d = the same in meters.

$\triangle$ = diameter in inches of the jet; 6 = the same in meters.

n_s = specific speed or type characteristic.

$R = \frac{D}{\triangle} = \frac{d}{6}$ or briefly, "ratio."

φ = velocity on the pitch line divided by jet velocity, a decimal, generally from 0.42 to 0.47.

The diameter of the runner D on the pitch circle in the English system is:

$$D = \frac{8.02H^{1/2}\varphi 12 \times 60}{\pi n} = \frac{1838H^{1/2}\varphi}{n} \qquad (1)$$

and in meters:

$$d = \frac{4.43H^{1/2}\varphi 60}{\pi n} = \frac{84.6H^{1/2}\varphi}{n} \qquad (1a)$$

and the diameter of the jet at 80 per cent total efficiency is given in inches by

$$\triangle = \sqrt{\frac{N \times 11 \times 144}{H8.02H^{1/2}0.7854}} = \frac{15.91N^{1/2}}{H^{3/4}} \qquad (2)$$

and in meters

$$6 = \sqrt{\frac{N \times 0.095}{H \times 4.43 \times H^{1/2} \times 0.7854}} = \frac{0.1653N^{1/2}}{H^{3/4}} \qquad (2a)$$

To find the value of R, divide the diameter of the runner on the pitch circle by the jet diameter.

$$R = \frac{D}{\triangle} = \frac{1838H^{1/2}\varphi H^{3/4}}{nN^{1/2}15.91} \qquad (3)$$

$$R = \frac{d}{6} = \frac{84.6H^{1/2}\varphi H^{3/4}}{nN^{1/2} \times 0.1653} \qquad (3a)$$

The specific speed is given by

$$n_s = nN^{1/2}/H^{5/4} \qquad (4)$$

Multiplying equations (3) and (4)

$$\frac{D}{\triangle} n_s = \frac{1838H^{1/2}\varphi H^{3/4}nN^{1/2}}{nN^{1/2}15.91H^{5/4}} = 115.5\varphi \qquad (5)$$

or in meters

$$\frac{d}{6} n_s = \frac{84.6H^{1/2}\varphi H^{5/4}nN^{1/2}}{n0.1653N^{1/2}H^{5/4}} = 511.92\varphi \qquad (5a)$$

Consequently, it is seen that in the English system

$$Rn_s = 115.5\varphi;\ R = 115.5\varphi/n_s \text{ and}$$
$$n_s = 115.5\varphi/R \qquad (6)$$

and in meters

$$Rn_s = 511.92\varphi;\ R = 512\varphi/n_s \text{ and}$$
$$n_s = 512\varphi/R \qquad (6a)$$

The value of φ depends upon the bucket. If the bucket is ground and polished inside and the linear dimensions are not too large φ may go up to 0.465, but for hydraulic surfaces with foundry finish it is not advisable to go above 0.43. Based on a jet velocity of $0.98\sqrt{2gh}$, this shows a friction loss of $(0.465^2 - 0.43^2/0.98^2)\ 100 = 3.23$ per cent, which has been verified by tests.

The following table gives an idea of the comparative values with φ at 0.45 and 80 per cent efficiency:

	English	Metric
R	n_s	n_s
7	7.43	32.90
8	6.50	28.80
9	5.78	25.60
10	5.20	23.00
11	4.73	20.94
12	4.33	19.20
13	4.00	17.73
14	3.72	16.46
15	3.47	15.36
16	3.25	14.40
17	3.05	13.55
18	2.89	12.80
19	2.74	12.13
20	2.60	11.52

From investigations by the writer it would appear that a ratio R of about 10 is as low as an efficient unit should go, counting first cost, loss in revenue due to decreased efficiency, etc. Such a unit would have a specific speed of 5.20 English or 23 metric. A runner with $R = 10$, but with two jets, has an equivalent R of $10/\sqrt{2} = 7.07$ or a specific speed of $5.20\sqrt{2} = 7.35$ English or 32.5 metric. In such a case, viz., a wheel with more than one jet, the comparative R varies inversely as the square root of the number of jets, and the equivalent specific speed directly as the square root of the number of jets.

There seems to be an unfounded prejudice against wheels with more than one jet, due probably to the jets being too close together and the lower jet often projecting the water nearly vertically against the upper housing.

The jets should be not less than 60 deg. apart, and preferably one should be horizontal and the other 60 deg. above it. In any case the first cost is generally less by one runner in a unit with two wheels and two streams than in a unit with one wheel and two streams.

When one compares specific speeds there goes with it also the thought of efficiency. All other things being equal, the linear dimensions of the buckets play an important part. Some designers make a bucket "large" in order "to be sure that they get the power." This only moves the point of maximum efficiency farther up the curve, thereby decreasing the average efficiency of the unit, or in other words, its commercial value.

CURVES TAKEN FROM ACTUAL TESTS

An examination of the efficiency curves in the drawing will show some important points. These curves are taken from actual tests and, as only the general law of the curve is pertinent to this discussion, maximum efficiencies have all been reduced to 80 per cent for comparison.

The curve A shows too large a bucket for the jet. The maximum efficiency, therefore, would, judging from the law of the curve, be found at about 50 per cent overload. The area of the jet should be 33 per cent larger in proportion to the given bucket at full load. Curve B shows an overloaded bucket, the area of the jet being about 25 per cent too large. Curve C is typical of the best designed units. The average efficiency for each curve is indicated—for one-fourth, one-half, three-fourths and full loads.

While all the curves have been reduced to 80 per cent maximum efficiency to show the advantage of the three different shapes, it is seen that C is 4 per cent better than A, all of which has a direct bearing on the revenue, showing the value of a flat curve with the "hump" or maximum at from 60 to 70 per cent of the maximum rating.

EFFICIENCY CURVE SHOULD BE CRITERION

There can be no doubt that the efficiency curve and the regulation guarantees should form the basis of comparison for purchase; for this the average efficiency of one-fourth, one-half, three-fourths and full loads is the best criterion of quality and performance.

It may also be said that curves B and C have the advantage of being usually better than the proportion of 4 per cent cited above in the case of C over A, due of course to the fact that A is still increasing.

Tests made at a testing station at Charlottenburg, Germany, by Prof. W. Wagenbach and Prof. Dr. Ernst Reichel, on carefully designed low-speed wheels with polished buckets gave for specific speed 21 (4.75 Eng.) to 32 (7.23 Eng.) efficiencies of 88 and 80 per cent respectively. Tests on the same kind of high-speed wheels (principally longer buckets radially) gave 85 per cent at 25 n_s and 83 at 35 n_s (5.65 and 7.9 English respectively).

Taking the low favorable limit of n_s for Francis turbines at 60 metric (13.55 English) and remembering that n_s varies directly as the square root of the number of jets, it is found that a unit with four jets is $60/4^{1/2} = 30n_s$ *or* 6.77 English. This unit should be made with two wheels and therefore two jets per wheel.

Assuming that the wheels were well designed, and allowing say 4 per cent as a margin, the wheels should have 80 per cent at $n_s = 30$ or 6.77 English.

Test Compounds for Making Wood Fire-Retardant

Herman and Arnold Von Schrenk Report Preliminary Investigations Made for Comparison of Various Commercial Materials

WHILE insisting upon the insufficiency of the results so far obtained and the necessity for planning a larger series of tests, Herman and Arnold Von Schrenk in a recent preliminary report to the National Lumber Manufacturers' Association conclude that practicable standard methods for fire tests can be developed, and that the tests so far conducted have been worth while in showing that there are a certain number of compounds claimed to make wood fire-retardant from which reliable results may be expected. Fifteen compounds for rendering shingles fire-retardant and eighteen compounds applied to yellow-pine panels were tested, and the results were tabulated and discussed in detail in the report. The following abstract suggests the method of testing and the principal conclusions.

OBJECT AND METHOD OF TESTS

The tests were undertaken with two objects in view: (1) The development of some practical methods which would lend themselves to general adoption as standard for testing and investigating the characteristics and efficiencies of various materials which can be used to render wood less combustible, and (2) a preliminary comparison of the merits of materials commercially offered at the present time as fire-retardant or fireproofing products when tested under similar conditions.

Tests were made in a testing furnace similar to that used by the U. S. Forest Products Laboratory and described in the Tenth Annual Proceedings of the American Wood Preservers' Association, page 158. In all the tests the heating plate of the furnace was brought to a constant temperature of 450 deg. C. This temperature was adopted after numerous trials as one which was severe enough practically to destroy the untreated pieces as well as those coated with the less resistant of the test materials, and still permit of a general grading upward to those having the highest resistance.

The method of testing was to expose the test pieces to the heated plate at a distance of ¾ in. from the latter, and flash a gas jet in front of the piece every 10 sec. until ignition took place. The piece was then permitted to burn for 12 min. without its position being changed; then, if still burning, it was moved back from the plate and allowed to burn 12 min. longer, or until the flame was out. The length of time which elapsed from the first exposure to the heated plate until ignition took place, the duration of burning next to the heated plate and away from it and the manner in which the burning took place were noted.

In an investigation of this character it is obvious that the first tests made must be considered as preliminary. The relative values given to the different fire-retardant substances may be very considerably changed by subsequent work. The main conclusions which can be drawn from the determinations so far made are that these tests have indicated that there are a certain number of compounds used for the yellow-pine panels from which reliable results may reasonably be expected. In the case of compounds for shingle protection, while the number is not so large, there appears to be a sufficient number to warrant the statement that when efficiently applied they will not only give a high degree of fire-resistance to a shingle-covered roof, but will also serve to reduce materially, if not entirely eliminate, the flying-brand hazard of the wooden shingle roof.

The investigation has shown in a very striking manner that the numerous variables which enter into the proper consideration of this problem will necessitate greatly enlarging these studies. Practical experience with the fire-testing apparatus has demonstrated that while it is highly efficient it could probably be very considerably improved. It is necessary to have a standard method of testing which will be absolutely reliable.

While the results obtained in the testing furnace are of great significance it will be absolutely essential to construct shingle roofs, as well as other wooden structures, in large numbers, treated with compounds which show the best indications at the present time, exposed to normal weathering conditions and from time to time subjected not only to tests in the furnace but also to standard tests on a large scale.

Design Needle for Road Material Penetration Tests

IN an effort to obtain a needle for road material penetration tests, which will give results in close accord with existing standards and which may be accurately described and easily reproduced, Charles S. Reeve and Fred P. Pritchard of the U. S. Office of Public Roads and Rural Engineering have produced, after the following manner, a needle which has given satisfactory results:

The needle is made by placing a 2-in. length of 0.041-in. annealed-steel drill rod in the chuck of a high-speed lathe, and by means of a fine sharp file turning the end to a sharp point having a ¼-in. taper. When it has been made as smooth and sharp as possible by this means the needle is tempered in a solution consisting of 5 teacupfuls of common salt, 6 ounces of saltpeter, 12 teaspoonfuls of powdered alum and 1 teaspoonful of corrosive sublimate dissolved in 10 gal. of water. The needle is tempered by heating carefully to a dull white heat and plunging at once into the tempering solution. It is then lightly cleaned with smooth emery cloth, heated carefully to a point below dull redness, and again plunged into the solution. It is then ground to a sharp point with a good stone, after which it is smoothed and polished with emery dust, crocus cloth and rouge, and finally held carefully on a buffing wheel. The finished needle should be sufficiently smooth and sharp to enter and pass through a piece of ordinary writing paper without sticking or friction. In other words, the needle must have as sharp a point and smooth a surface as any sewing needle. The important thing is to have the taper straight, beginning ¼ in. from the end, and the needle above the taper exactly 0.04 in. in diameter.

HERRON AVENUE VIADUCT AS IT APPEARED LAST NOVEMBER, WITH MAIN SPAN REMOVED

Single Grade-Crossing Elimination at Pittsburgh Will Cost $750,000

Maintaining of Traffic at Liberty Avenue Crossing of Baltimore & Ohio Railroad an Unusually Difficult Problem

HEAVY railroad traffic on a double-track line, with the view to the east cut off by a sharp curve; heavy street traffic, over a narrow, poorly paved roadway, with a double-track street car line, a steep hill just beyond the crossing, and driveways turning off along the railroad on both sides—all contributing to the congestion of trucks; lack of storage space for construction materials because of narrow right-of-way; lack of opportunity to shift tracks because of narrow right-of-way and because at the west line of the street the railroad passes upon a long steel viaduct; and the necessity at just this point of placing deep foundations to protect an 8-ft. city sewer that meanders through the whole scene of action—all of these things combine to make the intersection of Liberty Avenue and the Baltimore & Ohio Railroad in Pittsburgh, where a separation of grades is being effected, about as busy and cramped a spot as the most ingenious construction man would care to contend with. The necessity of raising the above-mentioned viaduct and part of the Allegheny River bridge on the west, and of protecting the sewer and holding the embankment with retaining walls on the east, will bring the cost of eliminating the single grade crossing to an estimated figure of $750,000. The construction problems are mainly those of maintaining a dense steam, electric and vehicular traffic. Design features include the footings bridging the sewer, and the construction of the new viaduct in such a way that the floor system can be raised to conform to an ultimate higher profile without interrupting traffic.

PRESENT CONDITIONS

The railroad involved in this work is the main double-track line of the Baltimore & Ohio from Pittsburgh to Chicago. Liberty Avenue is one of the two main thoroughfares from Pittsburgh's business district to the East Liberty residential section. West of the avenue the ground drops off and the railroad is carried in Thirty-third Street on a viaduct about 1800 ft. long, from the west line of Liberty Avenue to the Allegheny River bridge. This viaduct is approximately level. East of the avenue the railroad swings into a natural depression, climbing up along the bottom of this on a grade of upward of 1 per cent. Along this part are numerous industries on both sides of the track, in addition to which there are a 40-ton traveling crane for handling heavy freight on the north side and a small freighthouse and team yard on the south side adjacent to Liberty Avenue. These are reached by driveways turning off Liberty Avenue along the tracks on either side.

Liberty Avenue, a comparatively narrow and poorly paved street, carries a heavy vehicular traffic as well as a double-track line of the Pittsburgh Railways Company. Just north of the crossing it makes a sharp ascent to the turn at Forfar Street. This ascent, the bad pavement and the sharp turns into the driveways on either side of the tracks all tend to cause vehicular congestion.

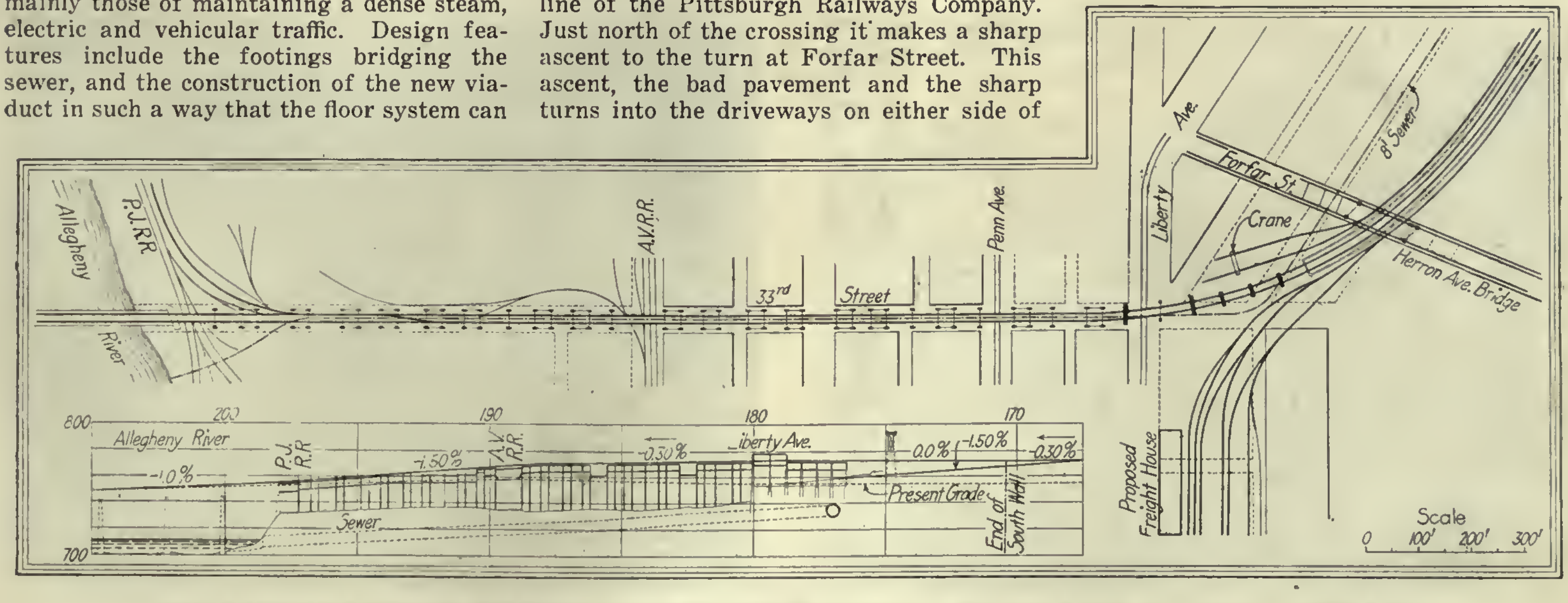
About midway between Liberty Avenue and the Allegheny River the viaduct passes over the main tracks of the Allegheny Valley Railroad, and it also passes over the Pittsburgh Junction Railroad along the river. These two low-level railroads are connected by the Carnegie Steel Company's tracks under the viaduct. These tracks have to be accommodated in any reconstruction of the viaduct. Under Thirty-third Street there is also an 8-ft. circular sewer, the path of which east of Liberty Avenue is shown on the general plan.

At Forfar Street a viaduct known as the Herron Avenue bridge carried street traffic over the railroad prior to the beginning of the improvement. The raising of the tracks has necessitated raising this viaduct in part and reconstructing it in part, and this work is now going on, the viaduct being closed to traffic.

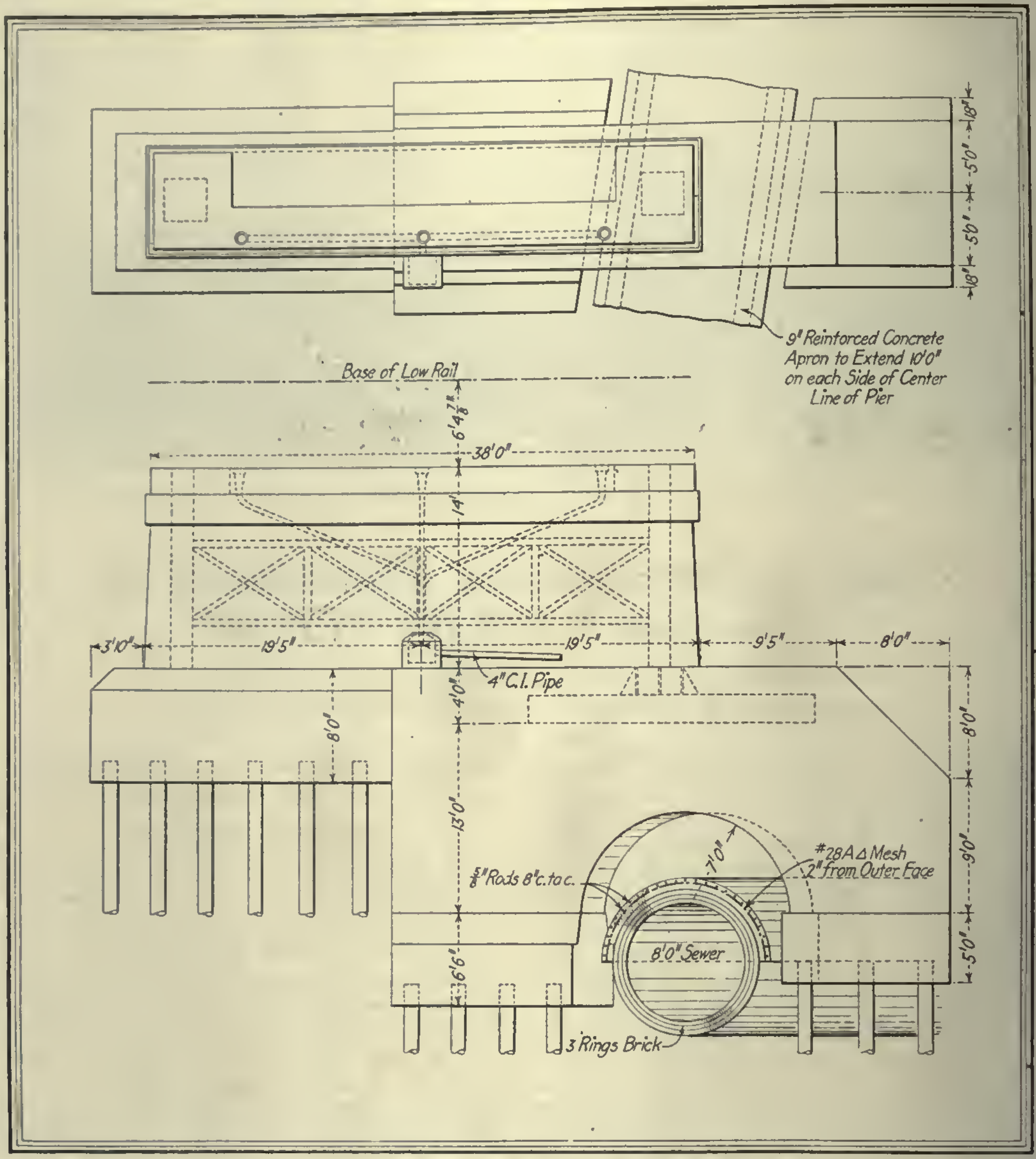
The foregoing were the existing conditions before the improvement was started. To eliminate the grade crossing without changing the railroad profile would have meant heavy damage claims in connection with the raising or lowering of Liberty Avenue. It would also have perpetuated a bad profile for the railroad. By raising the tracks practically the full amount at the crossing, the heavy grade east of the crossing will be to a large degree eliminated, and the railroad will be in a position, when it ultimately rebuilds the Allegheny River bridge, to build it considerably higher as required for the proposed Allegheny River improvement.

WORK INVOLVED

The railroad will be raised at the crossing about 18 ft., the street being depressed about 2 ft. The viaduct west to the river is being reconstructed. The tracks will descend part way on a 0.3-per cent grade, which will ultimately be extended to the high-level bridge over the river. For the time being, however, the high profile will be connected to the existing bridge by a short 1.5-per cent grade, which will necessitate slightly elevating the deck on one span of the river bridge. East of the crossing the tracks will be about level until they pass under the Herron Avenue bridge and around the 6½-deg. curve at that point. They will then ascend on a 0.3-per cent grade, compensated, to a point where this grade is overtaken by the steeper grade of



PLAN OF AREA AFFECTED, AND PRESENT AND PROPOSED PROFILES OF TRACKS—EAST APPROACH RUNS OUT 3000 FEET EAST



DETAIL OF PROVISION TO CARRY 8-FOOT SEWER UNDER END OF PIER

the present profile. This approach will be 4000 ft. long. The two main tracks will be held up by retaining walls to protect the low-level industry tracks on the north side and the lead to the freighthouse and team tracks on the south side. On the south side the retaining wall terminates at the east end of the curve; on the north side it will extend nearly to the end of the approach.

The earth fill will terminate 300 ft. east of Liberty Avenue, and over this intervening space the tracks will be carried on concrete piers and steel girder spans. This is for the double purpose of allowing teaming underneath to and from both yards, and affording protection to the 8-ft. sewer. The small freighthouse and team yard standing oblique to Liberty Avenue will be replaced by a larger layout parallel to the avenue, as shown.

First Stage of Work

The construction work was begun last September. The main tracks east of Liberty Avenue were first thrown to the north far enough to clear the south retaining wall, which was then built, on concrete piles. These walls are of standard mass construction, the concrete being placed by the pneumatic process. Steel forms are being used, handled by the special traveler shown in one of the views.

This south wall was completed during the winter, and late in February main-line traffic was shifted to a single track laid south of the new wall. It was hoped to retain one track north of the north wall as a westbound main, but it was found impossible to keep this open all the way through. Of the two photographs taken from the same point, the one on the left, taken Feb. 21, shows the former location of the two main tracks, with the westbound still in service. It also shows the eastbound track swung out to the south of the south wall. The other view, taken eleven days later, shows this latter track doing duty as the only main track, and various equipment preparing the foundations for the piers along and over the 8-ft. sewer.

The north retaining wall was being built when this journal's representative visited the work. Meanwhile the main track beyond the south wall was being filled under traffic, and the next shift, which was to come immediately after the completion of the north wall, was to be to a high-level trestle swinging to the north of most of the masonry in the piers east of Liberty Avenue.

Straddling a Large Sewer

Of these piers, each had to be designed to take care of the sewer. The first of these from the east is swung around perpendicular to the sewer, and arches it practically symmetrically. The sewer clears the next two. A detail of the fourth is shown. The sewer passes directly under the south end of the pier proper, which has a structural steel skeleton. The north column of this skeleton will, as indicated, be carried on an ordinary foundation on piles; the south end will be supported on an enlarged footing arched over the sewer. The bent just east of the avenue will be carried on a pedestal each side of the sewer. The foundations of these piers and pedestals are now being constructed of solid concrete masonry on precast reinforced concrete piles.

The changes in the Herron Avenue bridge are being made by the city. One of the photographs suggests what was required.

BLOCKING UP VIADUCT AT TWO POINTS DURING REMOVAL OF COLUMNS—NOTE SHORT PILE DRIVER IN RIGHT-HAND VIEW

The deck structure spanning the tracks would not have given the necessary clearance over the elevated tracks. It had to be removed and two new piers had to be built for the remodeled structure, which will have a shallow span over the tracks. Some of the adjoining spans have been raised slightly, but the new roadway will not be much higher than the old.

Raising 1800 Feet of Viaduct West from Crossing

While the work east of Liberty Avenue has been going on the piles and footings for the new viaduct west to the river have all been placed. Except in a few cases these have been set clear of the existing columns and tracks, and no special difficulties were encountered, except that it was necessary to drive the piles with a driver only 12 ft. high over all. A view of this is shown in one of the photographs. In some cases it was necessary to place new footings on the site of the old, supporting the viaduct structure after the manner shown in the photographs.

→ FEBRUARY 21 TWO MAIN TRACKS WERE IN SERVICE

MARCH 3 THERE WAS SCARCELY ROOM FOR ONE ←

Because the 1.5-per cent grade at the west end of this viaduct is ultimately to be eliminated when the new high-level bridge over the Allegheny River is built, it was found desirable to design the new viaduct structure to conform as far as possible with both profiles. For part of the distance this will be accomplished simply by framing the stringers between the cross girders, and taking them out and putting them on top of the girders when the tracks are raised.

At the end nearest the river it will be necessary, in addition to placing the stringers on top of the floorbeams, to place castings underneath the stringers, and in some cases also to raise the floorbeams slightly. The columns will be extended at this time to provide for such future raising of the floorbeams.

The improvement is being carried out under the direction of F. L. Stuart, chief engineer of the Baltimore & Ohio Railroad at Baltimore, and Paul Didier, principal assistant engineer at Pittsburgh. Claude Brown, assistant engineer, is in immediate charge on the ground. P. J. Joyce & Company, Inc., of New York, has the general contract, and is represented at the site by Mr. Joyce. The pile driving for the entire work was sublet to the Cranford Construction Company of Cincinnati. The American Bridge Company has the contract for the steel.

Maintaining the Washington-Atlanta Highway

Data on Organization and Cost of Maintenance of Project Under Supervision of Federal Office of Public Roads

SINCE May, 1914, 800 continuous miles of highway between Washington, D. C., and Atlanta, Ga., has been maintained under the direction of the U. S. Office of Public Roads. The plan was put into effect in order to demonstrate what could be done with road repair and maintenance on a large scale. The work necessitated the assignment of four engineers, three of whom took charge of the divisions between the two cities. The project has been carried on with remarkable results, according to L. I. Hewes, of the Office of Public Roads, from whose paper in the Cornell University highway short course the following notes on organization and costs are taken:

Condition of Road

In order to make the project possible, approximately thirty-seven counties entered into a specific agreement to allow the expenditure of that proportional part of the county funds applicable to the selected route to be under the sole authority of the Office of Public Roads, and during 1914 681.8 miles of the total route came under the plan; $75,786 was available from the various counties. On 153.7 miles operations properly classified as construction were completed, and used up a little over one-half of the funds above mentioned. A total of 139.5 miles was placed under a squad system of maintenance and 263 under patrol system.

The construction operations extended from systematic patch-work to extensive grading and drainage. Almost the entire stretch of road was of low type construction, namely, earth, sand-clay, or gravel. In the State of Georgia during 1914 none of the road was in condition for maintenance in these counties that signed application for government supervision. Construction work only was completed. On most of the road the greatest single defect was drainage. Sub-drainage was almost completely absent. Nevertheless, it was possible to keep nearly the entire mileage in fair to excellent condition until Christmas, 1914. For about 60 days following the winter, rains and water caused bad conditions. The engineers, however, would keep on their sections and whenever possible prompt attention was given to repair and maintenance items. The road became again generally good by the first week in February.

System Defective

It was found that the system prevailing in the various local units rather than the personnel of officials was defective. Suspicion and distrust soon yielded to substantial co-operation and support by business men and responsible citizens. A general scheme of county-road accounting became very desirable.

In many cases funds ran out at the end of seven months, and many county officials were unable to tell whether or not expenses for other roads had been drawn against the allotment. It appeared in general that county officials had a certain variable sum allotted for road work from year to year. They could go ahead and spend it until it was gone; bills received before the exhaustion of the fund were settled, others waited until the next year. This system made it impossible to carry out plans with any degree of certainty. Results accomplished under the systematic supervision outlined above were in many instances in spite of ridiculously low appropriations. In Brunswick County, Va., for instance, 104 pipe culverts occurred in 23 miles. There was available but $2.50 per mile per year for cleaning ditches, culverts, shoulders, and repairing, surfacing and dragging.

Present Condition of Project

The results have in general been very satisfactory. As expected, continuous organization and centralization of maintenance have markedly improved the general condition of the road between the two cities. Sentiment has been directed toward better organization and methods. Applications have in general been renewed for government supervision to continue. It has been found that convicts in gangs do not constitute an effective organization for systematic maintenance. In Georgia it was necessary to continue heavy repair and construction work rather than maintenance, as the roads could not be brought into condition to maintain without using the available money first for heavy repairs. Approximately $42,000 was spent during the past season, and only $18,000 on maintenance, applied largely to the road built the previous year. The total mileage now under supervision is 662. The total amount spent during 1915 was $146,762.

It has not been found necessary to change the general organization. The division engineer of the north division cares for 243 miles, from Blackstone, Va., to Fayetteville, N. C. The division engineer of the middle division, from Fayetteville, N. C., to Augusta, Ga., has 269 miles. The south division, from Augusta to Atlanta, has 306 miles. Each division engineer inspects his work continuously in an automobile. In nearly every county of North Carolina private subscriptions have been made available, in addition to road appropriations. During the winter of 1915 there has been no obstruction to traffic, except for one day at a point near Boydton, Va., where the convict gang placed clay in January and a heavy rain followed. This defect was repaired in 24 hr. by the addition of sand and dragging.

Conclusions and Costs

It has been found necessary to do a huge amount of miscellaneous construction, including projects of various sizes and kinds, culverts, new location, grading, etc. This work was absolutely necessary to put the road in reasonable condition for a maintenance project. It has been found that certain stretches of the road sustain too much traffic for the type of surface prevailing. On such stretches a patrol is absolutely necessary to keep the road in reasonable condition, and is more effective than the gang system, which works intermittently.

In eight selected counties, in which the mileage varied from 15 to 38, it was found possible to classify the work as truly maintenance work, both in 1914 and 1915. The cost during 1914, in these eight counties, varied from $98 to $34 per mile; in 1915, from $146 to $51 per mile. The increase in 1915 is due to the fact that more funds and better maintenance were available. The calendar year 1915 closed with 39 counties in operation, 662 miles in these projects, out of a total of 876 between the two cities. A total of 277 miles is under the patrol system of maintenance, and 274 miles under the squad system. In general, considering the results obtained, the continuous patrol system seems to have an advantage where the roads are traveled as heavily as are many sections of this highway, namely, from 24 to 35 automobiles per day. There are at present at work 13 patrolmen, and about 60 men in gangs of from 4 to 12. The patrolmen have an average of about 12 miles each of road; the gangs will average 18 miles. Patrolmen are paid $1.50 per day, and an extra dollar when they use two horses for the drag. Wages for men in gangs are also $1.50 per day, with $2 to $2.50 for foremen. It has been found that the two-horse scraping grader is very economical and efficient to supplement the drag.

Patching Concrete Pavements

The patches in concrete pavements at Gary, Ind., are allowed to set for 48 hours after placing. A tar covering, at the rate of ½ gal. to the yard, is then put on the patch and traffic turned on at once. Experience has shown that the method is satisfactory. The tar wears off in six or seven months, and the concrete patches are thoroughly hardened.

Largest Panel-Testing Furnace in This Country Constructed at Washington

U. S. Bureau of Standards Provides Heavy Steel Panel Frames and Trolley Runways for Testing Various Types of Fire-Resistive Construction

For the purpose of making fire-and-water tests of large panels of fire-resistive walls and partitions of various types the U. S. Bureau of Standards has designed and erected a test house accommodating twelve panel-testing frames of greater size than any in this country. The furnace is guaranteed to develop practically uniform temperatures between 1400 and 2400 deg. Fahr., with variations within 40 deg. from the desired figure. The burner is specially designed for this installation, and burns light oils without the necessity for previous heating.

General Plan of Building

To properly house the furnace, store and handle the twelve steel panel frames which are to be furnished, and provide for the application of the fire-hose stream necessary for these tests a steel-frame building about 37 x 85 ft. in plan has been built. This structure is to be divided by partitions into three sections, the furnace in one end, the crane runway for transferring the panels in the center, where the water is to be applied and drainage facilities are provided, and the storage room at the other end, where the frames are carried on I-beam runways and stored before testing.

The steel frame of H-column and typical Fink roof trusses with corrugated steel roofing is braced by 1-in. diagonal rods with turnbuckles, not only in the outside panels, as shown in the photograph, but in the intermediate panels between the columns supporting the steel racks, to prevent excessive bending stresses in the columns from the handling of the heavy frames—the total weight of the heaviest frame and panel being about 25 tons. Horizontal bracing also is provided above the 18-in. 70-lb. trolley beams in the storage room, single-angle diagonals being used across the top of the beams. These beams, four in each of the three 12-ft. bays across the building, are hung by ⅞-in. bolts from transverse 18-in. 60-lb. I-beams carried on rolled H-columns.

The special 25-ton crane carried on independent transverse crane-runway beams across the building is used to transfer the frames on a longitudinal I-beam from the storage end of the building to the furnace. All these panel frames are designed with bolted cast-steel hangers which fit the 2-in. pins in the trolley frames running on the lower flanges of the I-beam runways.

Details of Panel Frames

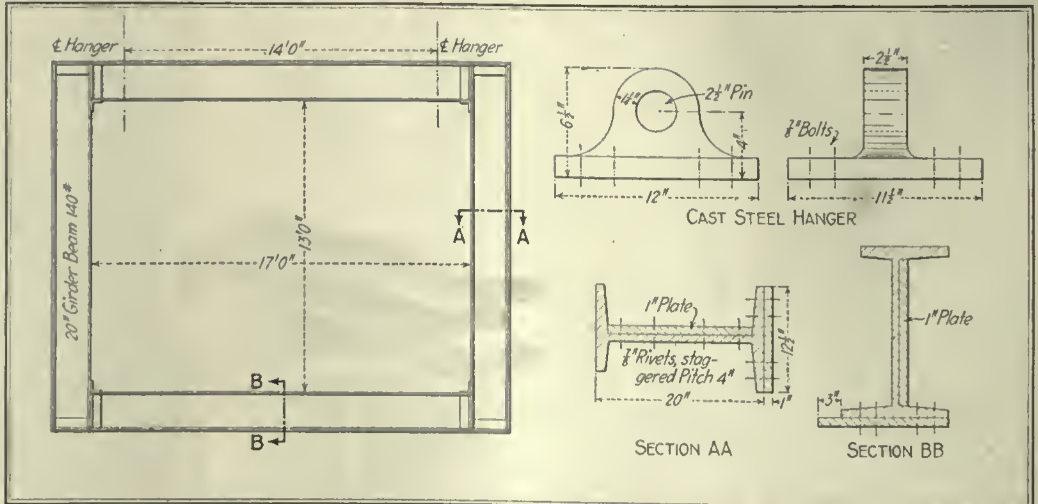
The steel panel frames are 13 x 17 ft., inside dimensions, and will accommodate test panels 12 x 16 ft. up to 12 in. in thickness. The frame used for the heaviest panels consists of four 20-in. 140-lb. girder beams, reinforced by 1-in. plates on the outside flanges and outside of the webs, as indicated in the accompanying drawing. The inside flanges are blocked out to accommodate the construction of the panels to be tested. The 1-in. plates top and bottom are run over the ends of the side girders, and corner connection angles are riveted to them.

The cast-steel hangers, details of which are shown, are offset ½ in. from the center of the frame toward the fire side, tending to make the panel hang close to the furnace face at the bottom. This position of the hangers tends to counteract partly the tendency of the panel to hang away from the furnace face at the bottom after the wall has been built in, since the center of gravity of the built-up panel is nearest the fire side.

Method of Shifting the Panel Frames in Position for Test

In order that it may be unnecessary to exert great pressure in forcing the panel to fit closely against the face of the furnace, the furnace has been built on a skew, the end nearest the crane being 4 in. and the far end ½ in. off a line parallel to the trolley beam carried by the crane. The trolley beam in front of the furnace consists of a 24-in. 90-lb. I-section suspended by a yoke from a cast-iron roller 8 in. in diameter at the crane end. The other end of this trolley beam rests on small steel rollers on the top of the H-section column.

After the panel has been rolled from the crane upon the trolley beam before the furnace, the roller end of the trolley beam is moved toward the furnace by means of a lever which brings the upper face of the panel in contact with the upper lining of the furnace face throughout its whole length. The lower face of the



DETAILS OF HEAVIEST STEEL FRAME AND CAST-STEEL HANGER

VIEW OF FURNACE ON RIGHT AND CRANE CARRYING STEEL FRAME IN CENTER

panel, which now hangs about 2 in. away from the furnace, is now forced into contact along its full length by a single movement of a large eccentric clamp which is fastened to the floor at the rear of the center of the panel.

After the firing is completed the eccentric clamp is released, the lever which operates the roller end of the trolley beams is reversed, thereby throwing the panel clear of the furnace, and the panel is rapidly pulled out upon the crane by means of a hand winch, where it may be exposed to the fire stream.

CONSTRUCTION OF FURNACE

The back of the furnace, as seen in the photograph, is constructed of reinforced concrete, with at least 18 in. of fire-brick lining. The open face is about 16 x 20 ft. in outside dimensions to receive the test panel frame. Two observation holes are provided at each end to facilitate the inspection of the test panel. The temperature measurements are made by means of seven pyrometers located at points symmetrically distributed over the face of the panel exposed to the fire.

The burner and arched fire-brick combustion chamber are located below the floor level. The furnace is to burn light fuel oil without previous heating. It is guaranteed to develop a temperature of 1700 deg. Fahr. within 30 min. and to furnish a uniform temperature between 1400 and 2400 deg. without varying more than 40 deg. either way from the desired value.

A fire pump and equipment for furnishing a stream of water under 80 lb. pressure through 1⅛-in. nozzles are provided, the test panel being rolled out into the center of the building before this water is applied.

The design of the building and the steel panel frames was made by the engineers of the U. S. Bureau of Standards. The furnace and burners were specially designed for this installation by W. N. Best, consulting engineer, of New York City.

Can Develop Winnipeg Power at Unusually Low Cost

Report of Dominion Water Power Branch Estimates Total Cost at $42.80 and Annual Cost at Less Than $5.50 per Horsepower

DUE in a great measure to the large capacities involved and the geological and topographical features of the power sites selected, the available power in the fall of the Winnipeg River in Manitoba can be developed at 7 sites at an average capital cost of the final output of $42.80 per horsepower and at an annual cost of from $4.50 to $5.50 per horsepower year, according to estimates contained in a report prepared by J. T. Johnston, chief hydraulic engineer of the Dominion Water Power Branch, acting under the direction of J. B. Challies, superintendent of the branch. J. R. Freeman, consulting engineer, of Providence, R. I., and J. B. McRae, consulting engineer, of Ottawa, advised on the organization and scope of the surveys on which the estimates are based. The following notes have been abstracted from a review of the report prepared by T. H. Hogg, assistant hydraulic engineer of the Ontario Hydroelectric Power Commission, Toronto:

The acceptance of a unified power development scheme for the whole river and the establishment of the necessary authority for the supervisory control preparatory to the development of particular sites is the only way in which the full measure of the power resources of the Winnipeg River may be realized. A minimum flow of 20,000 cu. ft. per second is obtainable at all seasons with an efficient and systematic control of the runoff. It is possible to concentrate practically the total fall of the river in Manitoba at 7 power sites.

Estimates of cost for each possible site were prepared in detail. These costs, which were made on a basis of low tension power at the power-house switchboard, indicate that the average capital cost of the total final output of the seven concentrations would be $42.80 per horsepower, based on machinery installed, with an annual cost of from $4.50 to $5.50 per horsepower. The capacity of installed machinery was based on 50 per cent excess over the continuous capacity of the site at 75 per cent overall efficiency. The estimates were carefully prepared and appear to be conservative, the large capacities involved and the geological and topographical features of the power sites being responsible in a large measure for the extremely low costs. No charge was included for the operation of the necessary storage dams of the ultimate developments, and the power rentals to the government were omitted.

STORAGE FOR ULTIMATE DEVELOPMENTS

The necessary storage for the ultimate developments must be secured on the head waters of the river in the Province of Ontario. For that reason some independent government board, such as joint control by the Hydroelectric Power Commission of Ontario and the Dominion Water Branch, must exercise supervision. Independent control will be necessary also for the regulation of local pondage, as control by conflicting and independent interests located at any of the various power sites would jeopardize the efficient operation of the plants below.

At all power sites provision has been made for the future installation of locks, should it be deemed advisable to canalize the river. This provision was made because slack water will exist practically from Lake Winnipeg to the Manitoba-Ontario boundary when the full potentiality of the river has been developed.

LEASES SHOULD BE GENEROUS TO INVESTOR AND PROTECT PUBLIC

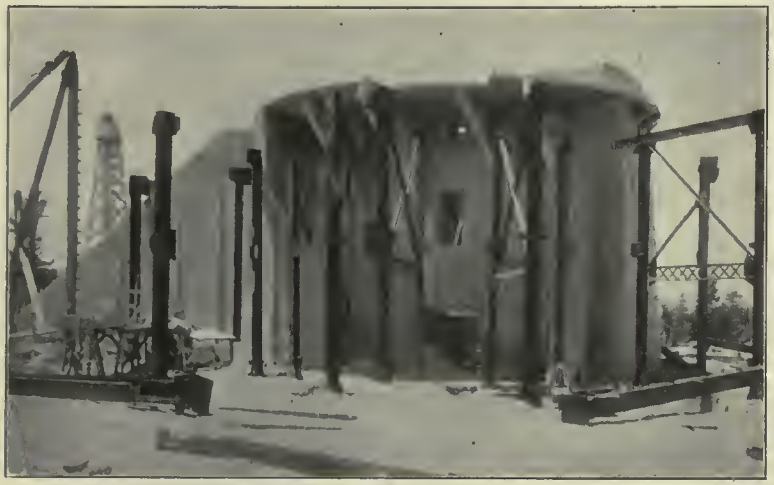
A necessary and vital factor for the success of such a scheme of development is fairness and liberality to the investor without sacrificing the interests of the public in granting the leases. The stated policy of the Dominion Water Power Branch is to encourage desirable development of water power resources, to discourage and prevent the initiation and development of uneconomic and wasteful projects; to insure that the river systems are developed along comprehensive lines wherein each unit is a component part in a system and that adequate storage measures are taken, in the interests of all powers affected; to prevent unnecessary and possible duplication of expenditures on the part of competing plants; to safeguard the public from monopolistic control by regulation and periodical revision of rates; to see to the early carrying into effect of agreements issued by the department for the development of power; to compel the development of existing plants to their limit when the market demands, and to promote in general the fullest conservation of the power resources of the western part of the country.

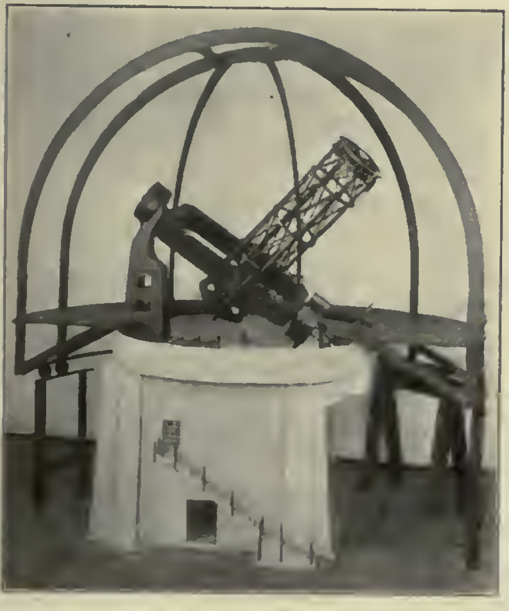
Mountain-Top Foundations Support Huge Telescope

Structure for 100-In. Reflector on Mount Wilson in Southern California Demands Precise Work—Transportation Difficult

On the summit of Mount Wilson (El. 5889 ft.), near Pasadena, Cal., there is now nearing completion the foundation and steel dome for a 100-in. reflecting telescope to be equipped with the largest mirror ever cast. From the outset great interest has attached to this work from the astronomers' viewpoint, and since the structure has been begun unusual problems of an engineering nature have been presented. Transportation has entered very largely into the enterprise; when the work on other instruments of the observatory was laid out and started in 1904, all equipment and material had to be brought over a rough mountain trail by burros.

The trail leading up the mountain was later replaced by a road which has been improved from time to time and in recent months has been traversed frequently by automobile trucks of capacities up to 6½ tons, which are now conveying the material to the summit. The present road, however, which is 9 miles long, is still extremely crooked and narrow, with grades running as heavy as 20 per cent or more, and sharp curves on the verge of deep gorges.


CONCRETE PEDESTAL WITH STEEL FRAME UNDER CONSTRUCTION


MODEL SHOWING HOW THE GREAT LENS WILL BE MOUNTED

The foundations on which the steel building and dome are erected were made heavy enough to withstand the stresses of a 75-mile wind against the dome which is 100 ft. in diameter and 106 ft. high. The large concrete pier, which is the main element of the telescope foundation, is 33 ft. high and 53 ft. in diameter on top. There are three floors in the pier, and an elevator is provided for handling the 100-in. mirror which will be taken to a lower floor occasionally for resilvering. The second floor is used for water tanks and auxiliary mechanical equipment. At the south end of the pier is an extension which a spectroscope 50 ft. long will be mounted. This extension is covered first with a concrete house and then by a metal structure calculated to keep temperature conditions constant.

The greatest care was used to keep all parts of the pier away from the steel building and its foundations so as to avoid the possibility of vibration which might be transmitted to the instrument through such contact. The earth at the site, which is decomposed granite, was removed from around the foundations and later thrown back loosely as an additional protection against vibration and in order to cushion the structure from even the slightest local disturbance. As no sand was available for mixing the concrete, clear decomposed granite that had passed through the rock crusher was used as a substitute. This gave excellent results, it is stated, the only apparent difference being that it caused a slightly greater shrinkage of the concrete than when ordinary sand was used.

SUPERSTRUCTURE AND EQUIPMENT

The lower part of the building, up to and including the tracks on which the dome revolves, was erected in 1914. The tracks were placed with great care and to insure a perfect surface on which to rotate the dome, a home-made radial arm supported on a pivot in the center was used to swing a grinding machine around the circular track. With this equipment the track was worked down until an extremely true and smooth surface was secured. In 1915 the steel superstructure of the observatory was completed to a point where it was considered waterproof, and some of the operating mechanism was installed. This included the trucks on opposite sides of the dome and the motors and connections by which it is operated and controlled.

The steel dome has a double wall and roof throughout to insure stable temperature conditions, and the main floor is a part of and revolves with the dome. This floor, however, is separated from the pier walls by a 2-in. clearance. A movable observers' platform, giving access to the instrument in any position, is hung from the dome and a wind shield is installed to shelter the telescope from wind coming through the openings. The opening through which observations are made is 20 ft. wide and is equipped with shutters arranged to roll to one side when the telescope is in use.

The steel for the dome was fabricated in Chicago, where it was erected before shipment to insure exact fit. When re-erected on Mount Wilson no serious difficulty was encountered, although two 8-ton parts had to be lifted bodily into the main arch nearly 100 ft. above the ground. The heavy parts of the telescope mounting, which weighs about 135 tons, were made by the Fore River Ship Building Company in Quincy, Mass., but all of the smaller and more accurate mechanism has been made in the Pasadena instrument shop of the observatory. Four pieces of the tube were too large to be shipped by rail and so had to come by steamer around Cape Horn. Loads of steel weighing as much as 11 tons have been taken up the road to the observatory site by a single 6½-ton Saurer truck.

4½-TON GLASS CASTING

The difficulty in the casting of a 100-in. reflector is that for so great a diameter a thickness of 13 in. was considered necessary in order to prevent bending. This would require a perfect glass casting weighing 4½ tons. A satisfactory casting was finally secured, however, at the plant of the St. Gobain Glass Company of Paris, France. Since the lens arrived at the observatory optical shop several years ago, work on it has been constantly carried on by Mr. Ritchey, and it is expected that the polishing process will be finished early in 1917.

Dr. George E. Hale is director of the Mount Wilson Observatory and, in addition to the structure now nearing completion, has had charge of the installation and operation of other astronomical equipment in use there. These men directed the work: Francis G. Pease, instrument design; G. W. Ritchey, chief optician; George D. Jones, superintendent of construction of buildings; Clement Jacomini, chief instrument maker, and Alden F. Ayers, foreman of instrument shop.

THE DOME IS 100 FEET IN DIAMETER AND 106 FEET HIGH

Suggests Fine Gravel Foundation Course for Concrete Roads

A layer of fine gravel, from 2 to 4 in. in thickness, laid on a thoroughly drained base, was suggested as an ideal foundation course for use under concrete pavements by J. H. Huber, resident engineer of the New York State Highway Commission, at this year's Good Roads Week at Cornell University.

Wide Range of Topics Discussed by Waterworks Men

Abstracts of Some of the Papers Presented at the Thirty-Sixth Annual Convention of the American Waterworks Association in New York City, June 5 to 9

Distributing Reservoirs Demand Careful Location

Where Not Economically Impossible, They Should Be Near Center of Congested Value District to Minimize Friction Loss

By DABNEY H. MAURY
Consulting Engineer, Chicago

WHERE economically possible the distributing reservoir should be located near the congested value district of the city so as to minimize friction losses in the mains. In the construction of a concrete reservoir leakage elimination is difficult, though it is possible with proper materials, mixture and workmanship.

STEPS IN TAKING WATER FROM SOURCE TO CONSUMER

In any waterworks system there are usually a number of steps between taking the water from its original sources and the actual delivery to the consumer. These steps are: The collection and storage of the water of a stream in an impounding reservoir; pumping it from a stream or lake, or from wells to such a reservoir or to a settling basin, filters or directly into the distribution system; purification either by sedimentation or by filtration, or both; pumping from the surface reservoir, the sedimentation basin or from the clear water reservoir of filters into the distribution system; and the actual delivery of the water from the distribution system to the various consumers. The usefulness of any reservoir depends upon and is limited by the position which it occupies in respect to the order or procession of the steps just enumerated. The nearer it is to the beginning of the procession the less will be its value, other things being equal, and the farther along it is the greater its value will be. A distributing reservoir properly located will help out the capacity of the distribution mains themselves, this being a very important function that has been frequently overlooked.

VALUE OF PROPER LOCATION

Where small waterworks plants have elevated storage one frequently sees the tank located on the pumping station lot. A tank so located is in most cases a monument to the bad judgment of the man who designs the plant. The capacity of a reservoir should be made as large as the finances of the local water department will permit. In any event, it should be made large enough to tide over the demand of the four or five hours of maximum consumption, and, if possible, its capacity should at least be equal to a full day's pumping. Where the elevation required is high and the capacity small, the reservoir will have an elevated tank supported by a tower, the whole structure usually being of steel. Other things being equal, that type of tank in which the average elevation of the stored water is highest is to be preferred, and when such tanks can be secured, as at present, at relatively low cost, and made in attractive design, it would seem that the old-fashioned tall standpipe, in which three-fourths of the contained water serves no useful purpose except to support the upper one-fourth, has no longer a right to exist.

CONSTRUCTION DIFFICULTIES

It is not an easy matter to build a reservoir which shall be absolutely watertight from the time the forms are removed. Fortunately, however, very small leaks will usually become less or "take up" in a short time, especially when the stored water contains iron or sediment, and, in most cases, it is not very difficult to stop large leaks, or at least to reduce them to so small an amount that they will ultimately stop of themselves. In one case a leak was stopped by grooves cut into the line of connection between successive pourings of concrete to a depth of 1½ in. and a width of 1 in. at the surface. These grooves were carefully filled with a mixture of ironite and cement.

It is entirely possible, with proper materials, mixture and workmanship, to prevent moisture from passing through a concrete wall a foot thick, even under fairly heavy pressure. Leaks are most likely to occur in construction joints. The use of steel dams will reduce the danger of such leaks, but these cannot always be relied upon to prevent the leakage, and their presence should not be allowed to diminish in any way the precautions which should always be taken to prevent leakage of the joints.

The surface of concrete which has begun to set should be scratched and roughened, and all rubbish and dirt should be carefully removed with a vacuum cleaner before the next batch of concrete is poured. This will not always present leakage, but it will go far toward doing so.

Filtration Would Reduce Typhoid's Toll by 3000 Lives Annually

Dollar Spent for Pure Water Will Save Many in Vital Capital—City Officials to Blame for Needless Loss

BY GEORGE A. JOHNSON
Consulting Engineer, New York City

IF all the urban population of the United States were supplied with filtered water or water of equal purity the average urban typhoid fever death rate would be 14 per 100,000. A reduction of 67 per cent in the typhoid rate immediately following filtration has been amply demonstrated. The average typhoid fever death rate among the urban population of the United States in 1913 was 20 per 100,000. By reducing this rate to 14, about 3000 lives would be saved annually and 45,000 cases of typhoid fever prevented. This represents an amount in vital capital equal to $22,500,000 annually, or, at 6 per cent, the interest on an investment of $375,000,000.

Of the 50,000,000 people representing the urban population of the United States, 20,000,000 are now supplied with filtered water. To build filtration works having a total daily capacity of 4000 million gallons daily, sufficient to provide pure water for the remaining 30,000,000 people, would not cost $100,000,000. To operate these works and pay all charges, including interest and sinking fund, would not cost more than $12,000,000 per year, or about one-half the present annual cost in vital capital.

TYPHOID PREVENTABLE

Typhoid fever is an easily preventable disease. Since it cannot be contracted naturally without taking the specific germ into the mouth, to eradicate it involves only the purity of food and drink. Preventive measures are seriously hampered by lack of funds. Annual budgets, with very few exceptions, are made up by officials who sense but dimly the responsibility they shoulder when they cut health department appropriations.

In the United States 20,000,000 people are now being furnished with filtered water at a cost not exceeding $8,000,000, or 40 cents per capita per year. In those cities having filtered supply the waterborne typhoid fever has been practically eliminated, as reliable statistics prove. The results of water purification always show a big balance on the right side of the ledger. For every dollar spent for pure water many lives are saved in the form of vital capital through the prevention of sickness and death. If a community of 19,000 people spends each year 40 cents per capita for filtered water, and thus each year prevents a single death and the attendant cases of illness from typhoid fever it will come out even financially and also increase its self respect. In Pittsburgh, for instance, the adoption of water filtration has saved over 600 lives, 900 cases of typhoid illness and $4,500,000 in vital capital annually.

TYPHOID TOLL, 20,000

In this country 300,000 persons suffer annually from typhoid fever and 20,000 die of it. Thus in the course of a decade one person in every 33 contracts the disease by taking into the mouth germs discharged in human urine and feces. Of those who recover a substantial number die later from other causes resulting from depleted vitality. Still others never completely recover from the effects and although they may live to old age their usefulness has been materially curtailed.

To give for each human life lost through typhoid fever an average value of $3,600, and for lost wages and medical attendance $200 per case, the present day annual typhoid toll in the United States amounts to $130,000,000. It would seem that the influence of depleted vitality in the case of typhoid convalescents resulting in earlier death from other causes, and depreciation of usefulness through the years of remaining life, should be given some expression of money value, and, if for this, even $75 is allowed for each typhoid convalescent the final result is $150,000,000 as representing in terms of dissipated vital capital the annual typhoid toll paid by citizens of the United States each year.

Pure Water More Important Than Grade-Crossing Elimination

Grade crossings are a menace to life but not nearly so great a menace as a bad water supply. Of all public work the waterworks is by far the most important and should always be given preference in the allotment of money for the city's maintenance. Ever since it became known that bad water was dangerous to health the public has been entitled by sovereign right to receive pure water. Bad water will put out conflagrations as promptly as pure water, but it will also cause wide-spread disease. In the last thirty-odd years the loss in vital capital through typhoid fever alone was over three times the net property loss from fire in the United States.

It is a customary desire that the waterworks department of a community shall be self-supporting, but it is seldom that large sums of money are kept on hand to defray extraordinary expenses in the department. When questions arise as to the adequateness of the supply as regards volume, or more satisfactory distribution, little difficulty is experienced in obtaining the necessary funds to carry out the work, for the comfort and convenience of the public are affected. With improvements in the supply respecting purification it is different. When a city of 100,000 people is confronted with evidence furnished by its own officials and those of the state health department showing that the water supply requires purification, and learns that works to effect this end will cost say $300,000, there follows an energetic sharpening of pencils to ascertain how this is going to affect the tax rate. Many cities have endured an exceptionally high typhoid fever death rate for years and withheld the finance of support necessary for the furtherance of measures of prevention even when it was plain that the public health of the community would be immensely benefited thereby.

Sewage Treatment Does Not Suffice

Sewage treatment in the large community materially reduces the dangerous pollution of water supply but it does not make safe for human consumption the waters of the stream into which the sewage effluent is discharged. Filtration of such waters is the only way to make them entirely safe.

The filtration of the urban water supply would not only reflect upon the general welfare of the city dwellers alone, but would also have its effect on those living in rural communities. This benefit is not measurable in precise figures, but what pure water in one city may mean to the health of a nearby community was never better demonstrated than in the case of Allegheny and Pittsburgh.

Allegheny has only quite recently received pure water from the Aspinwall filter plant, but as soon as filtered water was supplied to Pittsburgh the typhoid fever death rate in Allegheny, for no other apparent reason, began to decrease. For the three year periods before and after filtration of the water supply of Pittsburgh, the average typhoid fever death rates in Allegheny, located just across the river, were 91 and 93 per 100,000 population respectively. This was a reduction of 60 per cent, obviously due to the large number of residents of Allegheny working in Pittsburgh and drinking the pure filtered water of that city.

Various Factors Influence Pumping Plant Efficiency

Tested Efficiency Proves Builder's Guarantee, But Does Not Give True Indication of What Operating Results Will Be

BY J. N. CHESTER

Hydraulic and Mechanical Engineer, Pittsburgh

ASSUMING that the coal used at pumping plants contains heat represented by 100 per cent, it is known that with the contrivances in use to-day it is impossible to make apparent in work done as represented by the water column delivered with the most efficient machine, more than 20 per cent of the 100 per cent of heat in the coal fired under the boiler, and in many instances the net result does not exceed 5 per cent. In the boiler, efficiencies are not obtained greatly in excess of 70 per cent.

Radiation in Steam Lines

Radiation must take place and some loss due to friction must be incurred in steam lines. Due to the ineffective utilization of the heat delivered at the throttle by the highest grade steam motors or engines in use to-day, which seldom exceeds 20 per cent, the net result of the original 100 per cent assumed in the coal is 15 per cent.

Much may depend upon whether the steam lines are well proportioned, for if too large and the velocity sluggish the condensation will be increased. If too small, a portion of the heat must be lost in friction. If fair, a large amount of useful energy escapes through radiation and in 90 per cent of the steam plants the covering seldom fits the pipe tight, and, in consequence, is but 50 per cent as efficient as though it were continuous over fittings, and provided against air circulating between the covering and the steam pump. A 10 per cent loss of energy between boilers and engines is not an uncommon one, when by proper care in its design and construction it can be kept within 1 per cent.

Loss in Varying Demands and Heads

Another great loss comes from a varying demand and head and consequent load factor of the plant. It is not a matter that either the designing engineer or the operating officials can correct. Metering intensifies it, so that even when brought to the minimum it still remains a large factor, causing inroads on economy.

In 75 per cent of the waterworks plants there exist no high level reservoirs. Consequently the delivery of the pump is governed by the demand on the mains, which varies throughout the twenty-four hours in the ratio of its extremes of about 1 to 3.

In many plants having a capacity less than 10,000,000 gal. daily fire service is rendered by direct pressure, which calls for an increase, when the alarm comes in, of from 20 to sometimes 100 per cent, for all of which the boiler must be kept in constant readiness, thus grossly increasing the fixed thermal losses.

Acceptance Tests No Index to Operating Results

When an engine is tested for acceptance, and to prove the builder's guarantee of efficiency, a standard is too often set up in the purchaser's mind which he hopes to but never in the future realizes for the reasons mentioned previously, and because the boiler is used for other purposes than the pumping engine itself.

There is a tendency on the part of the station or operating engineer to neglect or disregard his means for removing the back pressure from the exhaust side of the low-pressure piston in his engine. The loss due to low vacuum may be roughly reckoned in precipitating engines at 1 per cent for each inch of mercury. Steam turbines require for economical operation a much greater vacuum than 26, and, while the condensing facilities may be nursed at the time of the test to produce the desired results, the greater is the fall when the lower vacuum of everyday work becomes effective. Another of the major elements that tend to reduce plant efficiency is the inadaptability of many of the steam producing, pumping and auxiliary units in use, due often to the exercise of bad judgment, or none at all, in the original selection and installation, which arises mainly from an unwillingness to incur expense for expert advice in the selection of the machinery.

Organisms in St. Paul Water Eliminated by Sulphate

One Part Copper Sulphate in 10,000,000 Parts of Water Effects Practical Elimination—Treatment Effective for Five Weeks

BY PROF. N. L. HUFF

Department of Botany, University of Michigan

THREE tests of the effectiveness of copper sulphate treatment for purifying the water supply for St. Paul, Minn., show this method to be effective in eliminating all forms of organisms with the possible exception of Eudorina and Pandorina. The treatment remains effective for about five weeks. At the end of that period the increase in reproduction is remarkably rapid.

Water is supplied to St. Paul from a series of small lakes extending 20 miles north from the city line. Lake Vadnais is nearest to the city and used as a distributing reservoir. Its average depth is 27 ft.; the ordinary capacity is 3,240,000,000 gal. Samples were collected just above the weir where the water enters the conduit to the McCarron pumping station. The number of organisms was determined by the Sedgwick-Rafter method.

The copper sulphate was distributed by putting the crystals in a burlap sack. This was tied to the stern of a boat which was rowed over the lake to obtain uniform distribution. Motorboats were used where depth permitted. Where access with boats was impossible a small pump was used to distribute the copper sulphate solution.

The water was first treated with copper sulphate June 14, 1915, at which time the number of Synedra pulchella per cc. of water was 3420. One part sulphate to 12,000,000 parts of water decreased the number of Synedra to 1116 per cubic centimeter by June 25. The second treatment was given July 12 and one part sulphate was used for 10,000,000 parts of water. This reduced the number of Synedra from 7720 per cc. to less than 100 per cc. in ten days. The Synedra remained inactive until about Aug. 20.

A third treatment with copper sulphate of the same strength as used in July was given Aug. 27. The number of Synedra was reduced to less than 100 per cc. by Sept. 24. Samples were taken from all over of the surface of the lake and down to a depth of 20 ft.

With conditions under which the treatments were made the use of one part of copper sulphate in 12,000,000 parts of water will eliminate Spirogyra, Cyclotella and most of the Cyanophyceae. Treatments with one part copper sulphate in 10,000,000 parts of water will suppress and practically eliminate Chlorophyceare, Diatomaceae, Cyanophyceae and Protozoa. Treatment with the stronger solution remains effective for about five weeks. After that period the growth becomes rapid.

Chlorination Requires Careful Supervision

Investigation of Details Shows Effects of Method of Mixing, Color and Temperature —Aftergrowths and Corrosion Discussed

BY JOSEPH RACE
City Bacteriologist and Chemist, Ottawa, Canada

WHEN chlorination was first introduced for the sterilization of water and sewage all that was required was the addition of the hypochlorite; the process was then supposed to take care of itself. Tests show that greatest efficiency depends upon attention to details.

Hypochlorite solution was added in a sedimentation basin at the entrance of the Ottawa, Canada, water intake July, 1914, by means of a perforated pipe. The mixture was effected as thoroughly as possible without recourse to mechanical methods. During August the bleach liquor was added directly to the suctions of the low-lift pumps, which take water from the sedimentation basin and place it in the intake pipe under a small positive pressure until it reaches the high-lift pumps. Tests showed that the latter method of mixing gives much superior results with a smaller consumption of chlorine.

EFFECT OF COLOR

Experiments showed that color reduces the efficiency of chlorination and necessitates a much larger dose. About 2½ times as much chlorine has been found to be necessary in treating water of color forty for one hour at 63 deg. Fahr. to get the results obtained with water practically free from color. Water at the Montreal intake, free from color, required about 0.3 part per million of available chlorine for satisfactory treatment.

Tests to determine the effect of temperature showed that 10 cc. of water of color forty containing 0.4 part per million of available chlorine retained only two of the original 424 colonies after being subjected to a temperature of 36 deg. Fahr. for twenty-four hours. All colonies were destroyed after twenty-four hours at 70 deg. Fahr. and only three of the original 424 colonies remained when a temperature of 98 deg. Fahr. was maintained for four and one-half hours.

It has been stated that after the preliminary germicidal action has subsided a second phase occurs in which there is an accelerated growth of organism known as aftergrowth. The aftergrowths obtained under usual working conditions vary according to the dosage of chlorine. When it is small few active organisms, in addition to spore bearers, will escape destruction. Others will suffer a reduction of reproductive capacity.

There is a persistent decrease in the number of B. coli organisms as the contact period is increased. The time required for the completion of two cycles comprising the first reduction caused by the chlorine, the increase or aftergrowth and the final reduction due to lack of suitable food material, depends upon various factors of which the dosage and temperature are the most important. With a small dosage the germicidal period is short and the second phase quickly reached; with large doses the second phase is not reached within forty-eight hours.

Low temperatures reduce the velocity of the germicidal action but extend the period over which it is effective. The higher the temperature the quicker are the action and development of the aftergrowth. These statements refer only to the total bacteria as found by development on nutrient agar. The B. coli did not act in this way and persistently diminished in every case.

DETERMINE CARBONIC ACID

Tests were made to determine the free carbonic acid in the raw and treated waters at Ottawa. During a period of excessive turbidity and pollution a heavy dose of chlorine was used and an increase in the free carbonic acid resulted. It was found that there was no increased corrosive action due to that acid. With the usual dosages of chlorine the increased electric conductivity had no practical significance at ordinary temperatures. At temperatures approaching the boiling point of water the percentage increase of conductivity is somewhat greater and possibly of practical importance.

Experiments were made to ascertain whether the B. coli found after chlorination were more resistant to chlorine than the original culture. The colonies surviving after treatment with comparatively large doses were fished into lactose broth and this culture used for a second chlorination. The surviving organisms were again fished and the process repeated several times. No evidence was obtained that the surviving organisms were in any way more resistant to chlorine than the original culture. A number of the colonies surviving several chlorinations were cultivated in lactose broth. All of the cultures produced less acid than the original one and the average was considerably less than the original cultivated under the same conditions, showing that the biochemical activity was diminished.

Water Consumers' Accounts Kept on Cards

Ripon Light & Water Company Keeps All Records in Compact Form—Not One Card Lost in 10 Years

By E. W. HASELTINE
Manager, Ripon Light & Water Company, Ripon, Wis.

TEN years ago the Ripon (Wis.) Light & Water Company adopted the plan of keeping its consumers' accounts on cards. One color is used for each department; white for water, blue for electricity, salmon for gas, and yellow for merchandise and repairs. Two vault omnibuses contain the records, one for the manager and one for the bookkeeper. Cards are kept for consumers' records, meter readings and meter records.

The advantages of the system are: Compactness, ease of handling and cost. With all the necessary information relating to a consumer's installation, the amount of his bills for eight years, the promptness with which he pays, etc., recorded on a 5 x 8-in. card, the settlement of disputes is greatly facilitated. The small cards are much easier to handle, arrange and keep up to date than any kind of bound or loose leaf books. They may be classed, divided and subdivided to any extent desired with a minimum of labor and time. A ledger may be worked on simultaneously by any number by assigning the cards as desired. The cost of a card system is materially less than that of loose leaf ledgers.

On introducing the system it was feared that some cards might be lost. After ten years of operation, during which thousands of cards have been handled, this fear has been proved groundless, as not one card has been lost.

Railroad Saves $34,674 a Year on City Water Bill

Illinois Central by Water-Waste Campaign Effects Big Economy, Principally in Eliminating Wastes Above Ground

BY C. R. KNOWLES
Superintendent, Water Department, Illinois Central Railroad

RAILROADS are among the largest users of water in the country, consuming daily approximately 1,950,000,000 gal., at a daily expense of over $100,000. It is safe to say that 15 per cent of all the water used by railroads is waste—that is, water drawn in quantities in excess of the amount actually required. The Illinois Central Railroad, by means of a water waste campaign, reduced the expense for city water alone from $225,112 in one year to $190,438. This represents only about 40 per cent of the total cost for water, 60 per cent being for that pumped by company forces. Consequently, there has been effected a greater reduction in the waste, which cannot be estimated in figures.

KINDS OF RAILROAD WASTE

Large quantities are wasted in taking water at tanks and penstocks unless care is exercised to properly spot the engine and avoid overflowing the tender. A conservative estimate of the total cost of this waste per year is $60 per tank. The constantly flowing pipes on bubbling drinking fountains will waste from $150 to $350 per year for each fountain. The only satisfactory way to control this waste is to restrict the size of the opening and to equip all fixtures of this type with self-closing valves.

Yard hydrants for sprinkling, filling water jugs and coach yard service also cause a heavy waste. A 1-in. hydrant of this type will waste from 20 to 30 cents worth of water per hour or $5 to $7 per day. Forty or fifty of these hydrants are often installed in a single coach yard, and, as there are nearly always a number of them open and running, the loss is enormous.

WASTE IN IMPROPER USE OF HOSE

The improper use of hose in sprinkling, washing coaches, etc., causes a great waste of water that may easily be avoided. All hose should be equipped with a nozzle so that the stream will do the maximum amount of work with the minimum waste of water.

Leaking or improperly adjusted valves in toilet tanks will waste from $3 to $50 per month for each battery, depending on the number of fixtures and the cost of water. A case was discovered recently where the toilet facilities at a large terminal were costing a loss of over $400 per month. Wash basins, slop sinks and other fixtures connected directly to sewers and drains offer opportunities for heavy water losses and a saving can be made in almost every instance by giving attention to the valves and faucets; keeping them in proper repair and making it a point to see that they are closed when they are not in use. A dripping faucet may represent a loss of over 50 cents per year, while one leaking through a ½-in. opening will waste water to a value of almost $2,000.

Columbus Waterworks Will Reclaim Its Spent Lime

Tests Indicate That Lime Can Be Recovered from Settling Basin Sludge at Yearly Saving of $9000

BY CHARLES P. HOOVER

Chemist, Filtration Plant, Columbus, Ohio

By building a plant costing $30,000 to reclaim water soluble calcium oxide lime from the sludge in the settling basins at its filtration plant, the waterworks department of Columbus, Ohio, basing its conclusions on experiments conducted on a small kiln, estimates that a saving of $9,000 per year will be realized in the cost of lime alone. The settling basin precipitate will be pumped into a thickener, and from there will be fed directly into a rotary kiln, where it will be burned into lime.

In experiments carried on during the past few months 5000 lb. of lime was produced from a kiln 20 ft. long and 34 in. in diameter, and was used as a softening agent for the entire water-softening plant for a period of 4 hr., during which time 4,000,000 gal. of water were treated. The results of the test indicated that it was possible to obtain just as good results from the reclaimed lime as with the high calcium lime which is ordinarily used.

Lime and Soda Ash Used

Lime and soda ash are used at the present time to soften the entire water supply of the city, which will average about 20,000,000 gal. per day. Approximately 76 per cent of the lime which is added to the local water absorbs carbon dioxide and is thus converted into lime carbonate, and the soda ash, combining with the sulphate of calcium, also forms lime carbonate, which is practically an insoluble and precipitable compound. The average quantity of lime added to the water for absorbing carbon dioxide is 7.3 grains per gallon and the average quantity of soda ash is 7.3 grains per gallon. Every grain of lime which is added to the water precipitates 3.57 grains of lime carbonate and every grain of soda ash added to the water produces 0.93 grain of lime carbonate.

During the year 1914, 3540 tons of lime were used for absorbing carbon dioxide and 3540 tons of soda ash were used. The addition of the chemicals resulted in the precipitation of 15,930 tons of lime carbonate, which if dried, burned and replaced would produce theoretically 8921 tons of lime.

It has been the practice at the plant to settle the lime carbonate in concrete settling basins and to wash the precipitates into the river below the pumping station intake. This results in trouble between the city and property holders below during the periods of low water in the river. During the winter and spring months, when the water from the river is high, there is no objection to turning the sludge into it. The water shows the maximum degree of hardness in the summer, and consequently the maximum quantity of lime carbonate sludge is produced then.

Theoretically it is possible to produce from the sludge a lime containing 79.48 per cent of calcium oxide. During the winter and fall months, when the river water is muddy, the sludge is so contaminated with mud that there appears to be no economical method for reclamation.

Thickener for Sludge

In the plant at Columbus the settling basin precipitates are to be pumped into a thickener, such as the Dorr thickener, and from the thickener the material will be fed directly into a rotary kiln, where it will be burned in the lime. The plan may be changed somewhat in the final design, and the material, after passing through the thickener, may be filtered by means of a suction filter of the continuous type and then fed into the kiln and burned.

During large-scale tests with the reclaimed lime forty-two samples of water were collected, fifteen of which were taken at different points in the plant for a period of 3 hr. previous to the time the reclaimed lime was used. Twenty samples were taken during the time the reclaimed lime was being used and fifteen were taken after the use of the reclaimed lime had been stopped. Results of these tests indicated very clearly that it is possible to obtain just as good results from the reclaimed lime as with the high calcium lime which is ordinarily used. The analyses show that the reclaimed lime contains from 63 to 73 per cent of water soluble calcium oxide, whereas the lime which is ordinarily purchased for water-softening purposes contains 88 per cent calcium oxide.

Estimates of Cost

It is estimated that 25,000 tons will be produced from lime sludge at a saving of $1.65 per ton and 3000 tons will be produced from local limestone, for which the kilns will also be adapted, at a saving of $1.69 per ton. The estimated saving total will be approximately $9,000 per year. The cost of the plant will be about $30,000.

Centrifugal Pump Increases Efficiency of Plant

Motor-Driven Unit Adapts Itself to Load Conditions and Permits of One Boiler Being Cut Out for Part of Each Day

BY S. R. BLAKEMAN

Superintendent, Dyersburg Water & Light Company

The water and light plant owned and operated by the city of Dyersburg, Tenn., is located on the banks of the Forked Deer River. As the turbidity of the stream is extremely high the water supply is pumped from deep wells, treated and filtered.

The original design included two compound steam pumps. One lifted water from the wells to the treating tank; the other delivered water into the mains against a pressure of 80 lb. per square inch. Later, another steam pump of 1,000,000 gal. per day capacity was added. About the same time two new engines and generators having an aggregate capacity of 435 kw. replaced the smaller original units. This equipment necessitated operating the plant for long periods on loads below half the rated capacity.

Conditions Improved

To eliminate this undesirable condition additional load was necessary. It was obtained from an outside source and by installing motor-driven pumps in the plant. The load curves made from data collected after the motor-driven pump had been put in operation show a marked improvement over conditions as they were previously. The last steam pump has now been replaced by a motor-driven triplex boiler-feed pump.

The most careful comparisons were made to determine the kind of pump best suited to conditions. All requirements and conditions were carefully surveyed before the pump was purchased. The location is at a point where the suction lift is a minimum. Extensive tests show that the guaranteed efficiency has been exceeded. Data for four running days in October, 1915, show that a steam pump operating for two days necessitated using 2.93 tons of coal more than was required for the centrifugal pump. The same amount of water was pumped in 48 hr. by each kind of pump. One boiler has been cut out for a great part of the day since the new installation.

Try Surface Oiling to Improve Old Gravel Road

Novaculite, or hill gravel, has been used to build a number of roads in and about Cairo, Ill. It is mined extensively from hills near Tamms, Ill., and is found to be an excellent bonding material which packs readily without rolling, but washes badly in the early spring and wet seasons.

Owing to heavy traffic on the roads in question it was necessary to resurface them about every third year, so the district road commissioners decided to oil the surface. At the advice of the state highway department they ordered one tank of Mexican asphaltic oil, containing from 60 to 65 per cent asphalt, and applied it to the surface.

Itemized Cost of Work

	Cost, cents per sq yd
*Superintendence, engineering and inspection.	0.21
Bituminous material, 8184 gal. at 4.7 cents f.o.b. siding	2.34
Torpedo gravel and stone chips, 66½ cu. yd. at 59 cents f.o.b. siding	0.24
Heating and applying bituminous material, demurrage, etc.	0.32
Spreading torpedo gravel and stone chips, sand	0.31
Sweeping and cleaning old road	0.034
Depreciation on equipment	*
Freight on equipment	0.54
Total cost	3.99

*Paid or furnished by state highway department.

The oil was put on cold and within twelve hours after the application a light dressing of river sand was applied and the road opened to traffic.

The cost data in the accompanying table recorded by Theodore Plack, engineer in charge for the state highway department, do not include contractor's profit or overhead expenses. The 8200 ft. of 18-ft. macadam road was treated with ½ gal. of Aztec liquid asphalt and 0.006 ton of torpedo gravel or stone chips and sand per square yard. The average haul of materials was ½ mile. The rate of pay was 15 cents per hour for labor and 40 cents per hour for teams.

Steel Truss Spans Raised More Than 6 Feet Without Interruption to Traffic

Pennsylvania Railroad Forces Successfully Design and Apply Simple Lifting Device to Bridge at Kiskiminetas Junction, Pennsylvania

WITHOUT detaining a single passenger train, and with a maximum delay of only 5 min. for freight trains, the three steel spans over the Kiskiminetas River at Kiskiminetas Junction, Pa., on the main line of the Allegheny division of the Pennsylvania Railroad, carrying a heavy traffic between Pittsburgh, Oil City and Buffalo, were raised an average height of more than 6 ft. This was accomplished by using an expeditious and economical method finally adopted after considering various schemes. This method utilized four 50-ton screw jacks with six sets of jacking beams to form lifting devices connected by eyebars to the end pins of the truss spans. Thus the work could be prosecuted from the bridge seats without the use of falsework other than the blocking on the piers and the abutments. After the spans were raised in successive lifts of about 16 in. each across the structure, the tops of the piers and the abutments were poured with concrete to form the new bridge seats.

GENERAL REQUIREMENTS

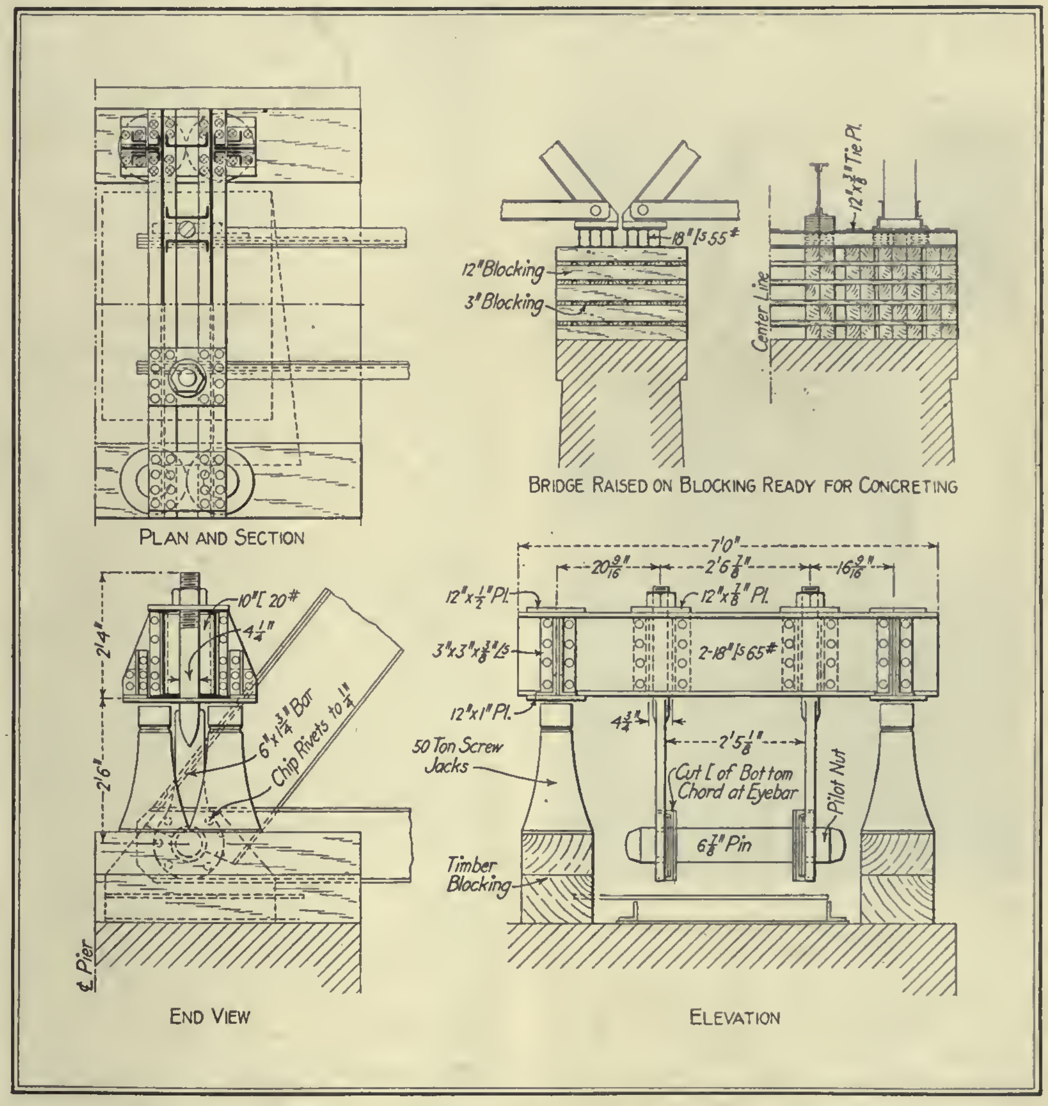
A revision of the facilities at Kiskiminetas Junction, where the Allegheny and Conemaugh divisions of the Pennsylvania Railroad intersect, involved a change in grade requiring the raising of the three-span bridge of the Allegheny division over the river by 5½ ft. at one end and 7 ft. at the other. The bridge is a single-track structure over which a heavy through freight and passenger traffic is gauntleted. The spans are of the pin-connected through-truss type, about 240 ft. long, carried on masonry abutments and piers with the base of rail about 45 ft. above the water.

The U-shaped abutments had sufficient width to allow side walls of concrete to be carried up without obstructing traffic. The walls supporting the fill for the ballasted roadway could not be carried up complete until after the bridge was raised. To provide for this fill about 3 ft. of these walls were constructed, forming an "L" with the side walls, against which 12 x 12-in. timbers were placed as a temporary back wall. These timbers acted as the form when the concrete was cast for the back wall, after the span was raised.

JACKING BEAMS USED

To accomplish the work of lifting the spans six jacking beams, each consisting of two 18-in. I-beams with two adjustable eyebars, as shown in the accompanying drawing, were designed for use with four 50-ton ratchet screw jacks. This furnished ample capacity for emergencies, as it was calculated that each end shoe carried only about 190,000 lb. dead load. One jacking beam was placed over each shoe on an abutment, and kept there until necessary to move to the other end of the bridge, and the other four beams were moved back and forth from pier to pier as required.

Fortunately the end pins in the trusses had sufficient projection to allow the use of the 6 x 1¾-in. eyebar hangers shown, by removing the pin nuts and replacing them by pilot nuts over which the eyebars could be slipped.



FOUR 50-TON JACKS LIFT JACKING BEAMS CONNECTED TO END PINS BY EYEBARS

The work of raising was begun at one end and carried up on the initial lift to a height of 16 in. To avoid excessive grades on the spans the end of each span resting on the next pier was carried up 16 in., and the work thus progressed back and forth until the required height was reached. The blocking consisted mainly of 12 x 12-in. oak timbers equal in length to the width of the abutment bridge seats, or of the piers. These blocks, supporting the spans under train load and the jacks during the operation of raising, were laid parallel to the bridge axis, alternating with 3 x 12-in. planks at right angles to tie them together.

As the bridge was raised wooden wedges were inserted under the shoe and kept driven tight as the work progressed. When the shoe was high enough these wedges were replaced by 3 x 12-in. plank, three in width under each shoe, 4 ft. long parallel to the bridge axis. Following this method to a height of 16 in., one width of plank blocking was removed from under each shoe and replaced with a 12 x 12-in. timber, the load being carried on the other two widths during this change. Three-inch planks and wedges were then used to take the load on the 12 x 12-in. blocking just inserted, and the next pile of 3 x 12-in. planks was replaced by the heavier blocking.

This method was followed under bridge shoes and stringer bearings until a course of 12 x 12-in. timbers extended the full length of the pier or abutment. When the bridge was raised to within 18 in. of its final position four piles of 3 x 12-in. planks, 4 ft. long, were laid under each shoe at right angles to the bridge axis, with a like arrangement under the stringer bearings. This permitted the easy installation of four 18-in. I-beams running the entire length of the pier (25 ft.) under the end of each span as shown. These beams were inserted to replace one pile of blocking at a time, and after all were in place were securely tied together by batten plates.

This I-beam grillage on top of the blocking was provided to carry the dead and live loads of the structure while the wooden blocking was being replaced with the permanent concrete of the pier. This system permitted the quick resumption of traffic by the reversing of the jacks and the settling of the structure on the wedges and blocking.

REPLACING BLOCKING WITH CONCRETE

By sawing through the 3 x 12-in. ties laid at right angles to the 12 x 12-in. blocking it was possible to remove all of the latter from under the I-beams immediately below the shoes, the space being bridged and the load carried on the beams. A block of concrete 4 ft. wide extending the full width of the pier was poured, with the top flush with the top of the beams. This arrangement was carried out on one pair of shoes on the pier at a time, and likewise for each shoe on the abutment until the trusses were carried on permanent bearings. The wooden blocking under the ends of the beams and between the concrete blocks could then be removed.

The stringer load was supported by the beam grillage reinforced with one 12 x 12-in. post under the end of each stringer. Round iron was inserted in the concrete blocks under the shoes and permitted to project to act as a tie for the concrete closures, which were then poured. The piers were thus extended to the new height and finished with the concrete-incased I-beam grillage for the bridge seat.

The raising operations were carried on in daylight at such intervals as the scheduled train service permitted, and required thirteen days. The structure was carried up true to line except at the north abutment, where a lateral movement of 2 in. occurred, which was easily brought back to its proper line by the use of jacks. There was no longitudinal movement in any of the trusses.

BRIDGE AT INTERMEDIATE PIER RAISED NEARLY TO FINAL HEIGHT

The work was carried out by the railroad company's forces entirely, under the immediate supervision of E. W. Holmes, master carpenter.

Meter Repair in Milwaukee Decreased in 1915

Meter repairs in Milwaukee during 1915 showed a decrease of about 3½ per cent as compared with the record of the three previous years. This result, according to the annual report of H. P. Bohmann, superintendent of waterworks, is accounted for by the fact that the distribution system was flushed during the year 1914. The number of meters taken off on account of sand trouble since flushing the distribution system has been greatly reduced. Last year 14,283 meters or 22.9 per cent of all meters in service were examined and repaired. On Dec. 31, 1915 there were in actual service in Milwaukee 52,188 water meters.

Letters to the Editor

Comment on matters of interest to engineers and contractors will be welcomed

Statement from Secretary Lane

Sir: My attention has been directed to an editorial in the Engineering Record of May 27, 1916, wherein, referring to the "Shields bill," you state that "Secretary Lane has indorsed the measure." This is an error, as I have not indorsed the bill in question, nor have I had occasion to express an official opinion thereon, because it deals with navigable waters, which are under the jurisdiction of the Secretary of War.

The water-power bill upon which I submitted a favorable report is known as the "Ferris bill," H. R. 408, and relates to development of water power upon the public lands.

Franklin K. Lane,
Secretary of the Interior.
Washington.

Cost of Railroad Surveys

Sir: The Engineering Record of March 4 has just been received and it is particularly gratifying to note that, on page 316, you have published a most timely article on the cost of surveys and engineering for railway work. There have in times past been numerous fallacies accepted by railway men in general and unfortunately at times by members of engineering departments who should know better. One of these has undoubtedly been the adage that "surveys cost about $100 per mile, ranging from $50 in easy prairie country to $150 in timbered or mountainous regions." There is no doubt in the mind of the writer that the general acceptance of this figure has tended greatly to bring competent engineers into disrepute. When men of recognized standing in the profession persistently repeat this figure it is not to be wondered at that promoters and administrative officials should take their word for it, and then find to their cost and deep regret that either the line secured was not obtained for any such figure, or if it was, that it undoubtedly differed greatly from the best the country could produce.

The writer has been an engineer on surveys and construction of railways and other works for a good many years, in the mountains, plains and swamps of a half dozen different countries, and he has personally never known of a case where a final location was obtained for $100 per mile, or anything like that figure, unless the cost of all previous surveys and equipment, transportation and reconnaissance be disregarded.

At the present time investors and bankers of the United States are devoting a great deal of attention to the undeveloped territory to the south of our country, and the development of the new fields will undoubtedly be accompanied by the construction of railways. A great deal of this work will undoubtedly be handled by American engineers, and it is to be earnestly hoped that a sensible estimate, such as was prepared by Mr. Sparrow, of the Missouri Public Service Commission (see the Engineering Record of March 18, page 386) will be seriously borne in mind.

It is doubtful if a survey can be made anywhere in South or Central America, and the plans prepared for staking out the work and instructing the contractors as to what they will be expected to do, under $500 a mile. If an exception be taken to this it would be that the plains of the Argentine and the plateau of Northern Mexico should not be included in this general statement, as they can be easily covered by the parties in the field, and there is a relatively small number of special structures, which would undoubtedly reduce the cost considerably. This estimate of $500 per mile does not include general work on construction, nor especial designs for large bridges, nor unusual buildings, nor any work on equipment and machinery, nor final records, but only the total cost from the beginning of reconnaissance until the contractors receive all the documents required for them to prosecute the work.

Cases have been known where the cost per mile was as low as $400, with the exception of overhead or administrative charges outside the engineering department, and cases have been known where the cost was $600 per mile in very bad territory, but it would seem that the preliminary estimates which are generally high enough to cover unexpected charges and which in the case of doing work in South America would include salaries and transportation expenses to get men to work, should not be less than $500 per mile of finished road. This does not refer to the cost of running one preliminary, but involves the cost of covering the ground two or three times before the final line is selected and located.

V. L. Havens,
M. Am. Soc. C. E., American Commercial Attaché.
Santiago, Chile.

Prospective Development and the Value of a Railroad

Sir: I have read with considerable interest your editorial criticism of my suggested method of determining the economical value of any railroad and am led to fear that I could not have made myself as clear as I had hoped.

To me it seems that there are certain fundamental propositions respecting the railroads of the United States which are so apparent that to be proved they need but to be stated—to wit:

1. The existing railroads were constructed with private capital under the uncontroverted conviction that the property created was privately owned and entitled to the same protection as that accorded all other property.

2. The public, in permitting and encouraging, even urging, the investments without in any way indicating a future discrimination, acquired obligations to the railroads in no degree less than those assumed by the railroads toward the public.

3. The present economical position of the railroads is not that of private enterprise, but the property has in essence been condemned for public use; and the absorbing problem at this time is the equitable deter-

mination of the compensation due the nominal owners. The present policy appears to be regulation of earnings and operation of sequestrated property rather than liquidation of the value itself; and under such a policy those whose capital is forced to serve the public on that public's own terms are certainly justified in asking that the terms be liberal enough to meet at least the *minimum* requirements of private operation.

The final finding of value by the Interstate Commerce Commission may be used for a number of nominal purposes, all revolving around the central fact of governmental administration. It may even be used as a basis for governmental acquisition of title. It is extremely doubtful that it will ever be used as a positive factor in the construction of rates; but may serve, as previous valuations have done, as a signal warning of the approach to limits beyond which the court says "No." This is the only rate-making function which any valuation can have, as rates must of necessity be based, at least partly, on the abilities of commodities to pay, whether the rates are constructed by the railroads or by other agencies.

Now, to answer, as well as I can, your criticisms. There is nothing revolutionary in the proposition to base present worth on future prospects, even in a railroad valuation. One of the so-called intangible values frequently mentioned is "strategic position," which gives to one road control of a rich and developing source of traffic; another is location with respect to topography and traffic, which gives one road an advantage in the ability to expand with the least expenditure of capital as demands require, and to secure an increasing share of the traffic. The principle is one generally recognized by investors in securities of all kinds and has its influence on their market quotations. It was used by the owners of certain Prussian railroads in the conferences with government representatives to effect higher compensation for their roads when they were taken by the state, and produced the desired result (see Bulletin 21, Bureau of the Census, page 68). It is a consideration of all engineers in making recommendations for expenditures.

Briefly, I do not conceive that I have propounded a new theory, but have merely given concrete expression to a generally acknowledged economical principle.

In the application to individual roads of the proposed measure of value it appears to me that in equity consideration must be given the economical conditions obtaining at the time of construction and those now prevailing, and to the causes of their change, if changed. Should it develop that under a continuation of natural conditions the road could not have been profitable, then the trend of actual earnings should be studied and followed regardless of where it led, as revealing what we are all seeking—the truth; but it should be borne in mind that unless restrained the owner could have suspended operations. If he is compelled to operate, then the total cost of service, including interest on his forced sacrifice, and also a profit for conducting the operation become public obligations. Further, should economic conditions have been artificially changed purposely to affect his property he is in equity and under the constitutional guaranty entitled to ask that the limit of depression be set at that point below which his operations cease to be profitable.

This, then, is my proposition: That the value so far as possible be determined on the same economic principles as would govern the free purchase or sale of the property; that the minimum value that can be assigned any railroad which, if free from artificial restraint would equal or exceed that amount, is the present worth based on continued profitable operation, and that the regulating agencies be restrained from *depressing* earnings *below* those required for operation at a profit.

R. B. SHEPARD, JR.,
Office Engineer, Valuation Department, Atlantic Coast Line Railroad.
Wilmington, N. C.

Present-Day College Education

SIR: The discussion between Professors Mead and Swain on college education which has recently appeared in the Engineering Record leads me to write you in reference to the operation of the co-operative engineering course inaugurated by Dean Herman Schneider at the University of Cincinnati.

Our firm has been employing co-operative students for a number of years and the writer has talked to a number of other employers in Cincinnati who use co-operative students, and all with whom I have talked agree that this is an excellent form of education. The course normally takes five years to complete, but we have in our employ at the present time a student who completed the course in four years, the first three years of which he took the co-operative work and the last year he spent entirely at the university.

This method of education enables an ambitious boy who could not otherwise obtain a college education to do so through his own efforts. Our company generally pays the first-year students about 20 cents an hour and, as they work ten hours a day, this would equal $12 per week. The students who have worked for us more than a year get regular laborer's wages, which for the last year have been 25 cents per hour—thus netting the boys about $15 a week, and from now on the wages will be even higher than this.

All the superintendents on our work prefer having these college students to any of their other laborers. The students do all kinds of work and do it more intelligently than our other workers. Sometimes we use them for timekeepers, but this is avoided, as it is found that the change from one student to another is not entirely satisfactory in this instance. However, even in a position of this kind we have found we could work them to advantage. In addition to the straight labor work which they do, such as helping concrete, placing reinforcing steel, etc., they also have experience in direct engineering work such as laying out the lines for buildings, checking subcontractors' work, making drawings, estimating the amount of work completed and assisting our superintendents and foremen in numerous ways. Of course it is probable that a relatively larger majority of good material take this course than is the case in the ordinary college or technical school.

Undoubtedly a great many men go to college simply because they think it is the thing to do, this being particularly the case with the sons of rich men. There are less of this class of students who take the co-operative course and more of the earnest workers who strive to get the utmost out of their education.

The boys in this co-operative course usually are employed during their entire summer months with the same employers, and they are practically assured of a job when their course is over, as their employers are glad to keep them. Also, after graduation, I believe they are assured of a better position than they would otherwise be able to obtain, on account of the practical knowledge they have gained during this course.

No boy going through college gets the most out of his opportunities. This is due partly to his not realizing the advantages he can gain and to his desire to have fun, and also to the fact that he does not realize how some of his studies will be applied in later life or their relative importance. I believe that the co-operative course helps to a certain extent to make a student realize how he is to apply some of his studies, and that his contact with actual workers tends to cause him to take advantage of his opportunities. Some of our superintendents are men who have worked their way up without college educations, but they invariably wish that they had had the chance to take a co-operative course, and undoubtedly so express themselves to the co-operative students.

Some of my associates feel that the principal advantage of this form of education is the fact that the earning power of the boy enables him to get through college, and that if his means allowed it he would get as good an education by continuous school work with possibly some work in the summer time for which he received pay, but I personally believe that, provided the college facilities and teachers are the same, a boy gains in co-operative work more than he would in a straight school course on account of the actual experience which he gets while he is doing his college work.

W. P. ANDERSON,
President, The Ferro Concrete Construction Company.
Cincinnati.

SIR: The letter written by Professor Swain and the reply by Professor Mead were read with great interest. They started something, set forth some startling facts —facts that may be new to the engineer, but, from the quotations cited, evidently not to the educator and philosopher. These men have been confronted with the problem for years; yet have been unable so to line the forces as to close the polygon. On the face of it it seems to be purely a pedagogical problem, one to be dealt with in the pedagogical journals and not on the pages of an engineering journal, however vital it may be to the development of the future engineer.

When we say that "it is possible to graduate from almost any college without an idea in one's head" are we to place the blame on the college and without further thought let it rest there? The college is not to blame. The student has been forced to spend twelve of the most impressionable years of his life in some elementary school before the doors of any college will be swung open to him.

Are our elementary schools what they should be? I shall not try to answer that here. But it is safe to presume that they are not. If they are not what are we who, through our experiences, are aware that something is wrong doing to aid in eradicating the wrong? There are educators by the score in our elementary schools that are alert to the evil of their methods; but they are only hirelings, and if they are forced to save the chaff and throw away the wheat it is no fault of theirs. They are your servants and mine. We have delegated the direction of their services to the school boards of the country, without giving a serious thought as to the personnel of the individuals who may compose these boards.

Are there any engineers on our school boards? The percentage is undoubtedly very low. These groups of individuals into whose hands we give the power of directing how the youth of the nation shall be educated are made up of politicians and those who seek the position for the social prestige that it may give them. As a result the trend of our elementary school training is toward the superficial, and the young mind that otherwise might be capable of close, concentrated and logical thinking is turned over to our colleges possessed of nothing but a veneer, made up of a conglomerate of polishes.

Is it any wonder, then, that the products of our colleges are as some one has put it, mere animated handbooks with a slide-rule attachment? Is it any wonder that the greater percentage of young men who do enter college choose such courses as will not mar the polish acquired in the elementary schools?

What are we going to do about it? Are we as engineers going to do as we and others have done before, let it go by default? Or are we going to cast our eyes about us and find some conscientious, struggling instructor in our elementary schools who is eager for support and help him? The writer can think of no more worthy field for the various engineering clubs and societies of this broad land, in which to exert their efforts and make their presence felt in the communities in which they may exist, than to give some attention to the personnel of the elementary school boards of their community, and thus purge our lesser temples of learning and make them worthy of the name.

Cincinnati. HARRY C. REELY.

High Velocity in Large Hydraulic Dredges

SIR: Major Dent's letter in the Engineering Record of May 27, 1916, page 714, has attracted my attention. Small sizes of discharge pipe are advisable on account of the constant handling of the lengths of pipe on shore. The only objection to large floating or pontoon pipe is the cost, both initial and operating.

The loss of the efficiency of the large pump working under high heads, due to length of pipe as well as diameter, should rather be stated as the loss in efficiency of the carrying power of the stream in the pipe. The longer the pipe the greater the length of time for the settling of the heavier material at the bottom of the pipe. It is a fact that the longer the discharge pipe the smaller is the percentage of solids pumped. The reason is that the solid material drops to the bottom of the pipe and moves more slowly than the water stream, the separation, and consequent difference in velocity of water and sand being more pronounced for longer pipes. High velocities mean less time for separation and a larger percentage of solids.

It is perfectly conceivable that the extra horsepower required for the higher velocity will result in an equal increase in percentage of solids pumped. If so there is no increase in operating expense, but there is a real gain when considering overhead charges.

An increasing use of electric motors for driving the centrifugal pumps on dredges would naturally influence dredge pump designers toward smaller diameter of impeller and higher speeds, having regard for the largest size of stones to be pumped. The writer calls to mind an episode bearing on the relative size of pump and stones pumped. A contracting company was using a 20-in. pump for transporting purposes only, the dredged material being deposited in a specially designed hopper by a dipper dredge. The material then passed through the interior of a revolving screen with holes 7½ in. square. Thus the screen rejected all stones more than 7½ in. in diameter, the pump handling all the rest. The holes in the screen were later changed to 10 in. and used for some time, but a return was finally made to the 7½-in. hole, although this meant a larger percentage of rejections to be handled in a much more expensive way than by pumping.

G. B. MASSEY,
Chicago. Consulting Engineer.

Heavy Rainfall at New Orleans

SIR: In your issue of June 3 you mention that nearly 8,000,000 tons of rain fell over Rochester during 23 days last month—a rainfall of 4.2 inches over an area of 16,000 acres.

The drained section of New Orleans covers an area of about 25,000 acres, and on May 21 and 22 we had a rainfall of 6.74 in. average for the entire city, with a high record of 8.11 in. at one of our central gages. The rain started at about 9.30 a. m. May 21 and stopped at 2.30 p. m. May 22. During this period of only 29 hr. there were three distinct showers of approximately equal intensity with a total precipitation of 6.74 in., or 611,655,000 cu. ft., weighing more than 19,000,000 tons. Our partly completed drainage system handled this near record rainfall very satisfactorily.

Our records of very severe storms show the following:

April 25, 1907	8.59 in. in 12 hr.
Sept. 29, 1915	8.36 in. in 21 hr.
Oct. 12-13, 1915	7.96 in. in 21¾ hr.
May 21-22, 1916	6.74 in. in 29 hr.

ALF. F. THEARD,
New Orleans. Civil Engineer.

Architect vs. Engineer

SIR: I read your editorial appearing in the issue of March 25, page 406, relative to the recent legislation enacted by the legislatures in this and other states, detrimental to the engineering profession; also the comment by President Waid of the State Board of Registration of Architects, appearing in the issue of May 13, page 651.

Although I have frequently had occasion to file plans (as architect and engineer), which have been approved by the Bureau of Buildings of New York City, I found that according to the wording of the present law in regard to registration engineers practising architecture would not be permitted to use the title "architect." It was only after I had written to the Department of Education calling attention to this unfair discrimination against engineers, and pointing out that this law if so applied against engineers would be found to be unconstitutional, that a ruling was finally received from the Attorney-General of this state to the effect that engineers or anyone else may practice architecture, but shall not be permitted to use the term "registered architect."

It seems to me, therefore, that a law of this character is worse than none at all, and is, therefore, only a farce. Would it not be far better to require that architects as well as engineers be obliged to give proof of actual work accomplished, before permitting them to practice their profession under a license of a state? Would it not also be much better for our professional societies to require proof of actual work accomplished, instead of depending upon a long list of references and taking it for granted that the qualifications given in the application represent work actually accomplished by the applicant?

The writer knows of several men who have become members of one of our engineering societies, although they have neither had the education nor the experience of engineers, but who now use their membership in that society as a means of obtaining work which they themselves are not in position to execute, but arrange with other engineers to do, and divide the fees obtained therefrom. If the co-operation of the architect and the engineer could be secured, legislation, no doubt, could be effected which would be of great advantage to both. MAURICE DEUTSCH,
Consulting Engineer.
New York City.

The Waste at Niagara

SIR: The enclosed clipping, taken in turn from the *Christian Science Monitor*, appeared on the editorial page of the Chicago *Herald* of May 18, 1916, and I believe it represents the sentiment of a large majority of influential citizens of the United States, and furthermore I am happy to say this movement is growing all the time. Its results are being manifested in the National Parks created by the government, and in many states tracts of land of exceptional natural beauty are being conserved as state parks.

I am certain that civilization has progressed far enough in the United States to prevent Niagara Falls, long known as one of the wonders of the world and for many years a source of pleasure and inspiration to thousands, from being exploited and ruined for the selfish ends of a few capitalists.

LEWIS B. MAYO, JR.
River Forest, Ill.

[The clipping referred to reads as follows.—EDITOR.]

One of these days the United States and Canada will come into agreement on the point that the way to preserve Niagara Falls is to internationalize the Niagara zone; that is, if they are agreed, in the first place, as to the wisdom of preserving them. So long as any part of the power of Niagara River is used for commercial purposes, that part of it which is not so used will be sought by private interests or municipalities. The only safe way to handle the matter is to remove the river and its falls from the possibility of commercialization.

1915 Lumber Cut Less Than in 1914

The final estimate of the lumber cut of the United States for 1915, as announced by the U. S. Forest Service, is 37,013,294,000 ft. b.m., a decrease in production as compared with 1914 of 332,729,000 ft. b.m.

HINTS FOR THE CONTRACTOR

Details Which Save Time and Labor on Construction Work

Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

[*Contributions to this section are solicited, and if found available will be paid for. They must be* SHORT, *and should be accompanied, if possible, by photographs or sketches.*—EDITOR.]

"Subcontractors' Room" Makes Figuring Easy and Saves Plans

THE ROOM shown in the accompanying photograph is referred to by the Shepherd Construction Company, in whose main office at Wilkes-Barre, Pa., it is located, as the "subcontractors' room." In it, on four large double drawing racks and on other drawing racks running around the room on all dead walls are displayed the drawings, blueprints and details upon which bids are desired from various subcontractors. Convenient to these racks is a drawing board with materials for the use of those estimating on the work displayed.

These racks are about 7 ft. high, and as they are in a 15-ft. square room, they are about 9 ft. long. Below the counter shelves, which are 3 ft. from the floor, are shelves opening on both sides of the racks on which are placed samples of building materials of every description, together with books, catalogs and other data required by the estimators.

The room is light and entirely secluded. Contractors can take their scratch pads and rules, walk from drawing to drawing without interfering with each other, and secure with the least possible trouble all the information they need.

In this way the Shepherd Construction Company is able to accommodate a great many people who wish to figure on different parts of their building work without having the usual tedious delay of sending out plans and specifications and awaiting their return to send them out again to the next man.

It may be taken for granted that the room furnishes to any clients of the company who happen to look in there impressive visual evidence of the volume and character of work the company has under way.

DISPLAY ROOM FOR PLANS MAKES IT POSSIBLE TO GET SUBCONTRACT BIDS IN QUICKLY

Accounting for the Contractor—Cash Book and Check Register

BY BENJAMIN L. LATHROP

Of Lathrop, Shea & Henwood Company, Scranton, Pa.

THE ADVANTAGES of a combined cash book and check register may be summed up as follows:

(1) The checks may be blocked into neat pads, occupying less room than the ordinary check-book, eliminating the useless stubs, and saving a duplication of entries and repeated forwardings of totals.

(2) The bank balance is readily ascertainable without thumbing over a lot of stubs.

(3) Instead of pasting the cancelled checks back into the check book, a practice in more general use than might be suspected, they are simply arranged in numerical order, and, with a memorandum of checks still "out," placed in a document file, or other space provided for their storage. Herewith is shown, condensed, a satisfactory form for the folio page of a combined cash book and check register.

If more than one bank account is kept from the general office, the principal one should be run through the cash book. The others, however, can readily be handled through journal entries from check stubs, unless all the bank accounts are very active, in which case a more elaborate check register can very readily be devised, following the general principles outlined, but with special columns added for the different bank accounts.

Petty cash can be recorded on an invoice folder, and the items entered collectively through the journal, or direct to the ledger, at the end of the month.

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Dr. 1916		Cash		
Jan.	2	Balance forward		2911.40
	5	Rec'd. of Martin & Co. on a/c	$150.00 v	
	8	Portland R.R. Freight refund	7.50 v	
	15	Pacific S.S. Co. Final estimate	7422.25 v	
	23	Leeds Mfg. Co. Estimate	1080.00 v	
	28	Neal & Co. on a/c	500.00 v	
		Cash, Dr.		v 9159.75
				12071.15

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1916		Cash		Cr.	
Jan.	2	Pd. B. H. Howard & Co. Ck. No.	611-v	45.00	
	15	Calvin & Co.	612-v	109.50	
		E. F. Fraser	613-v	8.00	
		G. H. Ingersoll	614-v	10.00	
	20	Leeds, Dec. Payroll (Ck. to B. H. Howard, paymaster)	615-v	475.50	
	30	Portland R. R. Co., Freight	616-v	250.00	
		Cash Cr.	v		898.00
		Balance forward			11173.15
					12071.15

While on the subject of cash, it is doubtless in order to discuss the matter of checks and vouchers. There are so many forms in use that it seems unnecessary to submit specimens. Ordinarily the simplest form is the best. Where a separate voucher is mailed with the check, it should, as a rule, bear the same number as that on the check. The separate voucher system is condemned by some on the ground that it is wasteful and annoying, involving the expenditure of return postage by the recipient. On the other hand, the folded voucher check is generally cumbersome and awkward to handle. Perhaps the most satisfactory solution is the ordinary straight bank check on the back of which is printed:

The endorsement below is acceptance of payment in full of the following items:

			$		
		Total			

If the check covers a long list of items it is not necessary to enter them in detail—just insert the words "Statement rendered to ———" and set down the full amount.

Steam Shovel Time Saved by Making Roadway Cuts by Halves

The use of the steam shovel is becoming common on highway work. Some contractors make their cuts all the way across and fill their wagons by a full 180-deg. turn.

Time could be saved by cutting half the width completely through and filling the wagons by a quarter turn of the boom.

Truck and Trailer Move 60-Ton Steam Shovel Economically

BY EVERETT N. BRYAN
Modesto, Cal.

A MARION model 60 steam shovel belonging to T. K. Beard was recently dismantled, hauled a distance of 32 mi. by truck and trailer from La Grange to Modesto, Cal., and assembled there at a cost of $1,186.60. This compares with another move made by the same shovel, 22 mi. by railroad and 17 mi. under its own power, which cost $3,974.39.

Before the move was begun the shovel stood 300 ft. from the nearest point on the highway in a hole 50 ft. deep. A road 750 ft. long was graded at a cost of $56.62, up which the shovel was moved to the highway for $218.18. The most of the rise was accomplished in a 200-ft. stretch of 18 per cent grade up which the shovel hauled itself with wire rope tackle. The shovel was then completely dismantled at a cost of $71.10.

Assistance to the truck driver and his helper in loading cost $34.94, and moving some of the heaviest parts on wagons drawn by cable a distance of 300 ft. across a high light bridge cost $37.76.

It took a 5-ton Locomobile truck drawing a wagon trailer nine trips to transport the shovel to Modesto. Including interest, insurance, depreciation on truck and trailer, repairs and rent, the transportation amounted to $441.75. The largest and heaviest single piece carried is shown in the photograph. It was the main frame with decking attached, and was 10 ft. wide, 35 ft. long and weighed 10½ tons. Its forward end was supported on a special bolster just forward of the rear wheels of the truck, and the rear end was carried on the rear truck of a 5-ton freight wagon. The trailer wheels failed on the trip and had to be renewed, but the truck came through safely.

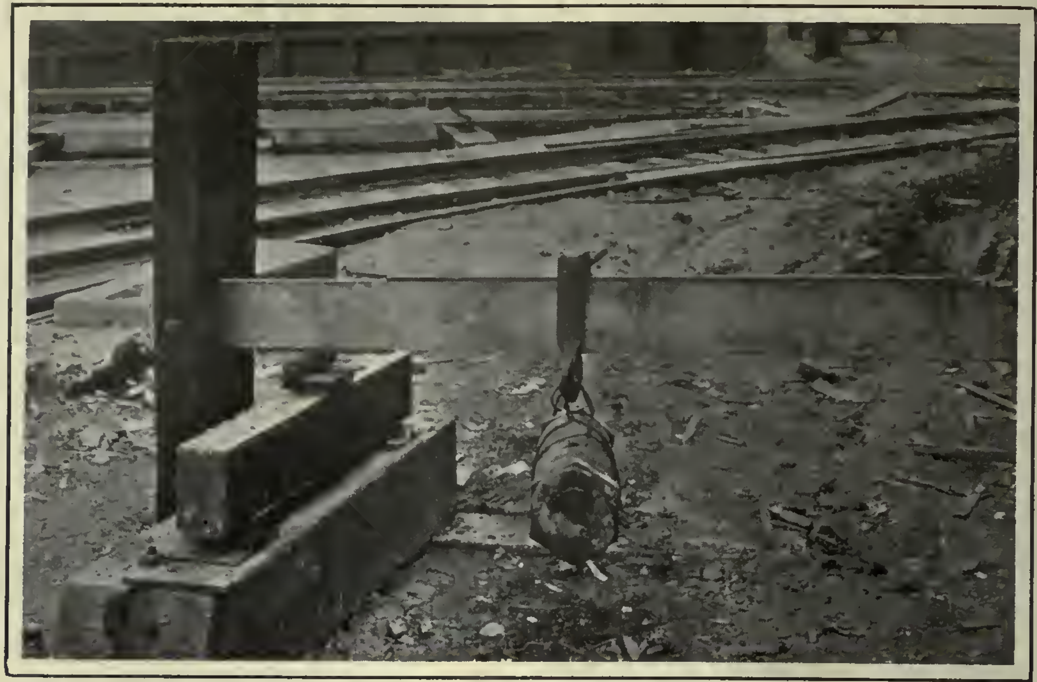
Assistance costing $11.40 was rendered the truck driver and his helper in unloading. While it took 21 8-man days to dismantle the shovel, it was completely reassembled in 43 5-man days at a cost of $194.45. The cost of getting the necessary tools, lumber and other equipment on the ground for the work of moving, and returning them after the shovel was ready for use, amounted to $46.40, and $50 would be a fair charge for rent on this equipment. It cost $20 additional to replace broken fire brick, lumber and small items.

A small crew was used and no effort was made at speed, although the shovel was ready for service 61 days after the work started. This time could probably have been cut in half if sufficient effort had been made. The work was supervised by William Lehlmkuhl, who also handled the shovel on its previous trip above referred to. On this occasion, it took 49 days working with all possible speed for the shovel to make the land and rail journey, ford the Tuolumne River and dig its way into the main canal of the Turlock irrigation district.

TEN-TON UNDERFRAME OF STEAM SHOVEL MAKES 32-MILE MOTOR TRUCK TRIP

Machine Tests Samples of Concrete Before Removing Arch Forms

By HAROLD E. KETCHUM
Superintendent The Hunkin-Conkey Construction Co., Cleveland, Ohio



REMOVAL OF FORMS FROM 175-FOOT ARCHES DETERMINED BY A SIMPLE TESTING MACHINE

THE MACHINE shown in the accompanying photograph for testing specimens of concrete used in pouring the arch ribs of the Detroit-Superior high level bridge in Cleveland was made on the work from material at hand for about $5. It consists of a 12 x 12-in. timber 4 ft. long bolted to two 6 x 8-in. sills of the same length, which are buried flush with the ground. The lever arm is hinged on a ¾-in. bolt through two 4 x 4-in. uprights. As may be seen in the photograph, the lever arm is shod with ¼ x 1½-in. iron on its upper edge and also on its lower edge near the point of support. The load is applied to the test piece by moving a 216-lb. weight suspended from the lever by means of a roller which is turned by hand.

The test specimens, which are made in the form, of plain concrete, are 3 ft. long, 4 in. wide, and 6 in. deep. One of them is shown in the machine. They are placed on knife-edge supports 30 in. center to center on the 12 x 12-in. timber, and a knife edge is placed on top of the beam at its center. A roller is used to transmit the load from the lever arm to the central knife edge.

In making a test one of the operators follows the load out with a pencil, the final position of which indicates the lever arm when the beam drops. As the deflection of a plain concrete beam is negligible, the fixed knife edge supports and the movement of the lever arm do not affect the accuracy of the results. The test specimens of 1:2:4 concrete 14 days old show a strength of from 250 lb. per square inch to 400 lb. per square inch, depending on the weather. A strength of 275 lb. per square inch is considered sufficient to warrant the removal of arch centers, the arch spans being from 130 to 175 ft. This simple machine represents a considerable saving over the cost of having the specimens tested in a laboratory, which was done at first.

The Detroit-Superior bridge is being built in the city of Cleveland by the Hunkin-Conkey Construction Company for Cuyahoga County, for which K. B. Cowan is resident engineer.

Domestic Sales of Motor Trucks 100 Per Cent Greater in 1915 Than in 1914

Domestic sales of motor trucks and delivery wagons in the United States during 1915 were 100 per cent greater than in 1914, according to Harry Wilkin Perry, secretary of the commercial vehicle committee of the National Association of Automobile Manufacturers, in an article published in the *Literary Digest.* The European war has had the effect of tripling the productive capacity of American truck factories. One of the most important developments of the past two years has been a greatly increased output of light trucks and low-priced delivery wagons. The tendency is toward the production of cheaper machines without sacrifice in quality.

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

With Imposing Ceremony Massachusetts Institute Dedicates New $7,000,000 Buildings

Masque Portraying Subjection of Elementary Forces by Science—Formal Dedication and Telephonic Banquet Main Features

With imposing pageantry, impressive formal exercises and an enthusiastic gathering at a banquet in which transcontinental telephony played the chief rôle, the Massachusetts Institute of Technology dedicated this week its new $7,000,000 home on the bank of the Charles River in Cambridge, Mass. Drawn by the importance of the ceremony, making a new epoch in the institute's life, alumni from every part of the land and from foreign countries flocked to Boston to take their part in the great event—to wish their alma mater godspeed in the larger work made possible by her new environment and by her co-operative agreement with Harvard.

Ceremonies Opened Monday

The ceremonies opened Monday with farewells to the present buildings. Tuesday evening with medieval pomp the seal, the charter and the archives were carried from the old to the new buildings. A solemn procession garbed in the costumes of the Middle Ages carried the treasures to the bucentaur, a stately barge built in the Venetian fashion. In the glare of searchlights on either bank the vessel made her way across the Charles River to the Cambridge side. Dr. Richard C. Maclaurin, president of the institute, and Samuel McCall, governor of Massachusetts, with appropriate escorts, awaited the barge, received the archives and seal and deposited them in their place of keeping. Then followed in the great court the "Masque of Power."

The masque began by showing Chaos—the elemental powers running riot. Wit, Wisdom, and Righteousness conquered the elemental forces one by one and Art and Science followed where Chaos had been. Superbly conceived, staged and acted, the masque was an excellent prelude to the formal exercises to follow.

Dedication Attended by 8000

The formal dedication exercises, attended by more than 8000 people, were held in the great court Wednesday afternoon. From '68 to '16, every class was represented, each class group in the alumni procession being preceded by its banner in the class colors. Following the alumni came a distinguished body comprising the corporation of the institute, delegates from learned societies and from other colleges, men prominent in engineering and in the affairs of the State of Massachusetts and of the nation. The dedicatory address by the president of the institute, Doctor Maclaurin, was very brief—"To science linked with industry" was his dedication phrase. The governor of Massachusetts followed, laying emphasis upon the idea that the material improvements just dedicated and the technical instruction to which they will conduce are of no avail unless they lead to spiritual betterment.

President Lowell, of Harvard, pointed out that the most enduring of human institutions are the centers of higher learning, citing the history of the universities of Bologna and Paris, which have flourished despite all the vicissitudes through which their states have passed. Such institutions, centers of enlightenment and spiritual power, are worthy of the most lavish gifts that can be showered on them. Henry Cabot Lodge, senior United States Senator from Massachusetts, closed the exercises with a warning to young men of education against closing their minds to the accomplishments of older people and of those who have gone before. He appealed to every educated person to remember that he is a unit in the making of the nation and to discharge faithfully the duty following from his relation to the state.

The closing feature of the dedication program was a formal banquet at Symphony Hall Wednesday night. Fifteen hundred alumni sat down to tables and 1500 spectators, alumni and guests filled the galleries. At every seat at the tables and in the galleries was a telephone receiver. The exercises were conducted through the courtesy of the American Telephone & Telegraph Company entirely over the long-distance wire. Technology clubs at thirty-six cities were on the line, every person in every city having an individual receiver. The cheers of San Francisco, Los Angeles and other points were clearly heard in Boston, while an occasional deafening roar told that all the clubs were cheering at once. Long-distance addresses were made in Boston by Charles A. Stone, President Maclaurin, Prof. Michael Pupin, Dr. Alexander Graham Bell, Orville Wright, Prof. C. R. Cross, President Lowell and T. Coleman du Pont. In San Francisco, Prof. Harris J. Ryan made a wire address; in Chicago, President Judson, of the University of Chicago; in Seattle, Judge Thomas Burke.

Gifts of $1,000,000 Announced

Gifts of $1,000,000 toward an endowment were announced, $800,000 of this being given by three members of the du Pont family. The mysterious "Mr. Smith," donor of the $3,500,000 for the new buildings, will, it was announced, give $5 to every $3 otherwise raised for endowment, his gift, however, not to exceed $2,500,000. The gifts from others, announced Wednesday, assure, therefore, $1,600,000 of Smith money.

At the Wednesday commencement exercises degrees were conferred upon 375 candidates—the largest number in a single year in the institute's record. An admirable exhibit of engineering progress in the last half-century was a feature at the new buildings.

President Maclaurin announced that the two smaller courts in the new group of buildings were to be known as du Pont and Lowell courts after T. Coleman du Pont and Augustus Lowell, the latter the father of Harvard's president.

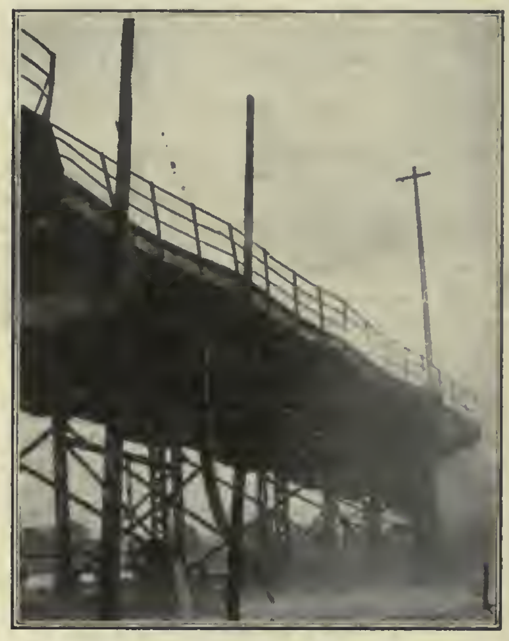
The exercises were closed with the playing of the "Star Spangled Banner" at Washington and formal good-nights from President Maclaurin to the thirty-six clubs on the wire.

Will Hold Better Community Conference in Illinois

A "better community" conference will be held at the University of Illinois, June 20, 21 and 22. This precedes a campaign for stimulating civic improvements so that Illinois can make a good showing in civic progressiveness at the centennial celebration in 1918 of the admission of the state into the Union. The program will provide for liberal discussion of the need of waterworks. The Illinois section of the American Waterworks Association is working for a big attendance. Professor Hieronymus, of the University of Illinois, has charge of arrangements.

Fire in Wood-Block Flooring Twists Steel of Omaha Viaduct

A fire, June 8, which originated from the overturning of a tar kettle being used in laying the cedar-block pavement of the new Locust Street viaduct at Omaha, Neb., spread rapidly over about 500 ft. of the bridge. The new structure, not yet completed, is being built by the Missouri Pacific Railway at a cost of about $275,000. The damage caused by the fire is roughly estimated at $50,000. About 350 ft. of the viaduct floor steel was so warped and twisted by the heat that it will have to be replaced. A large piece of the concrete in the east abutment was broken off. The Bates steel pole shown in the photograph was the only one of the three poles subjected to the heat of the fire which showed any bending effects. Some of the steel I-beam stringers were badly bent and twisted, especially those observed in the photograph, which have broken away from the brackets and dropped toward the ground. A high wind was responsible for the great heat and rapid spread of the flames.



HEAT WARPS AND TWISTS STEEL VIADUCT

Damages Alleged Due to Levee Construction Denied by Court

A decision has just been handed down by the United States Supreme Court stating that the Mississippi River Commission cannot be enjoined from constructing or repairing levees. The decision was announced in one of a series of suits begun in the federal district courts in four Southern states by a citizen of Memphis in behalf of himself and the Riparian Land Owners' Association against the Mississippi River Commission and various state levee boards. The argument of the claimants that the river bed and valley were identical was held to be inconsistent. The court decided that damages alleged to result from the building of levees cannot be recovered.

Phoenix, Ariz., to Enlarge Canal

The city commission of Phoenix, Ariz., has instructed the city attorney to take immediate action toward eliminating the Salt River Valley canal which passes through that city. The water will be carried outside of the city limits by the Maricopa Canal, which will be enlarged. The work will cost nearly $53,000.

Course at Tech Includes Study in Industrial Plants

Chemical-Engineering Students to Spend Year Studying in Six Big Plants of the Industry—Offers Practical Experience

In order to acquaint students with actual manufacturing conditions the new school of chemical engineering at the Massachusetts Institute of Technology will include nine months' study at various industrial plants. Five plants have already been selected, at each of which one professor will be stationed. Students will spend approximately six weeks at each plant. A special building to be constructed at each station will contain a library as well as a lecture room.

The student spends the first three and a half years of the course in obtaining a knowledge of the fundamentals of chemistry and engineering. The next nine months are given to study in five or six industrial plants. The last nine months are devoted to laboratory work at Cambridge in the buildings just dedicated. The students will be divided into as many groups as there are stations and spend about six weeks in each until the whole cycle is completed.

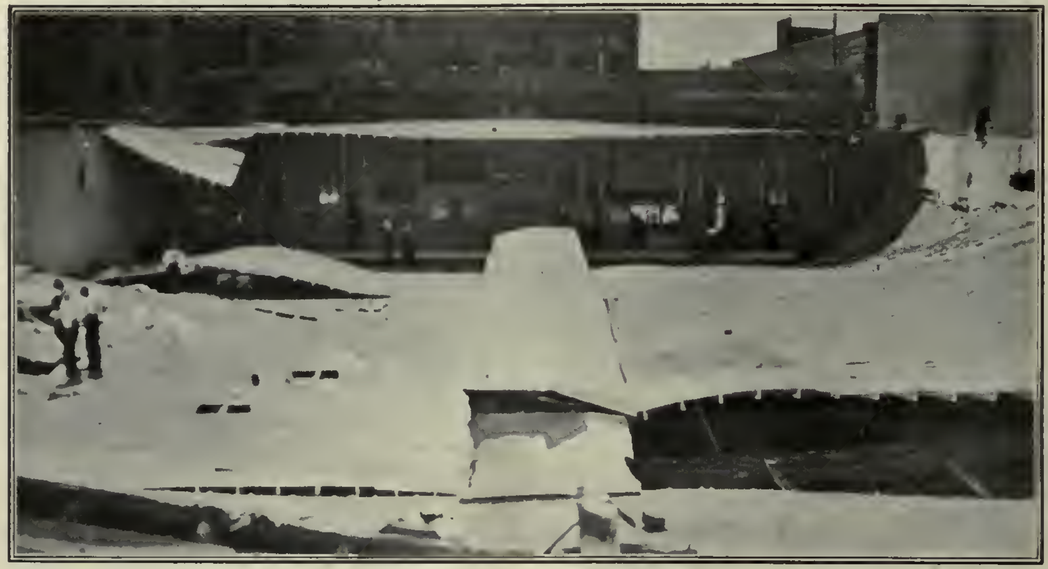
Five stations have been selected. One is to be established at Somerville for the study of fuels and combustion. The laboratory will be in connection with the works of the New England Gas & Coke Company. A second will be in the Eastern Manufacturing Company's plant at Bangor, Me., where the broad applications of electricity at comparatively low temperatures will be studied. At Niagara Falls a station will be established in connection with the Exolon Manufacturing Company, where investigation will be made of electricity at high temperatures. Inorganic chemistry will be the general line of investigation at the works of the Atlas Cement Company, at Allentown, Pa. The fifth station will be with one of the great chemical industries near New York or Chicago.

Dallas County to Improve Roads

A report on the proposed plan of completing the Dallas County (Tex.) road system by building roadways above high water or constructing concrete roads over which water may flow was ordered recently. Approximate estimates of the cost will also be made, and the complete report will be presented in about thirty days. Concrete culverts are expected to be used to a large extent.

Roof Collapses—Kills Three

The roof of the Casino skating rink building at Atlanta, Ga., collapsed June 9, killing three people and injuring ten. The roof of the 100 x 150-ft. building appears to have slipped toward the rear of the structure and slid down between the walls to the position shown in the picture. The blame for the accident has not yet been fixed.



ROOF OF BUILDING IN ATLANTA COLLAPSES—CAUSE UNKNOWN

The roof was supported by wooden arches, the members of which were bolted together and stiffened with iron rods. The arches rested in offsets in the brick side walls. The whole structure is said to have been a cheap and unsafe job. Poor material and workmanship are reported as probable causes contributing to the accident.

Road Supervisors Indicted for Neglecting Highways

Judge Ryan, of Doylestown, Pa., at the opening of the June criminal court told the jury that if reported bad road conditions in Bucks County were evidently caused by neglect of supervisors, indictments should be returned to that effect. As a result two supervisors were charged with maintaining public nuisances in allowing undesirable road conditions to exist in their townships.

Everybody—Even the Governor—Works on Pennsylvania Good-Roads Day

GOVERNOR BRUMBAUGH WAS AN ENTHUSIASTIC WORKER RECENTLY, WHEN THE MEN, WOMEN AND CHILDREN OF PENNSYLVANIA TURNED OUT TO WORK ON THE ROADS. THE MAN TO THE LEFT (STOOPING) IS THE GOVERNOR OF PENNSYLVANIA.

Fire Destroys $150,000 Wooden Pier at San Francisco

A fire on pier 46 at San Francisco completely destroyed that structure June 4. The damage to the pier is said to amount to $150,000—its construction cost. Merchandise on the pier valued at more than $1,000,000 was also reduced to ashes. No lives were lost, although several men had narrow escapes.

The cause of the fire is unknown. A small fire broke out under the bulkhead June 3, but was reported by the fire department to be completely extinguished. At 10 o'clock the next morning flames burst through the floor of the 200 x 800-ft. pier shed and spread so rapidly that it was impossible to check them. Officials of the Luckenbach Steamship Company, lessee of the dock, are reported as favoring a concrete structure to replace that destroyed.

County Commissioners of Washington Will Meet in September

W. H. Reed, of Tacoma, commissioner of Pierce County, Washington, is arranging for a meeting Sept. 14, 15 and 16 of the State Association of County Commissioners, of which he is president. Among the speakers who will address the convention are Rufus C. Holman, commissioner of Multnomah County and president of the Oregon State Association of County Judges and Commissioners, who will discuss efficiency and economy in county government; Almon H. Fuller, dean of engineering, University of Washington, whose lecture will be on highway bridges. Dr. H. K. Benson, professor of industrial chemistry, University of Washington, will present a paper on road bitumens. The county engineers of the State of Washington may hold a joint meeting with the commissioners if arrangements can be made.

2330 Chicago Engineers March

The recent preparedness parade in Chicago included in its 130,000 marchers 2330 engineers headed by members of the Naval Consulting Board. Bion J. Arnold, member of the National Naval Consulting Board, was accompanied by four members of the Illinois board, Robert W. Hunt, F. K. Copeland, Peter Junkersfeld and William Hoskins, and by one member of the Michigan board, Gardner S. Williams. Wharton Clay, marshal of the section, had H. S. Baker, E. H. Lee and D. K. Tomlinson as his aides. Each aide had command of a division headed by a band. The newspapers said that the engineers' division was one of the best organized sections. Two thousand cadets of the University of Illinois, one-half of whom were engineering students, took part in the parade.

American Waterworks Association Seeks to Improve Service to Its Members

Changes in Administrative Policy Foreshadowed in Presidential Address of N. S. Hill, Jr., at Annual Convention in New York, June 5 to 9

The keynote of the thirty-sixth annual convention of the American Waterworks Association, which concluded its five-day session at the Hotel Astor, New York City, June 9, with a registered attendance of about 1200 active members, associates and guests, was sounded in the address of the retiring president, Nicholas S. Hill, Jr., when he made a plea for enlarging the scope of the service of the organization to its members. Radical changes in the administrative policy of the association were foreshadowed by his remarks, among them being the separation of the duties of secretary and editor and the appointment of a trained man to perform the new editorial duties proposed. The need for co-ordination of the local sections and the parent body was emphasized, and the suggestion made that part of the association's funds be appropriated for improving the quality of its committee work. Great stress was laid upon the necessity for enhancing the value of the association's technical papers and printed proceedings. In fact, the whole tone of President Hill's speech, an abstract of which was published in last week's issue, page 766, indicated that the association was awakening to a realization of greater opportunities. The prediction was freely made that the incoming administration, under the leadership of Leonard Metcalf, the newly elected president, would write a new page of progress in the association's history.

Of the technical papers the one entitled "The Typhoid Toll," by George A. Johnson, was undoubtedly the feature of the convention. It told how 3000 lives could be saved annually by the filtration of city water supplies and presented the case for pure water in a forceful and easily understandable manner. This contribution elicited more discussion than any other paper on the program. Among the other technical papers the one on pumping machinery, by J. N. Chester, and that on reservoirs, by Dabney H. Maury, were received with marked favor by the delegates.

As usual, a number of committee reports were scheduled for presentation, but few were made in a form other than that of "progress." An innovation this year was the creation of a committee on city planning, and its report, presented by the chairman, E. P. Goodrich, consulting engineer, of New York City. It easily overshadowed any of the others in point of general interest, although the report of the committee on electrolysis, by Prof. Albert F. Ganz, called forth a vehement protest from Dabney H. Maury, who objected to the American Waterworks Association's participation in the work of the Joint National Committee on Electrolysis. This body, he charged, was so constituted that members of the waterworks industry could hope to exert very little influence in its deliberations.

Superintendent's Day, which had been heralded as an all-day forum for the discussion of practical waterworks problems by practical men, was cut short at the close of the morning session Thursday, and the afternoon period was given over to an organ recital in the grand ballroom of the Hotel Astor, where, incidentally, the exhibit of waterworks equipment and supplies was staged. The superintendents expressed a great deal of dissatisfaction at this move, which resulted in the passage of a resolution calling for at least two, and if possible three sessions for superintendents at future conventions.

New Officers

As a result of a letter ballot the following officers were elected for the ensuing year: President, Leonard Metcalf, consulting engineer, of Boston, Mass.; vice-president, Theodore A. Leisen, general superintendent, Board of Water Commissioners, Detroit, Mich.; treasurer, James M. Caird, consulting engineer, Troy, N. Y.; trustees, F. W. Cappelen, city engineer, Minneapolis, and M. L. Worrell, general manager of waterworks, Meridian, Miss. The executive committee reappointed J. M. Diven secretary for the ensuing year and referred to the publication committee, for report, the matter of securing an editor for the association's publications.

Richmond, Va., was chosen as the scene of the 1917 annual convention, and the following nominating committee was selected to name candidates for office next year: George A. Johnson, consulting engineer, New York City; Edward E. Wall, water commissioner, St. Louis, Mo.; Frank C. Jordan, secretary, Indianapolis Water Company; H. Hymmen, superintendent of waterworks, Berlin, Ont., and George W. Batchelder, water commissioner, Worcester, Mass.

New Membership Record

That the association is in a flourishing condition, both financially and in regard to membership, was made clear at the opening session June 6, when the regular committees made their reports. Secretary Diven reported a net gain in membership of 103 during the year, the figures being: Active members, 1123; corporate members, 79; associate members, 123; honorary members, 7—a total of 1332.

For the finance committee, H. E. Keeler, of Chicago, announced a new era in the association's history. There are no unpaid bills and the organization has about $7,000 in the bank. Of this amount about $3,000 represents the cash balance and the remaining $4,000 an investment in municipal bonds. These figures were elaborated in the report of the treasurer, J. M. Caird. Last year the finance committee regulated its expenditures according to a budget system, which has proved so successful, according to Mr. Keeler, that it will be repeated this year. He presented for approval a budget calling for an expenditure of about $10,000 this year. Some of the items are: Convention, $700; committee work, $400; local sections, $500; secretary, $1,800; printing $5,000; contingencies, $500.

The formation of local sections, according to the report of John W. Alvord, who spoke for the publication committee, has increased the printing bill and general cost of issuing the *Journal*, but in view of the association's present satisfactory financial status no embarrassment is anticipated in meeting the heavier obligations.

Special Investigations

Committee reports were the order of the day during the afternoon session of June 6. Of nine committees scheduled to present their findings, only one submitted a final report, and this dealt with standard specifications for hydrants and valves. It was presented by B. C. Little, who told the convention of the co-operative work which had been done by his committee and a similar committee of the New England Waterworks Association. The two bodies were able to agree on all except three points. The differences of opinion related to friction losses in hydrants, nipples and sizes of stems. John H. Gregory submitted a progress report of the committee on standard specifications of cast-iron pipe. This committee also has been working in co-operation with the New England Waterworks Association and with cast-iron pipe manufacturers. Mr. Gregory made a plea for funds in order that the work of his committee might be prosecuted effectively.

What promised to be one of the most important reports was the one of the committee on depreciation, of which Leonard Metcalf is chairman. The report is practically finished now, but inasmuch as there are several points which still need consideration by the full membership of the committee the presentation of this document was deferred. Scotland G. Highland's report on plumbing codes raised several objections. He advocated that the city water department control plumbing inside a building, but the sense of the meeting seemed to be that this enlargement of the water department's duties would merely add to the present complexities of inspection and permit routine necessary in constructing a building. The report was referred back to the committee.

While the committee on mechanical analysis of sand submitted only a progress report, Edgar M. Hoopes, Jr., city engineer of Wilmington, Del., pointed out that the matter of a standard screen scale for use by all industries is now under consideration by the U. S. Bureau of Standards. During a recent conference with that body representatives of the American Waterworks Association and other technical societies were present. It seems safe to predict that a recommendation will be adopted providing for the rating of screens by the size of opening rather than by the mesh number.

No National Association Yet

That the time is not yet ripe for an amalgamation of the American Waterworks Association and the New England Waterworks Association was made clear from the remarks of Leonard Metcalf in reply to a motion by Dow R. Gwinn, instructing the executive committee to investigate and report upon the matter before the close of this year's convention. Mr. Gwinn favored the coalition of the two bodies and was of the opinion that the time had come for definite action. President Metcalf, however, did not concur in this belief. "It is out of the question at present," he said, "to hope for a single national waterworks association and direct effort toward this end now is ill-advised. In fact, it might have the effect of creating a breach between the two associations. While the two organizations are to-day closer together than ever before, a consolidation, if it ever does come, must come gradually and not by forced effort."

Some of the major elements that tend to reduce pumping-plant efficiency were discussed in a paper by J. N. Chester, consulting engineer, of Pittsburgh (see page 804). In many instances, he said, from 20 to only 5 per cent of the heat in coal fired under boilers is converted into useful work, and he undertook to show some of the causes which account for this slow efficiency. In the discussion Capt. H. G. H. Tarr spoke of the need for "hitching up engineering to the dollar," and advocated consideration of the human, as well as the mechanical, problem in securing pumping-plant efficiency. He went on record in favor of giving bonuses to firemen who succeed in running their boilers on less than a specified quantity of coal.

Protest on Electrolysis

What was characterized by President Leonard Metcalf as a "frank, fearless and splendid stand" was taken by Dabney H. Maury, consulting engineer, of Chicago, when he made a vehement protest against the participation by the American Waterworks Association in the work of the Joint National Committee on Electrolysis, which has in preparation a report dealing with the subject of stray electric currents and their effect on subsurface structures. This national committee, Mr. Maury stated, is made up of three members each from the following organizations: American Waterworks Association, American Gas

Institute, National Gas Association, American Telegraph & Telephone Company, National Electric Light Association, American Railway Engineering Association, American Electric Railway Association and the American Institute of Electrical Engineers. In addition, the U. S. Bureau of Standards is represented by one member. Mr. Maury was explicit in stating that the national committee's membership indicated a preponderance in favor of the electric and street railway interests and that members of the American Waterworks Association, concerned solely with the integrity of subsurface pipe lines, could expect to wield little influence in its deliberations. His excoriation was precipitated by the report of the American Waterworks Association's committee on electrolysis, presented by Albert F. Ganz, professor of electrical engineering at the Stevens Institute of Technology.

Taking up the composition of the National Joint Committee on Electrolysis Mr. Maury contended that there existed a community of interest between the gas and electric industries and that it was misleading to say, as Professor Ganz had done, that pipe owners could be considered to have a majority control of the committee. On the contrary, he stated, the waterworks men were hopelessly in the minority.

Professor Ganz Replies to Critics

Professor Ganz replied to his critics by stating that the action of the national joint committee could not be considered as binding upon the association which had appointed representatives to it. He believed that the formation of the national committee was a step forward in adjusting the differences between the street railway companies and the interests concerned with metallic pipe lines. He did not see in the joint committee work the menace which was hinted at by Mr. Maury. Professor Ganz said that the association's former committee report, submitted when Mr. Maury was chairman, was exceedingly drastic and prescribed results which were impossible of attainment. The older report, he pointed out, required, in effect, a double trolley system, a feature which, in his opinion, there is small possibility of inducing the street railways to adopt. "We can provide adequate means of safeguarding pipe lines," said Professor Ganz, "without changing from the single to the double trolley." After a prolonged discussion the report of the committee on electrolysis was ordered received, but not approved. It was also provided that a committee be continued in power for further investigation of the subject.

Chemical and Bacteriological Section

By building a plant costing $30,000 to reclaim lime from the sludge in the settling basins at its filtration plant the waterworks department of Columbus, Ohio, according to Charles P. Hoover's paper, presented at the meeting of the chemical and bacteriological section June 8, estimates that a saving of $9,000 per year will be realized in the cost of lime alone. An abstract of Mr. Hoover's paper appears on page 806.

Some of the problems which confront the staff of the state water laboratory were discussed by L. H. Van Buskirk of the Ohio State Board of Health. Mr. Van Buskirk made a plea for uniformity of methods in the collection and shipment of samples of water for analysis. In the interpretation of results, it was pointed out, an inspection of the source of supply should be given great weight. Tests for B. coli as indicators of water pollution were discussed by Prof. C. E. A. Winslow.

City Planning

In presenting his committee report, E. P. Goodrich defined city planning as foresight in municipal matters. He called attention to the possibilities of the joint use of park lands and cited a case at Baltimore where a golf course flanks the Lake Montebello reservoir. A questionnaire on the subject of subsurface pipe galleries brought out the opinion that utility galleries are economical only for large cities. The report pointed to the undeveloped field of usefulness for the subsurface water hydrant in localities where snow and ice do not prevail during the winter months. At the present time, according to Allen Hazen, no American manufacturer is making a subsurface hydrant, and he believes that it might find favor in some of the cities on the Pacific Coast and in the South.

Dabney H. Maury's paper on reservoirs brought forth a discussion in which many members participated. His paper is published in abstract on page 803.

The Typhoid Toll

Toward the end of the final session of the convention, at about noon, June 9, President Hill called upon George A. Johnson for his paper entitled "The Typhoid Toll" (see page 803). The paper had been originally scheduled for the evening session of June 7, but had to be postponed because the greater part of the evening was taken up in listening to speeches presenting claims of various cities for the next convention of the association and in balloting—two votes being necessary before a majority was secured. In announcing Mr. Johnson's paper President Hill had some difficulty in recalling its title, and there was a slight pause while he hunted through his program to find it. "I don't wonder that Mr. Hill has forgotten the title of my paper," said Mr. Johnson, "as I have waited so long to deliver it that I have almost forgotten it myself."

Mr. Johnson confined his remarks merely to a brief résumé of his paper, which had been printed in the association's *Journal*. Judging by the amount of discussion which followed, Mr. Johnson's paper created a more widespread interest than any single contribution offered to the convention during its five-day session. Paul Hansen, chief engineer of the Illinois State Board of Health, characterized the paper as a mine of information for health officials who wish to place the typhoid problem before the public in a way that will impress it forcibly. The part-time health officer, he said, is responsible for many of the shortcomings of health departments.

"No greater service can be performed in the interest of public health," said Mr. Hansen, "than to urge, in season and out of season, the employment of the full-time health officer." Mr. Johnson's contention that state boards of health should not be given power to review plans met with opposition from Mr. Hansen. He held that state boards should have such power and that as a check upon unfair rulings a commission of expert engineers be appointed as a sort of court of appeal. Such a plan, it was pointed out, has worked well in Ohio.

Allen Hazen declared that his predictions, regarding the lowering of the death rate by pure water, made many years ago, are now being fulfilled. He sounded a note of warning, however, in referring to chlorination. With the advent of this form of sterilization, he said, there is a tendency to slight the design of filtration works and to depend upon the sterilizing equipment to do the work which should properly be done by the filters.

Facts and Figures Important

The consensus of opinion seemed to be that the facts and figures regarding the prevention of typhoid fever by pure water were important enough to warrant wide publicity. One of the speakers suggested that an elementary course on typhoid and its prevention by filtered water should be made a part of the curriculum of the public schools throughout the country. Theodore Horton, chief of the engineering division of the New York State Department of Health, gave figures to demonstrate how the typhoid curve had been lowered abruptly following the organization of an engineering division to control the purity of water supply. M. N. Baker urged the appointment of sanitary engineers, instead of physicians, as state and city health officers.

There were fifteen written discussions, among them communications from Dr. Harvey W. Wiley and Surgeon-General Rupert Blue, which could not be presented for lack of time. A resolution was passed authorizing the publication of Mr. Johnson's paper in pamphlet form and its distribution to municipal departments and newspapers throughout the country.

Superintendents Object to Curtailment of Their Sessions

Dissatisfaction was expressed at the manner in which Superintendents' Day was handled. The complaints were leveled mainly at the amount of time devoted to hearing the insurance companies' side of the private fire-service question, though allusion was made to the fact that less and less time has been devoted to matters of interest to superintendents at successive conventions during recent years. Secretary Diven replied to the criticisms, in part, by stating that in arranging the program he had received very little assistance from the superintendents themselves. As a result of the discussion a resolution was passed calling upon the president and the executive committee to arrange for three sessions for superintendents at the next convention.

Early in what was scheduled as the morning session the chairman proposed that instead of holding two sessions — morning and afternoon — as the program called for, one schedule lasting until 1.30 p. m. be held. Only one objection was registered against the proposal, and upon being referred to vote the suggestion was unanimously adopted. The entire morning, with the exception of two brief papers and a short time given to closing-up matters, was then given up to a discussion of the private fire-service question.

Insurance Viewpoint Presented

A. H. Blauvelt, associate manager of the Western Factory Insurance Association, of Chicago, opened the discussion by explaining the insurance companies' point of view, although with the reservation that there was very little cohesion or agreement among their representatives in respect to the private fire-service question. The beneficiary from a private fire service, the property owner, should pay, he believed, for the extra service rendered. He held also that the property owner should pay for the cost of installing and maintaining the system. A general installation of such services, it was maintained, would make special provisions for their care on the part of the water company absolutely unavoidable.

The insurance companies are practically agreed that a 4-in. connection for a sprinkler system is all that can be asked for. Joint connection to other sources of supply, according to Mr. Blauvelt, is a dangerous practice on account of the likelihood of contaminated water getting into the mains. All meters are liable to act as trash racks and for that reason provision should be made to bypass around them. The waterworks unquestionably should charge for fire service, he stated. A charge not exceeding $50 has been proved by experience to be collectible without difficulty. A higher charge might be justified, but the likelihood of its being collected without a great deal of trouble would be small.

Following Mr. Blauvelt's paper there was general discussion lasting several hours, the result of which was a resolution, offered by J. M. Diven, that the president and executive board be instructed to appoint a committee to confer with other associations and formulate a set of rules for private fire service. This resolution was opposed on the ground that in such a matter the American Waterworks Association should be sufficient unto itself. The general sense of the gathering was, however, that the insurance companies were vitally concerned in such matters, as were also the manufacturers, and the resolution as finally adopted included the two interests.

A great deal of favorable comment was heard on the excellent arrangements for the convention at the Hotel Astor. The grand ballroom was given over to the exhibits and there were two meeting rooms available for general and special sessions. The promenade afforded a convenient lounge for the members and was used by small groups for informal discussions.

Rain interfered with the entertainment features. The trip to the Kensico dam of the Catskill aqueduct was made during a heavy storm, but as the rain continued on June 9 the trip to Coney Island had to be abandoned. A smoker was substituted for it. On the evening of June 8 there was a reception and dance tendered to the president and delegates by the Waterworks Manufacturers' Association.

More than 70 firms participated in the exhibits, which were well staged in the grand ballroom. Men who have been attending the conventions of the association for many years said that the exhibit was the best in the organization's history.

To stimulate an increase in membership President Hill this year offered a handsome silver cup to the section reporting the greatest per capita increase. The prize was won by the newly formed Canadian section, which showed a gain of 35 per cent.

A. E. Cluett Made Chairman of Troy Harbor Commission

A. E. Cluett, member of the firm of Cluett, Peabody & Company, of Troy, N. Y., has been made chairman of the recently organized harbor and dock commission of that city. Mr. Cluett is a graduate of the Massachusetts Institute of Technology and has superintended the construction of many buildings for his company. The commission will expend nearly $2,000,000 in improving Troy's docks and river front.

Military Engineering Meetings in Chicago End—Drill Begins

Having concluded the course of lectures on military engineering with a paper on "Fortifications" by Capt. H. B. Sauerman, consulting engineer, the joint committee in Chicago has arranged for practical outdoor work. The lectures have accomplished their intended purpose—that of showing the engineer the futility of expecting a commission without military training. For members who cannot join the National Guard or attend training camp, drill was started in Grant Park June 8 and will be continued on Thursday evenings. The strong showing made by the engineers in the preparedness parade accentuated the call for personal instruction. Later in the season there will be exercises in map-sketching in conjunction with the engineer company of the Illinois National Guard, the officers of which have worked in the closest harmony with the joint committee. Before every lecture they have given informal instruction in the rudiments of the routine training.

$2,000,000 Fire at Baltimore

A fire on June 13 at Canton, Md., a suburb of Baltimore, destroyed elevator 3 belonging to the Pennsylvania Railroad, damaged two vessels and burned a string of freight cars. It is thought that fourteen men were killed and about forty injured. The damage to the elevator, ships and grain is estimated at $2,000,000. The conflagration is said to have been caused by an explosion of grain dust. The explosion wrecked the upper part of the elevator and the whole building was ablaze in a few minutes. The flames spread to an adjacent pier, where considerable damage was done. The steamships Willem Van Driel, Sr., and Welbeck Hall, which were loading grain, were badly burned and damaged by falling wreckage.

Leonard Metcalf Made President of Waterworks Association

Leonard Metcalf, consulting engineer, of the firm of Metcalf & Eddy, Boston, was installed last week as president of the American Waterworks Association to succeed Nicholas S. Hill, Jr., whose term of office expired. Mr. Metcalf was the unanimous choice of the nominating committee selected at last year's convention and his election is the result of a letter ballot of the membership counted recently. In order that he might be inducted into office Mr. Metcalf made the trip across the continent from San Francisco to the opening session of the convention in New York City.

Elected to the Presidency of American Waterworks Association

LEONARD METCALF

Mr. Metcalf enjoys the distinction of having been honored with the presidency of the country's two greatest waterworks associations—the American and the New England. He was elected to the presidency of the New England Waterworks Association at its annual meeting held in Boston, Jan. 13, 1915, and served at the head of that organization until succeeded this year by William F. Sullivan.

Mr. Metcalf was born in Galveston, Tex., in 1870, and received his degree from the Massachusetts Institute of Technology in 1892. During recent years he has been giving the greater part of his time to matters of valuation and rate making and testifying in legal cases. In this specialized field he is regarded as one of the country's leading authorities. For the last two years he has spent most of his time in California on the case of the Spring Valley Water Company in San Francisco. In collaboration with his partner, Harrison P. Eddy, Mr. Metcalf completed a three-volume work on "American Sewerage Practice."

Town Wants Engineering Advice

The citizens of Mount Pulaski, Ill., are looking for an engineer who can tell them how to rid the waterworks system of moss. The growth in the storage tank during the past year has necessitated turning off the water several times.

Savannah Ocean Terminals Completed

The new terminals of the Ocean Steamship Company at Savannah, Ga., have been completed. They occupy 20 acres along the Savannah River and consist of a slip 1020 ft. long and 225 ft. wide, flanked on the sides by freight sheds with trackage for 225 cars.

Engineering Society Activities

The Boston Society of Civil Engineers will hold a field day June 21 in conjunction with the New England Waterworks Association. The engineers will leave Boston at 10 a. m. for Pemberton. The trip will be made by boat and the program will be nearly the same as last year.

The Society of San Diego County (Cal.) Engineers has been organized for the purpose, it is said, of placing more authentic data before the taxpayers of that county. J. E. Sellers and Paul Watson are president and secretary.

The Colorado Association of Members of the American Society of Civil Engineers held its annual meeting June 10 at Denver. J. B. Lippincott, consulting hydraulic engineer, of Los Angeles, described the work on the Los Angeles aqueduct.

The Rochester Society of Technical Draftsmen will hold regular meetings the last Thursday of each month in the Sibley Block, Rochester, N. Y.

What Engineers and Contractors Are Doing

THE WARRACK CONSTRUCTION COMPANY, of Seattle, has removed its offices to the Lyon Building.

C. S. COE, engineer maintenance-of-way of the Florida East Coast Railway, has been appointed chairman of the Water Works Advisory Board to prepare and submit designs for an adequate and satisfactory water supply for the city of St. Augustine, Fla.

FREDERICK E. BECK, construction engineer for the board of water commissioners of the city of Binghamton, N. Y., has been made superintendent of the pumping stations and filter plants of that city. Mr. Beck has been with the water commissioners eighteen years, previous to which he served in the city engineer's office under the former city engineer, John A. Giles.

B. H. KLYCE and WALTER J. KACKLEY have formed the engineering firm of Klyce & Kackley, with offices in the Life and Casualty Building, Nashville, Tenn., and the Real Estate Building, Miami, Fla., for the practice of municipal, highway and drainage engineering. Mr. Klyce has been engaged in municipal engineering for the past ten years, having recently had charge as consulting engineer of extensive improvements at Miami, Fla. Mr. Kackley has been engaged in bridge and drainage construction in the Middle West and in Florida, having recently completed plans for the drainage of a large section of the Everglades. The new firm has been retained to design and take charge of the proposed $600,000 causeway across Biscayne Bay at Miami, Fla.

MCMAHON, FARRINGTON & BAKER is the name of a new engineering and contracting firm organized to handle heavy concrete design and construction as well as the design and construction of sewage-disposal plants and sewerage systems. The main office of the firm is in the Press Building, Binghamton, N. Y., with branch offices in Owego and Elmira. Mr. McMahon is a graduate of Union College and has had long experience in engineering work on the Panama Canal and several municipal jobs in South America and Mexico. Mr. Farrington is a Cornell graduate and was formerly chief engineer for the Appalachian Power Company on the Virginia transmission line. He was also with J. G. White & Company on power-plant construction at La Crosse, Wis. The firm has a large paving job at Waterloo, N. Y., under way.

DE FOREST A. WHEELOCK, who has been city engineer of Warren, Pa., for nearly twenty years, has engaged in the practice of consulting engineering with his son, H. A. Wheelock. Mr. Wheelock, Sr., first took up engineering work in 1874. He made several surveys to establish county boundary lines and was also employed on various railroad construction. From 1883 until 1895 he was engaged on the location and construction of several railways in Pennsylvania, including lumber roads and electric street railways. In 1895 he was made city engineer of Warren, Pa., which position he held until his recent resignation. He has also been chief engineer of the Warren Electric Street Railroad and city engineer of Salamanca, N. Y. Mr. Wheelock, Sr., has been county engineer of Warren County, Pennsylvania.

ALSON ROGERS has been appointed city engineer of Warren, Pa., succeeding De Forest A. Wheelock, whose resignation is noted elsewhere in this issue.

GAULT APPLEGARTH, formerly resident engineer for the Maryland Roads Commission, has been made road commissioner for Chestertown, Md. Mr. Applegarth is a graduate of the engineering department of the International Correspondence School. He took up engineering work in 1904 and was engaged on several surveys during the following three years. He began a private practice as general surveyor in 1907 at Patchogue, N. Y., and in 1908 was made topographer for the Madeira-Memoré Railroad in Brazil. He became connected with the Maryland Roads Commission in 1910. In 1913 he was made resident engineer in charge of construction and maintenance of state roads in Baltimore and Hartford counties, in which capacity he has directed work costing over $1,000,000.

LOUIS KAMPF, formerly with Lockwood, Greene & Company, architects and engineers, on work at Salem, Mass., is now representing several American companies in Shanghai, China.

GEORGE R. CAMPBELL has left the U. S. surveyor general's office at Olympia to become U. S. surveyor at Naches, Wash. Mr. Campbell has been engaged in engineering work in the Northwest since 1901. From that year until 1904 he had a consulting practice at The Dalles, Ore. In the latter year he was made a member of the firm of Campbell & Campbell, civil engineers, of Spokane, Wash. He took up private practice again in 1910 and in 1912 became connected with the Department of the Interior.

N. R. MELVIN, formerly superintendent on the recently completed Harlem River tunnels of the Lexington Avenue subway, New York City, has been made a member of the Arthur McMullen & Melvin Company, Baltimore. Mr. Melvin has had nearly twenty years' experience in construction work. Aside from his work on the tunnels of the Lexington Avenue subway, he had charge of the construction of the Interborough Rapid Transit crossing under the Harlem River at 145th Street. Mr. Melvin is now superintending the deepening and widening of the main-line double-track tunnels of the Pennsylvania Railroad at Baltimore.

J. A. BEEMER, formerly connected with the Bureau of Public Works of Manila, is now engaged in irrigation construction work for the State of Idaho.

C. C. JACOB, district engineer of the U. S. Geological Survey at Phoenix, Ariz., is making a tour of Nevada to collect data regarding that state's streams.

ELLIS TISDAL has recently been made assistant engineer in the sanitary engineering division of the West Virginia Department of Health. He is a graduate of Massachusetts Institute of Technology.

ALTON A. COOK has been made state chemist for the West Virginia Department of Health.

A. D. WAIDLE was recently appointed assistant engineer in the division of sanitary engineering of the Department of Health of West Virginia. Mr. Waidle is a graduate of the Massachusetts Institute of Technology.

J. B. ANDERSON, engineer and contractor, of Pittsburgh, is now superintending the construction of a warehouse for the American Sheet & Tin Plate Company at Canton, Ohio.

J. E. VAN LIEW, formerly chief engineer of the Des Moines Bridge & Iron Works, has organized the Des Moines Steel Company, at Des Moines, Iowa, to engage in the fabrication of structural steel. Mr. Van Liew was graduated from the electrical-engineering department of Iowa State College in 1899, and from the civil engineering department in 1901. He spent the summers between school terms with different railroads. From 1901 to 1903 he was enmployed by the American Bridge Company at Toledo. He went to the Scherzer Rolling Lift Bridge Company in the latter year and early in 1904 became connected with the American Bridge Company at St. Louis. After about six months with the American Bridge Company Mr. Van Liew entered the employ of the Des Moines Steel & Iron Works, of which he has been chief engineer since 1913.

R. L. WOOD has left the employ of the engineering department of the Missouri Pacific-Iron Mountain Railway to join the valuation department of the Atchison, Topeka & Santa Fé Railway, with headquarters at Galveston, Tex.

LEEDS & BARNARD, consulting engineers, of Los Angeles, have removed their offices to the Central Building. The firm has been retained by the city of Long Beach, Cal., in a consulting capacity on the concrete seawall and sidewalk in Long Beach.

HANSEN & COULTER, hydraulic and sanitary engineers, of New York City, have been retained as consulting engineers on the installation of an iron-removal plant for the Jamaica Water Supply Company, of Jamaica, L. I.

C. W. COOPER, who has been actively engaged on construction work in the South since 1909, has been made city engineer of Anniston, Ala. This is in addition to his work as consulting engineer for several other towns in Alabama. Mr. Cooper was graduated from the Alabama Polytechnic Institute in 1908. He recently completed a course in highway engineering at Columbia University, after which he returned to the South.

WILLIAM D. WRIGHTSON, sanitary engineer for the U. S. Public Health Service at New Orleans, has been given a four months' leave of absence to accompany Surgeon-General William C. Gorgas and his party as sanitary engineer on a tour of South America to study methods of eradicating fever. Mr. Wrightson has been connected with the Public Health Service for more than a year and a half. He was graduated from the University of Maryland in 1906, after which he spent a few months with the Wildell (W. Va.) Lumber Company on railroad work. From 1907 to 1909 he was chief engineer for the Capuzaya & La Palmilla Mining Company, in Mexico. In 1910 he was associated with General Gorgas as sanitary engineer on the Panama Canal. After two and a half years on the canal he was made engineer for the Texas Company, at Houston, Tex., and late in 1913 became chief engineer for the Pasadena Petroleum Company, at Shreveport, La. From May to December, 1914, Mr. Wrightson was sanitary engineer for the expeditionary forces of the United States Army which occupied Vera Cruz, Mexico.

F. H. NICHOLSON has been appointed by the New York, New Haven & Hartford Railroad to give his whole time to the subject of automatic train control. His title will be assistant engineer. The New Haven management states that it is the intention to conduct further experiments and tests on its own lines, to make thorough investigation of trial installations on other roads and to continue the examination of train-control devices brought to its attention by inventors and others.

CHARLES M. LEVEY has been made president of the recently reorganized Western Pacific Railway. He has been vice-president and general manager since 1909.

MAJOR JOHN C. OAKES, Corps of Engineers, U. S. A., now stationed at Louisville, will be transferred to Philadelphia July 1, where he will have charge of the work of improving the Delaware River and maintaining coast defenses at the mouth of that river. Major Oakes has been connected with the Corps of Engineers since 1897.

COL. GEORGE A. ZINN, Corps of Engineers, U. S. A., now stationed at Philadelphia, will, July 1, take charge of the second regiment of engineers, the organization of which was made possible by a recent act of Congress.

MAJOR ROBERT R. RALSTON, Corps of Engineers, U. S. A., in charge of improvement of the Big Sandy River, with headquarters at Cincinnati, will succeed Major Oakes at Louisville July 1.

W. C. RALEIGH, city engineer of Tacoma, Wash., for the past seven years, has purchased an interest in the real estate, insurance and loan business of Havelock C. Boyle & Company, of that city, and been made secretary-treasurer. He was appointed assistant city engineer for Tacoma under Frank L. Davis, whom he succeeded as engineer.

SAMUEL MURRAY, acting chief engineer for the Oregon-Washington Railroad & Navigation Company, of Portland, Ore., has been appointed permanently to that position.

THE BLACK MASONRY & CONSTRUCTION COMPANY, of St. Louis, has opened offices in the Alaska Building, Seattle.

Obituary Notes

LESLIE S. ROBERTSON, secretary of the Engineering Standards Committee of Great Britain, was among those who perished June 6 with Earl Kitchener on H. M. S. Hampshire. Since its inception in 1900 Mr. Robertson has been secretary to the standards committee with its one hundred or more dependent and subcommittees, which under this one organization cover the whole field of engineering in Great Britain. He had recently taken a responsible position in the Ministry of Munitions. His exceptional ability, genius for organization and intimate knowledge of men and affairs make his loss to the engineering standards committee almost irreparable. Mr. Robertson was about fifty-four years of age.

SIMPSON FLEMING, consulting waterworks engineer, for thirty years in the employ of the City of Ottawa, Canada, died recently in that city at the age of 89.

SIDNEY A. BUTLER, well known in Southern California for his activities in behalf of the good roads movement, and formerly a railroad construction engineer, died recently in Los Angeles. He began railroad engineering about 1870 and assisted in the construction of the Atchison, Topeka and Santa Fé Railway in Colorado and Kansas and in building the branch of that railroad between Las Vegas and Lamy, N. M. He also organized the Los Angeles County Good Roads Association and did much toward the construction of paved highways in Southern California. He was born in 1847 in Milwaukee.

HIRAM TARLETON, a member of the New York Central Railroad's surveying squad laying out a new line along the west branch of the Susquehanna River in Pennsylvania, was drowned June 4 in Bald Eagle Creek.

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Activities of the American Society of Civil Engineers

IN AN EDITORIAL published in this journal April 1 reference was made to the service which the American Society of Civil Engineers renders its members. The views expressed were adversely criticised by two officers of the society, and it was suggested that constructive comment would be in order. That suggestion is responsible for the following discussion of the society's work.

To begin with, this journal is second to no one in its admiration and acknowledgment of the achievements of the society. Its excellent committee work, its efforts, through strict admission requirements, to maintain high professional standards, and the fund of engineering knowledge accumulated in its publications have rightly earned for it the high position it holds.

Despite this good work there is a feeling of dissatisfaction among the members—a feeling that the society is not serving its members as it should, that it is missing opportunities to be of value to the profession. Undoubtedly there has been conservatism. Younger societies have been more courageous, particularly in matters touching the public welfare. Opportunities have been passed by to make the engineer's influence felt on river and harbor legislation, public building and road appropriations, hydroelectric laws, and on the many state and municipal engineering problems that press for solution. Such a statement may be met by the plea of insufficient resources, and that, in turn, would lead to endless discussion. While, therefore, believing that this broad view is of the first importance to the society, and insisting that in this direction lies the great future, its mere statement must suffice here, in order to give room for discussion of some details of immediate moment that have an important bearing on the society's success.

The dissatisfaction can be accounted for largely on two grounds—the lack of intimate relations between the society and its members and the unfortunate but persistent policy of "hiding its light under a bushel."

The lack of intimate contact is to some degree inseparable from large size, but a multiplication of the number of local associations, and especially the adoption of a district-organization plan, will do much to give a closer touch. The district-organization plan is in the hands of the committee revising the constitution, and the hearty indorsement of the scheme by the membership in the recent straw vote renders it safe to assume that the matter will be properly taken care of. Its discussion here is therefore superfluous.

The policy of hiding its light is particularly unfortunate. It prevents the society from receiving the credit it deserves. It creates dissatisfaction where dissatisfaction might not exist. The activities of the board of direction are many and diverse; the deliberations of its committees full of interest to the profession. Yet what does the membership know of them? Formal and greatly condensed minutes are the only public record of the one; annual reports of the other. Were some one with real editorial instincts put to the task, a readable department of society progress could be written for the "Proceedings" that would shortly give the membership a new conception of the society and its work. That result cannot be achieved through a "canned" set of minutes. The human touch must be present. Moreover, the work of local associations furnishes excellent news material, procurable by appointing a live correspondent in each association.

As a specific instance of failure to advertise its work even to its own members, the employment assistance rendered by the society may be cited. The work has not, it is true, been thoroughly organized, but even so it is of no mean proportions. Yet so little is this work known, that employment is one of the three fundamentals of a society started in Chicago two years ago largely because, it stated, *no civil engineering society was doing employment work.*

The major work of the society falls naturally into three classes—publications, committee work, and local-association activities. They will be considered in turn.

This journal does not know whether the board of direction or its committee on publications has inquired critically, and from the editorial point of view, into the society's publication work. Intrinsic evidence indicates that they have not. Yet an activity that absorbed $52,000 of the society's income in 1915, roughly 33 per cent of all expenditures, certainly should be subjected to severe scrutiny, and at frequent intervals. Only in that way can there be assurance that the dues are returning to the members the highest possible service.

Certainly no fair-minded person would contend that it is justifiable to devote 325 pages of the "Proceedings" to an article that interests less than one per cent of the membership. Yet that waste of society funds occurred recently. Again, much of an inconsequential nature, meaningless halftone illustrations, duplications between text and drawings are published. The long series of papers on the Pennsylvania Railroad's New York improvements is in point. An editor with authority could cut many a paper materially *without lessening its value.* To some extent papers are now referred to specialists, asking for opinions as to availability for publication. That practice should be widened and the request made, if the recommendation be for acceptance, for suggestions as to the elimination of useless detail. Economies of no mean total would result from the erection and enforcement of editorial standards that square with the classification of membership and the best possible use of the society's funds.

Passing now to committee work, it is freely and happily conceded that great progress has been made in recent years. In fact, there has been a veritable reformation in committee management. Even the committee on engineering education has shown signs of life. First came the set of rules for spurring on lagging committees and dispensing with useless committee members; then followed the closer scrutiny of committee appropriations. But there is still room for improvement.

There is now a "committee of special committees" to pass on budgets. But that supervision of appropriations is not alone sufficient. No corporation would think of appropriating funds without a particular knowledge of the purpose of the expenditure and periodical reports on progress. "Strict accountability" is a good principle in this connection.

While much excellent committee work is in progress, every member of the society can suggest other fit subjects for study. In the way of public service alone there are the many neglected opportunities above referred to. They would make excellent assignments and add greatly to the society's usefulness and prestige. Paving specifications sadly need the attention of a strong society capable of resisting commercial manipulation. The tilling of these virgin fields is impossible unless the society's resources are increased or funds otherwise used are released.

While the society must spend money for committee work, the attitude latterly taken by committee members is not encouraging. Not content with mileage, some have advocated the payment of *per diem.* Such a view is incompatible with the altruism without which no society can become great. If the hireling spirit is to prevail, let us have done with society work and frankly put our highest investigative studies on a commercial basis. Furthermore, the employment of paid secretaries for committees, except under exceptional circumstances, should be condemned.

Committee membership is not without reward. In fact the leaders of the profession testify that the reward is large. The intimate relations established, the broadening that comes from contact with representative men from other parts of the country, the professional and business advantages are beyond the purchase of money. Many an engineer has failed, or attained only mediocre rank, because he did not cultivate broad relationships. The prosperity of those who have served and succeeded is a fitting return for their investment of time and money for the advancement of the profession. It would be regrettable if committee assignments were accepted solely because of the personal advantages, but certainly it is legitimate to consider the benefits and to make sacrifices, confident that some time and somehow there will be a return.

Mileage, probably, cannot be entirely eliminated, but it can be considerably reduced by selection of committee members not scattered too far geographically. The appropriation can be further cut by reducing the number of members on each committee. As a rule, the real work is done by one or two men. The others act as advisory members, criticising plans and results only at long intervals. Why not adopt the form of organization indicated by experience? Each committee of three or five would have the privilege of selecting as large an advisory group as it saw fit. Committee members would receive mileage; advisory members none. Programs of work and progress reports would be submitted to the advisory members, but they would not be bothered with details. On a railroad matter, for example, a half-dozen competent chief engineers could in an hour check up six months' work, commend the course followed, or indicate a new one. The plan would recognize officially what practice has already made the rule.

With reference to local associations, increase in the number is desirable, while some plan must be worked out for extending professional influence even to those who are not members of any society. They, the men cut off, as it were, from the main trunk, are the most likely to bring the profession into disrepute. They must be made to feel professional responsibility. They must come to know that the profession is interested in them and sincerely wants them to feel their kinship with the great body of engineers. Some of them in time would develop and qualify for membership in, at least, the local bodies. This work, it would seem, is one for the local society, but the inspiration, the method, must come from the national body.

A fruitful field for local-association work is afforded by the leading universities and technical schools. Student sections have long proved their value in the mechanical and electrical engineering societies. The mechanical society has no less than 1000 student members. In the language of D. S. Jacobus, president of the American Society of Mechanical Engineers, "young men form the life of any society. We should keep our young men well in line, for in them lies the future strength of our organization." If taken while in college, when they are enthusiastic and impressionable, the young men will develop an appreciation of the society that will be an assurance of lifelong membership. Student sections, too, will be small, affording a good opportunity to the individual to participate in the activities of an organization that holds a large place in the profession. He will feel that the profession has an interest in him, and, with all the enthusiasm of youth, will give his best to the profession.

The society, as expressed in the constitution, has two principal purposes—the advancement of engineering knowledge and practice and the maintenance of a high professional standard. The latter is fostered in various ways, but sentiment has been growing in all societies that effective discipline is inevitably necessary. That is why the members of the society were recently asked whether the power to discipline members should be placed in the hands of the board of direction. The straw ballot was overwhelmingly in favor of that course. While this is a desirable change from present procedure, it does not go far enough. The board of direction is already too busy. Instead of having greater duties placed upon it, its burden should be lightened. A grievance committee, not composed of members of the board, should be established. Instead of requiring a petition from ten members before a case is taken up, the committee should be empowered to investigate the conduct of members upon the suggestion of any member, or to initiate inquiry of its own accord. It should have the power to mete out discipline, allowing the privilege of appeal, by the accused, to the board. Procedure following these general lines is in force in the American Institute of Architects and has given excellent satisfaction. Even if few cases reach the point where drastic action is needed, the mere knowledge that the committee is in existence, and that its sole business is to hear complaints, would be sufficient to deter those who are now willing to "take a chance" in violating the codes of professional ethics or public morality.

Corollary to the adoption of vigorous disciplinary measures is the establishment of a committee on ethics which would gradually build up a series of principles touching ethical questions. These principles when approved by the board would go into the society year book and stand as precedents for the determination of similar cases in the future.

Finally, it is the opinion of this journal that the society has held too much aloof, allowing the idea to gain ground that it is impressed with its own superiority and means to impress that superiority upon other societies, national as well as local. Far be it from the Engineering Record to advise that the society place itself on a plane with less important bodies. It should unbend, however—if that be the proper word?—when by so doing it can prevent others from taking a wrong course. Two instances illustrate the point. During the spring there was a conference on society co-operation in Chicago, called by a committee headed by F. H. Newell, while somewhat later there assembled in New York a committee on the classification (indexing) of engineering literature. At neither of these conferences was the American Society of Civil Engineers represented, though there were delegates from many local engineering bodies and from the other national societies. Criticism of the civil engineers' failure to participate was heard at both meetings. And the criticism was just. Even if it be granted, for the sake of argument, that both conferences were ill-advised, that their objects were impossible of attainment by the course in contemplation, the society would have rendered a service by being present and pointing out the dangers of the contemplated plan. As a matter of fact, at least two wrong steps were taken at the New York conference; and they probably would not have been taken had the society been represented. Neither of the meetings was a fly-by-night affair, called by insignificant or discredited members of the profession. The dignity of the society, therefore, would not have been lowered by participation. If the society lack the initiative to start good movements, it cannot make that an excuse for nonparticipation. Wherever it goes it will be looked up to as a leader and its views respected accordingly. Its present stiffnecked attitude has added nothing to its prestige; rather, it has prevented it from performing many a good service for the profession.

In the conduct of such a society a broad vision is necessary. The profession and its needs must be viewed in the large. Close confinement to routine interferes with perspective. There is reason to believe that, in the past, the board of direction has been so burdened with comparatively minor matters that it has not been able to stand back and take a comprehensive view of professional needs and appraise the degree to which it was meeting them. The new method of carrying on the board's work—by means of an executive committee, meeting at frequent intervals and reporting to the board quarterly—gives promise of a better utilization of the high abilities of that distinguished body. It has the experience, the ability and the determination to carry to success any plan which its good judgment determines is desirable and feasible.

Bought and Paid For

THE ESSENCE of professional service is to reach decisions that flow logically from the facts. The attitude is judicial, not partisan. Yet the City of Peoria, Ill., is advertising for a valuation engineer who is to come to a predetermined verdict. Not content with asking engineers to bid in a scramble against each other for making an investigation, the lights and lamps committee of the City Council also inserts in its advertisement the bold statement that the rates now charged by the local light and gas company are to be examined "with a view of establishing lower rates for such service." When a city deliberately advertises for some engineer to become an advocate for them, the whole profession is insulted. There is no other or softer term applicable, and it is time strong action was taken by the public relations committees of our engineering societies. They handle this sort of thing in Canada without gloves. Witness the refutation of charges against a city engineer in Calgary, as noted in this journal of June 10, page 770.

A Fitting Celebration

IT WAS a fitting celebration that marked the removal last week of the Massachusetts Institute of Technology to its new home. Due pride in one's own institution will not prevent men from other schools admitting that such an event is of significance to the whole profession. This is particularly true because the moving to the new building marked at the same time the consummation of the long-looked-for coöperation with Harvard University. The new structures and equipment are an essential feature of the co-operative arrangement. From the opening of the exercises on Monday, through the pageant, the masque, the formal dedication and the closing banquet, the proceedings were of a character that did credit to the greatness of the institution. Outwardly, at least, pageantry and show are not so popular here as they are abroad. Witness the formalism of the religions that predominate in this country and the boasted simplicity with which the head of our nation moves about. Yet those in charge at Boston felt that the full significance of the removal would best be brought home by dressing it in the pomp of a less practical age. That it was impressive was the universal testimony of those who attended. The actual dedicatory exercises, too, did honor to the institute. Addresses such as those of President Maclaurin and Senator Lodge, reprinted on page 834, and of President Lowell of Harvard deserve not merely a single cursory reading, but careful preservation and study. As the speakers so well said, the buildings were but a means to an end, an opportunity for a great school to achieve a greater future. The outpouring of its distinguished body of alumni was an earnest of the accomplishments to come. That it may make the best of its great opportunity, that its work may be commensurate with the vision of its president, is the earnest wish and confident hope of the engineering profession.

Maclaurin

NO TRIBUTE to the institute, no congratulatory words on the completion of its new home, would be complete without giving President Maclaurin due credit for his part in the great achievement. Without him it could not have been. The vision now realized in enduring stone on the bank of the Charles would be unborn. To say that in his five and a half years of incumbency he has raised over $10,000,000, that he has welded faculty and alumni together into effective, responsive units, that despite rapid technical progress he has kept the courses abreast of the times, is telling but half the story, for the background is lacking. When he came to "Tech" the institute was in a serious position financially. Alumni were making annual appropriations to meet a deficit, but the alumni organization was not such as to guarantee a continuance of the current contributions, much less the increase that was sure to be needed. There was talk of the State of Massachusetts discontinuing its annual appropriation; and as to new buildings to meet the growing demands, there was not a glimmer of hope. What a prospect for a new president! But the new incumbent did not shrink from the task. It is unnecessary to dilate on the vision, the energy, the enthusiasm that were needed for the task—or on the discouragements and the worries. Every man of affairs can picture them, having before him on the one hand the background, just sketched, and on the other the great group of buildings that has just been dedicated. President Maclaurin's work stands as his monument, but callous indeed would be the present generation if it did not voice unmistakably its appreciation of him and his work, and its congratulations on the eminently satisfactory issue of his labors.

The Telephonic Banquet

AS HAS BEEN SAID, the dedicatory exercises at Cambridge last week were truly worthy of the greatness of the institution and of the event. The banquet, the closing function, was no exception. Probably no feature more appropriate to the celebration could have been found than the wonderful demonstration of transcontinental telephony. The triumph of a great institution was accompanied by a triumph of American engineering and organization. The transcontinental telephone, it is true, has been in service over a year. On a number of occasions large audiences have been permitted to hear speakers across the continent. Never before, however, have 5000 people, in thirty-six different cities, from Boston on the east to San Francisco, Seattle and Los Angeles on the west, from New Orleans on the south to Duluth on the north, listened at one time to a single voice. What a thrilling thought! What a triumph in organization, in technical mastery! Never before have so many men, so widely scattered, been under a central control. The stage was set for a great triumph or a gigantic fizzle, and science and organization, as represented by the American Telephone & Telegraph Company and its chief engineer, J. J. Carty, won. An air gap of a pin point somewhere in the Rocky Mountains and all would have failed. On what little things success depended is shown by the failure of the Dayton Technology Club to respond when its name was called. Some one had forgotten to throw a switch, and while the diners in Dayton heard all that went on, the listeners in the other cities could not hear Dayton's reply. The telephonic dinner was indeed a fitting close for the celebration of the new Technology's dedication.

Ambiguity in Specifications

ONE CLAUSE discussed by Mr. Fleming in his review of one thousand specifications, which will be found on page 838 of this issue, is a good example of that ambiguity which is so deplorable in specification writing. This clause refers to column splices and is worded as follows: "Columns shall have as few splices as practicable, and where spliced the splice shall be strong enough to resist the direct as well as the bending stresses." Some engineers might give this clause a more liberal interpretation than Mr. Fleming, who takes it to mean that the whole direct stress must be carried through the rivets of the splice plates. There are those who would claim that a splice milled to bear and held in line by plates designed to take the bending stresses would be "strong enough to resist" both direct and bending stresses. This clause is thus an excellent example of the kind of specification writing which Mr. Fleming rightly condemns. This journal believes that, in view of the notorious variations, so well illustrated in Mr. Fleming's article, authoritative standard specifications should be drawn up by the American Society of Civil Engineers to cover the fundamental requirements of good structural-steel practice in building construction, just as the standard specifications of the American Society for Testing Materials cover the requirements for materials and the standard specifications of the American Railway Engineering Association cover the requirements for bridge design. Mr. Fleming's definition of the ideal specification might well be used as a basis by any committee.

Welcome to Our City

WHAT committee on arrangements for an engineering convention will have the courage to reduce the amount of time ordinarily given to addresses of welcome? There seems to be a growing tendency toward the belief that no convention can be opened without having the "keys of the city" turned over to the delegates by an interminable number of city fathers whose names carry the prefix "The Hon." or some equally awe-inspiring title. If care is not exercised engineers will be crushed by the weight of the keys delivered to them. Let there be only one address of welcome, and let it be short. Then have the convention get down to serious business without undergoing the ordeal of listening to platitudes on engineering by laymen. At waterworks conventions, for example, no address of welcome seems to be complete without reference to the fact that, while the city's water supply is of excellent quality, the town contains other beverages in which the delegates will probably be more interested. At almost every convention lack of time prevents the presentation of important technical papers and committee reports. For this curtailment of the technical program the frittering away of time on the welcome-to-our-city addresses is partly responsible. If the welcome could only be made to combine brevity with heartiness plenty of time would be available for more profitable subjects. It is inconceivable that any city official really enjoys delivering such addresses to conventions. In fact, many of them regard these speeches as necessary evils. Surely the audience gets neither pleasure nor profit from these oratorical effusions. The convention committee which will establish a policy of limiting the official welcome to a five-minute speech will earn the lasting gratitude of the delegates.

Simplicity the Keynote of Oregon's State Highway Cost-Keeping System

Few Books and Printed Forms Employed—Results Easily and Quickly Interpreted—All Accounts Are Numbered

By G. ED ROSS
Auditor, Oregon Highway Department, Salem

ACCURACY of results at a minimum cost for clerical labor is the primary object of the accounting system that has been in successful operation for about a year on the work of the State Highway Commission of Oregon. The main features are similar to those of the cost-keeping system formerly employed by the United States Reclamation Service on its construction work, but they have been worked over and simplified to make them suitable for commercial purposes. In the operation of the system few printed forms and very few books are required.

Construction accounts, from their very nature, require entirely different treatment from most any other class of accounts, if the results intended are to be accomplished. The chief essentials of construction accounting are not only to have a record of all transactions, but to have this record in such shape that the items making up the cost of a piece of work give an intelligent and reliable basis on which to estimate other work.

An important feature which should not be overlooked is the fact that usually timekeepers and men handling clerical matters on construction work are engaged a large part of the day with various other duties which are frequently of such importance that the time spent on cost keeping and accounts is looked upon as a side issue. If the system of accounting employed is intricate and topheavy with detail, it encourages guesswork and carelessly kept records which, at the close of the job, will be found inadequate and incomplete and of very little value either as a basis for the cost of that work which they are intended to cover or the working out of estimates on future jobs of a similar nature. It therefore stands to reason that the more simple an accounting system is in its operation, if it has the essentials, the more accurate and workable the cost data will be when finally compiled.

ESSENTIALS OF COST SYSTEM

The essentials for a practicable accounting system for construction work should embody the following features:

1. An accurate record of all obligations as they are made is necessary so that the state of finances may be known at any time with a minimum of uncertainty.

2. Individual items of cost of structures on divisions of the work should be kept in such detail and be available at such frequent intervals as to give the superintendent an opportunity of checking up and eliminating exorbitant costs from day to day while the work is in actual progress.

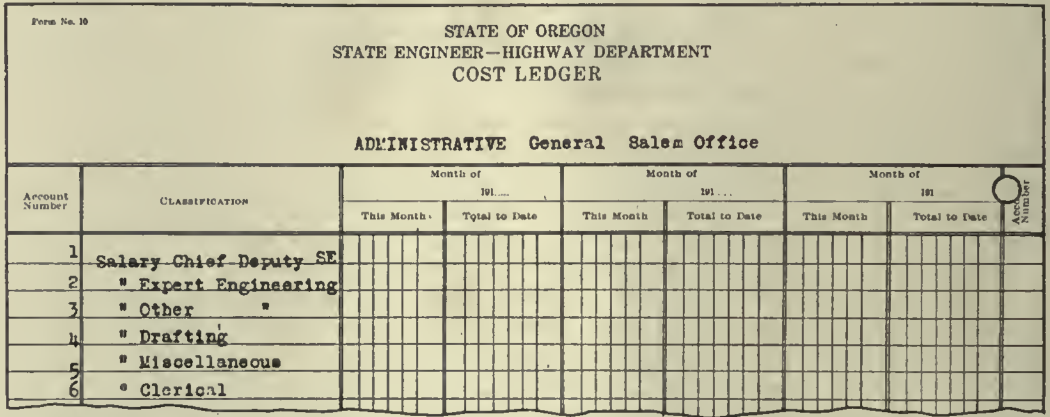
3. There is needed sufficient detail in items of cost, with supporting narrative as to conditions prevalent at the time of the work and locality in which it is done, as will make it possible on future work having some elements of similarity safely to base estimates upon these costs.

4. Every original entry, so far as possible, should be embodied as a portion of the permanent record, thus doing away with unnecessary copying and excessive clerical work.

5. All cost-keeping records must tie in and be a part of other office records kept, and balance with gross expenditures on the entire work.

6. On each gang's work there must be a check which will show its comparative accomplishments daily, weekly or monthly. This will create enthusiasm and friendly rivalry among foremen, resulting in more efficiency and lower unit costs.

7. There should be as few books and forms of record as possible to accomplish the result in the most simple and effective manner with a view of making permanent as many of the original records as practicable.



Form No. 10

STATE OF OREGON
STATE ENGINEER—HIGHWAY DEPARTMENT
COST LEDGER

ADMINISTRATIVE General Salem Office

Account Number	Classification	Month of 191....		Month of 191...		Month of 191		Account Number
		This Month	Total to Date	This Month	Total to Date	This Month	Total to Date	
1	Salary Chief Deputy SE							
2	" Expert Engineering							
3	" Other "							
4	" Drafting							
5	" Miscellaneous							
6	" Clerical							

THE IMPORTANT BOOK IS THE COST LEDGER, IN WHICH ARE SUMMARIZED ALL ITEMS ASSEMBLED FROM MONTH TO MONTH

8. Men operating this accounting system should have ordinary "horse-sense" and sufficient judgment to grasp the essential features of construction work on which unit costs are desirable and may be of value later as well as at time of construction, rather than men who are interested in the clerical work from a clerical standpoint only. This class of men is in abundance on most construction work. All that is required to make them valuable assistants is a man at their head who is thoroughly familiar with construction accounting and cost keeping, and also has sufficient knowledge of general office and accounting requirements to instruct his field assistants intelligently as to just what records to keep and how to keep them.

With a view to embodying the principles outlined, the State Highway Commission of Oregon in the spring of 1915 had installed by its auditor an accounting system based on one that had been very successfully demonstrated on the construction of the Tumalo Irrigation Project in central Oregon. This project was built with state funds during the years 1913 and 1914, directly under the supervision of state officials.

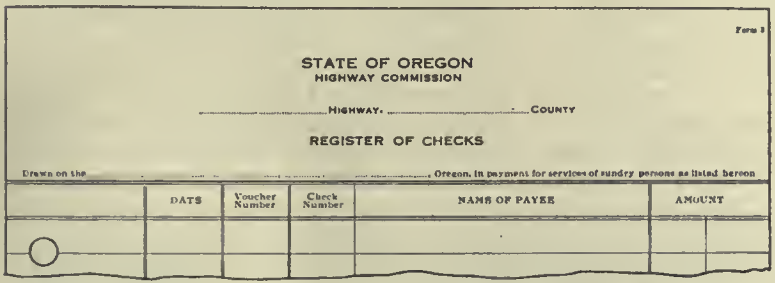
CLASSIFICATION OF WORK

In the operation of the system few printed forms and very few books are required. The important book, of course, is the cost ledger, in which are summarized all the items assembled from month to month. Before actual construction is started the work is divided into districts and each district into divisions. Divisions are made according to the character of the country in which the construction work is to be done. On highway work they may vary from one to several miles in length. Each division is laid off into features. The segregating of these divisions into features should be done very carefully, as proper forethought and study at this time will have much to do with the success of the system. It is of sufficient importance to warrant the engineer in charge, the superintendent and the accountant going over the work together, feature by feature, that they may start with a fairly good understanding of its purpose and the part each will have in the securing of accurate costs. It goes without saying that these three officials must work absolutely in harmony if the best results are to be obtained.

A set of account numbers is prepared to cover the items of expense which are chargeable to the general office and which cannot be charged directly to any of the districts—for example, such charges as salaries and expenses of administrative employees and the upkeep of the general office, an expense which is for the benefit of the entire job but cannot be prorated fairly at the time incurred. Account numbers are prepared for each division which may have the following features: General Expense, Preliminary Location, Right-of-Way, Construction—Subgrade, Culverts and Drains, Bridges, Riprapping, Macadamizing, Hard Surfacing, Camp Construction, Operation of Mess Houses, Corrals, Storehouse, Blacksmith Shop, and Machine Shop. At the head of each of these sheets is given the name of the road, county in which it is located, station-number limits comprising this division, width of roadbed and width of right-of-way. The same items are used over and over on the various divisions, but the numbers assigned are different in every case.

There is no repetition of the numbers on the job, so that when a number is once assigned it can mean only one thing. This does away with confusion which might otherwise result. These classification lists are bound into what is known as an account number book, a page of which is shown herewith, and each number alone, when taken from this book, gives full details as to what it is intended to cover. For instance, the item "7305—$16.75" coming into the general office on a summary of account numbers means there had been spent $16.75 for "labor, repairs to equipment" on the Pacific Highway in Douglas County, State of Oregon, Comstock Division, between Sta. 200+00 and Sta. 60+70, a distance of approximately 2 miles. As will be noted, with the two entries made all those concerned are fully informed, by reference to their account number books, as to every detail in the transaction.

Every man in a responsible position has a copy of such portion of the book as may have any connection with the work he is handling. The last item on each feature is "Depreciation on Equipment," and takes care of the equipment cost chargeable to each feature of the work. An "Equipment Record" book is kept in which each piece of equipment, date of purchase, price and estimated time of usefulness are entered. This is depreciated each month against the feature on which it is used, the amount being based on the estimated period of its usefulness or its estimated value at the completion of the job. At the end of quarterly, semi-annual or yearly periods an inventory of all equipment is taken, a survey of its actual value at that time made and the equipment charges adjusted accordingly.



Form 3

STATE OF OREGON
HIGHWAY COMMISSION

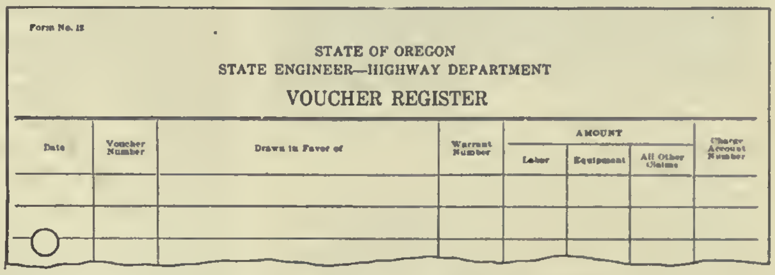
.... HIGHWAY. .... COUNTY

REGISTER OF CHECKS

Drawn on the .... Oregon, in payment for services of sundry persons as listed hereon

	DATE	Voucher Number	Check Number	NAME OF PAYEE	AMOUNT
○					

A PAGE FROM THE "ACCOUNT NUMBER BOOK" SHOWING THE CLASSIFICATION OF COSTS



Form No. 15

STATE OF OREGON
STATE ENGINEER—HIGHWAY DEPARTMENT
VOUCHER REGISTER

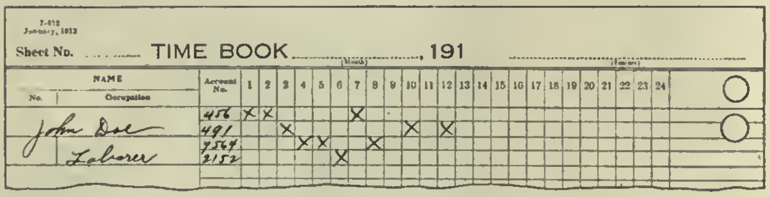
Date	Voucher Number	Drawn in Favor of	Warrant Number	AMOUNT			Charge Account Number
				Labor	Equipment	All Other Claims	
○							

THE VOUCHER AND CHECK REGISTER SHEETS ARE KEPT IN A 9 X 12-INCH RING BINDER

GENERAL EXPENSE PRORATED

At the end of quarterly periods the expense of the general office is prorated over to the district offices according to the percentage of work done in each district. The general expense in the district office is at the same time prorated to divisions and features of the work. The value of the equipment and storehouse inventories are taken, and these items, added to the cost ledger, should balance with the voucher register and bills payable and include every charge that has been incurred. This results in the production of a record of actual costs, including everything for which money has been expended.

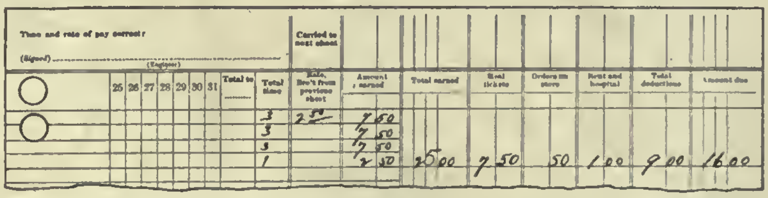
There is no comparison between this method of securing costs with an absolute check on every transaction and the method once quite common on construction, whereby the resident engineer secured as much data as came through his hands without any actual check as to their correctness or reference to general office records and overhead expense. The administrative cost is just as much a part of the unit cost of moving materials as the wage of the man at the end of a No. 2 shovel. Too frequently is this expense overlooked in making estimates on new work.



T-612
January, 1913

Sheet No. .... TIME BOOK .... (Month), 191 .... (Foreman)

NAME No. | Occupation	Account No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	○
John Doe	456	X	X					X																		
	491			X							X		X													○
Laborer	7564				X	X			X																	
	2152						X																			



Time and rate of pay correct:
(Signed) .... (Engineer)

Carried to next sheet

	25	26	27	28	29	30	31	Total to	Total time	Rate, Bro't from previous sheet	Amount earned	Total earned	Meal tickets	Orders on store	Rent and hospital	Total deductions	Amount due
○																	
									3	2.50	7.50						
○									3		7.50						
									3		7.50						
									1		2.50	25.00	7.50	50	1.00	9.00	16.00

ON THE TIME-BOOK SHEETS ARE COLUMNS FOR ACCOUNT NUMBERS, NAMES OF EMPLOYEES, OCCUPATIONS, TIME WORKED, RATES AND AMOUNTS

Numerous blank numbers are left in the classification of accounts to be supplied as the work progresses and when it is desirable to add special items, not foreseen in the beginning, on which costs are wanted. This may at first appear complicated. It must be borne in mind, however, that only a few of the account numbers are in use at any one time. For instance, on the cost of erecting bridges we have "labor, erecting concrete forms" and "labor, taking down concrete forms," "labor, pouring concrete" and "labor, placing reinforcing steel," "material and supplies, cement," "material and supplies, lumber." There are ninety numbers in this feature, and when the work is first started it is probable that, aside from the items previously enumerated, not more than three or four others in the feature would be used the first month. At a later period, as the work progresses, such items as "erecting steel," "erecting falsework," "testing materials," "field riveting," etc., would come into use, and so on throughout the job. At the end of the work, therefore, nearly all of the ninety numbers designated would have a charge. If all other records were lost the cost ledger itself would show a fairly good record of the monthly progress of the work.

LABOR COSTS SUMMARIZED DAILY

If this system is to achieve the results of which it is capable, a summary of labor costs should be taken frequently, possibly every evening, which on an ordinary piece of work should not take the timekeeper more than half an hour. This gives the superintendent an idea, while the work is active, just how the costs are running, and if they appear to be excessive at any one place he can give that certain job his immediate attention. If he is thoroughly in touch with the work he can, in his office, frequently locate the trouble in a fairly definite manner. It is this feature of the system which is considered its greatest value, inasmuch as when properly handled it actually increases the efficiency of the superintendent and his foremen and makes real money for the contractor through the medium of lower unit costs and greater accomplishments per gang.

Accounting is sometimes looked upon as a sort of necessary evil and dead expense. The sales department in the average commercial business is no more effective in its functions of preserving and stimulating the life of the business than this method of accounting is when placed in its proper relationship to the work. It certainly is a barometer on every activity on the job, and must show in its operation a little more speed than the speediest foreman or superintendent, if it is to retain its position as "pace setter" for the organization. In this age of close competition and advanced methods, when the element of guesswork on construction estimates is practically eliminated, the accounting system which is only "at home" in the very rear of the procession is of very little real value.

SEGREGATION OF ITEMS

Segregation of the items is left to the men interested in the cost-keeping and determined largely by the character of the work. They can be cut finer or the number materially reduced, according to the judgment of those in charge, and this element of elasticity of the system is another one of its strong points. However, it should be thoroughly understood that the account numbers, regardless of how many there may be in a book, will never give trouble in case they are not used, and the space they take in the book is immaterial, so that in laying out a piece of work it is well to have sufficient items to cover every detail of work that may possibly arise, so that after the work has been completed it may not be found that costs on numerous items are desired which it is then too late to secure because of lack of forethought and knowledge of construction work when the account number book was made up.

In case it is necessary at any time to make changes or additions in the account number book, these changes should be made only by the one responsible for all accounting. Copies of changes should be sent to all who may be interested before insertions in the book are entered, so that the books in the field and cost ledger items may be identical at all times. The observance of this rule is of great importance.

The time-book sheet, shown herewith, has columns for the insertion of account numbers, names of employees, occupations, time worked, rates, amounts earned, deductions, and amounts due. On ordinary construction jobs one man, as a rule, will not be working under more than two or three numbers the entire month. The exceptions are in the case of foreman, roustabout, blacksmith, timekeeper, and a few others whose duties make it necessary to charge their time to nearly every feature of the job, and these men should be given from two spaces to a whole page, depending on the requirement. It will be noticed that there is space for four account numbers in each division of the sheet. At the close of the month a recapitulation by pages of the time of the men is made. There is also a summary of account numbers made. This summary of account numbers and recapitulation of the time-book, showing the amount earned, should balance, and if they do the timekeeper can feel reasonably assured that his computations are correct. The time-book is then sent to the general office, the bookkeeper there taking off the summary and posting it in a classification book which is used to assemble the items for posting to the cost ledger.

The invoices passing through the field, after being carefully checked and O. K.'d by the proper person, should have inserted on them the account number to which the items are chargeable, and then sent to the general office for payment. The account numbers and charges are taken off on the classification book as they come into the general office. At the close of the month, when all accounts are in, the classification book is balanced and the gross amounts chargeable to each account number which has been active that month are posted in the cost ledger, which contains the account numbers and items identical with those in the account number book. When this has been completed and the cost ledger balanced up, the items are also added crosswise of the page, and this gives the totals to date and by months on each item and by features of all work.

ACCOUNT BOOKS NEEDED

The books recommended for this system vary according to the size of the project. The following outline should cover the ordinary construction job, with such additions and alterations as may, in the judgment of the accountant, seem desirable:

(a) Cost ledger
(b) Voucher register } Controlling accounts.
(c) Check register

An ordinary I-P ring binder, No. 701, size about 9 x 12 in., makes a very satisfactory cover for all three of these forms, one cover for all, with the proper divisions, making a convenient and compact record. As the record grows in size and features are completed, transfers may be made of sheets to inactive binders.

(d) Condensed financial reports and general pertinent information. For this purpose a convenient size is a sheet 4½ x 7 in., with a No. 6 Morden's loose-leaf binder or similar book, pocket size, which is usually carried by engineers and superintendents on their work.

(e) A small form with insert for carbon sheet about 7 x 4 in., which makes a very convenient book for requisitions, orders to foremen and for general memorandum where it is desirable to retain a copy.

(f) Time-book sheet.

(g) Check book.

(h) Classification book.

(i) Equipment record book.

(j) Storehouse stock book.

(k) Special forms for reports by foremen to superintendents, for use of timekeepers in checking time of men which they have taken during the day, and other miscellaneous reports which may be worked out to fit the particular piece of work.

There are two advantages in the use of the smaller binders and forms. One is the cost of printing the smaller form and the lack of waste in its use. The other is that it makes a very convenient record to take into the field or to public meetings.

FIELD AND OFFICE SHOULD CO-OPERATE

This system is not based on theory, but is outlined now after eight years' experience on a very large variety of construction work both in the field and in general offices. The writer has never found an instance in construction work where, with a little applied intelligence, this method did not absolutely cover the situation; but to get results there must be co-operation between the field and office forces. The superintendent and engineer should carefully go over all summaries of account numbers before they are sent to the general office. By each one working in his place and spending a little time on this important matter, errors will be kept down to a minimum and the fullest detail will be available at the close of the work.

In so far as nearly every construction job varies in detail, it requires a specially constructed accounting system to handle it, and the methods described, with a very little adjustment, can be easily made to fit any piece of work. When the principle is once thoroughly understood the detail of working it out will be found very simple.

COLUMBIA RIVER HIGHWAY, COLUMBIA COUNTY
Located at ....
State Engineer Highway Department
GRAVEL-SCREENING AND STONE-CRUSHING PLANT

5416	Salaries, Engineering.
5417	Draftsman.
5418	Clerical and timekeeping.
5419	Expert engineering.
5420	Miscellaneous.
5421	Labor, Erecting plant.
5422	Drilling and blasting.
5423	Handling materials.
5424	Stripping pit.
5425	Crushing.
5426	Repairs to equipment.
5427	
5428	
5429	
5430	M&S, Repairs to equipment.
5431	Explosives.
5432	Drill steel.
5433	Blacksmith shop.
5434	Engine oil, lubricants.
5435	Fuel.
5436	Lumber.
5437	Rental of equipment.
5438	Royalties on stone, etc.
5439	Freight, express and handling.
5440	Contractor's earnings.
5441	
5442	
5443	
5444	Administrative pro rata.
5445	Depreciation on equipment.

Dredge Washes and Stacks 10,000 Yards of Gravel Per Day

THERE WAS launched in April at Hammonton, Cal., the hull of a gold dredge said to be the largest ladder dredging unit thus far constructed. It is equipped with an endless chain of 100 buckets, having a capacity of 16 cu. ft. each, and is to excavate material from a depth of 82 ft. below water level. The dredge is operated by electric power, and a crew of only three men is required to run it while excavating, washing and stacking 300,000 cu. yd. of material per month.

The hull, without mechanical equipment, weighs about 1000 tons, and is built entirely of structural steel, fabricated in the East and erected in California. The equipment will include a 400-hp. motor for driving the excavator and six other motors, ranging in capacities from 35 to 150 hp. The dredge was built for operation by the Yuba Consolidated Gold Fields and will work along the Yuba River. It will be duplicated by a sister boat, to be launched late this fall. The dredge was designed and built by the Yuba Construction Company.

LARGEST GOLD DREDGE WILL WASH AND STACK 300,000 YARDS OF MATERIAL A MONTH

Gun Dislodges Soot from Stacks

A gun, made by drilling a hole in the center of a piece of shafting, and loaded with blasting powder, tamped with dry clay and fired by fuse, can be used to clean the soot from any type of stack or chimney without injuring it. In describing this method, the *Du Pont Magazine* suggests that to make such a cannon of convenient size a hole 1¾ in. in diameter may be drilled 10 in. into one end of a 14-in. piece of 4-in. shafting. A small touch hole should be drilled into the side of the large hole near its lower end. The proper charge consists of FFF blasting powder poured into the large hole to within 2 in. of the top and tamped with dry clay. The cannon is fired by a short piece of fuse. This charge is sufficient for a stack 100 ft. high, although the number of shots necessary to clean a stack thoroughly depends on its condition as well as on its size. Ordinarily three or four shots will suffice. It is stated that one of the largest manufacturing companies in this country has used this method for several years in its industrial plants without accident or injury to any of its stacks.

Six-Mile Sewer Extension Has Sinuous Course

Large Quantity of Equipment Permits Contractor to Rush Sewer Work to Completion Two Months Ahead of Schedule

UNEVEN contours along the route of the Canton (Ohio) sewer extension of 18,000,000 gal. daily capacity from the city limits to the new disposal plant made the alignment an extremely varying one so as to obtain sufficient covering to protect the sewer. The route follows the Nimishellen Creek valley, which has hills at many places almost abutting on the water's edge. Seven creeks or runs were bridged and a railroad track was crossed at five places. In the traversing of the heavily traveled 16-ft. highway constructed upon the hill side problems of keeping the road open at all times and making good progress in construction were presented.

PIPE LAYING FOLLOWS EXCAVATOR CLOSELY IN CAVING GROUND

The sewer proper is of 39-in. American segment vitrified tile, which was used only where the line is on the regular grade of 0.1 per cent. The length is 25,500 ft. In the three siphons totaling 5000 ft. lock-joint concrete pipe made on the ground was used.

SIPHON RUNS OUT FROM UNDER COVER

Solid rock excavation, encountered for 2½ miles, ranged from 18 to 22 ft. in depth. As this rock was in the highway or along the railroad only light blasts could be made, so that the improved highway and the telephone and telegraph wires would not be damaged. A mat to hold the shots could not be used conveniently, as the surface of the ground rose too abruptly on one side. About 20 per cent of the material was limestone and shale and the remainder gravel, sand and loam.

At stream crossings the sewer is designed as a beam, a reinforced casing on spans of 20 ft. between pier centers being provided to take the stress. This casing is lined with the regular tile construction. The stream beds were paved by slabs of reinforced concrete to prevent erosion at the site of the crossings. At railroad crossings the sewer was reinforced with concrete, and in addition at two points double-strength cast-iron pipe was cased in concrete.

To obtain sufficient velocity in two of the siphons at minimum flow two lines of 30-in. concrete pipe were used. The sluice gates at the inlets and outlets of the siphons are so arranged that an overflow is possible when one line cannot take care of the flow.

EQUIPMENT

The excavation was done by an Austin trench excavator for the gravel section, and also in a 27-ft. cut. Six gangs of about forty men each worked on the hand section work, and there was also provided an A-frame cableway with a 600-ft. span. Backfilling was done by a narrow-gage dinkey hauling more than 2000 ft. of track direct from the excavator, by a Marion steam shovel, by slip scraper and by hand.

For the rock excavation Ingersoll-Rand jack hammers were used, air being supplied twenty-four hours per day by two Westinghouse cross-compound compressors. As the work is in the country a well had to be drilled and water pumped to a tank erected on a hillside at a height of 150 ft. About 4½ miles of water lines were laid connecting the tank to the work. Two concrete pavers—a Ransome and a Foote—mixed the concrete.

SMALL CHARGES SAFEGUARD WIRES

Rapid progress was made from the start, an average of 6000 ft. being completed each month. In ten hours on one of the good days three masons laid up 210 ft. of 39-in. segment block sewer.

The work was carried out under the general direction of W. E. Sarver, city engineer, with George H. Wynn as resident engineer and designer for the city. The John F. Casey Company, with James A. Bowen as construction superintendent, was the contractor.

Engineers and Architects Want Branded Timber

Frank D. Chase Tells Lumbermen Clearly Defined and Easily Recognized Standards Will Develop National Market

ENGINEERS and architects want timber standardized so that they can buy a single stick, a carload or a trainload of lumber as easily as they can buy a carload of steel or cement, and with the assurance that they will get what the specifications call for. This, said Frank D. Chase, consulting engineer, to the National Lumber Manufacturers' Association meeting in Chicago recently, is the big reason why engineers and architects want branded timber. Buildings must be safe for habitation, and the architect or engineer is paid to see that they do the work they are designed to do. They cannot to-day always be certain that the lumber which goes into buildings will meet requirements.

UNCERTAINTY REGARDING LUMBER

Mr. Chase cited the penalty which lumber paid by reason of this uncertainty. The man who uses structural longleaf pine in Chicago must by ordinance use 40 per cent more than should be used. Fiber stresses must be figured at 1300 lb. instead of 1800 lb., recognized practice. Instead of increasing the sale of lumber 40 per cent, competition puts timber out of consideration for more cases than 40 per cent in the extra quantity used. He stated that he was completing a building just out of Chicago in which there are 4,000,000 ft. of lumber. Had the building been built in the city the added cost due to low fiber stresses would have eliminated lumber as a building material.

The building department will indorse an ordinance giving longleaf and fir an adequate fiber stress, Mr. Chase held, as soon as it can have definite assurance that the timber going into the buildings is what it is specified. Only one way is available, and that is for the inspector of the department to go to the job and see with his own eyes the brand of the national association stating exactly the grade of timber, thus putting it in the same class with other building materials. If this branding and labeling with the producer's name were done, and it is done now by some, the speaker believed that the engineer and architect would not take any chance on something they did not know anything about when they could get for the same price a material which they had every reason to believe was what was claimed for it. Usually more is paid for these identified articles, and the customer is perfectly willing to pay an extra price.

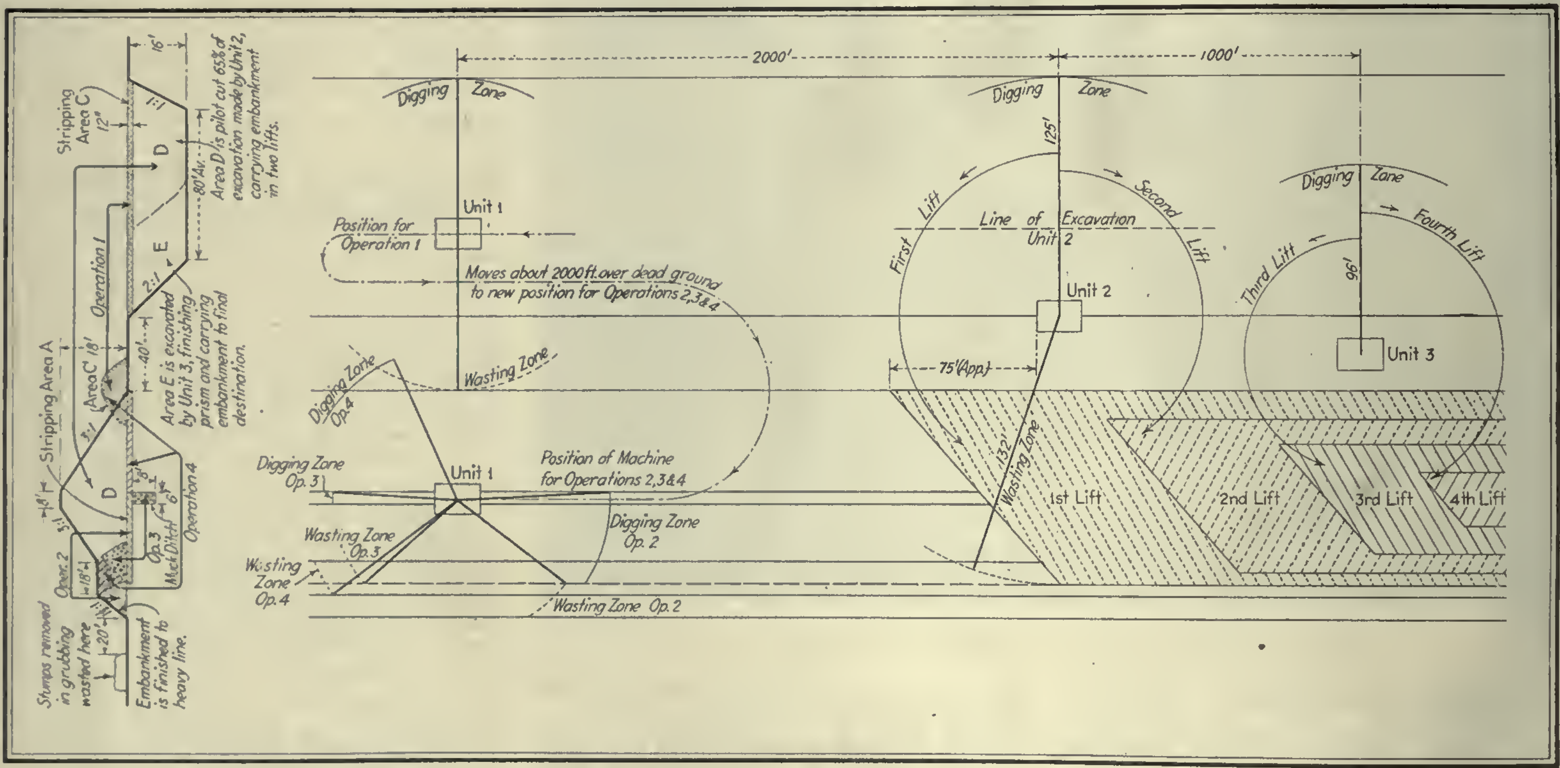
"There will be lots of good brands of lumber on the market, and if it costs more we will use it when its use is justified. It is going to be a very happy day for the engineer and architect when he knows that branded lumber which he specifies will be used; and more than that—when he can say to his contractor that he believes that such and such a brand is perhaps a little better than somebody else's, and everything being equal he would like to have him use it. That day is rapidly coming, I am very glad to believe, and when it does we will not have any more buildings with dry-rotted timbers taken out at the end of three or four years; buildings which cost too much, buildings which are inadequate for their service. We will design timber buildings as we do steel—know what we want and what we get, and will get it."

War Forces Use of Liquid Chlorine Installation

Inability to get hypochlorite of lime at a reasonable figure has forced several large cities to install liquid chlorine. One of the largest orders is for Chicago, which is installing twenty-three machines. They will be placed at the pumping stations to insure absolute prevention of reinfection of the open pump wells, rather than on the cribs where the bleach plants have usually been installed. Denver is installing a plant at the West Denver pumping station, replacing a bleach plant which required the services of two men at $60 per month.

Mammoth Electric Draglines Dig Diversion Channels and Construct Levees

Earth-Handling Methods Employed to Excavate 8,600,000 Cubic Yards on the Works of the Little River Drainage District of Missouri Get Stable Banks



THREE DRAGLINE EXCAVATORS APPORTION STRIPPING, CHANNEL AND LEVEE WORK TO GET BANKS BUILT IN LAYERS

HANDLING half a million cubic yards of earth a month on the headwater diversion works alone of the Little River Drainage District of Missouri is the goal toward which the engineer and contractor on that part of the district's work are striving. For only a year has the operation on this portion of the drainage works been in active progress, and during this time the contractor has been tuning up his various units, until now the machines are working very nearly to their full capacity at their respective tasks. Huge levees that form the barriers on each side of a floodway 900 ft. in width will, together with the diversion channel, divert to the Mississippi River the quick runoff from the Ozark foothills and prevent the flood waters from flowing into the lowlands to the south. The methods of building these levees are largely the result of experience with the monster electric dragline machines installed on this work and a close study of the conditions to be met. A study of these construction methods on the ground was recently afforded a representative of the Engineering Record. Articles outlining the design, general method of headwater diversion and canalization of the 900-square mile area of lowlands appeared in the Engineering Record in the issues of Aug. 22, 1914, page 204, and Dec. 5, page 612. This article will take up the construction of and the experience gained from the early work.

GETTING STABLE LEVEES

The levees on each side of the floodway from the Mississippi River, back for about 6 miles, have been constructed and are practically complete except for dressing, closing gaps at railway and highway crossings and topping out, as described later. The levees east of the Government Levee, between it and the Mississippi River, a distance of nearly 3 miles, have been subjected to a season's weathering, and the channel within the same limits has had repeated changes in water level.

The method of procedure to get stable embankments is to place the material in layers, first ahead and then back of the excavating machines, and the exact methods of getting three draglines to build up a levee in layers are shown in the drawing, which needs some explanation.

FOUR MACHINES TO DO WORK

First, a Clyde steam stump puller, not shown in the drawing, follows the timber-clearing gang and piles the stumps 20 ft. outside of the limits of the flooded area, where they remain temporarily, to be disposed of by burning or otherwise before the completion of the work.

Second, unit 1, a Bucyrus steam dragline, with caterpillar traction, 70-ft. boom and 1½-yd. bucket, strips about 6 in. of the top soil and vegetable matter from the diversion channel area. In this operation the machine occupies a central position in the digging zone and works away from the excavating machines. It wastes the stripping on an area toward the levee side at the limits of its boom reach. After completing a reach of about 2000 ft. the machine returns and operations 2, 3 and 4 are started, with the machine occupying a position on the center line of the levee. Operation 2 consists of removing the stripping from the area under the outer part of the levee and piling the material just outside the levee toe. The muck ditch is then excavated in operation 3 and the material placed to form the outer toe of the levee. The fourth operation is to strip the remainder of the levee area and rehandle the stripping taken from the channel area. The wasting zone for operation 4 is between that for opera-

SEASONED FLOODWAY LEVEE AND CHANNEL SHOW LITTLE DETERIORATION

IT IS NECESSARY TO OIL THE LARGE BUCKETS TWENTY TIMES A DAY

tions 2 and 3 and on top of the material placed in operation 2. This wasted material is kept quite free from roots, etc., the grubbing operations having preceded the stripping. The material will finally be leveled off to form a banquette with a top width of about 18 ft. and an outside slope of 1½:1.

UNITS 2 AND 3 ELECTRIC DRAGLINES

Third, unit 2, a Bucyrus electric dragline machine, mounted on trucks and having a 125-ft. boom and a 3½-yd. bucket, occupies a position over the berm line so that in making a pilot cut it can reach 125 ft. to the far side of the digging zone and still waste over the whole levee base area, the maximum reach for which is 132 ft. It places the material in two layers, one ahead to a depth of about 6 ft. over the area and one behind, filling in the holes and raising the embankment to a height of about 10 ft. The excavation by this machine is equivalent to about 65 per cent of the prism. The far bank is cut to a 1:1 slope, which it is expected will deteriorate a little, as may be seen by examining some of the photographs. Normally, this machine operates about 2000 ft. behind the stripping machine.

Fourth, unit 3, a Bucyrus electric dragline on trucks, having a 100-ft. boom and a 4½-yd. bucket, occupies the berm, excavates the remainder of the prism and places the material ahead of and behind itself as described in the operations of unit 2, building layers of about 6 ft. and 4 ft. in thickness making the third and fourth lifts of the levee. It finishes the near side of the canal prism to a slope of 2:1 and carries the embankment up to approximately its final line. Where the channel excavation, as specified, is insufficient to construct the levee, the excavation is carried to overdepth. The slopes of the prism are maintained and the base width is narrowed as the depth of required excavation increases—this method of obtaining the additional material required being more desirable than widening the channel, as generally the excavating machines are working practically to the limit of their boom reach.

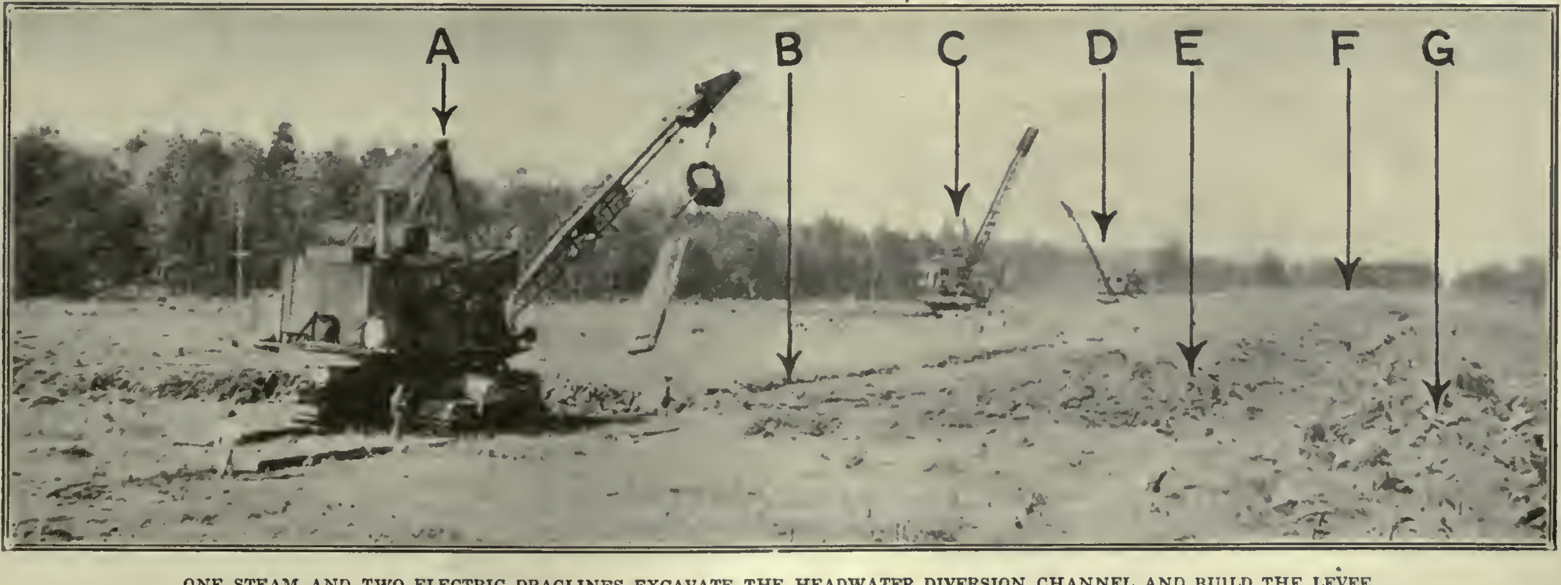
OVERSATURATION LIMITS LAYER HEIGHTS

During the winter season the material being excavated became oversaturated. The levee forming the north barrier of the diversion floodway had not been constructed ahead of the main channel and levee forming the south barrier, and so did not intercept the drainage from the hills to the north. Furthermore, there was an unprecedented stage of the Mississippi River over a considerable period. In consequence the oversaturated material would not stand when placed to the required height of the levee, and therefore the height during the period when this condition was encountered had to be limited to about 12 ft. The prism of the channel was fully excavated by the second machine, however, and the material spoiled so that it will be convenient for handling when the embankment is finally topped out. This topping-out operation will be done when the levee is brought to its final lines throughout, and it is contemplated that the work will be done by mounting a small dragline machine on top of the levee, which machine, in addition to topping out the levee, will dress the slopes and the banquette formed by the material from the stripping operation placed on the outer side of the levee as previously described.

The drainage afforded by the construction of the muck ditch is not sufficient, and there is usually more water encountered in the work than is necessary for easy operation of the buckets. To correct this condition, the contractor is using an earth dam across the channel behind the machine and is removing the water to the downstream side of the dam by using a motor-driven centrifugal pump. The stage of the water below the dam may be either higher or lower than the stage in the channel, being affected somewhat by the stage of the Mississippi River. The operations, however, have now progressed westward so far that the river stages will have little effect, except in extreme cases.

LEVEE BASE TWICE INSPECTED

To develop the soil characteristics, borings were taken at a depth of 12 ft. at 300-ft. intervals along the center line of the levees, the purpose of this being to ascertain if the muck ditch excavation would encounter material which would not intercept seepage. Where a condition was found which showed a large percentage of sand, a cutoff wall was constructed by driving Wakefield sheet piling, 2-in. three-ply, 6 in. thick, to a depth of 12 ft., in lieu of a muck ditch. At least 4 ft. of this sheet-piling wall extends above the ground and will penetrate the levee that distance.



ONE STEAM AND TWO ELECTRIC DRAGLINES EXCAVATE THE HEADWATER DIVERSION CHANNEL AND BUILD THE LEVEE

Unit 1 (A) in second position strips levee base, digs muck ditch (B) and piles material at (E). Units 2 and 3 (C and D) follow and pile channel excavation in levee (F). Stumps (G) are piled 20 ft. beyond toe of levee.

UNIT 1 DIGS BUCKET-WIDTH MUCK DITCH

Grubbing and stripping the channel area and the area upon which the levees are to be constructed assure a bond and an embankment free from vegetable matter or any surface soil which would tend to make the embankment pervious or unstable. The stripping operation is carried on under the supervision of an inspector who accompanies the machine, and the stripped area is examined by the inspector in charge of the excavation and levee-building operations. This double inspection is an added precaution taken by the engineers of the district to prevent unsatisfactory or unstable material being used in levee construction.

Transformers Mounted on Barges

For handling the current a pole line has been erected along the line of the channel of the floodway side. The transformers to reduce the voltage from 13,200 to 440 volts are mounted on barges and are moved along with the draglines. Connections with the pole-line wires are made by simple trolleys, hand made, out of two window sash pulleys, a piece of bent steel and an insulator. The current is supplied by the Missouri Public Utilities plant at Cape Girardeau, Mo.

The dragline excavators are operated day and night, the runners working in three shifts of 8 hours each, and the remainder of the crew consisting of foreman, three laborers, one helper and one spotter working in two 12-hour shifts. One electrician looks after both machines.

The rate of progress has averaged about 60,000 cu. yd. per month for the 3½-yd. machine and 70,000 cu. yd. per month for the 4½-yd. machine. During some months they have excavated as much as 80,000 and 90,000 cu. yd., and on a single day's run the record excavation is 5800 cu. yd. Due to the small number of breakages, the outfits have been shut down only about 5 per cent of the time.

Two-Machine Operation

Work on the western portion of the headwater diversion works, at the east end of the West Basin, is being prosecuted by two class 24 Bucyrus electric draglines, having 100-ft. booms and 3½-yd. Page buckets. A Clyde steam skidder is being used in connection with the clearing operations.

The operations on this portion of the work are somewhat different from those on the western end, where three machines are employed. The first machine strips the channel area, making 500-ft. moves, occupying the berm and wasting beyond the inside levee toe line. After completing the reach it returns, stripping the levee and digging the muck ditch, as does the caterpillar traction dragline on the east end of the work. Instead of traveling dead-head to the first position, it excavates a pilot cut, removing about one-third of the prism. The second machine in 75-ft. moves excavates the remainder of the prism, finishes the channel slope and builds the levee to its final lines. The levee-building operations of these machines are substantially the same as those of the other machines described.

Making a pilot cut ahead of the main excavation has the advantage of affording the soil reservoir an opportunity to drain, and the material from which the final lines of the levee have to be constructed is in a less saturated state, and therefore a more stable slope is assured.

Personnel

J. M. Floesch, Rochester, N. Y., has under contract the entire headwater diversion work, involving 8,600,000 cu. yd. of excavation. S. T. Neely, superintendent, Cape Girardeau, Mo., has active charge of the work. Bartson & Millard, Peoria, Ill., are subcontractors on that portion of the work designated as the Ramsey Creek diversion channel.

The executive body of the drainage district is the Board of Supervisors, composed of five men who are owners of land within the district. William A. O'Brien, Cape Girardeau, Mo., is chief engineer and Isham Randolph, Chicago, consulting engineer.

SEASONING WILL ELIMINATE VOIDS HERE

ONE OF THE ELECTRIC UNITS MAKES FINAL CUT AND FINISHES SLOPES

Heavy transformers supplied from high-tension line on left are mounted on barges and easily moved.

Tricalcic Silicate Most Important Constituent of Portland Cement

The major constituents of Portland cement are tricalcic silicate, dicalcic silicate and tricalcic aluminate. Of these constituents, according to a statement made by George A. Rankin in a paper on Portland cement in the *Journal* of the Franklin Institute, the compound tricalcic silicate is the one which hardens and develops the greatest strength within a reasonable time. This most important constituent, which is the one formed with the greatest difficulty, makes up only about 30 to 35 per cent of an average normal Portland cement. It may be said, therefore, that the essential process for the manufacture of Portland cement is the formation of this compound, and that any improvement in this process yielding an increased percentage of tricalcic silicate will increase the cementing value of Portland cement. In order to determine the most economical process for producing tricalcic silicate in the highest percentages, it will be necessary to study the rate of formation of this compound in a series of mixtures of various substances; this, in turn, necessitates the determination of the equilibrium relations of tricalcic silicate at high temperatures in such mixtures. Such a procedure will lead sooner to the discovery of the optimum composition in various cases and for various purposes than the empirical, cut-and-try methods that have hitherto been used.

Brush-and-Stone Jetties Prove Effective at Ventnor City and Longport, New Jersey

Stop Disastrous Erosion at Latter Point, Where ¾-Mile Spit Had Almost Disappeared in Thirty Years—Must Be Properly Maintained

By W. I. RISLEY
Civil Engineer, Atlantic City, N. J.

THE EFFICACY of brush-and-stone jetties, both for stopping the erosion of sea beaches and for building them up where there were none, has been demonstrated in the last year or two by the works at Ventnor City and Longport, N. J. At the latter point a beginning has been made toward the recovering of a spit nearly ¾ mile long, practically washed away since 1887. The experiences with the new jetties have shown that the brush-and-stone type must be properly maintained in order to be effective, but that when so maintained it is successful where the timber jetty is not. The brush-and-stone jetties at Ventnor City averaged to cost about $14.

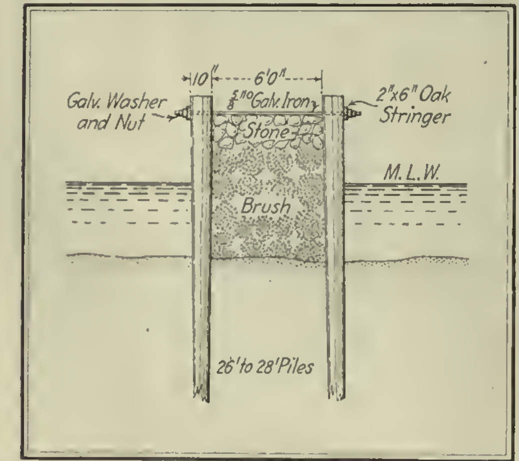
WORKS TO CREATE BEACH AT VENTNOR CITY

Ventnor City and Longport are seaside resorts on Absecon Island, and adjoin Atlantic City. Ventnor City is situated at about the middle of the island, which is 9 miles long, while Longport is at the extreme westerly end.

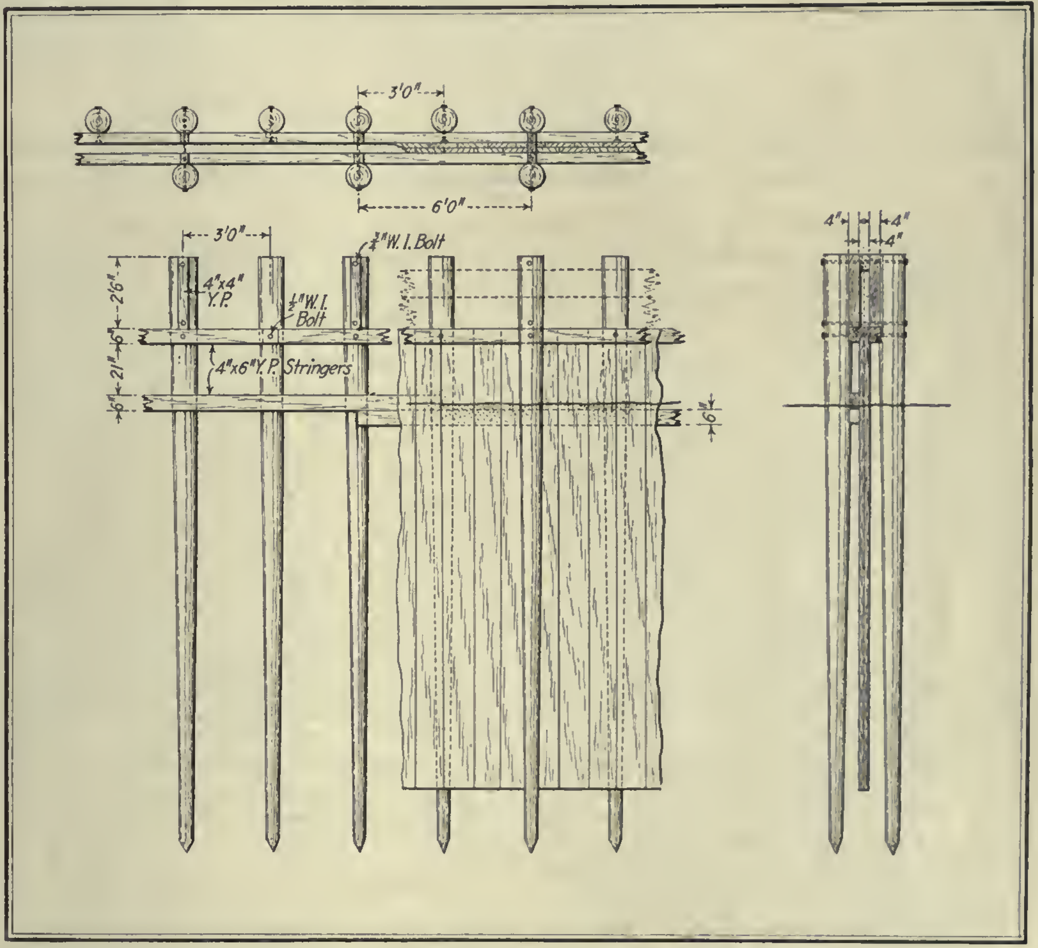
The beach front of Ventnor City has been bulkheaded throughout its entire length and filled in with sand, producing valuable building lot, but taking away the bathing beach, one of the chief assets of the city. The sand along the bulkheads was at low-water mark, there being no dry sand along the entire front except at three blocks not bulkheaded, and upon which the city secured leases, using them as bathing grounds. As these leases could be made for terms of but two or three years, the city authorities deemed it advisable to try to produce a bathing beach outside of the bulkhead by means of jetties.

Accordingly in January, 1912, plans and specifications were prepared by the writer for a jetty to be constructed between Cambridge Avenue and Cornwall Place. This jetty was of a type known as the brush-and-stone jetty. Short jetties somewhat similar had previously been constructed by individual owners, but on such a small scale that no results were visible.

This jetty consists of two rows of piles set 6 ft. apart. The piles in these rows are placed 15 in. on centers and are held in line by a 2 x 6-in. oak stringer securely nailed to the piles. It has been found more advisable to use a stringer of this size than one of larger dimensions, as it gives a more or less flexible construction and allows the jetty to sway with the waves. The piles used are pine, oak or cedar, varying in length according to the depth of water from 20 to 30 ft. The piles are 10 in. in diameter at the butt and 5 in. at the point. These piles, after being placed, are sawed off 7 ft. above low-water mark at the bulkhead, sloping to an elevation of 4 ft. above low-water mark 200 ft. from the bulkhead. From this point to the end the tops are level at this elevation.



CROSS-SECTION OF BRUSH-AND-STONE JETTY



TIMBER JETTY PARALLEL WITH BEACH AT VENTNOR CITY

The rows of piles are tied at intervals of 10 ft. by ¾-in. galvanized-iron rods. Headers of piles are put across the jetty at intervals of from 25 to 50 ft., forming pockets to hold the stone and brush. Red cedar brush is placed in these pockets as soon as completed, and is held in place by stone. This stone is usually traprock of a size commercially known as "two-man stone."

ENDS CURVED TO MAKE SAND TRAP

The first jetty constructed extended at right angles from the bulkhead for a distance of about 260 ft. It then curved to the left on a radius of 150 ft. for a distance of about 175 ft. A short tangent of about 50 ft. was added to the end. The object of this curve is to have the end to point directly into the east, and also to produce a sand trap on the easterly side of the jetty, the sand drift on the Ventnor beach being "down the beach" or toward the west. The curve also is a more stable construction, as it has the effect of an arch in resisting the storms.

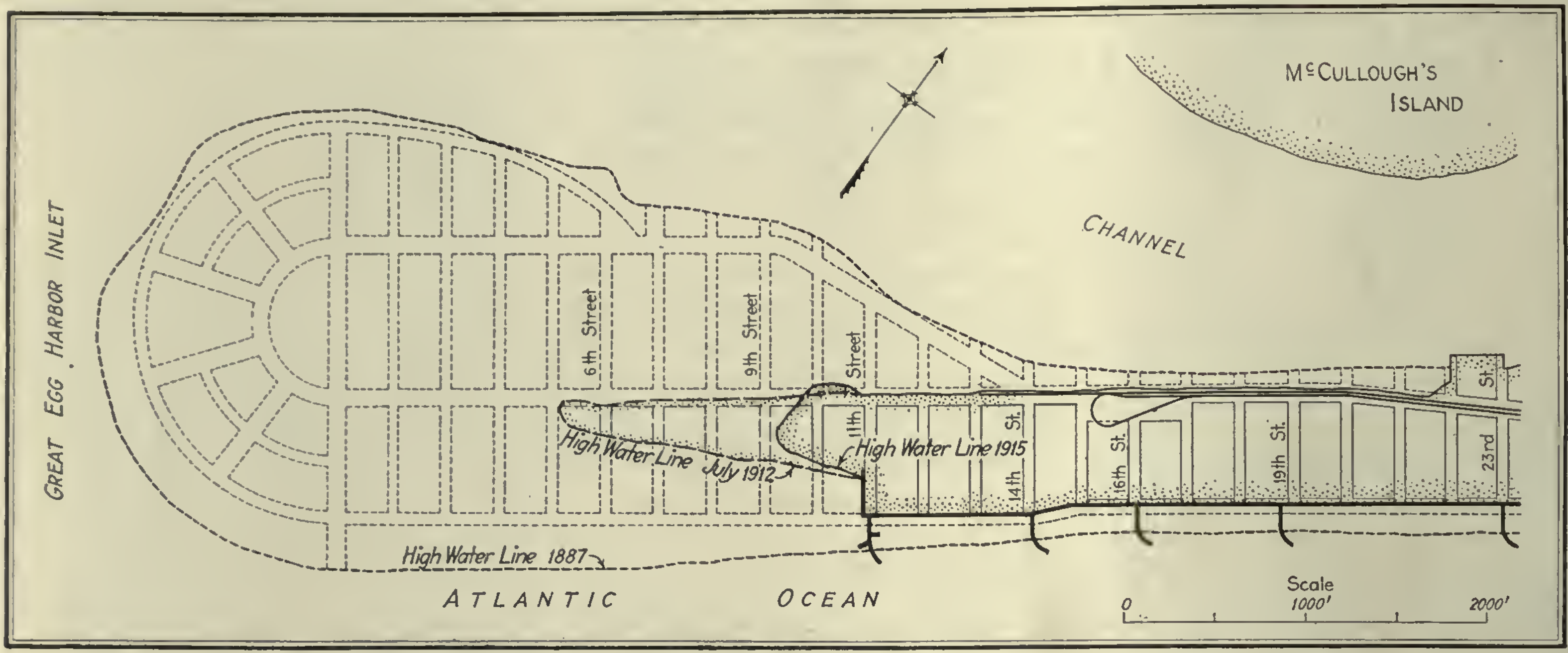
The results of this jetty became apparent before the construction was finally completed.

COST ABOUT $14 PER FOOT

The jetty is paid for on a basis of a price per linear foot of jetty completed exclusive of stone and brush. This price varies from $4.50 for a jetty with 20-ft. piles to $6.75 for one with 30-ft. piles. The stone is paid for by the ton when placed, according to the car weights. The cost of stone has been usually around $2.65 per ton. Red cedar brush is paid for by the cubic yard when placed, and is measured on the wagons as it is brought to the work. The brush has varied in price from 35 to 50 cents per cubic yard. The total cost of this jetty was $7,780 for 475 ft. of jetty and two spur jetties of 50 ft. each on either side, making the average cost about $14 per linear foot.

A jetty of similar construction, 375 ft. long, was built at Victoria Place during the same year; also one 400 ft. long at Newark Avenue. The total cost of these two was $12,650. A fourth one 200 ft. long, costing $3,700, was built at Portland Avenue.

The result has been to raise the Ventnor beach from low-water mark to about high-water mark, meaning the addition of 4 ft. of sand along the entire bulkhead east of Portland Avenue, and in places about 6 ft., thus giving from 50 to 100 ft. of dry beach outside the bulkheads. The beaches made at Victoria Avenue and at Cornwall Place were used by the city as bathing grounds last summer. The results at Newark Avenue have not been so good, as there was about 3 ft. of water at low



DESTRUCTION OF BEACH AT LONGPORT SINCE 1887 HAS AT LAST BEEN STOPPED BY THIS SYSTEM OF JETTIES

tide at the bulkhead when this jetty was constructed. The outer end of the jetty was not maintained and part of it was torn out during the severe storms of winter before last.

Three shorter jetties have been constructed above this Newark Avenue jetty, forming a basis for a different type now being used. This jetty is similar in construction to the ordinary timber bulkheads, consisting of piles 20 ft. long set on 3-ft. centers with two 4 x 6-in. yellow-pine stringers and sheathing 14 ft. long, with outer stringer and row of piles on 6-ft. centers to counteract the back wash of the waves. The top of this jetty is placed from 3 to 4 ft. above mean low water, allowing the sea to break over it at high tide. It is built parallel with the shore and about 150 ft. from the main bulkhead.

There have been constructed at Cornwall Place 500 ft. of this type of jetty, and 900 ft. is now under construction between Portland Avenue and Cornwall Place. The results have been very satisfactory and from present indications the city will use this type of work from New Haven Avenue to Newark Avenue.

DIFFERENT PROBLEM AT LONGPORT

The problem in the borough of Longport has been somewhat different from that at Ventnor City. At Longport the beach has been gradually eroding since 1887. Efforts have been made by individual owners to arrest this erosion, but without avail. However, in the spring of 1912 the encroachment of the sea had become so serious, the built-up portions being then endangered, that the borough took up the matter of sea protection and the writer was called into consultation. Accordingly a system of jetties as shown on the small-scale plan was proposed. (This plan shows the high-water mark of 1887.) These jetties were also of the brush-and-stone type, similar in construction to those used in Ventnor City.

Construction work was first begun at Eleventh Avenue in September of that year. The jetty at Ninth Avenue was next begun, but before it was completed a storm had swept away all of the beach below Ninth Avenue, locally known as "The Point," leaving the jetty standing about 200 ft. from the beach.

EFFORTS TO SAVE "THE POINT"

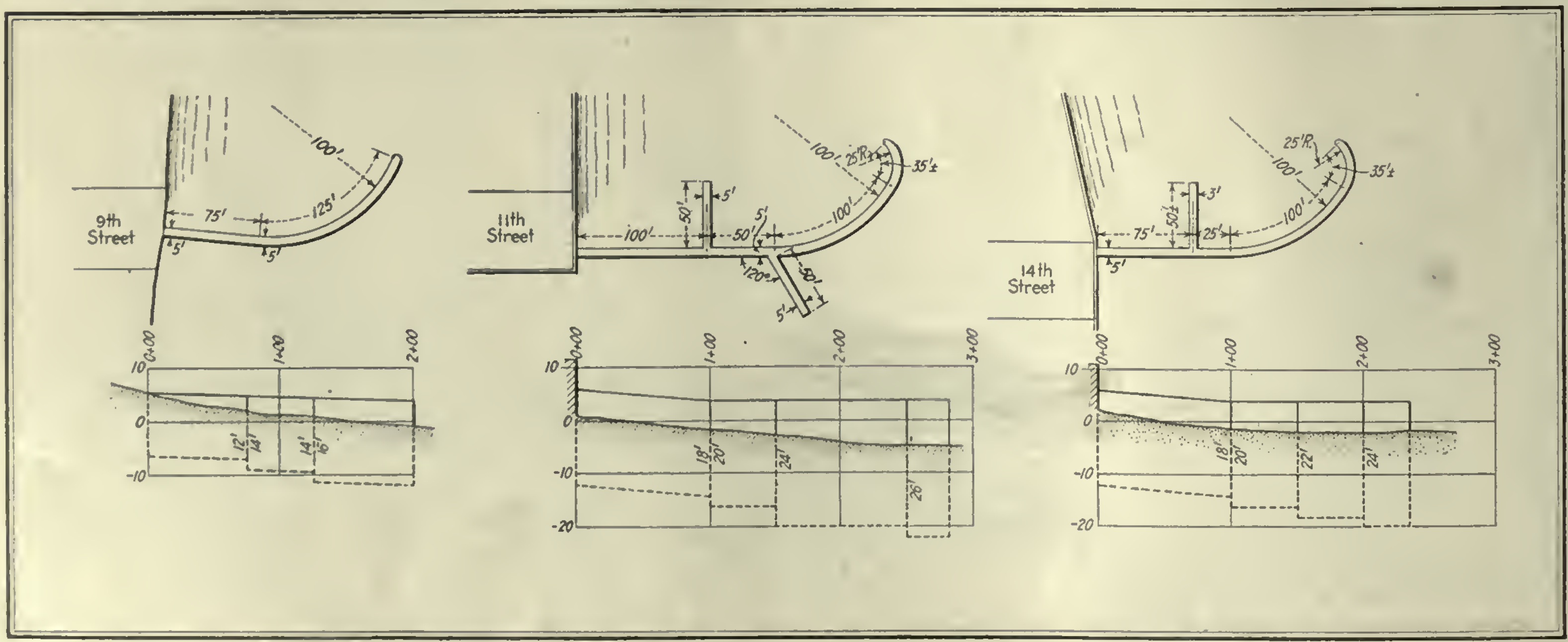
Efforts were then concentrated at this point, and a system of protection work as shown on the plan on page 831 was constructed. The results were immediate. Since 1913, although subjected to the severe storms of the last two winters, "The Point" has been maintained on about the same lines. The 1915 high-water line is shown on the small-scale plan.

The jetties at Fourteenth, Sixteenth, Nineteenth and Twenty-third Avenues were then constructed in the order named. The beach was raised from 2 to 3 ft. along its entire length.

Since the construction of these jetties the bulkheads were permitted to deteriorate and in several instances were washed out, particularly from Fourteenth to Eleventh Avenue, where the bulkheads were all down and the sea was encroaching. A protection jetty of construction similar to those previously used was built between Eleventh and Fourteenth Avenues parallel with the beach. The result has been to raise the beach behind and in front of the jetty, and to afford ample protection to this part of the beach.

MAINTENANCE OF BRUSH-AND-STONE JETTIES NECESSARY

Considerable discussion has arisen in this locality as to the best type of jetty to use. The chief objection raised to the brush-and-stone type has been the cost of maintenance, and efforts have been made by other cities and by individuals to use the

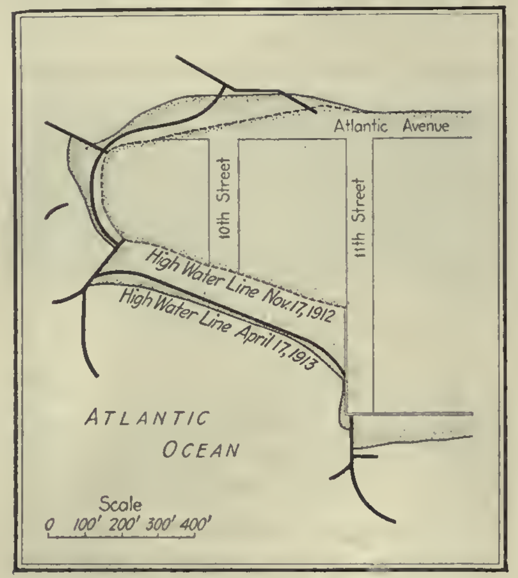


ALIGNMENT AND PROFILE FOR EACH LONGPORT JETTY WORKED OUT TO SUIT CONDITIONS timber jetty alone. Such jetties have not, however, resisted the storms, and they have not made the beach that has been made by the brush-and-stone type. It appears that the latter type absorbs the shock of the waves, causing them to deposit their sand, whereas the timber jetty merely turns the direction of the waves, causing them to wash gullies along the jetty.

Unless the brush-and-stone jetty is maintained it is practically without effect. Ventnor City makes its appropriation of about $2,000 each year for the maintenance of its jetties, and the work is done by the city department. The stone originally placed on the jetties is lifted, and new brush is added and the stone then replaced. If necessary new stone is also added.

BEST TYPE A COMBINATION

From the results and studies made in connection with the construction and workings of these different types of jetties, it is my firm opinion that the best type is a combination of both, using the timber jetty as a core wall with the two rows of piles about 6 ft. from it on either side of the timber jetty, and the intervening space filled with stone and brush, but using a larger proportion of stone than that used heretofore. The piles in this jetty should be creosoted, as some trouble has been experienced with the teredo in those now constructed of untreated timber.



THIS SYSTEM OF JETTIES AT "THE POINT," LONGPORT, BROUGHT IMMEDIATE RESULTS

Such a jetty is now being constructed at Dudley Place in Ventnor City, and although only 200 ft. of it has been completed it shows evidence of the confidence placed in it. The brush and stone does not settle as it does in the ordinary brush-and-stone jetty, hence the cost of maintenance is greatly reduced.

For this or any other type of jetty to be effective with permanent results it must be of such a length that the beach after being raised at the bulkhead maintains a natural slope, as it is impossible to maintain an abrupt slope through the storm tides. It should be normal to the beach for one-half its length, and should then curve into the direction from which come the most severe storms. The outer end should be well protected with extra-length piles and stone. After construction such a jetty should be well maintained by the addition of new stone, for it is through constant attention and maintenance that the best results are obtained.

Specifications Cover Grade A Office Building

New Requirements of National Fire Protection Association Compared with Those for Standard Building

EVIDENCE of the nature of the changes to be permitted by the fire-resistive committee of the National Fire Protection Association in drawing up detail specifications for the various classes of buildings is found in the difference between the requirements for the standard, or ideal, building as adopted in 1913 and the specifications for the Grade A office building recommended this year. The following abstracts of the new requirements indicate these differences, the nature of the changes being shown by comparisons with the requirements for the standard building to which this new Grade A office building corresponds.

HEIGHT AND AREA

The height limitation for the new Grade A office building is 125 ft. or 2½ times the width of the widest street upon which it is located, without reference to sprinkler requirements. The standard building is limited in height to 70 ft. if not sprinklered. The sprinkler requirements are introduced into the area limitations for Grade A office buildings as follows:

The area within inclosing or fire walls of a building not exceeding 70 ft. in height shall not exceed the following:

Fronting on	Without Sprinklers, sq. ft.	With Sprinklers (66⅔ per cent added), sq. ft.
One street	10,000	16,666
Two streets.............	12,000	20,000
Three or more streets....	15,000	20,000 (max.)

For buildings between 70 and 125 ft. in height, the area shall not exceed the following:

Fronting on	Without Sprinklers, sq. ft.	With Sprinklers (50 per cent added), sq. ft.
One street..................	7,500	11,250
Two streets..................	10,000	15,000
Three or more streets.......	12,500	18,750

It is evident that these areas are increased over the 7500 sq. ft., with no dimension greater than 125 ft., for buildings without sprinklers as required for the standard building, and that the effect of the street frontage is included.

The exit requirements are the same except that in the longitudinal exit to another floor area it is required that this other area must be sufficient to contain the joint occupancy, allowing not less than 3 sq. ft. of unobstructed floor space per person, instead of 5 sq. ft. Further, one new exit is required for each 5000 sq. ft. in excess of 10,000 sq. ft., for which two exits are required.

WALLS AND COLUMNS

The provisions for walls are changed but little. Instead of veneered walls being prohibited entirely, as for the standard building, they are prohibited "unless the veneering materials are of equal fire resistance to the bearing wall and properly bonded or tied thereto with non-corrosive metal binders." The thickness required for party or fire walls is reduced from 16 to 12 in. Instead of thicknesses of brick bearing walls having openings therein being prescribed, the allowable bearing values are fixed at 8 tons per square foot if laid in lime mortar, 12 tons if laid in lime-and-cement mortar, and 15 tons if laid in cement mortar, the unsupported height not to exceed fifteen times the thickness unless adequately reinforced. A new paragraph is added limiting the thickness of reinforced concrete walls to 8 in., designed according to best practice.

The requirements for the protection of columns include an added provision stating that the columns "may be provided with such other protection as may be determined as being satisfactory for full protection as the result of the investigation on column protection now in progress at the Underwriters' Laboratories." The required total thickness of concrete protection is reduced from 4 to 3 in.

For floor and roof construction the requirements limiting thicknesses of fireproofing material are omitted, and the clause made to enforce construction meeting requirements for full protection.

SHAFTS AND STAIRWAYS

The walls of stair, elevator and other shafts must not be less than 8 in. thick and must meet the requirements for full protection. No terra cotta tile specifications are included in the new Grade A requirements, and the shafts shall extend at least 6 in. instead of 3 ft. above the roof. New requirements for elevator doors with an interlocking device and for the separation of the lobby leading to elevators from other parts of the building by a partition and fire doors to give partial protection are added.

New paragraphs are added to the stairway specifications as follows:

"All exit stairs which extend to the top floor shall continue to the roof."

"Stairways which may be used as a means of exit shall not extend continuously to floors below the street level, unless partitioned off in such manner as will clearly indicate the street level and the direction of egress to the street be plainly marked."

BALCONIES AND PARTITIONS

The requirement for balcony construction of fire-resistive materials for the standard building is changed to allow incombustible materials. Room and hall partitions "subdividing allowable areas shall meet the requirements of fire test for temporary protection" is the wording used to replace the thickness requirements for the standard building.

Finally, several new requirements not included for the standard building in connection with service equipment are added. For example, a standpipe is required at each stair tower; where merchandise is placed on the grade floor or any floor below grade, an improved automatic sprinkler equipment shall be provided in such portion; all heating, ventilating and other service equipment shall be isolated by full-protection construction with openings provided with approved fire doors, and ducts of blower or indirect heating systems shall be insulated by incombustible covering not less than ½ in. thick.

Designer of Air Lift

The air-lift well-pumping equipment at Camden, N. J., described in the Engineering Record of June 3, page 737, was designed and installed by L. T. Edwards & Company, of Philadelphia, and not by the Standard Supply & Equipment Company, as stated in the article.

EFFECTIVE USE OF CURVING OUTLINES INCREASES GRACEFUL APPEARANCE

Appearance of Brooklyn-Brighton Viaduct, Cleveland, Improved by Special Features

Economy in Floor Construction Results from Equal Spacing of Spandrel Columns on All Arch Spans—Adjustable Steel Arch Centers Used

BOTH THE DESIGN and the construction of the new Brooklyn-Brighton Viaduct across Big Creek valley and Pearl Road at Cleveland involve unusual features. In the design perhaps the most striking feature is the use of unsymmetrical arch spans practically throughout the structure, to keep the piers symmetrical, with effective copings at heights that follow the ground slope in a general way, the adjacent arch springing lines being level at each pier. This results not only in unsymmetrical arch ribs, but also in unequal levels for the two springing lines of many of the main arches.

In addition large variations in span lengths —from 40 to 139 ft.—make the design of the hollow piers often dependent upon the effect of unbalanced thrusts. The architectural effects are improved and economy is insured in the spacing of the spandrel columns to suit the floor design. It is notable that no heavy pilasters are used above the piers, the column spacing being arranged continuously across the structure. The design with columns adjacent to the piers and never over them insures maximum duplication of form work for both columns and floor system.

General Dimensions

The total length of the new viaduct is nearly 1726 ft., consisting of eighteen arch spans of varying lengths, six equal spans of 139 ft. (clear rise 43 ft.), two equal spans of 104 ft. 3 in., one span of 115 ft. 10 in., one of 127 ft. 5 in., a series of four short spans at the south end varying from 70 down to 40 ft. in length and a similar series of four at the north end varying from 81 down to 40 ft. in length. The long south approach is partly curved, with deep panels in the side retaining walls spaced the same as the spandrel columns in the main spans.

The east side of the north approach consists of retaining walls 88 ft. long exactly similar to those in the south approach, while the west side provides for a roadway to the railroad yards and factories below the bridge. This is accomplished by the construction of a retaining wall similar in type to the others and extending 226 ft. southerly from the north abutment. This wall is continuous past the three northerly piers and replaces the west rib of the four northerly spans.

Location and Floor System

The viaduct is located on the new line of West Twenty-fifth Street on a grade considerably higher than the old viaduct, the wrecking of which was described in the Engineering Record of March 4, page 326. On the south end the curved retaining wall follows the Brookside Park Drive, which here joins West Twenty-fifth Street on an 8-per cent grade. A grade of 0.4 per cent up toward the south is maintained on the bridge proper, with a 2¾-per cent approach grade at the south end. The bridge is 76 ft. wide over all and 52 ft. between curbs, the sidewalk slabs being about 12 ft. square, reinforced in both directions.

The main floor system is composed of stringers and floorbeams of reinforced concrete supporting the 8-in. slabs, with a depression for the two trolley tracks in the center, as shown by the accompanying section. A concrete curb divides the tracks and protects the trolley poles in the center. Curving outlines have been used throughout to add to the appearance, except that the sidewalk brackets are straight. The elliptical curves used for the lower surfaces of the transverse floorbeams make them effective in giving lateral stiffness.

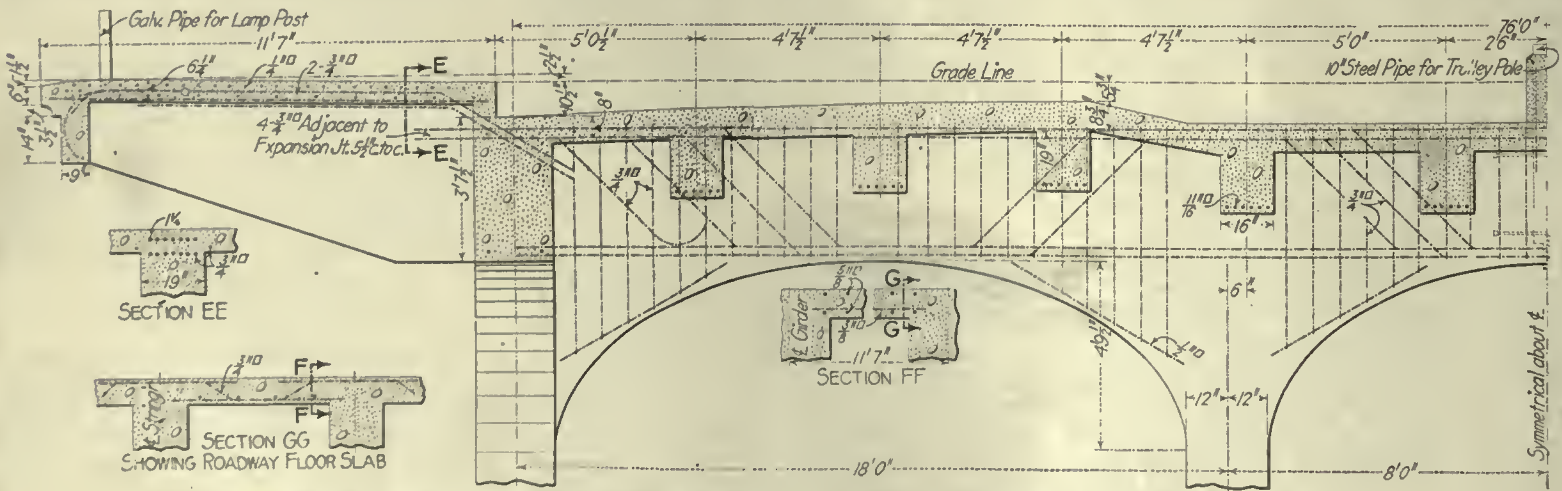
SAMPLE PANEL OF SANDSTONE RAILING

Loads and Allowable Stresses

The live load on the trolley tracks was taken as 60-ton trolley cars on four axles spaced 6 ft., 26 ft. and 6 ft. apart, with 14 ft. between the axles of adjacent cars. For the roadway floor a 24-ton truck on two axles spaced 12 ft. apart, with wheels 1 ft. wide and of 5-ft. gage, was assumed, and on the remaining floor space a uniform load of 100 lb. per square foot. The whole roadway was figured for street-car loading in case of derailment, nearly the same safety factor being used. Impact was allowed for these live loads by the formula

$$I = 200/(270 + L),$$

in which L is the length of span in feet multiplied by the number of lines of traffic. For example, if there are two tracks and



CROSS-SECTION OF FLOOR, SHOWING REINFORCEMENT OF FLOORBEAMS, STRINGERS AND SIDEWALK BRACKETS the length of span is 140 ft., L is 280 ft. The sidewalks are assumed to carry a live load of 80 lb. per square foot—with impact by the formula

$$I = 100/(150 + L)$$

The beams and columns were designed according to values allowed by the Cleveland building code. For the arches 700 lb. per square inch was taken as the allowable compression in concrete, 750 lb. sometimes being allowed with temperature effects considered. Temperature variations of 15 deg. rise and 45 deg. drop from normal were considered. Tension was permitted in the concrete to a limiting value of 50 lb. per square inch. In the steel the unit stresses varied from 13,500 to 16,000 lb. The allowable shearing stress in the concrete was 40 lb. per square inch.

Hollow piers designed with five intermediate vertical diaphragms, the outside walls reinforced as indicated in the cross-section, distribute the loading to the shale foundation with a unit pressure not exceeding 12 tons per square foot. The design of the footing for some of the piers was fixed by the increased batter necessary to provide for the unbalanced thrust which occurs when one arch is fully loaded and the adjacent arch unloaded, the unbalanced dead-load thrust being always considered for piers with unequal adjacent span lengths. Impact was included in the designing of these piers. The coping outlines were kept parallel to the grade for all piers of the six long-span arches, this resulting in the unsymmetrical outlines for the main arches, with ends at different levels.

In the design of the floorbeams and stringers continuous girder action was assumed and the exact stresses were obtained by influence lines or charts for the given concentrated loads. For the stringers continuity was considered over four spans. The panel length of 11 ft. 7 in. was fixed by the requirements for lengths of arch spans and locations of piers, together with the limitation set by economy in the dimensions and proportions of beams and floor slabs.

MAIN ARCH RIBS

The main arch ribs were first designed to fit the dead-load equilibrium polygon, then tested by a live-load analysis, using Cain's graphical method, for full live load, half live load and special concentrated load conditions. The curves were adjusted to four-centered or five-centered circular arcs, with short radii near the ends to bring the intrados tangent to the pier lines. In the adjusting of the curvature of the unsymmetrical arches the main arcs were made symmetrical about vertical axes not coinciding with the center line of the span, and the curves of shorter radii used at the ends to join the piers tangentially.

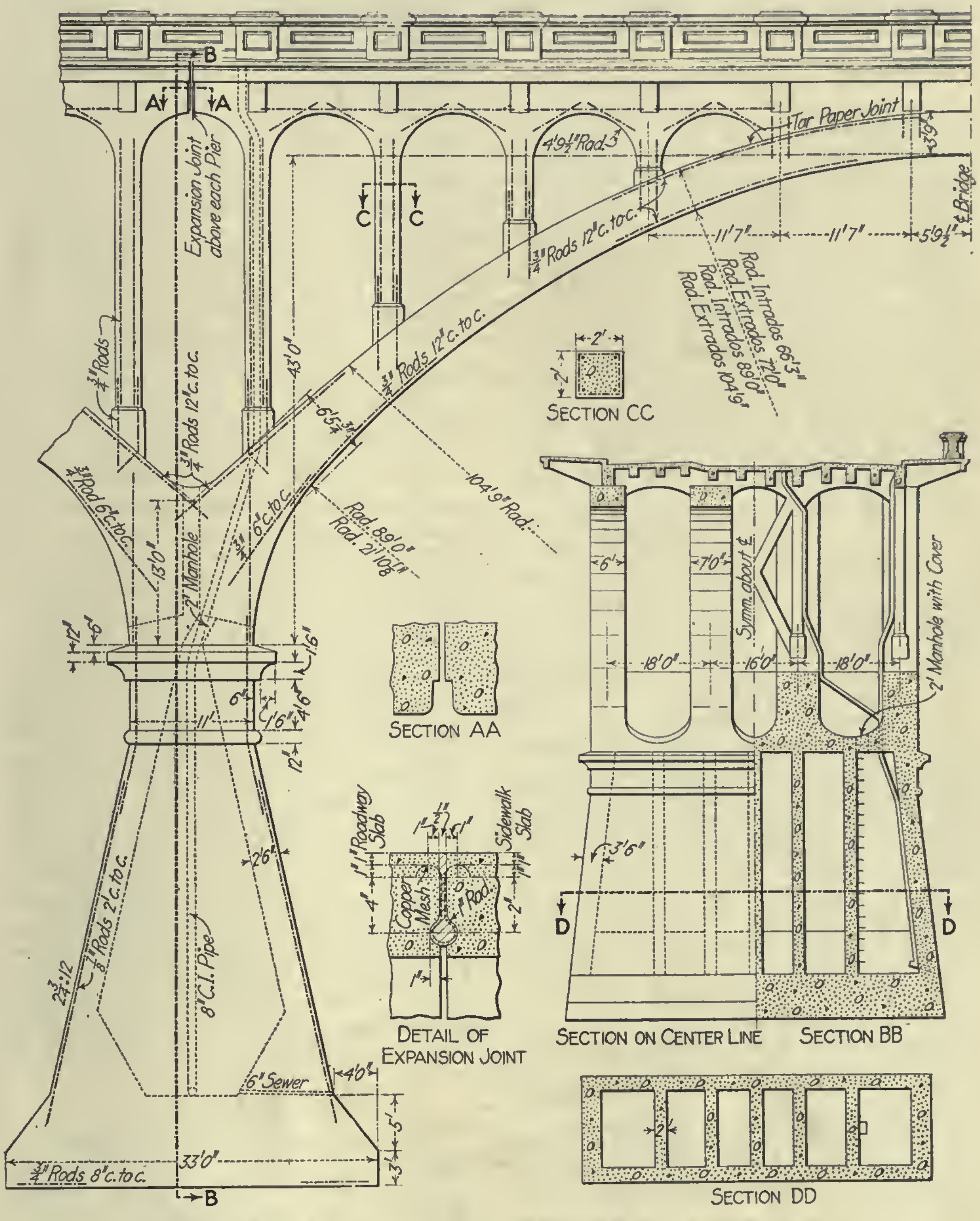
One notable feature of the design is the entire absence of any struts or bracing connecting the four main ribs. Lateral stability is provided only by the floor system and the transverse diagonals shown in the half-section at the piers, and by the concrete walls over the piers up to the level at the top of the ribs.

The expansion joints in the floor system occur in the panel over each pier, except for the smaller spans. The details of the unusual type of joint used are shown on the cross-sectional drawing herewith, the peculiar bulb form having been adopted to prevent the asphalt from running out and to insure free movement of the cantilever floor system. Keys were used in the beams for the purpose of transferring the shear, tar paper on the horizontal surfaces allowing free horizontal movement due to expansion.

The detail shown in the drawing for the copper plate bulb was found not entirely satisfactory when solid plates were used, because the concrete broke off in the small corner at the tops. By notching the plate with rectangular cuts in the edges this difficulty was overcome.

The pavement expansion joints, from 3/8 to 1/2 in. wide, were made of tar felt and located immediately over those in the concrete floor slab. The east half of the roadway is laid with "Durax" granite block and the other half with ordinary 4-in. granite block, both on a cement-sand cushion. Granite curbs 5 in. wide were set in mortar against the concrete sidewalks.

The viaduct was built by Cuyahoga County, Ohio, after the design made under the direct supervision of A. W. Zesiger, bridge engineer, and W. A. Stinchcomb, county engineer. W. H. Baker was resident engineer for the county. The construction was carried out by the Bates & Rogers Construction Company of Chicago, with C. S. Smith as resident superintendent.



TYPICAL DETAILS OF ARCH RIBS, SPANDREL POSTS AND HOLLOW PIERS

Eighty Loose Rivets Found in Important Pony Truss Bridge

Eighty loose rivets were found recently in the bottom chord and floor system of an important pony truss steel bridge in northern Iowa. Commenting upon this discovery the March *Service Bulletin* of the Iowa State Highway Commission says: "Several loose rivets in a bridge of this character are bad enough, but eighty are utterly inexcusable—and in only a part of the bridge at that. How eighty loose rivets could escape the eye of a foreman on the job can only be explained on the ground that the foreman did not know his business or was trying to get by for his firm a very carelessly constructed job. This is not the first instance of this kind. It illustrates the absolute need of the closest kind of inspection on every job. The contractor or the bridge foreman may be a very good friend. You may be sure that he would not do anything of that kind, but just the same you had better inspect his work. In the spring of 1915 one county engineer had many thousand dollars' worth of work rejected simply because, being overcrowded with work, he had relied upon the personal friendship of the bridge builders to do the work properly with adequate inspection."

President Maclaurin and Senator Lodge Make Memorable Addresses at Tech Dedication

Linking of Science with Industry, Danger of the Closed Mind and Appeal for a National Conscience Are the Themes

PRESIDENT RICHARD C. MACLAURIN and Senator Henry Cabot Lodge delivered the chief addresses at the formal dedication of the new group of buildings of the Massachusetts Institute of Technology in Cambridge last week. The chief address at the leave-taking of the old buildings was made by James Munroe. All three addresses, in full or in part, are reprinted here.

President Maclaurin took as his theme "Science Linked with Industry"—to which, in conclusion, he formally dedicated the new structures. He gracefully pointed out the debt of the present generation to the past, a debt acknowledged by clothing the new laboratories in the forms of classic art. Looking to the future, he emphasized the need of impressing on the rising generation that "for success nothing must be done haphazard or by rule of thumb." In closing, he asked whether the intellectual leadership of the world after passing in turn from Egypt and Babylonia, to Greece, to Alexandria, to Constantinople, and to Western Europe was now to cross the Atlantic. He pointed out what such leadership would mean.

Senator Lodge, in an address of polish and vigor, warned young men against the closed mind and appealed to all his hearers to give heed to the necessity of an active conscience if the nation is to endure. "A nation without conscience," he said, "has lost its soul." Developing his two points, Senator Lodge said that young men through self-confidence do close their minds to the valuable experience of preceding generations and of the older men of the present time. Taking as his text in the latter part of his address Rabelais' saying that all the training of the schools, if without conscience, is the loss of the soul, he showed what havoc low ideals and a conscienceless citizenry would play in the nation's life. He appealed to his auditors, as educated men and women, to discharge conscientiously their duties as "units in the making of a nation."

Mr. Munroe in taking leave of the Rogers Building referred feelingly to "the spirit of Technology" now transferred to the new home.

President Maclaurin's address is printed in full, Senator Lodge's with the omission of only a few paragraphs, Mr. Munroe's in abstract.

President Maclaurin's Address

President Maclaurin spoke as follows:

We are here to dedicate a noble group of buildings to a noble purpose. The buildings speak for themselves. They will form an enduring monument to the skill of the architect, the capacity of the engineers of construction, the devotion of the faculty that has planned so much of their detail, and the splendid public spirit of the anonymous benefactor whose gift they are. That gift has won admiration not only for its munificence but for the unostentatious manner in which it was made and for the patriotic purpose to which it has been devoted. It will have far-reaching consequences for the country at large, for its aim is to strengthen American industry at the base by fixing it firmly on the solid rock of science.

RELATION BETWEEN SCIENCE AND INDUSTRY

How striking is the change that has come over the world in its view of the relation between science and industry! Each is of venerable antiquity, for while science in its growth has gaged the intellectual development of mankind from the beginning, its application to practical affairs is coeval with the manifestation of the scientific spirit. In the early days, however, the two things, science and practice, rarely, if ever, went together, and were often regarded as antagonistic. To-day we are far removed, indeed, from the aristocratic contempt for practical things so freely expressed by Plato and even by Archimedes himself. No such feeling has been manifested by the great modern masters of science such as Newton, Pasteur, Faraday, or Kelvin, although a trace of it may be found occasionally among the lesser lights.

We do well to rejoice in this change of heart and outlook, a change that means so much to the world; but in so doing we should not fail to recognize our debt to the past. So we have clothed these laboratories in the forms of classic art, and have done this not merely that students may be influenced by the beauty of their simplicity, but that they may observe how well that art adapts itself to thoroughly modern needs. Thus may they have a practical proof of the error of supposing that old things are of necessity useless and a forcible reminder that much that is most potent in our life to-day has its roots deep in the past. For a somewhat similar reason we have inscribed on the walls of these buildings the names of the imperishable dead in the hope that they may inspire our students with the thought that each succeeding age inherits the intellectual wealth of all that has gone before and fails in its duty unless it makes it its high vocation to hand on the heritage that it has received and to enrich that heritage by contributions of its own.

THE FUTURE

But although we are not unmindful of what we owe to those who have preceded us, our look must be ever ahead. The opportunity immediately before us is alluring in the extreme. The greatest war in history will inevitably mark the end of one era and the beginning of a new. For some time before the war, but particularly during its progress, the world has been given an impressive demonstration that the methods and the means of science are indispensable in many a practical field. In the new era that is about to dawn we must take our share in making the dominance of the scientific spirit pre-eminent in *every phase* of industry and practice. In that era no half measures will avail. We must get it into the minds of the rising generation that for success nothing must be done haphazard or by "rule of thumb." All must be orderly and logically planned, resting ever on the solid ground of fact, and industry like science must be matter not of expedients nor of guesses, but of *laws*.

Our prosperity as a nation, perhaps even our very existence, must depend on the extent to which we assimilate this doctrine. In the great industrial struggle that will follow the present war, and that will go on indefinitely, many of the advantages of this country will be offset by serious disadvantages. If victory be ours, it will be no easy victory, but assuredly we have a splendid opportunity of success if only we organize our industries on a scientific basis. We must train men in the methods of science and make the proper use of these technically trained men when we have got them. This—the adequate supply of properly trained men—is the cardinal doctrine of industrial preparedness recognized by thinking men to-day as one of the greatest necessities of the times.

INTELLECTUAL LEADERSHIP

The opportunity for this country to take and keep the lead industrially is constantly before us in these days, but there is another opportunity seldom, if ever, mentioned, that is in some respects even greater. The center of intellectual achievements in the world has passed in turn from Egypt and Babylonia, to Greece, to Alexandria, to Constantinople and to western Europe. Is it to cross the Atlantic? If this be so, the intellectual leadership must accord with the genius of our people for practical affairs. That genius will inevitably show itself chiefly in industrial pursuits and industry will continue to attract a large proportion of the best minds of the country. Hence we must have industry linked with science, not merely for the benefit of industry but for the sake of science. Of course, our American science will never grow as it should if it is cramped by a shortsighted policy as to what is useful. But if the value of science to industry be generally appreciated, science will be free to expand in any direction, and if it be pursued with the same energy and intellectual power that have been applied to business, there is no reason why America should not become the intellectual leader of the world.

Here is a great hope and a great national opportunity. The problems that it presents are not local and must be looked at from no merely local point of view. They demand the co-operation of all, and as a step toward that great end, Harvard and Technology, each national in its scope and influence, are here combining for the common good.

And so, in the presence of representatives of other learned societies from all parts of this country and from abroad, inspired by their sympathy and their achievements, we dedicate these buildings to the great cause of *science, linked with industry*.

Senator Lodge's Address

Senator Lodge spoke in part as follows:

In the ceremonial observance of an important event affecting the advancement of learning the first thought which arises in the mind is inevitably of the men who will go forth from these buildings to take into their keeping the days that are yet to be.

To those whose morning hours lie far behind, shining in the golden haze of memory, the temptation to recall the teachings of their experience in the world's great school is irresistible, and when they yield to it they must be gently forgiven by the young and happy just entering upon active life. I shall try earnestly to avoid anything didactic, and yet I am going to venture so far as to utter first a word of warning and then an appeal, perhaps an exhortation. Both are merely suggestive, but both are deeply and sincerely felt and intended.

The word of warning first. Beware of the closed mind. This sounds like a paradox when addressed to young men, yet it will, I think, bear examination. It is a truism to say that the danger of maturity and especially of age is the closing of the mind to new ideas. Habit, most powerful of influences, hard experience, the very passage of the years, all alike tend to stiffen the muscles and to harden the arteries of the mind as they do those of the body. It is a misfortune with which advancing age must struggle, and the effort is severe and too often either neglected or fruitless. But the same peril besets youth, although not for the same reason.

AFFECTS THE CLEVEREST

The great mass of young men go forth from our universities, our institutes and schools prepared to learn and eager for the knowledge which experience alone can bring. Yet the disease of the closed mind lurks all about them and, curiously enough, is most likely to affect the cleverest, the ablest and the most ambitious. This comes from their very talents, from the high confidence which youth ought always to have and from the somewhat hasty conclusion that because they have thought for themselves nobody else has ever performed that same feat before.

I have met such cases, greatly to be regretted because the possibilities of usefulness are so much larger in youth than in age. From what I have observed let me illustrate and enforce my meaning. In these cases the mind, as a rule, is exceptionally good, the cleverness undoubted—very possibly there is much more than cleverness—and its possessor has enjoyed every advantage of the highest education, which ought to be liberalizing, and yet the mind is closed.

In my experience the fortunate youth is very kind, almost oppressively so, to those with whom he converses, even when they are elderly persons. I have met many men of achieved distinction in widely various fields of thought and action; I have met some great men, but never have I had conscious greatness so imposed on me as in such cases as I am attempting to describe.

CLOSED BY SELF-CONTENT

The repose, the remoteness, the attitude are truly Olympian. And yet as I have looked and listened it has seemed to me that I detected a lack of comprehension of the speaker's relation to the universe; have had an uneasy suspicion that my instructor had never fully grasped the fact that a realization of one's own ignorance is the beginning of knowledge and I became sure that a sense of humor, sanest of all senses, was still to be acquired. The type of man of whom I speak has a contempt for the past and dismisses all who differ from him as stagnant and immobile intelligences, if they can be called intelligences at all. He has the best of education and, no doubt, fine abilities, but nevertheless his mind is closed—closed by his own energy and self-content. He is in danger of having it said of him, as Tennyson said of "A Character," that he

> . . . "trod on silk as if the winds
> Blow his own praises in his eyes,
> And stood aloof from other minds
> In impotence of fancied power."

MUST NOT SCORN THE PAST

For the sake of his country and on account of the good he might do such a result would be much to be deplored. It is earnestly to be hoped that he will change by and by. Such minds, when they appear in youth, frequently open as the relentless years pass on. But the malady, nevertheless, is as dangerous to youth as to age. Age must, if it can, keep its mind flexible and open to all that is new, and youth, if it is to win true success, must not scorn the past nor wholly condemn those who differ. It must not turn with contempt from the mature or even the old because they are sceptical about the genuine newness of alleged new ideas.

Hood cried out against the "rarity of Christian charity," but outside the domain of science new ideas are even rarer. Even if the past can teach nothing to us, the all-wise heirs of the ages, it can at least, if rightly considered, show us our proper place in the general scheme of things.

I confess when I study the art of the Cro-Magnon men, whose civilization endured in Europe twice as long as ours has yet done, I feel humbled as I contrast their achievement with their opportunities.

GREATEST MEN DIED LEARNING

When I consider the imagination which gave us the Iliad and the Odyssey, the genius which produced the art and the architecture, the poetry and the drama of Greece; when I read the writings of Plato and Aristotle, I cannot but feel some doubt of the absolute superiority of the present moment in the field of pure intellect. It is well to remember that the very greatest men died learning, like Bacon and Pasteur. Socrates was entering old age when he drank the hemlock, but I do not think anyone would say that his last words were therefore of no worth.

The greatest benefactions to humanity, the greatest services to human thought have not all been bestowed or rendered by men under 25 or even under 40 years of age, a fact sometimes worthy of remembrance. Do not then fall victims to overconfidence and close your mind. The injunction is as important for youth as for age; easy of attainment for the former, difficult for the latter, possible for both. The past and the present, youth and age, new and old, all have their place in the sun; all are needed for the widest learning, for the highest achievement, for the best development of mankind.

THE APPEAL

From the word of warning, or suggestion—for warning perhaps is too grave a word—I come to the appeal, and an appeal everyone has the right to make for the cause nearest his heart, for the truth as he understands it. . . .

Rabelais said, "Science sans conscience est la perte de l'ame." The great French humorist used the word "science," I think, not with our modern and more restricted meaning, but with the older and broader sense of knowledge. Yet his meaning is clear. All the learning of the schools, he declared, if without conscience was the loss of the soul.

There is a certain inevitable vagueness in the words "conscience" and "soul," for they are of the spirit which forbids man to accept contentedly the belief that the "be all and the end all" are here on the earth we know. It is this spirit which inspired the great Apostle to the Gentiles when he appealed from the terrestrial to the celestial. From beings who lack soul and conscience, no matter how highly educated they may be, come the sordid and the selfish, those who are insensible to the sorrows and deaf to the appeal of their fellow men, those who see in money making, in comfort, in amusement, in shelter, the highest object of life; and, worst of all, the conscienceless and soulless supply the slavish and the criminal.

EDUCATION MEANS TO AN END

It is the function of the moralist and the preacher to deal with this theme as it touches the individual man. I shall not invade their province and I have no sermon to deliver. The great lesson, which to my thinking should be learned here, is that education and knowledge are not ends in themselves, but means to an end, and that one great purpose to be here achieved is to go forth with the understanding that all who have these privileges are units in the making of a nation. Our learning is vain if it fails to teach us that nations, like men, must have a conscience and a soul. If those have vanished it may be said of a people, even as of a single one of their number:

> "All else is gone; from those great eyes
> The soul has fled;
> When faith is lost, when honor dies,
> The man is dead."

So is a nation dead when its conscience has departed, when its ideals are forgotten, its faith unkept; when its soul has fled, and base desires alone survive.

IDEALS OF THIS NATION

What were the ideals of this nation? Freedom, democracy, liberty of conscience, personal liberty, equality before the law—these were the guerdon of the Revolution. Later came the mighty conflict for the preservation of all these things, maintained by the ideal of a Union broad enough and strong enough to cover this vast land. For these ideals men gave their lives and spent their treasure and so kept their faith. The last enemy they encountered in arms was the spirit of separation, and union triumphed. But that spirit is not confined to setting the states above the nation.

More insidious, but quite as dangerous, is the separatist spirit which in its greed for votes and power puts local above national interests; or that still darker spirit which would divide us into classes, or into groups, based on race, or religion, or allegiance to some country other than our own. We draw our blood and traditions from many people and many lands, but we labor in vain if here on this soil we are aught but Americans with one country, one loyalty and one tradition common to us all. All Americans, and especially all Americans who have been fortunate in securing the highest education, should fight everywhere against the spirit which would divide and be apostles of the spirit which will unite and of the tradition which should inspire all Americans.

That tradition, in its dominant meaning, tells us that the American people put liberty and independence and union in the war with England, and in the Civil War, above comfort and safety, above riches and life. Many voices are now heard proclaiming that there is nothing for which life and physical well being should be sacrificed, and great millionaires are using lavishly their suddenly acquired wealth to instill the doctrine that the undisturbed accumulation of money is the chief end of man. I have seen in the newspapers that the Anti-Enlistment League is preparing to circulate a pledge in our colleges and universities, which runs in this wise:

"I, being over 18 years of age, hereby pledge myself against enlistment as a volunteer for any military or naval service in international war, offensive or defensive, and against giving my approval to such enlistment on the part of others."

In the early days when our independence was won, in the later days when our Union was saved, such a pledge would have been described by the ugly word "treason." That anyone should now think such a pledge possible is an evil sign.

Two Doctrines To-day

A people who will not make ready to defend their own peace, their own security and their own honor are well on the way to helpless, hopeless war, or to supine submission. A people who are not ready, if the need come, to give their lives for their country will soon have no country. A nation that will not protect its citizens will soon have no citizens to guard and defend the national life. If a government deserts those who support and sustain it, alike in the calm of peace and in the hour of danger, that government itself will be deserted when the menaced peril comes. . . .

In every corner of the United States, with each recurrent year, we celebrate the deeds and honor the memories of those who fought the Revolution and died in the Civil War. If we do not mean what we say, if we are not instantly ready to translate our words into action, it would be far better to stand silent and bow our heads in shame that we are not as our forefathers, as the makers of the country were. No one must ever be permitted to say of us, as was once written of a country long since freed and redeemed:

. . . . "The voices of the dead
Sound like a distant torrent's fall,
And answer 'let one living head,
But one arise—We come, we come!'
'Tis but the living who are dumb."

Defense Rests with Young

With the young men, especially with those highly trained and educated, rests not only the defense of the country, if war comes, but the cause of preparation and readiness which will alone be able to prevent the coming of war. In their keeping are the ideals of the country, and it is to them we must look to make it known to all men that, like knowledge, a nation without conscience has lost its soul.

Mr. Munroe's Address

Likening the Rogers Building to a Westminster Abbey for Technology, Mr. Munroe emphasized the personal appeal which it makes to all institute men and pointed out various exceptional influences which have contributed to build up its power over young men. "It is no small thing," he said, "which this meeting symbolizes. The farewell that we are taking is no perfunctory good-by. On the contrary, it involves the uprooting of traditions, of sentiments, of loyalties that have been digging themselves deep for half a century. . . . The traditions which have come down to the students of to-day are very flesh and bone with those established by President Rogers, by his devoted associates on the corporation faculty, and by those pioneer youth of 1865, who, bringing to the institute, perhaps, no very great technical equipment, brought what is far better: earnestness, sobriety, thirst to learn, and industry to make that knowledge of the fullest effect."

Defining what he called the "spirit of Technology," Mr. Monroe continued: "To-day, as we take leave of the cradle of that spirit, we are confronted with the serious question: Has that Spirit of Technology—at once so tangible and so very real—has it the power, the vitality, the humility, to survive transplanting, not only to the new conditions and the new perplexities, but also to the novel luxuries of the Charles River site? More than this, has it the innate strength to do what all healthy, transplanted things should do—grow into something not only of even higher fame, but of still greater use? That we do believe, from the bottom of our souls, that the institute has this youthful vigor and this eternal promise, is witnessed by our coming together from every corner of America for these days of lively rejoicing and of solemn anointing, for the careless renewal of that human youth which can be ours never again, and for the serious consecration of that spiritual youth which is to be ours forever."

What the Rogers Building Means

After reviewing briefly the influences of the presidents and strong members of the faculty on the institute's life, he concluded:

"But woe to us if, having made that new shrine and having transferred to it that spirit of Rogers, we forget what it was and is that this Rogers Building means. Into it have been builded the multiform labors of hundreds of great leaders and thousands of their neophytes, all seeking the one enduring thing in life, the truth; all scorning to reach their ends by any road other than that of hard work; all ambitious, but for the general good; all fired with the desire to contribute something toward the bettering of human conditions and the uplifting of the world; all striving for that greatest of human possessions, character. But character does not come as the result of formal lectures, of the piling up of facts, or of the acquisition of complicated formulae. It comes through the contact, under favoring conditions, of trained mind with eager mind, of formed personalities with those forming; through the interpretation by men, not only expert in science, but reverent toward life, of the master books, the major discoveries, the basic verities of human experience. To multiply lecture-rooms, to elaborate apparatus, to magnify material facilities on the other side of the Charles, without at the same time extending and vivifying the influences which make for manhood, for social understanding, for reverence, that make, in short, for character, would be indeed to leave behind not only this Rogers Building itself, but also all that it stands for and has stood for throughout these fifty years. This battered and outgrown building to which we are bidding solemn and affectionate farewell may well be likened to the weary body that, a generation ago, the soul of William Barton Rogers laid down upon this consecrated platform. Whatever may become of this architectural body, never shall we forget its intrinsic beauty, its warm touch of companionship, its stimulus to our hearts and minds. But the soul of it, the legacy of Presidents Rogers and Runkle and Walker and all the rest, the Spirit of Technology, we take with us, not in memory but in actuality and we believe, yes, we know, that in conveying it across the Charles we are leading it to opportunities, to achievements, to new affections and associations far greater, far richer, far more full of promise than even those which we to-day so proudly and gratefully commemorate."

County Marks Its Roads with Simple Signs

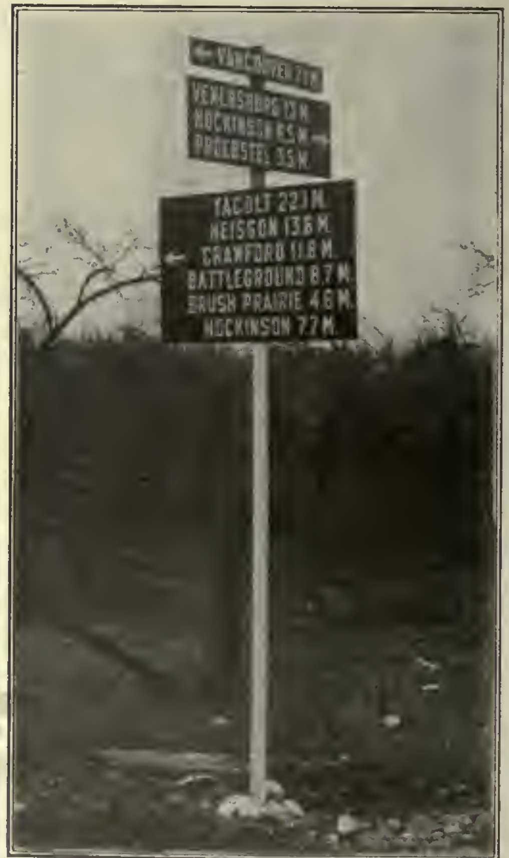
Main Plate Carried by 2-Inch Pipe Anchored in Post Hole by Grout and Rock Filling

CLARKE COUNTY, WASHINGTON, has adopted the policy of marking its highways with signs indicating the direction and distance to all towns within its limits. County Engineer W. A. Schwarz, who is directing the work, has supplied the following information about the signs and the methods of placing them:

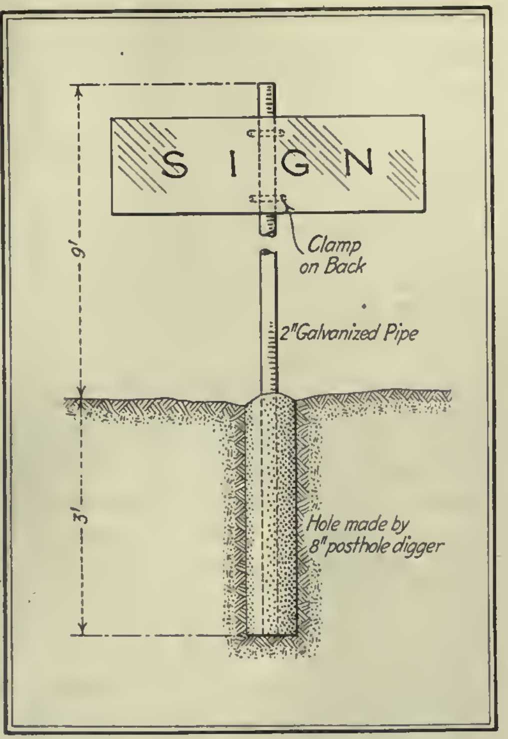
Iron Pipe Standards

The signs are made of iron. The main plate, on which the letters are riveted separately, is about No. 14 gage. The letters are of the same thickness and are painted aluminum, the plate being black.

In ordering the signs a sketch is made to show in which direction the signs would point. After the arrival of the signs, two men with a posthole digger, bar, shovels, etc., are sent out in a Ford car. This crew goes ahead and has the hole dug. A slower auto truck follows carrying the signs, sections of 2-in. galvanized water pipe 12 ft.



THE COST OF THIS SIGN COMPLETE, WITH ABOUT 20 LETTERS, IS $5.50; EXTRA LETTERS COST 5 CENTS EACH—EACH LETTER IS SEPARATELY RIVETED TO THE MAIN PLATE



SIGNS ARE RIGIDLY CLAMPED TO IRON PIPE

long, cement, sand and gravel, and a couple of buckets. As soon as the truck arrives the signs are clamped to the pipe in the direction in which they are to point. At the same time one of the men mixes a grout of sand, cement and water to a very thin consistency. As soon as this is ready the pipe is placed in the hole, which is dug about 3 ft. deep, leaving the signs about 9 ft. in the air. Then grout is poured into the hole and rocks added; the filling is thoroughly tamped with an iron rod. As the level of the mixture nears the ground surface the grout is thickened with sand, and the last foot is mixed the same as concrete.

In the case of the sign illustrated the iron pipe was an old one and received a coat of paint. With new pipe, however, painting may be omitted.

COST OF SIGNS $5.50 EACH

The cost of the sign complete, with about 20 letters, is $5.50, of which $3 is for the pipe alone. The lettering on the signs is furnished at the rate of 5 cents per letter. The manufacturer furnishes the arrow and the main plate.

The signs are attached to the pipe by means of a clamp, which, when drawn up with small bolts, is very rigid and firm. In two districts the signs were carried on cedar posts, but this practice is not to be commended.

East River Tunnel Has Not Moved Since 1908

An inspection just completed by engineers of the New York Public Service Commission of the south tube of the old subway tunnels under the East River in New York City has disclosed the fact that this tunnel has undergone no movement which could be detected with instruments. Careful observations were made both for grade and alignment. The leakage in this tunnel, which has always been slight, has materially decreased during the period of operation. A similar inspection of the north tube of the same tunnel is to be made shortly. These tunnels have been completed for eight years.

64,793 Miles of Railroad Now Covered by Government

Roadway Parties of Division of Valuation, Interstate Commerce Commission, Inventory 23,186 Miles in Six Months

THE RAILROAD mileage covered by the various roadway parties of the Division of Valuation, Interstate Commerce Commission, was 64,793 on May 31, showing an increase of 23,186 miles in the six months since Nov. 30, 1915. The progress of the other parties was similarly marked, and the government forces began work on about 21,000 additional miles, so that 120,000 miles are now under valuation. Of the larger roads the Central of Georgia is completely inventoried, all but the building parties have completed their work on the Cleveland, Cincinnati, Chicago & St. Louis, and only the bridge and building parties have work yet to do on the Boston & Maine. The field work on the Rock Island system is also nearing completion, and that on the Great Northern is far advanced.

The accompanying table, issued by Thomas W. Hulme, general secretary of the Presidents' Conference Committee, may be compared with a similar one showing the situation Nov. 30, 1915, and published in the Engineering Record of Jan. 15, page 85. The grand totals of the preceding table were as follows: Miles of road, 99,487; road and track, 41,607; bridges, 25,640; buildings, 24,291; signals, 21,042; telegraph and telephone, 43,367; "adjacent similar land inspected," 12,660.

PROGRESS OF FIELD INSPECTION, MAY 31, 1916, FOR GOVERNMENT VALUATION OF RAILROADS

Road	Date Division of Valuation forces began work	Miles of road	Total miles inspected and inventoried to date: Road and track	Bridges	Buildings	Signals	Telegraph and telephone	Total miles "Adjacent Similar Land" inspected
Eastern Group								
Boston & Maine	4-29-14	2,456	2,456	1,800	1,900	2,456	2,456	1,940
Chicago & Eastern Illinois	5-2-14	1,140	1,140	1,140	1,140	1,140	1,140	1,140
Cleveland, Cincinnati, Chicago & St. Louis	8-24-14	2,262	2,262	2,262	1,986	2,262	2,262	....
Pennsylvania Railroad	12-1-14	6,167	2,600	1,863	1,863	1,316	2,311	1,247
New York, New Haven & Hartford	3-31-15	2,046	1,196	688	221	....	903	411
Boston & Albany	4-21-15	392	392	389	312	55	380	12
Chicago, Indianapolis & Louisville	5-25-15	610	610	610	610	221	610	....
Ann Arbor	6-1-15	292	292	292	292	292	292	292
Chicago, Terre Haute & Southeastern	7-26-15	362	362	....	....	362	362	....
Maine Central	8-14-15	1,147	162	114	....	....	304	....
Bangor & Aroostook	8-16-15	626	255	32	32	458	200	....
Vandalia	8-16-15	851	750	814	80	118	805	....
Long Island	11-3-15	397	305	....	....	....	....	88
Philadelphia & Reading	11-4-15	1,582	225	166	166	....	225	....
Central of New Jersey	12-8-15	638	301	....	80	....	390	....
Chesapeake & Ohio	1-13-16	2,346	286	....	....	....	....	....
Pittsburgh, Cleveland, Chicago & St. Louis	2-28-16	1,424	181	250	....	....	667	....
Pennsylvania Company	3-27-16	1,684	221	....	....	....	....	....
New York Central (West)	4-1-16	2,105	268	....	....	....	....	....
Portland Terminal	4-4-16	31	31	....	31	....	....	....
Bridgeton & South River	......	21	21	....	....	....	....	....
Total	......	28,579	14,316	10,420	8,713	8,680	13,307	5,130
Western Group								
Texas Midland	1-12-14	111	111	111	111	111	111	111
New Orleans, Texas & Mexico	1-22-14	173	173	173	173	173	173	173
Kansas City Southern	1-26-14	878	878	878	878	878	878	878
San Pedro, Los Angeles & Salt Lake	2-10-14	994	994	994	994	994	994	994
Elgin, Joliet & Eastern	6-1-14	211	211	211	211	211	211	211
Western Pacific	7-24-14	981	981	981	981	981	981	981
Quincy Western	9-5-14	6	6	....	....	....	....	....
Missouri Southern	11-1-14	54	54	54	54	54	54	54
Mississippi River & Bonne Terre	12-15-14	54	54	54	54	54	54	54
Arizona & Swansea	2-9-15	21	21	....	....	....	....	....
United Verde & Pacific	3-15-15	26	26	....	....	....	....	....
Cape Girardeau & Northern	2-1-15	106	106	106	106	106	106	....
Spokane & British Columbia	10-20-15	36	36	....	....	....	....	....
Butte, Anaconda & Southern Pacific	10-9-15	62	62	....	....	....	....	....
Chicago, Memphis & Gulf	5-11-15	99	99	99	99	99	121	....
Trinity & Brazos Valley	12-1-15	303	303	....	....	....	....	....
Arizona Eastern	1-28-15	398	398	398	398	None on line	371	398
St. Louis Southwestern	11-12-14	1,575	1,575	1,575	1,575	....	1,575	1,517
Texas & Pacific	11-15-15	1,851	851	352	352	....	....	....
Great Northern	5-1-14	7,127	6,242	3,441	3,441	5,988	7,127	4,050
Minneapolis & Rainy River	......	63	63	63	63	63	63	63
Illinois Central Yazoo & Mississippi Valley Chicago, Milwaukee & Gary	11-18-14	6,120	3,687	3,155	3,155	2,731	5,200	2,936
Atchison, Topeka & Santa Fé	12-13-14	11,391	7,430	1,702	1,702	2,313	9,634	2,313
Chicago, Milwaukee & St. Paul	5-22-15	10,509	2,214	529	529	760	1,030	578
Southern Pacific (Pacific System)	1-3-15	6,935	1,838	1,313	1,313	468	5,097	1,410
Chicago, Rock Island & Pacific	8-3-14	7,673	7,536	5,191	5,191	5,525	7,673	2,578
Minneapolis, St. Paul & Sault Ste. Marie	5-1-14	4,177	2,743	403	403	(10 pl'ts)	363	1,470
Chicago & North Western Chicago, St. Paul, Minneapolis & Omaha	9-2-14	10,177	571	91	91	91	4,004	91
Oregon-Washington Railroad & Navigation Co.	3-30-16	2,272	100	....	....	....	2,090	....
Total	......	74,383	39,363	21,874	21,874	21,600	47,910	20,860
Southern Group								
Norfolk Southern	2-27-14	903	903	903	903	903	903	903
Atlanta, Birmingham & Atlantic	2-19-14	658	658	658	658	658	658	658
Central of Georgia	7-8-14	1,972	1,972	1,972	1,972	1,972	1,972	All except terminals
Savannah & Northwestern	2-18-15	109	109	109	109	....	109	109
Charleston & West Carolina	5-29-15	341	341	341	341	....	341	277
Georgia Southern & Florida	1-2-15	392	392	392	392	392	Unk'n	Unknown
Hawkinsville & Florida Southern	3-3-15	96	96	96	96	96	33	Unknown
Macon & Birmingham	1-25-15	97	97	97	97	97	67	Unknown
St. Johns River Terminal Co	1-21-15	7	7	7	7	7	Unk'n	Unknown
Mobile & Ohio	6-15-15	934	934	934	834	934	934	495
Southern in Mississippi	9-15-15	292	292	292	292	292	292	68
Okolona Branch Southern	10-12-15	38	38	38	38	38	38	38
Southern	7-14-15	7,000	2,439	676	None	3,879	3,166	206
Virginian	9-8-15	488	470	470	460	470	468	300
Winston-Salem Southbound	11-16-14	89	89	89	89	89	89	89
Nashville, Chattanooga & St. Louis	1-1-16	1,230	1,183	None	493	1,230	152	None
Florida East Coast	9-25-15	744	744	744	744	....	744	250
Norfolk & Western	1-3-16	2,020	238	....	....	....	....	....
Richmond, Fredericksburg & Potomac	1-3-16	80	80	None	None	None	80	80
Washington Southern	2-18-16	32	32	None	None	None	32	32
Total	......	17,522	11,114	7,818	7,525	11,057	10,078	3,507
Grand total	......	120,484	64,793	40,112	38,112	41,337	71,295	29,495

One Thousand Steel Specifications Reviewed

Examples Cited of Good and Bad Clauses Indicate That Art of Writing Good Specifications Can Be Mastered Only by Study and Experience

By R. FLEMING
American Bridge Company, New York City

THIS article is the outcome of reading more than a thousand specifications written by reputable architects and engineers, and dealing with the structural steelwork for buildings ranging from boiler houses requiring only a few tons of steel to office buildings requiring many thousands.

A specification should be clear, accurate, concise, consistent, complete and fair. Explanations of its meaning should not be necessary. It should not be so long as to be unwieldy nor should anything essential be omitted. The main features should be so clearly defined that there will be no doubt in the mind of a bidder as to what he is to furnish if awarded the contract. "Blanket" clauses and those embodying unusual requirements should be avoided. Sometimes such clauses are inserted to drive away the disreputable contractor, but they defeat this very end. Reputable contractors take few chances in bidding. If a paragraph can have two interpretations they give it the one most unfavorable. The less reputable contractor, on the other hand, "takes a gamble" and counts on a concession later. If this is not obtained he resorts to evasion and deception. "Specifications have no executive functions," and it is better that the requirements be moderate and followed than severe and disregarded.

Favoritism has no place in a specification. The owner, architect or engineer has a right to specify the make and kind of paint he wants used. He is not bound to give the contract to the lowest bidder. But the writer of a specification who, in the guise of being fair to all, manipulates clauses and sentences to favor a particular bidder is dishonest. The specifications should be a guide to assist the contractor rather than a set of rules from which there can be no possible deviation. A spirit of fairness to owner, engineer and contractor should prevail throughout.

Of course the writer of a specification should have adequate knowledge of the subject with which he is dealing.

ACTUAL SPECIFICATIONS

Although the specifications for structural steel are better than those for any other kind of engineering work, there is still much to be desired. The actual falls far short of the ideal. In the thousand specifications examined some are so very general in their provisions that they lack definiteness; others enter into so much detail that they embarrass the contractor. Some lack clearness and others are unfair. In some the writers have depended upon others and have not used good judgment in copying. Some are written by "men of technical ability but illogical mind." As might be expected, there is great variation in length. Of the 126 printed pages comprising the specifications of a twenty-story office building requiring 2500 tons of steel, just one page is devoted to structural steel. The steel specifications for many other buildings where not one-tenth this amount is involved are several times as long. The structural-steel specifications for the Equitable Building, New York City, the largest office building in the world, and which required 32,000 tons of steel, are written in 2800 words.

UNFAIR CLAUSES

A specification is unfair whenever it throws the risk belonging to one party upon some other party. Almost invariably it is the steel contractor who is called upon to shoulder what does not belong to him. What should be said of the following clause?

> The contractor shall make no claim upon the owners either for an extension of time or for extra payment on account of delay or damage, which it may be claimed have been caused by any other contractor employed upon the work or building by the owners; the several contractors being responsible to each other.

Sometimes a provision is made that the contractor must check and be responsible for the design. This is both unprofessional and unfair. It is an admission on the part of the engineer that he lacks confidence in his work. A striking instance is the following:

> All loadings, framing, beams, girders, columns, foundations and the like, and the entire structural design shall be carefully checked by an independent set of calculations which shall be submitted to and passed upon by the architect before orders for material are placed. Entire responsibility for the strength and sufficiency of the structural work shall be assumed by the contractor and all shall be increased where necessary or proper, and all necessary or required pieces, whether or not shown or called for, shall be furnished and erected without extra compensation.

Again,

> All work shall conform to the building code, drawings and specifications to the contrary notwithstanding.

The contractor has no valid objection to such a requirement as

> and all work must be in accordance with the ordinances of the city of Springfield.

But this should not be made to include the design.

INTERPRETATION OF CONTRACT

A clause often found is:

> The architect's judgment in all of the conditions of the contract or in any of the previously recited matters shall be conclusive and final.

It is doubtful whether such a clause would be upheld by any court in case of a lawsuit. Wait, in his "Engineering and Architectural Jurisprudence," chapter 12, says: "It is frequently declared from the bench that parties cannot by private agreement in advance of a controversy oust the courts of their jurisdiction." The following avoids this difficulty:

> The decision of the engineers shall control as to the interpretation of the drawings and specifications during the progress of the work. But this shall not deprive the contractor of the right of redress after the work is completed if the decision shall be proved wrong.

It may be noted that the standard specifications of the American Society for Testing Materials have a provision that

> Samples tested in accordance with Section 4, which represent rejected material, shall be preserved for two weeks from the date of the test report. In case of dissatisfaction with the results of the tests, the manufacturer may make claim for a rehearing within that time.

Clauses are sometimes found which, if interpreted in an arbitrary manner, will cause the contractor annoyance and expense. One such is:

> Contractor is to deliver and unload steelwork at the site, when and where directed by the owner.

There are also the familiar phrases, "to the satisfaction of the architect," "as required," "proper and sufficient," which, while they cannot be entirely done away with, should be reduced to a minimum.

SCOPE OF WORK

Nothing in a specification is more important than that the scope of work be clearly defined. Some writers do this in good English, but many resort to blanket clauses to cover omissions and deficiencies. Take, for example, lintels and masons' anchors. The bidder is left in the dark by paragraphs like this:

> Where heat and vent ducts pass through masonry walls, provide and set proper steel supports for masonry over same.
>
> Provide and set proper steel supports over register openings.
>
> Provide and set steel supporting shapes over window and door openings throughout the building.

The following paragraph is more definite:

> A schedule of the lintels required is given on the plans and in general will consist of . . .

Lintels should usually be furnished by the steel contractor and set by the mason, as embodied in one specification:

> Deliver all loose steel for the mason to set.

Masons' anchors are often called for in the structural steel specifications, as:

> Provide all necessary corner and other masons' anchors for properly tying the walls together.

As the list of anchors wanted will eventually have to be made by the mason contractor, it should be included in his bid.

MATERIAL AND WORKMANSHIP

A record sentence for brevity in describing materials and workmanship is:

> The material and workmanship shall conform to the Mfg. Std. Specs.

The specifications of a firm of engineers and contractors, who often make their own designs for steelwork, have only eleven short paragraphs, the first two reading:

> All structural steel shall conform in workmanship and materials to the manufacturers' standard specifications.
>
> Material to be open-hearth steel, medium or railway bridge grade, excepting rivets, which shall be rivet steel.

Another firm of engineers and contractors uses the specifications for steel railway bridges of the American Railway Engineering Association, "except as otherwise specified herein."

To an architect not familiar with steel construction the often used clause, "All workmanship must be first class in every particular," will probably bring as good workmanship as would a number of clauses copied at random from other specifications. The term "first-class" is preferable to "the best."

In regard to drifting, one specification reads:

> All holes are to match accurately and no drifting will be allowed.

Another reads:

> Moderate drifting will be permitted in order to draw parts together, but not for the purpose of matching unfair holes.

The latter clause is adequate for the ordinary office or mill building. It comes within "first-class" practice, but it is not "the best."

Three quotations will be given regarding field connections. The first refers to a church and parish house, the second to a factory building and the third to a twelve-story apartment house:

> Field connections may be bolted except in compression members.
>
> All field work is to be riveted, except connections of purlins, which are to be made with bolts.
>
> All connections within 3 ft. of the column centers must be riveted. All tank and sheave beam supports must be riveted. Other connections may be bolted.

The question of substituting material for that shown on the plans is met in one case thus:

> The contractor shall not on any pretense save the written order of the engineers deviate from the figures on the drawings and specifications.

A better way is this:

> Any approved steel shape which will not change the architectural lines and finish of the work may be used. Beams and girders must have a section modulus equal to that of those indicated, but no greater depth.

Still better is the requirement that the proposed substitution be sufficient in strength for the assumed loads and stresses. This is an example:

> Contractor will be allowed to use standard, Bethlehem or built-up sections for the structural steel provided the working stresses do not exceed those specified in Sections 137 and 138 of the Albany city building code adopted May 28, 1909; provided the depths of girders and column sections do not exceed that shown on plans, and provided the substituted sections do not interfere with the general construction and finish of the building as shown on drawings.

WORKING DRAWINGS

An eminent architect specifies that

> As shop drawings and erection plans will be furnished by an engineer designated by the architect, at the expense of the contractor, the bidder should include the sum of $3 per ton of 2000 lb. for making shop drawings.

This plan is not to be commended, for most shops prefer to make their own drawings in accordance with their shop requirements. They want to follow their own marking system and use their own printed forms. There is also the question of responsibility. The architect quoted continues with a clause which hardly seems fair to the contractor:

> The contractor will be responsible for the correctness and fit of the completed work at the building; therefore before beginning fabrication all shop drawings should be checked; and should any error be discovered, such must be referred to the architect for correction previous to fabrication of the steel.

The approval of drawings is often called for, sometimes in this form:

> After the contract has been awarded and before any material is ordered or work commenced, the contractor shall submit a complete set of all working or shop drawings, together with marking diagrams (blueprints), in duplicate to the engineer for approval, one set of which drawings shall be filed with the engineer and become the property of the company and the other set returned to the contractor with the engineer's approval or corrections.

There is no objection to such a clause, provided sufficient time is allowed to complete the contract. If the owner wishes work in an unusually short time he should either waive the approval of shop drawings or reduce it to a minimum.

The steel contractor should remember that there is a difference between an approval and a check. Few engineers will check drawings submitted to them for approval. As one firm expresses it:

> The architect's approval covers *general design of details only.*

WORK OF OTHER TRADES

A spirit of courtesy and mutual helpfulness should be sufficient reason for the steel contractor to provide holes for attaching the work of other trades, provided he knows their location when making the detail drawings. One engineering firm writes:

> Provide all necessary field holes in purlins, girts, lintels, etc., for the fastening of material of other trades, such measurements and locations to be furnished before commencing working drawings.

The specifications of a firm of architects for a large hotel building are quite elaborate:

> The attention of this contractor is directed to the following: That he will be required to punch the structural steel wherever necessary for anchoring or securing the work of other contractors, as for securing skylight work, ornamental iron work, anchoring of masonry, etc. Note that said punching generally is shown on structural-steel drawings. In ample time the contractor shall notify the superintendent that he will require by a fixed date the data for all punching to be done for other contractors and upon receipt of said data from the superintendent shall execute this punching in accordance therewith, noting that said punching is limited to that which can be done at the shop.

Clauses like, "Provide all tap bolts required by all trades in securing their work to ironwork, and do all tapping and drilling required," are conducive to friction and delay.

INSPECTION AND PAINTING

In important work the contractor is often called upon to add the cost of inspection to his bid. For example:

> The contractor shall allow the sum of $1 per ton to defray the expenses of all testing and inspection, which shall be done by persons designated by the architects.

In other specifications this sum varies from 40 cents to $1.50 per ton.

"This inspection to be paid for by the owners" seems a better way of meeting the cost. To cover cases where it has not been determined whether inspection will be required or not—in fact, to cover all cases—the following is well adapted:

> Mill and shop inspection will be at the option and expense of the owners. The steel contractors shall provide safe and proper facilities at all times for the inspection of the work by the engineers or their representative.

In no particular do specifications vary more than in that of painting. A well-known firm of architects gives eight paragraphs to the subject, the first and seventh of which are quoted:

> As the protection of the entire structural work is of the first importance, the following conditions will be insisted upon: . . .
>
> The paint shall be applied to the metal with the regular painter's brush and shall be thoroughly well worked in by hand over the entire surface, so as to secure an even and perfect covering. It shall not be applied with a swab or a long-handled brush, but must be carefully put on in a workmanlike manner.

As paint varies in cost from 60 cents to $1.60 per gallon, the engineer or architect should specify the kind he wishes used, or better still, give a choice of two or three kinds. The following is from the specifications of an engineering company:

> The owner shall provide the paint for the last coat, but the contractor shall apply it.

This is particularly adapted to large contracts.

NEEDLESS CLAUSES

Many specifications contain needless clauses. For example, a good detailer need not be told to

> Avoid eccentric loading by connecting back to the web as much as possible; take up the thrust and twist from eccentric loading by properly arranged riveted connections.

The writer of this, "No rivets shall have a greater grip than 4 in," should be sure that this can be carried out.

The clause, "Column splices are to be located 1 ft. 0 in. above floors for all columns," might not cause any difficulty, though in order to have the splices clear all the beam connections, columns are usually spliced not less than 18 in. from the floor line.

A standard specification has this clause:

> Columns shall have as few splices as practicable and where spliced the splice shall be strong enough to resist the direct as well as the bending stresses.

The interior columns of a twenty-story office building recently finished have direct loads varying from 850,000 to 950,000 lb. in the second column section. In a nine-story warehouse now building the direct load in the second section of each of twenty-two interior columns is 590,000 lb. The impracticability of transmitting such stresses through the column splices is readily seen.

Superfluous phraseology is by no means uncommon. A specification becomes part of a contract and is thus a legal document. While accuracy is essential, it is not necessary to be verbose. It is said that many of the wordy expressions found in so many contracts and specifications may be traced back to the days when compensation for drawing up legal papers was largely dependent on the number of words they contained.

SPECIAL REQUIREMENTS

Special requirements are often expressions of the writer's personal equation. A New York City architect, who has probably observed the severe wrenching to which some buildings are subjected in the course of erection, specifies that

> Care must be exercised not to overstress any part of the structure during erection. The tiers on which the derricks rest must be fully bolted up before the mast is raised.

A firm of engineers specifies this:

> All field connections may have the holes punched full size except shearing connections for girders that have a reaction of 100,000 lb. or more, which connections must have the holes subpunched and reamed to a metal template.

Another firm thinks it worth while to specify that

> All countersinking shall be uniformly done in a workmanlike manner. The angle of countersink shall be 30 deg. with the shank of rivet, unless otherwise shown on the drawings.

An architect requires that

> After erection the heads of all field rivets and all spots from which the paint has been scraped shall be touched up and all the steel and iron shall then receive a second thorough coat of the paint specified.

Another writer prescribes:

> All portions of the steelwork from which fresh paint may be washed off by rain shall be repainted.

A firm of California architects in its specifications for a twelve-story building writes this:

> Contractor is to include in his bid 10,000 lb. of extra steel beams and shapes, to be used where directed by the architects. If same are not used credit is to be given to the owner at a price per ton which shall be agreed upon before contract is signed.

This clause has considerable merit in that it provides against omission in the plans. It certainly is an improvement over this:

> Structural steel man will include all light as well as heavy steel in his figures, such as cornice, brackets, angles, ties, bucks, etc., whether shown on the plans or not, but which would be necessary to complete the job.

Specifications for Design

Most specifications are accompanied by more or less detailed designs and deal mainly with the fabrication and erection of the steel. Occasionally outline drawings only are sent and the bidder is asked to submit a design. Most office buildings are in cities and must usually conform to a building code which prescribes loads and unit stresses. Mill buildings are often outside of city limits and greater freedom is left to the designer. The weakest part of building codes and specifications for design is that relating to wind bracing. This is a chapter in itself and will not be touched upon here.

The following, from the specifications for a steel foundry, permits a wider range of choice than is usual:

> Design of roof and trusses to be the most suitable. Design shown on drawings need not necessarily be followed except in a general way.

The "actual dead load" is generally specified to be used for the dead load. Designers vary in their assumptions, but in the following it is given for the floors and roof:

> The floors are to be calculated for a live load of 120 lb. per square foot and dead load of 60 lb. per square foot, and the roof for a live load of 50 lb. per square foot and a dead load of 60 lb. per square foot.

Sometimes the textbook is drawn upon for formulas which do not belong in a specification.

The question whether the sentence, "No metal of less thickness than ¼ in. shall be used except for fillers," includes the web of channels is settled in each of the following:

> No material less than ¼ in. thick is to be used except for fills, but this clause does not apply to the webs of rolled beams and channels.
>
> No plate or rolled section having a thickness of less than ¼ in. shall be used except for fillers.

It should be noted that the latter clause bars out the light-weight section of all channels under 12 in. Is this necessary in every case?

There need be no guessing with this: "Purlins, girts, etc., are to be figured as beams, not as catenaries"; but if designing in competition it will be necessary to assume lower wind loads and higher unit stresses for girts than are given in textbooks.

Conclusion

It may be inferred from the foregoing that no hard-and-fast set of rules can be given as to what is essential in specifications. They would be interminably long if every clause with an advocate were inserted.

The art of writing good specifications must be acquired by study and experience. The literature on the subject is extensive. Kirby's "The Elements of Specification Writing" is excellent. For steel buildings the chapter on "Specifications for Engineering Material" in Davies' "Engineering Office Systems and Methods" and the section "Specifications" in Burt's "Steel Construction" are especially helpful. Standards like Schneider's "General Specifications for Structural Work on Buildings" can be studied to advantage. Added to reading and study there should be a sense of fairness, clear expression and keen observation of actual practice.

Excellent Results From Model Convict Camp

Has Running Water and Sewer System, and Incinerates Garbage—No Attempts to Escape, Though There Are No Armed Guards

THE model convict camp established Jan. 10 by the commissioners of Fulton County, Georgia, in co-operation with the U. S. Office of Public Roads and Rural Engineering, has already shown excellent results, in the opinion of the latter office. The living conditions of the inmates are an improvement on those in the usual camp, and the cost of feeding them is less, due to the elimination of waste and inefficiency. There have been no attempts to escape, though there are no armed guards, and some of the convicts are of such a character that at other camps it was deemed necessary to keep them in cages.

CONVICTS HOUSED IN PORTABLE BUILDINGS DESIGNED BY OFFICE OF PUBLIC WORKS

Portable Buildings

The convicts are housed in portable buildings, constructed and supplied in accordance with the plans and specifications of the Office of Public Roads and Rural Engineering. An average daily population of forty negro convicts is being maintained and employed under a form of the honor system. The camp and work are under the supervision of a deputy warden, a camp clerk, two foremen and a night watchman.

The diets in use have been prepared by the U. S. Public Health Service, and though a greater variety of better food is provided than has been customary in the county, it is being furnished at a lower cost than that obtaining in the other county camps. The latter result is accomplished by the elimination of waste and inefficiency through the use of a specially designed system of reports and cost accounting.

Sanitary Arrangements

Running water in the kitchen, sleeping quarters and bath is provided from a pressure tank. Garbage is disposed of by incineration and other wastes are conveyed through a sewer system to a cesspool.

The camp has attracted favorable attention locally, especially in connection with the methods of sanitation employed and the manner in which these methods are being followed. The camp is under the charge of R. F. Eastham, highway engineer, of the Office of Public Roads.

Canal Cleaning by Sheep and Goats Past Experimental Stage

FOR three years experiments with the use of sheep and goats for cleaning banks of canals and laterals on the Salt River project, Arizona, have been in the course of investigation. In the June *Reclamation Record*, A. J. Haltom, irrigation manager, gives a résumé of previous years' experience and the report for 1915. His final conclusions are to this effect:

1. Johnson grass, the most troublesome pest on the project, can be controlled and eventually eliminated from the banks of canals and laterals by the use of sheep.
2. The use of sheep has decreased materially the cost of cleaning canal and lateral banks.
3. Sheep drive out gophers and thus cut the cost of repairing breaks and reduce the loss of water by seepage to a minimum.
4. It is profitable for the farmer to maintain his farm ditches with sheep.
5. Johnson grass will fatten sheep in ninety days.
6. Sheep can be pastured on the banks of canals and laterals without damage to the banks.

Three years of experimentation have demonstrated that the pasturing of sheep and goats along the canals is a profitable undertaking and that the herd should be increased until a sufficient number are available to control the troublesome vegetation on all the government-owned canals and laterals. With the experience of the past it will be possible to reduce the losses and increase the efficiency of the herd as cleaners.

During 1900 the sheep were divided into two herds and maintained 31 miles of main canals and 24 miles of laterals of the Grand and Maricopa canals. The goats maintained 14 miles of Arizona canal and 8 miles of laterals. The herd numbered during 1915 821 sheep and 470 goats. They are inventoried at $5 each and produced in the March and November clip $1,160.85, a total value of $7,615.85, plus an estimated saving in canal maintenance of $4,000, from which must be taken $7,194.47, the original value of the herd, labor and various other expenses, leaving a profit of $4,421.38.

Literature

For the Civil Engineer and Contractor

New Publications

Industrial Preparedness. By C. E. Knoeppel. Cloth, 5 x 7½ in.; 145 pages. New York, The Engineering Magazine Company. $1 net.

Proceedings of Second National Conference on Concrete Road Building, 1916. Paper, 6 x 9 in.; 328 pages; illustrated. Chicago, J. P. Beck, secretary, 111 West Washington Street.

Engineering as a Profession. By Milo S. Ketchum, C.E., dean of the college of engineering, University of Colorado. General Bulletin 98. Paper, 5½ x 7½ in.; 27 pages. Boulder, Col. University of Colorado.

Weights and Measures. Report of the Tenth Annual Conference, 1915. Paper, 7 x 10 in.; 254 pages; illustrated. Issued by U. S. Bureau of Standards. Washington, Government Printing Office.

Proceedings of the Eleventh Annual Convention of the Mid-West Cement Users' Association, 1916. Paper, 6 x 9 in.; 93 pages: illustrated. Omaha, Neb., Frank Whipperman, secretary-treasurer, Twenty-eighth Avenue and Sahler Street.

Industrial Accident Prevention. Prepared by the Bureau of Statistics and Information. Special Bulletin 77, The Industrial Commission, Department of Labor, State of New York. Paper, 6 x 9 in.; 54 pages; illustrated. Albany, New York State Industrial Commission.

The Strength and Stiffness of Steel Under Biaxial Loading. By Albert S. Becker, professor of applied mathematics, University of North Dakota. Bulletin 85, Engineering Experiment Station, University of Illinois. Paper, 6 x 9 in.; 65 pages; illustrated. Urbana, Ill., University of Illinois. 35 cents.

The Speed of Trains on Narrow Gauge Railways. By A. J. Beaton, assistant engineer-in-chief, South African Railways and Harbors. Reprint from the South African Railways and Harbors Magazine. Paper, 7¼ x 9¾ in.; 30 pages; illustrated. Johannesburg, South Africa, Argus Printing and Publishing Company, Limited.

Determination of the Difference in Longitude Between Each Two of the Stations Washington, Cambridge and Far Rockaway. By Fremont Morse and O. B. French, assistants, U. S. Coast and Geodetic Survey. Special Publication 35, U. S. Coast and Geodetic Survey. Paper, 6 x 9 in.; 40 pages; illustrated. Washington, Government Printing Office.

Tests of Reinforced-Concrete Flat Slab Structures. By Arthur N. Talbot, professor of municipal and sanitary engineering, and in charge of theoretical and applied mechanics, and Willis A. Slater, research assistant professor of applied mechanics, University of Illinois. Bulletin 84, Engineering Experiment Station, University of Illinois. Paper, 6 x 9 in.; 128 pages; illustrated. Urbana, Ill., University of Illinois. 65 cents.

Concrete Construction for Rural Community

Author, Roy A. Seaton, M. S., professor of applied mechanics and machine design and superintendent of construction, Kansas State Agricultural College. Cloth, 6 x 8 in.; 223 pages; illustrated. New York, McGraw-Hill Book Company, Inc. $2 net.

This book is convincing evidence of the widening of the fields of application of concrete in new directions, in this case to agricultural engineering. While largely made up of simplified abstracts of data from various sources, there is included in addition to descriptions of the materials (cements and limes, with specifications and aggregates) a fairly technical consideration of plain and reinforced concrete. The distinctive parts of the book, however, are contained in Part 5, treating the typical applications of concrete. There are presented by good illustrations and by tabular data helpful in design such subjects as sidewalks, floors (barn and feeding floors), roads, tanks, cisterns and silos and small bridges and culverts. The chapter treating the methods of casting in molds is complete and useful, and contains several practical suggestions for the solution of rural engineering problems.

The book will doubtless find a real demand awaiting it, as there is evidence of a widespread tendency toward more substantial and permanent construction in small buildings and in rural structures, of which there are millions scattered over the country. The typography and illustrations are fully equal to the highest standards for such text books.

The Engineer in War

Author, P. S. Bond, Major, Corps of Engineers, U. S. Army, and M. Am. Soc. C. E. Flexible cover; 5 x 7½ in.; 187 pages; 70 illustrations. New York, McGraw-Hill Book Co. $1.50 net.

Appearing at a time when members of engineering societies and students in technical colleges throughout the country are enrolling in military lecture courses and forming battalions for armory and field instruction in the duties of a soldier, Major Bond's book, "The Engineer in War," will supply a widespread demand for information regarding the relation of engineering to the conduct of war and the adaptation of the principles of civil engineering to military requirements. The book is a revision and amplification of the series of articles entitled "National Defense—For Engineer and Contractor," which appeared recently in the Engineering Record. Many new illustrations have been inserted and important additions made, particularly in regard to military map-making and sketching and sanitation. While intended primarily for engineers and contractors, the subject matter is of real value to every man contemplating military training, for with the paucity of engineer officers in the regular service any of the combatant forces might be called upon for engineering work in case of emergency.

The author begins with chapters on the military policy of the United States and the economics of military engineering. The main body of the book, however, is devoted to such subjects as tools and equipment, stream crossings, military roads, field fortifications and sieges, demolitions, reconnaissance, sketching and surveying, sanitation, mobilization of industrial resources and hints on how the engineer and contractor may prepare to meet the military obligations of citizenship.

Many of the strictly military engineering manuals already in print are explicit in instructions regarding technical practice, but they fail to link up these features with the broad economic principles of modern warfare. It is in this respect that Major Bond's book is of particular value. It is not enough, he points out, for the engineer officer to know how wide and how deep to make a trench. He must appreciate fully its tactical value. On this point he gives some very timely advice: "The excessive and indiscriminate use of field fortification limits the mobility of the troops, tends to destroy the aggressive spirit which is essential to success and surrenders the initiative to the adversary. If used without due regard for the strategical and tactical requirements of the situation, they exercise a most baneful influence." The book is full of advice of this sort—advice which, if assimilated, spells the difference between the mere drillmaster and the military strategist.

An extremely interesting chapter of the book is the one on field fortifications and siege operations. A feature of the chapter is a map of an actual piece of ground showing the manner in which the rifle trenches of a battalion may be disposed to cover the ground in front of them with their fire. The map is accompanied by a full discussion of the trench location.

Aside from its technical excellencies, Major Bond's work is characterized by a facility of expression rarely found in writings on technical subjects. He presents his facts in a convincing and interesting manner, and the book is easy to read. The fact that the manuscript, before publication, was submitted to and approved by the Secretary of War adds to its intrinsic value the weight of official sanction.

Major Bond's book is such an excellent and concise presentation of modern warfare's most important branch of operations that it should form part of the prescribed reading in every military engineering course inaugurated by American universities, and by national and local engineering organizations.

American Civil Engineers' Pocket Book—Third Edition

Author, Mansfield Merriman, editor-in-chief. Flexible leather, 4 x 7 in.; 1571 pages; illustrated. New York, John Wiley & Sons, Inc. $5 net.

To further the originally announced purpose of the editor-in-chief, Mansfield Merriman, to make the American Civil Engineers' Pocket Book better and more complete than any in the English language, there has been added in the new edition an entirely new section treating "Harbor and River Works" in six chapters, covering 96 pages. Conforming with the previously adopted practice in obtaining highly-qualified engineers with specialized experience as associate editors to write the various sections, Frederick R. Harris, of the Corps of Civil Engineers, U. S. Navy, who has recently been appointed chief of the Bureau of Yards and Docks, was selected to write the new section.

He has presented a most satisfactory treatment of the subject, including good descriptions and illustrations of typical examples in the six chapters on harbors, rivers, quays, landing piers, wet and dry docks, ferries and special works. The latter includes the important subjects of transfer bridges, coal, ore and grain plants, cargo-handling plants and port developments. Credit is given to Charles W. Staniford, chief engineer, Department of Docks and Ferries, New York City, for examples of quay and pier construction which he furnished. One of the subjects which should have been given more adequate treatment is the important matter of flood control in rivers, which was discussed in three pages.

The third edition is also improved by many minor changes; the index has been revised and reset, and the new book contains 41 articles, 31 tables, 103 cuts and 120 pages more than the second edition. Extended reviews of the previous editions will be found in the Engineering Record of Feb. 18, 1911, page 203, and Jan. 4, 1913, page 28. The new edition will undoubtedly increase the popularity of this work as the most comprehensive reference book for civil engineers.

Letters to the Editor

Comment on matters of interest to engineers and contractors will be welcomed

Heavy Flood Tests Spillway of New Reservoir at Le Roy, N. Y.

SIR: You may be interested in an extremely heavy flood which occurred on Mad Creek, a small stream in western New York, on which the village of Le Roy recently constructed a reservoir, which is described in my article in the Engineering Record of June 3, page 735. The spillway has a width of 60 ft. and the area of the reservoir when full is somewhat more than 50 acres. The drainage area at the spillway is about 1½ square miles. Last month we had a flow over the spillway of a little more than 3 ft., and I estimate from the rate at which the water rose in the reservoir that the inflow was from 3000 to 3500 sec.-ft., which is as high a rate as I have ever known for any stream in the northeastern section of the United States. Slopes tributary to the creek are no steeper than in most streams of southwestern New York. Unfortunately we have no record of the rainfall.

J. P. WELLS,
Consulting Engineer.
Rochester, N. Y.

Colloidal Theories Applied to Water Decolorization

SIR: In connection with George F. Catlett's article entitled "Colloidal Theories, Applied to Colored Water, Reduce Cost of Chemicals," in the Engineering Record of June 3, page 741, the writer wishes to call attention to some experiments along this line which he made some years ago, and which were briefly summarized in an article appearing in your paper May 9, 1914, page 524, but details of which were omitted for want of space. These consisted in coagulating with aluminum sulphate, solutions colored with ferric chloride and potassium permanganate in small amounts, solutions of tannates and gallates, and natural leaf infusions. These solutions also were filtered through layers of precipitated and washed aluminum hydroxide.

From these tests the writer proved to his own satisfaction that part of the coloring matter in water was colloidal and part in true solution. That is, the color in the ferric and permanganate solutions was only slightly reduced (by adsorption) in filtering through layers of aluminum hydroxide; that in the organic colloidal solutions was completely removed, and that in the leaf infusions was removed to a large extent, leaving, however, a residuum which was only slightly removed by further repeated filtration. These results were checked by dializing the solutions. It also developed that the tannates, gallates and leaf infusions had an inhibitive effect on the flocculation of the aluminum hydroxide, confirming the theory that they are both positive colloids. Colored waters, therefore, require larger doses of "alum" to obtain good coagulation.

It seems to the writer that perhaps the most effective way of removing color from water is by means of a rather thick and dense layer or "matte" of aluminum hydroxide on the filter beds, on the basis that a colloid cannot pass through a semi-permeable membrane, which, in effect, such a matte is. The residual color is reduced by adsorptive action of the coagulum, both in the settling basin and in the passage of the water through the matte upon and in the filters. This argues for introducing a portion of the coagulant toward the end of the settling period and after the lime, if such is used, although this procedure may require modification owing to local conditions.

The writer has frequently had difficulty in obtaining a good floc with alum and soda ash in water of low or negative alkalinity, even in the absence of any appreciable color, and has found that the substitution of lime for the soda ash has generally resulted in bettering conditions. He attributes this to the inhibitive action of alkalis in certain concentrations upon the coagulation of colloids. The carbonic acid released also seems to have the effect of rendering the matte on the filters more porous and less tenacious, thereby preventing its retaining the colloidal coloring matter effectively. The use of soda ash under these conditions is also accompanied, sometimes, by the appearance of a fine precipitate in the filtered water, due to the passage of the fine coagulated aluminum hydroxide through the imperfect matte and to delayed coagulation.

Cleveland. M. F. STEIN.

Present-Day College Education

SIR: The discussion which has been running in your paper for several months on "Why is registration in civil engineering decreasing?" has proved to me most interesting reading, dealing as it does with a matter of apparently vital importance to the engineering profession; but its resultant editorial in your issue of May 27, page 693, on the mentor system used at the University of Michigan is still more interesting. In my opinion, through the inauguration of this system Dr. Cooley has struck the keynote of success in engineering education; because, if the mentors are truly of the right type and are practical men instead of merely theorists, the close, friendly association of pupil and teacher will do more to raise the standards of scholarship and ethics than anything else that is practicable. It will not suffice, however, for the mentor and student to get together only when the latter is in trouble, for they should make it a practice to meet informally several times a week, even if it is for only a few minutes. The success of the entire scheme depends upon whether the mentor can quickly establish relations of true friendship between his boys and himself—and the right kind of teacher most assuredly can do this. He should have them understand at the outset that if they get into trouble with the faculty, or even anticipate so doing, on account of mischief or any other reason, it will pay them to go to him at once, make a clean breast of the affair, ask his advice, and do as he counsels them. In such cases the confidence thus given should be treated as is that between lawyer and client, or, in serious matters, as in the Roman Catholic confessional.

Some thirty-odd years ago when I was a professor of civil engineering I endeavored to act as mentor to my students, partly as consulting engineer to the classes on technical matters, but also in a friendly way in relation to personal affairs. As the classes were very small, I was able, unaided, to look after all of my students in this manner. The scheme worked well; and for years after I had finished teaching, my old pupils continued to consult me about matters on which they needed advice; and most of them have made a practice of writing me a friendly letter about once a year. The fact that nearly all of them have been eminently successful professionally is one of the most satisfactory compensations that I have received for any of my life's work. In this connection I might mention the fact that I often run across younger engineers who tell me that something which I had told them in years long past, either when lecturing or in print, has been of material service to them in their careers.

I should like to see the mentor system formally adopted in every engineering course in America, for I firmly believe that if it were, there would result very quickly a general improvement in the work of engineering students which would continue to augment with the passage of years. The main object of the mentor should be to arouse in his boys a deep and permanent enthusiasm for the profession of engineer. That alone, as I have previously stated in print, if it were general, would increase the efficiency of the entire student body fully 25 per cent. In order to arouse their enthusiasm, my former partner, Mr. Harrington, and I a few years ago compiled and issued a book entitled "Addresses to Engineering Students." It has already served a good purpose, but could be made much more useful if it were more widely read; and I would suggest that one of the most effective ways for a mentor to benefit his boys would be to make sure that they read that book and consult with him occasionally concerning the various important questions of which it treats.

J. A. L. WADDELL,
Consulting Engineer.
Kansas City, Mo.

Names and Addresses of Concrete Engineers Desired

SIR: This association is endeavoring to compile a list of names and addresses of engineers specializing in concrete design and construction, for the following purposes:

1. To use in replying to requests for names and addresses of men competent to (*a*) design a structure, (*b*) pass upon a design, (*c*) report upon a project, (*d*) report upon a failure.

2. To enable us to give to parties who ask for assistance the names of specialists, for we do not encroach upon the field of men in practice.

3. To enable us to give to specialists the names and addresses of parties in their own and nearby cities who are contemplating building and who may be induced to use concrete.

We hope to receive from your readers the names of competent men.

PORTLAND CEMENT ASSOCIATION,
By Ernest McCullough,
Chief Engineer, Fireproof Construction Bureau.
Chicago.

HINTS FOR THE CONTRACTOR

Details Which Save Time and Labor on Construction Work

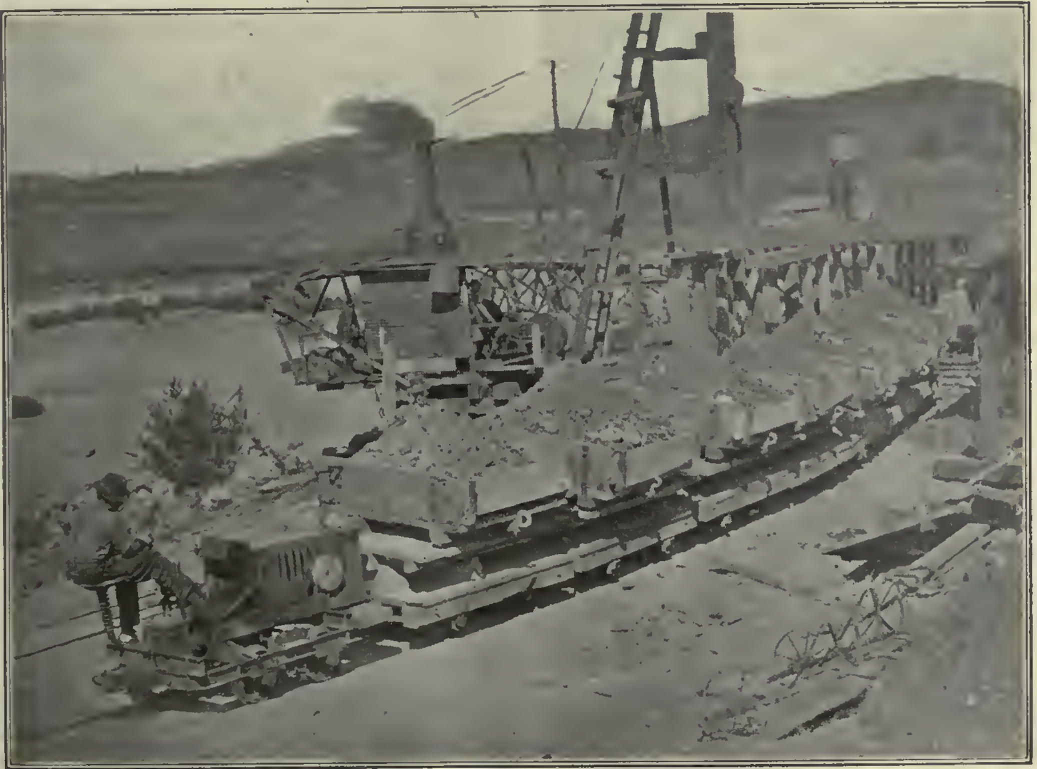
Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

[Contributions to this section are solicited, and if found available will be paid for. They must be SHORT, *and should be accompanied, if possible, by photographs or sketches.*—EDITOR.]

Falsework Girders, Placed Under Old Span, Handled Outside It

BY A. HALL
Maryville, Tenn.

IN SOME bridge work for the Louisville & Nashville Railroad the writer had to place three 25-ton falsework girders 65 ft. long under an existing span with a 15-ton locomotive crane. Four 12 x 12-in. timbers were placed across the top chords of the old span, each lashed down with wire rope on one end, while manila rope falls were hung from the other end outside the span. The first of these falls was hooked to one end of the girder while the locomotive crane took hold of the other. With the girder swung outside the old span the front end was transferred to the tackle from the next timber, and the girder led along in this way until it could be lowered with each end on falsework under the span and slid sidewise into place. The rope tackles were handled by an extra hoist that had been used for pile driving.



"HENRY 1," A HYBRID OF AUTO-DUMP-CAR ORIGIN, HANDLING HEAVY TRAIN AT SNAKE RIVER DAM

Plans had been made for sliding these girders into place endways, which would have required extra falsework in the middle of the channel that could not have been driven in less than 15 hours. As it was, all three of the girders were placed, buck-braced and decked with 24 timbers in 10 hours. It took 2 hours to place one girder, including the time shifting tackle, and it is likely that three days' time was saved over the method first proposed.

The bridge on which the work was done spans the Kentucky River at Worthville

Cross Ford and Dump Car to Get Gasoline Locomotive

BY F. T. CROWE
Superintendent of Construction, Jackson Lake Dam, Moran, Wyo.

TWO GASOLINE locomotives, each of which is a direct cross between a Ford automobile and a 1½-yd. Koppel dump car, are being used to handle dirt trains in the construction of the Jackson Lake dam across the Snake River in Wyoming. The locomotives have been christened Henry I and Henry II in honor of the would-be peace maker. Each was made by placing a Ford automobile engine on the running gear of a dump car. Power is transmitted to the wheels of the car by a chain drive connected to a cross drive shaft located immediately behind the regular Ford transmission. A gear shift is provided on this drive shaft to enable the car to be run on "high" in either direction. The ratio of engine speed to the travel of the car is one-fourth that in the automobiles from which the engines were taken.

The locomotives are wonderful little pullers and so simple that any laborer can operate them. Repair parts for them can be obtained at any small town where a Ford garage is maintained.

Accounting for the Contractor—The General Ledger

By BENJAMIN L. LATHROP
Of Lathrop, Shea & Henwood Company,
Scranton, Pa.

EITHER a loose-leaf ledger or a card ledger is preferable to a bound book. A bound book involves an index and repeated carrying forward of totals "to page number so-and-so" when the account has to be re-indexed. Furthermore, when the bound book is filled, all the balances have to be carried forward into a new book, and this often happens at a time when the entire office staff is busy, and the resulting bustle and confusion is a "caution."

Both loose-leaf and card systems are elastic, and the accounts, being arranged in alphabetical order, are always quickly accessible. Dead accounts can be filed in transfer boxes, thus keeping the bulk of the live ledger down to a minimum. The advantages of the alphabetical arrangement will be doubly apparent in taking off the monthly balance sheet.

The loose-leaf ledger is a little safer and more practical than the card system, as there is less liability to loss or misplacement of live matter.

Baby Hoist Overhauls Heavy Derrick Chain in Rock Quarry

By H. L. HICKS
Great Neck, N. Y.

A LITTLE air hoist at the quarry of the Wetmore & Morse Granite Company at Montpelier, Vt., placed on the opposite side of the pit from the derricks and railroad siding, has replaced six men in overhauling the derrick lines used in breaking out rock. The quarry had already been worked to a considerable depth and width, and the face opposite the loading derricks had then been attacked, working it down in terraces from the top. As there was no railroad siding on the far side of the pit, the stone was broken out by the regular derricks and allowed to roll to the bottom, where the derricks could hoist it directly.

In this process the chain sling would often slip off and, with the slack in the derrick line, drop to the bottom of the quarry. As this line was a 1½-in. cable, it took a large part of the time of six men every day to haul it repeatedly back to the top of the quarry. The little Ingersoll-Rand hoist, of

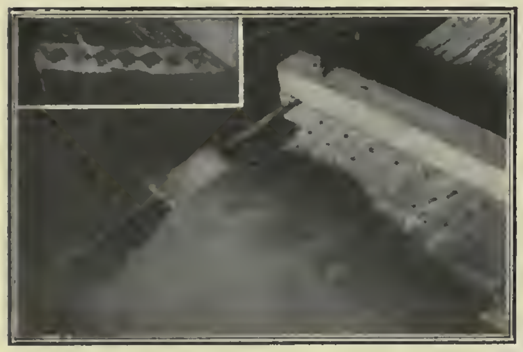
SMALL MINE HOIST PUT TO NEW USES IN ROCK QUARRIES a type originally developed for underground mining and described on page 117 of the Engineering Record for August 29, 1914, overcame the difficulty. Its line was attached to the chain sling, and every time the latter slipped it required but a few seconds to bring it to the working point again. The hoist is automatically lubricated and takes its power from the air line for the drills.

At other quarries these same hoists are used in place of other power or teams to pull cars. Many of them are run on steam. One in use at the quarry of the Rockland Lake Trap Rock Company's quarry at Congers, N. Y., is shown in the accompanying photograph.

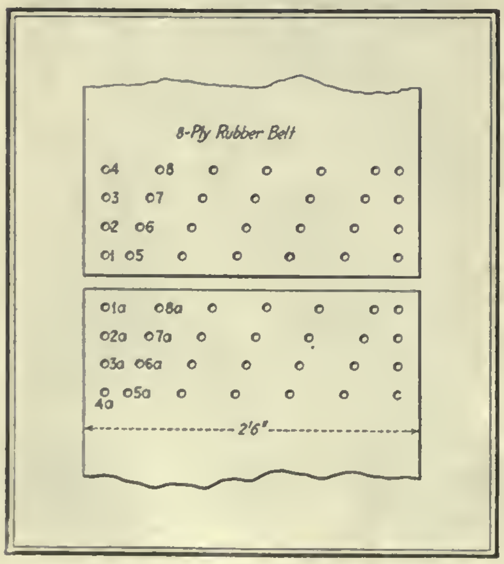
Life of Big Belt Prolonged by Two-Ply Lacing in Diagonal Holes

BY H. S. CARPENTER
Cobleskill, N. Y.

THE MAIN drive belt in a large-capacity stone crushing plant had deteriorated until the lacing would tear out when put in by ordinary methods. To save discarding the belt, which was 30 in. wide and of 8-ply rubber, the writer punched the ends for lacing as shown in the accompanying sketch. The lacing was started on the left edge in hole 1, carried to 1a, then to 2 and 2a, 3 and 3a, 4 and 4a, 5 and 5a and so on across the belt from left to right and then back from right to left to the fastening.


FINISHED JOINT SMOOTH AS WELL AS STRONG

In addition to securing much greater bearing in the belt, this 2-ply lacing itself is as strong as 4-ply lacing done in the ordinary way, and does not cause so much slap in going over the pulleys. The lacing, which was put in this spring, is giving very satisfactory service.



DIAGONAL ROWS GIVE MORE BEARING

Use Dump Wagons for Hoppers

FOR HANDLING material from the wrecking of an old building and from the excavation for a new eight-story structure being erected by the Hauser-Owen-Ames Company for Paul Steketee & Sons in Grand Rapids, Mich., hoppers were made by mounting the bodies of two dump wagons on a platform above a driveway. To one of the bodies, around which had been built up protecting sides, old material was led by chutes and to the other earth from the excavation came by way of an elevating bucket, shown discharging in the photograph. This obviated the necessity of building runways into the excavation, which would have blocked the street.

DUMP BODIES STORE A LOAD

Backfill Closely Follows Excavation on Large Sewer Contract

CONSTRUCTION speed on a 9-ft. three-ring brick sewer in the million-dollar Argyle Street system, providing an outlet for the extreme northwest section of Chicago, is from 96 to 108 ft. per day and not much in excess of this amount is left unbackfilled. In the system are 14 miles of sewer ranging from 2 to 9 ft. in diameter. The streets which the sewer traverses are in swampy condition and so impassable much of the time that most of the 24,000,000 brick were hauled and piled alongside the road over frozen ground during the winter. In this way they cost only $8 per 1000 delivered. The 44,000 bbl. of Utica natural cement required for laying them are, however, being delivered as the work progresses. The clay is of such a nature that it is desirable to backfill the trench as soon after opening it as possible to obviate the use of an excess of bracing.

The photograph shows the trimmers at work on the plastic clay under a steam shovel. They must keep pace with the dipper, which is attached to a 52-ft. stick made especially for the contractor. The close cutting to line of the dipper is seen on the left above the point where the men are at work. The bracing and sheeting crew works immediately under the machine, which straddles the ditch and runs on rollers over a plank track. Bracing is placed in 12-ft. sections and the bricklayers build the invert immediately behind the bracing gang. Rings, 4 ft. apart, and 2 x 6-in. beveled lagging for the arch forms follow rapidly. The excavated material is hauled back along the line in dump cars, twelve to a train, by Davenport dinkies and is dumped directly into the trench over the completed work.

Included in the equipment are two Bucyrus shovels and a Marion revolving crane with an orange-peel bucket for handling backfill where it is not cared for by trains. A Parsons excavator for the 2, 2½ and 3-ft. laterals is followed so closely by the various crews that backfilling is never more than 100 ft. from the head of the trench.

As wages paid on this sewer are high it is possible to hold the best class of men and maintain the rapid sequence of operations necessary to reduce the time the trenches must remain open in the treacherous soil. Bricklayers get $10 a day, with double pay for overtime; shovel engineers get $50 a week; engineers on the dinky engines, 75 cents an hour; bracers and trimmers, 57½ cents and common laborers 40 cents an hour. All men work eight hours a day.

OPERATIONS FOLLOW ONE ANOTHER RAPIDLY

The H. J. McNichols Company is the contractor. The work, which was started in 1915 and is to be finished in 1917, is being carried out under the general supervision of C. D. Hill, engineer of the Board of Local Improvements. G. C. D. Leuth, assistant chief engineer, had charge of the design and is handling the construction.

Students Build Military Bridges

Since the publication in the Engineering Record of May 6 of a military bridge built by students at Johns Hopkins University, the Engineering Record has received letters showing that similar work has been undertaken in quite a number of schools. Specific information and pictures of bridges have come from Washington University, St. Louis; Kansas State Agricultural College, Manhattan, Kan., and the Massachusetts Institute of Technology, Boston.

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

Winnipeg Aqueduct Work Proceeds Despite Cracks

Board of Canadian Engineers Appointed to Inspect Minor Defects Submits Interim Report on Work

Construction work on the Winnipeg aqueduct is to proceed actively this season in spite of newspaper agitation occasioned by the development of minor cracks on certain sections of the structure where the foundation material proved to be of treacherous character. From a reliable source the Engineering Record has secured the following information regarding the present status of the project:

Some clay soil upon which the invert of the aqueduct rested for a limited distance did not bear the load it was expected to carry without compression. Due to the compression of this particular soil, the side walls of the aqueduct, which are of the horseshoe section type, settled from zero to a maximum of about 1 in. The invert, not being reinforced so as to distribute the load of the aqueduct and its backfill uniformly over its entire area, developed in places a longitudinal crack approximately upon its center line. Ordinarily, according to this journal's informant, this would be considered a minor affair, as no appreciable settlement has taken place after approximately the first thirty days following the loading of the aqueduct with the backfill. Because of the public excitement worked up by one of the local newspapers the Administration Board of the Greater Winnipeg Water District, to allay public feeling, appointed an independent board of consulting engineers, consisting of R. S. Lea, consulting engineer, of Montreal; J. G. Sullivan, chief engineer of western lines of the Canadian Pacific Railway, and Col. H. N. Ruttan, ex-city engineer of Winnipeg. Their instructions were as follows:

Order Investigation

"That in order to determine the questions at issue as to the defects which have developed in some portions of the aqueduct now constructed and to ascertain as far as possible the means to be adopted to prevent a recurrence of defects in the work yet to be constructed, this board instructs the commissioners to procure a report from Col. H. N. Ruttan of Winnipeg, J. G. Sullivan of Winnipeg and R. S. Lea of Montreal for submission to the administration board, specifically on the report of the consulting engineer and chief engineer submitted to the board Feb. 18, 1916, such report to include all matters now in question and such other matters as may be submitted for their opinion."

This board last month submitted an interim report, which recommended that construction proceed on the following basis:

1. That on foundation of boulder clay, hardpan and gravel the standard section be used with the addition of extensions of the base on both sides.

2. That in foundations less firm than the above the section showing distributed load on the full width of the aqueduct be used. (The projection of the foundation shown in this section may be changed to 8 in. if the cost of excavation can thereby be reduced.)

3. That the circular section as designed and for laying which preparations are being made be proceeded with.

It is understood, the report stated, that these recommendations may be modified when the results of the investigations and experiments now being made are available and indicate that less substantial construction may be safely adopted.

New York Engineers Leave for Duty on Mexican Border

As a result of the call to arms many engineers of New York City will leave with their regiments for Camp Whitman at Beekman, N. Y. Merritt Smith, chief engineer of the department of water supply, gas and electricity, is a lieutenant colonel and will depart immediately with thirty-eight men from that department. The J. G. White Corporation will have its force diminished by five employees who are members of the National Guard.

From the Stone & Webster company's New York office two men will leave for camp, while nearly two dozen will go from the Boston office. The number of engineers of the Public Service Commission who have been called to military duty is not yet known. Eight members of the Board of Water Supply and seven from the department of plant and structures, headed by Col. H. D. Baldwin, will depart immediately.

Holbrook, Cabot & Rollins will lose only one man, while the Interborough Rapid Transit and the New York Railways will send nearly 200 to Camp Whitman. Thirty-eight Union Railway men will join their troops. Sufficient time has not yet elapsed to ascertain the exact number of engineers who will mobilize.

City employees will receive their regular pay in addition to that from the government. Other guardsmen will receive part pay from their respective employers.

Mobilization Order Takes Active Engineers from Chicago

The call to arms has taken many engineers in active practice from positions in Chicago. L. S. Marsh, engineering chemist in charge of the testing division of the city engineer's department, and H. S. Baker, first assistant city engineer, are captain and first lieutenant respectively of the only engineer company in Illinois which recruited twenty additional men following the preparedness parade. Other members of the city engineering department who have been called out are C. C. Saner, W. J. Mauer, W. H. Dean, H. I. Leviton, W. G. Heckathorn, Jay Rossiter, D. D. Goldberg and Max Kushlan.

Ernest McCullough, consulting engineer, is a lieutenant in Battery B. Harold and Kenneth Lockett, Robert A. Allton, H. S. Pardee and W. G. Stromquist are members of the same battery.

Other civil-engineer members of the engineer company are D. D. Guilfoil, W. E. Ramsey, K. R. Wagner, J. T. Child, J. A. Cook, W. E. Lucas, J. B. Schaub, Charles P. Stivers, D. A. Tomlinson, M. D. Kolyn, P. F. Auer, R. T. Reilly, N. M. Stineman, J. F. Ward and O. C. Schaefer.

The city council has under consideration the payment of salaries to its employees, and most of the firms are making such arrangements as will not embarrass men who have families or relatives depending on them. "This is one of the most important things to be cared for by those who are patriotic and do not go," said Lieutenant Baker.

Information received Thursday of this week states that Chicago is forming additional engineer companies. A definite movement is on foot in that city to organize two more companies of engineers which will be offered to the state and federal government. Applications for enrollment in these volunteer military engineer organizations are being received by Capt. H. B. Sauerman, Monadnock Building, Chicago.

Civil Engineers Will Meet at Pittsburgh June 27 to 30

Result of Vote on Removing Society's Headquarters Will Be Announced at Forty-Eighth Annual Convention

The American Society of Civil Engineers will hold its forty-eighth annual convention—a four-day meeting—at the William Penn Hotel, Pittsburgh, June 27 to 30. The meeting will be opened at 10 a. m., June 27, with addresses by Mayor Armstrong of Pittsburgh and Dr. John A. Brashear, past president of the American Society of Mechanical Engineers.

The result of the vote on the proposed change of headquarters of the society will be announced in the afternoon of the first day, and committee reports will be presented at that time. A dance will be held that evening in the hotel ballroom.

Wednesday will be devoted to an excursion down the Monongahela River on the steamer Sunshine. The visitors will have an opportunity to see many of Pittsburgh's manufacturing plants from the deck. Nothing has been planned for that evening.

Will Visit Industrial Plants

Arrangements have been made to visit about a dozen industrial plants Thursday, including trips to the works of the following companies: American Bridge Company, Armstrong Cork Company, Duquesne Steel Works, McClintic-Marshall Company, National Tube Company, and Universal Portland Cement Company. A trip will also be made to the Pittsburgh filtration plant. Thursday evening will be devoted to the president's ball and reception.

A golf tournament is scheduled for Friday, in which four prizes will be awarded. The contest will take place at the Oakmont Country Club. For those who do not play golf an automobile trip has been planned. A smoker that evening, given by the Engineers' Society of Western Pennsylvania, will terminate the meeting.

Air-Line Blowout on New York City Subway Work

A 6-in. line supplying compressed air at 90 lb. pressure for the drills on Section 2 of Routes 4 and 36 of the new Broadway subway in New York City blew out in three or four places on the morning of June 21. The line was buried under the west side of Sixth Avenue, well outside the limits of the decked cut and adjacent to the shaft plant in Herald Square below Thirty-fourth Street. The blowout loosened a large gas main, caused some noise and drew a crowd, which required the calling out of police reserves. No one was injured, there was no gas explosion and the damage was insignificant, being confined to the air line itself, small sections of the pavement on Sixth Avenue and the gas line mentioned. The accident was featured in afternoon editions as a "gas explosion" largely because it occurred in the crowded shopping district and because it happened on the same section that the rock slide of Sept. 25, 1915, occurred.

Motor-Truck Fender Ordinance Passed in Chicago

After Jan. 1, 1917, all motor trucks in Chicago must be equipped with fenders, an ordinance to that effect having been passed by the city council June 19.

Richard Cockburn Maclaurin

A Sketch of the Man Whose Ability, Energy and Zeal Have Made Possible the New Technology

Last week's issue of the Engineering Record contained a brief account of the impressive ceremonies marking the dedication of the new buildings of the Massachusetts Institute of Technology. Space limitations, however, forbade printing a sketch of the man—the president, Dr. Maclaurin—who has made the new "Technology" possible. Since taking the presidency less than six years ago he has not only done a great work of organization with faculty and alumni, and instituted new courses that the school might be abreast of the times, but has secured gifts of more than $10,000,000. The new plant in Cambridge represents an expenditure of $7,000,000, while at the dinner closing last week's festivities, gifts exceeding $3,100,000 were announced—$2,600,000 of it for endowment.

Richard Cockburn Maclaurin was born in Edinburgh in 1870. His early boyhood was spent in New Zealand, whence he returned to England to complete his preliminary education in English schools. In 1892 he entered the University of Cambridge, where he held a foundation scholarship in St. John's College. He took two degrees at Cambridge—bachelor of arts and master of arts, the thesis work for the latter being advanced mathematics. He received the Smith prize for excellence in mathematics, and upon graduation was elected fellow of St. John's College.

Dr. Maclaurin next spent ten months in the United States and Canada (1896-97) studying and visiting educational institutions and spending much time at McGill, Toronto and Leland Stanford universities. Returning to England he re-entered Cambridge, this time to study law, and was awarded the McMahon law studentship, the most highly valued of its kind in the university.

Appointed Professor of Mathematics

In 1898 Dr. Maclaurin was appointed professor of mathematics in the University of New Zealand, became a trustee of the university and took an active part in the organization of technical education in the colony. In 1903 he became dean of the faculty of law in the university, which office he held for four years. In 1907 he was invited to take the chair of mathematical physics at Columbia University, New York, and a year later was made head of the department of physics.

In 1898 the degree of doctor of science was conferred upon Professor Maclaurin by Cambridge University for his researches in pure science, and again in 1904 he was honored with the degree of doctor of laws by the same university for his achievements in the study of law.

Nov. 23, 1908, Dr. Maclaurin was appointed by the corporation of the Massachusetts Institute of Technology to be president. Without a head since the resignation of Dr. Pritchett, the institute had been unable to discuss important questions. One of these was the manifest impossibility of continuing its work in its present quarters if the full plans of its founders were to be carried out. There were financial problems of consequence, also.

Dr. Maclaurin unified the corporation and the faculty, and with his personality gained the confidence of the alumni and bound them as never before into a great force working for the benefit of their alma mater. One of the first fruits of this was the gift of T. Coleman du Pont of half a million toward the purchase of a new site, and that at Cambridge was chosen. Here there came an almost unnoticed bit of patriotism for the institute, for when the payment was really made for the land the corporation without any fuss or advertisement made up the necessary quarter million and paid down the cash. Following up the idea that it was proper to ask the Commonwealth of Massachusetts to continue its aid to the school, President Maclaurin and the alumni took up this matter, and the signing of the bill by Governor Foss following the du Pont gift came as an insurance of the future.

Secured Many Large Endowments

When the site question was settled the alumni began their quest of the million, which they already have half assured, and in the midst of the planning the enthusiasm was heightened enormously by the great gift of the two and one-half millions of "Mr. Smith." Other gifts followed in sufficient measure to warrant the beginning of construction. As Dr. Maclaurin himself has said, the whole plant is beyond the present means of the school, and gifts of the future must come to realize the full fruition of the great institute. What is done now will be done in the best manner and will include the essentials, while the splendid student quarters which are to be disposed about the Walker Memorial remain for the future. The planning of them will be undertaken as soon as the educational buildings are developed, and they will be of such nature that they will present their appeal as a most important adjunct to the splendid educational plant.

It must not for a moment be imagined that while the financial and construction portions of the institute's story have been so much in the public eye that there has been any neglect of the educational features. New courses and new laboratories testify that the institute has kept abreast of the times.

In all these varied functions Dr. Maclaurin has showed himself to be master of the situation, and by his skill, knowledge and his personality is smoothing away the difficulties that have attended the maintenance of the institute on the broad foundations laid for it by its projector and first president, William Barton Rogers.

To Build 18-Mile Cutoff in Utah

The Lincoln Highway Association now has funds to build an 18-mile cutoff across the Great Salt Lake Desert in Utah. The association is conferring with A. N. Johnson, consulting highway engineer of the Portland Cement Association, in regard to engineering problems involved in employing concrete construction for that portion of the Lincoln Highway.

University Dedicates Monument to Pioneer Railway Men

The twenty-fifth anniversary of the College of Mechanical and Electrical Engineering at the University of Kentucky was recently celebrated at Lexington. The feature of the ceremonies was the dedication of a memorial to the first railroad built in Kentucky. The monument, described on page 655 of the Engineering Record for May 13, is shown in the illustration, the caption for which is taken from the tablet set in the foundation. Among the addresses delivered on the occasion was that by D. F. Crawford, general superintendent of motive power, Pennsylvania Lines West of Pittsburgh, and the dedication speech by Samuel M. Wilson of Lexington.

THIS RESTORATION OF A PORTION OF THE ORIGINAL TRACK OF THE LEXINGTON & OHIO RAILROAD (NOW LOUISVILLE & NASHVILLE) LAID AT LEXINGTON IN 1831 IS DEDICATED TO THOSE MEN OF FORETHOUGHT AND COURAGE WHO WERE PIONEERS IN RAILROAD DEVELOPMENT IN AMERICA.

Attack Jersey's Water Policy

The Shark River Water Company has brought suit against the State of New Jersey and the water-supply commission of that state, attacking the constitutionality of the act of 1907 creating the commission. The recent act creating the North and South Jersey district commissions is also being attacked. The litigation is the outcome of the refusal of the water-supply commission to grant the Shark River company permission to divert water from that stream.

Lincoln Park, Chicago, Grants Motorbus Franchise

After three years' importuning by citizens and by private companies the Lincoln Park Board, Chicago, has granted a fifteen-year franchise to the Chicago Motor Bus Company to operate a line of passenger motorbuses through the Lincoln Driveway, Sheridan Road and the park roads. The fare is to be 10 cents. The compensation to the park board will be a percentage of receipts, but not less than $10,000 annually for the first five years, $11,000 for the next five years and $12,000 for the third five years.

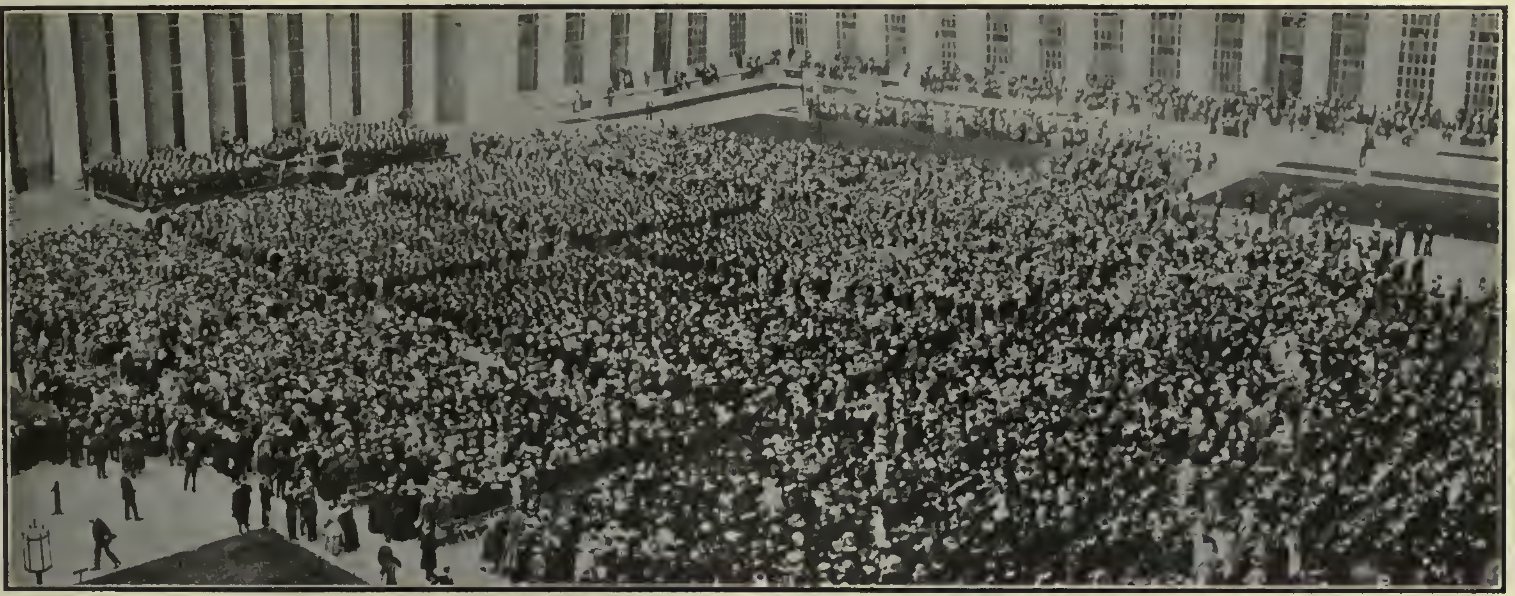
What Engineers and Contractors Are Doing

Edgar K. Ruth, assistant engineer in the bridges and viaducts department of Cincinnati, Ohio, has submitted his resignation to take effect Sept. 1, 1916, at which time he will become assistant professor of civil engineering at the University of Cincinnati. Mr. Ruth was graduated from Rensselaer Polytechnic Institute in 1909. His summers between college terms were spent in engineering work in the West. After graduation he entered the employ of the New York State Water Supply Commission. He later became connected with the engineering department of the New York Central & Hudson River Railroad, following which he entered the employ of the city of Cincinnati.

B. E. Reed, of the J. B. McCrary Company, engineers, of Atlanta, Ga., has made his headquarters at Tavares, Fla., where he will superintend the completion of the work his company is doing in the Lake County division.

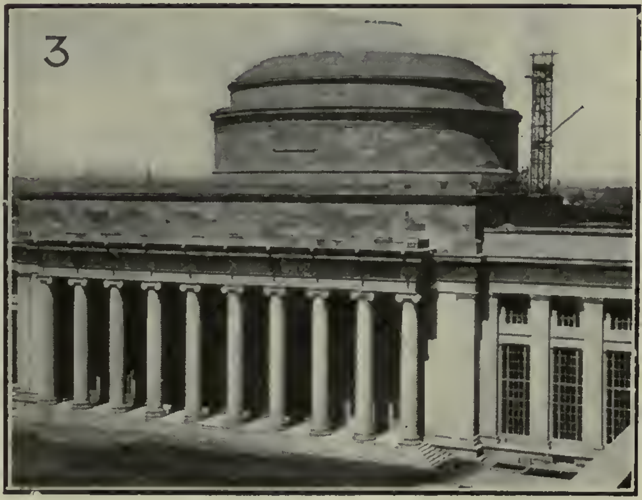
Albert L. Upham has left the employ of the Cuban Portland Cement Company, at Mariel, Cuba, to become associated with Dunn & McCarthy, contractors, with headquarters at Indianapolis. The firm was recently awarded a contract for the construction of a 42-mile cut-off between Terre Haute and Indianapolis for the Vandalia Railroad.

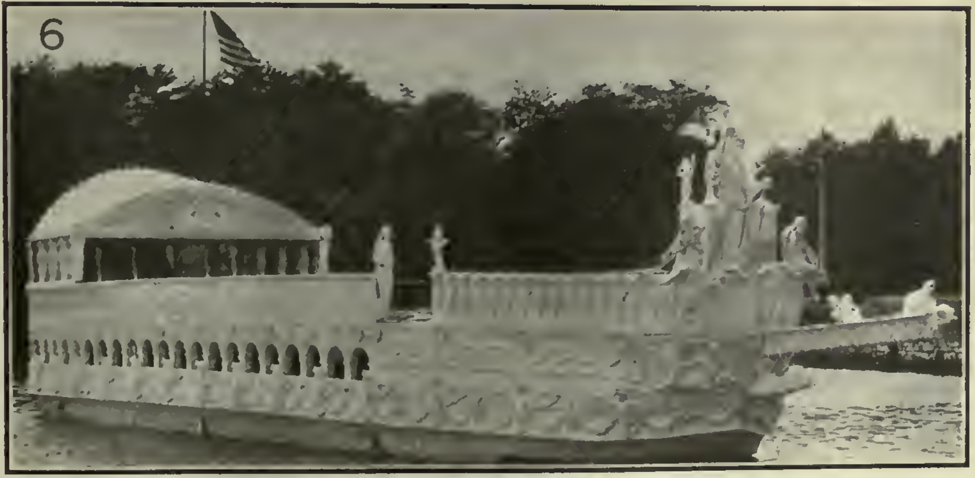
Walter E. Winn, chief engineer of the Winn Engineering Company, Helena, Ark., has been selected to make surveys, plans and cost estimates for a proposed levee and drainage district in Phillips County embracing an

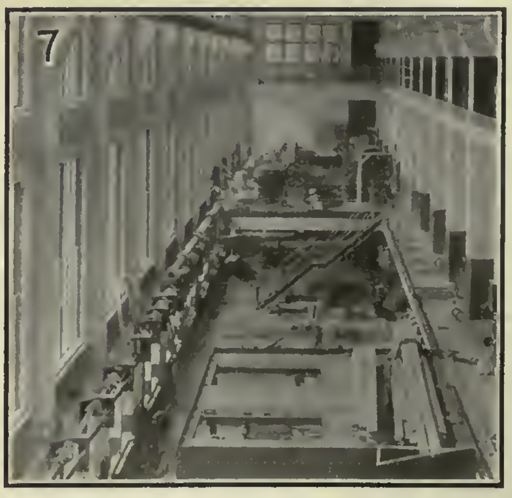


Tech Dedicates New Buildings

1—DEDICATORY EXERCISES IN THE GREAT COURT, MASSACHUSETTS INSTITUTE OF TECHNOLOGY. 2—EXCELLENT ILLUMINATION CHARACTERISTIC OF NEW BUILDINGS. 3—GREAT DOME AND CENTRAL PORTICO. 4—LEFT HAND, RICHARD C. MACLAURIN, PRESIDENT OF THE INSTITUTE; RIGHT HAND, CHARLES A. STONE, PRESIDENT OF THE ALUMNI ASSOCIATION, AND ALSO HEAD OF STONE & WEBSTER AND THE AMERICAN INTERNATIONAL CORPORATION. 5—COVER OF BANQUET MENU: PROMETHEUS DISCLOSING THE NEW TECH. 6—THE BUCENTAUR, STATE BARGE IN WHICH THE RECORDS WERE TRANSFERRED. 7—HYDRAULIC LABORATORY.







are of 125,000 acres. The division known as the Indian Bay Levee and Drainage District is north of the White River and west of the Mississippi, near their confluence.

ARVIL M. BINHACK, a student at the Rose Polytechnic Institute, is now employed by the maintenance-of-way department of the Chicago & Eastern Illinois Railroad at Salem. Ill.

B. M. LAUGHEAD, formerly engineer for the Robert Grace Contracting Company, has been made locating engineer for the Pennsylvania Railroad. Mr. Laughead will survey a line from Wheeling, W. Va., to Mariana, Pa., by way of Wheeling, Short and Tenmile creeks.

H. B. BREWSTER, engineer for H. S. Kerbaugh, engineer and contractor, of Buffalo, will have charge of the work his company will do under contract 23-A on the New York State Barge Canal near Rochester, N. Y.

PHILIP J. KEALY, civil engineer, whose appointment as head of the Kansas City Railways Company was noted in the Engineering Record for Feb. 12, 1916, has left his lucrative position to go to Mexico with the Third Regiment of the Missouri National Guard at regular army pay.

H. M. TRIPP, civil engineer and contractor, of Whitewater, Wis., has been made assistant field engineer for the Interstate Commerce Commission, Division of Valuation, effective July 1.

PROF. A. B. MCDANIEL, assistant professor of civil engineering at the University of Illinois, in charge of instruction in masonry construction and the theory and design of reinforced concrete, has resigned. In the fall he will become assistant professor of civil engineering at Union College, Schenectady, N. Y. Professor McDaniel is the author of a book on "Excavating Machinery" and has contributed a number of articles to the engineering press.

HAROLD A. RANDS, water commissioner of Oregon City, Ore., has been reelected. Mr. Rands was graduated from Cornell University in 1901, in which year he became connected with the government in charge of a survey in Idaho. In 1904 he was made city engineer of Oregon City, but re-entered the government service in 1905. He became connected with the Columbia Valley Railroad in 1906 and in 1907 made a hydraulic survey for the Portland (Ore.) Railway Light & Power Company. He later practised general engineering at Oregon City and was made engineer for the Portland Railway Light & Power Company in 1909. Mr. Rands has just completed plans for a new concrete reservoir for Oregon City.

GEORGE D. BALL, city engineer of Puyallup, Wash., has been made fire inspector. In addition to his duties as city engineer Mr. Ball must inspect all electrical wiring in Puyallup.

C. A. REYNOLDS, chairman of the Washington Public Service Commission, at Olympia, Wash., has resigned, effective July 1. Mr. Reynolds will resume the practice of law in Seattle.' He was appointed to the commission about two years ago.

S. L. STRICKLER, civil engineer, of Columbia, Pa., has become associated with Farley Gannett, consulting engineer, of Harrisburg, Pa. Mr. Strickler began engineering work in 1905. He was for several years connected with the engineering department of the Pennsylvania Railroad and later with the Wabash Railroad. Until recently he was assistant engineer for F. H. Shaw, consulting engineer, of Lancaster, Pa., for two years and borough engineer for Columbia, Pa., for a similar period. Mr. Strickler will be resident engineer on the York Haven Water & Power Company dam across the Susquehanna River, of which work Mr. Gannett has charge.

THEODORE L. WELLES, JR., formerly connected with the Pennsylvania State Health Department, has become associated with Farley Gannett, consulting engineer, of Harrisburg, Pa. Mr. Welles was graduated from Cornell University in 1913. He served for some time with the Spring Brook Water Company of Wilkes-Barre, Pa., on the Pike Creek dam and reservoir. He was later connected with the valuation department of the Atlantic Coast Line Railroad. For two years he was with the Pennsylvania State Health Department engaged on operation of sewage disposal and water filtration plants.

WILLIS WHITED, engineer of bridges of the highway department of Pennsylvania, has been appointed to co-operate with an engineer of the New Jersey highway department in determining the value of sixteen toll bridges spanning the Delaware River. Commissions from both states will consider means to abolish these toll bridges as soon as the report of the engineers is made.

CHARLES R. BACON, former chief of the bureau of shell fisheries of Trenton, N. J., has been made secretary of the Delaware River Bridge and Tunnel Commission.

ROBERT L. DEVEREAUX, of Cresson, Pa., who has been superintendent of highways in Cambria and Blair counties since 1912, has resigned to enter private business.

A. J. FASENMYER has just been made road superintendent of Blair and Cambria counties, Pennsylvania, succeeding R. L. Devereaux, resigned. Mr. Fasenmyer has been with the state highway department for five years. He is a graduate of Lehigh University. Prior to coming to the state highway department five years ago he had five years' experience in railroad work, most of which was gained in the employ of the Lehigh Valley Railroad.

FRANCIS C. SHENEHON, for the past seven years dean of the College of Engineering and professor of civil engineering at the University of Minnesota, has tendered his resignation to the Board of Regents. Mr. Shenehon will devote his entire time to his practice as consulting hydraulic engineer.

W. P. WOOD has been reappointed city engineer of Sumner, Wash. Mr. Wood has been actively engaged in engineering work in the West since 1883, in which year he located and constructed a 2-mile gravity water system for Sumner. Among Mr. Wood's more recent undertakings are the location of 110 miles of main lines and terminals for the Central Idaho Development Company and the electrical development of some 20,000 hp.

Obituary Notes

SIR HAY FREDERICK DONALDSON, chief technical adviser to the British Ministry of Munitions and until a year ago chief superintendent of the Royal ordnance factories, was among those who perished June 6 with Lord Kitchener on H. M. S. Hampshire. Sir Frederick was educated at Eton and Trinity College, after which he attended Edinburgh University. From 1875 to 1877 he was an apprentice at the London & North Western Railway works at Creive. He then spent two years at the Zurich Technical School, after which he was made engineer in charge of the construction of the Burnley street railways. He soon rose to an executive engineering position on the West of India Portuguese Railway and Harbor work, in charge of the forces at Goa. He left India in 1887 to become engineer on the Manchester Ship Canal. In 1891 he engaged in private practice and in 1893 was made chief engineer of the London and India Docks Joint Committee. Four years later he was appointed deputy director-general of ordnance factories. He was made chief superintendent of the Royal ordnance factories in 1903, from which position he resigned last year. He was then made chief technical adviser to the Ministry of Munitions. Sir Frederick took a most active part in engineering affairs. He was a past president of the Institute of Mechanical Engineers, a member of the Engineering Standards Committee and of the Institution of Civil Engineers. His recent work at the Woolwich arsenal involved vast responsibilities and taxed his health to such an extent that he was forced to resign as chief superintendent of the Royal ordnance factories after many years of distinguished service.

CHARLES HOPKINS CARTLIDGE, bridge engineer of the Chicago, Burlington & Quincy Railroad, died June 14 at his home in Hinsdale, Ill., after a short attack of pneumonia. He was born in Hannibal, Mo., April 29, 1869. His engineering training was obtained in the field, as he left high school in 1886 to start his engineering career as rodman with the Kansas City, Memphis & Birmingham Railroad. Two years later he became county and land surveyor of Buchanan County, Mo., which position he held from 1888 to 1890, when he entered the service of the Chicago, Burlington & Quincy Railroad as draftsman in the bridge department. From that time until his death he was connected with that department. In 1902 he was made bridge engineer and to him is due in large measure the rapidly increasing and, up to that period, daring use of reinforced concrete, both in monolithic construction and in immense unit slabs for railroad structures. He was a member of the American Society of Civil Engineers, American Society for Testing Materials, and American Railway Engineering Association. He was also a member and vice-president of the Western Society of Engineers and a member of the Chicago Engineers' Club.

Railway Bridge Engineer Dies

Photo by Matzene, Chicago

CHARLES HOPKINS CARTLIDGE

GEORGE GILMOUR, head of the engineering and inspection department of the Travelers' Insurance Company, died recently at his home in Brooklyn, at the age of 51. He was considered an authority on accident prevention and industrial safety.

S. H. REYNOLDS, chairman of the Greater Winnipeg Water District Commission, died suddenly in Chicago, June 16, at the age of 57. His appointment to the commission was made in October, 1913. He was at one time assistant city engineer of Winnipeg and was previously engaged in mining work.

CONTRACTING NEWS

Of Special Interest to Engineers, Contractors, Builders and Manufacturers of Engineering and Building Supplies

IN REGARD to the general economic condition in which this country enters the new year it is instructive to note that estimates of disbursements that will be made the first week in January in dividends and payments to bondholders are placed at $263,000,000, about 8 per cent greater than in 1915. Of this increase about 35 per cent goes to bondholders and 65 per cent to shareholders. Nearly 65 per cent of the entire gain is in dividends on industrial securities, while the gain in dividends paid by banks, railroads and street railways is slight. This is a good indication that the money made during 1915 in this country, which has been so large in amount as to enable us to buy back during the year American securities costing $1,200,000,000 from Europe on a rising market, has gone first to the manufacturer and the farmer. It is from these classes and from the governmental bodies, whose borrowing power has been increased by this wealth, that the bulk of the money for immediate new construction must come. The first need of the railroads has been adequate equipment. The large buying that has been going on in this line will possibly account for not a little of the increased earnings railroads have made so far; but if the revenue situation continues to improve the day of railroad construction work in fair volume will not be far distant.

With prospects good for construction activity, it is likely to prove a serious handicap that immigration has fallen off 75 per cent as compared with the ten-year average, and more than 93 per cent as compared with the fiscal year ending June, 1914. In addition, many laborers have undoubtedly returned to Europe to fight. As the native American has never taken kindly to the wheelbarrow and shovel, and as the steel and other industries are employing thousands of laborers who were idle last spring, a serious labor shortage may develop. New York City a short time ago was unable to raise enough men to shovel a 3-in. fall of snow from its streets.

It is said that the United States Steel Corporation is sold up to October, 1916, on steel rails. Structural material, according to the *Iron Age,* is now $1.90 to $2 per 100 lb., Pittsburgh, at three months' delivery, and stock delivery is quoted at $2.25. Steel bars are $2 on the same basis, and so hard to get that a thriving business has developed in making iron bars for reinforcing. These sell at $1.90, Pittsburgh. Plates are very strong at $2.25, Pittsburgh, because of heavy shipbuilding operations, and a large order for shipbuilding steel has recently been placed at $1.90 for third quarter delivery. Cast-iron pipe, class B, 6 in. and heavier, is now $28 per ton in carload lots, tidewater. Wrought-iron pipe is unchanged from last month's quotations, activity in this field depending on domestic buying for oil pipe-lines and waterworks.

Portland cement is still quoted on a base of $1.05, mill, Lehigh district, to dealers without containers. More kilns have been blown in in the Nazareth district, orders continue to come in at a high rate for the late season, and the market is very firm.

Hudson common brick, wholesale at dock, New York, rose during the month from $6.75 to $8.50 per thousand. Further immediate rises are not predicted, as dealers are said to have practically finished stocking for the winter.

A good demand is keeping New York gravel prices firm at 85 cents per cu. yd., 500 cu. yd. lots, for 1½ in.; 80 cents for ¾ in. and 95 cents for gravel meeting Public Service Commission specifications. Building sand is quoted at 45 cents per cu. yd., and is practically the only building material for which sufficient demand has not developed to raise the price. Crushed trap rock has advanced 10 cents to $1 per cu. yd. for 1½ in. and $1.10 for 1¾ in.

Lead is now quiet, but firm, having advanced during the month to $5.40 per 100 lb., New York, and $5.325, East St. Louis.

Lumber orders fell off at the Eastern and Southern mills in the last week reported, due to the holidays. Shipments continued to exceed production, however, and the volume of orders now on hand at 160 of these mills will keep them busy through the middle of February. Heavy orders are expected to resume with the new year, and the recent price advances are firmly maintained. Values, however, have not yet generally reached 1912-1913 levels. No. 1 hemlock, 4 x 4-in. to 8 x 8-in., is now $26 per 1000 ft., b.m., retail, at Chicago yards, an advance of $2. No. 1 yellow pine 2-in. plank up to 16-ft., 4 to 14 in. wide, are quoted at $27 to $30.

Buildings

The letting of large building contracts was very active last week for this time of the year. At the head of the list is a $1,379,000 contract for constructing the government heating and power plant, awarded at Washington, D. C. Contracts awarded for erecting a high-school building at Belmont, Mass., total $156,000. Two other public-school buildings contracted for, at Philadelphia and at Marion, Ind., will cost $292,000 and $143,700 respectively. Building contracts awarded by the Board of Regents of the University of California at Berkeley total $271,000, and contracts amounting to $300,000 have been awarded for building a bank at Los Angeles. Bids are desired for building a $200,000 hotel at Ottumwa, Iowa, and for erecting a $150,000 smelting plant at Buena Vista, Col.

If the construction of new industrial plants measures up to the number of prospects reported lately, contractors will be very busy in this line next year. Among the items noted this week are a $1,000,000 chemical plant at Niagara Falls, a $100,000 addition to an arms plant at New Haven, Conn.; a large addition to a graphite plant at Niagara Falls, and a $900,000 cold-storage warehouse contemplated at Chicago. Quincy, Mass., has appropriated $220,000 for erecting school buildings. Plans have been filed in New York City for two apartment houses to cost $220,000 and $200,000 respectively. It is reported that a $200,000 freight terminal will be built at Cleveland. Architects have been selected for a $225,000 theater to be constructed at Indianapolis. A bank building to be erected at St. Louis will cost $125,000, and a twelve-story fireproof office building is proposed at Minneapolis. Plans for a $150,000 building are being prepared at Sioux City, Iowa. Buildings to cost $250,000 are being planned by the board of trustees of Hamline (Minn.) University.

Bridges and Roads

Small bridge work was quite active last week, and a number of highway bridges are coming up in the central states. The lowest bid received recently for the birdges at New Gretna, N. J., was $93,000, and the county bridge at Phoenixville, Pa., has been awarded at $103,000. Bids are desired at Wegdahl, Minn., for building a 440-ft. steel-and-concrete bridge. A contract is soon to be let for a $125,000 concrete bridge at Hamilton, Ohio. Fifteen reinforced-concrete bridges, the largest to be 300 ft. in length, are to be let about Jan. 20 at Anthony, Kan. Viaduct work costing $75,000 is being planned at Kansas City, a $75,000 concrete bridge is to be built at Modesto, Cal., and plans for a $135,000 steel-and-concrete bridge have been completed at Portland, Ore.

Only one large paving concrete contract was let last week, that at Belleville, Ill., amounting to $228,000, though quite a number of small contracts are reported from all over the country. Rockford, Ill., let a $45,000 contract, and one amounting to $53,000 was awarded at Washington Court House, Ohio. A section of state highway contracted for in California will cost $52,000. Five small highway contracts have been awarded by the state of Washington. Bids will be opened Jan. 24 by the same state for road work to cost $59,000.

A number of bond issues for highway work are being offered for sale in the South. A $400,000 issue has been approved at Bryan, Tex., and a $1,000,000 issue is to be voted on at Pensacola, Fla. Bryson City, N. C., has sold a $100,000 road bond issue, and bonds have been voted for building a highway from Tampa to Jacksonville in Florida. Paving work proposed at Portland, Ore., will cost $113,000, and a county road tax voted at the same place will raise $643,000 for road and bridge construction in 1916.

Waterworks and Sewers

New Orleans has let a contract for water and sewer extensions which will cost $100,000. A contract has been awarded for laying the water main across Galveston Bay, on which bids were opened recently. Two sewer contracts awarded at Houston, Tex., will amount to $88,000. Bids are desired on sewer work at St. Louis and at Boston.

Prospective waterworks and sewer construction is not up to other fields in volume or in size of individual projects. However, small towns scattered all over the country are preparing for construction of this sort, and small bond issues for such purposes continue to be voted and sold. Savannah, Ga., will appropriate $71,000 for waterworks improvements. It is reported that the City Council at Los Angeles is in favor of building a filtration plant and also a new outfall sewer, which will cost together $1,300,000.

Miscellaneous

A contract for grading 65 miles of railroad has been awarded at Midland, Tex. The award of a $1,000,000 elevated railroad contract has been authorized in New York City, and bids are to be opened Jan. 14 for another section of the Eastern Parkway subway in Brooklyn. During 1916 the Public Service Commission for the First District of New York State will award eight more subway sections, one tunnel section under the East River and one elevated railroad section in Brooklyn requiring 50,000 tons of steel. The subway work will require approximately the same tonnage of steel in addition. The lowest bid received in New York City for the new Fifty-seventh Street pier was $129,000. Harbor work is active at Miami, Fla., where bids were opened last week on 1,650,000 cu. yd. of dredging and submarine rock excavation which will cost $470,000, and on a concrete dock to cost $57,000. Of the bonds voted to cover this work $450,000 have already been sold. A drainage project estimated to cost $350,000 has been planned at Birmingham, Mo. A company has been incorporated at Salt Lake City to construct a 5-mile drainage and electric railroad tunnel. Waterfront improvements voted at San Diego, Cal., will cost $118,000.

WATERWORKS

PROPOSED WORK.

Lewiston, N. Y.—State Conservation Commission at Albany has approved the $39,000 fire protection and water system project voted by the citizens. Contract will soon be let by the Village Trustees for the construction of same and bonds will be sold soon.

Bridgeton, N. J.—Plans prepared for two reservoirs, which it is proposed constructing at a cost of $50,000. Address Water Commissioner.

Arlington (P. O. Baltimore), Md.—The examiners appointed for the proposed sewerage system for Arlington and vicinity have submitted a report to the County Commissioners at Baltimore, estimating the cost at $142,350 for the system, with $33,972 additional for Jones Falls disposal plant, and $5,856 for Mount Hope disposal plant; total, $182,178.

Savannah, Ga.—Council has agreed to appropriate $71,000 for the rehabilitation of the water works.

Okeechobee, Fla.—Plans being prepared by Southern Utilities Company, Jacksonville, for installation of an electric light plant, water works and sewer system to cost $50,000. Election to be held on question of issuing bonds for said purpose.

Florence, Ala.—City has sold $210,000 water works bonds.

Galesburg, Ill.—All bids opened Dec. 20 for constructing a tubular deep well rejected. New bids to be asked in the near future. W. T. Cantelli, City Clerk.

Waukegan, Ill.—Contract will be let in February or March for laying 6180 ft. 16-in. c. i. pipe, Class C, six 16-in. valves and five fire hydrants, to cost $16,260. M. J. Douthitt, Engineer, City Hall. A. L. Rogers, Secy, Board Local Improvements.

Ft. Madison, Iowa.—Citizens voted to grant a 25-year franchise to the Citizens Water Works Company, of which Peter Kern, F. C. Schaper and others of Ft. Madison are the incorporators.

St. Paul, Minn.—Contract soon to be let by Aug. Hohenstein, Purchasing Agent, for furnishing .City Water Department pig lead and lead pipe for service connections during the season of 1916. Probably 50 to 100 tons of each will be required.

Chanute, Kan.—State Public Utilities Commission has approved plans for extending the mains of the municipal water plant at a cost of $20,000. Address City Commissioners.

Dallas, Tex.—Sewer bonds amounting to $250,000, it is reported, will be sold Jan. 17 by City Commissioners.

Fort Worth, Tex.—The Mayor's estimate includes: Conduit completion, $112,000; filter beds, $90,000; additional levee for Holly plan, $16,500; Holly pump repairs, $25,000; 12-in. North Side connection, $25,000; dual plant completion, $40,000.

Goldthwaite, Tex.—Bonds for $6,000 for water works will be sold Jan. 8 by L. E. Miller, City Secretary, advertised in Engineering Record.

Seattle, Wash.—A. H. Dimock, City Engineer, has filed plans and specifications with the Board Public Works for water main in Gross and Doris Streets, costing $10,000.

Baker, Ore.—A gravity system of water works is contemplated. Bonds will be sold Jan. 17 by James Cunning, City Clerk. L. R. Stockman, Engineer, Baker.

Los Angeles, Cal.—Council reported in favor of constructing a filtration plant; also considering constructing a new outfall sewer; total cost $1,300,000. Homer Hamlin, City Engineer.

Election to be held Jan. 18 to vote $1,020,000 bonds for purchase of plant of the Union Hollywood Water Company and to make extensions and improve distributing system.

Monteca, Cal.—Reservoir bonds amounting to $50,000 have been sold. Address Directors South San Joaquin Irrigation District, Manteca.

Whittier, Cal.—County has granted franchise to Whittier Water Company to construct 7800 ft. of water pipe along Puente Mills, Norwalk and Workman Mill Roads.

Pasadena, Cal.—Samuel Morris, Chief Engineer Water Department, is preparing plans for a $30,000 concrete reservoir to be built by force account.

San Francisco, Cal.—Hetch Hetchy $2,000,000 bonds will be sold Jan. 17, by Clerk Board Public Works.

Miami, Ariz.—Citizens Dec. 14 voted $80,000 water works bonds and $40,000 light bonds. J. H. Davis, Jr., Town Clerk.

Kamas, Utah.—Contract will be let in January for constructing water works for which citizens Dec. 14 voted $15,000 bonds. Address City Clerk.

McCammon, Idaho.—Citizens Dec. 21 voted $22,000 bonds for water works. Wilson Cotton, McCammon, Engineer; E. W. Rice, Town Clerk.

BIDS DESIRED.

Opelousas, La.—Until Jan. 18 by Mayor and Board of Aldermen for reconstruction of the building of the electric light and water works plant, to be brick with steel truss roof and standing seam galvanized corrugated iron covering, and furnishing one 150 hp. crude oil engine direct connected to 100 kva. alternator, one generator panel, one automatic voltage regulator, three series incandescent regulators and transformers, 40 electric meters and 200 water meters. T. G. Chachere, Archt., Opelousas. A. C. Jones, Supt., Opelousas.

Kenosha, Wis.—Until Jan. 29 by Board Water Commissioners for furnishing material and constructing water works pumping station and purification plant, advertised in Engineering Record.

Oshkosh, Wis.—Until Jan. 31 by Board Public Works for constructing a filtration structure at Municipal Pumping Station, advertised in Engineering Record.

Ridgefield, Wash.—Until Jan. 4, for furnishing material and constructing a 200,000-gal. reservoir, pumping main, distributing main, etc., for municipal water system. Probable cost $10,000. Engineers, Gilbert & Hall, Engrs., Couch Building, Portland.

Montreal, Que.—Until Jan. 4, by Board of Commissioners (L. N. Senecal, Secy.), for constructing at Papineau Avenue Pumping Station one electrically driven turbine or high lift centrifugal pump with electric motor complete.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Providence, R. I.—Following are unit figures of four lowest bids opened Dec. 23 by Water Supply Board for making wash and core borings in town of Scituate and city of Cranston (a) 4000 lin. ft. wash borings, (b) 2000 lin ft. core borings in rock, (c) 200 lin. ft. casing left in place, (d) totals: Sprague & Henwood, Inc., Scranton, Pa., (a) $1.40, (b) $2.40, (c) 30 cts., (d) $10,460; William Gates Stearns, Jamaica, N. Y., (a) 95 cts., (b) $4.25, (c) 40 cts., (d) $12,380; Alliance Well Co., Providence, R. I., (a) $1.55, (b) $3.30, (c) 15 cts., (d) $12,830; Edward Christman, Massillon, Ohio, (a) $1.13, (b) $4.45, (c) 24 cts., (d) $13,468. Frank E. Winsor, Chief Engineer.

★**Yonkers, N. Y.**—Contract awarded by Board Contract & Supply to J. E. Fox & Company, 253 Broadway, New York, for furnishing to Water Bureau pipe at $28.40 per ton, requiring about 1000 lengths of 8-in. pipe, weighing 640 lb. per length, and 500 lengths 6-in. pipe, 420 lb. per length.

★**Ventnor City, N. J.**—Contract for mechanical equipment for artesian water works (bids opened Nov. 22) awarded Dec. 20 to Joseph T. Suelgard & Company, Philadelphia, Pa., at $30,647. E. Steelman Royal, City Clerk.

★**Lakeland, Fla.**—Contracts for improvements at the water works awarded as follows: Pump, to Canton Hughes Pump Company, Wooster, Ohio; steam engine, Nordbury Engine Company, Milwaukee, Wis.; air compressor, Ingersoll-Rand Company, New York; laying of water mains, F. S. Perham, Jax, Fla.; valves and hydrants, R. D. Wood Company, Philadelphia, Pa.; Field water beater, Harrison Safety Boiler Works; surface condenser, C. H. Wheeler Mfg. Company, Philadelphia, Pa.; c. i. pipe and fittings, American Cast Iron Pipe Company, Birmingham, Ala. J. R. Boulware, Secretary Board Bond Trustees.

★**New Orleans, La.**—Following are four lowest bids opened Dec. 9 by Sewerage and Water Board for construction work—extension of sewers, water mains, drainage canals, house connections, etc., where ordered; total expenditure about $100,000: Etta Construction Company, Ltd., care of Board of Water and Sewerage Board, .02899 per cent (awarded contract); Standard Paving & Construction Company, Dallas, Tex., .0315 per cent; J. S. Codifer, .0345 per cent, and Nathan S. Stern, .0379 per cent.

★**Lorain, Ohio.**—Contract for three water tube boilers for water works pumping station (bids opened Dec. 15) awarded Babcock & Wilcox Company, Cleveland, at $12,345. To other bidders: Union Iron Works, Erie, Pa., $13,117, and D. Connelly Boiler Company, Cleveland, $14,746. Ira A. Richards, Director Public Service.

★**Minneapolis, Minn.**—Contract for furnishing Water Department with c. i. pipe for the year 1916, about 2156 tons of hub and spigot pipe 6 to 24 in., awarded American C. I. Pipe Company, 840 Plymouth Building, at $28.40 per ton f.o.b. cars Minneapolis; other bidder U. S. Cast Iron Pipe & Foundry Company at $28.50 per ton.

★**Galveston, Tex.**—Contract awarded by Board City Commissioners to Isaac Heffron, of Galveston, for laying underground the 30-in. c. i. water main across Galveston Bay, at about $60,000.

★**Houston, Tex.**—Contract for constructing power house and settling tanks for North Main Street Pumping Station awarded Charles S. Basham at $7,821.

★**Marshall, Okla.**—Contract for constructing a system of water works and electric lights awarded F. W. Kenney & Company, Oklahoma City, at about $20,000.

★**Portland, Ore.**—Following are bids opened Dec. 16 by city for 250 meters for the Water Bureau: Pittsburgh Meter Company, Pittsburgh, Pa., $5.70 each (awarded contract); Badger Meter Company, Milwaukee, Wis., $5.75; H. Worthington Company, 115 Broadway, New York, N. Y., $6, and Gamon Meter Company, Newark, N. Y., $6.25. J. R. Wood, Purchasing Agent.

SEWERAGE AND SEWAGE DISPOSAL

PROPOSED WORK.

North Tonawanda, N. Y.—Frank C. Tolles, District Engineer of the International Joint Waterways Commission, has submitted a report estimating the cost of constructing a sewage disposal plant for this city at $150,000.

Jersey City, N. J.—City Commissioners approved agreement for the new sewer for the Horseshoe section under Lackawanna R. R. property, to be 30-in. brick. This sewer is to take place of old Mill Creek ditch and box drain.

Manasquan, N. J.—Pugh & Hubbard, Witherspoon Building, Philadelphia, Pa., have been engaged by the Borough to prepare plans for outlet and ocean outfall sewer. Contract to be let in the spring.

Philadelphia, Pa.—George E. Dateman, the Director of Public Works for 1916, reported to have stated that a sewage disposal system, costing $25,000,000, will have to be constructed at once.

Baltimore, Md.—Bd. Awards, Dec. 15, rejected all bids opened for sanitary sewerage contracts. Work may be done by day labor.

Greensboro, N. C.—Citizens voted $75,000 bonds for constructing sewers.

Akron, Ohio.—Service Director Parker has recommended to Council constructing pumping station costing $8,000, to force West Hill sewage west of the divide into the city sewerage system.

Youngstown, Ohio.—State Board of Health is considering the plans for proposed Mill Creek district sewer. As soon as approved, contract will be let by Service Director.

Fairmont, Ind.—Preliminary plans to be prepared by W. J. Sherman Company, Toledo, Ohio, for complete sanitary sewer system, including sewage purification.

Rock Island, Ill.—City Commissioners are considering the construction of the southwest storm drain, estimated to cost about $80,000.

Neodesha, Kan.—Plans being prepared by Black & Veach, Kansas City, Mo., for the proposed sewer system. C. A. Case, City Engineer.

Pawnee City, Neb.—Reported an election will soon be held to vote bonds for constructing sewerage system.

Pierce, Neb.—Contract will be let about March 1 for constructing sewer system, for which citizens recently voted in favor. Cost $20,000. Bruce & Standeven, Engineers, Omaha; L. P. Towner, City Clerk.

Rooers, Ark.—No bids opened Dec. 20 by Bd. Sewers Improvement, District No. 3, for constructing the pipe line extension, sewage disposal plant, septic tank, etc. Date postponed indefinitely. M. A. Earl & Co., Engrs., Muskogee, Okla.

Hermosa Beach, Cal.—City Trustees considering constructing a sewage disposal plant.

Los Angeles, Cal.—See "Water Works."

Riverside, Cal.—City Council reported considering constructing a sewage disposal plant.

Moscow, Idaho.—Improvements contemplated in the new year include 25,000 sq. yd. paving, cost $65,000; 25,000 sq. yd. sidewalks, cost $2,500; cement bridges, cost $3,000; and 1400 ft. 24-in. vitr. sewer, cost $5,000. Harvey J. Smith, City Engr.

BIDS DESIRED.

Boston, Mass.—Until Jan. 5 by Commissioner of Public Works for constructing the Dorchester Brook Sewer through various streets in Dorchester District, Boston.

New Bedford, Mass.—Until Jan. 12, by Mayor and Board of Aldermen, and Committee on Roads, Bridges & Sewers, Municipal Building, New Bedford, for 10-in. centrifugal pumps and motors for intercepting sewer system.

Westfield, Mass.—Until Jan. 6 by Board of Selectmen, for sewer pipe, about 10,000 lin. ft., 6 to 24 in., advertised in Engineering Record. John L. Hyde, City Engineer.

Rochester, N. Y.—Until Jan. 5 by F. X. Pifer, Secy. Board Contract and Supply, for mechanical and electric equipment of the Brighton Sewage Disposal plant.

Baltimore, Md.—Until Jan. 12 by Board of Awards, care of Richard Gwinn, City Register, for purchase of air-dried sludge produced at sewage disposal plant at Back River, Baltimore, advertised in Engineering Record.

Cuyahoga Falls, Ohio.—Until Jan. 24, by W. F. Williston, Village Clk., for constructing sanitary sewers in West Broad, East Broad, Maple, High, Cooke and other streets. R. Winthrop Pratt, Consulting Engineer, Hippodrome Building, Cleveland, Ohio.

Middletown, Ohio.—Until Jan. 4, by City Commission (John Kunz, Clk.), for furnishing material and constructing sanitary sewers in Sycamore, Baltimore, Young, and other streets in all about 11,823 lin. ft. 6 to 20-in. sewer pipe, together with manholes, inlets, etc.

Elgin, Ill.—Until Jan. 24, by Board Administration (Frank D. Whipp, Fiscal Superv.), Springfield, for constructing sewage treating plant and intercepting sewers at Elgin State Hospital.

St. Louis, Mo.—Until Jan. 7, by city, for constructing North Baden public sewer, first section, and for constructing sewers in Glaise Creek Sewer Dist. No. 12. For further information address President Board Public Service, Room 325 New City Hall.

San Antonio, Tex.—Until Jan. 10, by Fred Fries, City Clk., for furnishing and installing pumps, motors, wiring, discharge pipe and other appurtenances necessary to complete the Concepcion Road sewer Pumping Plant.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Suffern, N. Y.—Following are unit prices of the lowest bidder, John W. Heller, South Orange, for constructing the sewerage works, bids opened Dec. 27: Sewers, $5,810; Imhoff tanks, $3,260; chlorine HO., $1,723; sludge beds $400; total, $11,193. Three other bidders: H. B. Sproul Company, Inc., Peekskill, N. Y., $14,236; Louis J. Sieling, 171 Madison Avenue, New York, $15,840, and Averill-Mathews, 917 Essex Building, Newark, N. J. $16,183. Clyde Potts, Engineer, 30 Church Street, New York.

★**Washington, D. C.**—Contract for constructing sewers (bids opened Dec. 9 by Commissioners D. C.) awarded Warren F. Brenizer Company, Washington.

★**Fort Sam .Houston, Tex.**—Contract awarded H. C. Gass, of San Antonio, for constructing a sewerage system and disposal plant at this post (bids opened Dec. 14), at $7,395. Capt. G. E. Stewart, Constructing Quartermaster.

★**Houston, Tex.** — Contracts awarded Horton & Horton, Houston, for constructing the Burnett Street storm sewer at about $70,500, and the Paschal Street storm sewer at about $17,600.

BRIDGES

PROPOSED WORK.

Holyoke, Mass.—Lewis E. Moore, Bridge Engineer, in a report submitted to Bd. Public Service, recommends the construction of a new bridge over canal on N. Bridge Street; also a new bridge on Cabot Street over second level canal.

New York, N. Y.—About $150,000 will be needed to remove rust from the cables of the Williamsburg Bridge. The Board of Estimates and Apportionment have appropriated $50,000 for immediate work and will appropriate the remainder as needed. Plans of the Bridge Department Engineer call for complete removal of steel coverings and fillings of the interstices between the wires of the cables with a protective mixture. Cables will then be covered with Swedish iron wire.

Yonkers, N. Y.—A six-arch concrete viaduct is to be constructed over Harlem River, railroad tracks, and Bronx Parkway Boulevard, to connect Vernon Avenue, Yonkers, with Broad Street, Mount Vernon; estimated cost $77,000. City of Mount Vernon to pay $31,800. Yonkers $14,070, Bronx Parkway Comn $3,230 of cost.

Mount Holly, N. J.—Plans being prepared for four bridges to be constructed in Burlington County. Contract will be let about March. James Logan, County Engineer, Mount Holly.

Miami, Fla.—Contract soon to be let by the city for constructing steel bridges over Miami River, one at Twelfth Street and one on Avenue D. The two bridges are to cost $150,000, and are to take the place of the present bridges at these streets. W. J. Kackley, City Engineer.

Louisville, Ky.—The bridge across the Ohio River between Louisville and Jeffersonville, Ind., owned by Pennsylvania Railroad Company, is a single track structure a mile in length crossing Ohio River at city of Louisville, consists of a draw span over the canal, a 370-ft. through span called the Kentucky Chute, and a 400-ft. through span for the Indiana Chute. The rest of the structure consists of deck Fink trusses of spans ranging from 149¾ ft. to 245 ft. It is proposed to renew this structure by a double-track bridge using the same masonry. Work is divided into five groups and it is proposed to reconstruct the five spans at the Indiana end of the bridge, comprising a length of about 790 ft. The renewal of the remaining portion of the structure will be done later.

Excello, Ohio.—The State Highway Commission at Columbus and County Commissioners at Hamilton contemplate constructing a bridge at Excello to cost $15,000.

Hamilton, O.—Contract about to be let by County Commissioners for constructing Columbia Bridge. To be concrete, 730 ft. long and cost $125,000.

Monroe, Mich.—Citizens voted $60,000 bonds for constructing two bridges east of city. A. H. A. Kutsche, City Engineer; Fred. M. Kressbach, City Clerk.

Chippewa Falls, Wis.—County Commissioners decided to construct a $75,000 steel bridge 750 ft. long and 20 ft. wide across Chippewa River near Chippewa Falls, and also a fill 1150 ft. long, from 15 to 35 ft. high, to cross the big pond created by Paint Creek Dam. Cost of work complete, $160,000.

Mankato, Minn.—Contract will be let last of January for the bridge to be constructed across Minnesota River at Main Street, to be reinforced concrete, contain five 90-ft. spans and cost $100,000. Donald D. Price, Engineer, 21 First National Bank Building, Lincoln, Neb.

Kansas City, Kan.—Plans to be prepared by L. R. Ash of Harrington, Howard & Ash, 1012 Baltimore Avenue, Kansas City, Mo., for the 700-ft. viaduct approach to the new high line bridge the County Commissioners will construct across Kaw River at Central Avenue. Cost of approach about $75,000.

Lowry, Mont.—Commissioners of Cascade and Teton Counties approved plans for constructing a bridge over Sun River near Lowry to be 281 ft. long with 21-ft. span. Chouteau county seat, Teton County.

Llano, Tex.—Attorney General has approved a bond issue of $34,000 for building bridges in Llano County.

Centralia, Wash.—Lewis County Comrs. at Chehalis having plans prepared for 210 ft. span bridge to be constructed over Cowlitz River; cost $10,000.

Randle, Wash.—County intends constructing a 210-ft. steel span bridge across Cowlitz River, about 9 miles east of Randle. J. D. Neville, County Engineer, Chehalis.

Seattle, Wash.—Plans nearing completion for steel bridge to be constructed over Lake Washington Canal at Tenth Street; structure to be 175 ft. clear span, 44 ft. wide, with two 6-ft. sidewalks; cost $300,000.

Spokane, Wash.—Chauncey A. Burnett, Engr. Illinois Steel Bridge Co., and Robt. Hedges of Puget Sound Bridge Dredging Co., Seattle, engaged to report on repair of Division Street bridge. Morton MacCartney, City Engineer.

McMinnville, Ore.—County Court considering constructing a concrete bridge over Cozine Creek near McMinnville; probable cost $15,000.

Portland, Ore.—Plans completed by City Engineer for a steel and concrete bridge to be constructed over Balch Creek Canyon. Structure to be 350 ft. long with two concrete arches at each end of main arch; cost $135,000.

Modesto, Cal.—Contract will be let early in the new year by the Board of Supervisors for constructing the reinforced concrete bride across Toul River at Modesto to cost about $75,000 and for about four miles of highway costing about $40,000. E. H. Anneau, County Engineer.

Avondale, Ariz.—State intends constructing by day labor reinforced concrete bridge across Agna River at Avondale. Cost $50,000. F. F. Nichols, State Engineer's Office, Phoenix.

BIDS DESIRED.

Berkeley Springs, W. Va.—Until Jan. 14 by County Court for constructing two reinforced concrete arch bridges of 60-ft. and 80-ft. spans respectively. Plans prepared by West Virginia State Road Bureau (R. P. Davis, Bridge Engineer), Morgantown.

Newland, N. C.—Until Jan. 15, by County Board Road Commissioners, Newland, for constructing steel highway bridges advertised in Engineering Record. George C. Love, County Bridge Engineer, Pineola, N. C.

Laporte, Ind.—Until Jan. 13, by County Commissioners, for constructing several bridges. F. A. Hauser, Co. Aud.

Rochester, Ind.—Until Jan. 4, by County Commissioners, for constructing bridge over Tippecanoe River. W. C. Miller, Co. Aud.

Adel, Iowa.—Reported desired until Jan. 5, by M. T. Finley, County Auditor, for constructing corrugated iron pipe culverts as follows: 5400 ft. 12 in., 6500 ft. 15 in., 100 ft. 18 in., 100 ft. 24 in. F. S. Naiden, County Engineer.

Iowa City, Iowa.—Reported desired until Jan. 31, by Homer Hughes, City Manager, for constructing three reinforced-concrete bridges, each bridge to cost $5,000.

Waverly, Iowa.—Reported desired until Jan. 6, by W. H. Pockels, County Auditor, for constructing three bridges and abutments and piers for a fourth bridge.

Wegdahl, Minn.—Reported desired until Jan. 6, by J. J. Stennes, County Auditor, for constructing a bridge across Minnesota River to have two 110 ft. steel trusses for four 55 ft. reinforced-concrete spans.

Anthony, Kan.—Until about Jan. 20 by County Commissioners at Anthony for constructing ten reinforced concrete bridges, largest 300 ft. over all, located at Bluff City; also five concrete roadways or low-water bridges varying in length from 100 to 200 ft. Cowan C. Eastham, Engineer, Anthony.

Washington, Kan.—Reported desired until Jan. 8, by County Commissioners (F. V. McKelvy, Clk.), for 350-ft. bridge of five steel spans, 18 ft. roadway and concrete floor in Hanover Township.

York, Neb.—Reported desired until Jan. 11, by County Clerk, for constructing steel and concrete bridges during the year 1916.

Minnewaukan, N. D.—Reported desired until Jan. 7, by W. E. Paulson, County Auditor, for constructing one I-beam steel bridge with concrete backing and wings on narrow point in Devils Lake, Section 30, Township 153.

Deadwood, S. D.—Reported desired until Jan. 5, by Fred Harris, Co. Aud., for concrete work required in constructing retaining walls, culverts and bridges, etc., for year 1916.

Sulphur, Okla.—Until Jan. 20 (readvertisement) for constructing a 200-ft. span bridge across Washita River. Boyd B. Horsman, Co. Clk.

Redlands, Cal.—Until Jan. 17 by Board Supervisors, San Bernardino, for constructing steel bridge with concrete substructure over San Timeteo Creek at Redlands.

PRICES AND LETTINGS.

★*Indicates award of contract.*

New Gretna, N. J.—Following are four lowest bids opened Dec. 8 by Bd. Chosen Freeholders, counties of Atlantic and Burlington, at G. A. R. Hall, New York Avenue, Atlantic City, for constructing a bridge 742 ft. long, to consist of creosoted pile trestle approaches, steel trusses and bascule draw span with wood block floor and concrete substructure, over Mullica River at Chestnut Neck, New Gretna: George S. Bennett, 45 E. Forty-second Street, New York, $93,248 (Scherzer); Bridgeton Construction Co., Bridgeton, N. J., $109,800 (Scherzer); Snare & Triest Co., Woolworth Building, New York, $115,700 (Scherzer or Strauss); Kelly-McFeeley Co., Camden, $116,000 (Scherzer or Strauss).

★**Berne, Pa.**—Contract for constructing four-track concrete bridge on Philadelphia & Reading R. R. between Berne and Hamburg awarded to Walsh Constr. Co., Davenport, Iowa.

★**Pennsylvania.**—Contract for constructing bridge at Capetown in Wyalusing Township, Bradford County, awarded by State Highway Commission at Harrisburg to M. H. Stebbins & Son of Wellsboro, O., at $20,020.

★**Sunbury, Pa.**—Contract for constructing 175-ft. span, steel truss bridge over Shamokin Creek, at Tenth Street, awarded by State Board Grounds and Buildings, at Harrisburg, to Wellsboro Bridge Building Co., at $17,200.

★**Louisville, Ky.**—Contract for constructing swing bridge over locks of Louisville & Portland Canal at Louisville, awarded Milwaukee Bridge Company, Milwaukee, Wis., at $23,717. American Bridge Company, New York, has contract for steel work for this bridge, requiring about 220 tons.

★**Defiance, Ohio.**—Contract for improvements to the Second Street Bridge over Auglaize River to consist of creosoted wood block floor, etc., awarded Standard Engineering Company, Toledo. Roger Daoust, County Auditor.

Indianapolis, Ind.—Bids were opened by Board of Works, Dec. 15, for construction of bridges, abutments and undergrade crossings connected with the crossing improvements at Dover Street and the White River levee under the Big Four and Vandalia Railroads. Work was divided into seven sections. Dunn-McCarthy Co., Chicago, only bidder on all sections, $53,695. Other bidders on four sections: O'Hagan & Lake, $43,890; Walsh Construction Co., $46,941; Marsh Cleary White Co., $47,500.

★**Illinois.**—Contracts awarded by State Highway Department, Springfield, as follows:

★Bridge No. 137-L. Belmont-Milford Township, Iroquois County, to Continental Bridge Company, Peotone, at $6,100. Other bidders: Hoeffer & Company, Chicago, $7,433, and Decatur Bridge Company, Decatur, $6,250.

★Bridge No. 1, Douglas Township, Iroquois County, to John J. O'Heron & Company, 326 W. Madison Street, Chicago, $9,600, for 110-ft. span concrete arch.

★**Hallettsville, Tex.**—Contract for constructing two steel bridges, one over North Mustang River near Sweet Home, the other near Yoakum, awarded by Commissioners Court to Austin Bros., Dallas.

PAVING AND ROADS

PROPOSED WORK.

Poughkeepsie, N. Y.—Bd. Supervisors voted to construct a county road over Quaker Hill at a cost of $35,913.

Cedar Run, N. J.—Reported 6 miles of gravel road will be constructed on Barnegat-Buddtown Rd. L. H. Cramer, Engr.

Baltimore, Md.—The Paving Commission voted to repave Foster, O'Donnell, Essex and Fleet Streets, Linwood and Montford Avenues with asphalt.

The Board of Estimate reported considering constructing a municipal asphalt plant; cost about $20,000.

Martinsville, Va.—Construction of roads at cost of $200,000 is being considered by county.

Bryson City, N. C.—About $100,000 Swain County Road bonds sold for constructing section of highway from Asheville to Murphy near Bryson City.

Greensboro, N. C.—Citizens voted $50,000 bonds for street improvements.

Columbia, S. C.—The sum of $1,250,000 has been appropriated for constructing a system of improved roads, some to be paved with vitr. brick. Address W. D. Melton, Chairman Richland County Permanent Highway Commission, Columbia.

Greenville, S. C.—County has been authorized to issue $750,000 to construct highways. W. H. Willimon, Chairman Greenville County Highway Commission, Greenville.

Bartow, Fla.—Election to be held in April in Polk County to vote $1,000,000 bonds for building 221 miles of sand asphalt road.

Homestead, Fla.—Street paving bonds amounting to $15,000 have been voted. Address City Clerk.

Tampa, Fla.—Bonds nave been voted for construction of the Jacksonville-Tampa highway from Jacksonville, south along west shore of St. John's River to Palatka, thence across river to East Palatka, south to DeLand, Sanford, Orlando, Kissimee, Haines City, Lakeland, Plant City and Tampa.

Houma, La.—Road Dist. No. 2 bonds for $100,000 will be sold Jan. 12 by Police Jury of Parish of Terrebone; also same time and place for Road Dist. No. 1 bonds for $50,000. (J. C. Dupont, Pres. Police Jury, Houma.)

Pensacola, Fla.—Citizens of the county will soon vote on $1,000,000 bond issue for paved roads.

Gulfport, Miss.—See "Bridges."

Macon, Miss.—Road bonds of Dist. No. 5 for $22,500 will be sold Jan. 4 by County Board Supervisors (John A. Tyson, Clk.).

Marysville, Tenn.—Pike bonds for $100,000 will be sold Jan. 5 by R. P. McReynolds, Chmn. Blount County.

★**Phoenixville, Pa.**—Following are unit figures of four lowest bids opened Dec. 21 by County Commissioners of Chester and Montgomery Counties at Norristown for constructing a reinforced concrete arch bridge of 5 spans over Schuylkill River connecting Phoenixville and Mont Clare, (a) Ambler-Davis Co., Philadelphia, $103,252 (awarded contract); (b) Dravo Contr. Co., Pittsburgh, $104,103; (c) F. M. Talbot Co., New York, N. Y., $104,866; (d) William C. Evans, Ambler, $106,011. B. H. Davis, Whitehall Building, New York, Consulting Engineer:

	(*a)	(b)	(c)	(d)
1,200 cu. yd. foundation excavation, earth	$2.00	$3.50	$3.90	$2.40
30 cu.yd. foundation excavation, rock	6.00	4.50	3.90	6.00
100 cu. yd. river dredging	2.00	0.60	0.50	2.00
100 cu. yd. roadway grading	0.75	0.50	0.40	0.90
1,400 lin. ft. hardwood piles	1.00	0.40	0.40	1.00
900 lin. ft. concrete piles	3.00	1.50	2.20	2,10
10 cu. yd. class "A" concrete	30.00	11.00	11.00	20.00
100 cu. yd. class "B" concrete	25.00	8.25	7.00	15.00
963 cu. yd. class "C" concrete	7.00	7.25	8.25	8.00
10 cu. yd. concrete in balustr	45.00	23.00	25.00	40.00
250 sq. yd. bush hammered surface	0.50	0.05	0.07	0.40
2,000 sq. yd. carbor. rubbed surface	0.50	0.02	0.05	0.65
108 sq. yd. wood block pavement	2.26	2.80	2.20	3.70
292 sq. yd. Metropolitan block pavement	2.10	2.30	1.90	2.30
108 sq. yd. standard Amiesite pavement	1.50	2.30	1.60	1.40
292 sq. yd. Belgian or granite block	3.25	2.75	3.20	3.00
500 sq. ft. waterproofing	0.40	0.16	0.08	0.60
3,500 lb. reinforcing steel	0.05	0.03	0.03	0.06
240 lb. curb protection bar	0.15	0.16	0.15	0.12
240 ft. 6-duct t. c. conduit	1.50	0.30	0.50	1.00
240 ft. 2-duct. t. c. conduit	1.00	0.10	0.30	0.40
40 ft. metal conduit	0.75	0.15	0.27	0.60
1,500 sq. ft. sidewalk and curb finish	0.25	0.03	0.05¾	0.22
10 lin. ft. 4-in. t. c. sewer pipe	0.35	0.10	0.20	0.30
100 lin. ft. 8-in. t. c. sewer pipe	0.80	0.15	0.40	0.80
300 lin. ft. 12-in. t. c. sewer pipe	1.50	0.27	0.70	1.50
2 catch basins	50.00	25.00	13.00	30.00
2 bronze light fixtures	50.00	100.00	90.00	40.00
2 draw boxes	25.00	7.00	7.50	20.00
60 cu. yd. broken stone fill	2.50	2.90	1.80	2.50

Marietta, Ohio.—The City Council voted to pave Quarry, Bank and Orchard Street.

New Philadelphia, Ohio.—County Commissioners approved plans for constructing 10 miles of roads in Tuscarawas County.

Richmond, Ind.—Bd. Public Works contemplates paving Richmond Avenue, Ft Wayne Avenue, S. Seventh Street and S. Ninth Street.

Chippewa Falls, Wis. — Chippewa County considering spending $50,000 for road improvements next summer.

Danville, Ill.—Supreme Court has validated the $1,500,000 bonds to be spent in constructing 174 miles of paved roads in Vermillion County during 1916 and 1917. System to reach every city and village in the county, and consist of two main north and south roads and five east and west roads. There are to be divisions with about 19 miles in each division, and the haul from the railroad sidings will not exceed three miles. Contracts will be let early by the County Road Improvement Committee at Danville through P. C. McArdle, Superintendent Engineer, who has prepared plans and specifications.

Blue Earth, Minn.—About 25 blocks of residence streets will be paved next season; macadam and asphalt are favored. Easten Floes, City Engineer.

County intends next season spending about $45,000 in improving roads. Ray J. Short, District Engineer, Highway Commission. Carl Hagger, County Surveyor.

Big Sandy, Tex.—Citizens voted $75,000 bonds for constructing roads in Precinct No. 7.

Bryan, Tex.—Attorney General has approved the $400,000 bond issue for constructing roads in Road District No. 1. Address Commissioners Court, Bryan.

Waelder, Tex. — Commissioners Court has ordered an election for February 5 to determine whether $76,000 bonds shall be issued to construct a link in the San Antonio-Galveston highway through this district, and to improve other roads leading into this city.

Bellingham, Wash.—City Council voted to pave G Street, cost $15,665, and Fourteenth Street, cost $10,000.

Contract about to be let by city for paving James Street, cost $10,655.

Chehalis, Wash.—About three miles of one course concrete pavement 16 ft. wide and one mile of one course 8 ft. wide is contemplated in the county. J. D. Neville, County Engineer, Chehalis.

Davenport, Wash.—Plans being prepared by E. G. Harvey, County Engineer, for hard surfacing Sunset Highway between Creston and Davenport, estimated cost $37,000.

Gettysburg, Wash.—County Comrs. at Port Angeles directed a survey to be made for extension of county road from Gettysburg west to Pysht; cost $90,000. Richard W. Remp, County Engineer, Port Angeles.

Pomeroy, Wash.—City Council voted to pave 16 blocks with bitulithic to connect with macadam road at each end of city.

Seattle, Wash.—A. H. Dimock, City Engineer, in a report to Board Public Works estimates cost of paving Thirty-second Avenue West, at $119,519; also paving and constructing seawall on Railroad Avenue at $74,000. Work involves 14,500 cu. yd. earthwork, 5914 sq. yd. brick paving, 3700 cu. yd. concrete wall, 13,800 lb. reinforcing steel and 2250 cu. yd. riprap.

Walla Walla, Wash.—About $75,000 will be spent by city for paving streets, Cherry, Oak, Colville, Boyer, Roosevelt, Catharine, Locust Streets, inclusive.

N. Fourth Avenue is to be paved by city, at cost of about $10,000.

Washington.—Following roads are to be constructed during 1916 (William R. Roy, State Highway Commissioner, Olympia): Central Washington Highway, northerly from Ritzville, $59,086; McLellan Pass Highway, Enumclaw to summit Cascade Mountains, $60,000; Sunset Highway, North Bend to Cle Elum, $70,000; Sunset Highway, Ellensburg to Wenatchee, $29,475; State Road No. 10, Chelan County, $20,000.

The State Highway Commission (William R. Roy, Commissioner, Olympia), will hard surface section of Pacific Highway between Renton and Kent. Contract will soon be let.

Astoria, Ore.—Plans completed by City Engineer for hard surfacing downtown streets in first reclamation fill.

Contract about to be let by Street Committee for paving Commercial Street.

City Council considering paving and constructing concrete walks on Franklin Avenue.

Oregon City, Ore.—Citizens voted to hardsurface roads during 1916; cost about $60,000. H. H. Johnson, County Engineer.

Portland, Ore.—The paving of Twenty-eighth Avenue with bitulithic is contemplated by city, cost $51,359.

Citizens of county voted a road tax

which will raise $643,000 for road and bridge construction throughout the county during 1916.

The paving of Union Avenue with bitulithic is contemplated by city, cost $37,135.

City Engineer estimates cost of extending and surfacing Greeley Street at $113,716.

Chino, Cal.—Election will be held early in the new year on $73,000 street improvement bonds and $55,000 sewer system. Olmstead & Gillelen, Los Angeles, Engrs. of sewer system.

Kingsburg, Cal.—City Trustees taking steps to have State Highway connected by concrete paving through the town. Contract will be let in the spring.

Los Angeles, Cal.—County Board Supervisors voted to construct approximately two miles 5-in. concrete pavement on Artesian Avenue, including culverts. Contract will be let about Jan. 15.

County Board Supervisors has voted to construct paved highway from West Los Angeles city limits to Santa Monica, approximately ten miles; also Whittier to Bassett highway, approximately six miles. County will furnish cement, rock and oil.

City Engineer preparing plans for 60,000 sq. ft. paving on Myra Avenue.

Contract will be let about Jan. 15 by Board Supervisors for constructing approximately 2 miles of 5 in. concrete pavt., 20 ft. wide, 4 in. granite base, bitulithic surface, etc., on Artesia Avenue.

Redondo Beach, Cal.—Contract will be let about February by City Trustees for paving with concrete and oil pavement, cement curbs and walks, concrete retaining walls, etc., on Lucia Avenue.

San Francisco, Cal.—Bd. Supervisors voted to pave Fairfax and Eighteenth Avenues with asphalt and Anza Street with broken rock pavement.

Contract about to be let by Bd. Public Works for improving Potrero Avenue; estimated cost $37,875.

Tropico, Cal.—City Trustees voted to construct macadam pavement curbs, gutters, etc., on Moore Street, at a cost of $11,231.

Holbrook, Ariz.—County will vote, Jan. 11, on issuing $63,000 bonds for county highway system and bridge construction.

Phoenix, Ariz. — City Commission adopted resolution of intention to pave Washington Street to the State Capitol and Seventeenth Avenue in all twelve blocks; also considering paving portions of eleven other business and residence streets. Material not selected, but bids on National, Tarvia, bitulithic with a concrete base. A. C. bitulithic, bitulithic with gravel base, bitustone, Topeka specifications with concrete base, Topeka specifications with A. C. base and concrete.

Lewiston, Idaho.—Citizens of Lewiston Highway District voted $150,000 bonds for constructing hard surface highway from Clearwater River to top of Union Town Hill.

BIDS DESIRED.

Brooklyn, N. Y.—Until Jan. 6, by L. H. Pounds, Boro. Pres., for furnishing and delivering 40,000 asphalt paving blocks 3 in. thick, 40,000 grade 1 granite paving blocks, 40,000 wood paving blocks 3¾ in. thick, furnishing and delivering 5000 bbl. Portland cement and 2000 cu. yd. paving sand, to be delivered at various municipal plants and corporation yards.

Jackson, Miss.—Reported desired until Jan. 4, by W. W. Downing, Chancery Clk., for surface treating about 5 miles of road.

Cincinnati, Ohio.—Until Jan. 4, by Parke S. Johnson, Secy. Dir. Pub. Service, for oiling streets, alleys, squares and public ways, of which are improved with macadam, gravel or earth.

Indiana.—By County Commissioners for constructing roads as follows:

Until Jan. 7.

Crown Point, for constructing gravel road in Cedar Township. Ed. Simon, Co. Aud.

Until Feb. 9.

Columbia City, for constructing road on line between Whitley and Noble Counties; also gravel road in Smith Township. Thos. McLaughlin, Co. Aud.

Fort Madison, Iowa.—Reported desired until Jan. 25, for constructing 1½ miles concrete and ½ mile brick pavement. R. J. Lewis, City Engr.

Carlton, Minn.—Reported desired until Jan. 7, Aug. R. Norman, Co. Aud., for State Rural Highway No. 11, to consist of 23,500 cu. yd. gravel, 13,315 cu. yd. grading and 2215 rods ditching. Probable cost $32,885.

Anthony, Kan.—See "Bridges."

Auburn, Wash.—Reported desired until Jan. 5, by Jas. F. Lemar, City Clk., for paving portion of Harriett and East First Streets. Probable cost $22,000.

Seattle, Wash.—Until Jan. 11 by County Commissioners for constructing 36,700 cu. yd. excav. and 2800 cu. yd. gravel surfacing on highway between Hazelwood and Newport, to cost $20,000. Arthur P. Duton, County Engineer.

Walla Walla, Wash.—Reported desired until about Jan. 15, by City Council, for paving South Second Street. Probable cost $10,000. W. R. Rehorn, City Engr.

Washington—Until Jan. 24, by State Highway Commission at Olympia, for constructing the Central Washington highway, Ritzville-Sprague, 23.8 miles; appropriation available $59,000.

Huntington Beach, Cal.—Until Jan. 3 (readvertisement), by City Clerk, for approximately 692,200 sq. ft. concrete pavt., 195,000 sq. ft. grading curbs, concrete and corrugated iron culverts, and concrete and timber subway on Main Street.

PRICES AND LETTINGS.

★Indicates award of contract.

Connecticut.—Following are four lowest bids opened Dec. 21 by State Highway Commissioner, Hartford, for constructing 7 miles of concrete roads in town of Branford—(a) 10,765 lin. ft. on Short Beach Road, (b) 4250 lin. ft. Indian Neck Road, and (c) 11,900 lin. ft. on Stony Creek Road: Frank Arrigoni & Brother, Middletown, (a) $27,437, (b) $38,288, (c) $34,127; Leonardo Suzio, Meriden, (a) $25,174, (c) $32,498; Connecticut Hassam Paving Company, New Haven, (b) $39,672; Charles W. Blakeslee & Sons, New Haven, (a) $23,143, (b) $31,399, (c) $29,251; Ahern Construction Company, Willimantic, (a) $27,799; John Arborio, New Haven, (b) $32,855.

★Norwalk—Constructing a section of brick highway on Armory Hill, awarded H. Sanford Osborne, Redding Ridge, at $5,622.

Cornwall—9300 lin. ft. grading, low bidder, Louis Longhi & Brother, Torrington, $8,893.

Thompson—5030 lin. ft. native macadam on Brandy Hill Road, lowest bidder, John Arborio, New Haven, $6,458.

★New York, N. Y.—Contract awarded J. Di Menna, 2435 Southern Boulevard, for constructing sidewalks on Waterbury Avenue (bids opened Dec. 27 by President Bronx Borough) at $13,069. Next three lowest bidders: F. V. Smith, $13,627; J. B. Malatesta, $14,418; and Di Menna & Del Balso, $14,692.

★Contract for constructing sidewalks, etc., on Newbold Avenue (bids opened Dec. 27 by President Borough Bronx) awarded J. B. Malatesta, 3169 Jerome Avenue, at $12,174. Next three lowest bidders: J. Di Menna, $12,293; F. V. Smith, $12,696; Burnside Contracting Company, $12,752.

★Tuckahoe, N. Y.—Contracts awarded as follows for improving portions of California Road: Section 1, Frank Bracalello, P. O. Building, Scarsdale, at $6,500, and Section 2, Eastchester Contracting Company, Tuckahoe, at $16,500. John Mathews, Town Superintendent.

New Brunswick, N. J.—Lowest bid opened by Middlesex Board Freeholders, Dec. 20, for macadamizing 7.7 miles Cranbury turnpike, submitted by Abraham Jelin of New Brunswick, at $168,835.

★Tampa, Fla.—Contract for 112,650 sq. yd. asphalt pavements and 3500 sq. yd. concrete pavements awarded by Board of Public Works, to E. G. Proudfoot, Miami, at about $300,000. Bids opened Dec. 20.

★Greenfield, Ind.—Following are four lowest bids opened recently by County Commissioners for constructing three-mile free gravel road on line between Hancock and Shelby Counties, known as Burkhart Road: Moberly & Company, $17,474 (awarded contract); George W. Hoppes, $17,889; McFurnan Brothers, $18,400, and Null & Company, $18,587.

★Washington C H, Ohio.—Contract for paving streets in Washington C H awarded by city to B. F. Bolin, Newark, Ohio, at $52,000.

St. Paul, Minn.—Lowest bid opened Dec. 13 by City Contracting Committee for grading Edgecombe Avenue submitted by Christ Johnson, St. Paul, at $31,049.

★Dallas, Tex.—Contract for paving Bishop Avenue awarded to Standard Engineering & Construction Co., Dallas, at $12,405.

★Washington.—Contracts awarded by State Highway Commission, Olympia, for grading Inland Empire Highway, as follows:

Rosalia-Oakesdale, 9 miles, to General Construction Company, Spokane, at $21,646.

Pullman, south 9 miles, to G. L. Stickler, Davenport, $23,887.

Touchert-Wallula, 9½ miles, G. L. Stickler, Davenport, $22,639.

Kiona-Richland, 12 miles, H. L. Wilson, Walla Walla, $16,946.

Sunset Highway, gravel surfacing, Wenatchee-Orlando, 11 miles, S. G. Kinder, Bridgeport, $7,568.

★Bakersfield, Cal.—Following are four lowest bids opened recently for grading and concrete paving, about 61,000 sq. yd., and constructing culverts on Bakersfield-McKittrick Road: Brashear-Burns Company, Van Nuys Building, Los Angeles, 37.5 cts. per sq. yd., total $27,914 (awarded contract); Mackie & McLean, $28,147; Leigh G. Garnsey, $33,481, and Messmer & Rice, $34,004.

★Contract for concrete paving awarded Federal Construction Company, Fresno, at $30,924, for three miles on Bellevue Avenue and $10,308 for one mile on Brundage Lane.

★San Francisco, Cal.—Contract for improving section of Twenty-fourth Avenue awarded by Bd. of Works to Owen McHugh, Russ Building, at $9,979.

★Belleville, Ill.—Following are four lowest bids opened Dec. 23 by Bd. Local Improvement for improving West Main Street (a) Reeb Brothers, Belleville, $228,468 (awarded contract), (b) Hoeffken Brothers, Belleville, $242,274, (c) Charles Degenhardt, Alton, $250,377, and (d) J. A. Sturdyrin, Rantoul, $255,205. W. C. Wold, City Engineer:

	(a)	(b)	(c)	(d)
124,000 sq. yd. limestone, top course 2½ in. thick, 1-2¼-4 granite; 2-course Portland cement concrete-paving bottom course 6½ in. thick, 1-2½-4	$1.62	$1.73	$1.72½	$1.77
32,000 lin. ft. ⅜-in. felt expansion joint across roadway, including armor plate	0.13½	0.15	0.15	0.19
55,500 lin. ft. ⅜-in. expansion joint along curbing	0.05	0.04½	0.06	0.05
55,500 lin. ft. Portland cement curbing 7" x 16"	0.25	0.27	0.38½	0.37
2,250 lin. ft. 12 in. sewer pipe	0.55	0.45	0.85	0.50
125 catch basins, each	38.00	30.00	33.50	35.00

★Rockford, Ill.—Following are unit figures of four lowest bids opened Dec. 22 by Bd. Local Improvements for furnishing material and paving with brick portions of Kishwaukee Street, about 20,000 sq. yd. (F. W. Bullock, City Engineer), (a) A. E. Rutledge, Rockford, $45,747 (awarded contract); (b) Cerney & Frey, 2415 Madison Street, Forest Park, $47,800; (c) J. E. Salfisberg & Co., Aurora, $48,114; (d) Williston Constr. Co., Chicago, $48,940:

	(*a)	(b)	(c)	(d)
6,700 cu. yd. excavation	$0.29	$0.45	$0.45	$0.45
19,770 sq. yd. brick pavt. on 5-in. concrete base	1.77	1.79	1.82	1.85
10,000 lin. ft. concrete curb and gutter	0.41	0.45	0.45	0.45
30 crossings with iron plate	5.00	7.00	7.00	7.00
32 curb intakes	6.00	6.00	5.50	6.00
1,525 lin. ft. 24-in. No. 2 sewer pipe	1.50	1.50	1.42	1.48
395 lin. ft. 20-in. No. 2 sewer pipe	1.20	1.25	1.22	1.24
350 lin. ft. 18-in. No. 2 sewer pipe	1.05	1.00	0.94	1.00
60 lin. ft. 15-in. No. 2 sewer pipe	0.90	0.90	0.83	0.85
765 lin. ft. 12-in. No. 2 sewer pipe	0.75	0.80	0.67	0.80
425 lin. ft. 10-in. No. 2 sewer pipe	0.50	0.70	0.69	0.68
1 catch basin	30,00	30.00	30.00	30.00
4 manholes	30.00	30.00	30.00	30.00
200 lin. ft. concrete box	1.25	1.25	1.25	1.25

Lewiston, Idaho.—Following are unit figures of the four lowest bids opened Dec. 20 by City Clerk for improvement District No. 8—(a) City Engineer's Estimate, $24,980; (b) C. N. Payne, Spokane, $21,807 (awarded contract); (c) John W. Hastings, Spokane, $22,108; (d) Tow Miracle Concrete Company, Kallispell, Mont., $23,319; (e) Security Bridge Company, Lewiston, $23,783:

	(a)	(b)	(c)	(d)	(e)
11,160 cu. yd. excavation	0.30	0.26	0.27	0.28.75	0.26
88 cu. yd. stone wall	4.00	3.50	3.85	4.00	4.00
50 cu. yd. rip rap	1.50	1.45	1.50	1.75	2.00
60 ft. hand rail	0.66⅔	0.65	0.66	1.00	0.75
102,330 sq. ft. sidewalk	0.10	0.08.95	0.09	0.09.25	0.09.5
20,719 ft. curb	0.30	0.24	0.24	0.27	0.28
2,614 ft. curb and gutter	0.60	0.51	0.50	0.50	0.55
800 sq. ft. alley crossing	0.14	0.14	0.14	0.14	0.13
1,600 ft. 8-in. vitr. pipe	0.50	0.45	0.50	0.45	0.44
1,155 ft. 10-in. vitr. pipe	0.60	0.56	0.60	0.55	0.57
200 ft. 12-in. vitr. pipe	0.65	0.64	0.65	0.65	0,73
816 ft. 16-in. vitr. pipe	1.20	1.19	1.20	1.50	1.50
4 manholes	42.00	42.00	40.00	40.00	45.00
17 catch basins	18.00	18.00	18.00	18.00	26.00
1 outlet for storm sewer	6.00	6.00	6.00	10.00	6.00
1 check valve	14.00	16.00	16.00	20.00	15.00

★California.—Contract awarded by California Highway Commission, Sacramento, for constructing a State Highway in Imperial County, Division VII, Route 12, Section C, between Dixieland and El Centro, to Fred Hoffman, 111 East Twelfth Street, Long Beach, at $72,089. For unit figures see issue of Engineering Record of Dec. 18.

Corona, Cal.—Lowest bid opened recently for one mile of concrete and macadam pavement with culverts, etc., on N. Main Street and River Street, submitted by George Snyder Contracting Company, Upland, at $6,759.

★Los Angeles, Cal.—Contract for improving Griffith Avenue, about 189,110 sq. ft. grading, 189,110 sq. ft. asphalt paving, 1432 sq. ft. asphalt repaving, 3820 lin. ft. cement curbing, 11,436 sq. ft.. concrete gutter, etc., awarded George H. Oswald, O. T. Johnson Building, at $29,878. Other bidders: Ford & Stout, $32,931; Clark & Henery Construction Company, $31,448; Coast Construction Company, $31,385.

★Los Angeles, Cal.—Contract for 2.4 miles of macadam road, District No. 39, involving about 9288 tons of macadam, two bridges, one 38-ft. frame truss, and one 60-ft. plate girder, awarded James L. Frazer, Long Beach, at $19,495.

Contract for 2½ miles of macadam road in county road Dist. No. 60 awarded M. L. Shafer, 220 W. Thirty-third Street, at $7,495.

STREET CLEANING AND GARBAGE DISPOSAL

PROPOSED WORK.

Madison, Wis.—G. R. Bascom, Madison, has been delegated by Madison Board of Commerce to make a study of the garbage disposal plant at Pontiac, Mich. It is planned to make a short test on the plant as a whole to determine, if possible, the value of the by-products obtained in the reduction of the garbage the cost of operation and net revenue.

PRICES AND LETTINGS.

★Indicates award of contract.

★Philadelphia, Pa.—Contract for collecting and disposal of garbage during 1916 awarded by Director Cooke of Dept. Public Works to Penn Reduction Co., Bulletin Bldg., at $373,588.

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS

PROPOSED WORK.

Pier—Atlantic City, N. J.—The Pier Realty & Holding Company (Alfred E. Burk, Philadelphia, Pres.) plans extending the Gardner Pier 1500 ft. further seaward.

Flood Protection Bonds—Erie, Pa.—Flood protection and grade crossing elimination bonds amounting to $150,000 have been sold.

Harbor and Improvements Bonds—Miami, Fla.—Harbor and improvements bonds amounting to $450,000 have been sold.

Dredging — Cleveland, Ohio. — Contract soon to be let for dredging. Bids will be asked on two propositions, one to dredge if river refuse is dumped at the point far out in the lake and the other if deposited close to the shore between East Ninth and East Twenty-sixth Streets. This work is in connection with the new union station. E. B. Thomas, City Engineer in charge river and harbor improvements.

Dam—Dublin, Ohio.—R. H. Royce and C. F. Bahrke, Engineers of the Franklin County Conservancy District, Columbus, are preparing plats of Green Camp, Pleasant and Prospect Township along Scioto River, and Waldo and Richland Townships, along Whetstone River, preparatory to constructing a dam on Scioto at Dublin and a dam above and another below Delaware, in Scioto River.

Docks—Superior, Wis.—Reported Great Northern R. R. (A. H. Hogeland, Ch. Engr., St. Paul, Minn.) contemplates in the new year replacing ore dock No. 3 and making extensive repairs to docks Nos. 1 and 2.

Drainage.—Onawa, Iowa.—Board Supervisors have been petitioned to construct a drainage system in Soldier Valley from Ute to the Harrison County Line. C. Moriarty, Sioux City, has been appointed engineer.

Drainage—Sac City, Iowa.—Contract will be let about April 1 by Board Supervisors for drainage work, including straightening and deepening of Boyer River and drain Goose Pond. Cost $81,000. Seth Dean, Engineer. Glenwood. Address County Auditor, Sac City.

Pier—New York, N. Y.—Following are unit figures of the four lowest bids opened Dec. 28 by Department of Docks and Ferries, New York, for widening pier at West Fifty-seventh Street; also for improving West Fifty-sixth Street Pier, Borough Manhattan—(a) George B. Spearin, 90 West Street, $129,345; (b) Lawrence Contracting Company, 2409 Walton Avenue, Bronx Borough, $129,900; (c) Bart S. Cronin Company, $130,000; (d) Isaac J. Stander, $134,700:

	(a)	(b)	(c)	(d)
Widening Fifty-seventh Street Pier..............	$109,037	$100,000	$112,000	$114,700
Laying concrete surface and shed foundation on Fifty-sixth Street Pier..........................	12,215	19,900	12,500	12,400
Concrete surfacing and bulkheading work between the two piers..............................	8,033	10,000	6,500	7,600

Ditch—Albert Lea, Minn.—County considering building Ditch No. 30, to cost $20,000. Petitions received for constructing county ditch No. 31, cost $20,000; surveys completed for Judicial Ditch No. 2, cost, approximately, $75,000. Contract will be let about March. Fred. Tavis, County Auditor; R. G. Lindgren, County Surveyor.

Ditch—International Falls, Minn.—Following open ditch work will be contracted for during 1916 (E. W. Kibby, County Engineer):

Judicial Ditch No. 21—Length 17.74 miles, average base 4.5 ft.; average cut 6.6 ft.; yardage 249,257 cu. yd.; clearing 136.65 acres; grubbing 63 acres; 11 bridges will be constructed in connection with the work and 46 culverts. Work will have to be done with a walking dredge and is from 3 to 9 miles from the railroad; estimated cost $43,617. Contract to be let in February.

Judicial Ditch No. 22—Length 60.16 miles; average base 5 ft.; average cut 6.4 ft.; yardage 854,988 cu. yd.; clearing 848.24 acres; grubbing 185 acres; 33 bridges and 101 culverts in contract; part of work with walking dredge and part with floating dredge; distance from railroad is from 1 to 14 miles; total cost $134,530. Contract will probably be let in February.

Judicial Ditch No. 25—Length 19.47 miles; average base 4 ft.; average cut 6.7 ft.; yardage 268,461 cu. yd.; clearing 155 acres; grubbing 90 acres; 11 bridges, and 28 culverts in contract. Work to be done with walking dredge. Distance from railroad 6 to 8 miles; estimated cost $46,214; contract to be let in February.

Drainage—Birmingham, Mo.—About ten miles of levee to be constructed in Birmingham Drainage District at a cost of $350,000 according to plans by Brooks & Jacoby, Kansas City, Mo. J. H. Powell, Secy. Birmingham Drainage Dist., 312 Reliance Bldg., Kansas City, Mo.

Drainage Bonds, Angleton, Tex.—Bonds amounting to $80,000 for Angleton Drainage District have been sold by A. R. Rucks, County Judge. T. A. Munson, County Engineer, Angleton.

Wharf—Houston, Tex.—New bids will soon be asked for constructing the concrete wharf. E. E. Sands, City Engineer.

Extend Wharf—Los Angeles, Cal.—City granted permission to construct a 1700-ft. addition to the Mormon Island channel wharf.

Dam—San Diego, Cal.—City has applied to Los Angeles Federal Land Office for permission to construct a 160-ft. dam in San Diego River, from which aqueduct and pipe lines will be constructed into the University Heights reservoir; approximately 22,000,000 gals. could be secured daily according to estimate. Cost of project about $2,000,000. H. A. Whitney, City Hydraulic Engineer.

Water Front Improvements—San Diego, Cal.—Ocean Beach section voted following water front improvements: 800-ft. jetty at Narragansett Avenue, cost $35,000; 220-ft. jetty at entrance to False Bay, $48,000; concrete pleasure pier, 20 x 800 ft., cost $28,000; steps and walks, $4,000; two breakwaters, $3,000.

Irrigation—Phoenix, Ariz.—City Commission adopted an ordinance making official plans and specifications prepared by J. B. Girard, City Engineer, for the proposed pipe line from Seventh Street to Seventh Avenue to carry the Salt River canal along Van Buren Street a distance of approximately 5500 ft. Plans provide for a redwood stave conduit with wood asphaltically treated.

Drainage—Salt Lake City, Utah.—Tintic Tunnel Company incorporated with F. C. Richmond, D. R. Beebe and others for the purpose of draining the eastern and southern sections of Titanic region. A tunnel about five miles long is to be driven from head of Goshen Valley under the district starting at an elevation of 6000 feet and driven on a grade of about 12 feet to the mile. Tunnel will accommodate a double track electric railway and a drainage ditch to carry heavy flow of water.

BIDS DESIRED.

Dams—Norfolk, Va.—Until Jan. 8, by Board Control, for furnishing material and rebuilding three dams and spillways. T. B. Dornin, Engr. in Charge Water Dept.

Fill—Jacksonville, Fla.—Until Jan. 4, by Secretary Port Commission, for filling to grade Pier No. 2, to consist of 16,000 cu. yds. to be dredged from St. Johns River. F. W. Bruce, Ch. Engr. of Comn.

Ditch—Memphis, Tenn.—Reported desired until Jan. 15, by Earl McDaniel, Secy. Wyanconda River Drainage Dist., No. 1, for 17.3 miles drainage ditch.

Ditch—Huntington, Ind.—Until Jan. 9, by Andrew Kilty, Co. Comr., for ditch in Salomonie Township.

Ditch—Parr, Ind.—Until Jan. 15, by J. E. Alter, Supt. of Construction, for constructing ditch.

Rods for Tunnel—Los Angeles, Cal.—Until Jan. 11 by Department Public Service for furnishing reinforcing bars to be used in tunnel work and other improvements at San Francisquito Canyon hydroelectric plant. James P. Broman, Secy.

Drainage—Tempe, Ariz.—Until Jan. 14 (readvertisement), by Board of Directors District No. 1 (J. W. Miller, Chmn.), Maricopa County, for constructing 8.4 miles main open drain ditch, northerly portion approximately 40,300 ft. from 6 to 12.5 ft. deep; southerly portion approximately 4000 ft. from 6 to 1 ft. deep; 11 structures, consisting principally of reinforced concrete, at various points where line of proposed ditch intersects highways, canals and ditches. L. G. Knipe, Engr., 16 South Second Avenue, Phoenix.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Dredging—New York, N. Y.—Following are bids opened Dec. 14 by U. S. Engineer, New York, for dredging in Newark Bay and Passaic River, N. J.—(a) scow measurement, (b) place measurement: L. T. Gaylord, Park Row Building, (a) 13.57 cts.; Standard Engineering Company, 11 Pine Street, (b) 18.35 cts.; Morris & Cumings Dredging Company, 17 State Street, (a) 14.89 cts.; Seely Engineering Company, Inc., 30 Church Street, (a) 28 cts., (b) 29 cts.; Maryland Dredging & Contracting Company, 1615 Fidelity Building, Baltimore, Md., 17.9 cts.; P. Sanford Ross, Inc., 277 Washington Street, Jersey City, 16 cts.

★**Waterway—Trenton, N. J.**—Contract for constructing the first unit of the Manaquan River Barnegat Bay inland waterway awarded by State Board of Commerce and Navigation to Rickards Dredging Company, Philadelphia, Pa., at 15.8 cts. per cu. yd. Total cost about $20,000.

Dredging and Dock—Miami, Fla.—Following are reported four lowest bids opened Dec. 22 by City Council for excavating slip, a turning basin and a channel across Biscayne Bay; also constructing a concrete dock. Isham Randolph & Company, Harbor Engineers, Room 28, Real Estate Building:

Channel Improvement—1,194,000 cu. yd. earth and sand excav. and 467,000 cu. yd. rock excav. (a) sand, (b) rock: Home Dredging Co., Mobile, Ala., (a) 9 cts, (b) 70 cts., total $434,530; American Dredging Co., Galveston, Tex., (a) 10 cts., (b) 55 cts.; L. T. Gaylord, New York, (a) 10 cts., (b) 58 cts.; Bowers Southern Dredging Co., Galveston, Tex., (a) 10 cts., (b) 48 cts.

Dock—Hillyer Spinney Co., Jacksonville, $57,069; McGriffin & Heyer, Tampa, $64,848; A. J. Trigg & Son, Tampa, $68,268, and E. P. Maule, West Palm Beach, $72,554.

★**Wharf—New Orleans, La.**—Contract for constructing wharf at U. S. Quarantine Station awarded Lester F. Alexander, New Orleans, at $11,360.

Bridge at Locks—Louisville, Ky.—See "Bridges."

★**Wharf—Houston, Texas.**—Contract for constructing sheds and railroad tracks at Municipal Wharf No. 1 awarded James Stewart & Company, at $21,360. Other bidder, Horton & Horton, Houston, $21,900.

★**Irrigation — Dorris, Cal.** — Reported contract awarded Chapman & Company, Klamath Falls, to construct for Butte Valley Land Company a ditch ten miles long with laterals. A reservoir will also be constructed to furnish the town with water.

ELECTRIC RAILWAYS

PROPOSED WORK.

New York, N. Y.—Contract to be awarded during 1916 by the Public Service Commission, 154 Nassau Street, New York, including Subway—Route 26, part of Steinway tunnel; Route 45, Nassau and Broad Street line; Route 12, Sections 1B and 2A, part of Eastern Parkway line; Route 8, Sections 1, 2, 4 and 5, part of Fourteenth Street-Eastern District Line; Route 61, Sixtieth Street tunnel. Elevated —Route 31, Livonia Avenue Line; Route 8, Section 6, part of Fourteenth Street Eastern District Line, Utica Avenue Line. About 50,000 tons of steel for subway and about an equal amount for elevated construction will be required for these contracts. In addition about 3000 tons of rail will be required during coming year. Elevated constructing includes about 24 miles of track and subway construction, including about 12 miles of track are involved.

Salem, N. J.—The Board Public Utility Comrs. approved general plan of Salem and Pennsgrove Traction Company to construct a line from Salem to Pennsgrove.

New Milford, Pa.—Scranton & Binghamton R. R. Co. (T. C. Dougherty, Ch. Engr., Scranton) contemplates constructing 20 miles of track between Heart Lake, New Milford and Hallstead.

Butler, Pa.—Surveys being made by West Penn Traction Co. (W. E. Moore, Gen. Mgr., Pittsburgh) for extension of lines in Butler Dist. It is proposed to extend lines to McFetridge coal mines.

Collingdale, Pa.—The Philadelphia & Garrettford Street Ry. Co. (C. A. Entrekin, Ch. Engr., Upper Darby), received franchise from Council to construct line through Collingdale.

Corry, Pa.—The Corry & Columbus Street Ry. Co. expects to build a 15-mile line between Columbus, Pa., and Sherman, Ky.

Clearwater, Fla.—Surveys are being made for an electric railway to be constructed from Tampa to Clearwater on west coast, distance of 30 miles. A bridge consisting of 160 ft. steel draw span and about 2 miles of wood approaches will be constructed in connection with the line. E. W. Parker, Curry Bldg., Clearwater, is interested.

Nashville, Tenn.—The Nashville-Gallatin Interurban Ry. Co. (H. H. Mayberry, Pres.), contemplates constructing extensions in central Tennessee; construction of another line to Springfield and an extension from Springfield to Adairville and Russellville, Ky., among contemplated improvements. Jas. E. Caldwell, Pres. Fourth and First National Bank, Nashville, said to be interested.

Jackson, Mich.—Further construction plans announced here following merger by Michigan Railway Company of various gineers making surveys for construction of electric line from Owosso to Saginaw electric lines of Southern Michigan. Enor Flint. J. F. Collins, Jackson, Gen. Mgr.

Des Moines, Ia.—In connection with rehabilitation of city lines. The Des Moines City Ry. Co. will construct an 11 mile extension of the Colfax line to Newton. New interurban lines are also planned to Indianola, Winterset, Red Oak and eventually to Omaha.

Rochester, Minn.—Reported the St. Paul Southern Electric Ry. Co. (K. A. Schaller, Supt., Hastings), proposes constructing a line from Hastings to Rochester, distance of 64 miles, during 1916.

Parsons, Kan.—Kansas Southern Traction Co. incorporated to construct a line from Parsons to Coffeyville and from Parsons to Columbus, about 70 miles. Capital $100,000. Among incorporators: Philip Strack of Parsons, and John M. Page of Topeka.

Santa Fe, Mo.—The Mexico Investment & Constr. Co. of Mexico, Mo., contemplates constructing 10 miles new line between Santa Fe and Perry during 1916.

Caney, Okla.—Plans being considered by Kansas-Oklahoma Electric Ry. Co. to build a line between Caney and Dewey, where connection will be made with the Bartlesville Interurban Ry. S. M. Porter, Caney, is interested.

Guthrie, Okla.—Guthrie-Edmond Electric Ry. Co. incorporated to construct a railway from Edmond to Guthrie, distance of 15½ miles; capital $500,000. Among incorporators: Burke Shartel and Charles Hoopes, both of Oklahoma City.

Los Angeles, Cal.—Pacific Electric Company (George E. Pillsbury, Ch. Engr., Los Angeles), has been directed by City Council to submit plans for elimination of grade crossings at Rose Hill; approximately one mile of line must be elevated.

Pacific Electric Ry. (Geo. E. Pillsbury, Ch. Engr., Los Angeles), granted franchise by county to construct approximately 1200 ft. of track on Bandini, near San Pedro.

Salt Lake City, Utah.—See "Hydraulic Construction and River Improvements."

Caldwell, Idaho.—The Caldwell Traction Co. will electrify the 11 miles of Wilder Branch of Oregon Short Line R. R. Co., recently leased to them.

Twin Falls, Idaho.—A preliminary survey is being made and work will soon begin on 20-mile extension to Castleford by Twin Falls Railroad Co.

BIDS DESIRED.

New York, N. Y.—Until Jan. 14 by Public Service Commission for First District, 154 Nassau Street, for constructing Section No. 2-A, Route No. 12, a part of the Broadway-Fourth Avenue Rapid Transit R. R., known as Eastern Parkway subway, in Brooklyn.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**New York, N. Y.**—Public Service Commission, 154 Nassau Street, authorized N. Y. Municipal Railway Corporation to award contract for reconstruction of the Brighton Beach line (bids opened Dec. 6) to Inter-Continental Construction Company, 215 Rogers Avenue, Brooklyn, at $1,110,000.

★**Newark, N. J.**—Contract awarded American Bridge Company, New York, for 800 tons of structural steel needed in the power house of the Public Service Electric Company.

Pearl Harbor, Hawaii—Lowest bid opened Dec. 18 by Chief Bureau of Yards and Docks, Navy Department, Washington, D. C., for constructing a marine railway at Naval Station, Pearl Harbor, submitted by United States Steel Products Company, 30 Church Street, New York, at $21,906, net price for structural steel ship cradle, complete with rollers and roller frames and $26,578 same, except material to be delivered f.o.b. naval station, Pearl Harbor.

RAILROADS

PROPOSED WORK.

Philadelphia, Pa.—See "Prices and Lettings."

Bryson City, N. C.—Alaska Valley R. R. Company, main office in Bryson City, incorporated to construct a railroad 12 miles long from Bryson City to the Falls on Alaska Creek. J. E. Coburn, Bryson City, one of the incorporators.

Raleigh, N. C.—The Alarka Valley R. R. Co., chartered to construct railroad from Bryson City to Alarka Creek to extend 12 miles through Swain County. Incorporators, Arthur Brooks, Buckhannon, W. Va., Leslie Brooks and Irene J. Brooks, both of Bryson City.

Pine Bluff, Ark.—George B. Blanchard, Chicago, Ill., consulting engineer, is reported taking steps to construct a railroad, either steam, oil or electric, from Pine Bluff to some point on the Mississippi River and has received permission from the Free Bridge Commissioners to operate the railroad over the free bridge.

Rush, Ark.—The Yellville-Rush & Mineral Belt Railway Company formed with J. C. Shepard, of Rush, president, to build a railroad 19 miles long connecting with White River division of the Iron Mountain System at Yellville Station, Ark.

Orange, Tex.—Lutcher & Moore, lumber manufacturers, of Orange, owners of the Gulf, Sabine & Red River Railroad, have decided to extend the line from Starks, La., to a connection with the Santa Fe's Louisiana line at Merryville, a distance of about 35 miles.

Clovis, N. M.—Reported Santa Fe R. R. (C. F. W. Felt, Ch. Engr. of system, Chicago, Ill.) plans constructing extensions of their lines in several directions from Clovis.

Seattle, Wash.—J. R. West, Ch. Engr. Port Commission, submitted following estimates to Commission for construction of proposed belt line railroad: Smith Cove to Salmon Bay, $113,000; Ballard to Fremont, $160,000; car ferry, $45,000; East Marginal Way Line, $30,000. Total, $348,000.

Wenatchee, Wash.—Reported Great Northern Railway Co. (A. H. Hogeland, Ch. Engr., St. Paul, Minn.) will construct branch line from Pateros into Methow Valley; also expects to electrify main line over Cascade Mountains and over Oroville-Wenatchee branch during the coming year.

Martinez, Cal.—Judge Clifford McClellan, Merchants Natl. Bank Building, San Francisco, reported interested in building a railroad a distance of 7 miles, connecting this city with Concord and the main line of the Oakland, Antioch and Eastern R. R. at Concord.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Philadelphia, Pa.**—Following are bids opened recently by Department of Public Works for grading in connection with the elimination of grade crossings on the Chestnut Hill Branch of the Pennsylvania R. R.: R. P. Bennis, Chew and Price Streets, $16,256 for Chelton Ave.; E. I. Karrick, $4,879 for Hortter Street, and F. D. Buckinus, $21,250 for St. Martins Lane. All grade crossings on this branch are to be eliminated at a cost of $700,000, to be divided between the city and the Pennsylvania R. R.

★**Knoxville, Tenn.**—Contract awarded Oliver & Hill, Knoxville, for constructing three-mile railroad extension in Blount County to the dam site of a power plant constructed by the U. S. Government.

★**Midland, Tex.**—Contract awarded by Midland & Northwestern R. R. to J. A. Hunter of Strawn for constructing the grade of the proposed line between Midland and Seminole, 65 miles.

PUBLIC BUILDINGS AND SCHOOLS

PROPOSED WORK.

Boston, Mass.—Site purchased on Blagden Street for annex to Public Library, for which $170,000 is available. Address the Mayor.

Lowell, Mass.—Plans prepared by Henry L. Rourke, Hildreth Building, for high school, adopted by Municipal Council. Address City Clerk.

Quincy, Mass.—City Council appropriated $220,000 for erecting two 16-room schools, one in Ward 2, the other in Ward 6.

Taunton, Mass.—James E. McLaughlin, 111 Dorchester Street, Boston, is architect for armory to be erected here.

Barrington, R. I.—Plans being prepared by Martin & Hall, Union Trust Building, Providence, for two-story and basement, 88 x 112 ft. brick school. Address School Board.

Wallum Lake, R. I.—Plans being prepared by Walter F. Fontaine, 285 Main Street, Woonsocket, for a three-story, 207 x 95 ft., and a two-story, 30 x 90 ft. brick addition to State Sanatorium.

Buffalo, N. Y.—Aldermanic Schools Committee voted to recommend to Board of Education purchase of land adjoining School No. 1 on Seventh Avenus, for purpose of erecting an eight-room brick addition to relieve congestion in Schools Nos. 1, 2 and 3.

Syracuse, N. Y.—Common Council authorized $113,000 bonds for purchase of additional land and enlargement of William McKinley, Townsend and Seymour Schools.

Steps being taken to erect Euclid and Franklin Schools. Address Board of Education.

Syracuse, N. Y.—Board of Contract and Supply Dec. 21 voted to readvertise for bids for erecting comfort station on North Side market.

Williamsville, N. Y.—Board of Education considering erecting new high school.

Jersey City, N. J.—Plans completed by John T. Rowland, 100 Sipp Avenue, for erecting Public School No. 16 on Washington Street; estimated cost $150,000.

Paterson, N. J.—School bonds for $250,000 will be sold Jan. 6, by Board of Finance (John J. Brophy, Clk.).

Pittsburgh, Pa.—Reported John P. Brennan, 5941 Alder Street, has completed plans for two-story and basement, brick and sandstone refectory building to be erected on City Poor Farm at Marshalsea; estimated cost about $45.000.

School bonds for $2,500,000 reported sold. Address Board of Public Education.

Tyrone, Pa.—Council considering erecting city hall on Logan Avenue and Eleventh Street. Address City Clerk.

Charleston, W. Va.—Reported contract will be let in January for three-story, reinforced-concrete, brick, steel and stone or terra cotta addition to St. Francis Hospital on Laidley Avenue; cost $40,000. W. P. Ginther, Archt., Everett Building. Akron, Ohio.

Huntington, W. Va.—Plans being prepared for Physical Education Building to be erected next summer at Marshall College. Address C. I. Woodley, President.

Dobson, N. C.—Plans will be completed about March for the proposed court house. J. B. Sparger, Chmn. County Commissioners.

Greenville, S. C.—Council approved plans prepared by J. E. Sirrine of Greenville, for city hall and auditorium. and appropriated $75,000 for same.

Macon, Ga.—C. R. Ellis of Macon, selected by Board of Education to prepare plans for Vineville School; cost $40,000.

Savannah, Ga.—Auditorium Commission accepted plans prepared by Henrik Wallin, 23 Abercorn Street, for auditorium to be erected here.

Anniston, Ala.—School improvement bonds amounting to $25,000 sold. J. L. Wikle, Mayor.

Bristol, Tenn.—City Commission passed ordinance providing for sale of $60,000 school bonds.

Clarksville, Tenn.—School Board accepted plans for addition to High School; cost about $27,000.

Covington, Ky.—School Commissioners selected site on Madison Pike for high school to be erected at cost of $165,000.

Cincinnati, Ohio.—Board of Education engaged architects to prepare plans as follows: S. Hannaford & Sons, Hulbert Block, for proposed Hoffman School, on Walnut Hills; cost not to exceed $175,000; Bausmith & Drainie, Gerke Building, for addition to McKinley School; cost not to exceed $40,000.

Cambridge, Ohio.—School bonds for $28,000 will be sold Jan. 20, by Geo. D. Dugan, Clerk Board Education, Cambridge School Dist.

East Youngstown, Ohio.—Municipal building bonds for $23,991 will be sold Jan. 8, by C. R. Anderson, Village Clerk.

Plain City, Ohio.—School bonds for $30,000 will be sold Jan. 14 by Board Education Canaan Township, Rural School Dist. (Clyde Razell, Clk.).

Wheelersburg, Ohio.—Citizens voted $35,000 bonds to erect new high school. Address Board of Education.

Youngstown, Ohio.—Contract will be let about March by Board of Education for erecting the Pine Hollow School. E. R. Thompson, Archt., Youngstown.

Notre Dame, Ind.—Reported a $125,000 Alumni and Knights of Columbus Building is to be erected at University of Notre Dame. William Maloney, Secretary Alumni Association.

Port Huron, Mich.—Erection of new building to replace old Washington School under consideration by Board of Education.

Owosso, Mich.—Reported election to be held in spring to vote $30,000 bonds to erect new fire station and purchase motor apparatus. Address City Clerk.

Ypsilanti, Mich.—City Council voted to purchase site on South Prospect Street to erect hospital for which August Beyer bequeathed $50,000.

Shannon, Ill.—Citizens voted $40,000 bonds to erect new high school. Address Board of Education.

Appleton, Wis.—Next spring the Myra Goodwin Plantz dormitory is to be erected at Lawrence College at a cost of $70,000; Child & Smith of Chicago, Ill., Architects.

Bangor, Wis.—Chandler & Clark of Racine, engaged to prepare plans for new school; estimated cost $29,000. Address Board of Education.

Boone, Iowa.—All bids opened for erecting courthouse rejected by County Board of Supervisors. New plans to be prepared and bids readvertised.

Des Moines, Iowa.—Smith & Keffer, Youngerman Building, chosen architects for School District for period of three years.

Galva, Iowa.—Plans prepared for consolidated school to cost about $48,000. Address I. E. Baumgardner, President School Board.

Waterloo, Iowa.—Citizens voted $250,000 bonds to erect high school in East Waterloo District.

Duluth, Minn.—Competitive plans will be asked early in the new year for the new city hall, to cost $400,000. Address City Clerk.

School Board has bsen petitioned to erect a fourth junior high school.

Hamline, Minn.—Board Trustees of Hamline University contemplate erecting fine arts building, dormitory and chapel to cost about $250,000.

Brownsville, Tex.—Citizens voted $100,000 bonds for erecting high school and two ward schools. Address Board Trustees, Independent School District.

Houston, Tex.—Reported contract soon to be let for administration building of Eastwood School, to be erected on cottage plan. Maurice J. Sullivan, Archt., City Hall. Address School Board.

Orange, Tex.—Contract will be let in January for erecting a three-story, fireproof school, reinforced concrete and brick, to cost about $85,000, including equipment. C. H. Page & Bro., Architects, Austin. George W. Curtis, Secy. School Bd.

Silsbee, Tex.—School Board adopted resolution to issue bonds for erecting ten-room brick school.

Chickasha, Okla.—Citizens Dec. 21 voted $70,000 bonds for repairs to high school. Contract will be let about March. William F. Ramey, Secy. Supt. of Schools.

Olympia, Wash.—Capitol building bonds for $1,500,000 will be sold Jan. 18 by State Capitol Commission.

Seattle, Wash.—Plans being prepared by Edgar Blair, 1426 Jackson Street, for proposed West Seattle High School contemplated in the spring; cost $250,000. Address Reuben W. Jones, Clerk School Board.

Contract soon to be let for erecting B. D. Day Grade School; cost $60,000. Edgar Blair, Archt., 1426 Jackson Street.

Lodi, Cal.—Citizens Dec. 17 voted $40,000 bonds to erect school. Contract will be let about February. Wright & Stone, Archts., Stockton. O. H. Weihe, County Clerk.

Los Angeles, Cal.—Contract will be let latter part of January by Board of Supervisors for erecting county hospital to consist of $250,000 tuberculosis hospital; $100,000 service building and $26,000 power house. Sub-contracts will include elevators, plumbing, heating, pipe lines, power plant equipment, etc. George Low, County Architect; Harry Lelande, County Clerk.

Riverside, Cal.—Plans approved by Regents of the University of California, as prepared by Lester H. Hibbard, Marsh Strong Building, Los Angeles, for the citrus experiment station to be erected here, to include two-story brick and tile administration building, one-story laboratory wings, each 50 x 90 ft., and a residence and a bungalow; $125,000 available.

San Bernardino, Cal.—Plans completed by Lyman Farwell, Story Building, Los Angeles, for erecting brick hospital to cost $130,000.

San Francisco, Cal.—Board of Supervisors approved decision of Board of Education to erect Redding School, to consist of 18 rooms, fireproof construction, at Pine and Larkin Streets.

BIDS DESIRED.

Fort Pierce, Fla.—Until Jan. 15 by Board Public Instruction (J. W. Hodge, Secy.) for erecting three-story brick school to cost $40,000.

Key West, Fla.—Until Jan. 31, by James A. Wetmore, Acting Supervising Architect, Washington, D. C., for construction, complete, of the surgeons' and attendants' quarters and a morgue at the U. S. Marine Hospital, Key West, advertised in Engineering Record.

Clarksdale, Miss.—Until Jan. 18 by Commissioners for constructing a power plant building and furnishing and erecting certain equipment for same and erecting certain other equipment for the light and water works plants. W. G. Shurgar Engineering Company, Engineers, Meridian, Miss. M. W. Purnell, City Clk.

Cherry Grove, Ohio.—Reported desired until Jan. 11, by Board of Education, Cherry Grove Rural School Dist. (Wm. Lewellen, Clerk) for erecting school. Separate bids for heating. Robertson & Fahnestock, Archts., Gerke Building, Cincinnati.

Delaware, Ohio.—Until Jan. 31, by W. Ott, Clerk Board Education, for erecting school for the Brown Township Rural Dist. Paul Cayhill, Archt., Cleveland.

Elkhart, Ind.—Until Jan. 10, by Fred E. Wilson, Trustee of Osolo Township, at office of A. H. Ellwood & Son, Archts., 129½ S. Main Street, for erecting school in said township.

Terre Haute, Ind. — Until Jan. 8, by Board Trustees of Schools (Stella C. Stimson, Secy.), for erecting a sixteen-room school. Johnson & Miller, Archts., Brazil, Ind.

River Rouge, Mich.—Reported desired until Jan. 4, by Village Clerk, for erecting two-story and basement, 60 x 82 ft. village hall. Probable cost $45,000. Geo. J. Haas, 1514 Kresge Building, Detroit.

Tuscola, Ill.—Reported architects will be selected Jan. 10, by Board Education (E. C. C. Kagey, Secy.), for high school in Dist. No. 152, Tuscola Township; $145,000 bonds available.

Nevada, Iowa.—Until Jan. 24, by J. R. Larson, Secy. School Board, Independent School Dist., for erecting high school. Separate bids for heating and ventilating, plumbing, electric work, etc. Cost $70,000. G. L. Lockhart, Archt., 285-288 Endicott Building, St. Paul, Minn.

Ortonville, Minn.—Until Jan. 12 (extension of date), by Bd. Educ. (R. B. Hudson, Secy.), for furnishing material and erecting a high school; also plumbing, ventilating and heating and electrical work. Probable cost $55.000. E. F. Bromhall, Archt., Alworth Building.

St. Louis, Mo.—Reported desired until Jan. 4 by E. R. Kinsey, Pres. Board Public Service, for erecting three tuberculosis ward buildings at Robert Koch hospital.

Prescott, Ariz.—Reported competitive plans and specifications until Jan. 10, by County Board Supervisors (T. R. Belcher, Clerk), for courthouse. Probable cost $200,000.

Ogden, Utah.—Reported desired until Jan. 8, at office of Shreeve & Madsen, Archts., 215 Col. Hudson Building, for erecting Isolation Hospital on county property north of city limits. Harry Hales, Co. Clk.

Lambton Mills, Ont.—Until Jan. 15, by Thos. Elliott, Secy., School Board, Lambton Mills, for erecting school. Ellis & Ellis, Archts., Manning Chambers, Toronto.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Attleboro, Mass.—Following are four lowest bids opened Dec. 22 by Supervising Architect, Washington, D. C., for erecting U. S. Post Office (a) limestone, (b) sandstone: King Lumber Company, Charlottesville, Va., (a) $81,475, (b) $90,000; Charles W. Wright, Lynn, (b) $84,819; W. H. Fissell & Co., New York, (a) $85,800, (b) $90,000; James A. Munroe, North Attlebore, (a) $86,640; Frymier & Hanna Co., 25 W. Forty-fifth Street, New York, (a) $86,680, (b) $89,600; Norcross Brothers, Worcester, (b) $89,900.

★**Belmont, Mass.**—Contract for erecting high school (bids opened Dec. 20) awarded Leighton-Mitchell Company, Boston, at $119,840. Next three lowest bidders: Tyson Wenie & Company, Boston, $120,900; John W. Duff, Inc., Boston, $123,760; and Wm. Crane Company, Boston, $127,660. Contract for plumbing awarded D. F. Keifer, Watertown, at $5,915; heating, Pierce & Cox, Boston, $19,818, and electric work, Elwin C. Lewis, Boston, $10,147 Brainerd & Leeds, Archts., Boston.

Paterson, N. J.—Following are lowest bids opened Dec. 20 by Board of Education for erecting School No. 10: Mason work, also carpenter work, Cona Construction Company, Hoboken, $46,045 and $24,067, respectively; sidewalks, etc., Sharpe Construction Company, Paterson, $2,065; concrete work, James Mitchell Company, Jersey City, $52,535; steel and iron work, Livingston-Stewart Company, Paterson, $17,550; roofing and metal work, Bert Gessler Company, Paterson, $2,600; plumbing, W. Gordon Corporation, New York, $10,414; electric work, Bennett & Brown, Inc., Paterson, $9,340. J. F. Dunphey, Secretary.

Philadelphia, Pa.—County Commissioners opened bids recently and James P. Farrell & Company, 1621 Sansom Street, submitted lowest, as follows: Addition to Court Building on Twenty-first and Race Streets, at $32,200; John T. Windrim, Archt., Commonwealth Building; and addition to Misdemeanants' Court, on Twelfth and Wood Streets, at $28,900; Philip H. Johnson, Archt., Land Title Building.

★Contracts for erecting 31-room fireproof school at B and Westmoreland Sts., known at John B. Stetson School (bids opened Dec. 10), awarded as follows: General construction, to Melody & Keating, 1218 Chestnut Street, at $227,918; heating, S. Faith & Company, 2427 Pennsylvania Avenue, $33,411; ventilating, John A. Call, 122 N. Franklin Street, $2,010; plumbing, Bulman Brothers, 2532 N. Fifth Street, $11,837; electric work, Cates & Shepherd, 1516 Sansom Street, $17,036. J. Horace Cook, Archt., 2242 Land Title Building; William Dick, Secretary Board Education.

★Contract awarded F. A. Havens Company, 845 N. Nineteenth Street, for erecting one-story and basement, brick, stone and concrete, 105 x 88 ft. library at McPherson Square and F Street; cost $43,000.

★**Washington, D. C.**—Contract for constructing the building for the heating and power plant for Government awarded by Treasury Department to W. G. Cornell Company, of Washington, at $1,397,484.

★**Live Oak, Fla.**—Contract awarded by Board of Public Instruction of Suwanee County to Florida Engineering & Construction Company, Jacksonville, for erecting reinforced concrete school here; approximate cost $50,000.

★**Cleveland, Tenn.**—Contracts awarded by County Board of Education for erecting Bradley County High School as follows: General construction, Cleveland Construction Company, Cleveland; heating, Chattanooga Heating Company, Chattanooga, and plumbing, Terrel Hedges Company, 607 Market Street, Chattanooga; total cost about $25,181.

Humboldt, Tenn.—Following are four lowest bids opened Dec. 20 by Supervising Architect, Washington, D. C., for constructing U. S. Post Office: Algernon Blair, Montgomery, Ala., $39,656; J. Frank Beggs, Scottsburg, Ind., $41,136; George Becking, Chattanooga, Tenn., $41,323; Frank L. Johnson & Co., Duluth, Minn., $42,670.

Cincinnati, Ohio.—Lowest bid opened Dec. 20 by Board of Education for constructing gymnasium, stadium, industrial arts building, power plant and two tunnels of new East Side High School submitted by Roche-Brunner Construction Company, Cincinnati, at $390,700.

★**East Youngstown, Ohio.**—Contract awarded Joseph Buchheit, Youngstown, for erecting the school (bids opened Dec. 24).

Middletown, Ohio.—Following are four lowest bids opened Dec. 18 by Supervising Architect, Washington, D. C., for erecting U. S. Post Office (a) limestone, (b) sandstone: George W. Stiles Construction Co., Rookery Building, Chicago, Ill., (a) $69,132, (b) $76.132; James Devault, Canton, (b) $75,545; Charles McCaul Company, 1715 Sansom Street, Philadelphia, Pa., (a) $69,340, (b) $76,340; Roche-Bruner Company, Johnston Building, Cincinnati, (a) $71,700, (b) $78,600; Charles W. Gindele, 3333 S. La Salle Street, Chicago, Ill., (a) $72,450.

★**Midvale, Ohio.**—Contract awarded by Goshen Township School Board to Union Lumber Company of New Philadelphia, at $26,668, for erecting Central High School.

★**New Philadelphia, Ohio.**—Contract awarded Union Lumber Company, N. Third Street, at $26,168, for erecting the Township grade school (bids opened Dec. 14). Next three lowest bidders: Franklin Construction Company, Columbus, $28,858; Cullen J. Vaughn, Hamilton, $29,878; C. A. Watts, Haskins, $31,749. J. W. Syron, Clk. Board of Education, Goshen Township.

★**West Manchester, Ohio.**—Contracts awarded as follows by Rusk & Sheets, architects, of Columbus, for erecting school in Preble County, Monroe Township, near West Manchester: General construction, Winter & Wilson, Strasburg, $39,463; heating, Columbus Heating & Ventilating Co., 425 West Town Street, Columbus, $4,490; plumbing, Stevenson & Mong, Piqua, $2,525.

★**Marion, Ind.**—Following are four lowest bids opened Dec. 17 by School Trustees (M. L. Swayzee, Secy.) for erecting a two-story brick school: Barley & Bowman, Marion, $143,700 (awarded contract); J. B. Goodall & Sons, Peru, $145,950; William Everley, Indianapolis, $146,488; and Barnes Bros., Marion, $151,000.

★**Alton, Iowa.**—General contract for erecting the high and grade school (bids opened Dec. 21) awarded H. M. Bosma, Sheldon, Iowa, at $26,848. Beuttler & Arnold, Archts., Sioux City.

Aurora, Neb.—Following are four lowest bids opened Dec. 22 for constructing U. S. Post Office: Heman Construction Company, St. Louis, Mo., $43,327; A. W. Lane, 19 S. La Salle Street, Chicago, Ill., $43,512; Algernon Blair, Montgomery, Ala., $43,698; W. D. Lovell, 1415 Eighth Street, S. E., Minneapolis, Minn., $45,247.

★**Pueblo, Col.**—Contract awarded by State Board of Corrections for erecting three buildings for Colorado State Insane Asylum to A. Olson Investment Company of Denver, at $140,000.

★**Berkeley, Cal.**—Bd. Regents of University of California awarded contracts as follows: Granite for Benjamin Ide Wheeler Hall to Raymond Granite Co., Division and Potrero Streets, San Francisco, at $225,000; structural steel for addition to University Library, Pacific Rolling Mills Co., Seventeenth and Mississippi Streets, San Francisco, at $46,232.

★**Kingsburg, Cal.**—Following are four lowest bids opened recently for erecting brick high school: Frewhitt & Shields, Fresno, $40,700 (awarded contract); D. B. Day, $40,900; Manning Bros., $41,614, and Benson & Johnson, $43,688. Johnson Bros., Archts., Kingsburg.

★**Los Angeles, Cal.**—Contract for erecting three buildings at the Jefferson High School awarded J. F. Atkinson, 1118 Story Building, at $182,028, omitting Mechanical Arts Building. Norman F. Marsh, Archt., Broadway Central Building.

Richmond, Cal.—Following are four lowest bids opened Dec. 18 by City Clerk for erecting a city hall: William Brothers & Henderson, Hobrook Building, San Francisco, $28,525; M. Morton, 1300 Alcatraz Avenue, Berkeley, $29,977; McLean & Paterson, Sharon Building, San Francisco, $30,976, and Carnahan & Mulford, 45 Kearney Street, San Francisco, $31,185. Narbett & Ogborn, Assoc. Archts., Richmond.

San Francisco, Cal.—Lowest bid opened by Bd. Awards for excavation and foundation work for northwest wing of San Francisco Hospital submitted by O. Monson, 1734 Tenth Avenue, at $15,637.

PRIVATE BUILDINGS

PROPOSED WORK.

Brooklyn, N. Y.—Plans filed for one-story brick Church of the Transfiguration to be erected at Driggs Avenue and Twelfth Street; cost $75,000. L. Allmendinger, Archt., 926 Broadway, Brooklyn.

Buffalo, N. Y.—Lafayette Hotel Company (George W. Sweeney, Pres.), Washington and Clinton Streets, contemplates erecting in early spring two-story addition; cost about $48,000.

Contract about to be let for erecting $65,000 addition to club house of Columbia Turn Verein at Genesee and Kiefer Streets. Brown & Hoffman, Archts., 778 Genesee Street.

New York, N. Y.—Plans being prepared by Herman Lee Meader, 2 West Thirty-third Street, for a 16- or 20-story office building contemplated at 20 Dey Street.

Plans filed for erecting following buildings: 12-story fireproof apartments at 337 W. 101st Street for Paterno Constr. Co., cost $220,000, Gaetan Ajello, Archt., 1 W. Thirty-fourth Street; 5-story brick stores and apartments at 204th Street and Broadway for Alexander Grant Constr. Co., cost $120,000, Neville & Bagge, Archts., 105 W. Fortieth Street; 5-story brick stores and tenement at 207th Street and Vermilyea Avenue for V. R. Bldg. Cor., cost $45,000, Chas. B. Meyers, 1 Union Square, W., Archt.; 16-story fireproof store and loft at 148 Madison Avenue for Charles Remsen, cost $200,000, Wallis & Goodwillie, Archts., 56 W. Forty-fifth Street; four 5-story brick tenements at Daly Avenue and 180th Street for Lanzner Kahn, Inc., cost $155,000, Andrew J. Thomas, Archt., 2526 Webster Avenue; four 5-story brick tenements at Crotona Park, East, and Wilkins Avenue for Kleban Leader, Inc., cost $280,000, Goldner & Goldberg, Archts., 391 E. 149th Street.

Camden, N. J.—State Street Methodist Episcopal Church, Sixth and Grant Streets, contemplates erecting, early in spring, a Sunday school building; cost about $30,000. Rev. George Johnson, Pastor.

Pompton Lakes, N. J.—Charles E. Sleight, Romaine Building, Paterson, is architect for addition to be erected to Susquehanna Hotel; cost about $25,000. Bert Miller, Proprietor.

Harrisburg, Pa.—Plans being prepared by A. A. Ritcher, Sixth and Court Streets, Reading, for new Messiah Lutheran Church to be erected at Sixth and Foster Streets; cost about $70,000. Rev. Henry H. A. Hanson, Pastor.

Homewood (P. O. Pittsburgh), Pa.—Plans being prepared by Thomas Hannah, Keenan Building, Pittsburgh, for brick, terra cotta, store and apartment building to be erected on Homewood Avenue and Heinz Street, for Henry Kreiling; cost $50,000.

Philadelphia, Pa.—Church Extension Board of United Brethren Eastern Conference at a meeting in Lebanon decided to erect Third United Brethren Church here on Wyoming Avenue; cost about $50,000.

Plans being prepared by C. P. Berger, Penn Square Building, for ten-story building to be erected at 329 South Broad Street for Pennsylvania Taximeter Co.

Pittsburgh, Pa.—Pennsylvania R. R. (Alex. C. Shand, Ch. Engr., Philadelphia) intends erecting on old stockyard site at East Liberty a one-story brick freight house, 27 x 368 ft.

Natrona, Pa.—Natrona Aerie, 2009, Fraternal Order of Eagles, contemplating erecting in spring a new building.

Pitcairn, Pa.—Plans being prepared for new McGinnis Presbyterian Church; cost about $35,000.

West Reading, Pa.—Reported preliminary plans being prepared for power house to be erected for Reading Transit Company (Norman McD. Crawford, Pres. and Gen. Mgr., Reading).

Fairmont, W. Va.—Reported Baltimore & Ohio Railroad Company (F. L. Stuart, Ch. Engr., Baltimore) contemplates erecting new passenger station here next spring.

Wilmington, N. C.—Plans being prepared for new edifice to be erected at Fourteenth and Princess Streets for Trinity Methodist Church; cost about $30,000. Rev. W. V. MacRae, Pastor.

Columbia, S. C.—Enoree Warehouse Company, Enoree, reported organized for the purpose of erecting a cotton storage warehouse. Allen J. Graham, Hamlin Beattie and J. G. Bryson, all of Greenville, S. C., incorporators.

Cleveland, Ohio.—A. F. Janowitz, 746 Euclid Avenue, is architect for five-story, brick store and apartment building to be erected at St. Clair Avenue and E. 109th Street for Joseph Schnader; cost $26,000.

Home Financing Company (A. A. Mudge, Secy.), 221 Williamson Building, reported promoters for proposed city-level freight terminal on West Ninth and Spring Streets and Main Avenue, to be used by Big Four & Lake Shore Railroads, eight stories on Ninth Street and twelve stories on Spring Street, concrete and steel construction; cost about $200,000.

Columbus, Ohio.—Erection of Y. M. C. Association building being considered here. John W. Pontius, Gen. Secy., 209 N. Eighteenth Street, may be able to give further information.

Tiffin, Ohio.—A two-story addition to English Lutheran Church is to be erected; cost approximately $30,000.

Toledo, Ohio.—Viking Lodge, Independent Order of Odd Fellows, accepted plans prepared by Sidney E. Aftel, 949 Ohio Building, for three-story and basement, brick, steel and terra cotta, fireproof building to be erected at 1623 Broadway; cost $50,000.

Fort Wayne, Ind.—Home Telephone & Telegraph Company contemplates erecting new building.

Isidor Lehmann is Chairman Building Committee for synagogue contemplated for Achduth Veshalom congregation; cost approximately, $75,000.

Greencastle, Ind.—Masons contemplate erecting new temple; probable cost $25,000.

Indianapolis, Ind.—Rubush & Hunter, American Central Life Building, are architects for $225,000 moving picture theater to be erected here. A. L. Block, 33 West Washington Street, member of Building Committee.

Kokomo, Ind.—Reported Lake Erie & Western Railroad Company (M. P. Deniston, Division Supt., Peru) contemplates erecting new depot here; cost about $25,000.

Milwaukee, Wis.—Stratford Arms Company, 179 Twelfth Street, will erect family hotel on Fourteenth Street and Grand Avenue, to cost about $110,000.

A. C. Clas, Colby-Abbott Building, is architect for eight-story, brick and terra cotta hotel to replace old Plankinton House, at West Water and Sycamore Streets, for West Water-Sycamore Company.

Sioux City, Iowa.—Plans being prepared by Beuttler & Arnold, Security Building, for Tackaberry Building to be erected at Third and Wall Streets; cost about $150,000.

Minneapolis, Minn. — Six additional stories will be erected to Andrews Hotel, Fourth Street and Hennepin Avenue; cost $210,000.

Exhibitor's Photo Play Company, 818 McKnight Building, contemplates erecting 12-story fireproof, reinforced-concrete and steel office building on Seventh Street and Nicollet Avenue.

St. Paul, Minn.—Tentative plans being prepared for $400,000 mosque temple to be erected next fall for Osman Temple of the Mystic Shrine. W. O. Washburn, Chairman Building Committtee.

Independence, Kan.—Reported Citizens' National Bank intends erecting a five-story steel and concrete bank and office building.

York, Neb.—York County Commercial Club reported interested in a company which will erect next spring a $75,000 hotel on old Le Grande House site.

Anaconda, Mont.—Jean MacDonald and others, care of Colonial Apartments, reported interested in erecting $50,000 fireproof apartment house.

Billings, Mont.—Plans completed by Dedrick & Piper, Billings, for three-story, 50 x 140-ft., fireproof brick temple for various labor organizations, to be erected early next spring. H. Anderson, Chairman Building Committee, Yellowstone Trades and Labor Assembly, may be able to give further information.

Butte, Mont.—Reported B. K. Wheeler of Butte will erect 5-story business building here; cost, $60,000.

St. Louis, Mo.—Guy C. Mariner, Chemical Building, is architect for bank building to be erected on Broadway and Washington Avenue, for E. G. Simmons; cost about $125,000.

Port Angeles, Wash.—Reported Seattle, Port Angeles & Western R. R. Company intends erecting terminals in the mouth of Ennis Creek, including a roundhouse, boiler plant, water tank and several miscellaneous structures.

Seattle, Wash.—Reported contract about to be let for erecting $75,000 Christian Science Church of Seattle at Seventh Avenue and Seneca Street.

Portland, Ore.—Reported Studebaker Corporation of America (A. L. Sumption, Mgr.), Chapman and Alder Streets, will erect eight-story reinforced concrete storage building at East Morrison and East Second Streets.

Pasadena, Cal.—Plans being prepared by Myron Hunt, 1017 Hibernian Building, Los Angeles, and contract will be let about February for erecting a five or six-story reinforced concrete 75 x 150 ft. apartment house as annex to Hotel Maryland (D. M. Linnard, Mgr.). Cost about $100,000.

Brantford, Ont.—An agreement has been reached between Brantford & Hamilton Electric Railway Company, Hamilton Terminal Building, Hamilton, and Lake Erie & Northern Railway Company to erect a radial station here to be used jointly by the roads; cost approximately $30,000.

BIDS DESIRED.

Toledo, Ohio.—Reported desired until Jan. 15, by Ottenheimer, Stern & Reichert, 220 S. State Street, Chicago, for erecting three-story and basement, 138 x 103 ft. temple. Probable cost $75,000.

Lansing, Mich.—Reported desired until Jan. 15, by S. D. Butterworth, Archt., 732 Tussing Building, for erecting eight-story and basement, 45 x 100 ft. bank and office building for the Lansing State Savings Bank, Washington and Michigan Avenues.

Britt, Iowa.—Reported desired until Feb. 15, for erecting two-story and basement 44 x 100 ft. brick and stone building for Commercial State Bank. Probable cost, $30,000. Jeffers & Broasters, 1st National Bank Bldg., Mason City, Archts.

Ottumwa, Iowa.—Reported desired until Jan. 5, by Ottumwa Hotel Co., for erecting 6-story and basement, 89 x 163 ft., concrete, brick and terra cotta hotel. Probable cost $200,000. Proudfoot, Bird & Rawson, Archts., Des Moines.

PRICES AND LETTINGS.

★Indicates award of contract.

★**Hoboken, N. J.**—Contract awarded Turner Construction Company, 11 Broadway, New York, for constructing Sections E and F for the Hoboken Land & Improvements Company's Terminal Development Buildings are to be 81 x 496 ft., with wing 27 x 80 ft., 12 stories and basement, all reinforced concrete. Charles Fall, Architect, 1400 Washington Street.

★**Birmingham, Ala.**—Contract awarded Evans Brothers Construction Company, 2231 First Avenue, for erecting five-story, brick, fireproof building at Second Alley and Twenty-second Street, South, for Harris Brothers Transfer Company; cost approximately $50,000.

★**Minneapolis, Minn.**—Contract awarded James Leck Construction Company, 311 South Seventh Street, for erecting apartment building at Tenth Street and Sixth Avenue, South.; cost $75,000. F. W. Densmore, Archt., 217 New York Life Building.

★Contract for erecting the Grace Evangelical Lutheran Church on Harvard and Delaware Streets S. E., awarded S. M. Klarquist & Son, 247 Second Bank Building, at $30,000.

★**Athens, Ga.**—Contract for erecting Y. M. C. Association Building awarded Southern Ferro-Concrete Company of Atlanta, at about $56,077.

★**Calexico, Cal.** — Reported contract awarded Welch Wright Construction Company, El Centro, for erecting steel and concrete warehouse for Imperial Valley Hardware Company, to cost $45,000.

★**Los Angeles, Cal.**—Contracts in connection with the Security Savings Bank Building awarded as follows: General contract to F. O. Engstrom Company, Fifth and Seaton Streets, and bronze and iron work to Bayer Rothgeb Company, total cost, $300,000. John Parkinson, Architect, Security Building.

★Contract, not including heating, plumbing, etc., for erecting a seven-story concrete warehouse at Alameda and Alpine Streets, for J. C. Hills, awarded National Fireproofing Company, 322 Central Building, at $56,954. A. C. Martin, Archt., 430 Higgins Building.

NEW INDUSTRIAL PLANTS

PROPOSED WORK.

Easthampton, Mass.—West Boylston Company will erect three-story, 120 x 600-ft. addition to textile plant.

New Bedford, Mass.—Sharp Manufacturing Company contemplates erecting four-story, 134 x 500 ft. mill, four-story, 70 x 200 ft. storehouse and a two-story, 50 x 110 ft. office building, all of brick construction. Engineers, C. R. Makepeace & Company, Providence, R. I.

Worcester, Mass.—New England Corset Company, Vernon Street, will erect three-story, brick, 60 x 100 ft. factory addition.

New Haven, Conn.—Marlin Arms Corporation (A. F. Rockwell President), Willow and Nicoll Streets, will enlarge plant, to cost about $100,000.

Buffalo, N. Y.—Reported Wickwire Steel Company, River Road, will erect steel and wire plant of approximately 400 tons daily capacity, consisting of open-hearth furnaces, metal mixer, blooming, continuous billet, rod and wire mills.

Niagara Falls, N. Y.—Plans prepared for additional plant to be erected in early spring for Hooker Electro-Chemical Company, Buffalo and Union Streets; probable cost $1,000,000.

International Acheson Graphite Company, Buffalo and Portage Streets, will erect $100,000 addition to plant.

Philadelphia, Pa.—Plans being prepared for power house and manufacturing plant to be erected at American and Somerset Streets for Hafleigh & Company. Engineer, W. E. S. Dyer, Land Title Building.

Contract about to be let for plant to be erected at Nicetown for George W. Blabon, to include four-story, 45 x 71-ft. storage building, oxidizing factory and two-story, 37 x 45 ft., brick and reinforced concrete pump house. Ballinger & Perrot, Archts., Methodist Building.

Thomas Wolstenholme Sons & Company, 3300 Frankford Street, will erect power house and factory at Westmoreland Street and Frankford Avenue; cost $300,000. Engineer, W. E. S. Dyer, Land Title Building.

Contract about to be let for factory to be erected at Twenty-fifth and Dickinson Streets for S. B. & B. W. Fleisher. Frank E. Hahn, Archt., 1112 Chestnut Street.

Crew-Levick Oil Company, Olney Street, intends erecting new plant.

Peuckert & Wunder, 310 Chestnut Street, are architects for two-story brick, concrete and steel ice plant to be erected for Consolidated Ice Manufacturing Company, 2331 Bodine St.

Bridesburg (P. O. Philadelphia), Pa.—Stearns & Castor, Stephen Girard Building, Philadelphia, are architects for three factory buildings to be erected here for Abrasive Material Company.

Baltimore, Md.—Contract about to be let for erecting six-story addition to plant of Wise Brothers, 126 West Fayette Street; cost about $100,000. Parker, Thomas & Rice, Archts., Union Trust Building.

Wheeling, W. Va.—Reported General Baking Company will replace on new site plant recently destroyed by fire.

Salem, Va.—Comas Cigarette Machine Company will erect two-story, brick and concrete fireproof factory on College Avenue; cost, including equipment, about $30,000.

Cincinnati, Ohio. — American Tool Works Company, Cincinnati, will erect new plant on Eggleston Avenue and Third Street, to cost about $250,000.

East Youngstown, Ohio.—Reported Directors of Youngstown Sheet & Tube Company have authorized erecting 500-ton blast furnace at plant here; cost approximately $1,000,000.

Chicago, Ill.—The Central Cold Storage Company, composed of S. Water and W. Randolph Street produce merchants, reported formed for the purpose of erecting a 14-story and two basement cold storage building on South Water Street between Kinzie and Dearborn Streets; cost $900,000.

Minneapolis, Minn.—Bardwell Robinson Company, Twenty-fourth Avenue, N., and Second Street, will erect $50,000 addition to plant.

St. Paul, Minn.—Frank A. Kernan, 1374 Breda Street, and others, reported interested in Hamline Manufacturing Company, which will erect next spring a $50,000 steel and concrete aeroplane factory at 1591 Almond Ave.

Spokane, Wash.—Reported Carstens Packing Company (Thos. Carstens, Pres. and Mgr., Tacoma) will spend early next year $50,000 in erecting reinforced concrete additions to plant on Broadway and Regal Street.

BIDS DESIRED.

Dallas, Tex.—Reported desired until Jan. 10 for erecting mattress factory for T. B. Burnett & Co.; probable cost $65,000.

Buena Vista, Colo.—Reported desired until Jan. 30, erecting smelting and cyanide plant for National Manufacturing & Constructing Co.;, probable cost $150,000.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Woburn, Mass.**—Contract for erecting an ore sintering plant and a sulphuric acid plant for Merrimac Chemical Company awarded Stone & Webster Engineering Corporation, Boston.

★**Hartford, Conn.**—Contract awarded Stone & Webster Engineering Corporation, Boston, Mass., for erecting a plant for the S. K. F. Ball Bearing Company.

★**Buffalo, N. Y.**—Contract awarded Stone & Webster Engineering Corporation, Boston, Mass., for erecting a 60,000 kw. steam power station near Buffalo for Buffalo General Electric Company.

★**Camden, N. J.**—Contract awarded Philip Haibach Contracting Company, Twenty-sixth and Thompson Streets, Philadelphia, Pa., for erecting varnish works and thinning plant on East and State Streets and Pennsylvania R. R., for Eugene E. Nice. Building to be of brick, steel and concrete. Peuckert & Wunder, Archts., 310 Chestnut Street, Philadelphia, Pa.

★**Coatesville, Pa.**—Contract awarded Irwin & Leighton, 126 North Twelfth Street, for erecting concrete and steel machine shop for Midvale Steel Company.

★**Harrisburg, Pa.**—Contract awarded McClintock-Marshall of Pottstown for erecting for the Welmer Machine Works Company of Lebanon an erecting and pattern shop to be steel construction throughout.

★**Monongahela, Pa.**—Contract awarded by Richard Irvin, Archt., Union Bank Building, Pittsburgh, for erecting Stauffer Chemical plant at Pigeon Creek, near Frye Station, to George Hogg Company, Keystone Building, Pittsburgh.

★**New Castle, Pa.**—Contract awarded Anderson & Filey, New Castle, for erecting addition to plant of American Car & Ship Hardware Company, on South Mill Street; cost about $20,000.

★**Tacony (P. O. Philadelphia), Pa.**—Contract awarded F. W. Van Loon, Denckla Building, Philadelphia, for erecting three brick and steel buildings for Henry Disston & Sons Company; cost $55,000.

★**Youngstown, Ohio.**—Contract awarded William B. Pollock of Youngstown, for constructing No. 5 Bessemer stack for Republic Iron & Steel Company.

★**Chicago, Ill.**—Contract awarded Woermann Construction Company, Century Building, St. Louis, Mo., for erecting fireproof hog hair house for Armour & Company, National Stock Yards, Ill.

★**Nonconnah, Tex.**—Contract for 350 tons of steel for the shop buildings of the Illinois Central R. R. awarded Kelly-Atchison Construction Company, 189 W. Madison Street, Chicago, Ill.

Seattle, Wash.—Following are four bids opened recently by Port Commission for installing refrigeration and other equipment in the apple storage warehouse: Harrington & Peters, Seattle, $117,500; Vilter Mfg. Company, Seattle, $126,500; Andrew MacLean, Seattle, $142,740, and York Mfg. Company, Seattle, $171,100.

MISCELLANEOUS

PROPOSED WORK.

Parks—Knoxville, Tenn.—Citizens will vote Jan. 29 on issuing $50,000 bonds for parks and playgrounds.

Dock — St. Louis, Mo.—Bd. Aldermen authorized constructing of first section of municipal dock system on Mississippi River. Dock to cost $250,000 and loading machinery $35,000 additional.

Subway, Sherbrooke, Que.—City Council considering the building of a subway on Richelieu Street to cost $9,200 plus cost of sewer, water and gas pipe to be laid. Thomas Tremblay, City Engineer. E. C. Gatun, Secy.-Treas.

BIDS DESIRED.

Iron Fence—New York, N. Y.—Until Jan. 6, by Cabot Ward, Pres. Park Comrs., for furnishing material and erecting a wrought-iron fence and setting of artificial granite gate posts around Morningside Park. Security, $7,000.

Cement—Baltimore, Md.—Until Jan. 15, by Board of Awards, at office of Rich. Gwinn, City Register, for furnishing American Portland cement to city during year 1916. R. M. Crooksey, Highway Engineer, Baltimore.

Cement—Atlanta, Ga.—Reported desired until Jan. 17, by Office Superintendent Prisons, Washington, D. C., for furnishing and delivering at U. S. Penitentiary, Atlanta, 8000 bbl. Portland cement.

Cement—Chicago, Ill.—Until Jan. 7, by Department of Public Works (W. R. Moorhouse, Comr.), for furnishing, delivering and unloading Natural cement as may be required for city during year 1916.

Elevator—Watertown, Ill.—Reported desired until Jan. 10, by Board of Administration (Frank D. Whipp, Fiscal Superv.), Springfield, for furnishing and installing freight elevator in laundry building at Watertown State Hospital.

Light Standards—Janesville, Wis.—Until Jan. 11, by Board Public Works (Jas. A. Fathers, Chmn.), for furnishing f.o.b. Janesville, 125 to 135 light standards for proposed lighting system.

Reinforced Bars—Adel, Iowa.—Reported desired until Jan. 5 by M. T. Finley, County Auditor, for furnishing reinforced bars, about 155,000 lb. ½ in. sq., 33,000 lb. ⅝ in., 20,000 lb. ¾ in., all to be in 30-ft. lengths and delivered f.o.b. cars Redfield, Moram, Perry and Adel.

Steel Oil Tanks—New Ulm, Minn.—Until Jan. 4 by William Backer, City Clerk, for furnishing two steel oil tanks f.o.b. cars New Ulm; one to be 10,000 gal. tank, 8 ft. diameter, 3/16-ft. shell, ¼-in. steel heads, and one 12,000 gal. capacity, 10 ft. 6 in. diameter, 3/16-in. steel shell and ¼-in. steel heads. Tanks to be provided with manhole and other necessary openings. F. D. Minium, City Engineer.

Barge—Dallas, Tex.—Until Jan. 27 by U. S. Engineer Office, Dallas, for constructing and delivering one steel barge, advertised in Engineering Record.

Removal of Wreck—San Francisco, Cal.—Until Jan 19, by U. S. Engr. Office, 401 Custom House, San Francisco, for removal of wreck "City of Panama," now lying in San Francisco Bay.

Rock Crusher Plant—Winnipeg, Man.—Until Jan. 10, by Greater Winnipeg Water Dist. (S. H. Reynolds, Chmn. of Comrs., 901 Boyd Building, Winnipeg), for rock crushing plant for said district.

Steel, Iron Pipe, etc.—Panama.—Until Jan. 17, by Maj. F. C. Boggs, Corps Engrs. U. S. A., General Purchasing Officer, the Panama Canal, Washington, D. C., for Cir. 1000—galvanized sheet steel or iron, spring steel, steel and iron pipe, valves, steam gauges, etc.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Bars—Minneapolis, Minn.**—Contract for furnishing steel reinforcing bars for city construction during 1916 awarded as follows: 450 tons corrugated bars to T. F. McCormick, 710 Pioneer Press Building, St. Paul, for $1.60 cwt. base; for 250 tons of plain bars to C. A. P. Turner Construction Company, Minneapolis, at $1.75 cwt. f.o.b. cars, Minneapolis.

★**Tucson, Ariz.**—Contract for constructing subway under Southern Pacific tracks at Congress Street awarded Bent Brothers, Los Angeles, at $56,700. Next three lowest bidders: Warren Brothers Company, $62,900; T. Boettger, $64,300, and Missouri Valley Bridge & Iron Company, $69,600.

Proposals

For Proposals Advertised, See Pages 53 and 54.

WATERWORKS.

Bids Close.		See Eng. Record.
Jan. 4.	Water Works, Wesson, Miss. Adv. Dec. 18.	Dec. 18
Jan. 4.	Pumps, etc., Montreal, Que.	Jan. 1
Jan. 4.	Ridgefield, Wash.	Jan. 1
Jan. 6.	Reservoir, Manteca, Cal.	Dec. 18
Jan. 10.	Filter, Danville, Pa. Adv. Dec. 18.	Dec. 18
Jan. 11.	Filter Plant, St. Hyacinthe, Que.	Dec. 4
Jan. 12.	Pumping Unit, Kansas City, Mo. Adv. Dec. 11 to Jan. 1.	Dec. 11
Jan. 17.	Pumping Unit, St. Paul, Minn. Adv. Dec. 24.	Dec. 25
Jan. 18.	Meters, etc., Opelousas, La.	Jan. 1
Jan. 8.	Bonds, Goldthwaite, Tex. Adv. Jan. 1.	Jan. 1
Jan. 29.	Pumping Station, etc., Kenosha, Wis. Adv. Jan. 1.	Jan. 1
Jan. 31.	Filtration Structure, Oshkosh, Wis. Adv. Jan. 1.	Jan. 1

SEWERAGE AND SEWAGE DISPOSAL.

Jan. 4.	Key West, Fla.	Dec. 4
Jan. 4.	Loveland, Col. Adv. Dec. 18 to Jan. 1. Adv. Dec. 4.	Dec. 18
Jan. 4.	Hampton, Iowa	Dec. 25
Jan. 4.	Middletown, Ohio	Jan. 1
Jan. 5.	Rochester, N. Y.	Jan. 1
Jan. 5.	Boston, Mass.	Jan. 1
Jan. 6.	Mason City, Iowa	Dec. 4
Jan. 6.	Westfield, Mass. Adv. Jan. 1.	Jan. 1
Jan. 7.	St. Louis, Mo	Jan. 1
Jan. 7.	Strawberry Point, Iowa	Dec. 25
Jan. 10.	San Antonio, Tex.	Jan. 1
Jan. 12.	Baltimore, Md. Adv. Jan. 1.	Jan. 1
Jan. 12.	New Bedford, Mass.	Jan. 1
Jan. 24.	Elgin, Ill.	Jan. 1
Jan. 24.	Cuyahoga Falls, Ohio	Jan. 1

BRIDGES.

Jan. 4.	Wadena, Minn.	Dec. 11
Jan. 4.	Rochester, Ind.	Jan. 1
Jan. 5.	Deadwood, S. D.	Jan. 1
Jan. 5.	Adel, Iowa	Jan. 1
Jan. 5.	Wagadahl, Minn.	Jan. 1
Jan. 6.	Waverly, Iowa	Jan. 1
Jan. 7.	Mannewaukon, N. D.	Jan. 1
Jan. 8.	Washington, Kan.	Jan. 1
Jan. 11.	York, Neb.	Jan. 1
Jan. 13.	Laporte, Ind.	Jan. 1
Jan. 14.	Berkeley Springs, W. Va.	Jan. 1
Jan. 15.	Tucson, Ariz.	Dec. 25
Jan. 15.	Sandpoint, Idaho	Dec. 25
Jan. 17.	Redlands, Cal.	Jan. 1
Jan. 18.	Knoxville, Iowa.	Dec. 18
Jan. 20.	Fort Benton, Mont. Adv. Dec. 25, Jan. 1.	Dec. 25
Jan. 20.	Sulphur, Okla.	Jan. 1
Jan. 26.	Rockford, Ill. Adv. Dec. 25.	Dec. 25
Jan. 31.	Iowa City, Iowa	Jan. 1

PAVING AND ROADS.

Jan. 4.	Oklahoma City, Okla	Dec. 25
Jan. 4.	Huntsville, Ala.	Dec. 18
Jan. 4.	Cincinnati, Ohio	Jan. 1
Jan. 5.	Seymour, Mo.	Dec. 25
Jan. 5.	Auburn, Wash.	Jan. 1
Jan. 6.	Brooklyn, N. Y.	Jan. 1
Jan. 6.	The Dalles, Ore	Dec. 18
Jan. 7.	Jackson, Tenn.	Jan. 1
Jan. 7.	Carlton, Minn.	Jan. 1
Jan. 7.	Indiana	Jan. 1
Jan. 8.	Anderson, Ind.	Dec. 25
Feb. 9.	Indiana	Jan. 1
Jan. 11.	Florence, S. C.	Dec. 18
Jan. 11.	Albany, N. Y. Adv. Dec. 18, 25.	Dec. 18
Jan. 11.	Seattle, Wash.	Jan. 1
Jan. 12.	Dadesville, Ala.	Dec. 25
Jan. 12.	Seattle, Wash.	Dec. 25
Jan. 13.	Sault Ste. Marie, Mich.	Dec. 4
Jan. 14.	Charlestown, W. Va.	Dec. 18
Jan. 15.	Walla Walla, Wash	Jan. 1
Jan. 17.	Evanston, Ill. 2 Props., Adv. Dec. 25, Jan. 1.	Dec. 25
Jan. 17.	East View, Ohio	Dec. 25
Jan. 20.	Greenfield, Iowa.	Dec. 25
Jan. 24	Washington	Jan. 1
Jan. 25.	Fort Madison, Iowa	Jan. 1

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS.

Bids Close.		See Eng. Record.
Jan. 4.	State Canal, Contract 73-A, Albany, N. Y.	Dec. 11
Jan. 4.	Indiana	Dec. 25
Jan. 4.	San Gabriel, Cal.	Dec. 25
Jan. 4.	Fill, Jacksonville, Fla	Jan. 1
Jan. 5.	Wharf, etc., New Orleans, La. Adv. Dec. 11 to Jan. 1.	Dec. 11
Jan. 5.	Piling, lumber, etc., for wharf, New Orleans, La. Adv. Dec. 11 to Jan. 1.	Dec. 11
Jan. 6.	Bakersfield, Cal.	Dec. 25
Jan. 6.	Power House at Dam, Wheeling, W. Va. Adv. Dec. 11 to Jan. 1.	Dec. 11
Jan. 7.	Ditch, Duluth, Minn	Dec. 18
Jan. 8.	Dredge, Macaco, China	Nov. 6
Jan. 8.	Dams, etc., Norfolk, Va.	Jan. 1
Jan. 9.	Ditch, Huntington, Ind.	Jan. 1
Jan. 10.	Ditches, Poplar Bluffs, Mo.	Dec. 18
Jan. 11.	State Canal Work, Albany, N. Y. Adv. Dec. 18 to Jan. 1.	Dec. 18
Jan. 11.	Bars for Tunnel Work, Los Angeles, Cal	Jan. 1
Jan. 12.	Sherman, Tex.	Dec. 25
Jan. 14.	Gates for dam, Wheeling, W. Va. Adv. Dec. 18 to Jan. 1.	Dec. 18
Jan. 14.	Drain, Tempe, Ariz	Jan. 1
Jan. 15.	Ditch, Memphis, Tenn	Jan. 1
Jan. 15.	Ditch, Parr, Ind	Jan. 1
Jan. 17.	Ft. Wayne, Ind Adv. Dec. 25.	Dec. 25
Jan. 17.	Irrigation, Oakdale, Cal.	Dec. 25
Jan. 18.	Irrigation, Montrose, Col.	Dec. 25
Jan. 22.	Power House at Dam, Wheeling, W. Va. Adv. Dec. 25 to Jan. 1.	Dec. 25
Jan. 25.	Ditch, Crookston, Minn.	Dec. 25

PUBLIC BUILDINGS AND SCHOOLS.

Jan. 4.	Cavite, P. I.	Nov. 13
Jan. 4.	Greenville, S. C.	Nov. 27
Jan. 4.	Gaylord, Minn.	Dec. 4
Jan. 4.	Crookston, Minn	Dec. 11
Jan. 4.	East Cleveland, Ohio	Dec. 11
Jan. 4.	Trinidad, Col.	Dec. 23
Jan. 4.	St. Louis, Mo	Jan. 1
Jan. 4.	River Rouge, Mich	Jan. 1
Jan. 5.	Harlan, Iowa	Nov. 27
Jan. 5.	Providence, R. I.	Dec. 18
Jan. 5.	Marcus Hook, Pa	Dec. 25
Jan. 6.	Wheeling, W. Va. Adv. Dec. 11 to Jan. 1.	Dec. 11
Jan. 6.	Howard, R. I.	Dec. 25
Jan. 8.	Ogden, Utah	Jan. 1
Jan. 8.	Terre Haute, Ind.	Jan. 1
Jan. 10.	Titusville, Pa. Adv. Dec. 4, 11.	Dec. 4
Jan. 10.	Toledo, Ohio	Dec. 18
Jan. 10.	Elkhart, Ind.	Jan. 1
Jan. 10.	Tuscola, Ill.	Jan. 1
Jan. 10.	Prescott, Ariz.	Jan. 1
Jan. 11.	Durham, N. C.	Dec. 18
Jan. 11.	Cherry Grove, Ohio	Jan. 1
Jan. 12.	Ortonville, Minn.	Jan. 1
Jan. 15.	Duluth, Minn.	Dec. 11
Jan. 15.	St. Louis, Mo	Dec. 25
Jan. 15.	Fort Pierce, Fla	Jan. 1
Jan. 15.	Lambton Mills, Ont	Jan. 1
Jan. 16.	Sidney, Neb.	Dec. 11
Jan. 17.	Hackensack, N. J.	Dec. 11
Jan. 17.	Smithfield, R. I.	Dec. 18
Jan. 18.	Anoka, Minn.	Dec. 11
Jan. 18.	Clarksdale, Miss.	Jan. 1
Jan. 19.	Hornell, N. Y.	Dec. 11
Jan. 20.	Crookston, Minn.	Dec. 25
Jan. 21.	Waterloo, N. Y.	Dec. 18
Jan. 22.	Wheeling, W. Va. Adv. Dec. 25, Jan. 1.	Dec. 25
Jan. 24.	Ashland, Ky.	Dec. 18
Jan. 24.	Nevada, Iowa	Jan. 1
Jan. 26.	Shelby, N. C.	Dec. 18
Jan. 27.	Ellensburg, Wash.	Dec. 18
Jan. 28.	Washington, Iowa	Dec. 25
Jan. 31.	Key West, Fla	Jan. 1
Jan. 31.	Delaware, Ohio	Jan. 1
Feb. 1.	Oneida, Iowa	Dec. 18
Feb. 1.	George West, Tex.	Dec. 18
Feb. 7.	Sioux City, Iowa	Dec. 25

PRIVATE BUILDINGS.

Jan. 5.	Ottumwa, Iowa	Jan. 1
Jan. 10.	Vicksburg, Miss.	Dec. 25
Jan. 15.	Toledo, Ohio	Jan. 1
Jan. 15.	Lansing, Mich.	Jan. 1
Feb. 15.	Britt, Iowa	Jan. 1

MISCELLANEOUS.

Jan. 3.	Garbage incinerator, Fort Wayne, Ind. Adv. Dec. 11, 18.	Dec. 11
Jan. 4.	Oil Tanks, New Ulm, Minn.	Jan. 1
Jan. 5.	Bars, Adel, Iowa	Jan. 1
Jan. 6.	Iron Fence, New York, N. Y.	Jan. 1
Jan. 7.	Cement, Chicago, Ill.	Jan. 1
Jan. 8.	Steel towers, Guam	Nov. 20
Jan. 8.	Iron, Steel, Etc., Panama Adv. Dec. 18 to Jan. 1.	Dec. 25
Jan. 10.	Rock Crusher Plant, Winnipeg, Man.	Jan. 1
Jan. 10.	Elevator, Watertown, Ill.	Jan. 1
Jan. 11.	Light Standards, Janesville, Wis.	Jan. 1
Jan. 12.	Cruiser, Chicago, Ill. Adv. Dec. 18 to Jan. 1.	Dec. 18
Jan. 14.	El. Rys., New York, N. Y.	Jan. 1
Jan. 15.	Cement, Baltimore, Md.	Jan. 1
Jan. 17.	Steel pipe, etc., Panama.	Jan. 1
Jan. 17.	Cement, Atlanta, Ga.	Jan. 1
Jan. 18.	Cement tank, Louisville, Ky.	Dec. 25
Jan. 18.	Garbage Disposal, New York, N. Y. Adv. Dec. 25, Jan. 1.	Dec. 25
Jan. 19.	Garbage Incinerator, Edgwood, Pa.	Dec. 25
Jan. 19.	Removal of Wreck, San Francisco, Cal.	Jan. 1
Jan. 24.	Boilers, West Point, N. Y. Adv. Dec. 25, Jan. 1.	Dec. 25
Jan. 27.	Barge, Dallas, Tex. Adv. Jan. 1.	Jan. 1
Feb. 11.	Locomotives for Sale, Panama Adv. Jan. 1.	Jan. 1
Apr. 1.	Memorial, Fort McHenry, (P. O. Baltimore, Md.).	Nov. 20

CONTRACTING NEWS

Of Special Interest to Engineers, Contractors, Builders and Manufacturers of Engineering and Building Supplies

But twice in the four years prior to 1915 had sales of stocks passed 15,000,000 shares in one month on the New York Stock Exchange, and only once had sales of bonds passed $100,000,000 in value in one month. The first of these figures has been exceeded five times and the second four times within the past year. Sales of stocks last year exceeded the average for 1911, 1912 and 1913 by 32½ per cent, and sales of bonds exceeded the same 3-year average by 27½ per cent. The charters filed in this country in 1915 for incorporations involving $100,000 or more are estimated at more than two billion dollars, the largest total since 1912. Of the whole, it is estimated that more than $500,000,000 is represented by companies formed either to produce war supplies or to make products the supply of which has been curtailed by the war. Conditions are believed to be favorable to a large volume of new incorporations during 1916, indicating that private construction work will continue to increase. Gross railway earnings for the past year are estimated at $3,245,000,000, practically equal to those of 1913, while net earnings are expected to exceed those of 1913 by $125,000,000 or $130,000,000, reaching $1,050,000,000. Union labor in New York State in the building trades was better employed last November than in any November in the previous four years except that of 1912. The latest statement of the Department of Labor shows 23.9 per cent of the membership of these unions unemployed as compared with 44 per cent a year ago and 28.5 per cent in 1913.

Buildings

The volume of building work, both actual and prospective, continues to increase in a most gratifying manner. Eight contracts amounting to $200,000 or more are reported as having been let, in addition to a number of contracts ranging between $100,000 and $200,000. Among the latter is the U. S. Post Office at Missoula, Mont., for which a low bid of $122,000 was received. Among the larger contracts are a $200,000 building at Brockton, the $600,000 chamber of commerce building at Rochester, N. Y., a $256,000 hospital at Philadelphia, hospital buildings to cost $284,000 at Spring City, Pa., a $390,000 school at Cincinnati, a sugar factory to cost $700,000 at Twin Falls, Idaho, and a $300,000 concrete warehouse contracted for at Crockett, Cal. Bids are desired for constructing on armory in Yonkers, N. Y., for erecting a $100,000 school in Windsor, Ont., for building a $130,000 hospital at San Bernardino, Cal., for a $150,000 university building at Seattle and for constructing and equipping complete a sugar plantation near Manila, P. I.

A $164,000 public library has been planned at Boston, and plans have been filed in New York City for a $600,000 hotel. Additions to an industrial plant at Allentown, Pa., to cost $350,000 are contemplated. A $500,000 commercial building and a $125,000 warehouse are planned in Cleveland. Plans are being prepared for a $400,000 hotel in Columbus, Ohio. At Milwaukee a $350,000 telephone exchange is being planned. An automobile plant to cost $200,000 is to be built at San Francisco. An appropriation of $1,000,000 is available for the Federal Building at Honolulu, for which a site has been purchased.

Among the bond issues sold last week for building construction was $500,000 of the $1,500,000 issue for the Newark (N. J.) memorial buildings, for which a site has been selected. Lexington and Hopkinsville, Ky., have each sold $100,000 school bonds, and a $165,000 bond issue for high-school construction has been sold at Covington, Ky.

Bridges and Roads

A contract for the bridge at New Gretna, N. J., has been awarded at $93,000. Bids have been opened by the California Highway Commission for a $90,000 bridge. Bids are asked for Jan. 31 by the Boston Elevated Railway for building the foundations for the Mystic River bridge. The bridge will require seventeen masonry piers, whose footings are to be carried more than 30 ft. below low water. Bids will be opened Feb. 1 for the superstructure of a steel bridge over the Kaw River in Kansas City. Bids are also desired for constructing a $50,000 concrete bridge at Tucson, Ariz. A report of the Philadelphia Bureau of Surveys transmitted to the city council states that the construction of a bridge between Camden and Philadelphia is feasible and estimates the cost at $18,000,000. Plans have been prepared for a $200,000 concrete bridge at Reading, Pa. A 740-ft. steel bridge on concrete piers is to be built at Chippewa Falls, Wis. It is expected that bridge and grade-crossing-elimination work to cost between $600,000 and $700,000 will be let this year at Portland, Ore.

Bids have been opened at Baltimore on an $86,000 paving contract, and three contracts on which bids were opened by the California Highway Commission will cost $128,000. Bids are desired at La Porte, Ind., for paving work to cost $110,000, and contracts for 34 miles of road construction will be let Jan. 18 at Jamestown, Tenn. Bids will be opened next week at Denison, Tex., for highway work for which $900,000 is available. San Antonio desires bids Jan. 20 for constructing 185,000 sq. yd. of pavements. Spokane will open bids the middle of next month for paving work to cost $210,000. A contract will be let next month for highway work to cost $200,000 at Barbourville, Ky. About $220,000 is to be spent at Walker, Minn., on county road construction. Paving work to be contracted for this year at Portland, Ore., will cost $250,000. Surveys have been ordered for a $1,000,000 highway from Los Angeles to Imperial Valley.

Waterworks and Sewers

A sewer contracted for at Cincinnati will cost $56,000. The lowest bid received for constructing a sewer at Seattle was $48,500. Bids have been opened for building a $41,000 sewer at Stockton, Cal. A report has been submitted to Watertown, N. Y., on a waterworks system to cost $900,000. Columbia, S. C., has sold waterworks and sewer bonds amounting to $500,000. Evansville, Ind., will contract next spring for 3200 ft. of 4 to 5-ft. trunk sewer. The construction of two additional reservoirs is being considered at Cincinnati. A high-pressure water system being considered at Joliet, Ill., will cost $150,000. A contract is to be let next month at Milwaukee for sewer work to cost $450,000, including a 1500-ft. tunnel. Marinette, Wis., is to build an $85,000 filtration plant. It is estimated that the waterworks proposed at Albuquerque, N. M., will cost $413,000. Portland, Ore., will spend $180,000 for sewer construction this year.

Miscellaneous

The lowest bid opened Jan. 4 at Albany, N. Y., for a section of state barge canal was $321,000. A $100,000 hydroelectric plant is being planned at Winsted, Conn. A permit for building two additional shipways and extending two piers has been issued to a Philadelphia shipbuilding concern. Niagara Falls, N. Y., has sold $190,000 bonds to pay for its share of grade-crossing elimination. Railroad double-tracking work reported at Hamilton, Ohio, will cost $360,000. An irrigation project at Stockton, Cal., will cost $285,000.

WATERWORKS

PROPOSED WORK.

New York, N. Y.—Board of Water Supply has applied to the Board of Estimate for $22,000,000 to develop Schoharie Creek watershed in connection with the Catskill Aqueduct project. A hearing is to be held Jan. 18.

Bridgeton, N. J.—Charles Collins, Philadelphia, Pa., is engineer for water works improvements contemplated here, including repairs to present reservoir and construction of a new reservoir.

Woodbine, N. J.—Woodbine Land & Improvement Company (W. E. Bertrand, Purchasing Agent), will install in 1916 about 2300 ft. 6-in. wood water mains and five 4-in. hydrants, one feed water meter, and some concrete work.

Mount Joy, Pa.—The water works plant destroyed by fire is to be rebuilt.

Pennsylvania.—The State Water Commission at Harrisburg, Dec. 22, approved application of Jones & Laughlin Steel Co. to construct a pumping station and intake on west bank of Ohio River at Aliquippa, Beaver County.

Columbia, S. C.—Water works and sewerage improvements bonds amounting to $500,000 have been sold.

Sharon, Tenn.—Citizens voted $25,000 bonds for installing a water and light plant. As soon as bonds are sold, contracts will be awarded. Address Town Clerk.

Canal Winchester, Ohio.—Water works bonds amounting to $12,000 sold.

Cincinnati, Ohio.—Reported construction of two additional reservoirs with a total capacity of approximately 200,000,000 gal. is under consideration. J. A. Hiller, Water Works Superintendent.

Greenwich, Ohio.—Improvements planned to the water works and electric light plant will include enlarging of the reservoir, repairing spillway, new pump, and lowering pumps, and other improvements; probable cost $15,000. F. Daniels, City Clerk.

Newcomerstown, Ohio.—Village Council is considering municipal ownership of water works and electric light plant.

Durand, Mich.—Reported improvements contemplated to the municipal water works and electric light plant. Address City Clerk.

Joliet, Ill.—Reported installation of a high pressure water system in the business district is being considered; probable cost $150,000. Address Mayor.

Madison, Wis.—Plans are to be prepared by Mead & Seastone, Engineers, for enlarging artesian well system.

Marinette, Wis.—City Council voted to purchase water works and constructing $85,000 filtration plant.

Audubon, Iowa.—See "Paving and Roads."

Vinton, Iowa.—The town will install by April or May two 300-kwv. steam turbines, new switchboard, and new pumps for water works system. W. E. Klingman, Superintendent.

Minneapolis, Minn.—See "Water Works."

Elkhart, Kan.—Reported an election to be held on constructing water works costing $17,500. W. B. Rollins, Consulting Engineer, Kansas City, Mo.

Emporia, Kan.—Citizens Dec. 28 voted to issue $150,000 bonds for improvements to the water works. Black & Veatch, Engineer, Kansas City, Mo.; Fred. H. Smith, City Clerk.

Pocahontas, Ark.—City Council organized the Water Works Improvement District and appointed E. Dalton one of the commissioners. Steps being taken to install the water works system.

Claude, Tex.—City is ready to grant a franchise for water works and an electric light plant. Address Board City Development.

Henryetta, Okla.—Water works bonds for $100,000 are for sale by T. S. Williamson, City Clerk.

Ringling, Okla.—Reported bond issue for $40,000 for water works system is contemplated.

Albuquerque, N. M.—In a report submitted to City Council, Jas. N. Gladding, City Engineer of El Paso, estimates cost of constructing water works in Albuquerque at $413,000.

Clovis, N. M.—Election soon to be held to vote $25,000 bonds for extensions to sewer and water systems.

Seattle, Wash. — City Council has adopted resolutions to lay water mains in Wyoming and 9th Avenues.

Calexico, Cal.—At election Dec. 28 citizens voted $64,000 bonds for water system; $25,000 bonds for extension of sewer system.

Riverside, Cal.—Reported plans being prepared for the water works to include two reservoirs, one on the first knoll for supplemental irrigation reservoir, and the other for domestic use. Address City Engineer.

San Bruno, Cal.—Election soon to be held to vote $35,000 bonds for providing needed water mains.

San Diego, Cal.—City has applied to Los Angeles Federal Land Office for permission to construct a 160-foot dam in San Diego River, from which aqueduct and pipe lines would be constructed into University Heights reservoir. H. A. Whitney, City Hydraulic Engineer.

Woodland, Cal.—Council reported to be considering constructing water works costing $45,000. Address City Engineer.

Centerville, Utah.—Citizens voted $15,000 water works bonds. It is proposed to construct a cement reservoir at mouth of the canyon and pipe water to resident portion of town.

Montreal, Que.—City Council has approved the three by-laws providing for an additional expenditure of $2,680,000 on the water works system.

BIDS DESIRED.

Pittsburgh, Pa.—Until Jan. 14, at office of City Controller, for piping and appurtenances at the Brilliant Pumping Station, Contract No. 13-H. Robt. Swan, Dir. Dept. Pub. Wks.

Baltimore, Md.—Until Jan. 19 by Board of Awards at office of City Register, for furnishing Water Board c. i. pipe and fittings, hypochlorite of lime sulphate of iron, caustic lime, galvanized iron pipe and fittings, brass service pipe connections, brick, pig lead, etc., required from Jan. 1 to April 1, 1916, advertised in Engineering Record. Walter E. Lee Water Engineer.

Orangeburg, S. C.—Until Feb. 1, by Mayor and Councilmen, for one or two engine-generator exciter units one surface condenser, one motor-driven triplex pump, complete switchboard and approximately 300 tons c. i. pipe with valves, fittings, etc., advertised in Engineering Record. James E. Salley, Superintendent Water and Light Plant; T. O. S. Dibble, City Clerk.

Clarksdale, Miss.—Until Jan. 18, by the City Commissioners, for constructing power plant building, furnishing and erecting certain equipment for same, and for erecting certain other equipment already purchased for Clarksdale Light and Water Works, advertised in Engineering Record. W. M. Purnell, City Clerk.

Galesburg Ill.—Until Jan. 14 (readvertisement), by Wm. L. Boutelle, City Clerk, for constructing tubular well, not less than 10 in. in diameter and to a depth of 2500 ft., more or less, advertised in Engineering Record. F. M. Connolly, City Engr.

Tracy, Minn.—Until Jan. 18, by Charles Campbell, City Recorder, for 100,000 gal. tank and steel tower.

Chanute, Kan.—Until Jan. 11, by City Clerk, for low service pump directly connected to an electric motor; two high-service pumps and one fire pump at water works station, and an additional three-phase unit at electric plant and a transmission line from electric plant to water station.

Coffeyville, Kan.—Until Jan. 10, by City Clerk, for machinery and equipment for the water works for which the citizens Dec. 28 voted $20,000 bonds. A 500-hp. water tube boiler, with superheater, smoke stack and stoker, and 750-kw. high-pressure condensing turbine generating unit. Alternate on Diesel engine will be considered. Carl E. Stronquist, Supt. Water and Light Dept.

Oswego, Kan.—Until Jan. 14, by J. F. Waskey, City Clk., for furnishing material and constructing extension to water works to consist of sedimentation basin, pumping equipping, hydrants, valves, piping, etc. Albert C. Moore, Engr., Frisco Bldg., Joplin.

Joplin, Mo.—Until Jan. 14 for water works extensions and filter plant to cost $30,000. Albert C. Moore, Engineer, Joplin.

Los Angeles, Cal.—Until Jan. 17 by County Board Supervisors for furnishing and installing 32,000 ft. 4 in. and 12,600 ft. 6 in. Class B c.-i. pipe and alterations to pumping plant in Water District No. 1.

Toronto, Ont.—Until Jan. 11, by T. L. Church (Mayor), Chmn. Board Control, for cast-iron special castings for main pumping station.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Providence, R. I.**—Contract for making wash and core borings (bids opened Dec. 22) awarded by Board Water Supply to Sprague & Henwood, Inc., Scranton, Pa., at $10,460. For unit figures see Engineering Record of Jan. 1. Frank E. Winsor, Chief Engineer of Board.

★**Batavia, N. Y.**—Contract for c. i. pipe and specials in connection with the water works awarded U. S. C. I. Pipe & Foundry Company, Burlington, N. J., and for lamps for street lighting to the Westinghouse Electric Manufacturing Company, Pittsburgh, Pa. Chester & Fleming, Engineers, Pittsburgh, Pa.

Reading, Pa.—Donaldson Iron Company, Emaus, submitted the lowest bid for c. i. water pipe at $6,956.

★**Cleveland, Ohio.** — Contract awarded by Board of Control to Allis Chalmers Company, Milwaukee, at $35,000, for dismantling and relocating three pumps at Division Avenue Pumping Station.

★**Brookville, Ind.**—Contract for furnishing a pump awarded John H. McGowan Company, Cincinnati, Ohio, at $2,950 for a triple expansion pump with a 200-ft. condenser.

★**Cedar Rapids, Iowa.**—Contract awarded Allis-Chalmers Company, Milwaukee, Wis., for a 7,000,000-gal. high lift pump at $18,000.

★**Lincoln, Neb.**—Contract for constructing water works and electric light plant at the County Poor Farm (bids opened Dec. 20) awarded Korsmeyer & Company, Lincoln.

SEWERAGE AND SEWAGE DISPOSAL

PROPOSED WORK.

Providence, R. I.—City Council Con. on Sewers recommended constructing sewers on 12 streets and storm sewers on two other streets.

Bridgeport, Conn.—Preliminary estimates submitted by Alfred H. Terry, City Engineer, for sewer improvements, estimated cost at $330,000, including $67,000 for completing Bond, Hawley, Marion and River Street and Housatonic and Seaview Avenue sewers.

Norwalk, Conn.—See "Paving and Roads."

Waterbury, Conn.—All bids opened recently by the city for the $400,000 sewer bonds have been rejected.

Charlotte, N. Y.—Construction of a sewage disposal plant and sewerage system is contemplated by city.

Lyndhurst, N. J.—The Bd. Commissioners sold $28,856 sewer bonds.

Point Pleasant, N. J.—Extensions and improvements to the sewer system costing about $21,000 reported under consideration by Borough Council. An election will probably be held on the matter.

Princeton, N. J.—About 8000 ft. of sewer pipe will be laid in Battle Road this spring at a cost of $17,000. Address Borough Clerk.

Shepherdstown, W. Va.—H. E. Adler, Brunswick, Md., retained as engineer for sewer system to be constructed by a company at a cost of $15,000. R. C. Ringgold said to be interested.

Jacksonville, Fla.—Sewer and drain bonds amounting to $250,000, were sold Dec. 29 by Board Bond Trustees.

Jacksonville, Fla.—Council passed an ordinance authorizing construction of sewers and drains through the property of the Commodore Point Terminal Company at a cost of $14,891.

Lexington, Ky.—The United States Government sanitary experts and a committee of local citizens appointed to investigate the sewage disposal have declared themselves in favor of the Imhoff system as recommended by Solomon-Norcross Company of Atlanta, Ga.

Alliance, Ohio.—Council has decided to engage R. W. Pratt of Cleveland to prepare plans for necessary changes to be made to the sewage disposal plant costing about $35,000.

Kenmore, Ohio.—Sewer bonds for $25,000 will be sold Feb. 1 by Erwin J. Shook, Village Clk.

Mansfield, Ohio.—Sewage Disposal bonds amounting to $110,000 sold.

Des Moines, Iowa.—Contract will be let in February by Department of Public Works for constructing the sewer system in Closes Creek District. Plans have been completed by the City Engineer's Department, and it is reported the cost is about $250,000.

Minneapolis, Minn. — Following work contemplated for the new year: 20 miles of sewers, cost $500,000; paving, cost $1,250,000; Elwell Law Grading, $350,000; water mains, etc., $400,000; curb and gutter, $150,000; sidewalks, $100,000; Bassett's Creek, $50,000; bridges, $150,000; widening and opening new streets, $45,000; new harbor, $50,000.

South St. Paul, Minn.—Reported residents of the Second Ward want lateral sewers constructed on Fourth and Fifth Avenues, south from Marie Avenue, to connect with the trunk system on Third Street, South.

Iola, Kan.—Sewer system is to be constructed this year.

Pawnee City, Neb.—Election to be held in April on issuing bonds for constructing a sewer system. J. L. Meek, City Clerk.

Columbus, Mont.—City Council reported taking ateps to construct a sewer system to cover the entire city.

Lake Village, Ark.—City to construct 24,000 feet. of sewers and an Imgoff tank. J. B. McCrary Company, Atlanta, Ga., Engineer and Contractor.

Henderson, Tex.—Franchise for constructing sewerage aystem in Henderson granted to J. M. Wood, Oberlin, Ohio.

Houston, Tex.—Reported contract to be let soon for constructing the sanitary sewer to connect the Second Ward system with the new disposal plant. Contract for the disposal plant to be let about Jan. 20. Bids on disposal plant are to be for a plant for both sections of the city north and south of Buffalo Bayou. E. E. Sands; City Clerk.

Paris, Tex.—Contract will be let about August for constructing sewage disposal plant to cost $15,000. R. G. Tyler, City Engineer, Paris.

Winnsboro, Tex.—Construction of sewer system, 5000 ft. of 8 and 10-in. pipe and a disposal plant, cost of both $15,000, is contemplated. Address City Secretary.

Clovis, N. M.—See "Water Works."

Portland, Ore.—About $180,000 sewer improvements will be contracted for in 1916. Philip H. Dater, City Engineer.

Alhambra, Cal.—Plans prepared for a sewage disposal plant which the cities of Alhambra, South Pasadena and Pasadena propose constructing jointly. The site is not yet decided upon. Nothing further has been done in the matter. R. B. Orbison, 489 Claremont Street, Pasadena; John McMillan, 1412 Fremont Street, South Pasadena, and Charles E. Hewes, 226 S. Hidalgo Street, Alhambra, are engineers in charge of the work.

Calexico, Cal.—See "Water Works."

Newport Beach, Cal.—Contract will be let about December for sewer system to cost $55,000. I. B. Fink, City Engineer, 514 Central Building, Los Angeles.

Riverside, Cal.—City Council voted to acquire about 500 acres for a sewer farm.

BIDS DESIRED.

Averville, Ill.—Until Jan. 12 by Board Local Improvements (Frank W. Brisendine, Secretary) for constructing a sanitary sewer system, estimated to cost $33,600, advertised in Engineering Record. Ray Crozier, Engineer, 129 N. Jefferson Street, Peoria.

Milwaukee, Wis.—Reported desired by Commissioner of Public Works for continuing the Linwood intake tunnel about 2500 ft.

Lisbon, Iowa.—Until Jan. 18, by H. C. Kurtz, City Clerk, for constructing sewer system and sewage disposal plant. F. R. Warriner, Engineer, Cedar Rapids.

South St. Paul, Minn.—Until Jan. 31, by City Council, for constructing 4000 ft. 12-in. sewer. J. R. Stevenson, City Recorder.

Wausa, Neb.—Until Feb. 7, by F. E. Anderson, City Clk., for 19,000 ft. sanitary sewer; also sewage disposal plant.

Kansas City, Mo.—Until Jan. 18, by Board Public Works (Thos. F. Callahan, Secy.), for constructing sewers in Sewer Dist. No. 346.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Doylestown, Pa.**—Contract awarded Green-Starr Engineering Company, Philadelphia, for constructing sewerage system for National Farm School.

★**Philadelphia, Pa.**—Reported contract for constructing the sewage disposal plant at Byberry for the city awarded Daniel Lynch, 1128 N. Forty-first Street (bids opened Dec. 31). Probable cost $23,000.

★**Cincinnati, Ohio.**—Contract for constructing Duck Creek Interceptor No. 3 (bids opened Dec. 13) awarded Connelly Construction Company, $57,364.

★**Painesville, Ohio.**—Contract for sewer improvements (bids opened Dec. 22, by F. N. Downer, City Engr.) awarded as follows:

★Sanford Street, 4930 ft. 12 and 20-in. pipe, to Ohio Engineering Co., Lorain, at $1.45 for 12-in. pipe and $2.46 for 20-in., $30 each for 12 manholes, etc.; total $13,097. Next three lowest bidders: Severson & Hughes, $13,785; Hukari & Watson, $13,837; and Tony Trifiletti, $14,148; and also East Main Street, about 3530 ft. 9, 12 and 14-in. pipe sewer, at $8,918.

★**Council Bluffs, Iowa.**—Contract for constructing the west end sewer requiring about 7550 ft. 6 in., 3445 ft. 8 in., 2140 lin. ft. 10 in., 2040 lin. ft. 12 in. and 2230 lin. ft. 15 in. pipe awarded E. A. Wickham & Company, Council Bluffs, at 62 cts. per ft. 6 in., 92 cts. 8 in., 96 cts. 10 in., $1.05 12 in., $1.25 15 in. Manholes, $38.50 each; cement, $10 per cu. yd. and lumber $37.50 per M. ft.

★**Cherryvale, Kan.**—Contract for constructing sewers in District No. 2 (bids opened Dec. 16) awarded Axtel Oldham of Kansas City, Mo., at about $16,000. Next three lowest bidders: McCoy & Taylor, Fort Scott, Kan., $16,319; Inter-Mountain Bridge & Construction Company, Kansas City, Mo., $17,019; O'Neil Contracting Company, Kansas City, Mo., $17,246.

Seattle, Wash.—Following are four lowest bids opened recently by Board Public Works for constructing sewers in West and North Fiftieth Streets: C. W. Colt Company, 7353 Fauntleroy Avenue, $48,583; V. Ramaglia, Box 172, Yesler Station, $55,602; T. Scalzo, 1708 Twenty-second Avenue, S., $56,195; and N. Fiorito & Brothers, 1630 Twenty-fifth Avenue, $56,913.

Stockton, Cal.—Following are four lowest bids opened Dec. 24 by City Council for constructing the sewers in Fair Oaks and vicinity: Leach & De Camp, San Francisco, $41,230; D. Bishop, Stockton, $44,718; Fred Meyers, Richmond, $45,018, and C. D. Vincent, $46,590.

BRIDGES

PROPOSED WORK.

Oil City, Pa.—Pennsylvania R. R. (Alexander C. Shand, Chief Engineer, Philadelphia) contemplates constructing a bridge over Allegheny River at Oil City, but nothing definite has been done about the matter.

Pennsylvania.—The State Water Supply Commission granted permission to Philadelphia & Reading R. R. Co. (A. T. Dice, Gen. Mgr., Philadelphia) to rebuild bridge at Sunbury and construct two small bridges in Chester and Berks Counties.

Philadelphia, Pa.—Bridging the Delaware River between Philadelphia and Camden from foot of Market or Race Streets is a feasible proposition according to preliminary report made by Geo. Webster, Ch. Bureau of Surveys, which Mayor Blankenburg transmitted to Council. Estimated cost of a high level bridge with no piers in river between pierhead lines is $18,000,000, including damages.

Reading, Pa.—Plans prepared by Charles F. Sander, County Engineer, for constructing a concrete bridge over Schuylkill River at Bingaman Street; cost between $200,000 and $350,000.

Contract will soon be let for constructing following bridges for county: Concrete structure over branch of Maiden Creek, to have single arch 75 ft. long, cost $7,000; concrete bridge with two 30-ft. spans over Tentain Creek at Lobachsville, cost $4,000; concrete bridge over Allegheny Creek in Breckersville, cost $4,000.

Lima, Ohio.—Construction of a viaduct over Ottawa River is contemplated by City Council, cost $50,000.

Detroit, Mich.—Contract about to be let for a timber and steel temporary bridge to Belle Isle. Geo. H. Fenkell, Comr. Public Works.

Chippewa Falls, Wis. — Wisconsin Minnesota Light & Power Company, Eau Claire, will construct a bridge across Chippewa River to have four 185-ft. spans, superstructue of steel and foundation of concrete.

Hampton, Iowa.—Plans will be completed about Jan. 10 by the State Highway Department for bridge to cost $10,000. Contract to be let latter part of January. A. G. Baker, County Engineer, Hampton.

Mason City, Iowa.—See "Paving and Roads."

Minneapolis, Minn.—See "Water Works."

Huntsville, Tex.—Comrs. Court of Walker County at Huntsville, and Trinity County at Groveton, are selecting a site for a bridge to be constructed over Trinity River as a part of Red River to Gulf Highway.

Walla Walla, Wash.—Construction of a bridge over Snake River at Strawberry Island is being contemplated, cost $50,000. Walla Walla and Franklin Counties each to pay one-half.

Portland, Ore.—Plans completed by City Engineer for a steel and concrete bridge to be constructed over Balch Creek Canyon to be part of a highway to connect Cornell Road with Lincoln Skyline Boulevard. Plans provide for a viaduct 350 ft. from center to center with 2 40-ft. concrete arches at each end of main arch, roadway 36 ft. wide with 2 6-ft. sidewalks on each side.

Ottawa, Ont.—The Railway Commission directed Toronto, Hamilton & Buffalo Ry. Co. (R. L. Latham, Ch. Engr., Hamilton) to construct a highway bridge in Hamilton, carrying the line of King Street over the railroad tracks.

BIDS DESIRED.

Boston, Mass.—Until Jan. 1, by Purchasing Agent, Boston Elevated Ry. Co., 101 Milk Street, for building foundation for Mystic River Bridge and viaduct and reconstructing Maiden Bridge, advertised in Engineering Record.

Connecticut.—Until Feb. 2, by Charles J. Bennett, State Highway Commissioner, Hartford, for constructing single leaf deck Strauss trunnion bascule bridge over the channel of the Saugatuck River in Westport.

Richmond, Va.—Until Jan. 7, by Commission for Purchase and Improvements of Roads at County Clerk's Office, for constructing two creosoted pile and timber bridges, one over Masons Creek on the Indian Poll Bridge Road, and one over Steamboat Creek on the Indian River Road. Alternative bids on several types of floor construction will be considered. Reconstructing floor system of Draw Span of the Indian Poll bridge over Lafayette River, reconstructing the superstructure of Indian River Road bridge over Indian River, constructing wooden draw span and superstructure of bridge over Western Branch on Hodges Ferry Road. G. P. Coleman, State Highway Engr.

Atlanta, Ga.—Until Jan. 27, for repairing bridge across Chattahoochee River between Fulton and Cobb Counties at Masons and Turners Ferry Road, about 17 miles from Atlanta. Cost $4 500, advertised in Engineering Record. Address S. B. Truman, Chmn. Board Fulton County Roads and Revenues Commissioners, Atlanta. Wm. C. Spiker, Consulting Engr., 1127 Candler Building, Atlanta.

Jackson, Minn.—Until Jan. 14, by Township of Petersburg, at County Engineer's office at Court House in Jackson for constructing bridge No. 1973 between Sections 7 and 8, Petersburg Township, superstructure 120-ft. span, 18-ft. roadway, on reinforced concrete abutments. Bids may be submitted separately for furnishing steel truss and reinforcing bars for floor and for erection of superstructure or for both steel and erection in one bid. L. A. Bilra, Town Clk, Jackson; W. E. Walters, C. E. Dist. Engr. Highway Commission, Jackson.

Kansas City, Kan.—Until about Feb. 1 for constructing the superstructure of the bridge across Kaw River at Central Avenue, to be of steel, approaches of concrete; bridge proper to have three 250-ft. spans; cost, complete, $500,000. Harrington, Howard & Ash, Engineers, Kansas City, Mo.

Falls City, Neb.—Reported desired until Jan. 11, by O. O. Marsh, Co. Clk., for constructing steel and concrete bridges during year 1916. J. S. Relf, County Surveyor.

Geneva, Neb.—Reported desired until Jan. 11 by Bert A. Lynn, County Clk., for constructing steel and concrete bridge for year 1916.

Dallas, Tex.—Until Feb. 3 by Chas. E. Gross, County Auditor, Dallas, for constructing Commerce Street viaduct across Trinity River, advertised in Engineering Record. J. F. Witt, Engr., Court House, Dallas.

Oklahoma City, Okla.—Reported desired until Jan. 10 by County Commissioners for constructing 12 reinforced concrete bridges, estimated to cost $35,000. M. Cornelius, County Clerk.

Portland, Ore.—Reported desired until Jan. 14 by A. L. Barbur, City Auditor, for the Union Avenue extension, reinforced concrete viaduct and fill. Probable cost $60,000.

Modesto, Cal.—Reported desired until Jan. 11 by Board Supervisors at Modesto for constructing reinforced concrete bridge over San Joaquin and Kings River Irrigation Company's Canal, and for two inverted siphons at Station 20 + 00 and 34 + 78.5 of highway survey. H. Benson, County Clerk.

Tucson, Ariz.—Reported desired until Jan. 15 by L. O. Cowan, City Clerk, for a reinforced concrete bridge across Santa Cruz River; estimated cost $50,000.

Frontenac, Que.—Until Jan. 11, by L. H. Charlebois, Secy. Quebec Stream Commission, Montreal, for bridge over Sauvage River, bids to be considered on either wooden bridge, wooden piers and abutments and bridge approach or steel superstructure with concrete piers and abutments and bridge approach.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**New Gretna, N. J.**—Contract for constructing the bridge across Mullica River between Burlington and Atlantic Counties awarded George S. Bennett, 45 East Forty-second Street, New York, st $93,248 (Scherzer). James Logan, Engineer, Burlington County, Mount Holly.

★**Pittsburgh, Pa.**—Contract for constructing the reinforced concrete, stone-faced, elliptical arch bridge over Sewickley Creek, between Allegheny and Beaver Counties (bids opened Dec. 28) awarded by County Commissioners to R. D. Hunter & Company, Beaver. Hyatt M. Cribbs, County Comptroller.

★**Bryson City, N. C.**—Contract for constructing four 40-ft. spans and one 300-ft. span concrete bridge (bids opened Dec. 20) awarded C. W. Requarth & Company, Charlotte, N. C., at $18,500. T. M. Howelton, Chief Engineer.

★**Port Royal, Ky.**—Contract for constructing bridge over Drennon Creek on road between Port Royal and Lockport awarded by Henry County Fiscal Court in Newcastle to Champion Bridge Co., Wilmington, Ohio, at $7,500.

★**Illinois.**—Contract awarded by State Highway Department, Springfield, for constructing Becker Bridge, Lexington Township, McLean County, to Porter-McCully Construction Company, Mackinaw, at $9,000. Other bidders: Brookville Bridge Company, $9,260; Decatur Bridge Company, $10,460, and Worden Allen, Milwaukee, Wis., $10738.

★**Missoula, Mont.**—Contract for constructing a steel bridge across Hell Gate River (bids opened Dec. 18) awarded by County Commissioners to Davis Graham, Missoula, at $5,443. W. J. Balington, County Recorder.

★**Houston, Tex.**—Contract for constructing reinforced concrete bridge over Buffalo Bayou at Milam Street, awarded J. H. Richardson Company of Houston at $37,397.

★**Sterling, Colo.**—Following are four lowest bids opened Dec. 28 by State Highway Commission, Denver, for constructing a reinforced concrete I-beam bridge over South Platte River at Sterling Crossing, to be in four bridges, one 372 ft. 6 in., two 110 ft., and one 20 ft.: McDonald Construction Company, Denver, $27,730 (awarded contract); Engineers Construction Corporation, Greeley, $27,985; Pueblo Bridge Company, Pueblo, $28,260; F. C. Dreher, Denver, $28,464.

California.—Following are totals of bids opened Dec. 27, by California Highway Commission, Sacramento, for constructing in Sonoma and Martin Counties Division IV, Route 8, Section A, steel bascule bridge across Petaluma Creek, at Green Point, span 148 ft.: Engineer's estimate, $94,460; Healy Tibbitts Construction Company, San Francisco, $89,791; McLeran & Peterson, San Francisco, $94,574; J. D. Hannah, San Francisco, $99,500; Ross Construction Company, Sacramento, $99,650.

★**Los Angeles, Cal.**—Contract awarded Mesmer & Rice, Marsh-Strong Building, for a 260 foot concrete and brick arched culvert at San Marino for Pacific Electric Ry., at $6,529.

San Andreas, Cal. — Following bids opened by Bd. Supervisors for constructing concrete bridge: Jenkins & Wells, $8,000, and Commonwealth Engineering Co., San Francisco, at $9,500.

PAVING AND ROADS

PROPOSED WORK.

Westerly, R. I.—The construction of a road between Watch Hill and Westerly, costing $65,000, is contemplated. Everitt E. Whipple, Town Clerk; F. G. Haswell, Chairman Commissioners.

Norwalk, Conn.—About 12,000 sq. yd. pavt., cost $15,000, and about $5,000 sanitary sewer construction are contemplated in the new year. G. A. Sherron, City Engineer.

Buffalo, N. Y.—Common Council voted to pave Navajo, Pawnee Streets, Cleveburn Place and Seminole Parkway with asphalt.

Johnson City, N. Y.—Election to be held Jan. 14 to vote $30,000 bonds for paving Grand Avenue and Arch Street.

Webster, N. Y.—Citizens voted to pave Main Street with brick; cost about $51,700.

Woodbury, N. J.—Council passed ordinance to improve five streets, using amiesite or something similar.

Ambler, Pa.—The Town Council considering spending $30,000 for street improvements.

Greenville, S. C.—County road bonds for $400,000 will be sold Jan. 10, by J. W. Norwood, Chmn. Greenville Highway Commission. W. H. Willimon, Co. Superv.

Savannah, Ga.—City Council passed the budget providing $30,000 for street improvements.

Savannah, Ga.—See "Water Works."

Knoxville, Tenn.—Local reports state street improvement bonds for $26,188 will be sold Jan. 17 by Robt. P. Williams, City Recorder.

Barbourville, Ky.—Contract will be let about February for 47 miles of highway construction to cost $200,000. F. McClure, County Highway Engineer.

Cincinnati, Ohio.—About 700,000 sq. ft. cement sidewalks, city and private work, will be laid in 1916; contract for city's portion, about 180,000 sq. ft., will be let about March. D. D. Barr, Asst. Engineer, Sidewalk Department.

Reported the Cincinnati Speedway Co., E. W. Edwards, Pres., contemplates constructing a speedway near Sharon.

Norwood, Ohio.—The paving of Forest Avenue with granite, Floral Avenue with bitulithic, cost of about $26,000, is contemplated by City Council.

Pierceton, Ind.—Resolution has passed Council to pave First and Market Streets. Material not decided upon. J. R. Hover, Town Clerk.

Joliet, Ill.—Bd. Local Improvements voted to pave Cass Street with brick and asphalt, cost $30,707.

Audubon, Iowa.—Contracts for street paving costing $40,000 and water mains costing $12,000 will be let about March in the new year. A. Segal, City Engr.

Council Bluffs, Iowa.—City Engineer estimates cost of paving Avenue A a distance of 2.3 miles at $119,780.

Mason City, Iowa.—Contract will be let about February for bridge and culvert work costing $30,000; one mile of pavement, cost $15,000, and 12 miles of grading, cost $10,000. R. E. Robertson, County Engineer.

Blue Earth, Minn.—County Commissioners during 1916 will construct about 25 miles of road. Contract will be let about April. Ten or 12 bridges will also be built by the county. J. L. Herring, County Auditor; Ray J. Short, District Highway Engineer, Blue Earth.

Minneapolis, Minn.—See "Water Works."

Walker, Minn.—About $220,000 is to be spent by Cass County for constructing new and repairing old roads.

York, Neb.—It is proposed to pave Nebraska, Burlington and Blackburn Avenues, in all about 30,000 sq. yd. on concrete foundation, with combination concrete curb, about 24,000 ft., at a cost of $75,000. George W. Sears, Engineer, York; A. B. Chatterton, City Clerk.

Paving bonds for $65,300 will be sold Jan. 25 by A. D. Chatterton, City Clerk.

Yankton, S. D.—Contract will be let probably in 1916 for 43 blocks of paving and 25 miles of curbing to cost $160,000, conditional upon the city bond issue. S. H. Edmunds, City Engineer.

Anaconda, Mont.—City Council voted to pave Main, Wyoming, Dakota, Hamilton, Park, Broadway, Granite and Quartz Streets.

Athens, Tex.—Citizens of Precinct No. 1 voted $100,000 bonds for constructing roads.

Beaumont, Tex.—The City Council voted to pave Railroad Avenue and Crockett Street with rock asphalt, cost about $85,000.

Dallas, Tex.—Bd. City Commissioners voted to pave Young and Wood Streets, estimated cost $40,000.

Giddings, Tex.—The Commissioners' Court voted to issue $30,000 bonds for road improvements.

Paris, Tex.—Contract will be let about April for paving to cost $75,000. R. G. Tyler, City Engineer.

Sulphur Springs, Tex.—Citizens voted $100,000 bonds for road improvements in Precinct No. 1.

Centralia, Okla.—County Commissioners have been petitioned to call an election to vote $10,000 bonds for improving roads.

Depew, Okla.—Citizens of Shannon Township voted $15,000 bonds for roads and bridges.

Everett, Wash.—The Citizens of Snohomish County voted $1,813,800 road bonds.

Eugene, Ore.—Citizens of Lane County approved the budget providing $133,700 for constructing roads.

Pendleton, Ore.—Contract about to be let by county for constructing highway on Umatilla River from Pendleton to Pilot Rock Junction; cost about $20,000.

Portland, Ore.—About $250,000 street improvements to be contracted for in 1916. Philip H. Dater, City Engineer.

Plans completed about Jan. 15 for constructing 20 miles of road around Mount Hood. Bill to be introduced in Congress asking $225,000 appropriation for constructing said road. B. J. Finch, Highway Engineer, Room 521 Beck Building.

Hemet, Cal.—Election to be held Jan. 14 to vote $10,000 bonds for paving Florida Avenue.

Los Angeles, Cal. — The California Highway Commission at Sacramento directed surveys to be made for paved highway system connecting Los Angeles with Imperial Valley and Yuma, selecting a route through Coachella Valley and southwest of Salton Sea to Brawley, estimated cost $1,000,000.

Newport, Beach, Cal.—About 20,000 sq. yd. of paving will be let about July. I. B. Funk, City Engineer, 514 Central Bldg., Los Angeles.

Santa Clara, Cal.—Citizens voted $45,000 bonds for completing highway in Santa Clara and paving Homestead Road.

Selma, Cal.—About 175,000 sq. ft. of street paving is to be done in 1916; cost $24,500. W. H. Shafer, City Engineer.

BIDS DESIRED.

Buffalo, N. Y.—Until Jan. 12, by Department Public Works (Geo. H. Horton, Acting Comr.), for paving Titus, Evelyn and Camden Avenues, repaving North Division, South Division and other streets.

New York, N. Y.—Until Jan. 12, by R. A. C. Smith, Comr. Docks, for Contract 1496, for furnishing material and repairing asphalt pavement on the marginal street and piers, North, East and Harlem Rivers, in all about 13,000 sq. yd. Borough of Manhattan. Security $6,000.

Newark, N. J.—Until Jan. 20, by Board Street & Water Commissioners (M. R. Sherrerd, Ch. Engr.), for constructing for year 1916 option to extend 1917 and 1918, about 61,500 sq. ft. new bluestone flag or artificial stone sidewalk together with curbs, etc.

Camdeh, Ala.—Until Jan. 17, by Road Supervisors, for constructing about 16 miles of gravel road. J. N. Stanford, Chmn. Co. Comrs.

Jamestown, Tenn.—Until Jan. 18, by County Highway Commission, for grading and macadamizing 34 miles of road and constructing steel bridges, advertised in Engineering Record. W. I. Smith, Engr., Jamestown.

Fort Wayne, Ind.—Plans and specifications on file in New York office of Engineering Record for improving the Rudisill Boulevard, bids for which are to be opened Jan. 17 by Board Park Commissioners.

LaPorte, Ind.—Until Jan. 22 by Board Public Works, for paving portions of Indiana and Michigan Avenues, about 38,000 sq. yd.; estimated to cost $110,000. L. Drew Goddard, City Engineer.

Danville, Ill.—Until about March 14, by County Road Improvement Committee (P. C. McArdle, Supervising Engineer), for constructing 174 miles of road throughout the county, in all about nine sections, having about 19 miles per section.

Until Jan. 20, for cement for above roads, and same date bonds amounting to $1,500,000 will be sold for this work.

Ames, Iowa.—Reported desired until Jan. 17 by City Clerk for paving and curbing with bitulithic, asphaltic concrete, vitri. brick, block, or creosoted wood block on 5-inch Portland cement foundation. About $300,000 street paving and curbing are provided for next year.

Clinton, Iowa.—Reported desired until Jan. 11 by City Clerk for paving with brick on seven blocks in downtown district; estimated cost $53,678.

Iowa Falls, Iowa.—Until Jan. 12 for 60,000 sq. yd. pavement and 35,000 lin. ft. cement curb and gutter. Bids desired on concrete, asphaltic concrete, sheet asphalt and bitulithic, using Natural Lake asphalt. E. L. Marriage, City Mgr.

Spencer, Iowa.—Until about Feb. 15 by E. O'Keefe, City Engineer, for approximately 60,000 sq. yd. paving on River, 1st, 2d, 3d, 6th, Pine and 7th Streets with bitulithic, brick, concrete natural lake asphalt, or asphaltic concrete. Cost about $100,000.

St. Paul, Minn.—Reported desired until Jan. 10 by August Hohenstein, City Purchasing Agent, for furnishing 60,000 gal. high-grade asphaltic road oil.

Kansas City, Mo.—Until Jan. 11, by Board Park Commissioners (T. C. Harrington, Secy.), for furnishing material and paving with bituminous macadam pavement Union Station Park.

Also same time as above, by Board Public Works (Thos. F. Callahan, Secy.), for paving with Portland cement concrete portions of McGee and Fifty-seventh Streets and Wabash and Prospect Avenues, and repairing macadam paving on a portion of Fifty-ninth Street.

Belton, Tex.—Reported desired until Jan. 13 for gravel, tarvia, Portland cement and asphaltic concrete pavement. Probable cost $15,000. W. E. Hall, Co. Aud.

Denison, Tex.—Reported desired until Jan. 12 by County Commissioners for improving highway system at an estimated cost of $1,150,000, of which $900,000 is now available. J. C. Field & Company, Engineers, 105 Field Building.

San Antonio, Tex.—Until Jan. 20 by Fred. Fries, City Clerk, for paving 26 streets, approximately 185,000 sq. yd. brick (vertical fiber or standard), bitulithic, rock asphalt, asphaltic concrete, bituminous macadam, granitoid, concrete or other standard paving, advertised in Engineering Record.

Seattle, Wash.—Reported desired until Jan. 16 by County Commissioners for Permanent Highway No. 12.

Spokane, Wash.—Until about Feb. 15 by County Commissioners for constructing about 200,000 sq. yd. pavements on various roads, including asphalt macadam and asphaltic concrete, foundation to be crushed rock; excavation 200,000 cu. yd. Cost, $210,000. J. W. Strack, County Engineer, Spokane.

Los Angeles, Cal.—Until Jan. 17 by County Board of Supervisors for 2.69 miles of road in Road District No. 66 approximate quantities: 6020 sq. yd. concrete pavt., 8375 tons macadam, 1194 lb. steel. Estimated cost, county furnishing oil, rock, sand and screenings, $18,326.

Wallace, Idaho.—Reported desired until Jan. 12 by Robert Merriam, City Engr., for paving streets in Dist. No. 4.

Also until Jan. 15 for improving a number of other streets.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Starkville, Miss.** — Contract for grading and graveling Main Street awarded by city to F. D. Harvey & Co. of Memphis, Tenn., at $14,000.

★**Atlantic City, N. J.**—Contract awarded by County Board of Freeholders at Mays Landing for paving Meadow Boulevard from Pleasantville to Chelsea (bids opened Jan. 1) to Edward L. Bader, Atlantic City, at $189,431. Howard Nelson, County Engineer, Atlantic City.

★**York, Pa.**—Contract for furnishing labor and materials for highway work to be done in York during 1916 awarded as follows: York Stone & Supply Co., York; General Supply & Constr. Co., York; George A. Barnitz, York; John W. Hartley and William H. Grothe of York.

Baltimore, Md.—The lowest bid opened by Bd. Awards Dec. 29 for repairing asphalt streets, in all about 65,000 sq. yd., submitted by Baltimore Asphalt Block & Tile Co., Baltimore, at $1.58 per sq. yd.

★**Kenton, Ohio.**—Contract for paving West Franklin Street (bids opened Dec. 22) awarded H. P. Streecher Company, Inc., Toledo, at $16,593, for sheet asphalt. G. S. Bueckley, Clerk Board Public Service.

★**Lisbon, Ohio.**—Contract awarded Hepburn & McClain, Lisbon, for paving part of Public Road in Elkrun Township at $26,662. Next three lowest bidders: W. N. Wright, Lisbon, $29,009; Smith Construction Company, Youngstown, $29,585; J. D. Paxton, Salem, $31,400. Horace Martin, Township Clerk.

★**Painesville, Ohio.**—Contract awarded E. A. Freshwater & Son, Chester, W. Va., for paving Richmond Street, about 5942 sq. yd. They bid $12,262 for Metropolitan block, $12,381 for Bessemer, Buckeye and Medal block, and $12,976 for Bula block. (Bids opened Dec. 22 by F. N. Downer, City Engr.)

★**Angola, Ind.**—Contract for paving East Maumee Avenue awarded to Brooks Constr. Co. at $50,000.

★**Astoria, Ore.**—Contract for paving 4½ miles of Clatsop Plains highway with bitulithic awarded by County Court to Western Paving Co., Oklahoma City, Okla., at $61,256.

California.—Following are unit figures of four lowest bids opened Dec. 27 by California Highway Commission, Sacramento, for constructing State Highways, as follows:

Placer County, Division III, Route 17, Section B—(a) Engineer's estimate, $43,277; (b) A. C. McLean Construction Company, San Francisco, $30,815; (e) G. W. Connors, Eureka, $35,314; (d) Spring Construction Company, Berkeley, $38,204; (e) Geo. S. Benson & Sons, Los Angeles, $39,417.

	(a)	(b)	(e)	(d)	(e)
20,000 cu. yd. excavation (unclassified)	$0.75	$0.40	$0.55	$0.74	$0.55
240 lin. ft. 12-in. corrugated metal pipe	0.40	0.40	0.40	0.50	0.70
606 lin. ft. 18-in. corrugated metal pipe	0.50	0.60	0.50	0.60	0.80
120 lin. ft. 24-in. corrugated metal pipe	0.60	0.70	0.50	0.75	0.85
110 cu. yd. cement concrete, Class "B" (culverts and manholes)	9.00	10.00	10.00	12.00	12.00
6,400 cu. yd. cement concrete, Class "B" (paving)	3.00	3.00	3.21	3.03	3.65
4,800 lin. ft. guard rail	0.35	0.35	0.40	0.32	0.50
291 monuments	1.00	1.00	1.00	2.00	2.00

Placer County, Division IV, Route 17, Section A—(a) Engineer's estimate, $43,198; (b) A. C. McLean Construction Company, San Francisco, $36,225; (c) G. W. Conners, Eureka, $38.207; (d) George S. Benson & Sons, Los Angeles, $38,958; (e) Spring Construction Company, Berkeley, $39,137.

	(a)	(b)	(c)	(d)	(e)
24,500 cu. yd. excavation (unclassified)	$0.50	$0.40	$0.50	$0 50	$0.55
696 lin. ft. 12-in. corrugated metal pipe	0.30	0.40	0.30	0.60	0.50
452 lin. ft. 18-in. corrugated metal pipe	0.40	0.60	0.40	0.70	0.60
256 lin. ft. 24-in. corrugated metal pipe	0.50	0.70	0.50	0.75	0.70
160 cu. yd. cement concrete, Class "B" (culverts and manholes)	9.00	10.00	9.00	12.00	12.00
7,400 cu. yd. cement concrete, class "B" (concrete base)	2.90	3.00	2.96	2.85	2.85
5,100 lin. ft. guard rail	0.35	0.35	0.40	0.50	0.32
111 monuments	1.00	1.00	0.50	2.00	2.00

Tehama County, Division 11, Routes 7 and 3, Sections "A" and "B"—(a) Engineer's estimate, $78,498; (b) Taylor & Berliner, Willow, $61,282; (c) A. C. McLean Constr. Co., San Francisco, $66,968; (d) Whitlock & Gorrill, Oakland, $68,883; (e) Marin Rock Company, San Anselmo, $69,704.

	(a)	(b)	(c)	(d)	(e)
42,600 cu. yd. earth excavation	$0.50	$0.40	$0.40	$0.43	$0.55
530 lin. ft. 12-in. corrugated metal pipe	0.40	0.50	0.60	0.50	0.50
116 lin. ft. 18-in. corrugated metal pipe	0.60	0.60	0.70	0.60	0.75
650 cu. yd. cement concrete, Class "B" (culverts, monuments, slope pavement)	10.00	9.00	10.00	10.00	11.50
10,130 cu. yd. cement concrete, Class "B" (paving)	3.75	3.50	4.00	4.06	3.50
3.75 miles moving and resetting property fences	125.00	150.00	125.00	150.00	320.00
5,624 lin. ft. guard rail	0.30	0.35	0.35	0 35	0.30
68 monuments	0.50	1.00	1.00	1.00	1.50

★**Riverside, Cal.**—Contract for constructing 13.43 miles macadam highway from Indio to Mecca Road, Route No. 21, for county, awarded to Brashear-Burns Co., Van Nuys Building, Los Angeles at $38,773 for 14-ft. macadam pavement.

★**Salt Lake City, Utah.**—Contract for changing roadway through reservoir dam in Parley's Canyon awarded by City Commission to Parrott Bros. at $9,500.

★**Lewiston, Idaho.**—Contract for grading, draining, curbs and cement sidewalks in Improvement Dist. No. 8 awarded to C. M. Payne, Spokane, at $21,807.

STREET CLEANING AND GARBAGE DISPOSAL

BIDS DESIRED.

Chicago, Ill.—Until Jan. 12, by Department of Health (John Dill Robertson, Comr.), for furnishing and erecting garbage pressing machinery at Municipal Reduction Plant, at Thirty-ninth and Iron Streets.

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS

PROPOSED WORK.

Hydroelectric Plant—Winsted, Conn.—Reported plans being prepared for a hydroelectric power plant for the Winsted Gas Company, to cost $100,000.

State Canal Work—Albany, N. Y.—Governor Charles S. Whitman has approved selection of the following consulting engineers named by State Engineer Williams, to be called in consultation in relation to the completion of that portion of the canal for which funds will be provided for out of the $27,000,000 bond issue: Dr. Elmer F. Corthell, New York; Henry C. Allen, Syracuse; Eugene E. Haskell, Ithaca; Joseph Ripley, Washington (to be resident member and Secretary of Board), and Ernest C. Moore, Brooklyn.

State Canal Work—Albany, N. Y.—State Engineer Frank M. Williams, Albany, has submitted to the Canal Board plan for constructing barge canal terminal in city of Oswego, known as Terminal Contract No. 20, and is located on Oswego River; another terminal located on Lake Ontario will also be constructed in this city. Engineer's preliminary estimate for this work is $103,700 and contract will soon be let.

State Canal Work—Lyons, N. Y.—State Department of Public Works, Albany, will this winter widen the Erie Canal at Chapel Street Bridge. Cost, $6,000.

Pier—Cape May, N. J.—Dr. Emlen Physick, of Cape May, reported to be taking steps to construct a pier 1000 ft. long between Guerney and Howard Streets, on ocean front, and having a convention hall three stories high and seating capacity 500.

Dam—Pennsylvania.—The State Water Commission at Harrisburg, on Dec. 22, approved report of Penn Central Light & Transportation Co. upon diversion dam located on Frankstown branch of Juniata River near Williamsburg.

Piers—Philadelphia, Pa.—The William Cramp & Sons' Ship & Engine Building Co. secured a permit from Dept. Wharves, Docks and Ferries to construct two additional shipways and extend two piers.

Dredging — Phoenixville, Pa. — State Waterway Commission, Harrisburg, insist on dredging of Schuylkill River, and has held up signing of the contract awarded Ambler-Davis Company, Philadelphia, for constructing concrete bridge across this river between Mont Clare and Phoenixville by Montgomery and Chester Counties.

Docks—Richmond, Va.—Reported Council is considering constructing docks and terminals, including a large dry dock, cost $4,000,000. Plans have been submitted by Col. J. B. Jervey, Corps Engrs., U. S. A.

Dam—Shepherdstown, W. Va.—L. E. Adler, Brunswick, Md., retained as engineer for constructing brick hydroelectric plant and repairs to dam of Shepherdstown Electric Light & Power Co., cost $15,000.

Drainage—Charleston, S. C.—Duncan C. Heyward, of Columbus, is reported interested in a corporation which will have offices in Charleston, and intends undertaking an extensive rice lands reclamation project on the Combahee River in Colleton and Beaufort Counties. Drainage to be effected by a combination of diking and pumping.

Drains—Bartow, Fla.—A drainage system is to be constructed in Peace Creek Drainage Dist., Polk County, to drain about 48,000 acres; cost about $256,000. Address Board of Supervisors.

Dredging—Cleveland, Ohio. — Contract will be let about February for 270,000 cu. yd. of dredging costing about $40,000. E. B. Thomas, River and Harbor Engr., 404 City Hall.

Hydroelectric Plant—Whitehall, Mich.—Contract will be let in the spring by the Frugale Power Company (E. H. Speese, Vice-Pres. and Gen. Manager) for constructing the hydroelectric plant to have 10 miles of transmission wire, power plant 500 hp., and generators a.c. 60-cycle, 2200-volt.

Harbor and Creek Improvements—Minneapolis, Minn.—See "Water Works."

Hydroelectric Plant—Polson, Mont.—County Commissioners have granted Missón Range Power Company right-of-way from mountain east of Polson to this city.

Dock—Freeport, Tex.—Reported Freeport Sulphur Company contemplates constructing on the Brazos River a dock of piling and heavy timber throughout and will be 300 ft. long; the banks of the river will be protected with treated sheet piles.

Levee Improvement Bonds—Port Arthur, Tex.—Election soon to be held to vote $175.000 bonds for constructing a protecting levee, excavation of drains and installation of pumping machinery.

Dam—Prosser, Wash.—Preliminary surveys being made for a dam to be constructed on Yakima River for municipal power plant for city. Address City Clerk.

Irrigation—Los Angeles, Cal.—Contract soon to be let by Board Public Service for pipe for water system contemplated for San Fernanda Improvement Dist., No. 3

Beach Protection and Jetty Work—Newport Beach, Cal.—Contract will probably be let in 1916 as follows: In July or August, for Beach protection to cost $85,000, about 6200 lin. feet; jetty work to cost $85,000, contract to be let in October, also in October for dredging to cost $15,000. I. B. Funk, City Engineer, 514 Central Building, Los Angeles.

Pier—Ocean Park (P. O. Santa Monica), Cal.—Pleasure pier and buildings owned by Fraser's Million Dollar Pier Company, and recently destroyed by fire, will probably be rebuilt.

Irrigation — Paradise, Cal. — Paradise Water Users' Assoc. plans constructing an irrigation system.

Drainage Bonds—Santa Ana, Cal.—Drainage bonds amounting to $25,000, it is reported, will be sold Jan. 12 by Directors Westminster Drainage District (Willis H. Warner, Secy.).

Irrigation—Stockton, Cal.—Trustees of the West Side Irrigation District have engaged Walter G. Hunter of Stockton to prepare plans for the proposed irrigation system to cost $285,000.

Hydroelectric Plant—Port Elgin, Ont.—Election soon to be held to vote on installation of a hydroelectric system.

BIDS DESIRED.

Dredging—New York, N. Y.—Until Jan. 13, by Cabot Ward, Pres. Commissioners of Parks, for dredging in North River between 103d and 109th Streets, Manhattan Borough. Security $2,000.

Dredging—New York, N. Y.—Until Jan. 12, by R. A. C. Smith, Comr. of Docks, for Contract 1497, Class 2, furnishing material and dredging in Boroughs of Manhattan, Brooklyn, Queens, the Bronx and Richmond. Security $3,600.

Drainage—Urbana, Ill.—Reported desired until Jan. 10 by Joseph P. Gulick, Attorney of Two Mile Slough Drainage District, for drainage work in Branch No. 23.

Ditch—Forest City, Iowa.—Until Jan. 11, by County Board Supervisors, for constructing Drainage Ditch No. 32, to consist of 46,647 ft. 6 to 30 in. tile. C. K. Nelson, Co. Aud.

Ditches — Fairmont, Minn. — Reported desired until Jan. 14, by H. C. Nolte, Co. Aud., for constructing ditches Nos. 62 and 50, tile and open work. Probable cost $16,995 and $25,755.

Ditch—Wilmar, Minn.—Reported desired until Jan. 11, by Samuel Nelson, Co. Aud., for constructing Ditch No. 34. Probable cost $7,672.

Irrigation—St. Ignatius, Mont.—Until Feb. 8, by U. S. Reclamation Service, St. Ignatius, for construction of canals and structures on Flathead Project, Mont., advertised in Enginering Record.

Drainage—Memphis, Mo.—Until Jan. 15 by Wyaconda River Drainage Dist. No. 1 (Earl McDaniel, Secy.), Scotland County, for constructing 17.3 miles of drainage ditch, bottom width 16 ft., to consist of 557,000 cu. yd. in Memphis, Mo. (not Tennessee).

Irrigation, Etc.—Barstow, Tex.—Until Jan. 25, by Director Ward County Irrigation Dist. No. 1 (Robt. L. McKnight, Secy.) for constructing dams, reservoirs head gates, sluice gates and other improvements for district. There will be about 55 miles of irrigation canals and levees built, approximately 1,400,000 cu. yd. excav. and 4500 cu. yd. reinforced concrete in structures. A. H. Dunlap, Engr., Barstow.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Dredging—New York, N. Y.—Lowest bid opened Dec. 28 by Department of Docks and Ferries for dredging slip east side of Pier No. 21, East River, Contract 1487, submitted by P. Sanford Ross, Inc., 277 Washington Street, Jersey City, N. J., at 34.5 cts. per yd. About 26,000 cu. yd.

★**Navy Yard Improvement—Charleston, S. C.**—Contracts awarded by Bureau of Yards and Docks, Navy Department, Washington, D. C., for constructing building ways and roadway at Charleston Navy Yard to Simons-Mayrant Company, of Charleston, at $25,000, and for constructing two shipbuilding cranes to McMyler Interstate Company, Bedford, Ohio, at about $22,000.

Jetties and Bulkhead—Sea Girt, N. J.—Lowest bid opened Dec. 17 by Quartermaster-General, Trenton, for two jetties and bulkhead at ocean front of State Camp grounds at Sea Girt submitted by Thomas Proctor, 212 Fifth Avenue, Long Branch.

State Canal Work—Albany, N. Y.—Following are unit figures of four lowest bids opened Jan. 4 by W. W. Wotherspoon, State Superintendent Public Works, Albany, for Contract No. 73-A, Champlain Canal, Section I, completing canal from Northumberland to Stillwater, about 15 miles: Engineers estimate (a), $432,045; (b) Great Lakes Dredge & Dock Co., Albany, $321,680; (c) James Stewart & Company, Inc., New York, $358,415; (d) Holler & Shepard, Rochester, $454,763; (e) New York State Dredging Corporation, Rochester, $577,977.

	(a)	(b)	(c)	(d)	(e)
Clearing (lump sum)	$200.00	$200.00	$200.00	$200.00	$200.00
274,540 cu. yd. excavation	1.40	0.998	1.14	1.48	1.90
16 M. ft. sheeting and bracing	50.00	50.00	50.00	50.00	60.00
22,600 cu. yd. forming embankment	0.15	0.15	0.15	0.15	0.15
840 cu. yd. lining	1.25	1.25	1.25	1.25	1.50
11.6 M. ft. sawed lumber	65.00	65.00	65.00	65.00	65.00
5,000 lin. ft. round timber bracing	0.25	0.25	0.25	0.25	0.25
2 M. ft. wooden sheet piling	50.00	50.00	50.00	50.00	50.00
1,150 cu. yd. second-class concrete	8.00	8.00	8.00	8.00	8.00
4,500 cu. yd. wash wall	2.50	2.50	2.00	2.50	3.00
160 sq. yd. second-class stone paving	2.00	2.00	2.00	2.00	2.00
200 cu. yd. first-class rip-rap	3.50	3.50	3.50	3.50	4.00
860 cu. yd. second-class rip-rap	3.25	3.25	3.25	3.25	3.75
130 cu. yd. third-class rip-rap	3.00	3.00	3.00	3.00	3.50
1,360 cu. yd. fourth-class rip-rap	2.75	2.75	2.75	2.75	3.25
140 lin. ft. 15-in. vitr. pipe, laid	0.75	0.75	0.75	0.75	0.75
1,030 lin ft. 24-in. vitr. pipe, laid	2.00	2.00	2.00	2.00	2.00
92,800 lb. structural steel	0.045	0.045	0.045	0.053	0.055
4,300 lb. iron castings, plain	0.03	0.03	0.03	0.033	0.04
1,920 lin. ft. wooden fence	0.25	0.25	0.25	0.25	0.30
Removing bridge superstructures (lump sum)	1,000.00	1,000.00	1,000.00	1,000.00	1,000.00
Maintaining highway traffic (lump sum)	200.00	200.00	200.00	200.00	1,000.00
Maintaining navigation (lump sum)	100.00	100.00	100.00	100.00	1,000.00
Cofferdams pumping, bailing and draining (lump sum)	3,000.00	3,000.00	3,000.00	3,000.00	5,000.00
Block signal (lump sum)	500.00	500.00	500.00	500.00	500.00

Dredging and Dock—Miami, Fla.—Following are official unit figures of four lowest bids opened Dec. 22 by W. B. Moore, City Clerk, for excavating a slip, a turning basin and a channel across Biscayne Bay, and also for constructing a concrete dock. Isham Randolph & Co., Jacksonville, Engrs.

Channel—(a) Bowers Southern Dredging Co., Galveston, Tex., $343,700; (b) Standard American Dredging Company, Tampa, Fla., $376,402; (c) L. T. Gaylord, New York, N. Y., $390,416; (d) P. Sanford Ross, Jersey City, N. J., $399,760.

	(a)	(b)	(e)	(d)
76,105 cu. yd. earth, slip No. 1	$0.10	$0.10	$0.10	$0.10
28,817 cu. yd. rock, slip No. 1	0.48	0.55	0.58	0.60
166,860 cu. yd. earth, turning basin	0.10	0.10	0.10	0.10
90,640 cu. yd. rock, turning basin	0.48	0.55	0.58	0.60
924,468 cu. yd. earth, Biscayne Bay channel	0.10	0.10	0.10	0.10
338,824 cu. yd. rock, Biscayne Bay channel	0.48	0.55	0.58	0.60
27,200 cu. yd. earth, F. E. C. channel	0.10	0.10	0.10	0.10
8,880 cu. yd. rock, F. E. C. channel	0.48	0.55	0.58	0.60

Dock—(a) Hillyer & Sperring, Jacksonville, $56,808; (b) A. J. Twiggs & Sons, $68,268; (e) McGucken & Hyer, Tampa, $68,531; (d) Everett P. Maule, West Palm Beach, $69,757.

	(a)	(b)	(c)	(d)
11,500 lin. ft. reinforced concrete piles (460)	$1.28	$1.79	$1.66	$1.90
92 reinforced concrete caps at 8.6 cu. yd. each, 791.2 cu. yd.	19.66	18.614	18.85	20.00
250 reinforced concrete stringers, 68 at 1.3 cu. yd. each; 84 at 2.3 cu. yd. each, 411.6 cu. yd.	18.02	23.90	19.00	20.00
17,584 sq. ft. concrete floor slab, 10-in. thick	0.531	0.70	0.75	0.65
16,380 sq. ft. sheet piles, 4-in. thick	0.322	0.307	0.35	0.36
92 wood anchors in place (92 pieces)	4.37	6.00	8.00	15.00
92 wood anchors, logs, in place (92 pieces)	1.61	2.00	5.10	10.00
92.90 lb. anchor rods (1¼-in. iron) (92 pieces)	4.50	9.05	15.00	10.00
23 cast iron snubbing posts (23 pieces)	56.43	90.30	120.00	40.00
184 oak wales, 12" x 12" x 14", 30.5 M ft.	73.20	70.00	80.00	100.00

★**Ditch—Morganfield, Ky.**—Contract for constructing 13 miles of open ditch (bids opened Dec. 30 by Bd. Drainage Commissioners Union County) awarded Collins & Pavey, Mt. Vernon, Ill., at 5.25 cts. per yd., approximately 670,000 cu. yd. Other bidders: T. Jacobs, Oaktown. Ind., 6.75 cts.; Fred C. Morgan, Indianapolis, Ind., 7.4 cts.; Sternberg Bros., Chicago, Ill., 7.4 cts. Norman R. Orcutt, Chief Engineer, Morganfield.

★**River Wall—Tiffin, Ohio.**—Contract for constructing the river wall on west side of the stream between Washington and Perry Streets awarded Louis Jones at $26,734.

★**Ditches—Lafayette, Ind.**—Contract for constructing Swanson Ditch in Lauramie Township (bids opened Dec. 31) awarded G. Buins, Clarks Hill, Ind., at $14,375. H. Fred Kessener, County Surveyor.

★**Dredging—Tacoma, Wash.**—Contract awarded O. W. R. & N. Company to T. Rutherford for constructing bulkhead and trestle on Middle Waterway and for dredging to Tacoma Dredging Company, 4500 Fourteenth Street, N. W., Seattle, Wash.

★**Rip-Rapping—San Diego, Cal.**—Contract for rip-rapping harbor bulkhead awarded Fred. Steffgen, San Diego at about $10,000.

ELECTRIC RAILWAYS

PROPOSED WORK.

Buffalo, N. Y.—International Ry. Co. contemplates constructing 33 miles new track during 1916.

San Angelo, Tex.—San Angelo Water, Light & Power Co. asked City Council for a street railway franchise on San Angelo. R. J. Irvine, Gen. Mgr.

Raton, N. M.—See "Railroads."

Martinez, Cal.—Reported plans being considered to construct an electric railway to connect Concord and Martinez. Clifford McClellan, San Francisco, said to be interested.

San Francisco, Cal.—Some time in January contract will be let hy Board of Public Works (F. Y. Churchill, Secy.) for constructing two more units of Church Street line.

Bingham Canyon, Utah.—Harry S. Joseph received franchise from Council to construct and operate an electric railway between West Jordan and Bingham Canyon.

London, Ont.—Election will be held in January on by-law authorizing expenditure of $101,000 for extensions to London & Port Stanley Ry.

Sarnia, Ont.—Contract will soon be let by Sarnia St. Ry. Co. for 5000 ft. 60 lb. rails.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Boston, Mass.—See "Miscellaneous."

RAILROADS

PROPOSED WORK.

Niagara Falls, N. Y.—Grade Crossing Commission has been granted permission by Common Council to issue $190,000 bonds as the city's share of cost of eliminating crossings at Portage Road, Sugar Street and College Avenue.

Niagara Falls, N. Y.—Grade crossing bonds amounting to $190,000 have been sold by the Board of Estimaet and Apportionment.

Bloomsburg, Pa.—Reported the Delaware, Lackawanna & Western R. R. Co. (Geo. J. Ray, Ch. Engr., Hoboken, N. J.) will double track line between Bloomsburg and Ruppert

Rutherford Transfer, Pa.—Philadelphia & Reading R. R. (S. T. Wagner, Ch. Engr., Philadelphia, will enlarge its yards here.

Cleveland. Ohio.—The East 105th Street grade crossing of the New York Central R. R. will be eliminated, work to be started in the spring, cost to be shared by railroad, city and the village of Bratenahl. Address City Engineer.

Hamilton, Ohio.—Reported steps being taken by the Baltimore & Ohio South-Western and the Cincinnati, Hamilton & Dayton R. R. (J. M. Davis, Cincinnati, General Manager) to double track roads between Hamilton and South Dayton; cost reported to be about $360,000. Twenty-four miles of track will be laid.

Matteson, Ill.—Reported the Illinois Central R. R. Co. (A. S. Baldwin, Ch. Engr., Chicago) considering electrifying the line to Chicago, with Matteson as the terminal.

Sutherlin, Ore.—The first unit of Sutherlin-Coos Bay R. R. is to be constructed to extend 15 miles from Sutherlin. Roach Timber Co. of Muscatine, Ia., said to be interested.

Kansas City, Mo.—Reported the Kansas City, Mexico & Orient R. R. is to be completed from Kansas City to Chihuahua, Mexico. W. S. Trimble, Acting Ch. Engr., San Angelo, Tex.

Houston, Tex.—Reported Sunset Central lines (Southern Pacific system) plans extensive improvements in 1916 which will include laying 81 miles of track of new 90-lb. steel rails. H. F. Jonas, Engineer of Structures, Houston.

Raton, N. M.—Reported Atchison, Topeka & Santa Fe Ry. (F. M. Bisbee, Ch. Engr. Western Lines, Amarillo, Tex.) plans to electrify its mountain lines between Raton and Trinidad.

Seattle, Wash.—Port Commission has directed J. R. West, Port Engineer to prepare plans and estimates for constructing the portion of the proposed public belt line railway from south end of Duwanish Avenue to a point near Stacy Street. Estimates to include crossings materials with the exception of rails already purchased, and labor. Cost about $22,500. Contract will be let about Jan. 25.

Los Angeles, Cal.—Council is considering an ordinance requiring elimination of all grade crossings in the city within the next ten years.

Manila, P. I.—See "New Industrial Plants."

PUBLIC BUILDINGS AND SCHOOLS

PROPOSED WORK.

Corning, N. Y.—Election to vote $200,000 bonds to erect new high school under consideration. Address Board of Education.

Elmira, N. Y.—Board Supervisors proposes erecting a tuberculosis hospital costing about $30,000. F. J. Gorman, Clk.

Jersey City, N. J.—Trustees of St. Francis Hospital plan erecting an addition at Pavonia Avenue and Erie Street to cost $23,000.

Newark, N. J.—Essex County Park Commission (Alonzo Church, Secy.) approved plans for pavilion to be erected in Weequahic Park, of concrete and tile construction.

City Controller sold $500,000 of the $1,500,000 Memorial Building bonds. Site on Broad and Camp Streets selected.

Altoona, Pa.—Board of Directors (J. A. Elder, Pres.) of the Mercy Hospital considering erecting an addition to the hospital to cost at least $25,000.

Gettysburg, Pa.—Board Trustees, Pennsylvania College, planning erecting $30,000 Y. M. C. A. building here.

Marcus Hook, Pa.—Reported contract soon to be let by Board of Education for erecting a two-story brick school according to plans by William E. Hance, Wilmington, Del.

Philadelphia, Pa.—Board of Education taking steps to erect annex to Northeast High School at Eighth Street and Lehigh Avenue to relieve congestion.

Reading, Pa.—Plans being prepared by A. A. Ritcher, Sixth and Court Streets, for two new ward buildings for Chronic Insane Asylum at South Mountain; $150,000 available.

Scranton, Pa.—Sketches prepared by Owen McGlynn of Wilkes-Barre for proposed high school approved by School Board.

West Chester, Pa.—Contract soon to be let for erecting armory here. Address State Armory Board, Harrisburg.

Alexandria, Va.—Waddy B. Wood, 816 Connecticut Avenue, N. W., Washington, D. C., is architect for new Alexandria Hospital to be erected on Washington and Duke Sts.; cost about $50,000.

Huntington, W. Va.—St. Francis Hospital Association contemplates erecting brick, stone and terra cotta, fireproof hospital near Ritter Park; probable cost $250,000.

Weirton, W. Va.—Citizens of School District embracing Weirton, Holliday's Cove and Zalla voted $50,000 honds to erect school on Taylor Avenue, Weirton.

West Liberty, W. Va.—State Board of Control, Charleston, contemplates erecting two-story, brick, stone and terra cotta normal school here; cost $40,000.

Dobson, N. C.—Contract will be let about April for erecting a four-story fireproof court house costing about $80,000. Harry Barton and Raleigh James Hughwa, Assoc. Architects, Greensboro.

Yazoo City, Miss.—R. H. Hunt, James Building, Chattanooga, Tenn., selected by Board Trustees of Yazoo City Schools to prepare plans for $45,000 school.

Covington, Ky.—High School improvement bonds for $165,000 sold. Address Board of Education.

Hopkinsville, Ky. — School bonds amounting to $100,000 sold. Address City Clerk.

Lexington, Ky.—School bonds amounting to $100,000 sold. Address Board of Education.

Clarksdale, Tenn.—Contract will be let about Feb. 1 by Board Education for erecting addition to high school, to be two-story, stone and brick, costing $30,000. J. W. Gaddes, of Vincennes, Ind., Architect. C. D. Runyon, Secretary Board.

Cambridge, Ohio.—School bonds for $28,000 will be sold March 5 by Board Education (Geo. D. Dugan, Clk.).

Cincinnati, Ohio.—Preliminary plans submitted to George E. Rendigs, Building Comr., by S. Hannaford & Sons, Hulbert Block, for proposed new 3-story medical college of University of Cincinnati.

Hamilton, Ohio.—Board of Education considering plans for erecting gymnasium for Hamilton High School.

Manistique, Mich.—Citizens voted $125,000 bonds to erect new central school. Address School Board.

Marquette, Mich.—Improving and remodeling city hall under consideration. Address City Clerk.

Chicago, Ill.—City Council Health Committee recommended $500,000 bond issue to be used for erecting public comfort stations in various parts of city.

Joliet, Ill.—John D. Chubb, 109 N. Dearborn Street, Chicago, reported engaged by School Board to prepare plans for Eastern Avenue School; probable cost $40,000.

Mattoon, Ill.—Citizens voted $27,000 bonds for erecting a school.

Trustees of the Memorial Hospital propose erecting a new building costing $50,000. S. W. Phillips, President.

Mattoon, Ill.—Contract will be let about Feb. 15 by Trustees Methodist Memorial Hospital (S. W. Phillips, Pres.) for erecting the building; to cost about $65,000.

Moline, Ill.—Board of Trustees of Moline City Hospital asked Council for permission to issue $25,000 bonds for erecting laundry and improving other buildings.

★**Audubon, Iowa.**—Citizens voted $55,000 bonds for erecting high school. Address Board of Education.

Minneapolis, Minn.—Board of Charities contemplates erecting a $25,000 building to care for aged and dependent people. T. J. Skellet, member of the Board.

Norton, Kan.—Citizens Dec. 28 voted $40,000 bonds to erect a school. Address Board Education.

Little Rock, Ark.—Plans being prepared by Frank M. Blaisdell, Bankers' Trust Building, for engineering and administration buildings for Little Rock College.

Brownsville, Tex.—Atlee B. Ayres, San Antonio, selected to prepare plans for the high school and the ward school buildings to be erected with the $100,000 bond issue. Address School Board.

Lipscomb, Tex.—Lipscomb County voted $25,000 for new court house. Address County Clerk.

San Antonio, Tex.—Election to be held Jan. 25 to vote $80,000 school bonds. Address School Board.

Tulsa, Okla.—Plans and specifications prepared for four-story, steel, concrete, brick, fireproof hospital contemplated here by Oklahoma Hospital Association; cost about $65,000. Dr. Fred S. Clinton, 405 Clinton Building, reported interested.

Seattle, Wash.—School bonds amounting to $750,000 will be sold Jan. 28 by R. W. Jones, Secretary School Dist. No. 1. School improvements include four new grade schools, additions and alterations to other schools, and probably a new high school on Sixth Street. Edgar Blair, Architect, 1426 Jackson Street.

Brea, Cal.—Citizens voted $66,000 bonds for erecting grammar school. Address School Board.

Kingman, Cal.—School Trus. engaged Norman F. Marsh, Broadway Central Bdg., Los Angeles, to prepare plans for a $65,000 concrete or stone high school.

Tucson, Ariz.—Council selected architect to prepare plans for $45,000 city hall, reinforced concrete faced with brick.

Toronto, Ont.—Separate School Board considering erecting new school; probable cost $100,000.

Honolulu, H. T.—The Irwin site has been purchased for the Federal building to be erected here. An appropriation of $1,000,000 is available for the building. Address James A. Wetmore, Acting Supervising Architect, Washington, D. C.

BIDS DESIRED.

Yonkers. N. Y.—Until Jan. 28 by Col. Franklin W. Ward, Secretary State Board Armory Commissioners, Albany, for construction, heating, plumbing, etc., an armory for Company "G" 10 Infantry, N.G.N.Y., Yonkers, advertised in Engineeing Record. Lewis F. Pilcher, State Architect, Albany.

Paterson, N. J.—Until Jan. 13 by Board of Education (James F. Dunphey, Secretary) for purchase and wrecking present school building No. 10 on Warren and Mercer Streets. Fred W. Wentworth, Architect. 140 Market Street.

Ebensburg, Pa.—Local reports state bids desired separately until Feb. 25, by Geo. M. Wertz, County Controller, for south and east wing additions of the Cambria County Courthouse. J. Riley Gordon, Archt., 507 Fifth Avenue, New York, N. Y.

Clarksdale, Miss.—See "Water Works."

Norwood, Ohio.—Until Jan. 24, by Board Education (Harold Ryland, Clk.) for erecting school on Carthage and Drex Avenues. Bausmith & Drainie, Archts., Gerke Building, Cincinnati.

Brazil, Ind.—Until Jan. 12 by City School Board (H. D. Falls, Secretary) for erecting a two-story and basement brick high school costing $80,000. Johnson & Miller, Archts.

Chicago, Ill.—Until Jan. 11, by Department Public Works (W. R. Moorehouse, Comr.) for erecting office, laboratory and lunch room building of the Marshall Boulevard Municipal plant.

Reported desired until Jan. 12 (extension of date), by A. F. Hussander, Archt. Bd. Educ., 7 South Dearborn Street, for erecting 3-story and basement, 107 x 124-ft. building to be known as Avalon School.

Fairmont, Minn.—Until Jan. 25, by A. Ward, Fairmont, for erecting four-story fireproof children's home, power house and barn. George Pass & Son, Archts., Mankato.

Redwood Falls, Minn.—Until Jan. 25, by Board Education (H. M. Aune, Secy.), for alterations and additions to high school. Separate bids for plumbing, heating and electrical work. Tyrie & Chapman, Archts., 320 Auditorium Bldg., Minneapolis.

Aberdeen, S. D.—Until Jan. 28, by Board Education, for erecting one-story fireproof school, including plumbing, heating and ventilating. George F. Fossum, Archt., Aberdeen.

Fort Sam Houston, Tex.—Until Jan. 21, by Constructing Quartermaster, for erecting surgical pavilion, addition to hospital, etc.

Lamesa, Tex.—Until Jan. 10 by County Commissioners, for erecting courthouse and jail at Lamesa. Sanguinet & Staats, Fort Worth, Archts.

Seattle, Wash.—Until about Feb. 15 by Trustees State University, Seattle, for erecting a 3-story brick and steel fireproof Class A political science and commercial building to cost $150,000. Main section only to be erected at this time. Bebb & Gould, Archts., Seattle. C. E. Jsches, Chairman Building Committee.

Manhattan Beach, Cal.—Until Jan. 19, by Board Trustees (Llewellyn Price, Clk.), for erecting city hall. Train & Williams, Archts., Exchange Building, Los Angeles

San Bernardino, Cal.—Reported desired until Jan. 18 for erecting hospital. Probable cost $130,000. Lyman Farwell, 616 Story Building, Los Angeles, Archt.

Toronto, Ont.—Until Jan. 26, by E. F. Henderson, Chmn. Sites Building Committee, Separate School Bd., for additions to St. Joseph's, St. Clare's and St. Anthony's schools. Also separate bids for erecting school for St. Monica's Parish. Charles J. Read, Archt., Confederation Life Bldg., Toronto.

Windsor, Ont.—Reported desired until Jan. 31, by Jas. Pennington, La Belle Building, for erecting 3-story and basement addition to school. Probable cost $100,000.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Boston, Mass.—Following are three lowest bids opened Dec. 27 by city for connecting corridors for the Boston City Hospital (West Department), Spring Street, West Roxbury: D. R. McKillop, 137 West Brookline Street, Boston. $27,893; M. F. McDonald & Son, 98 Granite Street, South Boston, $28,587; John Bowen Company, 184 Dudley Street, Boston, $28,850.

★**Greenwich, Conn.**—Contract for constructing U. S. Post Office awarded E. T. Abbott Construction Company, 1133 Broadway, New York, at $66,750.

Seymour, Conn. — Following are four lowest bids opened Dec. 28 by Supervising Architect, Washington, D. C., for erecting U. S. Post Office—(a) limestone, (b) sandstone: Frymier & Hann Company, 25 W. Forty-fifth Street, New York, (a) $48,155. (b) $48,500; Frank M. Weakley, Portsmouth, Va., (a) $48,400; Charles McCaul Company, Philadelphia, Pa., (a) $49,646, (h) $50,646; Joseph Christiano, Greenwich, (a) $49,787. (b) $50,790; E. T. Abbott Construction Company, New York, (b) $52,000.

★**Rochester, N. Y.**—Following contracts awarded for erecting Chamber of Commerce Building at Mortimer and St. Paul Streets: General construction, A. Friedrich & Sons, 710 Lake Avenue; heating and ventilating, Howe & Bassett, 23 Stillson Street; plumbing, Wright & Alexander, Rochester; electric work, Fish & Horton, 123 Mill Street; total cost about $600,000. Claude Bragdon, 416 Cutler Building, Rochester, and Foster & Gade, 15 West Thirty-eighth Street, New York, associate architects.

★**Montclair, N. J.**—Contracts awarded by Board of Education for erecting additions to Spaulding School as follows: General construction, John S. and L. Carson of Montclair, at $26,000; plumbing, Fentzlaff Engineering Company, Montclair, $6,400; electric work, L. R. Van Woert, 418 Chestnut Street, Arlington, $2,833.

★**Philadelphia, Pa.**—Contract awarded John McShain, 1610 North Street, for erecting six-story and basement, brick, stone, concrete and hollow tile, 162 x 190-ft. hospital for Sisters of Mercy, at Cedar Avenue and Fifty-third Street; cost about $256,000. E. F. Durang & Son, Archt., 1200 Chestnut Street.

Ridgway, Pa.—Following are bids opened Dec. 30 by James A. Wetmore, Acting Supervising Architect, Washington, D. C., for construction complete of U. S. Post Office at Ridgway—(a) limestone, (b) sandstone: Colonial Construction & Supply Company, Charlottesville, Va., (a) $50,999, (b) $53,000; Westchester Engineering Company, White Plains, (a) $51,400, (b) $53,000; George W. Stiles Construction Company, Chicago, Ill., (a) and (b) $51,650; Thomas W. Cissel, Wooster, Ohio, (a) $52,000, (b) $54,000.

St. Petersburg, Fla.—Following are four lowest bids opened Dec. 30 by James A. Wetmore, Acting Supervising Architect, Washington, D. C., for constructing complete U. S. Post Office: M. L. Hollody, Greensboro, N. C., reinforced concrete, $89,717; George W. Stiles Construction Company, Chicago, Ill., $90,433; Algernon Blair, Montgomery, Ala., $92,400; Dunlap & Company, Columbus, Ind., $97,649, both reinforced concrete.

★**Batavia, Ohio.**—Contract for erecting High School awarded A. P. Eveland, Miamiville, at $23,706.

★**Cincinnati, Ohio.**—Contract awarded by Board of Education to Roche-Brunner Construction Company, Cincinnati, at $390,700, for constructing gymnasium, stadium, industrial arts building, power plant and two tunnels of East High School.

★**Springfield, Ill.**—Contract for remodeling third, fourth, fifth and sixth floors of Illinois State Capitol Building awarded Frank Fitzsimmons of Springfield, at $44,500.

Amos, Iowa.—Lowest bid opened for erecting Mary Greeley Memorial Hospital submitted by Arthur Neumann of Des Moines, at $37,644.

Missoula, Mont.—Following are four lowest bids opened Dec. 29 by Supervising Architect, Washington, D. C., for erecting U. S. Post Office: Olson & Johnson Company, Missoula, $121,995; Sound Construction & Engineering Company, Seattle, Wash., $122,100; Campbell Building Company of Utah, Salt Lake City, Utah, $128,500; George A. Whitmeyer & Sons, Ogden, Utah, $129,966.

Los Angeles, Cal.—Lowest bids opened recently by Board of Education for Lincoln High School were as follows: Los Angeles Planing Mill Company, $89,980, for auditorium, library and music buildings; John Simpson & Company, $76,400, for auditorium and library, or $57,900 for auditorium alone. Neeham & Cline, Archts., Brockman Building.

★Contract for erecting above Lincoln High School awarded John Simpson & Company, Baker Detwiler Building, at $76,400.

PRIVATE BUILDINGS

PROPOSED WORK.

New Haven, Conn.—Reported J. H. Rubin, 377 State Street, has leased Law Chambers Building on Church Street and will remodel same at cost of $30,000.

Albany, N. Y.—Plans being prepared by D. Stewart Douglas, 100 State Street, for dormitory proposed in connection with New York State College for Teachers.

New York, N. Y.—Plans filed for erecting following buildings: 13-story apartment hotel at 23 East Forty-eighth and 50 East Forty-ninth Streets for 33 East Forty-eighth Street Realty Company, cost $600,000, Warren & Wetmore, Archts., 16 East Forty-seventh Street; 6-story tenement at 181st Street and Vyse Avenue for Philip Weinstein & Son, Inc., cost $70,000, Goldner & Goldberg, Archts, 391 East 149th Street; two 5-story tenements at Belmont Avenue and 179th Street for Harkness Holding Corp., total cost $100,000, Chas. Schaefer, Jr., Archt., 401 Tremont Avenue; 5-story tenement at Creston Avenue and 197th Street for Ajay Realty Corp., cost $50,000, Moore & Landsiedel, Archts., Third Avenue and 148th Street.

New York Times has purchased a site including 231 to 239 West Forty-third Street and will erect 12-story addition to "Times Annex."

Watertown, N. Y.—Frank L. Woolworth, Woolworth Building, New York, reported considering the erection of a 14-story office building in this city.

Newark, N. J.—Plans completed by Romolo Bottelli, 207 Market Street, for four-story, brick apartment house to be erected at 107 Parker Street for P. Pellechia; cost approximately $30,000.

West New York (P. O. Weehawken), N. J.—The West New York Realty & Construction Company will erect two five-story brick apartment houses on Hudson and Fourteenth Streets, costing $76,000.

New Kensington, Pa.—Sketches being prepared for four-story addition to Y. M. C. Association Building; cost $50,000. Address Chairman Building Committee.

Wilmington, Del.—Plans being prepared by Duhring, Okie & Ziegler, Bailey Building, Philadelphia, Pa., for three-story, 125 x 200-ft. reinforced concrete garage.

Spartanburg, S. C.—Spartanburg Hotel Company incorporated for purpose of erecting a hotel, "The Cleveland." Capital $125 000. L. W. Perrin, Secretary.

Birmingham, Ala.—Plans being considered by Collins & Company, 2101 Morris Avenue, for erecting warehouse on First Avenue and Twenty-fourth Street; cost about $40,000.

Louisville Ky.—Reported plans being prepared by S. P. Ostrander, Louisville, for negro moving picture theater to be erected on Walnut and Twelfth Streets; cost about $25,000.

Avondale, Ohio.—K. K. Adath Israel congregation contemplates erecting $30,000 synagogue on Knott and Prospect Avenues.

Bellaire, Ohio.—Reported Baltimore & Ohio Railroad Company (F. L. Stuart, Ch. Engr., Baltimore) contemplates erecting next spring a new depot here.

Cleveland, Ohio.—Plans being prepared by E. F. Gibbons, 1900 Euclid Avenue, for a $125,000 warehouse to be erected on East Fifty-fifth Street.

Richardson & Yost, Rockefeller Building, engaged to prepare plans for proposed $500,000 commercial building and warehouse to be erected on Euclid Avenue and East Fifty-fifth Street. W. R. Hopkins, 830 Society for Savings Building, interested.

Revised plans prepared by W. J. Carter, Illuminating Building, for four-story brick temple approved by Trustees of Newburg Masonic Temple Company; cost about $60,000.

Mansfield, Ohio.—Reported plans being prepared by Frank B. Hursh of Mansfield for a 1½-story, brick and stone church for St. Matthew's Lutheran congregation; estimated cost $25,000.

Wadsworth, Ohio.—R. H. Hinsdale, Osborn Building, Cleveland, is architect for $80,000 edifice to be erected for Lutheran Church. Rev. E. D. Etter, Pastor.

Fort Wayne, Ind.—Charles R. Weatherhogg, Hamilton National Bank Building, engaged to prepare plans for synagogue to be erected next spring for Achduth Veshalom Congregation; cost approximately $75,000.

Muskegon, Mich.—Lodge No. 32, Knights of Pythias, intends erecting at Third Street and Clay Avenue a combined lodge and office building to be five or six stories.

Milwaukee, Wis.—Plans being prepared for eight-story building on site of present main exchange on Broadway for Wisconsin Telephone Company, 183 Fifth Street; probable cost $350,000.

Mason City, Iowa.—Modern Brotherhood of America contemplates erecting next spring an 8-story office building; probable cost $75,000.

Minneapolis, Minn.—Reported Great Northern Railroad Company (A. H. Hogeland, Ch. Engr., St. Paul) will rebuild roundhouse on Colfax Avenue, North, recently destroyed by fire.

R. A. Jacobson, 699 Seventeenth Avenue, N. E., will erect a 3-story brick and concrete warehouse at 1701 Madison Street, N. E., estimated to cost $25,000.

Sketch plans submitted Building Committee of University Club for a $100,000 club house. Samuel S. Thorp, President.

Cataract Lodge No. 2. A. F. A. M., considering erecting a building on the East Side. W. H. J. Pearce, Secretary.

Larned, Kan.—Plans being prepared by Mann & Gerow of Hutchinson for 4-story, brick warehouse to be erected for Doerr Mercantile Company; cost $20,000.

Claremore, Okla.—Reported St. Louis & San Francisco Railroad Company (F. G. Jonah, Ch. Engr., St. Louis, Mo.) contemplates erecting new depot on present site to cost about $21,000.

Seattle, Wash.—Plans being prepared by T. L. West, Orpheum Building, for five-story brick and terra cotta, 60 x 120-ft. apartment building to be erected at Seventh and James Streets for L. M. Stern, Lowman Building; cost $50,000.

George Foote Dunham, Lumbermen's Building, Portland, Ore., engaged to prepare plans for edifice to be erected for Fourth Christian Science Church, Seattle, Seventh Avenue and Seneca Street; cost $75,000.

Spokane, Wash.—Contract about to be let for erecting four-story addition to warehouse of McGowan Brothers, Howard Street; cost $60,000.

BIDS DESIRED.

Yonkers, N. Y.—Until Jan. 26, by Edwin F. Howard, Chmn. Yonkers Masonic Guild, Putman Station Building, for erecting Masonic Temple. Vollman & Beersman, Evart Tracy, Assoc. Archts., 244 Fifth Avenue, New York, N. Y.

Rutherford, N. J.—Reported competitive plans desired until Jan. 15, by Rev. J. J. Smith, 91 Home Street, for a parochial school for St. Mary's R. C. Church. Probable cost $35,000.

East Greenville, Pa.—Reported desired until Jan. 17 for erecting 3-story, 60 x 125-ft. lodge and store building for East Greenfield Realty Co., G. Cleveland Freeman, 1111 N. Eleventh Street, Reading, Pa.

Nashville, Tenn.—Reported desired until Jan. 14, by Ludlow & Peabody, Archts., 101 Park Avenue, N. Y., for alterations to 5-story bank and office building.

Cleveland, Ohio.—Reported desired until Apr. 1 for erecting 3-story and basement gymnasium for Western Reserve University (Chas. F. Thwing, D.D., Pres.). Chas. W. Hopkinson, Archt., 900 Rose Building.

Michigan City, Ind.—Reported desired until Jan. 17 by Worthman & Steinbach, and C. L. Pointek, Architects, 1859 West Chicago Avenue, Chicago, Ill., for erecting St. Stanislaus R. C. Church, cost $100,000.

Cresco, Iowa.—Reported desired until Jan. 26, Rev. J. P. Wegener, R. C. Church, for erecting 50 x 129-ft. edifice. Probable cost $30,000. E. L. Masqueray, Archt., 595 Endicott Arcade, St. Paul, Minn.

Bismark, N. D.—Reported desired until Jan. 20, by Ashelman & Gage, Archts., Fargo, for 3-story 35 x 150 ft. brick apartment building, for F. W. Murphy. Probable cost, $28,000.

Bartlesville, Okla.—King Lumber Company, General Contractors, Charlottesville, Va., desire prices on brick, limestone, structural steel, crushed stone, sand, cement, plumbing, heating, wiring, plastering, mill work and roof for the Y. M. C. A. Building at Bartlesville, Okla., for which they have secured the contract. Shattuck & Hussey, Architects, Chicago, Ill.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Boston, Mass.**—Contract awarded T. A. Clarke Company, 122 Livingston Street, Brooklyn, N. Y., for erecting building on Nashua Street to be leased for North Station Postoffice; cost about $200,000.

★**Buffalo, N. Y.**—Contract awarded B. I. Crocker Company, Builders Exchange, for erecting 8-story and basement brick and steel store and office building at Franklin and Mohawk Streets for Wm. H. Crosby; cost $125,000. Robert North, Archt., Prudential Building.

★**Philadelphia, Pa.**—Contract awarded to Koelle, Speth & Company, Twenty-sixth and Oxford Streets, for erecting four-story, brick, stone, concrete and terra cotta, 75 x 127-ft. garage at Ninth and Cumberland Streets for Breyer Ice Cream Company; cost $50,000.

★Contract awarded by Ballinger & Perrot, Archts., Methodist Building, to Joseph Bechtel, 200 North Fifteenth Street, for erecting employers' building at Nicetown for American Pulley Company, 4200 Wissahickon Avenue, Philadelphia.

★**Baltimore, Md.**—Contract awarded by George W. Rife, to Clarence E. Stubbs, The Wentworth, for erecting Rife Building at 13 Harrison Street; cost approximately $40,000. Otto G. Simonson, Archt., Maryland Casualty Tower.

★**Detroit, Mich.**—Contract for erecting 15-story addition to the Hotel Statler awarded F. W. Mark Construction Company of Cleveland, Ohio.

★**Omaha, Neb.**—Contract for erecting Masonic Temple at Nineteenth and Douglas Streets awarded Walter Peterson, Fidelity Trust Company Building, at $274,000.

Bartlesville, Okla.—See "Bids Desired."

NEW INDUSTRIAL PLANTS

PROPOSED WORK.

Cohoes, N. Y.—Contract about to be let by C. G. Ogden, Archt., 59 State Street, Albany, for four-story and basement mill addition to plant of Fuld & Hatch; estimated cost $25,000.

Syracuse, N. Y.—Sanderson Brothers Steel Company (E. L. French, Gen. Mgr.), 104 Magnolia Street, will rebuild mills at cost of $500,000.

Trenton, N. J.—Reported American Bridge Company plans improving and enlarging plant here.

Allentown, Pa.—Traylor Engineering & Manufacturing Company (Samuel W. Traylor, Pres.), Allentown, contemplates spending about $350,000 for erecting new buildings to include machine shop and four-story warehouse; also installing new machinery.

Raleigh, N. C.—Reported Raleigh News and Observer will rebuild printing plant on West Martin Street recently destroyed by fire.

Winston-Salem, N. C.—P. H. Hanes Knitting Company contemplates erecting four or five-story addition to plant and installing machinery.

Woodruff, S. C.—W. S. Gray Cotton Mills, Woodruff, will erect two-story, 65 x 100-ft. addition.

Savannah Ga.—Mills B. Lane, 26 Gaston Street, East, and others reported interested in erecting sugar refinery here.

Maryville, Tenn.—Aluminum Company of America, Pittsburgh, Pa., will construct a power dam at Maryville in connection with their plant.

Cincinnati Ohio.—Bert L. Baldwin & Company, Perin Building, engaged to prepare plans for iron foundry to be erected on Queen City Avenue, Fairmount, for Lunkenheimer Company.

Cleveland, Ohio.—Plans being prepared by Richardson & Yost, Rockefeller Building, for $50,000 fireproof factory to be erected on Superior Avenue and East Forty-ninth Street for National Telephone Supply Company.

Lorain, Ohio.—Reported four open-hearth furnaces and a new blooming mill will be added to plant of National Tube Company.

Milwaukee, Wis.—Plans being prepared for 50 x 100-ft. brick and reinforced concrete addition to plant of Weyenberg Shoe Manufacturing Company, 121 Harmon Street; cost about $50,000.

Des Moines, Iowa.—Reported Des Moines Milk Company has purchased plant of Fairview Dairy Company, 1401 Grand Street, and Iowa Dairy Company, 510 Second Street, and will erect new plant on Second Street: cost about $25,000.

St. Louis, Mo.—Plans being prepared by T. P. Barnett Company, Central National Bank Building, for ten-story reinforced concrete building to be erected on Second and Spruce Streets for Blanton Manufacturing Company.

Dodd City, Ark.—Bear Hill Mining Company (J. M. Bergman, Pres.) will install zinc mining machinery to cost $30,000.

Dallas, Tex.—Reported Dallas Cotton Mills will spend $50,000 for enlarging and improving plant.

San Antonio, Tex.—Reported International & Great Northern Railroad Company (O. H. Crittenden, Ch. Engr., Houston) will erect new shops here to cost about $250,000.

Altus, Okla.—Reported Interstate Compress Company plans rebuilding burned plant.

Sand Springs, Okla.—Plans completed for paraffin factory to be erected here for Pierce Oil Corporation, Robinson Building, Tulsa; cost $800,000.

Portland Ore.—Plant of Emerson Hardwood Company (J. S. Emerson, Pres.), recently destroyed by fire, will be rebuilt.

San Francisco, Cal.—Preliminary plans prepared for five-story, reinforced concrete addition to assembling plant of Ford Motor Company, at Twenty-first and Treat Avenue; cost about $200,000.

BIDS DESIRED.

Chicago, Ill.—Reported desired until Jan. 15, by John Ashlschlager & Son, Archt., 111 W. Washington Street, for concrete foundation eight-story and basement 130 x 332 ft. cold storage plant for the Beatrice Creamery Co.; until about Jan. 20, for superstructure of building; probable cost $900,000.

Fergus Falls, Minn.—See "Miscellaneous."

Manila, P. I.—Until Apr. 15, by the Central Sugar Board, for constructing and equipping, complete, sugar plantation in district of Isabel-Binalbagan. Work includes factory to work up 1000 tons of cane per day, adequate mechanical apparatus for discharging cane from cars and wagons and distributing on cane carrier, cane carrier, crusher and four sets of three roll mills, engines, hand power traveling crane, clarification plant, concentration plant, pumps, crystallizers, mixers, tanks, piping, valves, guttering, electric power plant, water supply, including electric pumping plant and steel pipe line, factory building, workshops, tools and repair appliances, chemical laboratory, sugar house, 36-in. gage railway, rolling stock, track scales, locomotive sheds, etc. The work is financed by the Government of the Philippine Islands. Specifications may be obtained from the Bureau of Insular Affairs, War Department, Washington, D. C.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Woonsocket, R. I.**—Contract awarded Turner Construction Company, 11 Broadway, New York, for erecting a 4-story reinforced concrete and brick curtain walls factory, 55 x 166 ft., for the American Paper Tube Company. W. F. Fontaine, Architect, Woonsocket.

★**New Haven, Conn.**—Contract awarded by Marlin Arms Company for erecting factory addition at Willow and Mechanic Streets to James Stewart & Company, 30 Church Street, New York; cost about $100,000.

★**Buffalo, N. Y.**—Contract awarded by Buffalo Union Furnace Company to McClintic-Marshall Company, Pittsburgh, Pa., for furnishing and installing a 9-ton ore-handling bridge, requiring 275 tons fabricated steel.

★Harrisburg, Pa.—Contract awarded by Dauphin Cigar Company to Herman Voigt, 1251 N. Twenty-eighth Street, Philadelphia, for erecting 5-story, fireproof, steel and concrete factory here; cost about $100,000. C. H. Kain, Archt., Arcade Building.

★Philadelphia, Pa.—Contract awarded William Steel & Sons Company, 1600 Arch Street, for erecting three-story, brick and concrete, 78 x 87-ft. factory at Eighteenth and Courtland Streets. for Friedenberger-Aaron Manufacturing Company.

★Contract awarded Henry E. Baton, Twelfth and Sansom Streets, for five-story, brick and reinforced concrete, 54 x 100-ft. factory at 1220 Spring Garden Street for M. Rice Company. Sauer & Hahn, Archts., 1112 Chestnut Street.

★Contract for erecting three factory buildings on James and Fraley Streets for Abrasive Material Company awarded A. Raymond Raff, 1635 Thompson Street; cost $50,000. Stearns & Castor, Archts., Stephen-Girard Building.

★Contract awarded Harrison C. Rea Company, 1027 Wood Street, for erecting 4-story storage, oxidizing and pumphouse buildings, of reinforced concrete construction, at Nicetown, for George W. Blabon Company. Ballinger & Perrot, Archts., Methodist Building.

★Woodruff, S. C.—Contract awarded Fiske-Carter Construction Company, Greenville, for erecting four-story, 80 x 124-ft. addition to plant of Woodruff Cotton Mills. Engineer, J. E. Sirrine, Greenville.

★Chicago, Ill.—Contract awarded Great Lakes Dredge & Dock Company, Chicago Ill., for 40,000 cu. yd. concrete work in connection with the construction of additional open-hearth furnaces for Inland Steel Company at Indiana Harbor.

★Crockett, Cal.—Contract awarded by California & Hawaiian Sugar Refining Company, Crockett, to Clinton Construction Company of San Francisco, for erecting concrete warehouse No. 5, as addition to plant; total cost about $300,000.

★San Pedro Cal.—Contract for erecting structural steel for a number of buildings comprising the first unit of the plant of the American Trona Company, and including refinery buildings, boiler house, power plant, storage warehouse, etc., has been awarded Llewellyn Iron Works, Los Angeles. This first unit, including machinery and equipment, will cost about $750,000. Five other units are to be erected later. Construction is to be of steel frame.

★Twin Falls, Idaho.—Contract awarded by Amalgamated Sugar Company, Eccles Building, Ogden, Utah, to Larrowe Construction Company, 1199 Woodward Avenue, Detroit, Mich., for erecting sugar factory here; cost about $700,000.

★China.—Contract for 25,000 spindles for the two cotton mills which the Chinese Government intends erecting, one in Shanghai and the other in Tientsin, awarded Sacc Lowell Shops of Boston, Mass. Contract for the power equipment has also been let to an American firm.

MISCELLANEOUS

PROPOSED WORK.

Transmission Line—Deposit, N. Y.—Deposit Electric Company is considering extending transmission lines to Cannonsville, Delaware County, in the spring. George W. Vail, Supt.

Transmission Line—Morristown, N. Y.—Gregory Electric Company is taking steps to construct a transmission line from Heuvelton to Morristown, a distance of 15 miles.

Improving Camp Site—Columbia, S. C.—Adjutant-General W. W. Moore will ask the Legislature to appropriate $10,000 for improving State camp site at Styx, 7 miles from Columbia.

Transmission Line—Durant, Okla.—Durant Ice & Light Company will erect a high-tension transmission line to Caddo and connect the plant there with the Durant plant in the spring. W. J. O'Brien, Secy. & Mgr.

Transmission Line—Bridgeport, Wash.—Permission granted to Okanogan Valley Power Company of Brewster to construct a transmission line over public roads of Douglas County from Bridgeport to Mansfield.

BIDS DESIRED.

Cement—Providence, R. I.—Until Jan. 17 by Board Contract & Supply (Joseph H. Gainer, Mayor, Chairman), for furnishing about 7000 bbl. Portland cement and 1800 bbl. natural cement.

Fence—Cullman, Ala.—Reported until Jan. 10, by Lot D. Jones, Resident Engineer, for erecting about 3½ miles of fence or guard rails on all high fills along old Louisville & Nashville Railroad bed between Cullman and Garden City.

Street Signs—Cincinnati, Ohio.—Until Jan. 17 by Ernst Von Bargen, City Purchasing Agent, for furnishing approximately 4300 enameled street name signs and 4350 metal street name signs and 4300 metal street number signs.

Cincinnati, Ohio.—To sublet 27,000 yd. of grading in Eastern Ohio, advertised in Engineering Record; steam shovel and roller, dump wagons and wheel scrapers on the work, that a contractor can use; he must furnish bond. Address 302 Provident Bank Building, Cincinnati, Ohio.

Cement—Chicago, Ill.—Until Jan. 10 (re-advertisement), by W. R. Moorhouse, Comr. Pub. Wks., for furnishing, delivering and unloading at various locations in city of Chicago, approximately 70,000 bbl. Portland cement. Bureau of Engineering.

Fire Escapes—Cherokee, Iowa.—Reported desired until Jan. 17, for installing fire escapes on Webster, Lincoln and Wilson Schools, Independent School Dist., New Cherokee. William Shardlow, Secy.

Sprinkler—Fergus Falls, Minn.—Until Feb. 8, by the Fergus Manufacturing Company, for a complete sprinkler system in their plant.

Park Improvements—Kansas City, Mo.—Until Jan. 11 by Park Board, for grading 8½ acres of city park opposite Union Station. There is to be a fill in the ground at Twenty-fourth and Wyandotte Streets, Main Street side of the hill to Twenty-fifth Street will be terraced and south end of park on Twenty-fifth Street between Main and Baltimore Streets will be graded. A circular road varying from 30 to 50 feet will be built along the crest of the slope to Twenty-fifth and Wyandotte Streets. Ornamental cut stone steps will be erected on Plaza Road between Main and Wyandotte Streets.

Cement—St. Louis, Mo.—Reported desired until Jan. 14 by Jos. B. Thomas, Supply Comr., for furnishing Street Department with 600 tons asphaltic cement.

Pipe Line—Van Buren, Ark.—Reported desired until Jan. 10 by M. S. Crawford Gas & Oil Company for 10 miles of 6, 8 and 10-in. piping. C. H. Reece, Engineer.

Elevator—Lawton, Okla.—Until Jan. 25 by Jas. A. Wetmore, Acting Superv. Archt., Washington, D. C., for installing an electric passenger elevator in U. S. postoffice at Lawton, Okla., and McCook, Neb.

Steel Lockers—Los Angeles, Cal.—Until Jan. 14 by Board of Education (T. J. McGonigle, Purchasing Clerk) for 300 steel lockers.

Traveling Crane—Manila, P. I.—See "New Industrial Plants."

PRICES AND LETTINGS.

★Indicates award of contract.

Dorchester Tunnel Improvement—Boston, Mass.—Following are three lowest bids opened Dec. 28 by Boston Transit Commission for plastering walls and ceilings, 9200 sq. yd., in South Station under Dorchester tunnel, Boston: Keith & Craffey, 294 Washington Street, Boston, $13,285; Alfred B. Day, Boston, $13,320; Robert Gallagher, 116 Devonshire Street, Boston, $14,045.

Stone—Mount Holly, N. J.—Following are bids opened Jan. 1 by Board Chosen Freeholders for furnishing broken stone to county for the year 1916 (prices are f.o.b. quarry): Delaware River Quarry & Construction Company, Lambertville, N. J., 85 cts. per ton; Lambertville Stone Quarry Company, 1220 Filbert Street, Philadelphia, Pa., 75 cts. per ton. James Logan, County Engineer.

★Hoists — Philadelphia, Pa.—Contract awarded Maine Electric Company, Portland, Me., at $2,499, for one electric hoist for Southwark piers in Delaware River between Catharine and Christian Streets (bids opened Dec. 20 by Department of Wharves and Docks), and Lidgerwood Mfg. Company, 96 Liberty Street, New York, contract for another electric hoist (bids opened at same time and place) at $4,240.

★Cotton Trolley System—Houston, Tex.—Contract for constructing a cotton trolley system for municipal cotton sheds (bids opened Dec. 27) awarded Southwestern Mechanical Company of Fort Worth at $16,200.

Tunnel Into County Buildings—Seattle, Wash.—Lowest bid for constructing the tunnel into the Seattle-King County Building submitted by Jahn Contracting Company, Pioneer Building, at $25,006.

Proposals

For Proposals Advertised, See Pages 28, 29 and 30

WATERWORKS.

Bids Close.		See Eng. Record.
Jan. 10.	Filter, Danville, Pa. Adv. Dec. 18.	Dec. 18
Jan. 11.	Filter Plant, St. Hyacinthe, Que.	Dec. 4
Jan. 11.	Castings, etc., Toronto, Ont.	Jan 8
Jan. 12.	Pumping Unit, Kansas City, Mo. Adv. Dec. 11 to Jan. 1.	Dec. 11
Jan. 14.	Piping, etc., Pittsburgh, Pa.	Jan. 8
Jan. 14.	Extensions, Oswego, Kan.	Jan. 8
Jan. 14.	Extensions, Joplin, Mo.	Jan. 8
Jan. 14.	Well, Galesburg, Ill. Adv. Jan. 8.	Jan. 8
Jan. 17.	Pumping Unit, St. Paul, Minn. Adv. Dec. 24.	Dec. 25
Jan. 17.	Pipe, Los Angeles, Cal.	Jan. 8
Jan. 18.	Meters, etc., Opelousas, La.	Jan. 1
Jan. 18.	Improvements, Clarksdale, Miss. Adv. Jan. 8.	Jan. 8
Jan. 19.	C. I. Pipe, etc. Baltimore, Md. Adv. Jan. 8.	Jan. 8
Jan. 29.	Pumping Station, etc., Kenosha, Wis. Adv. Jan. 1, 8.	Jan. 1
Jan. 31.	Filtration Structure, Oshkosh, Wis. Adv. Jan. 1, 8.	Jan. 1
Feb. 1.	Exciter, c. i. pipe, etc., Orangeburg, S. C. Adv. Jan. 8.	Jan. 8

SEWERAGE AND SEWAGE DISPOSAL.

Jan. 12.	Baltimore, Md. Adv. Jan. 1.	Jan. 1
Jan. 12.	New Bedford, Mass.	Jan. 1
Jan. 12.	Averyville, Ill. Adv. Jan. 8.	Jan. 8
Jan. 18.	Lisbon, Ia.	Jan. 8
Jan. 24.	Elgin, Ill.	Jan. 1
Jan. 24.	Cuyahoga Falls, Ohio	Jan. 1
Jan. 31.	South St. Paul, Minn.	Jan. 8

BRIDGES.

Jan. 11.	York, Neb.	Jan. 1
Jan. 11.	Frontenac, Que.	Jan. 8
Jan. 11.	Geneva, Neb.	Jan. 8
Jan. 11.	Modesto, Cal.	Jan. 8
Jan. 11.	Falls City, Neb.	Jan. 8
Jan. 13.	Laporte, Ind.	Jan. 1
Jan. 14.	Berkeley Springs, W. Va.	Jan. 1
Jan. 14.	Jackson, Minn.	Jan. 8
Jan. 14.	Portland, Ore.	Jan. 8
Jan. 15.	Tucson, Ariz.	Dec. 25
Jan. 15.	Sandpoint, Idaho	Dec. 25
Jan. 15.	Newland, N. C. Adv. Jan. 1, 8.	Jan. 1
Jan. 17.	Redlands, Cal.	Jan. 1
Jan. 18.	Knoxville, Iowa	Dec. 18
Jan. 20.	Fort Benton, Mont. Adv. Dec. 25 to Jan. 8.	Dec. 25
Jan. 20.	Sulphur, Okla.	Jan. 1
Jan. 26.	Rockford, Ill. Adv. Dec. 25.	Dec. 25
Jan. 27.	Atlanta, Ga. Adv. Jan. 8.	Jan. 8
Jan. 31.	Boston, Mass. Adv. Jan. 8.	Jan. 8
Jan. 31.	Iowa City, Iowa	Jan. 1
Feb. 2.	Connecticut	Jan. 8
Feb. 3.	Dallas, Tex. Adv. Jan. 8.	Jan. 8

PAVING AND ROADS.

Jan. 11.	Florence, S. C.	Dec. 18
Jan. 11.	Albany, N. Y. Adv. Dec. 18, 25.	Dec. 18
Jan. 11.	Seattle, Wash.	Jan. 1
Jan. 11.	Clinton, Ia.	Jan. 8
Jan. 11.	Kansas City, Mo.	Jan. 8
Jan. 12.	Dadesville, Ala.	Dec. 25
Jan. 12.	Seattle, Wash.	Dec. 25
Jan. 12.	Iowa Falls, Ia.	Jan. 8
Jan. 12.	Dennison, Tex.	Jan. 8
Jan. 12.	New York, N. Y.	Jan. 8
Jan. 12.	Wallace, Idaho	Jan. 8
Jan. 12.	Buffalo, N. Y.	Jan. 8
Jan. 13.	Sault Ste. Marie, Mich.	Dec. 4
Jan. 13.	Belton, Tex.	Jan. 8
Jan. 14.	Charlestown, W. Va.	Dec. 18
Jan. 15.	Walla Walla, Wash.	Jan. 1
Jan. 15.	Wallace, Idaho	Jan. 8
Jan. 16.	Seattle, Wash.	Jan. 8
Jan. 17.	Evanston, Ill. 2 Props., Adv. Dec. 25, to Jan. 8.	Dec. 25
Jan. 17.	East View, Ohio	Dec. 25
Jan. 17.	Ames, Iowa	Jan. 8
Jan. 17.	Camden, Ala.	Jan. 8
Jan. 17.	Los Angeles, Cal.	Jan. 8
Jan. 18.	Jamestown, Tenn. Adv. Jan. 8.	Jan. 8
Jan. 20.	Greenfield, Iowa	Dec. 25
Jan. 20.	Danville, Ill.	Jan. 8
Jan. 20.	San Antonio, Tex. Adv. Jan. 8.	Jan. 8
Jan. 20.	Newark, N. J.	Jan. 8
Jan. 22.	La Porte, Ind.	Jan. 8
Jan. 24	Washington	Jan. 1
Jan. 25.	Fort Madison, Iowa	Jan. 1
Feb. 9.	Indiana	Jan. 1
Feb. 15.	Spokane, Wash.	Jan. 8

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS.

Bids Close.		See Eng Record.
Jan. 11.	State Canal Work, Albany, N. Y. Adv. Dec. 18 to Jan. 8.	Dec. 18
Jan. 11.	Bars for Tunnel Work, Los Angeles, Cal.	Jan. 1
Jan. 11.	Ditch, Forest City Iowa	Jan. 8
Jan. 11.	Ditch, Willmar, Minn.	Jan. 8
Jan. 12.	Sherman, Tex.	Dec. 25
Jan. 12.	Dredging, New York, N. Y.	Jan. 8
Jan. 12.	Bulkhead, Baltimore, Md.	Jan. 8
Jan. 13.	Dredging, New York, N. Y.	Jan. 8
Jan. 14.	Gates for dam, Wheeling, W. Va. Adv. Dec. 18 to Jan. 8.	Dec. 18
Jan. 14.	Drain, Tempe, Ariz.	Jan. 1
Jan. 14.	Ditches, Fairmont, Minn.	Jan. 8
Jan. 15.	Ditch, Memphis, Tenn.	Jan. 1
Jan. 15.	Ditch, Parr, Ind.	Jan. 1
Jan. 15.	Drainage, Memphis, Mo.	Jan. 8
Jan. 17.	Ft. Wayne, Ind Adv. Dec. 25.	Dec. 25
Jan. 17.	Irrigation, Oakdale, Cal.	Dec. 25
Jan. 18.	Irrigation, Montrose, Col.	Dec. 25
Jan. 22.	Power House at Dam, Wheeling, W. Va. Adv. Dec. 25 to Jan. 8.	Dec. 25
Jan. 25.	Ditch, Crookston, Minn.	Dec. 25
Jan. 25.	Irrigation, etc., Barstow, Tex.	Jan. 8
Feb. 8.	Irrigation, St. Ignatius, Mont. Adv. Jan. 8.	Jan. 8

PUBLIC BUILDINGS AND SCHOOLS.

Jan. 10.	Titusville, Pa. Adv. Dec. 4, 11.	Dec. 4
Jan. 11.	Durham, N. C.	Dec. 18
Jan. 11.	Cherry Grove, Ohio	Jan. 1
Jan. 11.	Chicago, Ill.	Jan. 8
Jan. 12.	Ortonville, Minn.	Jan. 1
Jan. 12.	Chicago, Ill.	Jan. 8
Jan. 12.	Brazil, Ind.	Jan. 8
Jan. 13.	Paterson, N. J.	Jan. 8
Jan. 15.	Duluth, Minn.	Dec. 11
Jan. 15.	St. Louis, Mo.	Dec. 25
Jan. 15.	Fort Pierce, Fla.	Jan. 1
Jan. 15.	Lambton Mills, Ont.	Jan. 1
Jan. 16.	Sidney, Neb.	Dec. 11
Jan. 16.	San Bernardino Cal.	Jan. 8
Jan. 17.	Hackensack, N. J.	Dec. 11
Jan. 17.	Smithfield, R. I.	Dec. 18
Jan. 18.	Anoka, Minn.	Dec. 11
Jan. 18.	Clarksdale, Miss.	Jan. 1
Jan. 19.	Hornell, N. Y.	Dec. 11
Jan. 19.	Manhattan Beach, Cal.	Jan. 8
Jan. 20.	Crookston, Minn.	Dec. 25
Jan. 21.	Waterloo, N. Y.	Dec. 18
Jan. 21.	Fort Sam Houston, Tex.	Jan. 8
Jan. 22.	Wheeling, W. Va. Adv. Dec. 25, Jan. 1.	Dec. 25
Jan. 24.	Ashland, Ky.	Dec. 18
Jan. 24.	Nevada, Iowa	Jan. 1
Jan. 24.	Norwood, Ohio	Jan. 8
Feb. 25.	Ebensburg, Pa.	Jan. 8
Jan. 25.	Fairmont, Minn.	Jan. 8
Jan. 25.	Redwood Falls, Minn.	Jan. 8
Jan. 26.	Shelby, N. C.	Dec. 18
Jan. 26.	Toronto, Ont.	Jan. 8
Jan. 27.	Ellensburg, Wash.	Dec. 18
Jan. 28.	Washington, Iowa	Dec. 25
Jan. 28.	Yonkers, N. Y. Adv. Jan. 8.	Jan. 8
Jan. 28.	Aberdeen, S. D.	Jan. 8
Jan. 31.	Key West, Fla. Adv. Jan. 1, 8.	Jan. 1
Jan. 31.	Delaware, Ohio	Jan. 1
Jan. 31.	Windsor, Ont.	Jan. 8
Feb. 1.	Oneida, Iowa	Dec. 18
Feb. 1.	George West, Tex.	Dec. 18
Feb. 7.	Sioux City, Iowa	Dec. 25

PRIVATE BUILDINGS.

Jan. 14.	Nashville, Tenn.	Jan. 8
Jan. 15.	Toledo, Ohio	Jan. 1
Jan. 15.	Lansing, Mich.	Jan. 1
Jan. 15.	Plans, Rutherford, N. J.	Jan. 8
Jan. 17.	East Greenfield, Pa.	Jan. 8
Jan. 17.	Michigan City, Ind.	Jan. 8
Jan. 26.	Yonkers, N. Y.	Jan. 8
Jan. 26.	Cresco, Iowa	Jan. 8
Feb. 15.	Britt, Iowa	Jan. 1
Apr. 1.	Cleveland, Ohio	Jan. 8

NEW INDUSTRIAL PLANTS.

Jan. 15.	Chicago Ill.	Jan. 8

MISCELLANEOUS.

Jan. 11.	Light Standards, Janesville, Wis.	Jan. 1
Jan. 12.	Cruiser, Chicago, Ill. Adv. Dec. 18 to Jan. 8.	Dec. 18
Jan. 12.	Garbage Machinery, Chicago, Ill.	Jan. 8
Jan. 14.	El. Rys., New York, N. Y.	Jan. 1
Jan. 14.	Cement, St. Louis, Mo.	Jan. 8
Jan. 14.	Steel Lockers, Los Angeles, Cal.	Jan. 8
Jan. 16.	Cement, Baltimore, Md.	Jan. 1
Jan. 17.	Steel pipe, etc., Panama.	Jan. 1
Jan. 17.	Cement, Atlanta, Ga.	Jan. 1
Jan. 17.	Fire Escapes, Cherokee, Iowa	Jan. 8
Jan. 17.	Signs, Cincinnati, Ohio	Jan. 8
Jan. 17.	Cement, Providence, R. I.	Jan. 8
Jan. 18.	Cement tank, Louisville, Ky.	Dec. 25
Jan. 18.	Garbage Disposal, New York, N. Y. Adv. Dec. 25 to Jan. 8.	Dec. 25
Jan. 19.	Garbage Incinerator, Edgwood, Pa.	Dec. 25
Jan. 19.	Removal of Wreck, San Francisco, Cal.	Jan. 1
Jan. 24.	Boilers, West Point, N. Y. Adv. Dec. 25 to Jan. 8.	Dec. 25
Jan. 25.	Elevator, Lawton, Okla.	Jan. 8
Jan. 27.	Barge, Dallas, Tex. Adv. Jan. 1, 8.	Jan. 1
Feb. 8.	Sprinkler, Fergus Falls, Minn.	Jan. 8
Feb. 11.	Locomotives for Sale, Panama Adv. Jan. 1.	Jan. 1
Apr. 1.	Memorial, Fort McHenry, (P. O. Baltimore, Md.).	Nov. 20
———	Grading, Cincinnati, Ohio Adv. Jan. 8.	Jan. 8

SEARCHLIGHT SECTION

Bids open January 28, 1916.

NOTICE TO CONTRACTORS

ARMORY AND FITTINGS

YONKERS, N. Y.

Sealed proposals for Construction, Heating, Plumbing and Drainage and Electric Work of Armory for Company "G," 10th Infantry, N. G. N. Y., Yonkers, N. Y., will be received by Col. Franklin W. Ward, Secretary, State Board of Armory Commissioners, 158 State Street, Albany, N. Y., until 2:30 o'clock P. M. on Friday, January 28, 1916, when they will be publicly opened and read. Proposals shall be enclosed in an envelope furnished by the State Architect, sealed and addressed, and shall be accompanied by certified checks in the following amounts: Construction Work, Proposal No. 1, $3,700.00, and Proposal No. 2, $3,700.00 (if contractor submits bid for both Proposal No. 1 and Proposal No. 2, one check for $3,700.00 will be deemed sufficient); Heating Work, $350.00; Plumbing, $250.00, and Electric Work, $150.00. The contractors to whom the awards are made will be required to furnish surety company bond in the sum of fifty per cent (50%) of the amount of contract and in accordance with the terms of specifications Nos. 2342, 2365, 2366 and 2367. The right is reserved to reject any or all bids. Drawings and specifications may be consulted at the Department of Architecture, Capitol, Albany, N. Y., and at the New York Office of the Department of Architecture, Room 1224, Woolworth Building. Drawings and specifications and blank forms of proposal may be obtained at the Department of Architecture, Capitol, Albany, N. Y., upon the deposit of a certified check in the sum of $10, made payable to the State of New York for each set of plans and specifications, which check will be returned if plans and specifications are sent back in good condition to the State Architect, Lewis F. Pilcher, Capitol, Albany, N. Y.

December 29, 1915.

Bids open January 18, 1915.

GARBAGE DISPOSAL

NEW YORK CITY

Bids or estimates for the disposal of garbage will be received until 12 o'clock noon, on TUESDAY, JANUARY 18, 1916, at Room No. 1247, Municipal Building, Borough of Manhattan, the City of New York.

Form No. 1, for the disposal of garbage from the Boroughs of Manhattan, The Bronx and Brooklyn, for a period of five years, beginning January 2, 1917. The bidder to provide the site for the plant and to pay the city for the privilege of garbage disposal.

Form No. 2, for the disposal of garbage from the Boroughs of Manhattan, The Bronx and Brooklyn, ON A SITE PROVIDED BY THE CITY OF NEW YORK, for a period of five years, beginning January 2, 1917. The city will acquire the plant upon the termination of the contract at a stipulated price.

For further information concerning these contracts, see current issues of The City Record, published at 96 Reade St., N. Y. City, or apply to the Commissioner of Street Cleaning, Municipal Building, New York City.

POWER-HOUSES.—U. S. ENGINEER Office, Wheeling District, Wheeling, W. Va. —Sealed proposals will be received here until 11 a. m. (Eastern time), January 22, 1916, and then opened, for building fireproof power-houses at Dams Nos. 16 and 17, Ohio River. Information on application.

LOCK GATES. — U. S. ENGINEER Office, Wheeling District, Wheeling, W. Va.—Sealed proposals will be received here until 11 a. m. (Eastern time), January 14, 1916, and then opened, for furnishing and erecting steel lock gates for Dam No. 14, Ohio River. Information on application.

Official Proposal Announcements

Price, $2.40 an inch.—Copy can be received until Thursday 10 a. m. for issue mailed the next morning

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Bids open January 27, 1916.

NOTICE TO BRIDGE CONTRACTORS

Contract to furnish material and labor and to make repairs to the bridges across the Chattahoochee River, between Fulton and Cobb counties, at Mason and Turner's Ferry Road, about seven miles from Atlanta, and about fifteen miles from Marietta, will be let to the lowest bidder, at public outcry, at the bridge site, at 11 a. m. on January 27, 1916.

Bids will be received on two plans, as per plans and specifications therefor now on file in the offices of the Commissioners of Roads and Revenues of Fulton and Cobb counties, and approved by order of such commissioners. Said plans and specifications being the same as prepared by Wm. C. Spiker, Consulting Engineer, 1127 Candler Building, Atlanta, Ga., and dated December 18, 1915. Plan for "concrete approaches" as per the foregoing, consists of one approach at each end of present bridge; each approach is to be 75 ft. long, with a 20-ft clearway, and to consist of two concrete spans carried on concrete piers; at the end of the approach away from the bridge there will be a re-enforced concrete abutment and wing-walls. The plan for "steel approaches" consists of one approach at each end of the present steel bridge; each approach is to be 75 ft. long, with a 20-ft. clear roadway carried on four spans, supported on steel bents resting on concrete foundations. At the end of each approach away from the bridge there will be a re-enforced concrete abutment and wing-walls. Plans, specifications, form of contract and bond may be had from Consulting Engineer William C. Spiker, 1127 Candler Bldg., Atlanta, Ga., and are on file in the office of the Clerk of the Board of Commissioners of Roads and Revenues of Cobb County, at Marietta, Ga., and at the office of the Clerk of the Board of Commissioners Roads and Revenues of Fulton County, at the Courthouse in Atlanta, Ga. The estimated cost of such work being $4,500.

Payments for work and material will be made in cash on the 10th day of each month for the value of the completed work, upon the first Tuesday of each month, for ninety per cent of such completed work as estimated by the supervising engineer as provided in the specifications; the balance upon completion and acceptance of the work. Each county to be responsible only for its pro rata share as agreed between them.

The successful bidder to give bond in the sum of double the amount of the bid, as set forth in the specifications.

The two lowest bidders under each plan must immediately upon completion of the bidding file with the said authorities of Fulton and Cobb counties the formal bid and certified check in the amount of five hundred dollars ($500), payable to them, said checks to be certified by some bank in Atlanta or Marietta, Ga., as a guarantee that the bidder, if awarded the contract, will, within six days after said award, file his bond and execute the contract in accordance with the said bid. On his failure to so execute said bond and contract, said checks to be forfeited to said counties as damages. The right is reserved to reject any and all bids.

S. B. TURMAN,
Chairman Board of Commissioners of Roads and Revenues of Fulton County.

R. D. MOON,
Chairman Board of Commissioners of Roads and Revenues of Cobb County.

WILLIAM C. SPIKER,
Consulting Engineer,
Atlanta, Ga.

Bids open January 11, 1916.

NOTICE TO CONTRACTORS

IMPROVING CANALS

STATE OF NEW YORK,
OFFICE OF SUPERINTENDENT OF PUBLIC WORKS,
ALBANY, N. Y.

Sealed proposals will be received by the undersigned at his office in the Capitol at Albany, N. Y., until 12 o'clock, noon, of Tuesday, January 11, 1916, at which place and hour they will be publicly opened and read, for improving the New York State canals pursuant to the provisions of Chapter 147 of the Laws of 1903, and of the amendments thereto, as follows:

For the construction of two connecting highways, Muck Road to James Street and Whitesboro Street to Mill Street, in the city of Rome, Oneida County, N. Y., and completing the same on or before December 1, 1916.

Plans may be seen and detailed specifications, engineer's estimate of quantities, proposal blanks, form of contract and bonds required and other information for proposers may be had at the office of the Superintendent of Public Works at Albany, N. Y., at the office of the Assistant Superintendent of Public Works for the Middle Division at Syracuse, N. Y., at the office of the Assistant Superintendent of Public Works for the Western Division at Rochester, N. Y., and at the canal office, Spaulding's Exchange, Buffalo, N. Y.

Copies of detailed plans or drawings may be obtained from the State Engineer and Surveyor at Albany, N. Y., upon payment to him of the cost of producing them.

Monthly estimates will be paid of ninety per centum (90 per cent) of the work done at the contract price. Every proposal for said work must be accompanied by a money deposit in the form of a draft or certified check upon some good banking institution in the city of Albany or New York, issued by a national or state bank in good credit within the State and payable at sight to the Superintendent of Public Works for five per centum (5 per cent) of the amount of the proposal.

The person whose proposal shall be accepted will be required to execute a contract and furnish bonds within ten days from the date of notice of award delivered to him or them in person or mailed to the address given in the proposal.

Upon execution of the contract and approval of bonds, the certified check or draft will be returned to the proposer unless the same shall have been presented for collection prior to such time, in which case the amount of the deposit will be refunded by the Superintendent of Public Works.

The deposits of bidders other than the ones to whom the award of contract shall be made will be returned immediately after the award has been made.

The amount of bond required for faithful performance will be ten per centum (10 per cent) of the amount of the estimated cost of the work according to the contract price, and an additional bond, known as the labor bond, in the sum of ten per centum (10 per cent) of the amount of the estimated cost of the work according to the contract price will be required as security that the contractor will pay in full at least once in each month all laborers employed by him upon the work specified to be done in the contract.

In the event that more than one surety company is offered as surety on said bonds, co-insurance only will be accepted.

Award, if made, will be made to the person or persons whose proposal shall be lowest in cost to the State for doing the work, and which shall comply with all provisions required to render it formal. Before any award shall be made the lowest bidder will be required to satisfy the Superintendent of Public Works of his ability to provide suitable equipment and materials for the proper performance of the work.

Each proposal must be addressed to the Superintendent of Public Works at Albany, N. Y., and must be endorsed on the envelope: "Construction of two connecting highways at Rome, N. Y." The right is reserved to reject any or all bids.

W. W. WOTHERSPOON,
Superintendent of Public Works.

December 13, 1915.

Bids open January 20, 1916.

NOTICE TO CONTRACTORS

STREET PAVING

SAN ANTONIO, TEX.

Sealed proposals will be received by the undersigned until 4 o'clock p. m., on January 20, 1916, for constructing paving on twenty-six streets in this city, approximating 185,000 sq. yd. in measurement, together with concrete curbing, etc., where required.

Proposals to be on wearing surfaces as follows, to be selected by the City Commissioners after the receipt of bids for said improvements, to wit:

Paving Brick, Vertical, fibre or Standard.
Bitulithic.
Rock Asphalt.
Asphaltic Concrete.
Bituminous Macadam.
Granitoid.
Concrete, one or two course, or any other standard paving laid on old or new foundation; all in accordance with forms, profiles, and specifications prepared and on file in the office of the City Engineer.

Each bidder shall file with his proposal a guaranty deposit in the form of a certified check or cashier's check on a San Antonio Bank, made payable unconditionally to the City Treasurer of the City of San Antonio, in the sum of the nearest even hundreds of dollars, approximating two and one-half per cent of the estimated maximum contract price of the work included in such bid.

Said improvements, contracts, payments, etc., in connection therewith shall be made under and governed by the Procedure Ordinance of the City of San Antonio.

The City of San Antonio reserves the right to reject any and all bids.

FRED FRIES,
City Clerk.

December 31, 1915.

Bids open January 15, 1916.

STEEL HIGHWAY BRIDGES

AVERY COUNTY, NEWLAND, N. C.

Bids will be received until noon, January 15, 1916, on steel work, erection, and masonry six (6) or more steel truss bridges from 15,000 to 30,000 lbs. each, designed for 12-ton roller. Plans will be on file at Newland, N. C., at this office, after January 10, 1916. Designs to be submitted with bids. Proposals on alternate plans will be received. The right to reject any or all bids in whole or in part is expressly reserved. Bidders may offer for all the work or any part of it.

Information may be had at office of
GEO. C. LOVE,
County Bridge Engineer,
Pineola, N. C

Bids open January 18, 1916.

NOTICE TO CONTRACTORS

ROADS AND BRIDGES

JAMESTOWN, TENN.

On January 18, 1916, Fentress County, Tenn., will receive bids for grading and macadamizing 34 miles of road and constructing steel bridges.

For particulars address W. I. Smith, Engineer, Jamestown, Tenn.

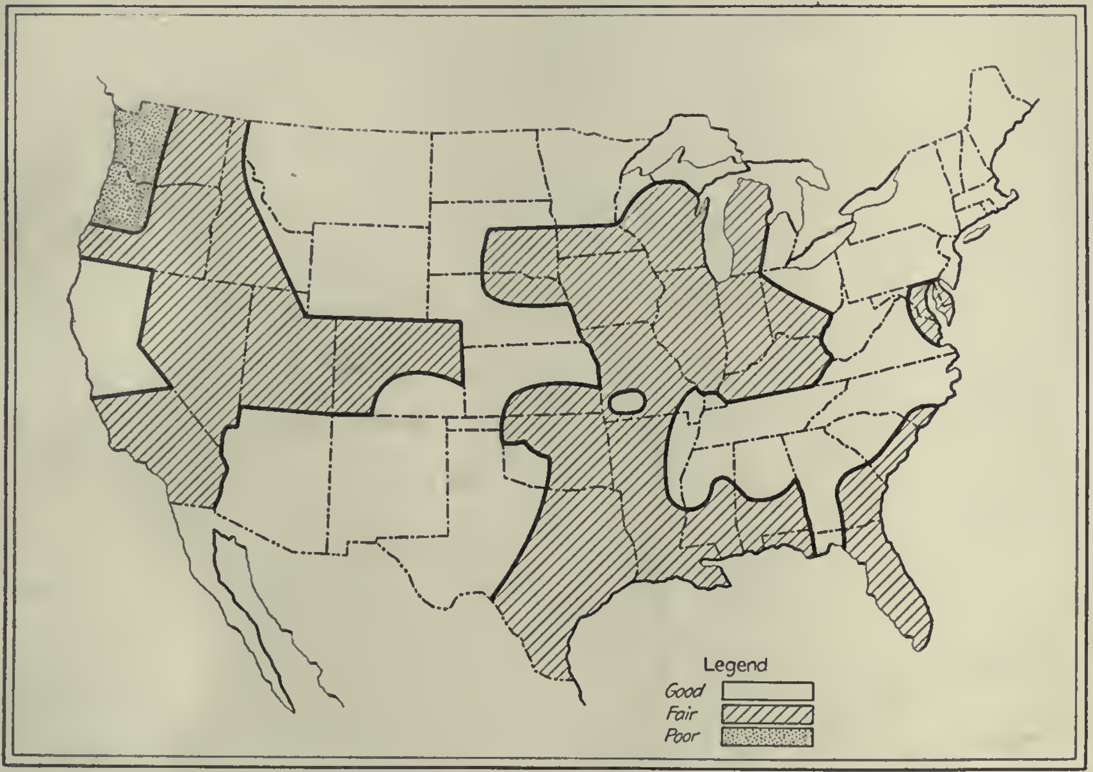
FENTRESS COUNTY HIGHWAY COMMISSION.

CONTRACTING NEWS

Of Special Interest to Engineers, Contractors, Builders and Manufacturers of Engineering and Building Supplies

THAT the general conditions in this country are far more favorable for good business during the first four months of 1916 than at this time last year is strikingly shown by the accompanying map, reproduced from the special bulletin on business and crop conditions issued Dec. 31 by the Chamber of Commerce of the United States. The same map issued last year contained but one white spot, a small area in the southwest corner of Minnesota.

The crop summary for 1915 issued Dec. 30 by the Secretary of Agriculture gives the total value of fourteen principal crops on which records have been kept since 1909 as exceeding $5,377,000,000, which is $411,000,000, or more than 8 per cent, greater than the value of the same crops last year and $664,000,000, or more than 13 per cent, greater than the average value for the six preceding years. Tobacco is the only crop which is worth less than last year, and tobacco, cotton and flaxseed, the last the smallest of the fourteen crops, are the only ones whose values do not exceed that of both last year's crop and the average by a substantial amount. This showing does not reflect on the buying power of the South, as might be supposed. A large share of the big gain in corn, wheat and other crops is due to increased planting in the Southern states, and should make up the $8,000,000 shrinkage in the value of the tobacco crop and the $141,000,000 decrease, due to a smaller crop, in the total value of cotton raised.



GENERAL CONDITIONS AFFECTING BUSINESS SHOW REMARKABLE IMPROVEMENT OVER LAST YEAR

Net railway revenues continued to increase during the fall, reaching $542 per mile of line for November. It is predicted from the car-loading records of the roads centering in Chicago that the past month will show the largest December earnings in the history of these roads. December loadings exceeded all records for that month and were from 10 to 20 per cent larger than in 1914.

Buildings

A factory to cost $150,000 has been contracted for at Hartford, Conn. The lowest bid received at the same place for erecting a school building was $84,987. The construction of a $281,000 high school has been contracted for at Tulsa, Okla. A $300,000 addition to an arms plant is to be built at New Haven, Conn. Plans have been filed in New York City for a $325,000 apartment house. Plans are being prepared for a $150,000 club house at Yonkers, N. Y. Wilmington, Del., has sold $150,000 bonds for erecting a high school. The construction of a $200,000 temple is being considered at Washington. It is reported that a $1,000,000 power house will be built at Dayton, Ohio. Toledo, Ohio, has sold nearly half its $1,000,000 school bond issue. Eleven new police stations, including a $1,000,000 central station, are planned for construction this year by the chief of police of Chicago. A packing plant to cost $150,000 is to be built at Green Bay, Wis. The construction of a $250,000 store and of a $500,000 hotel are being considered at St. Paul. An architect has been selected for a $250,000 college building to be erected at Los Angeles.

Bridges and Roads

Bids will be received Feb. 3 for constructing two large bridges at Miami, Fla., and Jan. 24 at Olympia, Wash., for constructing two good-sized concrete arch bridges. Plans have been completed for the Neponset bridge at Boston, which will be 732 ft. long with a 52-ft. draw span. Plans are being prepared for a $75,000 bridge at West Carrollton, Ohio. Plans have been completed for an $80,000 bridge at Iowa City, Iowa. It is reported that a $250,000 concrete structure will replace the Division Street bridge recently wrecked at Spokane. The construction of a highway bridge to cost $90,000 is proposed at Eureka, Cal.

Bids have been opened at Herkimer, N. Y., for six road contracts totaling $180,000. Missouri Valley, Iowa, desires bids Feb. 1 for 40,000 sq. yd. of paving. Paving work to cost $628,000 has been recommended at Newark, N. J. Morristown, Tenn., has sold $160,000 road bonds. A contract is to be let next month at Akron, Ohio, for road work to cost $180,000. Paving work costing $117,000 is contemplated at Morrison, Ill. Elgin, Ill., will spend more than $200,000 this year for paving. New paving and repairs contemplated at Milwaukee for 1916 will cost $468,000. Duluth, Minn., will spend $1,000,000 for municipal improvements, including a large sum for paving work. About $150,000 is to be spent on street improvements at Eveleth, Minn. Storm Lake, Iowa, is to let a contract in March for 60,000 sq. yd. of paving. Seventy blocks of permanent pavement are to be laid this year at Topeka, Kan. Santa Barbara, Cal., has sold $200,000 road bonds. An ordinance authorizing paving work to cost $120,000 has passed the city council at Seattle.

Waterworks and Sewers

Los Angeles has awarded two contracts for water pipe totaling $268,000. A 300,000-gal. filter plant for the city of Hartford is to be built at Collinsville, Conn. A waterworks system to cost $100,000 is being considered at Riverside, N. J. South Bend, Ind., has sold $250,000 waterworks bonds. Water and sewer bonds amounting to $750,000 have been sold at Shreveport, La. Plans have been completed for a new waterworks system at Oklahoma City, Okla. The construction of a $200,000 reservoir is proposed at Fresno, Cal.

A sewer system to cost $47,900 has been contracted for at Kenova, W. Va. Mason City, Iowa, has contracted for the construction of a sewage-disposal plant to cost $135,000. A sewer contract awarded at Seattle amounts to $48,000. Bids are desired at Milwaukee for constructing two large sewer sections in tunnel and for an additional open-cut section of sewer work. A franchise has been granted for constructing a $350,000 sewer system at Key West, Fla. The sewer work at Montreal, the first sections of which are under construction, will cost $2,000,000. A sewage-disposal plant is to be built at Wilkes-Barre, Pa.

Miscellaneous

Bids have been opened in New York City on three sections of elevated railroad to cost $106,000, $366,000 and $831,000 respectively. The dredging and dock work at Miami, Fla., on which bids were opened recently, has been awarded at a total of $400,500. The New York state barge canal contract noted recently has been awarded at $321,679, and bids are desired at Albany for three more barge canal sections. Harbor improvements costing upward of $2,000,000 have been recommended at Philadelphia, where municipal improvement bonds amounting to $5,360,000 have been sold. The mayor of St. Louis has signed the ordinance authorizing the construction of the $285,000 municipal dock at North Market Street. Dike and revetment work at Gasconade, Mo., proposed for this year will cost $325,000. Engineers have been engaged to design a $1,250,000 irrigation system at Lindsay, Cal. The Great Western Power Company of San Francisco has been authorized to issue bonds, $1,750,000 of which will be used for the construction of transmission lines. California harbor improvements ordered by the War Department at Washington will cost $1,400,000.

WATERWORKS

PROPOSED WORK.

Westfield, Mass.—See "Sewerage and Sewage Disposal."

Providence, R. I.—Construction of a dam 285 ft. on Pawtuxet River under consideration by the city. James A. McKenna, Asst. City Engineer.

Niagara Falls, N. Y.—See "Paving and Roads."

Rochester, N. Y.—Reported that the completion of the third conduit from Hemlock Lake to the local reservoirs is under consideration for the new year. About 17 miles of conduit will have to be laid.

Watertown, N. Y.—Report has been submitted to city by Hazen, Whipple & Fuller, 30 East Forty-second Street, New York, on a water works system estimated to cost $900,000. Mayor has recommended to the Council that action be taken during the present year.

Millville, N. J.—City Commission passed an ordinance providing for the acquisition by purchase or condemnation of the plants of the Millville Water Company and the People's Water Company by the issuing of $256,000 bonds for the purpose.

Riverside, N. J.—City Council reported to be considering water works at a cost of $100,000.

Allentown, Pa.—In the 1916 budget the City Council has included $13,500 for supply and installation of a 12-in. water main, replacing one of smaller size. C. D. Weirbach, City Engineer.

Media, Pa.—An appropriation has been made for installation of an additional engine and generator for the municipal electric light and water works plant. P. E. Ahern, Manager.

Pennsylvania—Following permits have been issued by the State Department of Health, Harrisburg, water works, improvements:

Black Lick Township, Cambria County (Nanty-Glo W. Co.), decree additional source of supply.

Easton, Lehigh Water Co. pump station, high service reservoir and distributing system.

Harrison Township, Allegheny County (Natrona W. C.,) disinfection apparatus.

Mahoning Township, Montour County (State Hospital for Insane), improvement to water works.

Williamsburg Borough, additional source of supply, drilled well.

Windsor Borough, municipal water works system.

Coatesville Borough, sand washer for filtration plant.

Butler Borough (Butler W. Co.), disinfection apparatus .

Danville Borough, additional filter unit.

New Castle (City of New Castle W. Co.), disinfection apparatus.

Hawley Borough (Hawley W. Co.), additional reservoir.

Greene Township, Franklin County (Fayetteville W. Co.), extensions refused and some method of purification required.

Jenner Township, Somerset County (Consolidation Coal Co.), water works extensions.

Waterford Borough, Waterford Water Co. (Chas. Himrod, Prop.), additional storage basin.

Mahanoy Township, Schuylkill County (Anthracite W. Co.), temporary additional source of supply.

Coatesville Borough, temporary intake and pumping station.

Dunbar Township, Fayette County, extensions to distributing system.

Kittanning Borough (Armstrong W. Co.), preliminary plans for filter improvements.

Carlisle Borough (Carlisle Gas & Water Co.), requiring improvements of filter plant.

Hatboro Borough (Hatboro Water Co.), requiring improvements at drilled wells.

Mercer Borough (Mercer W. Co.), requiring purification.

East Pennsboro Township, Cumberland County (Dauphin Cons. W. S. Co.), approval of plans of an additional filter equipment.

East Pennsboro Township, Cumberland County (D. S. Seitz & F. C. Sites), installation of water works, drilled well supply.

Gordon Borough (Citizens Water Co. of Gordon), additional source of supply and reservoir.

Pine Township, Indiana County (Pine Township W. Co.), water works and additional sources of supply from four drilled wells.

Ringtown, Pa.—A municipal gravity water works is contemplated, including a small feed reservoir, 16 to 20 fire hydrants, valves, meters and approximately 2 miles of 6-in. pipe. H. F. Hartman, Secretary.

Fairmont, W. Va.—Contract will be let in May or June for installing about 12 fire hydrants, 1000 meters and 2000 ft. 4-in. and 2000 ft. 6-in. c. i. pipe. S. B. Miller, Engineer, Fairmont; Ira L. Smith, Water Commissioner.

Lake Charles, La.—Construction of municipal water works is reported under consideration by City Council.

Shreveport, La.—Municipal ownership water and sewer bonds amounting to $750,000 have been sold. Address City Clerk.

Copperhill, Tenn.—Election to be held Feb. 5 to vote $20,000 bonds for water works and sewerage.

Portsmouth, Ohio.—See "Hydraulic Construction and River Improvements."

Zanesville, Ohio.—Engineers engaged to prepare plans and specifications for the repair of the Harvey Street and the Blandy Hill reservoirs.

South Bend, Ind.—Reported $250,000 water works bonds have been sold. Address City Clerk.

Albion, Mich.—Citizens voted $10,000 bonds for constructing a steam-operated water pumping plant. W. E. Baumgardner, Engineer; J. Clifford Smith, City Clerk.

Jackson, Mich.—Improvements contemplated in the new year (cost given being approximate), include, reservoir $15,000; water mains, $14,000; street paving, $84,000; sidewalks and curbing, $25,000.

Clinton, Ill.—Election is soon to be held to vote $8,000 bonds for reconstructing the reservoir and $4,500 for installation of high pressure fire pump.

Sheboygan Wis.—Improvements contemplated in the new year include extension of water works plant, including stand pipe, pump, 12,000,000 gal.; boiler, 300 hp., mains, etc. W. F. Kochn, Supt. Water Department.

Mankato, Minn.—A 1,500,000-gal. reservoir costing $15,000 is to be constructed this year. H. F. Blomquist, City Engineer.

Kiowa, Kan.—Kansas Public Utilities Commission has approved the plans for the water works to cost $17,600. City will issue $10,000 bonds toward said plant.

Plains, Kan.—Election soon to be held to vote $20,000 bonds for constructing water works and electric light plant. Address City Clerk.

Bellwood, Neb.—Election will probably be held in April on issuing bonds for constructing water works. John P. Delaney, Village Clerk.

Broadview, Mont.—Reported County Commissioners at Billings have engaged R. M. Murray of Billings to prepare plans and specifications and supervise the installation of water system, to cost $30,000.

Fort Worth, Tex. — Citizens voted against $500,000 bond issue for constructing a reservoir for the water works.

Tyler, Tex. — Citizens voted $250,000 bonds for water works. Address City Clerk.

Commerce, Okla.—Citizens, Dec. 30, voted $42,000 bonds for constructing water works according to plans by Benham Engineering Company, Oklahoma City. Bonds sold.

Seattle, Wash.—About 3380 lin. ft. 8-in. and 780 lin. ft. 12-in. c. i. pipe will be laid in Michigan Street. Cost, $10,000. Address Board Public Works.

Estimates approved for water mains in Forty-third Avenue, Northeast, and other streets at a cost of $26,040. Address Board Public Works.

A. H. Dimock, City Engineer, in report to Board Public Works estimates cost of constructing water mains in Forty-third Avenue, Northeast, at a cost of $26,040.

Council has passed ordinance authorizing water mains in numerous streets, including Forty-third Avenue Northeast, Forty-fourth Avenue Northeast, Forty-fifth Avenue and Forty-sixth Avenue.

Fresno, Cal.—White & Friant Lumber Company, Grand Rapids, Mich., reported to have asked the State Commission for permission to divert 100 miners inches of water from Whiskey Creek and construct a $200,000 reservoir to store 500 acre feet in high Sierras near Mount Peckinpah.

Martinez, Cal.—The Martinez Development Board is considering municipal water works, and will probably purchase the present plant.

Santa Barbara, Cal.—Construction of a reserve reservoir in Mission Canyon is contemplated by city.

Sierra Madre, Cal.—City Trustees contemplate laying new water mains at a cost of $60,000.

Cornwall, Ont.—Citizens voted $25,000 to improve and extend water works.

BIDS DESIRED.

New York, N. Y.—Until Feb. 1, by Board of Water Supply, Municipal Building, New York (Charles Strauss, president), for furnishing and placing copper lining in a portion of the city tunnel of Catskill aqueduct, between Shafts 18 and 19, New York City, Contract 170, advertised in Engineering Record.

Washington, D. C.—By Bureau Supplies and Accounts, Navy Department, Washington, D. C.: Brooklyn, N. Y., Sch. 9206—miscellaneous wrought pipe, Sch. 9217—miscellaneous safety relief valves, etc.; Washington, D. C., Sch. 9203—237,000 lb. lap welded steel tubes; Mare Island, Cal., Sch. 9211—70 low-pressure gate valves, and 48 low-pressure globe and check valves.

Cullman, Ala.—Reported desired until April 1 for laying 2 miles 6-in. water mains. Probable cost $12,000. A. G. Coe, City Clk.

Berwyn, Ill.—Until Jan. 18, by City Council, for 100 lin. ft. 16-in. c. i. water supply pipe, three 16-in. gate valves, one 10-in. Trident crest meter, one 6 x 20-ft. special casting, in Austin Avenue and Twelfth Street. B. Strutzenberg, City Engr.

Chicago, Ill.—Until Jan. 21, by W. R. Moorehouse, Commissioner of Public Works for three boiler feed pumps for Mayfair Pumping Station.

Kirkland, Ill.—Until Jan. 17, by Village Trustees for a deep well from 300 to 1000 ft. deep, starting with 10-in. outside diam. w.-i. casing. George Heyward, Village Clerk.

Sullivan, Ill.—Until Feb. 7, by F. C. Newbould, City Clerk, for furnishing material and improving water works and electric light plant. Hiram Phillips or Cliford Phillips, Consulting Engrs., 716 International Life Bldg., St. Louis, Mo.

Oshkosh, Wis.—Until Jan. 31 by Board of Public Works separate bids as follows: For filter and appliances; reservoir; elevated tank; all three proposals advertised in Engineering Record.

St. Paul, Minn.—Reported desired until Jan. 20, by Aug. Hohenstein, Purchasing Agent, for 1532 tons c. i. pipe with privilege of 943 tons additional, special castings, valves, hydrants, etc., for Water Bureau for year 1916.

Ridgefield, Wash.—Until Jan. 18 by Clerk of Council, for constructing municipal water works, to consist of 17,050 ft. 4 to 8 in. wood stave or lap welded steel pipe, 200,000 gal. reinforced concrete lined reservoir, pumping plant, etc. Probable cost $10,000. Gilbert & Hall, Consulting Engrs., Portland, Ore.

Los Angeles, Cal.—Until Jan. 17 by Board of Supervisors (A. M. McPherson, Clk.) for furnishing gate valves.

Panama.—Until Jan. 29, by Maj. F. C. Boggs, Corps Engrs., U. S. A., Gen. Purchasing officer, Panama Canal, Washington, D. C., Cir. No. 1004, pipe fittings, flush pipes, valves, cocks, steam gages, water gages, etc.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**East Liverpool, Ohio.** — Contract awarded Flanner Water Tube Boiler Company, Akron, for water tube boilers and equipment at $15,374. Chester & Fleming, Engineers, Pittsburgh, Pa.

★**East Youngstown, Ohio.**—Contracts in connection with the water works have been awarded as follows: Steel storage tank, Pittsburgh-Des Moines Steel Company, Pittsburgh, Pa., $5,685; valves and hydrants, Ludlow Valve Mfg. Company, $3,640. Chester & Fleming, Engineers, Pittsburgh, Pa.

★Additional contracts in connection with the water works awarded as follows: Meters, Neptune Meter Company, Cincinnati, Ohio, $1,134; hauling and laying pipes and mains, Morrison & Manley, Youngstown, $33,000.

Albion, Mich.—All bids opened Dec. 15 for constructing pumping station and boiler house for water works rejected. City will do the work. Lowest bid, Fred Schumacher, Albion, $7,688. J. Clifford Smith, City Clerk.

★**Minneapolis, Minn.**—Contracts recommended for award by the City Purchasing Agent for 178 hydrants, to Columbia Iron Works, Chattanooga, Tenn., at $32.80, and valves of various sizes to same company at $4,462.

★**Baker, Ore.**—Contract for constructing water works awarded Utah Concrete Pipe Company, Salt Lake City, Utah, at about $46,328.

SEWERAGE AND SEWAGE DISPOSAL

PROPOSED WORK.

New Haven, Conn.—Construction of a sewage disposal plant reported under consideration. Address City Clerk.

Binghamton, N. Y.—Surveys completed for intercepting sewer system and plans for sewage disposal plant of Imhoff tanks being prepared by George L. Robinson, Engineer, New York, N. Y. E. W. Earl Weller City Engineer.

Carthage, N. Y.—Plans approved by State Board of Health for an 8-in. sanitary sewer in West Street to be constructed by the Village Board.

Niagara Falls, N. Y.—See "Paving and Roads."

Pennington, N. J.—Mayor Walter Frisbie reported in favor of constructing a sewer system.

Ridgefield Park, N. J.—Reported improvements to be made in the sewage disposal plant. Address Board of Commissioners.

Bellewood, Pa.—Plans being prepared for a sewage disposal plant to cost $12,000 by Harvey Linton, 1717 Thirteenth Street, Altoona.

Contract soon to be let for constructing a sewerage system consisting of 10 miles of pipe and costing $30,000. Address City Clerk.

Pennsylvania.—Following permits have been issued by State Department of Health, Harrisburg, for sewer work:

Fell Township, Lackawanna County (Carbondale Machine Co.), sanitary sewer system and sewage treatment plant.

Hughestown Borough, lateral sewer extensions.

Philadelphia, lateral sewer extensions.

Ferndale Borough, lateral sewer extensions.

Lykens Borough, lateral sewer extensions.

Miners Mills Borough, lateral sewer extensions.

West Donegal Township, Lancaster County (Penna. Masonic Homes), sewage treatment plant.

Hanover Township, Lehigh County (Homeo. State Hospital for the Insane), lateral sewer extensions.

West Chester Borough, pumping station and district sewers.

Barnesboro Borough, lateral sewer extensions.

Ben Avon Borough, extension of time i which to discharge untreated sewag into the Ohio River.

Birdsboro (Birdsboro Steel Foundry & Machine Company), preliminary plans fo sewage treatment works.

Old Forge Borough, lateral sewer extensions.

Philadelphia, lateral sewer extensions.

Throop, lateral sewer extensions.

Kenova, W. Va.—Sewer bonds amounting to $55,000 have been sold. See "Price and Lettings."

Columbus, Ga.—Mayor in favor of constructing a sanitary sewer system.

Shreveport, La.—See "Water Works."

Copperhill, Tenn.—See "Water Works.

Ada, Ohio.—About 4208 ft. of 4-ft. bric sewer is to be constructed at a cost o $40,000. Thomas J. Smull, City Engineer

Portsmouth, Ohio.—See "Hydraulic Construction and River Improvement."

Evansville, Ind.—Contract for constructing the Blackenberg sewers will be let i the early spring, requiring about 670 f of 48-in., 1250 lin. ft. 54-in., and 1300 lin ft. 60-in. brick, concrete or tile circula sewer. F. A. Reitz, City Engineer' Office.

Milwaukee, Wis.—Contract will be le about Feb. 1 by Sewerage Commission (T Chalkley Hatton, Ch. Engineer) for sewe work, including 4000 ft. c. i. pipe, 4000 ft 54-in. concrete sewer, and 1500 ft. 144-in concrete tunnel; cost $450,000.

Rockwell City, Ia.—Improvements to th sewer system costing $35,000 are contemplated. Address City Clerk.

Manhattan, Kan.—Plans and estimate being prepared for 6800 ft. of 10-in. sewer contract will probably be let in March Fred Walters, City Engineer.

Fort Worth, Tex.—Contract soon to be let for constructing the Seventh Distric sewer, plans for which have been approve by City Council. Address City Clerk.

Tonkawa, Okla.—Benham Engineering Company, Oklahoma City, engaged to prepare plans for additional sanitary lateral sewers.

Chino, Cal.—Contract will be let by the city about March for constructing a sewer system to cost $44,000 and disposal plant to cost $6,000. Address City Clerk.

Los Angeles Cal.—Contract will be let in February for constructing the Florence Avenue sewer, approximately 16,000 lin. ft., 30 to 42 in. brick concrete, and 14,000 lin. ft. 16 and 20-in. vitr. pipe, and 2500 lin. ft. 10-in. c. i. force main, etc. Homer Hamlin, City Engineer.

Ottawa, Ont.—Citizens voted Jan. 3 to construct an intercepting sewer. Work will be done by day labor. F. C. Askwith, City Engineer; N. H. H. Lett, City Clerk.

BIDS DESIRED.

Worcester, Mass.—Until Jan. 18, by Matthew Gault, Supt. Sewers, for approximately 50,000 ft. vitr. pipe, together with fittings; 160,000 lb. castings, 2500 tons lime and 500,000 bricks, for Sewer Department for year ending April 30, 1917.

Cuyahoga Falls, Ohio.—Until Feb. 7, by C. D. Barstow, Village Clerk, for constructing about four miles of sanitary sewers and laterals thereto, for house connections in East and West Broad and Stow Streets and adjoining streets.

Gary, Ind.—Until Jan. 17, by H. C. Francis, City Clerk, for constructing local sewer No. 50, requiring 1125 ft. 18-in. double-strength tile sewer, 1944 lin. ft. 10 to 15-in. standard tile sewer, 17 manholes, 4 catchbasins and 4 gutter inlets. W. J. Fulton, City Engineer.

Saginaw, Mich.—Reported desired until Jan. 18, by Robt. F. Johnson, Comr. Water, Light & Sewer, for furnishing c.-i. water pipe and special castings for 1916.

Milwaukee, Wis.—Until Feb. 3 by Sewerage Commission for Contract 18 of the intercepting sewer system; also Contract 19 and 19-A of said system; both proposals advertised in Engineering Record.

Houston, Tex.—Until Jan. 17 by City Secretary, for constructing storm sewers in Gregg and Gillaspie Streets; laterals to First and Sixth storm sewers; extension of 42 in. sanitary sewer in Scott Street, storm sewer through College Park Cemetery.

Cushing, Okla.—Until Jan. 27, by L. P. Wharton, City Clerk, for constructing deep cut sanitary intercepting sewer, for which citizens voted $30,000 bonds. Benham Engineering Company, Oklahoma City, Engineers.

El Centro, Cal.—Until Jan. 19, by Lavinia Northcott, City Clerk, for constructing a sewage disposal system, consisting of four concrete tanks; cost about $25,000. Engineers, Olmsted & Gillenen, 1112 Hollingsworth Building, Los Angeles.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Boston, Mass.—Following are three lowest bids opened Jan. 5 by Public Works Department for constructing the Dorchester Brook Sewer: West Roxbury Trap

Rock Company, Grove Street, West Roxbury, $34,378; James J. Conway, 19 Beethoven Street, $35,885, and James J. Coughlin & Company, 43 Tremont Street, Boston, $36,413.

★**Westfield, Mass.**—Contract awarded John W. Ramsey, Boston, for furnishing sewer pipe, about 10,000 ft. 6 to 24 in. (bids opened Jan. 6), at 79½% off list price. John L. Hyde, Town Engineer.

★**Hartford, Conn.**—Contract awarded O'Neil Bros., Hartford, for constructing the sewer in Zion Street from Park to Broad Street at $7,351.

★**Syracuse, N. Y.**—Contract for extending Harbor Brook intercepting sewer awarded by Syracuse Intercepting Sewer Board to John Young, Syracuse, at $8,174.

★**Key West, Fla.**—Contract awarded John J. Quinn & Company, Miami and Key West, for 30 miles of 8 to 24-in. vitr. salt glazed sewer pipe, c. i. outfalls; cost $350,000. John R. Scott, Designing Engineer, P. O. Box 25, Key West.

★**Middletown, Ohio.**—Contract for constructing sewers in Sycamore, Baltimore and other streets (bids opened Jan. 4) awarded by City Commission W. J. Roberson, Middletown, at $12,090. Next three lowest bidders: Arpp-Simpson Company, Middletown, $12,130; C. H. Martin, Middletown, $13,677, and Frank Davis, Hamilton, $14,136. John Kunz, Secretary City Commission.

★**Mason City, Iowa.**—Contract for constructing the sewage disposal plant, Imhoff type, awarded William Henkel and H. L. Brown, Mason City, at $134,850. Frederick Bass, Engineer Minneapolis, Minn.

★**Seattle, Wash.**—Contract for constructing sewers in West and North Fiftieth Streets awarded C. W. Colt & Company, 7353 Fauntleroy Avenue, at $48,583.

BRIDGES

PROPOSED WORK.

Boston, Mass.—Mayor Curley received plans from Metropolitan Park Commission on Neponset Bridge to connect Boston with Quincy. The bridge to be a connecting link in proposed South Shore Boulevard system and to connect Wollaston Boulevard, Boston, with Old Colony Boulevard, on Quincy side of Neponset. Plans provide for a bridge 732 ft. long with a roadway 40 ft. wide, with a 52 ft. draw span.

Westfield, Mass.—City Engineer John L. Hyde in his annual report recommends the replacing of the wooden bridge at Loomis Street, leading to Granville, with a concrete structure.

Franklin, Pa.—A. B. Curry, Borough Engineer, has been directed to prepare plans for a steel and concrete bridge to be constructed to join Franklin and Johnstown.

Philadelphia, Pa.—See "Water Works."

Atlanta, Ga.—Construction of a viaduct over Southern Ry. tracks to connect Piedmont Park and North Boulevard is contemplated by city, county and railway company; cost $28,000.

Morganfield, Ky.—Contract soon to be let for constructing highway bridges in connection with the Dennis O'Nan Public Ditch. Norman R. Orcutt, Chief Engineer, Morganfield.

West Carrollton, Ohio. — Victor C. Smith, County Engineer at Dayton, preparing plans for a five-span bridge to be constructed over river. Superstructure to be of steel and sub-structure to be of concrete, river span 200 ft. long and other four to be each 100 ft. long; cost $75,000.

Sterling, Ill.—Plans being prepared by V. N. Taggett, County Supt. Highways, for a 30-ft. concrete bridge at Forth and an 8 x 10 cement box culvert at Frederick.

Iowa City, Iowa.—B. J. Lambert, Professor Structural Engineering of State University of Iowa, Iowa City, completed plans for a three-span reinforced-concrete arch bridge over Iowa River at Iowa Avenue, roadway 40 ft., with two 6-ft. walks; total length 360 ft; estimated cost $75,000 to $80,000. Address City Clerk.

Houston, Tex.—See "Water Works."

Spokane, Wash.—City Council reported to be in favor of constructing concrete bridge to replace steel structure over Spokane River at Division Street, recently destroyed, estimated cost about $250,000. Morton McCartney, City Engr.

Portland, Ore.—Following bridge improvements contemplated in 1916: Contract to be let in January for constructing the Union Avenue viaduct over Union Pacific tracks at a cost of $40,000; elimination of grade crossings, including construction of seven viaducts, cost $460,000, contract to be let in June; Miles Street viaduct, grade elimination, cost $7,500, contract to be let in July. Philip H. Dater, City Engineer.

Holgate Street viaduct, costing $60,000, is to be constructed by the Union Pacific Ry. Company (R. L. Huntley, Ch. Engr., Omaha, Nebr), cost $60,000.

Eureka, Cal.—Construction of a highway bridge over Eel River near Spy Rock is contemplated by State and county, the State to furnish plans and specifications and pay $40,000 of cost; total estimated cost $90,000.

Santa Barbara, Cal.—Abuot $350,000 is to be spent in Santa Barbara County this year. Walter C. Howe, Division Engineer California Highway Commission, San Luis Obispo. Address County Engineer, Santa Barbara.

Burley, Idaho.—John W. See of Burley selected to prepare plans for a steel bridge to be constructed over Name River between Howell's and Montgomery Ferries southeast of Acequia; cost $10,000.

BIDS DESIRED.

Boston, Mass.—Until Jan. 24, by Edw. F. Murphy, Comr. Pub. Wks., for constructing foot bridge at Gove Street, East Boston.

Miami, Fla.—Until Feb. 3, by W. B. Moore, City Clk., for constructing two bridges over Miami River, one at Twelfth Street and the other at Avenue D, each bridge to consist of bascule span of structural steel with approaches on either side of reinforced concrete arches or girders. Harrington, Howard & Ash, Consulting Engrs., 1210 Baltimore Avenue, Kansas City, Mo.

Bellaire, Ohio.—Until Jan. 24, by Bert W. Hopkins, Co. Aud., St. Clairsville, for furnishing material and reflooring the roadway and sidewalks and repairing the Union Street bridge, Bellaire.

Lancaster, Ohio.—Reported desired until Jan. 26, by County Commissioners, for constructing five bridges.

New Philadelphia, Ohio.—Reported desired until Jan. 24, by County Commissioners, for repairing substructure and for new steel superstructure of bridge across Laurel Creek, Rush Township.

Warsaw, Ohio.—Reported desired until Jan. 21, by County Auditor, Coshocton, for repairing bridge and one new steel span. Probable cost $4,500. A. H. C. Shaw, Co. Engr., Coshocton.

Austin, Tex.—Reported desired until Jan. 18, by P. W. Powell, Supt. of Streets, for reinforced concrete bridge over Shoal Creek, at State Street. W. C. Wellborn, City Engr.

Aberdeen, Wash.—Repōrted desired until Jan. 26, by City Clerk, for superstructure for West Bridge. L. D. Kelsey, City Engr.

Olympia, Wash.—Reported desired until Jan. 24, by Wm. R. Roy, State Highway Comr., for constructing reinforced concrete arch bridges on Sunset Highway between Easton and Cle Elum, in Kittitas County, as follows: Two 100-ft. spans over Yakima River, two 65-ft. spans over Cle Elum River, one 50-ft. span over Big Creek, one 30-ft. span over Little Creek.

Alaska.—Until Feb. 15, by Board of Road Commissioners for Alaska, at the office of the U. S. Engineer, Seattle, Wash., for furnishing material for a 300-ft. span steel highway bridge, advertised in Engineering Record.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Lawrence, Kan.** — Contract for constructing a 118-ft. span steel truss bridge with concrete floor over Wakarusa River, 6 miles southeast of Lawrence, awarded by County Commissioners to A. McClouth, McClouth. K. Broker, County Clerk.

★**Fort Worth, Tex.**—Contract awarded Austin Brothers, Dallas, for reconstructing the Park Street Bridge over Trinity River (bids opened Jan. 3) at $7,888. Other bidders: Midland Bridge Company, Houston, $8,900; and Tarrant Construction Company, Fort Worth, $9,258. H. P. Hayes, County Engineer.

★**Harrisburg, Tex.**—Contract for constructing bridge across Clear Creek awarded Q. M. Van Horn, 1217 San Jacinto Street, Houston. H. Z. Washburn, County Auditor.

PAVING AND ROADS

PROPOSED WORK.

Westfield, Mass.—See "Sewerage and Sewage Disposal."

Woonsocket, R. I.—About $15,000 will be spent by city for granite curbing. F. H. Mills, City Engineer.

Bridgeport, Conn.—The Street & Sidewalks Committee of the Common Council asks $200,000 for water bound macadam paving and $55,000 for extension of Boston Avenue from North Avenue to Main Street.

Manchester, Conn.—H. I. Taylor, Chairman Board Selectmen, writes that it is proposed to construct concrete sidewalks and granite curbs on a dozen or more streets early in the spring at a cost of $25,000. J. F. Bowen, Engineer, South Manchester.

Buffalo, N. Y.—Construction of two boulevards is contemplated by city for 1916, one a 5-mile macadam road on south side connecting turnpike and lake shore with Seneca Street via South and Cazenovia Parks, the second to start at Genesee Street and Scajaquada Creek and proceed along waterway to Main Street.

Ilion, N. Y.—Street paving bonds amounting to $50,000 are reported sold by city.

Niagara Falls, N. Y.—City Engineer Frederick S. Parkhurst has submitted to Mayor annual report and recommends paving of portions of several streets, including Twenty-fourth, Niagara, Nineteenth Streets, Ferry, Walnut and Ashland Avenues; construction of trunk sewers in Twenty-fourth, Twenty-seventh and Sugar Streets; a second water main from the pumping station along Columbus and other avenues.

Belmar, N. J.—The paving of "F" Street is contemplated by city; cost about $35,000.

Collingswood, N. J.—The issuing of $75,000 bonds for street improvements is contemplated by city.

Keyport, N. J.—Plans and specifications being prepared by Board Freeholders, Freehold, for building a road from Middlesex County line to Middletown, to be bitulithic and concrete.

Bellwood, Pa.—Bellwood Chamber of Commerce passed resolutions petitioning State Highway Dept. to improve main road between Altoona and Bellwood, distance of 7 miles.

Lock Haven, Pa.—In the annual budget $10,000 has been included for street paving.

Reading, Pa.—City is considering constructing municipal asphalt paving plant.

Scranton, Pa.—Contract will be let about March by J. G. Hayes, Dir. Public Works, for paving about 9956 sq. yd. on Ash, Olive and New York Streets with asphalt and stone block, to cost $20,000. W. A. Schunk, Chief Engineer.

Wellsburg, W. Va.—Reported Brooke County is to engage a road engineer. Election will soon be held to vote $450,000 bonds for road improvements.

Georgetown, S. C.—The construction of a highway from Georgetown to Charleston is being considered. J. B. Morrison, of McClellanville, and County Comrs. said to be interested.

Jacksonville, Fla.—City Council voted to pave Main Street.

Tallahassee, Fla.—Citizens voted to pave College Avenue with bitulithic.

Birmingham, Ala.—Surveys being made by George H. Clark, County Engineer, and Julian Kendrick, City Engineer, for a paved highway from city limits to Warrior River.

Chattanooga, Tenn.—County Court adopted resolution for constructing five miles of Dixie Highway to connect with the Marion County line; estimated cost $60,000.

Morristown, Tenn.—About $150,000 road improvement bonds sold by Hamblen County Road Commissioners. John Sharp of Morristown engaged to prepare preliminary survey.

Akron, Ohio.—Contract will be let in February or March by County Commissioners for about 10 miles of brick paving on Morgantown and Richfield Roads on concrete foundation; estimated cost $18,000 per mile. U. G. High, County Clerk.

Bucyrus, Ohio.—Election will probably soon be held to vote $45,000 bonds for paving several streets in Bucyrus.

Canton, Ohio.—About $74,400 paving bonds sold by City Council.

Cincinnati, Ohio.—Frank S. Krug, City Engineer, estimates cost of improving Reading Road from Mitchell Avenue to Paddock Road with wood block at $34,443.

County Comrs. will improve Wesselmann Road from Harrison Pike to Bogart and Fagaly Road; at cost of $10,499.

Dayton, Ohio. — See "Sewerage and Sewage Disposal."

Dayton, Ohio.—City Commission voted to repave Main Street, estimated cost $102,000.

Hillsboro, Ohio.—See "Bridges."

Hillsboro, Ohio.—Contract will be let in March or April for county road and brick improvements costing $50,000. Charles F. Clarke, County Surveyor.

Newark, Ohio.—Paving bonds for $25,000 will be sold Feb. 1, by County Commissioners. (Ben. B. Jones, Clk.)

Portsmouth, Ohio.—See "Hydraulic Construction and River Improvements."

Youngstown, Ohio. — Surveys being made by Ett S. Smith, County Surveyor, on Damascus-Berlin Center Road. Macadamizing of five miles of said road is contemplated.

Shoals, Ind.—Road bonds amounting to $15,800 have been sold.

Eaton Rapids, Mich.—City Commission voted to pave about 20,000 sq. yd. of asphaltic concrete pavements during 1916.

Flint, Mich.—Common Council approved plans for paving thirty-two streets.

Jackson, Mich.—See "Water Works."

East Moline, Ill.—Contract will be let in spring for paving Seventeenth Avenue from Seventh to Ninth Streets and Eighteenth Avenue, Ninth to Twelfth Streets, with brick. W. B. Warren, City Engineer.

Morrison, Ill.—Two miles of brick paving in Morrison is contemplated. Work to begin in spring; cost $117,287. Josiah Hall, Supt Streets.

Whiteside County will spend $14,000 on road building under State aid plan.

Sterling, Ill.—Three miles of State aid road is to be constructed in Genessee Township in the spring. State Division Engineer, Sherman, inspected roads.

Kenosha, Wis.—About 1 mile of concrete paving, to cost $12,000, is to be laid. J. F. Huzog, County Highway Commissioner; Russell & Jones, County Clerk.

Milwaukee, Wis.—About $325,000 is to be spent by city for paving and about $143,000 for repairs to pavements. Included is Eighth Avenue with cement, Morton Place, Eleventh Avenue, Twenty-sixth Street, Chambers, Knapp Street, Auer Avenue, Well Street, with asphalt, Jackson, Jefferson and Van Buren Streets with sandstone.

Sheboygan, Wis.—About 4 miles of paving and curbing contemplated in the new year. Address Board of Public Works; C. U. Boley, City Engineer.

Superior, Wis.—Plans being prepared for paving Central Avenue in South Superior.

Rockwell City, Iowa.—Two miles of paving are contemplated in Rockwell City during 1916, according to reports.

Storm Lake, Iowa.—Contract will be let about March by J. E. W. Buland, City Clerk, for paving Geneseo, West Seneca and Cayuga Streets, about 60,000 sq. yd. Bruce & Srandeven, Engineers, Omaha, Neb.

Carlton, Minn.—Carlton County Board is planning to complete road from Moose Lake to Barnum and to build a highway from Moose Lake to Kettle River.

Duluth, Minn.—Commissioners of St. Louis County directed construction of one mile of highway along Duluth-St. Vincent Road.

West First Street, between Twentieth and Thirtieth Streets is to be paved with brick; cost $40,000.

Construction of three roads into Duluth is contemplated; also extension of Piedmont Avenue. The Getchell, Nopeming and Farrell roads will be built to city limits.

About $1,000,000 will be spent during 1916 for pavements, sewers, sidewalks and street improvements.

The paving of three miles of road from East Fourth Street to Woodland and city limits being considered.

Eveleth, Minn.—About $150,000 will be spent on street improvements during 1916.

Faribault, Minn.—About $17,000 will be spent by city during the coming year on roads and bridges. Four bridges are to be built in connection with this work.

Hibbing, Minn.—Town Engineer of Stuntz is preparing survey for constructing road from southeast corner of Sect. 36 and extending 6 miles to town line and east 4 miles.

Minneapolis, Minn.—Council considering paving about two miles on Lowery Avenue. F. W. Cappelen, City Engineer.

City Council has ordered paving amounting to $1,250,000 exclusive of grading and other allied improvements. E. R. Dutton, Asst. City Engineer, in charge of the work.

St. Paul, Minn.—Board County Comrs. considering spending $60,000 for road improvements in Ramsey County.

El Paso, Tex.—County Commission about to spend $175,000 for road improvements in Dist. No. 1.

Houston, Tex.—See "Water Works."

Houston, Tex.—City Council has granted the petition of the property owners for repaving of Main Street, 60 ft. wide from McKinney Avenue, a distance of 2 miles.

Schulenburg, Tex.—Election to be held in February to vote $200,000 bonds for constructing 20 miles of roads. J. C. Baumgarten, President Highway League.

Seattle, Wash.—City Engineer filed plans with Bd. Pub. Wks. for grading concrete walks and planking on Michigan Street; cost $20,414.

Bd. Pub. Wks. approved plans of A. H. Dimock, City Engineer, for paving Ninth Avenue, West; cost $10,000.

Paving of Twelfth Avenue, Northeast, reported contemplated by Bd. Pub. Wks.; cost $25,699.

City Council considering paving Harrison Street between First and Fifth Avenues, North.

City Council voted to pave Second Avenue, West, and West Wheeler Street.

Street and Sewer Com., City Council, considering grading and paving Beacon Avenue between south line of Jefferson Park to Fifty-first Avenue, South; estimated cost of asphalt pavement $202,000, and wood block $230,000.

Estimates approved by the Board of Public Works for grading Hinds and other streets at a cost of $15,949 and paving Seventh Avenue, North, and other streets at a cost of $40,122.

Bill passed Council and submitted to the Mayor for grading, curbing and surface draining of Thirty-second Avenue West and other streets at an estimated cost of $120,000. This is the Carlton Park Addition.

Other improvements authorized by Council include paving with asphalt portion of Fifth Avenue North, concrete sidewalks and curb on Horton Street, etc.

Astoria, Ore.—An election will soon be held in city to vote bonds for constructing concrete wall, viaduct and hard-surface improvements in business district, to cost between $2,000,000 and $3,000,000.

Fresno, Cal.—City Trustees voted to spend about $80,000 in street improvements in Alta Vista section.

Los Angeles, Cal.—Contract will probably be let in February by County Board of Supervisors for constructing approximately one mile 5 in. oil macadam pavement 35 ft. wide with cement curb and gutter, between Burbank and Glendale Streets. Harry Lelande, County Clerk.

Martinez, Cal.—Construction of a concrete road from Walnut Creek to Alameda-Contra Costa County line near Dublin is being considered; cost $200,000; county to pay one-fourth and district the remainder.

Sacramento, Cal.—Highway bonds for $1,500,000 reported will be sold Jan. 27 by Friend W. Richardson, State Treasurer, Sacramento.

Santa Barbara, Cal.—County highway bonds amounting to $200,000 have been sold. Address Board of Supervisors.

BIDS DESIRED.

Cincinnati, Ohio.—Reported desired until Jan. 19, by Chas. F. Hornberger, Dir. Pub. Service, for constructing cement sidewalks in four districts for year 1916.

Indiana.—By County Commissioners for constructing roads as follows:

Until Feb. 7:

Greencastle, macadam roads in Washington, Jefferson and Mill Creek Townships. Joe Allen, Co. Aud.

Greenfield, gravel road in Buck Creek Township. Harvey J. Rhue, Co. Aud.

South Bend, concrete road in Olive Township. Clarence Sedwick, Co. Aud.

Newport, macadam or gravel road in Clinton Township. Roy Slater, Co. Aud.

Greensburg, for roads in Jackson and Clay Townships. John C. Barbe, Co. Aud.

Vernon, for stone road in Columbia Township. G. J. Bernhart, Co. Aud.

Franklin, gravel road in Ninerch Township. Length 14,466 ft. John C. Greggs, Co. Aud.

Rushville, for road between Center, Jackson and Union Townships, 12,600 ft. long. A. R. Holden, Co. Aud.

Until Feb. 8:

Noblesville, gravel road in Falls Creek Township, and concrete gravel road in Noblesville Township. W. O. Horton, Co. Aud.

Rochester, for two roads in Rochester Township. Ernest A. Smith, Co. Aud.

Decatur, macadam roads in French, St. Mary's, Blue Creek, Wabash, Kirkville, Washington, Union and Hartford Counties. T. H. Baltzell, Co. Aud.

Crawfordsville, three gravel roads in Coal Creek Township, one in Union Township, one in Walnut Township. Dr. W. F. Batman, Co. Aud.

Until Feb. 9:

Peru, gravel roads in Peru and Pipe Creek Townships. Frank K. McElhenney, Co. Aud.

Indianapolis, Ind.—Until Jan. 19 by Board Public Works (Jos. P. Turk, Secy.), for improving portions of Dearborn Street, Thirty-seventh, Ruskin, Forty-third and Draper Streets.

Elgin, Ill.—Until Jan. 20 by city, for paving Division Street, about 10,000 sq. yd. asphaltic concrete; Center Street, 17,168 sq. yd. asphaltic concrete, including 5-in. concrete base and 14,000 lin. ft. combined curb and gutter. Morgan H. Brightman, City Engineer.

Galva, Ill.—Until about Feb. 1, for 10,000 yd. brick pavement sand filler, 4000 yd. brick pavement asphalt filler, 5600 ft. curb and gutter, etc. Geo. E. Palmer, Pres. Board Engineers; Central Bureau of Consulting Engrs., 111 W. Monroe Street, Chicago.

Des Moines, Iowa.—Until Jan. 19, by City Council, for paving portions of Fortieth Street in all about 10,029 sq. yd. with either sheet asphalt with 1½ in. wearing surface, or Warren Bros. bitulithic 2 in. wearing surface, asphaltic concrete with 2 in. wearing surface, or No. 1 vitrified paving brick or vertical fiber brick with Portland cement or asphaltic top filler; for paving portions of South West Ninth Street, in all about 7945 sq. yd., with National pavement 2 in. wearing surface on present brick pavement. Horace Susong, City Clerk.

Missouri Valley, Iowa.—Reported desired until Feb. 1 for 40,000 sq. yd. brick, concrete, vertical fibre brick, tarvia or bitulithic. S. R. Williams, City Clk.

Hibbing, Minn.—Until Jan. 22, by J. Benoe, Town Clerk, for the Hibbing-Chisholm Road. Bids on concrete, tarvia, warrenite and bitulithic.

St. Paul, Minn.—Until Feb. 7, by Board County Commissioners, for a 10-ton steam or gasoline road roller in St. Paul. Geo. J. Ries, Co. Aud.

Great Falls, Mont.—Reported desired until Jan. 18, by W. H. Harrison, City Clk., for constructing concrete sidewalks and concrete curbing in city during the year 1916.

Higginsville, Mo.—Reported desired until Jan. 17, by Ralph Houscher, City Clk., for about 12,000 sq. yd. vertical fiber brick block paving and asphalt filler on 4-in. concrete base, together with curb and gutter. Chas. E. McCrae, Consulting Engr., 218 Glendale Building, Kansas City, Mo.

Paris, Tex.—Until Jan. 24, for 7000 sq. yd. bitulithic, asphaltic concrete, brick or other material, including 4600 ft. combined curb and gutter. R. G. Taylor, City Engineer.

Los Angeles, Cal.—Reported desired until Jan. 24, by H. J. Lelande, Clk. Board Supervisors, for constructing oil macadam pavement, including grading, metal culverts, concrete head walls, etc., in Road Improvement Dist. No. 77.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Boston, Mass.—Lowest bid for paving Washington Street opened Jan. 6 by Commissioner of Public Works was submitted by Charles J. Jacobs & Company, 107 Terrace Street, Roxbury, at $6,474 for asphalt and $6,508 for bitulithic.

Albany, N. Y.—Following are totals of four lowest bids opened Jan. 11 by W. W. Wotherspoon, State Superintendent Public Works, for constructing two connecting highways, Muck Road to James Street and Whitesboro Street to Mill Street, in city of Rome: Engineer's estimate, $28,634; Henry A. Schaupp, Guilderland, N. Y., $32,111; Bernard S. McCarey, Rome, $32,751; Walter S. Rae, 1624 Oliver Building, Pittsburgh, Pa., $34,943.

Herkimer, N. Y.—Following bids opened Dec. 28 by William H. Corey, Supt. County Highways, for improving highways in Herkimer County:

Road No. 7, Sect. 2, Old City east to intersect Northwoods road, south past school house, to intersect road 468, near Neely farm; 8 8 miles, in Fairfield. Atlantic Construction Co., $41,504; E. J. Cunningham, $44,980.

Road No. 9, Cook's Corners, northerly over Burrell Road to Thompson's Corners, 2.91 miles, Manheim. R. D. Cooper, $13,523; Michael O'Brien, Cortlandt, $11 918; Fort Schuyler Construction Co., Oneida, $12,863.

Road No. 14, from Ilion westerly over Barringer Road to town line of Litchfield, 3.79 miles in German Flatts and Frankfort. Corliar Construction Co., $27,313; Newport Construction Co., Herkimer, $26,662.

Road No. 16, Hull's Corners, westerly over Hull Road, via Jerusalem Hill to Norwich Corners, 6.83 miles in Litchfield. E. J. Cunningham, $38,104; Corliar Construction Co., $40,407; Newport Construction Co., Herkimer, $38,398.

Road No. 21 Newville easterly to the Montgomery County line, 4.45 miles in Danube. Michael O'Brien, Cortlandt, $20,814.

Road No. 23, Shell's Bush-Burrell's, 8 52 miles in Manheim. Atlanta Construction Co., Atlanta, $28 539; Fort Schuyler Construction Co., Oneida, $36,639; E. J. Cunningham, $40,672.

★**Ocean Grove, N. J.**—Contract for reconstructing and resurfacing about 9000 sq. yd. on Main Street in Neptune Township awarded Standard Bitulithic Company, 50 Church Street, New York, at about $17,600.

Cincinnati, O.—Following bids opened by Bd. Public Service, Jan. 4, for oiling macadam gravel and earth roadways of City: Citizens' Road Preserving Co., .045 cts. per sq. yd., and Breslin-Tyler Co., .06 cts.

★**Toledo, Ohio.**—Contracts for paving awarded by Bd. Control as follows: Oak, Forest, Yates, Locust Streets, Kenyon Drive and Varland Avenue to H. P. Streicher Co., Toledo, at $111,470, Michigan Street to Russell-Jennsion Co., 313 Huron Street, at $8,355, Yondota Street to M. F. O'Sullivan at $15 578. Willard Street and E. Broadway to Harris & Tansey, Toledo, at $33,009 and Wyandotte Street to Peters Bros. & Co., Toledo, at $4,334.

★**Bolivar, Mo.**—Contract for constructing roads in Bolivar Special Road District (F. M. Upton, Commissioner), to Little & Hays, St. Louis, Mo., at $25,308.

★**Daly City, Cal.**—Contract for paving in Vista Grande Dist. with asphaltic concrete awarded by city to Ransome-Crummey Co., at $31,914.

★**Los Angeles, Cal.**—Contract awarded by County Board of Supervisors for constructing about five miles of county road in Mint Canyon: Peter L. Ferry, Glendale, at 25 cts. per cubic yard for 36,000 cu. yd. excav., 29 cts. per square yard for 58,667 sq yd. concrete pavt., etc.; total $29,540. Next three lowest bids: Fred. Hoffman, $30,603; Leigh G. Garnsey, $31,984, and E. J. Hein, $32,089. County furnished cement, sand, rock and oil.

★**Los Angeles, Cal.**—Contract for improving Avenue Sixty-four, about 56,400 sq. ft. asphalt paving, awarded to Ford & Stout, Bradbury Building, at 13.8 cts. per sq. ft.; total, $11,082.

★Contract for asphalt paving on Shearer Street, about 138,243 sq. ft., awarded George H. Oswald, O. T. Johnson Building, at 12.5 cts. per sq. ft.; total, $22,493. Other bidders: George R. Curtis, $23,300; Ford & Stout, $23,450; and Fairchild-Gilmore-Wilton Company, $23,848.

★Contract for concrete paving on Westmoreland Avenue awarded Walter Overell, at $11,537.

★**San Jose, Cal.**—Contract for paving 3½ miles of road from Prospect Rd. to Saratoga with concrete asphalt awarded by Bd. Supervisors to Clark & Henry Constr. Co., Stockton, at $44,430.

Santa Monica, Cal.—Lowest bid for asphalt paving cement curbing, etc. on Ocean Avenue was submitted by J. D. Kneen Company, Dudley Building, at $59,609 and for bitulithic pavement on another portion at $27,898.

STREET CLEANING AND GARBAGE DISPOSAL

PROPOSED WORK.

Danbury, Conn.—City Council considering the establishment of a system of garbage collection and disposal.

Madison, Wis.—In the budget for 1916 $50,000 has ben included for garbage collection equipment, probably trucks, and for a disposal system, type not decided upon.

Port Arthur, Tex.—See "Hydraulic Construction and River Improvements."

PRICES AND LETTINGS.

★*Indicates award of contract.*

Fort Wayne, Ind.—Following are three lowest bids opened Jan. 3 by Board Public Works for constructing a garbage incinerator plant: Morse & Boulger, New York, from $10,000 to $14,900; J. C. Derrough & Co., Hobart, Oklahoma, $11,980; Charles F. Walters, East Chicago, Ind., $12,000.

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS

PROPOSED WORK.

Sea Wall—Bridgeport, Conn.—The Park Board asks $20,000 for extension to the sea wall Seaside Park.

Dock and Wharf Improvements—Philadelphia, Pa.—John Meigs, Director Department of Wharves, Docks and Ferries, in his annual report to the Mayor, recommends the following improvements: Completion of Pier 78-80 South wharves at foot of McKean Street, $30,000; purchase of site and construction of open deck pier, approximately 250 ft. wide x 900 ft. long, for rough cargo, at foot of Snyder Avenue (pier No. 82-84 South Wharves), $1,500,000; purchase of site and construction of one-story pier, approximately 80 ft. wide x 500 ft. long at foot of Cherry Street for accommodation of river steamers, $750,000; purchase of site and construction of general cargo piers for ocean steamers, approximately 200 ft. wide x 600 ft. long, either at foot of Fairmount Avenue or at site of former Neafie & Levy shipyard, $1,000,000; extension of Allegheny Avenue pier to pierhead line for use as general freight handling for river steamers and for recreation purposes, $100,000; extension of pier at foot of Bridge Street, Bridesburg, for use as general freight landing for river steamers and for recreation purposes, $50,000; completion of Schuylkill River bulkheads, $650,000; construction of new ice-breaking steamer, $350,000.

Pier and Shed—Baltimore, Md.—J. S. Young, Boston and Ellicott Streets, has engaged C. M. Anderson, 324 N. Charles Street, to prepare plans for a large reinforced concrete pier and shed for their plant on Boston Street. Estimates are being received.

Drainage—Monroe, Ga.—Surveys being made for the Alcony River Drainage District, to be earth excavation with floating dipper dredge. William D. Alexander, Engineer, Charlotte, N. C.

Wharves and Docks—Tuscaloosa, Ala.—Reported plans being prepared by Dr. George Jacob Davis, Dean of the engineering school of the University of Alabama for the municipal wharves and docks which the city intends constructing. Address D. B. Robertson, President City Commission.

Drainage — Owensboro, Ky.—Drainage Commissioners of Daviess County considering plant to drain 42,000 acres at a cost of $389,150.

Flood Protection—Columbus, Ohio.—Reported plans prepared for flood protection in Columbus and vicinity. The Directors of Franklin County Conservancy District have the matter in charge.

Floor Gages—Fort Wayne, Ind.—Fort Wayne & Northern Indiana Traction Company will install gages at different points along line as a matter of flood prevention.

Levee Work—Cairo, Ill.—The construction of the Dog Tooth Levee and Drainage District is in a preliminary stage. Oldfield & Brady Company, Cairo, Engineers; L. T. Berthe, Consulting Engineer, Charleston, Mo.

Drainage—Kankakee, Ill.—Reported establishment of a drainage project costing $57,350 is contemplated in West Kankakee. Address County Judge.

Drainage—Sioux City, Iowa.—Preliminary surveys and estimates being prepared for straightening 18 miles of channel of Soldier River. Report will be completed about March 15 and contract for construction let about June. C. Moriarty, Engineer, 600 N. Bank Building, Sioux City. J. P. Olander, County Auditor.

Drainage — Lawrence, Kan. — Maple Grove Drainage District Commissioners voted $8,000 drainage improvement bonds.

Drainage—Scandia, Kan.—J. A. Campbell, Topeka, engaged to make a topographical survey of District No. 1, Republic County.

Drainage—Clarks, Neb.—Merrick County Drainage District No. 1, near Village of Clarks, comprising about 11 acres, voted Dec. 29 approval of plans for a drainage system. Contract soon to be let. Donald D. Price, Consulting Engineer, Lincoln, Neb.

Dock Construction—St. Louis, Mo.—Mayor has signed the ordinance authorizing the construction of a municipal dock of reinforced concrete at North Market Street, costing $285,000.

Levee Improvement—Port Arthur, Tex.—Citizens voted following bonds: $180,000 for storm protection levees, drainage canals and pumps; $6,000 garbage crematory; $20,000 municipal abattoir, and $25,000 for taking over the pleasure pier property.

Jetties—Bandon, Ore.—Port of Bandon Commissioners will construct south jetty at a cost of $25,000.

Irrigation—Lindsay, Cal.—Directors of newly formed Lindsay-Strathmore Irrigation District having plans prepared for a $1,250,000 irrigation system, including dams, in Kaweah and Yakohl River Districts, auxiliary pumping plant, canals and laterals to serve 15,000 acres.

Irrigation — Los Angeles, Cal. — Chief Engineer William Mulholland, of the City Water Department, has been instructed to prepare plans for a $300,000 irrigation system to supply surplus water to San Fernando Mission Land Company's tract.

Hydroelectric Plant—Los Angeles, Cal.—Reported California Edison Company contemplates constructing a 30,000 k.w. hydroelectric plant on Kern River at an early date and probably in 1918 will construct a $1,000,000 generating unit at the Long Beach steam plant.

Flood Protection—Los Angeles, Cal.—Election soon to be held to vote bonds for flood control work and reclamation of washed lands. Matter under consideration by Los Angeles County Flood Control Association and County Board of Supervisors. Harry Lelande, County Clerk.

Irrigation—Modesto, Cal.—Modesto Irrigation District will, according to reports, make improvements to the main canal costing $275,000, as soon as Waterford Irrigation District, adjoining, purchases rights-of-way from the Modesto Irrigation District. Waterford Irrigation District, it is reported, will construct canal and laterals.

Drainage—Perris, Cal.—Reported Board of Supervisors will soon let contracts for constructing the Brownlands Drainage District.

Hydroelectric Plant — San Francisco, Cal.—Railroad Commission has authorized the Great Western Power Company of California to issue $6,000,000 convertible gold bonds, of which $1,500,000 will be used for construction of a second transmission line from the hydroelectric installation at Big Bend, Butte County, to Oakland, and $250,000 for construction of two cable lines across San Francisco Bay from Alameda County to San Francisco.

Irrigation — Susanville, Cal. — Citizens Dec. 24 voted to construct Southern-Lassen Irrigation System. G. E. Bassett, County Clerk.

Dam—Flagstaff, Ariz.—Reported J. B. Girard, City Engineer, Phoenix, engaged by a syndicate to construct a dam to be constructed on Colorado River, 21 miles north of Peach Springs to develop 60,000 h. p. to be increased later to 400,000 or more by addition of other units and dams

BIDS DESIRED.

Canal Work—Albany, N. Y.—Until Feb. 1, by W. W. Wotherspoon, Supt. Pub. Wks., for State Canal work as follows:

Contract 21 A, Erie Canal Section 9, length 2.23 miles.

Contract No. 29 A (revised), Erie Canal Section 4, length 4 miles; also for constructing barge canal terminals.

Terminal Contract No. 51, increasing height of dock walls, grading and surfacing terminal site on south side of Barge Canal at end of Church Street.

Lock Gates at Dam—Wheeling, W. Va.—Until Feb. 9, by U. S. Engineer's Office, Wheeling, for furnishing and erecting lock gates for Dams Nos. 16 and 17, Ohio River, advertised in Engineering Record.

Drainage Work—Mason City, Iowa.—Until Jan. 17, by George E. Frost, County Auditor, for constructing Drainage District No. 26 and Drainage District No. 27.

Drainage Ditch—Houston, Tex.—Until Jan. 17 by City Secretary for constructing drainage ditch along east line of Block 48 from Westheimer Road to College Park Cemetery.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★Dredging — Boston, Mass.—Contract for dredging in Neponset River at Milton Lower Mills (bids opened Dec. 27 by Port Directors of Boston) awarded to Gerrish Dredging Company, 101 Tremont Street, Boston, at 23.4 cts. per cu. yd.; about 35,000 cu. yd.

★State Canal Work—Albany, N. Y.—Contract for constructing Contract 73-A, Champlain Canal, between Northumberland and Stillwater (bids opened Jan. 4 by W. W. Wotherspoon, State Superintendent Public Works), reported awarded Great Lakes Dredge & Dock Co., of Albany, at $321,680.

State Canal Work—Albany, N. Y.—See "Paving and Roads."

★Dredging—Brooklyn, N. Y.—Contract for dredging at New York Navy Yard awarded by Bureau of Yards and Docks, Navy Department, Washington, D. C., to Coastwise Dredging Company, Norfolk, Va., at 25⅞ cts. per cu. yd. (bids opened Dec. 11).

★Dredging—New York, N. Y.—Contract for dredging slip east side Pier 21, Contract 1487 (bids opened Dec. 28 by Commissioner of Docks and Ferries), awarded P. Sanford Ross Company, 277 Washington Street, Jersey City, N. J., at 34.5 cts. per cu. yd.; about 26,000 cu. yd.

★Dredging—Washington, D. C.—Contract awarded by U. S. Engineer to Maryland Dredging & Construction Company of Baltimore, Md., for dredging in Anacostia River, about 800,000 cu. yd., at $44,000 (bids opened Dec. 18).

★Dredging and Dock—Miami, Fla.—Contract for constructing the dock and for dredging (bids opened Dec. 22 by W. R. Moore, City Clerk) awarded as follows: Channel construction, Bowers Southern Dredging Company, Miami, at $343,700; dock, Hillyer & Sperring, Jacksonville, $56,808. For unit figures see Jan. 8 issue of Record. Isham Randolph & Company, Engineers, Continental Bank Building, Chicago, Ill.

★Pier and Shed—Pensacola, Fla.—Contract awarded Eastern Construction Co. by Gulf, Florida & Alabama R.R. for erecting a shed 900 ft. long and 65 ft. wide on pier at Pensacola; cost $30,000.

★Dredge — Carrollton, Ill. — Contract awarded Monighan Machine Co., Chicago, Ill., for furnishing a dry land dredge to be used in connection with the drainage work here. G. W. Whiteside, Drainage Engineer, Carrollton.

★Ditch—Bemidji, Minn.—Contract for constructing ditch awarded American Drainage Company, Thief River Falls, Wis., at $52,500.

ELECTRIC RAILWAYS

PROPOSED WORK.

Albany, N. Y.—Public Service Commission, Albany, has approved the franchise granted to International Railway by city authorities for a double track extension of the trolley road with necessary switches, etc., in Skillen Street from the Military Road to O'Neil Street.

Clearwater, Fla.—Tampa, Clearwater & Island City R.R. Co. incorporated to construct a railway from Clearwater to Clearwater Key, 2¾ miles; capital $100,000. E. W. Parker, Pres. E. T. Roux, Plant City, Secy.

Cleveland, Ohio.—Cleveland Ry. Co. considering spending $934,370 for track renewals and repairs.

Mishawaka, Ind.—Plans are being considered to construct an electric railway to connect Mishawaka and Indianapolis. Among those interested are D. C. Dunlap, Wilmette, Ill.; Degroot Van Beckermanof, Chicago, Ill.

Manitowoc, Wis.—Surveys being made by Green Bay & Eastern Ry. Co. for proposed line from Green Bay to Sheboygan via Manitowoc.

Lincoln, Neb.—L. S. Cass, president Cedar Rapids & Waterloo Interurban Ry., Lincoln, reported considering constructing an interurban road from Lincoln to Beatrice, and on 12 miles to Virginia, Neb.

Bethany, Neb.—Omaha, Lincoln & Beatrice Interurban Railway will extend present terminus from Bethany to Omaha this year.

Kansas City, Mo.—Kansas City & Tiffany Springs Ry. Co. secured franchise from County Court to construct a line from Kansas City to Tiffany Springs.

Austin, Tex.—Reported the Illinois Constr. Co. considering constructing an electric railway between Austin and San Antonio.

Dallas, Tex.—Dallas Electric R. R. Co. will spend about $80,000 in paving and laying new rails and ties on Commerce Street between Houston & Texas Central R. R. and Exposition Avenue. The old rail will be replaced with 103-lb. steel girder rails and new steel rail will be laid to take place of wooden ties.

Reported Texas Traction Co. will rebuild substation near Sherman recently destroyed by fire.

Oklahoma City, Okla.—Guthrie-Edmond Electric Railway Company incorporated. It is proposed to extend the present Oklahoma City-Edmond Interurban to Guthrie.

Tacoma, Wash. — Intermountain Traction & Power Co. incorporated with capital of $500,000. Among incorporators: I. M. Iles, F. B. Chandler.

Salem, Ore.—Plans being considered by Willamette Valley Southern Electric Ry. Co. to extend its line from Mount Angel to Salem via Silverton, Macleavy and Aumsville.

San Bernardino, Cal.—Franchise granted Pacific Electric Ry. Co. to construct an electric railway in Orange Grove Avenue. L. R. Patty, Clerk.

San Diego, Cal.—San Diego Electric Ry. Co. applied to Council for franchise to build a line on San Diego Avenue, a distance of eight blocks.

Centerville, Utah.—Salt Lake & Ogden Ry. Co. plans to double-track line from Centerville to Wilcox, about 3 miles.

BIDS DESIRED.

Toronto, Ont.—Until Feb. 1, by T. L. Church (Mayor), Chmn. Board Control, for No. 70, street cars complete; No. 70A. street car bodies; No. 70B. street car trucks; No. 70C, street car motor equipment; No. 70D. street car air brake equipment ;No. 70E, copper cables for street car work; and No. 70F, street car fare boxes.

PRICES AND LETTINGS.

★*Indicates award of contract.*

New York, N. Y.—Following are four lowest bids opened Jan. 10 by Chief Engineer Interborough Rapid Transit R.R., 165 Broadway:

Webster Avenue Extension: M. J. Leahy. 1446 Prospect Avenue, $831,111; A. L. Guidone & Son, Vanderbilt Avenue, $838,765; Rodgers & Collier, $841,063, and Penn Steel Co., 71 Broadway, $853,850.

West Farms Extension: A. L. Guidone & Son, Inc., Vanderbilt Avenue, $105,915; Conners Brothers, 64 W. Eighty-eighth Street, $108,000: Post & McCord, 101 Park Avenue, $116,000, and Penn Steel Co., 71 Broadway, $118,000.

Lowest bid for constructing the Eighth Avenue Extension was submitted by Battery Engineering & Contracting Co., 17 Battery Place, at $336,000.

RAILROADS

PROPOSED WORK.

Paterson, N. J.—In the annual report of the New Jersey State Public Utilities Commission, submitted to the Governor, the Erie R. R. has been directed to abolish grade crossings in Paterson at an estimated cost of $3,000,000. R. C. Falconer, Supt. Construction, 506 Church Street, New York, N. Y

Norfolk, Va.—Norfolk & Western Ry. (J. E. Crawford, Ch. Engr., Roanoke, Va.) is reported considering electrification of the entire Pocahontas division.

Nashville, Tenn.—Reported Gulf, Mobile & Northern Ry. Company of Hardeman County incorporated to build a railroad from some point in Hardeman County between boundary line of Tennessee and Mississippi and passing through Madison County, Tenn., at or near Jackson. Incorporators, W. Bate Williams, Sam P. Walker, and others.

Birmingham, Ala.—The Atlanta, Birmingham & Atlantic R. R., recently reorganized, is to construct 20 miles of railroad into Cahaba coal fields. E. T. Lamb, Receiver.

Springfield, Ohio.—The elimination of grade crossings throughout the city is under consideration by the City Commission and the railroads.

Springfield, Ohio.—City Commission (E. F. McGilvray, Pres.) is considering grade crossings, particularly at East Main Street.

Toledo, Ohio.—State Public Utilities Commission, Columbus, has authorized the Toledo, Columbus & Ohio River R. R. Company to issue $2,000,000 capital stock, proceeds to be used for improving terminals and along the main division and for improving dock property in Toledo.

St. Paul, Minn.—Reported the construction of a tunnel for the St. Paul R. R. from St. Paul to Minneapolis from Chestnut Street to some point in the Midway District is under consideration. The civic Committee of the Junior Pioneer Assoc. is reported interested.

Seattle, Wash.—Great Northern Ry. Company (A. H. Hogeland, Ch. Engr., St. Paul, Minn.) is reported having plans prepared for concrete snowsheds to replace wooden structures in Cascade Mountains recently wrecked by an avalanche.

Payette, Idaho.—Oregon Short Line R. R. (Carl Stradley, Ch. Engr., Salt Lake City, Utah) will build a "Y" in the Payette Valley yards connecting Payette Valley tracks, recently purchased, with the main line of the Oregon Short Line, and will erect a two-stall roundhouse.

Mexico. — Reported Southern Pacific R. R. of Mexico (R. Castaneda, Asst. Supt., Guadalajara Jalisco, Mexico) is taking steps to rehabilitate their line in Mexico. The road extends about 1100 miles south of Nogales, Ariz., to Guadalajara.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★Washington, Ga.—Reported contract for grading of the Washington & Lincolnton R. R. awarded Morrow Construction Company, Atlanta.

PUBLIC BUILDINGS AND SCHOOLS

PROPOSED WORK.

Boston, Mass.—It is proposed to erect a 7-story and basement brick annex to the Public Library at a cost of $164,000, according to plans by Joseph McGinniss, 16 Arlington Street. Address Trustees Public Library, Copley Square, H. G. Wadlin, Librarian.

Brooklyn, N. Y.—Plans filed for 7-story brick annex to Brooklyn Hospital; cost $80,000; also 2-story brick superintendent's residence; cost $20,000.

Bridgeton, N. J.—A movement on foot here to erect new city hall costing about $30,000. Address City Clerk.

Camden, N. J.—Contract about to be let for stone library donated to city by Victor Talking Machine Company. Karcher & Smith. Archts., 34 South Seventeenth Street, Philadelphia, Pa.

Jersey City, N. J.—Plans prepared for community house and open-air swimming pool to be erected at Reservoir Playground in Hudson City section. Harry Moore, Commissioner Public Grounds.

Morristown, N. J.—Preliminary plans being prepared by Francis G. Hasselman, 30 East Forty-second Street, New York, for All Souls' Hospital building; cost about $90,000.

Charleroi, Pa.—School bonds amounting to $26,000 sold. Address School Board.

Gettysburg, Pa.—Board Trustees of Gettysburg College decided to erect addition to College Chemical Laboratory.

Johnstown, Pa.—School Directors of Upper Yoder Township considering plans for rebuilding Stutzman School recently destroyed by fire. Curtis Barnhart, Pres. Board of Directors.

Philadelphia, Pa.—School District of Philadelphia purchased land near junction of Byberry Meeting House Road and Bristol Turnpike, in Thirty-fifth Ward, on which it proposes erecting school for truant children.

Contract about to be let for erecting power house at Philadelphia Institution for Feeble Minded at Byberry. Dr. Krusen, City Director of Health and Charities.

Pittsburgh, Pa. — Preliminary plans being prepared by Janssen & Abbott, Century Building, for three-story brick addition to Western Pennsylvania Institute for Blind on Bellefield Avenue. Address Board of Trustees.

Wilmington, Del.—Board of Education sold $150,000 bonds for erecting and equipping addition to High School.

Charleston, W. Va.—Plans being prepared by H. Rus Warne, Charleston for three-story, brick and stone school; cost $35,000.

Warwood, W. Va.—R. A. Alexander, President Board Education Richland District, care of Bank of Woodward, Woodward, will Jan. 22 sell $85,000 school bonds.

Asheville, N. C.—Plans being prepared by W. H. Lord, Asheville, for the high school. Contract will not be let for several weeks. Harry Howell, Supt. Schools.

Charlotte, N. C.—Wheeler & Stern of Charlotte are architects for hospital and sanatorium to be erected in Elizabeth section; cost about $50,000.

Durham, N. C.—C. Howard Lloyd, Harrisburg, Pa., is architect for the proposed two schools. Address Board of Education.

Ooltewah, Tenn.—James County voted $25,000 bonds for school consolidation. Address County Clerk.

Lexington, Ky.—Anderson & Frankel, of Lexington, selected to prepare plans for the 8-room grammar school. J. O. H. Smith, Secy. School Bd.

Alliance, Ohio.—School bonds amounting to $100,000 have been sold.

East Liverpool, Ohio.—Market House bonds amounting to $40,000 will be sold January 18 by James A. Kenney, City Auditor.

Gallipolis, Ohio.—Contract soon to be let by Dr. C. E. Holzner, Second Street, for erecting three-story, 68 x 80-ft., brick, stone and tile hospital; cost about $25,000. F. L. Packard, Archt., Hayden Building, Columbus.

McCutchenville, Ohio.—School bonds for $40,000 will be sold Feb. 1 by J. L. Bare, Clk. Bd. Educ., McCutchenville Rural School Dist.

Nevada, Ohio.—School bonds amounting to $35,000 voted. Address School Board.

Toledo, Ohio.—$450,000 of the $1,000,000 school bonds have been sold.

Pierceton, Ind.—Township Advisory Board reported voted $34,000 bonds to erect new school. Address Town Clerk, Pierceton.

Tipton, Ind.—School bonds amounting to $36,000 have been sold.

Vincennes, Ind.—J. W. Gaddis of Vincennes engaged for proposed brick and stone Central School, to consist of 36 rooms, auditorium and gymnasium; cost $138,000.

Chicago, Ill.—Chief of Police Healey plans for this year erection of eleven new police stations to include a central station costing approximately $1,000,000, probably on Madison Street.

Atigo, Wis.—High school, recently destroyed by fire, will be rebuilt. Address Board of Education.

Sheboygan, Wis.—Erection of a new high school to cost, including site, $150,000, is under consideration. Address Board of Education.

Belmond, Iowa.—Election is to be held Jan. 12 to vote $65,000 bonds to erect a high and grade school, to be two-story, brick, and cost $70,000. Plans being prepared by L. G. Lockhart, St. Paul, Minn. Contract will be let about February.

Mount Pleasant, Ia.—Election soon to be held to vote $20,000 bonds to erect new grade school. Address Board of Education.

Duluth, Minn.—City Council authorized purchase of site at Twentieth Avenue, East, and London Road, and will erect in spring municipal garage and warehouse. Address City Clerk.

Eveleth, Minn.—W. T. Bray, Duluth, engaged as architect for the high school. Probable cost $200,000. B. O. Guenning, Supt. District 39.

St. Paul, Minn.—A four-story addition is to be erected to St. Luke's Hospital, Smith Avenue and Walnut Street; cost $75,000. Address Board of Trustees.

Thief River Falls, Minn.—Marshall, Roseau, Pennington and Red Lake Counties have united and will erect a tuberculosis hospital at Thief River Falls. Nothing definite has been done in the matter. Address County Clerk, Thief River Falls, Minn.

Quniter, Kan.—Plans being prepared by H. B. Winter, Manhattan, for a Rural District High School to cost $20,000.

David City, Neb.—R. A. Brady & Company, Hastings, are architects for two-story and basement brick and stone high school to cost $60,000. H. P. Schaaf, Secy. Board Education.

Austin, Tex.—All bids opened for erecting two dormitories at State Industrial Training Schools for Girls rejected by Board of Managers as being in excess of $40,000 appropriation.

Pullman, Wash.—Board of Regents, Washington State College, adopted plans for armory, dairy barn, farm engineering and mining buildings to be erected in the spring; cost $250,000.

Walla Walla, Wash.—Election to be held Jan. 22 to vote $139,000 bonds for addition to high school and $61,000 bonds for erecting grade school on Ninth Street. Address School Board.

Long Beach, Cal.—An election soon to be held to vote bonds for erecting two intermediate schools, each to cost $125,000. Address Board of Education.

San Bernardino, Cal.—Contract soon to be let for erecting the administration building at the county hospital to be four story and basement, 90 x 56 ft.; have two wings each two story and basement, one wing 180 x 40 ft. with a two-story extension 27 x 56 ft., the other wing 90 x 46 ft. with a ward building 27 x 56 ft. Cost exclusive of furnishings will be about $130,000. Other buildings are to be erected later. Lyman Farwell, Archt., Los Angeles. Address County Board Supervisors.

Phoenix, Ariz.—Plans of Lescher & Kibbey, Phoenix, selected for proposed female ward building at State College, to be erected probably by day labor; cost, including furnishings, about $25,000. Address State Engineer, Phoenix.

BIDS DESIRED.

Boston, Mass.—Reported desired until Feb. 15, by Library Department City of Boston, for additions to library. Probable cost $170,000. Jos. McGinniss, Archt., 16 Arlington Street, Boston.

Until Jan. 18, by Schoolhouse Commission (Jos. P. Lomasney, Chmn.), for erecting an elementary school for upper and lower grades, Oliver Wendell Holmes Dist., Harvard, Glenway and Greenwood Streets, Dorchester. Security $35,000.

Yonkers, N. Y.—Until Jan. 17, by Board Contract & Supply (Edw. P. Walsh, Secy.), for erecting addition to Municipal Tuberculosis Hospital, including masonry, carpentry, electric work, etc.

Asbury Park, N. J.—Until Jan. 19, by Board Fire Commissioners Neptune Township, Corliss Avenue (Wm. R. O'Brien, Secy.), for erecting fire house with heating plant at Hamilton. Clinton B. Cook, Archt., Asbury Park.

Newark, N. J.—Until Jan. 18 by Essex County Park Commission, 810 Broad Street (A. Church, Secy.), for erecting pavilion, comfort station and children's shelter at Weequshic Park, Newark. Separate bids for plumbing, heating and electrical work. F. A. Wright, 110 E. Twenty-third Street, New York, N. Y., Archt.

De Graff, Ohio.—Reported desired until Jan. 22, for erecting centralized school, 2-story and basement, 59 x 80 ft., for Harrison School Dist. E. H. Rickett, 274 Twelfth Avenue, Columbus, Archt.

Kilbourne, Ohio.—Reported desired until Jan. 31, by Board of Education (A. U. Humes, Pres.) for erecting school. Paul T. Cahill, Archt., 310 1900 Euclid Building, Cleveland.

Stoutsville, Ohio.—Reported desired until Feb. 5, for erecting 2-story, 80 x 87-ft. school for Washington Township. Probable cost $25,000. J. J. Warner, Clk. Township Bd. Educ., Stoutsville. R. Z. Dawson, Archt., 209 Brunson Building, Columbus.

Sugar Grove, Ohio.—Reported desired until Jan. 27, by Board Education (L. A. Carpenter, Clk.) for erecting school. E. S. Matheny, Archt., 710 Harrison Building, Columbus.

Brownstown, Ind.—Until Jan. 22, by Edgar M. Ferguson, School Trustee, for erecting two-story brick school.

South Bend, Ind.—Reported desired until Jan. 17, by Advisory Board Penn Township, for erecting consolidated school on Palmer-Eberhart Corners. Probable cost $25,000. Herbert Erickson, Archt., Gary, Ind.

Chicago, Ill.—Until Jan. 24, by First Cavalry Armory, I. N. G. Commission (Col. Milton F. Forman, Pres.), at office of Hon. J. B. Delbika, 130 N. Fifth Avenue, Chicago, for erecting armory building for First Cavalry. Separate bids for plumbing, heating and ventilating, electric wiring, electric elevators, ash elevator, etc.

Forest Park, Ill.—Until Jan. 25, by Board Education, Springfield School Dist. No. 186 (Eleanor Matheny, Secy.), for erecting high school for Forest Park. Wm. B. Ittner & Geo. H. Helmle, Assoc. Archts., Ferguson Building, Springfield.

Union Grove, Wis.—Reported desired until Feb. 1, by State Board Control, Madison, for erecting 3-story and basement Home for Feeble Minded. Probable cost $350,000. R. A. Messmer & Bro., Archts., 1006 Majestic Building, Milwaukee.

Caldwell, Kan.—Reported desired until Jan. 17, by J. E. Damon, Secy. Bd. Educ., for erecting 2-story and basement, 95 x 116-ft. school. Probable cost $50,000. Fred G. McCune, 211 Winne Building, Wichita, Archt.

Berkeley, Cal.—Reported desired until Jan. 17, by Comptroller University California, for general construction, plumbing, elevators, etc., for University Library.

Los Angeles, Cal.—Until March 9 by Board of Education (William A. Sheldon, Secy.), for general construction of a concrete, brick and hollow tile high school three and four-story, with separate agricultural and power building, also all subcontracts. Amount available $375,000. John C. Austin, Archt., 1012 Baker Detwiler Building.

San Bernardino, Cal.—Until January 31 by County Board of Supervisors (L. R. Patty, Clerk), for erecting a two-story and basement, two two-story wings and three-story and basement administration building at the county hospital to cost, including equipment, about $150,000. Lyman Farwell, 615 W. P. Story Building, Los Angeles. A. S. Guthrie, Clerk of Board.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Montpelier, Vt.—Following are bids opened Dec. 30 by State Capitol Commission for granite to be used in the new State Library to be erected near the Capitol: Marr & Gordon, Barre, Barre granite, $59,600 on building complete, and $50,600 on granite cut and delivered; Woodbury Granite Company, Hardwick, $67,189; Jones Brothers Company, Boston, Mass., $68,898; and J. B. Sanquinette, Barre, $83,908; E. R. Fletcher, West Chelmsford, Mass., $62,500.

★**Attleboro, Mass.**—Contract for constructing U. S. Post Office awarded King Lumber Company, Charlottesville, Va., at $81,475.

East Hartford, Conn.—Following are three lowest bids opened Jan. 3 by School Building Committee for erecting the high school: H. P. Cummings Construction Company, Ware, Mass., $84,987; Lewis A. Miller, Meriden, $89,298; George T. Kelley Company, Yonkers, N. Y., $89,488. Lowest bid for heating and ventilating was John H. Cooney, Harrison, N. J., at $21,470.

★**Jersey City, N. J.**—Contract for the steel work, about 2000 tons, on the new county jail awarded Fagan Iron Wks., Fourteenth Street.

★**Cresson, Pa.** — Contract awarded Charles Hood of Pittsburgh for erecting Union Chapel at State Sanitarium.

★**Spring City, Pa.**—Contract for erecting hospital buildings for Pennsylvania Institute for Feebleminded awarded F. H. Keiser & Company, Pottstown. Philip Johnson, Archt., Land Title Building, Philadelphia.

Somerville, Ohio.—Lowest bid opened Dec. 30 by Board of Education for erecting school submitted by George Georgenson, Hamilton, at $27,418.

★**Terre Haute, Ind.**—Contract awarded by School Board for erecting Eliza Warren Public School to A. W. Stoolman, Champaign, Ill., at $52,989, and plumbing to Prox & Burget, Terre Haute, at $12,500.

★**Muskegon, Mich.**—Contract for constructing addition and remodeling U. S. Post Office awarded Mayben & Freuchtel, Gadsden, Ala., at $63,666.

★**College Station, Tex.**—Contract for erecting hospital building for Texas Agricultural and Mechanical College awarded W. C. Hedrick Construction Company, Dallas, at $39,027. Next three lowest bidders: J. E Johnson, Waco, $39,109; L. R. Wright Construction Company, Dallas, $39,977; and Walsh & Burney, San Antonio, $42,085. R. Adelsperger, Professor of Architecture.

Galveston, Tex.—Following are four lowest bids opened Dec. 30 by Supervising Architect, Washington, D. C., for remodeling U. S. Post Office: O. E. Fischer Building Company, Galveston, $38,490; Newport Contracting & Engineering Company, Newport News, Va., $42,176; Algernon Blair, Montgomery, Ala., $43,380; Frank M. Weakley, Portsmouth, Va., $44,784.

★**Bellingham, Wash.** — Contract for erecting addition to the high school awarded as follows (contractors of Bellingham): General construction, Headrick, Baumeister & Klueter, $93,374; plumbing, Supar Bros., $4,660; heating, Christopher & Blythe, $15,446. F. B. Graves, Secy. School Dist No. 301.

★**Oakland, Cal.**—Contract awarded by Board of Supervisors for erecting women's hall and dormitory, the first unit of new county infirmary plan, to Larsen-Sampson Company of San Francisco, at $74,149.

★**Richmond, Cal.**—Contract for erecting city hall awarded Williams Brothers & Henderson, Holbrook Building, San Francisco, at about $28,525.

★**San Diego, Cal.**—Contract for erecting school on Block 111 awarded Rambo & Trepte, at $24,821. S. W. Belding, Secy. Board Education.

Cavite, P. I.—Following are two bids opened Jan. 4, by Bureau of Yards & Docks, Washington, D. C., for constructing reinforced concrete power house and operating buildings and three wooden buildings for officers' quarters at Naval Radio Station, Cavite: Construction & Engineering Company, San Francisco, $54,000; J. H. Tillman Company, Portland, Ore., $141,750.

PRIVATE BUILDINGS

PROPOSED WORK.

Hartford, Conn.—Plans being prepared by I. A. Guerriero, 647 Main Street, for four-story, 100 x 147 ft., brick store and apartment block for Nicholus Parllotti Estate.

Brooklyn, N. Y.—Erection of $125,000 Y. M. C. A. Building contemplated on present site of Carlton Avenue Branch, Carlton Avenue and Fulton Street. John W. Cook, General Secretary.

Ebenezer, N. Y.—Congregation of Evangelical Reformed Church decided to erect new edifice costing $20,000. Rev. H. H. Schultz, Pastor.

New York, N. Y.—Plans prepared by James Gamble Rogers, 470 Fourth Avenue, for $100,000 7-story fireproof parish house for Madison Avenue Presbyterian Church, at 921 Madison Avenue.

Plans filed for erecting following buildings: Two 6-story brick tenements at Sixth Avenue and Tenth Street for Citizens Investing Company, total cost $95,000, Louis A. Sheinert, Archt., 194 Bowery; 5-story brick apartment at 170th Street and Haven Avenue for Filrose Construction Company, cost $70,000, Gronenberg & Leuchtag, Archt., 303 Fifth Avenue; 8-story apartment house at 42 West Sixty-seventh Street for 50 West Sixty-seventh Street, Inc., cost $325,000 (about 700 tons steel), Shape & Brady, Inc., Archts., 220 West Forty-second Street; two 6-story brick tenements at 190th Street and Morris Avenue for Fordham Heights Realty Company, total cost $120,000, Chas. Schaefer, Jr., Archt., 401 Tremont Avenue; two 5-story brick tenements at Burnside and Davidson Avenues for Chas. M. Rosenthal, total cost $100,000, Gronenberg & Leuchtag, Archts., 303 Fifth Avenue; four 5-story tenements at 175th Street and Weeks Avenue for Strata Realty Company, total cost $200,000, Matthew J. McQuillan, Archt., 39 East Forty-second Street; 7-story fireproof garage, storage and factory, 418 to 426 Lafayette Street, for John Wanamaker, cost $100,000, William Steel & Sons Company, Archts., 1600 Arch Street, Philadelphia, Pa. (about 1200 tons structural steel required for this building).

Watertown, N. Y.—North Side Cemetery Association will erect a $100,000 mausoleum.

Yonkers, N. Y.—Plans being prepared for clubhouse to be erected in the spring for Hudson River Country Club, North Broadway (F. H. J. Knoblock, Secy. and Treas.); estimated cost $150,000.

Jersey City, N. J.—Plans being prepared by R. B. Morrison, 135 Front Street, New York, for addition to clubhouse; cost about $30,000.

Enlargement of St. Stephen's Episcopal Church on Union Street contemplated. Rev. Sydney Sweet, Pastor.

Philadelphia, Pa.—Folsom & Stanton, 1328 Walnut Street, are architects for four-story, 34 x 75-ft., brick and marble club house to be erected at 3416 Locust Street for Phi Sigma Kappa Fraternity.

Plans being prepared by Ballinger & Perrot, Methodist Building, for $50,000 addition to Parochial School of St. Peter's Roman Catholic Church at Fifth Street and Girard Avenue.

Sharpsburg, Pa.—Contract about to be let for $100,000 edifice to be erected here for St. Mary's Roman Catholic Church.

Wilkinsburg, Pa.—Plans being prepared by Alden & Harlow, 305 Fifth Avenue, Pittsburgh, for two-story and basement Masonic Temple to be erected on South Avenue; cost about $50,000.

Washington, D. C.—Almas Temple, Order of the Mystic Shrine, contemplate erecting $200,000 Memorial Temple.

J. G. White Engineering Corporation, 43 Exchange Place, New York, has secured contract for the engineering work in the improvements contemplated to Benning steam power plant of the Potomac Electric Power Company, Washington, D. C., which will include installation of an additional 15,000-kw. generator and enlarging of the power plant building by the construction of necessary extensions to accommodate the new machinery.

Orlando, Fla.—Plans being prepared for Masonic Temple to be erected on East Central Avenue. George McCullough of Orlando, Member Building Committee.

New Orleans, La.—A 15-story annex is to be erected to DeSoto Hotel on Baronne Street. V. Le Beau, Manager.

Clarksdale, Miss.—Contract soon to be let for erecting six-story, brick, stone and reinforced concrete bank and office building for Delta Bank & Trust Company. John Gaisford, Archt., Goodwyn Institute Building, Memphis, Tenn.

Cincinnati, Ohio.—Trustees of L. B. Harrison Hotel, 540 W. Seventh Street, considering plans for erecting gymnasium on Mound Street in connection with this hotel; cost about $40,000.

Columbus, Ohio.—Plans being prepared by D. Riebel & Sons, First National Bank Building, for 11-story, fireproof Broadway Hotel to be erected at Grant Avenue and East Broad Street; cost about $400,000.

Plans being prepared for building to be erected on Tenth Avenue and used as a girls' dormitory in connection with State University. Harvey Cockell, 200 West Tenth Avenue, interested.

Dayton, Ohio.—Dayton Power & Light Company, it is reported, will erect a power house to have 135,000 hp. Cost reported at $1,000,000.

Norwood, Ohio.—Reported Baltimore & Ohio Southwestern Railway Company (F. L. Stuart), Ch. Engr., Baltimore, Md.) will erect freight depot here.

Evansville, Ind.—Reported contract soon to be let for 5-story addition to Lincoln Hotel. C. Shopbell & Co., Archts., Furniture Exchange Building, Evansville.

Detroit, Mich.—George D. Mason, 80 Griswold Street, is architect for $500,000 addition to be erected to Masonic Temple on Lafayette Boulevard.

Peoria, Ill.—Peoria Board of Trade is reported taking steps to erect a building costing $80,000.

Milwaukee, Wis.—Plans being prepared for $100,000 moving picture theater to be erected in the spring on State Street for Metropolitan Investment Company, 290 Third Street.

Sparta, Wis.—Reported Parkinson & Dockendorff, La Crosse, engaged to prepare plans for theater to be erected next spring on South Water Street for Otto Bell; cost about $25,000.

Sioux City, Iowa.—American Brokerage Company (M. K. Hanson Pres.) incorporated and intends erecting an 8-story fireproof building to cost $205,000; also adjoining this building a club house for the farmers.

Bemidji, Minn. — Erection of $40,000 building for Elks Lodge contemplated here. Address Chairman Building Committee.

Duluth, Minn.—Contract will soon be let for $60,000 Y. M. C. A. Building. F. G. German, Archt., Exchange Building.

International Falls, Minn.—Odd Fellows plan erecting lodge building here. Thomas Tronson, Chairman Building Committee.

Minneapolis, Minn.—Reported Iron State Realty Co., Minneapolis, will erect three-story apartment building at 1001 Sixth Street S.; estimated cost $75,000.

Proctor, Minn.—Duluth, Missabe & Northern R. R. reported planning construction of a round house here.

St. Paul, Minn.—Milton Dairy Company will erect $30,000 fireproof building on Franklin and Chestnut Streets.

P. D. Youngman, 309 Dispatch Building, contemplates erecting in spring a 7-story, brick and concrete store and hotel building on Seventh and Jackson Streets; probable cost $250,000.

William Hamm, of Hamm Brewing Company, 681 E. Minnehaha Street, will erect hotel on site of Odd Fellows block at Fifth and Wabasha Streets; probable cost $500,000.

North Platte, Neb.—Tentative plans prepared for three-story and basement Roman Catholic parochial school to be erected here; cost about $20,000.

Dallas, Tex. — Higginbotham-Bailey-Logan Company (W. B. Williams, Secy.), 902½ Commerce Street, will erect additional 8-story and basement, reinforced concrete, steel and brick building on Jackson and Lamar Streets; cost about $200,000.

Reported plans completed for three-story hotel to be erected here for B. L Fielder of Sherman; cost $30,000.

Waco, Tex.—Plans prepared by Milton W. Scott & Company of Waco for 3-story and basement apartment house to be erected on Austin Street for Wilbur F. Crawford; cost approximately $40,000.

Los Angeles, Cal.—Los Angeles Public Market Company is reported taking steps to erect two-story brick or concrete market building 2000 ft. long, and six-story concrete warehouse and wholesale building, 500 ft. long, on present site of the car barns of the Pacific Electric Ry. Company on East Seventh Street. John Parkinson, Architect, Security Building.

The Panama-Pacific Warehouse Company has been organized by Moores & Dunford, 10 S. La Salle Street, Chicago, Ill., A. B. Cass, President Home Telephone Company, Los Angeles, and other local men, and has applied to State Railroad Commission for permission to issue $900,000 bonds to erect a five-story commercial warehouse.

Mayberg Industrial University (H. D. Mayberg, Pres.), 137 W. Adams Street, intends erecting a group of buildings, probably this year, on a site between the city and beach.

Allison & Allison, Security Building, are architects for the proposed stadium, auditorium and club house to be erected on Mount Washington for Chatauqua Association, 426 Security Building.

San Diego, Cal.—Plans being prepared for a 3-story brick and concrete building for the University Club (William Douglas, President). Cost $25,000.

BIDS DESIRED.

Poland, Me.—Reported desired until Feb. 1, by Nathan Baum, Pres. Summit Springs Hotel Co., Drexel Building, Philadelphia, Pa., for erecting 2½-story, 40 x 50-ft. dormitory. Le Roy B. Rothschild, 309 Bulletin Building, Philadelphia, Pa.

Vineland, N. J.—Reported desired until Jan. 17, for erecting hall and garage, 3-story, 42 x 140 ft., for C. G. Stansico. C. Clift, 511 Landis Avenue, Architect.

Miami, Fla.—Reported desired until Jan. 20, for erecting 7-story, 90 x 125-ft. hotel for Mrs. E. C. McAllister. Probable cost $300,000. Frohling & De Carmo, Archts., Miami.

Glasgow, Mont.—Reported desired until Jan. 22 for erecting 3-story building for Rundle Land & Abstract Co. Separate bids for plumbing and heating. Link & Haire, Archts., Helena.

PRICES AND LETTINGS.

★Indicates award of contract.

★Farrell, Pa.—Contract awarded by American Sheet & Tinplate Co. to Wallis & Carley Co. of Sharon for erecting two office buildings in connection with plant here; cost about $65,000.

★Lawndale (P. O. Philadelphia), Pa.—Contract awarded Horace H. Burrell, 1204 Chancellor Street, Philadelphia, for erecting two-story stone clubhouse for Curtis Publishing Company. Zantzinger, Borie & Medary, Archts., 139 South Fifteenth Street, Philadelphia.

★Pittsburgh, Pa. — Reported contract awarded W. F. Trimble & Sons Co., 1719 Penn Avenue, for erecting freight and office building on Carson and Smithfield Streets for Pittsburgh & Lake Erie Railroad Co.

★Gary, Ind.—Contract for erecting hospital and general office building for American Sheet Tin Plate Company awarded A. S. Hess, Gary; approximate cost $150,000.

★Pierceton, Ind.—Contract awarded by Reid-Murdoch Company for erecting a 2- and 3-story brick building to Fort Wayne Construction & Engineering Company, Fort Wayne; cost about $30,000.

NEW INDUSTRIAL PLANTS

PROPOSED WORK.

Lynn, Mass.—Plans being prepared by M. F. Burke, 333 Union Street, for four-story, 60 x 100-ft. concrete factory for Campbell Electric Company.

Northbridge, Mass.—Contract about to be let by Paul Whitin Manufacturing Company for erecting four-story, 102 x 112-ft. brick addition to spinning mill.

Baltic, Conn.—Plans being prepared by C. R. Makepeace & Company, Providence, R. I., for addition to plant of Baltic Mills Company.

New Haven, Conn.—Winchester Repeating Arms Company will erect five-story, 54 x 449-ft. fireproof factory estimated to cost $312,693.

New London, Conn.—Plans prepared for 5-story, 62 x 152 ft., addition to plant of Hopkins & Allen Arms Co.

Baltimore, Md.—Walter M. Gieske, Gunther Building, is architect for 100 x 150-ft. factory to be erected at Canton for Baltimore Oil Engine Company (Leon Wygodsky, Vice-Pres. and Gen. Mgr.).

Statesville, N. C.—Reported Winston-Salem Ice & Fuel Co. of Winston-Salem has purchased ice making machinery of Statesville Ice & Fuel Co. and will install same in new plant to be erected here.

Pensacola, Fla.—Reported Louisville & Nashville Railroad Company (W. H. Courteney, Ch. Engr., Louisville, Ky.) will erect new shops here.

Birmingham, Ala.—The plant of the Texas Oil Company at Twenty-third Avenue and Twenty-fourth Street, recently destroyed by fire, is to be rebuilt at once.

Watertown, N. Y.—New York Air Brake Company, 165 Broadway, New York, will erect a one-story shop to cost $50,000.

Chattanooga, Tenn.—Harrison Brothers & Company, Thirty-fifth Street and Gray's Ferry Road, Philadelphia, Pa., will erect sulphate factory here; probable cost $100,000.

New Orleans, La.—Federal Fruit & Cold Storage Co., 611 Whitney Street, will erect cold storage and ice plant here.

Cincinnati, Ohio.—Colter & Company, Sixth and Main Streets, will erect a reinforced concrete plant on Hunt Street, costing $125,000.

Green Bay, Wis.—Green Bay Packing Stockyards & Packing Company will erect next spring a $150,000 packing plant here.

Duluth, Minn.—Booth Fisheries Company, Lake Avenue, South, contemplates erecting cold storage plant.

Eveleth, Minn.—Commercial Club will erect creamery. J. C. Poole, 516 Jones Street, may be able to give further information.

Port Arthur, Tex.—See "Hydraulic Construction and River Improvements.

Tacoma, Wash.—Reported American Smelting & Refining Company, 120 Broadway, New York, N. Y., contemplates improvements to Tacoma Smelter to consist of a sulphuric acid manufacturing plant and a plant to separate minerals from smoke; cost about $500,000. Carl F. Buck, Ch. Engr., Tacoma.

Ashland, Ore.—Reported Oregon-Utah Sugar Co. of Salt Lake City, Utah. will let contract latter part of January for erecting sugar plant here; estimated cost $500,000.

Los Angeles, Cal.—Plans being prepared by the Alta Planing Mill Company, 830 McGarry Street, for a four-story brick furniture factory to be erected at Twenty-Second Street and Santa Fe Avenue for Van Vorst & Berman Company, 1332 East Sixth Street.

Reported Llewellyn Iron Works will in the spring erect a plant at Torrance, near Los Angeles Harbor.

San Dimas Cal.—The San Dimas Orange Growers' Assoc. is having plans prepared by C. M. Gray & Son, Los Angeles, Engineers, for a pre-cooling plant to be erected at San Dimas, of reinforced concrete, 70 x 208 ft. and 40 ft. high, to cost $50,000.

PRICES AND LETTINGS.

★Indicates award of contract.

★Hartford, Conn.—Contract awarded by S. K. F. Ball Bearing Company to Stone & Webster Engineering Corporation of Boston for erecting a two-story brick factory 180 x 209 ft. on New Park Avenue, estimated to cost $150,000.

★Coatesville, Pa.—Contract awarded Irvin & Leighton, Twelfth and Cherry Streets, Philadelphia, for erecting $30,000 addition to boiler house of Worth Brothers Company.

★Wierton, W. Va.—Contract awarded Penn Bridge Company, Beaver Falls, Pa., for 650 tons steel for the addition to the plant of Phillips Sheet Tin Plate Company at Wierton.

★Cincinnati, Ohio.—Contract awarded Concrete Steel Company, Youngstown, for 750 tons of reinforcing steel rods to be used in the plant of the American Tool Works, Eggleston Avenue and Pearl Street

★Indian Harbor, Ind.—Contract awarded Westinghouse Electric & Mfg. Company, East Pittsburgh, Pa., for electrical equipment for the addition to the plant of the Inland Steel Company, including two 5000-kw., 25-cycle, 2400-volt turbo generators complete, with surface condensers, exciters and switchboards; two 1000-kw. synchronous motor-generator sets; one 15,000-hp. direct current motor equipment; two 8000-hp. motor equipments, and several thousand horsepower of auxiliary apparatus.

MISCELLANEOUS

PROPOSED WORK.

Municipal Improvement Bonds—Philadelphia, Pa. — Municipal improvement bonds amounting to $5,360,000 sold.

Transmission Lines—Allegan, Mich.—Consumers Power Company, Jackson, is reported to be taking steps to extend transmission line from Allegan to South Haven via Fennville, Pullman and Lee, and also contemplates constructing a dam on Kalamazoo River on the south side of the city.

Transmission Line—Charlevoix, Mich.—Reported City is considering constructing a two-phase transmission line one mile from municipal plant for an auxiliary plant. A. J. Hamilton, Superintendent.

Transmission Line—Mattoon, Ill.—Central Illinois Public Service Company, Mattoon, contemplates constructing a high-tension transmission line between Sheldon Grove and Havana and from Beardstown to Virginia.

Subway—Fresno, Cal.—Southern Pacific Railway Fresno Traction Company and the city are considering the construction of a subway in Monterey Street.

BIDS DESIRED.

Tunnel Lining, New York, N. Y.—See "Water Works."

Cement—Saginaw, Mich.—Reported desired until Jan. 18, by City Clerk, for furnishing cement during present year.

Lumber—Chicago, Ill.—Until Jan. 22 by Commissioner of Public Works for furnishing 1,500,000 ft. of Norway and white pine, Douglas fir, hemlock and oak, required by Bureau of Engineering, Department of Public Works for general repair work during 1916.

Elevator—McCook, Neb.—Until Jan. 25, by Jas. A. Wetmore, Acting Supervising Archt., Treasury Department, Washington, D. C., for installing an electric passenger elevator in U. S. Post Office and courthouse at McCook.

Mechanical Stokers—St. Louis, Mo.—Until Feb. 11 by Secretary Mississippi River Commission, 1311 International Life Building, St. Louis, Mo., for furnishing and installing mechanical stokers on the U. S. Dredges B. M. Harrod and Henry Flad, at West Memphis, Ark., advertised in Engineering Record.

Castings—Panama.—Until Feb. 23, by Maj. F. C. Boggs, Corps Engrs., U. S. A., General Purchasing Officer, the Panama Canal, Washington, D. C., for Circular 1005, including bronze castings, malleable iron castings, etc., advertised in Engineering Record.

Monument Work—Havana, Cuba.—Until Feb. 3, at office of Civil and Military Constructions, Department Public Works, for enlargement of granite base of the monument to be erected to Major-General Antonio Maceo, at Havana, advertised in Engineering Record.

PRICES AND LETTINGS.

★Indicates award of contract.

★Tunnel to Seattle—King County Building, Seattle, Wash.—Contract for constructing tunnel into the Seattle-King County Building awarded Jahn Contracting Company, Pioneer Building, at $25,005.

Proposals

For Proposals Advertised, See Pages 46 and 47.

WATERWORKS.

Bids Close.		See Eng. Record.
Jan. 17.	Pumping Unit, St. Paul, Minn. Adv. Dec. 24.	Dec. 25
Jan. 17.	Well, Kirkland, Ill.	Jan. 15
Jan. 18.	Meters, etc., Opelousas, La.	Jan. 1
Jan. 18.	Improvements, Clarksdale, Miss. Adv. Jan. 8.	Jan. 8
Jan. 18.	Pipe, etc., Berwyn, Ill.	Jan. 15
Jan. 18.	Water Works, Ridgefield, Wash.	Jan. 15
Jan. 19.	C. I. Pipe, etc. Baltimore, Md. Adv. Jan. 8, 15.	Jan. 8
Jan. 20.	Pipe, etc., St. Paul, Minn.	Jan. 15
Jan. 21.	Boiler Feed Pumps, Chicago, Ill.	Jan. 15
Jan. 29.	Pumping Station, etc., Kenosha, Wis. Adv. Jan. 1, 8.	Jan. 1
Jan. 29.	Valves, Pipes, etc., Panama	Jan. 15
Jan. 31.	Filtration Structure, Oshkosh, Wis. Adv. Jan. 1 to 15.	Jan. 1
Jan. 31.	Tank, Oshkosh, Wis. Adv. Jan. 15.	Jan. 15
Jan. 31.	Reservoir, Oshkosh, Wis. Adv. Jan. 15.	Jan. 15
Jan. 31.	Filter Apparatus, Oshkosh, Wis. Adv. Jan. 15.	Jan. 15
Feb. 1.	Exciter, c. i. pipe, etc., Orangeburg, S. C. Adv. Jan. 8.	Jan. 8
Feb. 1.	Contract 170, Water Bd., New York, N. Y. Adv. Jan. 15.	Jan. 15
Feb. 7.	Improv., Sullivan, Ill.	Jan. 15
Apr. 1.	Mains, Cullman, Ala.	Jan. 15

SEWERAGE AND SEWAGE DISPOSAL.

Bids Close.		See Eng. Record.
Jan. 18.	Lisbon, Ia.	Jan. 8
Jan. 18.	Worcester, Mass.	Jan. 15
Jan. 18.	Kansas City, Mo.	Jan. 8
Jan. 18.	Saginaw, Mich.	Jan. 15
Jan. 19.	El Centro, Cal.	Jan. 15
Jan. 24.	Elgin, Ill.	Jan. 1
Jan. 24.	Cuyahoga Falls, Ohio	Jan. 1
Jan. 27.	Cushing, Okla	Jan. 15
Jan. 31.	South St. Paul, Minn.	Jan. 8
Feb. 3.	Milwaukee, Wis. Adv. Jan. 15.	Jan. 15
Feb. 7.	Cuyahoga Falls, Ohio	Jan. 15
Feb. 7.	Wausa, Neb.	Jan. 8

BRIDGES.

Bids Close.		See Eng. Record.
Jan. 18.	Knoxville, Iowa.	Dec. 18
Jan. 18.	Austin, Tex.	Jan. 15
Jan. 20.	Fort Benton, Mont. Adv. Dec. 25 to Jan. 15.	Dec. 25
Jan. 20.	Sulphur, Okla.	Jan. 1
Jan. 26.	Aberdeen, Wash.	Jan. 15
Jan. 21.	Warsaw, Ohio.	Jan. 15
Jan. 24.	New Philadelphia, Ohio	Jan. 15
Jan. 24.	Olympia, Wash.	Jan. 15
Jan. 24.	Boston, Mass.	Jan. 15
Jan. 24.	Bellaire, Ohio	Jan. 15
Jan. 26.	Rockford, Ill. Adv. Dec. 25.	Dec. 25
Jan. 26.	Lancaster, Ohio	Jan. 15
Jan. 27.	Atlanta, Ga. Adv. Jan. 8, 15.	Jan. 8
Jan. 31.	Boston, Mass. Adv. Jan. 8.	Jan. 8
Jan. 31.	Iowa City, Iowa	Jan. 1
Feb. 2.	Connecticut Adv. Jan. 8.	Jan. 8
Feb. 3.	Dallas, Tex. Adv. Jan. 8, 15.	Jan. 8
Feb. 3.	Miami, Fla.	Jan. 15
Feb. 15.	Alaska Adv. Jan. 15.	Jan. 15

PAVING AND ROADS.

Bids Close.		See Eng. Record.
Jan. 17.	Evanston, Ill. 2 Props., Adv. Dec. 25, to Jan. 8.	Dec. 25
Jan. 18.	Jamestown, Tenn. Adv. Jan. 8.	Jan. 8
Jan. 18.	Great Falls, Mont.	Jan. 15
Jan. 19.	Indianapolis, Ind.	Jan. 15
Jan. 19.	Des Moines, Iowa	Jan. 15
Jan. 19.	Cincinnati, Ohio.	Jan. 15
Jan. 20.	Greenfield, Iowa.	Dec. 25
Jan. 20.	Danville, Ill.	Jan. 8
Jan. 20.	San Antonio, Tex Adv. Jan. 8.	Jan. 8
Jan. 20.	Newark, N. J.	Jan. 8
Jan. 20.	Elgin, Ill.	Jan. 15
Jan. 22.	La Porte, Ind.	Jan. 8
Jan. 22.	Hibbing, Minn.	Jan. 15
Jan. 24.	Washington	Jan. 1
Jan. 24.	Los Angeles, Cal.	Jan. 15
Jan. 24.	Paris, Tex.	Jan. 15
Jan. 25.	Fort Madison, Iowa	Jan. 1
Feb. 1.	Missouri Valley, Iowa	Jan. 15
Feb. 1.	Galva, Ill.	Jan. 18
Feb. 7.	St. Paul, Minn.	Jan. 15
Feb. 7.	Indiana	Jan. 15
Feb. 8.	Indiana	Jan. 15
Feb. 9.	Indiana	Jan. 15
Feb. 9.	Indiana	Jan. 1
Feb. 15.	Spokane, Wash.	Jan. 8

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS.

Bids Close.		See Eng. Record.
Jan. 17.	Ft. Wayne, Ind Adv. Dec. 25.	Dec. 25
Jan. 18.	Irrigation, Montrose, Col.	Dec. 25
Jan. 22.	Power House at Dam, Wheeling, W. Va. Adv. Dec. 25 to Jan. 8.	Dec. 25
Jan. 25.	Ditch, Crookston, Minn.	Dec. 25
Jan. 25.	Irrigation, etc., Barstow, Tex.	Jan. 8
Feb. 1.	Canal Work, Albany, N.Y.	Jan. 15
Feb. 8.	Irrigation, St. Ignatius, Mont. Adv. Jan. 8.	Jan. 8
Feb. 9.	Lock Gate and Dam, Wheeling, W. Va Adv. Jan. 15.	Jan. 15

PUBLIC BUILDINGS AND SCHOOLS.

Bids Close.		See Eng. Record.
Jan. 18.	Anoka, Minn.	Dec. 11
Jan. 18.	Clarksdale, Miss.	Jan. 1
Jan. 18.	Boston, Mass.	Jan. 15
Jan. 18.	Newark, N. J.	Jan. 15
Jan. 19.	Hornell, N. Y.	Dec. 11
Jan. 19.	Manhattan Beach, Cal.	Jan. 8
Jan. 19.	Asbury Park, N. J.	Jan. 15
Jan. 20.	Crookston, Minn.	Dec. 25
Jan. 21.	Waterloo, N. Y.	Dec. 18
Jan. 21.	Fort Sam Houston, Tex.	Jan. 8
Jan. 22.	Wheeling, W. Va. Adv. Dec. 25 to Jan. 15.	Dec. 25
Jan. 22.	De Graff, Ohio	Jan. 15
Jan. 22.	Brownstown, Ind.	Jan. 15
Jan. 24.	Ashland, Ky.	Dec. 18
Jan. 24.	Nevada, Iowa	Jan. 1
Jan. 24.	Norwood, Ohio	Jan. 8
Jan. 24.	Chicago, Ill.	Jan. 15
Jan. 25.	Fairmont, Minn.	Jan. 8
Jan. 26.	Redwood Falls, Minn.	Jan. 8
Jan. 25.	Forest Park, Ill.	Jan. 15
Jan. 26.	Shelby, N. C.	Dec. 18
Jan. 26.	Toronto, Ont.	Jan. 8
Jan. 27.	Ellensburg, Wash.	Dec. 18
Jan. 27.	Sugar Grove, Ohio	Jan. 15
Jan. 28.	Washington, Iowa	Dec. 25
Jan. 28.	Yonkers, N. Y. Adv. Jan. 8, 15.	Jan. 8
Jan. 28.	Aberdeen, S. D.	Jan. 8
Jan. 31.	Key West, Fla. Adv. Jan. 1, 8.	Jan. 1
Jan. 31.	Delaware, Ohio	Jan. 1
Jan. 31.	Windsor, Ont.	Jan. 8
Jan. 31.	Kilbourne, Ohio	Jan. 15
Jan. 31.	San Bernardino, Cal.	Jan. 15
Feb. 1.	Oneida, Iowa	Dec. 18
Feb. 1.	George West, Tex.	Dec. 18
Feb. 1.	Union Grove, Wis.	Jan. 15
Feb. 5.	Stoutsville, Ohio	Jan. 15
Feb. 7.	Sioux City, Iowa	Dec. 25
Feb. 15.	Boston, Mass.	Jan. 15
Feb. 25.	Ebensburg, Pa.	Jan. 8
Mar. 9.	Los Angeles, Cal.	Jan. 15

PRIVATE BUILDINGS.

Bids Close.		See Eng. Record.
Jan. 20.	Miami, Fla.	Jan. 15
Jan. 22.	Glasgow, Mont.	Jan. 15
Jan. 26.	Yonkers, N. Y.	Jan. 8
Jan. 26.	Cresco, Iowa	Jan. 8
Feb. 1.	Poland, Me.	Jan. 15
Feb. 15.	Britt, Iowa	Jan. 1
Apr. 1.	Cleveland, Ohio	Jan. 8

MISCELLANEOUS.

Bids Close.		See Eng. Record.
Jan. 18.	Cement tank, Louisville, Ky.	Dec. 25
Jan. 18.	Garbage Disposal, New York, N. Y. Adv. Dec. 25 to Jan. 8.	Dec. 25
Jan. 18.	Heating Building, Farmingdale, N. Y. Adv. Jan. 15.	Jan. 15
Jan. 18.	Cement, Saginaw, Mich.	Jan. 15
Jan. 19.	Garbage Incinerator, Edgwood, Pa.	Dec. 25
Jan. 19.	Removal of Wreck, San Francisco, Cal.	Jan. 1
Jan. 22.	Lumber, Chicago, Ill.	Jan. 15
Jan. 24.	Boilers, West Point, N. Y. Adv. Dec. 25 to Jan. 15.	Dec. 25
Jan. 25.	Elevator, Lawton, Okla.	Jan. 8
Jan. 25.	Elevator, McCook, Neb.	Jan. 15
Jan. 27.	Barge, Dallas, Tex. Adv. Jan. 1 to 15.	Jan. 1
Feb. 1.	Street Cars, Toronto, Ont.	Jan. 15
Feb. 3.	Monument Work, Havana Adv. Jan. 15.	Jan. 15
Feb. 8.	Sprinkler, Fergus Falls, Minn.	Jan. 8
Feb. 11.	Locomotives for Sale, Panama Adv. Jan. 1.	Jan. 1
Feb. 11.	Stokers, St. Louis, Mo. Adv. Jan. 15.	Jan. 15
Feb. 23.	Castings, Etc., Panama Adv. Jan. 15.	Jan. 15
Apr. 1.	Memorial, Fort McHenry, (P. O. Baltimore, Md.)	Nov. 20
———	Grading, Cincinnati, Ohio Adv. Jan. 8.	Jan. 8

SEARCHLIGHT SECTION

Official Proposal Announcements

Price, $2.40 an inch.—Copy can be received until Thursday 10 a. m. for issue mailed the next morning

Bids open February 2, 1916.

SINGLE LEAF DECK STRAUSS TRUNNION BASCULE BRIDGE OVER THE SAUGATUCK RIVER

WESTPORT, CONN.

Sealed proposals will be received by the State Highway Commissioner, Room 27, Capitol, Hartford, Conn., until 2 p. m., Wednesday, February 2, 1916, for the construction of a Single Leaf Deck Strauss Trunnion Bascule Bridge over the channel of the Saugatuck River, Westport, Conn.

The work consists of furnishing, fabricating and erecting complete, ready for operation and traffic, the superstructure of a Single Leaf Deck Strauss Trunnion Bascule Bridge. This work is in connection with the construction of a reinforced concrete girder bridge which is now under construction. All work in connection with the construction of the substructure for the lift bridge will be performed by the general bridge contractor. The lift bridge will span a clear channel 50 feet in width and have a roadway 33 feet wide with two sidewalks each 6 feet wide.

Complete specifications and plans may be seen at the office of the State Highway Commissioner, Capitol, Hartford, Conn. Contractors may obtain complete sets of plans and specifications for Five Dollars per set upon application to the State Highway Commissioner. This deposit of Five Dollars will be refunded upon return of plans and specifications in good condition.

In consideration of the bids previous to the award of the contract the length of time required to complete the field work will be figured in addition to the prices submitted, on the basis of Twenty-five dollars per day for each working day specified in the proposal. No rebate will be allowed for the completion of the work before the time limit specified.

All bids must be accompanied by surety company bond or certified check for not less than one-third of the cost of the work. Contractors will be required to furnish satisfactory evidence of their experience in doing similar work and their ability to finance the work, and any bidder to whom the contract has been awarded refusing to sign the contract at the prices offered, and furnish a surety company bond, or a certified check in one-third of the amount of the work, shall forfeit from his bond or check a sum equal to the difference in price between his bid and the next highest bidder.

The State Highway Commissioner reserves the right to reject any or all proposals.

Dated at Hartford, Conn., January 5, 1916.

CHARLES J. BENNETT,
State Highway Commissioner.

Bids open January 20, 1916.

NOTICE TO BRIDGE DEALERS

FORT BENTON, MONT.

Notice is hereby given that Chouteau County, Montana, will receive sealed bids for steel for a single span steel bridge 180 ft. in length, for which plans and specifications are on file in the office of the County Surveyor of said County, at Fort Benton, Mont., and also at the offices of Engineering Record, in New York, Chicago, Philadelphia, Cleveland, Denver and San Francisco. Bids to be marked "Bid on Teton River Bridge" and accompanied by certified check for 15 per cent of bid, and to be filed with the County Surveyor and opened January 20, 1916.

GRADING TO SUBLET

Wanted: To sublet 27,000 yards of grading in Eastern Ohio. Steam shovel and roller, dump wagons and wheel scrapers on the work that a contractor can use. He must furnish bond. Address 302 Provident Bank Bldg., Cincinnati, Ohio.

Bids open January 27, 1916.

NOTICE TO BRIDGE CONTRACTORS

Contract to furnish material and labor and to make repairs to the bridge across the Chattahoochee River, between Fulton and Cobb counties, at Mason and Turner's Ferry Road, about seven miles from Atlanta, and about fifteen miles from Marietta, will be let to the lowest bidder, at public outcry, at the bridge site, at 11 a. m. on January 27, 1916.

Bids will be received on two plans, as per plans and specifications therefor now on file in the offices of the Commissioners of Roads and Revenues of Fulton and Cobb counties, and approved by order of such commissioners. Said plans and specifications being the same as prepared by Wm. C. Spiker, Consulting Engineer, 1127 Candler Building, Atlanta, Ga., and dated December 18, 1915. Plan for "concrete approaches" as per the foregoing, consists of one approach at each end of present bridge; each approach is to be 75 ft. long, with a 20-ft. clearway, and to consist of two concrete spans carried on concrete piers; at the end of the approach away from the bridge there will be a re-enforced concrete abutment and wing-walls. The plan for "steel approaches" consists of one approach at each end of the present steel bridge; each approach is to be 75 ft. long, with a 20-ft. clear roadway carried on four spans, supported on steel bents resting on concrete foundations. At the end of each approach away from the bridge there will be a re-enforced concrete abutment and wing-walls. Plans, specifications, form of contract and bond may be had from Consulting Engineer William C. Spiker, 1127 Candler Bldg., Atlanta, Ga., and are on file in the office of the Clerk of the Board of Commissioners of Roads and Revenues of Cobb County, at Marietta, Ga., and at the office of the Clerk of the Board of Commissioners Roads and Revenues of Fulton County, at the Courthouse in Atlanta, Ga. The estimated cost of such work being $4,500.

Payments for work and material will be made in cash on the 10th day of each month for the value of the completed work, upon the first Tuesday of each month, for ninety per cent of such completed work as estimated by the supervising engineer as provided in the specifications; the balance upon completion and acceptance of the work. Each county to be responsible only for its pro rata share as agreed between them.

The successful bidder to give bond in the sum of double the amount of the bid, as set forth in the specifications.

The two lowest bidders under each plan must immediately upon completion of the bidding file with the said authorities of Fulton and Cobb counties the formal bid and certified check in the amount of five hundred dollars ($500), payable to them, said checks to be certified by some bank in Atlanta or Marietta, Ga., as a guarantee that the bidder, if awarded the contract, will, within six days after said award, file his bond and execute the contract in accordance with the said bid. On his failure to so execute said bond and contract, said checks to be forfeited to said counties as damages. The right is reserved to reject any and all bids.

S. B. TURMAN,
Chairman Board of Commissioners of Roads and Revenues of Fulton County.
R. D. MOON,
Chairman Board of Commissioners of Roads and Revenues of Cobb County.
WILLIAM C. SPIKER,
Consulting Engineer,
Atlanta, Ga.

Bids open January 31, 1916.

FILTRATION STRUCTURE FOR BOARD OF PUBLIC WORKS

CITY OF OSHKOSH, WIS.

Sealed proposals will be received by the Board of Public Works of the City of Oshkosh, in the City Hall, until 2 o'clock P. M. of January 31, 1916, for providing all tools, material, labor and facilities to properly construct Filtration Structure at the Municipal Pumping Station, situated on the west shore of Lake Winnebago, between Washington and Merritt Streets, City of Oshkosh, in accordance with the terms and conditions of forms of Contract and Bond, and Specifications and Plans on file in the office of the Board of Public Works, City Hall, of said City.

Proposals must be made out upon printed forms furnished by the City at said office, and be addressed to the Board of Public Works, City of Oshkosh, with the following legend appearing on address side of envelope: "Proposals for Filtration Structure."

The City of Oshkosh desires to have constructed a Filtration Plant and has divided the contract work required into Four (4) sections or parts, of which this is No. 1. Bidders may submit proposals to do work required on any section or part, or on the construction of the Filtration Plant complete.

Applications for Specifications and Plans must be addressed to the Board of Public Works of the City of Oshkosh and be accompanied by a check made payable to the order of the Board of Public Works in the sum of Fifty Dollars ($50.00) to be deposited with the City pending return of Specifications and Plans aforesaid by the applicant to the City and to be retained by the City should the applicant fail to return such prior to February 7, 1916.

Each bidder must enclose with his proposal a certified check for Three Thousand Dollars ($3,000.00) on some responsible bank located and doing business in the City of Oshkosh, and made payable to the order of the Board of Public Works.

The Board of Public Works reserves the right to reject any or all bids.

R. A. HOLLISTER,
HENRY T. HAGENE,
GEORGE H. RANDALL.
FRED HEINTZ,
Board of Public Works.
Oshkosh, Wis., December 22, 1915.

Bids open February 3, 1916.

COMMERCE ST. VIADUCT

DALLAS, TEX.

The County Auditor of Dallas County, Texas, will receive sealed bids until 2 o'clock p. m., Thursday, February 3, 1916, for the construction of "Commerce Street Viaduct" across Trinity River, as per plans and specifications prepared by J. F. Witt, engineer. The electrical wiring, electrical fixtures, light standards, the paving and the earth embankment are not included in this bid and other bids will be asked for this work. Plans and specifications may be obtained from J. F. Witt, engineer, Court House, Dallas, Tex., upon a deposit of ten ($10.00) dollars, refundable upon return of same. This work to be paid for in cash. Cashier's check in the sum of six thousand ($6,000.00) dollars, payable to order of Quentin D. Corley, County Judge, must accompany each bid. All bids must be sealed addressed to Chas. E. Gross, County Auditor, Dallas, Tex., and marked "Sealed Bids Commerce Street Viaduct." The Commissioners' Court reserves the right to reject any or all bids.

CHAS. E. GROSS,
County Auditor.

Bids open January 28, 1916.

NOTICE TO CONTRACTORS

ARMORY AND FITTINGS

YONKERS, N. Y.

Sealed proposals for Construction, Heating, Plumbing and Drainage and Electric Work of Armory for Company "G," 10th Infantry, N. G. N. Y., Yonkers, N. Y., will be received by Col. Franklin W. Ward, Secretary, State Board of Armory Commissioners, 158 State Street, Albany, N. Y., until 2:30 o'clock P. M. on Friday, January 28, 1916, when they will be publicly opened and read. Proposals shall be enclosed in an envelope furnished by the State Architect, sealed and addressed, and shall be accompanied by certified checks in the following amounts: Construction Work, Proposal No. 1, $3,700.00, and Proposal No. 2, $3,700.00 (if contractor submits bid for both Proposal No. 1 and Proposal No. 2, one check for $3,700.00 will be deemed sufficient); Heating Work, $350.00; Plumbing, $250.00, and Electric Work, $150.00. The contractors to whom the awards are made will be required to furnish surety company bond in the sum of fifty per cent (50%) of the amount of contract and in accordance with the terms of specifications Nos. 2342, 2365, 2366 and 2367. The right is reserved to reject any or all bids. Drawings and specifications may be consulted at the Department of Architecture, Capitol, Albany, N. Y., and at the New York Office of the Department of Architecture, Room 1224, Woolworth Building. Drawings and specifications and blank forms of proposal may be obtained at the Department of Architecture, Capitol, Albany, N. Y., upon the deposit of a certified check in the sum of $10, made payable to the State of New York for each set of plans and specifications, which check will be returned if plans and specifications are sent back in good condition to the State Architect, Lewis F. Pilcher, Capitol, Albany, N. Y.

December 29, 1915.

Bids open January 31, 1916.

ELEVATED TANK FOR BOARD OF PUBLIC WORKS

CITY OF OSHKOSH, WIS.

Sealed proposals will be received by the Board of Public Works of the City of Oshkosh, in the City Hall, until 2 o'clock p. m. of January 31, 1916, for providing all tools, material, labor and facilities to properly construct an Elevated Tank at the Municipal Pumping Station, situated on the west shore of Lake Winnebago, between Washington and Merritt Streets; City of Oshkosh, in accordance with the terms and conditions of forms of Contract and Bond and Specifications and Plans on file in the office of the Board of Public Works, City Hall, of said city.

Proposals must be made out upon printed forms furnished by the City at said office, and be addressed to the Board of Public Works, City of Oshkosh, with the following legend appearing on address side of envelope: "Proposal for an Elevated Tank."

The City of Oshkosh desires to have constructed a Filtration Plant and has divided the contract work required into Four (4) sections or parts, of which this is No. 3. Bidders may submit proposals to do work required on any section or part, or on the construction of the Filtration Plant complete.

Each bidder must inclose with his proposal a certified check for Four Hundred Dollars ($400.00) on some responsible bank located and doing business in the City of Oshkosh and made payable to the order of the Board of Public Works.

The Board of Public Works reserves the right to reject any or all bids.

R. A. HOLLISTER,
HENRY T. HAGENE,
GEORGE H. RANDALL,
FRED HEINTZ,
Board of Public Works.
Oshkosh, Wis., December 22, 1915.

CONTRACTING NEWS

Of Special Interest to Engineers, Contractors, Builders and Manufacturers of Engineering and Building Supplies

BUILDING OPERATIONS for 1915, gaged by permits issued in seventy-two cities, show a 5 per cent gain over 1914. While the first seven months show large losses compared with 1914, the last five show progressive gains of 14, 32, 42, 75 and 84 per cent, the December filings being the largest of the year. The gain over 1914 was due as much to the falling off in the first months of the war as to the spurt during the past fall; but the fact remains that plan filings have returned to normal, and that building conditions are much improved. That the rising prices of materials will affect building adversely is feared by dealers in some quarters, and measures are being considered, especially in the East, to keep prices down. The high price of steel, however, did not prevent fabricating shops from booking orders for structural steel equal to 121 per cent of capacity in December, according to the Bridge Builders and Structural Society. Unfilled orders of the U. S. Steel Corporation showed a gain of 616,733 tons for the month of December, which is remarkable considering the falling off that usually results from the holidays. Unfilled orders now total 7,806,222 tons, the largest since January, 1913, exceeded only by two periods in the history of the corporation, and within last month's gain in unfilled orders of the record of December, 1906.

Buildings

Building work reported last week shows a still further improvement in volume. Bids opened for an addition to a hospital at Providence, R. I., totaled $268,000. A $350,000 contract for erecting a theater building has been awarded at Philadelphia. The court house to be built at Durham, N. C., has been awarded at a total of $256,500. A $320,000 addition to a Cleveland hotel has been contracted for. The lowest bid received for the reinforced-concrete elevator at New Orleans was $713,000. The lowest bid received for erecting the hotel at Ottumwa, Iowa, was $175,000. A college building contracted for Grinnell, Iowa, will cost $106,000. An office building to cost $150,000 has been contracted for at Seattle.

Bids are desired for erecting a $300,000 library at Boston, for erecting a jail and court house to cost the same sum of money at Wilmington, Ohio, for constructing school buildings to cost $210,000 at Portland, Ore., and for building a $275,000 club at Seattle. Plans have been filed in New York City for a $750,000 apartment house and a $300,000 store. Plans are being prepared for a $1,000,000 motion-picture plant at Corona, L. I. A $300,000 college building, a $350,000 school and a $300,000 factory are being planned or considered at Syracuse, N. Y. The sum of $300,000 is to be spent for building improvements to the college at Elmira, N. Y. Plans are being prepared for a $250,000 addition to a manufacturing plant at Tonawanda, N. Y. It is reported that a steel plant to contain two large electric furnaces will be built at Apollo, Pa. Preliminary plans for the $265,000 post office to be built at Columbia, S. C., have been made. Plans have been completed at Dawson Springs, Ky., for a $400,000 hotel. A $1,000,000 cold storage warehouse is to be built at Cleveland. Schools to be built at Dayton, Ohio, will cost $330,000. The construction of a $1,000,000 tannery is being considered at St. Louis. Plans are being prepared for a $200,000 court house at Boone, Iowa. A contract is soon to be let for a $500,000 hospital building in San Francisco.

Bridges and Roads

The Erie Railroad has awarded the contract for a 1500-ton steel bridge over the Susquehanna River at Susquehanna, N. Y. The Chicago, Burlington & Quincy Railroad has awarded contracts for 3400 tons of steel bridges. A $90,000 highway bridge has been contracted for by the California Highway Commission. Bids for constructing a 285-ft. reinforced-concrete bridge are desired at Iowa City, Iowa. It is reported that bids will be received February 8th for constructing a 490-ft. bridge at Newport, Wash. Bids are desired for another bridge at Seattle, to cost $300,000. A survey for a $600,000 viaduct has been ordered at Richmond, Va. Plans are to be prepared for reconstructing the Superior Avenue viaduct in Cleveland, at a cost of $500,000. The widening of a bridge at Akron, Ohio, at a cost of $100,000 is being considered. Plans for a $220,000 viaduct have been approved at Kansas City, Mo. A 700-ft. steel bridge is to be contracted for soon at Schuyler, Neb. Santa Barbara, Cal., has sold $500,000 bridge bonds.

Several additional highway contracts have been awarded by the State of Connecticut. Concrete paving to cost $59,000 has been contracted for at Huntington, Cal. Bids are desired at Rock Island, Ill., for paving work to cost $74,000. It is reported that road work to cost $100,000 will be let February 20 at Tacoma, Wash. Paving work to cost at least $500,000 is to be undertaken this year at Baltimore. State and county road and bridge work to cost $3,800,000 is to be undertaken this year in Alabama. Paving work to cost $350,000 will be let in March at Vincennes, Ind. Road improvements contemplated in the State of Arizona will cost $2,500,000 in addition to the construction of the $300,000 highway system at Tucson. A number of road bond issues have been sold, including $400,000 at Greenville, S. C., $219,000 at Claremore, Okla., $350,000 at Globe, Ariz., and $500,000 Bakersfield, Cal.

Waterworks and Sewers

The construction of the Woodward reservoir at Manteca, Cal., has been contracted for at $165,000. Water bonds amounting to $85,000 have been sold at Wardsworth, Ohio. An ordinance providing $60,000 for the extension of waterworks is before the city counsel of Dayton, Ohio. Waterworks bonds, amounting to $64,000 are to be sold at Athens, Ohio. Waterworks improvements for which $80,000 is available are being considered at Walla Walla, Wash. The construction of a $60,000 pipe line is being considered at Los Angeles.

Bids will be opened March 14 for constructing the sedimentation basin for the Passaic sewer on the Newark (N. J.) meadows. The work involves 68,000 cu. yd. of concrete. Bids will be opened for constructing a sewer system and disposal plant at Liberal, Kan. The construction of a sewage disposal plant has been recommended at Elmira, N. Y. Lexington, Ky., will sell $350,000 sewage bonds Jan. 24. Sewer and paving work to be undertaken this year in Cleveland will cost $1,500,000 and the removal of sewers in connection with grade crossing work will cost $60,000. Sewers and a disposal plant to be built at Lakewood, Ohio, will cost $185,000. Sewer work to cost $105,000 is to be contracted for at Vincennes, Ind. Two trunk sewers to be built at Billings, Mont., will cost $70,000. The construction of a $160,000 sewer system is being considered at Watts, Cal.

Miscellaneous

The contract for the Fourteenth Street eastern tunnel has been awarded in New York City at $6,689,000. Another rapid transit contract in the same city has been awarded at $1,237,000 by the New York Municipal Railway Corporation. A coal dock to cost $100,000 has been contracted for at Duluth. Bids will be opened Feb. 16 at Albany, N. Y., for constructing the Erie Canal lock and dam at May's Point and for completing a 12-mile section of the Erie Canal. The annual budget of Richmond, Va., includes $1,000,000 for improving Shockoe Creek. The city of Cleveland is ready to take up the elimination of grade crossings for which $1,600,000 was voted last November. The entire improvement will cost $4,550,000. Harbor improvement bonds amounting to $200,000 have been sold at Houston, Tex. Victoria, Tex., has sold $146,000 drainage bonds. An open cut through Bunker Hill being considered at Los Angeles will cost $4,000,000. A $6,000,000 reservoir is being planned at Fresno, Cal.

WATERWORKS

PROPOSED WORK.

Pass Christian, Miss.—Election to be held Jan. 31 to vote on municipal waterworks costing $45,000; also street improvements costing $30,000. X. A. Kramer, Engineer, Magnolia, Miss.; W. A. Terrell, City Clerk.

Lenox, Mass.—Directors of Lenox Water Company report in favor of constructing a second reservoir on Richmond Mountain water shed.

Collinsville, Conn.—City of Hartford will let contract this spring for constructing a municipal filter plant here to have maximum capacity of 300,000 gal. per day, pressure type. C. M. Saville, Chief Engineer Water Board, 702 Pilgard Building, Hartford.

Keansburg, N. J.—Raritan Township Committee, Keyport, is reported to have granted a franchise to People's Water Company for a water system in Keansburg.

Philadelphia, Pa.—The rebuilding of the old Fairmount dam is under consideration by the Park Commission, also the building of a steel ornamental footbridge across the river at the dam to connect the old mansion with the west bank of the river.

Richmond, Va.—See "Hydraulic Construction and River Improvements."

Buckhannon, W. Va.—City is considering establishing a high pressure water system.

Savannah, Ga.—R. B. Dole, Government Engineer, submitted a report to the Mayor recommending improvements to the water works, including construction of filtration plant; probable cost $240,000.

Brooksville, Fla.—City Council reported to be considering the construction of water works.

Key West, Fla.—Franchise granted to John J. Quinn & Company, Key West, to construct a water works in this city.

Oakdale, La.—Plans and specifications being prepared by Xavier A. Kramer, Magnolia, Miss., for municipal water works to cost $25,000. R. E. L. Ricjetts, Secy Water Works Committee.

Bucyrus, Ohio.—W. J. Sherman Engineering Company, Toledo, estimates cost of constructing a municipal water works at $590,000, and the purchase of the present plant of the Bucyrus Development Company and improving same at $588,000.

Athens, Ohio.—Water works improvement bonds for $64,000 will be sold Feb. 19, by C. W. Gross, City Aud.

Canton, Ohio.—Mayor in his annual message recommends immediate steps for improvements to the waterworks.

Dayton, Ohio.—Council has passed on first reading ordinance providing $60,000 bonds for extension of water works and $15,000 bonds for purchase of new meters.

Wadsworth, Ohio.—Water works and electric light bonds amounting to $85,000 have been sold.

Bicknell, Ind.—George W. Sturtevant, 38 S. Dearborn Street, Chicago, Ill., will finance and build a water works system for this city to be leased to the city.

Orleans, Ind.—Orleans Water Company incorporated and will construct water works here. Water is to be derived from driven wells. J. B. Marvin of Frankfort, engineer in charge, and will superintend construction.

Decatur, Ill.—Council considering water mains in territory north of Grand Avenue and west of Monroe Street, extending north to Sawyer Street; estimated to cost $11,257.

Kewanee, Ill.—Election to be held before March 1 to issue $70,000 bonds for water works improvements, said bonds sold conditionally on election carrying. H. G. Stokes, City Engineer.

Denmark, Wis.—W. G. Kirchoffer of Madison engaged by Village Trustees to prepare plans and specifications for water and sewer system.

Minneapolis, Minn.—See "Paving and Roads."

McPherson, Kan.—Improvements contemplated to the municipal waterworks and electric light plant. Arthur Groesbeck, Mgr.

Washington, Mo.—It is proposed to issue $60,000 bonds for extending waterworks. Address H. A. Krog, City Attorney.

Hartford, Ark.—Benham Engineering Co., Oklahoma City, Okla., engaged to prepare plans for the proposed water works and electric light plant.

Galveston, Tex.—Committee of Engineers appoined by Mayor to report on water works system at Alta Loma with a view to recommending advisability of installing an air compressor, recommend that bids be asked for four wells each producing 1,000,000 gallons daily, and also for a guaranteed supply of 4,000,000 gallons daily, regardless of the number of wells; also that a steam driven generating unit of high efficiency be installed. The wells, pumps and motors to cost $28,000 and the pipes, electrical equipment and other necessary equipment to increase supply $15,000 additional.

Houston, Tex.—City will soon issue $100,000 bonds to be used as follows: $36,000 for constructing North Main Street auxiliary water plant; $30,000 for Milan Street Bridge across Buffalo Bayou, and $34,000 for street paving.

In annual report of Dave Fitzgerald,

Water Commissioner, the construction of two pumping stations this year having a capacity of 37,000,000 gal. daily is recommended.

Oklahoma City, Okla.—Election soon to be held to vote bonds for constructing a new water works system, plans for which are about completed.

Fort Sumner, N. M.—Plans reported being prepared for water works and an electric light plant. Address City Clerk.

Colville, Wash.—Contract will be let about Feb. 15, by city for constructing a concrete dam, 3 miles of 10 and 12-in. pipe line, and a concrete reservoir, 120 ft. x 120 ft. x 12 ft.; cost $20,000. Samper Brothers, Engrs., Spokane, Wash.

Seattle, Wash.—Water mains to be laid in Dexter Avenue require 5060 lin. ft. 20-in. pipe, 16 hydrants and 4 26-in. gates. Address Board Public Works.

Mayor Gill is reported in favor of constructing a steel and concrete aqueduct from Landsburg to Seattle, and providing for more storage reservoirs for Seattle.

Walla, Walla, Wash.—City Commissioners considering improvements to the water works. A new reservoir also extending pipe line a distance of five miles into Wenaha Forest Reserve are being considered. About $80,000 bonds are available.

North Bend, Ore.—State Public Service Commission has directed Coos Bay Water Company to construct a reservoir of minimum storage capacity of 250,000 gals. in connection with the local water system.

Eagle Rock, Cal.—Committee appointed to investigate municipal water works.

Norwalk, Cal. — Water works bonds amounting to $15,000 have been sold.

Fullerton, Cal.—Reported Yorba Linda Water Company of Fullerton will spend about $10,000 for covering reservoir, new pipe line and for a pumping unit.

Los Angeles, Cal.—Public Service Commission contemplates constructing a pipe line from Garvanza to connect with distribution system serving Bairdstown, Sierra Vista and Rose Hill sections. William Mulholland, Chief Engineer, estimates cost at $60,903.

Santa Maria, Cal.—City Trustees reported considering the purchase of the plant of the Domestic Water Co.

Tropico, Cal.—Election will probably be held to vote $75,000 bonds for constructing water works and lighting system. George B. Adams, Hydraulic Engineer, 235 El Bonita Avenue, estimates cost as follows: reservoir, $7,484; c. i. pipe line, $21,395 (riveted steel pipe, $12,194); pipe line from diverting box, $6,864.

Yorba Linda, Cal.—Directors of the Yorba Linda Water Company will install a pumping unit, pipe lines and reservoir cover at a cost of $20,000.

Casa Grande, Ariz.—Election soon to be held to vote $35,000 bonds for water works, electric light and ice plant. Sidney Masbir, Engineer, Tucson.

Salt Lake City, Utah.—Water works and sewer bonds amounting to $300,000 will be sold Feb. 1 by City Recorder.

Ottawa, Ont.—Contract will be let last of February for furnishing water works supplies, including brass work, valves, pipe, etc. R. R. Haycock, Waterworks Engr.

BIDS DESIRED.

Lewiston, N. Y.—Until Feb. 15 by Board Water & Light Commissioners (F. E. Guard, Clerk) for furnishing material and constructing improvements to water works, advertised in Engineering Record. A. O. Peabody, Engineer of Board.

New Brunswick, N. J.—Until Feb. 1 by City Commissioners for turbo centrifugal pumps, advertised in Engineering Record. Edward F. Farrington, Director Department Public Affairs; Asher Atchison, City Engineer.

Washington, D. C.—Until Feb. 1, by Bureau Supplies and Accounts, Navy Dept., Washington, D. C., for pipe fittings, wrought pipe, railroad material, steel, etc., at the Navy Yard.

Dunedin, Fla.—Until Feb. 4, for constructing a city dock; cost, $4,800; water works, cost, $6,000; sanitary sewer and disposal plant, $5,500; brick paving, storm drains, etc., cost, $26,000. Joseph N. Drew, Engineer, Clearwater.

Camden, Ala.—Until Feb. 9 by Edgar B. Kay, Engineer, Tuscaloosa, for water works, consisting of 80,000-gal. steel tower and tank, 80,000-gal. reinforced concrete tank pumps, fire hydrants, c.-i. pipe, valves, distribution system, etc; cost $15,500.

Ligonier, Ind.—Reported desired until Jan. 27 for extending water mains in North, Main North and Chatham Streets.

Viola, Ill.—Until Feb. 14, by B. D. Baxter, Pres. Board Trustees, for water works advertised in Engineering Record. Terhune & Horton, Engrs., 401 Central Natl. Bank Bldg., Peoria.

Arcadia, Iowa.—Until Feb. 8 by E. C. Mohr, Town Clerk, for furnishing material and constructing water works, advertised in Engineering Record. Lawrence W. Cox, Engineer, Des Moines.

Coffeyville, Kan.—Until Jan. 28 (readvertisement), by H. H. Denkler, City Clk., Coffeyville, for equipment for water works. Carl E. Stronquist, Supt. Water & Light Dept.

Plains, Kan.—Reported desired until Feb. 3 for constructing water works; probable cost $12,000 .

Roundup, Mont.—Reported desired until Jan. 25 for 12,675 lin. ft. 6 and 4-in. c.-i. pipe, 15 hydrants, etc. Claude A. Renshaw, City Engr.

Thermopolis, Wyo.—Until Jan. 31, by A. J. Lowrey, Town Clerk, for water works.

McCammon, Idaho.—Reported desired until Feb. 22 by E. W. Riede, Village Clk., for constructing water works, to consist of 4700 ft. 48-in. pipe wells, steel car and tank; probable cost $22,000. Cotton & Wilson, Engrs., Idaho Falls, Idaho.

Ottawa, Ont.—Until Jan. 24 by Secretary Water Works Committee, Ottawa, addressed to Chairman, for c.-i. pipe. R. L. Haycock, Acting Water Works Engineer.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Danville, Pa.**—Contract for a reinforced concrete rapid sand filter of 300,000 gal. capacity awarded American Water Softener Company, Philadelphia, Pa. (Bids opened Jan. 10 by Water Commissioner.) Chester & Fleming, Engineers, Pittsburgh.

★**Jacksonville, Fla.**—Contract awarded United States Iron Pipe & Foundry Company of Memphis, Tenn., for the iron water pipe for the high pressure line on East Bay Street.

★**Chicago, Ill.**—Contract for furnishing water pipe 12, 24 and 48 in. 11,325 tons awarded U. S. C. I. Pipe & Foundry Company, 122 South Michigan Ave., at $27.75 per ton; total, $314,269. Contract awarded Glamorgan Pipe Company, 209 S. LaSalle Street, for furnishing 7500 tons c.-i. pipe at $26.85 per ton.

★**Chanute, Kan.** — Contract awarded Merkle-Hines Machine Co., Kansas City, Mo., for low service pump direct connected to electric motor (bids opened Jan. 11), at $19,200. C. G. Wood, City Clerk.

★**Fullerton, Cal.** — Contract awarded Western Reinforced Concrete Pipe Co., 1611 East Sixth Street, Los Angeles, by Anaheim Union Water Co. for a 535-ft. concrete pipe inverted siphon, 60 in. diameter, to replace flume.

★**Los Angeles, Cal.**—Contract for riveted steel pipe for Water Dist. No. 3 in San Fernando Valley, awarded Llewellyn Iron Works, Los Angeles, at $159,800 for 2456 tons 30 to 52 in. and to Lacy Mfg. Company, Los Angeles, at $109,681 for 1350 tons 12 in. to 20 in.

★**Manteca, Cal.**—Following are four lowest totals (bids opened Jan. 6 by C. A. Proudfit, Secretary, South San Joaquin Irrigation Dist.) for constructing Woodward reservoir: Keystone Construction & Log Co., Portland, Ore., $165,410 (awarded contract); Blake Bros., Oakland, $173,300; Seabury B. Peterson, San Francisco, $174,375, and McCaran & Peterson, San Francisco, $189,662.

SEWERAGE AND SEWAGE DISPOSAL

PROPOSED WORK.

Boston, Mass.—Mayor has ordered constructing of sewers in Almont Street, Dorchester, at a cost of $65,000.

Lenox Dale, Mass.—Selectmen of Lenox have been petitioned to construct a sewer system in Lenox Dale at a cost of about $20,000.

Westfield, Mass.—City Engineer John L. Hyde, in his annual report, recommends the construction of sewers in various streets; also drains in other streets; an 8-in. water main in Meadow Street and a 6-in. main in Lloyds Hill; also increasing the water storage capacity; also widening and extension of White Street and other streets.

Elmira, N. Y.—Water Board is reported to have recommended to the Common Council the constructing of a sewage disposal plant.

Ocean Beach, L. I., N. Y.—Property owners of Ocean Beach have petitioned the Town Trustees at Islip to construct a sewer system for the beach, costing $30,000.

New Brunswick, N. J.—State Department of Health, Trenton, has approved the plans for the sewage disposal plant to be constructed at Rockefeller Institute, near New Brunswick.

Wilkes-Barre, Pa.—City Engineer directed to prepare plans and specifications for a municipal sewage disposal plant as required by the State Board of Health.

Richmond, Va.—See "Hydraulic Construction and River Improvements."

Greensboro, N. C.—Sewer bonds amounting to $25,000 and paving bonds $50,000 will be sold soon by City Commissioners.

Mount Olive, N. C.—Construction of a sewerage system is reported under consideration. Cost $17,000. Address City Commissioners.

Atlanta, Ga.—Finance Committee has voted $25,000 for the completion of the Highland Avenue sewer.

Lexington, Ky.—Sewer bonds for $350,000 will be sold Jan. 24 by Frank G. Ott, Commissioner of Public Finance.

Cleveland, Ohio.—Robert Hoffman, City Engineer, is preparing schedule for sewer and paving work for next summer. He estimates the total expense for the work at $1,500,000, including city and property owners' cost.

Cleveland, Ohio.—Robert Hoffman, City Engineering Commissioner, will soon let contracts for removal of sewers under 25 street crossings of Nickel Plate R.R., where road is about to abolish its grade crossings; cost estimated at about $60,000.

Dayton, Ohio.—Plans being prepared by F. J. Cellarius, Dayton, for the Mount Auburn Sewer District No. 1, which the County Commissioners have established for Harrison Township along the Salem Turnpike. There will be three main sewers with necessary laterals.

Lakewood, Ohio.—Council authorized a bond issue of $185,000 for constructing sewers and sewage disposal plant. N. C. Cotabish, Director Public Works.

Kendallville, Ind.—Plans, specifications and estimates of the cost of constructing the west side and south side sewers have been submitted to the Common Council by Willis Sawyer, City Engineer; cost $39,000.

Vincennes, Ind.—Contract will be let about January for constructing sewers costing $105,000. H. T. Watts, City Engineer.

Detroit, Mich.—Clarence W. Hubbell, Consulting Engineer, has about completed his report on the pollution of the Detroit River by sewage, and will recommend the formation of a sanitary district comprising the territory between Macomb County line and Trenton with a commissioner to supervise all matters pertaining to sewage disposal and water works.

Grosse Pointe, Mich.—Council considering constructing a sewerage system and disposal plant. Address Village Clerk.

Port Huron, Mich.—Engineers of the International Waterways Commission recommend constructing an intercepting sewerage system in this city.

Pontiac, Ill.—Election soon to be held to vote $20,000 bonds for constructing a purification plant in connection with the municipal sewerage system.

Oskaloosa, Iowa.—State Board of Health, Des Moines, has approved the sewage disposal project contemplated in this city. Horace Hawkins, City Engineer. Black & Veach, Kansas City, Consulting Engineers.

Minneapolis, Kan.—City Council considering establishing a sewer district north of Fifth Street and west of Rock Street. A. D. Todd, City Clerk.

Neodesha, Kan.—Plans completed by Black & Veach, Interstate Building, Kansas City, Mo., for the sewer system and contract will soon be let. Address J. J. Carroll, City Clerk.

Osborne, Kan. — Plans completed by Black & Veach, Kansas City, Mo., for a storm sewer, curbing and guttering for the city; vitrified clay pipe, 12 to 36-in., will be laid. S. P. Crampton, City Clerk.

Billings, Mont.—City Council Jan. 4 passed resolution to create Special Improvement Dist. providing for construction of a trunk sewer in Second Avenue, North, from North Fifteenth Street to North Twenty-second Street, at a cost of $35,300, and a trunk sewer in Second Avenue North from North Twenty-second to North Twenty-sixth Street, to cost $35,000; objections are to be heard Feb. 1. E. S. Judd, City Clerk.

Belton, Tex.—Sewer bonds amounting to $40,000 have been voted.

Galveston, Tex.—Reported City Commissioners considering constructing a sewage disposal plant.

Houston, Tex.—See "Hydraulic Construction and River Improvements."

Batesville, Okla.—Sewer District No. 3 has been formed, and it is reported a sewer system is to be constructed at once. Address Secretary of the District.

Los Angeles, Cal.—Council voted to construct about one mile of sewer in Normal and Vermont Avenues and other strets.

San Francisco, Cal.—Board of Supervisors appropriated $41,000 for constructing sewers and appurtenances in South Bay View Dist.

Madera, Cal.—City Trustees appointed committee to ascertain cost of constructing a septic tank.

Watts, Cal.—City Trustees contemplate constructing a $160,000 sewer system, including septic tanks with pumps. R. B. Kyle, City Engineer; V. R. Franklin, City Clerk.

Salt Lake City, Utah.—See "Water Works."

Montreal, Que.—City is building brick sewers 2 ft. x 3 ft. and circular form 4 to 7 ft. in diameter. Probable cost $2,000,000. Paul E. Mercier, Ch. Engr. Public Wks.

BIDS DESIRED.

Boston, Mass.—Until Jan. 25, by Edw. F. Murphy, Comr. Pub. Wks., for constructing sewers in Frankfort Street and Neptune Road, East Boston.

Jersey City, N. J.—Until Jan. 27, by City Commissioners, for constructing a 30-in. circular brick sewer in Henderson and Eighteenth Streets.

Newark, N. J.—Until March 14 by Passaic Valley Sewerage Commissioners (Joseph H. Quigg, Clk.), Essex Building, Clinton Street, Newark, for constructing part of Section 4 of the outfall sewerage works, consisting of sedimentation basins, effluent and intake conduits, and all appurtenant work, in city of Newark, advertised in Engineering Record. William M. Brown, Chief Engineer of Commissioners.

Dunedin, Fla.—See "Water Works."

Strawberry Point, Iowa.—Until Jan. 25 (readvertisement), by J. Schofield, Town Clerk, for constructing sewer system and sewage disposal plant, about 23,000 ft. 6 to 10 in. pipe; cost system $18,000, and plant $7,000. M. Tschirgi & Sons, Engrs., Cedar Rapids.

Larned, Kan.—Until Feb. 1, by L. D. Burgess, City Clerk, for 9300 ft. 12 to 36 in. vitri. pipe storm sewers, also 30,000 sq. yd. of paving. Black & Veach, Engineers, Kansas City.

Liberal, Kan.—Until Jan. 25 by city (G. D. Gadoway, Mayor) for furnishing material and constructing sewerage system and disposal plant, to consist of 31,218 ft. 8 to 12-in. pipe sewer, 31,174 ft. trenching and backfilling, 829 Y branch sets, appurtenances, sewage lift, septic tank, alternating siphons, etc. E. T. Archer & Co., Consulting Engrs., 512-514 New England Building, Kansas City, Mo.

St. Louis, Mo.—Until Feb. 4, by City, for constructing sewers in Glaise Creek, Sewer Dist No. 12. Address President, 315 New City Hall.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Boston, Mass.—Following are three lowest bids opened Jan. 14 by Public Works Department for constructing Freeport Street sewer: James J. Conway, 19 Beethoven Street, Roxbury, $14,273, James J. Voughlin & Co., 43 Tremont Street, Boston, $15,551, and William Barrett, 37 Hunneman Street, Roxbury, $16,364.

★Contracts for above sewer awarded James J. Conway, 19 Beethoven Street at $14,273. William J. McGluchy, Contract Clerk.

★**Boston, Mass.**—Contract for constructing the Dorchester Brook sewer (bids opened January 5) awarded West Roxbury Trap Rock Company, Grove Street, West Roxbury, at $34,278.

★**Irvington, N. J.**—Contract awarded by Town Commissioners to John Dorer, Park Avenue, Irvington, for constructing extension to Ball Street sewer at $27,791.

★**Kenova, W. Va.**—Contract for constructing the sewer system awarded J. H. Sluss Construction Company, of Huntington, at $47,934 (bids opened Dec. 23, by J. W. Collins, City Recorder). Other bidders: Keatley & Hord, Huntington, $49,900; Wethers & Colgrove, Portsmouth, $50,014, and A. E. Miller Construction Company, Portsmouth, $51,560. A. B. Maupin, Engineer, Huntington. Sewer bonds amounting to $55,000 have been sold by city.

★**Cincinnati, Ohio.**—Contract for improving sewers in Colerain Avenue (bids opened Dec. 14) awarded Thomas P Strack, Cincinnati, at $11,971.

Averyville, Ill.—Only bid opened by Board Local Improvements for constructing the sewer system was submitted by Daily & O'Brien, Peoria, at $42,000. Bids rejected. Engineer's estimate $36,600.

★Woodbine, Iowa.—Contract for constructing a sanitary sewer system awarded H. J. Peterson, Omaha, Neb., at $15,823. I. A. Bruce, Omaha, Neb., Engr.

★Ottawa, Ont.—Contract for Segment Block awarded National Pipe Company, Montreal, Que. F. C. Askwith, City Engineer.

BRIDGES

PROPOSED WORK.

Bridgeport, Conn.—The War Department accepted plans prepared for the E. Washington Avenue and Grand Street bridges; probable cost $130,000 and $220,000 respectively.

Connecticut.—State Highway Department, Hartford (Charles J. Bennett, Commissioner), intends constructing a bridge across Housatonic River between Derby and Huntington. Wash borings are now being made by the Harper Machinery Co. of New York to determine the character of the river bed for abutments.

Freehold, N. J.—The Board of Freeholders directed Strauss Bascule Bridge Co. of Chicago, Ill., to submit plans and specifications for a bridge to be constructed over Shark River from "A" Street in Belmar to First Avenue in Avon. The bridge is to have a lift draw of steel, approaches on each side to be of concrete; estimated cost about $46,000.

Warren, Pa.—Borough Council voted in favor of contributing $60,000 toward constructing bridge over Allegheny River.

Delaware.—Contract will be let some time in March for constructing drawbridge at Laurel to cost $4,000; also for bridge of a movable type across U. S. Channel at Rehoboth, to cost $10,000. Morgan T. Green, County Road Engineer, Georgetown.

Richmond, Va.—City Engineer Bolling has been directed to make a survey for a viaduct over Shockoe Creek Valley to begin at Twelfth Street and end at Twenty-second Street; cost about $600,000.

Richmond, Va.—See "Hydraulic Construction and River Improvements."

Fairmont, W. Va.—Preliminary steps being taken to construct two bridges, one a concrete bridge over Mon River and the other either a causeway or a concrete bridge across Coal River. Albert J. Kern, City Clerk.

Birmingham, Ala.—Plans prepared by Julian Kendrick, City Engineer, for a viaduct to be constructed at Twenty-first Street at a cost of about $150,000.

Lake Charles, La.—In a report submitted to the Police Jury F. H. Frankland estimates cost of constructing a bascule lift and concrete viaduct over Calcasieu River, at $125,000.

McMinnville, Tenn.—County Court voted to construct a bridge over Charles River at Yager and one over Barren Fork River near Trousdale.

Commissioners of Warren and White Counties considering constructing a bridge over Caney Fork River at Rock Island. McMinnville, county seat Warren County.

Sturgis, Ky.—Construction of a bridge over Tradewater River by county is contemplated. To be 200 ft. long and cost $18,000. Morganfield, county seat.

Akron, O.—Widening the arch of bridge under North Forge Street crossing is contemplated. The city to pay $25,000 of cost and Baltimore & Ohio R. R. Company $75,000.

Cleveland, Ohio.—W. A. Stinchcomb, County Engineer, will soon prepare plans for the revamping of Superior Avenue viaduct, present east approach and turntable draw to be razed, west approach realigned so as to connect with St. Clair Avenue, new east approach constructed and bascule bridge erected over Cuyahoga River. All work to be contracted for. Cost reported at about $500,000.

Steubenville, Ohio.—The U. S. Senate passed a bill authorizing the Ohio West Virginia Bridge Co. to construct a bridge over the Ohio River at Steubenville.

Bluffton, Ind.—County Council has provided for the construction of three bridges across Wabash River, in Wabash Township; one, the William Burk Bridge, is to cost $16,000.

Hazleton, Ind.—The 'Dixie Bee Line Bridge Company, incorporated to construct a bridge over White River at Hazleton. Capital $50,000. Among incorporators: O. Bundy, Pres.; B. B. Johnston, Secy.

Indianapolis, Ind.—A bridge costing $100,000 is to be constructed across Fall Creek at Shriver Avenue by the city and the County Commissioners.

County Council reported considering the construction of a bridge across Fall Creek at Maple Drive; probable cost $350,000.

Wabash, Ind.—Bridge bonds for $44,000 will be sold Feb. 15 by Frank P. Kircher, Co. Aud.

Lansing, Iowa.—T. H. Baknell, Lansing, is designing engineer for bridge to be constructed between Lansing, Iowa, and De-Sota, Wis.

Duluth, Minn.—Contract will be let by County Commission during February for constructing a steel bridge over St. Louis River on Town Line Road. County Commissioners appropriated $32,400 for work in various County Dists.

Duluth, Minn.—City Council directed construction of a concrete culvert over Miller Creek; cost $5,000.

City Council has appropriated $20,000 for removal of wooden bridges and constructing concrete culverts during 1916.

Minneapolis, Minn.—Ordinance has been introduced in Council instructing City Engineer to prepare plans and estimated cost of strengthening Franklin Avenue bridge across Mississippi River in order that bridge may carry street cars.

Great Northern R.R. (A. H. Hogeland, Ch. Engr., St. Paul) reported considering constructing a railway bridge across Mississippi River between Hennepin and Anoka Counties about seven miles above Minneapolis.

Minneapolis, Minn.—See "Paving and Roads."

Preston, Minn.—Contract will be let June by the County Commissioners for constructing 20 bridges, to cost $30,000. Address J. J. Davy, County Engineer.

Hutchinson, Kan.—Contract about to be let by Reno County Commissioners for constructing two bridges over Arkansas River, one at Hutchinson and one at Nickerson. To be arch or girder types.

Geneva, Neb.—All bids opened Jan. 11 by County Commissioners for constructing steel and concrete bridges during 1916 rejected. No new date set yet. Bert A. Lynn, County Clerk.

Kansas City, Mo.—Park Board approved plans of Waddell & Son, Kansas City, for constructing a concrete bridge over tracks of Missouri Pacific and Frisco R. R. at Seventy-first Street in Swope Park. Structure to be 750 ft. long, roadway 60 ft. wide; cost $220,000.

Roswell, N. M.—The County Commissioners voted to construct a pile bridge over Pecos River; cost $9,000.

Seattle, Wash.—A double leaf steel bascule bridge, costing $150,000, is contemplated. F. A. Rapp, Structural Engineer, 305 City Hall.

Santa Barbara, Cal.—Bridge bonds for $500,000 have been sold.

Ventura, Cal.—Plans filed with County Board of Supervisors for a 200-ft. steel bridge over Ventura River at Casitas: cost about $9,000; also for La Grosse Saticoy and Sespe Bridges. Contract will be let in February.

Minidoka, Idaho.—A wooden trestle on pile foundation costing $10,000 is to be constructed about 4¼ miles below the Government dam, to be 1188 ft. long, have 36 4-pile bents, 31 3-pile bents, 630 ft. of roadway 16 ft. wide, and 558 ft. 12 ft. wide. Steel span later. John W. See and T. J. Stephenson, Burley, Idaho, Engrs., John W. Shea, Secy. of Board. John W. See, Burley, Engineer in charge.

Stamford, Ont.—Reported Niagara, St. Catharines & Toronto Ry. Company (E. F. Seixas, Gen. Mgr., St. Catharines) considering constructing a bridge in Stamford Township at Portage Road.

Nanaimo, B. C.—City Council decided to submit a by-law to citizens to vote $14,000 for constructing bridge over Mill Stream.

BIDS DESIRED.

Brookline, Mass.—Until Jan. 24 by Selectmen (Edw. A. McEttrick, Secy.) for steel for the Cypress Street and Aspinwall Avenue bridges. Approximately 80 tons of steel (2 in. and 28 in. rolled beams).

Paterson, N. J.—Until Feb. 2, by Board Chosen Freeholders, Paterson, for repairs to various bridge sin Passaic County; also for creosoted floor and oak wearing deck on the Beattle Bridge over Passaic River, Little Falls.

Albany, N. Y.—See "Hydraulic Construction and River Improvements."

Williamson, W. Va.—Until Feb. 5, by Robert C. T. Terrell, Commissioner Public Works, Frankfort, for constructing a bridge across Tug Fork of Big Sandy River at Williamson, connecting Pike and Mingo Counties, to have three 130-ft. spans and a 176ft. approach, superstructure to be of steel, 16-ft. roadway and wooden floor; substructure of concrete.

St. Clairsville, Ohio. — Reported desired until Jan. 24 by B. W. Hopkins, County Auditor, for repairing Union Street bridge.

New Albany, Ind.—Reported desired until Feb. 7 by County Commissioners for constructing bridge across Falling Run, to be 110 ft. long with concrete abutments and piers and steel superstructure.

Martinsville, Ind.—Until Feb. 8 by County Commissioners, for repairing seven bridges. Sam Watson, Co. Aud.

Michigan.—Reported desired until Feb. 1, by Frank F. Rogers, State Highway Commissioner, Lansing, for constructing two 40-ft. reinforced concrete girder bridges, 18-ft. roadway, Pentland Township, one between Section 11 and 14 and one in Section 3.

Cambridge, Ill.—Until Jan. 26 by James H. Redd, County Superintendent Highways, at Court House, for constructing a 70-ft. by 18-ft. steel highway bridge, on reinforced concrete abutments in Weller Township, Henry County; cost $4,360; also separate bids for a reinforced concrete culvert in Munson Township, Henry County, 63 cu. yd. concrete and 6250 lb. reinforcing steel.

Illinois.—By the State Highway Commission, Springfield, for constructing bridges as follows:

Until Jan. 31:

Woodstock, for O'Rourke Bridge, 54 ft. span, 18 ft. roadway, steel with reinforced concrete abutments, in Coral Township. Engieer's estimate, $2,180, including piles. C. L. Tryon, Co. Supt., Woodstock.

Until Feb. 7:

Carlinville, for Barber and Davis bridges, 14 and 32 ft. spans, 20 and 16 ft. roadways, reinforced concrete. Engineer's estimate, $670 and $1,710.

Rhine Bridge, 32 ft. span, 16 ft. roadway, reinforced concrete, between Chesterfield Township, Macoupin County and Ruyle Township, Jersey County. Engineer's estimate, $2,050.

Rigsby Bridge, 40 ft. span, 18 ft. roadway, reinforced concrete, in Chesterfield Township. Engineer's estimate, $2,240. O. B. Conlee, Co. Supt. Highways, Carlinville.

Hutchinson, Kan.—Reported desired until Feb. 10, for constructing the Arkansas River bridge and the Nickerson Bridge. Bids desired on the Luten arch type, and the deck girder type. Address County Engineer.

Gretna, Neb.—Reported desired until Feb. 10, by County Clerk, Papillion, for constructing three 100-ft. spans steel and concrete bridge. G. E. Johnson, State Engr., State House, Lincoln.

McCook, Neb.—Until Feb. 8 by C. K. Dutcher, County Clerk, for constructing 15 tons steel and wooden bridges during year 1916 advertised in Engineering Record. Plans at office of State Engineer, Lincoln.

Schuyler, Neb.—Reported desired until Feb. 12, by County Clerk Schuyler, for erecting steel bridge over Platte River to consist of four 175-ft. connected steel spans with creosoted block roadway and concrete abutments, also repairing present 6-span bridge. G. E. Johnson, State Engr., Lincoln.

Sutherland, Neb.—Alternate bids reported desired until Feb. 15, by County Clerk, North Platte, for two 250-ft. spans, steel or concrete bridge. G. E. Johnson, State House, Lincoln.

Perry, Okla.—Reported desired until Feb. 7, by County Committee, for constructing five bridges and two culverts. W. T. Faris, Co. Clk.

Newport, Wash.—Reported desired until Feb. 8 by County Commissioners for constructing steel bridge over Pend d'Oreille River substructure, to be of concrete, consisting of four piers, superstructure will be cable extension with wooden flooring. Length of span will be 372 ft. and there will be two 60-ft. pile approaches, with 16-ft. roadway. H. A. Sewell, Co Engr., Newport.

Seattle, Wash.—Reported desired until Feb. 11, by L. B. Young, Chmn. Board Public Works, for constructing city bridge over Lake Washington Government Canal at Tenth Avenue, Northeast. Probable cost of substructure $100,000, and superstructure $200,000. Bids will be received for substructure or superstructure, or both. A. H. Dimock, City Engr.

Santa Barbara, Cal.—Until Feb. 7, by County Board of Supervisors, for constructing four concrete bridges over Nojoqui Creek, between Vaca and Las Cruces, including one 50-ft. arch, cost $6,750; 60-ft. arch, $8,600; 65-ft., $9,250; also a concrete bridge consisting of two 50-ft. girders and estimated cost $14,800. McCurdy Bros., Pacific Electric Bldg., Los Angeles, Engineers.

Mammoth, Ariz.—Until Feb. 8, by Board Supervisors, Florence (C. H. Nieweyer, Clerk), for constructing steel arch bridge across San Pedro River, north of Mammoth; approximate cost $6,000.

PRICES AND LETTINGS.

★Indicates award of contract.

★Susquehanna, N. Y.—Contract awarded American Bridge Company, 30 Church Street, New York, for 1500 tons structural steel for the Erie R.R. bridge at Susquehanna.

★Reynolds, Pa.—Contract for constructing bridge over Little Schuylkill River at Reynolds for Philadelphia & Reading Ry. Co. awarded to Robert Grace & Co., Pittsburgh, Pa.

★Norfolk, Va.—Contract for constructing bridges awarded by Commission for Purchase and Improvement of Roads in Norfolk County to C. B. Cross & Son, Norfolk, as follows: New bridge over Masons Creek on Indian Pole Bridge Road, creosoted piling and timber, $8,700. Reconstruction of bridge at Indian River Road, $2,850. New bridge over Steamboat Creek, on Indian River Road. Reconstruction of Hodges ferry bridge, $3,192.

★Shelbyville, Tenn.—Contract for constructing a bridge over Duck River on Tullahoma turnpike awarded by county to Nashville Bridge Co., Nashville, at $5,990.

★Covington, Ky.—Contracts in connection with constructing the bridge across Licking River, from Ft. Thomas to Covington, to support the new emergency water main awarded Jan. 6 by City Commissioners as follows: Superstructure to Argonia Bridge Company, Lebanon, Ohio, at $25,373; installing piers to D. P. Foley Company, Cincinnati, Ohio, at $18,324; trenching to Vastine & Lowry, at $28,089.

★Cincinnati, Ohio.—Contracts awarded by Covington & Cincinnati Bridge Company for extending suspension bridge to Third Street in City of Cincinnati as follows: Steel work, American Bridge Company, Cincinnati; concrete and cement work, Ferro Concrete Construction Company, Cincinnati. John A. Johnson, Asst. Secy., Covington, Ky.

★Rochester, Ind.—Contract awarded by County Comrs. to Rochester Bridge & Structural Steel Co., Rochester, for constructing Michigan Road Bridge over Tippecanoe River at $24,495 for steel structure. Other bidders: Central States Bridge Co., $24,735; Illinois Bridge Co., $26,000, for steel and $45,000 for concrete.

★Washington, Ind.—Contract for constructing bridge joining Daviess and Pike Counties at Harriman's Ferry awarded by County Commissioners to Miller & Brocherding, St. Louis, Mo., at $16,650.

★Chicago, Ill.—Contracts for structural steel to be used in bridge work awarded by Chicago, Burlington & Quincy R. R. as follows: 1215 tons to Chicago Bridge & Iron Company, 1300 W. 105th Street; 594 tons to Milwaukee Bridge Company, Milwaukee, Wis.; 124 tons to Wisconsin Bridge Company, Milwaukee, Wis.; 80 tons to King Bridge Company, Cleveland, Ohio; 114 tons to Morava Construction Company, Eighty-fifth and Stewart Avenue, Chicago.

★Wegdahl, Minn.—Contract for constructing a bridge across Minnesota River (bids opened Jan. 5 by County Commissioners, at Montevideo) awarded M. A. Adams & Co., Minneapolis, at $14,400 for concrete. J. J. Stenes, County Auditor.

★Falls City, Neb.—Contract for constructing steel and concrete county bridges during year 1916 awarded Omaha Structural Steel Works, Omaha (bids opened Jan. 11). O. O. Marsh, County Clerk.

★Camden, Ark.—Contract for repairs to Martin Free Bridge over Quachita River awarded to Oats, Haynes & Taylor Co., Texarkana, at $30,000.

★California.—Contract awarded by California Highway Commission, Sacramento, for constructing a steel bascule bridge across Petaluma Creek in Sonoma and Marin Counties, Division IV, Route 8, Section A, to Healy Tibbitts Construction Co., Market and Main Streets, San Francisco, at $89,791.

★Santa Barbara, Cal.—Contracts awarded by Board of Supervisors as follows for constructing concrete bridges on the State Highway: Over Tajiguas Creek, to Munoz & Munoz, 800 Central Building, Los Angeles, at $6,393, and over Corral Creek, to Humphrey & Elliott, Santa Barbara, at $7,800.

PAVING AND ROADS

PROPOSED WORK.

Rhode Island—Legislature has been asked to appropriate $250,000 for building concrete and bituminous macadam roads throughout State. If appropriation is made contracts will be let before March 1.

Albany, N. Y.—See "Hydraulic Construction and River Improvements."

Binghamton, N. Y.—City Council considering paving of Beethoven Street and Glenwood Avenue. W. Earl Weller, City Engineer.

Elmira, N. Y.—City Council considering $200,000 bond issue for paving streets during 1916.

Johnson City, N. Y.—Citizens voted $30,000 bonds for paving Grand Avenue and Arch Street.

Syracuse, N. Y.—Plans and specifications to be prepared by State Highway Dept. at Albany, for constructing a State Fair Boulevard from West Genesee Street to entrance of grounds.

Jersey City, N. J.—Dow & Smith, 131 East Twenty-third Street, New York, N. Y., engaged to prepare plans and specifications for paving Hobart Avenue, Eighth, Twenty-second and Thirty-second Streets.

Morristown, N. J.—Morris County Bd. Freeholders considering widening and extending Mendham Road.

Newark, N. J.—In a report submitted to the Board of Freeholders by County Engineer Frederic A. Reimer the repaving of ten county roads at a cost of $628,297 is recommended, part of the cost to be met by the State Road Department.

West Reading, Pa.—About $35,000 is to be spent by city for repairs to streets.

Baltimore, Md.—At least $500,000 worth of paving will be done in this city this year. Address Paving Commission.
About $2,000,000 is to be spent by city for paving streets and alleys during 1916.

Harrisonburg, Va.—Election soon to be held in the county to vote $95,000 bonds for constructing roads under supervision of State Highway Department. Address Mr. Coleman, State Highway Commissioner, Richmond.

Richmond, Va.—See "Hydraulic Construction and River Improvements."

Greenville, S. C.—About $400,000 highway improvement bonds sold by County Highway Commission.

Miami, Fla.—Special road and bridge bonds of Dist. No. 2 for $275,000 will be sold Feb. 7 by County Commissioners (Z. T. Merritt, Clk.).

Alabama.—Approximately the following improvements contemplated during 1916: About $2,000,000 road work in counties; $500,000 bridge work in counties; $340,000 state and counties by State Aid for road and bridges; $175,000 in Franklin and Conecut Counties. By warrants: Monroe County, $120,000; Wilcox County, $150,000; Marengo County, $120,000; Fayette County, $75,000; Henry County, $100,000; Houston County, $100,000; Coosa County, $25,000; Tallapoosa County, $50,000; Greene County, $50,000. W. S. Keller, Engineer, State Highway Department, Montgomery.

Ashland, Tenn.—Election will probably be held soon to vote $150,000 bonds for road improvements.

Lawrenceburg, Tenn.—Election will probably be held in March to issue $350,000 bonds for road improvements.

Lonsdale, Tenn.—The City Council voted to pave eleven streets, cost $18,000.

Rogersville, Tenn.—Road bonds for $250,000 will be sold Feb. 12 by Trustees of Hawkins County (I. E. Shanks, Secy.).

Erwin, Tenn.—The County Court voted $100,000 bonds for road improvements.

Canton, Ohio.—Following paving work contemplated: Sheet asphalt on concrete foundation on Rowland Avenue N. E., cost $28,000; Fourth Street N. W., $50,904; sheet asphalt and vitr. brick on concrete foundation on Fourth Street S. E. and Waynesburg Road, at $118,090. George McClaskey, Director Public Service; B. F. Faust, City Clerk.

Eaton, Ohio.—About 30,000 sq. yds. of paving is contemplated. A. L. Reid, Village Engineer.

Edon, Ohio.—Bonds for $51,195 will be sold Feb. 7 by H. L. Eyster, Clk., for improving Michigan and Indiana Streets.

London, Ohio.—Contract will be let in March for 20,000 sq. yd. of street paving. J. H. Asher, City Engineer.

Springfield, Ohio.—Street improvement bonds for $51,395 will be sold Feb. 7 by W. J. Barrett, City Aud.

Washington, C. H., Ohio.—Paving bonds for $37,380 will be sold Feb. 1 by John N. McFadden, City Auditor.

Youngstown, Ohio.—Contract will be let in March for constructing Damascus-Berlin Center Road, paving with macadam about 5 miles. E. S. Smith, County Highway Superintendent.

Burlington, Ind.—An election will be held by citizens of Boone County to vote on issue of $200,000 bonds for road improvements.

Elkhart, Ind.—County Commissioners have been petitioned to improve with gravel three miles of road in Locke Township and 1½ miles in Union Township, Ohio.

Indianapolis, Ind.—Macadam road bonds for $36,800 will be sold Jan. 20 by George E. Kinzie, Co. Treas.

Muncie, Ind.—Board of Public Works has provided for paving Powers, North, Mulberry, High, Charles, Washington and Adams Streets.

Muncie, Ind.—City Engineer directed to prepare plans for considerable paving, including portions of Powers, Howard, Mulberry, High and other streets.

Richmond, Ind.—Improvements contemplated in the new year include 35,000 sq. yd. paving to cost $70,000. Fred. R. Charles, City Engineer.

Vincennes, Ind.—Contract will be let between March and August for 200,000 sq. yd. of paving to cost $350,000. H. T. Watts, City Engineer.

Warsaw, Ind.—Reported contract soon to be let for constructing the E. E. Cirle Road bridge in Jackson Township estimated to cost $22,761 and to be three miles in length.

Coldwater, Mich.—City contemplates laying about 7700 sq. yds. brick pavement and about 4000 yds. of asphalt macadam pavement. Material will be purchased, but work will be done by day labor. K. E. Norton, Supt. Public Works.

Alton, Ill.—Issuing of $1,250,000 bonds for constructing hard roads in Madison County is under consideration by Board of Supervisors.

Chicago, Ill.—Validation of technical infirmities in the law providing for $2,000,000 Cook County road bond issue has passed the senate and is before the house.

East Moline, Ill.—Paving of Seventeenth and Eighteenth Avenues and Eleventh and Thirteenth Streets with brick, in all about 16,000 sq. yd., and Third Street with concrete, about 4000 sq. yd., is contemplated. Also includes 12,000 lin. ft. concrete curb; cost $47,000. B. S. Warner, City Engineer.

Elgin, Ill.—About $284,644 will be spent this year in improving sewers and paving, including paving Center Street with asphaltic concrete 1¼ miles, at $44,500; Villa Street, brick, 1⅛ miles, cost $60,000; Porter Avenue and Division Street, asphaltic concrete, ⅝ mile, $21,000; North Gifford Street, asphaltic concrete, ⅝ mile, $18,500; Bluff City Boulevard, brick, ¾ mile, $22,600; Grove Avenue, repaving, brick, ¾ mile, $16,150; Douglas Avenue, repaving, asphaltic concrete, 1⅛ miles, $32,000; Raymond and Watch Streets, brick, ⅜ mile, $12,000; River Street, brick, ⅝ mile, $18,000; Dexter Avenue, brick, ¼ mile, $12,000; Prairie Street, brick, ⅛ mile, $6,400; sanitary sewer will be constructed in River Street, and an east end sewer system is contemplated.

Morrison, Ill.—Board of Local Improvements (Frank A. Van Osdol, Chmn.) has adopted resolution to pave with vitr. brick portions of several streets, including Jackson, Bartlett, Clinton and other streets, about 40,830 sq. yd., including 16,875 cu. yd. excav., 28,185 lin. ft. combined concrete curb and gutter, etc.; total cost about $117,287. Edward O. Hills, Engineer, Fulton, Ill.; A. R. Baird, City Clerk.

DePere, Wis.—County Board is considering holding an election to vote $650,000 bonds for constructing 90 miles of concrete highways this year.

Sioux City, Iowa.—City Engineer estimates cost of paving Leeds Highway and Twenty-seventh Street at $88,857.

Duluth, Minn.—City Commission directed Superior Street to be paved with either bitulithic or asphalt; cost about $45,000. Contract to be let this winter.

Minneapolis, Minn.—City Council Paving Committee has ordered the following paving for 1916: Minnehaha Avenue, Lake Street to city limits, $166,000; Lowry Avenue, Marshall to Central, southeast, $64,138; Chicago Avenue, Franklin to Thirty-ninth Street, $114,000; Fourth Avenue south, Lake to Thirty-eighth Street, $30,160; Lyndale Avenue north, Twenty-sixth to Forty-second Avenue, $95,083; Fourth Street northeast, Thirteenth to Lowry, $39,450; Western Avenue, between Hennepin and Plymouth avenues, $70,000; Central Avenue, Division Street project to city limits, $180,000.
Ways and Means Committee has recommended to Council that $500,000 bonds be sold Feb. 2 for street improvements.
City Engineer's report for 1916 includes sewers, $500,000; street openings, $405,000; water mains, $400,000; grading, $350,000; curb and gutter, $150,000; bridges, $150,000; sidewalks, $100,000; Bassett Creek, $50,000; city harbor, $50,000.

Warren, Minn.—About April contract will be let for about 200,000 cu. yd. of road grading under State Aid; cost $28,000. About $75,000 is to be spent in county and town road building.

Topeka, Kan.—About seventy blocks are to be paved with asphalt concrete on 5 in. concrete base including Woodward, Clay and Fifth Streets, Madison, Jackson and Fifteenth Streets to be paved with 20% vitr. block on 5 in. concrete base with asphalt filler. A. R. Young, Topeka, Engineer; Etta M. Covell, City Clerk

Chillicothe, Mo.—City Council voted to pave Woodward, Dickinson, Third, Cherry and Ann streets.

Kansas City, Mo.—City Council voted to repair pavements on Forest, Flora, Garfield and McGee Streets.

Clarksville, Tex.—The Attorney General at Austin has approved a $400,000 road bond issue for Red River County Road Dist. No. 1.

Claremore, Okla.—About $219,000 bonds sold by Bd. County Commissioners for road improvements in Rogers County.

Pawnee, Okla.—City is considering additional paving. Plans will probably be prepared by Benham Engineering Co., Oklahoma City.

Central City, Col.—State Highway Commission, Denver, has appropriated $15,000 for a motor road between Idaho Springs and Central City.

Joyce, Wash.—County Commissioners authorized Richard W. Remp, County Engineer, Port Angeles, to survey a permanent highway from Joyce to Pysht, a distance of 22 miles. Five and one half miles have been surveyed and the remainder will be completed by April. It is the intention to build about 10 miles this year. Probable total cost $100,000.

Kalama, Wash.—County Commissioners appropriated $21,000 toward constructing a 4-mile stretch of Pacific Highway, north and south 2 miles in each direction from Castle Rock.

Montesano, Wash.—County Commissioners of Chehalis County voted to construct a 4½-mile roadway; cost $15,900. George D. Robertson, County Engineer.

Seattle, Wash.—City Council considering paving Burke Avenue and Kilbourne Street.

Tacoma, Wash.—County Commissioners having plans prepared for seven miles of pavement to be laid during summer of 1916. Five miles in Mountain Road and two miles in Olympia Road. Bids will probably be called for on all classes of pavement.

Portland, Ore.—Bybee Avenue is to be paved by city; cost $10,000.

Anaheim, Cal.—City Trustees voted to pave one mile of Broadway, 80 ft. wide.

Bakersfield, Cal.—County Board of Supervisors has sold $500,000 highway bonds.

Los Angeles, Cal.—City Council voted to improve Fountain, North Boyle, Del Mar Avenues and Sunset Drive.
City Engineer directed to prepare plans for constructing a boulevard 100 ft. wide around the city.
Board of Supervisors, Los Angeles, adopted resolution of intention to construct a 5-in. oil macadam pavement with cement curb and gutter and reinforced concrete culverts in Whittier Avenue, town of Newark, Road Dist. No. 99, and to grade and oil, construct cement curb, gutters and walks in Road Dist. No. 98. A. M. McPherrin, Clerk of Board.

Richmond, Cal.—H. C. Chapman, City Engineer, reported preparing tentative plans for a scenic boulevard about three miles long on the water front.

San Diego, Cal.—City will start work about March to construct by day labor a 16-ft. concrete highway four miles long between Torrey Pines grade and La Jolla; cost about $33,000.

Ventura, Cal.—County Supervisors appropriated $20,000 for constructing road into Matilija Canyon and surveys will be made at once.

Watts, Cal.—Trustees contemplate constructing three miles of concrete highway, 6-in. base and 3-in. surface, through the town; cost about $40,000.

Whittier, Cal.—County Board of Supervisors, Los Angeles, adopted a resolution of intention to construct concrete pavement 5 in. thick and 20 ft. wide with expansion joints, granite base and bituminous surface, on 3.63 miles of Norwalk-Puente Road, near Whittier Road, Dist. No. 54. A. M. McPherrin, Clk. of Bd.

Arizona.—Road improvement contemplated throughout the State as follows: Election to be held about February in Cochise County (Tombstone County Seat) to vote $600,000 to $1,200,000 bonds; Gila County (Globe County Seat) has sold $350,000 bonds; Conconino County (Flagstaff County Seat) will vote $350,000 bonds next spring; Graham County (Solomonville County Seat) is considering issuing bonds for improving road from Solomonville to San Carlos.

Globe, Ariz.—County highway bonds amounting to $350,000 have been sold.

Phoenix, Ariz.—County Supervisors rejected all bids opened recently for constructing one mile of Tempe-to-Mesa Road and will construct by day labor paving with Tarvia under the supervision of E. P. Cowderey, Consulting Engineer of Barrett Mfg. Company, New York.

Phoenix, Ariz.—Paving improvements contemplated in the new year include about 204,458 sq. yd. paving, 87,468 curb and gutter, etc.; on portions of Washington, Jefferson, First streets and Central, Seventh avenues and other streets.

Tucson, Ariz.—County highway system costing $300,000 is to be constructed under the supervision of W. H. Rosencrans Engineering Company, Chicago, Ill. Plans are also to be prepared by this company. Mt. Leban Road, for which $100,000 bonds was voted, is to be constructed under the supervision of the U. S. Forest Service.

Lewiston, Idaho.—The hard surface highway proposed between Clearwater and top of Union Town Hill is to cost $150,000. Nothing very definite has been done about the matter. F. N. Finch, Secy. Highway District; George W. Tomshill, Attorney.

Wallace, Idaho.—Approximately 50,000 sq. yd. of paving contemplated include Cedar, Bank, River and other streets. Estimates being prepared. D. M. Faires, Engineer, Wallace; G. W. Walker, City Clerk.
Contract will be let some time in March for paving in District No. 4. R. S. Merriam, City Engineer.

Ottawa, Ont.—Contract will be let last week in February for following supplies: Asphalt, sand, brick, broken stone, castings, etc. F. C. Askwith, City Engineer.

BIDS DESIRED.

Manchester, Conn.—Until Feb. 1, by Board Selectmen (Arthur E. Bowers, Secy.), for concrete sidewalks, curbs, etc. Probable cost, $25,000.

East Orange, N. J.—Until Jan. 24, by Lincoln E. Rowley, City Clk., for furnishing and applying 270,000 gal. of non-asphaltic road oil to the streets of East Orange.

Jersey City, N. J.—Until Jan. 27 by City Commissioners for improving portions of Skillman Avenue with asphalt and repairing portions of Bay Street with belgian block. M. I. Fagen, City Clk.

Huntington, W. Va.—Reported desired until Feb. 2, by County Clerk, for grading, masonry and culverts of one mile of the Ohio River Road near Millersport Ferry. Oliver & Maupin Eng. Co., Huntingsburg.

Dunedin, Fla.—See "Water Works."

Jacksonville, Fla.—Until Jan. 29, by Port Commissioners, Realty Building, for No. 1 vitr. paving blocks to pave not less than 20,000 sq. yd. and not more than 35,000 sq. yd. Bidders to submit six samples of paving blocks and prices per thousand, f.o.b. municipal docks and terminals, Jacksonville. Advertised in Engineering Record.
Reported desired until Feb. 3, by County Commissioners, for constructing the Tamiami Trail, through the great cross state highway, through the Everglades from Miami on the Atlantic Coast to Tampa on the Gulf Coast.

Tazewell, Tenn.—Until Feb. 7 by Road Commissioners (J. H. Morison, Chmn.) for grading and macadamizing road on Clinch River, about 9 miles; road up Little Sycamore Creek, about 7 miles; portions of Powell Valley Road, about 2 miles, and a number of other roads throughout Claiborne County.

Norwood, Ohio.—See "Miscellaneous."

Indiana.—By County Commissioners, for constructing county roads as follows:
Until Feb. 8:
Bedford, gravel or macadamized roads in Shawswick Township, approximately 18,131 ft. long. Ezra W. Edwards, Co. Aud.
Wabash, for constructing gravel roads in Waltz, Pleasant and Paw Paw Townships. E. P. Kircher, Co. Aud.
Until Feb. 9:
Columbus, for crushed stone roads in Rock Creek, Sand Creek and Clifton Townships. W. H. Scott, Co. Aud.
Muncie, constructing two gravel roads in Liberty Township and one in Monroe Township. F. M. Williams, Co. Aud.
Until Feb. 10:
Shelbyville, for constructing county line road. F. W. Fagel, Co. Aud.
Laporte, for road in Union Township, Cass and Hanna Townships. Fred A. Hausheer, Co. Aud.
Evansville, rock road in Center Township. C. P. Beard, Co. Aud.

Monroe, Mich.—Reported desired until Jan. 27, by County Commissioners, for constructing highway between Monroe and the Ohio line, connecting with the Lucas County Road. Probable cost, $155,560.

Chicago, Ill.—Until Jan. 27, by Department Public Works (W. R. Moorhouse, Comr.), for the use of Bureau of Streets, approximately 4000 sq. yd. of No. 2 granite blocks, 6000 cu. yd. crushed granite, 2000 cu. yd. paving gravel, etc.

Rock Island, Ill.—Until Feb. 1, by Wallace Treichler, City Engineer, for paving Twelfth Street, Eighteenth to Fifty-fourth Streets, with brick; estimated cost $74,475.

Wapello, Iowa.—Reported desired until Feb. 7, by J. R. Syphrit, Clk. Port Louisa Township, for road work and dragging for year 1916.

Crookston, Minn.—Reported desired until Jan. 25, for constructing 9 miles of road. H. J. Welte, Co. Aud.

Duluth, Minn.—Reported desired until Jan. 25, by Jas. Farrell, Comr., for furnishing and delivering 30 tons asphaltic cement f. o.b. Duluth.

St. Paul, Minn.—Reported desired until Jan. 24, by Geo. J. Ries, Co. Aud., for improving portions of Kettle River Road, Washington County Line Road, Robinson Lake Road and a number of other roads throughout the county. Also for a 10-ton steam or gasoline road roller.

Albany, N. Y.—Following are unit figures of the four lowest bids opened Jan. 11 by W. W. Wotherspoon, State Superintendent of Public Works, Albany, for constructing two connecting highways, Muck Road to James Street and Whitesboro Street to Mill Street, in city of Rome: (a) Engineer's estimate, $28,634; (b) Henry A. Schaupp, Guilderland, N. Y., $32,111; (c) Bernard McCarey, Rome, $32,751; (d) Walter S. Rae, Pittsburgh, Pa., $34,943.

	(a)	(b)	(c)	(d)
5,230 cu. yd. excavation	$0.50	$0.45	$0.56	$0.60
2,460 cu. yd. forming embankment	0.12	0.11	0.14	0.14
35.3 M ft. sawed lumber (yellow pine)	60.00	70.00	60.00	72.00
53 cu. yd. second-class concrete	7.00	8.00	7.50	8.40
2.1 cu. yd. first-class masonry bridge coping	20.00	20.00	20.00	24.00
50 sq. yd. second-class stone paving	1.50	1.50	2.00	1.80
105 lin. ft. 12-in. vitrified pipe, laid	0.75	0.65	0.60	0.90
396,000 lb. structural steel	0.04	0.048	0.048	0.0495
140 lb. metal reinforcement	0.04	0.06	0.048	0.04
8,780 sq. yd. macadam pavement	0.75	0.78	0.80	0.90
1,180 lin. ft. wooden fence	0.20	0.20	0.25	0.24
236 lin. ft. lattice railing	1.75	1.50	2.00	2.10

Larned, Kan.—See "Sewerage and Sewage Disposal."

Butte, Mont.—Until Feb. 2 by City Council for repaving streets and constructing concrete gutters in Special Improvement Dist., No. 198, bids will be considered on creosoted wood lug block; bitulithic and asphalt concrete, estimated by City Engineer, respectively as follows: $132,041, $64,960 and $48,620.

Davenport, Wash.—Until about March 7 by George G. Harvey, County Surveyor, for about 13 miles of graveling on the Sunset Highway.

Seattle, Wash.—Until Feb. 7, by Byron Phelps, Co. Aud. and Clk. Board County Commissioners, for constructing 3 miles permanent highway between Renton and Newcastle. Alternate bids for 16 and 20-ft. roadway. Probable cost between $20,000 and $32,000. A. P. Denton, Co. Engr.

Tacoma, Wash.—Reported desired until about Feb. 20, by County Commissioners for constructing approximately 8 miles new pavement on Mt. Rainer Road and Pacific Highway, divided into 5.5 miles on the Mountain Road and 2.7 miles on the Pacific Highway. Both roads will cost about $12,000 per mile, according to type of pavement to be used, making total cost of about $100,000.

Bakersfield, Cal.—Until Feb. 8, by County Board of Supervisors, for grading, paving and constructing culverts in Division 7, Section 2, Bakersfield-Taft Road, about 11 miles, approximate quantities: 97,104 sq. yd. concrete pavt., 58,260 ft. shaping roadbed, etc.; also grading and constructing culverts and broken stone surface on Division 10, Sect. 6, Bakersfield-Mahave Road, between Edison and Sivert, about 4.8 miles, approximately 16,500 cu. yd. excav., 6625 tons broken stone and screening, in pavt., 25,480 ft. shaping roadbed, etc.; also grading and constructing culverts on Div. 11, Sect. 4, Caliente-Kernville Road, about 1.2 miles.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Connecticut.**—Contracts awarded by C. J. Bennet, State Highway Commissioner, at Hartford, as follows:

Thompson, 5230 ft. native stone macadam on Brandy Hill Road to John Arberie, 36 Ward Street, New Haven.

Cornwall—9300 lin. ft. graded road on Cornwall Hollow Road to Louis Longhi & Brothers, Torrington.

Portland, constructing 16-ft. reinforced concrete box culvert over Siam Brook to A. Brazos & Sons, Inc., Middletown.

Barkhamsted, 4500 ft. standard wood guard railing on New Hartford-Winsted Road to F. A. Wilcox, Norwich.

Guilford—1141 ft. standard wood guard railing on Boston Post Road to Webster & Webster, East Hartford.

★**Eldred, Pa.**—Contract for paving Main Street awarded by Borough Council to Chenango Constr. Co., Albany, N. Y., at $71,137.

★**Anderson, Ind.**—Contract for improving 2.75 miles of road (bids opened Jan. 8), awarded by County Commissioners to William Dillon, Anderson, gravel to be used. Ethan T. Flahovin, County Auditor.

★**Boonville, Ind.**—Contracts for constructing 2 stone roads, Lant Road and Holder Road, in Ohio Township, awarded by County Commissioners to Taylor & Kremp, Jasper, at about $21,000.

★**Elkhart, Ind.**—Contracts for constructing roads awarded by County Commissioners as follows: Main Street extension of Elkhart-Goshen Road to Amandus M. Smith, Elkhart, at $21,960, and the Harrison Township Road to Foley Constr. Co., at $30,580.

★**Williamsport, Ind.**—Contracts for constructing roads awarded as follows: B. F. Pottre Road, Steuben Township, to E. E. McKee & Co., at $8,114; C. W. Knotts, Anderson, secured the contract for Van Horn Road, in Pine Township, at $8,394; O. B. Johnson Road, Prairie Township, $7,434. and Borders Coffelt Road, Prairie Township, $7,243; Keegan Bros., Brazil, Willett Road, Prairie Township, at $12,687.

Duluth, Minn.—Following are lowest bids opened Jan. 14 by city for paving and curbing W. First Street from Twentieth Street W. to Thirtieth Avenue W.: Rogers & McLean, 422 Lyceum Building, bituminous concrete $55,171, vitr. brick $63,257, asphalt $59,430, sandstone blocks $73,906, reinforced concrete trap rock $49 549; Clough & Co., creosoted blocks $.6.303, bitulithic $61,412; Olson & Johnson, sandstone $49,398. Lyonel Ayres, City Engr.

★**Seattle, Wash.**—Following are three lowest bids opened Jan. 11 by County Commissioners for constructing highway between Hazelwood and Newport, requiring 38,700 cu. yd. excav., 2800 cu. yd. gravel surfacing, etc.: W. W. Wilcox, Sunnydale Station, Seattle, $17.995 (awarded contract); L. H. Goerig, Seattle, $19,200; Jarvis & Co., Seattle, $19,863; A. P. Denton, County Engineer.

Portland, Ore.—Lowest bids opened by City Council for paving E. Twenty-second Street submitted as follows: Oskar Huber, Portland, with bitulithic, $9,995, and Warren Constr. Co., Portland, with asphalt, $8,954.

★**The Dalles, Ore.**—Contract awarded Standefer-Clarkson Co., Portland, for constructing roads, to consist of approximately 25,500 cu. yd. hard rock, 8500 cu. yd. loose rock, at$21,890. F. S. Gunning, County Judge.

★**Bakersfield, Cal.**—Contract for grading, paving and constructing culverts on 6.7 miles of road between Maricopa and Taft, awarded Mackie & McLean, Wasco and San Francisco, at $29,412.

★**California.**—Contract awarded by California Highway Commission, Sacramento, as follows (bids opened Dec. 27):

★Tehama County, Division II, Routes 7 and 3, Sections A and B, to Taylor & Berliner, Box 35, Willows, $61,282.

★Placer County, Division III, Route 17, Section B, to A. C. McLean Construction Co., 320 Market Street, San Francisco, $30,815.

★**Hanford, Cal.**—Contract awarded O. D. John, San Francisco, by County Board of Supervisors for 7500 cu. yd. excav., 680,667 sq. ft. concrete base, with Topeka or Warrenite surface, etc., on Highway No. 3, Division A-1, Section 1, Hanford, to Guernsey, at $26,257.

★**Huntington Beach, Cal.**—Contract for 592,200 sq. yd. concrete paving, 8400 lin. ft. cement curbs, 1895 ft. corrugated iron and concrete culverts, timber and concrete subway under tracks, awarded Lehigh G. Garnsey, Central Building, Los Angeles, at $79,200.

Los Angeles, Cal.—Following are totals of the four lowest bids opened by Road Department of the County for Section "A" of Mint Canyon Road: Peter L. Ferry, 536 Acacia Street, Tropico, $29,540; Fred Hoffman, 111 East Twelfth Street, Long Beach, $30,603; Leigh G. Garnsey, 401 Bradbury Bldg., Los Angeles, $31,984; E. J. Hein, 511 Stimson Bldg., Los Angeles, $32,090. F. H. Joynes, Road Commissioner; E. F. Godse, Supt. of Construction.

★**Ontario, Cal.**—Contract for about 100,000 sq. ft. concrete pavement and 27,000 sq. ft. grading on State Street and Euclid Avenue awarded S. C. Constructing Co., Washington Building, Los Angeles, at 8 cents, concrete base with oil surface, and 8¼ cents, concrete base with cement surface.

★**Santa Barbara, Cal.**—Contract for paving Santa Maria-Guadalupe Road awarded J. T. Vornwell, Santa Barbara, at $9,490, county furnishing rock and oil.

STREET CLEANING AND GARBAGE DISPOSAL

PROPOSED WORK.

Paducah, Ky.—City Commissioners considering constructing a garbage disposal plant.

Canton, Ohio.—Mayor in his annual message recommends constructing a garbage disposal plant.

Springfield, Ohio.—Construction of a garbage disposal plant is under consideration. Address City Manager.

Madison, Wis.—City Engineer preparing plans for the proposed garbage-disposal plant. Address City Clerk.

Lincoln, Neb.—Plans being prepared for the garbage disposal plant, to have a capacity of 50 tons per day; bids to be taken on different kinds of furnaces; $50,000 bonds voted recently for this plant.

St. Louis, Mo.—Board of Aldermen reported considering construction of a garbage disposal plant at a cost of $150,000.

PRICES AND LETTINGS.

★*Indicates award of contract.*

New York, N. Y.—Following are bids opened Jan. 18 by J. F. Fetherston, Commissioner of Street Cleaning for garbage disposal in Boroughs of Manhattan, Brooklyn and Bronx (an injunction has been served):

Form I, for disposal of garbage—Gaffney, Gehagen & Van Etten: Fist year, $120,000; second year, $150,000; third year, $180,000; fourth year, $210,000; fifth year, $240,000. Newton A. Wilmont, $1 for each year.

Form II—Gaffney, Gehagen & Van Etten: Item I, price at which plant will be sold to city Jan. 2, 1922, $1,500,000; Item II, price for building and operating plant, $2,500,000.

★**Chicago, Ill.**—Contract for 130 tons of steel for extractor building of municipal reduction plant awarded A. Bolters Son, 2301 Ward Street.

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS

PROPOSED WORK.

Drydock—Boston, Mass.—Directors of the Port of Boston (Edward F. McSweeney, Chmn.) have requested Professor C. M. Spofford of M. I. T. to act with Guy C. Emerson of the Finance Commission and F. W. Hodgson as consulting engineers on the new drydock. Directors have also engaged Professor E. F. Miller, head of the department of mechanical engineering at M. I. T., to pass on testing materials to be used in the work.

State Canal Bonds—Albany, N. Y.—Class No. 1, $17,000,000 bonds for improvement of Erie, Champlain and Oswego Canals, and improvement of highways; Class No. 2, $3,000,000 for constructing barge canal terminals, to be sold Jan. 27, by Eugene M. Travis, State Comptroller, Albany.

Docks — Brooklyn, N .Y. — Reported agreement has been reached between the Dock Commissioner and the New York Dock Company for the leasing of the land at Montague and Joralemon Streets on which piers costing $1,500,000 are to be constructed.

Flood Abatement—Olean, N. Y.—Contract soon to be let by W. W. Wotherspoon, State Superintendent Public Works, Albany, for flood abatement work in this city. Printing of specification about completed.

Dam—Rockwood, N. Y.—See "New Industrial Plants."

Creek Improvement—Richmond. Va.—In the annual budget the following amounts are asked: Taking care of Shockoe Creek, $1,000,000; street improvements, $500,000; sewers, $500,000; new pavilion hospital, $500,000; flume to enlarge water supply, $300,000; First Street Viaduct, $250,000; Riverside Drive, $150,000; water mains, $108,361.
formation.

Flood Wall—Portsmouth, Ohio.—Mayor H. H. Kaps, in his message to Council, recommends extension of the flood wall as far eastward as the funds will permit, early restoration of the city reservoir and completion of new water works, construction of a complete sanitary sewer system in Hill Top Dist., and paving of remaining unimproved streets.

Channel Improvement—Hammond, Ind.—The deepening and widening of the channel of the Calumet River from Columbia Avenue east to the canal is under consideration. Peter Lyon Engineer, Hammond, may be able to give further in-

Drain—Hastings, Mich.—Reported contract soon to be let for constructing the big Collier drain through Ionia, Eaton and Barry Counties; cost estimated at $25,000. Address County Commissioners.

Drain—Hastings, Mich.—Reported contract soon to be let for constructing Collier Drain in Ionia, Eaton and Barry Counties, to cost $25,000. Upper half is to be tiled and lower half dredged. D. S. England of Hastings, Drain Commissioner of Barry County.

Dam—Decatur, Ill.—Reported a dam is to be constructed in Sangamon River at Decatur. Mayor Dinneen has submitted to Council a proposition to construct a levee along the river, to include on it a driveway to cost approximately $40,000.

Drain—Rock Island, Ill.—Reported City Council taking steps to construct the southwest storm drain system. Probable cost $135,000.

Drainage—Council Bluffs, Iowa.—Engineer J. H. Mayne estimates the cost of proposed Silver Creek drainage ditch in James, Washington, Silver Creek and Keg Creek Townships as follows: Main ditch excav., 628,800 cu. yd., $43,876; Middle Silver lateral, 8300 yds., $15,502; Little Silver, 8300 yd., $830; other laterals, 14,000 cu. yd., $2,100; right of way, etc., totaling about $100,000.

Drainage—Oskaloosa, Iowa.—Board of Supervisors has adopted the report of W. F. Byers and have voted to establish a drainage district in and through Mahaska County for the straightening of the channel of South Skunk River.

Ditch—Crookston, Minn.—Judge Watts has engaged an engineer to prepare preliminary surveys of the proposed Judicial Ditch No. 65 to run 10 miles in Polk and Red Lake Counties.

Creek Improvement—Minneapolis, Minn.—See "Paving and Roads."

Ditch—Walker, Minn.—Contract will be let about Feb. by C. D. Baron, County Auditor, for constructing G. L. Frazier Ditch, to consist of 12 miles of main ditch and laterals. A. W. Moulster, Engineer in Charge, Pine River, Minn.

Drainage — Manhattan, Kan. — O. E. Noble, County Surveyor of Riley County, has been appointed engineer for the Blue River Drainage District No. 1. Open ditches proposed for draining 1000 acres. Surveys now being made.

Drainage—Scandia, Kan.—J. A. Campbell, Topeka, engaged to make a survey for the Drainage District No. 1, Mitchell County; open ditches and levees are proposed.

Drainage—Silver Lake, Kan.—Election soon to be held to vote bonds, probably $30,000, for constructing river protection work in Kaw River Drainage District. H. B. Walker, Drainage Engineer, Manhattan, Kan.

Drainage—Topeka, Kan.—Surveys completed but plans not yet prepared for drainage work contemplated in North Topeka Drainage Dist. L. C. Caldwell, Secy., North Topeka, Kan.; H. B. Walker, Drainage Engineer, Manhattan.

Drainage—Williamstown, Kan.—Surveys soon to be made for a drainage district proposed to afford protection from Stone House Creek; 3000 acres to be protected. H. B. Walker, State Drainage Engineer, Manhattan.

Dike and Revetment—Gasconade, Mo.—In the new year it is proposed constructing 15,000 lin. ft. of wooden pile dike at a cost of $225,000, and 12,000 lin. ft. of concrete revetment, cost $100,000; work will be done by day labor. Following materials to be purchased: 1,000,000 lin. ft. ⅜-in. galvanized steel strand, 100,000 lin. ft. galvanized woven wire reinforcing fabric, 50 in.; 30,000 galvanized woven wire reinforcing mats, 22 in. x 22 in.; 100 tons structural steel, 15,000 lb. plate washers, 100 cars cement, 250,000 lin. ft. yellow pine piles, 1000 M ft. yellow pine or fir lumber, etc. Harry Hodgman, U. S. Asst. Engineer, Missouri River Improvement, Gasconade.

Dock—St. Louis, Mo.—Board of Estimate and Apportionment has been asked to appropriate $15,000 for construction of a temporary municipal dock at foot of O'Fallon or Victor Streets.

Ship Channel Bonds—Houston, Tex.—Harris County—Houston Ship Channel Navigation District bonds, amounting to $250,000 have been sold.

Wharf Bonds—Houston, Tex.—Wharf bonds amounting to $937,600 and drainage sewer bonds amounting to $387,500 will be sold Feb. 12 by Ben Campbell, Mayor.

Drainage Bonds—Victoria, Tex.—Drainage bonds amounting to $146,000 for District No. 3 have been sold. Preliminary work has been started on the district.

Hydro-electric Plant—Salem, Ore.—Permit issued for development of 952 h.p. from John Day River and Warm Springs near Prairie City have been granted by State Engineer to Prairie Power Company. The company intends extending canal near Prairie City about two miles, construct a reservoir at Strawberry Lake and develop power for lighting Prairie City, Canyon City and John Day. Estimated cost of project $45,000. A permit was also granted to Horace G. Campbell of West Lake, to develop power at outlet of Whoahink Lake in Lane County.

Harbor Improvements—California.—War Department Engineers, Washington, D. C., have ordered improvements to the Los Angeles and Long Beach harbors at a cost of $1,400,000.

Dams—Fresno, Cal.—Kings River Water Control and Conservation District (J. C. Moore, Secy.) are working a plan to organize to bring about conservation of approximately 600,000 acre-ft. of Kings River waste water per year. A $6,000,000 reservoir system at Pine Flats and Mill Creek is contemplated.

Levee—Imperial, Cal.—Construction of a levee 16 ft. high and nine miles long on present site of the Volcano Lake levee for the protection of Imperial Valley of California against Colorado River floods is recommended in a report sent to Congress by the War Department. An extension of 6 feet in height is also recommended, the total cost not to exceed $1,250,000.

Wharf Extension—Los Angeles, Cal.—The addition to the Mormon Island Channel wharf is to cost $125,000 and will include a bulkhead approximately 600 ft. long. Work to be done by day labor. J. C. Jubb, Asst. Harbor Engineer.

Irrigation—Madera, Cal.—Madera Irrigation Bureau (W. S. Orvis, Secy.) has had maps prepared for proposed irrigation district.

Irrigation—San Francisco, Cal.—Leon Bly, of San Francisco, has applied to State Water Commission for permission to appropriate 30,000 acre feet per annum of the water of Eagle Lake, Lassen County, and will construct a tunnel and canal to natural channel of Willow Creek.

Irrigation — Stockton, Cal. — Contract will be let about May for constructing the irrigation system for West Side Irrigation District, to consist of 2700-hp. pumps, 6600 ft. 48-in. wood pipe, 13,600 ft. 54-in. wood pipe, canals and structures. W. G. Hunter, Engineer, Stockton.

Flood Protection—Ventura, Cal.—County Supervisors and property owners of the Mound District reported considering forming an irrigation district and constructing storm water protection work.

Irrigation—Delta, Utah.—James A. Melville of Delta has applied to State Board of Land Commission, Salt Lake City, for permission to purchase 30,000 acre-feet of water from State's Piute reservoir. A delegation from Juab County has also applied for water rights from this reservoir. William Bailey, Chairman State Board of Equalization, Salt Lake City, represented Juab County.

Harbor Improvements—Toronto, Ont.—Toronto Board of Harbor Commissioners approved estimates for the year amounting to $2,500,000 including $650,000 for reclamation work and $100,000 for lift bridge across Don at Cherry Street, and remainder for different construction work.

BIDS DESIRED.

State Canal Work—Albany, N. Y.—Until Feb. 16, by W. W. Wotherspoon, State Superintendent, Public Works, Albany, for constructing state canal work as follows, advertised in Engineering Record:

Contract 46-B (revised)—Erie Canal, Section 7, completing construction of lock, dam, etc., at May's Point.

Contract No. 122 (revised)—Erie Canal, Section 4, constructing substructure, superstructure and approaches of highway bridge over Mohawk River near Little Falls.

Contract No. 63-A—Erie Canal, Section 9, construction of canal from west line of Wayne County, to east end of Contract 23-A at King's Bend, length 12.22 miles.

Bulkhead — Baltimore, Md.—Until Jan. 26 by Board of Awards at office of City Register for renewal of bulkhead at Harris Creek Dock, souhtward from Boston Street, and constructing a timber bulkhead along east side of Harris Creek dock southward from Boston Street a distance of 100 ft. H. K. McKay, Harbor Engr

Dredging—Baltimore, Md.—Until Jan. 26 by Board of Awards at office of City Register for dredging in Baltimore harbor. H. K. McKay, Harbor Engr.

Drains—Bluffton, Ind.—Until Jan. 25, by County Surveyor, for the Smith-Taylor drain. Probable cost $12,000. Also until Feb. 4, for the Michaels drain. Probable cost $13,000.

Ditch—Warsaw, Ind.—Reported desired until Jan. 28, by Hiram E. Smith, Drainage Commissioner, for constructing drainage ditch 19,400 ft. long and requiring 56,646 cu. yd. excavation.

Ditch—Washington, Ind.—Reported desired until Feb. 9, by Wm. J. Shanks, Co. Surv., for constructing Prairie Creek Ditch, about 34 miles long and 60 to 6 ft. wide.

Steel, Etc., for Locks—Sault Ste. Marie, Mich.—Until Feb. 23, by U. S. Engineer Office, 337 Federal Building, Detroit, for furnishing and delivering at Sault Ste. Marie 200 tons of steel, etc., for constructing guard gates of Fourth Lock, advertised in Engineering Record.

Rip Rap Slope—Chicago, Ill.—Until Feb. 3, by John McGillen, Clk. Sanitary Dist., 910 S. Michigan Avenue, for constructing rip rap slopes on Contract Sections 7 and 8 of the Calumet Sag Channel, consisting of furnishing and placing 200 sq. yd rip rap slope, and located in Townships Palos and Worth.

Drainage—Eldora, Iowa.—Reported desired until Jan. 24, by C. Boylan, Co. Aud., for constructing Drainage Dist. No. 66, about 10,600 ft. 6 to 18 in. tile.

Drainage—Jackson, Minn. — Until Feb. 15, by P. D. McKellar, Co. Aud., for constructing Judicial Ditch No. 35, to consist of 139,825 ft. of 6 to 36 in. tile; also 132,680 cu. yd. open work, etc. Estimated cost $58,256.

Ditch—Montevideo, Minn.—Reported desired until Jan. 25 for constructing County Ditch No. 16, about 69,147 lin. ft. of 6 to 18-in. tile, 710,702 cu. yd. excav., etc.; probable cost $68,119. Also separate bids for County Ditch No. 20, about 62,801 lin. ft. 5 to 18.- tile; probable cost $9,993. J. J. Stennes, County Auditor.

Ditches — Moorehead, Minn. — Reported desired until March 9, by A. O. Houghlin, Co. Aud., for constructing Ditch No. 36; also repairing and enlarging Ditch No. 3. Estimated cost $7,689 and $6,498 respectively.

Ditch—Princeton, Minn.—Until Feb. 15, by W. C. Doane, County Auditor, for constructing ditch No. 11. Probable cost $45,094.

Drainage—Clarks, Neb.—Until Feb. 4, by Board of Directors of Drainage-Dist. No. 1 for excavation and construction of a drainage system, advertised in Engineering Record. Donald D. Price, Engineer, 219 First National Bank Bldg., Lincoln.

Ditches—Powhatan, Ark.—Reported desired until Feb. 9, by Commissioner War Pond Flat Creek Drainage Dist. (J. S. Mize, Secy.), for constructing 7 miles of dredge ditches.

Spillway Gates — Seattle, Wash.—Until Feb. 16, by U. S. Engineer's Office, Seattle, for spillway gates, advertised in Engineering Record.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Dam—Norfolk, Va.—Lowest bid opened Jan. 8 by Board of Control for constructing two Little Creek dams and spillways and for Lake Taylor dam and spillway submitted by F. J. McGuire & Company, Norfolk, at $63,856.

★**Wharf Sheds — Macon, Ga.**—Contract for constructing platform stages at wharf for use of Macon-Atlantic Navigation Company awarded by Committee on Public Property to Ingram-Tarleton Engineering Company.

★**Dredging—Jacksonville, Fla.**—Contract awarded Standard American Dredging Company, Oakland, Cal., for dredging in St. Lucie Inlet at about $90,000.

★**Dredge Pumps — Cleveland, Ohio.**—Contract awarded by Nickel Plate R. R. to Strong, Carlisle & Hammond Company, 1394 W. Third Street, for furnishing four 12-in. centrifugal dredge pumps each capable of handling 4000 gal. of water a minute against a head of 125 ft. Pumps are to be used in sluicing in grade elimination work on the West Side.

★**Ditch—Crown Point, Ind.**—Contract for excavating Stoney Run ditch awarded Lover & Hewitt, Leroy, at $25,324.

★**Drainage—Carrollton, Ill.**—Contracts for pump and oil engine (bids opened Jan. 8) awarded as follows: to Farrar Pump & Machinery Co., St. Louis, Mo., for a 36-in. American Dow suct. pump and fittings at $2,960, and to Fulton Iron Works, St. Louis, Mo., one 260 B. h.p. Fulton Tosi Diesel oil engine delivered and erected, at $12,740. G. W. Whiteside, Drain Engineer.

★**Ditch—Urbana, Ill.**—Contract for constructing drainage work in Branch No. 23 (bids opened Jan. 10) awarded by Joseph P. Gulick, Attorney, for Two Mill Slough Drainage Dist., Champaign, to William R. Stewart, Urbana, at $7,699.

★**Ditch—Duluth, Minn.**—Contract for constructing St. Louis County Ditch No. 5, involving 8 miles main and lateral ditches and excavation of 33,000 cu. yd. earth, awarded G. G. Hartley, 804 Lonsdale Bldg.

★**Ditches—Poplar Bluffs, Mo.**—Contract awarded F. A. Walker, Poplar Bluffs, for constructing four drainage ditches, approximately 33,985 cu. yd. at 13 cts. per cu. yd. John H. Greason, Engineer, Drainage Dist. No. 11, Poplar Bluffs.

★**Drainage—Marion, Ark.**—Contract for constructing drainage system in Crittenden County award R. H. & G. A. McWilliams, Memphis, at $7.43½ per cu. yd. Total cost about $20,000. Morgan Engineering Company, Memphis, Tenn., Engineers.

ELECTRIC RAILWAYS

PROPOSED WORK.

Prattsburg, N. Y.—Plans being considered for an electric railway to be constructed between Prattsburg and Kanona, with possible extensions to Stanley or Branchport. John Kimmel, Wayland, said to be interested.

Rochester, N. Y.—Plans completed by Rochester Ry. & Light Co. for erection of sub-station between Atlantic Avenue and Leighton Avenue, near Culver Road.

New York, N. Y.—Following are unit figures of four lowest bids opened Jan. 10 by Chief Engineer Interborough Rapid Transit for constructing Section No. 6-D, West Farms subway connection: (a) A. L. Guidone, Vanderbilt Avenue, $105,791; (b) Conners Brothers Co., Inc., 64 W. Eighty-eighth Street, $108,280; (c) Pennsylvania Steel Co., 71 Broadway, $113,660; (d) Post & McCord, 101 Park Avenue, $116,625.

Item		(a)	(b)	(c)	(d)
1-B	3,200 cu. yd. excavation for column foundations	$2.10	$4.00	$4.00	$2.90
6-A	840 cu. yd. concrete masonry for foundations, in place	8.00	7.50	9.00	7.00
6-B	70 cu. yd. concrete masonry for fenders, in place	9.00	8.00	8.50	8.00
9	6 cu. yd. brick masonry, in place	16.00	20.00	20.00	25.00
17	60 lin. ft. (a) 4-in. vitrified pipe, in place	1.40	0.60	1.00	0.30
	50 lin. ft. (b) 6-in. vitrified pipe, in place	1.50	0.80	1.50	0.40
19-A	1,050 ton new structural steel, painted and erected	80.00	78.00	79.60	87.00
19-B	1,200 lin. ft. erection of old girders in new location, including painting	2.50	2.00	2.00	3.80
25-A	16 ton miscellaneous iron castings	80.00	80.00	75.00	70.00
25-B	1 ton new cast-iron hub and spigot pipe special castings, in place	85.00	50.00	80.00	85.00
30	800 sq. yd. street surfaces restored: (h) all surfaces of whatever character	3.00	2.60	3.40	3.25
31	30 sq. yd. park surface restored (all classes)	0.50	1.00	3.00	2.00
75	770 lin. ft. street surface railroads, including the support, reconstruction, rebuilding, etc., where necessary, as follows: For electric (overhead trolley) railroad, single track	0.80	1.00	3.00	1.00
127	100 duct ft. electric ducts and conduits, in place	1.00	0.20	1.00	2.00

New York, N. Y.—Following are unit figures of four lowest bids opened Jan. 10 by Chief Engineer Interborough Rapid Transit for constructing Section 9-B, Webster Avenue Line: (a) M. J. Leahy, 1446 Prospect Avenue, $831,111; (b) A. L. Guidone & Son, Vanderbilt Avenue, $838,765; (c) Rodgers & Collier, $841,063; (d) Pennsylvania Steel Co., 71 Broadway, $853,850.

Item		(a)	(b)	(c)	(d)
1-B	24,000 cu. yd. excavation for column foundations	$1.75	$1.65	$2.40	$3.30
6-A	8,500 cu. yd. concrete masonry, in place	6.67	6.00	6.00	7.90
6-B	580 cu. yd. concrete masonry for fenders, in place	7.31	10.00	8.00	7.50
6-C	600 cu. yd. concrete masonry for solid deck floor, in place	11.30	12.00	12.00	15.00
6-D	250 cu. yd. concrete masonry for protection of waterproofing on solid deck floor, in place	8.50	10.00	7.00	8.00
9	10 cu. yd. brick masonry, in place	20.00	16.00	13.00	18.00
12	500 lin. ft. timber piles, in place, and prepared	0.85	0.50	0.50	0.80
15	2,700 sq. yd. 3-ply waterproofing, treated woven fabric, laid with pitch, in place	0.65	1.50	1.25	0.90
17-A	50 lin ft. 4-in. vitrified pipe, in place	0.45	1.40	0.20	1.00
17-B	50 lin. ft. 6-in. vitrified pipe, in place	0.65	1.50	0.20	1.20
19	9,100 ton riveted steel, painted and erected	73.00	74.65	73.60	68.80
20	50 ton steel beams and shapes, with connections, painted and erected	67.00	67.00	67.60	66.80
21	10 ton steel rods and bars built in concrete	66.72	80.00	50.00	80.00
25-A	230 ton miscellaneous iron castings, in place	69.13	80.00	50.00	70.00
25-B	60 ton new cast-iron hub and spigot pipe, special castings, in place	63.54	90.00	80.00	76.00
30	3,800 sq. yd. street surface restored: (h) all surfaces of whatever character	2.00	2.50	1.36	2.50
75	17,900 lin. ft. street surface railroads, including the support, reconstruction, rebuilding, etc., where necessary, as follows: Electric (overhead trolley) railroads, single track	0.68	0.80	0.75	1.40
127	14,000 duct ft. electric ducts and conduits, in place	0.75	0.10	0.67	0.40
31	100 sq. yd. park surface restored (all classes)	3.00	0.76	1.00	2.50

New York, N. Y.—Following are unit figures of the four lowest bids opened Jan. 10 by Interborough Rapid Transit for constructing Section No. 10-C, Eighth Avenue and 162d Street connection: (a) Battery Engineering & Construction Co., 17 Battery Place, $336,784; (b) Arthur McMullen Co., 149 Broadway, $408,530; (c) A. L. Guidone & Son, Inc., Vanderbilt Avenue, $411,343; (d) Laurence C. Manuell, 11 Pine Street, $417,175. Earth excavation includes sheathing, disposal of excavated material and backfilling; rock excavation includes shoring, disposal of excavated material and backfilling. Earth excavation in trenches for sewers includes sheathing, disposal of excavated material and refilling, and rock excavation includes shoring and disposal of excavated material and backfilling. Rock excavation in open cut includes shoring, decking, maintenance of overhead, surface and subsurface structures, backfilling and disposal of waste material; earth excavation in open cut includes sheathing, shoring, decking, maintenance of overhead surface and subsurface structures, backfilling, grading and disposal of waste material. Excavation in tunnel includes shoring and disposal of waste material.

	(a)	(b)	(c)	(d)
Item 1—2,340 cu. yd. earth excav. for foundations for elevated structure on and east of Jerome Avenue	$2.65	$3.00	$1.85	$1.45
Item 2—294 cu. yd. rock excav. for foundations for elevated structure east of the west building line of Jerome Avenue	5.00	4.00	3.25	4.00
Item 3—160 cu. yd. earth excav. in trenches for sewers and sewer and other public service connections	3.60	3.00	2.25	1.45
Item 4—160 cu. yd. rock excav. in trenches for sewers and sewer and other public service connections	5.00	5.00	3.75	4.00
Item 5—5,900 cu. yd. earth excav. in open cut	2.00	5.00	0.35	1.80
Item 6—11,600 cu. yd. rock excav. in open cut	3.60	5.50	4.50	4.30
Item 7—150,000 cu. yd. excav. in tunnel	5.50	6.50	6.95	8.05
Item 8—1,500 sq. yd. repaving Anderson Avenue and W. 162d Street between curb lines	3.00	2.50	1.50	1.40
Item 9—70 sq. yd. repaving Jerome Avenue between curb lines	3.00	3.00	2.60	2.60
Item 10—480 sq. yd. repaving W. 162d Street and Anderson and Jerome Avenues within curb lines	3.00	1.60	1.60	1.40
Item 11—800 lin. ft. replacing curb	1.00	0.25	0.50	0.25
Item 12—100 lin. ft. underpinning buildings	1.00	10.00	80.00	70.00
Item 13—4,000 lin. ft. wooden piles	0.35	0.50	0.50	0.35
Item 14—20 M ft. timber ordered left in place	50.00	15.00	60.00	35.00
Item 15—3 M ft. spruce rough furnished in place	60.00	50.00	60.00	47.00
Item 16—3 M ft. yellow pine lumber dressed, 4s	70.00	80.00	80.00	51.00
Item 17—1,200 cu. yd. stone concrete, 1:2½:5, for elevated railroad column foundations, in place, including forms	7.00	7.00	7.50	6.30
Item 18—5,500 cu. yd. stone concrete, 1:2½:5, in open cut, in place, including forms	6.75	6.00	8.50	7.15
Item 19—3,010 cu. yd. stone concrete, 1:2½:5, in tunnel, including forms	7.00	8.00	9.00	8.75
Item 20—15 cu. yd. stone concrete, 1:2½:5, in trench	11.00	7.00	10.00	7.15
Item 21—1,607 cu. yd. stone concrete, 1:2:4, in tunnel arch, including forms	7.50	8.00	9.50	9.25
Item 22—25 cu. yd. stone concrete, 1:2:4, maximum size ¾ in., in place, including forms	8.30	7.00	12.00	8.50
Item 23—170 cu. yd. cinder concrete, 1:5:10, in place, including forms	5.40	5.00	6.00	5.00
Item 24—178 cu. yd. cinder concrete, 1:2½:5, in place, including forms	6.50	5.50	7.00	6.00
Item 25—100 cu. yd. stone concrete, 1:2½:5, reinforced, in place, including forms	9.40	10.00	11.00	14.00
Item 26—320 cu. yd. stone concrete, 1:2:4, reinforced, in place, including forms	10.40	16.00	16.00	16.00
Item 27—A—68 grout under column basis in place (per column)	1.00	1.00	1.50	1.00

Section No. 10-C. Eighth Avenue and 162d Street Connection—Continued.

Item 27B—100 other grout that as specified under Item 27-A as ordered by the Engineer, in place, per bbl. of cement used	3.00	2.50	3.00	2.50
Item 28—16,800 sq. ft. granolithic finish, ¾ in. thick, in place	0.07	0.05	0.12	0.10
Item 29—332 sq. ft. ornamental tile	1.50	1.50	1.75	1.60
Item 30—60 cu. ft. cut granite masonry in manholes and catch basins	2.50	1.00	2.50	1.75
Item 31—30 cu. yd. brick masonry in walls	15.00	15.00	20.00	15.00
Item 32—10 cu. yd. brick masonry in sewer, including centerings	15.00	16.00	20.00	19.00
Item 33—320 sq. yd. brick protection for 6-ply waterproofing	1.00	1.25	2.00	2.10
Item 34—425 sq. yd. brick and asphalt mastic waterproofing	2.50	2.75	2.60	2.50
Item 35—2,400 sq. yd. 6-ply waterproofing	1.76	1.75	1.60	1.90
Item 36—1,000 sq. ft. waterproofing column foundations	0.05	0.04	0.10	0.20
Item 37—620 cu. yd. stone packing over tunnel arches	2.00	2.00	4.00	2.00
Item 38—643 ton structural steel for elevated structure	63.00	80.00	83.00	81.00
Item 39—400 ton structural steel for tunnel approaches	66.00	78.00	81.00	79.00
Item 40—300,000 lb. fences rolled steel	0.06	0.06	0.07	0.10
Item 41—4,000 lb. rolled steel manhole frames, gratings, covers and ladders	0.06	0.05	0.06	0.08
Item 42—5.000 lb. rolled steel laddered steps	0.05	0.06	0.06	0.08
Item 43—28,000 lb. reinforcing rods	0.035	0.04	0.04	0.035
Item 44—20,500 sq. ft. wire mesh concrete reinforcement	0.03	0.04	0.05	0.07
Item 45—3,000 lb. steel doors, including fastenings	0.07	0.05	0.12	0.10
Item 46—500 sq. ft. kalameined doors, including fastenings	0.35	1.50	2.00	2.50
Item 47—200 lb. iron pipe railings	0.06	0.15	0.17	0.20
Item 48—10,000 lb. railings, ornamental iron	0.15	0.06	0.11	0.15
Item 49—90,000 lb. anchor bolts, including nuts, washers and temporary wrapping	0.04	0.05	0.05	0.045
Item 50—4,600 lb. steel casting	0.09	0.05	0.10	0.10
Item 51—32,600 lb. miscellaneous castings	0.045	0.03	0.04	0.05
Item 52—16 ton c.-i. pipe Standard "B," including corking	45.00	45.00	70.00	45.00
Item 53—28 ton c.-i. Standard 10-in. and over, including corking	43.00	40.00	70.00	47.00
Item 54—21.5 ton c.-i. pipe specials	65.00	75.00	80.00	72.00
Item 55—740 sq. ft. safety treads	0.50	0.80	0.85	1.00
Item 66—1,507 lin. ft. vitr. pipe, 3 in. diameter	0.20	0.18	0.30	0.35
Item 57—30 lin. ft. vitr. pipe, 4 in. diameter	0.20	0.20	0.40	0.40
Item 58—50 lin. ft. vitr. pipe, 6 in. diameter	0.25	0.25	0.65	0.50
Item 59—10 lin. ft. vitr. pipe, 8 in. diameter	0.30	0.30	0.55	0.50
Item 60—20 lin. ft. vitr. pipe, 10 in. diameter	0.40	0.35	0.65	0.70
Item 61—30 lin. ft. vitr. pipe, 12 in. diameter	0.50	0.40	0.85	0.80
Item 62—30,000 sq. ft. vitr. ducts one way, including galvanized iron wire and paraffined clubs	0.12	0.15	0.15	0.12
Item 63—550 sq. ft. hollow terra cotta tile, 4 in. x 12 in.	0.15	0.20	0.12	0.12
Item 64—18,200 lin. ft. hollow terra cotta tile, 4 in. x 4 in.	0.10	0.05	0.10	0.10
Item 65—360 lin. ft. hollow terra cotta tile, 6 in. x 12 in.	0.20	0.20	0.15	0.15
Item 66—1,440 lin. ft. hollow terra cotta tile, 12 in. x 12 in.	0.25	0.25	0.25	0.20

Pipes in Streets

For Work and Material as Called for by the Specification Sections Nos. 44 and 62

Water Pipe

Item 67—150 lin. ft. 4 in.	0.40	0.40	0.76	0.50
Item 68—400 lin. ft. 6 in.	0.60	0.60	1.00	0.75
Item 69—2 hydrants	50.00	10.00	76.00	50.00

Gas Pipe

Item 70—80 lin. ft. 4-in. c.-i. gas pipe	0.30	0.60	0.50	0.60
Item 71—225 lin. ft. 6-in. c.-i. gas pipe	0.40	1.00	0.75	0.80
Item 72—60 lin. ft. 4-in. w.-i. gas pipe	0.30	0.50	1.00	0.60
Item 73—225 lin. ft. 6-in. w.-i. gas pipe	0.40	0.75	1.50	0.75
Item 74—60 lin. ft. 4-in. w.-i. by-passing pipe upon or below the street surface	0.30	2.00	2.50	1.25
Item 75—350 lin. ft. 6-in. w.-i. by-passing pipe upon or below the street surface	0.40	3.00	3.00	2.50
Item 76—50 lin. ft. 4-in. w.-i. by-passing pipe above the street surface on trestle	0.30	1.50	2.60	1.30
Item 77—100 lin. ft. 6-in. w.-i. by-passing pipe above the street surface on trestle	0.40	2.00	3.00	2.50
Item 78—150 lin. ft. trestle to support by-passing pipe	1.00	1.00	2.50	4.00

New Water snd Gas Pipe

Item 79—2 ton 4 and 6-in. c.-i. pipe	40.00	40.00	60.00	45.00
Item 80—0.6 ton new 4 and 6-in. w.-i. pipe	60.00	90.00	90.00	95.00
Item 81—0.5 ton c.-i. pipe specials	70.00	75.00	80.00	72.00
Item 82—1,500 lb. malleable iron fittings for new w.-i. gas pipe	0.05	0.05	0.10	0.05

Ducts in Streets

Electric Ducts and Conduits in Streets

Item 83—100 duct ft. electric duct and conduits, in place, as provided in Section No. 53 of the Specifications	0.50	1.00	1.00	0.80

Patton, Pa.—Plans are being made by Northern Cambria St. Ry. Co. to construct an extension to Hastings.

Spring City, Pa.—Pottstown & Phoenixville R.R. Co. (Ralph Shaner, Ch. Engr., Pottstown) expects to construct 2½ miles of line between Linfield and Spring City.

Womelsdorf, Pa.—Surveys being made by Lancaster & Berks Electric Ry. Co. for railway from Womelsdorf to Kleinfeltersville. The road will be 6 miles long and will be built by Philadelphia Constr. Co., which is now in the market for 15,000 railroad ties and 1000 35-ft. chestnut poles.

Charleston, W. Va.—Plans being made by Charleston-Dunbar Traction Co. to build 20-mile extension in West Virginia.

Morgantown, W. Va.—Grading has been completed by Morgantown & Wheeling Ry. Co. on line between Price and Blacksville. Contract yet to be let for laying and ballasting tracks.

Miami, Fla.—Miami Traction Co. authorized issue of $1,000,000 bonds, of which $200,000 are to be sold now, proceeds to be used in construction of extension to Miami Beach, West Palm Beach, Florida City and other points. Plans are also being considered to construct an extension to Cape Sable, Lake Okeechobee and Tampa.

Smithville, Tenn.—Surveys being made by Nashville & Eastern Electric Ry. Co. for electric railway from Lebanon to Smithville, distance of 25 miles. C. T. Edwards, Smithville, is interested.

Morganfield, Ky.—S. B. Anderson of Memphis, Tenn., and G. K. Drury of Morganfield, petitioned Fiscal Court of Union County for a franchise to construct an electric, standard gage, trunk railroad between Morganfield and Uniontown, a distance of about 12 miles.

Marion, Ohio.—Plans being considered to build an electric railway from Marion to Mt. Gilead. George D. Copeland, Marion, said to be interested.

Zanesville, O.—Southeastern Ohio Ry. Co., organized to take over property of Southeastern Ohio Ry., Light & Power Co., is planning to construct extensions to lines.

Evansville, Ind.—Reported construction will begin in spring on constructing electric railway from Evansville to New Harmony. C. J. Seibert, Evansville, Gen. Mgr.

Frankfort, Ia.—Keokuk Electric Co. plans to extend line from Frankfort to Curryville, with extensions to Bowling Green on east and Centralia on west.

Wichita, Kan.—Arkansas Valley Interurban Ry. Co. plans to improve entire track and equipment. All worn tracks will be replaced, entire line ballasted with sand rock, old wooden bridges will be overhauled or replaced with concrete and terminal facilities at Wichita will be made larger.

Glendale, Cal.—Pacific Electric Ry., Los Angeles, granted franchise to extend line 1 mile and has secured 2½ acres for terminal.

Los Angeles, Cal. — Board of Public Service Commissioners instructed Chief Electrical Engineer E. F. Scattergood to prepare plans for paralleling lines of the Utility corporations in Hollywood, East Hollywood, Highland Park, Garvanza and Eastlake Park Districts; cost about $725,000.

San Diego, Cal.—San Diego Electric Railway Co. (B. M. Warner, Gen. Supt., San Diego) is arranging to construct a line into La Playa.

Upland, Cal.—Pacific Electric Railway, Los Angeles, granted franchise for spur track over a mile in length on Orange Grove Avenue.

Venice, Cal.—Reported Pacific Electric Ry. Company, Los Angeles, contemplates constructing two more tracks parallel to double track through Venice, spproximately two miles.

Ogden, Utah.—During 1916 the Ogden, Logan & Idaho Ry. Co. contemplates spending about $1,000,000 for extensions and improvements to its system. Right-of-way has been purchased for a line from Hot Springs to Brigham City.

London, Ont.—A by-law was carried by ratepayers of London for spending $101,000 on terminal connections for newly electrified London & Port Stanley Ry.

Toronto, Ont.—The Taxpayers of Toronto on Jan. 1 endorsed an agreement under which the city guarantees bonds for proposed Toronto Radial Ry., to be constructed and operated by Ontario's Hydro Electric Power Commission. The line will eventually be extended to Sarnia. A line will also be built northward from Toronto, extending to Collingwood, Barrie and Orillia. An easterly radial will extend along shore of Lake Ontario to Montreal.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**New York, N. Y.**—Contract awarded Jan. 10 by Public Service Commission for First District, 154 Nassau Street, for constructing Section 3 of Route No. 8. the tunnel portion of the Fourteenth Street-Eastern Rapid Transit R. R., to be operated by the New York Municipal Ry. Corporation, to Booth & Flinn, Ltd., 17 Battery Place, at $6,639,023 (bids opened Dec. 7). For unit figures see Engineering Record of Dec. 18.

★Contract awarded by New York Municipal Railway Corporation to Crenshaw Engineering & Construction Company, Inc., 259 W. Thirty-fourth Street, for constructing the East New York additional tracks and reconstructing East New York yard at $1,237,229, has been approved by the Board of Public Service, 164 Nassau Street.

No bids opened Jan. 14 by Public Service Commissioner First Dist., 154 Nassau Street, New York, for Section 2-A of Route 12, part of the Broadway Fourth Avenue Rapid Transit Ry. Date postponed.

RAILROADS

PROPOSED WORK.

Albany, N. Y.—A bill has been read twice in the Senate providing for issuing bonds not exceeding $25,000,000, for eliminating of grade crossings in the state and providing for an election to be held in 1916 to vote said bonds.

New York, N. Y.—Agreement has been reached between the city and the New York Central R. R. for the elimination of the tracks on West Side, costing railroad about $50,000,000. It is estimated that six years will be required for the completion of the work. It is proposed to eliminate tracks at grade on Eleventh Avenue and construct a subway along Riverside Drive and Riverside Drive north of Manhattan Street through Fort Washington Park and for a viaduct to connect with the docks at Dyckman Street. G. W. Kittredge, Ch. Eng., Grand Central Station.

Huntington, W. Va. — Chesapeake & Ohio R.R. (F. I. Cabell, Ch. Engr., Richmond, Va.) reported planning a railroad 13 miles long from Cabin Creek branch to the railroad running along Big Coal River branch.

Athens, Ga.—Robert W. Lamkin of Athens, W. J. Twiggs of Augusta, and others, and are interested in the incorporation of the Augusta & Western R. R., which intends constructing a railroad between Richmond, Columbus, McDuffie, Wilkes, Ogelthorpe and Clarke to Athens.

Monroe, La.—Arkansas & Louisiana Midland R. R. Company incorporated for purpose of constructing a railroad from Monroe, La., to Crossett, Ark. Edward Ford, New Orleans, La., President; W. A. Otis, Colorado Springs, Col., Vice-President, and Alfred Cowles, Chicago, Ill., Secy.-Treasurer.

Barbourville, Ky.—Louisville & Nashville R. R. (W. H. Courtenay, Ch. Engr., Louisville) is reported surveying for a line from Barbourville to Corbin.

Cleveland, Ohio.—Mayor Harry L. Davis has directed Robert Hoffman, City Engineering Commissioner, to confer with the Nickel Plate and the Pennsylvania Railroads regarding the eliminating of the grade crossings of these roads on the East Side, to cost $4,650,000, of which the city is to pay $1,600,000, amount voted last November by the citizens.

Van Wert, Ohio.—Reported Cincinnati, Northern R. R. (W. D. Williams, Ch. Engr., Van Wert) plans improvements including erection of buildings at a cost of $600,000.

Duluth, Minn.—Mayor has introduced an ordinance in Council granting a franchise to Western Terminal Company to construct a terminal line through the city.

Cotter, Ark.—Cotter, Rush & Mineral Belt R.R. Co. incorporated and will construct a railroad from Cotter 15 miles south and such extensions as may be necessary. Directors: E. J. Loop, Cotter; J. K. Rea, Rea Valley; E. B. Griswold, Cotter, and others.

San Antonio, Tex.—Reported Illinois & Great Northern R. R. (O. H. Crittenden, Ch. Engr., Houston, Tex.) plans improvements, including yards and shops costing $350,000.

Republic, Wash.—Reported Spokane & British Columbia Ry. Company of Republic, will construct this spring a connection between Republic and Spokane via San Boil Valley.

Keddie, Cal.—State Railroad Commission, Sacramento, granted to Engles Copper Mining Co. permission to sell stock and construct a railroad from Keddie 26 miles into the mountains.

Porterville, Cal.—Reported Southern Pacific R. R. (W. Hood, Ch. Engr., San Francisco), is considering an extension of the Porterville Northeastern branch from Adobe, four miles from here, to tap granite quarries, magnesia deposits and the Monache orange district.

Oatman, Ariz.—Mohave County Supervisors at Kingman have been petitioned by Henry Lovin, State Senator from same county, and Horace J. Pullem, for a franchise to construct and operate a steam or electric railroad between Oatman and some point on Atchison, Topeka & Santa Fé R.R.

BIDS DESIRED.

Atlanta, Ga.—By Western & Atlantic Railroad Commission, State Capitol (Cambell Wallace, Secy.), for extension of Western & Atlantic Railroad.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Edgemont, Md.**—Contract awarded Claiborne & Johnson, Baltimore, for constructing a second track on Western Maryland Ry. line between Blue Mountain and Edgemont, a distance of about 4 miles.

★**Richmond, Va.** — Contract awarded Winston & Company, Richmond, for constructing the Richmond Urbana Ry. from West Point to Urbana along Rappahannock River; a distance of 17 miles.

★**Pemberton, W. Va.** — Contract for steam shovel and tunnel work on seven miles of the Winding Gulf extension of the Virginia R. R. at Pemberton awarded Walton Construction Company.

★**Los Angeles, Cal.**—Salt Lake Railroad awarded contract to Union Switch & Signal Company, Swissvale, Pa., to install automatic block signals between this city and Riverside, 56 miles, at about $70,000.

PUBLIC BUILDINGS AND SCHOOLS

PROPOSED WORK.

Skowhegan, Me.—The Governor at Augusta has approved location of new Women's Reformatory at Skowhegan. Present available funds $50,000. Clyde H. Smith, Pres. Board Trustees, Skowhegan.

Boston, Mass.—Kilham & Hopkins, 9 Park Street, are architects for the $100,000 college building which the Massachusetts College of Pharmacy intends erecting at Brookline and Longwood Avenues.

Lynn, Mass.—Charles L. Bretton, 31 Exchange Street, is architect for the 18-room brick grammar school which the city will erect on Conomo Avenue.

Springfield, Mass.—Following improvements recommended for 1916 by School Board: Either sn eight-room addition with gymnasium and assembly hall to Armory Street School or erection of twelve-room primary school; an assembly and gymnasium at Chestnut Street School; primary and grammar school addition on School Street; plans for additions to technical and central high schools and an eight-room addition to Homer Street school.

Danbury, Conn.—Robert C. M. Moulton, Pawtucket, R. I., submitted to Daniel D. Lovelace, secretary Chamber of Commerce, tentative plans for an industrial building; cost about $42,000.

Montville, Conn.—Palmer Bros. Company, New London, are architects for three-story stone school to cost $50,000.

Binghamton, N. Y.—Plans being prepared by E. W. Dickerman, Perry Building, for addition to the court house to cost $69,000. Address Board of Supervisors.

Buffalo, N. Y.—City Council approved purchase of site on Walden Avenue and Moselle Street for new school and site on Cazenovia Street for School No. 27 annex.

Elmira, N. Y.—A dormitory, dining hall and main college building is to be erected at Elmira College. John B. Shaw, Pres. About $300,000 available for improvements.

Middletown, N. Y.—Governor Charles S. Whitman in his annual message to Legislature recommends erecting buildings, probably in Middletown, costing $600,000, for care of aged insane.

Ossining, N. Y.—A bill has been read once in the Assembly and twice in the Senate apprbpriating $25,000 for site and armory in Ossining.

Syracuse, N. Y.—Plans being prepared by Revels & Hallenbeck of Syracuse for the Joseph Slocum College of Agriculture, 190 x 95 ft., four story and basement, brick, steel and stone, to be erected on campus of Syracuse University; estimated cost $300,000. James R. Slocum, Chancelor.

Plans being prepared by Sackett & Parks, Syracuse Savings Bank Building, for the two story brick, tile and steel 30-room Franklin school to be erected at North Alvord and Butternut Streets at a cost of $350,000. R. D. Roney, Secy., Board Contract & Supply.

Troy, N. Y.—Donation of $250,000 made by Mrs. Russell Sage toward erection on site of Troy Female Seminary the Russell Sage School of Practical Art for Young Women.

Jersey City, N. J.—Plans completed by John Rowland, 109 Sipp Avenue, for remodeling Lincoln High School; estimated cost $40,000. Address Board Education.

Board of Education plans erecting new 40-room school on Romaine Avenue; cost $54,000.

Passaic, N. J.—Plans prepared by Crow, Lewis & Wickenhoefer, 200 Fifth Avenue, New York, for $50,000 addition to Passaic General Hospital approved. Mayor George N. Seger, Chairman Building Committee.

Paterson, N. J.—Board of Finance sold about $250,000 school bonds.

Summit, N. J.—Wilson Potter, 1 Union Square, New York, engaged to prepare plans for high school to be erected on Maple Street and Morris Avenue; cost about $175,000. Address Board of Education.

Trenton Junction, N. J.—Citizens of Ewing Township voted $27,500 bonds for purchase of site on Ewing Street for six-room school. Address School Board.

Washington, N. J.—Election to be held latter part of January to vote $43,000 bonds for remodeling Public School. Address Board of Education.

Haverford, Pa.—Stewardson & Page, 316 Walnut Street, Philadelphia, are architects for two-story stone dormitory to be erected at Haverford College.

Kutztown, Pa.—Erection of high school contemplated here. Address School Board.

Mount Union, Pa.—Bonds for $33,000 voted for new high school. Address School Board.

Newville, Pa.—Sum of $40,000 bequeathed to city for erecting new hospital.

Philadelphia, Pa.—Board of Education will erect 3-story stone High School at Coral and Cumberland Streets. J. Horace Cook, Archt., City Hall.

Mayor Smith, in his message to Council, will recommend erecting Municipal Convention Hall on site facing Parkway and Twenty-first Street.

Pittsburgh, Pa.—Board of Education, Jan. 3, decided to erect West End Sheraden High School on Chartiers Avenue, Sheraden; cost about $230,000.

Schuylkill Haven, Pa.—Frank X. Reilly, Pottsville, engaged to prepare plans for two-story and basement high school; cost about $60,000. Address School Board.

Trevorton, Pa.—School Board decided to erect school costing about $60,000.

Tyrone, Pa.—Erection of a city hall is under consideration. Richard Beaston, Burgess.

Washington, Pa.—County Commissioners voted in favor of erecting an addition to county home; cost $50,000.

Wilkinsburg, Pa.—Citizens voted $250,000 bonds for erecting a school at Wallace Avenue and Mill Street to replace Horner School.

Baltimore, Md.—Park Board intends erecting 2-story bath house with two wings at Clifton Park, to cost about $125,000. At present only basement, costing $25,000, will be erected.

Richmond, Va.—See "Hydraulic Construction and River Improvements."

Morgantown, W. Va.—West Virginia University will erect additions costing $75,000.

Columbia, S. C.—Preliminary sketches prepared by Supervising Architect, Washington, D. C., for postoffice to be erected on Gervais and Sumter Streets; $265,000 available.

McCormick, S. C.—Erection of courthouse and jail at McCormick under consideration. Address County Clerk.

DeFuniak Springs, Fla.—Reported citizens voted $40,000 bonds to erect high school. Address the Mayor.

Ocala, Fla.—Contract about to be let for erecting Carnegie Library on Ocklawaha Avenue. Address Secretary Library Commission.

New Orleans, La.—Erection of two additional units to the new cotton warehouse, and costing $260,000, is contemplated by the Dock Board.

Greeneville, Tenn.—County Court authorized erection of new court house; cost not to exceed $50,000. Address County Clerk.

Lebanon, Tenn.—Reported Cumberland Sanitarium at Lebanon, recently destroyed by fire, will be rebuilt. F. J. Sanders, Manager.

Sevierville, Tenn.—Erection of High School for Sevier County contemplated. Address School Board.

Cincinnati, Ohio.—Elzner & Anderson, Ingalls Bldg., are preparing for the city plans for brick dairy plant and abattoir to be erected in Paddock Road and Seventy-first Street for Longview Hospital, Carthage; total cost abiut $50,000.

Dayton, Ohio.—Board of Education approved issuing $330,000 bonds for erecting new schools in Ohmer Park, Edgemont and North Riverdale.

Above bonds will be sold Feb. 3 by C. J. Schmidt, Clk. Bd. Educ.

Eaton, Ohio. — Court house bonds amounting to $250,000 will be sold about March 1. A. L. Reid, Village Engineer and Chmn. Building Commission.

Kent, Ohio.—Preliminary plans prepared by Wilbur T. Mills, 49 North High Street, Columbus, for three-story, fireproof women's dormitory, approved by Trustees State Normal School.

Kingston, Ont.—Plans prepared for $150,000 library to be erected at Queen's University. Hamilton Cassels of Toronto, Chairman Board Trustees.

Martin's Ferry, Ohio.—School building to be erected; cost about $100,000. Address Board Education.

Plattsburg, Ohio.—Edward J. Mountstephen, U. B. Building, Dayton, is architect for Harmony Township High School, to be erected here.

Uhrichsville, O.—J. E. Lewis, New Philadelphia, selected to prepare plans for school on Trenton Avenue; cost $40,000.

Brazil, Ind.—Contract soon to be let for erecting the senior high school; cost $75,000. Address Board School Trustees.

Delphi, Ind. — County Commissioners voted to erect new court house costing $171,000. Address County Commissioners.

Elnora, Ind.—Town considering erecting a school costing $30,000. Hervey Tomey, Secy. School Board.

Pierceton, Ind.—Contract will be let about February for erecting the two-story and basement brick township school to cost $40,000. Mahurin & Mahurin, Architects, Fort Wayne; E. E. McCarter, Township Trustee, Pierceton.

Rock Creek Center, Ind.—Plans for consolidated brick school are to be prepared by Neusbaumer & Brown, Bluffton; cost $28,000. George W. Brickley, School Trustee.

Vincennes, Ind.—School bonds amounting to $138,000 will be sold Jan. 31 by E. O. Maple, Superintendent of Schools.

Contract will be let about February for erecting the Junior High School, according to plans by J. W. Gaddis, Vincennes. E. O. Maple, Supt. of Schools.

Windfall, Ind.—Wildcap Township, Tipton County, is considering erecting a school to cost $50,000. A. D. Riffe, Township trustee.

Highland Park, Mich.—School Board approved plans and specifications for addition to Willard School; cost $75,000; and two new schools, one to be erected west of Hamilton Boulevard and the other on Oakland Avenue, to cost $80,000 each.

Canton, Ill.—Election to be held to vote $50,000 bonds for erecting school. Address School Board.

Joliet, Ill.—Contract will be let about March for erecting Eastern Avenue School, to be two-story and basement and cost $75,000. John D. Chubb, Architect, 109 N. Dearborn Street, Chicago.

Tuscola, Ill.—Plans of S. L. Pillsbury, Bloomington, selected for the high school in District No. 152, contract for which will be let about April. C. C. Kagg, Secy. Trustees Township.

Antigo, Wis.—Erection of a high school reported under consideration. Address Board of Education.

Belmond, Iowa.—Citizens voted $65,000 bonds for erecting fireproof school. Contract will be let about Feb. 15. G. L. Lockhart, Archt., St. Paul, Minn. C. O. Fitts, Secy. Board of Education.

Boone, Iowa.—Revised plans being prepared by Norman T. Vorse, S. L. Building, Des Moines, for proposed $200,000 court house. Address County Clerk.

Eldora, Ia.—Proudfoot, Bird & Rawson, Hubbell Building, Des Moines, are architects for proposed $100,000 high school to be erected here in the spring. Address Board of Education.

Galva, Iowa.—Election to be held Feb. 4 to vote $55,000 bonds for erecting a two-story and basement fireproof brick school. Martin & Hoskins, Archts., Storm Lake; George E. Missildine, Secy. Board Education.

Bemidji, Minn.—Board of Education reported intends erecting in the spring an industrial high school costing $55,000.

Huntley, Minn.—Election of $20,000 consolidated school contemplated in spring. Address School Board.

Warren, Minn—Citizens voted $35,000 bonds for new school. Board Education will have plans prepared at once.

Emporia, Kan.—Plans and specifications being prepared by J. H. Felt & Co., Kansas City, Mo., for a $100,000 administration building for College of Emporia. W. A. White, Chrmn. Building Committee.

Hays, Kan.—Contract about to be let for erecting $50,000 college building at State Normal College. C. H. Chandler, State Architect, Topeka.

Norton, Kan.—M. J. Green of Manhattan engaged to prepare plans and specifications for $40,000 High School. W. A. Sarvis, President Board of Education.

Pittsburg, Kan.—Plans being prepared by Crowell & Van Meter, Wichita, for $100,000 building for Mt. Carmel Hospital.

Winfield, Kan—Election to be held Jan. 25 to vote $60,000 bonds for erecting school. J. M. Fuller of Winfield, architect. Earl M. Hartley, Clerk Board of Education.

Guide Rock, Neb.—School Board accepted plans for $20,000 school.

Mellette, S. D.—Citizens voted $25,000 bonds to erect new school. Address School Board.

Clayton, Mo.—Citizens voted $125,000 school bonds. Address School Board.

Joplin, Mo.—Contract soon to be let for erecting the high school, fireproof, probably three stories high, steel and brick, and cost, including equipment, $240,000. O. P. M. Wiley, Secy. Board Educ.

Hot Springs, Ark.—School bonds amounting to $30,000 sold. Address School Board.

Laredo, Tex.—Trustees of School Board petition City Council to call election voting $80,000 bonds for erecting high school and two ward schools.

Lubbock, Tex.—Bonds amounting to $100,000 for erecting courthouse sold. Address County Clerk.

Port Arthur, Tex.—Citizens Jan. 8 voted $450,000 school bonds. Address School Board.

San Diego, Tex.—Contract soon to be let for erecting two-story, fireproof, concrete and brick court house; cost $60,000. Givens Parr, County Judge.

Bartlesville, Okla.—Election will be held in the spring to vote $75,000 bonds for erecting junior high school. Address Clerk Board of Education.

Wray, Colo.—School bonds amounting to $30,000 sold. Citizens recently voted in favor of this issue. E. M. Hedrick, Town Clk.

Astoria, Ore.—Election to be held Jan. 27 to vote $100,000 bonds for erecting grade school. Address School Board.

Brea, Cal.—Randolph School District bonds amounting to $66,000 have been sold. Elmore R. Jeffery and Frank R. Schaefer, 1202 Van Nuys Building, Los Angeles, Archts.

Los Angeles, Cal.—A. C. Martin, Higgins Building, is architect for St. Vincient College to be erected on Sixteenth Street and Normandie Avenue to replace present college on Washington Street. Buildings to include a three-story community house 70 x 175 ft.; three-story academic building 80 x170 ft., both concrete, brick and terra cotta; total cost $250,000. Later a main auditorium, library science hall and chapel will be erected. Father Rupert of Los Angeles College in Garvanza is in charge.

San Francisco, Cal.—Contract soon to be let by Board Trustees Lane Hospital for erecting 5-story addition to Lane Hospital, operated by Trustees of Stanford University; cost $500,000.

Phoenix, Ariz.—Royal W. Lescher and J. Rinker Kibbey, Bank of Arizona Building, are architeots for the concrete ward building to be erected at State Hospital for Insane; cost $22,000.

Salt Lake City, Utah.—Reported Superintendent D. H. Christensen has recommended to Board of Education erection of 12 to 15-room school on Moon site, Twelfth South and Fifteenth East Streets, to replace old Irving School; also four-room school costing about $25,000 in Highland Park region.

Reported Board Regents University of Utah will take steps at once to erect the three-story fireproof normal industrial building for which there is $55,000 available. Ramm Hansen, Archt., Vermont Building.

BIDS DESIRED.

Agawam, Mass.—Until Feb. 16 by County Commissioners (Charles C. Spellman, Chmn.) for erecting the Hampden County Training School. George P. B. Alderman & Co., Archts., 437 High Street, Holyoke.

Batavia, N. Y.—Until Feb. 24 by James A. Wetmore, Acting Supervising Archt., Washington, D. C., for construction complete of U. S. post office at Batavia.

New York, N. Y.—Until Feb. 3, by F. J. H. Kracke, Commissioner of Bridges, for furnishing and installing metal partitions and railings in the Municipal Building. Security $18,000.

Caldwell, N. J.—Until Feb. 11 by Board Education (George W. Pullis, Dist. Clk.) for erecting primary school on Crane Street. Lynn G. Lockward, Archt., 285½ Bloomfield Avenue.

Teaneck, N. J.—Until Feb. 2 by the Board Education, Township of Teaneck, for erecting schoool on North Street, between Elm and Linden Avenues. Separate bids for heating, ventilating, plumbing and electrical work. C. V. R. Bogert and Clarence W. Brazer, Assoc. Archts., 1133 Broadway, New York, N. Y. Carl A. Richter, Dist. Clk., P. O. address Englewood.

Harrisburg, Pa.—Until March 7, by Trustees of Pennsylvania State Lunatic Hospital (Dr. H. L. Orth, Supt.), for erecting building for women for manufacturing purposes. J. A. Dempwolf, Archt., York, Pa.

Lancaster, Pa.—Reported desired until Feb. 16 by the School Board for erecting Boys' High School.

Mahanoy City, Pa.—Reported desired until Jan. 31, by Board Education, for erecting two-story, brick, 100 x 120-ft. school. Clyde S. Adams, Archt.

Norristown, Pa.—Plans desired until Jan. 31 by Stewart State Hospital for Insane, Norristown, for erecting female tuberculosis building for said hospital. Address Oscar L. Schwartz, State Hospital, Norristown.

Shamokin, Pa.—Until Jan. 24 by Board Directors School Dist (M. J. McBride, Secy., Shamokin) for erccting six-room brick addition to Lincoln Building, Johnson City. Thomas Nolan, Archt., May Building, Shamokin.

Amity, O.—Reported desired until Feb. 15 by Board Education for erecting 2-story and basement centralized school; probable cost $40,000. A. W. Stover & Co., Archts., Hartman Bldg., Columbus.

Conover, O.—Reported desired until Jan. 31 by H. Cronberry, Clk. Board Education, for erecting 2-story centralized school; probable cost $35,000. A. W. Stover & Co., Archts., Hartman Bldg., Columbus.

Mingo, O.—Reported desired until Feb. 5 by A. Aughinpaugh, Clk. Board Education, for erecting 2-story addition to grade school; probable cost $20,000. A. W. Stover & Co., Archts., Hartman Bldg., Columbus.

Wilmington, O.—Reported desired until Feb. 17 by Harry Gastl Co., Aud., for erecting 3-story and basement courthouse and jail, 110 x 140 ft.; probable cost $300,000. Weber, Werner & Adkins, 1206 Mercantile Library Bldg., Cincinnati.

Rochester, Mich.—Until Jan. 28, by Board of Education (J. F. Jackson, Secy.), for erecting a brick and steel high school to cost $25,000, including equipment. Fisher Bros., Archts., Pontiac.

Armstrong, Ill.—Until Feb. 1 by Township Board of Education (A. G. Mawry, Secy.) for furnishing material and erecting high school. N. S. Spencer & Son, Archts., Champaign.

Normal, Ill.—Reported desired until Feb. 7 by Board Administration (Frank D. Whipp, Fiscal Superv.), Springfield, for addition to school at Illinois Soldiers' Orphans' Home. J. B. Dibelka, State Archt., 130 North Fifth Avenue, Chicago.

Austin, Minn.—Reported desired until Mar. 20 by County Auditor for erecting 2-story and basement poor house; probable cost $25,000. Allen & Harris, Archts., 809 Commerce Bldg., St. Paul.

New Richland, Minn.—Until Feb. 7, by Board Education (C. A. Newgard, Secy.), for erecting high school. Separate bids for heating and ventilating. Kinney & Buckley, Archts., 1003-4 Plymouth Building Minneapolis.

St. Paul, Minn.—Reported desired until Jan. 24 by Aug. Honenstein, City Purchasing Agent, for erecting Ames school.

Ashland, Kan.—Until about Feb. 1, by Clerk Board Education for erecting a three-story 60 x 110-ft. semi-fireproof, brick and concrete high school; cost $30,000. Mann & Gerow, Archts., Hutchinson.

Caldwell, Kan.—Reported desired until Jan. 31 by Board Education (J. E. Damon, Secy.) for erecting 2-story school; probable cost $30,000.

St. Joseph, Mo.—Reported desired until Jan. 26, by Board Education (A. L. Loving, Secy.). for erecting two-story and basement 156 x 84 ft. school. Probable cost $70,000. Trunk & Gordon, Archts., Donnell Court.

Portland, Ore.—Reported desired until Jan. 31 by School Board Benson Polytechnic School (F. A. Naramore, Supt. of Properties) for erecting administration building and three units of the boy's shop at said school; probable cost $210,000.

Portland, Ore.—Reported desired until Jan. 26 by George L. Baker, Comr. Public Affairs, for erecting public auditorium of steel and reinforced concrete, construction faced with either granite or terra cotta.

Los Angeles, Cal.—Until Feb. 17 (change of date from March 9), by Board of Education or erecting the high school to cost $375,000. John C. Austin, Archt., Baker Detwiler Bldg.

Ketchikan, Alaska.—Reported desired until Feb. 10, by Inspector Lighthouse District, No. 16, Ketchikan, for erecting St. Elias Lighthouse. Probable cost $50,000.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Boston, Mass. — Following are bids opened Jan. 18 by Schoolhouse Commissioners for erecting the elementary school in Oliver Wendell Holmes District, Harvard, Glenway and Greenwood Streets, Dorchester: D. R. McKillop, 137 W. Brookline Street, $149,623 and $142,000; P. H. Rose Construction Co., 730 Washington Street, $149,735 and $145,000; John Bowan, 1208 Harrison Avenue, $153,000 and $149,000.

Providence, R. I.—Following are four lowest bids opened by Board of Control for erecting and improving buildings at Hospital for Insane (a) erecting two-story, brick dormitory, 90 x 80 ft.; (b) additional story to Ward 9, a one-story dormitory:

General Construction—Norcross Bros., Worcester, Mass., (a) $132,735; (b) $83,600. P. H. Rhodes Construction Company (a) $139,900. Horton & Hemenway, (a) $144,911; (b) $94,734. Darling & Slade Construction Company, Newport, (a) $149,061; (b) $96,145. William Williams, Providence, (b) $64,000.

Heating—J. J. Hurley & Company, (a) $31,500; (b) $14,700; Huey Brothers Company, (a) $34,302; (b) $16,865; Schofield Campbell Company, (a) $34,328; (b) $16,158; Files Engineering Company, (a) $38,563; (b) $17,240.

Lowest bid for plumbing was from Tierney-Colgan Company, (a) $15,878; (b) $7,750.

Hackensack, N. J.—Following are four lowest bids opened Jan. 17 by Supervising Archt., Washington, D. C., for constructing U. S. Post Office—(a) sandstone, (b) limestone: Frymier & Hanna Co., 25 W. Forty-fifth Street, New York, (a) $76,700, (b) $72,761; Thomas W. Cissell, Wooster, Ohio, (a) $79,735, (b) $74,980; R. P. Farnsworth Co., Owensboro, Ky., (a) $78,500, (b) $75,500; Charles McCaul Co., Philadelphia, Pa., (a) $83,818, (b) $75,818.

★**Philadelphia, Pa.**—Wilbert Beaumont, Stephen Girard Building, reported contractors for three-story, brick, stone and reinforced concrete school to be erected at Woodland Avenue and Seventieth Street.

★Contract awarded H. E. Baton, Twelfth and Sansom Streets for erecting one-story, 53 x 424 ft., addition to prison on Torresdale Avenue; cost $94,000. Philip H. Johnson, Archt., Land Title Building.

Titusville, Pa.—Following are four lowest bids opened Jan. 10 by James A. Wetmore, Acting Supervising Archt., Washington, D. C., for erecting the U. S. Post Office: (a) limestone; (b) sandstone: Westchester Engineering Company, White Plains, N. Y., (a) $54,470; (b) $57,800; Thomas W. Cissel, Wooster, Ohio, (a) $55,000, (b) $56,860; George W. Stiles Construction Company, Chicago, Ill., (a) $55,186, (b) $57,186; Frymier & Hanna Company, Chicago, Ill., (a) $56,351, (b) $57,226.

★**Spencer, W. Va.**—Contract for erecting high school awarded Jan. 4 to Spencer Brick Company, Spencer, W. Va., at $29,000. H. C. Ferguson, Secy. Bd. Educ.

Durham, N. C.—Contract for erecting court house (bids opened Jan. 12), awarded George A. Fuller Company, Munsey Building, Washington, D. C., at $221,500, and for jail cells to Pauly Jail Building Company, St. Louis, Mo., at $35,000. Milburn Heister & Company, Archts., Washington, D. C.

★**Greenville, S. C.**—Contract awarded J. A. Jones, Charlotte, N. C., for erecting court house; cost $125,000. P. Marye, Archt., Candler Building, Atlanta, Ga.

★**Akron, Ohio.**—Contracts awarded by Board of Education as follows: Erecting Portage Path School, to Harbaugh Construction Co., Akron, at $55,274; Miller School annex, to Indiana Engineering & Construction Co., Fort Wayne, Ind., at $66,589, and plumbing for both schools, to Stadtmiller & Merzweiler, Akron, at about $4,700 for each school.

★**Terra Haute, Ind.**—Contract for erecting Warren grade school awarded A. W. Stoolman, Champaign, Ill., and Prox & Burget, Terra Haute, at $52,500.

★**Grinnell, Ia.**—Contract for erecting Alumni Building at Grinnell College awarded Bailey-Marsh Company, Metropolitan Life Building, Minneapolis, Minn.; cost about $160,000.

Fulton, Mo.—Ernest Braun of Jefferson City reported lowest bidder for erecting high school; bonds amounting to $55,000 sold.

Austin, Tex.—Burney & Walsh of San Antonio, reported lowest bidders for erecting hospital at Confederate Woman's Home.

★**Houston, Tex.** — Contract awarded Horton & Horton, Houston, for erecting the dormitory at the Rice Institute, to cost $98,900. Cram & Ferguson, Archts., Houston.

★**Tulsa, Okla.**—Contract awarded Van Horn & Buckner for erecting the high school at $281,499. George Winckler, Archt., Tulsa.

★**Los Angeles, Cal.**—Contract for erecting a six-room hollow tile school in Cienga District awarded A. S. O'Neil, 515 Lankershim Building, at $23,800.

PRIVATE BUILDINGS

PROPOSED WORK.

Boston, Mass.—Charles E. Greco, 8 Beacon Street, is architect for nine-story business building to be erected on site of Hotel Nottingham, Huntington Avenue and Copley Square; cost about $150,000.

Bridgeport, Conn. — The Bridgeport Savings Bank, Main and State Sts., intends erecting a 1-story granite or marble bank building. Charles Gilbert, Archt., 11 East 24th St., New York.

Binghamton, N. Y.—Reported T. I. Lacey & Sons, Kilmer Building, engaged to prepare plans for a building costing $50,000, which the Redmen contemplate erecting.

Brooklyn, N. Y.—Bay Ridge Theater Corporation, Third Avenue (Robert Rasmussen, Secretary and Treasurer), contemplates erecting vaudeville theater on Fifth Avenue and Fifty-fifth Street; probable cost $300,000.

Plans filed for erecting following buildings: Six-story brick tenement at Hooper and South Second Streets for South Fifth Construction Company, cost $55,000, Sass & Springstein, Archts., 32 Union Square, New York; three six-story brick tenements at Bedford Avenue and Division Street for Ross Land Company, total cost $165,000, Shampan & Shampan, Archts., 772 Broadway, Brooklyn.

Hastings, N. Y.—Erection of a golf clubhouse at Hastings is contemplated, cost $500,000. C. C. Dula, 1109 North Broadway, said to be interested.

Long Island City, L. I., N. Y.—Shampan & Shampan, 772 Broadway, Brooklyn, engaged to prepare plans for three 5-story buildings to be erected on Hunterspoint and Van Alst Avenues for Degnon Contracting Co.; total cost $125,000.

New York, N. Y.—Plans filed for erecting following buildings: Two five-story brick apartment houses at Fort Washington Avenue and 172d Street for V. R. Building Corporation, total cost $150,000, Charles B. Meyers, Archt., 1 Union Square; twelve-story fireproof apartment house at 818 Fifth Avenue for Fifth Avenue and Sixty-third Street Company, Inc., cost $750,000, Starrett & Van Vleck, Archt., 8 West Fortieth Street; five-story fireproof garage at West End Avenue and Sixty-fifth Street for Thomas F. Devine, cost $50,000, Jos. C. Cocker, Archt., 2017 Fifth Avenue; twelve-story fireproof stores, show-rooms and factory at 15 East Twenty-ninth Street for Elbridge T. Gerry, cost $300,000, Frederick C. Zobel, Archt., 35 West Thirty-ninth Street; two five-story brick tenements at Eismere Place and Southern Boulevard for John McNulty, total cost $100,000, Chas. Schaefer, Jr., Archt., 401 Tremont Avenue; five five-story brick tenements at 194th Street and Decatur Avenue for Benenson Realty Company, total cost $275,000, Charles Schaefer, Jr., Archt., 401 Tremont Avenue.

Plans prepared by Bertram G. Goodhue, 2 W. Forty-seventh Street, for new St. Bartholomews Episcopal Church, to be erected at Park Avenue and Fiftieth Street; cost about $3,000,000. Present edifice, Madison Avenue and Forty-fourth Street.

Rochester, N. Y.—Plans being prepared by Foote, Headley & Carpenter, Carter Building, for brick and terra cotta fireproof Picadilly Building to be erected on Clinton Avenue and Main Street for Clinton Mortimer Company, at a cost of $200,000.

Troy, N. Y.—Erection of Y. W. C. A. building contemplated at State and First Sts. to cost about $200,000.

Jersey City, N. J.—Reported B. F. Keith, 174 Newark Avenue, contemplates erecting new theater, costing about $300,000.

Newark, N. J.—Preliminary plans being prepared by Cady & Gregory, 40 West 32d St., New York, for 2-story, 100 x 125 ft. store building to be erected at 909 Broad St. by Third Presbyterian Church; cost about $75,000. U. B. Brewster, 538 Mt. Prospect Ave., President Board Trustees.

Allentown, Pa.—Plans being prepared for $500,000 hotel to be erected here. S. W. Traylor of Allentown, reported interested.

Ardmore, Pa.—Plans being prepared by Furness Evans & Co., Provident Building, Philadelphia, for stone bank building for Merion Title & Trust Co.

Johnstown, Pa.—Contract soon to be let for $35,000 edifice to be erected at Homestead Avenue and Bedford Street for Walnut Grove United Brethren Church. W. S. Powell, Archt., Johnstown.

Lebanon, Pa.—Elks Club will erect $25,000 club house on Market Square and Cumberland Street. Address Secretary.

Philadelphia, Pa.—Arthur B. Gill and M. Roy Sheen, 1655 N. 56th Street, reported architects for five-story brick storage warehouse to be erected on Thirty-eighth Street and Powelton Avenue for Powelton Storage Co.

Charles E. Oelschlager, Harrison Building, architect for ten-story, brick, stone, concrete and terra cotta commercial building to be erected on Thirteenth and Appletree Streets for L. A. Belmont.

Plans being prepared by Frank E. Hahn, 1112 Chestnut St., for 5-story, brick, steel, concrete and terra cotta store building to be erected at Broad and Brown Streets.

Neff & Thames, Heed Building, are architects for stone church and Sunday school building to be erected at Thirteenth and Rockland Streets for Methodist Episcopal Church.

Pittsburgh, Pa.—Americus Republican Club, Penn Avenue and Fourth Street, contemplates erecting seven-story, fireproof, clubhouse, to cost about $150,000. Major T. L. Harper, Secretary and Manager.

Reported J. W. McCarthy, 100 North Fairmont St., contemplates erecting moving picture theatre on Liberty Ave. and Taylor St. in Bloomfield District; cost about $30,000.

Scranton, Pa.—Revised plans being prepared by Albert Kahn, 58 Lafayette Avenue, Detroit, Mich., for three-story, brick, stone and concrete service building to be erected here for Ford Motor Company.

Sharon, Pa.—Reported United Labor League contemplates erecting $100,000 Labor Temple and Lyceum here. David Niven, Chairman.

Womelsdorf, Pa.—Charles W. Bolton & Sons, Witherspoon Building, Philadelphia, are architects for stone and terra cotta Zion Reformed Church.

Baltimore, Md.—Theodore Wells Pietsch, American Building, is architect for proposed Sunday School to be erected on Charles Street and University Parkway for North Baltimore and Calvary Methodist Episcopal Church; cost about $35,000.

Wheeling, W. Va.—Plans being prepared by Fred F. Faris, Schmulbach Building, for bank building to be erected at 1143 Market Street for Security Trust Co.; cost approximately $100,000.

Reported plans being prepared for new Morgan Memorial Methodist Church, to be erected on site adjoining present edifice, at Main Street and Fairwood Avenue; cost $30,000.

Monroe, La.—Western Star Lodge No. 24, F. & A. Masons, contemplates erecting $50,000 temple on Desiard Street.

New Orleans, La.—Plans completed for eight-story, fireproof, steel, brick and hollow tile building to be erected in the spring on Poydras Street for Cumberland Telephone and Telegraph Co., Poydras and Carondelet Streets; cost, including equipment, about $655,000.

Nashville, Tenn.—Reported Cumberland Telephone & Telegraph Co. considering plans for rebuilding office building recently destroyed by fire.

Dawson Springs, Ky.—Plans completed by Brinton B. Davis, Inter-Southern Building, Louisville, for hotel and sanatorium to be erected here for Dawson Springs Hotel & Sanitorium Co.; cost, including equipment, about $400,000.

Akron, Ohio.—Odd Fellows Temple Co. contemplate erecting lodge building, probably three stories, on Buchtel and High Streets. Address Chairman Building Committee.

Cincinnati, Ohio.—Preliminary sketches prepared by Samuel Hannaford & Sons, Hulbert Block, for proposed $600,000 building to be erected at Race and Ninth Streets for Business Men's Club.

Cleveland, Ohio.—A site has been purchased on Cedar Avenue for erecting in the spring a high school to replace Loyola High School, a branch of St. Ignatius College; cost about $150,000. Rev. William Sommerhauser, Pastor.

Reported Roy Black, 505 Sincere Building, plans erecting a mercantile building on Chestnut Avenue and East Twelfth Street.

Directors of Cleveland Athletic Club, 1120 Euclid Ave., reported considering erection of a club house costing at least $1,000,000.

Fourth Church of Christ (Scientist) will erect new edifice at Fairmount Court and East 105th St. D. S. Humphrey, 10510 Euclid Ave., may be able to give further information.

Columbus, O.—Reported Peters Realty Company plans erecting twelve-story, concrete, steel and brick hotel on Wall and Long Sts. George A. Peters, 65 Hamilton Ave., may be able to give further infomation.

Franklin Loan & Savings Co., 347 S. High Street, intends erecting four-story, fireproof, reinforced concrete, brick and terra cotta office building at Main and High Streets; cost about $76,000.

Columbus, Ohio.—Plans being prepared for five-story building to be erected in spring on North Fifth and Spring Streets for Central Ohio Paper Company, 70 East Gay Street.

Fremont, Ohio.—Grace English Lutheran Church secured site on West State St. and will erect edifice costing $100,000. Rev. Walter E. Tressell, Pastor, Garrison and Clever Sts.

Toledo, Ohio.—Harry W. Wachter, Nicholas Building, is architect for three-story and basement commercial building to be erected on Superior Street for Fifty Associates Company; cost $30,000.

Tentative plans prepared by Mills, Rhines, Bellman & Nordhoff, Ohio Building, for 16-story fireproof hotel to replace Boody House; probable cost $2,000,000.

Bloomington, Ind.—Architects selected to prepare plans for stone edifice to be erected on site of Kirkwood Avenue Christian Church, and cost about $100,000.

Gary, Ind.—Reported contract soon to be let by Building Committee of Roumanian Benefit Society for erecting Roumanian Turner Hall; cost $60,000.

Kokomo, Ind.—Elks are planning erection of a lodge building costing $50,000.

Marion, Ind. — Stockholders of the Marion National Bank have authorized erection of seven-story fireproof bank building.

Menominee, Mich.—Reported Chicago & Northwestern R.R. Co. (W. H. Finley, Ch. Engr., Chicago, Ill.) contemplates erecting passenger station here.

Chicago, Ill. — Erection of $3,000,000 Board of Trade Building contemplated. B. A. Eckhart, 1300 Carroll Street, Chairman Building Committee.

American Cities Hotel Corporation, 111 W. Monroe Street, plans erecting ten-story fireproof family hotel at Stony Avenue and the Midway; cost about $500,000.

Eau Claire, Wis.—Lake Street Methodist Church intends erecting a new edifice costing $25,000.

Milwaukee, Wis.—C. B. Willis, General Secretary Y. M. C. Asssociation, recommends erecting $500,000 addition of twelve or fourteen stories to present building on Fourth Street and three new branch buildings.

Superior, Wis.—Reported a Y. M. C. A. building costing $75,000 is contemplated. $45,000 is available.

Minneapolis, Minn.—R. Larson, 2808 Minnehaha Avenue, will erect at 1704 Park Avenue a three-story brick apartment house costing $37,000.

Ames, Iowa.—Plans being prepared by Norman T. Vorse, S. & L. Building, Des Moines, for three-story and basement fraternity house for Acacia Club; cost about $25,000.

Erection of $50,000 Masonic Temple contemplated.

Elks Club intends erecting $25,000 building. Address Chairman Building Committee.

St. Paul, Minn.—Reported F. E. Ford, 808 Merchants' National Bank Building, will finance erection of four-story Industrial and Agricultural Exhibit Building at Eighth and Robert Streets, for Association of Commerce, for which plans have been prepared.

Aberdeen, S. D.—Masons have authorized the enlargement of the Masonic Temple.

Butte, Mont.—Reported Major Reno of Salvation Army of Butte, has been instructed to have plans prepared for a building costing approximately $60,000, to replace Salvation Army Building destroyed by an explosion.

Austin, Tex.—Charles I. Berg, 331 Madison Avenue, New York, N. Y., reported architect for sixteen-story newspaper and office building contemplated for "Austin American"; cost about $300,000.
Southwestern Telephone Co., 410 Congress Avenue, intends erecting new exchange building to cost about $85,000.

Dallas, Texas.—Alex Camp, 814 Commonwealth Bank Building, and others, reported interested in erecting seven-story hotel on South Akard and Young Streets; cost about $100,000.

Waco, Tex.—Site at 25th and Barnard Sts. selected for sanatorium to be erected for Baptists; cost about $100,000.

Denver, Col.—Plans being prepared by Gove & Walsh, Boston Building, for one-story brick, marble and tile restaurant building to be erected on Stout Street for Frederick Brown; cost $25,000.

Spokane, Wash.—Reported Northern Pacific Railway Company (W. L. Darling, Ch. Engr., St. Paul, Minn.) considering erecting next summer a depot here to serve both the Northern Pacific and Great Northern Railway companies.

Portland, Ore.—Plans being prepared by John V. Bennes, Chamber of Commerce Building, for four-story, fireproof apartment house to be erected on East First and Clackamas Streets; cost $75,000.
R. F. Wassell, 204 East 15th St., plans erecting four-story and basement brick and mill constructed apartment building on 19th and Flanders Sts.; cost $100,000.
Contract about to be let for erecting $80,000 building for Irvington Club. Lawrence & Holford, Archts., Chamber of Commerce Building.

Port Orford, Ore.—Reported A. J. Sigman of Boston, Mass., purchased site on which he intends erecting tourists' hotel; probable cost $100,000.

Long Beach, Cal.—City National Bank will erect an addition. B. F. Tucker, President.

Los Angeles, Cal.—Plans being prepared by A. B. Benton, 114 N. Spring Street, for a one and two story concrete building, 100 x 50 ft., to be used as a clinical ward for O. T. Johnson and Parent-Teachers Association.
William H. Willenrands, 537 H. W. Hellman Building, will let contract in February for erecting a two-story brick garage and machine shop, 50 x 150 ft.
Mayberry & Parker, 472 Pacific Electric Building, are architects for 2-story and basement brick loft building 50 x 120 ft. to be erected at Third and Wall Sts., and for a 2-story brick loft building to be erected at Third, near Wall St., for W. H. Harrieson.

Ocean Park (P. O. Santa Monica), Cal.—C. H. Russell, 1114 Story Building, Los Angeles, is architect for a one-story fireproof amusement building, 80 x 80 ft., to be first of a group of buildings which Leon Fighiera, Los Angeles, intends erecting on the ocean front.

Santa Barbara, Cal.—Reported plans prepared for a three-story concrete addition which proprietors of Arlington Hotel contemplates erecting at a cost of about $100,000.

Visalia, Cal.—J. S. Johnson, Visalia Bank Building, reported interested in erecting five-story hotel ot Main and Church Streets; cost $100,000.

Whittier, Cal.—Friends Church (H. E. McGrew, Pastor) considering erecting an edifice costing $50,000.

BIDS DESIRED.

Binghamton, N. Y.—Reported desired until Feb. 15 by E. W. Dickerman, Archt., for erecting 5-story bank and office building for Peoples Trust Co.; probable cost $70,000.

Camden, N. J.—Reported desired until Jan. 25, for erecting five-story reinforced-concrete 88 x 92 ft. commercial building for Farr & Bailey.

Eddystone, Pa.—Reported desired until Jan. 25 for erecting seven-story brick and stone, 50 x 120 ft., hotel for the Remington Hotel Co. Henon & Boyle, Archts., Fuller Building, Philadelphia.

Sharpsburg, Pa.—Reported desired by Bd. Trustees until Feb. 4 for erecting church for St. Mary's Parish; probable cost $100,000.

Williamsport, Pa.—Reported desired until Jan. 25, for erecting a 50 x 93-ft. stone and terra cotta building for West Branch National Bank. Mowbray & Uffinger, Archts., 56 Liberty Street, New York, N. Y.

Baltimore, Md.—Reported desired by Public Service Building Company for erecting the 20-story building at Lexington and Liberty Sts. Parker, Thomas, & Rice, Archts., Union Trust Building, Baltimore.

Fairmont, W. Va.—Competitive plans reported desired until Jan. 25 by George T. Watson, Chmn. Bldg. Com., for a 165 x 135 ft. hotel for the Fairmont Hotel Co.; probable cost $225,000.

Nashville, Tenn.—Reported desired until Feb. 15 by A. Ten Eyck Brown, Forsythe Building, Atlanta, Ga., and Russel H. Hart, Nashville, Archts., for remodeling Vanderbilt Law Building for commercial club; probable cost $70,000.

Wilmington, O.—Reported desired until Feb. 1, by J. F. Sheblessy, 411 Lincoln Inn Court, Bldg., Archt., and Rev. M. A, Higgins, Columkil's R. C. Church, for erecting 1-story and basement 50 x 150 ft. church. Probable cost $35,000.

Bloomington, Ill.—Until about Jan. 25, by Fugard & Knapp, Archts., 111 W. Monroe Street, Chicago, for erecting the addition to theater of Fred Wolkan. No award was made Jan. 15 for erecting foundation and basement.

Chicago, Ill.—Reported desired until Feb. 5, by S. H. Dunford, 10 S. La Salle St., for erecting 5-story 50 x 70 ft. furniture storage warehouse for David Fireproof Storage & Warehouse Co., 2616 Milwaukee Ave. Probable cost $40,000.

Mankato, Minn.—Until Feb. 10, by G. Widell, Chmn. Bldg. Com., First National Bank Building, as a whole or separately, for remodeling, plumbing, wiring, heating and ventilating Masonic Temple, corner of Hickory and Second Streets. Geo. Pass, Jr., Archt., Elks Building, Mankato.

Grand Forks, N. D.—Until Jan. 24, by Rt. Rev. Monsignor Lemieux, for erecting parochial school. Separate bids for heating, ventilating and plumbing.

Beaumont, Tex.—King Lumber Company, Charlottesville, Va., successful contractors for the ten-story reinforced-concrete Jefferson Hotel at Beaumont, desire prices on brick, structural steel, ornamental iron and bronze, terra cotta tile, marble, crushed stone, sand, cement, plastering, millwork, roofing and sheet metal. Cooke & Company, Houston, Archts.

Seattle, Wash.—Reported desired until Jan. 27, by A. Warren Gould, Archt., American Bank Building, for erecting nine-story club and office building on northeast corner of Third Avenue and Cherry Street for James Moses of New York. Separate bids for plumbing, heating and electrical work, etc. Probable cost $275,000. Purdy & Henderson, White Building, Seattle. Structural Engr., E. L. Webber, White Building, Sanitary and Electrical Engr.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**New Haven, Conn.** — Contract for erecting Mohican Hotel, requiring about 300 tons fabricated steel, awarded George A. Fuller Co., 111 Broadway, New York.

★**New York, N. Y.**—Contract awarded M. Reid & Co., Inc., 114 West Thirty-ninth Street, for erecting 5-story brick and limestone private dwelling at Fifth Avenue and Sixty-eighth Street for Morton F. Plant. Guy Lowell, Archt., 225 Fifth Avenue.
★Contract awarded Fred T. Ley Co., 52 Vanderbilt Avenue, for erecting 8-story warehouse and automobile service building at 521-531 West Fifty-seventh Street through to 518-528 West Fifty-eighth Street for Willys-Overland Co.; cost about $300,000. Mills, Rhines, Bellman & Nordoff, Archts., Toledo, Ohio.

★**Camden, N. J.**—Contract awarded J. W. Draper, Camden, for erecting two-story Sunday School building for State Street Methodist Episcopal Church; cost $30,000. G. E. Savage, Archt., Witherspoon Building, Philadelphia, Pa.

★**Philadelphia, Pa.**—Contract awarded Cramp & Co., Denckla Building, for erecting theater on Fifty-second and Chestnut Streets; cost complete about $350,000. Hoffman Co., Archts., Globe Theater Building.
★Contract awarded Thomas M. Seeds, 1207 Race Street, for erecting 12-story brick, stone, concrete and terra cotta apartment house at Juniper and Latimer Streets; cost $150,000. Simon & Bassett, Archts., 1112 Chestnut Street.

★**Baltimore, Md.** — Contract awarded Consolidated Engineering Co., Calvert Building, for erecting two-story, brick, moving-picture theater for Walbrook Amusement Co. at Walbrook Avenue and Ninth Street; cost about $30,000. J. E. Lafferty, Archt., 11 East Pleasant Street.
★Contract for erecting six-story concrete building at 21 Wyoming Street for Wise Brothers awarded Price Concrete Construction Co., 217 St. Paul Street, at $40,000. Parker, Thomas & Rice, Archts., Union Trust Building, Baltimore.

★**Cleveland, Ohio.**—Contract awarded James L. Stuart, 911 Illuminating Building, for erecting thirteen-story concrete and brick addition to Hooenden Hotel, to cost $319,910.

Lansing, Mich.—Following are four lowest bids opened Jan. 15 on general construction for the Lansing State Savings Bank building: Rickman Bros. Company, Kalamazoo, $109,422; Covell Construction Company, Ionia, $114,000; S. B. Cole, Battle Creek, $115,200; and H. L. Vanderhorst, Kalamazoo, $115,500.

Ottumwa, Iowa.—A. H. Neumann & Co. of Des Moines reported submitted lowest bid for erecting Hotel Ottumwa at $175,841.

★**Argyle, Minn.**—Contract reported awarded Edward Jackson of Bemidji for erecting Roman Catholic Church; cost $25,000.

★**Duluth, Minn.**—Contract for erecting Pearson Hotel on Superior Street and Sixteenth Avenue West awarded Jacobson Brothers of Duluth; cost $20,000.

★**Neodesa, Kan.** — Contract awarded Clements & Lavery, Coffeyville, for erecting addition to office building of the Standard Oil Co. at $27,000.

★**Beaumont, Tex.**—See "Bids Desired."

★**Dallas, Tex.**—Contract awarded by Sherwin-Williams Co. of Texas to Gilsonite Co. of Dallas for erecting 3-story and basement reinforced concrete, brick warehouse and office building at Wall and Monroe Streets; cost about $50,000.

★**Seattle, Wash.**—Contract reported awarded Hans Pederson, Alaska Bldg., for erecting the steel and reinforced concrete building at Second Avenue and Lenora Street to cost $150,000. B. Marcus Priteca, Archt., Pantages Theater Bldg.

★**Los Angeles, Cal.**—Contract for erecting four-story brick addition, 70 x 80 ft., to warehouse of Los Angeles Soap Co. awarded Alpeter, Hall & Alpeter, 704 Ferguson Building, at about $23,000.

San Diego, Cal.—Contract for erecting three-story brick and concrete building for University Club awarded F. O. Engstrum Co., Fifth and Seaton Streets, Los Angeles, at $26,000.

★**San Pedro, Cal.**—Contract for erecting three-story and basement brick hotel on Ninth Street for Western Architectural Building Co. awarded Luther Hill, 1142 Dewey Avenue, Los Angeles, at about $26,000.

NEW INDUSTRIAL PLANTS

PROPOSED WORK.

New Bedford, Mass.—Directors of the Manomet Mill Co. authorized the issue of $1,000,000 stock for erecting a new mill to have 72,000 spindles. William Witman, Mgr.

Woburn, Mass.—New England Manufacturing Co., 817 Albany Street, Boston, plans erecting six new buildings for manufacture of explosives at plant in North Woburn; cost, including equipment, about $1,000,000.

Corona (P. O. Flushing), L. I., N. Y.—Preliminary plans being prepared by Thomas W. Lamb, 644 Eighth Avenue, New York, for moving-picture studio plant to be erected here for Fox Feature Film Corp. (William Fox, President), 126 West Forty-sixth Street; cost about $1,000,000.

Endicott, N. Y.—Plans being prepared by Sacket & Parks, Syracuse, for 65 x 70 ft. addition to forge plant of Endicott Forging & Mfg. Co.; cost $20,000.

Rockwood, N. Y.—Plans being prepared by Morrell Vrooman, 10 N. Main Street, Gloversville, for a 1000-hp. water power development and storage dam of 100,000,000 cu. ft. capacity for the Rockwood Manufacturing Co. Work to commence as soon as weather permits.

Syracuse, N. Y.—Will & Baumer Co., Liverpool Road and Spring Street, contemplates erecting a series of factory buildings or one large building on Liverpool Road to cost about $300,000.

Tonawanda, N. Y.—Plans being prepared for an addition to plant of Buffalo Sled Co. on Schenck Street; cost $250,000.

Newark, N. J.—Reported Seaboard Chemical Co. (Charles M. Mason, President, 31 Clinton Street) will erect chemical plant near Point-No-Point.

Apollo, Pa.—Reported Apollo Electric Steel Co. intends erecting a plant here for manufacture of steel with electrical equipment. Two electric furnaces will be installed, daily capacity 100 net tons, and steel billets, bars and special products will be manufactured. Robert Lock, J. E. Gallagher of Apollo and others are interested.

Middletown, Pa.—Keystone State Fair Industrial Exposition Co., Kunkel Building, Harrisburg, reported contemplates erecting fair buildings and an automobile speedway and is having site graded for same.

Pittsburgh, Pa.—American Steel & Wire Co., Penn and Fifteenth Streets, contemplates enlarging Shoenberger plant.

Shamokin, Pa.—Reported Eagle Run Brewery of Fuhrman & Schmidt, destroyed by fire, will be rebuilt.

Chestertown, Md.—Du Pont Powder Co. of Wilmington, Del., reported to be considering erecting powder plant in Queen Annes County near Chestertown.

Halltown, W. Va.—Reported Halltown Paper Board Co. will enlarge mill and erect brick addition to machine room.

Franklinville, N. C.—Franklinville Manufacturing Co. will install 3000 additional spindles and 50 looms.

Memphis, Tenn.—Gillette Grain Co. of Nashville will erect an elevator at Memphis; cost $40,000.

Cleveland, Ohio.—Sheriff Street Market & Storage Co. (Homer McDaniel, Pres.) taking steps to erect a cold-storage warehouse along line of new Cleveland & Youngstown terminal district; cost $1,000,000.

St. Paul, Minn.—Berreson Manufacturing Co. contemplates erecting new factory on present site, at University and Curfew Avenues; cost $25,000.

Grand Forks, N. D.—North Dakota Union of the American Society of Equity reported considering erecting a packing plant. C. J. Lee, Valley City, Chmn.

St. Louis, Mo.—International Shoe Co. considering erecting tannery Fifteenth and Washington Streets to cost about $1,000,000.
Fred Medart Mfg. Co., 3535 De Kalb Street, will erect concrete factory on Second and Potomac Streets for manufacture of steel ladders; cost about $40,000.

Seattle, Wash.—J. R. West, Chief Engineer Port of Seattle Commission, Bell Street Dock, has been commissioned to prepare plans for the one-story reinforced concrete compressor plant building for the apple and fish storage on east waterway; cost $30,000.

BIDS DESIRED.

Gloucester, N. J.—Until Jan. 25 by Peuckert & Wunder, Archts. and Engrs., 310 Chestnut Street, Philadelphia, Pa., for erecting a reinforced concrete, brick and terra cotta machine shop for John M. Rogers Works, Inc.

Dallas, Tex.—Until Feb. 10, by Tom B. Burnett & Company, Dallas, for erecting a mattress factory.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Cambridge, Mass.**—Contract awarded J. H. Mendell Co. of Manchester, N. H., for erecting munitions plant here; cost approximately $45,000.

★**Bridgeport, Conn.**—Contract awarded Turner Construction Company, 11 Broadway, New York, for erecting the machine shop for Bullard Machine Tool Company, to be 50 x 268 ft., reinforced concrete with brick curtain walls, beam and girder type.

★**Buffalo, N. Y.**—Contract awarded Durolithic Co., 460 Ellicott Square, for erecting one-story brick and steel foundry at the Pierce plant of the American Radiator Co., Elmwood Avenue and New York Central Railroad; cost $75,000. John E. Youngberg, Archt., 50 North Dearborn Street, Chicago, Ill.

★**Bayonne, N. J.**—Contract awarded John W. Ferguson Co., United Bank Building, Paterson, for erecting addition to plant of Electro Dynamic Co.

★**Rockaway, N. J.**—Contract awarded by International High Speed Steel Co. to Eastern Pennsylvania Power Co., Dover, N. J., for supplying current for a 1200 kw. Heroult type electric furnace at Rockaway; furnace to have a capacity of treating 50 tons of steel per day from an open hearth furnace. A special type of transformer will be used to deliver current to the furnace.

★**Philadelphia, Pa.**—Contract awarded Turner Concrete Steel Company, 1713 Sansom Street, by Peuckert & Wunder, Archts. and Engineers, 310 Chestnut Street, for erecting the two-story brick, steel and concrete ice manufacturing plant for the Consolidated Ice Mfg. Co., at 2331 N. Bodine Street.
★Contract awarded William Steel & Sons Company, 1600 Arch Street, for erecting three-story, 60 x 96-ft., reinforced-concrete manufacturing building on Gratz Street for Friedburger-Aaron Company; cost $27,000.

★**Pittsburgh, Pa.**—Contract awarded W. F. Trimble & Sons Co., 1719 Penn Avenue, for erecting addition to plant of Pittsburgh Reinforced Brazing & Machine Co. on Liberty Avenue and Twenty-fifth Street.

★South Bethlehem, Pa. — Contract awarded William Steel & Sons Co., 1600 Arch Street, Philadelphia, for erecting one-story, 112 x 112 ft., brick and steel meter and boiler house for Bethlehem Steel Co.; cost $30,000.

New Orleans, La.—Following are four lowest bids opened Dec. 29, by Dock Board for erecting the reinforced-concrete elevator of about 1,000,000 bu. capacity, with equipment, and about 1500 ft. of conveyor galleries between Soniat and Valmont Streets: Janse Bros., Broomer, Hughes & Crane, $713,000; George Fuller, $718,000; Stevens Engineering Company, $719,737; James Stewart & Company, two bids, $633,000 and $744,000.

Lowest bids on other parts of above work, opened at same time, were: Elevator belting, Electric Hose Company, $24,382; furnishing and erecting seven 2000 bu. capacity grain hopper scales of the trussed lever type, Standard Scale Company, $4,940; furnishing and installing a 2000-lb. capacity electrically-operated freight elevator, Otis Elevator Company, $3,285.

★Madison, Wis. — Contract awarded Worden-Allen Co., Point Washington Road, Milwaukee, for erecting $40,000 plant for French Battery Carbon Co.

★Galveston, Tex.—Contract awarded by Clinchfield Fuel Co. for constructing coal-handling transfer and storage plant to M. C. Bowden of Galveston; cost approximately $50,000.

★Van Nuys, Cal.—Contract awarded Anderson Barngrover Co., San José, for erecting and equipping concrete, frame and iron fruit cannery for Van Nuys-Owensmouth-Marian Growers & Canners' Assoc., at $28,000.

MISCELLANEOUS

PROPOSED WORK.

Underground Wires—Mobile, Ala.—Reported City Commissioners considering laying of wires underground.

Subway—Chicago, Ill.—Reported William Barclay Parsons, 60 Wall Street, New York; Robert Ridgway Engineer of Subway Construction N. Y. Public Service Commission, 164 Broadway, New York, N. Y., and Bion J. Arnold, Consulting Engineer 105 S. LaSalle Street, Chicago, selected to devise plans for the subway system planned for this city.

Park Improvement—Minneapolis, Minn.—Park Superintendent has been instructed by the Board of Park Commissioners to prepare plans and make a survey for the new park between Forty-third Street and Lake Calhoun; estimated cost, including several ornamental concrete bridges, is $270,000.

Transmission Line—Oswego, Ore.—Oswego Lake, Water, Light & Power Company has applied to County Commissioners for a 25-year franchise to erect and operate transmission line on county roads near Oswego.

Rock-Crushing Plant—Hanford, Cal.—County Supervisors will purchase rock deposits and install crushing plant to furnish rock for Kings County highways. Ben Duffield, Highway Engineer.

Open Cut—Los Angeles, Cal.—Council considering constructing an open cut through Bunker Hill, to cost approximately $4,000,000.

Sheds—Vancouver, B. C.—Reported amended plans accepted for wooden sheds in place of reinforced concrete and steel buildings to be constructed on the docks between Salisbury and Commercial Drive. Cost $100,000. Robert Rogers, Minister Public Works.

BIDS DESIRED.

Cement—Norwood, Mass.—Until Feb. 1, furnishing f.o.b. Norwood, 400,000 granite paving blocks and 3000 bbls. Portland cement. C. A. Bingham, Gen. Mgr.

Fire Escapes—Springfield, Mass.—Until Jan. 26 by City Property Committee (Giles Blague, Chmn.) for fire escapes for Barrows, East Union, Hooker and Sixteen Acres School in Springfield.

Broken Stone, Etc.—East Orange, N. J.—Until Jan. 24, by Lincoln E. Rowley, City Clk., for furnishing 3000 tons 1½-in. trap rock, 3000 tons ¾-in. trap rock and 4000 tons broken trap rock screenings.

Broken Stone — Baltimore, Md.—Until Jan. 26 by Board of Awards, care of Richard Gwinn, City Register, for furnishing Gabbro broken stone Nos. 1, 2, 3, Gabbro broken dust and Gabbro granolithic for year 1916. R. M. Cooksey, Highway Engr.

Pumps—Washington, D. C.—By Bureau Supplies and Accounts, Navy Dept., Washington, D. C., for Brooklyn, N. Y., Sch. 9222, three auxiliary feed pumps, three main boiler feed pumps, two circulating distiller pumps, two dynamo condenser air pumps; Sch. 9230; twenty-five vertical simplex feed pumps; Washington, D. C., Sch. 9225, outfit for pumping water.

Fire Escapes—Cleveland, Ohio.—Until Feb. 14, by Board Education, for fire escapes for Willard school. Frank G. Hogen, Dir. of Schools.

Crane—Chicago, Ill.—Until Jan. 28, by Department Public Works (W. R. Moorhouse, Comr.), for furnishing material and constructing on runways provided by the city in the building to be constructed at the Birdewell Power Station, one 10-ton electric traveling crane.

Lumber—Tacoma, Wash.—Reported desired until Feb. 5, by Thos. N. Norris, Co. Aud., for 202 M ft. lumber, to be used in construction of the Day Island Bridge.

Concrete Gate—Idaho Falls, Idaho.—Reported desired until Feb. 1, by Idaho Irrigation District, for reinforced concrete gate, radio type. Cotton & Wilson, Engrs., Idaho Falls.

Tower—Honolulu, T. H.—Until Mar. 1, by Lighthouse Inspector, for furnishing one 72-ft. galvanized structural steel tower, delivered f.o.b. Honolulu.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Cement—Worcester, Mass.—Lowest bid opened Jan. 15 by Street Commissioner Albert T. Rhodes, for 20,000 bbls. cement for use in city department was submitted by P. W. Wood Lumber Company, Garden Park, Worcester, at $1.93¾ per bbl. for Dragon Portland cement, or 48 7/16 cts. per bag and an allowance of 10 cts. for bags returned.

★Cement—Chicago, Ill.—Contract for furnishing cement for the year 1916 awarded Chicago Fire Brick Company for Marquette cement at $1.74¼ team delivered and $1.64¼ car delivered. (Bids opened Jan. 7.)

★Coal Dock—Duluth, Minn.—Contract awarded Zenth Furnace Company, 542 Security Bank Building, Minneapolis, for constructing for the Barnett Record Company an extension to the coal dock and erecting an unloading tower; cost $100,000.

★Transmission Towers—Los Angeles, Cal.—Contract for furnishing 277 steel transmission towers awarded by Public Service Commission to Blaw Steel Construction Co., Pittsburgh, Pa., at $52,265 for 1,610,000 lb. galvanized and $35,560 for 1,666,000 lb. painted.

Guam.—Following are four lowest bids opened Jan. 8 by Bureau of Yards and Docks, Navy Department, Washington, D. C., for constructing two 400-ft. steel towers at the Naval Station, Guam: (a) net price erected complete in accordance with plans and specifications; (b) net price in accordance with plans and specifications, transportation from navy yard, Norfolk, Va., furnished by the government; (c) net price transportation furnished by the government from San Francisco, Cal.; (d) net price transportation furnished by the government from contractor's and manufacturer's works: Lakeside Bridge & Steel Co., North Milwaukee, Wis., (a) $49,640, (b) $41,478, (c) $43,556, (d) $38,650; Construction & Engineering Co., San Francisco, Cal., (b) $37,200, (c) $38,614, (d) $36,124; California Construction Co., San Francisco, Cal., (b) $38,000, (c) $40,600, (d) $37,000; Penn Bridge Co., Washington, D. C., (b) $43,235, (c) $46,900, (d) $41,435.

Proposals

For Proposals Advertised, See Pages 24a, 25 and 26

WATERWORKS.

Bids Close.		See Eng. Record.
Jan. 25.	C. I. Pipe, Roundup, Mont.	Jan. 22
Jan. 27.	Mains, Ligonier, Ind.	Jan. 22
Jan. 28.	Equipment, Coffeyville, Kan.	Jan. 22
Jan. 29.	Pumping Station, etc., Kenosha, Wis. Adv. Jan. 1, 8.	Jan. 1
Jan. 29.	Valves, Pipes, etc., Panama	Jan. 15
Jan. 31.	Filtration Structure, Oshkosh, Wis. Adv. Jan. 1 to 22.	Jan. 1
Jan. 31.	Tank, Oshkosh, Wis. Adv. Jan. 15, 22.	Jan. 15
Jan. 31.	Reservoir, Oshkosh, Wis. Adv. Jan. 15, 22.	Jan. 15
Jan. 31.	Filter Apparatus, Oshkosh, Wis. Adv. Jan. 15, 22.	Jan. 15
Jan. 31.	Water works, Thermopolis, Wyo.	Jan. 22
Feb. 1.	Exciter, c. i. pipe, etc., Orangeburg, S. C. Adv. Jan. 8.	Jan. 8
Feb. 1.	Contract 170, Water Bd., New York, N. Y. Adv. Jan. 15, 22.	Jan. 15
Feb. 1.	Pipe, etc., Washington, D. C.	Jan. 22
Feb. 1.	Centrifugal Pump, New Brunswick, N. J. Adv. Jan. 22.	Jan. 22
Feb. 4.	Waterworks, Dunedin, Fla	Jan. 22
Feb. 7.	Improv., Sullivan, Ill.	Jan. 15
Feb. 8.	Waterworks, Arcadia, Ia. Adv. Jan. 22.	Jan. 22
Feb. 9.	System, Camden, Ala.	Jan. 22
Feb. 14.	Waterworks, Viola, Ill. Adv. Jan. 22.	Jan. 22
Feb. 15.	Improvements, Lewiston, N. Y. Adv. Jan. 22.	Jan. 22
Feb. 22.	Waterworks, McCammon, Idaho	Jan. 22
Apr. 1.	Mains, Cullman, Ala.	Jan. 15

SEWERAGE AND SEWAGE DISPOSAL.

Jan. 25.	Liberal, Kan.	Jan. 22
Jan. 25.	Strawberry Point, Iowa	Jan. 22
Jan. 25.	Boston, Mass.	Jan. 22
Jan. 27.	Cushing, Okla	Jan. 16
Jan. 27.	Jersey City, N. J.	Jan. 22
Jan. 31.	South St. Paul, Minn.	Jan. 8
Feb. 1.	Larned, Kan.	Jan. 22
Feb. 3.	Milwaukee, Wis. (2 Pro.) Adv. Jan. 15, 22.	Jan. 15
Feb. 4.	St. Louis, Mo.	Jan. 22
Feb. 7.	Cuyahoga Falls, Ohio	Jan. 15
Feb. 7.	Wausa, Neb.	Jan. 8
Mar. 14.	Newark, N. J. Adv. Jan. 22.	Jan. 22

BRIDGES.

Jan. 26.	Rockford, Ill. Adv. Dec. 25.	Dec. 25
Jan. 26.	Lancaster, Ohio	Jan. 15
Jan. 26.	Aberdeen, Wash.	Jan. 15
Jan. 26.	Cambridge, Ill.	Jan. 22
Jan. 27.	Atlanta, Ga. Adv. Jan. 8, 15.	Jan. 8
Jan. 31.	Boston, Mass. Adv. Jan. 8.	Jan. 8
Jan. 31.	Iowa City, Iowa	Jan. 1
Jan. 31.	Illinois	Jan. 22
Feb. 1.	Michigan	Jan. 22
Feb. 2.	Connecticut Adv. Jan. 8, 15.	Jan. 8
Feb. 2.	Paterson, N. J.	Jan. 22
Feb. 3.	Dallas, Tex. Adv. Jan. 8 to 22.	Jan. 8
Feb. 3.	Miami, Fla.	Jan. 15
Feb. 5.	Williamson, W. Va.	Jan. 22
Feb. 7.	Perry, Okla.	Jan. 22
Feb. 7.	New Albany, Ind.	Jan. 22
Feb. 7.	Illinois	Jan. 22
Feb. 7.	Santa Barbara, Cal.	Jan. 22
Feb. 8.	Martinsville, Ind.	Jan. 22
Feb. 8.	McCook, Neb. Adv. Jan. 22.	Jan. 22
Feb. 8.	Newport, Wash.	Jan. 22
Feb. 8.	Mammoth, Ariz.	Jan. 22
Feb. 10.	Gretna, Neb.	Jan. 22
Feb. 10.	Hutchinson, Kan.	Jan. 22
Feb. 11.	Seattle, Wash.	Jan. 22
Feb. 12.	Schuyler, Neb.	Jan. 22
Feb. 15.	Sutherland, Neb.	Jan. 22
Feb. 15.	Alaska Adv. Jan. 15, 22.	Jan. 15

PAVING AND ROADS.

Jan. 24.	East Orange, N. J.	Jan. 22
Jan. 25.	Duluth, Minn.	Jan. 22
Jan. 25.	Crookston, Minn.	Jan. 22
Jan. 25.	Fort Madison, Iowa	Jan. 1
Jan. 27.	Jersey City, N. J.	Jan. 22
Jan. 27.	Chicago, Ill.	Jan. 22
Jan. 27.	Monroe, Mich.	Jan. 22
Jan. 29.	Jacksonville, Fla. Adv. Jan. 22.	Jan. 22
Feb. 1.	Missouri Valley, Iowa	Jan. 15
Feb. 1.	Galva, Ill.	Jan. 18
Feb. 1.	Rock Island, Ill.	Jan. 22
Feb. 1.	Larned, Kan.	Jan. 22
Feb. 1.	Manchester, Conn.	Jan. 22
Feb. 2.	Butte, Mont.	Jan. 22
Feb. 2.	Huntington, W. Va.	Jan. 22
Feb. 3.	Jacksonville, Fla.	Jan. 22
Feb. 7.	St. Paul, Minn.	Jan. 15
Feb. 7.	Indiana	Jan. 15
Feb. 7.	Seatle, Wash.	Jan. 22
Feb. 7.	Wapello, Iowa	Jan. 22
Feb. 7.	Tazewell, Tenn.	Jan. 22
Feb. 8.	Indiana	Jan. 15
Feb. 8.	Indiana	Jan. 22
Feb. 8.	Bakersfield, Cal.	Jan. 22
Feb. 9.	Indiana	Jan. 15
Feb. 9.	Indiana	Jan. 1
Feb. 9.	Indiana	Jan. 22
Feb. 10.	Indiana	Jan. 22
Feb. 15.	Spokane, Wash.	Jan. 8
Feb. 20.	Tacoma, Wash.	Jan. 22
Mar. 7.	Davenport, Wash.	Jan. 22

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS.

Bids Close.		See Eng. Record.
Jan. 25.	Ditch, Crookston, Minn.	Dec. 25
Jan. 25.	Irrigation, etc., Barstow, Tex.	Jan. 8
Jan. 25.	Ditch, Montivedeo, Minn.	Jan. 22
Jan. 25.	Drain, Bluffton, Ind.	Jan. 22
Jan. 26.	Dredging, Baltimore, Md.	Jan. 22
Jan. 26.	Bulkhead, Baltimore, Md.	Jan. 22
Jan. 28.	Ditch, Warsaw, Ind.	Jan. 22
Feb. 1.	Canal Work, Albany, N.Y.	Jan. 15
Feb. 3.	Rip Rap, Chicago, Ill.	Jan. 22
Feb. 4.	Drainage, Clarkes, Neb. Adv. Jan. 22.	Jan. 22
Feb. 4.	Drain, Bluffton, Ind.	Jan. 22
Feb. 8.	Irrigation, St. Ignatius, Mont. Adv. Jan. 8.	Jan. 8
Feb. 9.	Lock Gate and Dam, Wheeling, W. Va. Adv. Jan. 15, 22.	Jan. 15
Feb. 9.	Ditch, Powhatan, Ark.	Jan. 22
Feb. 9.	Ditch, Washington, Ind.	Jan. 22
Feb. 16.	Spillway Gates, Seattle, Wash. Adv. Jan. 22.	Jan. 22
Feb. 15.	Ditch, Princeton, Minn.	Jan. 22
Feb. 15.	Drainage, Jackson, Minn.	Jan. 22
Feb. 16.	State Canal Work, Albany, N. Y. Adv. Jan. 22.	Jan. 22
Feb. 23.	Steel for Lock, Sault Ste. Marie, Mich. Adv. Jan. 22.	Jan. 22
Mar. 9.	Ditch, Moorehead, Minn.	Jan. 22

PUBLIC BUILDINGS AND SCHOOLS.

Jan. 25.	Fairmont, Minn.	Jan. 8
Jan. 26.	Redwood Falls, Minn.	Jan. 8
Jan. 25.	Forest Park, Ill.	Jan. 15
Jan. 26.	Shelby, N. C.	Dec. 18
Jan. 26.	Toronto, Ont.	Jan. 8
Jan. 26.	St. Joseph, Mo.	Jan. 22
Jan. 26.	Portland, Ore.	Jan. 22
Jan. 27.	Ellensburg, Wash.	Dec. 18
Jan. 27.	Sugar Grove, Ohio	Jan. 15
Jan. 28.	Washington, Iowa	Dec. 25
Jan. 28.	Yonkers, N. Y. Adv. Jan. 8 to 22.	Jan. 8
Jan. 28.	Aberdeen, S. D.	Jan. 8
Jan. 28.	Rochester, Mich.	Jan. 22
Jan. 31.	Key West, Fla. Adv. Jan. 1, 8.	Jan. 1
Jan. 31.	Delaware, Ohio	Jan. 1
Jan. 31.	Windsor, Ont.	Jan. 8
Jan. 31.	Kilbourne, Ohio	Jan. 15
Jan. 31.	San Bernardino, Cal.	Jan. 15
Jan. 31.	Caldwell, Kan.	Jan. 22
Jan. 31.	Portland, Ore.	Jan. 22
Jan. 31.	Conover, Ohio	Jan. 22
Jan. 31.	Norristown, Pa.	Jan. 22
Feb. 1.	Oneida, Iowa	Dec. 18
Feb. 1.	George West, Tex.	Dec. 18
Feb. 1.	Union Grove, Wis.	Jan. 15
Feb. 1.	Ashland, Kan.	Jan. 22
Feb. 1.	Armstrong, Ill.	Jan. 22
Feb. 2.	Teaneck, N. J.	Jan. 22
Feb. 5.	Stoutsville, Ohio	Jan. 15
Feb. 5.	Mingo, Ohio	Jan. 22
Feb. 7.	Sioux City, Iowa	Dec. 25
Feb. 7.	New Richland, Minn.	Jan. 22
Feb. 7.	Normal, Ill.	Jan. 22
Feb. 11.	Caldwell, N. J.	Jan. 22
Feb. 15.	Boston, Mass.	Jan. 15
Feb. 15.	Amity, Ohio	Jan. 22
Feb. 16.	Agawam, Mass.	Jan. 22
Feb. 16.	Lancaster, Pa.	Jan. 22
Feb. 17.	Wilmington, Ohio	Jan. 22
Feb. 17.	Los Angeles, Cal.	Jan. 22
Feb. 24.	Batavia, Ohio	Jan. 22
Feb. 25.	Ebensburg, Pa.	Jan. 8
Mar. 7.	Harrisburg, Pa.	Jan. 22
Mar. 20.	Austin, Minn.	Jan. 22

PRIVATE BUILDINGS.

Jan. 25.	Williamsport, Pa.	Jan. 22
Jan. 25.	Camden, N. J.	Jan. 22
Jan. 25.	Bloomington, Ill.	Jan. 22
Jan. 25.	Fairmont, W. Va.	Jan. 22
Jan. 25.	Eddystone, Pa.	Jan. 22
Jan. 26.	Yonkers, N. Y.	Jan. 8
Jan. 26.	Cresco, Iowa	Jan. 8
Jan. 27.	Seattle, Wash.	Jan. 22
Feb. 1.	Poland, Me.	Jan. 15
Feb. 1.	Wilmington, Ohio	Jan. 22
Feb. 4.	Sharpsburg, Pa.	Jan. 22
Feb. 5.	Chicago, Ill.	Jan. 22
Feb. 10.	Mankato, Minn.	Jan. 22
Feb. 15.	Binghamton, N. Y.	Jan. 22
Feb. 15.	Nashville, Tenn.	Jan. 22
Feb. 15.	Britt, Iowa	Jan. 1
Apr. 1.	Cleveland, Ohio	Jan. 8

NEW INDUSTRIAL PLANTS.

Jan. 25.	Shop, Gloucester, N. J.	Jan. 22
Feb. 10.	Dallas, Tex	Jan. 22

MISCELLANEOUS.

Jan. 24.	Boilers, West Point, N. Y. Adv. Dec. 25 to Jan. 15.	Dec. 25
Jan. 24.	Broken Stone, East Orange, N. J.	Jan. 22
Jan. 25.	Elevator, Lawton, Okla.	Jan. 8
Jan. 25.	Elevator, McCook, Neb.	Jan. 15
Jan. 26.	Broken Stone, Baltimore, Md.	Jan. 22
Jan. 26.	Fire Escapes, Springfield, Mass.	Jan. 22
Jan. 27.	Barge, Dallas, Tex. Adv. Jan. 1 to 22.	Jan. 1
Jan. 28.	Crane, Chicago, Ill.	Jan. 22
Feb. 1.	Street Cars, Toronto, Ont.	Jan. 15
Feb. 1.	Cement Gate, Idaho Falls, Idaho	Jan. 22
Feb. 3.	Monument Work, Havana Adv. Jan. 15, 22.	Jan. 15
Feb. 5.	Lumber, Tacoma, Wash.	Jan. 22
Feb. 8.	Sprinkler, Fergus Falls, Minn.	Jan. 8
Feb. 11.	Locomotives for Sale, Panama Adv. Jan. 1.	Jan. 1
Feb. 11.	Stokers, St. Louis, Mo. Adv. Jan. 15, 22.	Jan. 15
Feb. 23.	Castings, Etc., Panama Adv. Jan. 15.	Jan. 15
Mar. 1.	Tower, Hononlulu, T. H.	Jan. 22
Apr. 1.	Memorial, Fort McHenry, (P. O. Baltimore, Md.).	Nov. 20
———	Grading, Cincinnati, Ohio Adv. Jan. 8 to 22.	Jan. 8

Official Proposal Announcements

Price, $2.40 an inch.—Copy can be received until Thursday 10 a. m. for issue mailed the next morning

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Bids open January 28, 1916.

NOTICE TO CONTRACTORS

ARMORY AND FITTINGS

YONKERS, N. Y.

Sealed proposals for Construction, Heating, Plumbing and Drairage and Electric Work of Armory for Company "G," 10th Infantry, N. G. N. Y., Yonkers, N. Y., will be received by Col. Franklin W. Ward, Secretary, State Board of Armory Commissioners, 158 State Street, Albany, N. Y., until 2:30 o'clock P. M. on Friday, January 28, 1916, when they will be publicly opened and read. Proposals shall be enclosed in an envelope furnished by the State Architect, sealed and addressed, and shall be accompanied by certified checks in the following amounts: Construction Work, Proposal No. 1, $3,700.00, and Proposal No. 2, $3,700.00 (if contractor submits bid for both Proposal No. 1 and Proposal No. 2, one check for $3,700.00 will be deemed sufficient); Heating Work, $350.00; Plumbing, $250.00, and Electric Work, $150.00. The contractors to whom the awards are made will be required to furnish surety company bond in the sum of fifty per cent (50%) of the amount of contract and in accordance with the terms of specifications Nos. 2342, 2365, 2366 and 2367. The right is reserved to reject any or all bids. Drawings and specifications may be consulted at the Department of Architecture, Capitol, Albany, N. Y., and at the New York Office of the Department of Architecture, Room 1224, Woolworth Building. Drawings and specifications and blank forms of proposal may be obtained at the Department of Architecture, Capitol, Albany, N. Y., upon the deposit of a certified check in the sum of $10, made payable to the State of New York for each set of plans and specifications, which check will be returned if plans and specifications are sent back in good condition to the State Architect, Lewis F. Pilcher, Capitol, Albany, N. Y.

December 29, 1915.

Bids open January 31, 1916.

ELEVATED TANK FOR BOARD OF PUBLIC WORKS

CITY OF OSHKOSH, WIS.

Sealed proposals will be received by the Board of Public Works of the City of Oshkosh, in the City Hall, until 2 o'clock p. m. of January 31, 1916, for providing all tools, material, labor and facilities to properly construct an Elevated Tank at the Municipal Pumping Station, situated on the west shore of Lake Winnebago, between Washington and Merritt Streets, City of Oshkosh, in accordance with the terms and conditions of forms of Contract and Bond and Specifications and Plans on file in the office of the Board of Public Works, City Hall, of said city.

Proposals must be made out upon printed forms furnished by the City at said office, and be addressed to the Board of Public Works, City of Oshkosh, with the following legend appearing on address side of envelope: "Proposal for an Elevated Tank."

The City of Oshkosh desires to have constructed a Filtration Plant and has divided the contract work required into Four (4) sections or parts, of which this is No. 3. Bidders may submit proposals to do work required on any section or part, or on the construction of the Filtration Plant complete.

Each bidder must inclose with his proposal a certified check for Four Hundred Dollars ($400.00) on some responsible bank located and doing business in the City of Oshkosh and made payable to the order of the Board of Public Works.

The Board of Public Works reserves the right to reject any or all bids.

R. A. HOLLISTER,
HENRY T. HAGENE,
GEORGE H. RANDALL,
FRED HEINTZ,
Board of Public Works.

Oshkosh, Wis., December 22, 1915.

Bids open January 31, 1916.

FILTRATION STRUCTURE FOR BOARD OF PUBLIC WORKS

CITY OF OSHKOSH, WIS.

Sealed proposals will be received by the Board of Public Works of the City of Oshkosh, in the City Hall, until 2 o'clock P. M. of January 31, 1916, for providing all tools, material, labor and facilities to properly construct Filtration Structure at the Municipal Pumping Station, situated on the west shore of Lake Winnebago, between Washington and Merritt Streets, City of Oshkosh, in accordance with the terms and conditions of forms of Contract and Bond, and Specifications and Plans on file in the office of the Board of Public Works, City Hall, of said City.

Proposals must be made out upon printed forms furnished by the City at said office, and be addressed to the Board of Public Works, City of Oshkosh, with the following legend appearing on address side of envelope: "Proposals for Filtration Structure."

The City of Oshkosh desires to have constructed a Filtration Plant and has divided the contract work required into Four (4) sections or parts, of which this is No. 1. Bidders may submit proposals to do work required on any section or part, or on the construction of the Filtration Plant complete.

Applications for Specifications and Plans must be addressed to the Board of Public Works of the City of Oshkosh and be accompanied by a check made payable to the order of the Board of Public Works in the sum of Fifty Dollars ($50.00) to be deposited with the City pending return of Specifications and Plans aforesaid by the applicant to the City and to be retained by the City should the applicant fail to return such prior to February 7, 1916.

Each bidder must enclose with his proposal a certified check for Three Thousand Dollars ($3,000.00) on some responsible bank located and doing business in the City of Oshkosh, and made payable to the order of the Board of Public Works.

The Board of Public Works reserves the right to reject any or all bids.

R. A. HOLLISTER,
HENRY T. HAGENE,
GEORGE H. RANDALL,
FRED HEINTZ,
Board of Public Works.

Oshkosh, Wis., December 22, 1915.

Bids open February 3, 1916.

COMMERCE ST. VIADUCT

DALLAS, TEX.

The County Auditor of Dallas County, Texas, will receive sealed bids until 2 o'clock p. m., Thursday, February 3, 1916, for the construction of "Commerce Street Viaduct" across Trinity River, as per plans and specifications prepared by J. F. Witt, engineer. The electrical wiring, electrical fixtures, light standards, the paving and the earth embankment are not included in this bid and other bids will be asked for this work. Plans and specifications may be obtained from J. F. Witt, engineer, Court House, Dallas, Tex., upon a deposit of ten ($10.00) dollars, refundable upon return of same. This work to be paid for in cash. Cashier's check in the sum of six thousand ($6,000.00) dollars, payable to order of Quentin D. Corley, County Judge, must accompany each bid. All bids must be sealed addressed to Chas. E. Gross, County Auditor, Dallas, Tex., and marked "Sealed Bids Commerce Street Viaduct." The Commissioners' Court reserves the right to reject any or all bids.

CHAS. E. GROSS,
County Auditor.

Bids open February 1, 1916.

PROPOSALS FOR TURBO CENTRIFUGAL PUMPS

NEW BRUNSWICK, N. J.

Sealed proposals for Turbo Centrifugal Pumps will be received by the Commissioners of the City of New Brunswick, N. J., at the Commissioners' Council Chambers, No. 380 George Street, at ten o'clock in the forenoon, on Tuesday, February 1, 1916, for the designing, construction, delivery and erection of two steam turbine, reduction gear, centrifugal pumping units of a capacity to pump continuously five million (5,000,000) gallons of water per twenty-four (24) hours each, against a total combined head of one hundred and twenty-five (125) feet and a steam pressure of one hundred and sixty-five (165) pounds per square inch at throttle; together with all machinery, tools and appurtenances necessary; all in accordance with the general specifications on file in the office of Asher Atkinson, City Engineer, Room No. 1, 40 Paterson Street, New Brunswick, N. J.

Each bid must be accompanied by a certified check for five hundred dollars ($500), made payable unconditionally to the Treasurer of the City of New Brunswick, which check must be presented with the bid as a guarantee that the bidder will within ten days after receiving the award of a contract, file a surety company bond, to be approved by the City Attorney, in the amount of five thousand dollars ($5,000), as a guarantee that he will enter into contract if bid is awarded to him.

The Commissioners reserve the right to reject any or all bids.

(Signed) EDWARD F. FARRINGTON,
Director of the Department of Public Affairs.

ASHER ATKINSON,
City Engineer.

Bids open February 1, 1916.

COPPER TUNNEL LINING

Sealed bids will be received by the Board of Water Supply, at its offices, twenty-second floor, Municipal Building, Park Row, Centre and Chambers Streets, New York City, until 11 A. M. on Tuesday, February 1, 1916, for Contract 170, for furnishing and placing copper lining in a portion of the City tunnel of Catskill aqueduct, between Shafts 18 and 19, New York City.

The actual length to be lined is about 1200 feet of 12-foot tunnel. The copper will be generally 5/64-inch in thickness and the sheets will be joined by brazing and attached to the surface of the existing concrete lining by bolts fastened into the masonry. After completion, the tightness of the brazed joints is to be tested by light water pressure on the back of the copper lining. The work includes the removal of certain riser-valves, covers and pavements to permit access to the tunnel and their replacement.

At the above place and time the bids will be publicly opened and read. Pamphlets containing information for bidders and contract drawings can be obtained at the above address, at the office of the secretary, by depositing the sum of Ten dollars ($10) in cash or its equivalent for each pamphlet. For further particulars, apply to the office of the Principal Assistant Engineer at the above address.

CHARLES STRAUSS, President,
CHARLES N. CHADWICK,
JOHN F. GALVIN,
Commissioners of the Board of Water Supply.

GEORGE FEATHERSTONE,
Secretary.

Bids open March 14, 1916.

NOTICE TO CONTRACTORS.

PASSAIC VALLEY SEWERAGE COMMISSIONERS

NEWARK, N. J.

Notice is hereby given that the Passaic Valley Sewerage Commissioners have designated Tuesday, the fourteenth day of March, nineteen hundred and sixteen, at two o'clock in the afternoon, as the time when they will meet at their usual place of meeting, Essex Building, Clinton Street, Newark, New Jersey, to receive proposals in writing, for constructing a part of Section 4 of the Outfall Sewerage Works, consisting of Sedimentation Basins, Effluent and Intake conduits, and all appurtenant work—all located in the City of Newark, Essex County, New Jersey.

Particulars that may enable Contractors to judge of the character of the work are given below:

APPROXIMATE QUANTITIES.

Item 1.—Earth excavation and refilling, in trench, for effluent and intake conduits, and appurtenant work, including regrading and disposal of surplus material, complete	2,720 Linear Feet
Item 2.—Earth excavation and refilling for sedimentation basins, Venturi meter chamber, and all other structures, excavating for and maintaining mosquito ditches; and all other excavations save those included under Item 1; for all regrading and disposal of surplus material; and for all appurtenant work, etc.	Lump Sum
Item 3.—Rock excavation in open excavations	100 Cubic Yards
Item 4.—Concrete masonry, Class A, 1:2:4, with Portland cement,	20,000 Cubic Yards
Item 5.—Concrete masonry, Class B, 1:2½:5, with Portland cement mortar,	48,000 Cubic Yards
Item 6.—Boulder concrete masonry, Class C, with Portland cement,	1,000 Cubic Yards
Item 7.—Brick masonry, with Portland cement mortar	200 Cubic Yards
Item 8.—Timber piles, in place,	200,000 Linear Feet
Item 9.—Steel for reinforcement, etc., in place	2,800,000 Pounds
Item 10.—Broken stone road surfacing,	8,000 Sq. Yards
Item 11.—Surface drains, vitrified pipe, complete, in place	Lump Sum
Item 12.—Gallery piping; cast iron piping system for 20 in. sludge and 6 in. water mains, and 4 in. wrought iron air main, including all valves, specials, connections, etc., complete, in place.	Lump Sum
Item 13.—Sludge main, 20 in., hub and spigot, cast iron pipe, including manhole pipes, plug drain valves and specials, complete, in place	Lump Sum
Item 14.—Gate valves, six 60 in., and including all 60 in. cast iron piping in Venturi meter chamber in place, complete	Lump Sum
Item 15.—Sluice gates, twenty-four, 24 in. x 36 in., including gate hoists, stem guides, etc., in place, complete,	Lump Sum
Item 16.—Sluice gates for effluent controlling house; two, 5 ft. x 10 ft. and four, 6 ft. x 8 ft., with operating mechanism, complete and in place	Lump Sum
Item 17.—Miscellaneous iron castings, such as floor plates, pressure covers, stop plank grooves, etc., complete and in place	50,000 Pounds
Item 18.—Air compressors in administration wing, including all electric wiring, piping, etc., complete and in place,	Lump Sum
Item 19.—Electric wiring and lighting system in sedimentation basin galleries and elsewhere, complete and in place,	Lump Sum

Drawings, form of contract and specifications, and blank form for proposal, may be obtained at the Commissioners' office from William M. Brown, Chief Engineer.

The Commissioners reserve the right to reject any or all bids.

PASSAIC VALLEY SEWERAGE COMMISSIONERS.

JOSEPH H. QUIGG, Clerk.

January 11, 1916.

CONTRACTING NEWS

Of Special Interest to Engineers, Contractors, Builders and Manufacturers of Engineering and Building Supplies

FOR the directors of the United States Steel Corporation to have sufficient confidence in the continuation of present greatly improved conditions to resume the payment of the regular dividend on the common stock, as was done last Tuesday, is most significant. Many have thought that because of the rapid rise of demand and prices in 1915 a rapid fall in both was due in 1916. A greatly improved banking system is one of the factors with which these prophets have failed to reckon. That the directors of the Steel Corporation did not agree with them is shown by their action, in view of the fact that this body of men is usually conservative. Unless continued higher demand, or a gradual drop to a stable level were in sight, it might be safely said that they would have acted as they did after the earnings of the September quarter wiped out previous deficits and left a surplus available for dividends, and again postponed a resumption. Since their action in October, however, both demand and earnings have increased progressively each month until December showed the largest earnings of the year and the earnings for the quarter, after deducting all operating expenses and interest on bonds of subsidiary companies, exceeded by almost $6,000,000 those of the best quarter in the corporation's history. The earnings were $51,232,788, which compares with the low figure of $10,933,170, for the December quarter of 1914. Since that date, every month of 1915 has shown progressive increase in earnings from $1,687,000, in January to $17,678,000, in December.

The December earnings of the Baltimore & Ohio Railroad Company, heretofore a good index of the railroads of the country, showed a 40 per cent gain in net operating revenue for the last half of 1915 over 1914, and a 45 per cent gain for December, 1915, over 1914. Exports for 1915 exceeded all records by a billion dollars, and the balance of trade in our favor for the year was $1,722,000,000, in spite of a net inward gold movement of $420,000,000. December exports broke all previous monthly records, reaching $359,300,000.

The lumber industry has felt the effects of the extreme cold weather, and logs are scarce in the Northwest, curtailing production. There seems to be a tendency to avoid overloading with orders for future delivery at present prices. Even with the slack period of the holidays the demand seems to be much in excess of what the present production and the greatly reduced stocks can take care of, and it is thought that prices will certainly advance and early deliveries become more difficult to secure.

Buildings

A contract for erecting a sixteen-story chamber of commerce building has been awarded at Pittsburgh. The enlarging of a steel plant at Titusville, Pa., at a cost of $300,000 has been contracted for. A factory building to cost $150,000 has been contracted for at Springfield, Ohio. The contracts awarded for building the hotel at Ottumwa, Iowa, totaled $200,000. The construction of a $400,000 warehouse has been contracted for at Los Angeles, Cal. The lowest bids received for the university library at Berkeley, Cal., totaled $292,000. It is reported that bids will be opened March 1 for constructing an $800,000 coliseum at Indianapolis.

A railroad ferry house and improvements contemplated at Hoboken, N. J., will cost $500,000. An architect has been engaged to prepare plans for a $230,000 high school at Pittsburgh, and work costing $250,000 is contemplated by the Carnegie Institute of Technology in the same city. Contracts are soon to be let at Jacksonville, Fla., for six school buildings to cost in the neighborhood of $500,000. A $200,000 manufacturing plant and a $175,000 hall are being planned at Cleveland, Ohio. The construction of a $150,000 hotel is also being considered. An architect has been engaged for the $250,000 Y. M. C. A. building proposed at Anderson, Ind. An architect has been selected for new schools at Port Arthur, Tex., to cost $450,000. A powder plant to be built at San Diego, Cal., will cost $500,000. Two college buildings are to be built in Washington, one costing $150,000 at Seattle and one costing $200,000 at Spokane.

Bridges and Roads

A contract has been awarded for constructing a temporary bridge to Belle Isle at Detroit for $97,000. The date for opening bids on the two bridges at Miami, Fla., has been extended to Feb. 17. Bids are reported desired for constructing a $60,000 concrete bridge at Harriman, Tenn., and for constructing the $300,000 East Lake bridge at Seattle. Bids are desired at Ventura, Cal., for constructing a number of bridges, including one 775 ft. long. A $116,000 concrete bridge is to be built at Ansonia, Conn. A bridge costing $300,000 is to be built at Lynchburg, W. Va. The construction of a $60,000 viaduct is being considered at Memphis, Tenn. Plans have been ordered prepared for a $200,000 bridge at Des Moines, Iowa.

A state highway contract has been awarded in Connecticut for $63,000. Two paving contracts have been awarded at Evanston, Ill., one for $100,000 and the other for $95,000. Three highway contracts amounting to $616,000 have been awarded at Dennison, Tex. Bids will be opened Feb. 2 at Baltimore for 140,000 sq. yd. of paving. A $100,000 paving contract is to be let at Lynchburg, Va. At Washburn, Tenn., $200,000 is to be spent for road improvements. A $640,000 road-bond issue has been voted at Biloxi, Miss. Paving work to cost $450,000 is contemplated at Cincinnati, where $280,000 has already been authorized. Paving contracts amounting to $400,000 are to be let next April at Vincennes, Ind. Paving work to cost $150,000 is to be contracted for next March at Madison, Wis. Highway improvements costing $140,000 will be made this year at Halifax, Wash. Paving work under consideration at Seattle will cost $358,000.

Waterworks and Sewers

Sewer contracts amounting to $90,000 have been awarded at Youngstown, Ohio. Two contracts for constructing sewers which will cost $105,000 have been awarded at Vincennes, Ind. The lowest bid received for constructing a sanitary sewer at Houston, Tex., was $118,000. Engineers have been engaged to prepare plans for a sewage-disposal plant at Lexington, Ky. Contracts are to be let next month for sewer work to cost $400,000 at Jacksonville, Fla. Plans have been completed at Lafayette, Ind., for sewer work to cost $73,000. At Emporia, Kan., plans are being prepared for waterworks extensions to cost $150,000. Contracts are to be let at Salt Lake City for sewer construction to cost $95,000. The sum of $1,020,000 has been voted at Hollywood, Cal., for buying and extending a waterworks system.

WATERWORKS

PROPOSED WORK.

Bayonne, N. J.—City Commission has authorized Daniel J. Murray, City Attorney to take steps for acquisition of perpetual water rights on Passaic River at or above Little Falls.

Coatesville, Pa.—City is considering building waterworks.

Morrisville, Pa.—State Department of Health, Harrisburg, has ordered this city to install a filter plant.

Lynchburg, Va.—The construction of a filtration plant has been dropped and the construction of a storage basin tray is under consideration. H. L. Shauer, City Engineer.

Robersonville, N. C.—Town is considering installing water works.

Pearson, Ga.—Franchise granted to Pearson Mfg. Co. for installation of an electric light plant and water work system.

Summerville, Ga.—Committee appointed by the citizens to investigate the feasibility of issuing bonds for constructing waterworks and sewers.

Summerville, Ga. — Construction of water works and sewers reported under consideration by the citizens.

Farmersville, O.—Water bonds for $16,000 will be sold Feb. 1 by A. F. Gilbert, Village Clk.

Wooster, Ohio.—Ordinance has passed first reading in Council appropriating $14,000 for building a water pipe line on West Larwell Street.

Milwaukee, Wis.—Contract soon to be let for extending the Linwood Avenue intake tunnel for a distance of approximately 2500 lin. ft., 12 ft. inside diameter, concrete. G. F. Staal, City Engineer. F. G. Simmons, Chmn. Public Works.

Arma, Kan.—Albert C. Moore, Engineer, Joplin, Mo., engaged to prepare plans, specifications and estimates, and supervise construction of extensions to water works system to cost $15,000.

Lawrence, Kan.—City Commission is considering the offer of the receivers of the Lawrence Water Company to sell their plant to the city for $175,000.

Emporia, Kan.—Plans will be completed about March 1st by Black & Veach, Engineers, Kansas City, Mo., for the extensions to the waterworks to cost $150,000, and to include a filtration plant, extensions to mains, a dam in Nesho River, tower tanks, pumps, etc. Fred H. Smith, City Clerk.

Great Falls, Mont.—Reported Great Northern Ry. Company (A. H. Hogeland, Ch. Engr., St. Paul, Minn.) will install water softening plants along the Great Northern between Shelby and Billings, including a large plant in Great Falls to cost $9,000. Cost of other plants about $6,000 each.

Election to be held Feb. 5 in city to vote $150,000 bonds for water works. Address City Clerk.

Hamilton, Mont.—Sawyer Bros., Spokane, engaged to prepare plans and specifications for the municipal water works to cost $50,000.

Roundup, Mont.—City Council has taken preliminary steps toward creating a special improvement district to improve water works system at a cost of $16,000.

Mount Vernon, Mo.—City engaged Albert C. Moore, Engineer, Joplin, to prepare plans and supervise construction of new electric light plant and extensions for water works system. Probable cost $15,000. Election to be held to vote bonds.

Cleveland, Okla.—Plans and estimates being prepared by Albert C. Moore, Joplin, Mo., for water works consisting of dam, filtration plant, pumping equipment, transmission line, and distribution system with elevated tank. Cost $125,000. Election to be held within 30 days to vote on issuing bonds.

Seattle, Wash.—City Council passed ordinances for water mains in Orcas Street, Fifty-first Avenue S., Mead Street, Fourteenth Avenue N. W. A. H. Dimock, City Engineer.

Seattle, Wash.—Council has authorized portions of water mains in following streets: Orcas Street, Fifty-first Street, Avenue South, and Mead Street, Fourteenth Avenue Northwest. A. H. Dimock, City Engineer.

Baker, Ore.—Bonds for $75,000 for extending city water line will be sold Feb. 8, by City Commissioners.

Banning, Cal.—Reported Banning Water Company has sold $80,000 bonds to install electric pumping plant in canyon and otherwise develop more water and improve system.

Hollywood, Cal.—Citizens voted $1,020,000 bonds for purchase of Union Hollywood Water Co.'s plant and installation of new supply mains.

Pocatello, Idaho.—City Council has directed city attorney and water committee to prepare plan for a municipal waterworks. The offer of the Pocatello Water Company to sell their plant to city has been refused.

Markham, Ont.—Water works bonds for $20,000 will be sold Jan. 29 by A. P. Graham, City Treas.

Calgary, Alta.—The extending of the gravity system is under consideration, but it will be some time before anything is done in the matter. The cost will not exceed $250,000. George W. Craig, City Engineer.

North Vancouver, B. C.—J. McCrady, Acting Engineer, estimates cost of installing water system east of Seymour River at $18,000, and including Deep Cover and White Cliff $12,000 additional.

BIDS DESIRED.

Bloomington, Ind.—Until Feb. 24 by Dr. C. E. Harris, Secy. Leonard Springs Water Company, Bloomington, for furnishing material and making improvements to the water works, advertised in Engineering Record.

Detroit, Mich.—Reported desired until Feb. 8, by Board Water Commissioners (H. A. Gilmartin, Secy.), for 704 of 4 to 48 in. gate valve.

Chicago, Ill.—Until Jan. 31, by W. R. Moorehouse, Comr. Pub. Wks., for furnishing, delivering and erecting structural steel and iron work for Mayfair Pumping Station.

Galveston, Tex.—Until Feb. 10, by John D. Kelley, City Secy., for sinking three electrically driven 12-in. wells and equipment with necessary pumping apparatus to produce delivery of 3,000,000 gals. of water per day, at Alta Loma. Cost, $20,000.

Houston, Tex.—Until Jan. 31, by City Secretary, for furnishing and installing two centrifugal pumps and motors, with necessary wiring and appurtenances in the new North Main Street pumping plant. E. E. Sands, City Engr.

Temple, Tex.—Reported desired until Jan. 31, by J. T. Martin, City Secy., for two multistate type centrifugal pumping units, direct connected, suitable 2220 volts, 6 cycle 3 phase induction motors.

Marshfield, Ore.—By R. H. Corey, General Manager Coos Bay Water Company, for 250,000 gal. wood tank with valves and other fittings; cost $5,000.

PRICES AND LETTINGS.

★*Indicates award of contract.*

New York, N. Y.—Until Feb. 15 by Board Water Supply, Municipal Building, for Contract 172, furnishing and delivering bronze gate valves for the city tunnel of the Catskill aqueduct in New York City, advertised in Engineering Record.

★Pittsburgh, Pa. — Contract awarded Jan. 20 to National Valve & Mfg. Co., Pittsburgh, for piping and appurtenances at Brilliant Pumping Station (bids opened Jan. 14), at $18,390. Robert Sawn, Director Department Public Works.

★Grand Rapids, Mich.—Following are four bids opened Jan. 20, by L. D. Cutcheon, Manager Board of Public Works, for about 600 tons c. i. pipe for city during 1916: American C. I. Pipe & Fdry. Company, $29.60 per ton; R. D. Wood & Company, $32.60; U. S. C. I. Pipe & Fdry. Company, $29.25, and Lynchburg Foundry Company, $29.11.

St. Paul, Minn.—Only one bid received Jan. 17 by August Hohenstein, Purchasing Agent, for new engine and pump to be installed in McCarron Station. G. O. House, General Superintendent Water Wks.

★Tracy, Minn.—Contract for a 100,000-gal. tank and steel tower (bids opened Jan. 18) awarded Minneapolis Steel & Machinery Company, Minneapolis, at $5,789. Charles M. Campbell, City Recorder.

Seattle, Wash.—Following are bids opened recently by Board of Public Works for water mains in Dexter Avenue: Scalzo & Tossone, 1708 Second Avenue South, $25,833; City Contracting Company, 1319 Twenty-first Avenue South, $27,896; D. & V. Bressi, 1101 Twenty-fifth Avenue South, $27,438; E. L. H. Morris, Seattle, $27,847.

★Oswego, Kan.—Contracts in connection with the water works improvements have been awarded as follows: Furnishing and laying c. i. pipe hydrants and valves, constructing filter building and doing all concrete work, N. S. Sherman Machine & Iron Company of Oklahoma City, Okla., at $14,772; pumping equipment, piping and erection, Merkle Hines Machinery Company, Kansas City, Mo., $2,205; installation of filter equipment, New York Continental Jewel Filtration Company, Kansas City, at $5,600; tower and tank, Chicago Bridge & Iron Works, Chicago, Ill., at $5,053; Albert C. Moore, Engineer, Frisco Building, Joplin, Mo.

Los Angeles, Cal.—Following are four lowest bids opened for furnishing and installing water pipe and alterations to pumping plant in Los Angeles County Water District No. 1: Municipal & Industrial Equipment Company, 715 Story Building, $25,806; Johnson-Shea Company, Riverside, $27,160; James Kennedy Construction Company, $27,584, and Rogers Brothers Company, $33,358.

Lowest bid for furnishing seventy 6 to 30-in. gate valves for Los Angeles County District No. 3 submitted by Water Works Supply Company at $2,954.

SEWERAGE AND SEWAGE DISPOSAL

PROPOSED WORK.

Ambler, Pa.—Borough Council has authorized a bond election to vote $30,000 bonds. It is proposed to make street and sewer improvements and purchase automobile fire apparatus.

Johnstown, Pa.—City Council appropriated $30,000 for new sewers and extensions during 1916.

Summerville, Pa.—See "Water Works."

Havre de Grace, Md.—State Board of Health has ordered city to make certain changes in sewer system costing $25,000.

Hampton, Va.—Plans being prepared for a sewage disposal plant. Address City Clerk.

Milledgeville, Ga.—State Supervisor of Roads, T. P. Stanley, Atlanta, has been surveying for a sewerage system for the state institutions here, including State Farm, State Sanitarium for Insane and State Reformatory.

Savannah, Ga.—The tentative plans for the expenditure of the $400,000 drainage bonds provide for the construction of all laterals and submains that are needed or will be needed in the near future within the city limits and for construction of a trunk sewer for both storm water and sanitary sewerage in West Savannah.

Jacksonville, Fla.—L. D. Smoot, Commissioner of Public Works, is preparing specifications and will let contracts soon after Feb. 15 for construction of sewer and drainage extensions costing approximately $400,000. Vitrified pipe 8 to 24-in. and concrete sewers of larger size will be constructed.

Lexington, Ky. — Solomon - Norcross Company of Atlanta, Ga., engaged to prepare plans for proposed sewage disposal plant. City Engineer will have charge of the outfall sewers and water mains leading to the plant.

Canton, O.—Bonds for $75,000 will be sold Feb. 7, by Sam'l E. Barr, City Auditor, for constructing sewage treatment plant.

Lakewood, Ohio.—Contract will be let about April for the sewers and sewage disposal plant to cost $50,000 and $150,000, respectively. Sewers will include 7500 lin. ft. 36 and 57-in. concrete sewer and disposal plant, a two-story tank for 50,000 population. R. Winthrop Pratt, Columbus, Engineer; E. A. Fisher, City Engineer; N. C. Catabish, Director Public Works.

Indianapolis, Ind.—It is reported that former channel of Pogues' Run from McCarty Street to White River is to be covered over and a sewer about one mile in length constructed at a cost of about $30,000. A sewer approximately two miles in length is to be constructed on West Tenth Street at a cost of $125,000. It is proposed to construct a 6-ft. sewer in Brightwood, a part of Indianapolis; approximate cost $10,000. B. J. T. Jeup, City Engineer.

LaFayette, Ind.—Plans completed by H. B. Overesch, Jr., City Engineer, for the Sixth Ward Sewerage System, which will include 18,211 lin. ft. 15 to 26-in. sewer pipe, 22.8 cu. yd. concrete, 62 manholes, 3 drop manholes and 8 catch basins; total cost $73.440.

Carbondale, Ill.—Construction of about 1½ miles of 22-in. outlet sewer is under consideration. E. A. Cox, City Engineer.

Christian, Ill.—Contract soon to be let for constructing 3700 ft. of 30-in. pipe storm sewer costing $11,000. C. P. Lycan, Engineer, Paris; Frank McCudeley, City Clerk.

Springfield, Ill. — City Commissioners contemplating constructing a sewage disposal plant for Town Branch sewer district.

Madison, Wis.—Finance Committee has recommended to Council the appropriating of $125,000 bonds for completing sewerage system.

St. Paul, Minn.—Commissioner of Public Works has been directed to prepare plans for sewers contemplated for 1916.

Atchison, Kan.—City Council adopted a resolution to construct a storm water and sanitary sewer at Midland College approximately 2000 ft. in length. Frank S. Altman, City Engineer.

Amarillo, Tex.—Four miles of 6-in. sewers and a sewage disposal plant costing $10,000 are to be constructed. M. H. Hardin, City Engineer.

Los Angeles, Cal.—Board of Supervisors has appointed a commission of five sanitary engineers to make a survey for a sewer system to serve every community in the county.

Salt Lake City, Utah.—Contract will be let soon by city for constructing the outlet for main trunk sewer, to include 16,300 ft. 60-in. concrete pipe, working under a head of approximately 5 ft. and approximately 10,000 ft. open canal; cost $75.000; also for the first unit to the sewage pumping plant, capacity of 50-second ft., cost approximately $20.000. Sylvester Q. Cannon, City Engineer.

BIDS DESIRED.

New York, N. Y.—Until Feb. 3, by Douglas Mathewson, Pres. Bronx Borough, for constructing sewers and appurtenances in portions of east side of Crotona Park, Merriam Avenue and W. 170th Street, also improving portions of Odell Street. Total security $5,050.

Philadelphia, Pa.—Until Feb. 2, by Geo. E. Datesman, Dir. Pub. Wks., for following: Sch. A, branch sewer in Second Street; Sch. B, reconstructing old inlets; Sch. C, new lateral inlets, etc., and Sch. D, test borings.

Cleveland, Ohio.—Until Feb. 3, by the city purchasing division, for a brick sewer, 24 to 48 in., in Prospect Avenue, between E. Twenty-second and Fortieth Streets; estimated cost $50,000. Robert Hoffman is city engineering Commissioner.

East View, Ohio.—Until Feb. 24 by Charles Vek, Village Clk., for constructing storm and sanitary sewers in Kinsman Road. Engineers, F. A. Pease Engineering Co., 804 Marshall Building, Cleveland.

Shaker Heights, Ohio.—Reported desired until Feb. 8, by Carl L. Palmer, Village Clerk, First National Bank, Cleveland, for constructing storm and sanitary sewers in Shaker Boulevard.

Youngstown, Ohio. — Reported desired until Feb. 4 by Harry Parrock, Dir. Public Service, for 8800 ft. 18, 24, 26 and 48-in. vitr. pipe sewers on Dennick Avenue. F. M. Lillie, City Engr.

Kendallville, Ind.—Until Feb. 29 by O. E. Michaelis, City Clerk, for constructing the south side and west side District Sanitary Sewer, requiring 21,891 ft. 8 to 24-in. tile sewer, 322 ft. 8, 10, 18 and 24-in. c.-i. pipe, 44 manholes, 20 flush tanks, one lamp hole, 140 house drains and one sewer lift; cost $38,845. Willis E. Sawyer, City Engr., prepared plans for sewers, and Smith & Boulay, Toledo, Ohio, plans for sewer lift.

Des Moines, Iowa.—Reported desired until Feb. 23, by City Clerk, for constructing sewer system in Closes Creek Dist. to consist of 113,935 ft. 10, 12, 15, 20-in. vitr. pipe, 6271 ft. 24 and 30-in. pipe or blocks, also 3988 ft. concrete, brick or segment block sewer. Probable cost $209,500. D. E. Thomas, Asst. Engr.

Garner, Ia.—Reported desired until Feb. 1 by E. P. Hanson, Co. Aud., 17,750 ft. of 10 to 24-in. sanitary vitr. sewer pipe.

Salina, Kan.—Reported desired until Feb. 7 by Charles E. Banker, City Clk., for 8180 ft. of 10, 12, 15 and 18-in. sewer pipe in various locations, together with manholes, catchbasins, etc. Paul C. Wakenhut, City Engr.

Pierce, Neb.—Until Feb. 25, for constructing sewer system. Cost $20,000. Bruce & Standeven, Engineer, 430 Bee Building, Omaha.

Houston, Tex.—Until Jan. 31, by City Secretary for constructing sewers in Noble, Shea and Vine and other streets. E. E. Sands, City Engr.

Toronto, Ont.—Reported desired until Feb. 1, by Board Control, for constructing sewers in Cawthra, Lloyd, Campbell and Gilmour Aves. Connolly and Dundas Sts.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Boston, Mass. — Following are bids opened Jan. 25 by Commissioner of Public Works for building concrete sewer in Frankfort Street, East Boston: J. J. Coughlin Company, 43 Tremont Street, $32,886; Peter W. Hill, 97 Proctor Street, Roxbury, $34,235; A. Cafalo, 316 Belgrade Avenue, West Roxbury, $34,475.

★Youngstown, Ohio.—Contracts for constructing the Youngstown & Southern District sewers awarded Jan. 19 as follows by Director Public Service: Section 1, to R. & O. J. Grady, $7,560; Sections 2 and 3, to Miller Bros., at $20,503 and $33,426 respectively, and Section 4, to Clyde Harris, $29,110, all of Youngstown.

★Vincennes, Ind.—Contracts for constructing sewers awarded as follows: To James M. O'Donnell of Vincennes, for constructing storm sewer No. 3 at $39.941; to Independent Construction Company, Terra Haute, for storm sewer No. 4, at $65,654.

Lisbon, Iowa.—Following are four lowest bids opened Jan. 18, by Town for constructing sanitary sewer system: M. S. Jackson, Cedar Rapids, $26,226; M. McEllgot, Evanston, $26,531; Dearborn Construction Company, Waterloo, $26,857, and Intermountain Bridge & Construction Company, Tecumseh, Neb., $27,360. Contract for sewage disposal plant and outlet sewers awarded Percy C. Smith, Cedar Rapids, at $8,550. T. R. Warriner, Engr., Cedar Rapids.

★Little Rock, Ark.—Contract for constructing sewer in Sewer District No. 81 awarded Nick Peay Construction Company at $9,685.

Houston, Tex.—Following are two bids opened Jan. 17, by City Commissioners for extension of 42-in. Scott Street sanitary sewer: Horton & Horton, Houston, $118,885; Freund & Quay, $132,435.

BRIDGES

PROPOSED WORK.

Ansonia, Conn.—A two 65-ft. span concrete bridge is to be constructed on Division Street, at a cost of $116,000. V. B. Clarke, City Engineer.

Ogdensburg, N. Y.—Common Council considering constructing a viaduct over New York Central tracks adjoining the concrete bridge in Lafayette Street.

Lynchburg, Va.—Bridge 1700 ft. long and costing approximately $300,000, is to be constructed. B. H. Davis of New York, Consulting Engineer; Joseph Crawford of Roanoke, Resident Engineer.

Jackson, Ala.—Construction of a bridge over Tombigbee River at Jackson is contemplated by John Craft and L. C. Irvine, Mobile; W. D. Marrigan, Fulton, and Frank W. Boykin, Calvert.

Memphis, Tenn.—Construction of a viaduct at McLemore Avenue, near Raybourn Boule., over tracks of Illinois Central and Yazoo & Mississippi Valley R. R. Co. is contemplated; cost about $60,000.

Dayton, Ohio.—Bonds for following purposes will be sold Feb. 25 by Hugh E. Wall, City Accountant: $115,000 for Keowee Street Bridge, $130,000 for fire department, $50,000 for workhouse, and $9,000 for parks and playgrounds.

Elkhart, Ind.—County Commissioners and the city officials propose constructing a bridge this spring on Cassopolis Street across Christiana Creek. A. R. Bemenderfer, Co. Aud.

Fort Wayne, Ind.—Steel bridge is contemplated over Spy Run Creek at Fourth Street costing $7,000. William Johnson, Co. Aud.

Frank M. Randall, City Engineer, directed to prepare plans for repairing Lawton Park Bridge, recently destroyed.

Indianapolis, Ind.—Bridge with a 70-ft. concrete span is to be built across Pleasant Run at Villa Avenue. B. J. Jeup, City Engineer.

Marion, Ind.—Two concrete bridges are to be constructed over Boots Creek by Board of Public Works.

Petersburg, Ind.—Public Service Commission at Indianapolis directed Wm. J. Jackson receiver of Chicago & Eastern R. R. Co., to reconstruct steel bridge over White River, 4 miles north of Petersburg.

Des Moines, Iowa.—City Council directed plans and specifications be prepared for North Street bridge; estimated cost $200,000.

Construction of a bridge at Grand Avenue reported contemplated. East Des Moines Commercial Club said to be interested.

Clovis, N. M.—Construction of three bridges over Deep Arroyos north of Clovis is contemplated by county.

Salem, Ore.—Plans have been prepared as follows for bridges by State Engineer's Department: Reinforced concrete bridge to cross Jackson Creek, Jackson County; steel structure over Willamette Slough; plans for number of small structures in Douglas County are nearing completion; reinforced concrete viaduct, 200 ft. long, for Lane County; two reinforced bow string structures for Crook County.

Oakland, Cal.—Alameda County Bd. Supervisors taking steps to construct a bascule bridge between Oakland and Alameda.

Holbrook, Ariz.—Citizens of county voted Jan. 11 $68,000 bonds for steel bridge. Charles E. Perkins, County Engineer.

BIDS DESIRED.

Maine.—Until Feb. 10, by State Highway Commission, Augusta, for steel highway bridge, 263-ft. span, over Sandy River at New Sharon.

Clay, W. Va.—Reported desired until Feb. 19 by D. A. Brawley, Pres. County Court, for constructing steel highway bridge with masonry foundation between two counties across Elk River. Frank G. Curdette, Co. Road Engr., Charleston.

Hinton, W. Va.—Until Feb. 12 by County Court at Hinton for constructing a 400 ft. bridge across Greenbrier River. Both steel and concrete will be considered. For further information apply to State Bureau, Morgantown. R. P. Davis, Engineer.

Miami, Fla.—Until Feb. 17 (extension of date) by W. B. Moore, City Clk., for constructing two bridges over Miami River—one at Twelfth Street and the other at Avenue D; each bridge to consist of a bascule span of structural steel, with approaches on either side, of reinforced concrete arches or girders. Harrington, Howard & Ash, Consulting Engrs., 1012 Baltimore Avenue, Kansas City, Mo.

Harriman, Tenn.—Reported desired until Feb. 14 by County Commissioners, Kingston, for constructing concrete bridge over Emory River at Harriman; probable cost $60,000.

Cleveland, Ohio.—Until Feb. 9, by Board County Commissioners (E. G. Krause, Clk.), for bridge work and culvert extensions per report No. 3672.

Illinois.—By the State Highway Commission for constructing the following bridges:

Until Feb. 1:

Monticello, Mackville Bridge, 100-ft. span, 16-ft. roadway, Unity Township. Engineer's estimate, $2.970. T. J. Anderson, Co. Supt.

Until Feb. 15:

Salem, Parill Bridge, reinforced concrete, 25-ft. span, 16-ft. roadway, Meacham Township. Engineer's estimate, $1,200.

Brewery Hill Bridge, reinforced concrete, 40-ft. span, 20-ft. roadway, Centralia Township. Engineer's estimate, $4.050.

Hodges Bridge, reinforced concrete, 20-ft. span, 16-ft. roadway, Racoon Township. Engineer's estimate, $1,005.

Thurman Bridge, reinforced concrete, 35-ft. span, 16-ft. roadway, Salem Township. Engineer's estimate, $2,120.

Tom Deadmond Bridge, repairing existing steel superstructure and constructing new reinforced concrete substructure in Odin Township. Engineer's estimate, $3.540.

Benson Bridge, reinforced concrete, 35-ft. span, 16-ft. roadway, between Alma and Stevenson Townships. Engineer's estimate, $1,640.

Christie Bridge, reinforced concrete, 26-ft. span, 16-ft. roadway, Pakota Township. Engineer's estimate, $1,200.

Shields Bridge, either reinforced concrete or steel I-beam bridge, 35 or 32-ft.

span, 16-ft. roadway, Iuka Township. Engineer's estimate, concrete bridge, $2,100; I-beam on creosoted timber structure, $980. Lee S. Trainor, Co. Supt.

Feb. 12:

Joliet, Goodspeed bridge, reinforced concrete, 40-ft. span, 25-ft. roadway, Joliet Township. Engineer's estimate $2,575.

Milwaukee, Wis.—Reported desired until Feb. 7 by Louis G. Widule, Co. Clk., for constructing bridge over Milwaukee River on Silver Spring Road.

Hampton, Iowa.—Reported desired until Jan. 31 by County Auditor for constructing bridge; estimated cost $10,000.

St. Cloud, Minn.—Until Feb. 15, by Geo. G. Magnuson, City Clerk, for constructing creosote block floor 818 ft. long and 20 ft. wide on Tenth Street bridge across Mississippi River.

Fairbury, Neb.—Until March 10 by County Commissioners for constructing bridges for 1916. Clyde Marthias, County Clerk.

York, Neb.—Until Feb. 9, by A. H. Beck, County Clerk, for constructing steel and concrete bridges during 1916.

Dickinson, N. D.—Reported desired until Feb. 23 by County Commissioners for constructing steel bridges during 1916, ranging in length from 10 to 32 ft. J. L. Hughes, County Auditor.

Jamestown, N. D.—Until Feb. 15, by Andrew Blewett, Co. Aud., for corrugated, galvanized, steel metal culverts, 12 to 60 in., for year 1916.

Until Feb. 16 by Andrew Blewett, Co. Aud., for constructing five short span steel bridges and reinforced concrete abutments in Stutsman County.

Livingston, Mont.—Until Feb. 9, by Board County Commissioners (Chas. A. Burg, Clerk), for furnishing steel and delivering same from railroad station at Springdale to bridge site across Yellowstone River for a 100 ft. span.

Austin, Tex.—Until Feb. 7 by City Clerk for constructing five reinforced concrete arch bridges and one masonry arch bridge across Waller and Shoals Creeks. Bartlett & Ranney, Inc., Consulting Engrs., San Antonio and Dallas.

Wenatchee, Wash.—Until Feb. 8 by T. L. Ross, Co. Aud., for constructing steel bridge over Wenatchee River; probable cost $12,000. Fred. A. Warren, Co. Engr.

Ventura, Cal.—Until Feb. 3 by Clerk Board Supervisors for constructing four bridges as follows: Saticoy bridge, 6 spans, each 129 ft. long; Casitas bridge, consisting of one 100 ft. combination steel and timber span bridge, and La Crosse bridge, one 150 ft. combination steel and timber span.

Ventura, Cal.—See "Miscellaneous."

Lachute, Que.—Reported desired until Feb. 2, by John A. Rice, Secy.-Treas., for constructing steel bridge on cement abutments over North River.

Lonesborough, Ont.—Until Feb. 3, by Council of Hullett Township (James Campbell, Clerk), for constructing a steel 60 ft. long and 16 ft. roadway, with cement floor built on cement abutments, over the Walkerburn Creek, 5 miles north of Lonesborough.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Boston, Mass. — Following are bids opened Jan. 24 by Department of Public Works for building foot bridge at Cove Street, East Boston: Boston Bridge Works, 18 Temple Pl., Boston, $8,626; Penn Bridge Company, Boston, $8,890; McClintock-Marshall Company, 68 Devonshire Street, Boston, $9,483.

★**Pittsburgh, Pa.**—Contract for constructing bridge at New Market House in Diamond Street awarded Henry Shenk Company, Pittsburgh, at $9,428. Robert Swan, Director Department Public Works.

★**Berkeley Springs, W. Va.**—Contracts for constructing two concrete arch bridges (bids opened Jan. 14) awarded Luten Bridge Company, York, Pa., at $4,385, 80 ft. span, and $2,290 for 60 ft. span. Roland P. Davis, Bridge Engineer, West Virginia State Road Bureau, Morgantown, W. Va.

★**Newland, N. C.**—Contract for bridge work in Avery County awarded as follows: Ten small bridges, to Roanoke Bridge Works, Roanoke, Va.; eight reinforced-concrete bridges to Luten Bridge Company, Knoxville, Tenn. George C. Love, Engineer, Pineola, N. C.

★**Detroit, Mich.**—Following are three lowest bids opened by Commissioner Fenkell for constructing temporary bridge to Belle Isle, plans submitted by city engineer: Candler Dock & Dredge Co., Detroit, $95,733 (awarded contract); Great Lakes Dredge & Dock Co., Monroe Building, Chicago, Ill., $117,876, and George R. Cooke, Detroit (two bids), $105,990 and $99,990.

★**Knoxville, Iowa.**—Contract for constructing county bridges awarded as follows: To International Steel & Iron Company, Evansville, Ind., for four truss bridges and eighteen beam bridges at $34,319; to Thor Construction Company, Cedar Falls, for twenty-four culverts at $11,520, and to J. P. Riddle, Creighton, Neb., bridges costing $30,212. W. P. Price, County Engineer.

★**Lowry, Mont.**—Contract for constructing a county combination wood truss bridge over Sauk River near Lowry awarded United States Bridge Company of Great Falls on percentage basis, cost not to exceed $4,500.

PAVING AND ROADS

PROPOSED WORK.

Watertown, N. Y.—Common Council voted to repave southerly half of Public Square from State Street to Stone Street and Franklin Street, between Public Square and Goodale Street, with creosote wood block pavement on concrete base. E. S. Sayles, City Engineer.

Collingswood, N. J.—Election will be held in the spring to vote on paving Haddon Avenue with brick or Belgian block at a cost of about $75,000. J. Remington, Engineer, Haddonfield; W. Hambrecht, Jr., Clerk.

Wilmington, Del.—Street and Sewer Department is considering paving 36 squares, contract to be let during spring.

Washington, D. C. — House passed Shackleford Good Road bill appropriating $25,000,000 to aid the States in improving their post roads.

Lynchburg, Va.—Contract will be let in about two months for repaving Main Street, double tracking, underground wires in conduits, railway company contributing toward cost; approximate cost $100,000. H. L. Shaner, City Engineer.

Warrenton, Va.—Citizens of Warrenton and automobilists of Washington have formed the Warrenton and Fairfax Turnpake Company, Inc., and will take over the old Alexandria-Warrenton pike grade and surface the road. Probable cost $50,000. J. Donald Richards, Secy. Company, Warrenton.

Charleston, W. Va.—Contract will be let about April 1 for 15,000 sq. yd. brick paving to cost $35,000. J. M. Clark, City Engineer.

Wellsburg, W. Va.—Citizens of Brooke County will vote on issue of $300,000 bonds for constructing roads.

Americus, Ga.—Reported election soon to be held to vote $30,000 bonds for street work and improvements.

Kissimmee, Fla.—Only one bid received Jan. 3 for constructing one mile of sand asphalt road, and it was rejected. J. L. Overstreet, Clerk County Commissioners.

Tallahassee, Fla.—Paving bonds for $100,000 will be sold Feb. 21 by County Commissioners. O. C. Van Brunt, Clk.

Hammond, La.—City Council voted in favor of spending $20,000 for paving streets.

Biloxi, Miss. — Citizens of Harrison County (Gulport County seat) voted $640,000 bonds for constructing brick highway 26 miles long from Biloxi to Christian.

Canton, Miss.—Road bonds for $80,000 will be sold Feb. 7 by Board Supervisors. D. C. McCool, Clk.

Ashland City, Tenn.—Election to be held March 21 to vote on paving 110 miles of Public Pike. Address S. L. Harper, County Court Clerk.

Cleveland, Tenn.—Reported the Bradley County Court considering spending $50,000 for road improvements.

Centerville, Tenn.—Citizens of Hickman County will on March 1 vote on issue of $200,000 bonds for constructing good roads.

Georgetown, Ky.—Citizens of George County voted $100,000 bonds for reconstructing roads.

Cincinnati, Ohio.—City Council Jan. 18 authorized issue of $280,000 bonds for repairs to streets, sewers, bridges and viaducts. The greater portion will be spent on macadam streets. In July another bond issue of approximately $200,000 will be authorized for the same purpose. Frank S. Krug, City Engineer.

City Council authorized a bond issue of $34,400 for improving Reading Rd.

Maryville, Tenn.—About $100,000 road improvement bonds sold by Blount County.

Washburn, Tenn.—About $200,000 is to be spent by Grainger County for road improvements.

Culver, Ore.—County will let contracts during summer for constructing 30 miles of highway costing $15,000. Walter M. Eaton, County Engineer.

Ohio.—State Highway Department Columbus, intends constructing 4 miles of water bound macadam road from Coshocton to West Lafayette. Contract will probably be let in July.

Ravenna, Ohio—Ravenna-Edinburg Rd., 2.4 miles, and Cleveland-Kent Rd., 2.7 miles, are to be improved by County Commissioners with state aid.

Steubenville, Ohio. — County Commissioners voted $24,000 bonds for constructing Ohio River market road.

Wooster, Ohio.—West Salem Street paving bonds amounting to $24,000 sold.

Boonville, Ind.—Bd. County Commissioners considering constructing 31 miles macadam roads; cost about $100,000.

Greencastle, Ind.—Paving bonds for $31,600 will be sold Feb. 7 by H. H. Runyan, County Treasurer.

Fort Wayne, Ind.—County will construct a double-track road, 10-ft. macadam, 11,400 ft. long, cost $12,059; 10,862 ft., 9 ft. wide, cost $12,790; 10,312 ft., 14 ft. wide, cost $14,038. William Johnson, Co. Aud.

Goshen, Ind.—City Council voted to pave Seventh and Third Streets during summer; cost about $75,000.

Indianapolis, Ind.—Street and sidewalk improvements—paving streets—will take in all sections of the city, it has been announced. Largest work now planned involves entire district north of Fall Creek, east of College Avenue and south of Thirty-eighth Street. Plans also are being prepared by City Engineer for permanently improving all of the avenues leading into Indianapolis. These thoroughfares will connect with the outlying roadways. B. J. T. Jeup, City Engineer.

Vincennes, Ind.—Contract will be let about April 1 by H. T. Watts, City Engineer, for 150,000 yd. asphalt and 65,000 sq. yd. brick pavement on portions of various streets, including Second, Seventh, Eighth, Church, Vigo and Perry Streets, with 50,000 ft. combined curb and gutter. Cost $400,000.

Williamsport, Ind.—Paving bonds for $66,820 will be sold Feb. 1 by Ernest Grey, County Treasurer.

Sault Ste Marie, Mich.—About $100,000 road improvement bonds sold by County Board of Supervisors.

St. Johns, Mich.—Citizens of Clinton County will this spring vote on issue of $100,000 bonds for road improvements.

Anna, Ill.—City contemplates laying about $40,000 worth of street paving this season. J. J. Waltman, City Engineer.

Bloomington, Ill.—City Engineer in a report submitted to Board of Local Improvements estimates cost of paving Madison Street with brick, at $12,642.

Edwardsville, Ill.—Township Highway Commission will spend $16,000 on road improvements during 1916.

Fairfield, Ill. — Contract will be let about May 1 by A. J. Poorman, Mayor, for about 30,000 yds. of brick paving and cement curb and gutter.

Sterling, Ill.—Paving of Lincoln Highway through Sterling Township with brick, about 2¼ miles, is contemplated. V. N. Taggett, County Superintendent of Highways.

Madison, Wis.—Contract will be let about March 15 for 60,000 sq. yd. sheet asphalt or asphalt concrete on Dunning, Oakridge, Rowley, Roby and Johnson Streets, and 40,000 lin. ft. combined gutter and curb. Cost $150,000. E. E. Parker, City Engineer.

Waukesha, Wis.—Paving with asphalt macadam about 10,000 sq. yd. on Beechwood Avenue, the Strand and Wisconsin Central Avenue, including 7000 lin. ft. combined cement curb and costing $15,000 is contemplated. William Powrie, City Engineer.

Creston, Iowa.—City Council is considering construction of about 100,000 yd. of street paving and 75,000 ft. curbing. Various types of pavement under consideration. Theo. S. DeLay, City Engineer; Carl Davenport, City Clerk.

West Liberty, Iowa.—Benton R. Anderson, Engineer, Marion, is preparing plans and specifications for about 35 blocks of paving and 28,000 lin. ft. curb and gutter.

Minneapolis, Minn.—The City Council has authorized the recommendation of the Paving Committee and will spend $1,060,000 for new paving during the season of 1916.

Park Board is considering the paving of Minnehaha Boulevard between Lake Harriett and the Mississippi River, a distance of about 6 miles.

McCook, Neb.—City contemplates paving about seven blocks of the business district in the spring with fiber brick for the slopes and concrete for the level surface. J. W. Chase, City Engineer.

Billings, Mont.—Citizens of Yellowstone County on March 4 will vote $175,000 bonds for constructing highways.

Billings, Mont.—Election to be held March 4 to vote $175,000 bonds for constructing roads. Address County Commissioners.

Amarillo, Tex.—Two miles of paving costing about $40,000 for city's portion is to be laid this year, contract to be let after April. M. H. Hardin, City Engineer.

Bartlett, Tex.—Citizens voted $24,000 street improvement bonds.

Orange, Tex.—See "Hydraulic Construction and River Improvements."

Taylor, Tex.—An election is to be held Feb. 15 to vote $50,000 bonds for street paving. Fifth, Sixth, Seventh and Vance Streets are to be paved with asphalt concrete at a cost of about $100,000. W. E. Dozier, Engineer, Taylor; G. V. Hyde, City Clerk.

Tyler, Tex.—Citizens voted $100,000 bonds for finishing the uncompleted road in Tyler Road Dist.

Fort Collins, Colo.—Contract will be let in March or April for 21,500 sq. yd. concrete pavement, costing $30,000. Frank P. Goeder, City Engineer.

Pueblo, Colo.—Contract will be let about April for paving Court Street and Grand Avenue Paving District, requiring 41,000 sq. yd. bitulithic pavement; 23,600 lin. ft. combined curb and gutter. D. P. Gaymon, City Engineer.

Albuquerque, N. M.—State Highway Commission has been authorized to improve road from Glorieta to Santa Fe. Address State Engineer, Santa Fe.

Chehalis, Wash.—County Engineer John Neville reports State Highway Commissioners have approved plans for constructing two miles and 600 ft. of concrete roadway to be laid this spring, one to complete road from Centralia to Thurston County line, 16 ft. wide, and the other 1 mile southeast to Chehalis.

Colfax, Wash.—About $140,000 is to be spent for highway improvements during 1916 by Whitman County. John M. McGraw, County Engineer.

Ephrata, Wash.—About $30,000 is to be spent by County Commissioners for constructing 17-mile road.

Seattle, Wash.—Plans and specifications presented to Bd. Public Wks. by A. H. Dimock, City Engineer, for paving Warren Avenue, cost $45,000, and W. McGraw Street, with asphalt, $110,000.

City Engineer A. H. Dimock estimates cost of improving Thirteenth Avenue at $19,483.

City Council considering paving 3 miles Beacon Avenue with asphalt, cost $203,000.

Benson Street is to be paved with asphalt and brick block at a cost of $180,853 and to include 23,755 lin. ft. concrete curb, 127,000 cu. yd. earth fill, etc. A. H. Dimock, City Engineer; address Board of Public Works.

Tacoma, Wash.—It is proposed to construct 8 miles of 17-ft. highway (Pacific Highway and National Park) at a cost of $120,000. David H. White, County Engineer.

Pendleton, Ore.—About $24,503 Alta Street improvement bonds sold by City Council.

Los Angeles, Cal.—The County Road Department plans following work in 1916, using concrete unless otherwise stated. Constructing Sections "B" to "G," inclusive, in all about 30 miles of Mint Canyon Road, at a total cost of $350,000; Pico Street extension, 3.5 miles, $42,000; Workman Mills Road, 6.59 miles, $79,000; Olive Street R. 35, 2.12 miles, $26,490 (contract to be let in March); Norwalk Puente Mills Road, 3.62 miles, $58,403 (contract to be let about March); Artesia Avenue R. 61, 1.5 miles, $18,000; Artesia Avenue R. 102, 3.48 miles, $42,000; Lexington Gallatin Road R. 103, 2.5 miles, $30,000; Barranca Street R. 87, 1.4 miles, $17,000; Tenth Street-Antelope Avenue R. 93, 1.37 miles, $66,000; Wright Road and Tweedy Road R. 94, 2.94 miles, $43,303; Mesa Drive R. 95, 2 miles, $25,000; Azusa Street R. 104, 1 mile, $12,000; Grand Avenue-Ballon Avenue R. 100, 2.36 miles, $29,000. Oiled macadam: Vine Avenue R. 55, 2.62 miles, $30,594; Sixth Street R. 59, 0.91 mile, $18,446; Tenth Avenue and Grand View (curbs), 2.21 miles, $25,872. Concrete and macadam: Roy Avenue-Texas Street R. 78, 1.28 miles, $15,500. Other streets to be improved include Willowbrook Streets R. 96, oiled curb sidewalk, 2.20 miles, $48,214; Brown Canyon Road R 97, 4 miles, $40,000; Roosevelt Avenue and Grand Oaks R. 96, 0.3 mile, $6,448; Whittier Avenue R. 99, macadam curb and gutter, 1.4 miles, $25,164.

Strathmore, Cal.—About 16 miles of concrete highway in Road Improvement District No. 1 will be ordered by Tulare County Board of Supervisors.

Visalia, Cal.—County Supervisors considering constructing paved roads throughout county. Byron Lovelace, County Engineer.

Ventura, Cal.—County secured rights of way and will construct state highway through county, about $250,000 available for proposed work.

Nogales, Ariz.—Road bonds amounting to $51,000 will be sold Feb. 7 by Board of Supervisors.

Caldwell, Idaho.—Council reported considering macadamizing 12 miles of principal streets, grading and sanding ·25 miles of other streets, building trunk sewer, lowering present sewers, etc.; cost $125,000.

Lewiston, Idaho.—Reported Council has authorized paving of portions of C and Seventh Streets, at a cost of $12,000.

Las Vegas, Nev.—Election will be held to vote $50,000 bonds for constructing roads.

Wallace, Man.—Road bonds for $40,000 will be sold Feb. 4 by William Whiteford, Secy. and Treas., Virden.

BIDS DESIRED.

Johnson, N. Y.—Until Feb. 21 by William C. Lewis, Village Clerk, for paving with brick on portion of Grand Avenue.

Camden, N. J.—Until Feb. 7 by Director Board Chosen Freeholders, Camden, for construction of Moorestown Turnpike with granite block and bituminous surface on concrete foundation, about 29,637 sq. yd. surface pavement and foundation. Also same time as above by Stone Road Committee at Court House, Camden, for constructing the Grenlock Road, bituminous surface on macadam foundation, about 13,782 sq. yd. surface pavement; also foundation, and 10,000 cu. yd. excav. J. J. Albertson, County Engineer.

Merchantville, N. J.—Until Feb. 7 by John Mickle, Borough Clerk, for paving of tracks and 3 ft. each side on portion of Maple Avenue on Moorestown Pike, with bituminous and granite block pavement on concrete foundation, in all about 6864 sq. yd. bituminous surface and 18,532 lin. ft. granite block, 4 ft. wide. J. J. Albertson, Engineer, Camden.

Baltimore, Md.—Until Feb. 2, by Board of Awards, care of Richard Gwinn, City Registrar, for furnishing Belgian or granite blocks, during the year 1916. R. M. Cokksey, Highway Engr.
Until Feb. 2, by Paving Commission, for 25,900 sq. yd. sheet asphalt, 1½ in. topping, 1½ in. binder, 5 in. concrete base; 85,900 sq. yd. sheet asphalt, 1½ in. topping, 1½ in. binder, 6 in. concrete base; vitri. block paving about 2510 sq. yd.; granite block, repaving, 10,410 sq. yd.; granite block paving, 15,800 sq. yd.; 3300 sq. yd. mixing and placing cement grout in ballast of steam railway tracks.

Baltimore, Md.—See "Miscellaneous."

Bath, W. Va.—Until Feb. 15 by Town Council for approximately 15,000 sq. yd. paving with necessary curbing, inlets, sewers, etc. Bids desired on 6-in. reinforced concrete, plain concrete; also brick with concrete base. J. A. Risinger, Mayor at Berkeley Springs, W. Va.

Miami, Fla.—Reported desired until Feb. 3 by County Commissioners at Miami, not Jacksonville, as previously stated, for constructing the Tamiami Trail through Everglades from Miami on Atlantic Coast to Tampa on Gulf Coast Road will be about 25 feet wide with a rock surface of 16 ft. in width.

Camden, Ala.—Until Feb. 21 by J. N. Stanford, Judge of Probate, for about 16 miles of gravel roads.

Hamilton, Ala.—Reported desired until Jan. 31 by County Commissioners for graveling 10 miles of road.

Huntsville, Ala.—Reported desired until March 6 for constructing 3¼ miles macadam roads. M. S. Bingham, Road Supervisor.

Shaker Heights, Ohio.—Until Feb. 5, by Carl L. Palmer, Village Clerk, First National Bank Building, Cleveland, for paving with brick, concrete, asphalt or bituminous macadam in Shaker Boulevard. B. W. Willard, Village Engr., 804 Marshall Building, Cleveland.

Indiana.—By County Commissioners for constructing roads as follows:
Until Feb. 8:
Mount Vernon, for constructing gravel roads in Black, Lynn, Robb, Smith and Center Townships, in all about 73,469 ft. respectively. Joseph R. Haines, Co. Aud.
Until Feb. 23:
Fort Wayne, for constructing macadam roads in Madison, Monroe and Wayne Townships. Will Johnson, Co. Aud.
Until March 6:
Portland, Wilson Frank Road, ¾ mile long, paved with brick on 6-in. concrete base. Probable cost $20,198. Also A. S. Black Road. Probable cost $26,108.

Lebanon, Ind.—Until Feb. 28 by City Council for improving of West Washington Street, including paving, constructing walks, etc., at a cost of $12,757. Walter Whitecotton, City Engineer.

Chicago, Ill.—Until Jan. 31, by Department Public Works (W. R. Moorehouse, Comr. Pub. Wks.), for delivering f.o.b. to city at such switch tracks as designated by Comr. Pub. Wks., 600,000 paving bricks.

Galva, Ill.—Until Feb. 3 (change of date), by Board Local Improvements (George E. Palmer, Pres.), for 10,000 sq. yds. brick pavement on concrete base, sand filler, 4000 sq. yds. brick pavement concrete base, bituminous filler, 4000 cu. yds. grading and 5600 lin. ft. combined curb and gutter.

Oak Park, Ill.—Until Feb. 1, by Board Local Improvements (B. C. Brandstadt, Secy.) for improving portions of Elmwood, Humphrey, Harvey Avenues, Adams and other streets.

Manitowoc, Wis.—Reported desired until Feb. 3, by Board Public Works (Henry F. Kelly, Chmn.), for paving portions of various streets with either brick, sheet asphalt, creosoted blocks or asphaltic concrete.

Milwaukee, Wis.—Reported desired until Feb. 4 by F. G. Simmons, Commissioner of Public Works for street paving for year 1916.

Wausau, Wis.—Until Feb. 15 by City Clerk for furnishing material and paving with vitrified brick on portions of Forest Street and Grand Avenue, in all about 30,000 yd.; also for concrete curbing.

Clinton, Iowa.—Until Feb. 8, by Frank W. Leedham, City Clerk, for improving streets to consist of 22,246 sq. yd. vitr. block paving, 1240 lin. ft. plain curb, 6121 lin. ft. curb and gutter. J. G. Thorne, City Engr.

Eldora, Iowa.—Until Feb. 14, by L. J. Stout, City Clerk, for 11,979 sq. yd. Portland cement concrete pavement, 4646 lin. ft. curbing, 10,712 sq. yd. asphaltic concrete pavement, 6068 lin. ft. curb., 10,712 sq. yd. bitulithic pavement, 5068 lin. ft. curb and gutter, and 915 sq. yd. Portland cement concrete pavement on alleys. E. L. Chamberlain, City Engineer.

Duluth, Minn.—Until Feb. 5 by Secretary Public Works for paving with brick, asphalt, concrete or bitulithic Grand Avenue, from Twenty-eighth to Fifty-fourth Streets.

Kansas City, Kan.—Reported desired until Feb. 14 by F. M. Holcomb, County Clk., for grading and macadamizing Rutledge-Lannon Road.

Minot, N. D.—Reported desired until Feb. 28, for approximately 24,844 sq. yd. paving, including creosoted wood block, bitulithic, reinforced-concrete brick and sandstone. E. J. Thomas, City Engr.

Washington.—Reported desired until Feb. 14, by William B. Roy, State Highway Commissioner, Olympia, for constructing 10-mile section of the Sunset Highway between Ellensburg and Vantage in Kittitas County, involving grading, drainage and clearing; cost $29,000.

Wenatchee, Wash.—Reported desired until Feb. 8 by T. L. Ross, County Auditor, for constructing one mile of Permanent Highway. Fred. A. Warren, Co. Engr.

Hanford, Cal.—Until Feb. 7 by Board of Supervisors for furnishing 11,000 tons asphaltum.

Santa Monica, Cal.—Until Feb. 15, by City Clerk, for 170,000 sq. yds. concrete pavement on Palisades Beach Road.

Ventura, Cal.—Until Feb. 4, by County Board Supervisors, for constructing Matilija Canyon Road, about 6 miles long, including several timber bridges, one 70 ft. long. Estimated cost, $29,000.

Globe, Ariz.—Until March 1 by Board of Supervisors for paving Globe and Miami Highway, approximately six miles. Roy G. Thomas, County Engineer, Globe.

PRICES AND LETTINGS.

★Indicates award of contract.

★**Connecticut.**—Contract awarded by Chas. J. Bennett, State Highway Commissioner, Hartford, for constructing three sections of concrete road on Stony Creek, Indian Neck and Short Beach Roads in Brantford, to C. W. Blakeslee & Sons, New Haven, at approximately $63,000.

★**Hartford, Conn.**—Contract for construction of a section of trap macadam road awarded Frank Arrigoni & Brother, Middletown, at $8,000.

★**Philadelphia, Pa.**—Contract awarded Edwin H. Vare, Betz Building, for paving, constructing sewers and building inlets on Delaware Avenue, from Mifflin Street to Snyder Avenue, at $89,974.

★**Florence, S. C.**—Contract for constructing 2½ miles of concrete sidewalks (bids opened Jan. 11), awarded J. R. Steel, Bennettsville, at 83 cents per sq. yd. C. H. Carlisle, City Engineer.

Fort Wayne, Ind.—Lowest bid opened Jan. 17 by Park Commissioners for improving Rudisill Boulevard was submitted by Grace Construction Company, Fort Wayne, $34,432, for paving with Standard Oil mixture or with a Bermudez natural lake pour.

★**Evanston, Ill.**—Following are unit figures of the successful bidder (bids opened January 17 by Board of Local Improvement), M. Foley Company, Main Street, Evanston, for brick paving: portions of Bridge Street, Payne, Noyes Streets, Country Road and Dodge Avenue, 30,000 lin. ft. curb , 50 cts.; 27,000 cu. yds. grading, 20 cts.; 41,400 sq. yds. paving, $1.86; 1800 lin. ft. sewer, 60 cts.; 56 catch basins, $30.00; 76 catch basins adjusted, $5.00; 8 manholes, $24.00; 33 manholes adjusted, $2.00; 26 valve covers adjusted, $2.00; total, $100,854. Simpson, Bridge and Grant Street, Leon Place and Asbury Avenue, 29,900 ft. curbing, 50 cts.; 198,866 cu. yds. grading, 18 cts.; 40,500 sq. yds. paving, $1.62; 1031 lin. ft. sewer, 60 cts.; 98 catch basins, $30.00; 52 catch basins adjusted, $5.00; 8 manholes, $23,00; 34 manholes adjusted, $2.00; 25 valve covers adjusted, $2.00; total, $95,546.

★**Milwaukee, Wis.** — Special County Board Committee on Highways has awarded contracts aggregating $251,470 for cement to be used in constructing concrete roadways, including one to Wilbur Lumber Company, Milwaukee, at $34,843 for cement to be used in Howell Avenue.

★**Ames, Iowa.** — Contract for paving with bitulithic (bids opened Jan. 17), awarded Des Moines Asphalt Company, Des Moines. A. B. Maxwell, Clerk Board Public Works.

★**Greenfield, Iowa.**—Contract for constructing about 25,000 sq. yds. of paving (bids opened Jan. 20) by H. G. Spooner, Town Clerk, awarded Western Improvement Co., Racine, Wis., at following bid: 24,000 sq. yds. asphalt concrete pavement, $1.58 per sq. yd.; 16,000 lin. ft. curb and gutter 42 in. over all, one course, straight, 60 cts.; park, 58 cts.; 600 ft. sewer pipe 15 in., $1.00; 400 ft. 12 in., 80 cts.; 300 ft. 10 in., 70 cts.; 200 ft. 8 in., 60 cts.; 100 ft. 6 in., 40 cts.; Y specials, 10 pieces 10 in. x 6 in., 50 cts.; 8 pieces 8 in. x 6 in., 40 cts.; 8 pieces 6 in. x 6 in., 40 cts. Theodore S. DeLay, Engr., Creston.

★**Higginsville, Mo.**—Contract awarded C. T. Petry, Marshall, Mo., for about 12,000 sq. yd. brick block pavement, at $1.59 per sq. yd. Next three lowest bidders: E. D. Tyner Construction Company, Kansas City, $1.66; Edgar Mains, Liberty, $1.74; Joe. W. Mendee, Sedalia, $1.83. Ralph A. Huscher, City Clerk.

★**Giddings, Tex.**—Commissioners Court awarded contract for constructing roads in Lee County to Smith Bros. of Crockett, at $30,000.

★**Denison, Tex.**—Contracts for improving highway system awarded by County Commissioners at Shermas as follows: Wamack Construction Company, Terrell, $453,000; W. P. McCoy, Arlington, $83,000, and J. W. Hoffman & Company, Muskogee, Okla., $80,000. Gravel purchased from J. W. Hoffman & Co. at 21¼ cts. per ton f.o.b. pits; approximately 250,000 yd. gravel will be used. Julian C. Field & Company, Denison, Consulting Engineer, 105 Field Building.

★**Oklahoma City, Okla.**—Contract for paving Thirteenth Street and Stiles Avenue awarded by City Commission to Sandringham Co., Oklahoma City, at $28,432.

Astoria, Ore.—Only bid opened by City Council for filling and planking 5 blocks of Commercial Street submitted by Standard American Dredging Co. at $39,000.

Los Angeles, Cal.—Following are four lowest bids opened recently for constructing 2.69 miles of highway in Road District No. 56 near Zaferia Station, involving approximately 6395 cu. yds. excavation, 6020 sq. yds. concrete pavement, 8375 tons macadam, etc.: James L. Frazer, 627 First Natl. Bank Bldg., Long Beach, $15,900; J. Hein, Los Angeles, $15,945; Metropolitan Contracting Company, $16,888; White & Gaskill, $17,350.
★Following are unit figures of Peter L. Ferry, 536 Acacia Avenue, Tropico, the successful bidder for Section "A" of Mint Canyon Road (bids opened Dec. 27 by County Board of Supervisors): Cement, broken stone, sand for all concrete and asphaltic oil for bituminous wearing surface furnished by county. Average haul for contractor .844 miles; for oil 40 miles; 36,000 cu. yds. excav., 25 cts.; 26,400 lin. ft. shaping road bed, 5 cts.; 58,667 sq. yds. concrete pavt. 5 in. thick, 29 cts.; 145 cu. yds. concrete (for culverts), $5,000; 7661 lbs. steel (for culverts), 4 cts.; 2350 lin. ft. standard guard fence, 50 cts.; total, $29,539.

★**Ontario, Cal.**—Contract for 469,657 sq. ft. of concrete base, 37,649 sq. ft. concrete gutter, 2075 cu. ft. concrete in culverts and 103,088 sq. ft. grading on A and Bon View Streets and Euclid Avenue awarded Ford & Stout, Bradbury Building, Los Angeles, at $45,231.

STREET CLEANING AND GARBAGE DISPOSAL

PROPOSED WORK.

Springfield, Ill. — City Commissioners considering constructing a garbage incinerator to cost $20,000.

Lincoln, Neb.—City Council has authorized City Clerk to let contract for a disposal plant to cost about $30,000, to have a daily capacity of disposing of 50 tons, including dead animals. Plans and specifications to be furnished with bid.

Bartlesville, Okla. — Reported $50,000 bonds have been sold. It is proposed to construct a public park system and an incinerating plant.

BIDS DESIRED.

New York, N. Y.—Until Feb. 7 by J. T. Fetherson, Comr. of Street Cleaning, for Form 1, for final disposition of ashes, street sweepings and rubbish, in Boroughs of Manhattan and Bronx. Form 1 and 2. Security $10,000 each on Forms 1 and 2.

Brooklyn, N. Y.—Same time and place as above for final disposition of ashes, street sweepings and rubbish. Security $5,000.

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS

PROPOSED WORK.

Hydroelectric Plant—Baltimore, Md.—Specifications have been prepared by Harbor Engineer McKay for the proposed hydroelectric plant to be constructed at Jones Falls Valley.

Dredging—Jacksonville, Fla.—All bids opened Nov. 8 by U. S. Engineer's Office, Jacksonville, for dredging an entrance channel to harbor of Miami on Biscayne Bay rejected. New bids to be asked.

Creek Improvement—Tiffin, Ohio.—City reported considering improving Rock Creek by straightening, widening and deepening from Coe Street a distance of about 1 mile. Address Mayor.

Drainage—Michigan City, Ind.—Ernest Dunn, Engineer; Stephen D. Flynn of Westville, and Leonard Punnewitz of San Pierre, instructed by the Commissioners to make a survey for proposed ditching of Kankakee River in south end of Laporte County and north end of Starke County, and report to court on April 10. The proposed drain is to be 15 miles long with 16 miles of lateral ditchings.

Levee Improvement — Anna, Ill.—About $10,000 will be spent this season in increasing the height of the levee along Mississippi River. E. S. Alden, Secy. Preston Levee Drainage District.

Drainage—Decatur, Ill.—Wabash Railroad and the farmers in the vicinity of Taylorville are considering constructing a drainage canal to relieve flood waters along Wabash River. J. E. Strunpf, Decatur, Division Superintendent.

Drainage—Dixon, Ill.—County Court has confirmed a levy of $89,982 to complete work under way on Inlet Swamp drainage district.

Drainage—Mason City, Iowa.—All bids opened Jan. 17 by County Commissioners for constructing Drainage District No. 26 rejected. George E. Frost, County Auditor.

Wharves—Orange, Tex.—Improvements bonds amounting to $325,000 have been sold to be used as follows: $150,000 for wharves and docks, $150,000 for schools, and $25,000 for street improvements.

Seawall—Seattle, Wash.—All bids received for constructing the proposed Elliott Bay seawall, extending from Washington to Madison Streets, have been returned unopened, because of an error in the specifications. New specifications will be prepared and bids again asked. City Engineer A. H. Dimock estimates cost at $81,000, to include 200,000 cu. yd. fill, a 30-ft. brick street and replacing existing planking.

Drainage — Tacoma, Wash. — Contract will be let about May by Commissioners of Hylebos Diking District No. 1 (Henry C. Christen, Secy., Tacoma), for improvements to Hylebos Creek Drainage District, costing $75,000, including sinking of 1800 acres of land adjoining city of Tacoma on east on tide lands. Don C. Roben, Engineer, Tacoma.

Irrigation — Bend, Ore. — George S. Young, Project Engineer, Suttle Lake Irrigation Project, Bend, reports contract will be let about March 15 for constructing the irrigation system to consist of concrete flumes, large dam, reinforced-concrete core wall, 23 miles of main canal, 100 miles large and small ditches, flumes of wood or metal. O. Lauregard, Railway Exchange Building, Portland, Ore., Consulting Engineer.

Dyke—Marshfield, Ore.—Reported L. P. Branstetter contemplates constructing a dyke to cost $125,000.

Irrigation—Doyle, Cal. — Directors of Lassen Irrigation District propose constructing 2 dams, about 60 miles of canals; 30 miles will be cemented. About 22,500 acres are to be irrigated. Surveys will be completed by May 15. Contract will be let in June. William Wales, Engineer, Woodland. Elbert Howard, member Board Directors.

Flood Protection—Los Angeles, Cal.—Election soon to be held in the county to vote $3,600,000 bonds for control of flood waters.

Pier—Manhattan Beach, Cal.—Citizens voted $90,000 bonds for constructing a 1500 ft. concrete pier at foot of Center Street to cost $70,000 and an amusement pavilion at Marine Avenue to cost $20,000.

Irrigation Bonds—Redding, Cal.—Directors of Anderson-Cottonwood Irrigation District will sell Feb. 4, $480,000 irrigation district bonds.

Irrigation—Terra Bella, Cal.—Directors of Terra Bella Irrigation District accepted plans of Engineer S. E. Kieffer, San Francisco, for irrigation system to include about sixteen wells, four 8 and two 12-in. centrifugal pumps, two 25 h.p. and two 75 h.p. motors, two 120 h.p. Diesel engines and 30 to 40-in. distributing pipe.

Drainage—Tempe, Ariz.—Trustees of Drainage District No. 1 will soon let contract for constructing drainage to drain 9000 acres south of Tempe and to cost $45,000.

Hydroelectric Plant — Cobden, Ont.—City contemplates installation of a distributing system for hydorelectric power to cost about $20,000.

Channel Improvement—Victoria, B. C.—Dominion Government during the present year intends dredging northwest passage north of Pelly Island, between Songhees Point and Work Point, to provide a channel 300 ft. wide, with an average depth of 20 ft. at low water, to facilitate the navigation of vessels in the inner harbor.

BIDS DESIRED.

Dykes, Etc.—Albany, N. Y.—Until Feb. 24, by W. W. Wotherspoon, State Superintendent Public Works, Albany, for constructing dykes, deepening and straightening channels, building walls, culverts, etc., along Allegheny River and Olean Creek at or near Olean in city of Olean, advertised in Engineering Record.

Dam Repair—Albany, N. Y.—Until Feb. 7, by W. W. Wotherspoon, State Superintendent Public Works, Albany, for making repairs to dam at Tonawanda. Engineer's estimate $36,052.

Levee Work — Alexandria, La. — Until Feb. 16, by Board Commissioners of Red River, Atchafalaya and Bayou Bouef Levee Dist., at Alexandria (Howard B. Gist, Secy.), for constructing and placing a subaqueous lumber mat for bank protection in Rapides Parish Red River, right bank, Alexandria, Front Reach, approximate length of bank to be protected 1100 ft.

Breakwater — Manistee, Mich. — Until Feb. 21 by U. S. Engineer's Office, Grand Rapids, for building part of breakwater and the shore connection and removing part of the old pier at Manistee Harbor, Mich., advertised in Engineering Record.

Wheaton, Minn.—Reported desired until Feb. 8 by J. T. Erickson, County Auditor, for constructing County Ditch No. 37; probable cost $8,000.

Dam—Emporia, Kan.—Until Feb. 1, by Fred Smith, City Clk., for furnishing material and constructing dam and revetment work on Neodesho River. Bids requested on two types of dam, Automatic Wicket gate dam, and a concrete dam of monolithic construction. Wicket dam approximately 180 cu. yds. plain concrete, 80 cu. yds. reinforced concrete, 50 cu. yds. rock excav., 200 cu. yds. earth excav., 43,000 lbs. steel, 2,800 board ft. timber. Monolithic concrete dam approximately 320 cu. yds. plain concrete, 70 cu. yds. reinforced concrete, 50 cu. yds. rock excav., 200 cu. yds. earth excav. Revetment work to consist of 18,000 sq. ft. willow mat, 30,000 stone rip rap and 2400 ft. cu. yds. earth in dike. Black & Veatch, Consulting Engrs., 507 Interstate Bldg., Kansas City, Mo.

Jetty Work—Dallas, Tex.—Until Feb. 21 by U. S. Engineer Office, Dallas, for jetty work at Sabine Pass, Tex., advertised in Engineering Record.

Drainage—Wagoner, Okla.—Until Feb. 7, by Verdigis Drainage Dist. No. 1, for 34,000 cu. yd. leveework and 30,000 yd. filling, concrete culverts, flood gates, etc. T. A. Parkinson, Co. Clk.

Jetty Work—Portland, Ore.—Until Feb. 21 by U. S. Engineer Office, Portland, for furnishing stone for north jetty construction at mouth of Nehalem River, Ore.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Dams — Norfolk, Va.** — Contract awarded F. J. McGuire, Norfolk, for reconstructing Little Creek and Lake Taylor dams at $64,509 (bids opened Jan. 8).

Steel Lock Gates—Wheeling, W. Va.—Following are four lowest bids opened Jan. 14 by U. S. Engineer's Office, Wheeling, W. Va., for erecting steel lock gates at Dam No. 14, Ohio River: Independent Bridge Company, Pittsburgh, Pa., $35,490; Walter S. Rae, Pittsburgh, Pa., $38,370; Penn Bridge Company, Beaver Falls, Pa., $40,365, and John Eichleay, Jr., Company, Pittsburgh, $41,980.

★**Drainage—Mason City, Iowa.**—Contract for constructing Drainage District No. 27 awarded Nels Paulson, Thornton, Iowa, at $10,044 (bids opened Jan. 17). George E. Frost, County Aud.

★**Ditch—Fairmount, Minn.**—Contract for constructing Judicial Ditch No. 50 (bids opened Jan. 14) awarded by County Commissioners to C. A. Walb of LaGrange for open portion at $22,322 and tiled portion to Leo Lark, Sherburn, at $1,787. H. C. Nolte, County Auditor.

★**Drainage—Memphis, Mo.**—Contract for constructing 17.3 miles of drainage ditch to consist of 557,000 cu. yd. in Wyconda River Drainage District No. 1 (bids opened Jan. 15), reported awarded to Sternberg Brothers, Chicago, at 5.92 cts. per yd.

Dikes, Etc.—Oak Harbor, Wash.—Following are three lowest bids opened recently by George C. Trott, Secy. Drainage Dist. No. 3 for constructing dike, embankment fill, sluice gates, etc. Bids are on cash or payment in bonds respectively: W. B. Lance, North Bank Bldg., Seattle, $17,333 and $18,628; L. H. Goerig, 1027 Bellevue Court, Seattle, $18,500 and $20,350; Stonehouse & Cutter, Everett, Wash., $18,430 and $19,500.

ELECTRIC RAILWAYS

PROPOSED WORK.

Tuscaloosa, Ala.—Birmingham-Tuscaloosa Ry. & Utilities Co. plans to make extensive improvements on line between Tuscaloosa and Holt.

Terre Haute, Ind.—Reported the Terre Haute & Indianapolis and Eastern Traction Co. contemplates extending line to Milligan Park, Crawfordsville.

Joliet, Ill.—Plans completed by Joliet & Eastern Traction Co. to extend line from Joliet to Hammond, Ind.

Rockford, Ill.—Among extensions contemplated by Rockford City Traction Co. this year are a line to Scandinavian Cemetery and on Whitman Street, from Church Street to North Avenue, and on North Avenue to Hoffman Boulevard.

Chippewa Falls, Wis.—Reported that Wisconsin-Minnesota Light & Power Co. is considering constructing an extension from Chippewa Falls to St. Paul and Minneapolis.

Eau Claire, Wis. — Wisconsin-Minnesota Light & Power Co. considering constructing an extension to St. Paul.

San Diego, Cal.—Work will soon begin by San Diego Electric Ry. Co. on constructing an extension to La Playa.

San Francisco, Cal.—Following extensions of Municipal Ry. is contemplated: Stockton Street Line across Market Street to Southern Pacific depot at Third and Townsend Streets; Potrero Street Line to Hunters Point.

BIDS DESIRED.

New York, N. Y.—Until Feb. 10 (readvertisement) by Public Service Commission for First District, 154 Nassau Street, for constructing Section No. 2-A, Route No. 12, a part of the Broadway-Fourth Avenue Rapid Transit R. R., known as Eastern Parkway subway, in Brooklyn.

Until Feb. 10 by Public Service Commission for the First Dist., 154 Nassau Street (Travis H. Whitney, Secy.) for installation of tracks for White Plains Road Rapid Transit Railroad in the Borough of Bronx.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**New York, N. Y.**—Public Service Commission has authorized the Interborough Rapid Transit Company to award contracts as follows (bids opened Jan. 10): Webster Avenue extension of Third Avenue elevated railroad to M. J. Leahy, 1446 Prospect Avenue, at $831,111; Eighth Avenue and 162d Street connection to Battery Engineering & Construction Company, 17 Battery Place, $336,784, and West Farms subway connection to A. L. Guidone & Son, Inc., Vanderbilt Avenue, for $105,791.

San Francisco, Cal.—F. R. Ritchie, Chronicle Building, submitted lowest bid for constructing Church Street extension of the Municipal Ry. from Sixteenth and Eighteenth Streets and Twenty-second and Thirtieth Streets, at $57,276.

RAILROADS

PROPOSED WORK.

Jamaica, N. Y.—Long Island R. R. has only taken preliminary steps for eliminating grade crossings in Richmond Hill, and will probably do the work with their own forces. J. R. Savage, Chief Engineer, Jamaica.

Evansville, Ind.—Public Service Commission of Indiana has granted permission to the Standard Brick Mfg. Co. (H. C. Kleymeyer, Gen. Mgr.) to construct a steam railroad for switching purposes across Hogue Road and Upper Mount Vernon Road in Vanderburg County, a total length of about 3285 ft.

Grand Rapids, Mich.—Great Northern R. R. (A. H. Hogeland, Ch. Engr., St. Paul, Minn.) is considering extending the line from Milaca into Mille Lacs County through the Cuyunga Range County and into Grand Rapids.

Norma, Wis.—Chicago, St. Paul, Minneapolis & Omaha R. R. (Herman Rettinghouse, Ch. Engr., St. Paul, Minn.) has authorized constructing six miles of new track from Norma to Jim Falls, Wis.

Mott, N. D.—Northern Pacific R. R. (W. L. Darling, Ch. Engr., St. Paul, Minn.) is planning a line of track from Mott through Lafore to Dickinson this summer.

Lewistown, Mont.—Contract for lengthening passing tracks on Rock Mountain Division of Chicago, Milwaukee & St. Paul Ry. reported awarded D. J. Burke, Lewistown, at about $200,000.

Keltys, Tex.—Angelina County Lumber Company of Kelyus intends constructing a railroad, standard gage, 16 miles long, and one steel bridge to cross Angelina River, and will be in the market for the necessary material for construction of same.

Hoquiam, Wash.—Reported Oregon-Washington R. R. & Navigation Company of Portland, Ore., intends rebuilding North River line south from Cosmopolis, a distance of 14 miles.

PUBLIC BUILDINGS AND SCHOOLS

PROPOSED WORK.

Wellesley, Mass.—Sum of $150,000 has been given for erecting new administration building at Wellesley College (Dr. Pendleton, President).

Torrington, Conn.—Town School Building Committee purchased site on Riverside and Highland Aves. for school, cost not to exceed $60,000.

Hackensack, N. J.—A three-story brick, fireproof nurses' home costing about $45,000 is to be erected in connection with the Hackensack Hospital. Messrs. Grow, Lewis & Wickenhoefer, Architects, 200 Fifth Avenue, New York.

Hoboken, N. J.—Board of Education plans to erect new school to be known as No. 10 at Park Avenue and Thirteenth Street.

Newton, N. J.—Erection of high school costing about $65,000 being considered. Address Board of Education.

Pompton Lakes, N. J.—Election to be held Feb. 15 to vote $40,000 bonds for erecting an eight-room brick school on Lenox Avenue. Address Board of Education.

Wildwood, N. J.—Plans being prepared for $100,000 High School. Address Board of Education.

Johnstown, Pa.—J. Emmet Lucas, J. E. Adams and George Wild, all of Johnstown, are preparing plans for the Junior High School. Charles H. Meyer, Business Manager, School District.

Lancaster, Pa.—Board Trustees Reformed Theological Seminary contemplate erecting $75,000 dormitory.

Philadelphia, Pa.—Plans being prepared by Albert Kelsey, Perry Building, for buildings to be erected at Carson College for Orphan Girls at Chestnut Hill.

Pittsburgh, Pa.—Carnegie Institute of Technology for 1916 contemplates erecting $125,000 head house for School of Applied Science and intends spending a similar amount for a field house and bridge to Morewood Avenue.

Board of Education engaged Edward Stotz, Monon Bank Building, to prepare plans for addition to South High School. and Charles Bickel, May Building, for $230,000 Halls Grove grade school. Site on Greenfield Avenue and Anthony Street selected for Greenfield grade school. Architect soon to be selected for addition to McCleary School; estimated cost $150,000.

Wilkes-Barre, Pa.—Preliminary sketches being prepared by Robert Ireland, School Archt., for $75,000 grammar school to be erected on North Street. Address School Board.

Wilkinsburg, Pa.—Contract will be let about April for erecting the school for which the citizens voted Jan. 15 $250,000 bonds. Ingram & Boyd, Archts., Vandergrift Street, Pittsburgh. James G. Sansom, Secy. Board Educ.

Chestertown, Md. — James W. Cain, President Washington College, instructed to have plans prepared for rebuilding William Smith Hall, recently destroyed by fire.

Norfolk, Va.—School Board selected site on Spottswood and Claremont Avenues for elementary school.

Holliday's Cove, W. Va.—Peterson & Clarke, Steubenville, Ohio, are architects for the two-story and basement school to be erected near Wierton, probably brick construction and cost about $35,000., A. A. McEndree, Secy. School Board.

Huntington, W. Va.—All bids opened recently for erecting the U. S. Post Office rejected by the Supervising Architect, Washington, D. C.

Jacksonville, Fla.—Contract will be let in about a month for erecting six schools plans for which are being prepared. Cost from $60,000 to $100,000 each.

Vidalia, La.—School bonds for $20,000 will be sold Feb. 8 by Board Directors, Schools of Concordia Parish. D. C. Strickler, Supt.

Cleveland, Ohio.—Plans being prepared by John Boddy, 627 Engineers' Building, for a 400 x 200 ft. horticultural hall to be erected next fall in Wade Park; estimated cost $175,000.

Plans completed by William C. Jansen, 403 O'Brien Building, for a four-story brick, steel and stone addition to St. Alexis Hospital, Broadway and McBride Avenue; cost $125,000.

Cleveland Heights, Ohio.—Walker & Weeks, 1900 Euclid Avenue, Cleveland, are architects for the $75,000 school which School Board intends to erect in Euclid Heights division. Ezra Bryant, Clerk School Board.

Columbus, Ohio.—See "Bids Desired."

Dayton, Ohio.—See "Bridges."

Eaton, Ohio.—Architects to be selected Feb. 3 by Board Building Commission (A. L. Reid, Chmn.) to prepare plans for new court house and jail for which the citizens recently voted $250,000 bonds.

Lancaster, O.—David Riebel & Sons, First National Bank Building, Columbus, engaged to prepare plans for remodeling Fairfield County courthouse; cost about $40,000. Address County Clerk.

Lebanon, Ohio—Citizens of Warren County voted $65,000 bonds to replace County Infirmary recently destroyed by fire; probable total cost $84,000. Address County Clerk.

Leroy, Ohio.—Briggs & Nelson, 669 Rose Building, Cleveland, engaged to prepare plans for a village gymnasium and domestic science building, for which citizens voted $30,000. Address Village Clerk.

Lockland, Ohio.—School bonds for $60,000 will be sold Feb. 16 by Board Education Reading School Dist. No. 1, Sycamore Township. L. H. Mohr, Clk.

Urichsville, Ohio.—School bonds for $45,000 will be sold March 1 by Board Education (W. V. Moody, Clk.).

Westfield, Ohio.—Plans completed by Rusk & Sheets of Columbus for $35,000 school. Address School Board.

Youngstown, Ohio.—Erection of $40,000 armory on West Rayen Avenue contemplated. Address State Armory Board, Columbus.

Bloomington, Ind.—Contract about to be let for erecting new Carnegie Library; cost $27,000.

Brooklyn, Ind.—Fred Fields, Township Trustee, considering improving school at a cost of $25,000.

Huntington, Ind.—School Board considering erecting a school costing $125,000. J. M. Scudder, Supt. Schools.

Markle, Ind.—Erection of a high school costing $25,000 under consideration. George W. Brickley, Trustee.

South Bend, Ind.—Erection of one-story grade school on Sample Street contemplated; estimated cost about $75,000. Address Board of Education.

Warsaw, Ind. — Plans prepared by Samuel Craig of Huntington for Carnegie Library to be erected here.

Board School Commissioners has approved plans for the grade school to be erected at a cost of $35,000. Samuel Craig, Huntington, Archt.

Flint, Mich.—Election to be held in April to vote $30,000 bonds to erect jail addition. Address Board of Supervisors.

White Cloud, Mich.—Board of Supervisors at White Cloud propose calling an election in April to vote $35,000 bonds to erect courthouse here. Address County Clerk.

Chicago, Ill.—Preliminary plans being prepared by Eric E. Hall, 139 N. Clark St., for $100,000 emergency hospital contemplated at South Chicago. Address County Clerk.

Homer, Ill.—Homer Township voted to erect township high school costing $40,000.

Ripon, Wis.—Citizens Jan. 11 voted to erect a municipal opera house and armory. Jay E. Carter, City Clerk.

Des Moines, Iowa.—School Board contemplates following improvements: New building for Nash School, $75,000; school at at Forty-second and Forest Streets, $45,000; school for Highland Park, $30,000; new building for Lucas School, $50,000; addition to Willard School, $25,000; prevocation school, equipment, $25,000.

Waukon, Iowa.—Citizens voted $65,000 bonds to purchase site and erect new school. Address School Board.

Duluth, Minn.—Contract soon to be let for erecting a brick library costing $30,000. Address Mayor.

Minneapolis, Minn.—School Board considering erecting two new schools to take the place of the Longfellow and Whitney Schools.

St. Paul, Minn.—Election to be held March 7 to vote $1,000,000 school bonds. Address City Clerk.

Wadena, Minn.—Election will probably be held to vote $20,000 bonds for erecting an addition to the school. Address School Board.

Cheney, Kan.—Preliminary plans completed by U. G. Charles, Wichita, for two-story and basement, 80 x 104 ft., brick, stone school with reinforced concrete floors; cost $30,000. J. T. Hessell, Chairman Building Committee.

Great Bend, Kan.—Owen & Payson, Scarritt Building, Kansas City, Mo., are architects for $25,000 ward school to be erected here. Joseph McNullin, Chairman Building Committee.

Newton, Kan.—Contract will be let in about thirty days for erecting the two-story and basement fireproof brick school. Lundburg & Green, Archts., Manhattan.

St. Charles, Mo.—Erection of $100,000 dormitory at Lindenwood College contemplated.

Marshall, Tex.—Citizens voted $60,000 bonds to enlarge and improve schools.

Orange, Tex.—See "Hydraulic Construction and River Improvements."

Port Arthur, Tex.—William B. Ittner, St. Louis, Mo., is architect for proposed new school and for addition to high school. Citizens recently voted $450,000 bonds for these schools. Thomas W. Hughes, Secy. School Board.

Wichita Falls, Tex.—Citizens voted $255,000 bonds for erecting court house.

Norman, Okla.—School Board will soon call election to vote $55,000 school bonds.

Olympia, Wash.—Reported steps being taken to complete the Temple of Justice; estimated cost, $150,000. Address State Capitol Commissioners.

Seattle, Wash.—Regents University of Washington, Henry Building, approved plans for second new building for University, and contract for erection will be let early in March; cost $150,000. Bebb & Gould, Archts., Denny Building.

Reported contract will soon be let by Edgar Blair, School Architect, for erecting addition to Lowell School to be 2-story brick and cost $75,000. Reuben W. Jones, Clk. School Bd.

Spokane, Wash.—School bonds amounting $300,000 reported sold. Address School Board.

A. Rigg, Empire State Building, engaged to prepare plans for 60 x 100 ft. reinforced-concrete administration building for Whitworth College; probable cost $200,000.

Eugene, Ore.—Board of Regents of the University of Oregon, has authorized the erection of the first unit of the new school building; cost $40,000.

Grants Pass, Ore.—Reported a court house costing $35,000 is contemplated.

Portland, Ore.—Contract about to be let by J. V. Bennes, architect, Chamber of Commerce Building, for erecting two-story, 80 x 140 ft., brick building for Oregon Agricultural College; cost $50,000.

Los Angeles, Cal.—Myron Hunt, Hibernian Building, engaged to prepare plans for $100,000 library for Occidental College.

Contract soon to be let by Library Board for erecting one-story fireproof branch library at Avenue 26 and Workman Street, to cost $30,000. Lester H. Hibbard and H. B. Cody, Marsh Strong Bldg., Archts.

Oxnard, Cal.—Allison & Allison, Hibernian Building, Los Angeles, engaged to prepare plans for one-story, six-room and auditorium, brick or hollow tile school building. Bonds will be voted.

San Francisco, Cal.—State Treasurer at Sacramento sold $200,000 of the $1,000,000 San Francisco State building bonds.

Visalia, Cal.—S. O. Walker of Visalia reported forming company for purpose of erecting $30,000 fireproof hospital.

Prescott, Ariz.—W. N. Bowman, Denver, Col.; N. R. Coulter, San Francisco, Cal., and F. J. DeLongchamps, San Francisco, Cal., engaged to submit final competitive plans Feb. 24 for the new court house. R. Belcher, Clk. Bd. Superv.

Salt Lake City, Utah.—Contract will be let about March or April for erecting a 14-room school two stories high. A. P. Judd, Clerk Board Education, 202 City and County Building.

BIDS DESIRED.

Binghamton, N. Y.—Until Feb. 2 by State Hospital Commission, Albany (E. S. Elwood, Secy.), for erecting addition to power house including heating, also addition to boiler plant and equipment at Binghamton State Hospital, Binghamton, advertised in Engineering Record. Lewis F. Pilcher, State Archt., Albany.

Hoboken, N. J.—Reported sub bids desired by Whitney Company, Inc., 1 Liberty Street, New York, for the gymnasium for Steven's Inst. Ludlow & Peabody, Archts., 101 Park Avenue, New York.

Succasunna, N. J.—Reported desired until Feb. 8 by R. V. Spencer, Principal, Succasunna, for erecting 2-story high school; probable cost $35,000. Rasmussen & Wayland, 1133 Broadway, New York.

Marcus Hook, Pa.—Until Jan. 31, by School Board, for erecting school at Eighth and Market Streets. Separate bids for heating, ventilating, plumbing and electrical work. W. E. Hance, Archt., 204 West Twenty-fourth Street, Wilmington, Del.

Philadelphia, Pa.—Until Feb. 3, by Committee on Property of Board Education (William Dick, Secy), for erecting Kensington high school and addition to Jenks school. Also for heating, portable buildings, general repairs, etc., to various schools.

Reported desired until Jan. 31 for erecting Carnegie library, one storp and basement, brick, stone, reinforced concrete and marble, 90 x 39 ft., and wing, 39 x 46 ft. J. T. Windrim, Archt., Commonwealth Bldg.

Fort Pierce, Fla.—Until Feb. 21 by Board of Education for erecting a three-story school.

Lake Helen, Fla.—Until March 6 by County Superintendent De Land, for erecting brick school at Lake Helen. C. R. M. Sheppard, Chmn. Board Public Instructions.

Okeechobee, Fla.—Reported desired until Feb. 12 by Trustees Special Tax Dist. No. 6 for erecting a school; proable cost $40,000. F. H. Trimple, Archt., Fellsmere.

Seabreeze, Fla.—Until March 6, by County Superintendent at Deland, addressed to C. R. M. Sheppard, Secy. Board Public Instruction, for erecting a reinforced concrete school at Seabreeze.

Ferriday, La.—Until Feb. 8, by School Board, Concordia Parish, addressed to D. C. Strickler, Supt., Vandalia, for erecting a two-story school at Ferriday.

Jennings, La.—Reported desired until Feb. 3 by Parish Police Jury for erecting court house; cost $75,000. W. L. Stevens, Baton Rouge, Archt.

Columbus, Ohio.—Until Feb. 24, by Board Education, Salt Creek Township, Pickaway County (Wallace Bockett, Clk.), for erecting school. Matheny, Allen & Mounts, Archts., 710 Harrison Bldg., Columbus.

Bonds amounting to $25,000 for above school will be sold Feb. 17, by said board.

Kilbourne, Ohio.—Reported desired until Jan. 31 by Board Education Brown Township, for erecting school. Paul T. Cahill, Archt., 310 Euclid Building, Cleveland.

West Richfield, Ohio.—Until Feb. 10, by R. E. Parker, Clerk Board Education, for furnishing material and erecting a high school. Harpster & Bliss, Archts., 21 S. Main Street, Akron.

Madison, Wis.—Until Feb. 18, by Lew F. Porter, Secy. Capitol Commission, for furnishing material and erecting a storage building for State Capitol at Madison.

Sparta, Wis.—Until Feb. 10, by Building Committee (H. B. Sowle, Chmn.), care of County Clerk, for erecting rock, stone and concrete addition and alterations to the Monroe County Insane Asylum, also brick and stone and concrete power house; also plumbing and heating plant. Parkinson & Dockendorff, Archts., La Crosse, Wis.

Belmond, Ia.—Until Feb. 23, by C. O. Fitts, Secy., School Board Independent School Dist., for erecting high and grade school. Separate bids for heating and ventilating, plumbing, electrical work, science and laboratory equipment, gymnasium equipment, etc. G. L. Lockhart, Archt., 285-288 Endicott Bldg., St. Paul.

Oakdale, Iowa.—Until Feb. 15, by Board Control, State Institutions (F. S. Treat, Secy.), Des Moines, for erecting two-story and basement fireproof addition to hospital for advanced cases at hospital for treatment of tuberculosis at Oakdale. H. F. Liebbe, State Archt., Des Moines.

Appleton, Minn.—Until Feb. 14, by Board Education (O. B. Carlson, Clerk), for erecting two-story and basement brick high school and for addition and alterations to present high school. Separate bids on heating, plumbing and electrical work. Also same time separate bids for about 100 M ft. face brick, 300 M ft. common brick for erecting school. Bids to be per 1000 brick f. o. b. Appleton.

Crookston, Minn.—Until Feb. 1 (extension of date) by State Board Control, State Capitol, St. Paul, for erecting, including mechanical equipment, nurses' home in connection with the tuberculosis sanitorium for Polk and Norman Counties. Sund & Dunham, Archts., 514 Essex Building, Minneapolis, Minn. Rose & Harris, Engrs.

Guide Rock, Neb.—Until Feb. 29, by School Board, Dist. No. 1, Webster County (J. H. Crary, Clerk), for furnishing material and erecting high school. R. A. Bradley & Co., Archts., Hastings.

Minot, N. D.—Until Feb. 21 by Board of Education (L. G. Byerly, Clerk) sketches and rough plans for a high school costing $150,000.

Miami, Okla.—Reported desired until Feb. 29 by County Commissioners (Isaiah Wellis, Chmn.) for erecting court house and jail.

Portland, Ore.—Plans and specifications reported desired until Feb. 18, by City Auditor, for public auditorium.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**East Hartford, Conn.**—Contract for erecting high school awarded Louis Miller, Meriden, at about $90,000. J. W. Kratzen, Supt. of Schools.

Hornell, N. Y.—Following are four lowest bids opened Jan. 19, by Acting Supervising Architect, Washington, D. C., for constructing stone and brick post office at Hornell (a) linestome, (b) sandstone: Geo. W. Stiles Constr. Co., Chicago, Ill., (a) $61,863, (b) $64,863; Thos. W. Cissel, Wooster, Ohio, (a) $63,000, (b) $64,800; The Durolithic Co., Buffalo, N. Y., (a) $63,123, (b) $68,123; Geo. C. Rossell, Rochester, (a) $63,924; W. C. Fissell Co., New York, (b) $66,595.

Waterloo, N. Y.—Following are four lowest bids opened Jan. 21 by Acting Supervising Architect, Washington, D. C., for constructing two-story and basement U. S. Post Office at Waterloo: George W. Stiles Construction Company, Chicago, Ill., concrete—reinforced concrete floors, $54,176; Westchester Engineering Company, White Plains, N. Y., Bedford limestone, $54,700; George C. Rossell, New York, Bedford limestone, $56,571; Durolithic Company, Buffalo, N. Y., Bedford limestone, $57,345.

Newark, N. J.—Following are three bids opened Jan. 18 by Essex County Park Commission on general construction for pavilion on Diffident Hill and a comfort station and children's shelter at Weequahic Park: William G. Sharwell, 377 North Fifth Street, and Henry Becker & Sons, 356 Prospect Street, South Orange, both bid $32,500; E. M. Waldron, Inc., 207 Market Street, $33,630. Lowest bid for plumbing, Jacob Rau, Jr., 43 West Kinney Street, at $1,592.

★**Plainsboro, N. J.**—Contract for erecting buildings for Rockefeller Institute for Medical Research of New York and New Jersey, including laboratories, operating and isolation buildings, power house, tunnel and dog kennels awarded Matthews Construction Co. of Princeton; total cost, $237,530.

★**Pittsburgh, Pa.**—Contract for erecting sixteen-story Chamber of Commerce Building at Smithfield Street and Seventh Avenue awarded Thompson-Starrett Co., Second National Bank Building. E. B. Lee, Archt., 345 Fourth Avenue.

★**Ridgway, Pa.**—Contract for erecting U. S. Post Office awarded Colonial Construction & Supply Company, Charlottesville, Va., at $50,999.

★**Birmingham, Ala.**—Contract reported awarded Ager & Cline, Third Avenue and Nineteenth Street, for erecting three-story, fireproof Science Hall at Birmingham College.

★**Clarksdale, Miss.**—Contract for erecting a building for the power plant awarded Dabbs & Wetmore, Meridian, Miss., at $14,811. Engineers, W. G. Shurgar Engineering Company, Memphis, Tenn.

★**Terre Haute, Ind.**—Contract awarded A. W. Stoolman, Champaign, Ill., for erecting high school. Probable cost $150,000.

Toledo, Ohio.—Following are four lowest bids opened by School Board for erecting addition to Ironville School: William A. Greunke of Toledo, $33,720; M. Rabbit & Sons, 115 Nasby Building, $34,674; Walls, Bock, Kuhlman Company, 409 Nasby Building, $35,998; O. J. Henahan of Toledo, $36,148. Lowest bid for heating: Bryce Heating & Ventilating Company, 415 Spitzer Building, at $7,195 and plumbing, Larsen & Wood Company, 326 Erie Street, at $8,501.

★**Monroe, Mich.**—Contract for erecting school for St. Mary's College reported awarded John Finn & Son, Detroit. Cost about $300,000.

★**Alton, Ill.**—Contract awarded James Godfrey & Company, St. Louis, Mo., at $53,500, for erecting annex at Monticello Seminary.

★**Harlan, Iowa.**—Contract for erecting high school awarded by Board of Education to C. E. Wierschke of St. Paul, Minn., at $67,708, and for grade school to Madsden Brothers, Plymouth Building, Minneapolis, Minn., at $21,083. John D. Chubb, Archt., 109 North Dearborn Street, Chicago, Ill.

Anoka, Minn.—Following are four lowest bids opened Jan. 18 by Acting Supervising Architect, Washington, D. C., for constructing U. S. Post Office, (a) limestone, (b) sandstone: Thomas W. Cissell, Wooster, Ohio, (a) $44,000, (b) $44,600; G. W. Stiles Construction Company, Rookery Building, Chicago, Ill., (a) $41,835, (b) $42,135; A. W. Lane, 19 S. La Salle Street, Chicago, Ill., (a) $42,633, (b) $42,983; McManis & Tarnoski, St. Paul, Minn., (a) $44,246; W. D. Lovell, Minneapolis, Minn., (a) $41,250.

★**Aurora, Neb.**—Contract for erecting U. S. Post Office awarded Heman Construction Company, St. Louis, Mo., at $43,327.

★**Woodburn, Ore.**—Contract awarded E. B. White, Lumber Exchange Building, Portland, for erecting $40,000 high school.

Berkeley, Cal.—Following are lowest bidders on various parts of work opened by Board of Regents of University of California for erecting the University Library: General construction, J. D. Hannah, Monadnock Building, San Francisco, $194,733; elevator work and book lifts, Otis Elevator Co., $7,485; granite work, Raymond Granite Co., $86,600; metal furniture and metal book stacks, M. G. West Co., $104,379; plumbing, Turner Co., $8,215.

PRIVATE BUILDINGS

PROPOSED WORK.

Worcester, Mass.—Dr. H. J. Hartnett of Worcester, intends erecting $50,000 fireproof garage at Franklin and Vine Sts.

Brooklyn, N. Y.—Plans filed for four four-story brick tenements to be erected at Parade Place and Parkside Avenue for Arden Construction Company, 3436 Broadway; total cost $160,000. W. T. McCarthy, Archt., 16 Court Street.

Plans being prepared by Cantor & Dorfman, 373 Fulton Street, for four-story apartment house to be erected on Clarendon Road and E. Twenty-third Street for S & G. Development Co.; cost about $70,000.

Buffalo, N. Y.—Plans being prepared by Robert North, Prudential Building, for an auditorium and art building to be erected at Delaware Avenue, Johnson Park and Elmwood Avenue for Spencer Kellogg and Assoc., Delaware Avenue and Niagara Square. Cost approximately $400,000.

Plans being prepared by Bricell Swain Co., Chapin Block, for 10-story and basement steel, brick, stone and terra cotta Niagara Square Hotel, to be erected on Niagara Square and West Genesee Street by Niagara Square Hotel Corporation. Cost $200,000.

Plans being prepared by S. F. Heckert, Bessemer Building, Pittsburgh, Pa., for a 1-story stone, brick and steel church, to be erected on Seneca Street for R. C. Church of St. John the Evangelist. Cost $75,000. Rev. Michael J. Weber, Pastor.

Ilion, N. Y.—Henry W. Congdon, 18 Broadway, New York, is architect for edifice and parish house contemplated for St. Augustine's Episcopal Church; cost about $60,000. Rev. L. R. Benson, Pastor.

New Rochelle, N. Y.—Plans being prepared by C. A. Lupprian, 180 Main Street, for two-story store and theater building to be erected on Church Street; cost about $60,000. B. Von Ottinger, 213 West Forty-second Street, New York, reported interested.

New York, N. Y.—Plans filed for erecting following buildings: Five-story brick tenement at Courtlandt Avenue and 155th Street for Benenson Realty Company, cost $50,000, Charles Schaefer, Jr., Archt., 401 Tremont Avenue; two five-story brick tenements at Briggs Avenue and 194th Street for Charles T. Streeter Construction Company, cost $100,000, Charles Schaefer, Jr., Archt., 401 Tremont Avenue.

Plans completed by J. M. Felson, 1133 Broadway, for five-story apartment house to be erected on 188th Street and Grand Avenue for Andrew J. McKegney, 258 Broadway; cost about $50,000.

Plans prepared by J. M. Felson, 1133 Broadway, for brick moving picture theater to be erected at Westchester and Forest Avenues for Orpheum Theater Company; cost about $50,000.

Rochester, N. Y.—Plans completed by Chas. W. Eldridge, 412 Cutler Building; John T. Comes and John E. Kauzer, Assoc. Architects, Renshaw Building, Pittsburgh, Pa., for edifice and parish house to be erected on Lexington Avenue and Oriole Street for Church of the Holy Rosary; cost about $60,000. Rev. Father Hughes, Pastor.

Bridgeton, N. J.—Plans being prepared for $30,000 edifice and Sunday School building for Wesley Memorial Methodist Episcopal Church.

Jersey City, N. J.—Trustees of Hebrew Orphan Asylum contemplate erecting new orphan home in Hudson City section. A. S. Newman, Bayonne, Chairman Building Committee.

West Hoboken, N. J.—St. Johns Episcopal Church will erect parish house to include gynmasium, choir and church school rooms. Rev. E. J. Cleveland, pastor.

Harrisburg, Pa.—Plans being prepared by Paul Monaghan, Drexel Building, Philadelphia, for stone edifice to be erected for St. Lawrence Roman Catholic Church.

Olney (P. O. Philadelphia), Pa.—Plans being prepared by Duhring, Okie & Ziegler, Bailey Building, Philadelphia, for stone edifice to be erected for Presbyterian Church.

Philadelphia, Pa.—Contract to be let in about three weeks for erecting 10-story garage on South Broad Street for Pennsylvania Taximeter Co. Carl P. Berger, Archt., Penn Sq. Bldg.

Competitive sketches being submitted for new bank building for Franklin Trust Co., Fifteenth and Market Streets.

Pittsburgh, Pa.—Plans being prepared by John T. Comes, Renshaw Building, for one-story, brick, steel and stone edifice to be erected on Mission St., Southside, for St. Josephat Roman Catholic Church; cost $40,000.

Wilkes-Barre, Pa.—Plans being prepared by C. W. Evans, 117 West River Street, for $100,000 parish house to be erected for St. Stephen's Episcopal Church. Rev. E. W. Sterrett, Pastor.

Baltimore, Md.—Contract soon to be let for erecting City Garage at 27 South Charles Street to cost $90,000. Clyde W. Fitch, Archt., Munsey Bldg.

Otto G. Simonson, Casualty Tower, reported architect for 10-story hotel which is to be erected at Light and German Streets at a cost of $1,000,000.

Bluestone, W. Va. (P. O. Pocahontas, Va.).—Erection of $25,000 station at Bluestone Junction contemplated by Norfolk & Western Railroad Co. (J. E. Crawford, Ch. Engr., Roanoke, Va.).

Huntington, W. Va.—Plans prepared by E. N. Alger of Huntington approved for new edifice and parish house to be erected at Fifth Avenue and Eleventh Street for Trinity Episcopal Church; total cost about $100,000.

Gadsden, Ala.—Elks contemplate erecting theater and lodge building to cost $35,000.

Shreveport, La. — Sarnger Amusement Company, Shreveport, contemplates remodeling the Saenger Theater and erecting a new theater; total cost $100,000.

Morristown, Tenn. — Stockholders of First National Bank voted $50,000 for erecting new banking house on Main and Cumberland Streets.

Nashville, Tenn.—C. K. Colley, L. & C. Building, is architect for three-story, fireproof apartment house to be erected on Bellecourt and Eighteenth Avenues for Bellecourt Improvement Co.; cost $75,000.

Cleveland, Ohio.—Briggs & Nelson, 669 Rose Building, engaged to prepare plans for Fourth Church of Christ (Scientist), to be erected at East 105th and Fairmount Streets; cost about $100,000.

Mills Hotel Co., 160 Bleecker Street, New York, N. Y., reported contemplating erecting at Lakeside Avenue and East Ninth Street a $150.000 hotel.

Reported Union Club (William Gordon Brown, Secy.) plans improving the interior of their club house at a cost of about $250,000.

M. E. Wells, 1448 Westwood Avenue, Lakewood, is architect for 3-story brick and concrete building for D. O. Summers Co. at 6200 Carnegie Avenue.

Columbus, Ohio.—Plans being prepared by W. T. Mills, 49 North High Street, for ten-story hotel which Thomas Hardesty contemplates erecting at State and Pearl Streets; probable cost $200,000.

Anderson, Ind.—Cyrus D. McLane of Rock Island, Ill., selected to prepare plans for proposed $250,000 Y. M. C. A. building.

Ebenezer, Ind.—Methodists have approved plans for a new edifice. W. I. Anderson, Chmn. Bldg. Com.

Fort Wayne, Ind.—Y. M. C. Assoc. is reported planning erecting a $250,000 building.

Frankfort, Ind.—Erection of sixty-room apartment house contemplated on Main and South Streets for William White of Camden.

Hammond, Ind.—Plans completed by Thompson & Graves of Hammond, for a store and flat building to be erected for Joe Topajna; cost about $25,000.

Indianapolis, Ind. — Elks contemplating erecting new lodge building on Vermont Street.

Peru, Ind.—Reported improvements contemplated by the Chesapeake & Ohio R. R. Co. during the coming summer include erecting office building, additional improvements to the shops and filling old canal from railroad shops to the bridge and constructing side tracks on this fill; cost, $150,000.

Detroit, Mich.—Albert Kahn, 58 Lafayette Avenue, is architect for eight-story, steel and concrete store building to be erected at Gratiot and Library Avenues for Crowley-Milner Company.

Beardstown, Ill.—Charles Kennedy of Beardstown, and others, interested in erecting business buildings here to cost approximately $350,000.

Chicago, Ill.—Charles G. Dawes, 125 West Monroe Street, President of Central Trust Co. of Illinois, intends erecting next summer a hotel for poor women; cost about $100,000.

Green Bay, Wis.—Elks are reported taking steps to erect a $25,000 building for the Junior Order of Elks.

Milwaukee, Wis.—Joseph P. Kalt, 130 Grand Avenue, will erect three-story and basement, 30 x 175 ft., brick apartment building on Grand Avenue and Seventeenth Street; estimated cost about $45,000.

Fort Dodge, Iowa.—Erection of six-story bank and hotel building contemplated on Seventh and Central Avenues for Iowa Savings Bank; probable cost $115,000.

Mason City, Ia.—C. E. Bell, Security Bank Building, Minneapolis, Minn., engaged to prepare plans for ten-story lodge building for Modern Brotherhood of America; cost $250,000.

Sioux City, Iowa.—Beuttler & Arnold, Security Building, engaged to prepare plans for brick and stone apartment building contemplated for P. H. Pilchard; cost approximately $45,000.

Minneapolis, Minn.—Gleuk Brewing Co., 2021 N. E. Marshall St., intends erecting a two-story brick store and office building at 201 Central Avenue estimated to cost $25,000.

The Northwestern Automobile Co., 217 South Fourth Street, will erect a reinforced concrete automobile salesroom and garage at Harmon Place and Willow Street. Cost, $35,000.

St. Paul, Minn.—A parochial school costing $25,000 is to be erected in connection with Church of St. Andrew.

Erection of five-story building contemplated by Twin City Wholesale Grocery Co., 409-411 Sibley Street.

Atchison, Kan.—Preliminary plans prepared by Shepard, Farrar & Weiser, 1202 R. A. Long Building, Kansas City, Mo., for 75 x 90 ft., brick and stone church building; cost $40,000. C. D. Walker, Chairman Building Committee.

Butte, Mont.—Reported John Whitney of Butte, and others, interested in erecting athletic and amusement club building, including swimming pool and auditorium; probable cost $100,000.

Glendive, Mont.—Northern Pacific R. R. Co. (W. L. Darling, Ch. Eng., St. Paul, Minn.) has decided to erect a freight and passenger depot at Glendive. Cost, $100,000.

Little Rock, Ark.—Plans being prepared by A. Klingensmith, of Fort Smith, for three-story apartment building for Arkansas Valley Trust Company; cost $30,000.

Seattle, Wash.—Reported contract will be let about Feb. 20 by B. D. Stuart, Architect, Railway Exchange Building, for erecting a 3-story brick and terra cotta apartment house on Denny Way and Fifth Avenue North. Cost between $60,000 and $75,000.

Portland, Ore. — Union Stock Yards, North Portland, plan constructing several exchange buildings, the largest to be two stories high, 120 x 160 ft., of concrete and cost $40,000.

BIDS DESIRED.

Philadelphia, Pa.—By Frederick Webber, Morris Building, for fifteen-story brick, stone, steel and terra cotta hotel.

Indianapolis, Ind.—Reported desired until March 1 by Indiana Coliseum Corp., 906 Hume-Mansur Building, for erecting an 11-story coliseum and display building; probable cost $800,000. Fred. Wallick, Archt., 1062 Lamcke Annex.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Boston, Mass.**—Contract awarded New England Structural Company, 110 State Street, for 300 tons of steel needed in the power house for the Boston Elevated R. R. Company.

★**Binghamton, N. Y.**—Contract for 400 tons of steel required for the addition to the department store of Sisson Brothers awarded Binghamton Bridge Co., Binghamton, at about $24,000.

★**Buffalo, N. Y.**—General contract for erecting 2-story steel, stone and brick building for Black Rock Bank at Niagara and Tonawanda Streets awarded Robert E. Williams, 37 Church Street; cost $30,000. Mann & Cook, Archts., Dun Bldg.

★**Butler, Pa.**—Contract awarded by M. Nirdlinger, Architect, Fidelity Title & Trust Building, Fourth Ave., Pittsburgh, to George Schenck of Butler for erecting four-story, 50 x 150 ft., brick clubhouse on West Jefferson St. for Loyal Order of Moose; cost $65,000.

★**Philadelphia, Pa.**—Contract awarded Henry E. Beaton, Twelfth and Sansom Streets, for erecting five-story and basement, brick, stone and concrete warehouse at Third and New Streets for Cover & Co.; cost $30,000. R. E. White, Archt., Penna Building.

★Contract awarded Warren Moore & Co., Commercial Trust Building, for erecting two-story reinforced concrete, 77 x 94 ft., warehouse on Tacony Street for Miller Lock Co.; cost, $50,000.

★**Pittsburgh, Pa.**—Contract awarded by H. E. Kennedy Co., Archts., Home Trust Building, to Henry Busse Co., Main and Wabash Streets, for erecting $25,000 moving picture theater for Henry Polk.

★**Vicksburg, Miss.**—Contract for erecting two-story brick club house for B. B. L. S. (bids opened Jan. 10) awarded Burke Construction Company, Hattiesburg, Miss. Sam Brown, Jr., Chairman Building Committee.

★**Cleveland, Ohio.**—Contract for erecting five-story brick and concrete Osborne Building at 2129 East Fourth Street awarded Reaugh Construction Co., 2835 East Fifty-first Street; estimated cost $65,000. Albert Allen & Co., Archts., 1900 Euclid Avenue.

★**Shadyside, Ohio.**—Contract awarded D. T. Burton of Moundsville, for erecting brick and limestone Methodist Church; cost $30,000.

★**Ottumwa, Iowa.**—Contract for erecting hotel for Ottumwa Hotel Company (bids opened Jan. 5) awarded as follows: General construction to J. C. Mardis Company, Des Moines, at $159,031; heating and plumbing, S. Grunwald, Omaha, Neb., at $35,981; electric wiring, Inland Electric Company, Des Moines, $5,464.

★**Los Angeles, Cal.**—Contract awarded Stone & Webster of Boston, Mass., for erecting a five-story reinforced-concrete storage warehouse for Panama-Pacific Warehouse Corporation to be 200 x 400 ft., and estimated to cost $400,000. Moores & Dunford, Archts.

NEW INDUSTRIAL PLANTS

PROPOSED WORK.

North Grosvenor Dale, Conn.—C. M. Praray of New Bedford, Mass., is architest for two-story, brick and steel, 60 x 109 ft. power house to be erected for Grosvenor Dale Company.

Niagara Falls, N. Y.—Plans being prepared by Kremers & Wright, 311 Falls Street, for extensive additions to paper mill of Defiance Paper Company, Walnut and Third Streets; estimated cost, $150,000.

Hoboken, N. J.—Delaware, Lackawanna & Western Railroad Company (M. Emery, Supt. Marine Dept., Hoboken), contemplates erecting new ferry house at Fourteenth Street and Hudson River, also carpentry and machine shops and extension of piers to bulkhead line; estimated cost about $500,000.

Darby, Pa.—Reported Willard Case & Co., 17 Battery Place, New York, are engineers for brick, stone, steel and concrete silk mill to be erected here for Griswold Worsted Co.

Philadelphia, Pa.—Plans being prepared by Day & Zimmerman, 311 Chestnut Street, for three brick and concrete buildings, including power house, to be erected for Philadelphia Textile Machinery Co.

Schaum & Uhlinger Co., Second and Glenwood Avenues, will erect three-story, brick, stone and reinforced concrete machine shop at American Street and Glenwood Avenue.

Reading, Pa.—Fleck Cigar Company, 138 Orange Street, will erect in spring a four-story addition; cost approximately $30,000.

Birmingham, Ala.—Reported Ford Automobile Company contemplates erecting an assembly plant here.

Monroe, La.—Reported West Monroe Mfg. Co., Ltd., will rebuild woodworking plant recently destroyed by fire; cost, $50,000.

Cleveland, Ohio.—Plans being prepared by Mills, Rhines, Bellman & Nordhoff, Toledo, for five-story, brick, steel and concrete, 100 x 300 ft. addition to plant of Overland-Cleveland Co., 6604 Euclid Ave.; estimated cost $200,000.

Reported Frantz Premier Company, Ivanhoe Road, plans two additions, each two stories, 370 x 60 ft. A power house and foundry also may be built. Total cost $200,000.

Delaware, Ohio.—Sunray Stove Company contemplates erecting new factory at Sandusky and Railroad Streets.

Frankfort, Ind.—Plans being prepared for concrete packing house to be erected for Milner Provision Company of Frankfort.

Peru, Ind.—See "Private Buildings."

Duluth, Minn.—Alexander McDougall has incorporated the McDougall-Duluth Co. and the Duluth Vessel Co., and it is reported will erect a ship building plant this spring.

Newport, Minn.—Reported directors of the Farmers Terminal Packing Co. of St. Paul will erect a packing plant here costing $400,000.

St. Paul, Minn.—C. F. Arrol, 402 Merchants Bank Bldg., will erect a 6-story factory on Fourth Street; estimated cost $75,000.

St. Paul, Minn.—Plans completed for $200,000 factory to be erected in the spring on University Avenue for Griggs, Cooper & Co., Third Street and Broadway.

Great Falls, Mont.—Montana Flour Mills Company of Lewistown, will erect a flour mill here, 1500-bbl. daily capacity.

St. Louis, Mo.—A $40,000 addition will be erected at plant of Busch-Sulzer Brothers-Diesel Engine Company, 3328 South Second Streets.

Seattle, Wash.—Reported Alaska Engineering Commission, Bell Street Dock, Seattle, will soon let contract for lathes, dynamos and other equipment for the new railroad shops at Anchorage.

Los Angeles, Cal.—Standard Oil Company reported taking steps to erect on tide lands at San Pedro tanks and warehouses for distributing plant to cost $100,000.

San Diego, Cal.—Hercules Powder Company (Herbert Taily, San Francisco, representative) will erect plant for refining potash from kelp on water front at north end of Chula Vista section, also 2200-ft. wharf, two-mile railroad from National City and a number of houses for employees; cost reported at $500,000. Contracts for piling for wharf and for some machinery have been let.

San Diego Sugar Company (John S. Akerman, President Chamber of Commerce, Pres.) reported incorporated and will erect a beet sugar factory; cost $600,000.

BIDS DESIRED.

Chicago, Ill.—Reported desired until about Feb. 1 by John Ahlschlager & Son, Archts., 111 W. Washington Street, for excavation for 10 and 11 story and basement cold storage plant for Beatrice Creamery Co., 122 S. Michigan Ave. About Feb. 15 architect will be ready for superstructure.

Astoria, Ore.—Reported desired until Feb. 21 by Port Commissioners for installing all machinery, shafting, belting, etc., in the grain elevator under construction for the Port Commission.

Toronto, Ont.—Until Feb. 1, by T. L. Church (Mayor), Chmn. Bd. of Control, for extension of cold storage division at City Abbatoir.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**New Bedford, Mass.**—Contract awarded J. J. Prindiville Company of Framingham, for erecting four-story and basement mill for Sharp Manufacturing Company; cost about $1,000,000. Engineers, C. R. Makepeace & Company of Providence, R. I.

★**Buffalo, N. Y.** — Contract awarded John W. Ferguson Company, Paterson, N. J., for erecting additions to plant of J. H. Williams Company. Contract includes extension to drop hammer shop, enlargement of stock and finishing building and new repair shop, all of structural steel. Cost $250,000.

★**Philadelphia, Pa.**—Contract awarded Robert Beatty & Brother, 2331 East Fletcher Street, for erecting factory for Bush & Terry; cost $28,000.

★**Titusville, Pa.** — Contract awarded Rogers Construction Company of Corry, for enlarging plant of Titusville Forge Company, purchased by Bethlehem Steel Company, to cost about $300,000.

★**Baltimore, Md.**—Contract awarded by Baltimore Cold Storage Company to Morrow Bros., Fidelity Building, for erecting additions and alterations to buildings at 17-23 East Pratt Street; cost $40,000. Nicholas Van R. Green, Engineer.

★**Memphis, Tenn.**—Contract for erecting 100,000 bu. grain elevator awarded by Gillette Grain Elevator Company to Burrell Engineering Company of Chicago, Ill.

★**Springfield, Ohio**—Contract awarded Structural Steel Company of Dayton for erecting additional factory on Lagonda Avenue for Robbins & Myers Company; cost complete about $150,000.

★**Seattle, Wash.**—Contract for refrigerating and other equipment in the apple storage warehouse (bids opened Dec. 15) awarded Harrington Peters Co., Oriental Building, at $117,500. Three other bidders: Vilter Mfg. Co., Milwaukee, Wis., $126,500; Andrew LacLean, Oriental Building, $142,740; York Manufacturing Co., Maritime Building, $171,110. J. R. West, Chief Engineer Port Directors.

★Following are four lowest bids opened Dec. 15 by Port Directors for erecting the fish storage building: Booker, Kiehl & Whipple, Central Bldg., $32,867 (awarded contract); Kieburtz & Smith, Railway Exchange Building, $35.600; Dow & Ryden, Mehlhorn Building, $36,250, and Manhattan Contracting Co., Central Building, $37,998. J. R. West, Chief Engineer.

MISCELLANEOUS

PROPOSED WORK.

Park Improvements—Baltimore, Md.—Mayor has signed an ordinance providing for widening and forming of a park on St. Paul Street, between Saratoga and Hamilton Streets, estimated to cost $750,000.

Subways — Cleveland, Ohio. — County Commissioners authorized a bond issue of $500,000 for the construction of subway approaches to the new high level bridge in Superior Avenue, Detroit Avenue and West Twenty-fifth Street. County Engineer estimates the cost of constructing the subways, including land damages, at $850,000.

Park Improvement Bonds — Dayton, Ohio.—See "Bridges."

Park Improvements—Indianapolis, Ind.—Board Park Commissioners propose making extensive improvements along Fall Creek.

Light Plant—Joplin, Mo.—City Commission engaged Albert C. Moore, Frisco Building, to prepare plans, estimates and reports on complete municipal electric light plant or extensions to present plant; both oil and steam plans will be reported on. Probable cost $175,000. Charles Patterson, Commissioner of Utilities.

Park Improvement—Bartlesville, Okla.—See "Garbage Disposal and Street Cleaning."

Transmission Line—Victorville, Cal.—Southern Sierra Power Company, Victorville, will construct 10 miles of three phase, 33,000 440 volt transmission line from substation to plant of Southwestern Portland Cement Co.

Electric Lighting and Gas Plants—Phoenix, Ariz.—Burns & McDonnell, Engineers, Interstate Building, Kansas City, Mo., preparing preliminary plans, estimates and report on complete new municipal electric lighting plant and new municipal gas plant. A bond issue will be called on the improvement. Cost for both projects will be about $750,000. In connection with these improvements the city has under consideration the purchase of power from the Roosevelt Dam. George W. Barrows, Chairman Committee.

BIDS DESIRED.

Cement—New York, N. Y.—Until Feb. 8 by Douglas Mathewson, Pres. Borough of Bronx, for furnishing supplies during the year 1916, including 4000 bags Portland cement, furnishing and delivering 400,000 gals. coal tar oil, 450,000 gals asphalt road oil, 7000 cu. yds. 1½ in. broken trap rock stone and 3000 cu. yds. broken trap rock stone screening, etc.

Stone Chips—Maryland.—Until Feb. 9. by State Roads Commission, 601 Garrett Building, Baltimore (O. E. Weller, Chmn.), for hauling out approximately 11,500 tons stone chips for oiling State roads, advertised in Engineering Record.

Wave Meters—Washington, D. C.—Until Feb. 8, by Bureau of Supplies and Accounts, Washington, D. C., for outfit for pumping water, radio receivers and wave meters at Navy Yard, Washington, D. C.

Steel and Cement—Decorah, Iowa.—Reported desired until Feb. 1, by Oscar Winger, Co. Aud., for 4 cars 80,000 ft. fir plank 3x12 in., 16 ft., and 3x12 in., 18 ft., 90,000 lb. ½-in. steel and 18,000 lb. ¾-in. steel, and 1500 bbl. cement, etc.

Cement, Etc.—Garner, Iowa.—Reported desired until Feb. 1, by E. P. Hanson, Co. Aud., for from 3000 to 3600 bbl. cement, 2 carloads reinforcing steel, 8500 ft. 10 to 24-in. corrugated pipe, etc.

Lumber—Waterloo, Iowa.—Until Feb. 1, by J. J. Rainbow, Co. Aud., for furnishing in carload lots f. o. b. various stations in Blackhawk County, lumber as follows: Not less than 150 M ft. nor more than 180 M ft. Douglas fir lumber; stringers and flooring, Douglas fir, selected common, 16, 18 and 20 ft. long, and one carload red cedar piling 16 to 24 ft. long.

Dredge Machinery—St. Paul, Minn.—Until Feb. 7, by Board County Commissioners, for engines and dredge machinery for dredge at Bald Eagle Lake. Geo. J. Ries, Co. Aud.

Cement—Denver, Col.—Until Feb. 2 by Department of Interior, U. S. Reclamation Service, 505 Tramway Building, Denver, for furnishing 13,000 to 20,000 bbl. Portland cement f.o.b. cars at works of the bidder.

Port Improvements — Seattle, Wash.—Until Feb. 9 by Port of Seattle, Bell Street, Warehouse (W. Lincoln, Auditor), for following: Water supply and fire protection system for Spokane Street transit shed, East Waterway Terminal; roofing Spokane Street Transit Shed; constructing asphalt roadway surface, East Waterway Terminal. J. R. West, Chief Engineer of Port Comrs.

Structural Steel for Bridges—Ventura, Cal.—Until Feb. 3 by Board of Supervisors, for furnishing structural steel for four bridges, approximately 660,350 lbs. steel, 15,800 lbs. c. i. and 2000 lbs. bolts and washers.

Cement, Etc. — Ventura, Cal. — Until Feb. 7 by Board of Supervisors (J. B. McCloskey, Clk.) for furnishing 15,000 tons cement, 100,000 tons gravel and 50,000 tons sand.

Blocking System—Panama.—Until Jan. 31 by Maj. F. C. Boggs, General Purchasing Officer, Panama Canal, Washington, D. C., for furnishing castings, bolts, and fittings for blocking system for dry dock No. 1.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Cement—Atlanta, Ga.—Following are two lowest bids opened Jan. 17, by Superintendent of Prisons, Department of Justice, Washington, D. C., for furnishing 8000 bbl. Portland cement at the U. S. Penitentiary at Atlanta: V. H. Kriegshaber, Atlanta, Ga., $10,800, exclusive of sacks; Scipie Sons, Atlanta, Ga., $14,560, including sacks.

★**Coal Dock—Superior, Wis.**—Contract awarded Barnett Record Company, Superior, for constructing for the Zenith Furnace Company an extension to the coal dock at Superior in the Ninth Ward. Dock to be lengthened 300 ft. and coal handling rigs rearranged. Cost $100,000.

★**Pumping Plant in Natatorium—Seattle, Wash.**—Contract awarded Gray & Barash, First Avenue and Jackson Street, for installation of pumping plant and salt water mains in natatorium at Second Avenue and Lenora Street for Natatorium Company; cost $31,000. B. Marcus Priteca, Archt., Pantages Theater Building.

★**Reinforcing Bars—Los Angeles, Cal.**—Contract for reinforcing bars for tunnel work (bids opened Jan. 11) awarded by Board Public Service Commissioners to Pacific Coast Steel Co., Union Oil Bldg., at $22,716. James P. Vroman, Secy. Comrs.

★**Ornamental Lighting Standards—Phoenix, Ariz.**—Contract for installing ornamental lighting standards on Central Avenue, Washington, Adams and Jefferson Streets awarded New State Electric Supply & Fixture Co., Phoenix, at $18,550. City to furnish standards, and contractor to furnish all necessary materials and labor.

★**Dump Cars — Yuma, Ariz.**—Contract awarded William J. Oliver Mfg. Company, Knoxville, Tenn., by U. S. Reclamation Service, Washington, D. C., for furnishing forty dump cars for use in connection with the work on the Yuma Irrigation project, Ariz., at $1,175 each, delivered f.o.b. cars Knoxville.

Proposals

For Proposals Advertised, See Pages 47, 48 and 49.

WATERWORKS.

Bids Close.		See Eng. Record.
Jan. 31.	Filtration Structure, Oshkosh, Wis. Adv. Jan. 1 to 22.	Jan. 1
Jan. 31.	Tank, Oshkosh, Wis. Adv. Jan. 15, 22.	Jan. 15
Jan. 31.	Reservoir, Oshkosh, Wis. Adv. Jan. 15, 22.	Jan. 15
Jan. 31.	Filter Apparatus, Oshkosh, Wis. Adv. Jan. 15, 22.	Jan. 15
Feb. 1.	Exciter, c. i. pipe, etc., Orangeburg, S. C. Adv. Jan. 8.	Jan. 8
Feb. 1.	Contract 170, Water Bd., New York, N. Y. Adv. Jan. 15. 22.	Jan. 15
Feb. 1.	Pipe, etc., Washington, D. C.	Jan. 22
Feb. 1.	Centrifugal Pump, New Brunswick, N. J. Adv. Jan. 22.	Jan. 22
Feb. 4.	Waterworks, Dunedin, Fla	Jan. 22
Feb. 7.	Improv., Sullivan, Ill.	Jan. 15
Feb. 8.	Waterworks, Arcadia, Ia. Adv. Jan. 22.	Jan. 22
Feb. 8.	Gate Valves, Detroit, Mich.	Jan. 29
Feb. 9.	System, Camden, Ala	Jan. 22
Feb. 10.	Wells, Galveston, Tex	Jan. 29
Feb. 14.	Waterworks, Viola, Ill Adv. Jan. 22, 29.	Jan. 22
Feb. 15.	Improvements, Lewiston, N. Y. Adv. Jan. 22, 29.	Jan. 22
Feb. 15.	Contract 172, New York, N. Y. Adv. Jan. 29.	Jan. 29
Feb. 22.	Waterworks, McCammon, Idaho	Jan. 22
Feb. 24.	Improvements, Bloomington, Ind. Adv. Jan. 29.	Jan. 29
Apr. 1.	Mains, Cullman, Ala	Jan. 15

SEWERAGE AND SEWAGE DISPOSAL.

Bids Close.		See Eng. Record.
Feb. 1.	Larned, Kan.	Jan. 22
Feb. 1.	Toronto, Ont.	Jan. 29
Feb. 1.	Garner, Iowa	Jan. 29
Feb. 2.	Philadelphia, Pa.	Jan. 29
Feb. 3.	Milwaukee, Wis. (2 Pro.) Adv. Jan. 15 to 29.	Jan. 15
Feb. 3.	New York, N. Y.	Jan. 29
Feb. 3.	Cleveland, Ohio	Jan. 29
Feb. 4.	St. Louis, Mo.	Jan. 22
Feb. 4.	Youngstown, Ohio	Jan. 29
Feb. 7.	Cuyahoga Falls, Ohio	Jan. 15
Feb. 7.	Wausa, Neb.	Jan. 8
Feb. 7.	Canton, Ohio	Jan. 29
Feb. 7.	Salina, Kan.	Jan. 29
Feb. 8.	Shaker Heights, Ohio	Jan. 29
Feb. 23.	Des Moines, Iowa	Jan. 29
Feb. 24.	East View, Ohio	Jan. 29
Feb. 25.	Pierce, Neb.	Jan. 29
Feb. 29.	Kendallaville, Ind.	Jan. 29
Mar. 14.	Newark, N. J. Adv. Jan. 22.	Jan. 22

BRIDGES.

Bids Close.		See Eng. Record.
Jan 31.	Boston, Mass. Adv. Jan. 8.	Jan. 8
Feb. 1.	Michigan	Jan. 22
Feb. 1.	Austin, Tex.	Jan. 29
Feb. 1.	Illinois	Jan. 29
Feb. 2.	Connecticut Adv. Jan. 8, 15.	Jan. 8
Feb. 2.	Paterson, N. J.	Jan. 22
Feb. 2.	Lachute, Que.	Jan. 29
Feb. 3.	Dallas, Tex. Adv. Jan. 8 to 29.	Jan. 8
Feb. 3.	Ventura, Cal.	Jan. 29
Feb. 3.	Lonesborough, Ont.	Jan. 29
Feb. 5.	Williamson, W. Va.	Jan. 22
Feb. 7.	Perry, Okla.	Jan. 22
Feb. 7.	New Albany, Ind.	Jan. 22
Feb. 7.	Illinois	Jan. 22
Feb. 7.	Santa Barbara, Cal.	Jan. 22
Feb. 7.	Milwaukee, Wis.	Jan. 29
Feb. 7.	Austin, Tex.	Jan. 29
Feb. 8.	Martinsville, Ind.	Jan. 22
Feb. 8.	McCook, Neb. Adv. Jan. 22, 29.	Jan. 22
Feb. 8.	Newport, Wash.	Jan. 22
Feb. 8.	Mammoth, Ariz.	Jan. 22
Feb. 8.	Wenatchee, Wash.	Jan. 29
Feb. 9.	York, Neb.	Jan. 29
Feb. 9.	Livingston, Mont.	Jan. 29
Feb. 9.	Cleveland, Ohio.	Jan. 29
Feb. 10.	Gretna, Neb.	Jan. 22
Feb. 10.	Hutchinson, Kan.	Jan. 22
Feb. 10.	Maine.	Jan. 29
Feb. 11.	Seattle, Wash.	Jan. 22
Feb. 11.	Seattle, Wash.	Jan. 29
Feb. 12.	Schuyler, Neb.	Jan. 22
Feb. 12.	Hinton, W. Va	Jan. 29
Feb. 12.	Illinois.	Jan. 29
Feb. 14.	Harriman, Tenn.	Jan. 29
Feb. 15.	Sutherland, Neb.	Jan. 22
Feb. 15.	Alaska Adv. Jan. 15 to 29.	Jan. 15
Feb. 15.	Jamestown, N. D	Jan. 29
Feb. 15.	St. Cloud, Minn	Jan. 29
Feb. 15.	Illinois	Jan. 29
Feb. 16.	Jamestown, N. D	Jan. 29
Feb. 17.	Miami, Fla.	Jan. 29
Feb. 19.	Clay, W. Va	Jan. 29
Feb. 23.	Dickinson, N. D	Jan. 29
Mar. 10.	Fairbury, Neb.	Jan. 29

PAVING AND ROADS.

Bids Close.		See Eng. Record.
Feb. 1.	Missouri Valley, Iowa	Jan. 15
Feb. 1.	Galva, Ill.	Jan. 18
Feb. 1.	Rock Island, Ill.	Jan. 22
Feb. 1.	Larned, Kan.	Jan. 22
Feb. 1.	Manchester, Conn.	Jan. 22
Feb. 1.	Chicago, Ill.	Jan. 29
Feb. 1.	Oak Park, Ill.	Jan. 29
Feb. 2.	Butte, Mont.	Jan. 22
Feb. 2.	Huntington, W. Va	Jan. 22
Feb. 2.	Baltimore, Md.	Jan. 29
Feb. 3.	Jacksonville, Fla.	Jan. 22
Feb. 3.	Miami, Fla.	Jan. 29
Feb. 3.	Manitowoc, Wis.	Jan. 29
Feb. 3.	Galva, Ill.	Jan. 29
Feb. 4.	Ventura, Cal.	Jan. 29
Feb. 4.	Wallace, Man.	Jan. 29
Feb. 4.	Milwaukee, Wis.	Jan. 29
Feb. 5.	Shaker Heights, Ohio	Jan. 29
Feb. 5.	Duluth, Minn.	Jan. 29
Feb. 7.	St. Paul, Minn.	Jan. 15
Feb. 7.	Indiana	Jan. 15
Feb. 7.	Seattle, Wash.	Jan. 22
Feb. 7.	Wapello, Iowa	Jan. 22
Feb. 7.	Tazewell, Tenn.	Jan. 22
Feb. 7.	Camden, N. J.	Jan. 29
Feb. 7.	Merchantsville, N. J.	Jan. 29
Feb. 7.	Canton, Miss.	Jan. 29
Feb. 7.	Greencastle, Ind.	Jan. 29
Feb. 7.	Hanford, Cal.	Jan. 29
Feb. 8.	Indiana	Jan. 15
Feb. 8.	Indiana	Jan. 22
Feb. 8.	Bakersfield, Cal.	Jan. 22
Feb. 8.	Clinton, Iowa	Jan. 29
Feb. 8.	Indiana	Jan. 29
Feb. 8.	Wenatchee, Wash.	Jan. 29
Feb. 9.	Indiana	Jan. 15
Feb. 9.	Indiana	Jan. 1
Feb. 9.	Indiana	Jan. 22
Feb. 10.	Indiana	Jan. 22
Feb. 14.	Washington	Jan. 29
Feb. 14.	Kansas City, Kan.	Jan. 29
Feb. 14.	Eldora, Iowa	Jan. 29
Feb. 15.	Spokane, Wash.	Jan. 8
Feb. 15.	Santa Monica, Cal	Jan. 29
Feb. 15.	Bath, W. Va	Jan. 29
Feb. 15.	Wausau, Wis.	Jan. 29
Feb. 20.	Tacoma, Wash.	Jan. 22
Feb. 21.	Camden, Ala.	Jan. 29
Feb. 21.	Johnson, N. Y.	Jan. 29
Feb. 23.	Indiana	Jan. 29
Feb. 28.	Lebanon, Ind.	Jan. 29
Feb. 28.	Minot, N. D.	Jan. 29
Mar. 6.	Huntsville, Ala.	Jan. 29
Mar. 6.	Portland, Ind.	Jan. 29
Mar. 7.	Davenport, Wash.	Jan. 22

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS.

Bids Close.		See Eng. Record.
Feb. 1.	Canal Work, Albany, N.Y.	Jan. 15
Feb. 1.	Dam, Emporia, Kan.	Jan. 29
Feb. 3.	Rip Rap, Chicago, Ill.	Jan. 22
Feb. 4.	Drainage, Clarkes, Neb. Adv. Jan. 22, 29.	Jan. 22
Feb. 4.	Drain, Bluffton, Ind.	Jan. 22
Feb. 7.	Drainage, Wagoner, Okla.	Jan. 29
Feb. 7.	Dam Repair, Albany, N. Y.	Jan. 29
Feb. 8.	Irrigation, St. Ignatius, Mont. Adv. Jan. 8.	Jan. 8
Feb. 8.	Ditch, Wheaton, Minn.	Jan. 29
Feb. 9.	Lock Gate and Dam, Wheeling, W. Va. Adv. Jan. 15 to 29.	Jan. 15
Feb. 9.	Ditch, Powhatan, Ark.	Jan. 22
Feb. 9.	Ditch, Washington, Ind.	Jan. 22
Feb. 15.	Ditch, Princeton, Minn.	Jan. 22
Feb. 15.	Drainage, Jackson, Minn.	Jan. 22
Feb. 16.	State Canal Work, Albany, N. Y. Adv. Jan. 22, 29.	Jan. 22
Feb. 16.	Spillway Gates, Seattle, Wash. Adv. Jan. 22, 29.	Jan. 22
Feb. 16.	Levee Work, Alexandria, La.	Jan. 29
Feb. 21.	Jetty Work, Dallas, Tex. Adv. Jan. 29.	Jan. 29
Feb. 21.	Breakwater Improvements, Manistee, Mich. Adv. Jan. 29.	Jan. 29
Feb. 21.	Jetty Work, Portland, Ore.	Jan. 29
Feb. 23.	Steel for Lock, Sault Ste. Marie, Mich. Adv. Jan. 22, 29.	Jan. 22
Feb. 24.	Dyke Work, Albany, N. Y. Adv. Jan. 29.	Jan. 29
Mar. 9.	Ditch, Moorehead, Minn.	Jan. 22

PUBLIC BUILDINGS AND SCHOOLS.

Bids Close.		See Eng. Record.
Jan. 31.	Key West, Fla. Adv. Jan. 1, 8.	Jan. 1
Feb. 1.	Oneida, Iowa	Dec. 16
Feb. 1.	George West, Tex.	Dec. 18
Feb. 1.	Union Grove, Wis.	Jan. 15
Feb. 1.	Ashland, Kan.	Jan. 22
Feb. 1.	Armstrong, Ill.	Jan. 22
Feb. 1.	Crookston, Minn.	Jan. 29
Feb. 2.	Teaneck, N. J.	Jan. 22
Feb. 2.	Binghamton, N. Y. Adv. Jan. 29.	Jan. 29
Feb. 3.	Philadelphia, Pa.	Jan. 29
Feb. 3.	Jennings, La.	Jan. 29
Feb. 5.	Stoutsville, Ohio	Jan. 15
Feb. 5.	Mingo, Ohio	Jan. 22
Feb. 7.	Sioux City, Iowa	Dec. 2
Feb. 7.	New Richland, Minn.	Jan. 22
Feb. 7.	Normal, Ill.	Jan. 22
Feb. 8.	Sucasunna, N. J.	Jan. 29
Feb. 10.	Sparta, Wis.	Jan. 29
Feb. 10.	West Richfield, Ohio	Jan. 29
Feb. 11.	Caldwell, N. J.	Jan. 22
Feb. 12.	Okeechobee, Fla.	Jan. 29
Feb. 14.	Appleton, Minn.	Jan. 29
Feb. 15.	Boston, Mass.	Jan. 15
Feb. 15.	Amity, Ohio	Jan. 22
Feb. 15.	Oakdale, Iowa	Jan. 29
Feb. 16.	Agawam, Mass.	Jan. 22
Feb. 16.	Lancaster, Pa.	Jan. 22
Feb. 17.	Wilmington, Ohio	Jan. 22
Feb. 17.	Los Angeles, Cal.	Jan. 22
Feb. 18.	Madison, Wis.	Jan. 29
Feb. 18.	Portland, Ore.	Jan. 29
Feb. 21.	Fort Pierce, Fla.	Jan. 29
Feb. 23.	Belmond, Iowa	Jan. 29
Feb. 24.	Batavia, Ohio	Jan. 22
Feb. 21.	Minot, N. D.	Jan. 29
Feb. 24.	Columbus, Ohio.	Jan. 29
Feb. 25.	Ebensburg, Pa.	Jan. 8
Feb. 29.	Guide Rock, Neb.	Jan. 29
Feb. 29.	Miami, Okla.	Jan. 29
Mar. 6.	Lake Helen, Fla.	Jan. 29
Mar. 6.	Seabreeze, Fla.	Jan. 29
Mar. 7.	Harrisburg, Pa.	Jan. 22
Mar. 20.	Austin, Minn.	Jan. 22

PRIVATE BUILDINGS.

Bids Close.		See Eng. Record.
Feb. 1.	Poland, Me.	Jan. 15
Feb. 1.	Wilmington, Ohio	Jan. 22
Feb. 4.	Sharpsburg, Pa.	Jan. 22
Feb. 5.	Chicago, Ill.	Jan. 22
Feb. 10.	Mankato, Minn.	Jan. 22
Feb. 15.	Binghamton, N. Y.	Jan. 22
Feb. 15.	Nashville, Tenn.	Jan. 22
Feb. 15.	Britt, Iowa	Jan. 1
Mar. 1.	Indianapolis, Ind.	Jan. 29
Apr. 1.	Cleveland, Ohio	Jan. 8

NEW INDUSTRIAL PLANTS.

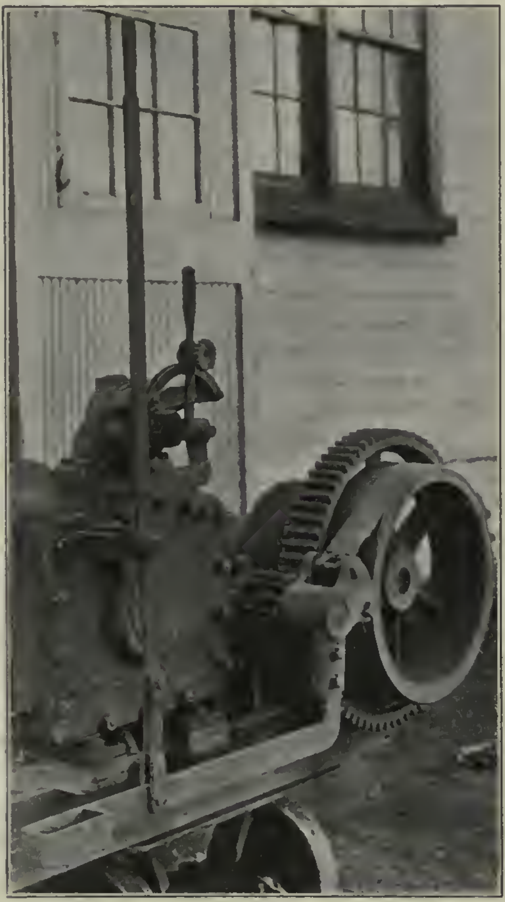
Bids Close.		See Eng. Record.
Feb. 1.	Toronto, Ont.	Jan. 29
Feb. 10.	Dallas, Tex	Jan. 22
Feb. 15.	Chicago, Ill.	Jan. 29
Feb. 21.	Astoria, Ore.	Jan. 29
Apr. 15.	Manilla, P. I.	Jan. 8

MISCELLANEOUS.

Bids Close.		See Eng. Record.
Feb. 1.	Street Cars, Toronto, Ont.	Jan. 15
Feb. 1.	Cement Gate, Idaho Falls, Idaho	Jan. 22
Feb. 1.	Cement, Etc., Garner, Iowa	Jan. 29
Feb. 1.	Steel and Cement, Decorah, Iowa	Jan. 29
Feb. 1.	Lumber, Waterloo, Iowa.	Jan. 29
Feb. 1.	Cement, Norwood, Mass.	Jan. 29
Feb. 2.	Cement, Denver, Col.	Jan. 29
Feb. 3.	Monument Work, Havana Adv. Jan. 15 to 29.	Jan. 15
Feb. 3.	Structural Steel, Ventura, Cal.	Jan. 29
Feb. 5.	Lumber, Tacoma, Wash.	Jan. 22
Feb. 7.	Dredge Machinery, St. Paul, Minn.	Jan. 29
Feb. 7.	Disposal of Ashes, Etc., New York, N. Y.	Jan. 29
Feb. 7.	Disposal of Ashes, Brooklyn, N. Y.	Jan. 29
Feb. 7.	Cement, Etc., Ventura, Cal.	Jan. 29
Feb. 8.	Sprinkler, Fergus Falls, Minn.	Jan. 8
Feb. 8.	Cement, Etc., New York, N. Y.	Jan. 29
Feb. 8.	Wave Meters at Navy Yard, Washington, D. C.	Jan. 29
Feb. 9.	Stone Chips for Road, Maryland Adv. Jan. 29.	Jan. 29
Feb. 9.	Port Improvements, Seattle, Wash.	Jan. 29
Feb. 10.	El. Rys., New York, N. Y.	Jan. 29
Feb. 11.	Locomotives for Sale, Panama Adv. Jan. 1.	Jan. 1
Feb. 11.	Stokers, St. Louis, Mo. Adv. Jan. 15 to 29.	Jan. 15
Feb. 14.	Steel Sash at Hospital, Napanoch, N. Y. Adv. Jan. 29.	Jan. 29
Feb. 23.	Castings, Etc., Panama Adv. Jan. 15.	Jan. 15
Feb. 28.	Counters, Gates, Etc., Boston, Mass. Adv. Jan. 29.	Jan. 29
Mar. 1.	Tower, Honolulu, T. H.	Jan. 22
Apr. 1.	Memorial, Fort McHenry, (P. O. Baltimore, Md.).	Nov. 20
———	Grading, Cincinnati, Ohio Adv. Jan. 8 to 22.	Jan. 8

Brake on Engine Stops Swinging Derrick Boom

A band brake has been placed on the derrick engine shown in the photograph to stop the swinging of the boom at a definite point. The hand lever, which has a link attached to the throttle lever, is also attached to the brake of the foot lever. In consequence, when the throttle is shut off the brake is applied automatically. It is claimed much time is saved over the usual method of shutting off steam and allowing the boom to coast to position, because the boom can be kept to speed almost up to the desired position and then stopped accurately by the brake, which gives a cushion effect, relieving the strain on the gears when a heavy load is being carried. The new device is furnished on derrick engines built by the Dake Engine Company, Grand Haven, Mich.



BRAKE APPLIED AUTOMATICALLY WHEN THROTTLE IS CLOSED

New Data on the Use of Sheet Piling

How to drive and pull sheet piling, the use of water jets, the various types of hammers and pulling devices, new methods of bracing cofferdams and making them watertight, and the latest information on earth pressures are some of the useful features of the recently issued tenth edition of the Carnegie Steel Company's hand book on Steel Sheet Piling. The book which is bound in paper, contains 96 pages and 59 illustrations. It gives tables and data on steel and wood bracing, the strength of tackles and hoisting rope, pile formulas, strength of engineering materials and cost of driving, pulling and cutting steel sheet piling by various methods, in addition to the usual tables of the weight, size and strength of the sections of sheet piling rolled. A new feature of the work is the extensive treatment of steel piling in permanent construction, such as composite steel-and-concrete bulkheads. An original discussion of earth and water pressures gives quick and accurate methods of determining stresses in cofferdam bracing, worked out by the engineers of the Carnegie Steel Company. The size of the edition, 5 x 7¾ in., contributes to make the book a handy volume for anyone interested in construction.

Good Versus Bad Concrete to Be Contrasted at Cement Show

One section of the joint exhibit at the Cement Show, to be held in Chicago, Feb. 12-19, will be devoted to good versus bad concrete. Exhibits will also be displayed with a view to demonstrating the possibilities of concrete for decorative purposes, and an effort will be made to instruct visiting builders in modern treatment of concrete surfaces.

Because of the possibilities of concrete for decorative purposes have in the past been subordinated to its wider use in actual construction, the purpose of the display of concrete products at the show will be to demonstrate that concrete can be used logically for beauty as well as for strength. The joint exhibit will have on display samples of an exceptionally wide variety of concrete surfaces. Walls large enough to show the appearance of concrete in large areas, full sized duplicates of the balustrade in Grant Park, Chicago, carved decorative panels from the Hollenden Hotel in Cleveland, the building stone so widely used in the East, and concrete simulating the finest of granites and marbles will be the features of the exhibit.

An important feature will be the road display. The government road models which were exhibited at the Panama-Pacific Exposition will be a feature of the concrete road division which should prove interesting to road builders. Full size pavement sections built to show road inspectors and contractors the errors of construction to be avoided will be worthy of careful study.

A section will be devoted to good versus bad concrete. A 2000-pound testing machine and other laboratory apparatus will be used to show that graded materials are more economical and make better concrete than bank run aggregates.

Business Notes

The Lehigh Portland Cement Company has established a sales office at Mason City, Iowa, under the supervision of J. H. Black as district sales manager.

The Titian Motor Car Company has purchased the capital stock, factory and equipment of the American Machine Company, maunfacturer of the Denny improved Rider and Ericsson hot air pumping engines and the Denny tag machine, of Newark, Del. The business will be continued as a department, in connection with the production of the Titian steam motor cars, under the original name.

Trade Publications

The following companies have recently issued trade literature:

Chain Belt Company, Milwaukee, bulletin 62, 12 pages, the Rex low charging concrete mixer.

Thew Automatic Shovel Company, Lorain, Ohio, catalog 9, 36 pages, full circle swing steam shovels.

Troy Wagon Works Company, Troy, Ohio, booklet 3, 16 pages, Troy trailers and their application to motor trucks.

National Fire Proofing Company, Pittsburgh, catalog, 32 pages, lock-joint sewer tile, triple-lock hermetically sealed.

Richardson Scale Company, Passaic, N. J., catalog 101, 64 pages, automatic weighing of coal and water in power plants.

Alexander Milburn Company, Baltimore, leaflet, 12 pages, Wells light and heating burner, a powerful light for contractors.

National Lead Company, catalog, 76 pages, Cinch anchorage bolts and anchoring system for securing fixtures to masonry, concrete, and the like.

Scherzer Rolling Lift Bridge Company, Monadnock Block, Chicago, booklet, 40 pages, the inception, development and use of rolling lift bridges.

General Fire Extinguisher Company, Providence, R. I., bulletin, 16 pages, January, 1916, Grinnell automatic sprinklers; big fires where they were not used.

Minwax Company, 18 East Forty-first Street, New York, bulletin 3, January, 1916, 12 pages, floor filler finish for concrete, terrazzo, tile, marble, and also wood floors.

Mark Manufacturing Company, Box G, Chicago, catalog 12, 184 pages, piping and well equipment and tools for irrigation and oil well outfits, boiler tubing and wrought-iron line and drive pipe.

Goheen Manufacturing Company, Canton, Ohio, house organ, "The Scientist" (June-December, 1915), 32 pages, paints for extraordinary conditions, metals, concrete and pipe surfaces; tests of spreading power.

C-A-Wood-Preserver Company, Inc., St. Louis, Mo., booklet, 7x10¼ in., 38 pages, illustrated; entitled, "Conservation by Preservation." This publication describes the method of applying C-A-Wood-Preserver to timber, its capacities and various uses, and also the results that have been obtained. An interesting feature of the booklet for engineers is the formation it contains on the treatment of timber with preservatives. Some valuable hints are included.

Turner Construction Company, New York City. Booklet; paper, 8½ x 11 in.; 16 pages, illustrated. Describes in brief form several reinforced-concrete buildings on which good records in construction have been made, and illustrates the type of factory or manufacturing plant which has become so popular in the last few years. Especial emphasis is placed upon the record of the company in completing all its contracts on time. A description of the organization which has accomplished such results is given, and should prove of value and interest to owners and engineers.

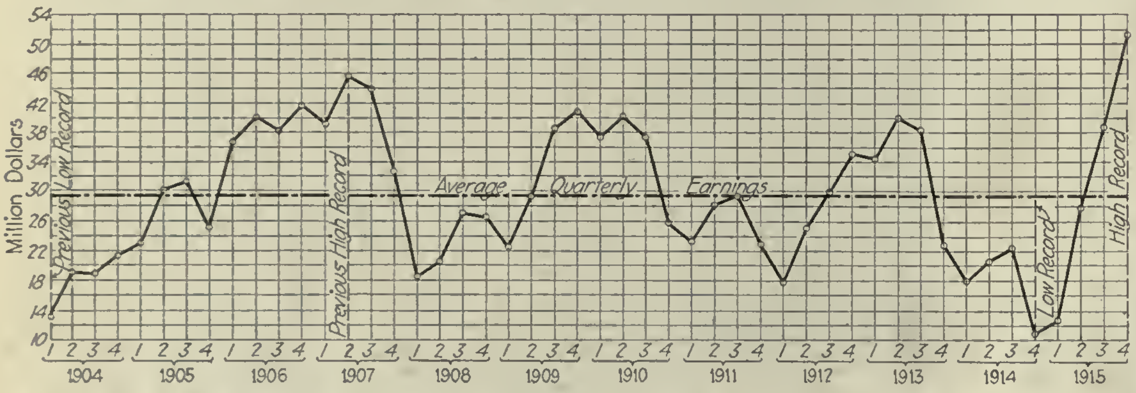
Union Iron Works, Hoboken, N. J., catalog 34, 7 x 10 in., 126 pages, illustrated. Pile driving machinery is the subject of this catalog. Besides the general description of types of hammers and parts, sectional views of which are shown, there are included a number of interesting articles on the performances of Union hammers and machinery and on the history of pile driving. Among these are an article of concrete pile driving at Halifax on the government piers, an account of the cofferdamming around the sunken and reclaimed U. S. S. "Maine" at Havana, a story of the work of pile driving at Toronto on the harbor improvements, and short pictorial accounts of cofferdamming and pile driving for building and bridge foundations, sewers, canals, notably the New York Barge Canal, and dock and pier works throughout the country. The catalog is an important adjunct to the contractor's equipment catalog file, because it gives interesting suggestions along the line it covers.

American Well Works, Aurora, Ill. Bulletin 141, 7½ x 10½ in., 40 pages, illustrated. Historical in its treatment of deep wells sinking in the Great Plains of the West and suggestive in its exposition of methods found best suited for different sections, this booklet is especially interesting to the irrigation engineer. Recent findings on the underground waters of the Southwestern sections that were formerly supposed to be without the practical reach of well drilling and information as to the best methods of sinking and developing large capacity deep wells taken from actual experience are its subjects. Appended are a general description of the type of machine used for drilling and particular recommendations for determining the most suitable types of well and pumping machinery for irrigation. The American rotary drilling machine and special parts are here described, showing its application to such work as is outlined in the first part of the bulletin. The illustrations show processes of well sinking and rotary drilling machinery.

CONTRACTING NEWS

Of Special Interest to Engineers, Contractors, Builders and Manufacturers of Engineering and Building Supplies

THE RECENT sale of the $25,000,000 issue of the New York State Barge Canal bonds indicates that money is still plentiful. The issue brought 103.27 and was later advanced to 104.125 on the market. The transportation situation is undoubtedly having effect in delaying construction work, especially on the Atlantic seaboard. It appears likely that embargoes will continue to be the rule, at least until spring, although the ocean freight situation has been temporarily helped by the recent arrival of a large number of vessels. Only a few contracts are being delayed by the high price of materials, though actual structural contracts fell off sharply last month. This is traceable to the fact that the railroads are not in the market for much bridge work. Although net railway revenues for the month of November again averaged more than $500 per mile of line, the period of improvement has yet been too brief to create the confidence needed before funds for extended betterments will be forthcoming. Brief as it has been, however, the union railway employees of the country are already organizing for a concerted raid on the gain in net revenue, and their action will delay and perhaps postpone indefinitely much construction work that has already been held up some years.



GRAPH OF U. S. STEEL CORPORATION'S QUARTERLY EARNINGS REFLECTS INDUSTRIAL DEPRESSION AND RAPID RECOVERY OF THE PERIOD SINCE JULY, 1914

Structural steel is still quoted at a minimum of $1.90 per 100 lb., Pittsburgh, the best deliveries being eight to ten weeks, according to the *Iron Age*. The same price holds for third and fourth quarter deliveries. The market shows the effect of the producers' efforts to keep prices within bounds, and only the smaller mills are exceeding these quotations. The warehouse price is $2.60 per 100 lb., Pittsburgh.

Steel plates have continued to advance, reaching $2.50 on eight weeks' delivery, Pittsburgh, and $2 for third and fourth quarter delivery. Warehouse prices are at $2.90 Pittsburgh. No. 28 black sheets are $2.60 Pittsburgh, and No. 28 galvanized sheets $4.75 to $5. Steel and iron bars have advanced still further, both bringing $2.25 per 100 lb. Pittsburgh, $2.60 warehouse delivery and $1.90 for third and fourth quarter delivery.

Pipe was much more active last month. Cast iron pipe advanced to $29 per ton, tidewater, on private and export buying, the municipal market being dull. Wrought steel and iron pipe, lap welded, has been very active for the past month, and prices generally have advanced. In carload lots, steel pipe, 2 to 6 in., plain ends, is now quoted at $48 per ton, Pittsburgh, while galvanized steel pipe is $81 per ton on the same basis. Iron pipe of this class is quoted at $72 per ton, Pittsburgh, for black and $104 per ton for galvanized.

Lead continued to advance throughout the month, reaching $6.10 per 100 lb., in 25 ton lots, New York, and $6 East St. Louis.

The building materials market is marking time, especially in the East, being affected by the various railroad embargoes on structural steel. There is a feeling among manufacturers that, should prices advance further, speculative building work might be postponed.

Portland cement continues to be quoted on a mill base of $1.05 per barrel, wholesale, without containers, Lehigh district. Hudson common brick in New York are bringing $8.50 and $9.00, having declined from the high prices ruling earlier in the month. Building sand is still quoted at 45 cents, dock, New York, after showing a tendency to advance to 50 cents per cubic yard. New York gravel prices have advanced 5 cents to 90 cents, dock, 500 cu. yd. lots, for 1½-in. and 85 cents for ¾-in. Gravel meeting subway specifications is unchanged at 95 cents. Crushed trap rock advanced 10 cents per cubic yard early in the month to $1.10 for 1½-in. and $1.20 for ¾-in.

New York and Chicago lumber prices remain practically unchanged. Weather conditions have interfered with building operations, but orders booked during the week ending Jan. 21 at 155 eastern and southern mills averaged 86 per cent of production, and these mills still have unfilled orders of more than 19,000 cars. In addition, stocks of all standard sizes are now very low. Heavy snow falls have already cut down production on the Pacific Coast by an amount estimated at 7 per cent of the average yearly production. In addition, a shortage of logs will prevent night work when the mills are able to resume. The export trade continues to take lumber as fast as ships can be found to carry it.

Immigration continues to fall, only 18,501 persons having been admitted in December. This total is 10 per cent under that of December, 1914, and is more than 30 per cent under that of November, 1915. According to the U. S. Bureau of Labor Statistics, the number of new strikes has decreased steadily since the month of September, when 152 were reported. Only nine strikes in the building trades were in progress during December, compared with thirty-five difficulties in the metal trades, which were the worst troubled. Nearly 30 per cent more strikes were reported during 1915 than in 1914.

Buildings

A contract has been awarded at Meriden, Conn., for erecting factory buildings to cost $125,000. An armory contracted for at Yonkers, N. Y., will cost $104,000. The construction of a high school to cost the same sum has been contracted for at Little Falls, N. Y. A $200,000 bank building has been contracted for at Williamsport, Pa. A contract for building a $150,000 factory has been awarded at Cleveland. A hotel, the construction of which has been contracted for at Toledo, will cost $250,000. Bids are desired at Sioux City, Iowa, for building a warehouse to cost $150,000.

The construction of a $200,000 hotel is contemplated at Springfield, Mass. Bills introduced in the New York State Assembly provide for the construction of State buildings to cost nearly $1,000,000. Plans have been filed in New York City for a $225,000 apartment house, and plans are being prepared in the same place for a power plant to cost $500,000. At Morristown, N. J., plans have been approved for a high school for which $243,000 has been appropriated. A grain elevator to be built at Montgomery, Ala., will cost $200,000. Municipal building construction being considered at Detroit will cost $1,000,000, and it is reported that an automobile company in the same city will enlarge its plant at a cost of $10,000,000. Clayton, Mo., has sold $125,000 high-school bonds. Plans are being prepared at Denton, Tex., for a college building for which $140,000 has been appropriated. Plans have been completed at Denver for a $150,000 hospital. The construction of a $600,000 ship-building plant is being planned at San Francisco. Los Angeles reports that a $250,000 plant for an oil company is to be built, and that the construction of a $1,000,000 hotel is proposed.

Bridges and Roads

The lowest bid received at Rockford, Ill., for constructing a concrete bridge was $83,000. A contract for building a concrete bridge at Iowa City, Iowa, has been awarded at $57,000. Bids will be opened by the State of Kentucky on Feb. 15 for constructing a 550-ft. highway bridge. The $60,000 concrete bridge to be constructed at Harriman, Tenn., will be let Feb. 10. The construction of a large bridge is to be contracted for next spring by New Haven, Conn. Bridgeport, Conn., will let this month a contract for building a $130,000 drawbridge. Plans for the new bridge on the New York, New Haven & Hartford Railroad at New London, Conn., will not be completed until May or June. The construction of a $500,000 bridge is being considered at Wilkes-Barre, Pa. The bill providing for the construction of a $1,500,000 bridge over the Potomac River at Washington has been approved by the Secretary of War. The Southern Pacific railroad is to replace the bridge recently washed out by the Gila River in Arizona with a $500,000 structure.

A contract for paving work to cost $104,000 has been awarded at Iowa Falls, Iowa. The contract for paving the Union Station plaza at Kansas City has been awarded at $67,000. A contract for paving work at Hutchinson, Kan., has been awarded on a bid of $86,000. Sherman, Tex., has already contracted for the construction of 22 miles of road to be paid for out of the $867,000 available for road improvements. Bids are desired at Mason City, Iowa, for 204,000 sq. yd. of pavement.

The sum of $188,000 has been appropriated for granite paving at Woonsocket, R. I. Newark, N. J., will soon let contracts for 65,000 sq. yd. of wood and granite block paving. Canton, Miss., reports that $330,000 is to be spent in county road improvements. A paving contract to be let at Cheviot, Ohio, will cost $80,000. Paving work to cost $200,000 is to be contracted for soon at Champaign, Ill. Creston, Iowa, will let a contract in a few days for 100,000 sq. yd. of paving. Contracts are to be let soon at Phoenix, Ariz., for 204,000 sq. yd. of paving.

Waterworks and Sewers

A $129,000 contract for clearing a reservoir site has been awarded at North Yakima, Wash. Bids will be opened Feb. 22 at Havana, Cuba, for constructing a $40,000 addition to the waterworks system. The New York City Board of Estimate has approved the expenditure of $22,000,000 for developing the Schoharie watershed. Hendersonville, N. C., is considering the report of a consulting engineer on its proposed $150,000 waterworks system. A reservoir and filtration plant, the construction of which has been recommended at Highland Park, Mich., will cost $340,000. An engineer has been engaged by Tyler, Tex., to design waterworks for which $250,000 has been voted.

A $74,000 contract for building a sewage-disposal plant has been awarded at Mansfield, Ohio. The lowest bid received at Kansas City for constructing a storm sewer was $81,000. Hammond, Ind., will let a contract Feb. 21 for constructing a section of sewer to cost $250,000. Contracts for a large-diameter reinforced-concrete intercepting sewer more than 3000 ft. long are to be let Feb. 10 at Chicago. Bids are to be opened

Monday for further sewer construction at Houston, Tex. A $125,000 bond issue for sewer construction has passed the city council of Buffalo. An agreement for the construction of a $125,000 sewer system and disposal plant has been reached at Haddonfield, N. J. Contracts for constructing an intercepting sewer in Philadelphia for which $500,000 is available will be let soon. A report has been made on a $91,000 sewage-disposal system for Govans, Md. Plans are being prepared for sewers to cost $200,000 at Cleveland, and contracts for two sewage-disposal plants are to be let this summer. Dayton, Ohio, has sold $250,000 sewer bonds. A preliminary order for the construction of a $500,000 relief sewer system has passed the city council at St. Paul. Sewer construction to cost $175,000 is being considered at Wichita, Kan. The city council of Omaha, Neb., has approved a $200,000 bond issue for sewer construction. Galveston, Tex., is considering the construction of a $250,000 sewage-disposal plant.

Miscellaneous

A $246,000 dredging contract has been awarded at Philadelphia. The construction of a hydroelectric power plant to cost $250,000 has been contracted for at Kingsport, Tenn. It is reported that a $300,000 irrigation contract has been awarded at Tucson, Ariz. A contract for the marine railway to be built at Pearl Harbor, Hawaii, has been awarded at $95,000. New York City will open bids Feb. 11 for building the superstructure of its new Forty-sixth Street pier. Bids will be opened Feb. 29 for a $1,000,000 section of the New York State Barge Canal. Drainage work amounting to $220,000 will be let Feb. 15 at McCrory, Ark. It is reported that the preliminary investigation of the site for the Barber freight subway in Cleveland has been completed, and that work will start on its construction in the spring. The plans of Sacramento, Cal., for a $300,000 diversion dam have been approved by the Board of Army Engineers at Washington. A $200,000 interurban railway company has been formed to build a 7-mile line near Martinez, Cal.

WATERWORKS

PROPOSED WORK.

New York, N. Y.—Board of Estimate and Apportionment Jan. 31 passed expenditure of $22,000,000 for the construction of the Schoharie water supply for New York City.

Braddock, Pa.—Committee appointed to consider new water works costing about $35;000.

Greenville, Pa.—Chester & Fleming, Pittsburgh, engaged to prepare plans for a high service pumping station, reservoir and connecting force mains for the Greenville Water Co.

Mercer, Pa.—Chester & Fleming, Pittsburgh, engaged by Mercer Water Co. to prepare plans and specifications for a filtration plant.

Baltimore, Md.—Only bid opened Jan. 19 by Board of Awards for furnishing hypochlorite of lime used in treating water at the filtration plant was rejected as being too high; also for same reason the bids on furnishing pig lead and lead lined pipe.

Hendersonville, N. C.—Gilbert C. White, Consulting Engineer, Charlotte, has submitted a preliminary report on the new supply and proposed water works system which city officials propose installing at a cost of $150,000. It will be necessary to construct a pipe line 14 miles to the head of North Fork Creek and Big Creek at a junction where an intake can be constructed and a sufficient volume of pure mountain water can be secured.

Alabama Port, Ala.—Reported Tidewater Securities Power Co., Mobile, is planning to construct an electric light plant and water works system in connection with the proposed development at Alabama Port.

Barbourville, Ky.—Council reported to have passed ordinance appropriating $25,000 for building and installing filtration plant, a pumping station and an elevated tank and purchase of additional ground for water works and extending pipes for same. F. Waldo Hilles, Village Clk.

Bowling Green, Ky.—Reported steps being taken by Council to engage an engineer to prepare plans for the proposed sedimentation basin. Address City Clerk.

Mount Sterling, Ky.—Reported construction of municipal water works and electric light plant costing $40,000 is under consideration.

Barnesville, Ohio.—Ordinance passed providing for improvements to the water works including installation of filtration plants, pumping station, elevated tank, etc., at a cost of $25,000.

Highland Park (P. O. Detroit), Mich.—Council is considering the recommendation of W. G. Hoad, Consulting Engineer, to construct a storage reservoir with a capacity of 16,000,000 gal. and a filtration plant; probable cost $340,000.

Madison, Wis.—Improvements to water works at University of Wisconsin include purchase and installation of a motor driven pump and air compressor, together with a new structure to house the pumping equipment.

Kinney, Minn.—Village is reported having plans prepared by S. S. Rumsey of Duluth for a filter plant which it is proposed installing.

Rochester, Minn.—Citizens voted $36,000 bonds for water works and power plant. A. F. Weight, City Clk.

St. Paul, Minn.—All bids opened Jan. 26 by August Hohenstein, Purchasing Agent for about $15,000 worth of meters have been rejected.

Chanute, Kan.—Contract soon to be let by City Commissioners for motor-driven pumps, 27 blocks service water lines, water regulators and 205 k.v.a. generators, engine driven at light plant. C. G. Wood, City Clerk.

Lawrence, Kan.—Election to be held March 7 to vote on the purchase of present water works owned by Lawrence Water Co.

Riley, Kan.—City contemplates constructing water works.

Solomon, Kan.—Election to be held Feb. 8 to vote $40,000 bonds for a municipal water works system.

Kearney, Neb.—Finance Committee of City Council reported considering improvements to water works.

Kearney, Neb.—Council considering improving the water works.

Leeds, N. D.—Commercial Club is reported considering installing a water system to take in about 19 blocks and cost probably $20,000.

Rector, Ark.—Water and sewer district bonds amounting to $56,000 have been sold.

Fort Worth, Tex.—Investigations being made by Water Commissioner for proposed improvements to water supply for the coming summer.

Fort Worth, Tex.—The city, it is reported, would like an engineering firm willing to complete Lake Worth conduit and take city's note in payment. Address Water Commissioner.

Galveston, Tex.—Citizens Jan. 18 voted in favor of following bond issues: $125,000 for making repairs caused by August storm (some of the work has been contracted for); $200,000 to be used for repairing and restoring or submerging water mains across Galveston Bay (contracted for); $250,000 for repairing street damaged caused by August storm.

Temple, Tex.—The Santa Fe Ry. Co. (C. F. W. Felt, Ch. Engr. System, Chicago, Ill.) is reported taking steps to improve all the pumping stations on the entire system at a cost of about $250,000.

Tyler, Tex.—Henry E. Elrod, Consulting Engineer, Dallas, is engineer for proposed water works for which citizens Jan. 23 voted $250,000 bonds.

Bartlesville, Okla.—City is considering purchase of present water works, owned by private parties.

Dewar, Okla.—Election to be held Feb. 11 to vote $40,000 water works bonds.

New Wilson, Okla.—Election to be held to vote $20,000 bonds for water works. C. W. Henson, Town Clerk.

Woodville, Okla.—Election to be held Feb. 15 to vote $15,000 bonds for water works. Claude D. Jackson, Pres. Board Trustees.

Albion, Wash.—City Council plans installation of a water works and distribution system. C. E. Wright, Chmn. of Committee investigating cost, etc.

Bellingham, Wash.—Contract soon to be let by H. J. Korthauer, City Clerk, for furnishing Water Department 396,000 lb. 6-in. c.-i. pipe and 48,000 lb. 4-in. c.-i. pipe. W. H. North, City Engineer.

Everett, Wash. — City Commissioners have passed ordinance authorizing city attorney to start condemnation proceeding against plant of the Everett Light & Water Company, and take over the local water system. City plans to extend and improve the system as soon as acquired.

Seattle, Wash.—City Engineer Dimock has presented to Board Public Works plans and specifications for water mains in Bangor and other streets, to cost $50,000.

Milwaukie, Ore.—J. I. Johnson, President Minthorne Springs Water Co., intends extending system at a cost of about $25,000.

Fresno, Cal.—A $10,000 water system is to be laid in the cemetery by Mountain View Cemetery Assoc. (M. D. Huffman, Pres.).

Oceanside, Cal.—Water bonds amounting to $12,000 will soon be sold. Address City Clerk.

Pasadena, Cal.—City Commission considering calling an election to vote bonds for constructing a c. i. main from Sunset Reservoir to Glenarm Street with branch out East Colorado Street; estimated cost, $60,000. Samuel Morris, Chief Engineer Water Dept.

San Francisco, Cal. — Hetch Hetchy bonds amounting to $1,000,000 have been sold.

Seal Beach, Cal.—City Trustees propose holding an election to vote bonds for constructing water, sewer and light systems and for paving main streets.

Whittier, Cal.—It is proposed to submit to the voters the proposition to issue about $111,000 bonds for improvements to the water system. Preliminary plans being prepared.

Yorba Linda, Cal.—Contract soon to be let by Yorba Linda Water Co. (Eldo R. West, Secy.) for 4000 ft. 24-in. pipe and to cover two reservoirs. F. C. Finkle, Engineer, Los Angeles.

Bowie, Ariz.—Town is reported contemplating installing water system.

Casa Grande, Ariz.—Election to be held Feb. 15 to vote on constructing municipal water works, electric light and power and water and ice plants, to cost $35,000. Sidney F. Mashbir, Engineer, Tucson; E. R. Stoner, City Clerk.

Glendale, Ariz.—Franchise granted town of Glendale to construct, maintain and operate water works and electric light and power system in or near the town.

Ogden, Utah. — Recommendations for 1916 made by the retiring city engineer in his annual report include installation of automatic devices to register the flow of water from distributing reservoirs, complete plan of underground sewer, and that the city commissioners instead of property owners designate kind of pavement needed. Joseph M. Tracy is new city engineer.

BIDS DESIRED.

New York, N. Y.—Until Feb. 24, by Board Water Supply, Municipal Building, New York, for Contract 169, lining with brick masonry a portion of Eastview tunnel, Catskill Aqueduct, advertised in Engineering Record.

Newark, N. J.—Until Feb. 17, by Board of Street & Water Commissioners (Morris R. Sherrerd, Ch. Engr.), for furnishing and installing in South Eighth Street Meter Testing Station, a meter testing apparatus, also a Fairbanks Scale and a tank, advertised in Engineering Record.

Washington, D. C.—Until March 2, by Commissioners D. C., for constructing a cover of concrete or other material over Reno reservoir for Water Department at Donaldson Place and De Russey Street, N. W., advertised in Engineering Record.

Washington, D. C.—Until Feb. 15, by Bureau Supplies and Accounts, Navy Department, Washington, D. C., for steel forgings, terra cotta pipe, hydraulic pump, steel rails, etc.

New Orleans, La.—Reported desired until March 22 by Sewerage and Water Board (F. S. Shields, Secy.) for addition to Pumping Station No. 3.

Attica, Ohio.—Reported desired until Feb. 8 by F. R. Stultzman, City Clerk, for filtration plant pipe line, etc., for water works.

Ligonier, Ind.—Until Feb. 24 by R. E. Nament, City Clerk, for 400 water meters.

Saginaw, Mich.—Until Feb. 8 (readvertisement), by H. S. Gay, City Clerk, for c. i. water pipe and specials.

Chicago, Ill.—Until Feb. 9 by Department Public Works (W. R. Moorhouse, Comr.) for three motor-driven centrifugal pumps and accessories, two at Wilson Avenue tunnel shafts and one at Cook County School for Boys.

Also until Feb. 7, same place as above, for furnishing and delivering to city f.o.b. cars at city pipe yards, Thirty-first Street and Sacramento Avenue, twenty-five 36-in. gate valves and forty 24-in. gate valves for Bureau of Engineering.

Elmhurst, Ill.—Until Feb. 9 by Arthur H. Kochalsky, City Clerk, for constructing pumping station, tower and tank, reservoir and well house, all of reinforced concrete. H. L. Emerson, Engr., 1118 Chamber of Commerce Building, Chicago.

Rock Island, Ill.—Reported desired until Feb. 23 by Frank D. Whipp, State Fiscal Supervisor, Springfield, for constructing a pump house and well, also pump equipment and accessories at Watertown State Hospital, Rock Island. Martin C. Schwab, Consulting Engineer, Mailers Bldg., Chicago.

Milwaukee, Wis.—Reported desired until Feb. 9 by Fred. G. Simmons, Comr. Public Works, for furnishing 1700 tons 6, 8 and 12-in. water pipe, 333 gate valves, etc.

Trinity, Tex.—By Thompson Bros. Lumber Co., Trinity, specifications and prices on installing 15,000 ft. wooden pipe line, either 8 or 12 in.; also a pump to deliver water, advertised in Engineering Record.

Santa Ana, Cal.—Until Feb. 7, by E. L. Vegely, City Clerk, for furnishing 15,000 ft. 4-in. and 5000 ft. 6-in. Class A c. i. water pipe.

Havana, Cuba.—Until Feb. 22 by Francisco Garcia, Acting Chief Engineer, Department of Sewers and Paving, 24 Cuba Street, for constructing water supply system, including storage tank, for Pogolotte, a suburb of Havana; approximate cost $40,000.

PRICES AND LETTINGS.

★*Indicates award of oontract.*

Hartford, Conn.—Lowest bid opened Jan. 25 by Board of Water Commissioners for furnishing meters was submitted by Hersey Mfg. Co. of Boston, Mass., at $5,080.

New Brunswick, N. J.—Following are bids opened Feb. 1, by Asher Atkinson, City Engineer, for two steam turbine pumping units: Southern Machinery Company, Philadelphia, Pa., $10,900; T. J. Radley Company, New York, two bids, $13,000 and $13,900; Turbine Engine Company, New York, $13,700.

★**Emporia, Kan.**—Contract for about 400 tons c. i. pipe awarded National Iron Pipe Company, Black & Veatch, Engineer, Kansas City, Mo.; Fred. H. Smith, City Clerk.

★**North Yakima, Wash.**—Contract awarded Harrington-Peters Co., Seattle, for clearing Keechelus Reservoir site, at $129,000. This is one of the reservoirs of the Yakima irrigation storage system.

★**Seattle, Wash.**—Contract awarded by Board Public Works to Scalzo & Tassoni, 1708 Twenty-second Avenue S. for water mains in Dexter Avenue, at $25,833.

★**Ridgefield, Wash.**—Contract awarded Jan. 18 to Morris & Kinney, Seattle, at $6,877 for wood pipe. Gilbert & Hall, Engineers, Portland, Ore.

★**Yorba Linda, Cal.**—Contract awarded Cameron Steam Pump Wks., Los Angeles, for one 8-in. Cameron horizontal, double-suction, volute pump 150 hp., Westinghouse motor automatic control. F. C. Finkle, Engineer, Los Angeles; Eldo R. West, Secy. Yorba Linda Water Co.

SEWERAGE AND SEWAGE DISPOSAL

PROPOSED WORK.

Fall River, Mass.—See "Hydraulic Construction and River Improvement."

Woonsocket, R. I.—See "Paving and Roads."

Stamford, Conn.—Constructing of a sewage disposal plant is under consideration by city. Address City Clerk.

Buffalo, N. Y.—Council has voted in favor of the $125,000 bond issue to finance construction of a connecting trunk sewer in Swan and Seneca Streets between Hydraulic and Hamburg Streets to relieve sewer contamination in Ohio Basin.

Haddonfield, N. J.—Agreement reached between Borough Officials and Haddon Township Committee whereby a joint sewer is to be constructed. Tentative plans have been prepared by the Borough Engineer, and plans are also to be prepared for a disposal plant; total expenditure about $125,000.

Johnstown, Pa.—City Planning Commission submitted a report recommending that the sewer system be constructed at once.

Philadelphia, Pa.—Contract soon to be let by Director Department Public Works for constructing the intercepting sewer for Frankford Creek; $500,000 is available for the work.

Wilkes-Barre, Pa.—B. K. Finch, City Engineer, is considering the connecting of the sewer lines of Parsons Borough, Hanover and Wilkes-Barre Township with the city of Wilkes-Barre's system and construct a sewage disposal plant for said townships and the city.

Govans, Md.—Ezra B. Whitman of Greiner & Whitman Consulting Engineers, Fidelity Building, Baltimore, has submitted to County Commissioners, Towson, a report estimating cost of constructing sewerage system for Govans at $91,000 to $108,000, including construction of a disposal plant costing between $30,000 and $47,000.

Rockville, Md.—County Commissioners and a committee of engineers interested are considering the proposition pertaining to constructing proposed sewerage system in lower section of county. The securing of legislation which will permit the connecting of the sewerage systems of Maryland counties lying adjacent to the District of Columbia with the system of the District.

Birmingham, Ala.—Ordinance has been drawn for constructing sanitary sewers in East Thomas Street; estimated cost, $8,000. Julian Kendrick, City Engineer.

Akron, Ohio.—R. W. Pratt of Cleveland has recommended to Director of Public Service the laying of a main trunk sewer as a solution of the West Hill sewage and the construction of a disposal plant problem.

Cleveland, Ohio.—Plans being prepared by R. Winthrop Pratt, City Sanitary Engineer, for the outfall sewer for the Newburgh sewage disposal plant. Outfall sewer will be about 5400 ft. long, 8 ft. diameter, brick, and cost about $200,000.

Contract will be let this summer for constructing the sewage disposal plants at Newburgh and White City, according to plans by E. Winthrop Pratt, City Sanitary Engineer.

Cleveland, Ohio. — See "Paving and Roads."

Dayton, Ohio.—Sewer bonds amounting to $250,000 sold.

Hamilton, Ohio.—State Board of Health, Columbus, is considering adoption of plans for the proposed intercepting sewer for this city. F. E. Weaver, City Engineer.

Newark, Ohio.—Sewer and paving bonds for $73,300 will be sold Feb. 18 by A. Nelson Dodd, City Aud.

Youngstown, Ohio.—Contract soon to be let by city for constructing the Mill Creek sewer. Frank Lillie, City Engineer.

Fairmont, Ind.—The W. J. Sherman Co., The Nasby, Toledo, Ohio, engaged to survey and report on proposed sewer system.

Fort Wayne, Ind.—Board Public Works has adopted plans and authorized construction of the east end sewer. Address City Engineer.

Grand Rapids, Mich.—Hood & Decker, Ann Arbor, are Consulting Engineers for the proposed sewage disposal plant and sewers contemplated. Nothing definite has been done about the construction. L. D. Cutcheon, Manager Board Public Works.

Northwood, Iowa.—City reported planning installation of a sewer system.

Sioux City, Iowa.—City Engineer preparing plans for South Morningside sanitary sewer system, to be about 6 miles long and cost approximately $25,000.

St. Paul, Minn.—City Council has passed preliminary order for construction of St. Anthony relief sewer system; probable cost $500,000.

Wichita, Kan.—Reported extending the sewer system at a cost of $175,000 is under consideration. Bert Wells, City Engineer.

Omaha, Neb.—Council has approved bond issues as follows: $200,000 for sewers, $100,000 for paving intersections and $50,000 for parks.

Omaha, Neb.—City Commission has agreed upon storm sewer construction work, of which estimates aggregate $151,000. Work includes extension of Thirty-seventh Street sewer at a cost of $14,000; Fiftieth Street sewer $10,500; California Street sewer $7,000; Gifford Park sewer $15,000; Saddle Creek sewer $40,000; Miller Park sewer $30,000; Fontenelle Park sewer $11,000. E. E. Bruce, City Engineer.

Pawnee, Neb.—Preliminary survey and estimates have been prepared by E. T. Archer & Co., 406 New Eng. Building, Kansas City Mo., for the proposed sewer system, to cost $35,000. An election will be held April 4 to vote on the proposition. The extending of the water works is also under consideration. J. L. Meek, City Clerk.

Dallas, Tex. — County Commissioners propose constructing a new septic tank sewerage system at the county farm.

El Paso, Tex.—City is reported considering sewage disposal plant costing $50,000.

Galveston, Tex. — City Commissioners considering construction of a sewage disposal plant for that section of the city west of Thirty-ninth Street. A. T. Dickey, City Engineer, estimates the cost at $250,000.

Gatesville, Tex.—Sewer bonds amounting to $22,500 have been sold.

San Antonio, Tex.—Galveston, Harrisburg & San Antonio Ry. Company (I. A. Cottingham, Asst. Gen. Mgr., Houston), will construct a 30-in. storm water sewer from Houston Street to Florida Street, connecting with big city main, in return for franchise for additional track.

Bellingham, Wash.—William H. North, City Engineer, instructed by City Council to prepare plans for a trunk sewer; 12 and 16-in. pipe to be constructed in James Street.

Myrtle Point, Ore.—Council has directed plans prepared for sewer system costing approximately $20,000.

Los Angeles, Cal.—Preliminary plans and estimates being prepared for sewage disposal plants, one at Hyperion and the other at Los Angeles Harbor; probable cost $1,350,000. Election to be held on the erection of the plants. W. T. Knowlton, Engineer of Sewers; Homer Hamlin, City Engineer.

The Florence Avenue sewer will require 12,943 ft. 8 to 20-in. pipe and 13,197 ft. 30 to 42-in. brick and concrete sewer; cost $150,000. W. T. Knowlton, Engineer of Sewers; Homer Hamlin, City Engineer.

Sacramento, Cal.—City Engineer estimates the cost of connections between Sump No. 1 and Sump No. 2 to accommodate dry weather flow at $109,000. The grade is so flat that a 51-in. sewer will be necessary.

Ogden, Utah.—See "Water Works."

Elko, Nev.—Election soon to be held to vote $30,000 bonds for constructing sewers.

BIDS DESIRED.

New York, N. Y.—Until Feb. 9 by Marcus M. Marks, Pres. Manhattan Borough, for repairs to sewers in 110th Street, between Seventh and Eighth Avenues; security $6,500; also same time and place for the Catherine Street sewer under Pier No. 26, East River; security $12,000.

North Bergen (Post Office Weehawken), N. J.—Until Feb. 17, by Township Committee for constructing system of sanitary and storm sewers in Secaucus Road. Estimated cost $20,000.

Hammond, Ind.—Until Feb. 21, by Board Public Works (Jacob Schroeter, Chmn.), for constructing Calumet Avenue sewer, 6580 ft. long and 72 in. wide, running from Conkeyville to the Grand Calumet. Probable cost $215,563.

Kendallville, Ind.—Until Feb. 29, by O. E. Michaelis, City Clerk, for constructing District Sanitary Sewer; cost $38,845, advertised in Engineering Record.

Chicago, Ill.—Until Feb. 10 by John McGillen, Clk. Sanitary Dist., 910 S. Michigan Avenue, for Stock Yard Intercepting Sewer No. 1, semi-elliptical in sections, reinforced concrete, comprising 770 lin. ft., 9 ft. internal horizontal diameter, and 2675 lin. ft., 7 ft. internal horizontal diameter, extending from Ashland Avenue along south bank of west arm of the south fork of South Branch of Chicago west of Robey Street to connect with existing W. Thirty-ninth Street conduit.

Kenwood, Iowa.—New bids about March 1 by C. M. Doolittle, City Clerk, for constructing the sewerage system. Bids opened Jan. 25 rejected.

Keota, Iowa.—Until Feb. 16, by Town Clerk, for constructing about 1½ miles 8 to 10 in. sanitary sewers, 13 concrete or brick manholes, 5 flushtanks with fittings and pipings complete. Engineers, Iowa Engineering Company, Clinton, Iowa.

Strawberry Point, Iowa.—Until Feb. 15 (readvertisement), by Town Clerk, for constructing sewers, including 21,554 lin. ft. 6, 8 and 10 in.; 36 manholes; 2000 lb. bituminous compound filler; 96 standpipes. G. F. Scofield, Acting Town Clk.

Mountain Lake, Minn.—Until Feb. 17, by Village Council, for constructing sewer system to consist of approximately 16,256 ft. long, 18 manholes, 5 flush tanks, etc. C. W. Grove, Engr., Windom.

Polson,. Mont.—Until March 6 by City Clerk for furnishing material and constructing approximately 15,000 lin. ft. sanitary sewers, 8 to 18-in. vitr. pipe, advertised in Engineering Record. Long & Olson, Engineers, Polson, Mont.

Houston, Tex.—Until Feb. 7, by City Secretary, for constructing Second Ward Sewer system east of Milby Street, using 18 to 120 in. sewers. E. E. Sands, City Engineer.

Until Feb. 7 (readvertisement), by City Secretary, for extension of Scott Street sewer, new bids to be on 36 in., and a sewage lift will be installed at the junction.

El Centro, Cal.—Until about Feb. 9 (extension of date) for constructing four septic tanks for sewage disposal for cities of El Centro and Imperial; cost $25,000. Olmsted & Gillelen, Engineers, 1112 Hollingsworth Building, Los Angeles.

Havana, Cuba.—Until Feb. 22 by Francisco Garcia, Acting Chief Engineer, Department of Sewers and Paving, 24 Cuba Street, for constructing a sewerage system, including pumping station for Pogolotti, a suburb of Havana; cost $20,000.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Jersey City, N. J.—Patrick Connolly, 13 E. Hamilton Place, is reported lowest bidder for constructing 30 in. brick circular sewer in Henderson Street, between Fourteenth and Eighteenth Streets.

Cincinnati, Ohio.—Lowest bid opened Jan. 25 by Director Public Service for making house connections with water and sewer mains submitted by Hollander Plumbing Co. at $12,610.

★**Mansfield, Ohio.** — Contract awarded Ohio Valley Contracting Co. of Cincinnati for constructing sewage disposal plant at $74,055. W. J. Hazeltine, City Engineer.

★**Saginaw, Mich.**—Contracts awarded as follows on bids opened Jan. 18 by city: To South End Gray Iron Foundry Co., Saginaw, sewer and water castings, at $1.78 per 100 lb.; to L. C. Smith & Co., Saginaw, 3 to 8, at 23 per cent off; cement sewer pipe, Consolidated Coal Co., Saginaw, at 80 per cent off. H. S. Gay, City Clerk.

Kansas City, Mo.—Lowest bid opened recently for constructing the storm water and sanitary sewer in district from Twenty-third to Thirty-first Street and Denver and Lawndale Avenues submitted by Leo Koehler, Kansas City, at $81,491.

BRIDGES

PROPOSED WORK.

Springfield, Mass.—The Bridge Commission at Boston engaged Fay, Spofford & Thorndike of Boston as engineers for planning a bridge to be constructed over Connecticut River at Springfield.

Bridgeport, Conn.—Contract will be let about Feb. 15 by Bridge Commission (C. H. Poland, Secy.), for constructing bridge at E. Washington Avenue to have three 70-ft. spans, cement foundation, Strauss bascule type, and cost $130,000; also same time for constructing Grand Street Bridge, double-leaf bascule steel superstructure and concrete foundation; cost $22,000.

New Haven, Conn.—About April 1 city will let contract for constructing bridge over Tomlinson Street at Belle Dock, on the harbor front. The bridge is to be 550 ft. long and bids on both steel and concrete will be considered. Foundations and supports will have to be built on spiles. Approaches will call for large excavating job. Address City Engineer.

New London, Conn. — Plans for the bridge to be constructed by the New York, New Haven & Hartford R.R. will be ready for the superstructure in about 6 months and for the substructure in about 4 months.

New York, N. Y.—Reconstruction of the roadway of Queensboro Bridge and transfer of car track service to outer brackets of structure as recommended by F. J. H. Kracke, Bridge Commissioner, has been approved by the Mayor. Estimated cost $144,000. The plan provides for relaying wood block pavement on foundation reconstructed to meet specific conditions. Request for appropriation is now pending in Board of Estimate and Apportionment..

Pittsburgh, Pa.—Contract soon to be let by the city for two small bridges costing $11,000: one a short span I-beam and concrete will carry Alexander Street over Saw Mill run in West End section of city; the other to connect Tuxedo and Chartiers Avenues, to be light structural steel foot bridge 300 ft. long; about $20,000 will be spent by the Division of Bridges in repairs, work to be done by day labor, and about $10,000 to be for painting. Robert Swan, Dir. Department Public Works.

Robert Swan, Director Public Works, is having designs made for a monumental portal for Manchester Bridge over Allegheny River; about $50,000 available.

Watsontown, Pa. — Commissioners of Union and Northumberland Counties considering constructing a bridge across Susquehanna River at Watsontown. A cement bridge of arch type is favored. M. J. Flynn, Engineer of Mt. Carmel, has submitted plans for the bridge.

Wilkesbarre, Pa.—Construction of a bridge over Susquehanna River, replacing Market Street Bridge, is being considered. Col. J. A. Biddle said to be interested; probable cost $500,000.

Washington, D. C.—Secretary of War Garrison approved the Swanson-Carlin bill providing for constructing bridge over Potomac River near site of present Aqueduct Bridge, with its Washington approach not east of Thirty-fourth Street, and appropriating $1,500,000 for the purpose.

Chillicothe, Ohio.—Henry M. Redd, City Engineer, instructed to prepare plans for an overhead viaduct or an undergrade crossing for B. & O. and the N. & W. Railway crossings at the intersection of Paint and Main Streets, cost to be about $500,000.

Cleveland, Ohio.—City is having plans prepared for high level bridge between Huron Road on East Side and Lorain Avenue on West Side.

Tiffin, Ohio. — County Commissioners considering constructing a bridge over river at a cost of about $15,000.

Columbus, Ind. — See "Paving and Roads."

Detroit, Mich.—Local press reports state Council has decided to ask new bids on Belle Isle Bridge. Before bids can be asked plans will have to be approved by Board of Supervisors; said action will be taken Feb. 21.

Monroe, Mich.—It is proposed to construct steel or concrete bridge, one at the east end and one at the west end of town. Plans and specifications to be submitted with bids. F. Krewbach, City Clerk; A. H. A. Kuteche, City Engineer.

Elgin, Ill.—City Council is considering replacing Kimball Street Bridge with new structure; cost about $20,000.

Joliet, Ill.—Construction of a new bridge over Hickory Creek at Fourth Avenue is contemplated; cost about $20,000. The city, street railway and township to share cost.

Des Moines, Iowa.—About $60,000 bridge bonds sold by Polk County.

Humboldt, Iowa.—Plans being prepared by the State Highway Commissioner for 14 bridges, both concrete and steel with concrete substructures. H. N. Legreid, County Engineer.

About 50 concrete culverts are to be built in this county, also 10 miles of permanent road grading. H. N. Legreid, County Highway Engineer.

Osceola, Iowa. — Contract will be let about February for 1200 cu. yd. concrete culverts costing $15,000. J. L. Hyland, County Engineer.

Alma, Kan.—County Commissioners will let contracts about March 1 for constructing 50 small bridges and culverts.

Concordia, Kan.—County Commissioners appropriated $15,000 for new bridges and repairs to old bridges.

Leavenworth, Kan.—County Commissioners will construct two concrete bridges, costing $30,000.

Kearney, Neb.—Plans being prepared by State Engineer at Lincoln for a concrete and steel bridge to be constructed over Platte River south of Kearney, connecting Kearney and Buffalo Counties.

Tecumseh, Neb.—Contract soon to be let by the County Commissioners for constructing bridges during the ensuing year.

Houston, Tex.—See "Paving and Roads."

Marietta, Wash.—County Commissioners at Bellingham considering constructing a steel bridge over Nooksack River at Marietta; cost $25,000.

Seattle, Wash.—A. P. Denton, County Engineer, directed to prepare plans for constructing two bridges, one to be built at Fall City, to be 250 ft. long, cost $35,000, and one at Stossel, to be 209 ft. long and cost $17,000. Both spans to be of steel on concrete piers.

County Comrs. considering constructing a 133-ft. steel span over White River, near Kent.

Spokane, Wash.—An election will probably be held to vote bonds for constructing a steel bridge at Boone Avenue, replacing present structure, at cost of $17,107. Morton MacCartney, City Engineer.

Portland, Ore.—Philip Dater, City Engineer, directed to estimate cost of constructing a concrete viaduct over Oregon-Washington R.R. & Navigation tracks at Vancouver Avenue; cost about $50,000.

Berkeley, Cal.—A reinforced concrete bridge costing $7,000 is to be constructed. J. Jessy, City Engineer.

Fresno, Cal.—Reported concrete bridge on county road over Kings River, east of Sanger, constructed recently at a cost of $26,000, was seriously damaged by flood. Scott McKay, County Surveyor.

Long Beach, Cal.—Plans being prepared for a 50-ft. extension and repairs to concrete and timber bridge on West Anaheim Street.

Redlands, Cal.—All bids opened Jan. 17 by County Commissioners for constructing steel bridge with concrete substructure over San Timeter Creek rejected. L. R. Patty, County Clerk.

San Bernardino, Cal.—Center span of the steel county bridge between Redlands and Highlands has been washed out and entire structure damaged; cost of repairs $20,000.

Total damage to county roads and bridges by recent floods will amount to about $200,000 . H. A. Sourwine, County Engineer.

City Council considering calling an election to vote bonds for rebuilding and repairing bridges wrecked by the recent floods. John L. Oakey, City Engineer.

San Diego, Cal.—Board of Supervisors appropriated $50,000 for repairing bridges and roads damaged by recent floods. George Butler, County Surveyor.

Arizona.—Central and Southern Arizona has been damaged by floods to the extent of $1,500,000. Bridges on Roosevelt Highway have been washed out and about 4½ miles of the road will have to be hard surfaced.

The Southern Pacific R.R. (W. Hood, Ch. Engr., San Francisco, Cal.) will replace the steel bridge over Gila River, washed out by the flood of January, with a new bridge costing about $500,000, supported on steel caissons sunk in sand to bed rock, between 105 and 125 ft. below the bed of the river. The bridge destroyed was 1080 ft, long, cost $225,000, and was supported on steel caissons of 100 tons each, mounted on piling driven to bed rock.

Phoenix, Ariz.—Two spans of the Southern Pacific bridge over Gila River south of Phoenix have been washed out.

BIDS DESIRED.

Maine.—Until Feb. 23 (extension of date from Feb. 10) by State Highway Commission, Augusta, for steel highway bridge, 263-ft. span, over Sandy River at New Sharon; also abutments for same. Estimated quantities: 550 cu. yd. concrete, 100 cu. yd. wet excav., 3300 cu. yd. earth fill, 100 cu. yd. rock excav.

York, Pa.—Until Feb. 17, by County Commissioners for repairing and painting Penn and George Street bridges in city of York. F. S. Bartenschlager, Co. Controller.

Baltimore, Md.—Until Feb. 9, by State Road Commission (O. E. Weller, Chmn.), 601 Garrett Building, for painting Sharpatown bridge over Nanticoke River.

Berkeley Springs, W. Va.—Until March 4 by County Court for constructing a two-span, reinforced concrete, arch bridge across Sleepy Creek, each span 55 ft. with 14-ft. roadway. R. P. Davis, Bridge Engineer, State Road Bureau, Morgantown.

Williamson, W. Va.—Reported desired until Feb. 8, for constructing bridge across Tug Fork of the Big Sandy River at Williamson, connecting Pike County, Ky., and Mongo County, W. Va., substructure of concrete, steel superstructure with wooden roadways. Address Commissioner Public Roads, Williamson.

Harriman, Tenn.—Later official reports state bids desired Feb. 10, not Feb. 14, as previously stated at office of County Court Clerk, Kingston, for constructing concrete bridge over Emory River at Harriman, about 800 ft. long. Probable cost $60,000.

Kentucky.—Until Feb. 15 by State Department Public Roads, Frankfort, for constructing a joint bridge between Hardin and Bullitt Counties: Superstructure will be of steel and have one 150-ft. span, one 100-ft. span and two 154-ft. approaches. Robert C. Terrell, Commissioner of Public Works, Frankfort.

Dayton, Ohio.—About March 1, by Department of Public Service for constructing three reinforced-concrete arch bridges over Mad and Miami Rivers, and the placing of about 30,000 cu. yd. of concrete. The reinforcement bars and cement will be furnished by the city and have been contracted for. Foundation for bridges will rest on timber piles 12 to 14 ft. below ordinary low water. Paul D. Fuqua, Engr. of Bridges.

Terre Haute, Ind.—Until Feb. 12, by Herbert C. Anderson, County Auditor, for constructing superstructure of concrete bridge over Honey Creek, near Allendale; cost $8,950.

Superior, Wis.—Reported desired until Feb. 9, by C. J. Morisset, County Highway Commissioner, for following bridges: 75-ft. span 16-ft. roadway, at Gordon; 60-ft. span 16-ft. roadway, at Rockmont; 50-ft. span 16-ft. roadway and 38-ft. I-beam span 16-ft. roadway, at Poplar.

Hutchinson, Kan.—Reported desired until Feb. 23 by County Commissioners (George W. Lee, Clk.) for constructing two reinforced concrete bridges over Arkansas River, one at south end of Main Street and one south of Nickerson.

Topeka, Kan.—Reported desired until Feb. 14 by W. J. Arnold, Co. Engr., for constructing 40-ft. span, steel, concrete bridge, 18-ft. roadway, concrete abutments on piling, or a 40-ft. span, reinforced concrete arch bridge, Luten design, 18-ft. roadway, over Butcher Creek, on South Kansas Road; a 30-ft. span, steel, concrete bridge, 18-ft. roadway, concrete abutments, on piling, or 30-ft. span, reinforced concrete arch bridge, Luten design, 18-tt. roadway, over North Branch Mission Creek; 40-ft. span, steel, concrete bridge, 16-ft. roadway, stone abutments on reinforced concrete base, or a 45-ft. span, reinforced arch bridge, Luten design, 16-ft. roadway.

Everett, Wash.—Reported desired until Feb. 21, by Mae Weatherbee, Co. Aud., for constructing concrete structure known as Pilchuck bridge; cost $10,000.

Port Angeles, Wash.—Reported desired until Feb. 7, by County Commissioners (J. W. Warren, Clerk), for constructing a 170-ft. steel Pratt truss span over the Callowa River. R. W. Kemp, Co. Engr.

Seattle, Wash.—Until March 3, according to later official information by Board Public Works (C. B. Bagley, Secy.), for constructing concrete substructure with steel superstructure, operating machinery and electrical equipment for bascule bridge at Eastlake Avenue over the Washington Canal. Plans and specifications cost $5, said sum not returned.

Reported desired until Feb. 21, by Byron Phelps, Co. Aud., for constructing, with concrete piers, two steel bridges, one at Fossel Street, 209 ft. long, probable cost $17,000, and one at Falls City, 250 ft. long, probable cost $35,000. A. P. Denton, Co. Engr.

Santa Barbara, Cal.—Reported desired until Feb. 7, by County Board Supervisors, for constructing three hinged reinforced-concrete bridge across El Capitan Creek. Probable cost $8,000.

Tucson, Ariz.—Until March 6 (readvertisement) by L. O. Cowan, City Clerk, for constructing a reinforced concrete bridge and removing present steel bridge over Santa Cruz River at Congress Street. See "Prices and Lettings."

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Brookline, Mass.**—Contract for steel for Cypress Street and Aspinwall Avenue Bridges awarded Smith & Townsend, 294 Washington Street, Boston, at $4,176. H. A. Varney, Town Engineer.

★**Atlanta, Ga.**—Contract for constructing bridge over Chattahoochie River, between Fulton and Cobb Counties, awarded Case & Cochran, Candler Building, at $8,225. William C. Spikes, Consulting Engineer, Atlanta.

★**Cincinnati, Ohio.**—Contract awarded Jan. 25 by Board of Control to Runck Brothers, Cincinnati, at $11,934 for widening masonry arches on Montgomery Avenue bridge over Pennsylvania R.R. tracks, Pleasant Ridge. Bids for this work were opened Oct. 26. 1915.

★**Fort Wayne, Ind.**—Contract for reconstructing the Lawton Park Bridge awarded Moellering Construction Co., Fort Wayne.

Rockford, Ill.—Following are four lowest bids opened Jan. 26 by Edwin Main, City Engineer, for constructing reinforced concrete bridge over Rock River at Morgan Street: A. C. Woods, Rockford, $82,828 (steel): N. M. Stark & Company, Des Moines, $82,975; Gust Holm, Rockford, $83,000; Midwest Cosstruction Company, Kansas City, Mo., $83,000.

★**Iowa City, Iowa.**—Following are four lowest bids opened Jan. 21 by Council for constructing the concrete bridge at Iowa Avenue over Iowa River: William Horrabin, Iowa City, $77,400 (awarded contract); Widell Construction Co., Mankato, Minn., $77,900; T. E. Doty, Omaha, Neb., and N. M. Stark & Co., Des Moines, bid the same at $86,000.

★**Aberdeen, Wash.**—Following are four lowest bids opened Jan. 26, by City Clerk, for superstructure of West bridge: A. R. Eichler, 211 Howard Avenue, $15 692 (awarded contract): T. Ryan & Co., $16,886: Weymouth Construction Company, $17,079: E. E. Davis & Co., $18,108. Bidders all of Seattle. L. D. Kelsey, City Engineer.

★**Walla Walla, Wash.**—Contract awarded H. L. Wilson Co., Walla Walla, for constructing two concrete bridges across Mill Creek, at $6,054.

Tucson, Ariz.—Following are four lowest bids opened recently for constructing a reinforced concrete bridge across Santa Cruz River at Congress Street: N. E. Carter, Tucson. $45,874; J. B. Ryland, Tucson, $45,915; Mercereau Bridge & Constr. Co., Los Angeles, Cal., $46,348, and Merchants Realty & Investment Co., Los Angeles, Cal., $47,852.

★**Portland, Ore.**—Following are unit figures of the three lowest regular bids opened Jan. 19 by A. L. Barbour, City Auditor, for Union Avenue extension, reinforced concrete viaduct and fill: (a) Giebisch & Joplin, Portland, Ore., $33.990 (awarded contract); (b) Stebinger Brothers, Portland, $34,690; (c) Beers Building Co., Portland, $35,208.

	*(a)	(b)	(c)
1,200 cu. yd. excavation and embankment	$0.35	$0.30	$0.75
2,300 cu. yd. excavation and embankment	0.50	0.575	1.00
300 cu. yd. gravel fill	1.10	1.32	0.75
900 cu. yd. concrete, substructure	8.00	6.381	8.00
855 cu. yd. concrete, superstructure	10.90	12.977	9.60
108 M ft. temporary trestle	15.00	20.92	20.00
265,000 lb. reinforcing steel	0.04	0.03645	0.035
19,000 sq. ft. wire mesh	3.70	0.03179	0.021
440 lin. ft. curb guard	0.20	0.2541	0.30
440 lin. ft. hand rail	2.25	1.863	2.25
440 lin. ft. electric lighting	270.00	329.00	330.00
Wrecking trestle	200.00	168.00	500.00

Railway equipment: (a) $730.00. (b) $1,593.00, (c) $2,475.00.

★Portland Ry., Light & Power Po., Portland, secured contract for electric railway equipment at $200. Pacific Bridge Co., Portland, secured contract for filling at $13,775.

PAVING AND ROADS

PROPOSED WORK.

Woonsocket, R. I.—City Council has appropriated $188,000 for granite paving on several streets, $72,000 for asphalt binder on several streets, and $37,000 for sewers and surface drains. F. A. Mills, City Engineer.

Arcadia, N. Y.—Construction of a 4-mile highway from New York R. R. tracks in Newark to Fairville is contemplated. Address Town Clerk, Rural Delivery, Newark.

Little Falls, N. Y.—Bd. Public Works considering spending about $50,000 for street improvements.

Rochester, N. Y.—City Council voted to pave Raeburn and Burlington Avenues with asphalt, at cost of $45,000.

Watertown, N. Y.—Contract will be let about March 15 for wood block pavt. on 8-in. concrete foundation to cost $30,000. E. W. Sayles, City Engineer.

Bayonne, N. J.—Contract will be let about March 15 by City Clerk for paving eleven streets with asphalt on concrete base; five with asphalt on old macadam foundation, one street with bituminous macadam on old macadam and one street with granite block on concrete. Walter L. Clarkson, City Engineer.

Bordentown, N. J. — James Logan, County Engineer, Mount Holly, is making surveys for improved road from Bordentown toward Yardville; estimated cost $20,000.

Newark, N. J.—Board of Street and Water Commissioners will soon let contracts for following work: Wood block, 13,500 sq. yd., on Broad Street, from South to Poinier Street; 6300 sq. yd. on Commerce Street, from Broad to Lawrence Street; granite block will also be considered on this street. Granite block on following: Mulberry Street, from Market to Center Street, 7500 sq. yd.; River Street, from North Canal to Mulberry Street, 8750 sq. yd.; Front Street, Centre to Saybrook Place, 3200 sq. yd.; South Street, Van Buren to Tyler Street, 2000 sq. yd.; Elm Road, from Tyler to Gotthard Street, 6500 sq. yd.; Tyler Street, from South to Chestnut Street, 4000 sq. yd.: Ogden Street, from Clay to Oriental Street, 9700 sq. yd.; Vanderpool Street, Broad to Avenue R, 6700 sq. yd.

City intends paving with asphalt portions of following streets: Munn and Brokdale Avenues, Mead, Valley, Salem and other streets, in all about 46,000 sq. yds.

Allentown, Pa.—About 3 miles of paving is to be constructed during 1916.. Charles Weirbach, City Engineer.

Ebensburg, Pa.—County Commissioners considering constructing a 12-mile roadway from Ebensburg to Johnstown through state aid; estimated cost $96,000.

Pittsburgh, Pa.—City intends constructing a highway supported by two concrete retaining walls to take the place of the present Spencer Avenue Bridge in Lincoln Avenue section of the city. Concrete work to cost between $10.000 and $16.000. Contract will be let during February. Contract soon to be let for grading, paving and curbing Sprague Street from Spencer to Oakdene Street; estimated to cost $16,000. Robert Swan, Dir. Department Public Works.

Alexandria, Va.—City Council considering spending about $24,000 for street improvements in recently annexed territory.

Buckhannon, W. Va.—Citizens of Buckhannon District, Upshur County, voted $181,000 bonds for constructing roads.

Kingwood, W. Va.—Citizens of Kingwood Dist. voted to issue $164,000 road bonds.

Election to be held Feb. 29 by Lyon District to vote road improvement bonds.

Parkersburg, W. Va.—The City Council voted to pave Seventeenth, Covert, Latrobe Streets.

Washington, N. C.—Road bonds for $50.000 will be sold Feb. 7 by County Commissioners (W. E. Swindell, Chmn.).

Sebring, Fla.—Citizens of city voted $50,000 bonds for improving streets.

Birmingham, Ala.—Board of Commissioners instructed Julian Kendrick, City Engineer, to draw ordinance for paving with standard pavement portions of Twenty-second Street and Fifteenth Avenue at a cost of $10,000.

Canton, Miss.—About $330,000 is to be spent in Madison County for road improvements.

Bardwell, Ky.—Fiscal Court of Carlisle County at Bardwell and Fiscal Court of Ballard County at Wickliffe voted to construct a highway from Wickliffe to Bardwell.

Cheviot, Ohio.—Contract soon to be let by County Commissioners at Cincinnati for improving Harrison Pike with granite in the village of Cheviot; William Boeh, County Engineer, estimate cost at $80,823. Albert Reinhardt, County Clerk.

Chillicothe, Ohio.—Henry M. Redd, City Engineer, instructed to complete plans for paving with either brick, wood block, or crushed limestone about five city squares on Webster Avenue, width of street 22 ft.

Cincinnati, Ohio.—Contract soon to be let by Board Public Service for improving by paving with wood block Reading Road from Mitchell Avenue to Paddock Road; $34,000 bonds have been authorized for this work.

City Engineer Frank S. Krug submitted to Council Feb. 1 approximate estimate of $88,299 as cost of improving Coleraine Avenue, from Hopple Street to Spring Grove Avenue, with granite and water main appurtenances. Bids for work will probably be received within six or eight weeks by Director of Pub. Service. City Engineer Frank S. Krug also submitted an approximate estimate of $15,555 as cost of improving Pearl Street, from Brosdway to Martin Street, with granite and water connections. Contract will be let by Director Public Service Charles F. Hornberger probably in the early spring.

Cleveland, Ohio.—Robert Hoffmann, City Engineering Commissioner, has asked Council to authorize a $225,000 and $275,000 bond issue to defray city's share of the cost of paving and sewer work in 1916.

Newark, Ohio. — See "Sewerage and Sewage Disposal."

Springfield, Ohio.—City Commission reported in favor of paving following streets: East Street, cost $30.000: S. Limestone Street, $92.819; Woodlawn Avenue. $13,771, and Fountain Avenue, $42,981.

West Salem, Ohio.—City Council sold $24,240 bonds for paving Buckeye Street.

Zanesville, Ohio.—It is proposed to pave with reinforced concrete on Woodlawn Avenue about 1952 sq. yd. and on Market Street with brick 11,887 sq. yd.. cost $3.500 and $22,000 respectively. J. S. Dennis, Engineer, Zanesville; C. R. Spencer, City Engineer. Address Director Public Service.

Columbus, Ind.—Lloyd Rogers, County Surveyor, preparing plans for a road to be constructed to county hospital site, including a concrete bridge over Haw Creek; total cost $30,000. Road probably will be tarvia treated.

Elkhart, Ind.—Contract will be let about March 1 for 27,000 sq. yd. asphalt or concrete pavement, estimated to cost $50,000, and about April 1 for 11,000 sq. yd. asphalt or concrete pavement, to cost $24,000. L. M. Russell, City Engineer.

Goshen, Ind.—City contemplates about $100,000 worth of street paving.

Ligonier, Ind.—City intends paving this year costing about $75.000 to $100,000. Material not decided upon. Rossback & McKee, Hamilton, Bank Building, Fort Wayne, Engrs.

South Bend, Ind.—Bd. Public Works is considering constructing about 6 miles of streets during 1916. Michigan and Eddy Streets, Mishawaka and Indiana Avenues are included.

Grand Rapids, Mich.—Street paving bonds amounting to $25.000 will be sold Feb. 7. James Schriver, City Clerk.

Paw Paw, Mich.—Main Street is to be paved. D. P. Smith, City Engineer.

Bloomington, Ill.—The paving of Madison Street with brick on concrete base, about 6222 sq. yd., is contemplated. E. H. Packard, City Engineer.

Champaign, Ill.—Contract soon to be let by Council for brick paving, asphalt filler, to cost $200,000. E. S. Swigart, Mayor; N. Woodward, City Clerk.

Cartersville, Ill. — Township Trustees considering the paving of Division Street through the whole Township, material not decided upon, but may be brick or macadam.

Edwardsville, Ill.—Bd. Local Improvements approved paving of Alton & Springfield Roads; cost about $29,000; and for paving and sewer on Randle Street; cost about $21,000.

Illinois.—Within the next five years Cook County will spend $2,000,000 on good roads, and Vermillion County, within the next three years, $1,500,000.

Kankakee, Ill.—Bd. Local Improvements contemplates paving Maple Street with asphalt; cost $22,000.

Marion, Ill.—City considering paving about 12 miles of streets with brick, including combined curb and gutter and storm sewers. Frank Payne, City Engr.

Mattoon, Ill.—City contemplates paving about 40 blocks this season. J. A. Goetx, City Engineer.

Moline, Ill.—Board Local Improvements authorized paving with asphalt on portions of several streets, including Ninth, Eighth. Eleventh Streets and Seventeenth and Twenty-third Avenues: total cost $134,000. Lyle Payton, City Engr.

Moline, Ill.—Bd. Local Improvements approved plans for paving Fifth, Ninth, Eighteenth and Nineteenth Streets; estimated cost $21,381.

Duluth, Minn.—The City Council voted to pave portions of Superior, First Streets, Grand, Central, Fifth and Nineteenth Avenues.

Eveleth, Minn.—It is proposed to pave with bitulithic or creosoted blocks on Jones Street and McKinley Avenue at a cost of $10,000. C. M. Dorway, City Engineer; C. H. Williams, City Clerk.

Fort Scott, Kan.—It is proposed to construct 8 miles of macadam road between Fort Scott and Redfield. N. J. Rose, County Clerk.

Lawrence, Kan.—About 15,000 sq. yd. of brick paving costing $28,000 will be laid in 1916. E. H. Drummond, City Engineer.

Omaha, Neb.—See "Sewerage and Sewage Disposal."

Fargo, N. D.—City will soon let contract for about 90,000 sq. yd. paving during year 1916. Bids on asphalt, bitulithic, bituminous concrete, Portland cement concrete, vitr. brick and creosoted wood block will be considered. F. L. Anders, City Engineer.

Jonesboro, Ark.—Creating of paving districts embracing six miles of residential streets is under consideration. Concrete is being considered. Address Mayor.

McCrory, Ark.—See "Bids Desired."

Cuero, Tex.—Dewitt County road bonds amounting to $35,000 have been approved by the Attorney General.

Galveston, Tex.—See "Water Works."

Houston, Tex.—Citizens of the county are in favor of building the Turning Basin Road, paving Harrisburg Road and constructing a bridge over Brays Bayou at a cost of $220,000. Address County Commissioners.

Luling, Tex.—Citizens voted to construct road in Independent Road Dist. No. 2.

Orange, Tex.—See "Hydraulic Construction and River Improvements."

Ozona, Tex.—Crockett County Commissioners in favor spending $25,000 for road improvements.

Sweetwater, Tex.—Contract to be let this spring by City Commissioners for paving ten blocks and intersections in the Orient addition. H. C. Hord, Jr., City Engineer.

Lehigh, Okla.—Township No. 6 voted $25,000 bonds for good road improvements.

Denver, Col.—State Highway Commission, Denver, reported considering constructing a road between Idaho Springs and Central City surfaced with local material.

Centralia, Wash.—Contract will soon be let by County Commissioners for paving Pacific Highway west of Centralia to Lewis County Line near Forest.

Everett, Wash.—County Commissioners adopted a plan to construct permanent highways, including about 45 miles of road paved, 45 miles regraded and made ready for surfacing during 1917, and a short stretch north from Edmonds built on the new roadway leading north toward Mukilteo. W. C. Bickford, County Engineer; M. Weatherbee, County Auditor.

Olympia, Wash.—Thurston County Commissioners directed Wm. Yeager, County Engineer, to prepare plans for paving 1½ miles of Pacific Highway from city limits toward Lacey; cost $15,000 per mile. Anna Gaston, County Auditor.

Seattle, Wash.—Estimates of cost for paving Bailey Street submitted to Bd. Public Wks. by City Engineer; cost $36,099.

Plans and specifications submitted by A. H. Dimock, City Engineer, to Bd. Public Wks. as follows; Concrete walks on W. Sixty-fifth Street, cost $25,000; paving Thackeray Place and E. Fiftieth Street, $20.000.

Walla Walla, Wash.—Contract will be let by City Commission about March 1 for 100,000 sq. yd. hard surface pavt. W. R. Rehorn, City Engineer.

Winlock, Wash.—City Council voted to pave First Street; cost $12,000.

Portland, Ore.—Plans being prepared by R. E. Kremers, Chief Bureau of Bridges and Highways of City, for improvements to College Street, from Twelfth to Sixteenth, to include reinforced concrete retaining walls, with roadways on two different levels, viaduct, rock excavation, etc.

Fresno, Cal.—Council adopted resolutions of intention to pave portions of First Street and Kerckhoff Avenue with 2½-in. asphaltic concrete base and 1½-in. warrenite surface; Ventura Avenue and Santa Fe Avenue with 5-in. concrete base and 2-in. bitulithic surface, including curbing culverts, etc. W. H. Ryan, City Clerk.

Hanford, Cal. — County Commissioners will let contract about February for 8 miles of highway between Hanford and Hardwick and for bridges on road between Lemoore and Stratford. E. F. Pickerell, County Clerk.

Los Angeles, Cal.—Board of Supervisors will let contract about March 6 for 5-in. concrete pavement in Road Dist. No. 76, with bituminous wearing surface and expansion joints, on Azusa Avenue, and in Road Dist. No. 63 5-in. concrete pavement, 20 and 30 ft. wide, with bituminous wearing surface, and including grading and concrete culverts on Tenth Street. F. H. Joyner, Highway Engineer.

South Pasadena, Cal.—City Trustees adopted resolution to pave 18 blocks on Fremont Avenue with either asphalt or bitulithic surface on concrete base.

San Diego, Cal.—Board of Supervisors will authorize an election to vote about $400,000 bond issue to repair and replace bridges and road damaged by floods and for new highways. John T. Butler, County Clerk; George Butler, County Engr.

Selma, Cal.—Contract will be let by City Trustees about the middle of February for constructing about one mile of concrete streets to connect ends of state highway.

Visalia, Cal.—Plans being prepared by L. F. McCabe, City Engineer, for 14 blocks of street paving.

Kingman, Ariz.—About $100,000 good road bonds sold by Mohave County.

Phoenix, Ariz.—Contracts will be let in February or March for paving portions of several streets, including Monroe, Washington, Seventh and Jefferson, and in all about 204,539 sq. yd. paving and 98,946 lin. ft. curb, etc, J. B. Girard, City Engineer.

Blackfoot, Idaho.—It is proposed to pave about twenty blocks, including Main, Taylor and other streets, at a cost of $100,000. Address City Clerk.

BIDS DESIRED.

Maine.—Until Feb. 23, by State Highway Commission, Augusta. for constructing 0.64 mile of State highway in Scaraboro and an adjoining section in Saco, 3.48 miles, advertised in Engineering Record. Paul D. Sargent, Ch. Engr. of Commission.

New York, N. Y.—Until Feb. 9 by Marcus M. Marks, Pres. Manhattan Borough, for repaving with wood block light oil treatment and heavy oil treatment on a concrete foundation portions of Chambers Street, together with sidewalks, curbing, receiving basins, sewer manholes, etc. Total security $6,000.

Jersey City, N. J.—Until Feb. 10, by Board City Commissioners, for repairs to asphalt pavement, which are not under guarantee to Nov. 30, 1916. Also for repaving portions of Oakland Avenue with Belgian block.

Clearwater, Fla.—Until Feb. 9, by R. T. Daniel, City Clerk, for grading and paving with vitr. brick on Turner Street, in all about 4600 yd. paving and 4500 ft. concrete curb and gutter. Jos. N. Drew, Engr.

Miami, Fla.—Until Feb. 11, by County Commissioners (Z. T. Merritt, Clerk), for constructing road in special Road and Bridge Dist. No. 2.

Ohio.—Reported desired until Feb. 18 and Feb. 17, by Highway Commissioners, Columbus, for constructing Toledo-Monroe-Detroit highway.

Indiana.—By County Commissioners for constructing road as follows:

Until Feb. 23:

Anderson, concrete road, Anderson Township, Ethan T. Flahavin, Co. Aud.

March 8:

Covington, stone or gravel road in Mill Creek, Van Buren, Troy and Richland Townships. H. W. Newlin, Co. Aud.

Pontiac, Mich.—Until Feb. 7 by Leman A. Cambrey, City Clk., for paving Elizabeth Lake Road, Sect. A, Franklin Road, Williams, Paterson and other streets in all about 33,682 sq. yd.

Creston, Iowa.—Reported desired until Feb. 7, by City Council, for 100,000 sq. yd. paving and 75,000 ft. curbing. Theo. S. De Lay, City Engr.

Fort Madison, Iowa.—Reported desired until March 1, by George C. Anthes, City Clk., for 1½ miles of brick pavement and 1½ miles concrete pavement.

Mason City, Iowa.—Reported desired until Feb. 8 by City Clerk for about 7 miles sheet asphalt pavement and 3 miles of reinforced concrete pavement, in all about 204,000 sq. yd. and about 20 miles cement curbing. S. P. Wilson, City Engineer.

Hibbing, Minn.—Until March 2 by J. Benoe, Town Clerk, for constructing Hibbing-Chisholm Road.

Eldorado, Kan.—Until Feb. 8, by O. C. Allebach, City Clerk, for 30,000 sq. yd. brick or asphalt concrete pavement on Washington and Starr Streets, including 18,000 lin. ft. concrete curb; cost $50,000. F. E. Devlin, Engineer, Newton.

Lyons, Kan.—Reported desired until Feb. 21 by R. S. Turner, City Clk., for about 11,000 yd. brick and concrete pavement.

St. Paul, Minn.—Until Feb. 14, by August Hohenstein, Purchasing Agent, for furnishing crushed granite or trap rock for street repairs, also crushed limestone, during the year 1916.

Mitchell, S. D. — Until Feb. 10 by Thomas Eastcott, City Auditor, for constructing approximately 29,000 sq. yd. concrete, asphalt concrete or wood block pavement, 4200 yd. of brick, 4800 cu. yd. concrete alley pavement and 13,500 lin. ft. curb or gutter.

Davenport, Wash. — Reported desired until Feb. 9, by C. W. Jarvis, Jr., City Clerk, for macadamizing portions of Morgan, Sixth, and Seventh Streets.

South Bend, Wash.—Reported desired until Feb. 9 by County Auditor for clearing, grubbing, draining and grading about 2½ miles of Mill Creek Road and 2½ miles of State Road No. 19.

Hanford, Cal.—Until Feb. 10 by Board County Supervisors (E. F. Pickerell, Clk.) for Hanford to Harwick Road, about 8 miles, in all about 675,578 sq. ft. Topeka or Warrenite surface, on 2½-in. concrete base, etc. Benn Duffield, Highway Engr.

Ventura, Cal.—Until Feb. 14 by County Board Supervisors (J. B. McCloskey, Clk.) for grading and culverts on 2 miles of Ventura-Nordhoff Road, approximately 50,700 cu. yd. excav., 3000 lb. reinforcing steel, 648 ft. 18 to 36-in. corrugated iron pipe, etc.

Wallace, Idaho.—Until Feb. 28, by George W. Walker, City Clerk, for paving portions of Cedar, Bank and River Streets. Bids will be considered on asphalt, 43,825 sq. yd. and 46,297 sq. yd. concrete. D. M. Faires, Engr., box 777, Wallace.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Mount Holly, N. J.**—Reported contract for cleaning roads and applying thereon 100,000 gal. of heavy oil awarded by Board of Freeholders to Manwaring & Cummings, Philadelphia, Pa. James Logan, County Engineer.

★**Newark, N. J.**—Annual flagging contract (bids opened Jan. 20) awarded by Board Street & Water Commissioners to Newark Blue Stone Co., Newark, at $7,095.

★**Centerville, Md.**—Contract for constructing the Crumpton-Millington Road awarded by Queen Anne's County Commissioners to Major Contracting Co., Salisbury, at $11,307.

★**Charleston, W. Va.**—Contract for paving with asphaltic concrete on portions of Kanawha, Hale and other streets awarded as follows: 22,118 sq. yd., to R. M. Hudson, Charleston, at $45,624; 6554 sq. yd., Central Engineering Co., Charleston, $12,908; 5885 sq. yd. Casey Reed Co., Lexington, Ky., $13,616. J. M. Clark, City Engineer.

★**Cincinnati, Ohio.**—Contract awarded Jan. 24 by Board of Control for laying cement sidewalks in District Nos. 1 to 3, inclusive, to Charles Kuhl Artificial Stone Co., Cincinnati, at a total of $17,641; to Billing Artificial Stone Co., Cincinnati, for District No. 4, at $5,750 (bids opened Jan. 19). Frank S. Krug, City Engineer.

★Contract awarded by Board of Control Jan. 24 to Citizens' Road Preserving Co. for street oiling for 1916 and 1917 at 4½ cts. per sq. yd., about 1,120,000 sq. yd. oiled in 1915.

★**Fort Wayne, Ind.**—Following is unit prices of successful bidder, Grace Construction & Supply Co., Fort Wayne, for improving Rudisill Boulevard (bids opened Jan. 17 by Park Commissioners): 17,720 cu. yd. excav., 30 cts.; 8175 lin. ft. 2-ft. concrete curb and gutter, 50 cts.; 10,900 lin. ft 4-in. drain tile, 9 cts.; 920 lin. ft. 12-in. sewer, 80 cts.; 4 inlets, $25.50; 7 catchbasins, $39.50; 450 lin. ft. header plank, 15 cts.; 35 lin. ft. curb and gutter reconstructed, 50 cts.; 27,230 sq. yd. macadam, 84 cts.; total $34,432. Totals of next three lowest: Richard Shafer, Findlay, $35,050; Moellering Construction Co., Fort Wayne, $35,281; McAfee & O'Connor, Fort Wayne, $35,589.

★**Galesburg, Ill.**—J. B. McAuley of Galesburg, awarded contract for paving Pine Street, at $19,992.

★**Ames, Iowa.**—Contract awarded Des Moines Asphalt Co., Des Moines, for about 122,000 yd. of paving at $1.89½ per yd. for patent bitulithic; total $231,190: curbing and guttering, to Akin & Flutter, at 44½ cts. per sq. yd.; total $32,608.

★**Des Moines, Iowa.**—Contract for paving with bitulithic on portion of Fortieth Street awarded James Horrabin & Co., Des Moines, at $1.99 per sq. yd Horace Susong City Clerk

★**Iowa Falls, Iowa.**—Following are unit figures of four bids opened Jan. 12 by H. C. McKean, City Engineer, for asphalt concrete pavement: (a) Ford Paving Co., Cedar Rapids (awarded contract); (b) White Construction Co., Milwaukee, Wis.; (c) Bryant Asphalt Paving Co., Waterloo; (d) Des Moines Asphalt Co., Des Moines:

	*(a)	(b)	(c)	(d)
51,000 sq .yd. asphalt concrete pavement	$1.62	$1.61	$1.64	$1.66
35,000 ft. curb, 6 x 18 ft.	0.33	0.41	0.37	0.38
35,000 ft, curb and gutter	0.45	0.51	0.47	0.50
8,000 yd. excavation	0.40	0.51	0.60	0.52

Duluth, Minn.—Following are lowest bids opened by City Council for paving E. Superior Street: General Contracting Co., asphalt, $44,650; E. A. Dahl, 510 Columbia Building, creosoted blocks, $49,365; D. H. Clough, Fidelity Building, bitulithic, $43,066, and concrete with sandstone surfacing, $38,660; Olson & Johnson, one course concrete, with trap rock surface, $38,220, and concrete, with gravel surface, $36,507.

Laporte, Ind.—Following are unit figures of the four lowest bids opened Jan. 22 by L. Drew Godard, City Engineer, for paving portions of Indiana and Michigan Avenues, about 38,000 sq. yd.: (a) Hodson Davis Co., Gary, $30,629; (b) Commonwealth Improvement Co., Chicago, Ill., $32,765; (c) Western Construction Co., Mishawaka, $37,934; (d) Frank J. King, Laporte, $38,395.

	(a)	(b)	(c)	(d)
Indiana Avenue:				
2,500 sq. ft. 4-in. cement sidewalk	$0.12	$0.12	$0.10	$0.10
200 sq. ft. 6-in. cement crosswalk	0.16	0.19	0.13	0.12
26 6-ft. x 15-in. x ¾-in. gutter plates	8.50	10.50	5.00	5.00
1,500 lin. ft. combined cement curb and gutter	0.52	0.55	0.50	0.42
500 lin. ft. concrete marginal curb	0.22	0.30	0.25	0.25
18 catchbasins	32.00	35.00	30.00	25.00
100 lin. ft. 10-in. catchbasin connections	0.50	0.90	0.40	0.60
100 cu. yd. extra gravel or stone filling	1.25	1.50	0.50	1.00
484 lin. ft. 5-in. x 18-in. concrete curb	0.32	0.35	0.30	0.38
Michigan Avenue:				
2,400 sq. ft. 4-in. cement sidewalk	0.12	0.12	0.10	0.10
200 sq. ft. 6-in. cement crosswalk	0.16	0.19	0.13	0.12
26 6-ft. x 15-in. x ¾-in. crossing plates	8.50	10.50	5.00	5.00
1,200 lin. ft. combined cement curb and gutter	0.52	0.55	0.50	0.50
400 lin. ft. concrete marginal curb	0.22	0.30	0.25	0.25
20 catchbasins	32.00	35.00	30.00	30.00
100 lin. ft. vitr. sewer pipe, including trenching	0.50	0.90	0.40	0.40
100 cu. yd. extra gravel or stone filling	1.25	1.50	0.50	0.50

Following are lowest bids submitted for above work on various kinds of pavement: (a) Veedersburg brick $1.92, Republic creosoted block $2.74, sheet asphalt $1.90; (b) Trinidad Lake asphaltic concrete, $1.68, Trinidad sheet asphalt $1.78; (c) Aztec sheet asphalt $1.62, Standolind sheet asphalt $1.64, Mexican sheet asphalt $1.62, bitulithic on 6-in. concrete found. $1,89, bitulithic on macadam $1.36, on rebuilt waterbound macadam $1.47, asphaltic concrete on 6-in. concrete found. $1.48; (d) reinforced concrete $1.55, Texaca asphaltic on croncrete $1.51, on macadam $1.27.

★**Hutchinson, Kan.**—Following are unit figures of the four lowest bids opened Jan. 25 by G. L. McLane, City Engineer, for paving Fourth Avenue from Walnut to Packsinhouse—(a) Stamey Mackey Construction Co., Hutchinson, $86,364 (awarded contract); (b) Everett & Burt, Hutchinson, $91,143; (c) Beebe Construction Co., Hutchinson, $91,402; (d) A. R. Young, Lawrence, $91,580:

	*(a)	(b)	(c)	(d)
33,950 sq. yd. 3-in. brick pavement, asphalt filter	$1.65	$1.7775	$1.715	$1.70
6,000 cu. yd. excavation and grading, Walnut to C., R. I. & P. Ry.	0.35	0.35	0.35	0.38
10,850 lin. ft. street railway paving, 7 ft. wide, 2½ in. brick, asphalt filler	2.00	1.98	2.20	2.25
3,640 sq. yd. 2½-in. brick, monolithic highway type, cement cushion and filler	1.52	1.70	1.65	1.60
5,375 sq. yd. excavating, grading, etc., C., R. I. & P. Ry. to Chemical	0.05	0.046	0.06	0.08
3,640 sq. yd. excavating, grading, etc., Chemical to Halstead	0.05	0.046	0.06	0.08
145 lin. ft. steam railway pavement, 8 ft. wide, 3-in. brick, asphalt filler	2.50	2.90	2.30	2.60
200 lin. ft. 20-in. concrete drain	1.00	1.00	1.64	1.25

★The successful bidder for the curbing, etc., in connection with above work is Beebe Construction Co., Hutchinson, at the following bid: 17,240 lin. ft. curb and gutter, 61 cts.; 2320 lin. ft. 3-ft. gutter, 48 cts.; 200 lin. ft. curb, 25 cts.; 150 sq. yd. concrete alley pavement, including excavation, $1.40; 600 lin. ft. 12-in. tile or concrete pipe, incased, etc., 47 cts.; 85 concrete catchbasins, $16.50; 1 reinforced concrete culvert, complete, $115; total $12,864.

Duluth, Minn.—Lowest bid opened by city for paving Superior Street, from Sixteenth to Twenty-third Avenue E. with asphalt, with granite headers along street railway tracks, submitted by E. A. Dahl, Duluth, at $47,559. Lyonel Ayres, City Engr.

★**Concordia, Kan.** — Contract awarded Watts & Amerman for paving 7 blocks with concrete asphalt on Ninth and Olive Streets. C. B. Tynan, City Clerk.

★**Kansas City, Mo.**—Reported City Park Commissioners awarded contract for grading, paving and curbing Union Station Park awarded to Spiteaufsky Bros., Twenty-sixth and Grand Avenues, Kansas City, at $67,000.

★**Little Rock, Ark.**—Contract awarded Shelby & Bateman, Little Rock, for paving with asphalt 10½ blocks on Park and Wright Avenues at $27,000.

★**Batesville, Tex.**—Contract for constructing Southern National Highway through Zavala County, beginning at Nueces River and extending through Batesville to west line of Frio County, awarded to Bexar Constr. Co., San Antonio.

★**Paris, Tex.**—Contract for 7000 sq. yd. pavement awarded Texas Bitulithic Co., Dallas, at $17,710, for bitulithic. R. G. Tyler, City Engineer.

★**Washington.**—Following are four lowest bids opened Jan. 24 by State Highway Commissioner, Olympia, for constructing three state roads in Eastern Washington:
★Central Washington Highway: Mitchell Bros., Spokane, $31,961 (awarded contract); Newport Land & Construction Co., Herminston, $32,641; General Construction Co., Spokane, $41,292; Carbon Chindahl Co., Spokane, $32,860.
★McClellan Pass Highway, Enumclaw Summit, Sloan Bros., Seattle (awarded contract); Torger Peterson, Eatonville, $49,981; George A. Banderey, Bryn Mawr, $51,528; Graff & Sheldon, Tacoma, $53,380.
★Sunset Highway, Kittitas County, Cle Elium Easton Road: (this contract includes construction of four concrete bridges) Herrold & Burdsall, Portland, $22,895 (awarded contract); Illinois Steel Bridge Co., Spokane, $24,100; Skagit Construction Co., Mount Vernon, $26,659; Charles G. Huber, Seattle, $25,734.

★**Portland, Ore.**—Contract for paving Bybee Street with bitulithic awarded Oregon Independent Paving Co., Portland, at $9,181.

★**Los Angeles, Cal.**—Contract awarded James L. Frazer, Long Beach, for 2.69 miles of road in Road District No. 56 at $15,900.

San Diego, Cal.—Following are four lowest bids opened recently for decomposed granite paving, cement curb and walls on Chatsworth Boulevard and Capistrano Street: Olaf Nelson, $17,012; A. N. Parker, $17,998; G. R. Daley, $18,468, and Hyde Construction Co., $18,790; all of San Diego.

STREET CLEANING AND GARBAGE DISPOSAL

PROPOSED WORK.

Springfield, Mass.—Fred H. Clark, Supt. Department of Street and Engineering is reported in favor a rubbish incinerating plant costing $15,000.

BIDS DESIRED.

Ashland, Ohio.—Reported desired until Feb. 18 by William A. Mason, Mayor, for collection and disposal of garbage from March 1, 1916, to March 1, 1917.

Fresno, Cal.—Reported desired until Feb. 21, by W. H. Ryan, City Clerk, for disposal of garbage for a period of 20 years.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**New York, N. Y.**—Board of Estimate has authorized Commissioner Fetherston to enter into a contract with Gaffney, Gahagan & Van Etten for disposal of city garbage for a period of five years, beginning Jan. 2, 1917, at a plant to be constructed by contractors, on city property on Rikers Island. The plant will be purchased by city in 1922 for $1,500,000. The Board also approved the issue of $1,500,000 in corporate stock for the purchase of the disposal plant in 1922.

★**Glen Ridge, N. J.**—Borough Council has entered into a contract with Decarie Incinerator Co., Minneapolis, Minn., to erect a garbage incineration plant in the south end of the borough at a cost of $12,300.

★**Wichita, Kan.**—Contract for disposing of dead animals awarded R. A. Bransom of Wichita. He will erect a desecrating plant costing between $5,000 and $10,000.

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS

PROPOSED WORK.

River Improvement, Etc.—Fall River, Mass.—The Committee representing the riparian owners has submitted a report for the consideration of the General Court recommending that three commissioners be appointed to have plans prepared for sewers and Quequechan River improvements, to be submitted for approval to the Board of Aldermen, and that two issues of bonds, $500,000 for sewers and $250,000 for improvements to the river shall be authorized.

State Canal Bonds—Albany, N. Y.—The $25,000,000 state bonds have been sold by State Treasurer.

Dam—Birmingham, Ala.—The DeBardeleben Coal & Coke Company, it is reported, contemplates constructing a lock and dam at Sanders' shoals in Warrior River, five miles above Cordova. Cost $100,000.

Drainage—New Orleans, La.—Sewerage and Water Board has approved plans for extension of drainage station No. 3 at Marigny and London Avenues. This work is known as Contract 76-D.

Wharf, Etc.—New Orleans, La.—Board of Port Commissioners (Ernest M. Loeb, Pres.) rejected all bids opened Jan. 5 for constructing Dumaine Street creosoted wharf and reinforced concrete causeway with creosoted wood block roadway; also separate bids for piling, lumber, etc., for said wharf. J. Devereaux O'Reilly, Engr.

Flood Protection Wall—Indianapolis, Ind.—City plans constructing a flood protection wall on the east bank of the White River, from Maryland Street to a point near City Hospital, a distance of about 2½ miles. B. J. T. Jeup, City Engineer.

Drainage—Marion, Ill.—Construction of the Saline Special Drainage District No. 1, costing about $75,000, is under consideration. Fowler & Duty, Attorneys, Marion.

Ditch—Grand Rapids, Minn.—Contract soon to be let for constructing County Ditch No. 4 to be 17½ miles long and cost $36,000. Address Co. Comrs. County Ditch No. 3 is to be constructed this spring. It will be 40 miles long and cost $104,000. Contract soon be let for constructing Judicial Ditch No. 2, estimated to cost $63,761.

Dock Bonds—Minneapolis, Minn.—Sale of $100,000 river terminal bonds for building docks and wharves has been recommended by the special county committee.

Dam—Pillager, Minn.—Cuyuna Range Power Company will install a 2000 hp. dam at Pillager to double capacity of plant.

Hydro-Electric Plant—Rochester, Minn.—Citizens Jan. 25 voted $360,000 bonds for constructing hydro-electric plant near Zumbro Falls. A. T. Wright, City Clerk.

Levee, Etc. — St. Paul, Minn. — The Budget of 1916 contains $50,000 for dock and levee purposes, and Commissioner of Public Utilities is planning a survey of the river traffic possibilities in the near future.

Drainage — Bellevue, Kan. — Surveys being made for channel for Lost and Welch Creeks and relief channel for Vermillion River. Plans and estimates completed by Feb. 15. V. R. Parkhurst, Engineer, Topeka; F. E. Hooper, Secy., Bellevue Drainage Dist.

Drainage — Wichita, Kan. — H. B. Walker, State Drainage Engineer, has recommended the digging of three canals to drain the Big Slough west of Wichita, instead of one long 30-mile canal. Over 11,000 acres of land will be redeemed. Plans will be drawn soon, according to recommendation of the State Engineer.

Retaining Walls—Kansas City, Mo.—Fire & Water Board authorized expenditure of $17,000 for retaining walls for Turkey Creek pumping station basins to increase the storage capacity of those basins.

Wharves and Dock Bonds—Orange, Tex.—Bonds for improvements have been sold as follows: $150,000 for wharves and docks; $150,000 for schools, and $25,000 for paving.

Dock Improvement—Seattle, Wash.—Arthur L. Loveless, Colman Building, engaged to prepare plans for reconstructing the Colman Dock for the Colman Dock Co. Cost, $40,000.

Irrigation—Fresno, Cal.—Frank Johnson and Charles King, both of Hanford, reported interested in the project to construct a $6,000,000 reservoir system and dams at Pine Flats to impound water from Kings River.

Irrigation—Madera, Cal.—It is reported to form an irrigation district and will construct concrete dam 100 ft. high across San Joaquim River and main canals for irrigating district. W. S. Orvis, Secy. Madera County Irrigation Bureau, Madera.

Irrigation—Madera, Cal.—City Trustees and others are interested in the forming of an irrigation district and have applied to State Water Commission for permission to divert 5000 second feet of water from San Joaquin River.

Weir—Sacramento, Cal.—Board of Army Engineers at Washington, D. C., has approved the city's plan for constructing a weir above Sacramento on Sacramento River to divert the flood waters of the river away from the city. City will spend $500,000 for the project.

Flood Control Work—San Bernardino, Cal.—County of San Bernardino and cities of Colton and San Bernardino are considering forming a drainage district to construct works to control flood waters from Lytle Creek. J. A. Sourwine, County Engineer, San Bernardino.

Wharf — San Diego, Cal. — Hercules Powder Co., Wilmington, Del., has applied to U. S. Engineer's Office at Los Angeles for permission to construct a wharf, 220 x 100 ft. in the bay. The company also intends erecting a plant to extract chemicals from kelp.

Pier—San Francisco, Cal.—State Advisory Board, Sacramento, has received plans from San Francisco for reconstruction of Pier No. 13 at foot of Vallejo Street into a modern pier.

Wharf — Santa Monica, Cal. — Santa Monica Land Company has applied for franchise to construct a 650-ft. wharf.

Irrigation—Lindsay, Cal.—S. E. Kieffer 67 Post Street, San Francisco, is engineer for irrigation system to be constructed by Lindsay-Strathmore Irrigation Dist. Probable cost $600,000.

Irrigation—Mesa, Ark.—Reported Grand Prairie Canal Co. incorporated by L. T. Mountz of Mesa and will immediately construct a 28-mile irrigation canal to provide water from White River to develop the rice growing industry. A pumping station will be installed on White River.

BIDS DESIRED.

Dredging — Hartford, Conn. — Until March 6 by U. S. Engineer's Office, New London, for maintenance dredging in Connecticut River below Hartford, advertised in Engineering Record.

State Canal Work—Albany, N. Y.—Until Feb. 29, by W. W. Wotherspoon, State Superintendent of Public Works, Albany, for Contract 47-A, completing construction of canal from southeast corner of town of Galen to New York Central RR. crossing at Lyons, length 14.46 miles. Engineer's estimate $1,038,469.

Pier—Brooklyn, N. Y.—Until Feb. 9, by R. A. C. Smith, Comr. of Docks, New York City, for Contract 1494, furnishing material and constructing pier with appurtenances near W. Eighth Street, Dreamland Park, Brooklyn Borough. Security $20,600.

Freight Shed—New York, N. Y.—Until Feb. 11 by R. A. C. Smith, Comr. of Docks, for Contract 1488—Furnishing material and erecting freight shed with appurtenances on the pier at foot of W. Forty-sixth Street, North River, Borough Manhattan. Security required for Classes 1 and 2, $200,000; for Class 3, $6,000, and Class 4, $700.

Dredging—New York, N. Y.—Until Feb. 10 by U. S. Engineer's Office, Room 802, Army Building, New York, N. Y., for dredging in Raritan River, South River and Raritan Bay, N. J., advertised in Engineering Record.

Dredging—New York, N. Y.—Until Feb. 29 (readvertisement) by U. S. Engineer's Office, Room 802, Army Building, 39 Whitehall Street, New York, for dredging in Newark Bay and Passaic River, N. J., advertised Engineering Record.

Piers—Philadelphia, Pa.—Until Feb. 14 by Pennsylvania Railroad (A. C. Shand, Ch. Engr.) for Contract No. 10, alterations to pier 46 and cutting off corners of bulkhead shed between piers 46 and 48. This work is appurtenant to South Philadelphia track elevation.

Dock—Chicago, Ill. — Until Feb. 8, by Department Public Works (W. R. Moorehouse, Comr.), for reconstructing about 388.6 ft. of dock, Slip A, at Twenty-second Street pumping station.

Drainage—Guthrie Center, Iowa.—Until Feb. 12 by County Board Supervisors on Guthrie County Drainage Dist. No. 9, for furnishing and laying following: 11,275 ft. 20 to 38-in. double strength vitr. drain tile, and 21,725 ft. 6 to 12-in. hard burned drain tile; also 9550 lin. ft. 14 to 18-in. vitr. drain tile. L. T. Truax, Co. Aud.

Ditch — Bemidji, Minn.—Reported desired until Feb. 16 for Judicial Ditch No. 35, 9.24 miles long, in all about 28,062 cu. yd. excav.; probable cost $7,884. J. L. George, Co. Aud.

Ditch—Grand Rapids, Minn.—Reported desired until Feb. 10, by Frank Sherman, Co. Aud., for constructing County Ditch No. 4. Probable cost, $36,200. Also for County Ditch No. 5, estimated cost $35,000.

Tile—Marshall, Minn.—Until Feb. 14, by E. S. Shepherd, County Auditor, on 32,621 ft. 5 to 12-in. tile, deepest cut, 10.3 average on main 5 ft., average haul four miles, cost $7,794.

Ditches—Wheaton, Minn.—Until Feb. 8, by County Auditor, for constructing following ditches: Ditch No. 37, about 60,000 cu. yd., lateral No. 1, 5 to 8 ft. deep, 4 to 6 ft. bottom, about 2½ miles long; main ditch about 4 miles long, 4 to 6 ft. bottom, 3 to 6 ft. deep; work to be done by dry land machine beginning at the outlet.

Ditches—McCrory, Ark.—Until Feb. 15 by County Commissioners at the Bank of McCrory for constructing ditches and drains for Bayou De View Drainage Dist. No. 1, of Cross, Jackson and Woodruff Counties, to include removal of approximately 2,000,000 yd. and digging one main ditch and six lateral ditches. R. J. Kibler, Chmn. Drainage Comrs.; Burr, Stewart & Burr, Attorneys, Paragould. Bonds amounting to $220,000 for this work will be sold Feb. 16. Newsom Engr. Co., Engrs., Wynne, Ark.

PRICES AND LETTINGS.

★*Indicates award of contract.*

State Canal Work—Albany, N. Y.—Following are lowest bids opened Feb. 1 by W. W. Wotherspoon, State Superintendent Public Works, for state canal work:
Contract 21A—Engineer's estimate $416,700; lowest bidder Walsh Construction Company, Davenport, Iowa, $384,928.
Contract 29A—Engineer's estimate $162,005; F. H. Wells, Corfu, $158,056.
Terminal Contract 51—Engineer's estimate, $6,379; Fred. H. Rhody, Albion, $5,325.

★**Dredging—Philadelphia, Pa.**—Contract for dredging the Delaware River on Bellevue, Cherry Island and Deep Water Point lighthouse ranges awarded Home Dredging Company, Mobile, Ala., at $246,726.

★**Steel for Dam—Wheeling, W. Va.**—Contract for furnishing 300 tons of fabricated steel for constructing gate at Dam No. 14, Ohio River, at Woodland, awarded by U. S. Engineer's Office, Wheeling, to Indiana Bridge Co.

★**Hydroelectric Plant—Kingsport, Tenn.**—Southwestern Engineer Company of Bristol, awarded contract for erecting and equipping the hydroelectric power plant for the Federal Dyestuff & Chemical Company to operate the extensive dye works here; estimated cost $250,000.

★**Drainage — Carrollton, Ill.** — Contract awarded Fulton Iron Wks., St. Louis, Mo., for installing engine and fittings in Eldred Drainage & Levee Dist. at $12,700, and to Farrar Pump & Machine Co., St. Louis, contract for installing pump and fittings in the district at $2,060.

Ditch — Montevideo, Minn. — Contracts for constructing county ditch No. 16 (bids opened Jan. 25) awarded by County Commissioners as follows: Open work to Ewing & Brokinbrough, Chicago, Ill., at $51,383, and for tile work to William B. Bosworth, Ada, at $23,876.

★**Barge—Dallas, Tex.**—The bid of J. J. Kane, Galveston, at $9,960, for constructing steel barge has been recommended for award (bids opened Jan. 27, by U. S. Engineer's Office, Dallas).

★**Irrigation—Oakdale, Cal.**—Contracts in connection with the Oakdale Irrigation District awarded as follows: Driving Cape Hall tunnel, 7000 ft. in length, awarded James Willison, Modesto, at $56,787; also contract for extensions to Cometa lateral, the Leitch lateral and the Yourn lateral, and for concrete work; L. W. Hoskins of Turlock, contract for extensions to Swede lateral, Adams lateral, S-1-a lateral and 5-1-b lateral; J. D. Nimon, Turlock extension to west pump lateral. Total cost will be about $75,000.

★**Drainage—Tempe, Ariz.**—Contract for constructing drainage system south of Tempe awarded Watson & Spicer of Los Angeles, at approximately $45,000. They bid 15 cts. per yd. for excavation and $14 per cu. yd. for concrete work. Other bidders (a) excavation per yd (b) price per cu. yd. concrete: W. E. Callahan of Omaha, Neb. (a), 13 cts., (b) $17.95; McWilliams Co. of El Paso, (a) 13,98 cts., (b) $19. Proposed ditch will be about 8 miles in length to drain Dist. No. 1, recently created south of Tempe. Estimated amount of excavation, 223,000 cu. yds.; concrete work, 1000 cu. yds.

★**Irrigation — Tucson, Ariz.** — Contract reported awarded W. H. Rosecrans Engineering Company, Chicago, Ill., for system of irrigation flumes and ditches; probable cost $300,000.

ELECTRIC RAILWAYS

PROPOSED WORK.

Providence, R. I.—Work will soon begin by Rhode Island Co. on repairing line on Cranston Street. New and heavier rails will be laid from city line to School Street. Plans being made to double track line on Randall Street from Charles Street to N. Main Street next spring.

Fairmont, W. Va.—Plans being made by Monongahela Valley Traction Co. to construct 4-mile loop in East side, Fairmont.

Cleveland, Ohio.—Power Dept. of Cleveland Ry. contemplates spending $507,840 for improvements.

Columbiana, Ohio.—The Chamber of Commerce of Columbiana considering constructing an electric line from Columbiana to East Palestine.

Youngstown, Ohio. — Youngstown & Suburban Ry. Co. incorporated to construct a line from Youngstown to Leetonia. Capital $10,000. Among incorporators are John T. Harrington and James P. Wilson.

Gary, Ind.—Plans being considered by Gary & Interurban Ry. Co. to construct 2-mile extehsion to Gary Tin Mills.

Harrisburg, Ill.—Southern Illinois Ry. & Power Co. plans to build sixty miles of track to connect Harrisburg with Marion, Johnson City, Herrin and Benton.

Milwaukee, Wis.—Work will begin in spring on constructing electric railway from Milwaukee, Sussex, Pewaukee, Waukesha, Neosho, Hustisford, Juneau, Beaver Dam and Fox Lake. Alvin P. Kletzsch, Milwaukee, Pres.

Sheboygan, Wis.—Green Bay & Eastern Ry. Company (A. C. Lingelback, Mgr.) engaged Western Engineering & Construction Company of Milwaukee to survey the proposed interurban line between Green Bay and Sheboygan via Manitowoc.

Hutchinson, Kan.—Kutchinson Interurban Ry. Co. contemplates rebuilding and constructing addition to line.

Lawrence, Kan.—K. D. Klema, President Kansas City, Kaw Valley & Western Interurban Company has applied for a franchise through Lawrence to extend his line through to Topeka.

Mexico, Mo.—Reported plans being considered by Mexico Investment & Constr. Co. to construct extensions into Callaway and Monroe Counties in the spring.

Corpus Christi, Tex.—J. H. Cassell and associates propose constructing an interurban line to Island, 8 miles west.

Corpus Christi, Tex.—Corpus Christi Traction Co. is to construct an electric railway from Corpus Christi to Ward Island, 8 miles.

San Angelo, Tex.—Election soon to be held to vote on granting a franchise to Interstate Electric Company, New York.

Martinez, Cal.—Martinez & Concord Interurban Ry. Co. incorporated to construct a line from Martinez to Concord, 7 miles. Capital $200,000. Among incorporators: Clifford McClellan and I. H. Steffan, San Francisco; J. A. Olson, Alameda.

Martinez, Cal.—Martinez & Concord Interurban Ry. Co. incorporated with a capital of $200,000, and will construct a line between Martinez and Concord, seven miles. J. A. Olson of Alameda, Irving Peterson and G. F. Peterson, Berkeley, and others incorporators.

Montreal, Que.—Vercheres, Chambley & Laprairie Tramways Co. applied to Quebec Legislature for a charter. Capital $500,000. Among incorporators are James W. Domville, Rosemere; Alfred Colas, Longueuil and Douglas W. Ogilvie.

BIDS DESIRED.

New York, N. Y.—Bids to be opened Feb. 10 for constructing tracks on White Plains Road extension of the Lenox Avenue branch of the first subway are a readvertisement of bids opened Nov. 23, contract for which was reported awarded December. The two lowest bids opened Nov. 23 were Coast Lakes Contracting Co. at $53,930 and South Eastern Construction & Engineering Cor., 43 Exchange Place, $101,206,

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**San Francisco, Cal.**—Contract awarded Western Motor Draying Co., 351 Noe Street, at $57,455, for constructing the Church Street Municipal Ry. from Sixteenth to Eighteenth and from Twenty-second to Thirtieth Streets, and John Spargo, 240 Montgomery Street, secured contract for furnishing trolley poles, at $6,590.

★**Pearl Harbor, Hawaii.** — Contract awarded Spaulding Construction Co., San Francisco, Cal., for constructing marine railway at Pearl Harbor at $95,275.

RAILROADS

PROPOSED WORK.

Dallas, Tex.—Missouri, Kansas & Texas R.R. Co. (L. F. Lonnbladh, Ch. Engr., Dallas) will make extensive improvements, including extensions to 1744 miles in state of roadbed, ballasting, concrete bridges, new equipment, etc.

California. — Reported State Railroad Commission, Sacramento, will soon take steps to eliminate all dangerous railroad crossings.

Roseburg, Ore.—Railroad bonds for $100,000 reported to be sold March 6, by R. L. Whipple, City Recorder.

Los Angeles, Cal.—Huensme, Malibu & Southern Ry. incorporated with Frederick H. Rindge, M. K. Rindge and others for the purpose of constructing a railroad, either steam or electric, through Malibu Ranch, owned by Rindge Estate, Trust & Savings Building. Approximate length 65 miles.

PUBLIC BUILDINGS AND SCHOOLS

PROPOSED WORK.

Amherst, Mass.—A gift of $250,000 has been given to Amherst College for new library.

Woonsocket, R. I.—City Council has appropriated $40,000 for erecting an 8-room school on High Street. Dr. W. F. Barry, Chmn. School Board.

New Haven, Conn.—Contract soon to be let for erecting several buildings for the New Haven Orphan Asylum costing $100,000.

New York State.—Following bills have been read once in Assembly: Construction in city of New York of a state public office building, cost of site and buildings $1,600,000; normal and training school in Bath, cost $300,000 for site and buildings; state normal school in New Paltz, cost $125,000, including site and buildings; addition to Twenty-third Regiment armory in Brooklyn, cost $160,000 for site and building.

White Plains, N. Y.—Board of Supervisors selected site on new Cochran Farm for new County Alms House Buildings and appropriated $700,000 for same.

Morristown, N. J.—Plans approved for proposed high school; appropriation $243,000. Address Board of Education.

Ridgewood, N. J.—Citizens voted $225,000 bonds to build and equip new high school. Address Board of Education.

Trenton, N. J.—City intends erecting a $160,000 library.

Erie, Pa.—See "Miscellaneous," "Prices and Lettings."

Newfield, Pa.—Sum of $50,000 has been bequeathed to town for school purposes; a $25,000 school is to be erected at once to be known as General Warren Edgerton School.

Philadelphia, Pa.—No contracts will be let before May or July on buildings to be erected this year at Carson College for Girls on Chestnut Hill which will include cottages and garage, two stories high and fireproof. Albert Kelsey, Archt., 1530 Chestnut Street.

Rockville, Md.—Georgetown University, Washington, D. C., intends erecting a preparatory school near Rockville. Marsh & Peter. Archts., 520 Thirteenth Street, N. W., Washington, D. C.

Grundy, Va.—Milburn, Heister & Company, Washington, D. C., engaged by Board of Supervisors to prepare plans and specifications for the new court house, with fireproof floors, steam heat, etc. Plans expected to be completed March 1.

Middlebourne, W. Va.—Tyler County Court Commissioners engaged S. W. Ford of Clarksburg to prepare plans for County Infirmary; cost $20,000.

Wheeling, W. Va. — School bonds amounting $85,000 sold by Board of Education, Richland District.

Greenville, S. C.—Citizens voted $75,000 bonds for school improvements. Address School Board.

Rome, Ga.—Election to be held Feb. 29 to vote $40,000 bonds for completing and equipping Municipal Building. Address City Clerk.

Tifton, Ga.—City Council passed resolution to spend $30,000 for erecting and equipping new high school on present site.

Panama City, Fla.—School bonds for $20,000 will be sold March 6, by Board Bond Trustees (M. A. Coleman, Chmn.).

Mobile, Ala.—Citizens Jan. 18 voted $150,000 bonds for school improvements in the country. Richard Hines, Jr., Secy. Board School Com.

Mansfield, La.—Election to be held Feb. 14 to vote on erecting brick high school, two stories, costing $55,000, with equipment. E. F. Weld, Shreveport, Archt.; G. O. Houston, Secy. School Board.

Gulfport, Miss.—Plans being prepared for rebuilding Harrison County Courthouse recently destroyed by fire. Address County Clerk.

Jackson, Miss.—Governor-elect Bilbo in his inaugural message to Legislature will recommend an appropriation of $100,000 for preservation and repair of old capitol building.

Yazoo City, Miss.—School bonds amounting to $45,000 sold. Address City Clerk.

Owensboro, Ky.—Council decided to remodel present city hall at cost of about $25,000.

Braceville, Ohio.—School bonds for $25,000 will be sold Feb. 5 by Board of Education (R. C. Hatfield, Clerk).

Chillicothe, Ohio.—Trustees of the Six County District Hospital to be erected here, engaged Frank L. Packard of Columbus to prepare plans for the hospital, to cost $35,000.

Citizens of Green Township, Jan. 26, voted $33,000 bonds to erect a centralized school this spring.

Plans submitted to Ross County Memorial Building Committee for the $75,000 armory and memorial building to be erected this spring. Bonds have been sold.

Cincinnati, Ohio.—County Commissioners, June 28, authorized bond issue of $300,000 for improvement to Longview Hospital for Insane. This sum is to be used for new dormitories, chiefly for women. Albert Reinhardt, Clk.

Fremont, Ohio.—Warren Sabin, 1900 Euclid Avenue, Cleveland, engaged to prepare plans for the $100,000 Memorial Hospital.

Lakewood, Ohio—C. W. Hopkinson, 900 Rose Building, Cleveland, is architect for high school to be erected on Warren Road to cost $300,000 and the other a grade school to be erected on Jackson Avenue and cost $100,000.

School bonds for $100,000 will be sold Feb. 22 by P. T. Harrold, Clk. Board Education.

Lockland, Ohio.—School bonds for $60,000 will be sold Feb. 16 by Board Education Reading School Dist. No. 1 (L. F. Mohr, Clk.).

Nevada, Ohio.—Howard & Merriam, 8 East Broad Street, Columbus, engaged to prepare plans for $40,000 school.

Tippecanoe City, Ohio.—Citizens voted $80,000 bonds for erecting two-story and basement school. Address Board of Education.

Toledo, Ohio.—County Commissioners taking steps toward improving Children's Home for which $35,000 bonds were voted last fall.

Indianapolis, Ind.—Tuberculosis hospital bonds amounting to $80,000, and Orphan Home bonds amounting to $60,000 will be sold March 14 by Leo K. Ferler, County Auditor.

Detroit, Mich.—Erection of four additional stories to county buildings costing about $600,000 contemplated. William Gutman, Chairman Board of Auditors.

Board of Education approved erection of 16 new schools, a $450,000 annex to Cass Technical High School and purchase of additional school sites, at cost of $570,000.

Fremont, Mich.—Edgar M. Wood of Alma engaged to prepare plans for proposed addition to school. E. H. Babcock, Supt. School Board.

Lakeview, Mich.—Citizens voted $25,000 bonds for a grade and high school. Address School Board.

Danville, Ill.—Board of Supervisors approved plans prepared by L. F. W. Stuebe of Danville, for three-story, 70 x 40 ft. cell house; cost about $20,000.

Kenney, Ill.—A High School to cost about $40,000 contemplated here. Address School Board.

Watertown, Wis.—High School bonds amounting $100,000 bonds reported sold. Address Board of Education.

Des Moines, Iowa.—Election to be held March 13 to vote $353,000 school bonds. Address School Board.

Sloan, Iowa.—Plans being prepared by Beuttler & Arnold, Security Building, Sioux City, for consolidated school for which citizens recently voted $56 000 bonds.

Duluth, Minn.—Contract soon to be let for erecting the school in Morgan Park, plans about completed by Kelly & Williams, First Natl. Bank Bldg. Charles B. Bronson, Clk. Board Education.

Perham, Minn.—Citizens considering the erection of an addition to present high school at a cost of $25,000 or the erection of an entire new building.

Red Wing, Minn.—Bell & Bentley, 310 Security Building, Minneapolis, engaged to prepare plans for proposed high and grade school to be two-story, semi-fireproof and of brick and concrete construction; cost $130,000. Andrew Lindgren, Clerk Board Education.

Neodesha, Kan.—Election soon to be held to vote on erecting a high school.

Topeka, Kan.—Board of Education engaged Thomas W. Williamson & Company of Topeka to prepare plans for a fireproof 3-story grade school to be erected at Fifth and Madison Streets and cost $100,000. P. W. Griggs, Chairman Building Committee.

Winfield, Kan.—Citizens voted $77,000 school bonds. It is proposed to erect a $65,000 school. J. M. Fuller, Winfield, Archt. Earl M. Hartley, Clk. Board Education.

Columbus, Neb.—Erection of $100,000 court house for Platte County contemplated. Address Board of Supervisors.

David City, Neb.—Contract will be let in February or March for erecting brick and stone school. R. A. Bradley & Company, Archts., Hastings. H. O. Schaaf, Secy. Board Education.

Lincoln, Neb.—Contract will be let in about two weeks by University of Nebraska for erecting an agricultural and engineering building, fireproof, steel frame, three stories. Coolidge & Hodgdon, Archts., 134 S. La Salle Street, Chicago, Ill. Address Superintendent.

Mandan, N. D.—Election to be held in February to vote $25,000 bonds to erect high school. Address Board of Education.

Clayton, Mo.—School Board sold $125,000 bonds for a new high school.

Kansas City, Mo.—Fred C. Gunn, Republic Building, is architect for the nurses' home, 4 stories, which is to be erected by the city at a cost of about $80,000. Address I. O. Jenkins, Secy. Hospital Board.

Cold Springs, Tex.—Citizens of San Jacinto County voted $58,000 bonds to erect new court house here. Address County Clerk.

Denton, Tex.—Plans being prepared for Brackenridge Hall to be erected for College of Industrial Arts; appropriation $140,000.

Fort Worth, Tex.—Election contemplated to vote $100,000 bonds for erecting school in Washington Heights. Address Board of Education.

Lipscomb, Tex.—Contract will be let some time during April for erecting the 2-story brick and concrete fireproof court house to cost $35,000. W. M. Rice, Archt., Amarillo; W. N. Sewell, County Judge; P. O. Boyd, County Clerk.

Orange, Tex.—See "Hydraulic Construction and River Improvements."

San Antonio, Tex.—Citizens Jan. 25 voted in favor of $800,000 bonds for erecting high school and other school improvements. Paul H. Scholz, Business Agent.

Drumwright, Okla. — School bonds amounting to $80,000 have been voted.

Denver, Colo.—Plans completed for $150,000 for children's hospital to be erected in the spring at Nineteenth Avenue and Downing Street.

Walla Walla, Wash.—See "Bids Desired."

Bakersfield, Cal.—Board of Supervisors Feb. 11 will sell $75,000 Bakersfield high school bonds and $45,000 Wasco high school bonds.

Modesto, Cal.—Stone & Wright, Modesto, selected to prepare plans for the high school, and De Remer & Hewitt, 624 Title Insurance Building, Los Angeles, for the $60,000 grammar school. Election will be held to vote bonds on both projects.

San Francisco, Cal.—Board of Health approved plans for new $30,000 Central Emergency Hospital.

Montpelier, Idaho.—Steps being taken to call an election to vote $25,000 bonds for erecting city hall. Address City Clerk.

BIDS DESIRED.

Montpelier, Vt.—Reported desired until Feb. 18, by State Auditor, State House, for erecting 3-story and basement 60 x 80 ft. with wing 65 x 80 ft., concrete and brick library. Probable cost $130,000. Densmore & Le Clear, Archts., 88 Broad Street, Boston, Mass.

Lynn, Mass.—Reported desired until Feb. 15 from local architects competitive sketches by George A. Cornet, Supt. Pub. Bldgs., for library.

Westfield, Mass.—Until Feb. 12 by Malcom B. Harding, Archt., Columbus Building, for furnishing material and erecting a grade school at White Street and White Avenue. Separate bids for heating, plumbing, electric wiring, etc.

Baldwin, L. I., N. Y.—Until Feb. 15 by F. D. Smith, Secy. Board Education, for furnishing material and erecting school No. 3. Probable cost $40,000. Separate bids for heating, plumbing and electrical work. Tooker & Marsh, 101 Park Avenue, New York City, Archts.

New York, N. Y.—See "Hydraulic and River Improvements."

Rochester, N. Y.—Until Feb. 21 by Board Education (J. S. Mullen, Secy.) for erecting school on Post and Congress Avenues to be known as Lewis H. Morgan's School No. 37. Edwin S. Gordon, Archt.

Berwyn, Pa.—Until Feb. 24 for erecting school for St. Monica's Church. Ralph E. White, Archt., Penna. Building, Philadelphia.

Bethlehem, Pa.—Until March 7 by James A. Wetmore, Acting Supervising Archt., Treasury Dept., Washington, D. C., for construction complete, including mechanical equipment and approaches U. S. Post Office at South Bethlehem.

Mahanoy City, Pa.—Reported desired until Feb. 15 (extension of date), by Board of Education, for erecting the school. Clyde Adams, Archt., 1509 Arch St., Philadelphia.

Rydal, Pa.—Reported desired until Feb. 7, by Trustee Ogontz, school for Young Girls, for erecting 3-story brick and stone 236 x 45 ft., with two wings 45 x 223 ft. and 45 x 112 ft school. Horace Trumbauer, Archt., Land Title Bldg., Philadelphia.

Slatington, Pa.—Until Feb. 21 by J. W. Snyder, Supervising Principal, for erecting a 2-story and basement high school, brick and stone, costing, including equipment, about $56,000. E. Z. Scholl, Archt., Reading.

Industrial, W. Va.—Until March 1, by State Board Control (J. S. Lakin, Pres.), Charleston, for furnishing material and erecting brick, fireproof school, 130 x 48 ft., chapel room 32 x 60 ft., at West Virginia Industrial Home for Girls. H. Rus Warne, Archt., Charleston, W. Va.

Martinsburg, W. Va.—Until Feb. 29, by James A. Wetmore, Acting Supervising Archt., Washington, D. C., for alterations to U. S. Postoffice and Courthouse at Martinsburg.

Clarksville, Tenn.—Until Feb. 24, by A. J. Smith, Supt. of Schools, for erecting a two-story addition to the school to cost $30,000. J. W. Gaddis, Archt., Vincennes, Ind.

Krotz Springs, La.—Reported desired until Feb. 21 by C. J. Thompson, Supt. Public Schools of St. Landry Parish, for erecting 2-story brick school. T. G. Chachere, Archt., Opelousas.

Olmstead Falls, Ohio. — Until Feb. 28, by R. F. Gallagher, Clerk Board Education, for erecting fireproof school on Dutch Road. Separate bids for fireproofing and concrete work; steel and iron work; carpentry; plumbing; electric wiring, etc. W. H. Nicklas. Archt., 608 the 1900 Euclid Building, Cleveland.

Westville, Ohio.—Until Feb. 26 by Board Education Mad River Township Rural School Dist. Campaign County, for furnishing material and erecting to present grade and high school. Separate bids desired on heating, ventilating, sewerage, etc. F. S. Rusk and Cree Sheets, Archts., 145 N. High Street, Columbus.

Brazil, Ind.—Reported desired until Feb. 21 by Dr. A. T. Spear, Secy. Board Education, for erecting 2-story and basement high school 148 x 120 ft.. Archts., Johnson & Miller, 105 S. Seventh Street, Terre Haute.

Miami, Ind.—Until Feb. 19, by J. D. Havens, Trus. Deer Creek Township, for erecting brick school.

Rochester, Ind.—Reported desired until Feb. 18 for erecting 2-story and basement 60 x 73-ft. high school. Probable cost $25,000. Freyermuth & Mauer, 9 Warner Building, South Bend, Archts.

Winchester, Ind.—Until Feb. 11, for erecting a brick 10 to 15 room L shape school in Stoney Creek Township. Sam'l G. Bartel, Farmland, Archt. Thos. E. Dickson, Township Trus.

Highland Park, Mich.—Reported desired until Feb. 10, by C. S. Pitkin, Secy. Board Education, for erecting high school. W. D. Butterfield, Archt., 1113-15 David Whitney Bldg., Detroit.

Laingsburg, Mich. — Reported desired until Feb. 14, by W. H. Hunt, Secy. Board Education, for wrecking, remodeling and additions to high school. T. E. White, Archt., 312 City National Bank Bldg., Lansing.

St. Charles, Ill.—Until Feb. 23 by Board of Administration (Frank D. Whipp, Fiscal Supervisor, Springfield) for erecting employers' building at St. Charles School for Boys. Separate bids for heating, plumbing and electric wiring. Jas. B. Dibelka, State Archt., 130 N. Fifth Street, Chicago.

Antigo, Wis.—Until March 14, by James A. Wetmore, Acting Supervising Archt., Treas. Dept., Washington, D. C., for construction complete, including mechanical equipment and approaches, of U. S. Postoffice at Antigo.

Oshkosh, Wis.—Until March 1 by Board of Regents of Normal School, at Madison (William Kittle, Secy.), for furnishing material and erecting 3-story and basement building for State Normal School. Separate bids for plumbing, heating, ventilating, etc. Van Ryn & De Gelleke, Archts., 726 Caswell Block, Milwaukee.

Ellsworth, Iowa.—Reported desired until Feb. 25 by Board Education for erecting 2-story and basement 50 x 70-ft. high school. J. W. Bradford, Archt.. 618 First National Bank Building, Ft. Dodge, Iowa.

Fort Dodge, Iowa.—Plans reported desired until Feb. 10 by J. L. Hanrahan, Co. Aud., for 3-story and basement county home. Probable cost $50,000.

Oneida, Iowa.—Until Feb. 29, by Harry E. Netcott, Archt., Independence, for erecting a two-story, 70 x 50 ft. school.

St. Paul, Minn.—Until Feb. 14, by August Hohenstein, General Purchasing Agent, for furnishing material and erecting Carnegie Library No. 1 at St. Anthony Park.

New Richland, Minn.—Until Feb. 10 (change of date from Feb. 7), by Board Education (C. A. Newgard, Secy.), for erecting high school. Separate bids for heating, ventilating, etc. Kinney & Buckley, Archts., 1003 Plymouth Bldg., Minneapolis.

Great Bend, Kan.—Reported desired until Feb. 16 by Board Education (Joseph McMullin, Chmn. Bldg. Cum.) for erecting 1-story and high basement 76 x 142-ft. brick school. Probable cost $25,000. Owen & Payson, Achts., 713 Scarritt Building, Kansas City, Mo., Archts.

Quenemo, Kan.—Reported desired until Feb. 16 by Board of Education (C. H. Crum, Clk.) for erecting 2-story and basement 68 x 86-ft. brick school. Probable cost $21,000. Thomas W. Williamson & Co., Archts., Central Nation Bank Building, Topeka.

Kalispell, Mont.—Until March 10 by James A. Wetmore, Acting Supervising Archt., Treasury Dept., Washington, D. C., for erecting post office at Kalispell.

Beaumont, Tex.—Reported desired until Feb. 12 by Wharf & Dock Commissioners for constructing three steel sheds. O. A. Stewart, Resident Engr.

Reported desired until Feb. 14 by R. J. Barry, Co. Aud., for erecting story brick and concrete jail annex building. Babin & Beck, Archts, 15-17 Blanchette Bldg.

Oklahoma City, Okla.—Until March 13, by Jas. A. Wetmore, Acting Supervising Archt., Treas. Dept., Washington, D. C., for extensions, remodeling, etc., U. S. Post Office and court house at Oklahoma City.

Springer, N. M.—Reported desired until Feb. 14 by Board Trustees, New Mexico Reform School, for erecting school. Rapp & Rapp, Archts., Santa Fé.

Walla Walla, Wash.—Until Feb. 15 by Board of Education (N. Higgins, Pres.), for erecting a high school, cost $139,000, and also a grade school, cost $61,000. Citizens voted $200.000 bonds for these schools. Osterman & Seibert, Archts., Walla Walla. Bonds will be sold Feb. 10.

Lordsburg, Cal.—Reported desired until Feb. 7, by Walter E. Dailey, City Clerk, for erecting a two-story brick building for the Fire Department. Paul F. Higgs, Archt., Pomona.

Los Angeles, Cal.—Until Feb. 18, by Public Library Bd. (E. R. Perry, Clk.), for erecting a one-story and basement brick and hollow tile branch library at Twenty-sixth Avenue and Workman Street; $35,000 available. Lester H. Hibbard, Archt., Marsh Strong Bldg.

Leupp, Ariz.—Until Feb. 21 by Cato Sells, Commissioner Indian Affairs, Washington, D. C., for erecting stone dormitory addition to Leupp school, Ariz.

Prescott, Ariz.—Until Feb. 21 by R. T. Belcher, Clerk Board Superv., for wrecking old county court house and either wrecking or moving county jail.

Boise, Idaho.—Reported desired until Feb. 15 by County Commissioners, Stephen Utter, Clerk, for erecting 2-story county hospital. Tourtellotte & Hummell, Archts., Boise.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**East Hartford, Conn.** — Contract awarded on revised plans to Lewis A. Miller, Meriden, for erecting high school at $70,490; heating and ventilating to Liby & Blinn, Hartford, at $12,190.

★**Little Falls, N. Y.**—Contract awarded George B. Wills, Inc., 101 Park Avenue, New York, for erecting high school at approximately $104,000, and for plumbing and heating to John F. Leary Company, Little Falls, at approximately $12,000. William Neil Smith, Archt., 101 Park Avenue, New York; M. A. Leahy, City Clerk.

★**Yonkers, N. Y.**—Following are lowest bids opened Jan. 28 by State Board Armory Commissioners, Albany, for erecting armory at North Broadway and Quincy Place: general construction, Kelly Construction Company, 45 Warburton Ave., $93,000; plumbing, P. F. Kenny, Yonkers, $5.800; heating, A. B. Barr & Co., 6 River St., $5,100; electrical work, Isidor Fajans, 122 E. 25th St., New York.

★**Marcus Hook, Pa.**—Contract awarded J. Harry Richardson, Marcus Hook, for erecting school at Eighth and Market Streets (bids opened Jan. 31), at $33,400. F. Barlow, Secy. School Dist.

★**Titusville, Pa.**—Contract for erecting U. S. Post Office awarded Westchester Engineering Company, White Plains, N. Y., at $54,470.

Shelby, N. C.—Following are four lowest bids opened Jan. 26, by Supervising Architect, Washington. for erecting U. S. Post Office at Shelby; (a) limestone, (b) sandstone: Chandler & Campbell, Chattanooga, Tenn., (a) $47,600; R. V. Richardson, Hampton, Va., (a) $48.732, (b) $49,490; George W. Stiles Construction Company, Rookery Building, Chicago, Ill., (a) $48,353; Algernon Blair, Montgomery, Ala., (b) $50.600; W. F. Brent, Norfolk, Va., (b) $52,442; Thomas W. Cissel, Wooster, Ohio, (a) $48,000, (b) $50,000.

Key West, Fla.—Lowest bid opened Jan. 31 by Supervising Architect, Washington, D. C., for erecting surgeon's and attendants' quarters and morgue for U. S. Marine Hospital at Key West submitted by M. L. Holladay, Greensboro, N. C., at $22,120.

★**St. Petersburg, Fla.**—Contract for erecting U. S. Post Office awarded M. L. Hollady, Greensboro, N. C., at $89,717.

Ashland, Ky.—Following are four lowest bids opened Jan. 22, by Supervising Architect, Washington, D. C., for erecting U. S. Post Office; (a) limestone, (b) sandstone: Colonial Construction & Supply Company, Charlottesville, Va., (a) $63,197; G. W. Stiles Construction Company, Rookery Building, Chicago, Ill., (a) $62,320; Mettler Gloyd Company, Cleveland, Ohio, (a) $61,600, (b) $63,100; R. S. Moore, Lafayette, Ind., (b) $63,817; Frank L. Johnson & Company, Duluth, Minn., (a) $59,346; R. P. Farnsworth & Company, Owensboro, Ky., (a) $59,200, (b) $63,000.

★**Salem, Ohio.**—Contract for erecting a $75,000 hospital awarded A. M. Allen Company, 1900 Euclid Avenue, Cleveland.

★**Bloomington, Ind.** — Contracts for erecting the gymnasium at the Univ. of Indiana awarded as follows: General contract, A. E. Kemmer, Lafayette; electric work, Sanborn Electric Company, Indianapolis; vacuum cleaning system, Atwood Vacuum Cleaner Company, Chicago, Ill.; plumbing, Lane Pyke Company, Lafayette; heating, W. H. Johnson & Sons Company, Indianapolis. R. P. Daggett & Company, Lemcke Annex, Indianapolis.

★**Brookston, Ind.**—Contract for erecting two-story high school (bids opened Jan. 22) awarded by Edgar M. Ferguson, School Trustee, to Leslie Colvin, Anderson, Ind.

★**Springfield, Ill.**—Contracts for erecting High School awarded by Board of Education as follows: General construction, Boeke Construction Company, Chicago, $232,000; heating and ventilating, Peters-Eighler Heating Company, St. Louis, Mo., $67,735; electrical work, F. H. Cbeyne Company, Indianapolis, Ind., $9,380.

Washington, Iowa.—Following are four lowest bids opened Jan. 28 by Supervising Architect, Washington, D. C., for constructing U. S. Post Office: (a) limestone, (b) sandstone: George W. Stiles Co., Chicago, Ill., (a) $46,500, (b) $48,700; Frank L. Johnson & Co., Duluth, Minn., (a) $46,997; Balkan Construction Co., Chicago, Ill., (a) $47,997; Charles Weitz Sons, Des Moines, Iowa, (a) $47.841, (b) $49,317; Thomas W. Cissel, Wooster, Ohio, (b) $51.400; Northern Construction Co., Milwaukee, Wis., (b) $51,228.

★**Fairmont, Minn.**—Contract for erecting children's home, power house and barn (bids opened Jan. 25) awarded Madsen Bros., 737 Plymouth Bldg., Minneapolis.

Ellensburg, Wash.—Following are four lowest bids opened Jan. 27, by Supervising Architect, Washington, D. C., for erecting U. S. Post Office; (a) limestone, (b) sandstone: Thomas E. Young & Company, Seattle, Wash., (a) $55,843. (b) $53,915: Welch Bros., Hannaman, Oakland Cal., (a) $58.307, (b) $57,874; Stebinger Bros., Portland, Ore., (a) $58,400, (b) $57,400; John Wsilin, Tacoma, Wash., (a) $59,182, (b) $58,182.

★**Berkeley, Cal.**—Contracts for erecting University Library awarded as follows: General contract to J. D. Hannah, $194,733; granite work, Raymond Granite Company, $86,600; elevators, Otis Elevator Company, $7,485; and bookstacks, F. W. Wentworth Company, $84,069. Bidders of San Francisco. R. G. Sproul, Asst. Comptroller University of California.

★**Cavite, P. I.**—Contract awarded Construction Engineering Company, 1047 Folsom Street, San Francisco, Cal., for constructing buildings at Cavite Radio Station at $42,800.

PRIVATE BUILDINGS

PROPOSED WORK.

Springfield, Mass.—Clifford A. Tinker of Springfield, is architect for hotel which the Cohasset Hotel Company contemplates erecting on Dwight and Worthington Streets; probably nine stories high and cost about $200,000.

Providence, R. I.—Calvary Episcopal Church plans erecting a $75,000 stone church. Clark & Howe, Architects, Turks Head Building.

Bridgeport, Conn.—North and South Congregational Churches have consolidated, and it is reported will erect a $200,000 edifice.

Hartford, Conn.—Y. W. C. Assoc. are planning erecting a $250.000 building.

T. R. Fox & Sons, 283 Sheldon Street, will erect an apartment house costing $75,000 at Sigourney and Ashley Streets, according to plans by George H. Mathews, 48 Camfield Avenue.

Albany, N. Y.—Odd Fellows will rebuild lodge building recently destroyed by fire. Edwin W, Sanford, President Board Trustees.

Brooklyn, N. Y. — Erection of $50,000 edifice contemplated in the spring for Congregational Church of the Evangel, Bedford Avenue and Hawthorne Street. Rev. Albert E. Rorsback, Pastor.

Plans filed for erecting following buildings: Two 4-story brick tenements at Tenth Avenue and Fiftieth Street for Nathan Lampert, total cost $80,000, Goldner & Goldberg, Archts., 391 East 149th Street, New York; 4-story brick store and tenement at Marcy Avenue and Division Avenue for Ross Land Co., cost $60,000. Shampan & Shampan, Archts., 772 Broadway, Brooklyn.

Gowanda, N. Y.—Relief Lodge. No. 511, I. O. O. F., contemplates erecting new brick building on Jamestown St.

Lockport, N. Y.—Erection of $30,000 edifice contemplated for East Avenue Congregational Church. Rev. George A. Brock, Pastor.

New York, N. Y.—Plans filed for erecting following buildings: 9-story fireproof apartment at 108 Eighty-second Street for East 82d St. Corporation, cost $225,000, Schwarz & Gross, Archts., 347 Fifth Avenue; 6-story store and office building at 4 East Forty-third St. for 4 East 43rd St. Company, cost $50,000, Andrew J. Thomas, Archt., 2526 Webster Avenue; 6-story fireproof convent at 112 East Eighty-sixth Street for Society of the Helpers of the Holy Souls of New York City, cost $100,000, Maginnis & Walsh, Archts., 30 East Forty-second Street; two 5-story brick tenements at Wilkins Avenue and Crotona Park East for Kleban Leader Co., total cost $135,000, Goldner & Goldberg, Archts., 391 East 149th Street; two 5-story brick tenements at Intervale Avenue and 165th Street for Absar Realty Co., total cost $125,000, Kreymborg Architectural Co., Archts., 1029 East 163d Street; 5-story brick dormitory at University Avenue and Kingsbridge Road for Hebrew Infant Asylum, cost $60,000, Edward Necarsulmer, Archt., 507 Fifth Avenue.

Plans being prepared by Starrett & Van Vleck, Everett Building, for four-story power building to be erected on Pearl and Water Streets for New York Steam Co.; cost $500,000.

Rochester, N. Y.—Frank G. Frey, 45 Randolf Street, is architect for four-story hotel to be erected on Clinton Avenue North for Dr. L. K. Mezger; estimated cost $50,000.

Newark, N. J.—Plans being prepared by Fred Pierson, 162 Bloomfield Avenue, Bloomfield, for four-story tenement to be erected on Hawthorne Avenue for Charles Selvage, Union National Bank Building; cost about $60,000.

Altoona, Pa.—Sacred Heart R. C. Church plans erecting an $80,000 edifice. Rev. Matthew S. Smith, Rector.

Harrisburg, Pa.—St. Mary's Croation Catholic Church contemplates erecting $30.000 edifice. Rev. Father Anthony Zuvich, Pastor.

Philadelphia, Pa.—Italian Roman Catholic Church contemplates erecting edifice on East Haines and Morton Streets, Germantown; cost about $25,000. Rev. P. Montiani, Pastor.

Plans being prepared by Frank E. Hahn, 1112 Chestnut Street, for four-story, 24 x 120 ft. business building to be erected at Fifteenth and Walnut Streets, for A. S. Marks; cost about $50,000.

Woodlawn, Pa.—Plans being prepared by Carlisle & Sharrer, Jenkins Arcade Building, Pittsburgh, for a 60-stall brick stable to be erected for Paul Moore; cost about $35,000.

Baltimore, Md.—Ernest Roberts, Calvert and Fidelity Streets, is reported interested in company being formed to rebuild the Blue Mountain House at a cost of $150,000.

Plans being prepared by George R. Callis, Knickerbocker Building, for a two and a half story residence for Mary Kennedy; estimated cost $35,000.

Washington, D. C.—Milburn Heister & Company. Union Savings Bank Building, engaged to prepare plans and specifications for a new department store for Lansburgh & Bro.

Clarksburg, W. Va.—Monongahela Valley Traction Co. (S. B. Miller, Ch. Engr., Fairmont) contemplates erecting this summer a 4-story reinforced concrete building on present site at Fourth Street and Glen Elk Ridge.

Wheeling, W. Va.—Reported Baltimore & Ohio Railroad Company (F. L. Stuart, Ch. Engr., Baltimore, Md.), will spend $25,000 for improving station.

Atlanta, Ga.—Lucian L. Knight, 476 N. Jackson Street, plans erecting apartment house on Highland and Ponce de Leon Avenues; probable cost $76,000.

Tifton, Ga.—Erection of $30,000 bank building on Main Street for Bank of Tifton under consideration.

Akron, Ohio.—Fred Harpster of Akron is architect for three additional stories to Ohio Building, costing $110,000, to be leased to Akron City Club.

Avondale, Ohio.—St. Andrews Roman Catholic Church will erect $100,000 edifice on Reading Road.

Cleveland, Ohio.—George B. Post & Son, 101 Park Avenue, New York, are architects for the proposed hotel to be erected on site of the old Forest City House. Homer H. Johnson, Attorney, reported interested.

George F. Hammond, 4220 Prospect Avenue, contemplated plans for the $200,000 addition to the Gillsy Hotel.

Plans being prepared by George Rutherford Company, 2160 East Eighteenth Street, for a 6-story warehouse for Lincoln Fireprof Storage Company to be erected at West Seventy-eighth Street and Detroit Avenue. Cost $40,000.

Reported Abeyton Realty Co., 213 Rockefeller Building, reported considering erecting a 16-story addition to Rockefeller Building to cost $1,000,000.

Hubbell & Benes, 4600 Euclid Avenue, are architects for two-story brick and sandstone and terra cotta Fairmont Exchange planned by Cleveland (Bell) Telephone Co. at Cedar Avenue and Edgewood Road; cost with equipment $500,000.

Columbus, O.—Plans being prepared by Marriott, Allen & Hall, 20 East Broad St., for addition to Plymouth Congregational Church on West Fourth Ave.; cost about $40,000.

Struthers, Ohio.—Contract soon to be let by Trustees of Slovak Church for erecting parochial school in Washington Street; cost about $50,000.

Westerville, Ohio.—Plans for $100,000 edifice under consideration for Methodist Episcopal Church. Rev. Jonathan B. Hawks, Pastor.

Youngstown, Ohio. — St. Stanislaus Kostka Roman Catholic Polish Church on South Avenue contemplates erecting $75,000 edifice. Rev. Francia Szydzik, Pastor.

Mishawaka, Ind.—Mishawaka Trust & Savings Co. (M. W. Mix, President) will rebuild bank building recently destroyed by fire.

Rochester, Ind. — Methodists propose erecting a $28,000 edifice at Jefferson and Seventh Streets. Rev. A. S. Warriner, Pastor.

South Bend, Ind.—Two additional stories costing about $150,000 will be erected to Oliver Hotel.

Terre Haue, Ind.—Young Men's Inst. reported considering erecting a club house at Eighth and Eagle Streets.

Detroit, Mich.—Detroit Golf Club, Palmer Park, plans erecting new clubhouse to cost about $100,000. Malcolm McGregor, Secretary and Treasurer.

Ionia, Mich.—Odd Fellows contemplate erecting lodge building to cost about $30,000.

Champaign, Ill.—Cecil S. Baker, Michigan Boulevard Building, Chicago, engaged to prepare plans for $45,000 edifice to be erected on Mathews Avenue for Congregational Church.

Urbana, Ill.—Plans of Cecil F. Baker. 30 N. Michigan Avenue, Chicago, Ill., accepted for the $45,000 Congregational Church to be erected adjacent to University of Illinois.

Plans being prepared for an Odd Fellows Building to cost $40,000. W. H. Lee, Urbana, Chmn. Bldg. Committee.

The Methodists propose erecting this spring a social center building costing $100,000. G. E. McGammon, Executive Secretary, Urbana.

Stevens Point, Wis.—Elka Lodge contemplates erecting $30,000 club house.

Fort Dodge, Iowa.—Preliminary plans prepared by E. O. Damon of Fort Dodge, for seven-story, fireproof building to be erected on Central Avenue for Prusia Hardware Company.

Ottumwa, Iowa. — Charles Dafferner, proprietor of McElroy Hotel, plans erecting three-story brick hotel on Second and Washington Streets; cost approximately $25,000.

Duluth, Minn. — J. J. Wangenstein, Providence Building, is architect for two-story office building to be erected at Superior and Twenty-first Avenues West; estimated cost $50,000. F. I. Slater Co. is agent for owner.

St. Paul, Minn.—Sulzer Bread Company of Chicago, Ill., intends erecting a bread plant at Curfew and University Avenues cost $25,000. Address Haynes Broad Company, St. Paul.

Murphy Transfer Co., 186 East Eighth Street, will erect in spring first unit, to consist of four stories and cost $50,000, of proposed $100,000 twelve-story office, warehouse and garage building on Broadway and Tenth Street.

Fargo, N. D.—Building Committee appointed by Pontoppidian Lutheran Church to have plans prepared for a $25,000 edifice.

Mandan, N. D.—St. Joseph R. C. Church intends erecting a $25,000 convent.

Presbyterians propose erecting a $40,000 church.

Bozeman, Mont.—Plans being prepared for two-story, brick combination store and hotel block for R. S. Dawes of Bozeman; cost $60,000.

St. Louis, Mo.—Erection of $150,000 Y. M. C. A. Building contemplated. David D. Jones, Secretary.

Beaumont, Tex.—A three-story addition costing $40,000 is to be erected to First Baptist Church on Pearl Street. Rev. George B. Butler, Pastor.

Dallas, Tex.—Studebaker Corporation intends erecting an assembly plant here to cost $150,000.

Galveston, Tex.—Reported K. G. Jorgensen, 1813 Twenty-fifth Street, intends erecting a $65,000 bath house and "Joy Palace," including swimming pool, free pavilion steel viaduct across boulevard, etc. Building to be four stories high. Contract for pile driving and foundation awarded Spence & Howe Construction Company of Port Arthur.

San Marcos, Tex.—Baptist Church taking steps to erect $50,000 edifice.

Guthrie, Okla. — Masons contemplate erecting four-story addition to cost about $35,000.

Oklahoma City, Okla.—Carhart Motor Company, 218 West First Street, contemplates erecting $50,000 building.

Gearhart, Ore. — Reported Gearhart Hotel Company will rebuild Gearhart Hotel recently destroyed by fire; cost $100,000.

Fresno, Cal.—Plans being prepared for a building for First National Bank to be at least 6 stories high and erected at Mariposa and I Streets.

Los Angeles, Cal.—Torrance, Marshall & Co., Fourth and Main Streets, propose erecting at Main, Spring and Eighth Streets a 14-story hotel, costing $1,000,000, to be operated by A. Fred Way of Salt Lake City.

Plans completed by Morgan, Walls & Morgan, Van Nuys Building, for a five-story and basement reinforced concrete garage sales room and service building, 100 x 150 ft., at Eleventh and Hope Streets, for N. H. Newmark.

San Francisco, Cal.—Plans prepared by engineering department of the Great Western Power Company for a steel frame and reinforced-concrete walls and floor for building for the distributing station to be erected on Bush Street and Grand Avenue; estimated to cost $100,000.

BIDS DESIRED.

Bridgeton, N. J.—Reported desired until Feb. 7, for erecting two-story stone edifice for Wessley Memorial Methodist Church. Geo. E. Savage, Archt., Witherspoon Bldg., Philadelphia.

Camden, N. J.—Until Feb. 9, by Peuckert & Wunder, Archts. and Engrs., 310 Chestnut Street, Philadelphia, Pa., for one and two-story brick, steel and concrete warehouse to be erected at 23 N. Second Street, for Crane Co.

Evansville, Ind.—Reported desired until Feb. 15 by Gilbert Co., Archt., 305 Furniture Exchange Building, for erecting motion picture theater for American Amusement Co.; probable cost $75,000.

West Frankfort, Ill.—Reported desired until Feb. 15 by West Frankfort Medical and Relief Assoc. for erecting 2-story hospital. Probable cost $30,000. H. R. Temple, Archt., Champaign.

Des Moines, Iowa.—Reported desired until Feb. 20 for erecting 2-story and basement 76 x 130 ft. church for Highland Park Presbyterian Congregation. Probable cost $35,000. F. A. Harris, 211 Crocker Bldg., Archt.

Sioux City, Ia.—Reported desired until Feb. 8, by Beuttler & Arnold, Archts., 609-10 Security Bldg., for erecting 5-story and basement brick and stone 100 x 100 ft. warehouse for Tackaberry Allen Realty Co., 205 Pearl St. Probable cost $150,000.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**New York, N. Y.**—Contract awarded B. Aronson, 32 Union Square, for erecting one-story synagogue at 22 West 114th St. for Congregation Kel Israel Anshe Poland, 20 Forsyth St.; cost about $75,000. Sommerfeld & Steckler, Archts., 31 Union Square.

★**Bayonne, N. J.**—Contract awarded by New York Telephone Company to E. E. Paul Company, 101 Park Avenue, New York, at $35,240, for erecting two-story and basement fireproof building at Broadway and Twenty-ninth Street.

★**Allentown, Pa.**—Contract awarded W. A. Stein & Brothers of Allentown, for erecting $100,000 addition to Y. M. C. A. Building. Ruhe & Lange, Archts., Allentown.

★**Elkins Park, Pa.**—Contract for erecting three-story, hollow tile and plaster apartment house awarded James B. Flounders, 1329 Arch St., Philadelphia; cost $48,000.

★**Philadelphia, Pa.**—Contract awarded Spect & Sperry, Heed Building, for erecting residence and garage on Martin & Hartwell Aves.; cost $27,000.

★**Scottdale, Pa.**—Contract for erecting United Brethern Church awarded J. E. Myers of Penn Station at $53,000.

★**Williamsport, Pa.** — Contract for erecting new bank building for West Branch National Bank awarded Samuel Larrivee of Williamsport; cost about $200,000.

★**Brookville, Pa.**—Contract for erecting Y. M. C. A. Building awarded Ray H. Richards, South Pickering Street, at $39,000.

★**Baltimore, Md.**—Contract awarded J. Henry Miller, Inc., Baltimore, exclusive of structural steel and foundation for the Lexington Street building for Public Service Building Co., at $800,000. Parker, Thomas & Rice, Archts., Union Trust Building.

★**Nashville, Tenn.**—Contract for erecting five-story, reinforced-concrete, limestone and granite bank building for Fourth and First National Bank awarded Foster & Creighton Company of Nashville; total cost about $230,000.

★**Jackson, Ky.** — Contract reported awarded by Louisville & Nashville Railway Co. to J. D. Fitzgibbons, Chemical Building, St. Louis, Mo., to erect $25,000 depot here.

★**Toledo, Ohio.**—Contract for erecting ten-story fireproof Waldorf Hotel on Summit Street awarded H. J. Spieker Co., 409 Michigan Street, and plumbing to Eagan Brothers, 237 Erie Street; total cost about $250,000.

★**Albion, Mich.**—Contract awarded by R. A. Leroy, Architect of Kalamazoo, to O. J. Reniger of Marshall, for erecting bank building for Commercial Savings Bank; cost $40,000.

★**Lansing, Mich.**—Contract for erecting bank and office building for Lansing State Savings Bank (bids opened Jan. 15), awarded Rockman Construction Company, Owosso. S. D. Butterworth, Archt., Lansing.

★**Springfield, Ill.**—Charles W. Black, 1825 S. Fourth Street, secured contract to erect a three-story stone and brick building for the Boston Store; cost $40,000.

★**Cresco, Iowa.**—Contract for erecting Roman Catholic Church awarded Parkinson & Company, Iowa City, at $34,660. Next three bidders: Osage & Amler, St. Paul, Minn., $35,766; A. Zwack, $35,877; Zitterell & Sullivan, Webster City, $36,684. Rev. J. P. Wagoner, Pastor.

★**Mankato, Minn.**—Contract awarded J. B. Nelsen Construction Company of Mankato, for rebuilding Mankato Commercial College recently destroyed by fire; cost about $70,000. H. C. Gerlach, Archt., Mankato.

★**Grand Forks, N. D.**—Contract awarded by Rev. J. A. Lemieux, pastor, for erecting parochial school (bids opened Jan. 24) to Dinnie Bros., Grand Forks, at $24,497, and for heating, ventilating and plumbing to Spriggs Bros. at $9,889.

NEW INDUSTRIAL PLANTS

PROPOSED WORK.

New Haven, Conn.—Mysto Manufacturing Co., 57 Foote Street, plans erecting addition to plant in Cedar Hill district; cost about $100,000.

Brooklyn, N. Y.—F. A. Koch & Co., 524 Broadway, New York, will erect $50,000 plant on East Thirty-fifth Street and Avenue J.

Utica, N. Y.—Avalon Knitwear Company, 700 Broad Street, contemplates erecting four-story fireproof addition to plant.

Hoboken, N. J.—Reported Delaware, Lackawanna & Western Railroad Company (G. J. Ray, Ch. Engr., Hoboken), approved plans for new ferry house on Fourteenth Street, and boiler, machine and carpenter shops; also extension of piers; cost about $500,000.

Watsessing (P. O. Bloomfield), N. J.—Preliminary plans prepared by Westinghouse, Church, Kerr & Co., 37 Wall Street, New York, for addition to plant of Westinghouse Lamp Works. Erection of four-story building also contemplated.

Mauch Chunk, Pa.—Reported Mauch Chunk Iron Works recently destroyed by fire will be rebuilt.

Meadville, Pa.—Reported Bronze Metal Company will erect $80,000 addition to plant.

Philadelphia, Pa.—Philadelphia Tapestry Mills, Allegheny Avenue and Front Street, will erect new plant at East Tioga and C Streets.

Wilkes-Barre, Pa.—Reported Duplan Silk Company of Hazleton, intends erecting silk mill on North Pennsylvania Ave.

Sisterville, W. Va.—Reported Caldwell Chemical Company of Evansville, Ind., contemplates erecting new plant near Sisterville; cost about $100,000.

St. Pauls, N. C.—St. Pauls Cotton Mill Co. contemplates enlarging plant at cost of $65,000.

Clover, S. C. — Reported Hawthorne Spinning Mills incorporated to build a cotton yarn mill. M. L. Smith of Clover interested.

Greenland, Fla.—M. C. Greeley, Baldwin Building, Jacksonville, engaged to prepare plans for $50,000 factory for Greenland Town & Improvement Company.

Alexander City, Ala.—Russell Manufacturing Company will build an addition and install 2000 spindles.

Montgomery, Ala. — Reported Hobbie Brothers of Montgomery, will erect a grain elevator here at a cost of $200,000.

New Orleans, La.—Reported New Orleans Steel & Iron Company, Inc., 610 Audubon Building, plans erecting rolling mill of 1500 tons capacity.

Memphis, Tenn.—Directors of Business Men's Club, 79 Monroe Ave., have instructed Cotton Mill Committee to proceed with plans for $500,000 cotton mill.

Dayton, O.—Dayton Metal Products Company, Taylor St., plans erecting one-story, steel and concrete addition to cost aproximately $75,000.

Youngstown, Ohio. — Carnegie Steel Company will erect 210 by-product coke ovens at McDonald Works, in addition to ten bar mills, for which $5,000,000 has been appropriated.

Kokomo, Ind.—Superior Machine Tool Co. intends erecting an addition to the plant costing $50,000.

Highland Park (P. O. Detroit), Mich.—Reported Ford Motor Company will spend $10,000,000 in enlarging plant here.

Madison, Wis.—Plans being prepared for two-story, 100 x 180 ft. fireproof factory to replace plant of French Battery & Carbon Company, recently destroyed by fire.

St. Paul, Minn.—George B. Wray Sanitary Supply Company, 602 N. Fairview Avenue, has purchased site on Thomas Street and Fairview Avenue, and will erect $25,000 warehouse, factory and laboratory.

C. F. Arrol, 402 Merchants' Bank Building, has purchased site on E. 4th St. on which he will erect a six-story factory to be occupied by Scheffer & Rossum, 216 E. 4th St.; cost about $75,000.

San Antonio, Tex.—International and Great Northern (O. H. Crittendon, Ch. Engr., Houston), has prepared plans for division shops of reinforced-concrete and steel.

Spokane, Wash.—Plans being prepared for rebuilding plant of Spokane Ornamental Iron Works (A. H. C. Trepte, President), recently destroyed by fire.

Salem, Ore.—Reported Steusloff Bros. of Salem, will erect abattoir and meat packing plant of concrete construction, 40 x 70 ft., and two stories; cost $40,000.

Los Angeles, Cal.—General Petroleum Company, Higgins Building, it is reported, intends spending about $250,000 at Santa Fe Avenue and Jefferson Street, including erection of refineries, stills, and numerous storage tanks.

San Diego, Cal.—Reported San Diego Fish Company (John Osbourne, Mgr.) will erect a fish drying and refrigerating plant to cost $25,000.

San Francisco, Cal.—J. D. Barnes Co., 175 Steuart Street, plans erecting $600,000 shipbuilding plant on the Oakland estuary.

Thorold, Ont.—Ontario Paper Company Limited, of Thorold, will erect in spring a sulphite mill. Warren Curtis, Jr., Manager.

BIDS DESIRED.

Corvallis, Ore.—Reported desired until Feb. 7, by N. R. Moore, Secy. Board of Regents, Oregon Agricultural College, for constructing two-story and basement mill and brick 80 x 140 ft. Forestry Building for said college. Separate bids for heating. Probable cost $50,000. John V. Bennes, Archt., Chamber of Commerce Building, Portland.

Vancouver, B. C.—Reported desired until Feb. 10, by the American Can Co., for constructing addition to its factory on Railway Street, two stories 125 x 145 ft. brick and mill construction. Probable cost $70,000.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Meriden, Conn.**—Contract awarded H. Wales Lines Company, Meriden, for erecting eight factory buildings for S. T. Bird & Son, paper manufacturers at East Walpole; cost $125,000. Charles T. Main, Boston, Mass., Archt.

★**Camden, N. J.**—Contract awarded Harrison C. Rea, 1027 Wood St., Philadelphia, Pa., for erecting five-story brick and reinforced concrete, 92 x 88 ft., factory for Farr & Bailey Company. F. Smith Archt., 513 North Charles St., Baltimore, Md.

★**Ardmore, Pa.**—Contract awarded Loos & Dothard, 1438 S. Penn Square, Philadelphia, for erecting two-story, brick and concrete, slow-burning construction, 200 x 300 ft. factory; cost about $100,000. Stearns & Castor, Archts., Stephen Girard Building, Philadelphia.

★**Darby, Pa.**—Contract awarded George & Borst, 277 South Eleventh St., Philadelphia, for erecting two-story, brick, steel and concrete, 60 x 300 ft. mill for Griswold Worsted Company. Engineers, Willard Case Company, 17 Battery Place, New York.

★**Philadelphia, Pa.**—Contract awarded William Steel & Sons Company, 1600 Arch St., for erecting one-story, 126 x 175 ft. brick, stone and concrete factory at American St. and Glenwood Ave., for Schaum & Uhlinger Company; cost $30,000.

★**Spray, N. C.**—Contract awarded by Thread Mills Company to J. A. Jones of Charlotte, to erect additional mill; cost, including equipment, about $70,000.

★**Cleveland, Ohio.** — Contract awarded James H. Wells, Heed Building, Philadelphia, Pa., for erecting brick, concrete and steel factory for Briggs Manufacturing Co; cost about $150,000. Albert E. Kahn, Archt., 58 Lafayette Avenue, Detroit, Mich.

★Contract awarded Honkin - Conkey Construction Co., 321 Cuyahoga Building, for erecting two-story factory at Cuyahoga Avenue and West Third Street, for J. N. Hahn Co., Osborn Engineering Co., Engineers, 740 Engineers' Building.

MISCELLANEOUS

PROPOSED WORK.

Subway — Cleveland, Ohio.—Foundation Co., New York, reported to have completed a report on the test made along route of the proposed Barber freight subway under East Fifty-fifth Street for O. C. Barber. The project calls for a four-track subway from the lake front to the upper Cuyahoga River valley, a distance of about seven miles, and freight terminals, piers and warehouses at lake end. Contract will be let by private bidding and work is to start early in spring.

Concrete Bleachers—Madison, Wis.—See "Prices and Lettings."

Park Improvements—Omaha, Neb.—See "Sewerage and Sewage Disposal."

Snow Sheds—Corea, Wash.—The Great Northern R.R. (A. H. Hogeland, Ch. Engr., St. Paul, Minn.) intends extending the concrete snow sheds in this vicinity, making total length about 7 miles.

Power Station—Martinez, Cal.—Western Power Co. intends establishing a central station here; included in improvements is a 100,000-volt power line along Contra Costa shore from Antioch to Richmond.

BIDS DESIRED.

Elevator—Boston, Mass.—Until Feb. 8, by Schoolhouse Commissioners (Jos. P. Lomasney, Chmn.), for furnishing and installing elevator and elevator machinery in Boston Industrial School for Boys, Parker and Halleck Streets, Roxbury.

Elevator—Martinsburg, W. Va.—Until Feb. 29 by Jas. A. Wetmore, Acting Superv. Archt., Treas. Dept., Washington, D. C., for installing complete an electric passenger elevator in the U. S. Postoffice and courthouse at Martinsburg.

Cement—Saginaw, Mich.—Until Feb. 8 (readvertisement), by H. S. Gay, City Clerk, for furnishing cement during year.

Lighting Standards—Macomb, Ill.—Until Feb. 17, by John Crams, City Clk., for furnishing material and installing a street lighting system of sixty-one ornamental five-light standards.

Cement, Steel, Etc.—Greenfield, Iowa.—Reported desired until Feb. 21 by M. A. Gettis, Co. Aud., for cement, gravel and reinforcing steel for year 1916.

Road Oil—Bakersfield, Cal.—Until Feb. 7, by Board Supervisors (F. E. Smith), for furnishing 19,000 bbl. asphaltic road oil.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Oiling Streets — Bridgeport, Conn.**—Contract reported awarded Logan & Hatheway Co., Newark, N. J., for furnishing and sprinkling the streets with oil. They bid 1.1 cts. per sq. yd. and 6.65 mills per gal. Approximately 2,568,000 sq. yd. of macadam paved and dirt streets will be sprinkled this summer. About 296,000 gal. will be used between May 25 and Sept. 1.

Grading Site—Erie, Pa.—Lowest bid opened recently for grading site for new academy high school at Twenty-ninth and State Streets submitted by J. & M. Doyle Co. at $16,444. This is preliminary steps to the erection of an academy high school costing $500,000. William J. Flynn, Secy. and Mgr. School Board; William B. Ittner, St. Louis, Archt.

★**Cable — Cincinnati, Ohio.** — Contract awarded by Board of Control, Feb. 1, for supplying saturated paper core lead incased No. 14 gage cable for the police and fire telegraph and signal system. equipment to Western Electric Co., Cincinnati, at $18,994.

★**Concrete Bleachers—Madison, Wis.**—Contract awarded George Keachie, Madison, for necessary grading for construction of concrete bleachers at Camp Randall, at $8,473. Detailed plans for concrete work not yet ready for bids.

Elevator—McCook, Neb.—Lowest bid opened Jan. 25 by Supervising Architect, Washington, D. C., for installing electric passenger elevator in U. S. Post Office, submitted by Kaestner & Hecht Company, Chicago, Ill., at $3,325.

Elevator—Lawton, Okla.—Lowest bid opened Jan. 25, by Supervising Architect, Washington, D. C., for installing an electric passenger elevator and hydraulic freight lift pumping plant, etc., in U. S. Post Office and Court House, submitted by Kaestner & Hecht Company, Chicago, Ill., at $4,680.

Retaining Wall, Etc.—Astoria, Ore.—Only bid opened by City Council for improving Commercial Street was from Standard American Dredging Company, Astoria, at $39,000. Work includes filling, wood retaining walls, sewers and replanking with salvaged plank.

Proposals

For Proposals Advertised, See Pages 48 and 49.

WATERWORKS.

Bids Close		See Eng. Record.
Feb. 8.	Waterworks, Arcadia, Ia. Adv. Jan. 22.	Jan. 22
Feb. 8.	Gate Valves, Detroit, Mich.	Jan. 29
Feb. 8.	Pipes, Valves, Etc., Milwaukee, Wis.	Feb. 5
Feb. 8.	C.-I. Pipe and Specials, Saginaw, Mich.	Feb. 5
Feb. 8.	Filtration Plant, Attica, Ohio	Feb. 5
Feb. 9.	System, Camden, Ala.	Jan. 22
Feb. 9.	Centrifugal Pumps, Chicago, Ill.	Feb. 5
Feb. 9.	Tank and Tower, Elmhurst, Ill.	Feb. 5
Feb. 9.	Water Pipe, Etc., Milwaukee, Wis.	Feb. 5
Feb. 10.	Wells, Galveston, Tex.	Jan. 29
Feb. 14.	Waterworks, Viola, Ill. Adv. Jan. 22, 29.	Jan. 22
Feb. 15.	Improvements, Lewiston, N. Y. Adv. Jan. 22 to Feb. 5.	Jan. 22
Feb. 15.	Contract 172, New York, N. Y. Adv. Jan. 29, Feb. 5.	Jan. 29
Feb. 15.	Pipe, Etc., Washington D. C.	Feb. 5
Feb. 17.	Meter Testing Apparatus, Newark, N. J. Adv. Feb. 5.	Feb. 5
Feb. 22.	Waterworks, McCammon, Idaho	Jan. 22
Feb. 22.	Water Works, Havana, Cuba.	Feb. 5
Feb. 24.	Improvements, Bloomington, Ind. Adv. Jan. 29.	Jan. 29
Feb. 24.	Meters, Ligonier, Ind.	Feb. 5
Feb. 24.	Contract 169, New York, N. Y. Adv. Feb. 5.	Feb. 5
Feb. 23.	Pump, etc., Rock Island, Ill.	Feb. 5
Mar. 2.	Reservoir, Washington, D. C. Adv. Feb. 5.	Feb. 5
Mar. 22.	Add. to Pump Sta., New Orleans, La.	Feb. 5
	Pipe Line, Trinity, Tex. Adv. Feb. 5.	Feb. 5
Apr. 1.	Mains, Cullman, Ala.	Jan. 15

SEWERAGE AND SEWAGE DISPOSAL.

Bids Close		See Eng. Record.
Feb. 8.	Shaker Heights, Ohio	Jan. 29
Feb. 9.	New York, N. Y.	Feb. 5
Feb. 10.	Chicago, Ill.	Feb. 5
Feb. 15.	Strawberry Point, Ia.	Feb. 5
Feb. 16.	Keota, Iowa	Feb. 5
Feb. 17.	North Bergen, N. J.	Feb. 5
Feb. 17.	Mountan Lake, Minn.	Feb. 5
Feb. 20.	Kenwood, Ia.	Feb. 5
Feb. 21.	Hammond, Ind.	Feb. 5
Feb. 22.	Havana, Cuba.	Feb. 5
Feb. 23.	Des Moines, Iowa	Jan. 29
Feb. 24.	East View, Ohio	Jan. 29
Feb. 25.	Pierce, Neb.	Jan. 29
Feb. 29.	Kendallsville, Ind.	Jan. 29
Feb. 29.	Kendallville, Ind. Adv. Feb. 5.	Feb. 5
Mar. 6.	Polsom, Mont. Adv. Feb. 5.	Feb. 5
Mar. 14.	Newark, N. J. Adv. Jan. 22, Feb. 5.	Jan. 22

BRIDGES.

Bids Close.		See Eng. Record.
Feb. 8.	Martinsville, Ind.	Jan. 22
Feb. 8.	McCook, Neb. Adv. Jan. 22, 29.	Jan. 22
Feb. 8.	Newport, Wash.	Jan. 22
Feb. 8.	Mammoth, Ariz.	Jan. 22
Feb. 8.	Wenatchee, Wash.	Jan. 29
Feb. 8.	Williamson, W. Va.	Feb. 5
Feb. 9.	York, Neb.	Jan. 29
Feb. 9.	Livingston, Mont.	Jan. 29
Feb. 9.	Cleveland, Ohio.	Jan. 29
Feb. 9.	Baltimore, Md.	Feb. 5
Feb. 9.	Superior, Wis.	Feb. 5
Feb. 10.	Gretna, Neb.	Jan. 22
Feb. 10.	Hutchinson, Kan.	Jan. 22
Feb. 10.	Harriman, Tenn.	Feb. 5
Feb. 11.	Seattle, Wash.	Jan. 22
Feb. 11.	Seattle, Wash.	Jan. 29
Feb. 12.	Schuyler, Neb.	Jan. 22
Feb. 12.	Hinton, W. Va.	Jan. 29
Feb. 12.	Illinois.	Jan. 29
Feb. 14.	Harriman, Tenn.	Jan. 29
Feb. 14.	Topeka, Kan.	Feb. 5
Feb. 15.	Sutherland, Neb.	Jan. 22
Feb. 15.	Alaska Adv. Jan. 15 to Feb. 5.	Jan. 15
Feb. 15.	Jamestown, N. D.	Jan. 29
Feb. 15.	St. Cloud, Minn.	Jan. 29
Feb. 15.	Illinois	Jan. 29
Feb. 15.	Kentucky	Feb. 5
Feb. 16.	Jamestown, N. D.	Jan. 29
Feb. 17.	Miami, Fla.	Jan. 29
Feb. 17.	York, Pa.	Feb. 5
Feb. 19.	Clay, W. Va.	Jan. 29
Feb. 21.	Seattle, Wash.	Feb. 5
Feb. 21.	Everett, Wash.	Feb. 5
Feb. 23.	Dickinson, N. D.	Jan. 29
Feb. 23.	Hutchinson, Kan.	Feb. 5
Feb. 23.	Maine	Feb. 5
Mar. 3.	Seattle, Wash.	Feb. 5
Mar. 4.	Berkeley Springs, W. Va.	Feb. 5
Mar. 6.	Tucson, Ariz.	Feb. 5
Mar. 10.	Fairbury, Neb.	Jan. 29

PAVING AND ROADS.

Bids Close.		See Eng. Record.
Feb. 8.	Indiana	Jan. 15
Feb. 8.	Indiana	Jan. 22
Feb. 8.	Bakersfield, Cal.	Jan. 22
Feb. 8.	Clinton, Iowa	Jan. 29
Feb. 8.	Indiana	Jan. 29
Feb. 8.	Wenatchee, Wash.	Jan. 29
Feb. 8.	Mason City, Ia.	Feb. 5
Feb. 8.	Eldorado, Kan.	Feb. 5
Feb. 9.	Indiana	Jan. 15
Feb. 9.	Indiana	Jan. 1
Feb. 9.	Indiana	Jan. 22
Feb. 9.	South Bend, Wash.	Feb. 5
Feb. 9.	Clearwater, Fla.	Feb. 5
Feb. 5.	Davenport, Wash.	Feb. 5
Feb. 9.	New York, N. Y.	Feb. 5
Feb. 10.	Indiana	Jan. 22
Feb. 10.	Mitchell, S. D.	Feb. 5
Feb. 10.	Jersey City, N. J.	Feb. 5
Feb. 10.	Hanford, Cal.	Feb. 5
Feb. 11.	Miami, Fla.	Feb. 5
Feb. 14.	Washington	Jan. 29
Feb. 14.	Kansas City, Kan.	Jan. 29
Feb. 14.	Eldora, Iowa	Jan. 29
Feb. 14.	Ventura, Cal.	Feb. 5
Feb. 14.	St. Paul, Minn.	Feb. 5
Feb. 15.	Spokane, Wash.	Jan. 8
Feb. 15.	Santa Monica, Cal.	Jan. 29
Feb. 15.	Bath, W. Va.	Jan. 29
Feb. 15.	Wausau, Wis.	Jan. 29
Feb. 16.	Ohio	Feb. 5
Feb. 20.	Tacoma, Wash.	Jan. 22
Feb. 21.	Camden, Ala.	Jan. 29
Feb. 21.	Johnson, N. Y.	Jan. 29
Feb. 21.	Lyons, Kan.	Feb. 5
Feb. 23.	Indiana	Jan. 29
Feb. 23.	Maine Adv. Feb. 5.	Feb. 5
Feb. 28.	Lebanon, Ind.	Jan. 29
Feb. 28.	Minot, N. D.	Jan. 29
Feb. 28.	Indiana.	Feb. 5
Mar. 1.	Fort Madison, Iowa	Feb. 5
Mar. 2.	Hibbing, Minn.	Feb. 5
Mar. 8.	Indiana	Feb. 5
Mar. 6.	Huntsville, Ala.	Jan. 29
Mar. 6.	Portland, Ind.	Jan. 29
Mar. 7.	Davenport, Wash.	Jan. 22

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS.

Bids Close.		See Eng. Record.
Feb. 8.	Irrigation, St. Ignatius, Mont. Adv. Jan. 8.	Jan. 8
Feb. 8.	Ditch, Wheaton, Minn.	Jan. 29
Feb. 8.	Dock, Chicago, Ill.	Feb. 5
Feb. 9.	Lock Gate and Dam, Wheeling, W. Va. Adv. Jan. 15 to Feb. 5.	Jan. 15
Feb. 9.	Ditch, Powhatan, Ark.	Jan. 22
Feb. 9.	Ditch, Washington, Ind.	Jan. 22
Feb. 9.	Pier, Brooklyn, N. Y.	Feb. 5
Feb. 10.	Dredging, New York, N. Y. Adv. Feb. 5.	Feb. 5
Feb. 10.	Ditch, Grand Rapids, Mich.	Feb. 5
Feb. 11.	Freight Shed, New York, N. Y.	Feb. 5
Feb. 12.	Drainage, Guthrie Center, Ia.	Feb. 5
Feb. 14.	Tile, Marshall, Minn.	Feb. 5
Feb. 14.	Piers, Philadelphia, Pa.	Feb. 5
Feb. 15.	Ditch, Princeton, Minn.	Jan. 22
Feb. 15.	Drainage, Jackson, Minn.	Jan. 22
Feb. 15.	Ditches, McCrory, Ark.	Feb. 5
Feb. 16.	State Canal Work, Albany, N. Y. Adv. Jan. 22 to Feb. 5.	Jan. 22
Feb. 16.	Spillway Gates, Seattle, Wash. Adv. Jan. 22 to Feb. 5.	Jan. 22
Feb. 16.	Levee Work, Alexandria, La.	Jan. 29
Feb. 16.	Ditch, Bemidji, Minn.	Feb. 5
Feb. 21.	Jetty Work, Dallas, Tex. Adv. Jan. 29, Feb. 5.	Jan. 29
Feb. 21.	Breakwater Improvements, Manistee, Mich. Adv. Jan. 29, Feb. 5.	Jan. 29
Feb. 21.	Jetty Work, Portland, Ore.	Jan. 29
Feb. 23.	Steel for Lock, Sault Ste. Marie, Mich. Adv. Jan. 22, 29.	Jan. 22
Feb. 24.	Dyke Work, Albany, N. Y. Adv. Jan. 29, Feb. 5.	Jan. 29
Feb. 29.	State Canal Work, Albany, N. Y.	Feb. 5
Mar. 9.	Ditch, Moorehead, Minn.	Jan. 22

PUBLIC BUILDINGS AND SCHOOLS.

Bids Close.		See Eng. Record.
Feb. 8.	Sucasunna, N. J.	Jan. 29
Feb. 10.	Sparta, Wis.	Jan. 29
Feb. 10.	West Richfield, Ohio	Jan. 29
Feb. 10.	Great Bend, Kan.	Feb. 5
Feb. 10.	Fort Dodge, Ia.	Feb. 5
Feb. 10.	New Richland, Minn.	Feb. 5
Feb. 10.	Highland Park, Mich.	Feb. 5
Feb. 11.	Caldwell, N. J.	Jan. 22
Feb. 11.	Winchester, Ind.	Feb. 5
Feb. 12.	Okeechobee, Fla.	Jan. 29
Feb. 12.	Beaumont, Tex.	Feb. 5
Feb. 12.	Westfield, Mass.	Feb. 5
Feb. 14.	Appleton, Minn.	Jan. 29
Feb. 14.	Beaumont, Tex.	Feb. 5
Feb. 14.	Springer, N. M.	Feb. 5
Feb. 14.	St. Paul, Minn.	Feb. 5
Feb. 14.	Laingsburg, Mich.	Feb. 5
Feb. 15.	Boston, Mass.	Jan. 15
Feb. 15.	Amity, Ohio	Jan. 22
Feb. 15.	Oakdale, Iowa	Jan. 29
Feb. 15.	Boise, Idaho	Feb. 5
Feb. 15.	Lynn, Mass.	Feb. 5
Feb. 15.	Baldwin, L. I., N. Y.	Feb. 5
Feb. 15.	Mahanoy City, Pa.	Feb. 5
Feb. 15.	West Frankfort, Ill.	Feb. 5
Feb. 15.	Walla Walla, Wash.	Feb. 5
Feb. 16.	Agawam, Mass.	Jan. 22
Feb. 16.	Lancaster, Pa.	Jan. 22
Feb. 16.	Kuenemo, Kan.	Feb. 5
Feb. 17.	Wilmington, Ohio	Jan. 22
Feb. 17.	Los Angeles, Cal.	Jan. 22
Feb. 18.	Madison, Wis.	Jan. 29
Feb. 18.	Portland, Ore.	Jan. 29
Feb. 18.	Rochester, Ind.	Feb. 5
Feb. 19.	Miami, Ind.	Feb. 5
Feb. 18.	Montpelier, Vt.	Feb. 5
Feb. 21.	Fort Pierce, Fla.	Jan. 29
Feb. 21.	Prescott, Ariz.	Feb. 5
Feb. 21.	Leupp, Ariz.	Feb. 5
Feb. 21.	Krotz Springs, La.	Feb. 5
Feb. 21.	Brazil, Ind.	Feb. 5
Feb. 21.	Rochester, N. Y.	Feb. 5
Feb. 23.	Belmond, Iowa	Jan. 29
Feb. 24.	Batavia, Ohio	Jan. 22
Feb. 21.	Minot, N. D.	Jan. 29
Feb. 24.	Columbus, Ohio.	Jan. 29
Feb. 24.	Berwyn, Pa.	Feb. 5
Feb. 25.	Ebensburg, Pa.	Jan. 8
Feb. 25.	Ellsworth, Ia.	Feb. 5
Feb. 25.	St. Charles, Ill.	Feb. 5
Feb. 26.	Westville, O.	Feb. 5
Feb. 28.	Olmstead Falls, O.	Feb. 5
Feb. 29.	Guide Rock, Neb.	Jan. 29
Feb. 29.	Miami, Okla.	Jan. 29
Feb. 29.	Martinsburg, W. Va.	Feb. 5
Mar. 1.	Industrial, W. Va.	Feb. 5
Mar. 1.	Normal, Ill.	Feb. 5
Mar. 6.	Lake Helen, Fla.	Jan. 29
Mar. 6.	Seabreeze, Fla.	Jan. 29
Mar. 7.	Harrisburg, Pa.	Jan. 22
Mar. 7.	Bethlehem, Pa.	Feb. 5
Mar. 10.	Kalispell, Mont.	Feb. 5
Mar. 13.	Oklahoma City, Okla.	Feb. 5
Mar. 14.	Antigo, Wis.	Feb. 5
Mar. 20.	Austin, Minn.	Jan. 22

PRIVATE BUILDINGS.

Bids Close.		See Eng. Record.
Feb. 8.	Sioux City, Ia.	Feb. 5
Feb. 9.	Camden, N. J.	Feb. 5
Feb. 10.	Mankato, Minn.	Jan. 22
Feb. 12.	Toronto, Ont.	Feb. 5
Feb. 15.	Binghamton, N. Y.	Jan. 22
Feb. 15.	Nashville, Tenn.	Jan. 22
Feb. 15.	Britt, Iowa	Jan. 1
Feb. 15.	Evansville, Ind.	Feb. 5
Feb. 20.	Des Moines, Ia.	Feb. 5
Mar. 1.	Indianapolis, Ind.	Jan. 29
Apr. 1.	Cleveland, Ohio	Jan. 8

NEW INDUSTRIAL PLANTS.

Bids Close.		See Eng. Record.
Feb. 10.	Dallas, Tex	Jan. 22
Feb. 10.	Vancouver, B. C.	Feb. 5
Feb. 15.	Chicago, Ill.	Jan. 29
Feb. 21.	Astoria, Ore.	Jan. 29
Apr. 15.	Manilla, P. I.	Jan. 8

MISCELLANEOUS.

Bids Close.		See Eng. Record.
Feb. 8.	Sprinkler, Fergus Falls, Minn.	Jan. 8
Feb. 8.	Cement, Etc., New York, N. Y.	Jan. 29
Feb. 8.	Wave Meters at Navy Yard, Washington, D. C.	Jan. 29
Feb. 8.	Cement, Saginaw, Mich.	Feb. 5
Feb. 8.	Elevator, Boston, Mass.	Feb. 5
Feb. 9.	Stone Chips for Road, Maryland Adv. Jan. 29, Feb. 5.	Jan. 29
Feb. 9.	Port Improvements, Seattle, Wash.	Jan. 29
Feb. 10.	El. Rys., New York, N. Y.	Jan. 29
Feb. 11.	Locomotives for Sale, Panama Adv. Jan. 1.	Jan. 1
Feb. 11.	Stokers, St. Louis, Mo. Adv. Jan. 15 to Feb. 5.	Jan. 15
Feb. 14.	Steel Sash at Hospital, Napanoch, N. Y. Adv. Jan. 29.	Jan. 29
Feb. 17.	Light Standards, Macomb, Ill.	Feb. 5
Feb. 18.	Garbage, Ashland, O.	Feb. 5
Feb. 21.	Garbage, Fresno, Cal.	Feb. 5
Feb. 21.	Cement, Etc., Greenfield, Iowa	Feb. 5
Feb. 23.	Castings, Etc., Panama Adv. Jan. 15.	Jan. 15
Feb. 23.	Boilers in Boat, Cincinnati, Ohio Adv. Feb. 5.	Feb. 5
Feb. 28.	Counters, Gates, Etc., Boston, Mass. Adv. Jan. 29, Feb. 5.	Jan. 29
Feb. 29.	Maneuver Boats, Wheeling, W. Va. Adv. Feb. 5.	Feb 5
Feb. 29.	Elevator, Martinsburg, W. Va.	Feb. 5
Mar. 1.	Tower, Honolulu, T. H.	Jan. 22
Apr. 1.	Memorial, Fort McHenry, (P. O. Baltimore, Md.).	Nov. 20
——	Grading, Cincinnati, Ohio Adv. Jan. 8 to 22.	Jan. 8

SEARCHLIGHT SECTION

Bids open February 24, 1916.

NOTICE TO CONTRACTORS

OLEAN FLOOD ABATEMENT

STATE OF NEW YORK

OFFICE OF SUPERINTENDENT OF PUBLIC WORKS

ALBANY, N. Y.

Sealed proposals will be received by the undersigned at his office in the Capitol at Albany, N. Y., until twelve o'clock noon of Thursday, February 24th, 1916, at which place and hour they will be publicly opened and read:

For the construction of dykes, deepening and straightening channels, building of walls, culverts, etc., along the Allegany river and Olean creek at or near the city of Olean, N. Y., and completing the same on or before December 1st, 1916, pursuant to the provision of Chapter 717 of the Laws of 1915. Contract plans, sheets 1 to 23.

The attention of bidders is particularly called to Paragraph 17 of the form of contract, in which the contractor must agree to compensate the Superintendent of Public Works for any damages which may result by reason of the failure to complete said work by December 1st, 1916, which damages shall be deemed to be $50.00 per day, or more, as the case may be. Bids for the work will be received only upon this condition.

Plans may be seen and detailed specifications, engineer's estimate of quantities, proposal blanks, form of contract and bonds required and other information for proposers may be had at the office of the Superintendent of Public Works at Albany, N. Y.; at the office of the Flood Abatement Commission at Olean, N. Y.; at the office of the Assistant Superintendent of Public Works for the Middle Division at Syracuse, N. Y.; at the office of the Assistant Superintendent of Public Works for the Western Division at Rochester, N. Y., and at the canal office, Spaulding's Exchange, Buffalo, N. Y.

Copies of detailed plans may be obtained from the Superintendent of Public Works at Albany, N. Y., upon payment to him of the sum of $3.00 per set.

Monthly estimates will be paid of ninety percentum (90 per cent.) of the work done at the contract price. Every proposal for said work must be accompanied by a money deposit in the form of a draft or certified check upon some good banking institution in good credit within the State, and payable at sight to the Superintendent of Public Works for ten percentum (10 per cent.) of the amount of the proposal.

The person whose proposal shall be accepted will be required to execute a contract and furnish bonds within ten days from the date of notice of award delivered to him or them in person or mailed to the address given in the proposal.

Upon execution of the contract and approval of bonds, the certified check or draft will be returned to the proposer unless the same shall have been presented for collection prior to such time, in which case the amount of the deposit will be refunded by the Superintendent of Public Works.

The deposits of bidders other than the one to whom the award of contract shall be made will be returned immediately after the award has been made.

The amount of bond required for faithful performance will be ten per centum (10 per cent.) of the amount of the estimated cost of the work according to the contract price, and an additional bond, known as the labor bond, in the sum of ten per centum (10 per cent.) of the amount of the estimated cost of the work according to the contract price, will be required as security that the contractor will pay in full at least once in each month all laborers employed by him upon the work specified to be done in the contract.

In the event that more than one surety company is offered as surety on said

Official Proposal Announcements

Price, $2.40 an inch.—Copy can be received until
Thursday 10 a. m. for issue mailed the next morning

Superintendent of Public Works, Albany, N. Y., and must be endorsed on the envelope with the name of the construction for which the proposal is made.

Award, if made, will be made to the person or persons whose proposal shall be lowest in cost for doing the work, and which shall comply with all provisions required to render it formal. Before any award shall be made the lowest bidder will be required to satisfy the Superintendent of Public Works of his ability to provide suitable equipment and materials for the proper performance of the work.

The right is reserved to reject all proposals and readvertise and award the contract in the regular manner if in the judgment of the undersigned the interests of the State will be enhanced thereby.

W. W. WOTHERSPOON,
Superintendent of Public Works.
January 24th, 1916.

Bids open February 16, 1916.

NOTICE TO CONTRACTORS.

STATE OF NEW YORK, OFFICE OF SUPERINTENDENT OF PUBLIC WORKS.

ALBANY, N. Y.

Sealed proposals will be received by the undersigned at his office in the Capitol at Albany, N. Y., until twelve o'clock noon of Wednesday, February 16, 1916, at which place and hour they will be publicly opened and read, for improving the New York State canals pursuant to the provisions of Chapter 147 of the Laws of 1903, and of the acts amendatory thereof and supplementary thereto, and Chapter 570 of the Laws of 1915, as follows:

1

CONTRACT NO. 46-B (Revised).

Erie Canal—Section 7.

For completing the construction of lock, dam, etc., at May's Point.

Sheets 1 to 39 inclusive.

2

CONTRACT NO. 122 (Revised).

Erie Canal—Section 4.

For constructing the substructure, superstructure and approaches of a highway bridge over the Mohawk River near Little Falls, at about Barge Canal Center Line Station 4246—42. Sheets 1 to 11 inclusive.

3

CONTRACT No. 63-A.

Erie Canal—Section 9.

For completing the construction of the canal from the west line of Wayne County to the east end of Contract No. 23-A, at King's Bend. Length 12.22 miles. Sheets 1 to 18 inclusive.

Plans may be seen and detailed specifications, engineer's estimate of quantities, proposal blanks, form of contract and bonds required and other information for proposers may be had at the office of the Superintendent of Public Works, at Albany, N. Y.; at the office of the Assistant Superintendent of Public Works for the Middle Division at Syracuse, N. Y.; at the office of the Assistant Superintendent of Public Works for the Western Division at Rochester, N. Y., and at the canal office, Spaulding's Exchange, Buffalo, N. Y.

Copies of detailed plans or drawings may be obtained from the State Engineer and Surveyor at Albany, N. Y., upon payment to him of the cost of producing them.

Monthly estimates will be paid of ninety per centum (90 per cent.) of the work done at the contract price. Every proposal for said work must be accompanied by a money deposit in the form of a draft or certified check upon some good banking

in good credit within the State and payable at sight to the Superintendent of Public Works for five per centum (5 per cent.) of the amount of the proposal.

The person whose proposal shall be accepted will be required to execute a contract and furnish bonds within ten days from the date of notice of award delivered to him or them in person or mailed to the address given in the proposal.

Upon execution of the contract and approval of bonds, the certified check or draft will be returned to the proposer unless the same shall have been presented for collection prior to such time, in which case the amount of the deposit will be refunded by the Superintendent of Public Works.

The deposits of bidders other than the one to whom the award of contract shall be made will be returned immediately after the award has been made.

The amount of bond required for faithful performance will be ten per centum (10 per cent.) of the amount of the estimated cost of the work according to the contract price, and an additional bond, known as the labor bond, in the sum of ten per centum (10 per cent.) of the amount of the estimated cost of the work according to the contract price, will be required as security that the contractor will pay in full at least once in each month all laborers employed by him upon the work specified to be done in the contract.

In the event that more than one surety company is offered as surety on said bonds, co-insurance only will be accepted.

Each proposal must be addressed to the Superintendent of Public Works, Albany, N. Y., and must be endorsed on the envelope with the name of the construction for which the proposal is made.

Award, if made, will be made to the person or persons whose proposal shall be lowest in cost to the State for doing the work, and which shall comply with all provisions required to render it formal. Before any award shall be made the lowest bidder will be required to satisfy the Superintendent of Public Works of his ability to provide suitable equipment and materials for the proper performance of the work.

The right is reserved to reject all proposals and readvertise and award the contract in the regular manner if, in the judgment of the undersigned, the interests of the State will be enhanced thereby.

W. W. WOTHERSPOON,
Superintendent of Public Works.
January 17, 1916.

Bids open February 15, 1916.

BRONZE GATE-VALVES

Sealed bids will be received by the Board of Water Supply, at its offices, twenty-second floor, Municipal Building, Park Row, Centre and Chambers streets, New York City, until 11 a. m., on Tuesday, February 15, 1916, for Contract 172, for furnishing and delivering bronze gate-valves for the City tunnel of the Catskill Aqueduct, in New York City.

At the above place and time the bids will be publicly opened and read. Pamphlets containing information for bidders, and contract drawings can be otained at the above address, at the office of the Secretary, by depositing the sum of ten dollars ($10.00) in cash or its equivalent for each pamphlet. For further particulars apply to the office of the Principal Assistant Engineer at the above address.

CHARLES STRAUSS, President.
CHARLES N. CHADWICK,
JOHN F. GALVIN,
Commissioners of the Board
of Water Supply.

Bids open March 14, 1916.

NOTICE TO CONTRACTORS.

PASSAIC VALLEY SEWERAGE COMMISSIONERS

NEWARK, N. J.

Notice is hereby given that the Passaic Valley Sewerage Commissioners have designated Tuesday, the fourteenth day of March, nineteen hundred and sixteen, at two o'clock in the afternoon, as the time when they will meet at their usual place of meeting, Essex Building, Clinton Street, Newark, New Jersey, to receive proposals in writing, for constructing a part of Section 4 of the Outfall Sewerage Works, consisting of Sedimentation Basins, Effluent and Intake conduits, and all appurtenant work—all located in the City of Newark, Essex County, New Jersey.

Particulars that may enable Contractors to judge of the character of the work are given below:

APPROXIMATE QUANTITIES.

Item 1.—Earth excavation and refilling, in trench, for effluent and intake conduits, and appurtenant work, including regrading and disposal of surplus material, complete ....2,720 Linear Feet

Item 2.—Earth excavation and refilling for sedimentation basins, Venturi meter chamber, and all other structures, excavating for and maintaining mosquito ditches; and all other excavations save those included under Item 1; for all regrading and disposal of surplus material; and for all appurtenant work, etc. ....Lump Sum

Item 3.—Rock excavation in open excavations ....100 Cubic Yards

Item 4.—Concrete masonry, Class A, 1:2:4, with Portland cement, 20,000 Cubic Yards

Item 5.—Concrete masonry, Class B, 1:2½:5, with Portland cement mortar, 48,000 Cubic Yards

Item 6.—Boulder concrete masonry, Class C, with Portland cement, 1,000 Cubic Yards

Item 7.—Brick masonry, with Portland cement mortar... .....200 Cubic Yards

Item 8.—Timber piles, in place, 200,000 Linear Feet

Item 9.—Steel for reinforcement, etc., in place ....2,800,000 Pounds

Item 10.—Broken stone road surfacing, 8,000 Sq. Yards

Item 11.—Surface drains, vitrified pipe, complete, in place.........Lump Sum

Item 12.—Gallery piping; cast iron piping system for 20 in. sludge and 6 in. water mains, and 4 in. wrought iron air main, including all valves, specials, connections, etc., complete, in place.Lump Sum

Item 13.—Sludge main, 20 in., hub and spigot, cast iron pipe, including manhole pipes, plug drain valves and specials, complete, in place..........Lump Sum

Item 14.—Gate valves, six 60 in., and including all 60 in. cast iron piping in Venturi meter chamber in place, complete ....Lump Sum

Item 15.—Sluice gates, twenty-four, 24 in. x 36 in., including gate hoists, stem guides, etc., in place, complete, Lump Sum

Item 16.—Sluice gates for effluent controlling house; two, 5 ft. x 10 ft. and four, 6 ft. x 8 ft., with operating mechanism, complete and in place.......Lump Sum

Item 17.—Miscellaneous iron castings, such as floor plates, pressure covers, stop plank grooves, etc., complete and in place ....50,000 Pounds

Item 18.—Air compressors in administration wing, including all electric wiring, piping, etc., complete and in place, Lump Sum

Item 19.—Electric wiring and lighting system in sedimentation basin galleries and elsewhere, complete and in place, Lump Sum

Drawings, form of contract and specifications, and blank form for proposal, may be obtained at the Commissioners' office from William M. Brown, Chief Engineer.

The Commissioners reserve the right to reject any or all bids.

PASSAIC VALLEY SEWERAGE COMMISSIONERS.

CONTRACTING NEWS

Of Special Interest to Engineers, Contractors, Builders and Manufacturers of Engineering and Building Supplies

THE NEGOTIATIONS for the settlement of the submarine controversy have been watched with anxiety during the past week, and the successful outcome has been immediately reflected in increased business confidence throughout the country. While a break in diplomatic relations with an important power would not cause any immediate derangement of our economic structure, it is realized on all sides that our position will be much stronger if this country can remain neutral in the present war without sacrificing its principles. The chances of our being able to establish mutually profitable trade relations with many foreign countries are greatly improved by our continued neutrality, and the likelihood of our being drawn into entangling relations which might affect our foreign commerce unfavorably is correspondingly reduced.

January was the best first month of the past three years, from the contractor's point of view, according to summaries of building and engineering operations for that month recently published. In the territory east of the Missouri River and north of Mason and Dixon's line, which a year ago reported work valued at $43,250,000 for January, the construction reported for this year is valued at $62,780,000. The reports of industrial corporations for the year ended Dec. 31 given out recently in considerable numbers on the New York stock exchange show extraordinary profits in spite of the fact that business expansion was largely limited to the last half of the year. Although manufacturers of export products are not seeking publicity, press reports indicate that additions to plants of this character all over the country are still being planned. These additions are expected to prove a factor in the structural steel market.

The danger of a labor shortage is again reflected in the difficulty which the Public Employment Bureau of New York City has had recently in filling requests for factory employees. The bureau reports that increasing industrial and railroad demand for skilled and unskilled workers in the Eastern territory has reduced the supply to a minimum, and that employment even in the building trades, which is always at low ebb in the winter, is much better than last year, and will continue to improve.

Buildings

The activity in building work of all kinds continues to be marked. A $175,000 mill building has been contracted for at Philadelphia, and bids have been opened in the same city for a high-school building to cost $436,000. At Columbus, Ohio, a $200,000 manufacturing plant and a $156,000 automobile warehouse have been contracted for. An addition to an automobile plant costing $100,000 has been contracted for at Indianapolis. A contract for erecting a rolling mill to cost $125,000 has been awarded at Kalamazoo, Mich. A low bid of $232,000 was received for erecting a club house in Seattle. Bids are desired at Morristown, N. J., for erecting a $243,000 high school. A contract for constructing a hospital building to cost $130,000, on which the date for opening bids has been extended from Jan. 31 to Feb. 14, is noted at San Bernardino, Cal.

The construction of a $180,000 fire headquarters is to be recommended at Hartford, Conn. Plans have been prepared in New York City for a $200,000 loft building, and plans are being prepared in Troy, N. Y., for a $100,000 Y. W. C. A. building. A $250,000 bank building has been planned at Philadelphia. The erection of a $250,000 warehouse is proposed at Pittsburgh. A $250,000 theater is to be built at Reading, Pa. It is reported that a $3,000,000 tin-plate mill will be built at Baltimore. Plans are prepared for a $1,000,000 building to house the Washington (D. C.) Athletic Club. It is reported that plans are being prepared for a $3,500,000 sugar refinery to be built at Savannah, Ga. It is reported that a $250,000 warehouse is to be contracted for soon at Augusta, Ga. Plans have been prepared for a $500,000 hotel at Cleveland. Plans are being prepared in the same city for a group of factory buildings to cost $250,000. A contract is to be let soon for a $160,000 high school at Huntington, Ind. The erection of additional college buildings to cost $250,000 for the state university at Madison, Wis., is being planned. It is reported that the railroad shops of the Chicago, Burlington & Quincy at West Burlington, Iowa, will be enlarged at a cost of $1,000,000. A $500,000 railroad office building is to be erected at St. Paul. An architect has been selected for a $300,000 hotel to be built in the same city. A contract for a $150,000 school building is to be let soon at Eveleth, Minn. Seattle has sold $304,000 school bonds.

Bridges and Roads

Contracts on the Sunbury (Pa.) bridge of the Philadelphia & Reading Railway have finally been awarded both for the substructure and the superstructure, which are reported to require 3000 tons of steel. A contract was also awarded for the bridge at Ashland, Ky., requiring the same tonnage of steel. An $83,000 bridge has been contracted for at Rockford, Ill. Bids are desired at Columbus, Ohio, for considerable bridge work. The construction of a bridge costing $155,000 is to be contracted for March 9 at La Salle, Ill. Bids will be opened Feb. 26 for the Central Avenue Bridge in Kansas City, which will cost $500,000. The construction of a $100,000 bridge is proposed at Willoughby, Ohio. Preliminary steps have been taken to build a $700,000 viaduct in Cincinnati.

An $87,000 road contract has been awarded at Cape May, N. J. Bids have been received at Baltimore on paving work to cost $130,000. An increased volume of road work on which bids are desired is reported in this week's issue. Among these items are: 58,000 sq. yd. of paving to be let Feb. 16, and ¾ mile of concrete road to be let Feb. 23, at Baltimore; paving work to cost $128,000 at Parkersburg, W. Va.; road work to cost $150,000 at Ravenna, Ohio; 171 miles of road construction to be let in nine sections at Danville, Ill.; and 50,000 sq. yd. of paving to be contracted for Feb. 18 at Denison, Iowa.

A contract is to be let in the spring at Huntington, W. Va., for road construction to cost $250,000. Road bonds in the sum of $100,000 have been sold at Jasper, Tenn. Paving work proposed by the city of New Orleans for this year will cost $1,423,000. A $300,000 road bond issue has been validated at La Center, Ky. Macadam roads to cost $125,000 will be contracted for about April 1 at Hartford City, Ind. South Bend, Ind., expects to undertake paving work costing $210,000. County road bonds in the sum of $150,000 have been sold at Monroe, Mich. County commissioners will spend $615,000 on road improvements this summer at Duluth. Paving work costing $180,000 is contemplated at London, Ont.

Waterworks and Sewers

Bids have been received at Kenosha, Wis., for a waterworks system and filtration plant to cost $226,000. Bids totaling $115,000 have been received for constructing a filtration plant at Oshkosh, Wis. Bids have been opened by Milwaukee for two sewer sections to cost $400,000. Savannah, Ga., is to let contracts for 35 miles of sewer construction on March 6. Bids will be opened for constructing an $80,000 storm sewer Feb. 17 at Houston, Tex. It is reported that sewer work to cost $63,000 will be let March 7 at Billings, Mont.

The sum of $150,000 has been voted at Binghamton, N. Y., for constructing an intercepting sewer. Revised specifications will soon be ready for the $1,000,000 pipe line to be built from Brookdale to Jersey City, N. J. Tampa, Fla., is to build a sewage-disposal plant. Waterworks and sewer extensions planned at Poteau, Okla., will cost $60,000. Preliminary plans for increasing the water supply of Seattle indicate that a large amount of construction work will be necessary. The city engineer of Los Angeles has been instructed to prepare plans for sewer work to cost $2,500,000. The construction of sewers costing $195,000 is contemplated at London, Ont.

Miscellaneous

Bids have been opened at Albany, N. Y., on two state canal sections costing $158,000 and $385,000 respectively. Another elevated railroad contract has been let by the city of Philadelphia at $257,000. A contract for constructing 35 miles of second track for the Erie Railroad near Chicago has been awarded. Bids are desired at Boston for an additional section of the Dorchester subway tunnel. Bids are desired by the U. S. Engineer Office at Milwaukee for a reinforced-concrete breakwater to be built at Racine Harbor, Wis. Ditch work to cost $105,000 is to be let Feb. 19 at Duluth. Among a number of items of proposed railroad and interurban trolley-line construction noted this week are a 20-mile line to cost $300,000 at Birmingham, Ala., a 52-mile electric line proposed at Eau Claire, Wis., 260 miles of railroad proposed at Eugene, Ore., and 318 miles of railroad near Topeka, Kan. Grade-crossing elimination work ordered at Far Rockaway, New York City, will cost $1,150,000. New York City has appropriated $240,000 toward the $435,000 needed for the removal of Coenties Reef in New York harbor. Estimates for a rapid-transit tunnel proposed at Cincinnati indicate a cost of between $1,000,000 and $2,000,000. An irrigation project costing $750,000 has been planned at Atascadero, Cal. Harbor improvements to cost $700,000 are to be undertaken at Richmond, Cal.

WATERWORKS

PROPOSED WORK.

East Hartford, Conn.—Commissioners of the Fire District engaged James H. Fuerts, 140 Nassau Street, New York, as consulting engineer for the water plant. It is proposed taking Colebrook Stream in Glastonbury as an addition to the present water supply.

Cape May Point, N. J.—Borough has voted $15,000 bonds to extend water works system.

Dover, N. J.—The increasing of the water supply is under consideration by the Council.

Jersey City, N. J.—Revised specifications for the proposed pipe line between Brookdale and Jersey City about completed by the engineers of the Water Department.

Lehighton, Pa.—C. W. Knight & Co. of Rome, N. Y., estimate constructing a municipal water plant at $81,061. Address Borough Clerk.

Pennsylvania.—Following permits have been issued for water works by Pennsylvania Department of Health at Harrisburg:

Catawissa (Catawissa Water Co.)—Requiring protection of springs.

Conemaugh Township, Somerset Co. (Jenner-Quemahoning Coal Co.)—Approving plans for filtration; requiring detail plans of distributing system and bacteriological analyses.

Twin Rocks, Blacklick Township, Cambria Co. (Marie Water Co.)—Approving new spring supply; requiring protection of springs.

Kittanning (Armstrong Water Co.)—Approving plans for modifications at filtration plant; requiring revised plans of distributing system within four months and weekly bacteriological analyses.

Morris Knowles, Oliver Building Pittsburgh, is engineer for water works improvements at Shepley, Greensburg, Phillipsburg and Franklin.

Pittsburgh, Pa.—Council affirmed an ordinance granting permission to Department of Supplies to purchase $100,000 worth of water meters and meter fixtures.

Brunswick, Md.—City has applied to Legislature for permission to issue $75,000 bonds for constructing water works.

Bogalusa, La.—Citizens voted resolution to call an election to vote on $200,000 bonds to purchase existing water works and sewerage systems from Great Southern Lumber Company at $91.000 and also to make school and road improvements and erect county jail.

Newburg Heights (P. O. Newburg), Ohio.—Bonds for $12,198 will be sold Feb. 19 by J. A. Fitzgerald, City Clk., for water mains in E. Forty-ninth Street.

St. Paul, Minn.—New bids asked for furnishing meters. Estimated cost $25,000. G. O. House, General Supt., Water Dept.

Oskaloosa, Kan.—City Council is considering municipal water works.

Lake Norden, S. D.—City is considering constructing an electric light plant and water works.

Hamilton, Mont.—Election to be held in April to vote $70,000 bonds to construct water works. Sawyer Brothers, Spokane, Wash., Designing Engineers. George A. Ruse, City Clerk.

Jefferson City, Mo.—Chester & Fleming, Pittsburgh, Pa., engaged to prepare plans and specifications for an elevated tank of 50,000 gals. capacity to be installed in connection with the local water supply.

Lampasas, Tex.—See "Hydraulic Construction and River Improvement."

Poteau, Okla. — Benham Engineering Co., Oklahoma City, engaged to prepare plans for a larger and new water supply, also for water works extensions sewer extensions and sewage treatment plant. Cost $60,000. Dan W. Patton, Mayor; M. X. Beard, City Clerk.

Everett, Wash.—Water bonds for $1,700,000 will be sold March 1 by Louis Lesh, City Clk.

Seattle, Wash.—Fire Chief Frank L. Stetson, in his annual report, recommends a high pressure water system for fire purposes in the business and industrial districts of the city, supplied primarily from Cedar River water mains, secondly from Lake Union and, in case of emergency, with salt water from Elliott Bay. Cost estimated at $1,000,000. Plans provide for a network of 12-in. mains on First, Second, Third and Fourth Avenues, connected with high pressure hydrants and laterals on every other atreet between Pine and Walker Streets from Fourth Avenue and Elliott Bay for fire boats and salt water connections; also construction of 20-in. main from fire reservoir in Volunteer Park along Thirteenth Avenue to Denny Way, along Denny Way to Virginia, along Virginia to Minor Avenue, with a connection of same size extending from there to the city's steam lighting plant on Lake Union, where three electrically driven turbine pressure pumps will be installed.

Preliminary plans of A. H. Dimock, City Engr., for increasing the city water supply include acquisition of Swan Lake for auxiliary storage purposes, with a capacity of 4,300,000,000 gals., by the construction of a 15-ft. dam at the outlet, the construction of a concrete aqueduct from Swan Lake to Molasses Creek, a distance of two miles, and a steel pipe line from Molasses Creek to the city, a new reservoir to be built in West Seattle and Lincoln Park and an addition to the Volunteer Park container.

Oxnard, Cal.—Conejo Mutual Water Co. incorporated with Sherman Stevens of Tustin and P. R. Reynolds of Santa Ana and others for tbe purpose of acquiring wells, engines and pipe lines to supply water for domestic and irrigation purposes in Santa Rosa Valley.

Santa Maria, Cal.—Election to be held Feb. 26 to vote $72,000 bonds to purchase and improve the Domestic Water Co.'s system.

Oatman, Ariz.—Mohave-Oatman Water Co., organized with Daniel Cahill, Pres. and D. L. Mayhew, Secy. and Treas., for the purpose of constructing water works for Oatman.

Pocatello, Idaho.—City has filed with Public Utilities Commission at Boise a certificate of necessity and convenience for construction of a municipal water works system.

London, Ont.—Contract soon to be let for c.-i. pipe, 4 and to 12 in., various gate valves, stop cocks, valve chambers, etc. F. W. Peart, Chief Draftsman, Public Utilities Commission.

North Vancouver, B. C.—Nothing very definite done about construction of water works in east end of district between Seymour River and north arm of Burrard Inlet and costing $18,388. John McCready, Acting District Engineer.

BIDS DESIRED.

North Collins, N. Y.—Until Feb. 23 by Board Village Trustees for constructing water works, advertised in Engineering Record. J. F. Witmer Co., Engineers, Dun Building, Buffalo.

New Bern, N. C.—Until March 6 by F. F. Patterson, City Clerk, for furnishing material and sinking a well the first 100 ft. depth not less than 24 in. in diam. and remaining depth not less than 12 in. diam., capacity not less than 3000 gals. per minute; also same time for an electric motor or steam driven pump for use with this well. Advertised in Engineering Record.

Columbia, Ind.—Reported desired until Feb. 14 for improving water works. George Rader, City Engr.

St. Paul, Minn.—Until Feb. 21 by August Hohenstein, Purchasing Agent, for 2435 disc type water meters, ⅝, ¾. 1 in., 1¼, 1½ and 2 in., as required by the Bureau of Water during 1916.

Bayard, Neb.—Until March 1 by George H. Cronetta, City Clerk, for constructing municipal water works to cost $12,000. Selzer & Finley, Engineers, Scottsbluff, Neb.

Lander, Wyo.—Reported desired until Feb. 15 by Town Council for improving water system. F. B. Gilbert, Town Clk.

Kansas City, Mo.—Until Feb. 16, by J. P. Langan, City Purchasing Agent, for 300 fire hydrants delivered at railroad depot.

Fort Bliss, Tex.—Until March 8 by Depot Quartermaster, El Paso, for constructing pumping station and water pipe lines at Fort Bliss, advertised in Engineering Record.

Colville, Wash.—Reported desired until March 1 by City Clerk for constructing three mile 10 and 12-in. pipe and concrete reservoir and dam. Probable cost $20,000.

Delano, Cal.—By J. H. Ogle, Box 82, supplies for constructing water works.

San Diego, Cal.—By City Manager for pipe required for the construction of the pipe line from Upper Otay reservoir to Lower Otay intake to city approximately 18 miles.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Erie, Pa.**—Contract awarded R. D. Wood & Co. of Philadelphia for 73 valves and boxes at $1,390. No action taken yet of bids received for 175 meters.

Kenosha, Wis.—Lowest bids opened Jan. 29 by Water Works Comrs. for constructing water works submitted by Klug & Smith of Milwaukee at $144,500 for pumping plant and equipment, and New York Continental Jewell Filtration Co., 15 Broad Street, New York, for filtration plant at $85,300 concrete roof and $85,500 tile roof.

Oshkosh, Wis.—Following are lowest bids opened Jan. 31 by Board Public Works for constructing the filtration plant: Larsen Construction Co., Oshkosh, $55,500, for a 6,000,000-gal. filter or $75,000 for an 8,000,000-gal., $11,800 on cover to reservoir; Roberts Filter Manufacturing Co., Darby, Pa., $40,000 on filter appliances and accessories: Wausau Iron Works, Wausau, $7,950 on elevated tank; total, $115,250.

★**Los Angeles, Cal.**—Contracts for gate valves for Water Works Dist. No. 3 awarded A. H. Busch Company for 6, 8 and 12 in and to Water Works Supply Company for 16, 22 and 30 in.

SEWERAGE AND SEWAGE DISPOSAL

PROPOSED WORK.

Bridgeport, Conn.—Election to be held in March or April to vote on issuing $2,275,000 bonds to be used as follows: $300,000 for new schools; $500,000 for street paving; $500,000 for sewer construction; $75,000 for addition to police and charities building; $125,000 for building for police and fire department; $275,000 for park extensions; $250,000 for street extensions, and $225,000 for bridges and land damages.

Meriden, Conn.—Common Council has authorized construction of 3293 ft. of sewer in three streets.

Binghamton, N. Y.—City Council voted to issue $150,000 bonds for constructing Section No. 1 intercepting sewer in connection with the sewage disposal plant. George L. Robinson, Engineer, 37 E. Twenty-eighth Street, New York; Earl Weller, City Engineer.

Oriskany, N. Y.—Plans prepared by A. M. Scripture of New Hartford for the proposed sewer system and disposal plant have been accepted by the Village Board; cost $32,000. Election will probaly be held in March on question of constructing same.

Watertown, N. Y.—Common Council voted to construct sanitary sewers in Lawrence, Cadwell and Sill Streets. E. W. Sayles, City Engineer.

New Brunswick, N. J.—Lederle & Provost, 39 West Thirty-eighth Street, New York, N. Y., are engineers for the sewage disposal plant to be constructed at Rockefeller Institute near New Brunswick.

North Arlington, N. J.—Borough Council has appointed a committee, of which John R. O'Connor is chairman, to make a survey preliminary to the installation of the sewer system to connect with the Passaic Valley trunk sewer. Robert Watson of Rutherford has prepared a profile of the project.

Monongahela City, Pa. — Chester & Fleming, Pittsburgh, engaged to make an investigation and study of the intercepting sewers and partial disposal works for the municipal sewer system.

Pennsylvania. — Following permits for sewerage have been issued hy the Pennsylvania Department of Health.

Prospect Park Borough, Delaware Co.—Withholding approval of proposed sewer extensions pending compliance with a previous permit.

Corry City—Granting extension of time; requiring partial treatment of sewage in one year and complete treatment in three years. Plans have been previously approved.

Erie City—Granting eight months' extension of time for the discharge of untreated sewage.

Mill Creek Township, Erie Co. (Erie Improvement Co.)—Granting one year's extension of time; requiring plans for sewage treatment.

Philadelphia City—Approving plans for relocation of sewers to provide for City Transit subway construction.

Sayre Borough — Approving minor changes in previously approved sewer plans and granting an extension of time; requiring plans for sewage treatment to be submitted by July 1, 1916.

Philadelphia City—Approving construction of lateral sewer extension.

Philadelphia City—Approving construction of various lateral sewer extensions.

Williamsport City—Approving plans for lateral sewer extensions and granting one year's extension of time for discharge of untreated sewage; requiring plans for interception and treatment within six months.

Philadelphia, Pa.—Lower Merion Township plans issuing $40,000 sewer bonds.

Pittsburgh, Pa. — See "Paving and Roads."

Slippery Rock, Pa.—Plans for sewage disposal plant prepared by Morris Knowles, Oliver Building, Pittsburgh.

Wheatland, Pa.—Morris Knowles, Pittsburgh, Pa., engineer for sewer disposal plant.

Williamsport, Pa.—Council passed resolution authorizing City Engineer to investigate means of procuring sewage disposal plant.

Windber, Pa.—Council considering establishing modern sewage disposal plant and improving present sewerage system.

Salisbury, Md.—Hazen, Whipple & Fuller, 30 E. Forty-second Street, New York, engaged to make a survey of the city preparatory to extending sewerage system.

Suffolk, Va.—Road and Sewer improvements costing $70,000 to be carried out this spring. R. H. Brinkley, City Engr.

Greensboro, N. C.—Sewer bonds for $75,000 will be sold Feb. 17 by city. T. J. Murphy, Mayor.

Tampa, Fla.—Contract will be let in about two months for constructing a sewage disposal plant. Address P. G. Ekman, Engineer in charge, 606 Selnea Avenue, Tampa.

Bogalusa, La.—See "Water Works."

Louisville, Ky.—Ernest Kettig, Superintendent of Parks, has submitted a report to Board of Park Commissioners to establish a sewerage system in Southern Parkway at a cost of $10,000 and resurface the parkway with macadam at a cost of $21,000.

Toledo, Ohio.—Agreement has been reached between the city and the New York Central R. R. whereby the railroad company will pay 65 per cent of the cost of draining property adjoining the Hawley Street subway.

Vermilion, Ohio. — Morris Knowles, Oliver Building, Pittsburgh, Pa., is engineer for sewage disposal plant.

Youngstown, Ohio.—The State Board of Health has recommended that the city construct a sewage disposal plant.

Logansport, Ind.—Plans and specifications to be prepared at once by H. H. Thompson, City Engineer, for trunk line sanitary sewer for the southeast section of the city.

St. Paul, Minn.—City Council has ordered construction of storm water and sanitary sewers on various streets estimated to cost $26,685, and also for grading various streets at an estimated cost of $22,760.

Atchison, Kan.—City is considering the construction of Sewer District No. 8, requiring about 5585 ft. 10 to 36 in. pipe, 24 manholes, etc. Frank Altman, City Engineer.

Washington Springs, S. D.—Citizens voted $12,000 bonds for constructing a sewerage system. Address City Clerk.

Manhattan, Mont.—Council is reported to have approved plans for sewer system covering city as prepared by Billings Engineering & Construction Co. of Billings.

Corsicana, Tex.—Attorney General has approved $20,000 sewer extension bonds.

El Paso, Tex.—Reported a system of storm sewers to be constructed this year. Address City Clerk.

Houston, Tex.—Reported contract soon to be let for constructing storm sewer in Euclid Avenue, to cost approximately $270,000.

Muskogee, Okla.—It is proposed to construct an outfall sewer to Arkansas River to be about 12,000 ft. 15 and 18-in. pipe and cost $22,000. E. F. Petersen, City Engr.

Muskogee, Okla.—City Council, Feb. 15, will sell $25,000 sewer bonds. Address City Clerk.

Los Angeles, Cal.—Homer Hamlin, City Engineer, instructed to prepare plans for a $2,000,000 storm drain for West Jefferson Street district and $500,000 storm drains for northwest section and in Leonard Street in east section.

City Council has authorized repairs to main outfall sewer estimated by Homer Hamlin, City Engineer, to cost $32,190.

Globe, Ariz.—City Council voted to construct sewer system. Ralph Smith, City Engineer.

Rexburg, Idaho.—City Council reported engaged Cotton & Wilson, Idaho Falls, to prepare plans for the municipal sewer system.

London, Ont.—Sanitary sewers costing $75,000 and storm water sewers costing $120,000 are contemplated. J. A. Bragien, City Engineer.

New Westminster, B. C.—City Council is planning improvements to the sewer system, including extensions.

BIDS DESIRED.

Hartford Conn.—Until Feb. 15 by Bd. Contract & Supply for furnishing and erecting two 12-in. centrifugal sewage pumps for Sheldon Street pumping station. R. N. Clark, City Engr.

New York, N. Y.—Until Feb. 17, by Douglas Mathewson, Pres. Bronx Borough, for constructing sewers and appurtenances in portions of Sacket Avenue, Colden, Van Nest Avenue, and other streets, in all about 573 lin. ft., 3 ft. x 3 in., and 263 lin. ft. 2 ft. x 9 in., concrete sewer, 12,701 ft. 12 to 30 in. vitr. pipe sewer, 5 M ft. sheeting, receiving basins, manholes, etc. Security $35,000.

Camden, N. J.—Reported desired until Feb. 21 for inlets sewer pipe, manholes and other material for year 1916. A. B. Sparks, Chmn. Highway Co.

Montclair, N. J.—Until Feb. 28 by Harry Trippett, Town Clerk, for constructing a storm sewer in Church Street, advertised in Engineering Record.

Savannah, Ga. — Until March 6 by Mayor and Aldermen for furnishing material and constructing certain sanitary and storm water sewers, advertised in Engineering Record. E. R. Conant, Chief Engineer; Thomas Halligan, Clerk of Council.

West Palm Beach, Fla.—See "Hydraulic and River improvements.

Brewster, Ohio.—Until Feb. 19 by L. S. Lash, Village Clk., for furnishing material and constructing sewer extension and sewage disposal plant. W. J. Sherman Co., Engrs., 615 Nasby Building, Toledo.

Billings, Mont.—Reported desired until March 7 for constructing storm water sewer system. Probable cost $63,000. E. M. Sneckenberger, City Engr.

Keota, Iowa.—Reported desired until Feb. 16 by W. F. Stouet, City Clk., for approximately 1½ miles 8 to 10-in sanitary sewers, manholes, flush tanks, etc.

Kansas City, Mo.—Until Feb. 15, by Board Public Works (Edw. F. Webster, Acting Secy.) for constructing sewers in Dist. 346, Sewer Div. No. 4.

Houston, Tex.—Until Feb. 17 by E. B. Barney, City Secretary, for constructing the Hill Street storm sewer system; estimated cost $80,000.

El Centro, Cal.—Until Feb. 16, by L. Northcutt, City Clerk, for four concrete septic tanks each about 40 x 20 ft., cost about $25,000. Olmsted & Gillelen, Engineers, 1112 Hollingsworth Building, Los Angeles.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Boston, Mass.**—Contract for constructing sewers in Frankfort Street and Neptune Road (bids opened January 25) awarded James J. Coughlan Co., 43 Tremont Street, at $32,886.

★**Cincinnati, Ohio.**—Contract for water and sewer connections on newly paved streets awarded Hollander Plumbing Co., Cincinnati, at $12,610.

★**Cleveland, Ohio.**—Contracts awarded by Service Director Alex. Bernstein for brick sewer in Prospect Avenue from East Twenty-second to E. Fortieth Street, as follows: To Gawne Construction Company, from East Twenty-second to East Thirtieth Street, at $19,068, and to Manson Company, from East Thirtieth to East Fortieth Street, at $25,104. Their unit figures are as follows: Gawne Construction Company, East Twenty-second to East Thirtieth Street, 430 lin. ft. 4 ft. 3 in. x 3 ft. 4 in., $9.35; 340 lin. ft. 3 ft. 9 in. x 3 ft., $8.20; 340 lin. ft. 4 ft. 3 in. x 3 ft. 6 in., $7.15; 680 lin. ft. 2 ft. 9 in. x 2 ft. 3 in.; $6.15; remodeling bulkhead and making connections with Prospect Avenue sewer, $15; remodeling bukhead in East Twenty-second Street sewer, $15; making connection with East Thirtieth Street sewer, $15; 750 lin. ft. curb connections to curb line, $1.50; 750 lin. ft. curb connections to car tracks, $1.50; 310 lin. ft. 24-in. D. S. pipe sewer, $3.39; 6 manholes, $40; etc. Manson Company, Thirtieth to Fortieth streets: 72 lin. ft. 3 ft. 9 in. x 3 ft., $9.92; 610 lin. ft. 4 ft. 3 in. x 2 ft. 6 in., $7.18; 340 lin. ft. 2 ft. 9 in. x 2 ft. 3 in., $6.37; one connection with east Thirtieth Street sewer, $20; one connection with East Fortieth Street sewer, $20; 1000 ft. 10 in. curb connection to curb line, $1.50; 1,000 ft. 10 in. curb connection to car tracks, $1.67; 15,000 sq. ft. pavement taken up, 2 cts.; 650 lin. ft. 24-in. D. S. sewer pipe, $3.60; 300 ft. 20-in. D.S. sewer pipe, $3.05; eight manholes, $55; etc.

★**Elgin, Ill.**—Contract awarded by F. H. Whipp, State Supervisor Board of Administration, Springfield, to Logan & Giertz Construction Co., Elgin, for constructing a sewage treating plant and an intercepting sewer at the Elgin State Hospital at about $8,952.

★**Milwaukee, Wis.**—Following are four lowest bids opened Feb. 3 by Sewerage Commission as follows:

Contract 19—Constructing one regulating and by pass chamber, two concrete drop shafts approximately 14 ft. deep, outside diameter 70 ft. deep each, etc.: Western Foundation Company, St. Paul, $192,800 (awarded contract); Chas. A. Haskin, Boston, Mass., $254,000; O'Brien & Jackson, Milwaukee, Wis., $267,740, and Thomas-Harmon Company, St. Louis, Mo., $299,202.

★Contract No. 18—Building approximately 3560 ft. combined sewer, consisting of 60 in. c.-i. pipe, and 4 ft. 1 in. x 5 ft. 8 in. reinforced concrete conduit, 1630 lin. ft. 12 to 24-in. terra cotta pipe sewer manholes, etc.: Jennings & Ross, Ltd., Toronto, Ont., $206,529 (awarded contract); James Kennedy, Fargo, N. D., $213,415; F. H. Nakielski, Milwaukee, $221,193; Herman Hohensee, Milwaukee, $256,096.

BRIDGES

PROPOSED WORK.

Hartford, Conn.—City Council considering constructing a highway bridge over Park River; cost about 18,000.

New Haven, Conn.—Public Utilities Commission has given permission to New York, New Haven & Hartford R. R. (Edward Gagel, Chief Engr., New Haven) to reconstruct the bridge over the Schoolhouse crossing at Old Saybrook. Bridge will be 63 ft. long, 24 ft. wide, of steel with wooden flooring. The company has also applied for permission to reconstruct the four other bridges in town of Saybrook.

Watertown, N. Y.—Board Public Works decided to construct a bridge across Black River at Van Duzee Street estimated to cost $25,000. E. W. Sayles, City Engr.

Wilkesbarre, Pa.—The bridge at Market Street across Susquehanna River, which is to replace present bridge, is to be constructed by the county. Address Fuller Hendershot, County Comptroller.

New Orleans, La.—Work proposed by the city for 1916 includes bridges and buildings costing $300,000 and paving $1,423,177,

Cincinnati, Ohio.—City Council taking preliminary steps to construct the Delta Avenue viaduct by authorizing the sale of all buildings on land appropriated for the viaduct. The viaduct is to be of concrete and cost $702,000 and will eliminate the Pennsylvania crossing at that point. Specifications being prepared by Asst. City Engineer Frank L. Haschig, in charge of the bridge division of the Department of Public Works. Contract soon to be let.

Cleveland, Ohio.—Mayor Harry L. Davis has signed the Council's resolution granting permission to the County Commissioners to construct a subway approach to Detroit-Superior high level bridge at Superior Avenue Northwest, Detroit Avenue Northwest and West Twenty-fifth Street. The County Commissioners will the end of February vote $50,000 bonds for this work. William A. Stinchcomb, County Engineer.

Hamilton, Ohio.—Surveys being made for constructing bridge over Seven Mile Creek; cost about $12,000. Address County Clerk.

Willoughby, Ohio.—Maple Grove Grange members petitioned Lake County Commissioners at Painesville to construct a semi-high level bridge over Chagrin River at Willoughby, costing $100,000.

Youngstown, Ohio.—Bridge is to be constructed at Himrod Avenue. Address Director Public Service.

Aurora, Ill.—Bd. Local Improvements considering constructing 2 concrete bridges, one at Benton Street and one at Holbrook Street; cost $62,000.

Belleville, Ill.—See "Hydraulic Construction and River Improvement."

Danbury, Wis.—The construction of a bridge across St. Croix River, between Danbury, Wis., and Pine County, Minn., is under consideration. Address County Commissioners, Grantsburg, Wis.

Atchison, Kan.—County commissioners, Atchison, intend spending about $12,000 in reinforced concrete culverts and bridges in 1916 and will probably construct about 2 miles of macadam or other permanent pavement.

Muscotah, Kan.—County Commissioners, Atchison, propose constructing a riveted truss steel highway bridge over Delaware River ¼ mile west of Muscotah; cost $7,000. S. K. McCrery, County Engineer.

Wichita, Kan.—Wichita R. R. & Light Co. (A. M. Patten, Gen. Mgr., Topeka) is to construct an iron bridge over Arkansas River at Douglas Avenue; cost about $50,000.

Mandan, N. D.—Road Supervisors and county and city officials are considering constructing a bridge over Missouri River between Mandan and Bismark.

Marble Falls, Tex.—Election to be held March 4 in Burnet County to vote $10,000 bonds for constructing a bridge over Colorado River on Lampasas and Llano Road. Address County Auditor, at Burnet,

Uvalde, Tex. — Commissioners Court voted to construct a number of concrete crossings over river beds on several roads in county.

Nisqually, Wash.—Plans being prepared by State Highway Commission at Olympia for constructing a concrete overhead bridge at Nisqually; cost $16,000.

Seattle, Wash.—City Council considering constructing approaches to bridge over Lake Union at Eastlake Avenue, and appropriating about $95,000 for same.

Spokane, Wash.—Plans being prepared for constructing the Division Street Bridge. Reported contract will be awarded about May. A temporary bridge is to be constructed at a cost of about $8,000. Morton McCartney, City Engr.

San Bernardino, Cal.—See "Prices and Lettings."

San Diego, Cal.—See "Paving and roads."

Santa Ana, Cal.—A bond issue of $200,000 for repairing roads and bridges damaged by the flood is contemplated by County Commissioners.

Ventura, Cal.—See "Miscellaneous."

Visalia, Cal.—Board of Supervisors will order reconstruction of the Cottage post office bridge and the River Inn bridge, damaged by flood. Each bridge will require a 90-ft. span.

London, Ont.—A bridge, reinforced concrete, is to be constructed across Thames River at Richmond Street at a cost of $40,000. J. A. Bragien, City Engineer.

BIDS DESIRED.

Albany, N. Y.—See "Hydraulic Construction and River Improvements."

Honeoye Falls, N. Y.—Until Feb. 23, by Town Board at office of Town Clerk, for constructing concrete steel arch bridge over Honeoye Creek. Probable cost $6,000.

Charleston, W. Va.—Until Feb. 19 by County Commissioners for constructing a bridge across Elk River; also will soon let contract for constructing a bridge across Davis Creek. P. J. Walsh, 507 Kanawha Street, Charleston, will give information.

Columbus, Ohio.—Until March 7, by Board County Commissioners (John Scott, Clerk), for removing and reconstructing Third Avenue bridge over Olentaugy River; constructing superstructure of Hopewell bridge over Little Walnut Creek with approaches and paving.

Dayton, Ohio.—Until Feb. 29, by County Commissioners (W. H. Aszling, Clk.), for furnishing material and constructing a concrete substructure to replace the substructure of bridge 174 over Great Miami River, Jefferson Township, known as West Carrollton bridge.

Illinois.—Reported desired by State Highway Department, at Springfield, for constructing bridge as follows: Feb. 16—Huey, 55-ft. reinforced concrete bridge 20 ft. wide. J. G. Goldsmith, Co. Supt. Highways.

Illinois.—By State Highway Commission, Springfield, for constructing bridges as follows:

Until March 2:

Rockford, Watson bridge, reinforced-concrete, 3 spans, 50 ft. span, 16 ft. roadway in Cherryvale Township; engineers estimate, including lines for reinforced-concrete bridges, $6,640 for steel bridge $7,620.

Hardshell bridge, reinforced-concrete, 30 ft. span, 16 ft. roadway, between Monroe Township, Ogle County, and Cherry Valley Township, Winnebago County. Engineers' estimate, $3,180.

La Salle, Ill.—Until March 9 by George L. Farnsworth at Court House, Ottawa, for constructing Shippingsport Bridge in town of La Salle, advertised in Engineering Record. Engineer's estimate $155,000. Plans by State Highway Department, Springfield.

Decorah, Iowa.—Reported desired until Feb. 15, by County Commissioners, for constructing two 20-ft. clear I-beam span bridges with concrete floors, 20 ft. roadway, concrete abutments and wings, and two 32 ft. clear I-beam span bridges 16 ft. roadway, reinforced abutments and approaches. Oscar Wingar, Co. Aud.

Hampton, Iowa.—Until Feb. 18, by Frank McSpaden, County Auditor, for constructing in Marion Township, Sect. 1, a pony truss, 45-ft. span bridge, cost $2,392, and Sect. 19, an I-beam, 26-ft. span bridge, cost $2,588; in Ingram Township, Sect. 20, a skew pony truss, 90-ft. span bridge, cost $5,822. A. G. Baker, County Engineer, Hampton.

Kansas City, Kan.—Until Feb. 26 by county for constructing superstructure of bridge across Kaw River at Central Avenue. Superstructure to be of steel, have three 250-ft. spans, and approach of concrete. Cost $500,000. Harrington, Howard & Ash, engineers, Kansas City, Mo.

Fairbury, Neb.—Until March 9 by County Commissioners at Fairbury for constructing superstructure and substructure and approaches of all bridges of the length of 16 ft. and over to be built by the County during the year, advertised in Engineering Record.

Jonesboro, Ark.—Reported desired until Feb. 15 by J. M. Mundy, Clk. Board County Commissioners, for constructing reinforced concrete bridge across Jester Mill Pond on Jonesboro and Atlanta Roads.

PRICES AND LETTINGS.

★Indicates award of contract.

★**Erie, Pa.**—Contract for steel work on the bridge of the Nickel Plate R.R., about 530 tons, awarded King Bridge Co., Cleveland, Ohio.

★**Sunbury, Pa.**—Contract awarded by Philadelphia & Reading R. R. (Samuel T. Wagner, Ch. Engr., Philadelphia) as follows for constructing Sunbury bridge: Substructure, Seeds & Derham, 6311 Wissahickon Avenue, Philadelphia; superstructure, American Bridge Co., Widener Building, Philadelphia.

★**Ashland Ky.** — Contract awarded Mount Vernon Bridge Co., Mount Vernon, Ohio, for 3000 tons of steel for the bridge here.

Pontiac, Mich.—The Grand Trunk Ry (H. R. Safford, Ch. Engineer, Montreal, Que.) intends constructing double-track steel bridge across Pike, Lawrence and Grand River Boulevards, at Pontiac, and has awarded contract for the steel work. Any changes in the masonry work will be taken in hand by forces of the railroad.

★**Rockford, Ill.**—The City Council on Jan. 28 awarded contract for constructing Morgan Street concrete bridge to J. J. O'Heron & Co. of Chicago at $83,433 for a 28-ft. roadway with two 7-ft. walks. Bids received on various widths of roadways.

★**Chetek, Wis.**—Contract awarded by Mayor to Illinois Steel Bridge Co., St. Paul, Minn., for constructing the Long Bridge at $4,000.

★**Anthony, Kan.**—Contract for constructing concrete bridges awarded by County Commissioners (bids opened Jan. 20) as follows: Beebe Constr. Co., Hutchinson, for four bridges at $18,732, and W. J. Carmean, Attica, five bridges at $7,530.

★**Washington.**—Contracts for constructing four concrete arch bridges on Sunset Highway between Easton and Cle Elum in Kittitas County awarded by State Highway Commission at Olympia (bids opened Jan. 24) to Security Bridge Co., Spokane, at $23,200. Work includes a two-span bridge over Yakima River, a two-span bridge over Cle Elum River, one span over Big Creek and one over Little Creek.

★**Riverside, Cal.**—Contract awarded by Council to Mercereau Bridge & Construction Company, Pacific Electric Building, Los Angeles, for constructing temporary bridge 532 ft. long across Santa Ana River at $5,945.

San Bernardino, Cal.—Lowest bid opened recently by Board of Supervisors for constructing bridge across San Timoteo Creek on Barton Avenue submitted by Missouri Bridge & Iron Co., Fullerton Building, St. Louis, Mo., at $4,242 for superstructure. New bids are to be on a 120-ft. steel span with 20-ft. concrete floor or buckle plate and asphalt.

★**Sandpoint, Idaho.**—Following are bids opened Feb. 2 by C. J. Chaffins, County Surveyor, for constructing the steel superstructure and piers of the bridge over Pend d'Oreille River; Illinois Steel Co., Spokane, Wash., $15.440 (awarded contract); O. E. Peppart, Missoula, Mont., $15,546; O. T. Graves, Spokane, $16,416, and R. E. Muth, Portland, $16,950.

Toronto, Ont.—Board of Control recommended for award of contract the bid of C. J. Townsend for constructing concrete bridge on Mt. Pleasant Road; cost $45,000.

PAVING AND ROADS

PROPOSED WORK.

Bridgeport, Conn.—See "Sewerage and Sewage Disposal."

New Haven, Conn. — The Board of Aldermen has authorized the issue of $100,000 bonds for paving.

Little Falls, N. Y.—Election to be held April 4 to vote $50,000 bonds for paving. Charles Byron, City Clerk.

Lakewood, N. J.—Township Committee reported considering the issuing of $60,000 bonds for street paving.

Pittsburgh, Pa.—Board of Public Works has withdrawn advertisement for bids on paving and sewer work. About twenty separate jobs ranging from $54,000 down to $1,800 were advertised to have been opened Feb. 15. The matter is held over, pending the consideration of a bond issue and other matters.

Dover, Del.—Kent County Levy Court voted to issue $10,000 bonds for road improvements.

Huntington, W. Va.—Reported contract will be let in spring by county for constructing about 12 miles of roads; cost $250,000.

Darien, Ga.—Citizens of McIntosh County voted $20,000 bonds for road improvements.

Tampa, Fla.—Contract will be let about Feb. 15 for 90,000 lin. ft. concrete curb for Virginia Park sub-division. Address P. G. Ekman, Engineer in charge, 606 Selnea Avenue, Tampa.

Fort Lauderdale, Fla.—In Road and Bridge District No. 1 of Broward County, citizens voted $150,000 bonds for road improvements; this year about $92,000 will be used and 12 miles of road and a 50-ft. draw span bridge constructed. H. C. Davis, Engineer, Fort Lauderdale.

Election to be held March 18 to vote $175,000 bond issue for roads and bridges Dist. No. 2. About 40 miles of road and one 60-ft. and one 50-ft. draw span and several fixed bridges. H. C. Davis, Engineer, Fort Lauderdale; F. A. Bryan, Clerk Board Commissioners.

Birmingham, Ala.—Paving of Eleventh Avenue South, Tenth Avenue South and Twelfth Street South by city is contemplated; cost $26,000. Julian Kendrick, City Engineer.

Bogalusa, La.—See "Water Works."

Brookhaven, Miss.—Bd. Supervisors of Lincoln County considering spending about $110,000 bonds for road improvements.

Edwards, Miss.—Citizens voted $30,000 bonds for constructing a road from Big Black River on west through Edwards and to a point 2 miles east. Bonds will be sold by County Bd. of Supervisors.

Jasper, Tenn. — About $100,000 road bonds sold by Commissioners of Marion County.

La Center, Ky.—The Appellate Court validated the Ballard County $300,000 road bond issue.

Bucyrus, Ohio.—Election to be held Feb. 15 to vote $47,000 bonds to pay city's share of paving twelve streets. If carried city will do about $200,000 worth of paving, probably $100,000 this year. F. Niederheiser, City Engineer.

Findlay, Ohio.—Contract will be let in March for paving as follows: Brick on Maple Street, cost $4,000; asphaltic concrete, brick, sheet asphalt or concrete on East Street, cost $16,000, and Liberty Street, cost $16,000; also concrete on Garfield Avenue, cost $7,000. U. K. Stringfellow, Engineer, Findlay; J. L. Metzler, Director of Public Service.

Jefferson, Ohio.—Street paving bonds for $14,600 will be sold Feb. 18 by F. G. Brown, Village Clk.

New Concord Ohio.—Paving bonds for $13,923 will be sold Feb. 17 by W. C. Trace, Village Clk.

Ravenna, Ohio.—Until about March 1, by J. L. Walter, County Highway Superintendent, for bituminous macadam, concrete or brick pavement on Randolph, Atwater Road and Drakesburg-Winham Road, each about 4 miles long, and to cost $50,000 each.

Washington C. H., Ohio.—About $28,000 street improvement bonds sold by city.

Bluffton, Ind.—Reported county will build about twenty miles macadam and brick roads. Contract will be let about March 1.

Frankfort, Ind.—County Commissioners have been petitioned to pave seven roads in Center and Jackson townships, each road averages two miles in length and two will be paved with brick and four with concrete; estimated cost $10,000 per mile. Edw. Spray, County Auditor.

Hartford City, Ind.—County will build about $125,000 worth of macadam roads. Contract will be let about April 1. Address County Auditor. F. P. Wallace, County Engineer.

Indianapolis, Ind.—Board Public Works voted to resurface brick pavements with asphalt on following streets: Maryland, Pearl, South, Meridian, Delaware, West, and Pennsylvania Streets.

Orleans, Ind.—Trustees of Orleans Township, reported considering petitions for concrete road 16 ft. wide, to cost about $11,000 per mile; total $40,000. Address County Auditor, Paoli.

South Bend, Ind.—It is proposed to pave with asphalt, asphaltic concrete, bitulithic or brick on concrete foundation on Eddy Street and Mishawaka Avenue to cost $140,000, and Indiana Avenue at a cost of $69,500. The paving of Michigan Street is under consideration. T. C. Sweeney, Clerk Board Public Works; F. J. Anderson, City Engineer.

Williamsport, Ind.—About $38,000 Warren County gravel road bonds sold by county.

Monroe, Mich.—About $150,000 road bonds sold by County Road Commissioners for construction of road from Monroe to Ohio State line.

East St. Louis, Ill.—City Council voted to pave Thirty-sixth Street; cost $26,635.

Decatur, Ill.—Board Local Improvement approved plans for paving Green, Van Dyke and W. King Streets; estimated cost $40,730.

Freeport, Ill.—Bd. of Local Improvements considering spending about $60,000 for street improvements.

Kankakee, Ill.—It is proposed to pave about 8000 sq. yd. on Maple Street with brick, 2 in. sand cushion and 6 in. concrete base; cost $22,400. Robert D. Gregg, City Engineer.

Moline, Ill.—City Council voted to pave Eleventh Street and Seventeenth Avenue with asphalt; cost $28,386; also Twenty-third Avenue, $20,097.

Peoria, Ill.—About two miles of McClure Avenue are to be paved with brick. Henry C. Fuller, Secy. Board Local Improv.

Washburn, Wis.—Contracts soon to be let for paving about seven blocks on Bayfield Street.

Forest City, Iowa.—Resolution introduced in Council providing for constructing about 40,000 yds. of street paving and 22,000 ft. curbing. G. B. Chryst, Town Clerk; Theodore S. De Lay, Town Engr., Creston.

Oakland, Ia.—City Council voted to pave 3 miles of streets with concrete.

Duluth, Minn.—County Commissioners will spend $615,000 on roads and bridges in the seven districts during coming summer.

Eveleth, Minn.—Contract will be let about May 1 by C. H. Williams, City Clerk, for paving on Jones Street and McKinney Avenue about 6000 sq. yd. at a cost of $20,000. C. M. Darwin, Engineer, Eveleth.

Minneapolis, Minn.—Board Park Commissioners has ordered A. L. Godward, Park Board Engineer, to prepare plans and estimates for paving 48 miles of park driveways and boulevards.

Minnesota.—Reported about 100 miles of improved State roads are to be constructed in Winona County. Address C. W. Andling, County Aud., Winona.

St. Paul, Minn.—See "Sewerage and Sewage Disposal."

St. Paul, Minn.—The Council has approved the report of the Finance Committee on the following paving hearings to be heard on objections the last of February: Canada Street cost $18,420; North Snelling Avenue cost $26,647; Ninth Street, $14,293; Broadway $8,713; Twelfth Street $13,254; Como Avenue $31,328; Prior Avenue $24,926.

Two Harbors, Minn.—County Commissioners reported taking steps for road improvements costing $50,000. J. P. Paulson, County Auditor.

Atchison, Kan.—County intends issuing $500,000 bonds for constructing good roads. S. K. McCrery, County Engineer.

Seneca, Kan.—Reported paving of about twenty blocks is under consideration. Address C. C. K. Scoville, Pres. Commercial Club.

El Dorado, Ark.—About 2 miles of pavements contemplated by City Council.

Bracketville, Tex.—Kinney County Commissioners sold $80,000 bonds for constructing roads.

Contract is about to be let by County Commissioners for constructing Brackett-Spofford Road, to include construction of a macadam base with asphalt or tarvia hard rock topping, and construction of culverts and bridges.

Corsicana, Tex.—Attorney General has approved the $80,000 street improvement bonds.

Houston, Tex.—City Council considering paving of Milam Street from Franklin Avenue to Milam Street across Buffalo Bayou.

Madisonville, Tex.—Election is to be held to vote $200,000 bonds for constructing roads in Madison County.

Mercedes, Tex. — Commissioners Court considering calling an election for issuing $300,000 bonds for road improvements linking horder with Corpus Christi-San Antonio-Houston highway. Brooks, Starr and Cameron Counties will co-operate.

Texarkana, Tex.—Reported county contemplates paving fifty-five blocks in Texarkana Improvement Dist. No. 20.

Tilden, Tex.—Commissioners Court ordered issue of $30,000 bonds for constructing roads, bridges, culverts, etc., throughout county.

Victoria, Tex.—Steps being taken by the city for street paving, for which the citizena recently voted $30,000 bonds.

Goldendale, Wash.—Surveys will be completed about March 1 by Lyman W. Ward, County Engineer, for hardsurfacing about 4 miles of highway, beginning at center of business district at Lyle; bids for constructing road will be received after March 1; cost $25,000.

Seattle, Wash.—Bd. of Public Works directed to receive bids for paving Twelfth Avenue N. E.; cost $25,099.

City Council voted to pave Burker Avenue, Bailey Street, Ninth Avenue West, and for concrete walks on E. Fifty-fifth Street.

Astoria, Ore.—City Council voted to hardsurface and plank Ninth and Tenth Streets.

Marshfield, Ore.—City Engineer directed to prepare plans for paving Central Avenue between Fourth Street and Central Avenue; also Central Avenue between Eighth and Eleventh Streets.

Portland, Ore.—E. Glisan Street is to be paved a distance of 25 blocks by city.

The Dalles, Ore.—State Highway Commission at Salem voted to spend $90,000 on Columbia Highway between Hood River and Mosler, provided Wasco County issue bonds for constructing highway between The Dalles and Mosier.

Lakeport, Cal. — Preliminary surveys completed by E. Goodwin, State Road Engineer, at Sacramento, for constructing Lake-Yolo State Road, which will connect Lower Lake with Rumsey, a distance of 35 miles; probable cost $100,000.

Newport Beach, Cal. — City Trustees propose constructing about 20,000 sq. yd. of paving this summer. I. B. Funk, City Engineer, 514 Central Bldg., Los Angeles.

San Diego, Cal.—County Supervisors considering $2,000,000 bond issue for roads and bridges.

Santa Clara, Cal.—The Town Trustees sold $45,000 street improvement bonds.

Flagstaff, Ariz.—City Council voted to pave business district and construct cement walks in residence district.

London, Ont.—Asphalt and brick paving costing $180,000 contemplated. J. A. Bragian, City Engineer.

Ottawa, Ont.—Reported Carleton County Council voted to spend $[illegible],000 on constructing macadam roads. Charles McNab, Nicholas Street, Ottawa, Clerk.

BIDS DESIRED.

Providence, R. I.—See "Miscellaneous."

Binghamton, N. Y.—To sublet 6500 sq. yd. vitr. brick paving with concrete base and curb, advertised in Engineering Record. Address P. O. Box 748, Binghamton.

Brooklyn, N. Y.—Until Feb. 16 by Louis H. Pounds, Borough Pres., for laying sidewalks, curbing, etc., portions of Tehama Street; also for furnishing and delivering 50,000 iron slag paving blocks, 300 paving pitch blocks, etc., at various asphalt plants and corporation yards.

Elmira, N. Y.—Until Feb. 24, by Louis C. Andrews, City Clerk, for grading, curbing and paving with vitr. block on North Water and East Church streets, about 18,400 sq. yd. advertised in Engineering Record.

New York, N. Y.—Until Feb. 17 by Park Commissioners (Cabot Ward, Pres.) for grading and paving with bituminous concrete pavement on concrete foundation portions of roadway of Forest Park, Boro. Queens. Security $6,000.

Watertown, N. Y.—Until March 18 by Board Public Works for paving with creosoted wood block on Public Square and Franklin Street. E. W. Sayles, City Engr.

Bloomfield, N. J.—Until Feb. 21, by Raymond F. Davis, Town Clerk, for approximately 80,000 gal. road oil, non-asphaltic; asphalt containing from 40 to 45 per cent asphalt, and asphaltic containing 60 per cent asphalt. Also same time for constructing asphalt bound telford road and bluestone curb in Waverly Terrace, about 2500 sq. yd.

Jersey City, N. J.—Until Feb. 17, by Board City Commissioners for repaving Johnston Avenue, from Grand Street to the Lehigh Valley Railroad, except between rails and 18 in. outside of outer rails of the street car line. M. I. Fagen, City Clk.

Newark, N. J.—See 'Miscellaneous."

Baltimore, Md.—Until Feb. 16 by Board of Awards, care of City Register, for grading, curbing and paving with sheet asphalt, vitr. block, and graphite block repaving as follows: Contract No. 130, repaving with granite block Dallas, Dock and Sharp Streets and Uhler's Alley, about 7,210 yds.; Contract 131, Eutaw and Ostend Streets and Guilford Avenue, 17,675 sq. yds.; Contract 132, sheet asphalt, vitr. block and granite block on Frederick Avenue and Hollins Street, sheet asphalt, 31,640 sq. yds., granite block 1,170 sq. yds., vitr. block 1,990 sq. yds. R. Keith Compton, Chairman and Consulting Engineer Paving Commission.

Maryland.—Until Feb. 23, by State Roads Commission, 601 Garrett Building, Baltimore, for constructing one section along line of Annapolis Boulevard from Patapsco River to Old Annapolis Road, approximately .78 mile in Anne Arundel County, advertised in Engineering Record. Roadway to be concrete. William L. Marcy, Secy. of Comn.

Parkersburg, W. Va.—Until March 1, by T. L. Higgs, City Engineer, for 20 paving jobs, about 37,270 sq. yd. vitr. paving brick on concrete base, with cement filler, and 24,989 sq. yd. one course cement paving. Appropriation $82,776 and $45,006 respectively.

Gulfport, Fla.—Reported desired until Feb. 15 by N. B. McKinney, Town Clk., for constructing 2 miles modified asphalt streets and docks; probable cost $18,000.

West Palm Beach, Fla.—See "Hydraulic Construction and River Improvements."

Columbus, Miss.—Until Feb. 18, by Gus E. Hauser, Jr., Engineer, Columbus, for 10 miles of macadam road to be part of the Jackson Highway.

Knoxville, Tenn.—Until Feb. 21, by Board City Commissioners for paving, grading, curbing and sewers for State Street Improvement District No. 115, advertised in Engineering Record. J. B. McCalla, City Engr.

Louisville, Ky.—Reported desired until Feb. 23, by Board Public Works, for paving with asphalt portions of Deerwood, Stoll, Hill and Brandeis and other streets, with vitr. brick, Charles, Greene, Ninth and other streets. Cost $110,000.

Indiana—By County Commissioners for constructing roads as follows:

Feb. 19:

Muncie, for constructing roads in Harrison, Delaware and Washington townships. F. M. Williams, Co. Aud.

Feb. 23:

Anderson, for constructing concrete and macadam road in Anderson Township. Ethan T. Flahavin, Co. Aud.

Sidney, Ind.—Until March 1, by Clerk Jackson Township, for constructing the E. E. Circle Road in Jackson Township, paving with concrete; cost $23,000. Paul Surmuy, Engr., Warsaw.

Kalamazoo, Mich.—Until Feb. 28, at office of County Clerk, by Board County Road Commissioners, for 6½ miles trunk line gravel roads, 1½ miles macadam roads, and 2¼ miles trunk line road grading.

Lansing, Mich.—Until Feb. 14 by John McClellan, City Clk., for erecting stationary asphalt plant.

Also until Feb. 28, same place as above, for furnishing asphalt cement for the year 1916.

Danville, Ill.—By John R. Moore, County Clerk, for constructing roads in Vermilion County as follows, advertised in Engineering Record:

Until March 15, Divisions 2, 5 and 7.
Until March 15, Divisions 1, 4 and 9.
Until March 16, Divisions 3, 6 and 8.

Appleton, Wis.—Reported desired until March 1 for 6000 yds. sandstone pavement and 10,000 yds. brick, asphalt or concrete. A. C. Remley, City Engr.

New London, Wis.—Reported desired until Feb. 15, by C. J. Thompson, City Clerk, for furnishing 235,000 sq. ft. reinforced metal and concrete street paving work.

Oconomowoc, Wis.—Until Feb. 21, by Board of Public Works, for furinishing material and improving portions of Silver Lake, Walnut and Lake streets. Also for curbing and guttering South, North Main, South Cross and other streets.

Richland Center, Wis.—Until March 7, by Committee on Public Works (G. H. Strang, Chmn.), for paving, advertised in Engineering Record.

Cherokee, Iowa.—Until Feb. 19, by City Council for approximately 90,000 yd. concrete, asphalt or brick and 21,000 ft. curb and gutter. G. Y. Skeels, City Engr. Wm. Shardlow, City Clk.

Denison, Iowa.—Until Feb. 18, by E. F. Tucker, City Clerk, for about 50,000 yd. of paving.

Eagle Grove, Iowa.—Reported desired until Feb. 14 by Samuel Middleton, City Clk., for paving with asphaltic concrete Portland cement or sheet asphalt, portions of Lucas and Lincoln Avenues and various alleys.

West Liberty, Iowa.—Until Feb. 21, by Irwin Aikins, Town Clerk, for about thirty-five blocks of paving and 28,000 lin. ft. curb and gutter, advertised in Engineering Record.

Minneapolis, Minn.—See "Miscellaneous."

Atchison, Kan.—Until March 6 by City Commissioners for paving 8000 yd. with brick and 10,000 yd. with concrete alley pavement. Frank Altman, City Engr.

Council Grove, Kan.—Until Feb. 15 by M. W. Perry, City Clk., for 19,500 sq. yds. brick paving, 6000 lin. ft. concrete combined curb and gutter and 7500 yds. excav.

McPherson, Kan.—Reported desired until Feb. 15 by M. W. Perry, City Clk., for 19,500 sq. yd. brick paving and 6000 ft. curbing and guttering. H. A. Rowland, Engr., McPherson.

Bolivar, Mo.—Reported desired until March 20 for constructing 10 miles of oil gravel roads. G. M. Upton, Secy. Road Dist.

Kansas City, Mo.—Until Feb. 15, by Board Public Works (Edw. F. Webster, Acting Secy.), for paving portions of following streets: Grand Avenue with sheet asphalt, Broadway with rock asphalt, Fifteenth Street creosoted wood block, and concrete paving and curbing on Tenth Street.

St. Louis, Mo.—Reported desired until Feb. 25 by Board Public Service, City Hall, for improving portions of Delmar Boulevard, W. Sixteenth, Eleventh, Kaiser and other streets; estimated total cost $32,230.

Washington.—Until Feb. 21, by State Highway Commission, Olympia, for grading and draining about 10 miles of the Sunset Highway, between Ellensburg and Vantage, in Kittitas County.

Los Angeles, Cal.—Until Feb. 14 by County Board Supervisors (H. J. Lelande, Ex-officio Clk.) for constructing oil macadam pavement, including grading and other incidental work, on certain streets in Road Improv. Dist. No. 59.

Globe, Ariz.—Reported desired until March 1 for constructing 6 miles of pavement. R. G. Thomas, Co. Engr.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**South Manchester, Conn.** — Contract for constructing sidewalks and laying curbing in town for year 1916 awarded by Bd. of Selectmen to Walter F. Potter, North Haven.

Herkimer, N. Y.—Following bids opened by County Board Supervisors Feb. 1 for constructing roads:

Road No. 11, commencing on county highway No. 459, northerly over Carden Lane to Schuyler's Bush, 2.28 miles in Schuyler; Rock & Griffin, Massena, $12,605; Frank Gallo, Herkimer, $12,103; Phelan & Sullivan, Utica, $9,571; Charles O. McComb, Syracuse, $9,756.

Road No. 18, Cedarville-Van Hornesville, Sec. 2, distance 4.9 miles in Warren; C. R. Snell & Company, Canajoharie, $25,425; Crim & Gay, Jordanville, $23,647; Atlanta Construction Company, Atlanta, N. Y., 25,164.

Road No. 26, West Schuyler-Oneida County line, distance 1.93 miles in Schuyler; Frank Gallo, Herkimer, $12,462; Phelan & Sullivan,, Utica, $9,987; Rock & Griffin, Massena, $14,248; C. O. McComb, Syracuse, $9,617.

Road No. 27, Joslyn Hill, distance 2.29 miles. No bids offered.

Camden, N. J.—Following bids opened Feb. 7 by Board Chosen Freeholders at Camden for constructing Moorestown Turnpike with granite block and bituminous surface on concrete foundation about 29,637 sq. yd. pavement: W. Penn Corson, Camden, (2 bids), $58,749 and $57,802; Kelly McSeely Co. Camden, $64748 and J. F. Shanley & Co., Newark, $69,596.

Following bids opened same time and place as above for constructing Grenlock Road bituminous surface on macadam foundation about 13,782 sq. yd surface pavement: John R. Bates, $26,277; Juniata Co., Philadelphia, $29,617; W. Penn Corson, Camden, $27,159.

★**Cape May C. H., N. J.**—Contract for repair and reconstruction of 4 miles Holly Beach Road awarded by Cape May County Board Freeholders to Harry P. Willis at $87,545.

Baltimore, Md.—Following are lowest bids opened by Paving Commission Feb. 2 for about 130,000 sq. yd. of asphalt pavements (price per sq. yd.): American Paving Co., Baltimore, Contract No. 126, on 5-in. concrete base, 96 cts., and on 6-in. base, $1.03, and on Contracts Nos, 127 and 129, on 6-in. base, $1.11; Baltimore Asphalt Block and Tile Co., Monroe and Lowman Streets for Contract No. 128, on 6-in. base, $1.27.

Danville, Ill.—See "Miscellaneous."

★**Elgin, Ill.**—Following detail bid of Logan & Giertz Construction Co., Elgin, successful bidder for paving Porter Avenue, also Center Street (bids opened Jan. 20 by City, awarded Feb. 3). Morgan H. Brightwood, City Engr. **Porter Avenue:** 9994 sq. yds. asphaltic concrete pavement, $1.50; 2350 lin. ft. curb and gutter, 45c.; 834 lin. ft. gutter, 20c.; 150 lin. ft. concrete headers, 20c.; twenty sidewalk headers, $2; twenty gutter plates, $2; 9 catchbasins, $20; 275 lin. ft. 8-in. sewer, 40c.; 284 lin. ft. 12-in. sewer, 60c.; 833 lin. ft. 10-in. sewer, 50c.; two manholes. $25; adjusting manholes and catchbasins, $50. Total, $17,737. **Center Street:** 17,468 sq. yds. asphaltic concrete pavement, $1.48; 11.310 lin. ft. curb and gutter, 45c.; 933 lin. ft. concrete headers, 20c.; 102 sidewalk headers, $2; 102 gutter plates, $2; 1187 lin. ft. 24-in. sewer, $1.20; 355 lin. ft. 18-in. sewer, 80c.; 979 lin. ft. 12-in. sewer, 60c.; 1507 lin. ft. 10-in. sewer, 50c.; 740 lin. ft. 8-in. sewer, 40c.; eleven manholes, $25; thirty-seven catchbasins, $20; adjusting manholes and catchbasins, $30. Total, $35,927.

★**Winona, Minn.**—Contract for constructing 55 miles of county roads in Winona County awarded by county to Hanlon & Oakes, Sioux City, Iowa, at about $25,000.

Little Rock, Ark.—Following are lowest bids opened by Commissioners of Street Improvement Dist. No. 235 for paving in said district: I. B. Shelby & Co., vitrified brick, $32,861, and asphalt concrete $26,955, and M. D. L. Cook, Little Rock, asphalt $28,611, and bitulithic $31,233.

★**Dallas, Tex.** — Contract for paving Bishop Avenue with asphaltic concrete awarded to Levy & Levy, at $32,249.

★**San Antonio, Tex.**—Contracts for about 140,000 sq. yd. paving awarded by City Commission (bids opened Jan. 20) to the following: Western Paving Co., Oklahoma City, Okla., at $135,000; Uvalde Rock Asphalt Co., at $64,000, and Colgazier Contsr. Co., at $20,000.

★**Washington.**—Contract for clearing, grading and draining about 13½ miles of the Sunset Highway between Easton and Cle Elum in Kittitas County to General Construction Company, Spokane, at $29,564.

★**San Francisco, Cal.**—Contracts for paving awarded by Bd. of Public Works as follows: Valley Street, to Flinn & Treacy, First National Bank Building, at $12,848, and Thirty-seventh Avenue, to Owen McHugh, Russ Building, $8,088.

STREET CLEANING AND GARBAGE DISPOSAL

BIDS DESIRED.

Swissvale, Pa.—Until Feb. 17, by Borough Secretary, Municipal Bldg., for collection and disposal of garbage, starting March 1, 1916. Bids for a period of one, three and five years respectively.

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS

PROPOSED WORK.

River Improvement—Albany, N. Y.—Contract soon to be let by W. W. Wotherspoon, State Superintendent Public Works, Albany, for the Chadokoin River improvement in Jamestown to prevent flood damages.

State Canal Work—Albany, N. Y.—All bids opened Feb. 1, by W. W. Wotherspoon, State Superintendent of Public Works, Albany, for Contract 29-A, constructing canal from Station 5140, near Sterling Creek to the Herkimer-Oneida County line, have been rejected. New bids to be asked soon.

Channel Improvement—New York, N. Y.—Board of Estimate and Apportionment has appropriated $240,000 as city's share for improving Coenties Reef by removal of same to low water depth of 40 feet. The city and the U. S. Government are to work together in this improvement, and the Government's cost will be about $175,000 additional.

Hydro Electric Plant—Baltimore, Md.—Plans and specifications for the Jones Falls Valley hydro electric plant are not yet completed, and contract will not be let before May or later. H. K. McCay, Harbor Engineer.

Dredging—Jacksonville, Fla.—All bids received by the U. S. Engineer at Jacksonville, Fla., for dredging and rock removal at Miami Harbor and St. Lucie Inlet, Florida, have been rejected as excessive or informal.

Drainage—Gueydan, La.—Election to be held Feb. 29 to vote $250,000 bonds for drainage improvements.

Drainage—Belleville, Ill.—Court has appointed commissioners to have charge of the construction of Richland Creek Drainage District; work consists of straightening and widening the creek and construction of about five highway and four railroad bridges. City's share of expense will be about $60,000. W. Woolf, City Engineer.

Dredging—Wisconsin-Minnesota.—Federal improvements to Duluth-Superior Harbor, Minnesota and Wisconsin, by enlarging Superior harbor basin, dredging 160 acres, there to a depth of 21 ft., at an estimated cost of $360,000, has been recommended to Congress by War Department.

Drainage—Madison, S. D.—The Commissioners of Lake and Moody Counties have authorized the construction of a ditch to drain several sloughs near Wentworth. C. A. Trimmer, County Engineer, has completed a survey and work will start in the spring on the reclamation of 1700 acres of the eastern part of Lake County and 700 acres western part of Moody County.

Dam — Lampasas Springs, Tex.—Reported Gulf, Colorado & Santa Fe R.R. (Frank Merritt, Ch. Engr., Galveston) intends constructing a dam across Brown's Creek near Lampasas Springs, to have a capacity of 300,000,000 gal. of water, to insure an adequate supply for general needs of the railroad in that section and on Lampasas branch. Dam is to be 25 to 30 ft. high, one-quarter of mile in length and spillway 250 to 300 ft. long; cost $75,000.

Irrigation — Atascadero, Cal. — H. T. Corey, consulting engineer for the Atascadero Mutual Water Co. of Atascadero, San Luis Obispo County, has applied to State Water Commission, Sacramento, for permission to use 30 cu. ft. per second from Salinas River, equivalent to 20,000,- gal. per day. Cost of work about $750,000.

Irrigation—Colusa, Cal.—Cheney Slough Irrigation Co. has applied to State Water Commission, Sacramento, for permission to appropriate 8000 miners' inches of water from main Sacramento River for the irrigation of about 10,000 acres in Colusa County on the old Jimmineo Rancho. A pumping system consisting of three units is proposed. A canal 10 miles long is to be constructed and the water delivered through laterals.

Flood Protection—Long Beach, Cal.—City Council contemplates forming assessment district to construct storm drain on slope of Signal Hill, to cost about $100,000.

River Improvement—Los Angeles, Cal.—Board of Supervisors (A. M. McPherrin, Clerk) appropriated $7,750, the property owners to appropriate a like sum, for flood protection work along San Gabriel and Rio Hondo Rivers. James W. Reagan, Flood Control Engineer.

Wharf—Los Angeles, Cal.—The addition to Mormon Island channel wharf, to cost $137,000, including bulkhead, 1010-ft. wharf and 500-ft. bulkhead will be built under city force account.

Dredging—Los Angeles, Cal.—City Harbor Commissioners have applied to the U. S. Engineer's Office for permission to dredge a portion of the San Pedro Harbor to a depth of 30 ft.

Irrigation—Madera, Cal.—Madera Irrigation Bureau (W. S. Orvis, Secy.), acting as trustee for promoters of proposed irrigation district, has applied to State Water Commission, Sacramento, to divert water from San Joaquin, Fresno and Chowchilla rivers and tributaries to irrigate about 400,000 acres. A dam 2400 ft. wide and 230 ft. high, and a main canal 45 miles long, including several hundred miles of laterals and ten storage reservoirs with a total storage capacity of about 124,000,000,000 gal. are contemplated.

Harbor Improvement—Richmond, Cal.—Council and Richmond Industrial Commission will spend approximately $700,000 for improvements to the inner harbor.

Dredging—San Diego, Cal.—War Department recommends dredging to cost about $220,000 at harbor to facilitate approach of warships to coaling station.

Flood Protection—Venice, Cal.—A bond issue for constructing storm water protection work is contemplated by the City Trustees, C. S. Thatcher, City Clerk.

Irrigation—Mesa, Ariz.—Reported Grand Prairie Canal Co. incorporated by L. T. Mountz of Mesa, Ariz. (not Ark., as previously stated), and will immediately construct a 28-mile irrigation canal to provide water from White River to develop the rice growing industry. A pumping station will be installed on White River.

Drainage—Logan, Utah.—Contract will be let in March by Logan Land & Drainage Company (A. F. Cardon, Mgr. and Pres.), for draining about 3000 acres of land at a cost of $60,000. Two small pumps and 200,000 ft. of tiling will be required. Brown & Kleinschmidt, Engineer, Salt Lake City.

BIDS DESIRED.

State Canal—Albany, N. Y.—Until Feb. 24, by W. W. Wotherspoon, State Superintendent of Public Works, Albany, for constructing a steel plate girder bridge over Erie Canal at Clinton Street in Whitesboro. Engineer's estimate, $9,689.

Dredging—New York, N. Y.—Until Feb. 24 by U. S. Engineer's Office, New York, for dredging Keyport Harbor and Shrewsbury River, N. J., advertised in Engineering Record.

Dredging — New York, N. Y. — Until March 7 by U. S. Engineer's Office, New York, for dredging and removal of rock and boulders in Staten Island Sound, N. Y. and N. J., advertised in Engineering Record.

Drainage—Largo, Fla.—Until March 6 by Board Supervisors of Lake Largo-Cross Bayou Drainage Dist. (F. R. Francke, Pres.) for approximately 26,000 cu. yd. open ditch 20 ft. wide at bottom, side slopes one and two, one timber crib spillway, etc., advertised in Engineering Record. Isham, Randolph & Co., Ch. Engr., Jacksonville, Fla.

Seawall—West Palm Beach, Fla.—Until Feb. 24 by City Council for constructing a seawall, improving sanitary sewer system and additional street paving. J. B. McCrary Co., Engrs., the National Bank Building, Atlanta, Ga.

Drain—Sunfield, Mich.—Reported desired until Feb. 23, by Sunfield Commissioners at Sunfield for constructing the Collier drain from Sebewa Township Ionia County across Sunfield Township in Eaton County. The ditch is 7 miles long and will cost about $25,000.

Breakwater—Racine, Wis.—Until March 10 by U. S. Engineer's Office, Milwaukee, Wis., for constructing reinforced concrete caisson breakwater and removing old timber crib pier at Racine Harbor, Wis., advertised in Engineering Record.

Ditch—Duluth, Minn.—Reported desired until Feb. 19, for constructing County Ditch No. 4, to consist of 651,000 cu. yd. excav., 68 miles of grading, 2 steel bridges, etc.; probable cost, $105,715.

Ditches—Jackson, Minn.—Until Feb. 29, by P. D. McKellar, County Aud., for repairing, etc., County Ditch No. 3, to consist of approximately 52,000 ft. 5 to 12 in. tile. Cost $10,334.

Irrigation, Ft. Laramie, Wyo.—Until March 10, by U. S. Reclamation Service, Ft. Laramie, for constructing various structures on about 10 miles of Ft. Laramie Canal; also same time and place separate bids for earthwork on about 5½ miles of main canal, Ft. Laramie Unit, both North Platte Project, Nebraska-Wyoming, both proposals advertised in Engineering Record.

Look Gates, etc.—New Glasgow, N. S.—Until Feb. 28 by R. C. Desrochers, Secy. Dept. Pub. Wks., Ottawa, Ont., for constructing timber lock gates and their equipment for the East River Lock, near New Glasgow.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**State Canal Work—Albany, N. Y.**—Contracts awarded by W. W. Wotherspoon, State Supt. Pub. Wks., for Terminal Contract No. 51, to Fred H. Rhodey, of Albion, at $5,325 (bids opened Feb. 1).

Docks—Buffalo, N. Y.—See "New Industrial Plants."

★**State Canal Work—Albany, N. Y.**—Following are unit figures of four lowest bids opened Feb. 1 for Contract 21-A, Erie Canal, Section 9, completing construction of canal, from about Station 2449, about 400 ft. west of Genesee River, to about Station 2566+58, about 442 ft. from east end of Contract No. 6, length 2.23 miles: (a) Engineer's estimate, $415,700; (b) Walsh Construction Co., Davenport, Iowa, $384,929 (awarded contract); (c) E. W. Foley Contr. Corporation, 71 Wall Street, New York, $389,414; (d) H. S. Kerbaugh, Inc., Buffalo, $430,124; (e) Scott Bros., Rome, $431,740.

	(a)	*(b)	(c)	(d)	(e)
Clearing (lump sum)	$100.00	$100.00	$100.00	$100.00	$100.00
401,000 cu. yd. excavation	0.90	0.8325	0.84	0.92	0.94
12 M ft. sheeting and bracing	50.00	55.00	55.00	50.00	50.00
24,900 sq. ft. channeling	0.50	0.40	0.55	0.55	0.50
880 cu. yd. forming embankment	0.15	0.15	0.18	0.15	0.15
520 cu. yd. lining	1.50	1.40	1.75	1.50	1.50
3 M ft. sawed lumber	55.00	55.00	60.00	55.00	55.00
1,820 cu. yd. second-class concrete	8.00	7.50	7.80	9.00	8.00
100 cu. yd. dry retaining wall, including coping	2.50	2.50	2.50	2.50	2.50
525 cu. yd. rubble masonry	5.00	4.50	4.90	5.00	5.00
4,600 cu. yd. rock spoil protection	1.00	1.00	0.90	1.10	1.00
265 sq. yd. cobblestone paving	1.25	1.25	1.30	1.35	1.25
105 cu. yd. fourth-class riprap	2.00	2.00	2.10	2.00	2.00
360 cu. yd. fourth-class grouted riprap	4.00	4.00	4.50	4.75	4.00
2,500 lb. structural steel	0.05	0.05	0.05	0.06	0.05
3,260 lb. metal reinforcement	0.035	0.04	0.04	0.04	0.035
1,000 lb. furnishing metal in guard gates, f.o.b. cars Rochester	0.04	0.04	0.05	0.04	0.04
27,390 lb. transporting, erecting and painting metal in guard gates	0.015	0.016	0.015	0.015	0.015
180 lb. iron castings, plain	0.035	0.035	0.04	0.04	0.035
30 post, transporting, placing and painting snubbing posts	2.50	2.50	2.50	2.50	2.50
675 lin. ft. wooden fence	0.30	0.30	0.35	0.36	0.30
930 lin. ft. drilling bolt holes in rock	0.60	0.50	0.50	0.60	0.60
10 cu. ft. chipping concrete	2.50	2.50	2.75	2.50	2.50
Cofferdams, pump, bail, and drain. (lump sum)	15,000.00	15,000.00	12,000.00	17,500.00	15,000.00

State Canal Work—Albany, N. Y.—Following are unit figures of four bids opened Feb. 1 by W. W. Wotherspoon, State Superintendent Public Works, for state canal work, Contract 29-A, Erie Canal, Section 4, completing construction of canal from Station 5130, near Sterling Creek, to Herkimer, Oneida County line, length 4 miles: (a) Engineer's estimate, $162,005; (b) F. H. Wells, Corfu, $158,056; (c) Eastover Construction Co., Utica, $186,434; (d) Troy Public Works Co., Utica, $220,951. (Bids rejected).

	(a)	(b)	(c)	(d)	(e)
Clearing (lump sum)	$300.00	$300.00	$300.00	$300.00	$300.00
344,200 cu. yd. excavation	0.28	0.28	0.345	0.36	0.44
40 M ft. sheeting and bracing	55.00	50.00	40.00	55.00	55.00
69,300 cu. yd. forming embankment	0.20	0.18	0.20	0.20	0.20
3,300 cu. yd. cinder filling	1.00	0.80	1.00	1.00	1.10
1,090 cu. yd. lining	2.25	2.15	2.00	2.25	2.20
31.3 M ft. sawed lumber (Y. P. or D. F.)	60.00	55.00	70.00	60.00	60.00
3,400 lin ft. foundation piles	0.30	0.30	0.40	0.30	0.33
76 M ft. wooden sheet piling	55.00	50.00	60.00	55.00	57.75
1,000 sq. ft. steel sheet piling	1.15	1.20	1.00	1.15	1.15
515 cu. yd. second-class concrete	7.50	7.25	8.00	8.50	9.00
680 cu. yd. second-class reinforced concrete	12.00	11.60	12.00	12.00	13.20
100 cu. ft. removing and replacing defective concrete	1.00	0.80	1.25	1.00	1.00
10,000 sq. ft. finishing concrete surfaces	0.25	0.22	0.25	0.25	0.30
2,370 cu. yd. laying wash wall	0.75	0.80	1.00	0.75	1.00
320 sq. yd. furnishing and laying first-class stone paving	4.00	3.90	5.00	4.00	4.00
2,190 sq. yd. laying first-class stone paving	1.00	1.00	1.00	1.00	1.00
200 cu. yd. furnishing and laying first-class riprap	3.75	3.50	5.00	3.75	3.75
400 cu. yd. laying first-class riprap	1.50	1.40	1.80	1.50	1.50
1,350 cu. yd. furnishing and laying third-class riprap	3.25	3.00	4.50	3.25	3.25
4,050 cu. yd. laying third-class riprap	1.00	0.95	0.70	1.00	1.00
2,020 lb. structural steel	0.15	0.15	0.15	0.15	0.15
15,800 lb. metal reinforcement	0.03	0.0325	0.04	0.03	0.044
8,100 lb. iron casting, plain	0.03	0.0325	0.03	0.03	0.066
1,380 lin. ft. wooden fence	0.25	0.26	0.25	0.25	0.275
16 M ft. removing existing flooring	1.00	0.80	1.00	1.00	4.68
Maintaining highway traffic (lump sum)	250.00	300.00	100.00	250.00	250.00
Storehouse (lump sum)	500.00	550.00	500.00	500.00	500.00
Cofferdams, pump, bail, and drain. (lump sum)	2,000.00	2,500.00	2,000.00	2,000.00	2,000.00
Cleaning up site of contract, removing plant and debris (lump sum)	1,500.00	1,000.00	1,500.00	1,500.00	1,600.00

★**State Canal Work—Albany, N. Y.**—Following are unit figures of four lowest bids opened Feb. 7 by W. W. Wotherspoon, State Superintendent Public Works, for making repairs to dam at Tonawanda: (a) Engineer's estimate $36,053; (b) Henry P. Burgard Co., Buffalo, $30,277 (awarded contract); (c) John D. Rust, 32 Woodlawn Avenue, Buffalo, $30,277; (d) Chesley, Earl & Heimbach, Inc., Buffalo, $31,999; (e) Lathrop, Shea & Henwood Co., Buffalo, $33,251.

	(a)	*(b)	(c)	(d)	(e)
0.46 M ft. sawed lumber (yellow pine)	$60.00	$60.00	$60.00	$48.00	$70.00
1 M ft. contingent sawed lumber	50.00	1.00	40.00	40.00	60.00
3,036 cu. yd. gravel filling	1.50	1.34	1.00	1.27	1.40
20,065 sq. ft. steel sheet piling	1.25	1.00	1.12	1.15	1.15
203 cu. yd. second-class concrete	8.00	8.00	8.00	7.00	7.76
6,628 lb. structural steel	0.07	0.07	0.05	0.06	0.07
4,940 lb. metal reinforcement	0.05	0.05	0.04	0.04	0.05
300 cutting steel sheet piling (per pile)	1.00	0.25	0.40	0.50	0.10
1,235 cu. yd. third-class riprap	3.00	3.00	2.00	2.30	2.85

★Pier — Wildwood, N. J. — Contract awarded Mark B. Reeves, Wildwood, for constructing the Casino Ocean pier, to be nearly 200 ft. wide.

★Dredging — Baltimore, Md.—Contracts awarded as follows by Board of Award, work to be done under the Harbor Board supervision: To Maryland Dredging Co., 1515 Fidelity Building, dredging docks and inner basin, at $17,400, and to Sanford & Brooks Co., Commerce and Water Streets, dredging in Spring Gardens, at $16,300.

★Dredging, Etc.—Norfolk, Va.—Contract awarded by Norfolk & Western R. R. to James Stewart Company, New York, N. Y., for dredging bulkhead and pier work at Lamberts Point at approximately $1,000,000. Contract to be let later on the sheds and superstructure of the two coastwise merchant warehouses to be erected in connection with this work.

★Drainage—Council Bluffs, Iowa.—Contract awarded by Supervisors of Harrison and Pottawattamie County to Seabury Co. of Logan for constructing levee along Boyer cut-off at 18.5 cts. per cu. yd. Total cost about $30,000.

★Drainage — Ozan, Ark. — Contract awarded Edgar A. Kahn of Little Rock to construct a drainage ditch four miles long near Ozan known as Drainage District No. 1.

★Dam—Jackson, Cal.—Contract for constructing reinforced concrete dam for Argonaut Mining Co. awarded Bent Bros., Central Building Los Angeles, at about $20,000.

ELECTRIC RAILWAYS

PROPOSED WORK.

Spartanburg, S. C.—Plans being considered to construct a line from Spartanburg via Walnut Grove and Cross Anchor to Clinton. Among those interested are: L. H. Wilson, Pres. Bank of Cross Anchor, and W. W. Harris, Clinton, and T. B. Thackston, Cedar Springs.

Birmingham, Ala. — Birmingham, Railway, Light & Power Co. considering constructing a 20-mile line from Birmingham to Warrior River; cost about $300,000.

Eau Claire, Wis.—Wisconsin Minnesota Light & Power Company of Eau Claire is planning a 72-mile electric interurban line from Chippewa Falls to St. Paul through Paint Creek Dam, Eagle Point, Colfax, Boyceville, Wheeler, Downing and Glenwood city. Albert E. Peirce, Vice Pres. Eau Claire, may be able to give further information.

St. Paul, Minn.—The St. Paul Southern Electric Ry. Co. will soon issue $1,200,000 bonds to finance the construction of an extension to Rochester.

Olathe, Kan.—Plans being perfected by Missouri & Kansas Interurban Ry. Co. (Fred O'Flaherty, Ch. Engr., Kansas City, Mo.), for construction of a line from Olathe to Ottawa, 26 miles.

Kansas City, Mo.—The Kansas City & Tiffany Springs Ry. Co. plans to construct railway northward from Kansas City.

Huntsville, Tex.—Construction of an interurban line between Huntsville and Brenham. S. S. Felder, Pres. Huntsville Business League, said to be interested.

Fresno, Cal.—This summer a 5-mile extension to Clovis and a 12-mile extension to Centerville will be built by the Fresno Interurban Ry.

Lewiston, Idaho. — Lewiston-Clarkston Transit Constr. Co. announce construction work will begin about Feb. 15 on construction of East Lewiston extension. The company plans to construct the line to Delsol Park and Fair Grounds, and if possible service to Park Hill will be provided before summer.

BIDS DESIRED.

Boston, Mass.—Until March 2, by Boston Transit Commission (B. Leighton Beal, Secy.), for building Sect. F, Dorchester Tunnel advertised in Engineering Record.

Boston, Mass.—See "Miscellaneous."

New York, N. Y.—Until Feb. 24 by Public Service Commission, 154 Nassau Street, City (Travis H. Whitney, Sec.), for installation of tracks for portion of Seventh Avenue-Lexington Avenue Rapid Transit Railroad, in three parts, designated Lexington Avenue Line, Jerome Avenue Line and 149th Street Loop.

RAILROADS

PROPOSED WORK.

Far Rockaway, L. I., N. Y.—Public Service Commission has ordered the elimination of eight grade crossings in Far Rockaway on the Far Rockaway Branch of the Long Island R. R., cost $1,150,000, the L. I. R. R. to pay $575,000 and the State and city each $287,500. J. R. Savage, Ch. Engr., Jamaica.

★Philadelphia, Pa.—Following are unit figures of the four lowest bids opened Dec. 14 by Department of City Transit for Contract 519, steel superstructure and appurtenant work in Frankford Avenue: (a) American Bridge Co., 1720 Widener Building, $257,475 (awarded contract); (b) Pennsylvania Steel Co., Steelton, $267,100; (c) McClintock-Marshall Co., Morris Building, $270,305; (d) Phoenix Bridge Co., Phoenixville, $277,675.

	*(a)	(b)	(c)	(d)
Whole work as shown on plans (lump sum)	$249,000.00	$258,080.00	$263,000.00	$269,800.00
10,000 lb. riveted steel girders	0.0375	0.0363	0.0375	0.037
10,000 lb. rolled steel beams	0.035	0.0335	0.035	0.033
10,000 lb. steel columns	0.04	0.0386	0.04	0.04
10,000 lb. steel rods	0.04	0.03	0.04	0.03
10,000 lb. iron castings	0.03	0.05	0.025	0.045
100 cu. yd. excavation	1.45	1.50	1.25	1.00
100 cu. yd. concrete	10.75	12.00	10.00	12.00
100 sq. yd. asphalt paving	2.30	5.40	4.50	3.50
100 sq. yd. new granite block paving	4.50	5.40	4.50	4.00
100 sq. yd. new vitr. block paving	3.60	5.40	4.50	4.00
100 sq. yd. new wood block paving	4.00	5.40	4.50	4.00
100 sq. yd. granite, wood or vitr. block repaving, concrete base	3.60	3.00	2.25	1.50
100 sq. yd. granite, wood or vitr. block repaving, gravel base	2.10	2.40	2.00	1.50
100 sq. yd. granolithic sidewalk paving	1.90	1.80	1.50	2.00
100 sq. yd. flagstone sidewalk repaving	0.75	0.90	0.75	2.50
100 sq. yd. brick sidewalk paving	1.20	0.90	1.00	1.50
100 lin. ft. 6-in. straight granite curb	2.00	1.20	1.00	1.25
100 lin. ft. 8-in. straight granite curb	2.90	1.44	1.20	1.50
100 lin. ft. 6-in. or 8-in. curved granite curb	3.50	2.70	2.25	2.50
100 lin. ft. granolithic curb	0.85	0.66	0.55	1.50
100 lin. ft. resetting stone curb	0.50	0.60	0.50	0.50
1,000 M ft. yellow pine lumber	60.00	66.00	55.00	50.00
Force account, $10,000 (per cent added)	20%	20%	12½%	15%

★Philadelphia, Pa.—Following are unit figures of four lowest bids opened Dec. 7 by Department of City Transit for Contract 502, foundations in Frankford Avenue from Unity to Dyre Streets: (a) Edwin H. Vare, Lincoln Building, $23,870 (awarded contract); (b) James F. Leary Construction Co., Inc., 311 Cutler Building, Rochester, N. Y., $25,415; (c) Peoples Brothers, Inc., 237 Commercial Trust Building, $26,909; (d) Robert Lombardi, 600 Lincoln Building, $29,705.

	*(a)	(b)	(c)	(d)
Whole work as shown on plans (lump sum)	$17,700.00	$19,100.00	$18,499.00	$27,000.00
100 cu. yd. excavation	1.00	1.65	2.00	0.50
100 cu. yd. concrete masonry	6.00	7.00	6.00	2.00
1,000 sq. ft. precast reinforced concrete planking	0.20	0.15	0.50	0.40
100 cu. yd. brick masonry	12.00	11.00	20.00	4.00
100 cu. yd. rubble stone masonry	6.00	5.50	4.00	2.00
1,000 M ft. yellow pine lumber	50.00	50.00	60.00	40.00
1,000 lb. steel work	0.05	0.045	0.05	0.04
1,000 lb. iron castings	0.05	0.04	0.08	0.04
100 lin. ft. 5-in. or 6-in. vitr. clay pipe	0.20	0.30	0.30	0.40
100 lin. ft. 8-in. or 10-in. vitr. clay pipe	0.80	0.40	0.40	0.40
100 lin. ft. 12-in. vitr. clay pipe	1.00	0.50	1.00	0.50
100 lin. ft. 15-in. or 18-in. vitr. clay pipe	1.20	0.75	1.50	0.75
100 sq. yd. stone block invert lining or sewer paving	1.00	2.50	4.00	0.50
100 sq. yd. vitr. brick invert lining	1.00	2.00	4.00	1.00
10 inlets, taking out existing sewer inlets	9.00	15.00	40.00	5.00
10 inlets, taking out and rebuilding inlets	85.00	70.00	100.00	5.00
10 inlets, building new inlets	80.00	90.00	100.00	5.00
10 lamp posts, moving gas lamps and posts	9.00	12.00	6.00	5.00
100 lin. ft. steel bound granolithic curb	1.00	0.80	0.80	0.75
100 lin. ft. resetting stone curb	0.15	0.25	0.25	0.10
100 sq. yd. brick and flagstone sidewalk repaving	0.60	0.60	0.75	0.40
100 sq. yd. granolithic sidewalk repaving	1.25	1.50	1.35	0.40
100 sq. yd. granite block repaving on gravel base	0.50	0.45	0.40	0.15
100 sq. yd. asphalt repaving on concrete base	1.00	2.10	3.00	2.25
100 duct ft. terra cotta conduits	0.20	0.20	0.10	0.25
100 lin. ft. moving and relaying gas or water mains	1.00	2.00	0.55	1.00
100 boxes, new curb stop boxes or vent boxes	2.50	0.60	1.00	1.00
Force account, $1,000 (per cent added)	15%	15%	12%	15%

Philadelphia, Pa.—The grade crossings at Chelten Avenue, Hortter Street and Highland Avenue, on Chestnut Hill branch of Pennsylvania R. R., are to eliminated at a cost of $500,000.

Honaker, Va. — Reported Norfolk & Western R.R. (J. E. Crawford, Ch. Engr., Roanoke) intends constructing a line from Clinch Valley division near Honaker through coal and timber fields of Buchannon County, Va., and the Blackberry and Peter Creek sections of Pike County into Elkhorn.

Montgomery, Ala.—Reported extensive improvements are to be made by Louisville & Nashville R. R. (W. H. Courtenay, Ch. Engr., Louisville, Ky.) in this city and between Montgomery and Calera.

Bristol, Tenn. — Reported Norfolk & Western R.R. intends constructing a line from Bristol to Kingsport.

South Bend, Ind.—City reported taking steps to eliminate grade crossings. Fred Keller, Mayor.

Aurora Ill.—Reported Burlington R.R. will start this spring track elevation.

Faribault, Minn.—The Dan Patch R. R. Company, Minneapolis, will construct a line from Mankato to Faribault and will lay tracks into Faribault next spring.

Topeka, Kan.—Charter granted to Garden City, Hastings & Omaha Ry. Co. to build a road in Kansas 318 miles long from Nebraska line in Smith County southwest to Oklahoma line in Morton County.

Oklahoma.—Reported Missouri, Kansas & Texas R. R. (L. F. Lonnbladh, Ch. Engr., Dallas, Tex.) intends making extensive improvements throughout the State including replacing steel tracks with heavier rails, replacing various kinds of ballast with rock and replacing wooden bridges with steel and concrete structures.

Eugene, Ore.—Southern Pacific R. R. Co. (W. Hood, Ch. Engr., San Francisco, Cal.) will construct 260 miles of railroad between Coos Bay and Eureka, Cal., connecting with the Willamette Pacific R. R.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★Stonington, Conn. — Contract for four-tracking New York, New Haven & Hartford Railroad through here awarded Lathrop & Shea of New Haven, at about $180,000.

★Chicago, Ill.—Contract awarded Robert Grace Construction Co., 409 Electric Building, Cleveland, Ohio, for constructing a second track south of Chicago for the Erie R.R., a distance of about 35 miles.

PUBLIC BUILDINGS AND SCHOOLS

PROPOSED WORK.

Boston, Mass.—Charles W. Hubbard is member of a committee having in charge the erection of the maternity hospital in connection with Harvard University Medical School; cost $300,000.

Chelmsford, Mass.—The committee appointed to report on school needs has decided to recommend the erection of a high school on Adams lot and an appropriation of $60,000 for said purpose.

Saugus (P. O. Lynn), Mass.—William H. McLean of Cambridge, submitted plans to School Board for proposed one-story, 14-room school to be erected on Dewey Street; probable cost $50,000. John L. Bryer, Chairman School Board.

Bridgeport, Conn.—See "Sewerage and Sewage Disposal."

Hartford, Conn.—Finance Board has voted to recommend $180,000 be appropriated for proposed central fire headquarters building. (Horace B. Clark, President Frie Board.)

Dunkirk, N. Y. — Board of Education contemplates erecting high school to cost about $50,000.

Buffalo, N. Y.—City official considering erecting eight-story stone and brick, steel frame, City Office Building on present site of Department of Public Works building at Franklin and Church Streets at an approximate cost of $800,000.

Elmira, N. Y.—The sum of $50,000 has been given to this city to erect a Carnegie library.

Yonkers, N. Y.—New bids to be asked for erecting armory at Yonkers. Address Armory Commissioners, Albany. Lewis F. Pilcher, State Archt., Albany.

Newark, N. J.—Board of Freeholders taking preliminary steps toward erecting County Tuberculosis Sanatorium on Caldwell Mountain.

Board of Education has voted to purchase the asylum site on South Orange Avenue for the proposed West Side High School.

Rutherford, N. J.—Citizens Jan. 27 voted to issue $40,000 bonds for erecting new building on site of present Sylvan Street school.

Beaver, Pa.—School Board taking steps to erect a high school costing $75,000.

Brackenridge, Pa. — School Board adopted plans for an eight-room brick school to be erected in the Second Ward.

Johnstown, Pa.—Architects engaged by School Board to prepare plans for the junior high school.

Lititz, Pa.—Election to be held March 7 to vote $95,000 bonds to erect a school.

New Castle, Pa.—Board of School Controllers considering erecting an addition to the Thaddeus Stevens School on East Washington Street.

Pittsburgh, Pa.—Department of Public Charities (John J. McKelvey, Director), has caused repealed ordinances authorizing building additions to the city homes and hospitals at Marshalsea. New plans are to be prepared. Bids were opened recently on plans prepared two years ago.

Pottsville, Pa.—Erection of $45,000 Carnegie Library contemplated here.

Canton, Md. — County Commissioners, Towson, have decided to erect a two-story brick police station in Canton.

Washington, D. C.—Charles Herbert Stockton, President, George Washington University, recommended to Board of Trustees erection of science hall and law school building at University.

Norfolk, Va.—John Kevan Peebles. Law Building, is architect for the fireproof school. R. A. Dobin, Division Supt.

West Liberty, W. Va.—F. F. Faris of Wheeling, and M. L. Wells of Wellsburg, engaged by State Board of Control at Charleston to prepare plans for dormitory to be erected at West Liberty State Normal School; appropriation $60,000.

Morgantown, W. Va.—State Board of Control, Charleston, will have charge of brick and stone woman's dormitory and building for college of agriculture to be erected at West Virginia Univ.; cost $100,000.

Newnan, Ga.—Election to be held March 2 to vote $55,000 bonds for erecting additional school buildings.

Clearwater, Fla.—Citizens Feb. 3 voted $130,000 bonds for erecting a court house and jail. Address Clerk of Circuit Court.

Bogalusa, La.—See "Water Works."

Nashville, Tenn. — State Tuberculosis Commission, Nashville, taking steps to erect the sanitarium for treatment of pulmonary tuberculosis for which legislature has appropriated $50,000.

Boardman, Ohio.—Election to be held Feb. 15 to vote $30,000 bonds for erecting school in connection with present centralized school at Boardman Center. Address School Board.

Brook Park (P. O. Berea), Ohio.—School bonds for $35,000 will be sold March 1 by A. H. Pincombe, Clk. Board Education Brook Park Village School Dist.

Bristolville, Ohio.—School bonds for $30,000 will be sold March 1 by Board Education (O. J. Hammon, Clk.).

Camden, Ohio.—A fireproof high and grade school costing $47,894 is to be erected. E. Rufus Thompson, Archt., Youngstown; G. W. Homsher, Clerk Board Education.

Chillicothe, Ohio.—School bonds for $29,000 reported to be sold Feb. 11 by Sinking Fund Trustees (R. D. Alexander, Secy.).

Oberlin, Ohio.—Dr. Dudley P. Allen has bequeathed $100,000 for a hospital in Oberlin. George M. Jones, Secy. Oberlin College, may be able to give further information.

New Straitsville, Ohio.—Citizens voted $50,000 bonds to erect new school. Address School Board.

Plumwood, Ohio.—Citizens voted $45,000 bonds for erecting central school in Plumwood for Monroe, Summerford and Deercreek Township. J. A. Jones of Jones & Maddox, Dispatch Annex, Columbus, preparing plans.

Huntington, Ind.—Contract soon to be let for erecting high school to be two-story and basement brick and cost $160,000. E. E. Dunlap, Archt., State Life Building, Indianapolis; J. M. Scudder, Superintendent School Board.

Brazil, Ind.—The city will erect a new city hall to cost approximately $25,000. Address City Clerk.

Marion, Ind.—A $180,000 high school will be erected here in the spring. Address Board of Education.

Michigan City, Ind.—Plans to be prepared by Wilson B. Parker, Board of Trade Building, Indianapolis, for an eight-room addition to the Central School. Address School Trustees.

Pleasantville, Ind.—J. Frank Spencer Jefferson Township Trustee, will erect a school to cost $25,000.

Portland, Ind.—Plans prepared by T. D. McLaughlin, Lima, Ohio, for the court house to cost $250,000.

South Bend, Ind.—Reported the erection of a coliseum and market combined is under consideration by the city. Fred Keller, Mayor.

Vincennes, Ind.—School bonds amounting to $135,000 sold. Address Board of Education.

Windfall, Ind.—Contract will be let about March 25 by A. D. Riffe, School Trustee, for erecting a two-story and basement brick and stone school, costing $50,000. Clarence Martendale, Archt., Indianapolis.

Detroit, Mich.—Election to be held to vote $40,000 bonds for erecting school on Salliotte Road in District No. 3, Ecorse Township.

Port Huron, Mich.—Citizens Jan. 31 voted $100,000 bonds for erecting school. L. C. Elliott, City Clerk.

Tuscola, Ill.—DeLand Township voted to erect Township High School, costing $40,000.

Urbana, Ill.—Contract will be let about March 1 by University of Illinois Trustees for erecting a three-story brick and stone fireproof girls' dormitory at the University, according to plans by James M. White, Supervising Archt., University of Illinois.

Waukegan, Ill. — Board of Education plans erecting schools, to cost approximately $90,000.

Madison, Wis.—Wesley Foundation of Milwaukee is reported planning erecting a non-sectarian school of religion at the State University to cost $250,000.

Menasha, Wis.—Contract will be let in February for erecting a three-story brick addition to the high school to cost $55,000, including equipment. Van Ryn & DeGillicke, Archts., Milwaukee. John Callahan, Supt. Schools.

Dolliver, Iowa.—Citizens Jan. 14 voted $48,000 bonds for erecting a school. Hardy & Son, Archts., Estherville; L. P. Stillman, Secy. Bd. Educ.

Holstein, Iowa.—Citizens voted to erect a $50,000 school.

Eveleth, Minn.—Contract soon to be let by the School Board for erecting the school costing $150,000. C. Bray of Duluth, Archt.

Gilbert, Minn.—Citizens voted $40,000 bonds to erect a school next summer.

St. Paul, Minn.—Commissioner of Public Buildings, Parks & Playgrounds has been authorized to prepare plans and specifications for a 4-room addition to Drew School; a 4-room addition to Gordon School and a 16-room school to take the place of the Lafayette School.

Ellis, Kan—Citizens voted $25,000 bonds to erect new high school. Address School Board.

Marquette, Kan.—An election is to be held in March to vote on erecting a $35,000 high school.

North Platte, Neb.—School bonds for $50,000 will be sold March 6 by A. F. Streltz, Secretary Board Education.

St. Charles, Mo.—La Beaume & Klein, Chemical Building, St. Louis, engaged to prepare plans for $100,000 dormitory to be erected at Lindenwood College.

Seattle, Wash.—School Board Jan. 26 sold $304.000 school bonds.

West Bend, Ore.—City intends erecting school costing $62,500. Address Board Education.

Barstow, Cal.—Election to be held April 7 to vote $30,000 bonds to erect school in Union High School District. Address Clerk School Board.

Los Angeles, Cal.—J. S. Dean, State Engineer, Sacramento, has plans for a fish hatchery to be erected in Oak Creek, Los Angeles, to have concrete and tile buildings, and cost $30,000.

Tucson, Ariz.—Sum of $175,000 available for erecting mining building at University of Arizona (R. B. von Kleinsmid, President).

Salt Lake City, Utah.—Election to be held to vote on $200,000 school bonds. Address Board of Education.

Idaho Falls, Idaho.—Citizens voted $85,000 bonds for erecting three schools. Address School Board.

BIDS DESIRED.

Fair Haven, Vt. — Reported desired until Feb. 15, by Vail Allen, Chmn. Building Committee Board Education, for erecting two-story and basement 60 x 110 ft. school. Fuller & Robinson, Archts., 95 State Street, Albany, N. Y.

Springfield, Mass.—Until Feb. 21, by Committee on City Property, Giles Blague, Chmn., for additions and alterations to Howard Street School. Separate bids for plumbing, and electrical work. Kirkham & Parlett, Archts., Carr Bldg.

Baldwin, L. I., N. Y.—Until Feb. 28 by T. D. Smith, Secy. Board Education, for furnishing material and erecting school No. 3. Separate bids for heating, plumbing and electrical work, advertised in Engineering Record. Probable cost $40,000. Tooker & Marsh, 101 Park Avenue, New York City, Archts.

Morristown, N. J.—Until Feb. 25 by Board of Education (William H. Linder, Clk.) for erecting the high school; cost approximately $243,000. Guilbert & Betellel Archts., Newark.

Seabreeze, Fla.—Until March 4 by C. R. M. Shepard, Secy. Board Pub. Instructions, De Land, Fla., for erecting reinforced concrete school building at Seabreeze. Marks & Sheftall, 210 Clark Building, Jacksonville, Archts.

Columbus, Ohio.—Reported desired until Feb. 26, for erecting school for Salt Creek Township, for erecting one-story and basement centralized school. Probable cost $25,000. Matheny, Allen & Mounts, Archts., Columbus.

Palmyra, Ohio.—Reported desired until March 4, by Board Education (Jos. Williams, Clerk), for erecting two-story and basement, 60 x 70 ft., centralized school. W. C. Owen & Co., Archts., 449 Leader-News Building, Cleveland.

Highland Park, Mich.—Until Feb. 24 by Board Education (Caleb S. Pitkin, Secy.) for erecting an 18-room addition to the Willard school building on Hamilton Boulevard between Davison and Waverly Avenues. Wells D. Butterfield, Archt., 1113-15 David Whitney Building, Detroit.

Mattoon, Ill.—Until Feb. 22. by John S. Goodyear, Mattoon, for erecting two-story and basement stone county hospital to cost $25,000. F. W. Stuebem. Archt., 415 Adams Building, Danville.

Rockford, Ill.—Until March 2, by Public Grounds and Building Committee, Board County Supervisors (Peter T. A. Anderson, Chmn.), for erecting jail and addition to court house. J. W. Royer, Archt., Urbana.

Sycamore, Ill.—Until Feb. 26, by Board Education (Geo. A. James, Clerk), for furnishing material and erecting school. N. S. Spencer & Son, Archts., Champaign.

Bradford, Iowa—Until Feb. 25, by Board Directors Independent School Dist. (C. B. Jones, Secy.), for erecting a school, including heating. ventilating, plumbing, etc. H. C. Hardy, Architect, Estherville.

Bradgate, Iowa.—Reported desired until Feb. 23, by Consolidated School Dist. (R. M. Higby, Secy.), for erecting two-story and basement, 60 x 75 ft., school. Proudfoot, Bird & Rawson, Archts., 810 Bubble Building, Des Moines, Archts. Probable cost $35,000.

Charles City, Iowa.—Until March 17 by James A. Wetmore, Acting Supervising Archt., Treasury Department, Washington, D. C., for erecting U. S. Post Office at Charles City.

Gilbert, Minn.—Reported desired until Mar. 15 by W. T. Bray, Archt., Fidelity Bldg., Duluth, for Manual Training School; probable cost $65,000.

St. Peter, Minn.—Until Feb. 23, by State Board Control, in their office State Capitol, St. Paul, for erecting addition to Criminal Building, State Hospital at St. Peter. C. H. Johnson, Archt., 715 Capital Bank Building, St. Paul.

Bridgeport, Neb.—Reported desired until March 1, by School Board (J. E. Trainer, Secy.), for erecting two-story and basement brick school in Dist. No. 63.

Enderlin, N. D.—Until Feb. 25, by Board Education (E. T. Danielson, Clk.), for general construction, heating. ventilating, plumbing, etc., new addition to and remodeling present school. John D. Chubb, Archt., 109 N. Dearborn Street, Chicago.

Normandy, Mo.—Reported desired until Feb. 16, by Building Committee of the German St. Vincent's Home Association (Jos. Gruender, Secy.), for erecting orphans' home. Separate bids for heating, plumbing, etc. Wessbecher & Hilderbrand, Archts., 408 Temple Building, St. Louis.

La Porte, Tex.—Until Feb. 21 by George Van Pelt, Secy. Independent School Dist., for erecting school, including heating, plumbing and electric work.

Lubbock, Tex.—Until March 8, by Board County Commissioners, for erecting court house. Separate bids for steam heating. Cost $100,000. Sam G. Davis, County Clerk.

Sacramento, Cal.—Reported desired until Feb. 16, by E. F. Pfund, Clerk Board of Supervisors, for erecting detention home on the County Hospital grounds; also separate bids same time and place for erecting Nurses' Home. R. A. Herold, Archt., 430-37 Forum Building.

San Bernardino, Cal.—Until Feb. 14 (extension of date from Jan. 31), by County Board of Supervisors (L. R. Patty, Clerk), for erecting a two-story and basement, two two-story wings and three-story and basement administration building at the county hospital to cost, including equipment, about $130,000. Lyman Farwell, Archt., 615 W. P. Story Building, Los Angelea. A. S. Guthrie, Clerk of Board.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Philadelphia, Pa.—Following are lowest bids opened by Board of Education for erecting the Kensington High School on Coral and Cumberland Streets: General contract, Thomas Reilly, 1616 Thompson Street, $332,927; heating and ventilating, S. Faith & Co., 2427 Pennsylvania Avenue, $54,522; electric work, S. Miller & Co., $32,631; plumbing, Bulman Brothers, 2532 N. Fifth Street, $16,441.

Lowest bid opened Feb. 1 by Director Kusen of the Department of Health and Charities for constructing a power plant at the home for feebleminded at Byberry submitted by Peoples Bros., Inc., 2508 Callowhill Street, at $35,900.

★**Wheeling, W. Va.**—Contract awarded the Ohio Building & Construction Co., Cincinnati, at $23,500, for building a fireproof power house at dam No. 14, Ohio River.

★**Cookeville, Tenn.**—Contract awarded Jan. 26 by State Board of Education to Fulcher Brick Co. of Nashville, at $61,761, for erecting boys' and girls' dormitory, remodeling administration building, boiler house and heating apparatus for Polytechnic Institute at Cookeville. Asmus & Norton, Archts., 505 Cole Building, Nashville.

★**Nashville, Tenn.**—Contract awarded Foster & Creighton Co., Nashville, for erecting the 3-story fireproof dormitory addition to Ward-Belmont College, at $55,000.

★**Sugar Grove, Ohio.** — Contract for erecting school awarded S. Q. Henke of Lancaster; cost about $22,000. E. S. Matheny, Archt., 710 Harrison Building, Columbus.

★**Rochester, Mich.**—Contracts for erecting high school (bids opened Jan. 28) awarded as follows by Board of Education (J. F. Jackson, Secy.): General contract, J. H. Patterson, Plymouth, Mich., $21,584; heating, American Heating & Ventilating Co., Toledo, Ohio, $2,869; plumbing, William Timken, Rochester, $938.

★**Caldwell, Kan.**—Contracts for erecting school (bids opened Jan. 31) awarded as follows: General contract to H. I. Ellis Construction Co., Wichita, $38,200, pumping and heating, R. R. Moore & Co., Wichita, $7,125, and electric work, Southwestern Electric Co., Wichita, $1,123. J. E. Damon, Clerk Board Educ.

★**El Paso, Tex.**—Contract awarded Capital Iron Works, Topeka, Kan., for structural steel needed in the county court house.

PRIVATE BUILDINGS

PROPOSED WORK.

Boston, Mass.—Louis W. Reycroft of Cambridge, intends erecting at Massachusetts Avenue and Green Street an office building and theater, also a five-story, brick and stone office building on Massachusetts Avenue and Brookline Avenue; estimated cost of both $450,000.

Marlboro, Mass.—Sacred Heart R. C. Church is having plans prepared for a stone edifice. Rev. J. A. Curtin, Pastor.

Gabriels, N. Y.—Sisters of Mercy taking steps to rebuild Sanatorium for Incipient Tuberculosis, destroyed by fire.

Brooklyn, N. Y.—Plans filed for erecting following buildings: Six-story brick store and tenement at Marcy Avenue and Division Street for Ross Land Company, cost $60,000, Shampan & Shampan, Archts., 772 Broadway, Brooklyn; two 5-story brick tenements on Cranberry Street for Heights Operating Company, total cost $85,000, Slee & Bryson, Archts., 154 Montague Street.

Plans being prepared by Arthur Carlson, 226 Henry Street, for moving picture theater to be erected on Park Place for St. Marks Avenue Realty Company; probable cost $125,000.

Morris Park (P. O. Jamaica), L. I., N. Y.—Roman Catholic Diocesan Board of Consultors, Brooklyn, has approved plans for the Church of St. Benedict Joseph to be erected at Morris Park at a cost of $70,000.

New York, N. Y.—Cadillac Motor Co., 1881 Broadway, has purchased the northwest corner of Columbus Avenue and Sixty-second Street and will erect a building, probably 11 stories high.

Plans filed for erecting following buildings: Three 5-story brick apartments at 178th Street and Northern Avenue for Haven Construction Company, total cost $230,000, Charles B. Meyers, Archt., 1 Union Square; 6-story fireproof garage at 219 East Sixty-seventh Street for Paterno Construction Company, cost $60,000, John C. Watson, Archt., 271 West 125th Street; 2-story fireproof telephone exchange building at 208-216 East Seventy-ninth Street, cost $150,000, McKenzie, Voorhees & Gmelin, Archts., 1123 Broadway; 12-story fireproof lofts at 28 East Thirty-second Street for 149 Madison Avenue Company, Inc., cost $250,000. Henry C. Pelton, Archt., 8 West Thirty-eighth Street.

Plans being prepared by Schwartz & Gross, 347 Fifth Avenue, for twelve-story, brick, limestone and terra cotta, fireproof store and loft building to be erected at 30-38 East Thirty-third Street for Wallach Realty Company; cost about $200,000.

Troy, N. Y.—Charles C. Grant, 37 East Twenty-eighth Street, New York, engaged to prepare plans and specifications for six-story, fireproof, 84 x 130 ft., brick, terra cotta and limestone Y. W. C. A. building to be erected at State and First Streets; cost approximately $200,000.

Morristown, N. J.—Morristown Hebrew Synagogue Association (Jacob M. Levine, Secretary), contemplates erecting $35,000 synagogue on Speedwell Avenue.

West New York, N. J.—Alexander Mulhoiland of West New York will erect a four-story brick apartment at Seventeenth Street and Harrison Place; cost $35,000.

Chester, Pa.—Delaware County Trust Co. reported contemplating erecting eight-story office building at Fifth and Market Streets.

Philadelphia, Pa.—A site on Broad and South Streets selected for diocesan church to be erected for Episcopal Diocese as a memorial to Mrs. Annie Masden Vaughan Watson. Probabzle cost $100,000. Rev. Philip Mercer Rhinelander, Bishop.

Plans prepared by Horace Trumbauer, Land Title Building, for a one-story, stone, 50 x 125 ft., bank building, to be erected at Twelfth and Chestnut Streets for the Beneficial Savings Fund Society; cost $250,000.

Hoffman Co., Globe Theatre Building, has prepared plans for a 10-story loft building to be erected on Arch and Juniper Streets; cost $125,000.

Magaziner & Potter, 603 Chestnut Street, are architects for three-story brick, stone and concrete store building to be erected at Front and Dauphin Streets for A. A. Frankel.

Pittston, Pa.—Plans being prepared for $30,000 parochial school on William St. for Slovak Catholic Church.

Reading, Pa.—Carr & Schadd, 748 Penn Street, plan erecting $250,000 moving picture theatre.

Baltimore, Md.—Plans prepared by Louis Levi, 1408 Munsey Building, for insurance building to be erected on Grant and German Streets; estimated cost $75,000.

Plans prepared for proposed $50,000 school to be erected for Sacred Heart of Jesus Church, of Polish District of Cracow.

Reported Frank Novak Realty Company, 2401 Hartford Street, have secured a tract of land on Hartford Road and will erect 280 dwellings.

Plans filed for an apartment house to be erected on Lincoln Avenue and Brooka Lane by the New York & Maryland Company, according to plans by John Freund, 11 East Lexington Street.

Washington, D. C.—Plans prepared by T. P. Barnett Co., Central National Bank Building, St. Louis, Mo., for the club house to be erected for the Washington Athletic Club on Lafayette Square; cost $1,000,000.

Suffolk, Va.—National Bank of Suffolk, contemplates erecting seven-story fireproof bank building.

American Bank of Suffolk having plans prepared for a seven-story fireproof building. Cost $60,000. W. Jones, Cashier.

Augusta, Ga.—Reported contract soon to be let by G. Lloyd Preacher, Archt., Augusta, for erecting a group of fireproof warehouses for George H. McFadden & Brother and Rigers & Company; probable cost $250,000.

St. Augustine, Fla.—An addition is to be erected this summer to the Munson Hotel. Mrs. A. V. Munson, Owner.

Cincinnati, Ohio.—Plans of the Board of Directors of the Evangelical Protestant Society for a home for sisters and nurses have been approved by the Salem Reformed Church, Sycamore and Orchard Streets,; cost $30,000.

Bratenahl (P. O. Cleveland), Ohio.—Meade & Hamilton, 1002 Garfield Building, Cleveland, are architects for $25,000 residence to be erected on East 109th Street for Henry P. McIntosh.

Cincinnati, Ohio.—Contract about to be let by Frank G. Hamer, 811 Elm Street, for erecting a three-story apartment building at Ashland Avenue and Chapel Street, Walnut Hills; cost $50,000.

Cleveland Ohio. — Building Committee appointed, of which C. E. Terrill is a member, to have plans prepared for an addition to the Windermere Presbyterian Church, Euclid Avenue, East Cleveland, to cost $25,000.

Plans prepared by H. T. Jeffrey, 1836 Euclid Avenue, for a seven-story fireproof terra cotta family hotel and apartment house which the Whitehall Hotel Company intends erecting on East 107th and University Streets, facing the Wade Park; cost at least $500,000.

Reported Cleveland Real Estate Security Company, Erie Building, plans erecting a five-story building on Ontario Street to cost $50,000.

Abbott-McIntosh Co. (Edwin H. McIntosh, Secy.), 5606 Euclid Avenue, intends erecting five-story office and store building at Euclid Avenue and East Fifty-fifth Street; cost $40,000.

Edward P. Strong and Fred Desberg, 919 Society for Savings Building, about to have plans prepared for business block and additions at East Fifty-fifth Street, Utica and Lexington Avenues; total cost about $100,000.

Defiance, Ohio.—Plans being prepared by George B. Rheinfrank, 601 Gardner Building, Toledo, for a steel and stone bank building to be erected for Defiance Home Savings & Loan Association, at a cost of $50,000.

Ladoga, Ind. — Masons will rebuild the temple recently destroyed by fire.

Detroit, Mich.—Charles W. Norton, proprietor of the Hotel Norton, Griswold Street and Jefferson Avenue, is reported interested in the syndicate which intends erecting a 14-story hotel on Jefferson Avenue and Griswold Street, to cost $250,000.

D. H. Gillespie, 78 Coburn Place, it is reported, represents a syndicate which intends erecting on Lafayette Boulevard and First Street an eight-story hotel.

Grand Rapids, Mich.—Michigan Railway Co. (G. H. Webb, Ch. Engr., Detroit) is reported taking steps to construct the terminal on Monroe Avenue and Lyon Street. An 8-story brick building is contemplated on Monroe Avenue front to be used as a public utility office building.

Highland Park (P. O. Detroit), Mich.—The Church of Christ will erect on Sixth and Euclid Avenues a $40,000 edifice. Rev. John Gratton, Pastor.

Danville, Ill.—First National Bank plans erecting twelve-story bank and office building.

Springfield, Ill.—Bullard & Bullard, Unity Building, are architects for synagogue to be erected for B'rith Scholom Congregation; cost about $40,000.

Waukegan, Ill.—Erection of Methodist Church costing about $35,000 contemplated.

Milwaukee, Wis.—Martin Tullgren & Sons, 133 Second Street, are architects for three-story and basement, brick and concrete, apartment house to be erected on Farwell Avenue for Oscar Brachman; cost about $30,000.

Dubuque, Iowa.—Guido Beck, Eighth and Main Streets, is architect for $50,000 edifice to be erected for Sacred Heart Roman Catholic Church.

St. Paul, Minn.—A. H. Stem, Endicott Building, is architect for seven-story, 80 x 170 ft. steel, stone and terra cotta hotel to be erected at Laurel and Western Avenues for A. B. Creelman; cost about $300,000.

Ellis, Kan.—Plans being prepared by J. C. Holland & Son, Mills Building, Topeka, for $30,000 Y. M. C. A. building. H. J. Weber, Secretary.

Wichita, Kan.—Elks Club purchased site on Market and English Streets and will erect a three-story lodge building to cost about $150,000.

St. Louis, Mo.—Reported Central Institute for the Deaf incorporated with Hanford Crawford, International Life Building, president, and intend erecting $50,000 building. Institution at present at 3858 Westminster Place, conducted under Dr. Max A. Goldstein.

Galveston, Tex.—See "Prices and Lettings."

Silver City, N. M.—Masons intend erecting a temple costing $75,000.

Bellingham, Wash. — Reported First Church of Christ Scientists will erect first unit of $200,000 edifice at Maple and Forest Streets. V. A. Roeder, Chairman Building Committee.

Spokane, Wash.—The Merriam Interests, Exchange Bank Building, reported planning a 3-story and 1-story club house on First Avenue for the University Club of Spokane; cost $85,000. Ballard Plannery of Spokane, Archt.

Tacoma, Wash.—Reported H. E. Wilson of the Wilsonia Realty Company, Seattle, intends erecting at South Fifth Street and Broadway a $50,000 apartment house.

Los Angeles, Cal.—Los Angeles Harbor Warehouse Co., 815 Trust & Savings Building, is having plans prepared for a three-story concrete warehouse to be erected at the harbor; cost $55,000; also plans being prepared for a one-story warehouse; probably concrete, for the same locality. Mayberry & Parker, Archts., 472 Pacific Electric Building.

W. J. Dodd and Engineer William Richards, 607 Brockman Building, engaged by H. R. Boynton Company, 216 North Los Angeles Street, to prepare plans for a five-story reinforced-concrete warehouse, 77 x 140 ft., to be erected on Bay Street.

Pasadena, Cal.—Contract to be let latter part of February by Myron Hunt, Archt., 1017 Hibernian Building, Los Angeles, for erecting a 1-story brick garage, salesroom and service building, 100 x 175 ft., at Colorado and El Molino Streets for Charles Y. Knight of the Willys-Overland Co., Toledo, Ohio.

Orange, Cal.—C. B. Bradshaw, 262 North Glassel Street, is architect for three-story brick store and office building for Kogler-Frazen Company; cost about $30,000.

San Francisco, Cal.—Plans completed for reinforced-concrete moving-picture theater to be erected on Mason Street and leased to Mason Street Theater Company; estimated cost $65,000. Baldwin & Howell, 318 Kearney Street, agents for owner.

Flagstaff, Ariz.—Reported B. P. O. E. Lodge considering plans for new Elks building and opera house to replace Majestic Theater, destroyed by recent snows; cost about $25,000.

Miami, Ariz.—Miami Copper Company has donated $75,000 for erecting a Y. M. C. A. building at this place. W. H. Day, Interstate Secy., Albuquerque.

Wickenburg, Ariz.—W. W. Bass of Grand Canyon, intends erecting a sanitarium and winter resort here; cost $75,000.

Idaho Falls, Idaho.—L. M. Earl, Archt., Idaho Falls, is preparing plans for a 5 or 6-story fireproof office building to be erected in this city in the spring.

BIDS DESIRED.

St. Albans, L. I., N. Y.—Reported desired until Feb. 14, by H. P. Knowles, Archt., 52 Vanderbilt Avenue, New York, N. Y., for erecting two-story clubhouse for St. Albans Country Club. Probable cost $35,000.

Yonkers, N. Y.—Until Feb. 17 (extension of time from Jan. 26), by Edwin F. Howard Chmn. Yonkers Masonic Guild, Putnam Station Building, for erecting Masonic Temple. Vollman & Beersman, Evart Tracy, Assoc. Archts., 244 Fifth Avenue, New York, N. Y.

Erie, Pa.—Reported desired until March 1, by Shutts & Morrison, Archts., Marine Bank Building, for erecting three-story, 20 x 120 ft., confectionery shop for Geo. Pulaskos & Son, 828 State Street. Probable cost $25,000.

Philadelphia, Pa.—Reported desired until Feb. 16, by Folsom & Stanton, Archts., 1328 Walnut Street, for erecting a four-story brick and marble clubhouse for the Phi Sigma Kappa Fraternity at 3416 Locust Street.

Reported desired until Feb. 14, by Duhring, Okie & Ziegler, Archts., Bailey Building, for erecting a 2½-story stone residence and two-story stone garage in Germantown for Robert M. Hogue.

Long Prairie, Minn.—Until Feb. 21, by Jas. Hart & Son of Long Prairie, for erecting two-story brick store building, 93 x 140 ft. Separate bids for heating, plumbing, electric wiring, etc. R. C. Buckley, Archt., 654 Plymouth Building, Minneapolis.

Pipestone, Minn.—Reported desired until Feb. 25, by P. J. Linhoff, Archt., 906 Germania Life Building, St. Paul, and the First National Bank, for erecting two-story and basement, 50 x 78 ft., bank and office building, for said bank.

Kingman, Ariz.—Reported desired until Feb. 14 by Lesher & Kibbey, Archts., Phoenix, for erecting 3-story addition to Beale Hotel; probable cost $40,000.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Philadelphia, Pa.**—Contract awarded A. Raymond Raff, 1635 Thompson Street, for erecting three-story stone edifice and rectory at Twenty-ninth and Fletcher streets, for Church of the Intercession. Street & Stackhouse, Architects, Drexel Building.

★**Nashville, Tenn.**—Contract awarded Foster & Creighton, Nashville, for altering the Cole Building, which will require about 1200 tons of steel.

★**Columbus, Ohio.**—Contract for erecting $200,000 building for Central Ohio Paper Company awarded R. H. Evans & Company, Columbus Savings & Trust Building.

★Contract for erecting $150,000 Ford building at Buckingham Street and Cleveland Avenue awarded R. H. Evans & Company, Columbus Savings & Trust Building.

★**Culver, Ind.** — Contract awarded Rochester Bridge Company, Rochester, for furnishing about 250 tons steel for the riding hall for the Culver Military Academy; building to cost $100,000.

★**Minneapolis, Minn.**—Contract awarded Minneapolis Steel & Machinery Company, Twenty-ninth and Minnehaha Streets, for 850 tons of steel for the Metropolitan Bank Building.

★**Galveston, Tex.**—Reported Gilsonite Construction Company of Dallas has contract at $65,000 for erecting first unit of Crystal Palace Bathhouse for G. K. Jorgensen. A second unit will be erected in a short time.

★**Seattle, Wash.**—Following are four lowest bids opened recently for erecting the 10-story Artic Club House on Third Avenue and Cherry Street: Hans Pederson, Alaska Building, $232,000, awarded contract; Brandt Construction Company, 2327 Fifth Avenue, N., $240,013; T. Ryan & Co., Lowman Building, $248,339; Nettleton Bruce & Eschbach, American Bank Building, $249,215. A Warren Gould, Archt., American Bank Building.

NEW INDUSTRIAL PLANTS

PROPOSED WORK.

Greenfield, Mass.—W. A. Davenport, Chairman of Board of Trade, is interested in syndicate which intends erecting a $40,000 factory for the Keystone Stoker Company.

Haverhill, Mass.—Plans prepared by Roland S. Simonds of Boston for 8-story factory contemplated on Essex Street have been tentatively accepted by local capitalists who have formed the "Franklin Associates." Willard G. Cogswell, 813 Barrister Hall, Boston, interested.

Worcester, Mass.—Bickford & Sweet, 60 King Street, intends erecting five-story and basement, brick factory addition; cost about $30,000.

New Haven, Conn.—The Morley Button Company is having plans prepared for a factory addition to cost $100,000.

Buffalo, N. Y.—Plans filed for 6-story factory addition at Niagara Street and Potomac Avenue and New York Central Railroad for F. N. Burt Company, Seneca and Hamburg streets; estimated cost $25,000.

Denahy Packing Company, Metcalfe and Clinton streets, will erect a four-story brick and steel addition to cold storage and packing plant; cost $25,000.

Bayonne, N. J.—Crucible Steel Co., South Fifth Street, will erect $80,000 annealing plant.

New Jersey.—Reported Bethlehem Steel Co., Morris Building, Philadelphia, Pa., has purchased holdings of old United States Sugar Cane Co. in Cape May County, N. J., for purpose of erecting shrapnel shell plant.

Cedartown, Pa.—Cedartown Cotton & Export Company, plans enlarging plant and installing 8640 spindles and other accompanying machinery; total cost about $225,000.

Chester, Pa.—Scott Paper Company, Seventh Street and Glenwood Avenue, Philadelphia, intends erecting six new steel and concrete buildings to replace present plant here and installing additional machinery at total cost of about $310,000.

Clairton, Pa.—Reported United States Steel Corporation will erect this spring a by-product coke oven plant, the first block of the group to call for 204 ovens.

Easton, Pa.—Northampton Silk Company of Easton intends erecting buildings at Ann and St. Joseph streets, costing between $50,000 and $75,000.

Baltimore, Md.—J. E. Aldred of Consolidated Gas, Electric Light & Power Co., Lexington and Liberty Streets, reported interested in Baltimore Sheet & Tin Plate Co., which intends erecting $3,000,000 tin plate rolling mill in the vicinity of Highlandtown.

The Raymond Concrete Pile Co., 425 Munsey Building, reported considering erecting a plant and wharf on Colgate Creek on a site recently purchased.

Beech Bottom (P. O. Wellsburg), W. Va.—Reported Whitaker-Glessner Company of Wheeling, will erect steel mill here.

Savannah, Ga.—Reported Westinghouse, Church & Kerr, 37 Wall Street, New York, are preparing plans for a sugar refinery to be erected here at a cost of $3,500,000.

Coster (P. O. Knoxville), Tenn.—Southern Ry. (B. Herman, Ch. Engr., Maintenance of Way, Washington, D. C.), intends erecting a car repair shop here.

Lexington, Ky.—The Lexington Stock Yards Company and the Blue Grass Packing Company incorporated and will establish a stock yard and abattoir. Roger V. Hart of Lexington, interested.

Cleveland, Ohio.—American Stove Company, 1787 East Fortieth Street, intends erecting new factory on Thirty-ninth Street and Kelley Avenue; cost $50,000.

Lima, Ohio.—Reported A. L. White and W. T. Agerter of the White Locomotive Company, Lima, will erect a plant in East Lima for the manufacture of mountain climbing engines exclusively.

East Iron & Machine Company, 352 East Market Street, will erect a branch factory in West Lima to cost $150,000.

Indianapolis, Ind.—American Consolidated Storages with William J. Hogan of Indiana Refrigerating Co., 232 South Pennsylvania Street, as president and general manager, is about to be incorporated for purpose of erecting chain of cold storage warehouses in the larger cities, including Kansas City, Cleveland, Cincinnati and Columbus.

Mishawaka, Ind.—Reported Milmore Corporation of South Bend intends enlarging plant and will erect two-story, steel, brick and glass building here.

La Crosse, Wis.—Reported La Crosse Rubber Mills Company intends erecting a fireproof building.

Sheboygan, Wis.—John C. Nichols Mfg. Co. of Janesville intends erecting a 4-story factory here to replace the present factory in Janesville.

Council Bluffs, Iowa.—The Mansy Milling Company of Omaha, Neb., will erect a grain elevator and warehouse here costing $50,000.

Burlington, Ia.—Erection of Masonic Temple contemplated at Fifth and Washington Streets, to cost about $75,000.

West Burlington, Iowa.—Chicago, Burlington & Quincy R.R. Co. (T. E. Calvert, Ch. Engr., Chicago, Ill.) intends enlarging shops here at a cost of about $1,000,000.

St. Paul, Minn.—Chicago, St. Paul, Minneapolis & Omaha R. R. (H. Pettinghouse, Ch. Engr., St. Paul) intends erecting an office building on site of present office at Fourth and Rosabel Streets, plans for which are about completed. Plans provide for an 8-story steel and reinforced concrete building estimated to cost $500,000. Charles S. Frost, Archt., 105 S. La Salle Street, Chicago, Ill.

The Creosote Company Paving Block Manufacturers of Chicago, Ill., it is reported contemplates erecting a plant either in Minneapolis or St. Paul costing $100,000.

St. Paul, Minn.—L. Eisenmenger Meat Co., 455 Wabasha Street, will erect packing plant to cost about $100,000.

Maendler Brothers, 42 East Third Street, plan to erect $50,000 brush factory on Ninth and Jackson Streets.

Houston, Tex.—Captain J. F. Lucey, President of the Lucey Manufacturing Company, is reported to have purchased the plant of the Union Iron Works and will enlarge and improve same.

Los Angeles, Cal.—Plans being prepared by J. Schulz, Wright & Callender Building, for a factory, power house and office buildings to be erected on Santa Fe Avenue for the Southern California Box Company, 1335 E. Sixth Street.

Homer Laughlin Engineering Corporation, 2652 Long Beach Avenue, voted $400,000 increase of capital stock to install drop forge and enlarge plant to handle automobile construction.

Oakland, Cal.—The Union Iron Works of San Francisco has purchased the plant of the United Engineering Works of Oakland and will improve said plant at a cost of $250,000.

San Diego, Cal. — Swift & Company, California and D Streets, will erect a plant for the production of potash from kelp.

Turlock, Cal.—Valley Ice Company, Bakersfield and Stockton, intends erecting an ice plant here costing $100,000.

Tombstone, Ariz.—Reported Mountain States Telegraph & Telephone Co., Denver, will rebuild plant here.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Buffalo, N. Y.**—Contract awarded by Eastern Grain, Mill & Elevator Corporation to Monarch Engineering Company, Chamber of Commerce Building, for erecting a 1,000,000-bu. grain elevator of concrete and steel construction with movable marine towers, on the Buffalo River and New York Central Railroad.

★**Philadelphia, Pa.**—Contract awarded Hennebique Construction Co., 1170 Broadway, New York, N. Y., for erecting a mill building in Philadelphia for the Philadelphia Textile Machinery Co., to be 1 story, 251 x 261 ft., reinforced concrete, saw-tooth roof construction; cost $175,000.

★Contract awarded William Steele & Sons Company, 1600 Arch Street, for erecting a two and three-story reinforced concrete manufacturing building at Richmond and Tioga streets; cost about $60,000.

★**Akron, Ohio.**—Hunkin Conkety Construction Company, Cuyahoga Building, Cleveland, awarded contract for addition to plant of the Firestone Rubber Company, to be of brick and steel and cost $500,000.

★**Cleveland, Ohio.** — Contract awarded Pratt Company, Columbia Building, for erecting factory at 2216 Superior Avenue for M. W. Heller; cost $55,000. Christian, Schwartzenberg & Gaede, Archts., 1900 Euclid Avenue.

★Contract awarded by Parrish & Bingham Company, Madison Avenue and West 106th Street to Riverside Bridge Company, Martins Ferry, Ohio, and American Cement Tile Company, Schofield Building, Cleveland, for erecting a $150,000 factory, Ernest McGeorge, Archt., Leader-News Building.

★**Indianapolis, Ind.**—Contract awarded William P. Jungclaus Co., 827 Massachusetts Avenue, for erecting four-story addition to plant of Stutz Motor Car Co., Capitol Avenue and Tenth Street; cost about $100,000.

★**Kalamazoo, Mich.**—Contract awarded by Harrow Spring Co. to Byers Brothers Construction Co. of Kalamazoo for erecting rolling mill; cost, including machinery, $125,000.

MISCELLANEOUS

PROPOSED WORK.

Transmission Line—Boston, Mass.—The Metropolitan Water and Sewerage Board, in its annual report, advocates the connection of the Wachisetts and Sudbury power stations and recommends erecting a transmission line to connect the two systems at a cost of $60,000 and also an expenditure of $90,000 for additional improvements.

Park Improvements—Bridgeport, Conn.—See "Sewerage and Sewage Disposal."

Park Improvement—New Haven, Conn.—Professor Theodore Woolsey, Chairman of the City Park Commission, has outlined the extensive development in the vicinity of Mill River. Frederick Law Olmstead, Jr., Landscape Architect.

Tunneling—Cincinnati, Ohio.—Chief Engineer Krug has submitted several estimates for rapid transit to Price Hill providing for tunneling under the hill; minimum cost $1,195,700 and maximum $2,415,500.

Subway — Cleveland, Ohio. — See "Bridges."

Conduits—Springfield, Ohio. — Springfield Light, Heat & Power Co. and the American Telegraph & Telephone Co. are reported taking steps to replace overhead wires in the downtown district underground in conduits.

Oiling Road — Champaign, Ill. — This spring the county will drain and oil highways throughout the county under appropriation of $40,000. D. J. Holterman, Chmn. County Commissioners.

Subway—Oakland, Cal.—See "Bridges."

Structural Steel for Bridges—Ventura, Cal.—All bids opened Feb. 3 by Board of Supervisors, for furnishing structural steel for four bridges, approximately 660,350 lbs. steel, 15,800 lbs. c.-i. and 3000 lbs. bolts and washers, rejected. J. B. McCloskey, County Clerk.

BIDS DESIRED.

Waterproofing Fabric—Boston, Mass.—Until Feb. 23 by Boston Transit Commission (B. Leighton Beal, Secy.) for furnishing any quantity up to 100,000 sq. yd. of asphalt saturated woven cotton fabric, advertised in Engineering Record.

Road Oil—Providence, R. I.—Until Feb. 23 by State Board Public Roads (John F. Richmond, Chmn.) at State House, Providence, for furnishing 400,000 gal. asphaltic road oil to state highways, advertised in Engineering Record.

Cement—Newark, N. J.—Until Feb. 24, by Board Street and Water Commissioners (M. R. Sherrerd, Ch. Engr.), for 300 tons and 2000 lb. asphaltic cement, for the municipal asphalt repair plant.

Asphaltic Cement—Newark, N. J.—Until Feb. 24, by Board Street & Water Commissioners for furnishing city 300 tons asphaltic cement for use at city asphalt repair plant. M. R. Sherrerd, Ch. Engr.

Fire Escapes—Cleveland, Ohio.—Until Feb. 14 by Board Education, East Sixth Street, for fire escapes for Willard School, Willard Ave., N. W. corner Ninety-third Street.

Grandstand—Troy, Ohio.—Reported desired until Feb. 21, by County Commissioners for constructing reinforced-concrete grandstand and judge stand on Fair Grounds of the Miami County Agricultural Society. Fred G. Mueller, Archt., 755 Rentschler Building, Hamilton.

Tractor—Mitchell, S. D.—Reported desired until Feb. 17 by J. M. Crampton, Co. Aud., for one gas-oil tractor 30 to 50 hp. and one 12-ft. grader.

Asphalt—Montreal, Que.—Reported desired until March 2 by Board of Control for 6000 tons asphalt.

Cement, etc. — Hamilton, Ont.—Until March 1 by S. H. Kent, City Clk., for cement, broken stone, asphalt, vitr. brick, creosoted wooden blocks, specials, hydrants, etc.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Cement — Atlanta, Ga.** — Contract awarded by Superintendent of Prisons, Dept. of Justice, Washington, D. C., for furnishing 8000 bbl. of Portland cement for delivery at Atlanta, Ga., Penitentiary, to V. H. Kriegshaber & Son, Atlanta, Ga., at $10,800.

★**Cement — Danville, Ill.** — Contracts awarded by Council as follows: To Danville Lime & Cement Company, Danville, for 25,000 bbls. Portland cement and to Chicago Portland Cement Company, Chicago, for 125,000 bbls. Portland cement, said cement to be used in the construction of concrete or brick roads; proceeds of a bond issue recently sold. P. C. McArdle, Superintending Engr., Danville.

Proposals

For Proposals Advertised, See Pages 40a, 40b and 40c.

WATERWORKS.

Bids Close.		See Eng. Record.
Feb. 14.	Waterworks, Viola, Ill. Adv. Jan. 22, 29.	Jan. 22
Feb. 15.	Improvements, Lewiston, N. Y. Adv. Jan. 22 to Feb. 5.	Jan. 22
Feb. 15.	Contract 172, New York, N. Y. Adv. Jan. 29, Feb. 5.	Jan. 29
Feb. 15.	Pipe, Etc., Washington D. C.	Feb. 5
Feb. 15.	Improvements, Lander, Wyo.	Feb. 12
Feb. 16.	Fire Hydrants, Kansas City, Mo.	Feb. 12
Feb. 17.	Meter Testing Apparatus, Newark, N. J. Adv. Feb. 5.	Feb. 5
Feb. 21.	Meters, St. Paul, Minn.	Feb. 12
Feb. 22.	Waterworks, McCammon, Idaho	Jan. 22
Feb. 22.	Water Works, Havana, Cuba.	Feb. 5
Feb. 23.	Pump, etc., Rock Island, Ill.	Feb. 5
Feb. 23.	Water Works, North Collins, N. Y. Adv. Feb. 12.	Feb. 12
Feb. 24.	Improvements, Bloomington, Ind. Adv. Jan. 29.	Jan. 29
Feb. 24.	Meters, Ligonier, Ind.	Feb. 5
Feb. 24.	Contract 169, New York, N. Y. Adv. Feb. 5, 12.	Feb. 5
Mar. 1.	Water Works, Colville, Wash.	Feb. 12
Mar. 1.	Water Works, Bayard, Neb.	Feb. 12
Mar. 1.	Water Works, Everett, Wash.	Feb. 12
Mar. 2.	Reservoir, Washington, D. C. Adv. Feb. 5.	Feb. 5
Mar. 6.	Well, New Bern, N. C. Adv. Feb. 12.	Feb. 12
Mar. 8.	Pumping Station, Fort Bliss, Tex. Adv. Feb. 12.	Feb. 12
Mar. 22.	Add. to Pump Sta., New Orleans, La. Adv. Feb. 5.	Feb. 5
Apr. 1.	Mains, Cullman, Ala.	Jan. 15
——	Pipe Line, Trinity, Tex.	Feb. 5

SEWERAGE AND SEWAGE DISPOSAL.

Feb. 15.	Strawberry Point, Ia.	Feb. 5
Feb. 15.	Kansas City, Mo.	Feb. 12
Feb. 16.	Keota, Iowa	Feb. 5
Feb. 16.	El Centro, Cal.	Feb. 12
Feb. 17.	North Bergen, N. J.	Feb. 5
Feb. 17.	Mountain Lake, Minn.	Feb. 5
Feb. 17.	New York, N. Y.	Feb. 12
Feb. 17.	Houston, Tex.	Feb. 12
Feb. 19.	Brewsters, Ohio	Feb. 12
Feb. 19.	Keota, Iowa	Feb. 12
Feb. 20.	Kenwood, Ia.	Feb. 5
Feb. 21.	Hammond, Ind.	Feb. 5
Feb. 21.	Camden, N. J.	Feb. 12
Feb. 22.	Havana, Cuba.	Feb. 5
Feb. 23.	Des Moines, Iowa	Jan. 29
Feb. 24.	East View, Ohio	Jan. 29
Feb. 25.	Pierce, Neb.	Jan. 29
Feb. 28.	Montclair, N. J. Adv. Feb. 12.	Feb. 12
Feb. 29.	Kendallville, Ind. Adv. Feb. 5.	Feb. 5
Mar. 6.	Polsom, Mont. Adv. Feb. 5.	Feb. 5
Mar. 6.	Savannah, Ga. Adv. Feb. 12.	Feb. 12
Mar. 7.	Billings, Mont.	Feb. 12
Mar. 14.	Newark, N. J. Adv. Jan. 22, Feb. 5.	Jan. 22

BRIDGES.

Feb. 15.	Sutherland, Neb.	Jan. 22
Feb. 15.	Alaska Adv. Jan. 15 to Feb. 5.	Jan. 15
Feb. 15.	Jamestown, N. D.	Jan. 29
Feb. 15.	St. Cloud, Minn.	Jan. 29
Feb. 15.	Illinois	Jan. 29
Feb. 15.	Kentucky	Feb. 5
Feb. 15.	Decorah, Iowa	Feb. 12
Feb. 15.	Jonesboro, Ark.	Feb. 12
Feb. 16.	Jamestown, N. D.	Jan. 29
Feb. 17.	Miami, Fla.	Jan. 29
Feb. 17.	York, Pa.	Feb. 5
Feb. 18.	Hampton, Iowa	Feb. 12
Feb. 19.	Clay, W. Va.	Jan. 29
Feb. 19.	Charleston, W. Va.	Feb. 12
Feb. 21.	Seattle, Wash.	Feb. 5
Feb. 21.	Everett, Wash.	Feb. 5
Feb. 23.	Dickinson, N. D.	Jan. 29
Feb. 23.	Hutchinson, Kan.	Feb. 5
Feb. 23.	Maine	Feb. 5
Feb. 23.	Honeoye Falls, N. Y.	Feb. 12
Feb. 26.	Kansas City, Kan.	Feb. 12
Feb. 29.	Dayton, Ohio.	Feb. 12
Mar. 2.	Illinois	Feb. 12
Mar. 3.	Seattle, Wash.	Feb. 5
Mar. 4.	Berkeley Springs, W. Va.	Feb. 5
Mar. 6.	Tucson, Ariz.	Feb. 5
Mar. 7.	Columbus, Ohio	Feb. 12
Mar. 9.	La Salle, Ill. Adv. Feb. 12.	Feb. 12
Mar. 9.	Fairbury, Neb. Adv. Feb. 12.	Feb. 12
Mar. 10.	Fairbury, Neb.	Jan. 29

PAVING AND ROADS.

Bids Close.		See Eng. Record.
Feb. 15.	Spokane, Wash.	Jan. 8
Feb. 15.	Santa Monica, Cal.	Jan. 29
Feb. 15.	Bath, W. Va.	Jan. 29
Feb. 15.	Wausau, Wis.	Jan. 29
Feb. 15.	Gulfport, Fla.	Feb. 12
Feb. 15.	McPherson, Kan.	Feb. 12
Feb. 15.	Council Grove, Kan.	Feb. 12
Feb. 15.	New London, Wis.	Feb. 12
Feb. 15.	Kansas City, Mo.	Feb. 12
Feb. 16.	Ohio	Feb. 5
Feb. 16.	Brooklyn, N. Y.	Feb. 12
Feb. 16.	Baltimore, Md.	Feb. 12
Feb. 19.	Cherokee, Iowa.	Feb. 12
Feb. 17.	New York, N. Y.	Feb. 12
Feb. 17.	New Concord, Ohio	Feb. 12
Feb. 17.	Jersey City, N. J.	Feb. 12
Feb. 18.	Denison, Iowa	Feb. 12
Feb. 18.	Columbus, Miss.	Feb. 12
Feb. 19.	Indiana	Feb. 12
Feb. 20.	Tacoma, Wash.	Jan. 22
Feb. 21.	Washington.	Feb. 12
Feb. 21.	Camden, Ala.	Jan. 29
Feb. 21.	Johnson, N. Y.	Jan. 29
Feb. 21.	Lyons, Kan.	Feb. 5
Feb. 21.	West Liberty, Iowa Adv. Feb. 12.	Feb. 12
Feb. 21.	Bloomfield, N. J.	Feb. 12
Feb. 21.	Knoxville, Tenn. Adv. Feb. 12.	Feb. 12
Feb. 21.	Oconomowoc, Wis.	Feb. 12
Feb. 23.	Indiana	Jan. 29
Feb. 23.	Maine Adv. Feb. 5.	Feb. 5
Feb. 23.	Maryland Adv. Feb. 12.	Feb. 12
Feb. 23.	Louisville, Ky.	Feb. 12
Feb. 23.	Indiana	Feb. 12
Feb. 24.	Newark, N. J.	Feb. 12
Feb. 24.	Elmira, N. Y. Adv. Feb. 12.	Feb. 12
Feb. 25.	St. Louis, Mo.	Feb. 12
Feb. 28.	Lebanon, Ind.	Jan. 29
Feb. 28.	Minot, N. D.	Jan. 29
Feb. 28.	Indiana.	Feb. 5
Feb. 28.	Wallace, Idaho	Feb. 5
Feb. 28.	Lansing, Mich.	Feb. 12
Feb. 28.	Kalamazoo, Mich.	Feb. 12
Mar. 1.	Fort Madison, Iowa	Feb. 5
Mar. 1.	Parkersburg, W. Va.	Feb. 12
Mar. 1.	Globe, Ariz.	Feb. 12
Mar. 1.	Ravenna, Ohio	Feb. 12
Mar. 1.	Sidney, Ind.	Feb. 12
Mar. 2.	Hibbing, Minn.	Feb. 5
Mar. 2.	Montreal, Que.	Feb. 12
Mar. 6.	Huntsville, Ala.	Jan. 29
Mar. 6.	Portland, Ind.	Jan. 29
Mar. 6.	Atchison, Kan.	Feb. 12
Mar. 7.	Davenport, Wash.	Jan. 22
Mar. 7.	Richland Center, Wis. Adv. Feb. 12.	Feb. 12
Mar. 8.	Indiana	Feb. 5
Mar. 11.	Appleton, Wis.	Feb. 12
Mar. 14.	Danville, Ill. Adv. Feb. 12.	Feb. 12
Mar. 15.	Danville, Ill. Adv. Feb. 12.	Feb. 12
Mar. 16.	Danville, Ill. Adv. Feb. 12.	Feb. 12
Mar. 18.	Watertown, N. Y.	Feb. 12
Mar. 20.	Bolivar, Mo.	Feb. 12
Feb. 15.	Oakdale, Iowa	Jan. 29
Feb. 15.	Boise, Idaho	Feb. 5
Feb. 15.	Lynn, Mass.	Feb. 5
Feb. 15.	Mahanoy City, Pa.	Feb. 5
Feb. 15.	West Frankfort, Ill.	Feb. 5
Feb. 15.	Walla Walla, Wash.	Feb. 5
Feb. 15.	Fair Haven, Vt.	Feb. 12
Feb. 16.	Agawam, Mass.	Jan. 22
Feb. 16.	Lancaster, Pa.	Jan. 22
Feb. 16.	Kuenemo, Kan.	Feb. 5
Feb. 16.	Normandy, Mo.	Feb. 12
Feb. 16.	Sacramento, Cal.	Feb. 12
Feb. 17.	Wilmington, Ohio	Jan. 22
Feb. 17.	Los Angeles, Cal.	Jan. 22
Feb. 18.	Madison, Wis.	Jan. 29
Feb. 18.	Portland, Ore.	Jan. 29
Feb. 18.	Rochester, Ind.	Feb. 5
Feb. 19.	Miami, Ind.	Feb. 5
Feb. 18.	Montpelier, Vt.	Feb. 5
Feb. 21.	Fort Pierce, Fla.	Jan. 29
Feb. 21.	Prescott, Ariz.	Feb. 5
Feb. 21.	Leupp, Ariz.	Feb. 5
Feb. 21.	Krotz Springs, La.	Feb. 5
Feb. 21.	Brazil, Ind.	Feb. 5
Feb. 21.	Rochester, N. Y.	Feb. 5
Feb. 21.	La Porte, Tex.	Feb. 12
Feb. 21.	Springfield, Mass.	Feb. 12
Feb. 23.	Belmond, Iowa	Jan. 29
Feb. 23.	St. Peters, Minn.	Feb. 12
Feb. 23.	Bradgate, Iowa	Feb. 12
Feb. 24.	Batavia, Ohio	Jan. 22
Feb. 21.	Minot, N. D.	Jan. 29
Feb. 24.	Columbus, Ohio.	Jan. 29
Feb. 24.	Berwyn, Pa.	Feb. 5
Feb. 24.	Clarksville, Tenn Adv. Feb. 5.	Feb. 5
Feb. 24.	Highland Park, Mich.	Feb. 12
Feb. 25.	Ebensburg, Pa.	Jan. 8
Feb. 25.	Ellsworth, Ia.	Feb. 5
Feb. 25.	St. Charles, Ill.	Feb. 5
Feb. 25.	Bradford, Iowa	Feb. 12
Feb. 25.	Enderlin, N. D.	Feb. 12
Feb. 26.	Westville, O.	Feb. 5
Feb. 26.	Sycamore, Ill.	Feb. 12
Feb. 26.	Columbus, Ohio	Feb. 12
Feb. 28.	Olmstead Falls, O.	Feb. 5
Feb. 28.	Oneida, Iowa	Feb. 5
Feb. 28.	Baldwin, L. I., N. Y. Adv. Feb. 12.	Feb. 12
Feb. 29.	Guide Rock, Neb.	Jan. 29
Feb. 29.	Miami, Okla.	Jan. 29
Feb. 29.	Martinsburg, W. Va.	Feb. 5
Mar. 1.	Industrial, W. Va.	Feb. 5
Mar. 1.	Normal, Ill.	Feb. 5
Mar. 1.	Oshkosh, Wis.	Feb. 5
Mar. 1.	Bridgeport, Neb.	Feb. 12
Mar. 2.	Rockford, Ill.	Feb. 12
Mar. 4.	Palmyra, Ohio	Feb. 12
Mar. 4.	Seabreeze, Fla.	Feb. 12
Mar. 6.	Lake Helen, Fla.	Jan. 29
Mar. 6.	Seabreeze, Fla.	Jan. 29
Mar. 7.	Harrisburg, Pa.	Jan. 22
Mar. 7.	Bethlehem, Pa.	Feb. 5
Mar. 8.	Lubbock, Tex.	Feb. 12
Mar. 10.	Kalispell, Mont.	Feb. 5
Mar. 13.	Oklahoma City, Okla.	Feb. 5
Mar. 14.	Antigo, Wis.	Feb. 5
Mar. 15.	Gilbert, Minn.	Feb. 12
Mar. 17.	Charles City, Iowa	Feb. 12
Mar. 20.	Austin, Minn.	Jan. 29
Mar. 22.	Mattoon, Ill.	Feb. 12

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS.

Feb. 15.	Ditch, Princeton, Minn.	Jan. 22
Feb. 15.	Drainage, Jackson, Minn.	Jan. 29
Feb. 15.	Ditches, McCrory, Ark.	Feb. 5
Feb. 16.	State Canal Work, Albany, N. Y. Adv. Jan. 22 to Feb. 12.	Jan. 22
Feb. 16.	Spillway Gates, Seattle, Wash. Adv. Jan. 22 to Feb. 5.	Jan. 22
Feb. 16.	Levee Work, Alexandria, La.	Jan. 29
Feb. 16.	Ditch, Bemidji, Minn.	Feb. 5
Feb. 19.	Ditch Work, Duluth, Minn.	Feb. 12
Feb. 21.	Jetty Work, Dallas, Tex. Adv Jan. 29 to Feb. 12.	Jan. 29
Feb. 21.	**Breakwater Improvements, Manistee, Mich.** Adv. Jan. 29 to Feb. 12.	**Jan. 29**
Feb. 21.	Jetty Work, Portland, Ore.	Jan. 29
Feb. 23.	Steel for Lock, Sault Ste. Marie, Mich. Adv. Jan. 22, 29.	Jan. 22
Feb. 23.	Drain, Hastings, Mich.	Feb. 12
Feb. 24.	Dyke Work, Albany, N. Y. Adv. Jan. 29, Feb. 5.	Jan. 29
Feb. 24.	Seawall, West Palm Beach, Fla.	Feb. 12
Feb. 24.	Dredging, New York, N. Y. Adv. Feb. 12.	Feb. 12
Feb. 28.	Lock Gates, New Glasgow, N. S.	Feb. 12
Feb. 29.	State Canal Work, Albany, N. Y.	Feb. 5
Feb. 29.	Dredging, New York, N. Y. Adv. Feb. 5, 12.	Feb. 5
Feb. 29.	Ditch, Jackson, Minn.	Feb. 12
Mar. 6.	Drainage, Largo, Fla. Adv. Feb. 12.	Feb. 12
Mar. 6.	Dredging, Hartford, Conn. Adv. Feb. 5, 12.	Feb. 5
Mar. 7.	Dredging, New York, N. Y. Adv. Feb. 12.	Feb. 12
Mar. 9.	Ditch, Moorehead, Minn.	Jan. 29
Mar. 10.	Breakwater, Racine, Wis. Adv. Feb. 12.	Feb. 12
Mar. 10.	Irrigation, Fort Laramie, Wyo. (2 Props.) Adv. Feb. 12.	Feb. 12

PUBLIC BUILDINGS AND SCHOOLS.

Feb. 15.	Boston, Mass.	Jan. 15
Feb. 15.	Amity, Ohio	Jan. 22

PRIVATE BUILDINGS.

Feb. 15.	Binghamton, N. Y.	Jan. 22
Feb. 15.	Nashville, Tenn.	Jan. 22
Feb. 15.	Britt, Iowa	Jan. 1
Feb. 15.	Evansville, Ind.	Feb. 5
Feb. 16.	Philadelphia, Pa.	Feb. 12
Feb. 17.	Yonkers, N. Y.	Feb. 12
Feb. 20.	Des Moines, Ia.	Feb. 5
Feb. 21.	Long Prairie, Minn.	Feb. 12
Feb. 21.	Eau Claire, Wis.	Feb. 12
Feb. 25.	Pipestone, Minn.	Feb. 12
Mar. 1.	Erie, Pa.	Feb. 12
Mar. 1.	Indianapolis, Ind.	Jan. 29
Apr. 1.	Cleveland, Ohio	Jan. 8

NEW INDUSTRIAL PLANTS.

Feb. 15.	Chicago, Ill.	Jan. 29
Feb. 21.	Astoria, Ore.	Jan. 29
Apr. 15.	Manilla, P. I.	Jan. 8

MISCELLANEOUS.

Feb. 14.	Steel Sash at Hospital, Napanoch, N. Y. Adv. Jan. 29.	Jan. 29
Feb. 17.	Light Standards, Macomb, Ill.	Feb. 5
Feb. 17.	Tractor, Mitchell, S. D.	Feb. 12
Feb. 17.	Garbage, Swissvale, Pa.	Feb. 12
Feb. 18.	Garbage, Ashland, O.	Feb. 5
Feb. 21.	Garbage, Fresno, Cal.	Feb. 5
Feb. 21.	Grand Stand, Troy, Ohio.	Feb. 12
Feb. 21.	Cement, Etc., Greenfield, Iowa	Feb. 5
Feb. 23.	Castings, Etc., Panama. Adv. Jan. 15.	Jan. 15
Feb. 23.	Boilers in Boat, Cincinnati, Ohio Adv. Feb. 5, 12.	Feb. 5
Feb. 23.	Road Oil, Providence, R. I. Adv. Feb. 12.	Feb. 12
Feb. 23.	Waterproofing Fabric, Boston, Mass. Adv. Feb. 12.	Feb. 12
Feb. 24.	Track Installation, New York, N. Y.	Feb. 12
Feb. 24.	Cement, Newark, N. J.	Feb. 12
Feb. 25.	Asphaltic Cement, Newark, N. J.	Feb. 12
Feb. 28.	Counters, Gates, Etc., Boston, Mass. Adv. Jan. 29, Feb. 5.	Jan. 29
Feb. 29.	Maneuver Boats, Wheeling, W. Va. Adv. Feb. 5. 12.	Feb 5
Feb. 29.	Elevator, Martinsburg, W. Va.	Feb. 5
Mar. 1.	Tower, Honolulu, T. H.	Jan. 22
Mar. 1.	Cement, Etc., Hamilton, Ont.	Feb. 12
Mar. 4.	Projectile Hoists, Philadelphia, Pa. Adv. Feb. 12.	Feb. 12
Apr. 1.	Memorial, Fort McHenry, (P. O. Baltimore, Md.).	Nov. 20

SEARCHLIGHT SECTION

Official Proposal Announcements

Price, $2.40 an inch.—Copy can be received until
Thursday 10 a. m. for issue mailed the next morning

Bids open February 16, 1916.

NOTICE TO CONTRACTORS.

STATE OF NEW YORK, OFFICE OF SUPERINTENDENT OF PUBLIC WORKS.

ALBANY, N. Y.

Sealed proposals will be received by the undersigned at his office in the Capitol at Albany, N. Y., until twelve o'clock noon of Wednesday, February 16, 1916, at which place and hour they will be publicly opened and read, for improving the New York State canals pursuant to the provisions of Chapter 147 of the Laws of 1903, and of the acts amendatory thereof and supplementary thereto, and Chapter 570 of the Laws of 1915, as follows:

1

CONTRACT NO. 46-B (Revised).

Erie Canal—Section 7.

For completing the construction of lock, dam, etc., at May's Point.

Sheets 1 to 39 inclusive.

2

CONTRACT NO. 122 (Revised).

Erie Canal—Section 4.

For constructing the substructure, superstructure and approaches of a highway bridge over the Mohawk River near Little Falls, at about Barge Canal Center Line Station 4246—42. Sheets 1 to 11 inclusive.

3

CONTRACT No. 63-A.

Erie Canal—Section 9.

For completing the construction of the canal from the west line of Wayne County to the east end of Contract No. 23-A, at King's Bend. Length 12.22 miles. Sheets 1 to 18 inclusive.

Plans may be seen and detailed specifications, engineer's estimate of quantities, proposal blanks, form of contract and bonds required and other information for proposers may be had at the office of the Superintendent of Public Works, at Albany, N. Y.; at the office of the Assistant Superintendent of Public Works for the Middle Division at Syracuse, N. Y.; at the office of the Assistant Superintendent of Public Works for the Western Division at Rochester, N. Y., and at the canal office, Spaulding's Exchange, Buffalo, N. Y.

Copies of detailed plans or drawings may be obtained from the State Engineer and Surveyor at Albany, N. Y., upon payment to him of the cost of producing them.

Monthly estimates will be paid of ninety per centum (90 per cent.) of the work done at the contract price. Every proposal for said work must be accompanied by a money deposit in the form of a draft or certified check upon some good banking institution in the city of Albany or New York, issued by a national or State bank in good credit within the State and payable at sight to the Superintendent of Public Works for five per centum (5 per cent.) of the amount of the proposal.

The person whose proposal shall be accepted will be required to execute a contract and furnish bonds within ten days from the date of notice of award delivered to him or them in person or mailed to the address given in the proposal.

Upon execution of the contract and approval of bonds, the certified check or draft will be returned to the proposer unless the same shall have been presented for collection prior to such time, in which case the amount of the deposit will be refunded by the Superintendent of Public Works.

The deposits of bidders other than the one to whom the award of contract shall be made will be returned immediately after the award has been made.

The amount of bond required for faithful performance will be ten per centum (10 per cent.) of the amount of the estimated cost of the work according to the contract price, and an additional bond, known as the labor bond, in the sum of ten per centum (10 per cent.) of the amount of the estimated cost of the work according to the contract price, will be required as security that the contractor will pay in full at least once in each month all laborers employed by him upon the work specified to be done in the contract.

In the event that more than one surety company is offered as surety on said bonds, co-insurance only will be accepted.

Each proposal must be addressed to the Superintendent of Public Works, Albany, N. Y., and must be endorsed on the envelope with the name of the construction for which the proposal is made.

Award, if made, will be made to the person or persons whose proposal shall be lowest in cost to the State for doing the work, and which shall comply with all provisions required to render it formal. Before any award shall be made the lowest bidder will be required to satisfy the Superintendent of Public Works of his ability to provide suitable equipment and materials for the proper performance of the work.

The right is reserved to reject all proposals and readvertise and award the contract in the regular manner if, in the judgment of the undersigned, the interests of the State will be enhanced thereby.

W. W. WOTHERSPOON,
Superintendent of Public Works.
January 17, 1916.

Bids open March 9, 1916.

NOTICE TO BRIDGE BUILDERS

FAIRBURY, NEB.

Sealed bids will be received by the Board of County Commissioners of Jefferson County, Nebraska, at the office of County Clerk, up to twelve o'clock, noon, of the 9th day of March, 1916, for the construction and erection of the superstructure, the substructure and approaches of all bridges of the length of Sixteen feet and over, and for the furnishing of all material in connection with the same, to be built within and by said County for the period of one year as hereinafter specified. All bids to be according to law.

Said bridges to be built under contract to commence on the 11th day of March, 1916, and to terminate on the 11th day of March, 1917. The number, location and size of such bridges to be hereafter determined by the Board of County Commissioners, and each bridge to be completed within sixty days of notice as to location and size.

Bids for the construction of said bridges shall be according to the plans and specifications which were prepared by the Secretary of the State Board of Irrigation, and furnished by the Secretary of the State Board to the Board of County Commissioners of this County, and by them this day adopted and on file in the office of the County Clerk, in Fairbury, Nebraska.

All bids must be on full sawed material used, and each bidder will be required to deposit with his bid cash or certified check for one hundred dollars payable to the order of C. O. Marthis, County Clerk, to be forfeited in case his bid is accepted and the bidder refuses to enter into a contract and furnish bond as required by law and by the conditions herein named.

The Board reserves the right to reject any bid or bids or all bids. Said bids will be opened by said County Clerk in the presence of the Board of County Commissioners at their office at 12:05 o'clock in the afternoon of the said 9th day of March, 1916.

Done in adjourned, regular session this 13th day of January, 1916. By order of the Board of County Commissioners of Jefferson County, Nebraska.

C. O. MARTHIS,
County Clerk.

Bids open February 23, 1916.

NOTICE TO CONTRACTORS

WATER WORKS

NORTH COLLINS, N. Y.

Sealed proposals will be received by the Board of Trustees of the Village of North Collins, Erie County, N. Y., up to 2 o'clock p. m. of the 23d day of February, 1916, for furnishing the materials and constructing a water works system for said village.

There will be required approximately the following materials: About 6 miles of 8, 6 and 4-in. cast-iron water mains.

Fifty (50) fire hydrants; forty-eight (48) gate valves and boxes; two triplex power pumps and two gas engines; pumping station and well; stand pipe (steel); concrete standpipe foundation, etc. A certified check in an amount equal to two (2) per cent of the amount of the bid, made to the treasurer of the village must accompany each proposal. Plans may be seen and specifications and blank forms of proposal procured at the office of the Clerk of the Village, North Collins, N. Y., or at the office of the engineers, J. F. Witmer Company, 97, 98 Dun Building, Buffalo, N. Y.

The right is reserved to reject any and all bids.

North Collins, N. Y., February 3, 1916.

LEE B. WARD,
Village Clerk.
J. F. WITMER COMPANY,
Engineers,
Brooklyn, N. Y.

Bids open February 21, 1916.

PAVING BIDS

KNOXVILLE, TENN.

Sealed bids will be received by the Board of Commissioners of the City of Knoxville, Tenn., until noon, Monday, February 21, 1916, for the paving, grading, curbing and sewers for State Street Improvement District No. 115, beginning at the intersection of Church Street and extending to the north intersection of Commerce Street. Profiles, maps and specifications can be had on application to the City Engineer.

Approximate quantities: 1650 cu. yd. grading, 4900 sq. yd. paving, 3000 lin. ft. curb reset, 1500 lin. ft. storm sewer with catch basins and manholes.

The Board of Commissioners reserves the right to reject any or all bids.

JOHN W. FLENNIKEN,
Commissioner Streets and Public Improvements.
J. B. McCALLA,
City Engineer.
ROBT. P. WILLIAMS,
City Recorder.

Bids open February 23, 1916.

NOTICE TO CONTRACTORS.

CITY OF BOSTON, MASS.

WATERPROOFING FABRIC

Sealed bids for furnishing and delivering any quantity up to 100,000 sq. yd., more or less, of asphalt-saturated woven cotton fabric will be received by the undersigned at 15 Beacon Street, Boston, Mass., until 12 o'clock, noon, of Wednesday, February 23, 1916. Specifications and forms of contract can be had at 15 Beacon Street, ninth floor. The right to reject any and all bids and to award the contract as is deemed to be for the best interest of the City of Boston is reserved.

By order of the
BOSTON TRANSIT COMMISSION,
B. LEIGHTON BEAL,
Secretary.

Bids open March 6, 1916.

DITCHES AND SPILLWAY

LARGO, FLA.

Sealed proposals will be received at the office of the Board of Supervisors of the Lake Largo-Cross Bayou Drainage District, in Pinellas County, Largo, Fla., until Monday, March 6, 12 o'clock noon, for the construction of approximately 26,000 cu. yd. of open ditch 20 ft. wide on the bottom, side slopes one on two. One timber crib spillway. Approximately 350 cu. yd. of open ditch 2 ft. wide on the bottom, side slopes one on two.

Bids must be accompanied by a proposal bond of approved form or by a certified check for not less than five (5) per cent of the bid.

Bids will be accepted for the work as a whole or any part or parts thereof. The right is reserved to reject any or all bids.

A charge of five dollars ($5.00) will be made for plans and specifications, which may be obtained from the Engineer. No refund.

LAKE LARGO-CROSS BAYOU
DRAINAGE DISTRICT.
F. R. FRANCKE, President.
H. A. VAN NICE, Member.
FREEMAN P. LANE, Member.
ISHAM RANDOLPH & COMPANY,
Chief Engineers,
Chicago-Jacksonville.
Address Jacksonville office.

Bids open March 14, 15 and 16, 1916.

ROAD CONSTRUCTION COUNTY OF VERMILION

DANVILLE, ILL.

1. Notice is hereby given that sealed proposals for the construction of roads in Vermilion County will be received at the office of the County Clerk, Court House, City of Danville, Ill., until 2 p. m., March 14, 1916, for Divisions 2, 5, 7; until 2 p. m., March 15, for Divisions 1, 4, 9; and until 2 p. m., March 16, for Divisions 3, 6, 8, at which times and place during the meetings of the Board of Supervisors, the proposals will be publicly opened and read.

2. The proposed work comprises the construction of concrete or brick roads ten (10) feet wide with three (3) foot macadam or gravel shoulders together with all grading, shaping earth shoulders, reinforced concrete work, ditching, drainage and other incidental work as shown in detail on plans and specifications, on file in the office of the County Clerk and the Superintending Engineer.

3. Proposals shall be made on forms furnished by the County of Vermilion.

4. The Board of Supervisors reserves the right to reject any or all proposals, and to waive technicalities in any proposal.

5. Bidders may furnish proposals on one or more of the nine divisions of approximately 19 miles each, into which the work is divided.

6. All proposals must be accompanied by a certified check in the sum of two (2) per cent of the total bid and made payable to the order of Thomas J. Dale, County Treasurer of said county; said check to be returned unless in case of the acceptance of his proposal, the bidder should fail to execute a contract and file a bond in a sum equal to the amount of the bid within ten (10) days of the date of the acceptance of this proposal, in which case the check is to become the property of Vermilion County and is to be considered as payment of damages due to delay and other causes suffered by the county from neglect of the bidder to execute a contract.

7. Proposals must be addressed or delivered to said County Clerk, Court House, Danville, Ill.; marked plainly on the outside, "Proposal for the Construction of Vermilion County Bond Roads, Division Number ——————."

Dated at Danville, Ill., this the 4th day of February, A. D. 1916.

JOHN R. MOORE,
County Clerk.

CONTRACTING NEWS

Of Special Interest to Engineers, Contractors, Builders and Manufacturers of Engineering and Building Supplies

"BUYERS who stop to ask questions about new bond issues these days find that while they are talking someone else has taken their share without even asking the price." This remark, attributed to a New York banker, was called forth by the way in which several large bond issues have been absorbed recently, one of them even before a price was fixed for the bonds. These issues include the Chicago Union Station $30,000,000 first mortgage bonds, a $5,000,000 block of Chicago & North Western bonds and the $50,000,000 issue of the Midvale Steel Company. The good terms on which the two railroad issues were taken are an encouraging display of growing confidence. Net railroad revenues for December have been reported by the Interstate Commerce Commission at $101,838,000, almost 45 per cent in excess of $58,880,000 reported for the same road in December, 1914.

The unfilled tonnage of the U. S. Steel Corporation increased only a little more than 100,000 tons during January, but this was due to a reluctance on the part of the corporation to take many new contracts which might have been secured while the plants of the company are in the present congested condition. Inquiries of all sorts and buying are as active as ever, and the industry as a whole is now sure of capacity operation for the whole of 1916. The securing of new locomotives has continued a serious question with the railroads. The locomotive plants are working on large foreign orders and steel is hard to secure. On the whole, however, the recent snowstorms have added less to the freight congestion than might have been expected, and conditions should improve with the coming of spring.

Buildings

The renewed activity in building work was well sustained during the past week. A general contract was awarded on a $150,000 prison building at Caldwell, N. J. The building of a $175,000 factory has been contracted for at Camden, N. J. A $500,000 contract for constructing a warehouse has been let in Philadelphia. The construction of paper mills to cost $750,000 has been contracted for at Oregon City, Ore. Bids were received at Portland, Ore., for constructing school buildings to cost $190,000. Bids are desired at Hazleton, Pa., for erecting a $120,000 school building. The U. S. Treasury Department will open bids Feb. 23 for constructing the Custom House at Wilmington, N. C. It is reported that bids will be opened April 1 in Minneapolis for constructing a $250,000 warehouse. At Boston a shipbuilding company contemplates erecting a $300,000 woodworking shop. Plans have been prepared for a connection to cost $750,000 between the Metropolitan Museum of Art and the American Museum of Natural History in New York City.

The New Jersey State Senate has appropriated $150,000 for additional hospital buildings at Morris Plains. An ice plant to cost $200,000 is proposed at Hoboken, N. J. The sum of $825,000 is available for Philadelphia's new public library, and an ordinance providing for its erection has been approved by the finance committee of the city council. A Pittsburgh company intends erecting a $250,000 warehouse. A steam power station which is to be built at Winona, Minn., will cost $200,000. It is reported that a contract is about to be let for a $250,000 hospital at Butte, Mont. Plans are being prepared for a $250,000 theater at Vancouver, B. C. An architect has been selected for the terminal market at Los Angeles, which will be 2 miles long.

Bridges and Roads

The contract for constructing the Commerce Street viaduct at Dallas, Tex., has been awarded at $100,000. Bids are desired March 15 for three large reinforced-concrete bridges at Dayton, Ohio. Contracts for the Central Avenue bridge in Kansas City, costing $450,000, are to be let March 6. A new bridge of some size is to be built this spring at Beloit, Wis. The construction of an $85,000 railroad viaduct has been ordered in Omaha.

Paving contracts amounting to $220,000 have been awarded at Baltimore. The paving work at Rock Island, Ill., has been awarded at $74,000. A $73,000 contract has been awarded at La Porte, Ind. Paving work contracted for at Butte, Mont., will cost $117,000. Bids are reported desired at Canton, Miss., for gravel roads to cost $80,000. Cherokee, Iowa, will open bids Feb. 25 for 95,000 sq. yd. of paving. It is reported that bids will be opened three days later by Mason City, Iowa, for 210,000 sq. yd. of paving.

The Pennsylvania cities of Reading and South Bethlehem will spend $100,000 each for street improvements. Road work to cost $250,000 is planned near Fayetteville, W. Va. Anderson County, Clinton, Tenn., has issued $425,000 highway bonds. Paving work to cost $130,000 is to be undertaken at Freeport, Ill. At Sulphur Springs, Tex., $400,000 road bonds have been sold.

Waterworks and Sewers

A contract has been let in New York City at $130,000 for lining a section of the city tunnel of the Catskill aqueduct. Bids are desired at Westchester, Pa., for constructing a sewer system. Ottawa, Ontario, will open bids on March 1, for a pumping station. Bids are desired at Billings, Mont., for sewer works to cost $63,000. Cleveland will sell $500,000 additional waterworks bonds next week. Lexington, Ky., has sold $350,000 sewer bonds. Flint, Mich., has voted in favor of building a $200,000 sewer system. Plans are to be prepared at Beaumont, Mich., for water mains to cost $200,000. Dallas, Tex., has sold $250,000 sewage-disposal bonds. Plans are being prepared for a $100,000 sewage-disposal plant at El Paso, Tex. Salt Lake City has sold $300,000 sewer and water bonds. Plans have been submitted to Richmond, Cal., for a $90,000 storm sewer. Approximately $235,000 will be required to repair the flood damage to the water system of San Diego, not including the rebuilding of the lower Otay dam.

Miscellaneous

The lowest bid received in New York City for erecting the superstructure of the Forty-sixth Street pier was $542,000. The lowest bids received in the same city for a track laying contract and a subway section were $94,000 and $1,350,000 respectively. The construction of 7½ miles of railroad, including five bridges and a tunnel, has been contracted for at Pemberton, W. Va. It is reported from Coos Bay, Ore., that the construction of 260 miles of railroad has been contracted for by the Southern Pacific. An irrigation contract amounting to $540,000 is reported from Bend, Ore. Bids have been re-advertised for a $150,000 section of the New York state barge canal, and bids on three other sections will be received at the same time.

It is reported that a freight yard for the New York, New Haven & Hartford Railroad is to be built at Meriden, Conn. Grade-crossing-elimination work to be undertaken this spring at Cheektowaga, N. Y., will cost $400,000. A depressed street crossing is to be widened at Harrisburg, Pa., at a cost of $200,000. Estimates for grade-crossing elimination submitted to Chillicothe, Ohio, total $450,000. A company has been incorporated to build 163 miles of railroad from Garden City, Kans., to Omaha. Grade-crossing-elimination work to cost $1,000,000 has been ordered at Houston, Tex.

WATERWORKS

PROPOSED WORK.

Lowell, Mass.—Municipal Council has applied to Legislature for permission to borrow $100,000 for about 25,000 ft. of 16-in. pipe laying.

Red Creek, N. Y.—Village Board of Trustees engaged H. C. Kittredge, Rochester, to prepare plans and specifications for a municipal water works system, and contract will be let for same some time this spring.

Atlantic City, N. J. — Department of Parks and Public Property propose making connections with Lower Doughty Pond and the pumping station with a 48-in. conduit, a distance of 9500 ft., at a cost of from $75,000 to $125,000, according to material used; also improve artesian well system, at approximate cost of $6,000, in the vicinity of the pumping station. Extensions to the distributing system within the city will be made as building operations may require. Directors of the department will recommend that the 20-in. Artic Avenue main be extended along the beach front to Oriental Avenue, connecting with the mains at head of Atlantic, Euclid, Pacific and Oriental Avenues and Dewey Place, with the object of equalizing the pressure and giving better fire protection to the upper section of the city; cost $20,000; the erection of a 1,000,000-gal. standpipe at the Inlet section, at an approximate cost of $40,000, is also recommended.

Braddock, Pa.—Water Committee has recommended to county that equipment and repairs to water works be made at a cost of $51,900. New equipment will include two centrifugal pumps with motors, new suction pipes and repairs on the pump pit and a filtration bed at the reservoir.

Windsor, Pa.—Borough Council considering a water system.

Wilmington, Del.—Water Board has submitted to Council a report recommending improvements to water works costing $600,000. A local survey has been made by George W. Fuller, 170 Broadway, New York, and report submitted recommending installation of three 8,000,000-gal. turbine-driven pumps, a new filtered water reservoir of 7,500,000 gal. on site of the old Rodney Street reservoir, and the construction of a sedimentation basin with rapid sand filters and the necessary installation of mains and pipe lines.

Graham, Va.—Reported Bluefield Valley Water Works Co. incorporated with W. J. Montgomery, Secy., for purpose of constructing water works here.

Winston-Salem, N. C.—Board of Aldermen has submitted to Finance Committee and the Water Committee for investigation the advisability of laying a 15-in. water main from the Salem pumping station to this city at a cost of about $28,000.

Philadelphia, Miss.—Citizens voted municipal water works and sewerage bonds.

Chattanooga, Tenn.—Board of Appraisers in the matter of negotiation for purchase of the City Water Company's property includes for the city, James Nisbet Hazlehurst, Consulting Municipal Engineer, Atlanta, Ga.; for Water Company, William Wheeler, Consulting Engineer, Boston, Mass., and the third party on board, John W. Alvord, Consulting Engineer, Chicago, Ill. The plant was offered for sale several years ago for $1,000,000, and the citizens have authorized a bond issue of $2,000,000 for purchase of plant or construction of new works.

Barnesville, Ohio.—Water bonds for $25,000 will be sold March 10 by F. Waldo Hilles, Village Clk.

Cleveland, Ohio.—Water works bonds for $500,000 will be sold Feb. 28 by Sinking Fund Commission. B. H. Dayton, City Treas.

Columbus, Ohio.—See "Sewerage and Sewage Disposal."

Farmersville, Ohio.—Water works bonds amounting to $16,000 have been sold. Address City Clerk.

Hamilton, Ohio.—Sinking of three additional wells at a cost of $10,000 is reported under consideration by city. Frank E. Weaver, City Engineer.

Middletown, Ohio.—It is proposed to issue $40,000 bonds for improvements to the water works. John Kunz, City Clerk.

St. Marys, Ohio.—Fred Froelich of Toledo engaged to report on condition of the municipal light and water plant relative to rebuilding.

Clio, Mich.—Election will be held about April to vote on constructing water works; cost about $25,000. W. G. Goodrich, Village Clerk.

Menominee, Mich.—Citizens have again voted in favor of $285,000 water works bond issue for purchase of present water works.

Fairbury, Ill.—Citizens voted $15,000 bonds for wells and pumps. T. W. Burns, Engineer, Fairbury. John Burkhart, Chairman Fire and Water Committee.

Rochester, Minn.—Mayor is reported in favor of purchasing the present plant or constructing a new water works.

Geuda Springs, Kan.—Benham Engineering Co., Oklahoma, Okla., engaged to prepare plans and specifications, estimates, etc., for water works and sewer system, an election to be held on issuing bonds for said purpose.

Lambert, Mont.—Committee appointed to investigate cost of installing water works system and electric light plant. Address City Clerk.

Pocahontas, Ark.—Board of Commissioners of Water Improvement District reported to have engaged an engineer to prepare survey preparatory to putting in a water system.

Beaumont, Tex.—Committee appointed by Council to have plans prepared for laying water mains in streets to be paved and for connections to lots. Total cost about $200,000.

Belton, Tex. — Water works bonds amounting to $40,000 approved by Attorney General.

Houston, Tex.—City Council considering appropriating $40,000 for extension of water mains and purchase of meters.

Dallas, Tex.—An additional pumping station for Fair Park main, costing $10,000, is recommended by the engineers. Address City Commissioners.

Board City Commissioners rejected all bids received for water meters. City will probably purchase in the open market.

The duplicate main in Zangs Boulevard, Oak Cliff, is to cost $21,500, and will be installed by city labor. About 4616 ft. 16-in. and 2840 ft. 12-in. c.-i. pipe will be required, with three 16-in. gate valves and three 12-in. gate valves, and seven three-way 6-in. fire hydrants. Hal. Moseley, City Engineer.

Cleveland, Okla.—City Council contemplates calling an election to vote bonds for improvements to the water works.

Oklahoma, Okla.—Election to be held in April to vote on water works bonds.

Oilton, Okla.—Citizens Jan. 28 voted to construct water works and sewerage system. L. Y. McFarland, Engineer, 316 East Ninth Street, Tulsa. Roy McFarland, City Clerk.

Wilson (P. O. New Wilson), Okla.—Benham Engineering Co., Oklahoma City, engaged to prepare plans and specifications for water works and electric light system; estimated cost $25,000. S. P. Brimer, Pres. Board Trustees.

Alamogordo, N. M.—Construction of a municipal water works, electric light and power plant is under consideration by City Board of Trustees.

Carlsbad, N. M.—Public Utilities Co. of Carlsbad contemplates installing new equipment in local electric light plant and water works system at a cost of $10,000.

Montesano, Wash.—City Council is considering calling an election to vote on constructing water works and an electric light plant.

Seattle, Wash.—Council has passed ordinances authorizing water mains in Ninth Avenue North and Twenty-fifth Avenue North.

Mayor Hiram C. Gill, in his annual message, recommends construction of permanent water mains between the Cedar River intake and the city reservoirs, rather than the establishment of additional reservoirs.

Oakland, Cal.—Peoples Water Co. of Oakland is to be reorganized and will be known as the East Bay Water Co., and plans extensive improvements.

Oceanside, Cal. — Reported pumping plant of the South Coast Land Co., recently destroyed by fire will probably be rebuilt.

San Diego, Cal.—Approximately $235,000 will be required to repair flood damages to the city water system, not including the replacement of the Lower Otay dam. Work includes concrete conduits, wood-stave and steel pipe lines and bridges to carry them, repairs to dams, etc. Address City Manager.

Florenze, Ariz.—Town Council authorized an election March 11 to vote $50,000 bonds for installation of municipal water works and electric light plant.

Phoenix, Ariz.—City Commission will probably submit to the citizens on April 4 the question of issuing $1,000,000 bonds for new city water system, including construction of water line from Horseshoe Canyon on Verde River, 40 miles north of Phoenix, and building a dam at Horseshoe Canyon.

Salt Lake City, Utah.—C. F. Barrett, Superintendent of Water Works, has submitted a report to W. H. Shearman, Commissioner Water Works Department, recommending installation of water meters; also recommends laying water mains in various streets, and either the construction of a storage reservoir in City Creek canyon or the continuation of the Parley's conduit around the bench east of the city to supply pressure to section of city served by City Creek high line.

Salt Lake City, Utah. — Sewer and water bonds amounting to $300,000 have been sold.

McCammon, Idaho.—City has sold $27,500 bonds for municipal water works which city intends intsalling.

Ottawa, Ont.—The Engineer of the Water Works has in the 1916 estimates asked the Water Works Committee for $50,000 for short main extensions and new service.

BIDS DESIRED.

Albany, N. Y.—Until March 6 by Board Contract and Supply (Isidore Wachsman, Secy.) for furnishing and delivering standard c.-i. water pipe and special castings for Bureau of Water.

Rochester, N. Y.—Until Feb. 23, by F. X. Pifer, Secy. Board Contract and Supply, for two electric pumps, one water tower, etc.

Wheeling, W. Va.—Until Feb. 24, by U. S. Engrs. Office, Wheeling, for furnishing and delivering water turbines, air compressors, valves, jacks, gate engines, pumps, etc., for Dams Nos. 12, 14 and 20, Ohio River.

Macon, Ga.—Until Feb. 28, by Board Water Commissoners, for a steam turbine centrifugal pump of 5,000,000 gal. capacity, advertised in Engineering Record.

Fairhope, Ala.—Until Feb. 21, by Mayor and Town Council, for constructing water works and electric light plant. Xavier A. Kramer, Consulting Engr., Magnolia, Miss.

Attica, O.—Until Feb. 24, by Board Trustees Public Affairs, for improvements to the municipal water works, including pipe line, filtration plant, etc. Frank Stutzman, Village Clk.

Cincinnati, Ohio.—Until Feb. 23 by Charles F. Hornberger, Director Public Service for laying water pipe in Eastern Avenue, about 5500 ft. 36 in., laying 2500 ft. 4 in., 55,000 ft. 6 in., 6000 ft. 8 in., 3400 ft. 12 in. pipe in various parts of city in 1916; also for furnishing pipe for Eastern Avenue and for pipe for new 36-in. low service main, requiring 2100 tons pipe and hub and spigot Class B and 30 tons 36-in. special castings hub and spigot Class B. Eastern Avenue requires following, all Class C.: 1950 tons 36-in. pipe hub and spigot, 500 tons 6-in. pipe, 10 tons 4-in. pipe, 40 tons 8-in. pipe, 25 tons 10-in., 25 tons 12-in., 40 tons 36-in. to 60 in. special castings hub-and spigot, 50 tons special castings hub and spigot, 12 in. in diam. and less, and 50 tons miscellaneous castings.

Until Feb. 25 for steam piping, fittings and valves on Snow engines at Western Hills Pumping Station. J. A. Hiller, General Superintendent Water Works.

Cleveland, Ohio.—Until Feb. 23 by Commissioner of Purchases and Supplies for one steam-driven air compressor for the Division Avenue pumping station, Department of Public Utilities, Division of Water.

Milwaukee, Wis.—Until March 8 by Department Public Works (Fred G. Simmons, Commissioner), for constructing an extension to Linwood Avenue Intake Tunnel, advertised in Engineering Record.

Crofton, Neb.—Reported desired until March 14, by City Clerk, for 5686 ft. 4-in. water mains, 13 fire hydrants, etc. Probable cost, $5,363. J. D. Clair Smith, Engr., Harrington, Neb.

St. Louis, Mo.—Until Feb. 25 by Board Public Service (William T. Findly, Secy.) for furnishing and delivering at City Pipe Yard 7210 tons, more or less, 36-in. c.-i. coated water pipe; also delivering f.o.b. cars St. Louis, at such switches as Water Comrs. may direct, 26,900 lin. ft. 36-in. lock bar steel coated water pipe, and hauling and laying of same.

Ottawa, Ont.—Until Feb. 24, by Secretary Water Works Committee, addressed to Chmn. and members of Waterworks Committee, for c. i. pipe, lead pipe, special pipe casting and valves, etc. R. L. Haycock, Acting Waterworks Engr.

Ottawa, Ont.—Until March 1, by John B. McRae, Consulting Engineer, 310 Booth Building, Ottawa, for constructing a pumping station and electric substation on Lemieux Island, within the city boundary, furnishing and delivering (a) main piping, valves and specials, (b) heating and plumbing for said station, advertised in Engineering Record.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**New York, N. Y.**—Contract for Contract 170, furnishing and placing copper lining in portion of city tunnel of Catskill Aqueduct between Shafts 18 and 19, Borough of Manhattan (bids opened Feb. 1 by Water Board), awarded Lupfer Remick, 594 Ellicott Square, Buffalo, at $130,050.

Saginaw, Mich.—Following are bids opened Feb. 8 by Commissioner of Light, Water & Sewers for furnishing c.i. water pipe and special c.i. castings: Massillon Iron & Steel Co., Chicago, Ill., Class C, 4 in. pipe $33.36 per ton; Class C. 6 in., $30.36 per ton; Class B, 8, 10, 12 and 16 in., each $30.36 per ton; U. S. Cast Iron Pipe & Fdry Co., Chicago, Ill., $34.50, $31.50 and $31.50, respectively, per ton. Herbert S. Gay, City Clerk.

★**Galesburg, Ill.**—Contract awarded S. B. Geiger, Chicago, Ill., for constructing tubular deep well (bids opened Feb. 9) at $19,533. W. L. Boutelle, City Clerk.

★**Sullivan, Ill.**—Contract for improvements to water works awarded P. K. Engineering Co., St. Louis, Mo. F. Newbould, City Clerk.

★**Minneapolis, Minn.**—Rensselaer Valve Co., Troy, N. Y., secured the contract for furnishing gate valves to the Water Department for the year 1916.

★**Roundup, Mont.**—Contract awarded Security Bridge Co., Billings, for constructing extension system at a cost of $16,000.

★**Temple, Tex.**—Contract awarded Smith & Whitney, Dallas, at $5,886 for two centrifugal pumping units (bids opened Jan. 31). J. T. Martin, City Secretary.

★**Trinity, Tex.**—Contract for constructing a 50,000 gallon water tower and distribution system awarded W. Wilder, of Houston, at $15,000.

Los Angeles, Cal.—Following are bids opened recently by County Board of Supervisors for furnishing 3000 ft. 54-in. sheet steel pipe for channel main in Mission Creek section, Los Angeles Water Works, Dist. No. 3: Baker Iron Works, Los Angeles, $19,860, plus 2 cts. lb. for bends; Western Pipe & Steel Co., $20,280, ½ ct. for bends; Lacy Mfg. Co., Los Angeles, $21,330, 1 ct. for bends; Llewellyn Iron Works, Los Angeles, $22,110, including bends.

★**New York, N. Y.**—Following are unit figures of four lowest bids opened Feb. 1 by Water Board, New York, for Contract 170—Furnishing and placing copper lining in a portion of the city tunnel of Catskill Aqueduct between Shafts 18 and 19 in the borough of Manhattan: (a) Lupfer & Remick, 594 Ellicott Square, Buffalo, $130,050 (awarded contract); (b) Marble Arch. Co., 216th Street and Broadway, New York, $146,300; (c) Booth & Flinn, Ltd., 17 Battery Place, New York, $147,380; (d) Charles Meads & Co., 38 Park Row, New York, $162,600.

	*(a)	(b)	(c)	(d)
1,200 lin. ft. copper lining around whole periphery of 12-ft. tunnel and all appurtenances, including concrete walk	$89.00	$110.00	$110.00	$119.00
4 end anchorages or water-stops for copper lining	250.00	400.00	170.00	650.00
1,000 sq. ft. copper lining in isolated patches	5.50	4.00	5.50	6.00
80 2-in. brass flap-valves	5.00	10.00	10.00	15.00
5,000 drilling holes for grouting	1.75	0.50	0.20	0.60
2,000 lin. ft. steel pipes for grouting, etc	0.55	0.75	0.20	0.50
Making 1,000 connections for grouting	1.00	2.00	1.50	1.00
Mixing and placing 5,000 cu. ft. grout	0.90	0.30	1.00	0.60
Removing and replacing 2 riser valves	500.00	200.00	250.00	1,000.00

SEWERAGE AND SEWAGE DISPOSAL

PROPOSED WORK.

Lenox, Mass.—Town has voted to extend sewer system to Lenoxdale at a cost of $21,000. James Beglin, Selectman.

Milford, Mass.—In annual report of the Sewer Commission an appropriation of $10,000 is recommended for constructing a 16-in. siphon on Depot Street.

Elmira, N. Y.—Plans prepared by F. H. Shaw, 308 Breneman Building, Lancaster, Pa., have been accepted for the interception and disposal of sewage of this city in a gravity plant.

Lodi, N. J.—Election to be held March 28 to vote $200,000 bonds for constructing a sewer system and disposal plant according to plans by Bowe & Wessells, Consulting Engineers, Rutherford. James A. McMahon, Borough Clerk.

Orange, N. J.—Trustees of South Orange Township are considering constructing a sewage disposal plant.

Point Pleasant, N. J.—Election soon to be held to vote $22,000 bonds for sewer extensions. R. W. Morris, Boro. Engr.

Rahway, N. J.—Reported steps being taken to construct sewage disposal plant. Address Mayor.

Somerville, N. J.—Borough Council considering constructing a sewage disposal plant as directed by State Board of Health.

Hazelton, Pa.—City Council is arranging for a $150,000 bond issue for extensions to street paving and constructing additional sewers and other permanent work.

Williamsport, Pa.—Nothing very definite has been done about the sewage disposal plant. City is having plans prepared subject to the approval of the State Board of Health. John R. Mundy, Asst. City Engineer.

Towson, Md.—Ezra B. Whitman, Baltimore, engaged to prepare plans for the sewerage system.

Eustis, Fla.—Contract will be let in March for $20,000 sanitary sewers and $40,000 storm sewers and paving. Paving will probably be sand asphalt paving on clay base. Charles L. Armsby, City Clerk.

Birmingham, Ala. — City Commission Feb. 8 adopted resolution providing for constructing sanitary sewers in East Thomas; estimated to cost $8,000. Julian Kendrick, City Engineer.

De Ridder, La.—Sewer and water bonds for $41,000 will be sold March 1 by Mayor, Town Council and Sewerage Commission (J. E. McMahon, Chmn.).

Rayville, La. — Citizens voted $20,000 bonds to construct a sewerage system, and M. Griffin O'Neil & Sons of Dallas engaged to prepare plans and supervise construction. The Board of Sewerage Commissioners (T. H. McGregor, Secy.) will purchase all material and furnish labor.

Lexington, Ky.—The $350,000 sewer bonds have been sold. Address Board of City Commissioners.

Owensboro, Ky.—Solomon & Norcross, Atlanta, Ga., engaged as engineers for the new sewerage system to be constructed here. Council has authorized the sale of the $225,000 bonds voted here last fall for a sewer system.

Canton, Ohio.—Sewage treatment bonds amounting to $75,000 have been sold.

Columbus, Ohio.—Election is to be held April 25 to vote $1,000,000 bonds to be used toward following: $211,000 for sewer extension; $250,000 for new streets; $80,000 for collection of garbage and refuse; $100,000 for widening High Street from Union Station to Fifth Avenue; $50,000 for street repairs; $25,000 for sewer and drainage repairs; $20,000 for bridge and viaduct repairs; $20,000 for hydrants and connections.

Lakewood, O.—Sewer bonds for $11,760 and $185,000 sewage treatment bonds will be sold March 6 by B. M. Cook, Dir. of Finance.

Sandusky, Ohio.—The No. 3 intercepting sewer will be 5700 ft. long, 12 and 15-in. pipe and cost $25,000. Probably nothing further will be done about the construction for some time. H. A. Bannister, Acting City Engineer.

Youngstown, Ohio.—Sewer bonds for $18,000 reported to be sold Feb. 21 by J. P. Edwards, City Aud.

Fort Wayne, Ind.—Board of Public Works is considering the constructing of the east end sewer on Warren Street from Maumee Avenue to Wayne Terrace. Engineering Department submitted estimates for a 3500-ft. sewer, 24 to 54 in. in diameter, costing $28,000.

Indianapolis, Ind.—City Engineer Jeup recommends a system of pumping stations to prevent water from backing up in sewers during floods.

Detroit, Mich.—Public building bonds amounting to $500,000 and sewer bonds $205,000 will be sold March 1 by City Comptroller.

Flint, Mich.—Citizens voted in favor of issuing $196,000 bonds for constructing storm water sewers and the city's 25 per cent. of the cost of sanitary and intercepting sewers.

Champaign, Ill.—City Council is considering improving sewer system costing about $30,000. Fred Lohman, City Engr.

St. Paul, Minn.—A pumping station is to be constructed in connection with the Payne-Edgerton sewer system. Cost for system about $30,000. Oscar Claussen, Chief Engineer.

Gueda Springs, Kan. — See "Water Works."

Yankton, S. D.—Citizens voted in favor of $50,000 bond isue for streets and sewer improvements.

Amarillo, Tex.—Attorney General has approved $40,000 street paving bonds and $10,000 sewerage bonds.

Canadian, Tex.—Construction of a sewerage system costing $25,000 under consideration.

Corsicana, Tex.—See "Paving and Roads."

Dallas, Tex.—$250,000 sewage disposal bonds sold.

El Paso, Tex.—Plans being prepared for installation of Imhoff septic tank system costing approximately $100,000. Contract soon to be let.

Itasca, Tex.—Issuing of $15,000 bonds for constructing sewer system under consideration. M. S. Wood, City Attorney.

Winnsboro, Tex.—Water and sewer improvement bonds amounting to $25,000 have been sold. Installation of a sewer system and improvements to water works contemplated. Address City Clerk.

Yorktown, Tex.—Business men reported in favor of installing a septic tank sewerage system in the business portion of the city.

Haileyville, Okla.—Election to be held to vote on constructing a sewerage system. Address City Clerk.

Muskogee, Okla.—Citizens voted $25,000 bonds for constructing sewers. E. F. Petersen, Engr., City Hall.

Long Beach, Cal. — Council adopted resolution of intention to construct a 30-in. brick storm drain in Hill Street.

Los Angeles, Cal.—Contract will be let in about six months by Council for constructing the Florence Avenue sewer; approximately 16,000 lin. ft. 30 to 42 in. brick-concrete and 14,000 lin. ft. 16 and 20 in. vitri. pipe sewer and 2500 lin. ft. 10 in. c. i. force main, etc. Homer Hamlin, City Engineer.

Richmond, Cal.—H. D. Chapman, City Engineer, submitted to Council plans for storm sewer, 6 ft. diameter, to extend from the northern part of the city on Tenth Street to the Cutting Canal; cost $90,000.

Richmond, Cal.—City Engineer H. D. Chapman has submitted plans for storm water and drainage systems for the east side.

Venice, Cal.—City Trustees considering calling an election to vote $50,000 bonds for constructing outfall sewer.

BIDS DESIRED.

New Haven, Conn.—Until Feb. 25, by F. L. Ford, City Engineer, for furnishing for the year 1916 vitr. sewer pipe, granite catch basin stone, sewer castings, etc.

West Chester, Pa.—Until Feb. 23, by Borough Council for furnishing material and constructing a system of sanitary sewers, terra cotta, in Northeastern Section of West Chester, advertised in Engineering Record. N. R. Rambo, Boro. Engr.

Roanoke, Va.—Until Feb. 25, by P. H. Tucker, City Clk., for constructing sanitary sewers and storm drains in Rorer, Patterson, Norfolk Avenues and other streets. F. L. Gibboney, City Eng.

Cleveland, Ohio.—Until Feb. 24, by A. R. Callow, Director Public Service, for constructing sewers in Darley Avenue, Diana Avenue, Danbury Avenue, Edwin Court, W. 110th Street and other streets.

Ft. Wayne, Ind.—Until March 9, by H. W. Becker, Clerk Board Public Works, for 3426 ft. of 24, 30, 36, 48 and 54 in. pipe, brick and concrete sewer in east end of city; estimated cost, $26,000. W. W. Chatfin, Asst. City Engineer.

Vincennes, Ind.—See "Hydraulic and River Improvements."

Chrisman, Ill.—Until March 1 by President Board Local Improvements for sewers, to consist of 9938 ft. 8 to 30 in. Bids desired on concrete pipe, vitrified pipe, shale pipe or segment block pipe. C. P. Lycan, Engr., Paris, Ill.

Randolph, Wis.—Until Feb. 28, by Village Trus., at office of State Bank, for constructing sanitary sewers to consist of 18,140 ft. 6 to 12-in. vitr. tile pipe, with manholes, flushtanks and a sewage disposal plant, etc.

Sheboygan Falls, Wis.—Reported desired until April 1 for constructing 2 miles 8 to 15-in. sewers in eight streets. F. R. Kroeger, City Clk.

Union, Iowa.—Until Feb. 24 by H. L. Cartwright, Town Clerk, for constructing sanitary sewer system.

Billings, Mont.—Until about April 4, by E. S. Judd, City Clerk, for trunk or public sewer along Second Avenue, north about 9670 ft., 18 to 54-in. concrete and pipe sewer, costing about $66,350. E. M. Sneckenberger, Engineer, City Hall.

Tonkawa, Okla.—Until March 7, by E. H. Stalnaker, City Clerk, for constructing sanitary lateral sewer district No. 4. Approximate amount of work, 0 to 4 ft. cut, 55 ft.; 4 ft. to 6 ft. cut, 3695 ft.; 6 to 12 ft. cut, 100 ft.; 1900 ft. 8-in. sewer pipe and 5610 ft. 6-in. sewer pipe, 16 manholes, 9 flush tanks, etc. Benham Engineering Company, Engineers, Colcord Building, Oklahoma, Okla.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Rochester, N. Y.—Following are three bids opened Feb. 2 by Board of Contract and Supply for furnishing a grit excavator for the sewage disposal plant in Irondequoit: Rochester Excavating Machinery Co., $12,719; Sanitarion Corporation, $16,500, and Seneca Engineering Co., $16,700.

Minneapolis, Minn.—The lowest bids opened Jan. 31 by Kossuth E. Alexander, City Purchasing Agent, for furnishing sewer department approximately 400,000 vitr. paving blocks or 500,000 vitr. paving brick for sewer construction during 1916 submitted by Landers, Morrison Christensen Co., 315 Library Exchange, at $14.75 per M, and Hydraulic Press Brick Co., 211 South Fourth Street, at $14.50.

★Contract awarded Streator Clay Mfg. Co., 3032 Twenty-second Avenue S., for furnishing vitr. clay sewer pipe for season 1916. This company submitted lowest bid for the vitr. clay segment sewer blocks for the season of 1916, but no action has yet been taken on awarding contract for these blocks.

Houston, Tex.—Houston Construction Co., Houston, submitted lowest bid Feb. 7 for constructing the Scott Street sewer of reinforced concrete at $17,189, bidding $2.43 per ft. for 2375 lin. ft. 36-in. pipe 4-6 ft. deep, $2.49 per ft. for 3025 lin. ft. 6 ft. to 8 ft. deep, and $2.52 per lin. ft. for 400 lin. ft. 8 ft. to 10 ft. deep. Next three bidders: F. C. Youmans Construction Co., Houston, $18,364; Freund & Quay, $19,519, and H. C. Gass, $20,732.

★**Rogers, Ark.**—Contract for constructing sewage disposal plant awarded L. H. Adamson, Rogers, at $11,115. Next three lowest bidders: D. E. Koch, Joplin, Mo., $11,448; Cardwell Construction Co., Texarkana, Ark., $11,512, and O'Neal Construction Co., Leavenworth, Kan., $13,900.

Houston, Tex.—Following are unit figures of the four lowest bids opened Feb. 7 for constructing the Second Ward storm sewer system east of Milby Street: (a) Freund & Quay, Houston, $98,382; (b) Horton & Horton, Houston, $104,325; (c) H. C. Gass, Houston, $105,157; (d) Lucius Taylor, $110,609.

	(a)	(b)	(c)	(d)
100 cu. yd. extra excavating	$1.00	$1.50	$1.00	$1.00
200 ton-mile hauling	0.30	0.30	0.30	0.25
500 man-hour extra work labor	0.30	0.30	0.40	0.30
200 team-hour extra work teams	0.70	0.70	0.75	0.70
10 M ft. timber in foundations	30.00	30.00	30.00	23.00
150 M ft. timber ordered left in trenches	20.00	18.00	15.00	18.00
10 cu. yd. extra Class I concrete	9.00	10.00	14.00	9.00
10 cu. yd. extra Class II concrete	10.00	15.00	15.00	10.00
10 cu. yd. extra Class III concrete	12.00	15.00	16.00	12.00
10 cu. yd. extra brick masonry	15.00	15.00	12.00	12.50
100 lb. extra castings	0.06	0.05	0.10	0.04
100 lb. extra reinforcing steel	0.06	0.10	0.20	0.04
200 cu. yd. road gravel	2.50	2.50	2.00	2.00
100 cu. yd. road shell	2.00	2.00	2.00	2.00
9 standard manholes, Type "A," each	50.00	40.00	45.00	50.00
34 extra depth manholes, Type "A," per ft	6.00	6.00	6.00	5.50
20 standard manholes, Type "B," each	55.00	50.00	50.00	50.00
180 extra depth manholes, Type "B," per ft	6.00	9.00	6.00	5.00
70 supplying and setting catchbasins, Type "A," each	30.00	30.00	26.00	27.50
12 supplying and setting standard inlet, Type "B," each	30.00	24.00	35.00	23.50
3 supplying and setting standard inlet, Type "C," each	60.00	65.00	70.00	62.50
500 piling untreated, per ft	1.50	0.50	0.50	0.45
10 cu. yd. concrete, 1:2:4	12.00	15.00	16.00	10.00
1 outfall, complete, as shown on plan	1,790.00	3,500.00	3,600.00	1,950.00
30 lin. ft. 90-in. pipe, 18-20 ft. deep	17.60	16.50	16.50	16.25
900 lin. ft. 90-in. pipe, 20-22 ft. deep	18.35	16.75	17.30	17.00
30 lin. ft. 90-in. pipe, 22-24 ft. deep	19.50	17.50	18.00	17.00
10 lin. ft. 84-in. pipe, 18-20 ft. deep	16.50	15.00	16.00	15.00
680 lin. ft. 84-in. pipe, 20-22 ft. deep	17.40	15.60	15.60	16.50
17 lin. ft. 84-in. pipe, 22-24 ft. deep	18.50	16.50	16.30	16.50
100 lin. ft. 78-in. pipe, 0-6 ft. deep	9.50	9.00	8.70	13.00
1,800 lin. ft. 78-in. pipe, 6-8 ft. deep	9.50	9.60	9.60	13.00
200 lin. ft. 78-in. pipe, 8-10 ft. deep	11.50	10.00	10.20	13.50
70 lin. ft. 78-in. pipe, 10-12 ft. deep	12.00	10.40	10.90	14.00
10 lin. ft. 78-in. pipe, 12-16 ft. deep	15.00	12.60	12.20	14.50
10 lin. ft. 78-in. pipe, 16-20 ft. deep	17.00	13.50	13.50	15.00
100 lin. ft. 72-in. pipe, 14-16 ft. deep	12.00	10.75	10.90	13.00
500 lin. ft. 72-in. pipe, 16-18 ft. deep	12.50	11.35	11.50	13.50
173 lin. ft. 72-in. pipe, 18-20 ft. deep	13.00	12.10	12.20	14.00
50 lin. ft. 66-in. pipe, 12-14 ft. deep	8.50	9.00	9.10	9.00
400 lin. ft. 66-in. pipe, 14-16 ft. deep	9.00	9.50	9.75	10.00
42 lin. ft. 66-in. pipe, 16-18 ft. deep	10.00	10.50	10.30	11.00
40 lin. ft. 60-in. pipe, 12-14 ft. deep	7.50	7.50	8.00	7.50
500 lin. ft. 60-in. pipe, 14-16 ft. deep	7.50	8.00	8.50	7.50
48 lin. ft. 60-in. pipe, 16-18 ft. deep	8.50	8.75	9.00	7.50
10 lin. ft. 57-in. pipe, 10-12 ft. deep	7.00	6.50	7.10	6.75
600 lin. ft. 67-in. pipe, 12-14 ft. deep	7.00	7.00	7.40	7.00
10 lin. ft. 57-in. pipe, 14-16 ft. deep	8.00	7.75	8.10	7.00
30 lin. ft. 51-in. pipe, 8-10 ft. deep	6.50	5.50	5.80	5.25
200 lin. ft. 51-in. pipe, 10-12 ft. deep	7.00	6.65	6.50	6.50
30 lin. ft. 51-in. pipe, 12-14 ft. deep	7.00	6.50	6.60	6.50
30 lin. ft. 48-in. pipe, 8-10 ft. deep	4.80	4.80	5.00	5.00
200 lin. ft. 48-in. pipe, 10-12 ft. deep	4.80	5.00	5.50	5.00
30 lin. ft. 48-in. pipe, 12-14 ft. deep	5.25	5.75	5.80	6.00
100 lin. ft. 36-in. pipe, 8-10 ft. deep	3.85	3.50	3.60	4.10
400 lin. ft. 36-in. pipe, 10-12 ft. deep	4.00	3.90	3.90	4.25
300 lin. ft. 36-in. pipe, 12-14 ft. deep	4.60	4.25	4.10	4.25
92 lin. ft. 36-in. pipe, 14-16 ft. deep	4.70	5.00	4.40	4.75
20 lin. ft. 36-in. pipe, 16-20 ft. deep	6.00	5.75	5.10	6.00
60 lin. ft. 33-in. pipe, 8-10 ft. deep	3.50	3.25	3.15	2.60
200 lin. ft. 33-in. pipe, 10-12 ft. deep	3.85	3.60	3.45	3.00
10 lin. ft. 33-in. pipe, 12-14 ft. deep	4.50	4.25	3.75	3.00
200 lin. ft. 30-in. pipe, 6-8 ft. deep	2.50	2.55	2.50	2.00
500 lin. ft. 30-in. pipe, 8-10 ft. deep	2.80	2.90	2.80	2.25
253 lin. ft. 30-in. pipe, 10-12 ft. deep	3.10	3.20	3.10	2.75
100 lin. ft. 24-in. pipe, 0-6 ft. deep	2.35	2.35	2.50	2.20
400 lin. ft. 24-in. pipe, 6-8 ft. deep	2.40	2.50	2.80	2.40
470 lin. ft. 24-in. pipe, 8-10 ft. deep	2.60	2.95	3.00	2.50
10 lin. ft. 24-in. pipe, 10-12 ft. deep	3.50	3.60	3.30	2.50
100 lin. ft. 18-in. D. S. vitr. pipe, 0-6 ft. deep	1.25	1.65	1.70	1.60
100 lin. ft. 18-in. D. S. vitr. pipe, 6-8 ft. deep	1.50	1.80	1.90	1.75
10 lin. ft. 18-in. D. S. vitr. pipe, 8-10 ft. deep	1.80	2.20	3.10	1.75
1,000 lin. ft. 15-in. D. S. vitr. pipe, 0-6 ft. deep	1.00	1.15	1.35	1.18
600 lin. ft. 15-in. D. S. vitr. pipe, 6-8 ft. deep	1.25	1.25	1.60	1.65
300 lin. ft. 12-in. D. S. vitr. pipe, 0-6 ft. deep	0.80	0.90	1.00	0.90
200 lin. ft. 12-in. D. S. vitr. pipe, 6-8 ft. deep	0.90	1.05	1.10	1.00
1 36-in. pipe joint in manhole	5.00	10.00	7.00	3.50
1 33-in. pipe joint in manhole	6.00	8.00	6.00	3.00
1 30-in. pipe joint in manhole	5.00	6.00	5.00	2.50
1 24-in. pipe joint in manhole	3.00	5.00	4.00	2.00
1 18-in. pipe joint in manhole	3.00	3.00	3.00	1.50
1 15-in. pipe joint in manhole	2.00	2.00	2.20	1.00
1 12-in. pipe joint in manhole	2.00	1.50	1.50	1.00
150 lin. ft. 27-in. pipe, 12-14 ft. deep	4.00	3.70	3.30	3.25
410 lin. ft. 27-in. pipe, 10-12 ft. deep	3.10	3.20	3.00	3.25
240 lin. ft. 27-in. pipe, 8-10 ft. deep	2.80	2.90	2.70	3.25
50 lin. ft. 27-in. pipe, 6-8 ft. deep	2.50	2.55	2.40	3.25
260 lin. ft. 54-in. pipe, 12-14 ft. deep	6.75	6.60	6.70	5.00

★**Los Angeles, Cal.**—Contract for sewer in Vine Street awarded J. C. Wukojevich, Los Angeles, at $19,400. Next three lowest bidders: Wattson & Spicer, $20,990; Peter S. Tomich, $21,000, and John Sutalo, $21,169.

BRIDGES

PROPOSED WORK.

Hartford, Conn.—Election to be held April 4 to vote on constructing reinforced concrete bridge on pile foundation across Park River; cost $18,000. R. N. Clark, City Engineer.

Bayonne, N. J.—Plans about completed by Central of New Jersey R. R. (J. O. Osgood, Ch. Engr., New York), for bridge to be constructed across Newark Bay between Bayonne and Elizabethport. Within a month plans will be submitted to War Department at Washington, D. C., for approval. After a period of about 6 months, it is expected to let contract for constructing bridge which is to be reinforced concrete, have four tracks, will be 24 feet above mean high tide and have a draw span. Bridge will replace present two track wooden structure.

Camden, N. J.—Board of Freeholders has petitioned Governor to appoint a commission of five members to aid in the preparing of plans for a bridge from Philadelphia to Camden over Delaware River.

Hollidaysburg, Pa. — County Commissioners propose constructing several concrete bridges, and will let contracts as soon as plans are approved at Harrisburg.

McKees Rocks, Pa.—House Committee on Interstate and Foreign Commerce on Feb. 11 reported favorably on authorizing Allegheny County (Pittsburg county seat) to construct a bridge over Ohio River between Woods Run and McKees Rocks.

Milton, Pa.—U. S. Senate has passed a bill authorizing Ahamokin, Sunbury & Lewisburg R.R. Co. and the Catawissa R.R. to construct a bridge between Milton and West Milton.

Millington, Pa. — Commissioners of Queen Anne and Kent Counties will construct a concrete bridge over Chester River at Millington.

Pittsburgh, Pa.—The replacing of the Greenfield Avenue Bridge with a concrete structure is under consideration by Council.

Pittsburgh, Pa.—See "Private Buildings."

Cumberland, Md.—Election to be held March 27 to vote bonds for constructing bridges. James T. Gaffney, City Engr.

Anderson, S. C.—A bill has been introduced in Legislature authorizing the Commissioners of Anderson County to spend $16,000 toward constructing a bridge across Savannah River at Browns Ferry. The bridge is to be constructed between Anderson County, S. C., and Hart County, Ga., and is to cost complete $32,000.

Right, Tenn.—Contract will be let about April by J. M. Yancey, Right, for constructing a steel and concrete bridge, one 45-ft. span, over Morris Chapel and Adamsville Road.

Cleveland, Ohio.—Council referred to Committee on Judiciary a resolution to vote April 25 on issuing $2,500,000 bonds for erecting a convention hall and $1,200,000 bonds for converting the Superior Avenue viaduct into a span to connect with St. Clair Avenue after completion of new high level bridge. Robert Hoffman, City Engineering Commissioner, and F. H. Betz, City Architect, City Hall, are to prepare plans.

County Commissioners have signed the revised plans for subway approach to Detroit-Superior high level bridge. The $500,000 subway bonds recently sold will have to be readvertised because of a technicality.

The plans for the straightening of the Cuyahoga River and for constructing the Lorain-Huron high level bridge are under consideration by the County Commissioners. Address County Engineer.

Columbus, Ohio.—See "Sewerage and Sewage Disposal."

Dayton, Ohio.—Bridge bonds for $15,000 will be sold March 2 by Walter H. Aszling, County Clerk.

Hamilton, Ohio.—Contract soon to be let by County Commissioners, Hamilton, for constructing the Columbia Bridge. Bids will probably be asked on both steel and concrete bridges. Fred. Hammerle, Co. Engr.

Youngstown, Ohio.—Engineers of the Lake Shore R.R. (G. C. Cleveland, Ch. Engr., Cleveland) are preparing detailed plans for the proposed East Federal Street viaduct to replace the present structure and to eliminate the Himrod Avenue grade crossing. Cost is estimated at $672,000. Frank Lillian, City Engineer, is preparing plans for the approach from Cedar Street, cost of which is to be borne jointly by the city and the street railway company.

Bridge bonds for $17,000 will be sold Feb. 21. J. P. Edwards, City Aud.

Indianapolis, Ind.—County Council adopted resolution providing for issue of $100,000 bonds for constructing bridge over Fall Creek.

Richmond, Ind.—County Engineer instructed to prepare plans for a concrete bridge at South G Street, roughly estimated to cost $175,000.

Oakford, Ill.—Contract will be let some time this spring for constructing a bridge across Sangamon River at Oakford. Address H. V. Schoonover, Bishop.

Beloit, Wis.—A new bridge is to replace Central Bridge this spring, and the city engineering department has completed soundings in the river bed beneath the bridge and a survey of the property adjoining. Plans and specifications to be submitted with bids. Address City Clerk.

Omro, Wis.—County Commissioners at Oshkosh and State Highway Commission taking steps to construct a bridge, probably of the bascule type, across Fox River and an island in the river in this town. M. W. Torkelson, Bridge Engineer Wisconsin Highway Commission, Madison.

Kansas City, Kan.—The bridge over Kaw River at Ohio Avenue to be reconstructed by the Kansas City Street Ry., Kansas City, Mo., is to be a through riveted truss bridge, have one 400-ft. and one 215-ft. span; superstructure of steel, estimated cost $140,000, and foundation of concrete, estimated cost $60,000; American Bridge Co. has contract for steel spans. Substructure work consists in remodeling one abutment, removing two piers and one abutment, and building two piers and one abutment. Waddell & Son, Engineers, Kansas City, Mo.

Omaha, Neb.—City Commission has directed the Missouri Pacific R.R. Co. (S. L. Wonson, Bridge Engr., St. Louis, Mo.) to build the Dodge Street viaduct at a cost of about $85,000.

Reported Union Pacific R.R. (R. I. Huntley, Ch. Engr., Omaha) intends constructing a new double-track bridge in this city to have 13 spans, two of them to be 246 ft. long, and other spans range down to 50 ft.

Superior, Mont.—Election is to be held in March in the county to vote on constructing two 225-ft. span steel bridges, to cost $28,500; also on a 140 and 175-ft. steel bridge costing $18,500. Contract will be let in April if election carries. Ray B. Leib, County Surveyor.

Houston, Tex. — See "Paving and Roads."

Perry, Okla.—All bids opened Feb. 7 for constructing four bridges and two culverts have been rejected by County Commissioners. W. T. Faris, County Clerk.

Seattle, Wash.—County Commissioners propose opening bids Feb. 21 for constructing two steel bridges, one at Fall City, 294 ft. span, cost $37,000, and one at Strossel, 209 ft. span, cost $18,000, both on concrete piers. Concrete arch bridge and wharf and dock work also are contemplated. Charles D. Calley, Bridge Engineer; A. P. Denton, County Engineer.

Washington.—Contract to be let early in March by State Highway Commission, Olympia, for constructing the "S" shaped reinforced concrete bridge at Nisqually to replace present wooden bridge. William R. Roy, State Highway Commissioner, Olympia.

Portland, Ore.—Reported contract soon to be let by County Commissioners (John B. Coffey, Clerk) for constructing seven reinforced concrete bridges as follows: Four viaducts between Linnton and county line, average length 200 ft.; one concrete arch, 80-ft. span, on Base Line extension, overhead crossing on Capitol Highway at Multonomah Station over Oregon Electric Line; one under crossing of Oregon-Washington R.R. & Navigation Co.'s line on Gresham-Fairview Road, to have concrete abutments and filler and steel girders, to include 14,000 yd. excav. John B. Yeon, County Roadmaster, preparing plans.

Portland, Ore.—The viaduct talked of between Vancouver and Williams Avenues will probably not be constructed for a year or more. The Council has only been petitioned to construct this viaduct, and many preliminary steps have to be taken before construction can begin. George S. Edmondstone, Chief Engineer, Design & Construction, Department of Public Works.

San Diego, Cal.—About $8,000 will be required to replace bridges in the city, exclusive of the $25,000 concrete bridge across Mission Creek, according to estimate of City Manager.

San Diego, Cal.—San Diego & Arizona Ry. Co. (B. J. Kallright, Ch. Engr.) will this month rebuild about 800 ft. of bridges and a mile of track on the line to Tia Juana, Mexico.

Santa Ana, Cal.—Board of Supervisors contemplates calling an election May 1 to vote $175,000 bonds for erecting extensions to reinforced concrete bridges.

BIDS DESIRED.

New London, Conn.—By New York, New Haven and Hartford R. R. (Edw. Gagel, Chief Engineer, New Haven), according to official information, about Feb. 24, for constructing the bridge over Thames River at New London.

Newark, N. J.—Until Feb. 24, by Committee on Roads, Assessments and Speedway of the Board Chosen Freeholders (William Cardwell, Chairman), desired separately for the following work: Extension of culvert in South Orange Avenue, Village of South Orange; extension to Morris Turnpike, Millburn Township, and reconstructing bridge superstructure over Deepavaal Brook on Fairfield Road, Caldwell Township.

Paterson, N. J.—Until March 1, by Board Chosen Freeholders (George W. Botbyl, Clerk), for extending and widening Bridges Nos. 54 and 63 on Paterson and Hamburg Turnpike, between Butler and Charlottesburg. Also for a 10-ton steam macadam road roller.

Georgetown, Del.—Reported desired until Mar. 7, by Morgan T. Gum, County Road Engineer, for constructing bridge at Poplar Street, Laurel, a one-span movable type on concrete piers on pile foundation, with 110-ft. drawbridge.

Washington, Va.—Until Feb. 23, by County Clerk, Washington, for reinforced concrete bridge 63 ft. long, 11 miles from Front Royal, also separate bids, same time and place, for a reinforced concrete bridge, 12 miles from Front Royal, 45 ft. long.

Hinton, W. Va.—Until Feb. 25 (extension of oate) by County Court at Hinton, for constructing bridge over Greenbrier River near Hinton. R. P. Davis, Engr., State Road Bureau, Morgantown.

Wheeling, W. Va.—Until Feb. 23, at U. S. Engrs office, Wheeling, for furnishing and delivering structural steel, etc. (service bridge, trestle, etc.), for Dams Nos. 14, 16 and 17, Ohio River.

Athens, Ga.—Until Feb. 28, by Commissioners Roads and Revenues and W. J. Tidwell, Ordinary, for constructing reinforced concrete pier, raising the existing 119 ft. steel span, placing concrete caps on piers, repairing and erecting a 119-ft. steel span, painting, placing joists on floors, etc. Also for Flowery Branch River Bridge approach, 135 ft. long, a 16-ft. concrete pier at end of approach. Searcy B. Slack, Engr. Good Roads Dept., University of Ga., Athens.

Jacksonville, Fla.—Until Feb. 28, by Committee Public Works of Board Bond Trus. (S. C. Harrison, Jr., Chmn.) for constructing reinforced concrete bridge over Hogan's Creek at Eagle Street.

West Palm Beach, Fla.—Until Mar. 7, by Board County Commissioners (Geo. O. Butler, Clk.) for furnishing material and constructing a bridge across the St. Lucie River at Stuart.

Dayton, Ohio.—Until March 15 by Director Public Service for constructing concrete arch bridges over Mad and Miami Rivers, one at Webster Street and one at Keowee Street, both over Mad River and one at Fifth Street over Miami River, advertised in Engineering Reord. Harrington, Howard & Ash, Engineers, Kansas City, Mo.

Hamilton, Ohio.—Until March 11 by County Commissioners for constructing bridges and culverts to cost $128,000. F. Hemmerle, County Surveyor.

Columbus, Ind.—Until about Mar 1, by County Commissioners, for constructing a three-span concrete bridge across Hair Creek, to cost $20,000. Lloyd Rogers, County Surveyor.

Indiana.—By County Commissioners for constructing bridges as follows:

Feb. 23:

Indianapolis, for constructing steel plate girder bridge on National Road over Lick Creek. Leo K. Fesler, Co. Aud.

March 8:

Winchester, for constructing 28 bridges. Charles E. Tilson, Co. Aud.

Decatur, for constructing bridges and approaches. T. H. Baltzell, Co. Aud.

Bluffton, for constructing 35 bridges, retaining walls and bridge repairs. C. T. Kain, Co. Aud.

Rockford, Ill.—Until Feb. 21, by A. R. Carter, Supt. of Highways, Rockford, for constructing a concrete bridge between Winnebago and Ogle Counties; estimated cost, $12,000.

Oshkosh, Wis.—Reported desired until Feb. 23, by Jas. Binning, Co. Aud., for constructing bridges as follows: Two 35-ft. spans reinforced concrete girder bridges, 20-ft. roadways, and 24-ft. span bridge and one 35-ft. span.

Fort Dodge, Iowa.—Reported desired until March 6, by J. L. Hanrahan, Co. Aud., for road and bridge work for the year 1916.

Mt. Pleasant, Ia.—Until Feb. 21, by County Auditor, for 83 concrete bridges and culverts. Total cost, $45,000. C. E. Smith, Co. Engr.

Nevada, Iowa.—Reported desired until March 2, by F. E. King, Co. Aud., for 114 reinforced concrete bridges and culverts and one steel bridge with concrete floor.

Red Oak, Ia.—Until March 9 by Peter Ostrom, County Auditor, for constructing pipe culverts about 4830 lin. ft., 12 to 48 in. Bids on corrugated, reinforced concrete, boiler iron and c.i., both C. L. and L. C. L., will also be considered. C. D. Forsbeck, County Engineer.

Brainerd, Minn.—Reported desired until March 7, for iron and steel culverts during the year 1916. Also repairing bridge over Mississippi. C. W. Mahlum, Co. Aud.

Ivanhoe, Minn.—See "Paving and Roads."

Kansas City, Kan.—Until March 6 by F. M. Holcomb, County Clerk, Kansas City, for constructing the Kansas River Central Avenue Bridge and approaches, advertised in Engineering Record. Harrington, Howard & Ash, Engineers, Kansas City.

Nelson, Neb.—Reported desired until March 8, by E. F. Hedgcock, County Clk., for constructing and repairing all bridges for year 1916.

Nebraska.—Reported desired by County Commissioners as follows for constructing bridges:

March 1:

At Rushville, for bridge construction during year 1916. Mand. E. Gillespie, County Clerk.

At Columbus, for bridge construction during year 1916. John Graf, County Clerk.

March 10:

At Butte, for bridge over Niobrara River, 170-ft. span, 16-ft. roadway. S. A. Richardson, Co. Clk.

Wayne, Neb.—Until March 17, by Charles W. Reynolds, Co. Clk., for constructing bridges as follows: 60-ft. steel span, township 26, 30-ft. girder township 27, 22-ft. I-beam, township 25; also for repairs to all bridges as ordered by County Commissioners for year 1916.

Grand Forks, N. D.—Reported desired until March 7, for constructing steel and concrete bridge during the year 1916. Jos. Ingram, Co. Engr.

Wahpeton, N. D.—Until March 2 by Commissioners of Richland and Wilkin Counties for constructing a steel bridge across Boise de Sioux River, separate bids on concrete and wood floor. F. A. Burton, County Auditor, Wahpeton.

Casper, Wyo.—Reported desired until March 7, by Frank H. Sawyer, Co. Clk., for two 34-ft. spans with concrete piers.

Newport, Wash.—Until March 6 (readvertisement) by H. A. Sewell, County Engineer, for constructing the substructure of the bridge over Pend d' Orielle River.

Brantford, Ont.—Reported desired until Feb. 26, by Township Clerk, County Building, Brantford, for reinforced concrete abutments and steel superstructure for Fonger and Barton bridges. Allan Mair Jackson, Township Engr., Temple Building, Brantford.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★Cedar Grove, N. J.—Contract awarded by Erie R. R. (R. C. Falconer, Asst. Chief Engineer, New York, N. Y.), for constructing bridges at Cedar Grove and Essex Falls, N. J., to H. J. Collier Company, Fort Wayne.

★Williamson, W. Va.—Contract awarded Virginia Bridge & Iron Company, Roanoke, Va., as follows, for constructing bridge over Tug Fork of Big Sandy River, between West Virginia and Kentucky (bids opened Feb. 5): Superstructure 3-in. oak floor, at $12,249; substructure above low water level, $7,131; substructure below low water level, cost, plus 15 per cent. Redman Wiky, Bridge Engineer, Department of Public Works of Kentucky, Frankfort, Ky.

★Milwaukee, Wis. — Contract awarded Stein Construction Co., Medford, Wis., at $25,970, for constructing a bridge across Milwaukee River at Silver Spring Road (bids opened Feb. 7). Louis G. Widule, County Clerk.

★McCook, Neb.—Contract awarded Standard Bridge Company, Omaha, Neb., for constructing steel and wooden bridges during year 1916 (bids opened Feb. 8) C. K. Dutcher, County Clerk.

★York, Neb.—Contract for constructing steel and concrete bridges during 1916 awarded Western Bridge & Construction Co., Omaha (bids opened Feb. 9). A. H. Beck, County Clerk.

Newport, Wash.—Lowest three bids opened Feb. 8 by County Commissioners for constructing the suspension bridge over Pend d' Orielle River were: Security Bridge Co., Lewiston, Idaho, $26,575; Portland Bridge Co., Portland, Ore., $27,500, and Illinois Steel Bridge Co., Spokane, Wash., $27,900. All bids rejected. See "Bids Desired." H. A. Sewell, County Engineer.

★Santa Barbara, Cal. — Contract awarded Dominquez & Walters, Santa Barbara, for constructing a concrete bridge across Gaviota Creek, near Sheeps Camp, at $6,845.

★Ventura, Cal.—Contract awarded C. H. Hudson, Trust & Savings Building, Los Angeles, for 50,719 cu. yd. unclassified earth and rock excav., 706 ft. 18 to 48-in. corrugated iron pipe, 1200 lb. steel, 11,950 ft. lumber for bridges, etc., on Sections A and B, on Matilija Canyon Road, at $24,609.

★Dallas, Tex.—Following are detail bids of four lowest bids opened Feb. 3 by J. F. Witt, County Engineer, for constructing the Commerce Street Viaduct: (a) Gilsonite Construction Co., St. Louis, Mo., and Dallas, $100,000 (awarded contract); (b) Omaha Structural Steel Co., Omaha, Neb., $114,000; (c) O'Hagan & Lake, Chicago, Ill., $121,780; (d) Hickey Brothers, St. Louis, Mo., $124,591

Section "A" Concrete:	*(a)	(b)	(c)	(d)
710 cu. yd. concrete pier bases	$5.39	$6.00	$3.98	$4.45
1,750 cu. yd. concrete pier shafts, etc.	5.50	7.00	6.10	7.00
950 cu. yd. concrete encasing river piers	5.50	6.80	5.30	5.25
690 cu. yd. concrete girders, beams, etc.	7.10	9.90	10.90	9.40
595 cu. yd. concrete floor slabs, etc.	7.10	8.00	10.90	9.40
11,736 ft. concrete sidewalks	0.04	0.095	0.25	0.20
1,980 ft. concrete hand rail, etc.	3.35	1.50	2.50	1.50
7,140 ft. concrete piling	1.00	1.00	1.50	1.20
2,000 ft. timber piling	0.35	0.55	0.45	0.60
740 cu. yd. excav. river piers	1.75	4.00	3.50	1.50
3,200 cu. yd. excav. all piers and abutments	0.75	1.00	1.25	0.75
1,500 cu. yd. backfilling piers and abutments	0.20	0.50	0.25	0.20
388,000 lb. steel reinforcing	0.04	0.036	0.0375	0.0375
5,000 lb. cast-steel expansion pls	0.0975	0.05	0.12	0.10
5,000 lb. cast-iron drains and guards	0.075	0.04	0.05	0.06
400 ft. removal timber approach	150.00	400.00	200.00	300.00
Section "B" Steel:				
850,000 lb. structural steel, 3 spans	0.05	0.0495	0.0605	0.063
9,000 cast-steel bearings	0.08	0.05	0.12	0.10
82 cu. yd. concrete top of piers	5.50	10.00	6.00	10.00
7,500 lb. reinforcing steel piers	0.04	0.036	0.04	0.04
Removal old steel spans	810.00	900.00	2,200.00	2,000.00

PAVING AND ROADS

PROPOSED WORK.

Batavia, N. Y.—Council considering the paving of Oak Street with bituminous macadam at a total cost of $21,000, the state to pay $9,000 and the city $12,000.

Newark, N. Y.—Reported an election will be held in March to vote on continuing the brick paving on N. Main Street; probable cost $10,000. Address Village Clerk.

Paterson, N. J.—Board of Finance has provided for improvements, including $30,000 for sewers, $30,000 for sidewalks and $25,000 for macadam roads. Address Mayor.

Woodbury, N. J.—Council has authorized issue of $25,000 bonds for street improvements.

New Castle, Pa.—Construction of roads in county is reported contemplated; cost $400,000.

Reading, Pa.—City Commission has decided to issue $150,000 bonds, of which $100,000 will be spent for street improvements.

South Bethlehem, Pa.—City will issue $175,000 bonds for street improvements and for purchase of motor-driven fire apparatus.

Annapolis, Md.—Chief Engineer Shirley of the Maryland Highway Department and the Governor are considering a large road loan.

Covington, Va.—Citizens of county will probably vote on issue of $200,000 bonds for road improvements.

Fayetteville, W. Va.—County intends paving about 12 to 14 miles of road this year at a cost of $250,000. Address County Clerk.

Kingwood, W. Va.—Paving bonds for $280,000 for Portland Dist. and $164,000 for Kingwood Dist. will be sold Mar. 7 by County Court (E. C. Everly, Clk.).

County Court of Preston County has authorized an election Feb. 26 in Lyen District to vote $200,000 bonds for building improved roads. Portland and Kingwood Districts, adjoining, have issued $464,000 bonds to build concrete roads.

Wellsburg, W. Va. — An election will probably be held in the county to vote $600,000 bonds for road improvements. Address County Clerk.

Shelby, N. C.—Citizens Feb. 12 voted $20,000 road improvement bonds. J. J. Lattimore, Recorder of District.

Americus, Ga.—Election will be held in city on March 15 to vote $30,000 bond issue for street improvements.

Clearwater, Fla.—State Supreme Court declared valid the $715,000 bond issue recently voted by Pinellas County.

Sebring, Fla.—Ridgewood Drive and Commerce Avenue are to be paved at a cost of $50,000. Bonds being sold but nothing very definite decided upon. George H. Bagelty, City Clerk.

St. Petersburg, Fla.—Brick Road bonds amounting to $715,000 will be sold March 7 by County Commissioners. Contract for this work has been awarded to Edwards Construction Co.

Tallahassee, Fla. — Paving bonds for $100,000 will be sold Feb. 21 by County Commissioners (O. C. Van Brunt, Clk.).

Birmingham, Ala. — City Commission Feb. 8 instructed the City Engineer to draw ordinances for paving with permanent pavement on portions of Seventh Avenue, Thirty-first Street and Avenue G; estimated cost $20,000; also adopted ordinances providing for paving with asphalt and asphaltic concrete portions of Twenty-second Street and Arlington and Fifteenth Avenues; cost $10,000. Julian Kendrick, City Engineer.

Mobile, Ala.—Harry L. Fisher, County Engineer of Mobile County, authorized to make investigations and report to Board of Revenue and Road Commissioners of Mobile County on the Mobile-Baldwin Highway. The road is to be built between Mobile and Baldwin Counties and the Commissioners of Mobile County have pledged $60,000 toward the construction of this road in Mobile County and Baldwin County contemplates issuing bonds for their share of the construction.

Chattanooga, Tenn.—Paving bonds for $18,917 will be sold Feb. 26 by Jesse M. Littleton, Mayor.

Clinton, Tenn.—Anderson County has issued $425,000 for highway improvements.

Greenville, Tenn.—County Court has appropriated $100,000 for completing pike roads.

Huntsville, Tenn.—Citizens of Floyd District, Scott County, will on Apr. 25 vote on issue of $43,800 bonds for road improvements.

Sneedville, Tenn.—Election to be held in April at the County Court to vote $190,000 bonds—$150,000 for pikes and $40,000 for bridges over Clinch River.

Morganfield, Ky.—County will vote April 1 $450,000 bond issue for road building.
Surveys, plans and estimates prepared for 8 miles of gravel road in Union County, Morganfield, to Boxville Road. Norman R. Orcutt, Engineer, Morganfield.

Akron, Ohio.—About $271,000 will be spent by Summit County for constructing County roads.

Canton, Ohio.—Paving bonds for $24,700 will be sold Feb. 28 by Samuel E. Barr, City Aud.

Chillicothe, Ohio.—Council has referred to Service Committee estimates for paving as follows: Webster Avenue, brick on concrete foundation, $17,414; on rolled stone foundation, $15,128; crushed macadam roadway, $12,386; four squares of Bridge Street, brick on concrete base, $17,148; creosoted wood block, $37,986. M. U. Shuitt, City Engineer.

Columbus, Ohio.—See "Sewerage and Sewage Disposal."

East Liverpool, Ohio.—State has given Columbiana County $27,000—$17,000 to be used for the inter-county road improvements and $10,000 for main market road improvements.

Lakewood, O.—Paving bonds for $13,090 will be sold March 6 by B. M. Cook, Dir. of Finance.

Portsmouth, Ohio.—About $45,000 allotted by State Highway Commission at Columbus to Scioto County for road maintenance and construction.

Salem, Ohio.—It is proposed to pave about 25,500 sq. yd. on East Seventh Street with brick on concrete foundation and stone curbing. B. M. French, City Engineer; I. N. Russell, Director Public Service.
County and Trustees of Perry and Butler Townships are reported considering extensive paving this summer, including Cox route west from this city and on Depot, Goshen, Ellsworth, Canfield and Lisbon Roads in Butler and Perry Townships.

Urbana, Ohio. — Election to be held March 14 to vote $33,000 bonds for street improvements. Address City Clerk.

Greencastle, Ind.—Putnam County Road bonds amounting to $27,120 have been sold.

Vevay, Ind.—York Township Road bonds amounting to $10,540 have been sold.

Flint, Mich.—Council rejected all bids opened recently for street paving during 1916, and the city will do the work.

Kalamazoo, Mich.—Street Committee of City Council is planning about $75,000 worth of street paving this spring and summer. Andrew Lenderink, City Engineer.

Averyville, Ill.—Contract soon to be let by Village Trustees for paving with small red brick Galena Highway in this village and city of Peoria.

Bloomington, Ill.—South Main Street is to be paved. E. E. Jones, Mayor.

Freeport, Ill.—Paving work ofr the year will require about $130,000. O. E. Hills, City Engineer.

Harvard, Ill.—City plans $100,000 worth of paving this year; 44 blocks, 4 alleys and possibly 8 resident blocks are involved. Walter H. Allen, City Engineer, recommends asphaltic concrete, except a short piece, which is to be brick.

Illinois.—About $20,000,000 will be available for improving roads throughout the state through bond issues being considered in 30 counties in all sections of the State. Cook County alone has voted $2,000,000. Address State Highway Commission, Springfield. W. W. Marr, Chief Highway Engineer.

Joliet, Ill.—Board Local Improvements voted to pave Pleasant Street with asphalt; cost $17,330.
Paving of Nicholson Street with bituminous pavement is contemplated; cost $22,143.

Moline, Ill.—City Council considering the paving with asphalt on Seventeenth and Twenty-third Avenues and Eleventh Street at a total cost of $48,483; and brick on Ninth, Eighteenth, Fifth and Nineteenth Streets at a total cost of $21,381. Lyle Payton, City Engineer.
Nothing will be done by Council on the paving of the 40 blocks of street until after March 7. The matter is being held up by legal proceedings.

Paris, Ill.—Stratton Township will vote on a $20,000 road bond issue and also on a $20,000 hard road levy this spring.
Embarass Township has passed a hard road levy for $10,000.
About $60,000 will be spent by the county for road improvements this season. Karl L. Barr, County Surveyor.
About three miles of State aid road will be constructed; brick surface preferred.

Peoria, Ill.—Board Local Improvements considering paving Richmond Avenue with brick, cost $15,269, and McClure Avenue with brick, cost $82,183.

Racine, Wis.—Douglas and Mound Avenues are to be paved at a cost of about $45,000. Address City Clerk.

Sioux City, Iowa.—Contract soon to be let by Council for paving Leeds Highway and Twenty-seventh Street, a feeder to the highway. City Engineer authorized to prepare the plans and schedule for the Broken-Kettle Highway, which is to cost $90,000.

Albert Lea, Minn.—It is proposed to pave about 35,000 sq. yd. on Broadway and Newton Street on concrete foundation, material not yet decided upon. W. Barneck, City Engineer.

Abilene, Kan.—Dickinson County will improve about 171 miles of road this spring; about 10 per cent will be gravel, about three miles concrete, and the remainder graded earth; $20,000 available for bridges and road improvements for the year.

Hastings, Neb.—Paving bonds amounting to $50,000 have been sold. Address City Clerk.

Mandan, N. D. — City Commissioners passed resolutions to pave portions of Second Avenue N. E., Third Avenue N. E., Fourth Avenue N. E., Sixth Avenue N. W. and First Street. Address City Auditor.
About 30,000 sq. yds. of paving are to be laid. Thomas J. Lough, County Engineer.

Springfield, Mo.—Citizens of Billings Special Road District have voted $40,000 bonds for constructing permanent highways within the district.

Amarillo, Tex.—See "Sewerage and Sewage Disposal."

Corpus Christi, Tex.—See "Paving and Roads."

Denton, Tex.—See "Public Buildings and Schools."

Fredericksburg, Tex. — Election will probably be held to vote $70,000 bonds for constructing roads in Gillespie County.

Houston, Tex.—City Council sold $118,000 bonds for road, bridge and court house improvements.

Hutto, Tex.—Citizens of Hutto Precinct will vote on $50,000 bond issue for constructing roads.

Sulphur Springs, Tex. — Road bonds amounting to $400,000 have been sold by County Commissioners.

Tyler, Tex.—Tyler Road District bonds amounting to $100,000 have been sold. Address Road Commissioner.

Chehalis, Wash.—Contract soon to be let for paving National Avenue estimated by City Engineer to cost $15,000.

Ritzville, Wash.—City plans paving 20,000 sq. yd. in the business and residence districts; type of pavement not decided upon.

Seattle, Wash.—Reported about 45 miles of the brick paving along tracks of the Puget Sound Traction, Light & Power Co. has been damaged by the snow and ice and will have to be replaced with new material.

Spokane, Wash.—Council is considering constructing concrete curb and walks on Twenty-fourth Avenue at a cost of about $10,000. Morton MacCartney, City Engineer.

Tacoma, Wash.—County Commissioners have approved plans for 8 miles of hard-surfacing on Pacific Highway, and contract will soon be let; cost $131,000. D. H. White, County Engineer.

Thornton, Wash.—Petition being circulated for a permanent highway between La Crosse and Duster, about 12 miles graveled; probable cost $32,000. No action taken yet. J. M. McCaw, County Engineer.

California.—Election to be held this year to vote $15,000,000 bonds for highway improvements throughout the State. Address California Highway Commission, Sacramento.

Kingsburg, Cal.—City Council voted to pave 10 blocks on Simpson Street with concrete pavement.

Pasadena, Cal.—Reported State is considering the building of the Arroyo Seco Road to Palmdale. State has appropriated $7,500 for the survey of this road. W. T. McClure, State Engineer.

Porterville, Cal. — Citizens petitioned County Supervisors to vote $1,250,000 road bonds.

San Diego, Cal.—Council adopted resolution to pave with asphalt-concrete on Prospect Street and Prospect Place, including cement curbing. Allen H. Wright, City Clerk.

Selma, Cal.—Contract will be let about May or June by O. E. Dillon, City Clerk, for four blocks of paving on Front Street, 40 ft. wide and about 1 mile 20 ft. wide. Specifications not yet completed. W. H. Shafer, Engineer, Selma.

Visalia, Cal.—Contract will be let about March 15 for 25,000 sq. yds. of paving, including East, Oak and Church Streets., 5-in. concrete base and 1½-in. Topeka surface. L. E. McCabe, City Engineer.

Idaho Falls, Idaho.—Bonneville County Roads Assoc. organized to construct cement or macadam roadway 13 miles from city north to county line through Madison County. Otto E. McCutcheon, President.

Orofino, Idaho.—City Council will construct four blocks of conrete pavements and sidewalks in business district; cost $12,000.

Rigby, Idaho.—Plans being prepared by Fay Hardesty for constructing thirty-nine street crossings and forty-six blocks of cement sidewalks; cost $28,000.

Niagara Falls, Ont.—Welland County Council has designated roads to be built on the county system this year at an estimated cost of $101,000.

BIDS DESIRED.

New Haven, Conn.—Until Feb. 25, by F. L. Ford, City Engineer, for constructing cement sidewalks for the year 1916.

Brooklyn, N. Y.—Until Feb. 25, by L. H. Pounds, Borough President, for improving portions of roadway of Bedford Avenue, East Thirty-seventh Street, constructing sidewalks on Douglass Street and East Twenty-first Street, to consist of 4210 sq. yd. granite pavement, 20,935 sq. ft. cement sidewalks, 2630 sq. yd. asphalt pavement, etc. Total security, $10,000; also for furnishing and delivering 250,000 gal. of tar road surfacing material to be delivered by rail or boat any or all railroad stations or public docks in the Borough of Brooklyn.

New York, N. Y.—Until Feb. 24, by Douglas Mathewson, Pres. Bronx Boro., for repairing asphalt block pavement, etc., in the borough, to consist of approximately 5000 sq. yd. completed asphalt block pavement, including asphalt pitch filler, concrete foundation, etc.; also furnishing and delivering 20,000 gal. bituminous road surfacing material (for use hot). Security, $5,000.

Camden, N. J.—Until March 6 (readvertised), by Board of Freeholders, Camden, for constructing the Moorestown Pike, about 29,637 sq. yd. surface pavement.

Fleming, N. J.—Until March 2 by Board of Chosen Freeholders for placing a thin bituminous surface on approximately 100,000 sq. yd. of macadam roads in said county, advertised in Engineering Record. Grant Davis, County Engineer, Whitehouse Station.

Jersey City, N. J.—Until Feb. 24, by City Commissioners, for repaving portions of Congress Street. M. I. Fagen, City Clk.

Paterson, N. J.—See "Bridges."

Maryland.—See "Miscellaneous."

Lynchburg, Va.—Until March 6, by Joint Council Committee of Streets and Sewers at office of H. L. Shaner, City Engineer, for improving Main Street, including constructing an underground conduit system for electric wires, furnishing and laying sewer pipes and repaving with either granite block, Medina sandstone block, asphalt block, Durax cubes or sheet asphalt, advertised in Engineering Record. About 10,500 sq. yd. paving.

Petersburg, Va.—Reported desired until Feb. 29 by J. R. Jones, Chmn. Street Com., for 5000 yd. granite block pavement on River Street, 15,000 ft. concrete curb and gutter and 10,000 sq. yd. concrete paving. R. D. Budd, City Engr.

Charleston, W. Va.—Until Apr. 1, for 16,000 yd. brick paving. J. M. Clark, City Engr.

De Land, Fla.—Reported desired until March 20, by Saml. C. Jordin, Co. Clk., for 230,239 lin. ft. roadway, 285,807 sq. yds. pavement, 378,532 lin. ft. curb, 74,158 cu. yds. excav., etc., for improving roadway in Halifax Special Road and Bridge Dist.

Canton, Miss.—Reported desired until Mar. 6, for 20 miles gravel road in Dist. No. 2. Probable cost, $80,000. X. A. Kramer, C. E., Magnolia.

Vicksburg, Miss.—Reported desired until Feb. 21, by City Commissioners, for paving portions of Catherine, Walnut, Crawford and other streets.

Louisville, Ky.—Until Feb. 28, by Board of Public Works for constructing sidewalks on numerous streets.

Maysville, Ky.—Until March 6 by Mayor and Council for improving Sutton, Market, Plum, Third, Bridge and Second Streets with vitr. brick and cement curb, and Court and Second Streets with asphalt and cement curb, advertised in Engineering Record.

Cheviot, Ohio.—Until Feb. 25, by County Commissioners (Albert Reinhardt, Clk., Cincinnati), for grading and paving with granite the Harrison Turnpike through the village of Cheviot.

Chicago Junction, Ohio.—Until March 7 by E. K. McMorris, Corporation Clerk, for grading, curbing and paving with brick, concrete, asphalt or other suitable material portions of Maple and Woodbine Streets, about 14,000 sq. yd.

Cincinnati, Ohio.—Until Feb. 28, by Charles F. Hornberger, Director Public Service, for improving Vine Street, with wood block, about 3500 sq. yd.; estimated cost, $24,270. Frank S. Krug, City Engineer.

Mt. Gilead, O.—Reported desired until Feb. 25 by C. O. Higgins, Co. Aud., for improving 3 miles of Fayo-Sipe Road, 5 miles of Beech Grove Road and 2 miles Taylor-Wreen Road.

Columbus, Ind.—Until about Mar. 1, by County Commissioners, for constructing a tarvia macadam road to county hospital, to cost $10,000. Lloyd Rogers, Co. Surveyor.

Goshen, Ind.—Until about March 7, by S. F. Spohn, Mayor, for paving Seventh Street, at a cost of $54,000, and Third Street, at a cost of $33,000; material not yet decided upon, but probably brick, with combination concrete curb and gutter. H. J. Haverly, Engineer, Goshen.

Indiana.—By County Commissioners, for constructing roads as follows:
Feb. 28:
Peru, constructing gravel roads in Perry, Butler, Harrison and Jackson Townships. Frank H. McElheny, Co. Aud.
March 2:
Winchester, two miles stone road in Nettle Creek Township, and one mile road between Nettle Creek and Stoney Creek Townships. Two roads in Monroe Township and one in Green Township, 7900, 2646 and 8023 ft. in length. Charles E. Tilson, Co. Aud.
March 6:
Greenfield, gravel roads in Buck Creek, Brown Township. Harvey J. Rhue, Co. Aud.
Williamsport, gravel road 11,580 ft. long, in Liberty Township. David H. Moffitt, Co. Aud.
Kentland, macadam roads in Washington, Colfax and Lake Townships. S. R. Sizelove, Co. Aud.
Versailles, crushed stone roads in Shelby and Franklin Townships. J. Francis Lochard, Co. Aud.
Greencastle, for gravel road 6775 ft. long, Franklin Township; 7907 ft. macadam road, Franklin Township; 5307 ft. gravel road in Russell Township; 14,900 ft. gravel road, Clinton Township. Joseph M. Allen, Co. Aud.
Newport, gravel roads in Clinton and Helt Townships. Roy Slater, Co. Aud.
Salem, 16,343 ft. long, Franklin Township. Ira H. Rutherford, Co. Aud.
Portland, three brick roads in Wayne Township. John Bonifas, Co. Aud.
Williamsport, gravel roads, in all 14,826 ft. long, Adams Township. D. H. Moffitt, Co. Aud.
March 7:
Bloomington, three gravel roads in Clear Creek, Richland and Perry Townships. W. F. Kinser, Co. Aud.
March 8:
Columbus, gravel roads in Union and Harrison Townships. W. H. Scott, Co. Aud.
Brazil, stone and gravel road in Perry Township. William O. Gaeser, Co. Aud.
Decatur, macadamized roads in Root, French, Monroe and Wabash Townships. T. H. Baltzell, Co. Aud.
Covington, stone or gravel roads in Mill Creek, Van Buren, Troy and Richland Townships. H. W. Newlin, Co. Aud.
March 10:
Indianapolis, concrete road in Center Township. Leo K. Fesler, Co. Aud.
Corydon, gravel or macadam road between Taylor and Boone Township. J. L. O'Bannon, Co. Aud.
March 11:
Bluffton, constructing brick and asphalt streets, about 8236 ft. stone road in Jefferson Township, about 18,552 ft. macadam road in Lancaster Township, 7676 ft. stone roads in Rock Creek Township, about 21,634 ft. stone road in Union Township, 14,653 ft., and stone road 15,840 ft. in Chester Township. C. T. Kain, Co. Aud.

Chicago Heights, Ill.—Until Feb. 21, by Board Local Improvements, for approximately 13,000 sq. yd. brick pavement, on 6-in. concrete base, with cement grout filler and approximately 7500 lin. ft. concrete curb. M. H. McCoy, Engineer of Board.

Appleton, Wis.—Reported desired until Mar. 1 for 6000 yd. sandstone paving, 10,000 yd. asphalt, brick or concrete. A. C. Remley, City Engr.

Carroll, Iowa.—Until March 2, by J. A. Dougherty, City Clk., for paving to consist of 69,000 sq. yd. sheet asphalt, 69,000 sq. yd. asphaltic concrete, and 75,700 sq. yd. vitr. vertical fibre brick block pavement.

Cherokee, Iowa.—Until Feb. 25, by Wm. Shardlow, City Clerk, for 90,000 sq. yd. paving and 21,000 lin. ft. concrete curb and gutter. Bids are wanted on one course concrete, two course concrete, sheet asphalt, asphaltic concrete and brick.

Fort Dodge, Iowa.—See "Bridges."

Mason City, Ia.—Reported desired until Feb. 28, for about 60,000 yd. concrete paving and 150,000 sq. yd. sheet asphalt paving. E. P. Wilson, City Engineer.

Spencer, Iowa.—Reported desired until Feb. 23, by E. O'Keefe, City Engr., for approximately 43,000 sq. yd. either plain concrete, reinforced-concrete, bitulithic, asphalt concrete, brick block or natural sheet asphalt pavement, and approximately 27,000 lin. ft. straight curb or combined curb and gutter.

Ivanhoe, Minn.—Until Feb. 23, by Karl A. Hansen, Co. Aud., for State Roads Nos. 3, 12 and 13, culverts, etc., also constructing State Bridge No. 2058 of concrete, 20 ft. span, 18 ft. roadway. Also same time and place for roads in village of Benton, also State Bridge No. 2059 of concrete, two 10 ft. spans and 18 ft. roadway.

Holton, Kan.—Until Feb. 21, by J. D. Fowler, for constructing three blocks of vitr. fiber brick pavement. Contract will probably be extended to include about twenty blocks.

Higginsville, Mo.—Until Feb. 21, by Ralph Huscher, City Clk., for approximately 10,000 sq. yd. vertical fibre brick paving with asphalt filler, approximately one mile combined curb and gutter.

Corsicana, Tex.—Reported desired until Feb. 21, by J. A. Harper, City Secy., for paving portions of W. Fourth Avenue, S. Thirtieth and S. Fifteenth Streets. Bids desired on asphalt, bitulithic, asphalt macadam, rock asphalt, concrete and vitrolithic.

Seattle, Wash.—Reported desired until Feb. 28 by Byron Phelps, County Commissioner, for constructing proposed Newcastle-Renton Road, about 3 miles long. Probable cost $25,000. A. P. Denton, Co. Engr.

Los Angeles, Cal.—Until March 6, by County Supervisors (A. M. McPherson, Clk.) for 8.44 miles concrete pavement on Section C, Unit Canyon Road, to consist of approximately 99.071 sq. yds. concrete pavement, 35,680 ft. expansion joints, three 38 ft. pile bridges, 8230 ft. guard fence, etc.; estimated cost. $69,588.

Venice, Cal.—Until Feb. 28, by C. S. Thatcher, City Clerk, for approximately 35,000 sq. ft. bitulithic surface on Venice Boulevard and Rivera Street.

Phoenix, Ariz.—Until Feb. 21, by V. A. Thompson, Superintendent of Streets, for paving West Washington Street, ten blocks, and Seventeenth Avenue, two blocks.

Montreal, Que.—Until Feb. 24, by Board Commissioners for 6000 net tons of refined asphalt.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Camden, N. J.**—Contract awarded by Chosen Freeholders, Camden, to John R. Bates, Laurel Springs, N. J., for constructing Grenlock Road about 13,782 sq. yd. bituminous surface on macadam foundation (bids opened Feb. 7), at $26,277. Fred W. George, County Clerk.

★**Baltimore, Md.**—Contracts awarded Feb. 9, by Paving Commission, as follows (bids opened Feb. 2): To American Paving Company, Baltimore, Contract 126, $70,883; Contract 127, $64,121, and Contract 129, $104,883. Baltimore Asphalt Block & Tile Company, Lowman and Monroe Streets, Contract 128, at $57,119.

★**Indianapolis, Ind.**—Contract for constructing Case concrete road between Perry and Center Townships awarded by Marion County Comrs. to Boone Constr. Co. at $42,244.

★**LaPorte, Ind.**—Reported contract for paving Michigan Avenue and Indiana Avenue with Trinidad Lake asphalt, awarded Western Construction Company, Mishawaka, at a total cost of about $73,000.

★**Pontiac, Mich.**—Contracts for paving (bids opened Feb. 7) awarded by Leman A. Cambrey, City Clerk, as follows: To Henry Venderveen, for Bermudez asphalt concrete on West Lawrence, West Pike, Williams, Patterson, Garland Streets and Franklin Road, at a total of $45,506, and to James H. Baker, for reinforced concrete on Elizabeth Lake Road Section "A" and Elizabeth Lake Road Section "B," at a total cost of $14,517.

Chicago, Ill.—Purrington Paving Brick Co., 133 W. Washington Street, submitted lowest bid for furnishing and delivering 600,000 paving brick (bids opened Jan. 31), at $16 per M ft. where Chicago rate applies and $17.46 where Chicago rate does not apply. A. W. Miller, Superintendent of Streets.

★**Kankakee, Ill.**—Contracts for paving awarded by Bd. Local Improvements to F. P. Caughlin & Co., Milwaukee, Wis., East Sharon Street with asphalt at $14,$628, and Schuyler Avenue with brick at $11,233.

Rock Island, Ill.—McCarthy Improvement Co., Davenport, Iowa, submitted lowest bid Feb. 1 for Twelfth Street paving at $1.90 per sq. yd. and 40 cts. per lin. ft. concrete; total cost about $74,000. Independent Construction Co. bid $2.08 per sq. yd. and 45 cts, for curbing. P. F. Trenkensch, $2.12, and Tri-city Construction Co., $2.14. Estimated cost $74,475.

★**Milwaukee, Wis.**—Contracts for street paving awarded by Department of Public Works as follows: To Gumz, Gutknecht & Wussow, 709 M. & M. Bank Building, sandstone pavement on Jackson, Van Buren and Jefferson Streets, at $16,696, and White Construction Co., 1006 Railway Exchange Building, asphalt pavement, on Twenty-fourth Avenue, at $11,295, and to F. P. Caughlin Co., 534 Stock Exchange, Chicago, Ill., asphalt pavement on Knapp Street, at $16,032 (bids opened Feb. 4).

★**Clinton, Iowa.**—Following are unit figures of the four lowest bids opened Feb. 8 by J. G. Thorne, City Engineer, for paving Fourth, Fifth, Sixth and Seventh Avenues and First Street: (a) Thomas Carey & Sons, Clinton, $54,354 (awarded contract); (b) Independent Construction Co., Davenport, Iowa, $55,122; (c) D. E. Keeler Co., Davenport, $55,865; (d) C. B. McNamara & Co., Dubuque, $56,048.

	*(a)	(b)	(c)	(d)
6,121 lin. ft. combined curb and gutter	$0.70	$0.74	$0.75	$0.78
1,246 lin. ft. plain curb	0.60	0.65	0.65	0.64
22,246 sq. yd. vitr. block paving	2.20	2.22	2.25	2.245
3 catchbasins, complete	35.00	35.00	35.00	68.00
365 lin. ft. 10-in. c.-i. pipe	0.60	0.64	0.65	0.74
152 lin. ft. reinforcing bars, 6-ft. radius	0.25	0.25	0.30	0.28
76 lin. ft. reinforcing bars, 3-ft. radius	0.25	0.25	0.30	0.28

★**Mitchell, S. D.**—Contract for constructing approximately 29,000 sq. yd. of asphaltic concrete pavement awarded C. H. Aitkinson Paving Co., Watertown, at $1.79½ per sq. yd.; also 13,500 lin. ft. combined curb and gutter, about 4800 sq. yd. of alley paving, awarded Dan Smith of Mitchell at $1.62 and $1.64 per sq. yd. Thomas E. Gastcott, City Auditor.

★**Butte, Mont.**—Contract for repaving streets and constructing concrete gutters in Special Improvement District No. 198 (bids opened Feb. 2) awarded by J. J. Armstrong, Commissioner Public Works, to Robert Metcalf, Butte, at $3.29 per sq. yd. for 35,536.5 yds. of lug wood block; total, $116,915. Lowest bids on other pavements were: (a) 35,536.5 yds., (b) 32,329.5 yds., (c) 14,430 lin. ft. concrete gutters, (d) totals: Lug wood block, R. M. Boardman Co.., (a) $3 65, (d) $129,708; Nick Hughes, lug wood block, (a) $3.49, bitulithic (b) $2.44, (c) $1.33, (d) $121,022 and $98,076 respectively; J. C. Maguire, bitulithic, (b) $1.97, (c) 49 cents, (d) $70,759; G. H. Nash & Co., lug wood block, (a) 3.70, (d) $131,486; Fred Laner, lug wood block (a) $3.53, bitulithic $2.04, (c) 60 cents, (d) $125,444 and $74,610; J. R. Silver & Sons, lug wood block, (a) $3.47, (b) bitulithic $1.98, asphalt concrete $1,66, (c) 67 cents, (d) $122,112, $72,238 and $61,892 respectively; S. Birch & Son, lug wood block (a) $3.80, bitulithic (b) $1.99, (c) 66 cents, (d) $135,039 and $72,994 respectively. ⅜-in. lug is used on grades over 67 deg. and ¼-in. lug on grades under where wood block is used; on bitulithic flush coat is left off and more rock rolled in.

★**Brackettville, Tex.** — Contract for constructing Spofford-Brackett Road and constructing concrete bridges and culverts awarded by Commissioners Court to W. H. Davis, San Antonio. at $27,000.

★**Ritzville, Wash.**—Contract awarded by Council to Sawyer Brothers, Spokane, for paving about 10 blocks at about $40,000.

Seattle, Wash.—Following are four lowest bids opened by Board of Public Works for paving with concrete on Thirtieth Avenue Southwest—(a) with expansion joints, (b) without expansion joints: Voluccio & Niblett, 1642 Lane Street, (a) $44.940, (b) $43,480; McHugh Paving & Construction Co., Third Avenue North and Mercer Street, (a) $74,136, (b) $44,216; Jahn Contracting Co., Pioneer Block, (a) $48,777, (b) $47.609; Cascade Construction Co., Central Building, (a) $48,454, (b) $46,994.

Wenatchee, Wash.—Following are four lowest bids opened Feb. 8 by County Commissioners for constructing one mile of permanent highway: Quigg Construction Co., Wenatchee, $38.945; Coast Bridge Co., Portland, Ore., $47,960; Illinois Steel Bridge Co.. Spokane, Wash., $48,750; G. L. Graves, 728 Old Neb. Building, Spokane, Wash., $49,916. F. L. Ross, County Auditor.

★**Ventura, Cal.**—Lowest bid opened by Bd. Supervisors Feb. 14 for grading and constructing culverts on Ventura-Nordhoff Road submitted by C. H. Hudson, Trust and Savings Bldg., Los Angeles, at $25,500.

STREET CLEANING AND GARBAGE DISPOSAL

PROPOSED WORK.

Alliance, Ohio.—The Sanitary Service Co. has been granted a franchise for the disposal of garbage and will erect a plant.

Columbus, Ohio.—See "Sewerage and Sewage Disposal."

Grand Rapids, Mich.—Reported construction of a garbage disposal plant is under consideration.

Galveston, Tex. — Reported replacing present garbage incinerator with a larger plant, costing approximately $40,000, is under consideration by city. Address H. O. Sappington, City Commissioner.

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS

PROPOSED WORK.

Dock—Niagara Falls, N. Y.—Harbor Advisory Commission considering tentative plans for municipal dock near city water works.

Hydroelectric Plant—Seneca Falls, N. Y.—The Seneca Power Corporation has applied to Public Service Commission for permission to increase the capital stock from $5,000 to $1,600,000, and to issue $450,000 in bonds. The company proposed to build a hydroelectric power plant at Seneca Falls.

Harbor Improvements—Philadelphia, Pa.—Finance Committee of City Council has approved an ordinance authorizing expenditure of $87,000 of State funds for the improvement of the harbor and erection of McKean Street municipal pier.

River Improvement—Urbana, Ill.—City Engineer preparing plans for changing course of stream around business district of this city and alternate plans for rebuilding large stone arch washed away by the flood.

Dam—Amarillo, Tex.—D. C. Priddy and Dan O. Martin of Amarillo and W. F. White of Fort Worth have applied to the Texas Board of Water Engineers for privilege of constructing dam in Palo Duro Canyon near here for domestic and manufacturing purposes.

Bluff Improvement—Corpus Christi, Tex.—Mayor Miller in a report to Council recommends calling an election to vote $150,000 bonds for completion of the bluff improvement and for paving of a number of streets. City Engineer estimates the cost of the bluff improvements at $57,800.

Drainage — Victoria, Tex. — Tentative plans have been arranged for new drainage and levee district in Bloomington section of county along Guadalupe River. Address County Clerk.

Dithch—Medford, Ore.—Rouge River Canal Company will do all their own work. H. B. Stoner, Chief Engineer.

Irrigation—Anderson, Cal.—Irrigation bonds for Anderson-Cottonwood Irrigation District amounting to $400,000 have been sold.

Irrigation—Fresno, Cal.—Omega Mutual Water Co. incorporated by William E. Keller, 543 Shatto Place, President Globe Grain & Milling Co., Marco H. Hellman, Pres. Hellman Commercial Trust & Savings Bank, and others for the purpose of installing pumping plants and pipe lines to irrigate San Joaquin Valley Farm Land Co.'s tract near Fresno. Water will be obtained from San Joaquin and Kings Rivers, and about 50 artesian wells installed, capacity 1000 gal. each per minute.

Irrigation—Mohave, Cal.—James Arp and W. W. Kaye, Bakersfield, are forming a company for the purpose of constructing a dam in Oak Creek to irrigate about 15,000 acres; dam will be 1095 ft. long at top, 600 ft. at bottom, and 87 to 92 ft. thick; cost $90,000.

Harbor Improvemsnts—Richmond, Cal.—Haviland & Tibbetts, Alaska Commercial Building, San Francisco, have been requested to submit estimates on the cost of constructing 2750 ft. of bulkhead and filling in behind the inner harbor.

Weir—Sacramento, Cal.—Contract for constructing the weir above Sacramento River for flood protection will be let about April or May; specifications being prepared. C. L. Knight, Deputy City Engineer.

Dam—San Diego, Cal.—Repair to break in concrete dam of the Sweetwater Co. on Sweetwater River will cost approximately $100.000. John E. Covert, Company's Engineer.

Irrigation—San Fernando, Cal.—Irrigation bonds amounting to $868,000 have been sold by Board of Supervisors.

Dike—Phoenix, Ariz.—City and county considering building protective dyke along north bank of Salt River as a protection from floods. William H. Caruthers, County Engineer.

BIDS DESIRED.

Dredging, Etc.—New Bedford, Mass.—Until March 16 at U. S. Engrs. sub-office, Post Office Building, New Bedford, Mass., for rock removal and dredging in New Bedford harbor.

Breakwater — Newport, R. I. — Until March 15 at U. S. Engrs. Office, Newport, for repairing Point Judith breakwater.

State Canal Work—Albany, N. Y.—Until March 14 by W. W. Wotherspoon, State Superintendent Public Works, for State Canal Work as follows, advertised in Engineering Record: Contract 29-A (re-advertisement), Contract 130, Contract 131 and Terminal Contract 30.

Riprap — Tompkinsville, N. Y. — Until March 7 by J. T. Yates, Lighthouse Inspector, Tompkinsville, for furnishing and placing riprap around West Bank Light Station, New York Lower Bay.

Dredging, Etc.—Philadelphia, Pa.—Until Feb. 24 by Department Public Works (George E. Datesman, Dir.), for grading streets, dredging creeks and watercourses in the Fortieth Ward.

Levee Work—New Orleans, La.—Until Feb. 29 by Levee Commissioners, Orleans Levee District, Suite 201, New Court Building, New Orleans, for constructing Seventeenth Street Canal new levee, length 13,000 ft., approximate contents 185,000 net cu. yd.; Lake Avenue new levee, length 2262 ft., approximate contents 17,000 net cu. yd. (C. J. Donner, Secy.)

Ditch—Bucyrus, O.—Reported desired until Mar. 1, by H. L. Keller, County Engr., for Mud Run Ditch to consist of 72,355 cu. yd. open ditch, 8276 yd. tile ditch and 7916 ft. vitr. shale tile.

Levee, Etc. — Vincennes, Ind. — Until March 23, by Jacob B. Spiker, Construction Commissioner, Noble Block, for constructing the Wm. H. Brevoort Levee System and sewers through same.

Drainage—Hahnaman, Ill.—Until March 4, by Drainage Dist. No. 2, in town of Hahnaman, at office of Carl E. Sheldon, Sterling, for 35,685 cu. yd. drainage ditch excav.

Drainage Work—Charles City, Ia.—Until Feb. 26, by Jas. A. Cutler, County Auditor, for constructing Drainage Dist. to consist of 2000 rods tile ditch. Estimated cost, $18,500. G. S. Wacker, Engr., Charles City.

Ditch—Redwood Falls, Minn.—Until Mar. 8, by L. P. Larson, County Auditor, for constructing county ditches No. 23, 27 and 32, and Judicial Ditch No. 16, total estimated cost $26,880. All tile work.

Dike—Jefferson City, Mo.—Until March 14,. by U. S. Engineer's Office, Kansas City, for three-row dike on Missouri River, about 5 miles above Jefferson City, advertised in Engineering Record.

Ditches—Sequim, Wash.—Reported desired until Feb. 21, by Frank H. Dyer, Secy. Highland Irrigation Dist., for constructing ditches, etc., in all about 14,000 acres of land. Probable cost, $100,000.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Pier—New York, N. Y.—Following are four lowest bids opened Feb. 9 by Department of Docks and Ferries, New York, for Contract 1494, building pier with appurtenances, near West Eighth Street, Dreamland Park, Borough Brooklyn: (a) Pier, bulkhead, etc., (b) pavilion, (c) electric light, (d) totals. The Snare & Triest Co., 2333 Broadway, (a) $53,870, (b) $6,600, (c) $64,470; North-Eastern Construction Co., 225 Fifth Avenue, (a) $57.702. (b) $7,625, (c) $5,250, (d) $70,500; A. M. Hazell Co., 90 West Street, (a) $59,990, (b) $9,035, (c) $4,700, (d) $73,000; Kaufman & Garcey, (a) $64,600, (b) $10,000, (c) 4,000, (d) $78,600.

Pier—New York, N. Y.—Following are four lowest bids opened Feb. 11 by Department of Docks & Ferries, New York, N. Y., for Contract 1488, building a freight shed with appurtenances on the pier at foot of West Forty-sixth Street, North River, borough of Manhattan: (a) Shed, (b) 13,400 sq. yd. asphalt pavement, (c) total: W. F. Plass & Bro., 145 West Eighteenth Street, (a) $528,000, (b) $1.10, (c) $542,000; The Snare & Triest Co., 233 Broadway, (a) $532,300, (b) $1.12, (c) $547,308; P. F. Kenny Co., 33 Old Broadway, (a) $570,497, (b) $1.10, (c) $580,287; Post & McCord, (a) $569,000, (b) $1.16, (c) 584,000. Lowest bid for water system in connection with this work was submitted by John J. Kenny Co. at $10,369.

Locks at Dams—Wheeling, W. Va.—Following are four lowest bids opened Feb. 9 by U. S. Engineer, Wheeling, for furnishing and erecting litering lock gates for Dams (a) 16 and (b) 17, Ohio River: Milwaukee Bridge Co., 1440 Thirty-fourth Street, Milwaukee, Wis., (a and b) $40,000 for each; Whitehead & Kaies Iron Works, Beecher Avenue and M. C. R.R., Detroit, Mich., (a) $40,558, (b) $40,552; Independent Bridge Co., Beaver Avenue, Pittsburgh, Pa., (a) $44,852; Walter S. Rae, 1624 Oliver Building, Pittsburgh, Pa., (a) $45,900, (b) $46,877; Penn Bridge Co., Beaver Falls, Pa., (b) $46,350.

★Drainage — Portland, Ind. — Contract awarded by W. J. Braughn, Superintendent of Construction of the John F. Warren Drain, to F. A. Irwin, Greenville, Ohio, at $22,348.

★Ditch—Washington, Ind.—Contract for constructing Prairie Creek Ditch, about 34 miles long, 60 to 6 ft. wide (bids opened Feb. 9), awarded R. A. Brown, Washington, at $63,700. William J. Shanks, County Surveyor.

★Ditch—Grand Rapids, Minn.—Contract for constructing county ditch No. 4 (bids opened Feb. 10) awarded by County Commissioners to Minnesota Drainage Co., Beaudette, Minn., at $29,707. Next three lowest bidders: W. J. Gleason & Co., Aitkin, $29,870; Frederick & Barnard, Minneapolis, $30,062, and Lawrence Construction Co. Grand Rapids, Minn., $30,225. Frank Sherman, County Auditor.

★Ditch—Grand Rapids, Minn.—Contract for constructing ditch No. 5, opened same time and place as above, awarded Minnesota Drainage Co., Beaudette, at $29,045. Next three bidders: W. J. Gleason & Co., Aitkin, $31,324; Lawrence Construction Co., Grand Rapids, Minn., $35,461 and D. A. Foley & Co., Aitkin, $42,086. Frank Sherman, County Auditor.

★Ditch — Wheaton, Minn. — Contract awarded C. T. Glasser, Minneapolis, Minn., for constructing county ditch No. 37 (bids opened Feb. 8) at $9,513. Next three lowest bidders: C. W. Rood Construction Co., $9,519; Earl B. Lockridge, Peru, $9,710; Morrison Construction Co., Des Moines, $10,836. J. T. Cricksen, County Auditor.

Irrigation—St. Ignatius, Mont.—Following are bids opened Feb. 8 by U. S. Reclamation Service, St. Ignatius, Mont. (E. F. Tabor, Project Manager), for constructing canals and structures on Flathead project: Long & Olson, Polson, Mont., $10,861, and Earl D. Covell, Ronan, Mont., $13,637.

★Levee Work — Wagoner, Okla.—Contract awarded Sprankle Co., Oklahoma, Okla., for 34,000 cu. yd. levee work (bids opened Feb. 7) at 20 and 25 cts. for dirt and $12 per cu. yd. for concrete. T. A. Parkinson, County Clerk.

Seawall—Seattle, Wash.—Following are four lowest bids opened Feb. 4 by Board of Public Works for constructing a concrete seawall along Railroad Avenue between Washington and Marion Streets, including paving of Railroad Avenue: Jahn Contracting Co., Pioneer Block, $79,888; Washington Paving Co., L. C. Smith Building, $80,181; M. P. Zindorf, Alaska Building, $85,348; Independent Asphalt Paving Co., Northern Bank Building, $37,838.

★Irrigation—Bend, Ore.—Contract for constructing the Suttled Lake Irrigation District awarded Feb. 5 to Henry J. Kieser Construction Co., Vancouver, B. C.; estimated cost $540,000. George S. Young, Engineer, First National Bank Building, Bend.

★Oak Harbor, Cal.—Contract for constructing dikes, etc., in Diking District No. 3, Island County, awarded H. Cotton Co. of Port Angeles, at $16,000.

★Irrigation—San Fernando, Cal.—Board of Supervisors awarded a contract to Baker Iron Works, Los Angeles, for 3000 ft. 54-in. pipe for the San Fernando Valley Irrigation District at $19,860.

ELECTRIC RAILWAYS

PROPOSED WORK.

Buffalo, N. Y.—Total cost of new double track line between Buffalo and Niagara Falls to be constructed by International Ry. Co. is $2,745,200. Nineteen bridges will be constructed in Tonawanda and North Tonawanda and power transformer station and four passenger terminals will be constructed in these two cities.

Pensacola, Fla.—The U. S. Senate passed a bill authorizing George H. Hervey to construct and operate electric railway on military reservation at Ft. Barrancas and Ft. McRae.

Morganfield, Ky.—Right-of-way granted to Uniontown Southern Electric Ry. Co. by Fiscal Court to build a line along public road from Morganfield to Uniontown, Ky., a distance of 5.2 miles. Norman R. Orcutt, Engineer, Morganfield.

Lowellville, Ohio.—Mahoning & Shenango Ry. & Light Co. of Youngstown will construct a high tension power line to connect its plant at Lowellville, Ohio, with plant at Ellwood City, Pa.

Indianapolis, Ind.—Indianapolis & Cincinnati Traction Co. will extend line from Rushville to Cincinnati, distance 62 miles. City of Cincinnati will vote in April on issue of $6,000,000 bonds for constructing 15-mile terminal loop.

Chenoa, Ill.—Public Utilities Commission of Illinois approved application of Bloomington & Normal Ry. & Light Co. at Bloomington to extend a transmission line from Chenoa to Lexington.

New York, N. Y.—Following are unit prices of four lowest bids opened Feb. 10 by Public Service Commission for First District for installation of tracks on White Plains Road line in borough of the Bronx: (a) Coast & Lake Contracting Corporation, 41 Broad Street, $94,280; (b) C. & C. Construction Co., 277 Broadway, $112,306; (c) The Empire Construction Co., 51 E. Forty-second Street, $115,013.

Note No.		(a)	(b)	(c)
1017	For furnishing and delivering to the works 4,850 9-in. structural channels, 13¼ lb. per ft., 3 in. long, punched.	$0.15	$0.16	$0.18
1025-A	For furnishing, delivering and installing 2 timber bumping posts	100.00	300.00	350.00
1026	For furnishing, delivering and installing 45,000 lin. ft. hand rail	0.52	0.58	0.64
1027	For installation of plank walks complete, 600 ft. plank walk	6.00	10.00	11.25
1028	For installation of 15,900 anti-creepers complete	0.04	0.05	0.09
1053	For installtion of Type III track complete, as follows:			
	(a) On tangents and curves (not superelevated) of more than 2,000 ft. radius, 56,000 lin. ft.	0.74	0.75	0.70
	(b) On curves of 2,060 ft. to 701 ft. radius, 1,750 lin. ft.	0.76	1.00	0.96
	(c) On curves of less than 701 ft. radius, 6,450 lin. ft.	0.76	1.50	1.25
	(d) At and adjoining stations, 14,300 lin. ft.	0.74	0.70	0.70
	(e) On superelevated tangents and curves of more than 2,000 ft. radius, 2,200 lin. ft.	0.74	1.00	0.88
1058	For installation of Type VI track complete, as follows:			
	(a) On tangents and curves of more than 2,000 ft. radius, 4,100 lin. ft.	0.48	1.00	0.85
	(b) On curves of 2,000 to 701 ft. radius, 2,550 lin. ft.	0.48	1.00	1.13
	(c) On curves of les sthan 701 ft. radius, 100 lin. ft.	0.48	1.00	1.49
2083-A	For installation of special work, Portion 83	250.00	500.00	790.00
2084-A	For installation of special work, Portion 84	150.00	450.00	660.00
2085-A	For installation of special work, Portion 85	400.00	750 00	700.00
2086-A	For installation of special work, Portion 86	100.00	300.00	500.00
2087-A	For installation of special work, Portion 87	60.00	150.00	360.00
2088-A	For installation of special work, Portion 88	60.00	150.00	340.00
2089-A	For installation of special work, Portion 89	250.00	500.00	800.00
2090-A	For installation of special work, Portion 90	250.00	500.00	800.00
2091-A	For installation of special work, Portion 91	325.00	750.00	1,370.00
2092-A	For installation of special work, Portion 92	250.00	600.00	625.00
2093-A	For installation of special work, Portion 93	250.00	500.00	1,060.00
2094-A	For installation of special work, Portion 94	250.00	500.00	1,050.00

New York, N. Y.—Following are unit prices of four lowest bids opened Feb. 10 by Public Service Commission for First District, for Route 12, Section 2A, a part of the Broadway-Fourth Avenue Rapid Transit R.R., known as Eastern Parkway, in Brooklyn: (a) Degnon Contracting Co., 30 E. Forty-second Street, $1,370,098; (b) Litchfield Construction Co., 875 Seventh Avenue, $1,468,476; (c) John C. Sullivan, 30 Church Street, $1,504,293; (d) Mason & Hanger Co., Inc., Van Cortland Park and 242d Street, $1,549,528.

Item		(a)	(b)	(c)	(d)
1	14,100 cu. yd. earth excav. above mean high water	$6.00	$9.00	$9.00	$7.20
2A	4,960 cu. yd. earth excav. above and below mean high water	2.50	1.00	1.25	2.00
5	133,700 cu. yd. tunnel excav., incl. timbering and disposal of material	4.50	5.25	4.75	5.25
6	68,100 cu. yd. concrete masonry in place	8.00	8.00	9.00	9.00
7	90 cu. yd. protective concrete masonry in place	8.00	8.00	8.00	9.00
8	10 cu. yd. rubble stone masonry in place	5.00	8.00	7.00	7.00
8A	10 cu. yd. dry rubble masonry in place	4.00	6.00	3.50	5.60
9	10 cu. yd. brick masonry in place	15.00	20.00	20.00	18.00
9A	10 cu. yd. vitrified brick masonry in place	16.00	25.00	22.00	22.00
10	10 cu. yd. hollow terra cotta brick or tile masonry	15.00	20.00	15.00	18.00
11	2,000 bbl. grout of Portland cement	4.00	2.15	4.30	2.80
12	1,000 lin. ft. timber piles, in place and prepared	0.30	0.40	0.50	0.70
13	2 M ft. timber foundations, placed and fastened.	40.00	50.00	65.00	65.00
14	10 cu. yd. broken stone or gravel in place	2.00	2.00	2.00	2.50
15	100 sq. yd. (a) waterproofing, one ply	0.45	0.30	0.50	0.55
15	100 sq. yd. (b) waterproofing, two ply	0.60	0.50	0.80	0.80
15	800 sq. yd. (c) waterproofing, three ply	0.90	0.70	1.10	1.00
15	100 sq. yd. (d) waterproofing, four ply	1.15	0.90	1.35	1.40
15	100 sq. yd. (e) waterproofing, five ply	1.50	1.10	1.60	1.70
15	100 sq. yd. (f) waterproofing, six ply	1.75	1.30	1.80	2.10
15	100 sq. yd. (i) waterproofing, dry ply	0 30	0.20	0.40	0.50
16	10 cu. yd. brick in asphalt mastic, in place	25.00	25.00	25.00	30.00
17	10 lin. ft. (a) drain pipe, 12-in., vitrified	1.50	0.60	1.00	1.40
17	50 lin. ft. (b) drain pipe, 10-in., vitrified	1.25	0.50	0.85	1.20
17	50 lin. ft. (c) drain pipe, 8-in., vitrified	1.00	0.40	0.70	0.85
17	50 lin. ft. (d) drain pipe, 6-in., vitrified	0.70	0.30	0.60	0.70
17	50 lin. ft. (e) drain pipe, 4-in., vitrified	0.50	0.20	0.55	0.50
17	50 lin. ft. (g) drain pipe, 6-in., cast iron	1.50	1.20	1.50	1.80
17	50 lin. ft. (h) drain pipe, 4-in., cast iron	1.00	0.75	1.00	1.30
17	50 lin. ft. (l) drain pipe, 10-in., cast iron	2.50	1.50	2.40	3.00
17	50 lin. ft. (m) drain pipe, 18-in., vitrified	2.00	1.70	1.75	2.20
17	50 lin. ft. (n) drain pipe, 24-in., vitrified	2.50	2.00	2.50	2.80
17A	50 lin. ft. (a) 3-in. extra heavy cast-iron pipe and fittings	1.00	0.50	0.50	1.40
17A	50 lin. ft. (b) 4-in. extra heavy cast-iron pipe and fittings	1.25	0.70	0.60	1.70
17A	350 lin. ft. (c) 6-in. extra heavy cast-iron pipe and fittings	1.50	1.25	1.00	2.00
17A	50 lin. ft. (d) 8-in. extra heavy cast-iron pipe and fittings	2.00	1.75	1.25	2.80
18	50,400 duct ft. tunnel ducts in place	0.12	0.10	0.15	0.11
18A	119,600 duct ft. railroad ducts in place	0.15	0.10	0.15	0.14
19	100 ton riveted steel, painted and erected	95.00	80.00	90.00	90.00
20	200 ton steel beams and shapes, painted and erect.	88.00	75.00	85.00	80.00
21	550 ton steel rods and bars built in concrete	70.00	50.00	75.00	70.00
25	3 ton miscellaneous iron castings	75.00	75.00	100.00	100.00
26	1,000 lb. special wire forms in place	0.15	0.04	0.10	0.10
27B	8,700 lin. ft. 1¾-in. seasoned oak hand rail	0.30	0.30	0.25	0.40
28	2,300 sq. ft. steel gratings for ventilation	1.80	1.00	1.00	1.75
29	50 sq. ft. vault lights in place	1.25	2 00	1.00	1.75
30	30 sq. yd. (a) sidewalks restored	2.00	2.00	0.25	2.50
30	50 sq. yd. (e) repavement of roadways, asphalt	2.50	3.00	1.50	3.00
30	2,400 sq. yd. (f) repavement of roadways, granite block	3.50	3.00	1.00	3.50
30	300 sq. yd. (ff) repavement of roadways, belgian block	3.00	1.00	2.25	3.00
30	10 sq. yd. (g) repavement of roadways, asphalt block	3.50	3.00	1.00	1.00
30	50 lin. ft. (i) new bluestone curb in place	1.25	1.00	1.00	1.00
30	50 lin. ft. (k) new 8-in. granite curb	2.00	1.00	2.00	1.50
75C	700 lin. ft. electric (overhead trolley) railroads, single-track	3.00	3.00	5.00	7.00
80	100 lin. ft. water pipe, 8-in	1.25	1.00	1.25	1.40
82	100 lin. ft. water pipe, 12-in	1.75	1.50	1.50	1.80
84	250 lin. ft. water pipe, 20-in	2.50	2.50	3.00	3.00
88A	3 service connections for water pipes (each)	25.00	10.00	10.00	20.00
89	50 lin. ft. gas pipe, 3-in	1.00	0.50	0.40	0.80
91	50 lin. ft. gas pipe, 6-in	1.25	0.75	0.90	1.40
94	100 lin. ft. gas pipe, 12-in	1.50	1.00	1.25	2.30
99D	2 service connections for gas pipe (each)	25.00	10.00	10 00	20.00
100	20 ton new cast-iron hub and spigot, straight pipe	40.00	35.00	75.00	40.00
101	10 ton new cast-iron hub and spigot, special pipe.	80.00	60.00	100.00	80.00
127	1,500 duct ft. electric ducts and conduits	1.00	0.35	0.12	0.50
127A	150 lin. ft. (a) 2½-in. wrought-iron elec. conduits.	1.00	0.40	0.12	0.50
127A	150 lin. ft. (b) 3-in. wrought-iron elec. conduits	1.25	0.50	0.12	0.60
127A	150 lin. ft. (c) 3½-in. wrought-iron elec. conduits.	1.50	0 60	0.12	0.70
127A	100 lin. ft. (h) 3-in. Edison conduit	1.00	0.60	0.12	1.10
127C	10 service connections for elec. conduits (each)	25.00	10.00	1.00	25.00
127D	150 duct ft. wooden electric ducts and conduits	1.00	0.60	0.10	0.70

Galesburg, Ill.—Galesburg Ry., Lighting & Power Co. contemplates constructing following improvements: Enlarging and re-equipping boiler plant, installing railway unit in electric dept., replacing gas pipe, new boilers at plant and sinking of deep well. Heating plant will also be enlarged and mains extended; estimated total cost about $225,000.

Columbus, Tex.—Texas Airline Interurban Co. to construct an interurban railway between Columbus and Gonzales and between Austin and Port Lavaca. Ben R. Hunt of Columbus said to be interested.

Tulsa, Okla.—The Sand Springs Ry. Co. will construct extensions and double track line between Sand Springs and Tulsa.

Los Angeles, Cal.—See "New Industrial Plants."

BIDS DESIRED.

Martinez, Cal.—Until March 6, by City Trustees, for electric railway franchise as applied for by Martinez & Concord Interurban Electric Line.

San Diego, Cal.—Until Mar. 6, by City Council, for constructing electric railway on University Avenue, from Fairmont to Euclid Avenue, for San Diego Electric Ry. Co. (Wm. Clayton, Gen. Mgr.)

PRICES AND LETTINGS.

★*Indicates award of contract.*

★Kansas City, Mo.—Contracts for grading Metropolitan St. Ry. extensions awarded by Board Public Works as follows: Troost Avenue line, from Forty-eighth Street to Seventy-third Street, to Edw. Meegan, and for grading Twenty-fifth Street, from Southwest Boulevard to Broadway.

RAILROADS

PROPOSED WORK.

Meriden, Conn.—New York, New Haven & Hartford R.R. (Edw. Gagel, Chief Engineer, New Haven), it is reported, will soon construct a freight yard at Meriden Junction.

Cheektowaga, N. Y.—The grade crossing elimination in this city is to begin this spring by the Delaware, Lackawanna & Western R.R. The cost will be about $400,000, and when completed the roadway will be carried on a 30-ft. wide viaduct, 3000 ft. long, over 57 tracks of the Delaware, Lackawanna & Western, three tracks of the Lehigh Valley and two of the Erie. Plans include a system of drainage, and of marginal streets and other adjacent improvements.

Newark, N. J.—Agreement has been reached between the city and the Pennsylvania R.R. and approved by Board of Public Works for the reopening of Mechanic Street through the wall and under the tracks of the Pennsylvania R.R.; cost to city $80,000. Work will be done by the railroad company.

Trenton, N. J.—A bill has passed the Senate compelling railroads to abolish grade crossings.

Philadelphia, Pa.—The eliminating of the grade crossings on the Chestnut Hill branch of the Pennsylvania R.R. (Alex. Shand, Ch. Engr., Philadelphia) at Chelten Avenue, Hortter Street and Highland Avenue is to be carried on by the city and the railroad company; cost for real estate damages and construction to be equally divided.

Chillicothe, Ohio.—Estimates submitted to Council as committee of the whole, in conjunction with committees from N. & W. Ry., B. & O. Ry. and Electric Street Ry., for constructing grade crossings and subway over railroad tracks on Main Street. Cost estimated: Grade crossings $300,000, subway $150,000. M. U. Shultt, City Engineer.

Toledo, Ohio. — Council has approved plans of City Engineer for East Broadway grade elimination. New York Central R.R. is interested.

Sioux City, Iowa.—Chicago & Northwestern R.R. (W. H. Finley, Chief Engineer, Chicago, Ill.) intends laying 80-lb. rails between Salix and Onawa, between Mapleton and Onawa and between Moville and Holstein, at a cost of about $100,000. A number of new stations also are planned; also an electric traveling crane to be installed in the Nebraska Street yards this spring.

Garden City, Kan.—Garden City, Hastings & Omaha R. R. Co. of Garden City, incorporated by George W. Finnup of Garden City, Frank T. Buros of Kansas City, Mo., and others for the purpose of constructing a railroad across western end of Kansas and through Nebraska to Omaha. A main line, 163 miles long, from Garden City to Stockton, with three branches, one from Ogallah to Hays, one northwest from Stockton to the north line of the state, and the third southeast from Garden City to the south line of the state, in Morton County.

Dallas, Tex.—Railroads entering the city have submitted plans for eliminating grade crossings.

El Paso, Tex.—Santa Fe R.R. Co. (G. W. Harris, Ch. Engr., Los Angeles, Cal.) intends constructing five miles additional trackage along Rio Grande border in near future.

Houston, Tex.—City Council has ordered San Antonio & Aransas Pass R.R. Co. (G. Oliver, Asst. Engr., Yoekum, Tex.) to elevate tracks over eight or ten crossings at a cost of $1,000,000. Steel or masonry structures to be built with 60-ft. openings for street and 8 ft. for each side for sidewalks. Main Street crossing plans to be filed by March 1.

Eugene, Ore.—Reported Southern Pacific R.R. (W. Hood, Ch. Engr., San Francisco, Cal.) intends making improvements in the railroad yards here, costing $50,000.

San Diego, Cal.—See "Bridges."

Tucson, Ariz .—Reported Arizona Eastern Ry. (William Hood, Ch. Engr., San Francisco, Cal.) considering building new cut-off to connect Phoenix and Salt Lake Valley points with main line.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Pemberton, W. Va.**—Contract awarded Walton Construction Co., Falls Mills, Va., for constructing the Piney Creek branch of the Virginia Ry. from Pemberton along Piney Creek to Leckie, 7.5 miles. There is included in contract five steel bridges, from 35 to 100 ft. long, and a tunnel 350 ft. long, near Pemberton.

★**Coos Bay, Ore.** — Reported contract awarded Twohy Bros., Wells Fargo Building, for constructing 260 miles of the extension of the Southern Pacific R.R. between Coos Bay, Ore., and Eureka, Cal.

PUBLIC BUILDINGS AND SCHOOLS

PROPOSED WORK.

Lynn, Mass.—Municipal Council authorized securing $75,000 bonds for erecting and furnishing proposed school on Conomo Avenue, Wyoma.

Peabody, Mass.—Election to be held to vote $25,000 bonds to remodel Wallis School.

Providence, R. I.—Contract soon to be let by Board of Contract and Supply for erecting the grammar school on Charles Street, to contain 17 rooms, and an assembly hall. William R. Walker & Sons, Archts.

Warren, R. I.—School bonds amounting to $50,000 reported sold. Address Board of Education.

Waterbury, Conn.—Board of Education is considering erecting three new high schools.

Allegany, N. Y.—Plans being prepared by Mowbray & Uffinger, 56 Liberty Street, New York, for college building to be erected at St. Bonaventure's College; cost about $100,000. Rev. Father Fidelis, in charge.

Binghamton, N. Y.—Board of Education contemplating erecting school on Oak Street to cost about $200,000.

East Aurora, N. Y.—The school for which plans are being prepared by Harris & Merritt, Erie County Bank Building, Buffalo, is to be three story, brick, terra cotta and steel, 100 x 140 ft., and estimated to cost $125,000. Contract for construction will be let in March. F. H. Fuller, president School Board.

Gowanda, N. Y.—School Board selected Harris & Merritt, Erie County Bank Building, Buffalo, to prepare plans for proposed high school to cost approximately $60,000.

Mechanicsville, N. Y.—Election to be held March 10 to vote $75,000 bonds to erect school on Main Street, from plans prepared by John T. Simpson, Essex Building, Newark, N. J.

New York, N. Y.—Henry Fairfield Osborn, President, American Museum of Natural History recommends erection of southeast wing and a plaza linking the American Museum in West Seventy-seventh Street with the Metropolitan Museum of Art on the east side of Central Park, plans for which have been prepared by Trowbridge & Livingston, 527 Fifth Avenue; estimated cost $750,000.

Utica, N. Y.—Council considering erection of new city hall. Harry R. Hayes, Commissioner Public Works, may be able to give further information.

Atlantic City, N. J.—Reported State Armory Commissioners, Harrisburg, intend erecting an armory here.

Camden, N. J.—Contract will soon be let for erecting two-story brick, stone, terra cotta and steel 250 x 178 ft. high school. Paul A. Davis, 3d, Archt., 1713 Sansome Street, Philadelphia, Pa. Address Board of Education.

Dover, N. J.—Board of Education authorized to purchase site and erect high school; cost not to exceed $112,000.

Garfield (P. O. Passaic), N. J.—Board of education engaged John F. Kelly, of Passaic, to prepare plans for two additional schools.

Lyndhurst, N. J.—Board of Education considering erecting one school of 16 rooms, costing $50,000, or two small buildings.

Lodi (P. O. Hackensack), N. J.—A. L. Vegliante, of Garfield, engaged to prepare plans for proposed school. Address Board of Education.

Morris Plains, N. J.—State Senate has passed a bill appropriating $150,000 for extensions to the State Hospital for Insane at Morris Plains.

Beaver, Pa.—Citizens voted $65,000 school bonds, of which $55,000 is to be used for erecting 12-room school at Second and Commerce Streets. Address Board of Education.

Carbondale, Pa.—School Board approved plans prepared by Owen McGlynn of Wilkes-Barre, for proposed high school; probable cost $150,000.

Chester, Pa.—Election to be held in November to vote $500,000 school bonds.

Connellsville, Pa.—Board of Education considering calling an election to vote $250,000 bonds for rebuilding and improving school properties.

Greenville, Pa.—Thiel College has been bequeathed $50,000 for erecting a recreation building or dormitory. Address Board of Trustees.

Letitz, Pa.—E. Z. Scholl, Sixth and Court Streets, Reading, is architect for the 2-story brick and stone school for which the citizens voted recently.

Millersburg, Pa.—Reported plans prepared for proposed library and gymnasium to be erected on North and Walnut Streets as a memorial to Henry J. Johnson; cost about $35,000.

Nesquehoning, Pa.—School Board will issue $80,000 bonds for new high school.

Norristown, Pa.—George S. Idell, 34 South Sixteenth Street, Philadelphia, engaged to prepare plans for $42,000 tuberculosis cottage to be erected at State Hospital for Insane.

Philadelphia, Pa.—Preliminary plans being prepared by D. K. Boyd, 139 South Fifteenth Street, for brick, stone and steel building to be erected at Nineteenth and Spring Garden Streets for Philadelphia College of Osteopathy.

Finance Committee of Councils approved ordinance providing for erection of Public Library at Nineteenth and Vine Streets on the Parkway; $825,000 available.

Finance Committee of Board of Education Feb. 7 adopted resolutions providing for a loan of $2,500,000 to be used for erecting elementary and high schools and an administration building on the Parkway.

Councils' Finance Committee approved ordinance authorizing erection of a convention hall on the Parkway at Twenty-first Street; $1,418,000 available.

Mayor Smith reported in favor of rebuilding the Philadelphia General Hospital at a cost of $4,000,000.

Uniontown, Pa.—Plans being prepared by John H. Harmon, First National Bank Building, for a grade school 80 x 124 ft., brick and stone.

Citizens voted $225,000 bonds for replacing Central and Park Schools, recently condemned. Address School Board.

Vandergrift, Pa.—Election to be held Feb. 26 to vote $170,000 bonds for purchasing site and erecting fireproof high school. Address Board of Education.

Yardley, Pa.—Election to be held March 15 to vote $30,000 bonds to erect new school. Address Board of Education.

Cambridge, Md.—School Board considering issuing $75,000 school bonds.

Ronceverte, W. Va.—Election to vote $30.000 bonds to erect district high school for Greenbrier County, at Ronceverte contemplated. Address County Board of Education, Lewisburg

Eatonton, Ga.—Election to be held Feb. 29 to vote $30,000 school bonds. Roy D. Subbs, Mayor.

St. Augustine, Fla.—County Commissioners have secured a site and will soon consider preliminary plans for a court house.

Mobile, Ala.—Board of Revenue & Road Commissioners of the County considering the $150,000 school bond issue recently authorized by citizens.

Laurel, Miss.—School bonds for $25,000 will be sold March 13 by Mayor and Board City Commissioners. D. F. Gardinier, City Clk.

Knoxville, Tenn.—R. F. Graf & Sons of Knoxville, engaged to prepare plans for fifteen-room addition to Moses School to cost approximately $40,000.

Akron, O.—The $50,000 appropriated by the city for purpose of acting in conjunction with the State Armory Board in the erection of an armory building has been declared legal. State has appropriated $75,000 additional.

Cleveland, O.—See "Bridges."

Dayton, Ohio.—School bonds for $330,000 sold by Board of Education.

East Youngstown, Ohio.—School bonds amounting to $60,000 sold. Adress Board of Education.

Findlay, O.—Citizens of Allen Township have petitioned Election Board to vote March 7 for $45,000 bonds to erect centralized school.

Girard, Ohio.—Election to be held March 14 to vote $70,000 bonds for erecting two 8-room schools. Address Clerk Board of Education.

Lebanon, O.—Weber, Werner & Adkins, 1206 Mercantile Library Building, Cincinnati, engaged to prepare plans for proposed County Infirmary.

McCutchenville, Ohio.—Board of Education sold $40,000 school bonds.

New Philadelphia, Ohio. — Reported Board of Education of Dover Township appropriated $30,000 to erect a consolidated school between Parral and Loudon.

New Straightsville, O.—School bonds amounting to $50,000 will be sold April 1 by E. A. Davidson, Clerk School Board. A school, two story brick and concrete, is to be erected. Date for receiving bids on construction not yet set. E. S. Matheny, Harrison Building, Columbus, Archt.

Oxford, Ohio.—Louis Dittoe, Provident Bank Building, Cincinnati, is architect for the dormitory to be erected at Oxford University. Nothing further will probably be done before the end of the year. R. M. Hughes, Secy. Board Trustees.

Salem, O.—School bonds for $65,000 will be sold March 6 by Albert Hayes, Clk. Board Education.

Tippecanoe City, Ohio.—Plans being prepared by F. L. Packard, Hayden Building, Columbus, for a fireproof school to cost $65,000 with equipment. F. M. Grant, Clk. Board of Education.

Markle, Ind.—Neubaumer & Brown, Bluffton, are architects for the proposed high school to be two stories, fireproof brick, and cost $28,000. George W. Brickley, Trus. Rock Creek Township.

Flint, Mich.—Common Council has authorized purchase of site on Union and Harrison Streets for a municipal market; probable cost $40,000. City Engineer is on the Committee.

Chicago, Ill.—Board of Education will spend approximately $4,000,000 in 1916 on new buildings and additions to buildings and about $1,000,000 additional for permanent improvements, renovations, etc.

Urbana, Ill.—Wesley Foundation, recently organized by Urbana citizens, reported to be planning erecting welfare group of buildings near the University of Illinois campus, first unit to be a social center building, costing about $100,000. Address Wesley Foundation, care University Illinois.

Milwaukee, Wis.—Light Horse Squadron Association (C. R. Hoffman, Secretary), has appropriated $30,000 to erect a new riding hall and stables.

Alta, Ia.—Citizens of Consolidated High School District voted $90,000 school bonds.

Lewis, Iowa.—The Consolidated Independent School District (G. E. Weaver, Superintendent) intends erecting a two-story fireproof school costing about $50,000. Architect not selected yet.

Holstein, Iowa.—T. M. Watts, Secretary School Board will sell Feb. 18 $50,000 school improvement bonds recently voted.

Ottawa, Ia.—Election to be held March 13 to vote $125,000 bonds for erecting additional building and equipment for the high school.

West Liberty, Ia.—Election to vote $60,000 bonds to rebuild high school destroyed by fire contemplated. Address School Board.

Brainerd, Minn.—Alden & Harris, Commerce Building, St. Paul, are architects for county jail and sheriff's residence to be erected by County Commissioners at cost of $28,000.

Luverne, Minn.—Board of Education reported considering erecting new school to replace Central School; cost, $50,000.

Minneapolis, Minn.—Board of Education has approved plans for proposed Hiawatha School.

Moorhead, Minn.—Citizens in favor of erecting a high school. Address School Board.

Perham, Minn.—Contract will be let about March for erecting the brick fireproof high school to cost $45,000. T. B. Miller, Clerk Board of Education.

Tower, Minn.—Erection of $80,000 school reported under consideration. Address Board of Education.

Wabasha, Minn.—Citizens voted $40,000 bonds to erect addition to high school. Address Board of Education.

Omaha, Neb.—Architect to be selected about Mar. 1 by Board of Education for two buildings, each 16-grade rooms, auditorium, kindergarten and manual training room; three buildings, each 12 rooms, plus auditorium, kindergarten and manual training room; one 8-room building and two 4-room additions; remodeling 12-room school and erecting addition to make it 20 to 22 rooms, plus auditorium.

Dickinson, N. D.—City Council considering erecting a city hall.

Mellette, S. D.—George F. Fossum, Aberdeen, is architect for the 2-story brick school to cost $25,000. Don Cheatham, Clerk Board of Education.

Butte, Mont.—Reported contract about to be let by C. Lewis Wilson, Montana Power Building, for erecting a five-story, 94 x 183 ft., reinforced concrete and hollow tile hospital building for Dr. T. J. Murray; cost $250,000.

Bowling Green, Mo.—Citizens of Pike Count voted bonds for erecting two courthouses, one at Bowling Green, costing $75,000, and one at Louisiana, costing $25,000. Address County Clerk.

Corsicana, Tex. — See "Paving and Roads."

Denton, Tex.—Street and school bonds amounting to $85,000 have been sold.

Georgetown, Tex.—Walker & Co., Fort Worth, are architects for Williamson County science building.

Houston, Tex.—See "Paving and Roads."

Roscoe, Tex.—County Commissioners petitioned to call an election to vote $100,000 bonds for erecting a court house.

Clayton, N. M.—Citizens voted $35,000 bonds to erect new school. Address Board of Education.

Portland, Ore.—See "Prices and Lettings."

Fresno, Cal.—A. E. Sunderland, Pres. Board of Education, recommends $400,000 bond issue for erecting high school and additional buildings at two elementary schools.

San Francisco, Cal.—Competitive plans to be received for the State office building to be erected in San Francisco. Address George B. McDougall, State Archt., Sacramento.

San Luis Obispo, Cal.—Bond issue for $100,000 for school buildings is contemplated. Address Board of Education.

Woodland, Cal.—W. H. Weeks, 75 Post Street, San Francisco, is architect for proposed three-story, fireproof, reinforced-concrete, stone or terra cotta courthouse to be erected for Yolo County. Address County Clerk.

Kingman, Ariz.—Trustees of Mohave County Union High School (Thomas Devine, Clerk) have sold $60,000 bonds for erecting union high school.

Tucson, Ariz.—Contract soon to be let for erecting city hall. Sidney Masbir, Architect, Tucson.

Ottawa, Ont.—School Board intends submitting to voters at the April election the erecting of a modern high school costing $115,000.

Dominion Government reported to be taking steps to rebuild Parliament buildings, recently destroyed.

Windsor, Ont.—Dominion Parliament appropriated $25,000 for an extension to the Windsor Armory. Lieut. Col. S. C. Robinson may be able to give further information.

St. Boniface, Man.—Election to be held Feb. 28 to vote $85,000 bonds to erect addition to Provencher School. J. S. Marion, Chairman School Board.

BIDS DESIRED.

Brookline, Mass.—Until Feb. 24, by Board School Committee (Geo. I. Aldrich, Secy.), for erecting addition to and alterations in high school. Probable cost, $100,000. Andrews Jaques & Rantoul, Archts., 50 Congress Street, Boston.

Amsterdam, N. Y.—Reported desired until March 1, by Board Education (William McCleary, Pres.), for erecting 2-story, 135 x 50-ft. school, on Vrooman Avenue, near Edson Street. Probable cost, $40,000. Leland Niles, 81 Ninaville Street, Architect.

Fort Terry, N. Y.—Until March 18, by Constructing Quarter Master, Fort H. G. Wright, N. Y., for erecting double set of officers' quarters at Fort Terry, advertised in Engineering Record.

Hazleton, Pa.—Reported desired until March 13, by Board of Education for erecting a school costing $140,000.

Monongahela, Pa.—Until Feb. 28, by Carl E. Gibson, Pres. School Board, or Charles J. Rieger & Co., Archts., 807 Germania Bank Building, 421 Wood Street, Pittsburgh, for erecting school at Jackson and Pleasant Streets.

Wilmington, N. C.—Until Feb. 23, by James A. Wetmore, Acting Supervising Architect, Treasury Department, Washington, D. C., for erecting U. S. custom house, appraisers' stores and courthouse at Wilmington.

Lafayette, Ga.—Until March 13, by County Commissioners (John C. Young, Chmn.), for erecting court house. Chas. E. Bearden, Archt., Chattanooga, Tenn.

De Funiak Springs, Fla.—Until Feb. 24, for erecting a high school. N. D. Trotman, Secy. School Board.

New Smyrna, Fla.—Until March 16, by C. R. M. Sheppard, Secy. Board Pub. Instruction, De Land, for erecting reinforced concrete school at New Smyrna. A. E. Lewis, Archt., Miami.

West Richfield, O.—Until March 7 (readvertisement), by R. E. Parker, Clk. Board Education, for furnishing material and erecting high school. See "Prices and Lettings." Harpster & Bliss, Archts., 21 S. Main St., Akron.

Vincennes, Ind.—Reported desired until March 2, by Dr. J. N. McCoy, Secy. Board Education, for erecting the junior high school and graded building.

Lakeview, Mich.—Until March 1 by School Board (Scott Swarthout, Secy.) for erecting a 3-story high school in District No. 3, brick and tile, costing $25,000.

Lincoln, Ill.—Until March 7, by Board of Administration, Capitol, Springfield, for erecting a school at Lincoln State School and Colony. James B. Dibelka, State Archt., 130 North Fifth Avenue, Chicago.

Taylorville, Ill.—Until March 24, by James A. Wetmore, Acting Supervising Architect, Treasury Department, Washington, D. C., for erecting U. S. postoffice at Taylorville.

Dollivar, Iowa.—Until March 10, for erecting school in Consolidated Independent School Dist. Jas. S. Cox and H. C. Hardy, Archts., Estherville.

Ashby, Minn.—Until Feb. 29, by Board Education (L. J. Hague, Secy.), for erecting high school. A. H. Foss, Archt., Elbow Lake.

Winfield, Kan.—Until Feb. 24 for erecting school for which citizens recently voted $77,000 bond issue. J. M. Fuller, Architect, Winfield. E. M. Hartley, Clerk Board of Education.

Fort Bliss, Tex.—Until March 15, by Department of Quarter Master, El Paso, for erecting a second story addition to hospital at Fort Bliss, advertised in Engineering Record.

Houston, Tex.—Reported desired until Feb. 28, by City Secretary for erecting the Eastwood administration building. Maurice J. Sullivan, City Archt.

Miami, Okla.—Until Feb. 28, by W. P. McCullough, County Clk., for erecting court house and jail.

Aberdeen, Wash.—Until March 22, by James A. Wetmore, Acting Supervising Architect, Treasury Department, Washington, D. C., for constructing complete (including mechanical equipment and approaches) a U. S. post office at Aberdeen.

Seattle, Wash.—Until March 1, by Port Seattle Commission (C. E. Remsberg, Secy.) for erecting one story reinforced concrete compressor building at foot of Spokane St.; probable cost, $30,000.

Until March 25, by Board Regents, Univ. of Washington, for erecting a 50 x 200 ft. three-story university building on the campus, to be a duplicate of Home Economics Building; probable cost, $170,000. Bebb & Gould, Archts., Seattle.

Alameda, Cal.—Reported desired until March 7 by School Board for erecting unit of Lincoln School in square bounded by Central Avenue and Van Buren Street. Also a 2-story and basement addition to Washington School.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Westfield, Mass.**—Contracts for erecting grade school on White Street and White Avenue (bids opened Feb. 12), awarded as follows: General contract to P. J. Mahoney, Westfield, $36,714; heating, J. J. Cotter Co., Springfield, $4,996; plumbing, W. M. & W. E. Ahern, Westfield, $2,964. Malcolm B. Harding, Archt., Westfield.

★**Hornell, N. Y.**—Contract for erecting U. S. Post Office awarded Sidney K. Eastwood, Owego, at $61,863.

★**Little Falls, N. Y.**—Contract awarded George B. Wills, Inc., 101 Park Avenue, New York, for erecting the municipal building here, and not the high school as previously stated.

★**Caldwell, N. J.**—Contract awarded by Board of Freeholders, Newark, to Essex Construction Co., 85 Academy Street, Newark, for erecting new wing for women at Caldwell Penitentiary, at $120,990. Two lowest bids on plumbing and gasfitting in this building submitted by James F. Kelly, at $20,358, and Salmon Heater & Construction Co., at $29,899.

★**Hackensack, N. J.**—Contract for constructing complete U. S. Post Office awarded Frymler & Hanna Co., 25 West Forty-fifth Street, New York, N. Y., at $72,761.

★**Newark, N. J.**—Contract awarded by Essex County Park Commission for erecting pavilion, children's shelter and comfort station at Weequahic Park to William E. Sharwell, 377 North Fifth Street, at $29,270, and plumbing to Jacob Rau, Jr., 43 West Kinney Street, at $1,592.

★**Leighton, Pa.**—Contracts awarded by Board of Education for erecting Central High School as follows: General construction, Beard Construction Company, Reading, $81,896; plumbing and drainage, E. P. Saeger, Allentown, $6,245; electric wiring, Reading Electric Company, Reading, $1,794.

★**Jennings, La.**—Contract awarded by Police Jury for erecting Jefferson Davis Parish Court house to Caldwell Brothers of Abbeville, at $85,000.

★**Cincinnati, Ohio.**—Contracts in connection with erecting $30,000 Nurses' Home for German Deaconess Hospital awarded as follows: Carpentry, M. Marcus Building Co., 2023 Reading Road; cut stone, David Hummel Building Co., 2629 Spring Grove Avenue, Camp Washington; roofing and metal work, Fahnle & Dietrich, 537 Oliver Street; plumbing, H. Niemes, 6102 Main Avenue, Pleasant Ridge; electric work, A. Becker & Son, 8 West Sixth Street; marble, Standard Marble Works, 706 West Front Street; heating, Peck, Anderson & Peck, Court and Sycamore Streets.

West Richfield, Ohio.—Following are bids opened Feb. 10, by School Board (R. E. Parker, Clk.), for erecting school: Pardee & Reid, Akron, $37,000; Rowe & Giles Lumber Company, Chagrin Falls, $39,556; Foraker Bros., Barberton, $39,905; James H. Wells, Cleveland, $42,694. Separate bids were submitted on heating and ventilating and plumbing. All bids rejected, as they exceeded the amount available. Harpster & Bliss, Archts., 21 S. Main St., Akron.

★**Armstrong, Ill.**—Contract for erecting high school (bids opened Feb. 1) awarded Freeman & Moore, Champaign. A. G. Maury, Secy. Board of Education.

★**De Pere, Wis.**—Contract for erecting four-story, 180 x 66-ft. fireproof dormitory at St. Norbert's College awarded Peter Francken of De Pere; cost about $100,000. W. E. Reynolds, Archt., Green Bay.

★**Anoka, Minn.**—Contract for erecting U. S. Post Office awarded W. D. Lovell, Minneapolis, Minn., at $41,250.

★**Galveston, Tex.**—Contract for remodeling U. S. Court House awarded O. E. Fischer Building Co., 2331 Mechanic Street, Galveston, at $38,490.

Portland, Ore.—Following are four lowest bids opened Jan. 31 by School Board Benson Polytechnic School for erecting administration building and three units of the boys' shop: Parker & Banfield, Portland, $189,410; Dinwiddie Construction Company, Portland, $199,500; Sound Construction Company, Seattle, Wash. $207,546; Brayton Engineering Company, Portland, $210,500. All bids rejected.

PRIVATE BUILDINGS

PROPOSED WORK.

Boston, Mass.—Various labor unions said to be contemplating erecting Temple of Labor to cost about $300,000. William C. Ewing, Supt., Wells Memorial Bldg., 985 Washington Street, may be able to give further information.

Pittsfield, Mass.—Frank Howard, 59 North Street, it is reported, has secured a site on Fenn, First and Federal Streets on which he intends erecting a three-story store and business building costing, including site, $90,000.

Providence, R. I.—St. Ann's Roman Catholic Church is having plans prepared by J. F. O'Malley, 75 Westminster Street, for a two-story and basement brick school, 80 x 133 ft.

New Haven, Conn.—R. W. Foote, 185 Church Street, has prepared plans for alterations to Hotel Duncan to cost $30,000. Contract to be awarded at once.

Albany, N. Y.—Contract to be let in March for erecting 16-story and basement addition to Ten Eyck Hotel, steel frame, brick and terra cotta; estimated cost $600,000. Contract for structural steel, 1400 tons, awarded Ferguson Steel & Iron Co., Buffalo. Eisenwein & Johnson, Archts., 775 Ellicott Square, Buffalo.

Bay Shore, L. I., N. Y.—Gustave Steinback, 15 East Fortieth Street, New York, reported architect for $75,000 edifice to be erected on Main Street and Clinton Avenue for St. Patrick's Roman Catholic Church. Rev. Henry C. Jordan, Pastor.

Binghamton, N. Y.—Plans being prepared by T. I. Lacey & Son, 1110 Kilmer Building, for Masonic Temple, to cost about $75,000. B. Newell, Broome County Trust Company, Court and Collier Streets, Chairman Building Committee.

Buffalo, N. Y.—Plans being prepared by Robert North, Prudential Building, for structural steel and brick edifice to be erected for Grace Episcopal Church, Niagara and Penfield Streets; estimated cost $80,000. Rev. John C. Ward, Pastor, 1141 West Avenue.

Plans being prepared by Lansing, Bley & Lyman, Prudential Building, for a brick and terra cotta, 384 x 80 ft. store and office building which Robert W. L. Pomeroy, Fidelity Building, will erect on Delaware Avenue and Chippewa Streets; estimated cost $100,000.

Fredonia, N. Y.—Chautauqua Lodge of Odd Fellows has purchased site on West Main Street and intends erecting three-story brick business and lodge building.

New York, N. Y.—McKim, Mead & White, 101 Park Avenue, engaged to prepare plans for five-story, 38 x 100-ft. residence, to be erected at 13 East Seventy-ninth Street, for Mrs. Thomas Newbold, 289 Madison Avenue; cost about $100,000.

Plans being prepared by Henry C. Pelton, 8 West Thirty-eighth Street, for five-story fireproof brick dwelling with a facade of limestone and granite to be erected at 50 East Sixty-ninth Street for Logan O. Timberlake, of Brooklyn; estimated cost, $75,000.

Scarsdale, N. Y.—Plans being prepared by Charles A. Platt, 101 Park Avenue, New York, for a two-and-one-half-story residence to be erected for Alonzo Cottler; cost about $60,000.

Schenectady, N. Y.—Sol Levi, 322 State Street, interested in forming company for purpose of erecting theater and store building at 206 State Street, to cost about $125,000.

Schenectady, N. Y.—Demers, Mosley & Campaigne, Illuminating Building, 410 Fulton Street, Troy, are architects for five-story Masonic Temple to be erected here.

Camden, N. J.—Philadelphia & Reading R. R. (S. T. Wagner, Ch. Engr., Philadelphia, Pa.) is reported considering erecting a terminal station in Camden for Atlantic City division.

Bala, Pa.—Plans being prepared by George L. Lovatt, 416 Walnut Street, Philadelphia, for three-story, 60 x 150 ft. stone parochial school for St. Matthias' Roman Catholic Church.

Glenside, Pa.—Contract about to be let for erecting three-story, brick, 80 x 74 ft. apartment house on Mt. Carmel and Roberts Avenues for William T. B. Roberts & Son; cost $25,000. E. Allen Wilson, Archt., 1208 Chestnut Street, Philadelphia.

Monongahela, Pa.—The Methodist Episcopal Church has appointed a committee to have plans prepared for erecting a wing to cost $25,000.

Mount Union, Pa.—Julian Millard, Altoona, is architect for the building which the Central National Bank will erect this spring.

Nanticoke, Pa.—Plans prepared by Austin L. Reilly, Bennett Building, Wilkes-Barre, for $55,000 edifice to be erected for St. Joseph's Roman Catholic Church.

New Castle, Pa.—Plans prepared by Frank H. Foulke of New Castle, for four-story lodge building to be erected on North Mill Street for Moose Club; cost about $50,000.

Philadelphia, Pa.—Colonial Trust Company, Thirteenth and Market Streets, contemplates erecting 12-story, stone, brick and concrete bank building.

Henry E. DeHoff, 48 South Sixty-first Street, is architect for three-story, brick and concrete building which the Jones Dairy Company intends erecting at 1211 North Fourth Street.

Pittsburgh, Pa.—Plans prepared by Harry S. Bair, Vandergrift Building, for a $25,000 stone residence to be erected on Fairfield Lane, Schenley Farms, for Arthur K. Rabe.

C. E. Roth, President of the German Savings & Deposit Bank, 1401 Carson Street, contemplates erecting $40,000 residence on Beacon Street and Shady Avenue, Squirrel Hill.

Schenley Farms Company intends erecting an eight-story warehouse to cost $250,000. Councilmanic Committe on Public Service and Surveys has affirmed an ordinance providing for the constructing of a bridge across Duquesne way from elevated tracks of Pennsylvania R. R. Company to the warehouse of this company.

Wilkinsburg, Pa.—Contract soon to be let by Alden & Harlow, Archts., 305 Fifth Avenue, Pittsburgh, for a five-story Masonic Temple, to be erected at an approximate cost of $90,000.

Wheeling, W. Va.—Plans being prepared by E. N. Alger, Huntington, for a one and two-story brick and stone or terra cotta edifice and parish house to be erected on Fifth Avenue and Eleventh Street for Trinity Episcopal Church; cost $50,000.

Plans being prepared by F. F. Faris, 419 Schmulbach Building, for a two or three-story fireproof bakery contemplated by General Baking Company; probable cost $50,000.

Spartanburg, S. C.—Erection of $45,000 Masonic Temple contemplated here.

Atlanta, Ga.—F. E. Mackle Construction Co., of Atlanta, reported engaged on a three-story brick apartment building to be erected on Ponce de Leon Avenue and Durant Place, for C. W. Lane; cost approximately $60,000.

Plans prepared by Morgan & Dillon, Grant Building, for three-story brick building to be erected on Luckie Street for W. S. Elkin; cost, $75,000.

Tampa, Fla.—Plans prepared for three-story and basement, reinforced concrete, brick, stone and terra cotta college building to be erected on Florida Avenue and Madison Street, in connection with Sacred Heart Roman Catholic Church; cost about $60,000. Rev. Michael McNally, Pastor.

Meridian, Miss.—Fifteenth Avenue Baptist Church taking steps to erect three-story edifice on Sixth Street and Sixteenth Avenue, cost about $30,000.

Alliance, Ohio.—Plans completed for $50,000 brick building to be erected for Eagles Lodge.

Cincinnati, O.—Rapid Electrotype Company, Canal and Race Streets, plans erecting on McMicken Avenue and Elm Street a building costing about $50,000.

Columbus, O.—Sketches prepared for six-story bank building to be erected on Gay and High Streets for Citizens' Trust and Savings Bank.

Youngstown, Ohio.—Henry W. Davis, 601 Mahoning Building, reported one of the promoters for a three-story brick and steel apartment building contemplated at Elm Street and Rayen Avenue; probable cost $50,000.

Richmond, Ind.—See "New Industrial Plants."

Highland Park (P. O. Detroit), Mich.—Methodist Episcopal Church intends erecting $90,000 edifice on present site.

Hamline, Minn.—Trustees of Hamline University and Hamline Methodist Church propose uniting and erecting a $100,000 church on the university campus.

Rochester, Minn.—M. C. Lawler, Rochester, reported interested in $40,000 theater, three-story fireproof brick and terra cotta, to be erected on Main Street.

St. Paul, Minn.—Alexander Ramsey estate will erect on Robert and Fourth Streets a business building costing $50,000. W. H. Yardley, of Yardley & Tiffany, 685 Endicott Building, may be able to give further information.

Reported Van Paper Supply Company, East Third and Minnesota Streets, intends erecting warehouse to cost about $50,000.

H. H. Freng, 1153 Portland Avenue, will erect a $75,000 apartment house at Linwood Avenue and Victoria Street; estimated cost, $75,000.

Winona, Minn.—The Wisconsin Ry., Light & Power Company (R. M. Howard, manager, Winona), will erect a steam reserve station in Winona, to cost, with machinery, $200,000.

Salina, Kan.—H. D. Lee, of Salina, will erect $150,000 building here, to be used by Lee Mercantile Company and Lee Hardware Company.

Omaha, Neb.—Plans being prepared by J. J. Nachyigall, 333 Paxton Street, for the lodge building for the Knights of Columbus.

Mandan, N. D.—Various lodges in this city, including Elks, Knights of Pythias, and others, propose erecting a joint club house costing $100,000.

Glendive, Mont.—Reported plans prepared for a depot which the Northern Pacific Ry. Company (W. L. Darling, Ch. Engr., St. Paul, Minn.) intends erecting here.

Carthage, Mo. — Plans being prepared by John Gaisford, Goodwyn Institute Building, Memphis, Tenn., for $25,000 edifice to be erected for First Presbyterian Church.

St. Louis, Mo.—Erection of additional story to Metropole Hotel, Twelfth and Morgan Streets, contemplated; cost about $40,000.

Austin, Tex.—C. H. Page, Austin National Bank Building, is architect for three-story, 90 x 109 ft., fireproof, brick and reinforced-concrete warehouse to be erected for Voss & Koock; cost about $25,000.

Paris, Tex.—First Christian Church (Scientist) will erect new edifice to cost about $40,000.

Seattle, Wash.—Hillman Interests will erect six-story, 60 x 120-ft. reinforced concrete apartment house at Bellevue Avenue and Roy Street, costing $100,000, and a three-story brick store and office building at Hillman City; cost about $60,000. E. S. Bateman, Central Building, Agent.

Fresno, Cal.—Southern Pacific Railroad Company (W. Hood, Ch. Engr., San Francisco) will spend $60,000 in rebuilding present passenger station and erecting Pullman sheds.

Los Angeles, Cal.—John Parkinson, Security Building, is architect for the terminal market to be erected on East Seventh Street by the Los Angeles Terminal Company recently incorporated. It is proposed to erect four 6-story and basement warehouses, each 1250 x 100 ft. and two 2-story and basement public market buildings, each 1250 x 75 ft., all reinforced concrete construction, with a quantity of steel sash and glass; total length about two miles.

Pacific Electric Ry. Co. (G. E. Pillsbury, Ch. Engr., Los Angeles) will erect barns and shops this spring at Vineyard Station for Western Division; at Covina Junction for Eastern Division, and at Sixth and Alameda Streets for Southern Division.

Wilmington, Cal.—Los Angeles Warehouse Company will erect on Breeze Street, Wilmington, a three-story reinforced concrete warehouse. C. H. Eubank, Pres. First Natl. Bank, Wilmington, is President of the company.

Vancouver, B. C.—Preliminary plans being prepared by B. Marcus Priteca, Pantages Building, Seattle, Wash., for $250,000 vaudeville theater to be erected here for A. Pantages.

BIDS DESIRED.

Marcellus, N. Y.—Reported desired until March 15, by Harry D. Phoenix, Archt., 417 Union Building, Syracuse, for erecting 2½-story bank and public library building, 35 x 50 ft., in Main Street, for the First National Bank (Dr. John Parsons, Pres.). Probable cost, $100,000.

Wilmington, Del.—By Wilson, Eyre & McIlvaine, Archts., 1003 Spruce Street, Philadelphia, Pa., for erecting $75,000 residence for F. G. Tallman.

Gastonia, N. C.—Reported desired until Feb. 21 by First National Bank for erecting 7-story building. Probable cost $100,000. Wilson & Sompawrac, Archt., Columbia, S. C.

Minneapolis, Minn.—Reported desired until April 1, by Chapman & Magney, Archts., Essex Bldg., for erecting an 8-story 132 x 308 ft. warehouse for Pence Auto Co. Probable cost $250,000.

Butte, Mont.—Reported desired until Feb. 28 by M. Warrem, Power Building, for erecting a six-story fireproof business building for the Granite Alaska Co.; cost $300,000.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★Norwood, Mass.—Contract awarded A. A. Appleby & Company, Norwood, for erecting brick, limestone and granite Masonic Temple for Orient Lodge. William G. Upham, Archt., Norwood.

★Shelton, Conn.—Contract awarded by Sidney Blumenthal Company to Turner Construction Company, 11 Broadway, New York, for erecting four-story, 75 x 216 ft., reinforced-concrete and steel building.

★Loudonville, N. Y.—Contract for erecting Mendelson Memorial Chapel at Hebrew Rural Cemetery awarded Peter Keeler Building Company, Albany; cost about $30,000.

★Camden, N. J.—Contract awarded H. E. Grau Company, 1707 Sansom St., Philadelphia, Pa., for erecting a two-story and basement 62 x 95 ft. brick, steel and concrete warehouse at 23-29 N. Second St. for Crane Company, Chicago, Ill. Peuckert & Wunder, Engineers and Architects, 310 Chestnut St., Philadelphia, Pa.

★Ocean Grove, N. J.—Contract awarded by Ocean Grove Association to Joseph Chamberlain & Son, Asbury Park, for erecting pavilion at the South End; cost about $30,000.

★Philadelphia, Pa. — Contract awarded Irwin & Leighton, 1200 Cherry Street, for erecting ten-story, brick, stone, reinforced-concrete and steel 145 x 152 ft. warehouse on Delaware Avenue and Chestnut Street for Charles J. Webb & Company; cost $500,000.

★Pittsburgh, Pa.—Contract awarded by Paul Irwin, Archt., Renshaw Building, to B. A. Groah Construction Company, 847 West North Street, for erecting five-story, reinforced-concrete building at 319 Liberty Avenue for Nielen & Company; cost about $60,000.

★Atlanta, Ga—Contract awarded Fulton County Home Builders, Candler Building, for erecting twin apartments on Highland and Ponce de Leon Avenues for Lucien L. Knight; total cost about $75,000.

★Huntsville, Ala.—Contract for erecting Hutchens Building awarded Baxter Brothers, of Huntsville, at $24,000.

★Danville, Ky. — Contract reported awarded by Danville Hotel Company to E. R. Dillehay, Danville, for erecting $60,000 fireproof hotel on site of old Gilcher House, destroyed by fire.

★Akron, Ohio.—Contract awarded Carmichael Construction Company, Akron, for erecting three-story fireproof building to replsce Jackson Block at Main and Quarry Streets, cost about $80,000.

★Elyria, O.—L. A. Burget & Company, Lorain, have general contract for erecting Lewis Block on East Broad St., at about $62,000, and J. A. Lucas & Company of Elyria for heating. Paul Rissman, Archt., Lorain.

★Shadyside, Ohio.—Later reports state Trustees of Methodist Church have rescinded former action and awarded contract to Freeman & Hudson of Bellaire, for erecting $30,000 edifice.

★Springfield, Ill.—Contract for erecting three-story, brick and steel building to replace Boston Store destroyed by fire awarded Charles W. Black, Springfield, and iron and steel, to Springfield Bridgs & Iron Company, 632 Reisch Building; cost approximately $42,000. W. H. Conway, Archt., 104 East Side Square.

★Mapleton, Iowa.—Contract awarded Lytle Construction Company, Sioux City, for erecting bank building for Mapleton Trust & Savings Bank; cost $30,000.

★Omaha, Neb.—Contract for erecting 6-story addition to Castle Hotel 70 x 100 ft., awarded Selden Breck Construction Company, State Bank Building, at $130,000.

★Beaumont, Tex.—Contract for erecting passenger station for Kansas City Southern R. R. awarded Herman Weber, Beaumont. C. E. Johnston, Consulting Engineer, Kansas City, Mo.

★Seattle, Wash.—Contract awarded by Thompson & Thompson, Archts., Mutual Life Building, to Hans Pederson, Alaska Building, for erecting four-story and basement, 60 x 120-ft. office, hotel and lodge building at Seventh Avenue and King Street, for Chinese Masonic Association; cost, $50,000.

★Spokane, Wash. — Contract awarded Fred Phair, Paulsen Building, Spokane, for erecting a five-story concrete and steel grocery warehouse for McClintock Trunkey Co. at Stevens Street near Northern Pacific Ry.; cost $70,000. Whitehouse & Price, Archts., Spokane.

NEW INDUSTRIAL PLANTS

PROPOSED WORK.

Manchester, N. H.—The W. H. Griffins Shoe Company of Manchester will erect a four-story brick factory addition 45 x 150 ft. on Belmont Avenue.

Boston, Mass.—Fore River Shipbuilding Corporation, Quincy Point, contemplates erecting three-story brick and steel woodworking shop; cost about $300,000.

Malden, Mass.—Converse Rubber Company intends to erect a factory addition, four-story brick, 65 x 150 ft.; cost, $150,000.

Pawtucket, R. I.—Rhode Island Textile Company, Prairie Avenue, is having plans prepared for a two-story brick factory addition, 60 x 160 ft.

Buffalo, N. Y.—Plans prepared by H. P. Henschien, 37 West Van Buren Street, Chicago, Ill., for a three story and basement oil storage building and an eight story cold storage warehouse 80 x 116 ft., to be erected by the Jacob Dold Packing Co. at Williams Street and New York Central R. R.

Plans filed for Mentholatum Co. for a four story and basement brick and steel factory to be erected at Seneca and Wells Streets at a cost of $25,000.

Hoboken, N. J.—Consumers' Ice Company contemplates erecting ice manufacturing plant here to cost about $200,000. A. J. Volk, 670 Bergsline Avenue, West New York, may be able to give further information.

Trenton, N. J.—Plant of William F. Taubel Hosiery Company, recently destroyed by fire, will be rebuilt on new site at Chestnut and Grand Streets.

Christiana, Pa.—Business Men's Association reported interested in erection of a silk mill, steel and brick construction, and costing $50,000.

Lancaster, Pa.—Bayuk Brothers, Third and Spruce Streets, Philadelphia, will erect $75,000 cigar plant here.

Lancaster, Pa.—Hamilton Watch Company, Lancaster, contemplating erecting an addition to the factory.

Armstrong Cork Company, Lancaster, will erect additional buildings at plant here, including warehouse.

Reading, Pa.—A four-story 40 x 100 ft. addition will be erected to Luden candy factory (W. H. Luden, Pres.); cost, including machinery, about $50,000.

Wilmington, Del.—Plans filed for one-story 179 x 230 ft. brick, terra cotta and steel addition to plant of Artillery Fuse Company, Garasche's Lane and B Street; cost about $35,000.

Atlanta, Ga. — Reported Centralia Creamery Company (O. Rognan Lee, Pres. and General Manager) of Centralia, Ill., intends erecting $100,000 plant here.

Cedartown, Ga.—The plant which the Cedartown Cotton & Export Company intends erecting is at Cedartown, Ga., not Pa., as previously stated.

Savannah, Ga.—Globe Machinery & Barrel Company incorporated, with Gordon Saussy, 103 St. Julian Street East, and others, will erect plant here.

American Specialty Company incorporated, with O. S. Kulman, 610 Abercorn Street, and others, and intends erecting a plant on River and Williamson Streets.

Tampa, Fla.—Reported plant of Tampa Fertilizer Company (T. D. Fitzgerald, manager) destroyed by fire will be rebuilt.

Richmond, Ind.—Starr Piano Company, Richmond, is considering erecting a five-story factory either concrete or brick, also a business block at 8-12 N. Eighth Street.

Beloit, Wis.—Gardner Machine Co., Beloit, plans a second addition to their plant 60 x 60 ft.

Sioux City, Ia.—Reported Chicago, St. Paul, Minneapolis & Omaha Railway Company (R. Rettinghouse, Ch. Engr., St. Paul, Minn.) contemplates spending about $60,000 for improving shops at Howard and Twenty-second Streets.

Duluth, Minn.—Hugh Manufacturing Co. intends erecting on Forty-ninth Avenue West and Halifax Street a seven unit factory according to plans by Kelly & Williams, First National Bank Building. The first unit will be erected at this time and is to be 2 story concrete, also a brick office building to be erected now.

Minneapolis, Minn.—The Coffeetone Mfg. Company will erect a factory on University Avenue and Twenty-seventh Street S. R. E. K. Stratju, President Provident Loan & Trust Company, 1147 McKnight Street, is managing director.

The Soo R. R. (C. N. Kalk, Ch. Engr., Minneapolis), is considering erecting in Northeast Minneapolis at 1,000,000 bu. grain elevator.

The Washburn Crosby Flour Mill Company, Sixth and Seventh Streets, intends making improvements to their plant to cost $85,000.

McAlester, Okla.—A bill has passed State House of Representatives providing for a twine factory to be erected at State Penitentiary; $125,000 has been appropriated for this, of which $75,000 is to be used for buildings and equipment.

Portland, Ore.—Long Fruit Produce Company (F. A. Long, president), Portland, will erect cherry preserving plant to cost about $100,000.

Los Angeles, Cal.—See "Private Buildings."

PRICES AND LETTINGS.

★*Indicates award of contract.*

★Albany, N. Y.—Contract awarded Samuel Austin & Sons Co., 14230 Euclid Avenue, Cleveland, Ohio, for erecting for the Albany Perforated Wrapping Paper Co. a factory, brick and concrete, 200 x 300 ft.

★Staten Island, New York.—Contract awarded Rhodes & Manvel, Inc., 90 West Street, New York, for foundations for plant of the Ammo-Phos Corporation, 200 Fifth Avenue, New York, at Tremley Point, Staten Island Sound. About 14,000 foundation piles and placing timber capping on same required in work.

★Camden, N. J.—Contract awarded Irwin & Leighton, Twelfth and Cherry Streets, Philadelphia, Pa., for erecting a seven-story reinfored-concrete factory for Victor Talking Machine Company at $175,000. Ballinger & Perrot, Archts., Methodist Building, Philadelphia, Pa.

★Philadelphia, Pa.—Contract awarded William Steel & Sons Company, 1600 Arch Street, for erecting four-story and basement, brick, stone and concrete manufacturing building on Westmoreland and Collins Streets for C. H. Mastland & Sons; cost $25,000.

★Oregon City, Ore.—Contract awarded Hurley-Mason Company, Portland, for erecting two and four-story reinforced concrete and steel buildings on Main and Third Streets, for Hawley Paper Company; total cost about $750,000.

MISCELLANEOUS

PROPOSED WORK.

Park Bonds—Jersey City, N. J.—Park bonds amounting to $800,000 will be sold Feb. 24 by Board Chosen Freeholders. Walter O'Mara, Clerk.

Subway—Harrisburg, Pa.—M. B. Cowden, City Engineer, is preparing plans for widening subway under Pennsylvania R.R. tracks on main business street at a cost of $200,000.

Park Improvements—Baltimore, Md.—Commission for Opening of Streets will submit a report to Board of Estimate for widening and forming a park on St. Paul Street, from Saratoga to Hamilton Street.

Subway — Cleveland, Ohio. — See "Bridges."

Subway—Decatur, Ill.—A subway, to cost approximately $100,000, is to be constructed under Wabash R.R. tracks either at North Water or North Church St. Dan Dineen, Mayor.

Park Improvements — Houston, Tex.—Maurice J. Sullivan, City Architect, is making recommendations to City Council for city park improvements.

BIDS DESIRED.

Road Oil—Providence, R. I.—Until 2:30 P. M., Feb. 21, by W. C. Pelkey, City Clerk, for furnishing asphaltic oils, oil asphalt and tarvia required by the city during 1916.

Elevator—Albany, N. Y.—Until March 9, by Trustees Public Buildings, Albany, for electric elevators in connection with the alterations and additions to State House, Albany, advertised in Engineering Record. Lewis F. Pilcher, State Architect, Albany.

Cement, Etc.—New York, N. Y.—Until Feb. 23 by Marcus M. Marks, Borough Pres., for furnishing and delivering 6500 cu. yd. sand, 18,000 bags Portland cement, 18,000 tons asphaltic paving cement, 5000 cu. yd. paving gravel, 1800 tons coal tar pitch paving, 3500 cu. yd. course aggregate for concrete, and 400,000 wood paving blocks.

Fire Escapes—Rochester, N. Y.—Until Feb. 21, by Board of Education (J. S. Mullan, Secy.), for erecting fire escapes on East and West high schools. Edwin S. Gordon, Archt., Rochester.

Road Oil—Wilkes-Barre, Pa.—Until Feb. 26 by Fred H. Gates, City Clerk, for furnishing and delivering f.o.b. cars Wilkes-Barre 40,000 gal. road oil, more or less. Bidders to quote prices per barrel tank car or otherwise, delivered and placed on roads, submit samples with brand of oil. Martin C. Murray, Supt. Dept. Streets and Public Improvement.

Road Oil—Maryland.—Until March 1, by State Roads Commission, 601 Garrett Building, Baltimore, for oiling 7 sections of State Highways, approximately 1,085,879 gals. of oil, advertised in Engineering Record.

Chips—Maryland.—Until March 1, by State Roads Commission, 601 Garrett Bldg., Baltimore, for hauling out approximately 14.547 tons stone chips for oiling State roads, advertised in Engineering Record.

Sulphate of Alumina—Washington, D. C.—Until March 6 by U. S. Engineer, Washington, D. C., for furnishing and delivering 400 tons, 25 per cent., more or less, sulphate of alumina, advertised in Engineering Record.

Hoistway, Etc.—Cincinnati, Ohio.—Until March 13, by James A. Wetmore, Act. Superv. Archt., Treas. Dept., Washington, D. C., for installing complete new hoistway, hydraulic mail lift, etc., in U. S. post office and custom house, Cincinnati.

Cement—Cleveland, Ohio.—Reported desired until Feb. 23, by Commissioner Purchases and Supplies, for asphalt cement for Division of Street Repairs.

Road Oil—Indianapolis, Ind.—Reported desired until March 6 (readvertisement) for 750,000 or more gallons road oil. B. J. T. Jeup, City Engr.

Testing Machine—Chicago, Ill.—Until Feb. 26, by Department of Public Works for furnishing and delivering a 200,000-lb. testing machine at the Marshall Boulevard, Municipal Plant, Thirty-first Street and Marshall Boulevard.

Road Oil—Oshkosh, Wis.—Reported desired until Feb. 18 by Board Public Works for furnishing city 50,000 gal. road oil. George H. Randall, City Engr.

Elevator, Etc. — Omaha, Neb. — Until March 13, by James A. Wetmore, Acting Superv. Archt., Treas. Dept., Washington, D. C., for installing elevator, pump, etc., in U. S. public building, Omaha.

Railroad Supplies—Seattle, Wash.—Reported desired until Feb. 23, by Alaska Engineering Commission, Bell Street Dock (C. E. Dole, Purchasing Agent, for miscellaneous supplies involved in construction of Government Railroad in Alaska, to consist of milling machinery, air drills, wheel press, steam hammers.

Asphalt—Montreal, Que.—Reported desired until Feb. 24. L. M. Senecal, Secy. City Comrs., for furnishing about 6000 tons refined asphalt.

Brick, Asphalt, Etc.—Ottawa, Ont.—Reported desired until Feb. 24, by Board Control, City Hall, for broken stone, brick, sand, asphalt, vitr. clay pipe, castings, etc.

Cable, Etc.—Panama.—Until March 3, by Maj. F. C. Boggs, Corps Engrs., U. S. A., General Purchasing Officer, Panama, Washington, D. C., for Cir. 1015—steel or iron pipe, steel cables, lead pipe, etc.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Road Oil—Indianapolis, Ind.—Two lowest bids opened Feb. 4 by Board of Public Works for furnishing oil for year 1916 for oiling unimproved streets were submitted by Standard Oil Co., at $4.85,, and Indiana Refining Co., at $4.99, 100 gal. basis. Specifications call for oil containing 40 per cent. asphalt. About 750,000 gal. will be needed.

★**Cement — Saginaw, Mich.** — Contract awarded L. C. Smith & Co., Saginaw, for Portland cement (bids opened Feb. 8). They bid $1.42, cloth sacks per bbl., delivered on line of work, and $1.35 delivered in car load lots. F. L. Muehlenbeck, $1.45 and $1.44, and Remer Brothers, $1.55 and $1.40. Herbert S. Gay, City Clerk.

Proposals

For Proposals Advertised, See Pages 44, 45, 46 and 47.

WATERWORKS.

Bids Close.		See Eng. Record.
Feb. 22.	Waterworks, McCammon, Idaho	Jan. 22
Feb. 22.	Water Works, Havana, Cuba.	Feb. 5
Feb. 23.	Pump, etc., Rock Island, Ill.	Feb. 5
Feb. 23.	Water Works, North Collins, N. Y. Adv. Feb. 12, 19.	Feb. 12
Feb. 23.	Air Compressor, Etc., Cleveland, Ohio.	Feb. 19
Feb. 23.	Pumps, Tower, Etc., Rochester, N. Y.	Feb. 19
Feb. 23.	Valves, Castings, Etc., Cincinnati, Ohio	Feb. 19
Feb. 24.	Improvements, Bloomington, Ind. Adv. Jan. 29.	Jan. 29
Feb. 24.	Meters, Ligonier, Ind.	Feb. 5
Feb. 24.	Contract 169, New York, N. Y. Adv. Feb. 5. 12.	Feb. 5
Feb. 24.	C.-I. Pipe, Etc., Ottawa, Ont.	Feb. 19
Feb. 24.	Pumps, Etc., Wheeling, W. Va.	Feb. 19
Feb. 24.	Improvem'ts, Attica, Ohio	Feb. 19
Feb. 25.	Laying Pipe, Etc., St. Louis, Mo.	Feb. 19
Feb. 25.	Piping, etc., Cincinnati, Ohio.	Feb. 19
Feb. 28.	Improv., Macon, Ga. Adv. Feb. 19.	Feb. 19
Mar. 1.	Water Works, Colville, Wash.	Feb. 12
Mar. 1.	Water Works, Bayard, Neb.	Feb. 12
Mar. 1.	Water Works, Everett, Wash.	Feb. 12
Mar. 1.	Pump Station, Ottawa, Ont. Adv. Feb. 19.	Feb. 19
Mar. 2.	Reservoir, Washington, D. C. Adv. Feb. 5.	Feb. 5
Mar. 6.	Well, New Bern, N. C. Adv. Feb. 12.	Feb. 12
Mar. 6.	C.-I. Pipe, Albany, N. Y.	Feb. 19
Mar. 8.	Pumping Station, Fort Bliss, Tex. Adv. Feb. 12, 19.	Feb. 12
Mar. 8.	Tunnel, Milwaukee, Wis. Adv. Feb. 19.	Feb. 19
Mar. 14.	Mains, etc., Crofton, Neb.	Feb. 19
Mar. 22.	Add. to Pump Sta., New Orleans, La.	Feb. 5
Apr. 1.	Mains, Cullman, Ala.	Jan. 15
———	Pipe Line, Trinity, Tex. Adv. Feb. 5.	Feb. 5

SEWERAGE AND SEWAGE DISPOSAL.

Bids Close.		See Eng. Record.
Feb. 22.	Havana, Cuba.	Feb. 5
Feb. 23.	Des Moines, Iowa	Jan. 29
Feb. 23.	West Chester, Pa. Adv. Feb. 19.	Feb. 19
Feb. 23.	Cleveland, Ohio.	Feb. 19
Feb. 24.	East View, Ohio	Jan. 29
Feb. 24.	Union, Ia.	Feb. 19
Feb. 25.	Pierce, Neb.	Jan. 29
Feb. 25.	Roanoke, Va.	Feb. 19
Feb. 25.	New Haven, Conn.	Feb. 19
Feb. 28.	Montclair, N. J. Adv. Feb. 12.	Feb. 12
Feb. 28.	Randolph, Wis.	Feb. 19
Feb. 29.	Kendallville, Ind. Adv. Feb. 5.	Feb. 5
Mar. 1.	Chrisman, Ill.	Feb. 19
Mar. 6.	Polsom, Mont. Adv. Feb. 5.	Feb. 5
Mar. 6.	Savannah, Ga. Adv. Feb. 12, 19.	Feb. 12
Mar. 7.	Billings, Mont.	Feb. 12
Mar. 7.	Tonkawa, Okla.	Feb. 19
Mar. 9.	Fort Wayne, Ind.	Feb. 19
Mar. 14.	Newark, N. J. Adv. Jan. 22, Feb. 5, 19.	Jan. 22
Apr. 1.	Sheboygan Falls, Wis.	Feb. 19
Apr. 4.	Billings, Mont.	Feb. 19

BRIDGES.

Bids Close.		See Eng. Record.
Feb. 19.	Joliet, Ill.	Feb. 19
Feb. 23.	Dickinson, N. D.	Jan. 29
Feb. 23.	Hutchinson, Kan.	Feb. 5
Feb. 23.	Maine	Feb. 5
Feb. 23.	Honeoye Falls, N. Y.	Feb. 12
Feb. 23.	Wheeling, W. Va	Feb. 19
Feb. 23.	Washington, Va.	Feb. 19
Feb. 23.	Indianapolis,	Feb. 19
Feb. 23.	Oshkosh, Wis.	Feb. 19
Feb. 26.	Kansas City, Kan.	Feb. 12
Feb. 26.	Brantford, Ont.	Feb. 19
Feb. 28.	Jacksonville, Fla.	Feb. 19
Feb. 28.	Athens, Ga.	Feb. 19
Feb. 29.	Dayton, Ohio.	Feb. 12
Mar. 1.	Columbus, Ind.	Feb. 19
Mar. 1.	Paterson, N. J.	Feb. 19
Mar. 1.	Nebraska.	Feb. 19
Mar. 2.	Illinois	Feb. 12
Mar. 2.	Wahpeton, N. D.	Feb. 19
Mar. 2.	Nevada, Iowa.	Feb. 19
Mar. 3.	Seattle, Wash.	Feb. 5
Mar. 4.	Berkeley Springs, W. Va.	Feb. 5
Mar. 6.	Tucson, Ariz.	Feb. 5
Mar. 6.	Kansas City, Kan. Adv. Feb. 19.	Feb. 19
Mar. 6.	Fort Dodge, Iowa	Feb. 19
Mar. 7.	Columbus, Ohio	Feb. 12
Mar. 7.	West Palm Beach, Fla.	Feb. 19
Mar. 7.	Georgetown, Del.	Feb. 19
Mar. 7.	Brainerd, Minn.	Feb. 19
Mar. 7.	Grand Forks, N. D.	Feb. 19
Mar. 7.	Casper, Wyo.	Feb. 19
Mar. 8.	Indiana.	Feb. 19
Mar. 8.	Nelson, Neb.	Feb. 19
Mar. 9.	La Salle, Ill. Adv. Feb. 12.	Feb. 12
Mar. 9.	Fairbury, Neb. Adv. Feb. 12, 19.	Feb. 12
Mar. 9.	Red Oak, Iowa	Feb. 19
Mar. 10.	Nebraska.	Feb. 19
Mar. 11.	Hamilton, Ohio.	Feb. 19
Mar. 17.	Wayne, Neb.	Feb. 19
May 15.	Dayton, Ohio Adv. Feb. 19.	Feb. 19

PAVING AND ROADS.

Bids Close.		See Eng. Record.
Feb. 21.	West Liberty, Iowa Adv. Feb. 12, 19.	Feb. 12
Feb. 21.	Knoxville, Tenn. Adv. Feb. 12.	Feb. 12
Feb. 23.	Indiana	Jan. 29
Feb. 23.	Maine Adv. Feb. 5.	Feb. 5
Feb. 23.	Maryland Adv. Feb. 12, 19.	Feb. 12
Feb. 23.	Louisville, Ky.	Feb. 12
Feb. 23.	Indiana	Feb. 12
Feb. 23.	Spencer, Iowa.	Feb. 19
Feb. 23.	Ivanhoe, Minn.	Feb. 19
Feb. 23.	Murray, Ky.	Feb. 19
Feb. 23.	Louisville, Ky.	Feb. 19
Feb. 24.	Newark, N. J.	Feb. 12
Feb. 24.	Elmira, N. Y. Adv. Feb. 12, 19.	Feb. 12
Feb. 24.	Jersey City, N. J.	Feb. 19
Feb. 24.	Newark, N. J.	Feb. 19
Feb. 24.	Montreal, Que.	Feb. 19
Feb. 24.	New York, N. Y.	Feb. 19
Feb. 25.	St. Louis, Mo.	Feb. 12
Feb. 25.	Cherokee, Iowa.	Feb. 19
Feb. 25.	Mount Gilead, Ohio	Feb. 19
Feb. 25.	Cheviot, Ohio	Feb. 19
Feb. 25.	Brooklyn, N. Y.	Feb. 19
Feb. 25.	New Haven, Conn.	Feb. 19
Feb. 28.	Lebanon, Ind.	Jan. 29
Feb. 28.	Minot, N. D.	Jan. 29
Feb. 28.	Indiana.	Feb. 5
Feb. 28.	Wallace, Idaho	Feb. 5
Feb. 28.	Lansing, Mich.	Feb. 12
Feb. 28.	Kalamazoo, Mich.	Feb. 12
Feb. 28.	Chicago Junction, Ohio.	Feb. 19
Feb. 28.	Venice, Cal.	Feb. 19
Feb. 28.	Indiana.	Feb. 19
Feb. 28.	Seattle, Wash.	Feb. 19
Feb. 28.	Cincinnati, Ohio	Feb. 19
Feb. 28.	Louisville, Ky.	Feb. 19
Feb. 29.	Petersburg, Va.	Feb. 19
Mar. 1.	Fort Madison, Iowa	Feb. 5
Mar. 1.	Parkersburg, W. Va.	Feb. 12
Mar. 1.	Globe, Ariz.	Feb. 12
Mar. 1.	Ravenna, Ohio	Feb. 12
Mar. 1.	Sidney, Ind.	Feb. 12
Mar. 1.	Maryland Adv. Feb. 19.	Feb. 19
Mar. 1.	Columbus, Ind.	Feb. 19
Mar. 1.	Appleton, Wis.	Feb. 19
Mar. 2.	Hibbing, Minn.	Feb. 5
Mar. 2.	Montreal, Que.	Feb. 12
Mar. 2.	Fleming, N. J. Adv. Feb. 19.	Feb. 19
Mar. 2.	Indiana.	Feb. 19
Mar. 2.	Carroll, Iowa.	Feb. 19
Mar. 6.	Huntsville, Ala.	Jan. 29
Mar. 6.	Portland, Ind.	Jan. 29
Mar. 6.	Atchison, Kan.	Feb. 12
Mar. 6.	Maysville, Ky. Adv. Feb. 19.	Feb. 19
Mar. 6.	Camden, N. J.	Feb. 19
Mar. 6.	Los Angeles, Cal.	Feb. 19
Mar. 6.	Indiana.	Feb. 19
Mar. 6.	Lynchburg, Va. Adv. Feb. 19.	Feb. 19
Mar. 6.	Canton, Miss.	Feb. 19
Mar. 7.	Davenport, Wash.	Jan. 22
Mar. 7.	Richland Center, Wis. Adv. Feb. 12, 19.	Feb. 12
Mar. 7.	Indiana.	Feb. 19
Mar. 7.	Goshen, Ind.	Feb. 19
Mar. 8.	Indiana	Feb. 5
Mar. 8.	Indiana.	Feb. 19
Mar. 10.	Indiana.	Feb. 19
Mar. 11.	Appleton, Wis.	Feb. 12
Mar. 11.	Indiana.	Feb. 19
Mar. 14.	Danville, Ill. Adv. Feb. 12, 19.	Feb. 12
Mar. 15.	Danville, Ill. Adv. Feb. 12, 19.	Feb. 12
Mar. 16.	Danville, Ill. Adv. Feb. 12, 19.	Feb. 12
Mar. 18.	Watertown, N. Y.	Feb. 12
Mar. 20.	Bolivar, Mo.	Feb. 12
Mar. 20.	De Land, Fla.	Feb. 19
Apr. 1.	Charelston, W. Va.	Feb. 19
———	Binghamton, N. Y. Adv. Feb. 12, 19.	Feb. 12

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS.

Bids Close.		See Eng. Record.
Feb. 21.	Jetty Work, Dallas, Tex. Adv. Jan. 29 to Feb. 12.	Jan. 29
Feb. 21.	Breakwater Improvements. Manistee, Mich. Adv. Jan. 29 to Feb. 19.	Jan. 29
Feb. 23.	Steel for Lock, Sault Ste. Marie, Mich. Adv. Jan. 22 to Feb. 19.	Jan. 22
Feb. 23.	Drain, Hastings, Mich.	Feb. 12
Feb. 24.	Dyke Work, Albany, N. Y. Adv. Jan. 29, Feb. 5.	Jan. 29
Feb. 24.	Seawall, West Palm Beach, Fla.	Feb. 12
Feb. 24.	Dredging, New York, N. Y. Adv. Feb. 12, 19.	Feb. 12
Feb. 24.	State Canal Work, Albany, N. Y.	Feb. 12
Feb. 24.	Dredging, Etc., Philadelphia, Pa.	Feb. 19
Feb. 26.	Drainage, Charles City, Iowa	Feb. 19
Feb. 28.	Lock Gates, New Glasgow, N. S.	Feb. 12
Feb. 29.	State Canal Work, Albany, N. Y.	Feb. 5
Feb. 29.	Dredging, New York, N. Y. Adv. Feb. 5 to 19.	Feb. 5
Feb. 29.	Ditch, Jackson, Minn.	Feb. 12
Feb. 29.	Levee, New Orleans, La.	Feb. 19
Mar. 1.	Ditch, Bucyrus, Ohio	Feb. 19
Mar. 4.	Drainage, Hahnaman, Ill.	Feb. 19
Mar. 6.	Drainage, Largo, Fla. Adv. Feb. 12, 19.	Feb. 12
Mar. 6.	Dredging, Hartford, Conn. Adv. Feb. 5 to 19.	Feb. 5
Mar. 7.	Dredging, New York, N. Y. Adv. Feb. 12, 19.	Feb. 12
Mar. 7.	Riprap, Tompkinsville, N. Y.	Feb. 19
Mar. 8.	Ditch, Redwood Falls, Minn.	Feb. 19
Mar. 9.	Ditch. Moorehead, Minn.	Jan. 22
Mar. 10.	Breakwater, Racine, Wis. Adv. Feb. 12, 19.	Feb. 12
Mar. 10.	Irrigation, Fort Laramie, Wyo. (2 Props.) Adv. Feb. 12.	Feb. 12
Mar. 13.	Levee, Vincennes, Ind.	Feb. 19
Mar. 14.	Dike, Jefferson City, Mo. Adv. Feb. 19.	Feb. 19
Mar. 14.	State Canal Work, Albany, N. Y. Adv. Feb. 19.	Feb. 19
Mar. 15.	Breakwater, Newport, R. I.	Feb. 19
Mar. 16.	Dredging, Etc., New Bedford. Mass.	Feb. 19

PUBLIC BUILDINGS AND SCHOOLS.

Bids Close.		See Eng. Record.
Feb. 23.	Belmond, Iowa	Jan. 29
Feb. 23.	St. Peters, Minn.	Feb. 12
Feb. 23.	Bradgate, Iowa	Feb. 12
Feb. 24.	Batavia. Ohio	Jan. 22
Feb. 21.	Minot, N. D.	Jan. 29
Feb. 24.	Columbus. Ohio.	Jan. 29
Feb. 24.	Berwyn, Pa.	Feb. 5
Feb. 24.	Clarksville, Tenn Adv. Feb. 5.	Feb. 5
Feb. 24.	Highland Park, Mich.	Feb. 12
Feb. 24.	Brookline, Mass.	Feb. 19
Feb. 24.	De Funiak Springs, Fla.	Feb. 19
Feb. 24.	Winnfield, Kan.	Feb. 19
Feb. 25.	Ebensburg, Pa.	Jan. 8
Feb. 25.	Ellsworth, Ia.	Feb. 5
Feb. 25.	St. Charles, Ill.	Feb. 5
Feb. 25.	Bradford, Iowa	Feb. 12
Feb. 25.	Enderlin, N. D.	Feb. 12
Feb. 26.	Westville, O.	Feb. 5
Feb. 26.	Sycamore, Ill.	Feb. 12
Feb. 26.	Columbus, Ohio	Feb. 12
Feb. 28.	Olmstead Falls, O.	Feb. 5
Feb. 28.	Oneida, Iowa	Feb. 5
Feb. 28.	Baldwin, L. I., N. Y. Adv. Feb. 12.	Feb. 12
Feb. 28.	Monongahela, Pa.	Feb. 19
Feb. 28.	Miami, Okla.	Feb. 19
Feb. 28.	Houston, Tex.	Feb. 19
Feb. 29.	Guide Rock, Neb.	Jan. 29
Feb. 29.	Miami, Okla.	Jan. 29
Feb. 29.	Martinsburg, W. Va.	Feb. 5
Feb. 29.	Ashby, Minn.	Feb. 19
Mar. 1.	Industrial, W. Va.	Feb. 5
Mar. 1.	Normal, Ill.	Feb. 5
Mar. 1.	Oshkosh, Wis.	Feb. 5
Mar. 1.	Bridgeport, Neb.	Feb. 12
Mar. 1.	Lakeview, Mich.	Feb. 19
Mar. 1.	Amsterdam, N. Y.	Feb. 19
Mar. 1.	Seattle, Wash.	Feb. 19
Mar. 2.	Rockford, Ill.	Feb. 12
Mar. 2.	Vincennes, Ind.	Feb. 19
Mar. 4.	Palmyra, Ohio	Feb. 12
Mar. 4.	Seabreeze, Fla.	Feb. 12
Mar. 6.	Lake Helen, Fla.	Jan. 29
Mar. 6.	Seabreeze, Fla.	Jan. 29
Mar. 7.	Harrisburg, Pa.	Jan. 22
Mar. 7.	Bethlehem, Pa.	Feb. 5
Mar. 7.	Alameda, Cal.	Feb. 19
Mar. 7.	West Richfield, Ohio.	Feb. 19
Mar. 7.	Lincoln, Ill.	Feb. 19
Mar. 8.	Lubbock, Tex.	Feb. 12
Mar. 10.	Kalispell, Mont.	Feb. 5
Mar. 10.	Dollivar, Iowa.	Feb. 19
Mar. 13.	Oklahoma City, Okla.	Feb. 5
Mar. 13.	Lafayette, Ga.	Feb. 19
Mar. 13.	Hazelton, Pa.	Feb. 19
Mar. 14.	Antigo, Wis.	Feb. 5
Mar. 15.	Gilbert, Minn.	Feb. 12
Mar. 15.	Ft. Bliss, Tex. Adv. Feb. 19.	Feb. 19
Mar. 16.	New Smyrna, Fla.	Feb. 19
Mar. 17.	Charles City, Iowa	Feb. 12
Mar. 18.	Ft. Terry, N. Y. Adv. Feb. 19.	Feb. 19
Mar. 20.	Austin. Minn.	Jan. 22
Mar. 22.	Mattoon, Ill.	Feb. 12
Mar. 22.	Aberdeen, Wash.	Feb. 19
Mar. 23.	Wilmington, N. C	Feb. 19
Mar. 24.	Taylorville, Ill.	Feb. 19
Mar. 25.	Seattle, Wash.	Feb. 19
Mar. 29.	Aberdeen, Wash.	Feb. 19

PRIVATE BUILDINGS.

Bids Close.		See Eng. Record.
Feb. 25.	Pipestone, Minn.	Feb. 12
Feb. 28.	Butte, Mont.	Feb. 19
Mar. 1.	Erie, Pa.	Feb. 12
Mar. 1.	Indianapolis, Ind.	Jan. 29
Mar. 15.	Marcellus, N. Y.	Feb. 19
Apr. 1.	Cleveland, Ohio	Jan. 8
Apr. 1.	Minneapolis, Minn.	Feb. 19

NEW INDUSTRIAL PLANTS.

Bids Close.		See Eng. Record.
Apr. 15.	Manila, P. I.	Jan.. 2

MISCELLANEOUS.

Bids Close.		See Eng. Record.
Feb. 23.	Castings, Etc., Panama Adv. Jan. 15.	Jan. 15
Feb. 23.	Boilers in Boat, Cincinnati, Ohio Adv. Feb. 5 to 19.	Feb. 5
Feb. 23.	Road Oil, Providence, R. I. Adv. Feb. 12, 19.	Feb. 12
Feb. 23.	Waterproofing Fabric, Boston, Mass. Adv. Feb. 12, 19.	Feb. 12
Feb. 23.	Railroad Supplies, Seattle, Wash.	Feb. 19
Feb. 23.	Cement, Etc., New York, N. Y.	Feb. 19
Feb. 23.	Cement, Cleveland, Ohio.	Feb. 19
Feb. 24.	Track Installation, New York, N. Y.	Feb. 12
Feb. 24.	Brick, Etc., Ottawa, Ont.	Feb. 19
Feb. 24.	Asphalt, Montreal, Que.	Feb. 19
Feb. 25.	Asphaltic Cement, Newark, N. J.	Feb. 12
Feb. 25.	Road Oil, Wilkes-Barre, Pa.	Feb. 19
Feb. 26.	Testing Machines, Chicago, Ill.	Feb. 19
Feb. 28.	Counters, Gates, Etc., Boston, Mass. Adv. Jan. 29, Feb. 5.	Jan. 29
Feb. 29.	Maneuver Boats, Wheeling, W. Va. Adv. Feb. 5 to 19.	Feb 5
Feb. 29.	Elevator, Martinsburg, W. Va.	Feb. 5
Mar. 1.	Tower, Honolulu, T. H.	Jan. 22
Mar. 1.	Cement, Etc., Hamilton, Ont.	Feb. 12
Mar. 1.	Hauling Chips and Road Oil, Maryland (2 Props.) Adv. Feb. 19.	Feb. 19
Mar. 2.	Electric Railway, Boston, Mass. Adv. Feb. 12, 19.	Feb. 12
Mar. 3.	Pipe, Etc., Panama	Feb. 19
Mar. 4.	Projectile Hoists, Philadelphia, Pa. Adv. Feb. 12, 19.	Feb. 12
Mar. 6.	El. Ry. Franchise, Martinez, Cal.	Feb. 19
Mar. 6.	Electric Railway, San Diego, Cal.	Feb. 19
Mar. 6.	Sulphate of Alumina, Washington, D. C. Adv. Feb. 19.	Feb. 19
Mar. 8.	Road Oil, Indianapolis, Ind.	Feb. 19
Mar. 9.	Elevator, Albany, N. Y.	Feb. 19
Mar. 13.	Hoistways, Etc., Cincinnati, Ohio	Feb. 19
Mar. 13.	Elevator, Etc., Omaha, Neb.	Feb. 19
Apr. 1.	Memorial, Fort McHenry, (P. O. Baltimore, Md.).	Nov. 20

SEARCHLIGHT SECTION

Bids open March 6, 1916.

DITCHES AND SPILLWAY

LARGO, FLA.

Sealed proposals will be received at the office of the Board of Supervisors of the Lake Largo-Cross Bayou Drainage District, in Pinellas County, Largo, Fla., until Monday, March 6, 12 o'clock noon, for the construction of approximately 26,000 cu. yd. of open ditch 20 ft. wide on the bottom, side slopes one on two. One timber crib spillway. Approximately 350 cu. yd. of open ditch 2 ft. wide on the bottom, side slopes one on two.

Bids must be accompanied by a proposal bond of approved form or by a certified check for not less than five (5) per cent of the bid.

Bids will be accepted for the work as a whole or any part or parts thereof. The right is reserved to reject any or all bids.

A charge of five dollars ($5.00) will be made for plans and specifications, which may be obtained from the Engineer. No refund.

LAKE LARGO-CROSS BAYOU
DRAINAGE DISTRICT.
F. R. FRANCKE, President.
H. A. VAN NICE, Member.
FREEMAN P. LANE, Member.
ISHAM RANDOLPH & COMPANY,
Chief Engineers,
Chicago-Jacksonville.
Address Jacksonville office.

Bids open March 14, 15 and 16, 1916.

ROAD CONSTRUCTION COUNTY OF VERMILION

DANVILLE, ILL.

1. Notice is hereby given that sealed proposals for the construction of roads in Vermilion County will be received at the office of the County Clerk, Court House, City of Danville, Ill., until 2 p. m., March 14, 1916, for Divisions 2, 5, 7; until 2 p. m., March 15, for Divisions 1, 4, 9; and until 2 p. m., March 16, for Divisions 3, 6, 8, at which times and place during the meetings of the Board of Supervisors, the proposals will be publicly opened and read.

2. The proposed work comprises the construction of concrete or brick roads ten (10) feet wide with three (3) foot macadam or gravel shoulders together with all grading, shaping earth shoulders, reinforced concrete work, ditching, drainage and other incidental work as shown in detail on plans and specifications, on file in the office of the County Clerk and the Superintending Engineer.

3. Proposals shall be made on forms furnished by the County of Vermilion.

4. The Board of Supervisors reserves the right to reject any or all proposals, and to waive technicalities in any proposal.

5. Bidders may furnish proposals on one or more of the nine divisions of approximately 19 miles each, into which the work is divided.

6. All proposals must be accompanied by a certified check in the sum of two (2) per cent of the total bid and made payable to the order of Thomas J. Dale, County Treasurer of said county; said check to be returned unless in case of the acceptance of his proposal, the bidder should fail to execute a contract and file a bond in a sum equal to the amount of the bid within ten (10) days of the date of the acceptance of this proposal, in which case the check is to become the property of Vermilion County, and is to be considered as payment of damages due to delay and other causes suffered by the county from neglect of the bidder to execute a contract.

7. Proposals must be addressed or delivered to said County Clerk, Court House, Danville, Ill.; marked plainly on the outside, "Proposal for the Construction of Vermilion County Bond Roads, Division Number ——————."

Dated at Danville, Ill., this the 4th day of February, A. D. 1916.

JOHN R. MOORE,
County Clerk.

Official Proposal Announcements

Price, $2.40 an inch.—Copy can be received until Thursday 10 a. m. for issue mailed the next morning

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Bids open February 21, 1916.

BIDS DESIRED FOR PAVING

WEST LIBERTY, IOWA.

West Liberty, Iowa, Until February 21, by Irwin Alkins, Town Clerk, for furnishing material and constructing about 35 blocks paving, kind to be selected after bids are opened, and about 28,000 lineal feet of curb and gutter. Plans and specifications on application.

Bids open February 23, 1916.

NOTICE TO CONTRACTORS

STATE OF MARYLAND—STATE ROADS COMMISSION

BALTIMORE, MD.

Sealed proposals for building one section of State Highway, as follows:

CONTRACT No. A.B.9, ANNE ARUNDEL COUNTY

One section along the line of the Annapolis Boulevard, from the Patapsco River to the Old Annapolis Road, approximately .78 miles. (Concrete Roadway.) will be received by the State Roads Commission, at its offices, 601 Garrett Building, Baltimore, Md., until 12 m., on the 23d day of February, 1916, at which time and place they will be publicly opened and read.

Bids must be made upon the blank form contained in the book of specifications. Specifications and plans will be furnished by the Commission upon application and cash payment of $1, as hereafter no charges will be permitted.

No bids will be received unless accompanied by a certified check for the sum of five hundred ($500) dollars, payable to the State Roads Commission.

The successful bidder will be required to give bond, and comply with the Acts of the General Assembly of Maryland, respecting contracts.

The Commission reserves the right to reject any and all bids.

By order of the State Roads Commission this 5th day of February, 1916.

O. E. WELLER,
Chairman.
WM. L. MARCY,
Secretary.

Bids open February 23, 1916.

NOTICE TO CONTRACTORS

WATER WORKS

NORTH COLLINS, N. Y.

Sealed proposals will be received by the Board of Trustees of the Village of North Collins, Erie County, N. Y., up to 2 o'clock p. m. of the 23d day of February, 1916, for furnishing the materials and constructing a water works system for said village.

There will be required approximately the following materials: About 6 miles of 8, 6 and 4-in. cast-iron water mains.

Fifty (50) fire hydrants; forty-eight (48) gate valves and boxes; two triplex power pumps and two gas engines; pumping station and well; stand pipe (steel); concrete standpipe foundation, etc. A certified check in an amount equal to two (2) per cent of the amount of the bid, made to the treasurer of the village must accompany each proposal. Plans may be seen and specifications and blank forms of proposal procured at the office of the Clerk of the Village, North Collins, N. Y., or at the office of the engineers, J. F. Witmer Company, 97, 98 Dun Building, Buffalo, N. Y.

The right is reserved to reject any and all bids.

North Collins, N. Y., February 3, 1916.

LEE B. WARD,
Village Clerk.
J. F. WITMER COMPANY,
Engineers,
Buffalo, N. Y.

PAVEMENT TO SUBLET

Will sublet 6500 yards of vitrified brick pavement, with concrete base and curb. Address P. O. Box 748, Binghamton, N. Y.

Bids open February 23, 1916.

NOTICE TO CONTRACTORS.
CITY OF BOSTON, MASS.

WATERPROOFING FABRIC

Sealed bids for furnishing and delivering any quantity up to 100,000 sq. yd., more or less, of asphalt-saturated woven cotton fabric will be received by the under signed at 15 Beacon Street, Boston, Mass., until 12 o'clock, noon, of Wednesday, February 23, 1916. Specifications and forms of contract can be had at 15 Beacon Street, ninth floor. The right to reject any and all bids and to award the contract as is deemed to be for the best interest of the City of Boston is reserved.

By order of the
BOSTON TRANSIT COMMISSION,
B. LEIGHTON BEAL,
Secretary.

Bids open March 6, 1916.

STREET IMPROVEMENT

LYNCHBURG, VA.

Sealed proposals for the improvement of Main Street will be received by the Joint Council Committee on Streets and Sewers, at the office of the City Engineer, Lynchburg, Va., until 12 noon of Monday, March 6, 1916, and on that day will be publicly opened and read. The entire work is to be let in one contract.

All bids must be made upon blank forms to be provided, and must give the prices both in writing and figures, and be signed by the bidder, with his address.

The work to be let embraces the construction of an underground conduit system for electric wires, the furnishing and laying of sewer pipes and the repaving of the street with either granite block, Medina sandstone block, asphalt block, Durax cubes or sheet asphalt.

Each bid shall be accompanied by a certified check for $3,000.00, payable to John P. Pettyjohn, Chairman of the Joint Committee on Streets and Sewers, said check to be returned to the bidder unless he fails to execute the contract should it be awarded him.

A bond for $20,000.00 will be required for the faithful performance of the contract, the surety to be a substantial surety company satisfactory to the Joint Committee on Streets and Sewers, and authorized by law to do business in the State of Virginia. No personal surety will be considered.

The principal items of work are as follows:

10,500 sq. yds. paving.
5,200 lin. ft. granite curb.
3,000 sq. yds. granolithic walks.
1,100 cu. yds. concrete.
5,000 cu. yds. excavation.
15,000 cu. yds. trench excavation.
6,000 lin. ft. sewer pipe.
80,000 lin. ft. fibre duct.
110 manholes.

Plans can be seen and specifications and forms of proposals obtained at the office of the City Engineer, Lynchburg, Virginia.

The Committee reserves the right to reject any or all bids should they deem it to be for the interest of the City of Lynchburg to do so.

H. L. SHANER,
City Engineer.

Bids open March 14, 1916.

NOTICE TO CONTRACTORS.

PASSAIC VALLEY SEWERAGE COMMISSIONERS

NEWARK, N. J.

Notice is hereby given that the Passaic Valley Sewerage Commissioners have designated Tuesday, the fourteenth day of March, nineteen hundred and sixteen, at two o'clock in the afternoon, as the time when they will meet at their usual place of meeting, Essex Building, Clinton Street, Newark, New Jersey, to receive proposals in writing, for constructing a part of Section 4 of the Outfall Sewerage Works, consisting of Sedimentation Basins, Effluent and Intake conduits, and all appurtenant work—all located in the City of Newark, Essex County, New Jersey.

Particulars that may enable Contractors to judge of the character of the work are given below:

APPROXIMATE QUANTITIES.

Item 1.—Earth excavation and refilling, in trench, for effluent and intake conduits, and appurtenant work, including regrading and disposal of surplus material, complete ....2,720 Linear Feet

Item 2.—Earth excavation and refilling for sedimentation basins, Venturi meter chamber, and all other structures, excavating for and maintaining mosquito ditches; and all other excavations save those included under Item 1; for all regrading and disposal of surplus material; and for all appurtenant work, etc. ....Lump Sum

Item 3.—Rock excavation in open excavations ....100 Cubic Yards

Item 4.—Concrete masonry, Class A, 1:2:4, with Portland cement, 20,000 Cubic Yards

Item 5.—Concrete masonry, Class B, 1:2½:5, with Portland cement mortar, 48,000 Cubic Yards

Item 6.—Boulder concrete masonry, Class C, with Portland cement, 1,000 Cubic Yards

Item 7.—Brick masonry, with Portland cement mortar... .....200 Cubic Yards

Item 8.—Timber piles, in place, 200,000 Linear Feet

Item 9.—Steel for reinforcement, etc., in place ....2,800,000 Pounds

Item 10.—Broken stone road surfacing, 8,000 Sq. Yards

Item 11.—Surface drains, vitrified pipe, complete, in place..........Lump Sum

Item 12.—Gallery piping; cast iron piping system for 20 in. sludge and 6 in. water mains, and 4 in. wrought iron air main, including all valves, specials, connections, etc., complete, in place.Lump Sum

Item 13.—Sludge main, 20 in., hub and spigot, cast iron pipe, including manhole pipes, plug drain valves and specials, complete, in place...........Lump Sum

Item 14.—Gate valves, six 60 in., and including all 60 in. cast iron piping in Venturi meter chamber in place, complete ....Lump Sum

Item 15.—Sluice gates, twenty-four, 24 in. x 36 in., including gate hoists, stem guides, etc., in place, complete, Lump Sum

Item 16.—Sluice gates for effluent controlling house; two, 5 ft. x 10 ft. and four, 6 ft. x 8 ft., with operating mechanism, complete and in place.......Lump Sum

Item 17.—Miscellaneous iron castings, such as floor plates, pressure covers, stop plank grooves, etc., complete and in place ....50,000 Pounds

Item 18.—Air compressors in administration wing, including all electric wiring, piping, etc., complete and in place, Lump Sum

Item 19.—Electric wiring and lighting system in sedimentation basin galleries and elsewhere, complete and in place, Lump Sum

Drawings, form of contract and specifications, and blank form for proposal, may be obtained at the Commissioners' office from William M. Brown, Chief Engineer.

The Commissioners reserve the right to reject any or all bids.

PASSAIC VALLEY SEWERAGE COMMISSIONERS.
JOSEPH H. QUIGG, Clerk.
January 11, 1916.

CONTRACTING NEWS

Of Special Interest to Engineers, Contractors, Builders and Manufacturers of Engineering and Building Supplies

THE DEMAND for building materials is largely governed by the terms on which money can be secured to finance the construction of those classes of buildings constructed for rent or for sale. If the demand for building space is such that a quick return on the investment is assured, neither tight money nor high prices of building materials can hold back construction. The mortgage situation at present is thought to be such that plenty of money will be available this spring if the demand for renting space warrants construction. This demand is gaged with considerable accuracy by the amount of estimating being done by architects, which reflects the belief of owners that the demand is to be good. Judging from the fact that a considerable amount of estimating is being done at present, it seems that sufficient demand for space is expected to develop to make building profitable for owners in spite of recent advances in materials.

Lumber reports from the Eastern and Southern districts indicate that the volume of orders is again in excess of production after the decline due to severe weather and the holidays. Car builders and manufacturers, as well as export buyers, have been taking an unusually large share of lumber products, and, with the winter's lull apparently at an end, there has been little opportunity for the mills to build up stocks, which are at a low ebb. Shipments and production having been hampered in the South by floods, and in the Northwest by cold and snow, the lumber industry is entering upon what may prove to be a very busy year with little reserve to draw on.

Buildings

Contracts amounting to $208,000 have been awarded for building a library at Montpelier, Vt. The construction of a $250,000 hospital has been contracted for at Salem, Mass. The construction of a $500,000 locomotive plant has been contracted for at Philadelphia. Bids have been opened for building the county court house at Sioux City, Iowa, which will cost $528,000. A sugar factory to cost $600,000 has been contracted for at Medford, Ore. A low bid of $200,000 has been received at San Bernardino, Cal., for erecting the county hospital.

An architect has been selected at Providence, R. I., for the $300,000 high school to be built there. Plans have been filed in New York City for an $800,000 office building and for a $300,000 hotel. A ship-building company has applied to the Baltimore board of estimate for approval of plans for shops, etc., to cost $500,000. A $1,000,000 powder-plant extension is to be built at New Castle, Pa. Plans have been prepared in Pittsburgh for a $300,000 armory. Plans are being prepared for remodeling a coliseum in Cleveland at a cost of $250,000. It is reported that a hotel costing $200,000 is to be built at Indianapolis, and that the light and heat company of that city is to erect a $4,000,000 central power station. The construction of a packing plant to cost $500,000 is under consideration at Billings, Mont. A contract is to be let next fall for a $175,000 mining building for the University of Arizona at Tucson. The construction of a factory to cost $350,000 is contemplated at Seattle, and plans are being prepared for a $350,000 theater. The state of California has sold $800,000 bonds for the San Francisco state building.

Bridges and Roads

The Boston Elevated Railway Company has awarded a contract for constructing the piers for the Mystic River bridge. The bridge over the Platte River at Schuyler, Neb., has been contracted for at $51,500. Plans have been prepared in Boston for a $50,000 concrete bridge. Plans are being prepared for a $110,000 concrete highway bridge at Warren, Pa. A bill providing for the $1,000,000 bridge over the Potomac River at Washington has been reported favorably to the House of Representatives. Funds have been voted by the city council for the $370,000 Tenth Avenue bridge at Seattle. Plans for a $170,000 steel bridge at Nichlous, Cal., are to be referred to the War Department for approval. The sum of $65,000 has been subscribed by Colusa County toward the construction of a bridge over the Sacramento River at Cranmore, Cal.

A contract for constructing a highway has been awarded at Monroe, Mich., for $153,000. A road contract amounting to $134,000 has been awarded at Los Angeles. Two paving contracts amounting to $64,000 have been awarded at Bakersfield, Cal. Bids will be opened March 8 at Atlantic City, N. J., for building a boulevard involving 106,000 sq. yd. of paving, over 200,000 cu. yd. of fill, eight pile bridges and one drawbridge. Bids for constructing 3 miles of paving will be opened March 7 at Oakland, Iowa. Paving work to cost $205,000 will be let March 10 at Seattle.

A bill providing $10,000,000 for the construction of highways in the up-state counties has passed the New York State assembly. A road costing $125,000 is to be built near Greensboro, N. C. County road bonds amounting to $359,000 will be sold March 15 at Winchester, Tenn. Paving work to cost $112,000 is being considered at Alton, Ill. The sum of $3,000,000 has been voted at Clayton, Mo., for constructing county roads. Mason City, Iowa, will soon let contracts for 210,000 sq. yd. of paving. Plans for 1,000,000 sq. yd. of paving are being completed at Topeka, Kan. Contracts for constructing highways to cost $350,000 will be let soon at Globe, Ariz. Preliminary surveys have been completed for another $100,000 hghway in California. This state has also sold $1,500,000 additional highway bonds.

Waterworks and Sewers

Contracts amounting to $115,000 for waterworks construction have been awarded at Oshkosh, Wis. Bids are desired March 8 at Durham, N. C., for constructing a reservoir 8½ acres in extent. The construction of a reservoir to cost $750,000 is under consideration at Waterbury, Conn. A contract is to be let in the spring at Ada, Ohio, for sewer works to cost $40,000. Plans for a sewer to cost $98,000 are under consideration at Streator, Ill. Improvements to the sewerage system of Grosse Pointe, Mich., which will cost $285,000, are under consideration. Sewer work amounting to $66,000 has been authorized at Salt Lake City. Storm sewers to cost $63,000 are to be built at Billings, Mont. The sum of $150,000 has been voted for waterworks construction at Great Falls, Mont. An intermediate reservoir and 18 miles of pipe lines have been surveyed and are to be built shortly near Oatman, Ariz.

Miscellaneous

The New York City subway contracts noted last week have been awarded to the low bidders. Bids have been opened by the New York Municipal Railway Corporation for the construction of a double-deck terminal at Coney Island. The newest bids received by the New York State Superintendent of Public Works for the lock and dam at May's Point was $257,000, and for a section of state canal, $420,000. A contract for constructing a $600,000 irrigation system at Grand View, Ore., has been awarded. Bids are desired for 450,000 cu. yd. of dredging and for 1,000,000 cu. yd. of fill by the Directors of the Port of Boston.

Application has been made at Cleveland for permission to sell bonds to build an electric railway costing $261,000. Improvements planned by the Galesburg (Ill.) Light and Railway Company will cost $225,000. Plans have been completed for a $250,000 irrigation development at Tacoma, Wash. Applications to the California State Water Commission have been made for constructing a large dam at Bakersfield and for constructing a $1,232,000 irrigation development.

WATERWORKS

PROPOSED WORK.

Waterbury, Conn.—The Board of Aldermen is considering the construction of a third reservoir at the west bank costing about $750,000. A report has been submitted to the Board asking $100,000 for preliminary work incident to the construction of this reservoir. Address City Engineer.

Avon, N. Y.—Election will probably be held in March to vote on constructing an additional reservoir; probable cost $6,000.

Ilion, N. Y.—Board Water Commissioners has decided to construct two more filtration beds and to reconstruct the walls of the coagulation basin at an approximate cost of $30,000.

North Tonawanda, N. Y.—Board of Public Works has requested Common Council to authorize a $40,000 bond issue for installing new boilers, pumps, smokestacks, etc.

Perry, N. Y.—Village Trustees have engaged C. C. Hopkins, Rochester, to prepare preliminary plans for a modern slow sand filtration plant to purify the water used by the village.

Watertown, N. Y.—Common Council has voted to add eight filtration beds and two coagulation basins to the city's filtration system, at an estimated cost of $53,000. E. W. Sayles, City Engineer.

Magnolia, N. J.—Laurel Springs Water Co. will apply for a franchise to lay pipes through borough of Magnolia.

Altoona, Pa.—Commissioner John P. Stouch, of the Water Department, has instructed City Solicitor T. C. Hare to prepare an ordinance authorizing construction of feeding lines direct from main Kittanning Point line to the reservoir. Cost $25,000.

Braddock, Pa.—It is proposed to install at the water works two 3,000,000-gal. centrifugal pumps and motors. Hamp Hopkins & Taylor, Engineers, Second National Bank Bldg., Pittsburgh. S. L. Todd, Borough Secretary.

Brackenridge, Pa.—Construction of a municipal water system is under consideration. Address Borough Clerk.

Lancaster, Pa.—Contract soon to be let for improving water works. Address Superintendent of Water Works.

McKeesport, Pa.—Reported building of an intake to Monongahela River costing about $74,000 is under consideration by Council. Address City Clerk.

Pennsylvania.—State Water Supply Commission, Harrisburg, has approved the following applications: Pennsylvania Railroad Company, to construct bridge across Moose Run, at Milesburg, Centre County, Pa.; also permission to construct a bridge across the Schuylkill River, north of Ridgewood, Berks Co. Cambria Steel Company, to construct wall along the right bank of the Conemaugh River, from Cambria City Bridge to Fourth Avenue Bridge, city of Johnstown, Cambria County. Butler Water Co., to install flashboards in the spillway of its Boydetown dam on Connequenessing Creek in Butler County. Findley Run Water Supply Co. (a subsidiary of the Cramer Coal, Coke & Stone Company), to construct a dam on Findley, or Trout run, one-half mile above Cramer, in East Wheatfield Township, Indiana County. Philadelphia & Reading Railway Company, to construct bridge across Manatawney creek, 500 ft. north of Pine Forge Station, Berks County. Supervisors of Jackson Township, Cambria County, to construct concrete culvert across Salt Lick run, at Burkharts Station. Baltimore & Ohio Railroad Co., to construct bridge No. 26 across Blue Lick run, 0.7 miles west of Salisbury Junction, Somerset County. Baltimore & Ohio Railroad Co., to construct Bridge No. 31 across an unnamed tributary of Casselman River, 1.6 miles west of Garrett, Somerset County. Carnegie Steel Co., to make a change in the channel of Thompson run, beginning 1.6 miles above mouth and extending to said mouth, near Gascola Station on Patton-Penn Township Line, Allegheny County. Bessemer & Lake Erie Railroad Co., to construct a bridge across Cool Spring creek (Bridge No. 25), 3.4 miles east of Houston Junction, Mercer County. Baltimore & Ohio Railroad Co., to construct Bridge No. 30 across Pine or Piney run, 0.9 mile west of Garrett, Somerset County. Baltimore & Ohio Railroad Co., to construct Bridge No. 32 across Weiner run, 2.0 miles east of Rockwood, Somerset County. Philadelphia & Reading RR. Co., to rebuild a culvert across Tacony and Jenkintown Road 3000 ft. east of Jenkintown Station, Abington Township, Montgomery County. M. S. Hershey, to construct bridge across Spring Creek, in Hershey Park, Derry Township, Dauphin County. M. S. Hershey, to construct bridge across Manada Creek, in South Hanover Township, Dauphin County. Lukens Iron & Steel Co., to construct a conduit across Sucker run, in Valley Township, Chester County. Pennsylvania Railroad Co., to make a change in or addition to Bridge No. 33, Creason Division, across Chest creek, near La Jose, Clearfield County, Pa. Supervisors of Conewago Township, Adams County, to construct a bridge across Indian run, southeast of Mount Pleasant, on road to Baltimore Pike. Pennsylvania Railroad Co., to renew piers under Bridge No. E-2, across Red Bank Creek, in Hawthorne Borough, Clarion and Armstrong counties, Pa. MacBeth-Evans Glass Co., to make a fill along the left or west bank of the Monongahela River, at Charleroi, Washington County, Pa. Pennsylvania Railroad Co., to construct an extension to Bridge No. 107.46 (old No. 156), for one additional track, across Armstrong creek, 700 ft. above mouth and 4784 ft. westward, in direction of traffic, from Halifax, in Halifax Township, Dauphin County, Pa. Pennsylvania Railroad Company, to construct an extension to Bridge No. 108.16 (old No. 157), across Gerty's run, 180 ft. from mouth, and 1.63 miles westward, in direction of traffic, from Halifax Station, in Halifax Township, Dauphin County, Pa. Pennsylvania Railroad Company, to construct fills along the east bank of Oil Creek, at Rouseville and near Rynd Farm Station, in Cornplanter Township, Venango County, Pa. Pennsylvania Railroad Co., to construct a bridge across the Schuylkill River, south of Orrton Station, Berks County, Pa.

Renovo, Pa.—Borough Council will construct a reinforced concrete reservoir about 50,000-gal. capacity.

Sharon, Pa.—Improvements costing $50,000 are to be made this summer by the Sharon Water Company.

Madison, W. Va.—Construction of municipal water works, to cost $12,000, is under consideration. S. E. Bradley, Engineer, Madison. H. W. B. Mullin, Mayor.

Wheeling, W. Va.—Mayor Harvey L. Kirk is in favor of installing a filtration plant. Address Chairman Committee on Lights and Water.

Acworth, Ga.—Citizens voted in favor of a new water works and electric light plant.

Savannah, Ga.—J. P. Flagg, Superintendent and Engineer of the Water Works Department, has submitted a report recommending purchase of a 15,000,000 gal. pump for Gwinnett Street Station, and an air compressor.

Summerville, Ga.—J. B. McCrary & Company, Atlanta, engaged as engineers for the proposed water works. Address City Clerk.

Tifton, Ga.—Election to be held to vote $76,000 bonds for municipal improvements, including $30,000 for high school, $25,000 for water works, including mains and sewerage system; $15,000 for street improvements.

Hurtsboro, Ala.—Citizens voted $9,000 bonds for water works and extensions to electric light plant.

Lenoir City, Tenn.—The improving of the water works is under consideration by city. Prof. John A. Switzer of Knoxville will probably be asked to prepare plans, etc., for the improvement. Address City Clerk.

Bowling Green, Ky.—Council has authorized construction of a sedimentation basin in connection with the water works system.

Newport, Ky.—See "Paving and Roads."

Whitesburg, Ky.—The installation of water works and other public utilities is under consideration. J. J. Bell, Lexington, is interested.

Coshocton, Ohio.—Construction of the 3,000,000-gal. reservoir will be begun at an early date under the supervision of Chester & Fleming, Engineers, Pittsburgh, Pa.

Defiance, Ohio.—The company which has taken over the water plant, and of which Judge Julian Tyler, 1605 Second National Bank Building of Toledo, is president, will construct filtration plant, costing $60,000.

Ironton, Ohio.—Council voted $250,000 bonds for constructing water works. Address City Clerk.

Lima, Ohio.—Election soon to be held to vote bonds for a new water supply system. Engineers have made a survey and submitted a report estimating cost at $550,000, including new reservoir, and $110,000 will be needed for new filtration plant.

East Palestine, Ohio.—City Council has authorized an issue of $35,000 bonds for water works improvements, but an election will probably be held on the matter before finally settled. Address City Clerk.

Ravenna, Ohio.—Ordinance passed by Council authorizing issue of $40,000 bonds for purchase of site and building of dam, and water treatment plant, and laying pipe and necessary appurtenances for improving water works. Address City Clerk.

St. Marys, Ohio.—F. H. Frochlish, Engineer, 813 Second National Bank Building, Toledo, expects to report about March 15 on the reconstruction of the water works and electric light plant. An election is to be held on the question of improvement. Probable cost $50,000.

Zanesville, Ohio.—Director of Public Service authorized to engage an engineer to prepare plans and specifications for an improved water supply. The citizens recently voted in favor of wells.

New Albany, Ind.—Reported extensive improvements are to be made in the pumping station of the New Albany Water Co.

Wauconda, Ill.—Council authorized constructing water works. About $18,000 will be spent in water works, electric light plant and erecting a township high school. Address City Clerk.

Denmark, Wis.—Village voted $20,000 bonds for constructing water works and sewerage system. Address Village Clerk.

Merrill, Wis.—City is reported considering the purchase of the present water works. Address Mayor.

Greensburg, Kan.—Petitions being circulated for water works system costing $30,000. Address City Clerk.

Oskaloosa, Kan.—Council is considering holding an election to vote on constructing water works.

Ottawa, Kan.—A filtration plant costing about $15,000 is being considered. Address City Clerk.

Crofton, Neb.—Citizens voted water works bonds for extensions to the system. Address City Clerk.

Great Falls, Mont.—Citizens voted a $150,000 bond issue for constructing a filtration plant and water softening plant. Address City Clerk.

Pocahontas, Ark.—J. B. McCrary & Company, Little Rock, are engineers for the water works district.

Cooper, Tex.—Henry E. Elrod, Southwestern Life Building, Dallas, engaged to prepare plans for water works and sewerage system.

Denver, Colo.—The $8,000,000 bond issue for municipal water works has been declared valid by the U. S. Circuit Court of Appeals.

Texhoma, Okla.—City Board has been authorized to raise funds for improvements to the water works and sewer system.

Everett, Wash.—Ordinance passed by Council providing for condemnation of water plant owned by Everett Railway, Light & Power Company, is a preliminary step toward expenditure of $600,000 in extensions and improvements. Hans Mumm, Jr., City Engineer.

Seattle, Wash.—Contract soon to be let by Board of Public Works (L. B. Young, Chmn.), for water mains in Forty-third, Avenue N. E., and other streets, at a cost of $37,000. A. H. Dimock, City Engr.

Canby, Ore.—Council will either purchase and improve existing plant or construct a new water works: New system would cost $15,000.

Yoncalla, Ore.—Election to be held April 17 to vote $20,000 bonds for constructing water system. Surveys have been completed. M. B. Germond, Engr., Roseburg, Ore.

Portland, Ore.—City Council passed an ordinance authorizing sale of $125,000 bonds to purchase St. Johns water plant or build a new one.

Calexico, Cal.—Water works bonds will be sold Feb. 29. It is proposed to construct municipal water works costing $60,000, to include 8, 10 and 12 in. c. i. pipe. Blaisdell Company, Engineers, Pacific Electric Building, Los Angeles; C. B. Browne, City Clerk.

Corcoran, Cal.—City has asked State Railroad Commission to compel Corcoran Water & Gas Co. to install large pipes, construct a 60,000-gal. tank on an 80-ft. tower and make extensions to water system.

Covina, Cal.—F. H. Trask, Los Angeles, is engineer for proposed municipal water works. An election is to be held Feb. 28 to vote on the question.

El Centro, Cal.—City Trustees may call an election to vote $35,000 bonds for a water filtration plant.

Sacramento, Cal.—The proposition to connect between Sump No. 1 and Sump No. 2 has been abandoned. C. L. Knight, Deputy City Engineer.

Casa Grande, Ariz.—Citizens voted $35,000 bonds for installing a municipal ice plant, water works and light plant. Plans have been prepared. Sidney F. Mashbir, City Engineer.

Oatman, Ariz.—Mohave Oatman Water Company (D. L. Mauhew, Secy., Oatman), has completed a survey for 18 miles pipe line to Oatman from Colorado River and will install 16 in. pipe and construct intermediate reservoir with distributing lines to Oatman and various mines in the district; company also intends installing a sewer system.

Salt Lake City, Utah. — City Commission has authorized laying water mains extensions on various streets at a total cost of $66,000. The main on Seventeenth Street E. is to be 12 in. and will cost alone $28,000. Address City Engineer.

BIDS DESIRED.

Lancaster, Pa.—Until March 22 by Water Committee for furnishing and erecting centrifugal pumping machinery, Contract No. 1, advertised in Engineering Record.

South Boston, Va.—Until March 30, by Mayor and Board of Aldermen for furnishing material and installing pumping station and filter plant building, auxiliary pumping station, coagulating basin, etc., advertised in Engineering Record. Anderson & Christie, Inc., Consulting Engineers, Charlotte, N. C.

Durham, N. C.—Until March 8 by the Mayor and Board Aldermen for constructing an earth and concrete reservoir, to consist of approximately 8½ acres stripping, 45,000 cu. yd. embanking, 3000 sq. yd. concrete pavement, etc., advertised in Engineering Record. Gilbert C. White, Engr., Durham.

Athens, Ohio.—Reported desired until Feb. 29, by Director of Public Service for new water mains and constructing a 2,000,000 gallon reservoir on North Hill.

Columbus, Ohio.—Reported desired until Feb. 29, by Board of Purchase (L. J. Guthke, Secy.), for furnishing and delivering 10,000 ft. 2-in. and 5000 ft. ¾-in. galvanized pipe; also lead and c. i. pipe.

Shaker Heights (Cleveland P. O.) Ohio. Reported desired until March 13, by Carl A. Palmer, Village Clk., 2855 Coventry Road, for water mains, storm and sanitary sewers, paving, etc., in various streets. B. W. Willard, Village Engr., 804 Marshall Bldg., Cleveland.

Fairbury, Ill.—Until March 15 by City Council for drilling and casing an artesian well, advertised in Engineering Record. T. W. Burns, Engineer.

New Ulm, Minn.—Until March 7, by Wm. Backer, City Clerk, for repairing or rebuilding of a (Luitweiler) deep well working head, present head now working on well 180 ft. deep, attached to 7¾ in. working barrel and delivering 225 gal. per minute against 15 lb. pressure, head to be rebuilt to work on same depth attached to 5¾ in. working barrel and to deliver about 150 gal. per min. against 80 lb. pressure. Also separate bids same time and place for furnishing material for one belted deep well working head, discharge to be 225 gal. per min. against 80 lb. pressure, 180 ft. deep, 7¾ in. working barrel, with electric motor, starting apparatus and switch complete. F. D. Minium, City Engineer.

Kiowa, Kan.—Until March 7, by City Clerk, for furnishing material and installing an additional generating unit to water works, to consist of 250 h.p. oil engine and a 175 k.w. alternating current generator.

Malta, Mont.—Until March 8, by U. S. Reclamation Service, Washington, D. C. (A. P. Davis, Ch. Engr.), for two pressure pumps, each 30 gal. per min. capacity, for Yakima, Wash., and Milk River Front projects.

Polson, Mont.—Until March 20, by City Clerk for constructing water works, advertised in Engineering Record. F. F. Faucet, Engineer, Polson.

Malvern, Ark.—Until March 1 by Commission Water Works Improvements Dist. No. 10, Sewer Improvements Dist. No. 11, at offices of Commissioners, for furnishing material for waterworks and sewerage systems to consist of 12,600 ft. gal. pipe, 100,000-gal. tank on 75-ft. tower, 500-gal. motor-driven service pump, 500-gal. motor-driven centrifugal pump, etc. 147,000 brick, 31 flush tanks, etc.

Jones, Okla.—Reported desired until March 10 (readvertisement) by Board Town Trustees for constructing water works and electric light system. Benham Eng. Co., Colcord Bldg., Oklahoma City, Okla., Engineers.

Arcadia, Cal.—Until March 2, by Geo. E. Grimes, City Clk., for 5000 ft. galvanized pipe from ¾ to 2 in., etc.

Collingwood, Ont.—Until March 1, by Hugh A. Currie, Chmn. Collingwood Water & Light Commission, for steel water tower, foundation for tower, pumping machinery, comprising one motor-driven unit, 800 Imperial gal. capacity, pump, wells, etc. Chipman & Powers, Engrs., 204 Mail Building, Toronto.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★Wilson, N. C.—Contract awarded Lynchburg Foundry Company, Lynchburg, Va., for pipe for both the water and gas systems; probable cost $45,000.

Dunedin, Fla.—Edwards Construction Company, Tampa, reported to have submitted lowest bid for improvements here, including waterworks, sewerage system, street paving and constructing a public dock.

★Camden, Ala.—Contract for a 50 hp. oil engine direct connected to a 500 gal. per min. duplex pump and 150 cu. ft. per min. corp. compressor, awarded Fairbanks-Morse & Company, New Orleans, La., at $3,107. Edgar B. Kay, Engineer, Tuscaloosa. (Bids opened Feb. 9.)

★Philadelphia, Miss.—Contract for constructing waterworks awarded J. M. Evans & Company, Jackson, Miss. Citizens recently voted $30,000 bonds for said system. M. L. Culley, Jackson, Engineer. J. M. Irving, City Clerk.

★Toledo, Ohio.—Contract awarded Pittssburgh-Des Moines Steel Company, Pittsburgh, Pa., for a water tower with 250,000 gal. capacity to be built at Ottawa Hills for the W. H. Close Realty Company.

★Bloomington, Ill.—Contract for furnishing a 6,000,000 gal. pump for water works awarded American Well Works, Aurora, at $1,400. C. C. Williams, Superintendent Water and Light.

Viola, Ill.—Following are low bidders, opened Feb. 14 by Board Trustees, on constructing waterworks: Tower and tank, Chicago Bridge & Iron Works, Chicago, $4,100; Sewell Well Company, St. Louis, Mo., machinery and piping, $3,400; F. E. Luedburg, Viola, pump station, $1,500. Terhune & Horton, Civil & Sanitary Engineers, Peoria.

★Milwaukee, Wis.—Contract awarded by Department of Public Works to Chapman Valve Mfg. Co., Indian Orchard, Mass., for furnishing 1700 tons 6, 8, and 12 in. pipe, 333 gate valve, etc. (bids opened Feb. 9.)

Oshkosh, Wis. — Following are bids recommended for award for constructing the filtration plant (bids opened Jan. 31): Filtration structure, Section 1, also cover to reservoir, Section 4, Larsen Construction Co., Oshkosh; filter appliances and accessories, Section No. 2, Robert Filter Manufacturing Co., Darby and Philadelphia, Pa.; elevated tank, Section 3, Wausau Iron Works, Wausau, total cost $115,250. The Council is considering an additional $50,000 water works improvement bond issue; $72,036 is available, but final contracts cannot be signed until full amount is available.

Jones, Okla.—All bids opened Feb. 10, by Chester A. Keyes, City Clerk, for constructing water works and electric light plant have been rejected. The lowest bid opened Feb. 10 was from Kerby & Company, Oklahoma, at $10,554.

★Galveston, Tex. — Contract awarded Layne & Bawler Company, Houston, for sinking three wells at $17,500 (bids opened Feb. 10.)

★Santa Ana, Cal. — Contract awarded United States Cast Iron Pipe & Foundry Company, San Francisco, at $35.60 per ton for 5000 ft. class A c. i. pipe, 6 in., and at $37.60 per ton for 1500 tons class A c. i. pipe 4 in.

SEWERAGE AND SEWAGE DISPOSAL

PROPOSED WORK.

Boston, Mass.—Mayor Curley in his address to Council recommends appropriation of money for the study of purification for commercial use of the city sewage.

Rochester, N. Y.—All bids opened recently for a grit excavator at disposal plant have been rejected. Address Board of Contract and Supply.

Newark, N. J.—Reported plans being prepared for a sewage disposal plant for South Orange Township.

Pitman, N. J.—Board of Trade interested in the building of a municipal sewer system.

Ambler, Pa. — Citizens voted $30,000 bonds for street and sewage disposal.

Corry, Pa.—City Commission is considering constructing new system and sewage disposal plant.

Milton, Pa.—Borough Council engaged an engineer to prepare estimates for a sewage disposal plant.

Orange, Va.—Seville & Company of Richmond engaged to survey for a sewerage system contemplated here. Address Business Men's Assoc.

Burlington, N. C.—King Cotton Mills and the E. M. Holt Plaid Mills have applied to Council for permission to install a modern sanitary sewage disposal plant in the mill communities.

Macon, Ga.—Contracts soon to be let by the city for constructing sewer in Vineville branch. Cost estimated at $25,000. Address City Engineer.

Tifton, Ga.—See "Waterworks."

Dunedin, Fla.—See "Water Works."

Ada, Ohio.—Contract will be let about May 1 by City Engineer, for constructing 3000 ft. 30-in. and 4208 ft. 60-in. sewer to cost $40,000. J. S. Wetherell, County Engineer, Kenton, Designing Engineer.

Akron, Ohio.—Sewer bonds amounting to $24,200 have been sold.

Canton, Ohio.—See "Paving and Roads."

Delphos, Ohio.—Black & Veatch, Kansas City, Mo., are engineers for the proposed sewer system to cost $30,000.

Lima, Ohio.—Director of Public Service authorized to receive bids for surveying present sewer system and recommendations of improvements to make it a first-class sewer system.

Springfield, Ohio.—Sewer bonds amounting to $24,500 have been sold. Address Director Public Service.

Lafayette, Ind.—City Council has passed resolution to construct a sewer for territory south of South Street and east of Columbiana Park. Harry Overesch, City Engineer.

Princeton, Ind.—City is planning a number of sanitary sewers. Address City Engineer.

Battle Creek, Mich.—Election to be held April 3 to vote $50,000 bonds for sewer improvements. City will do their own work. W. W. Bridgen, Engineer, Battle Creek. Thomas H. Thome, City Clerk.

Grosse Pointe, Mich.—Election to be held March 9 to vote on $285,000 bonds for improving sewerage system. Plans provide for a tank to purify the sewage and for some alterations to the present system. Address Village Clerk.

Beardstown, Ill.—Election will be held in April to vote on a $30,000 bond issue for constructing a sewer system.

Crete, Ill.—Board of Local Improvement is considering constructing sanitary sewers estimated to cost $48,344.

Rock Island, Ill.—Petitions being filed in County Court for constructing a sewage plant between Eighteenth and Twenty-third Avenues and Twenty-third and Twenty-fourth Streets; estimated to cost $16,457. Address City Clerk.

Streator, Ill.—City Council is considering plans for Coal Run Creek sewer; estimated to cost $97,981.

Marshfield, Wis.—Council is reported considering the issuing of $20,000 bonds for sewer improvements, including construction of a sewage disposal plant.

Milwaukee, Wis.—The Finance Committee recommended to Council appropriation of $1,560,000 to complete intercepting sewer system. Also that a bond issue of $840,000 for school improvements be submitted to the people at coming election. Ordinances for a $50,000 animal house, $20,000 to complete grand stand in Washington Park, $300,000 for Lake Shore Drive and $240,000 for the new Long Avenue bridge were approved by the Finance Committee.

Ellis, Kan.—Council considering constructing a sewer system.

Lincoln, Kan.—Ronald & Co., Kansas City, Mo., are engineers for a $40,000 sewer system to be installed here.

Baker, Mont.—Council has directed City Engineering Department to prepare an estimate of cost of a 2-unit sewer system for District No. 3, which includes Morris, Monroe and Savage Additions.

Billings, Mont.—Reported city will create a storm sewer district to drain the entire north and west sides of the city at a cost of $63,300. A. E. Gerhart, Mayor.

Cooper, Tex.—See "Waterworks."

Itasca, Tex.—Election to be held March 11 to vote $15,000 bonds for constructing a sewer system. Address Mayor.

Oakesdale, Wash.—Council has appointed a committee to investigate the cost of installing a sewerage system.

Los Angeles, Cal.—The Finance Committee has recommended an appropriation of $15,000 for repairs to the outfall sewer which collapsed recently. An additional $15,000 may be needed later to complete the repairs. Address City Engineer.

BIDS DESIRED.

Boston, Mass.—Until 12 M. March 1, by Supply Department (D. Frank Doherty, Secy.), for furnishing iron castings, manholes, catchbasins, frames and covers, tide gates, iron inlets, etc., required between March 1, 1916, and Jan. 31, 1917.

North Bergen, N. J.—Until March 2 (extension of date) by Township Committee for constructing system of sanitary and storm sewers in Secaucus Road. Estimated cost $20,000. P. A. Brady, Township Clerk.

Chardon, Ohio.—Until March 3, by Robert S. Parks, Clerk Village Council, for approximately 1½ miles of sanitary sewers. Mostly 8 in. E. A. Fiedler, Village Engr.

Cleveland, Ohio.—Reported desired until March 2, by Board Purchase and Supply for constructing sewers in 10 streets.

Shaker Heights (Cleveland P. O.), Ohio. See "Waterworks."

Crawfordsville, Ind.—Reported desired until March 7 by C. H. Harlan, Clk., for constructing storm vitr. pipe sewers.

Martinsville, Ind.—Reported desired ununtil March 7 by County Commissioners, constructing 36-in. concrete sewers. C. Haase, Co. Surv.

Bad Axe, Mich.—Until March 8, by City Council, for furnishing material for one two-story sedimentation tank, one four section filter, one sludge drying bed or filter, 45,380 lin. ft. 6 to 15-in. pipe, 156 lin. ft. 8 to 15-in. c.-i. sewer pipe, 100 manholes, covers, etc. Rolla W. Roberts, Engr., Saginaw. James A. Burgess, City Recorder, Bad Axe.

Johnson City, Wis.—See "Paving and Roads."

La Crosse, Wis.—Reported desired until March 9, by Board Public Works, for extending trunk sewers. Probable cost, $42,186.

Strawberry Point, Iowa.—Until Feb. 29 (readvertisement) by G. F. Scofield, Acting Town Clerk, for constructing sewers.

St. Paul, Minn.—Until Feb. 28, by August Hohenstein, Purchasing Agent, for constructing sewers in portions of Agate, Chatsworth and Butternut Streets, Prior, Central Avenue and other streets.

Iola, Kan.—Reported desired until Feb. 29, by O. W. Holmes, City Clk., for sanitary sewers to consist of 7035 lin. ft. 8 in. vitr. pipe, manholes, etc. F. B. Bartlett, City Engr.

Kansas City, Mo.—Until Feb. 29, by Board Public Works (Edw. F. Webster, Acting Secy.), for constructing sewers in Dist. No. 346, Sewer Div. No. 4.

Malvern, Ark.—See "Waterworks."

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**New York, N. Y.**—Contract for constructing the Catharine Street barrel sewer under Pier 26, East River (bids opened Feb. 9), awarded by Borough President to the Kingsbridge Contracting Company, 341 Tenth Avenue, at $16,619. Charles E. Gregory, Engineer in charge of sewers.

Rochester, N. Y.—The only bid opened recently by the Board of Contracts and Supplies for revolving screens at the sewage disposal plant was submitted by the Sanitation Corporation of New York City at $68,872.

★**Cuyahoga Falls, Ohio.** — Contract awarded C. Lou Wright, Mt. Vernon, for constructing East Broad Street lateral sewer system, W. Broad Street lateral sewer system and Stow Street lateral sewer system at about $20,000 (bids opened Feb. 7). R. W. Pratt, Engineer, Cleveland; E. D. Barstow, Village Engr.

★**Toledo, Ohio.**—Contract awarded John C. Carland & Company, Spitzer Building, by Welles Bowen Realty Company for installation of a grading and drainage system in the West Moreland addition, opposite Ottawa Park.

★**Youngstown, Ohio.**—Contract awarded P. & P. J. Grady at $32,529 for constructing Dennick Avenue sewer.

Strawberry Point, Iowa.—All bids opened Feb. 15 for constructing sewers have been rejected by the Town Trustees. Two bids submitted were: Oliver G. Kungle, Dubuque, $18,070, and Cook & Kean, Dubuque, $18,137. See "Bids Desired."

★**Mountain Lake, Minn.**—Contract for constructing sewerage system (bids opened Feb. 17) awarded Gerischer & Royer, Chicago, Ill., at $17,013. W. A. Nickel, Village Clerk.

★**Wausa, Neb.**—Contract for 19,000 ft. of sanitary sewers (bids opened Feb. 7) awarded Gordon & Taylor, Denver, Col., at $19,396. Three next bidders: Schmith & Jackson, Sioux City, Iowa, $19,945; Elkhorn Construction Company, Fremont, Neb., $20,164; H. J. Petersen, Omaha, Neb., $20,857. F. B. Anderson, Village Clerk.

Houston, Tex.—Following are four lowest bids opened Feb. 17 by City Council for constructing sewers:

Hill Street Storm Sewer System: Lucius Taylor, Houston, $51,382; F. C. Youmans Construction Co., $51,602; Horton & Horton, $52,534, and Houston Construction Co., $[illegible],980.

Euclid Avenue Sewer: Horton & Horton, Houston, $263,994; H. C. Gass, $272,728, and F. J. Shea, $396,399.

★**Stockton, Cal.**—Contract for constructing sanitary sewers awarded Leech & Decamp. San Francisco, at about $40,000.

BRIDGES

PROPOSED WORK.

Boston, Mass.—Plans prepared by Metropolitan Park Commission for a 3-span concrete arch bridge to be constructed over Charles River at Weston; cost, $50,000.

Albany, N. Y.—See "Hydraulic Construction and River Improvements."

Hopewell, N. J.—See "Railroads."

Watertown, N. Y.—Bonds amounting to $25,000 have been appropriated for constructing a bridge over Black River, to be 360 ft. long, 18 ft. roadway. Contract will be let about April 1. Bids will be considered on both steel and concrete. E. W. Sayler, City Engineer.

Washington, N. J.—Construction of a drawbridge over Morris Canal, replacing present structure at Belvidere Avenue, being considered. Harry Christine, Mayor.

Whitehouse, N. J.—Bd. Freeholders of Hunterdon County (Flemington, county seat) and Somerset County (Somerville county seat) voted to construct a bridge over Lamington River, to be 2-span bridge of steel truss construction and concrete flooring; cost $5,000.

Hollidaysburg, Pa.—It is proposed to construct about five bridges, but nothing very definite has been done about the matter. H. G. Hinkle, Engineer, Altoona; C. H. Edwards, County Clerk, Hollidaysburg.

Pennsylvania.—See "Water Works."

Reading, Pa.—Pennsylvania R.R. (Alex. Shand, Chief Engineer, Philadelphia) intends renewing bridge over Schuylkill River, at Reading, by building intermediate piers and using a half through girder structure with solid concrete floor.

Warren, Pa.—Plans prepared by Leuten Engineering Co., Harrisburg, for constructing county bridge over river to have 4 center piers and 5 spans; cost $110,000.

Baltimore, Md.—Baltimore & Ohio R. R. Co. (F. L. Stuart, Ch. Eng., Baltimore) directed to begin work on constructing viaduct over tracks on Cross Street.

Princess Anne, Md.—Citizens of St. Peter, Dames Quarter, Rock Creek and Deal Island requested the County Commisioners to erect a bridge over thoroughfare at Deal Island and construct a shell road connecting state road leading from this town; estimated cost, $20,000 each.

Washington, D. C.—The House Committee on Interstate and Foreign Commerce reported Feb. 11 favorably on the bill providing for construction of a $1,000,000 aqueduct bridge over Potomac River connecting Washington, D. C., and Virginia.

Richmond, Va.—Virginia Railway & Power Co. will construct a bridge over Appomattox River to replace present structure.

Louisburg, N. C.—Construction of a concrete bridge over Tar River, at cost of $14,000, is contemplated by county.

Bradentown, Fla.—Construction of a bridge over the Manatee River, between Bradentown and Palmetto is contemplated. Board of Trade is interested.

Fort Myers, Fla.—Special road and bridge bonds for $102,500 will be sold March 6 by Board County Commissioners. H. A. Hendry, Clk.

Knoxville, Tenn.—Bd. City Commissioners appointed as a committee of the whole by Mayor John E. McMillan to confer with Southern Ry. Co. in regard to constructing Gay Street Viaduct.

Covington, Ky.—Election will be held in Kenton County April 10 on issue of $200,000 bonds for constructing roads and bridges.

Bloomington, Ind.—Contract will be let between June and August for constructing steel county bridges to cost $10,000. Address County Clerk.

Decker, Ind.—W. J. Jackson, Receiver of the C. & E. I. R.R. (L. C. Hartley, Ch. Engr., Chicago, Ill.), is taking steps to construct a railroad bridge over the river near Hazelton.

Indianapolis, Ind.—T. C. Gulden, County Surveyor, has filed with the County Commissioners plans, specifications and profiles for 35 bridges, bridge repair work and retaining walls.

Beloit, Wis.—M. A. Rosson, Beloit, is engineer for the concrete arch bridge to be constructed at East Grand Avenue over Rock River (Central Bridge) to have three 70 ft. spans on pile foundations and cost about $25,000. G. E. Heebink, City Engineer.

Omro, Wis.—Contract will be let latter part of March by Wisconsin Highway Commission, Madison, for constructing the bridge at Omro, to be 350 ft. long, have 20 ft. roadway and one 6 ft. walk; consist of five fixed spans and one bascule span to have 70 ft. clear opening. Estimated cost $30,000. M. W. Torkelson, Bridge Engineer.

Mankato, Minn.—Plans approved by Minnesota State Highway Commission and adopted by the city for the Mankato Bridge No. 411. Construction is delayed because of financial reasons. D. D. Price, Engineer, 21 First National Bank Building, Lincoln, Neb.

Wichita, Kan.—Plans being prepared by Wichita Railroad & Light Co. for a bridge to be constructed over Arkansas River at Douglas Avenue, to cost $50,000.

Roundup, Mont.—Reported Town Council considering constructing a concrete viaduct over railroad tracks from Main Street to Fair Grounds; cost $10,000.

Marshall, Tex.—Viaduct bonds amounting to $50,000 have been sold by the city.

Cordell, Okla.—The Township of Bessie will vote on issue of $25,000 bonds for constructing bridges.

Kelso, Wash.—P. M. McLaughlin, County Commissioner, Kalama, and Glen McKenzie, Deputy Engineer, Cowlitz County, inspecting sites for constructing a bridge over Toutel River to replace Eddy Bridge.

Prosser, Wash.—Bd. County Commissioners voted to construct 2 steel span approaches, one 85 ft. long and the other 60 ft. long, to Kiona-Benton Bridge over Yakima River; cost $4,600.

Seattle, Wash.—Council has passed and referred to the Mayor for approval the bill providing for sale of $370,000 bonds for constructing the steel and concrete portion of the Tenth Avenue Northeast Bridge.

Bend, Ore.—Construction of a steel bridge connecting east and west sides of Deschutes River at Bend is contemplated by county. H. A. Kelley, County Engineer, Prineville.

Jacksonville, Ore.—Reinforced concrete bridge 160 ft. long is to be constructed near Tolo in Jackson County. State Highway Dept. at Salem to prepare plans.

Oregon—The State Engineer at Salem has been directed to prepare plans for constructing Marion-Polk County Bridge. Salem, county seat, Marion County. Dallas, county seat, Polk County.

Pendleton, Ore.—The U. S. House passed bill authorizing construction of and appropriating $19,000 for two wagon bridges over Umatilla River at Mission and Thorn Hollow.

California.—Reported State Highway Commission, Sacramento, will this spring construct a 300 ft. concrete and steel bridge across New River, west of Seeley, and timber bridge across same river north of Seeley.

Cranmore, Cal.—Construction of a bridge over Sacramento River between Cranmore and Grimes is reported contemplated by Sutter County (Yuba City, county seat), and Colusa County (Colusa, County seat), Colusa County subscribed $65,000 to meet its share of cost.

Nicholaus, Cal.—An alternative plan for steel bridge to be constructed over Feather River at Nicholaus accepted by county and will be forwarded to War Dept. at Washington, D. C., for approval. Estimated cost, $170,000. Address County Clerk, Yuba City.

Riverside, Cal.—About $23,000 has been lost in this county in bridges through the recent floods.

County Surveyor is preparing plans for a bridge over Temecula River, south of Temecula, and for bridge between Murietta and Temecula.

San Bernardino, Cal.—Plans and specifications soon to be prepared for a number of bridges damaged by the recent high water. Lengths 50 ft. to 150 ft. L. R. Lathrop, County Highway Commissioner.

San Diego, Cal.—City Engineer is completing plans for a 600 ft. pile trestle bridge over San Diego River. Address Allen H. Wright, City Clerk.

Santa Ana, Cal.—Pacific Electric Ry. (J. McMillan, Gen. Mgr., Los Angeles), Los Angeles, is planning constructing a steel bridge of five 90 ft. spans with long trestle approach across new channel of Santa Ana River.

Santa Barbara, Cal.—Contract soon to be let by Board of Supervisors for constructing concrete bridge over Zaca Creek; cost about $11,500. Engineers: Mayberry & Parker, Pacific Electric Building, Los Angeles; also for constructing two concrete bridges in Gaviota Pass; cost $11,500 each. W. M. Thomas, Engineer.

Ventura, Cal.—Board of Supervisors rejected all bids opened recently for furnishing 660,350 lb. steel, 15,800 lb. cast iron and 3000 lb. bolts and washers, and will ask new bids. J. B. McCloskey, County Clerk.

North Dorchester, Ont.—Contract to be let in March for constructing three concrete bridges. C. E. Talbot, Engineer, London, Ont.; W. B. Lane, Clerk, Dorchester.

BIDS DESIRED.

Atlantic City, N. J.—See "Paving and Roads."

Burlington, N. J.—Until March 1, by Board Chosen Freeholders (Harry Hawkins, Clerk), at Mount Holly, for rebuilding the bridge at Broad Street spanning the Assicunk Creek. Jas. Logan, Co. Engr.

Mount Holly, N. J.—Until March 1, by Board Chosen Freeholders (Harry Hawkins, Clerk), for rebuilding the bridge on King Street, spanning the Rancocas Creek. Jas. Logan, Co. Engr.

Wayne, W. Va.—Until March 10, by Samuel J. Crum, County Clerk, Wayne, for constructing two bridges. R. P. Davis, Bridge Engineer, Morgantown.

Arcadia, Fla.—Until March 8, by Board County Commissioners (A. L. Durrance, Clerk), for constructing two concrete bridges, one 60 ft. span acoss Big Paynes Creek, the other across Little Payne Creek 64 ft. long, both in Special Road Dist. No. 1.

Mobile, Ala.—Until March 2, by H. Pillans, Commissioner, for constructing a reinforced-concrete canal in the Southern Drain and a reinforced-concrete bridge over same at Intersection of Virginia and Lawrence Streets; cost not to exceed $7,500.

Dayton, Ohio.—Plans and specifications on file in the New York office of Engineering Record for the three bridges, bids for which are to be opened March 15—Webster, Fifth and Keowee Streets. J. E. Barlow, Dir. Public Service.

Indiana.—By County Commissioners for constructing bridges as follows:

March 7:

Bloomfield, 80 ft. span, also 100 ft. span bridge. Geo. E. Kidd, Co. Aud.

March 8:

Buffton, 35 bridges, retaining walls, etc. C. T. Kain, Co. Aud.

South Bend, one 60 ft. concrete arch of Lute design at Leban, and one 120 ft. steel bridge over Willipa River on East Raymond Camp Road. Chas. B. Nimms, Co. Engr.

Johnson Creek, Wis.—Until April 29, for constructing a 45 ft. span reinforced concrete arch bridge. E. C. Stiehm, Village President.

Hastings, Neb.—Reported desired until March 2, by Board Supervisors, for bridges for year 1916. C. H. Judson, Co. Clk.

Fort Scott, Kan.—Until March 7, by N. J. Rose, Co. Clk., for constructing high truss steel bridge 100 ft. long, 12 ft. roadway, over Osage River, a reinforced concrete 30 ft. long, 16 ft. wide, over Bunnion Creek, and reinforced concrete slab 20 ft. long, 16 ft. wide, over Pain Creek. ..

Sisseton, S. D.—Reported desired until March 3, for constructing steel and concrete bridges and .steel culverts for year 1916. O. E. Lien, Co. Aud., Sisseton.

Donniphan, Mo.—See "Hydraulic Construction and River Improvements."

Fairfax, Mo.—Reported desired until March 6 by County Court (L. R. Scott, Clk.), Rockport, for two 40 ft. and one 50-ft. steel span bridges, in Fairfax. J. A. Krusor, Co. Engr., Rockport.

Santa Barbara, Cal.—Until March 6, by Board of Supervisors for constructing three-hinged skew concrete bridge and a three-hinge arch concrete bridge across Gaviota Creek on State Highway in Fourth Road Dist. Cost $11,500 each. Also for constructing a concrete bridge across Zaca Creek; cost $11,500.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Boston, Mass.**—Contract for constructing foundations for Mystic River Bridge and viaduct and reconstructing Malden Bridge (bids opened Jan. 31), awarded H. Nawn Constructing Company, Roxbury. Edward Mahler, Purchasing Agent, Boston Elevated Railway Company, 101 Milk Street.

Albany, N. Y.— See "Hydraulic Construction and River Improvements."

Chester, Va.—See "Electric Railways."

★**Kentucky.**—Following are four lowest bids opened Feb. 15 by Commissioners of Hardin and Bullitt Counties for constructing a bridge 558 ft. long: Champion Bridge Co., Wilmington, Ohio, $22,229 (awarded contract); Vincennes Bridge Co., $22,388; Oregonia Bridge Co., $22,550, and Nachville Bridge Co., $23,150. R. Wiley, Bridge Engineer, Frankfort.

★**Terra Haute, Ind.**—Contract awarded Bresee Mfg. Company, Mattoon, Ill., for constructing superstructure of concrete bridge over Honey Creek. (Bids opened Feb. 12). Herbert C. Anderson, County Surveyor.

★**Hampton, Iowa.** — Contract awarded A. P. Munson, Marion, Iowa, for constructing three bridges, two in Marion Township, one 45-ft. pony truss and one 26-ft. I-beam; also one in Ingham Township, 90-ft. pony truss, at $9,100. Next three lowest bidders: Iowa Bridge Company, Des Moines, $9,456; Des Moines Bridge & Iron Company, Des Moines, $9,550, and Elkhart Bridge & Iron Company Elkhart, Ind., $10,400 (bids opened by County Comrs. Feb. 18). A. G. Baker, County Engineer.

★**Cloquet, Minn.** — Contract awarded Hewitt Steel Company, Minneapolis, for rebuilding bridge across north fork St. Louis River on road to Duluth.

★**St. Cloud, Minn.**—Contract awarded Minneapolis Bridge Company, 608 Metropolitan Life Building, Minneapolis, at $5,825, for constructing creosoted block floor on Tenth Street Bridge (bids opened Feb. 15). George G. Magnuson, City Clerk.

★**Schuyler, Neb.**—Contract for constructing steel bridges with four 175-ft. connected steel spans with creosoted block roadway and concrete abutments over Platte River awarded by County Commissioners Feb. 12, to Elkhart Bridge & Iron Co., Elkhart, Ind., at $51,500.

★**Jamestown, N. D.**—Contract for constructing corrugated galvanized steel metal culverts (bids opened Feb. 15) awarded by County to Minneapolis Steel & Machinery Company, Minneapolis, Minn. A. Blewett, County Auditor.

Great Falls, Mont.—See "Hydraulic Construction and River Improvements."

★**Austin, Tex.**—Contracts for constructing 6 bridges awarded by City Commissioners as follows: Four reinforced concrete bridges, one at First, Twelfth, Eighteenth and Speedway-Twenty-ninth Streets, awarded McCall-Moore Engineering Co., Waco, at $12,500, $9,175, $8,200 and $7,345 respectively. A. A. Mundt, Austin, for bridge at Fourteenth Street, at $7,100, and Ben J. Knape, Austin, for Twenty-second Street bridge, at $3,895.

Port Angeles, Wash.—Contract for constructing steel bridge, 170 ft. span over Callowa River (bids opened Feb. 7) awarded Charles G. Huber, Seattle, at $9,338. Next two bidders: F. Ryan Co., Seattle, $9,457, and H. A. Cotton & Co., Port Angeles, $10,845. J. W. Warren, County Auditor.

★**Santa Barbara, Cal.**—Following are four lowest bids opened by Board of Supervisors Feb. 7 for constructing four concrete bridges across Nojoqui Creek, between Las Cruces and Vaca—(a) 50-ft. arch, (b) 60-ft. arch, (c) 65-ft. arch, (d) two 50-ft. girder spans: Robert Sherer & Co., Pacific Electric Building, Los Angeles, (a) $6,974, (b) $8,672, (c) $9,453, (d) $14,700 (awarded contracts are all bridges); Domonguez & Walters, (a) $7,500, (b) $9,920, (c) $10,500; Mercereau Bridge & Construction Co., (a) $7,540, (b) $9,400, (c) $10,200, (d) $15,470; Munoz & Munoz, (a) $7,574, (b) $9,773; Boardman Construction Co., (a) $8,389, (d) $15,387; Whitlock & Gorrill, (b) $9,980; E. A. Garland, (c) $11,500, (d) $15,500; C. E. Cotton, (d) $16,550. Three hinge concrete arch bridge across El Capitan Creek: Mercereau Bridge & Construction Co., Pacific Electric Building, Los Angeles, $9,500 (awarded contract); Whitlock & Gorrill, $10,918; Boardman Construction Co., $10,989; Munoz & Munoz, $11,243.

Alaska.—Following bids opened by Maj. J. B. Cavanaugh, U. S. Engr., Burke Building, Seattle, Wash., on Feb. 15, for steel fabrication of a bridge 300 ft. span at Chena Slough, Fairbanks, for Alaska Engineering Commission, as follows: Illinois Steel Bridge Co., $9,265; U. S. Steel Products Co. (2 bids), $11,062 and $11,354; King Bridge Co., $11,200; Pennsylvania Bridge Co., Beaver Falls, Pa., $11,536. The latter named company was only one to meet specifications requiring delivery in 100 days.

PAVING AND ROADS

PROPOSED WORK.

Kingston, R. I.—Construction of a road from Kingston Depot to Dale Carlia Corner is contemplated by county; probable cost $50,000.

Albany, N. Y.—Assembly has passed bill appropriating $10,000,000 for highway construction in up-State counties this year. The bill was recommended in the report of Edwin Duffey, State Highway Commissioner.

Batavia, N. Y.—Common Council voted to pave Oak Street and Lincoln Avenue with asphalt and Ellicott Street with brick.

Canandaigua, N. Y.—About $58,000 Ontario County highway bonds sold.

Elmira, N. Y.—Assembly Cities Committee at Albany favorably reported bill providing $200,000 bond issue for pavements in Elmira.

Belvidere, N. J.—Warren County Bd. Freeholders voted to construct Hope Road as far as White Township, a distance of 4 miles, and Washington Road as far as Oxford, a distance of 4 miles; cost between $14,000 and $16,000 per mile.

Newton, N. J.—Sussex County Bd. Freeholders authorized Harvey Snook, County Engineer, to survey road from Newton to Fredon, about 3 miles of said road to be macadamized at cost of about $30,000.

Woodbury, N. J.—Paving bonds for $25,000 will be sold March 7 by Mayor and Council.

Charleroi, Pa.—Town Council voted to pave Crest Avenue, Fourth and Fifth Streets.

Waynesburg, Pa.—County Commissioners voted to pave Rices Landing Road, distance of 31,042 ft.; about $64,000 is available for road work.

Whitehall, Pa. — Commissioners of Whitehall Township, Lehigh County, have appropriated $58,000 for road improvements, fire system and lighting Mickley Pike with electricity.

Wilkesbarre, Pa.—Reported about 56,238 sq. yd. of brick and asphalt pavements will be constructed in Wilkesbarre during 1916.

Williamsport, Pa.—It is proposed to pave approximately 12,000 sq. yd. on Parker and Arch Streets with brick on concrete foundation at a cost of about $25,000. John B. Otto, City Engineer; John R. Mundy, Asst. City Engineer.

Easton, Md.—State Roads Commission, 601 Garrett Building, Baltimore, has been authorized to spend $30,000 in improving road from Easton to Miles River Ferry.

Princess Anne, Md.—See "Bridges."

Norfolk, Va.—Resurfacing of stone boulevards of Norfolk County reported considered by Commission on Roads and Bridges, cost about $20,000.

Parkersburg, W. Va.—Ordinances have been passed by Council for paving Ann Street, from Third to Eighth Streets, brick, at $16,555; Lynn Street, from Fourteenth to Nineteenth Streets, brick, $11,498.

West Virginia. — Three districts in Raleigh County will soon vote on $400,000 bonds for building permanent roads; Districts in Doddridge and Marion Counties will vote $340,000 road bonds; Randolph County, $220,000; Wetzel County, $100,000; Greenbier County, in the White Sulphur District, on bonds, amount of which has not yet been determined. A. D. Williams, State Road Engineer, Morgantown.

Pineville, W. Va.—Contract will soon be let by the County Commissioners for grading and improving 30 miles of county road. Address Blake Taylor, County Engineer, Pineville.

Greensboro, N. C.—County Commissioners voted to construct a concrete public road from Greensboro to High Point; cost about $125,000.

Atlanta, Ga.—City Council considering paving Home, Greenwich, Park, Austin Avenues with macadam, McDaniel, Walker and other streets with asphalt.

Tifton, Ga.—See "Waterworks."

Dunedin, Fla.—See "Water Works."

Fort Lauderdale, Fla.—Bonds for Special Road & Bridge District No. 1 will be sold March 21, by County Commissioners (F. A. Bryan, Clerk); $250,000 was voted, but $92,000 is available for immediate use. H. C. Davis, Engineer of Board, Fort Lauderdale.

Fort Myers, Fla.—See "Bridges."

St. Cloud, Fla.—Citizens of St. Cloud and Narcoossee will vote March 11 on issue of $150,000 bonds for constructing hard surface road from St. Cloud to Brevard County line.

Birmingham, Ala.—Board of Commissioners instructed City Engineer to draw up ordinances for paving portions of Tenth Avenue South, Ninth Street and Avenue G; estimated cost $7,000. Also adopted ordinances providing for asphalt and asphaltic concrete pavement on Tenth and Twelfth Streets and Eleventh Avenue at an estimated cost of $26,000. Also for grading, macadamizing, cement curb gutters and sidewalks on Forty-seventh Street, costing $8,000. Julian Kendrick, City Engineer.

Abbeville, La.—The Police Jury contemplates constructing a road from Abbeville to Perry's Bridge.

Winchester, Tenn.—Bonds for $359,000 will be sold March 15, by Franklin County Highway Commission (W. H. Rippel, Secy.), for approximately 125 miles macadam roads.

Covington, Ky.—See "Bridges."

Harlan, Ky.—Citizens of Harlan County voted to issue $250,000 bonds for constructing roads.

Newport, Ky.—About $20,000 allowed Campbell County by State for constructing State aid roads.

Newport, Ky.—City Commissioners have approved the apportionment ordinance providing $20,000 for new streets, $4,000 for new boilers at the pump house.

Owensboro, Ky.—About $600,000 bonds will be sold by Davies County for road improvements.

Whitesburg, Ky.—Election will probably be held April 15 for voting on issue of $200,000 bonds for constructing roads.

Bucyrus, Ohio.—Citizens voted $47,000 bonds for city's portion of paving fifteen streets. F. L. Niederheiser, Engineer, Bucyrus.

Canton, Ohio.—Between 20 and 30 miles of brick and macadam road is to be constructed in Stark County during spring and summer. A bond issue of $300,000 will probably be voted upon.

City Council reported in favor of a bond election on April 25 to vote $413,000 for repaving Market Avenue South and Tuscarawas Street East, and constructing sewers.

Cincinnati, Ohio.—Contract soon to be let by Director Public Service for improving portion of Flint Street with asphalt and 6-in. water main at an approximate cost of $18,896. Frank S. Krug, City Engineer.

City Council has authorized the following improvements: Granite resurfacing on portions of Colerain and Rulison Avenues and Pearl Street; also concrete steps on Rose Hill Lane. Council is considering the improving of Beech Avenue, Price Hill, with bituminous macadam.

County Commissioners considering building a road from First Avenue, Addystone, to Shady Lane Road, Miami Township. County Engineer W. Boeh estimates the cost at approximately $19,000.

Cleveland, Ohio.—Alex Bernstein, Director Public Service, reports cost of extending and widening Broadway from East Fifteenth Street and Orange Avenue to Woodland Avenue and East Ninth Street will be about $390,000. Election will probably be held on the improvement.

County Commissioners considering extending Cedar Avenue from East Ninth to East Fourteenth Streets at an estimated cost of $100,000.

Cleveland, Ohio.—The county and city officials considering widening Superior Avenue, from E. Ninth Street to E. Fifty-fifth Street, and repaving thoroughfare from E. Ninth Street to E 105th Street.

Cleveland Heights, Ohio.—Council is considering grading, draining and sidewalk laying on Broxford, Clarion, East Fairfax, East Scarborough, Kingston and Stafford Roads this spring. Fred A. Pease of Cleveland has been retained as Village Engineer. It is reported that between $700,000 and $800,000 worth of improvements—mainly on streets—is planned for the coming two years.

Dayton, Ohio.—Commissioners of Montgomery County considering constructing 9.2 miles of brick roads. Estimated cost $181,200.

Defiance, Ohio.—About $25,000 county road improvement bonds sold.

Elyria, Ohio.—Reported County Commissioners contemplate paving Lake Shore Highway, between Lorain City limits and Cuyahoga county line; probable cost $140,000.

Lakewood, Ohio.—City officials considering the construction of a new boulevard from 12900 Lake Avenue to Rocky River; estimated cost, exclusive of land, is $150,000. Clayton Tyler, Mayor.

Lancaster, Ohio.—Plans prepared by City Engineer for paving Main and West Wheeler Streets, cost $17,600.

Marion, Ohio.—Paving bonds for $31,600 will be sold March 15, by Frank J. Weber, City Aud.

New Lexington, Ohio.—Twenty miles of limestone roads are to be constructed in Perry County this spring.

New Philadelphia, Ohio.—About $44,000 will be spent by Tuscarawas County for road improvements.

Oakwood, Ohio.—Paving bonds for $28,050 will be sold March 18 by George E. Keller, City Clerk.

Tiffin, Ohio.—City Council voted to pave Apple Street.

City Engineer directed to prepare plans for paving Sandusky Street.

Woodsfield, Ohio.—The Woodsfield-Malaga Road is to be graded; bridges and culverts to be constructed thereon, at cost of about $30,000, by county.

Bloomington, Ind.—Contract will be let between May and July for paving with bituminous concrete about 25,000 sq. yd., at a cost of about $85,000; between April and June, for 50,000 sq. yd. bituminous macadam pavement, to cost $50,000. Address City Clerk.

Goshen, Ind.—It is estimated that about 40 miles of improved highways will be constructed in the county this year, at an aggregate cost of $350,000. Albert A. Reith, County Engineer, Goshen.

Michigan City, Ind.—County Commissioners have been petitioned to construct an 18-ft. concrete highway along lake front about 3 miles long, being a continuation of Hermitage Avenue; cost $50,000.

City Engineer instructed to prepare plans and specifications for the paving of Eleventh Street at an estimated cost of $57,988, and Union Street at a cost of $17,278.

South Bend, Ind.—Reported new bids may be asked for constructing the Haven Hubbard Road from New Carlisle through Hamilton. Specifications may be changed from concrete to brick.

Wabash, Ind.—About $51,000 gravel road bonds sold by county.

Eaton Rapids, Mich.—Citizens Feb. 14 voted $17,000 bonds for paving. Contract will be let some time in April. H. S. De Golia, City Clerk.

Alton, Ill.—City Council considering paving Main Street, at cost of $112,669.

Decatur, Ill.—Board Local Improvements voted to pave with brick on concrete foundations Monroe and Division Streets; cost $32,761.

Kankakee, Ill.—City Council has passed ordinances for paving with brick on South Fifth Avenue at an estimated cost of $10,600, and S. Dearborn Avenue at a cost of $9,800.

Rockford, Ill.—Council has been petitioned to pave with macadam at a cost of $28,890, and with brick at a cost of $125,000.

Rock Island, Ill.—The paving of Eighth Avenue from Ninth to Nineteenth Street, at an estimated cost of $22,558, is under consideration. Address City Clerk.

Sterling, Ill.—Election will probably be held to vote $60,000 bonds for constructing hard surface roads. John S. Landis, Highway Commissioner.

Missouri Valley, Iowa.—Contract soon to be let by Council for about forty blocks of paving, costing $96,000.

Storm Lake, Iowa.—Buena Vista County intends building about 20 miles of permanent roads this year. Address County Clerk.

Topeka, Kan.—Plans about completed by A. R. Young, City Engineer, for about 1,000,000 sq. yds. of paving, both brick and asphalt, with curbs and gutter. E. M. Covell, City Clerk.

Fremont, Neb.—Election soon to be held to vote $50,000 bonds for paving intersections.

Norfolk, Neb.—Election to be held March 10 to vote $30,000 bonds for paving intersections and $10,000 water bonds.

Madison, S. D.—City will probably lay about 35,000 sq. yd. paving this year. Address City Clerk.

Clayton, Mo.—Citizens voted Feb. 15 to issue $3,000,000 bonds for constructing roads in St. Louis County.

Osceola, Mo.—Reported an election will be held in St. Clair County in the fall to vote $1,500,000 bonds for constructing hard roads.

Bastrop, Tex.—Road and bridge bonds for Precinct No. 1, amounting to $80,000, have been sold.

Bastrop, Tex.—Road bonds amounting to $50,000 have been sold by County Commissioners.

Houston, Tex.—Election will probably soon to be held to vote $400,000 bonds for road improvement in Harris County. Address County Clerk.

Karnes City, Tex.—Road Dist. No. 1 bonds amounting to $75,000 have been sold.

Lockhart, Tex.—Road bonds amounting to $50,000 have been sold. Address County Clerk.

Martindale, Tex.—Citizens of Martindale and Reedville voted $10,000 bonds for repairs to macadamized roads in the vicinity of these points.

Mount Pleasant, Tex.—Citizens of the county voted $200,000 bonds for road improvements. Address County Clerk.

Taylor, Tex.—Citizens voted an additional $50,000 bonds for street paving. Work is being done by Kaw Paving Company, Topeka, Kan. W. E. Dozier, Supervising Engineer, Taylor.

Sapulpa, Okla.—Sapulpa Township has voted $45,000 good road bonds.

Bellingham, Wash.—County Commissioners intend paving Northwest Diagonal Road from present pavement to Ferndale, a distance of several miles. C. M. Adams, County Engineer.

Pacific Highway, Waterfront Road, south of Bellingham, recently damaged, will be repaired, cost of road $80,000. C. M. Adams, County Engineer.

Port Angeles, Wash.—Surveys are to be made by Clallam County for a 20-mile road from Joyce to Pysht, surface a 20-mile road at cost of $30,000, and grade a 40-mile road at cost of $12,000.

Seattle, Wash.—Plans and specifications for following paving submitted by A. H. Dimock, City Engineer, to Board of Public Works have been approved: Paving West McGraw Street, $110,000; Warren Avenue, $45,000.

Paving bonds for $300,000 will be sold March 14 by Byron Phelps, County Aud.

Spokane, Wash.—Reported 3 miles of "Apple Way" from city limits of Spokane to Dishman will be paved this year and about 4 miles will be oiled. J. W. Strack, County Engr.

Burlingame, Cal.—About $325,000 is to be spent by city for street improvements.

California.—E. Goodwin, State Road Engineer, Sacramento, has completed preliminary surveys of the Lake-Yolo state road, which will connect Lower Lake with Rumsey, a distance of 31 miles. Estimated cost about $100,000.

State has sold $1,500,000 State highway bonds. Address California Highway Commission, Sacramento.

Chino, Cal.—Election to be held March 15 to vote $128,000 bonds for paving, sewers and a sewer farm. Address City Clerk.

Los Angeles, Cal.—County Supervisors will sell $500,000 State Highway bonds for constructing highways in Los Angeles County.

Board of Supervisors has appropriated $50,000 for road repair caused by flood destruction.

Oakdale, Cal.—Trustees voted to construct about 1½ miles of concrete pavement with Topeka surface to connect ends of highway.

Pomona, Cal.—Mayor Vandergridt reported in favor of constructing a $30,000 concave concrete road to carry waters of Thompson Creek during flood season.

Redondo Beach, Cal.—Trustees adopted resolution to pave Lucia Avenue with concrete base and oil surface and construct cement curbs, walks, concrete retaining walls and timber bridge 96 ft. long.

Richmond, Cal.—City Engineer directed to prepare plans for paving Twenty-third Street from Macdonald Avenue north to city limits with asphalt.

Riverside, Cal.—Board of Supervisors is considering election to vote on issuing bonds to construct concrete roads through Hemet, Corona, Perris, Elsinore, San Jacinto, Beaumont and Banning, and to replace washed out roads and bridges.

San Francisco, Cal.—The Supervisors Street Committee recommended appropriation of $10,000 for constructing sidewalks on Van Ness Avenue, McAllister, Polk and Grove Streets around city hall.

Globe, Ariz.—Contract soon to be let by Board of Supervisors, Globe, for constructing highways as follows, for which $350,000 has been appropriated: Roosevelt-Payson Strawberry Highway, $75,000; Pleasant Valley Highway, $15,000; Globe-Winkelman Highway via El Capitan, $100,000; Miami-Pinal County Line Highway, $40,000; Globe-Copper Hill Highway, $5,000; completion of convict highway to Summit of Pinals, $10,000.

Tombstone, Ariz.—Petitions being circulated favoring a bond issue of $1,200,000 and the construction of 525 miles of highway system as prepared by County Engineer.

Brigham City, Utah.—About $20,000 is available for constructing roads in Boxelder County.

Leamington, Ont.—City intends laying about 2 miles of concrete pavement this summer. J. J. Newman, Engineer, Windsor; A. H. Noble, Board of Works.

York, Ont.—York County Council voted to construct system of good roads, cost about $750,000.

BIDS DESIRED.

Long Island City, L. I., N. Y.—Until March 1, by Maurice E. Connolly, Borough President, for repairing with asphaltic concrete on concrete foundation portions of Fourth, Fifth, Sixth and Seventh Avenues in College Point, Third Ward; also sidewalks, etc., in portions of Sedgwick Street, Second Ward, Borough Queens.

New York, N. Y.—Until March 2 by Marcus M. Marks, Pres. Manhattan Boro., for repaving with wood block pavement, light oil treatment; also heavy oil treatment, concrete roadway on portions of Chamber Street; security $6,000.

Atlantic City, N. J.—Until March 8, by Board Chosen Freeholders, at a meeting in Atlantic City, for constructing the Absecon-Atlantic City Boulevard, from intersection of White Horse Pike and Ocean Highway and terminating at the Atlantic City line to consist of 106,546 sq. yd. surface paving, together with an embankment of 247,236 cu. yd., 8 creosoted pile bridges, one bascule bridge with creosoted pile approaches. A. H. Nelson, Co. Engr., 637 Guarantee Trust Building, Atlantic City.

Jersey City, N. J.—Until March 2, by City Commissioners, for repairing Hoboken Avenue with Belgian blocks. M. I. Fagen, City Clerk.

Paterson, N. J.—Reported desired until March 1, by Board County Freeholders, for 10-ton macadam steam road roller.

Sunbury, Pa.—Reported desired until March 7 for paving one mile of Market Street with brick. Geo. F. Keefer, City Engr.

Lynchburg, Va.—Specifications for the improving of Main Street, bids for which are advertised in Engineering Record, to be opened March 6 by Joint Council Committee on Streets and Sewers, are on file in New York office of Engineering Record.

Virginia.—Reported desired until Feb. 29, by State Highway Commission (G. P. Coleman, State Highway Comr., Richmond), for constructing 2½ miles macadam road, from city limits to Three Clopt Road and from The Brook 1½ miles west.

Morgantown, W. Va.—Until March 30, by County Court (W. S. Downs, Engineer, Morgantown), for constructing brick and concrete roads in Morgan District. R. P. Davis, State Road Bureau, Morgantown.

Burlington, N. C.—Until March 9, by Mayor and Board Alderman, for constructing approximately 25,000 sq. yd. street pavement, 7400 lin. ft. curb and gutter, and 4000 lin. ft. street railway track pavement.

Arcadia, Fla.—Until March 7, by Board County Commissioners (A. L. Durrance, Clk.), for constructing approximately 20,000 sq. yd. asphalt pavement. H. S. Jaudon Engineering Co., Barstow, Fla.

Flora, Miss.—Until March 6, by Commissioners of Supervisors, Dist. No. 2, addressed to J. E. Wilson, Chmn., for improvements to roads in said District, constructing concrete bridges, vitr., cast or corrugated iron pipe drains, etc.

Louisville, Ky.—Until March 3, by Board Public Works (Roger G. McGrath, Secretary), for paving numerous alleys throughout city. Samples of vitr. brick to be submitted.

Caruthersville, Ohio.—Until March 6 by J. M. McGinnis, City Clerk, for street paving concrete base with asphaltic binder, advertised in Engineering Record. B. O. Bennett, City Engineer.

Cleveland, Ohio.—Reported desired until March 1, by Commissioner Purchase and Supplies for paving portions of 28 streets.

Marietta, Ohio.—Reported desired until March 1, for improving Belpre, Marietta-Athens, and Beverly Roads, and macadamizing Lowell Road. C. M. Weeks, Co. Engr.

Newark, Ohio.—Until March 6, by W. C. Christian, Director Public Service, for furnishing material and paving Tenth, Indiana and North First Streets. All kinds of pavements will be considered. City specifications call for brick. C. H. Wells, City Engineer.

Shaker Heights (Cleveland P. O.), Ohio.—See "Waterworks."

Indiana.—By County Commissioners for constructing roads as follows:

March 6:

Franklin, two gravel roads, one 14,182 ft. long. John C. Greegs, Co. Aud.

Bedford, two gravel or macadamized roads in Shawswick Township and one in Spice Valley Township, 3254, 1900 and 7853 ft., respectively. Ezra W. Edwards, Co Aud.

Danville, constructing roads in Eel River and Lincoln Townships. Chas. M. Havens, Co. Aud.

March 7:

Martinsville, constructing roads in Adams, Washington, Monroe and Greggs Townships. S. Watson, Co. Aud.

March 8:

Shelbyville, gravel roads in Noble, and macadam road in Liberty Townships. Frank W. Fagel, Co. Aud.

Delphi, two roads in Deer Creek Township. H. D. Godd, Co. Aud.

Kokomo, for five road graders and ten three-way road drags. Wm. L. Benson, Co. Aud.

Until March 9:

Laporte, for roads in New Durham and Scipico Townships. F. A. Hausheer, Co. Aud.

March 10:

Sullivan, gravel roads, 12,110 ft., Fairbank Township; 15,625 ft., Haddon Township and 10,550 ft. in Gill Township. W. S. Bicknell, Co. Aud.

March 14:

Fort Wayne, macadam roads in Madison and Monroe Townships. Will Johnson, Co. Aud.

March 18:

Muncie, County line road 10,550 ft. long. F. M. Williams, Co. Aud.

Madison, Ind.—Until March 6, by Harry E. Nichols, City Clerk, for 14,000 sq. yd. of paving on Main Street; asphalt, concrete, vitri. brick, or creosoted wood block will be considered. Cost at outside estimated by Engineer at $44,000. J. W. Moore, Designing Engineer, 47 Union Trust Building, Indianapolis; Roscoe F. Lee, City Engineer.

Chicago, Ill.—Until March 15, by South Park Commissioners, Fifty-seventh Street and Cottage Grove Avenue (J. F. Neil, Secy.), for purchase of an asphalt paving plant equipment or any portion thereof advertised in the Engineer Record.

Sullivan, Ill.—Reported desired until March 6, by Board Local Improvements for approximately 5710 sq. yd. vitr. brick paving, cement filler and 4388 lin. ft. combined curb and gutter, etc., on Water Street. Claude L. James, Engr., Mattoon.

Johnson Creek, Wis.—Until March 8, by Village Board, for paving with vitr. block or reinforced concrete approximately 13,049 sq. yd. pavement, 6052 lin. ft. concrete curb and gutter, together with sewers, manholes, etc. E. B. Parsons, Consulting Engr., Jefferson, Wis.

Portage, Wis.—Reported desired until March 1, for 14,000 yd. paving and relaying 10,000 yd. brick on new concrete base. Fred Goss, City Clerk.

Davenport, Iowa.—Until Feb. 29 by Board Public Works, for repaving Harrison Street about 15,000 sq. yd., brick block on 5 in. concrete base. Estimated cost $34,000. Allen R. Boudinot, City Engineer.

Mason City, Iowa.—Reported desired until Feb. 28 for 60,000 yd. concrete, and 150,000 yd. sheet asphalt paving. F. P. Wilson, City Engr.

Oakland, Iowa.—Until March 7 (readvertisement) by E. F. Wentz, Town Clerk, for paving 3 miles of streets with concrete.

Duluth, Minn.—Reported desired until March 3, by County Commissioners, for constructing roads as follows: 2¾ miles Yoki Road, 2 miles Wood Road, 3 miles Heino Road and 1¼ miles of Lane-Anderson connection, and 2 miles Laine Road.

St. Cloud, Minn.—Until March 7, by Geo. G. Magnuson, City Clerk, for about 17,000 sq. yd. concrete asphalt or bitulithic pavement, and 36,000 sq. yd. creosote block, granite block or bitulithic pavement.

Topeka, Kan.—Until Feb. 29, by Etta M. Colville, City Clk., for 65,000 sq. yd. asphaltic concrete pavement and 46,000 sq. yd. brick pavement.

Hastings, Neb.—Reported desired until March 13, by City Clerk, for 173,900 sq. yd. pavement on concrete base; also 98,000 lin. ft. combined curb and gutter. W. H. Fuller, City Engr.

Fargo, N. D.—Until March 1, by F. L. Watkins, City Auditor, for approximately 20,000 sq. yd. paving on Fourth N. Street, District No. 2, with either Portland cement concrete, bituminous concrete, bitulithic asphalt, creosoted block or vitr. brick; also separate bids for paving in Road District No. 3, approximately 10,000 sq. yd. on Sixth Avenue and Tenth Street North, with Portland cement concrete, bituminous concrete, bitulithic, asphalt creosoted block or vitr. brick.

St. Louis, Mo.—Until March 7, by Board Public Service (Wm. T. Findly, Secy.), for improving portions of Koeln Avenue, Sarah, Cooper and other streets.

Seattle, Wash.—Reported desired until about March 10 for paving Beacon Avenue, with asphalt. Probable cost $205,000. A. H. Dimock, City Engr.

Bakersfield, Cal.—Until March 6, by Board of Supervisors (F. E. Smith, Clerk), for grading, concrete pavement and corrugated iron and concrete culverts on Division 7, Sect. 8, Bakersfield-Taft Road, 8 miles, and on Division 9, Sect. 6, Bakersfield-Greenville Road; also for grading and constructing culverts on Division 10, Sect. 8, Bakersfield-Mohave Road between Mountain Ranch and Keene School, 6 miles.

El Monte, Cal.—Until March 3, by I. Worth Everett, City Clerk, for 110,000 sq. ft. 6 in. oil macadam, 8600 ft. 5 ft. walk, 7600 lin. ft. curb, and 13,400 ft. gutter. R. L. Woods, City Engr.

Fresno, Cal.—See "Miscellaneous."

Los Angeles, Cal.—Until March 6, by H. J. Lelande, Clerk, Board County Supervisors, for improving Section C, Mint Canyon Road in Road Dist. No. 5.

Ontario, Cal.—Until March 13, by R. O. Brackenridge, City Clerk, for approximately 512,000 sq. ft. concrete pavement with oil and screenings surface and 35,000 lin. ft. cement curbs on San Antonio Avenue. B. B. Mann, City Engineer.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Youngstown, Ohio.**—Contract for riprap paving for Princetown Road fill at Milton awarded to Mahoney Contracting Co. at $12,950.

★**Goshen, Ind.**—Contract for constructing Dussell Road in Washington Township awarded by the County Commissioners to W. W. Hatch & Sons Co., Goshen, at $30,890.

★**Greensburg, Ind.**—Contract awarded by County Commissioners Feb. 7 for repair Pavy Road, in Clay Township, to J. A. Stagg, Greensburg, at $9,637.

Lowest bid opened by County Commissioners Feb. 7 for constructing John Evans Road, in Jackson Township, submitted by Thomas & Davis, Greensburg, at $9,846.

★Contract awarded Wilk & Co., Rushville, Ind., at $10,245, for constructing the Orange Township Road, Bush County, and also for the gravel road in Jackson and Union Townships at $9,895.

South Bend, Ind.—No bids received by County Commissioners Feb. 7 for constructing concrete road in Olive Township.

★**Monroe, Mich.**—Reported County Road Commissioners on Feb. 17 awarded contract for constructing Monroe-Toledo highway from Monroe to Ohio State Line Road, to be 16 ft. wide, with concrete base 5 in. thick, with 2-in. asphalt-bituminous surface, to Harry Vanderveer, Grand Rapids, at about $173,500.

★**Galva, Ill.**—Contract awarded by City Council to A. D. Thompson, Peoria, for paving Front, Market and Chester Streets at about $31,000.

Milwaukee, Wis.—Lowest bid opened by Commissioners of Public Works, Feb. 16, for paving with sandstone and creosote blocks on Humboldt Avenue, submitted by John Weiher at $57,080.

Denison, Iowa.—Following are four lowest bids opened Feb. 18 by city for 57,000 sq. yd. of paving; price given is per sq. yd.: M. L. Flynn Paving Company, Sioux City, $1.29.5; Western Construction Company Sioux City, $1.31; Dearborn Construction Company, Waterloo, $1.32; John A. Beebe, Omaha, Neb., $1.34. Frank Woolston, City Engineer.

★**Eldora, Iowa.** — Contract awarded Dearborn Construction Company, Waterloo, for 11,979 sq. yd. asphaltic concrete pavements (bids opened Feb. 14), at $22,000. L. J. Stott, City Clerk.

★**Temple, Tex.**—Contract awarded Levy & Lowry, Dallas, for paving with asphaltic concrete at an approximate cost of $25,000.

★**Tilden, Tex.**—Contract awarded Bexar Co., San Antonio, for buildings, roads, bridge, culverts, etc., in the county, at about $30,000.

★**Van Alstyne, Tex.**—Contract awarded Womack Construction Co. for constructing 14 sections of road improvements covering three-fourths of the county and the other fourth awarded to J. A. McCoy.

★**Seattle, Wash.**—Contract awarded by Board of Public Works to Coluccio & Niblett, 1642 Lane Street, for paving, etc., on Thirty-fifth Avenue, S. E., at $43,480.

South Bend, Wash.—Lowest bid opened by County Commissioners Feb. 9 for constructing the State Road No. 19 submitted by Burnette Construction Co., Seattle, at $10,439.

★**Bakersfield, Cal.**—Contract for 97,104 sq. yd. concrete pavt., 58,260 ft. shaping roadbed, etc., on 11 miles of Bakersfield-Taft Road, Division 7, Section 2, awarded W. E. Green, Tulare, at $50,892. Next three lowest bidders: Ford & Stout, Bradbury Building, Los Angeles, $57,881; Blanchard & Eberhard, $62,921; A. C. McLean, $67,026.

★Following are four lowest regular bids opened by Board of Supervisors for constructing 4.8 miles on Bakersfield-Mohave Road, between Edison and Sivert, Division 10, Sect. 6, involving 16,500 cu. yd. excav., 25,480 ft. shaping roadbed, 6625 tons broken stone and screenings in pavement, etc.: Lehigh G. Garnsey, Central Building, Los Angeles, $13,136 (awarded contract); Benson & Son, Los Angeles, $13,252; Brashear Burns Co., Los Angeles, $15,419, and W. A. Donionville, Pasadena, $15,800.

★**Hanford, Cal.**—Contract for 675,578 sq. ft. surface on road from Hanford to Harwick Road (bids opened Feb. 10), awarded by Board County Supervisors to Blanchard & Ehrhart, San Francisco.

★**Los Angeles, Cal.**—Contract awarded Bayard & Austin, 1650 Compton Avenue for improving Central Avenue, about 36,449 sq. ft. asphalt paving, 1300 sq. ft. granite block gutter, 11,700 sq. ft. cement walk, etc., at $8,923.

★Contract awarded to George H. Oswald, 405 O. T. Johnson Building, at about $134,000, for 8½ miles of road in Palms District Road, District No. 91; approximate quantities: 38,390 cu. yd. excav., 45,280 ft. shaping, 32,190 tons crushed rock (county to furnish 28,490 tons), 80,730 lin. ft. cement curb, 370,200 sq. ft. cement walks, 3262 bbl. oil hauled and placed.

Contract awarded Coast Construction Co., 353 South Hill Street, at $18,572, for improving 1.51 miles of Atesia Avenue, Road District 61, involving 14,880 sq. ft. concrete pavement, 4500 cu. yd. excav., etc. Next three lowest bidders: Oscar Ford, Riverside, $20,500; James L. Frazer, Long Beach, $20,550; J. Hein, Los Angeles, $20,940.

Following are four lowest bids opened Feb. 14 by County Board of Supervisors for 5 in. macadam pavement on about one mile of county road on Sixth Street in Road District No. 59, approximately 11,496 cu. yd. excav., 9560 ft. cement curb, 5576 tons macadam, etc.: Fred Hoffman, 111 East Twelfth Street, Long Beach, $12,500; J. Hein, Los Angeles, $12,894; Oswald, Croman & Ashton, $13,000, and S. C. Contracting Company, Los Angeles, $13,059.

★**Santa Monica, Cal.**—Following are 3 bids opened recently for approximately 2 miles of paving on Colorado Street and Palisades Beach Road with 20-ft. concrete pavement with reinforced wire mesh and bituminous wearing surface: J. D. Kneen Contracting Co., Dudley Building, $35,324 (awarded contract); S. C. Contracting Co., $37,645, and Crown Contracting Co., $47,469.

★**Ventura, Cal.**—Contract awarded C. H. Hudson, 509 Trust & Savings Building, Los Angeles, for 1½ miles of pavement on Santa Ana Road involving about 82,350 cu. yd. excav., 966 ft. 18 to 48 in. corrugated iron culverts, and 3000 lb. reinforced steel; approximate cost, $20,000.

Following are four lowest bids opened by County Board Supervisors, Feb. 14, for grading and culverts on about 2 miles of Ventura-Nordhuff Road, Sect. 2, involving approximately 50,700 cu. yd. excav., 648 ft. 18 to 36 in. corrugated iron pipe, and 3000 lbs. reinforcing steel: E. A. Garland, Ventura, $10,908; Spring Construction Company, $14,845; George F. Dodson and E. L. Butterfield, $16,629, and W. B. Hunt & Son, $18,673.

STREET CLEANING AND GARBAGE DISPOSAL

PROPOSED WORK.

Greenville, Pa.—The Borough officials have engaged Chester & Fleming, Pittsburgh, Pa., to prepare plans and specifications for a garbage incinerating plant.

Annapolis, Md.—County Commissioners considering letting contract for disposal of garbage from town of Brooklyn, Curtis Bay, Fairfield and Masonville.

Peru, Ind.—Council is considering a garbage disposal plant.

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS

PROPOSED WORK.

Docks—Baltimore, Md.—See "New Industrial Plants."

Hydro-Electric Plant—Troy, N. C.—Smithtown Power Company reported contemplates constructing a hydro-electric development on Little River, about 7 miles northeast of Mount Gilead.

Dredging — Cleveland, Ohio.—Reported steps to be taken early in the year for dredging Cuyahoga River at a cost of $50,000. Asst. City Engineer Thomas is in charge of rivers and harbors.

Flood Protection—Tippecanoe City, Ohio.—Professor Mitchell of Syracuse University has approved the Dayton plans for the protection of the village in case of flood. Address City Clerk.

Drainage—Homer, Ill.—Village Trustees Payton, Morrison and Allison appointed a committee to engage an engineer to survey and estimate cost of a drainage system.

Levee Work—Peoria, Ill.—Petitions have been filed in the county court establishing the Rome Drainage and Levee District, comprising 7000 acres of land. Joseph E. Dailey of Peoria, Attorney.

River Improvements — Urbana, Ill. — Contract will be let about May 15, by Board Local Improvements for altering course of stream, arching 100 ft. of new channel, and building reinforced-concrete slab bridge; approximate cost $10,000. A. M. Danely, City Engineer.

Bank Revetment—Silver Lake, Kan.—C. H. Scholer of Manhattan is engineer for the Kaw River Drainage District, which is to consist of constructing about 4000 ft. of bank revetment work and is estimated to cost $30,000. L. C. Caldwell, Secy. Dist., Topeka.

Drainage — Columbus, Tex. — Attorney General has approved $17,000 bonds of Colorado County Drainage District No. 3.

Drainage — Victoria, Tex. — Attorney General approved the $146,000 drainage district bond issue for Victoria County.

Irrigation — Sequim, Wash. — Thomas Watson, 410 Globe Block, Seattle, commissioner to prepare plans for watering 14,000 acres of land in Happly Valley Irrigation District, near Sequim. Plans call for 19 miles of main ditch, a 5200 ft. siphon having a 625 ft. head; cost $100,000. Contract to be let some time in March by Otto Sinders, President of the Happly Valley Irrigation District, Sequim.

Coal Handling Docks—Astoria, Ore.—Plans about completed by Engineer Walsh of the Port of Astoria for the proposed coal handling docks, and equipment to cost $37,000.

Dam — Bakersfield, Cal. — Oak Creek Land and Water Co., San Francisco, has applied to the State Water Commission for permission to construct concrete dam, 120 ft. high, 1100 ft. long on top and 500 ft. long at bottom, to form 16,350,000,000 gal. reservoir to irrigate 60,000 acres in Kern County.

Irrigation—La Mesa, Cal.—La Mesa Lemon Grove & Spring Valley Irrigation District has applied to State Water Commission for permission to divert water from San Diego River to fill a proposed reservoir, 11,000,000,000 gal. capacity, at lower end of El Cajon Valley. It is proposed to supply domestic water to La Mesa, acquire system of Cuyamaca Water Co. and irrigate about 15,000 acres; cost $1,232,500. J. B. Lippincott, Engineer, 1134 Central Bldg., Los Angeles.

Pier—Long Beach, Cal.—Citizens petitioned Council to hold an election to vote on issuing approximately $500,000 bonds for building a concrete horsehoe pier connecting American and Pine Avenues.

Wharf—Los Angeles, Cal.—See "Private Buildings."

Irrigation—Merced, Cal.—The construction of an irrigation system is reported under consideration. R. L. Hargrove of the Irrigation Bureau, Madera, may be able to give further information.

Irrigation—Porterville, Cal.—Bonds for Anderson-Cottonwood Irrigation District, comprising 30,000 acres, will be sold soon.

Irrigation—Santa Ana, Cal.—There is a movement on foot to form a flood control district embracing all of Orange County. Election to vote bonds for building protection work along Santa Ana River and Santiago, Aliso, San Juan and Trabucco Creeks is contemplated. C. F. Heil of Santa Ana is a member of a committee appointed to consider the matter and to secure data.

BIDS DESIRED.

Dredging—Boston, Mass.—Until March 6. Directors of the Port of Boston (Robert E. Barrett, Acting Chief Engineer), Boston, for dredging Mystic River, Charlestown, advertised in Engineering Record.

Reclamation of Flats—Boston, Mass.—Until March 6 by Directors of the Port of Boston (Robert E. Barrett, Acting Chief Engineer), Boston, for reclamation of flats in East Boston, advertised in Engineering Record.

Retaining Wall—Williamstown, Mass.—Until March 3, by Board of Selectmen (Geo. W. Grundy, Clerk), for constructing a 180 ft. long and 7½ ft. high concrete retaining wall, sufficient thickness to protect highway from being washed away by river.

State Canal Work—Albany, N. Y.—Until March 7 by W. W. Wotherspoon, State Superintendent Public Works, Albany, for improving Chadakoin River, known as Chautauqua Lake Outlet, in city of Jamestown. Engineer's estimate $89,252, also for constructing a foot bridge between the north and south walls of the Lock No. 3, on Cayuga and Seneca Canal at Seneca Falls, Engineer's estimate $4,001.

Dredging — New York, N. Y. — Until March 1 by R. A. C. Smith, Comr. of Docks, for Contract 1497, Class 2, for furnishing material and dredging in the Boroughs of Manhattan, Brooklyn, Queens, Bronx and Richmond. Security required $3,600.

Drain—Mobile, Ala.—See "Bridges."

Drainage — Brownsville, Tenn. — Reported desired until March 3 by Board Directors, First Fork Creek Drainage Dist. of Haywood and Crockett Counties (R. E. Jerman, Alamo, Secy.), for drainage work, including main canal and two laterals.

★**State Canal Work—Albany, N. Y.**—Following are four lowest bids opened Feb. 16 by W. W. Wotherspoon, State Superintendent of Public Works, for Contract 46-B, Erie Canal, Section 7, completion of construction of lock, dam, etc., at May's Point: (a) Engineer's estimate, $314,661; (b) Scott Brothers, Rome, $277,348 (awarded contract); (c) State Highway Construction Co., Beacon, $280,620; (d) Henry P. Burgard, 1968 Fillmore Avenue, Buffalo, $283,777; (e) Lord Construction Co., 105 W. Fortieth Street, New York, $287,050.

	(a)	*(b)	(c)	(d)	(e)
Clearing (lump sum)	$100.00	$50.00	$100.00	$100.00	$100.00
84,500 cu. yd. excavation	0.55	0.455	0.52	0.40	0.50
136.7 M ft. sheeting and bracing	50.00	50.00	45.00	40.00	50.00
54,600 cu. yd. forming embankment	0.15	0.12	0.09	0.15	0.16
400 cu. yd. lining	1.25	1.25	1.25	1.25	1.25
25.6 M ft. sawed lumber (Y. P. or D. F.)	65.00	65.00	60.00	65.00	70.00
15.7 M ft. white oak sawed lumber in miter sills, lock gates and movable dam gates	150.00	150.00	130.00	150.00	150.00
18 M ft. sawed lumber in needles	100.00	80.00	85.00	100.00	100.00
3,850 cu. yd. stone or gravel filling	2.00	1.75	1.25	2.00	2.00
119,800 lin. ft. foundation piles	0.35	0.22	0.29	0.20	0.30
20 mooring piles, each	7.00	7.00	7.00	7.00	7.00
119.4 M ft. wooden sheet piling	50.00	50.00	45.00	50.00	50.00
13,900 sq. ft. driving steel sheet piling	0.10	0.10	0.10	0.10	0.15
1,000 lin. ft. cutting off steel sheet piling	2.50	2.00	2.25	2.50	2.50
18,780 cu. yd. second-class concrete	7.50	6.50	6.50	7.50	7.00
13 cu. yd. first-class reinforced concrete	12.50	12.50	12.50	12.50	15.00
1.7 cu. yd. first-class masonry bridge coping	20.00	20.00	20.00	20.00	20.00
280 cu. yd. fourth-class riprap	2.00	2.00	2.40	2.00	2.00
361,500 lb. structural steel	0.045	0.054	0.054	0.045	0.05
16,200 lb. metal reinforcement	0.04	0.04	0.045	0.04	0.04
12,800 lb. cast-steel snubbing posts	0.05	0.06	0.06	0.06	0.06
1,600 lin. ft. wooden fence	0.20	0.24	0.20	0.20	0.20
6,000 lb. wrought-iron chains	0.07	0.084	0.08	0.07	0.08
14,500 sq. ft. finishing concrete surfaces	0.05	0.05	0.03	0.05	0.05
90,000 lb. hauling and erecting metal in buffer beams	0.0125	0.0125	0.015	0.0125	0.015
25,000 lb. hauling and erecting metal in lock valves	0.0125	0.0125	0.015	0.0125	0.015
188,000 lb. hauling and erecting metal in lock gates	0.0125	0.0125	0.015	0.0125	0.015
6,600 lb. hauling and erecting iron castings, mach.	0.0125	0.0125	0.015	0.0125	0.015
43,000 lb. hauling and erecting metal in truss span over Lock 25	0.0125	0.0125	0.0125	0.0125	0.015
6,178 lb. hauling and erecting miscellaneous metal	0.0125	0.0125	0.0125	0.0125	0.015
25,000 lb. machinery	0.15	0.18	0.18	0.15	0.15
Cofferdams, pump, bail. and drain. (lump sum)	20,000.00	24,000.00	18,000.00	20,000.00	6,700.00
Maintaining highway traffic (lump sum)	250.00	150.00	250.00	250.00	250.00
Deduct price for gravel (lump sum)	2,000.00	1,600.00	2,000.00	1,000.00	1,000.00

★**State Canal Work—Albany, N. Y.**—Following are unit prices of four lowest bids opened Feb. 16 by W. W. Wotherspoon, State Superintendent Public Works, for Contract 122, Erie Canal, Section 4, substructure, superstructure and approaches of highway bridge over Mohawk River, near Little Falls: (a) Engineer's estimate, $59,339; (b) Thomas Leonard, 121 Division Street, Saratoga, $56,615 (awarded contract); (c) Frank L. Cohen, Buffalo, $58,998; (d) Chesley, Earl & Heimbach, Inc., 20 Breckenridge Street, Buffalo, $59,042; (e) New York State Dredging Corporation, Rochester, $61,335.

	(a)	*(b)	(c)	(d)	(e)
14,000 cu. yd. excavation	$0.60	$0.45	$0.25	$0.55	$0.50
495 cu. yd. lining	1.50	1.40	1.50	1.50	1.50
1,700 cu. yd. second-class concrete	8.00	6.75	9.00	7.20	7.50
35 cu. yd. fourth-class riprap	2.50	2.00	2.00	2.40	3.00
110 sq. yd. cobblestone gutter	1.25	0.65	1.00	1.25	1.25
51.5 M ft. sawed lumber	60.00	55.00	63.00	50.00	55.00
10.5 M ft. sheeting and bracing	45.00	40.00	30.00	40.00	45.00
37.6 M ft. wooden sheet piling	60.00	60.00	40.00	60.00	60.00
4,930 lin. ft. foundation piles	0.30	0.30	0.20	0.30	0.30
1,410 lin. ft. wooden fence	0.25	0.25	0.25	0.20	0.25
546,000 lb. structural steel	0.042	0.0485	0.049	0.047	0.0504
6 oil signal lamps, each	15.00	15.00	15.00	10.00	15.00
Cofferdams, pumping, bailing and draining (lump sum)	5,000.00	4,000.00	5,800.00	5,400.00	5,000.00
Removing existing buildings (lump sum)	100.00	50.00	10.00	1.00	100.00
Removing existing superstructure (lump sum)	100.00	300.00	10.00	1.00	100.00
Maintaining navigation (lump sum)	300.00	1.00	10.00	1.00	300.00
Maintaining highway traffic (lump sum)	200.00	1.00	200.00	1.00	100.00

State Canal Work—Albany, N. Y.—Following are unit figures of four lowest bids opened Feb. 16 by W. W. Wotherspoon, State Superintendent Public Works, for Contract 63-A, Erie Canal, Section 9 constructing canal from west line of Wayne County to east end of Contract No. 23-A, at Kings Bend, length 12.22 miles: (a) Engineer's estimate, $567,746; (b) State Highway Construction Co., Beacon, $488,103; (c) Lathrop, Shea & Henwood Co., Buffalo, $532,267; (d) Scott Brothers, Rome, $537,792; (e) R. T. Ford & Co., Rochester, $543,006.

	(a)	(b)	(c)	(d)	(e)
Cofferdams, pumping, bailing and draining (lump sum)	$5,000.00	$5,000.00	$6,000.00	$6,000.00	$5,000.00
549,060 cu. yd. excavation	0.47	0.37	0.43	0.42	0.46
38,000 cu. yd. forming embankment, first class	0.25	0.25	0.20	0.23	0.23
99,200 cu. yd. forming embankment, second class	0.15	0.15	0.12	0.13	0.13
960 cu. yd. lining	1.50	1.00	1.50	1.40	1.50
33,010 cu. yd. second-class concrete	6.00	5.35	5.75	6.00	6.50
12,900 cu. yd. wash wall	2.50	2.50	2.50	2.50	2.40
490 sq. yd. third-class stone paving	1.25	1.25	1.25	1.25	1.25
7,300 cu. yd. fourth-class riprap	1.75	1.75	1.75	1.75	1.75
33,600 lb. cast-iron culvert pipe and specials	0.03	0.03	0.03	0.03	0.03
2,940 lbs. structural steel	0.05	0.05	0.06	0.05	0.05
74,200 lb. metal reinforcement	0.05	0.05	0.04	0.045	0.05
3,550 lin. ft. wooden fence	0.30	0.30	0.30	0.30	0.30
18,500 sq. ft. steel sheet piling	0.60	0.60	0.65	0.60	0.70
1 sluice gate, 12-in. in diameter	200.00	200.00	200.00	200.00	200.00
60,400 sq. ft. tar felt waterproofing	0.05	0.05	0.05	0.05	0.05
12,500 lb. lead seal plates	0.15	0.15	0.16	0.15	0.15
1,800 cu. yd. screened gravel	1.00	1.00	1.20	1.20	1.00
3,000 lin. ft. 4-in. drain tile	0.10	0.10	0.12	0.10	0.10
2,800 cu. yd. excavating concrete	2.00	1.00	1.50	2.00	1.80
630 pulling piles, each	1.50	1.50	1.50	1.50	1.50
6,500 cu. yd. removing and storing riprap	0.50	0.50	0.35	0.40	0.50
For removing timber flume (lump sum)	100.00	100.00	120.00	100.00	100.00
For removing bridge superstructure (lump sum)	50.00	50.00	60.00	50.00	50.00
For maintaining navigation (lump sum)	1,000.00	1,000.00	1,200.00	1,000.00	1,000.00

Breakwater — Conneaut, Ohio. — Until March 24 by U. S. Engineer Office, Cleveland, for constructing rubble mound breakwater at Conneaut Harbor, Ohio, advertised in Engineering Record.

Dredging—Detroit, Mich.—Until March 24, by U. S. Engineer's Office, Detroit, for dredging ship channel in Lake St. Clair, Mich., advertised in Engineering Record.

Drain—North Branch, Mich.—Reported desired until March 28, by Drainage Commissioners of Sanilac, Tuscola and Lapeer Counties, at North Branch, for constructing the Flint River drain.

Ditches—Algona, Ia.—Reported desired until Feb. 29, by E. H. Beardsley, Co. Aud., for constructing tile ditches and drains in Dist. No. 125.

Ditches—Alexandria, Minn.—Reported desired until March 9, by C. H. Jensen, Co. Aud., for constructing Judicial Ditches Nos. 3 and 4.

Ditches—Blue Earth, Minn.—Reported desired until March 11, by Jesse L. Herring, Co. Aud., for constructing tile ditches, 11, 42 and 43.

Irrigation—Malta, Mont.—Until March 15, by U. S. Reclamation Service, Malta, for earthwork and structures, Bowdoin Canal, Milk River Irrigation Project, Mont., involving about 68,000 cu. yd. excavation, 390 cu. yd. reinforced-concrete, 720 sq. yd. paving, placing 17,000 lb. reinforcing steel and the placing in wooden structures of about 50 M. ft. lumber. Work is located about 7 miles east of Malta, near Strater and Bowdoin Stations on Great Northern Ry.

Irrigation—St. Ignatius, Mont.—Until March 23, by U. S. Reclamation Service, St. Ignatius, for constructing canals and structures on Flathead Project, Mont., advertised in Engineering Record.

Drainage, Ditches, Etc.—Donniphan, Mo.—Until March 14 by John H. Greason, Eng. Drainage Dist No. 3, for constructing two drainage ditches, main ditch 39,550 ft. long, lateral ditch No. 1, 8,336 ft. long, in all about 399,196 cu. yds.; also for constructing four steel bridges to cross ditches.

Revetment—Kansas City, Mo.—Until March 23, by U. S. Engineer, Kansas City, for constructing about 5400 ft. standard revetment on Missouri River, 9 miles below Kansas City, Mo.; advertised in Engineering Record.

Irrigation—Barstow, Tex.—Reported desired until March 7, by Directors Ward County Irrigation Dist No. 1 (Robt. L. McKnight, Secy.), for constructing dams, reservoirs, headgates, sluicegates, etc., for said district.

Dredging—Seattle, Wash.—Reported desired until March 15, by Maj. J. B. Cavanaugh, U. S. Engr., Burke Building, Seattle, for dredging Lake Washington Canal from Locks at the Narrows to Lake Washington a distance of 3 miles, in all about 1,000,000 cu. yd. Also removal of dams at Portage and Fremont. Contracts to be let in three sections. Amount available $380,000.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★Jetties—Spring Lake, N. J.—Reported contract for completing construction of beach front jetties has been taken over by Jesse Howland, Seabright.

★Ditch — Jackson, Minn. — Following are four lowest bids opened Feb. 15, by P. D. McKellar, County Auditor, for constructing Judicial Ditch No. 35, Jackson County: Open work, Clyde A. Walb, LaGrange, $10,600, about 132,580 yd. (awarded contract); Cary Keliher Ditch Company, $16,800, and Henry P. Johnson, Sterling, Ill., $13,000. Tile portion: Snyder & House, Fort Dodge, Iowa, $55,000 (awarded contract); Schoel Bros., Worthington, Minn., $55,495; R. L Cox, Webster City, Iowa, $56,948; and Hansen & Christensen, Northwood, Iowa, and Chris. Axelsen, Clear Lake, Iowa, bid the same, $58,100.

★Drainage — Clarks, Neb. — Contract awarded I. E. Doty, David City, for constructing three drainage ditches in Merrick County Drainage District No. 1, at 12¾ cts. per cu. yd., approximately 82,000 cu. yd. D. D. Price, Engineer, Lincoln.

★Irrigation—Great Falls, Mont.—Contract awarded by U. S. Reclamation Service to Des Moines Bridge & Iron Works, Des Moines. Iowa, for furnishing and erecting highway and pipe bridge for the Sun River Irrigation project near Great Falls, at about $9,000.

★Shed — Beaumont, Tex. — Contract awarded by City Council to J. S. Merriweather, Main and Fannin Streets, for constructing the municipal freight shed on the city wharf at $18,005, and to J. J. Burke, for constructing the foundations at $2,303. (Bids opened Feb. 12.)

★Sea Wall—Seattle, Wash.—Contract awarded by Board of Public Works to Jahn Contracting Company, Pioneer Building, for constructing the Railroad Avenue concrete seawall and paving the improvement to extend from Washington to Madison Streets, at $79,887.

★Irrigation—Grandview, Ore.—Contract for constructing Suttle Lake Grandview Irrigation Project awarded Henry J. Kaiser, Everett, Wash., at about $600,000 cost, plus 13½ per cent. O. Luargaard, Railway Exchange Building, Portland, Project Engineer.

★Irrigation—Grandview, Ore.—Contract awarded Henry J. Kaiser, Everett, for constructing the Suttle Lakes Irrigation Project; cost about $600,000. Reported sub-bids on construction of dams, reservoirs and canals desired by the contractor. A. Laurgaard, Engineer, Railway Exchange Building, Portland.

ELECTRIC RAILWAYS

PROPOSED WORK.

Albany, N. Y.—Plans being considered by Albany Southern R.R. Co. to extend road to Massachusetts State line, there to connect with an extension that it is proposed to have the Berkshire Street Ry. make.

Allentown, Pa.—Lehigh Valley Transit Co. will double-track line between Bethlehem and Easton, a distance of about 9 miles. Franchise for double-tracking will be asked for in the city of Bethlehem. H. R. Fehr, Allentown, President.

Durham, N. C.—Reported that Durham Traction Co. contemplates spending about $100,000 for improvements during year.

Canton, Ohio.—During the spring the Northern Ohio Traction & Light Co. (B. L. Luke, Ch. Engr., Cuyahoga Falls) plans a complete renewal of its tracks on Market Avenue, from Sixth Street N. to Sixth Street S.

Cleveland, Ohio.—Cleveland & Sharon R.R. Co. has applied to the Public Utilities Commission for permission to sell $185,000 bonds and $75,000 stock for building an electric railway between Middlefield and Lockwood, a distance of 12 miles; cost $261,000. Extensions are planned both north and south. C. H. Felton, Secy.

Findlay, Ohio.—The Toledo, Bowling Green & Southern Traction Co. (C. F. Smith, Gen. Mgr., Findlay) will repair ties and rails on roadbed from Findlay to Toledo.

Detroit, Mich.—Detroit Commercial Club is considering constructing an electric railway from Detroit to Ponsford, a distance of 40 miles.

Champaign, Ill.—Illinois Traction Company (G. M. Mattes, Vice-Pres., Champaign), contemplates constructing a line between this city and Bloomington, a distance of 50 miles.

Galesburg, Ill.—Improvements planned by Galesburg Light & Railway Co., to cost $225,000, including enlargement and reequipment of the boiler plant, new railway unit in electric department, replacing of gas pipes, new boilers in plant and sinking of deep wells.

Fort Scott, Kan.—L. A. Wells Construction Co.. 34 Wade Building, Cleveland, Ohio, will receive figures on grading about 250,000 cu. yd. for construction of an electric railway from Fort Scott to Mulberry. Work to begin as soon as the weather will permit. The company is also in the market for steel rails and connections, ties, poles, high-tension wires, etc.

Kansas City, Mo.—The Metropolitan Street Railway tracks on Swope Parkway will be constructed from Fifty-ninth Street to Swope Park. There will be 26-ft. roadway on each side, with 40 ft. on east and west sides for sidewalks and parking. The tracks will be paved with bituminous macadam.

Corpus Christi, Tex.—Corpus Christi Railway & Light Co. plans to construct about ½ mile permanent track.

Fresno, Cal.—Fresno Interurban Ry., Fresno, Cal., intends this summer constructing extensions, in all about 15 miles. A 7-mile extension is under construction between Barton Vineyard and Kutner Colony, in addition to the 15 miles proposed. John S. Bates, Chief Engineer.

Preston, Utah.—Reported that Ogden, Logan & Idaho Ry. (R. W. Armstrong, Ch. Engr., Ogden) is contemplating construction of a line from Preston north through Pocatello, Blackfoot, Idaho Falls into Yellowstone Park.

BIDS DESIRED.

New York, N. Y.—Until March 9 by Public Service Commission for First Dist., 154 Nassau Street (Travis H. Whitney, Secy.), for constructing station finish for 7 stations on the Broadway-Fourth Avenue Rapid Transit R.R. in borough of Manhattan. Also separate bids for station finish for the Hunters Point Station on Queensboro Subway, Rapid Transit R.R.

Toronto, Ont.—Until March 14, by T. L. Church, Mayor, Chmn. Board Control, for single truck, double end street car, completely equipped ready for operation, one car body double end, single truck, equipment for one single truck, etc., for Bloor Street Division, Toronto Civic Ry.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Brooklyn, N. Y.—Lowest bid opened by the Municipal Railway Corporation for constructing the Coney Island terminal submitted by Lord Construction Co., 105 W. Fortieth Street, New York City. Building to be steel and concrete and double decked.

★New York, N. Y.—Contract awarded by Public Service Commission for First District, 154 Nassau Street, for laying tracks on White Plains road, Bronx, to Coast & Lakes Contracting Company, 41 Broad Street, at $94,280, and for Route 12, Section 2-A, borough of Brooklyn, to Degnon Contracting Company, 30 East Forty-second Street, at $1,370,098.

★Chester, Va.—Contract for constructing Chester & City Point Railway from Chester City to City Point and Hopewell awarded to Vaughan Construction Co., Inc., of Roanoke. A 60-ft. draw bridge will be constructed over Appomattox River in connection with construction of the line. H. D. Eichelberger, Chester, President.

★Kansas City, Mo.—Reported contract awarded by Kansas City & Tiffany Springs Ry. Co. to Willard E. Winner for constructing line from Kansas City to Tiffany Springs, 15 miles. H. G. Pert, President.

RAILROADS

PROPOSED WORK.

Hopewell, N. J.—Reported Philadelphia & Reading R.R. (S. T. Wagner, Ch. Engr., Philadelphia, Pa.) intends making extensive improvements here this summer, including the construction of a steel girder bridge across tracks near the station.

Wheeling, Va.—Reported the Wellsburg & Eastern Railroad Co., incorporated, to construct a railroad from Wellsburg, W. Va., to Washington. Incorporators: John B. Arbenz and Carl O. Schmidt of Wheeling, and others.

Cincinnati, Ohio.—City Collector Fred W. Schmidtz has submitted to City Commissioners an amendment to a bill with reference to the regulation and control of public utilities in second class cities. The amendment has reference to a plan to compel railroads to eliminate grade crossings.

Columbus, Ohio.—Agreement has been signed between city and Big Four and Pennsylvania railroads to construct elevated crossings at Second, Fifth, Eleventh and Seventeenth Avenues. North Side work is to be started about March 15 and cost is about $600,000, of which the city will pay about one-third. Grade crossings are to be eliminated also at Dennison Avenue and Cleveland Avenue and Pennsylvania tracks and in the eastern part of the city along the Norfolk & Western R. R. The city's share of this work will be $300,000.

Reserve, Minn. — Soo Railway (C. N. Kalk, Ch. Engr., Minneapolis, Minn.) is planning constructing a railroad from Reserve to Mellen, Wis., a distance of about 45 miles. Time of construction not definitely settled.

Hot Springs, Ark.—The Hot Springs, Pine Bluff & Mississippi R.R. has been incorporated to build and operate a railroad from Hot Springs to some point on the Mississippi River, east of DeWitt, in Arkansas County. George B. Blanchard, 10 S. La Salle Street, Chicago, Ill., one of the directors.

Seattle, Wash.—The Northern Pacific Ry. Co. (W. L. Darling, Ch. Engr., St. Paul, Minn.) intends building about 19 miles of new track this summer in Eastern Washington. The Sunnyside branch will be extended from Grand View to connect with the main branch at Gibson, 7 miles; the Simcoe branch extended from Harrah to White Swan 10½ miles, and the Cowiche Valley branch 1½ miles.

PUBLIC BUILDINGS AND SCHOOLS

PROPOSED WORK.

Boston, Mass.—Mayor Curley, in his address to Council recommends the establishment of a municipal maternity hospital.

Chelmsford, Mass.—Citizens voted $65,000 bonds to erect consolidated high school. Address School Board.

Lowell, Mass.—Municipal Council instructed James E. Donnelly, City Commissioner, to have plans prepared for additions to Highland, Bartlett and Pawtucketville schools.

School bonds amounting to $100,000 have been sold.

New Bedford, Mass.—Erection of city bath houses in Hazelwood Park being considered; probable cost $50,000.

Providence, R. I.—City Council Committee on City Property selected Hoppin & Field, 32 Westminster Street, to prepare plans for proposed $300,000 high school.

Buffalo, N. Y.—Mayor has recommended to Council erection of a municipal detention home for children, including plans for a Children's Court and probation offices.

Elmira, N. Y.—Henry D. Whitfield, 160 Fifth Avenue, New York, engaged to prepare plans for proposed Carnegie Library.

Burlington, N. J.—H. A. Brown of Burlington is architect for 3-story 100 x 120-ft. brick high school to be erected here. Address Board of Education.

Spring Lake, N. J.—Revised plans being prepared by Magaziner & Potter, 603 Chestnut Street, Philadelphia, Pa., for two-story, fireproof, brick hospital to replace present Ann May Memorial Hospital at Spring Lake. Cost, $50,000.

Pittsburgh, Pa.—Plans reported prepared for annex contemplated for Eighteenth Regiment Armory, Thackeray and O'Hara Streets, Bellefield. Probable cost, $300,000. Address Armory Commissioners, Harrisburg.

Reading, Pa.—Steps being taken to erect $25,000 Municipal Hospital. Address City Clerk.

Cambridge, Md.—State Armory Commissioners, Annapolis, are considering the erection of an armory here costing $35,000.

Clarksburg, W. Va.—Clarksburg Protestant Hospital Co. intends erecting five-story hospital on site of present Kessler Hospital, to cost $100,000.

Tifton, Ga.—See "Waterworks."

Huntsville, Ala. — City Commissioners sold $40,000 school bonds.

New Orleans, La.—Plans adopted by Sewerage and Water Board for a 6-story office building to be erected for the board at Lafayette and Carondelet Streets.

Columbus, Miss.—Citizens voted $50,000 bonds for erecting high school.

Owensboro, Ky.—Erection of a city hall costing $40,000 is under consideration. Address City Clerk.

Bryan, Ohio.—Election to be held March 7 to vote on erecting a grade and high school with auditorium annex; cost $95,000. William H. Nicklas, Architect, Cleveland. Address J. W. Wyandt, Supt. Board of Education.

Chillicothe, Ohio.—School bonds amounting to $29,000 sold. Address School Board.

Cleveland, Ohio.—Erection of municipal bathhouse and auditorium on Holmden Avenue being considered; probable cost $85,000. Address City Clerk.

Cleveland, Ohio.—Chamber of Commerce will spend $25,000 in altering the fifth floor of the Chamber of Commerce Building.

Lowellville, Ohio.—Citizens voted $25,000 bonds for erecting addition to North Side school.

McCuthenville, Ohio. — Pretsinger & Muzzleman, Dayton, are architects for the 2-story stone and concrete school to be erected at a cost of $37,000. Nothing further has been done in the matter. J. L. Ban, Clerk Board of Education.

Struthers, Ohio.—Election to be held March 1 in Poland Township to vote $35,000 bonds for erecting an eight-room school in Lyon's plat district, near Struthers, and a three-room school at Poland Center.

Huntington, Ind.—County Commissioners considering appropriating $40,000 for erecting county hospital.

Indianapolis, Ind.—Board of Education is considering erecting an annex to the Manual Training High School, to cost $180,000.

Winchester, Ind.—All bids opened Feb. 11 for erecting school in Stony Creek Township have been rejected. Plans are to be altered so as to reduce the cost. Address Samuel G. Bartel, Farmland.

Detroit, Mich.—Citizens of Ecorse Township voted $40,000 bonds for purchase of site and erecting eight-room brick school. Address School Board.

Ludington, Mich.—Board of Education has appointed committee to secure plans for grade school to replace Longfellow School.

Rockford, Mich.—Reported erection of a grade and high school to cost $75,000 being considered. Address Board of Education.

Chicago, Ill.—All bids opened Jan. 24 by First Cavalry Armory, I. N. G. Commission, at office J. B. Dibelka, 130 North Fifth Avenue, Chicago, for erecting the First Cavalry Armory have been rejected. New bids will be asked very soon.

Longview, Ill.—Village considering issuing $25,000 bonds for erecting a high school. Address Village Clerk.

Paxton, Ill.—County Superintendent of Schools plans erecting a township high school, costing $40,000.

Sullivan, Ill.—Citizens voted $40,000 bonds for erecting a township high school. Address Township Clerk.

Shawano, Wis.—Citizens voted $100,000 bonds for erecting new high school. Address Board of Education.

Rockwell City, Iowa.—State Board of Control, Des Moines, selected site here on which to erect woman's reformatory.

Waterloo, Iowa.—M. B. Cleveland of Waterloo, engaged to prepare plans for proposed $250,000 high school to be erected in East Waterloo.

Minneapolis, Minn.—Council Committee on Ways and Means has recommended to Council the granting to Board of Education $400,000 for school improvements, including Adams School addition, $20,000; Corcoran School addition, $60,000; Hiawatha School, $75,000; Horace Mann School addition, $50,000, and other schools.

St. Paul, Minn.—Macalester College will erect a church costing $60,000. Professor Hugh S. Alexander, Chairman Bldg. Committee.

Concordia, Kan.—Election soon to be held to vote $100,000 bonds for erecting a school.

Ellis, Kan.—W. E. Hulse & Company, Hutchinson, engaged to prepare plans for proposed $25,000 high school for which bonds were recently voted.

Independence, Kan.—Election is to be held Feb. 26 to vote $75,000 bonds to erect an additional high school. Address Board of Education.

Wichita, Kan.—Election to be held to vote $100,000 bonds for erecting a school. Address School Board.

Havelock, Neb.—Election to be held Feb. 29 to vote $35,000 bonds for erecting high school.

Bismarck, N. D.—City Commission is in favor of erecting $25,000 Carnegie library.

Houston, Tex.—Citizens voted $35,000 bonds for erecting school for Harrisburg, Magnolia Park and Park Place districts. Address Clerk School District.

Plainview, Tex.—Election soon to be held to vote $50,000 bonds for erecting a high school.

San Antonio, Tex.—Ralph Cameron, 416 State Bank Building, is architect for the high school. The citizens recently voted $800,000 school bonds. Paul H. Scholz, Business Agent.

Sweetwater, Tex.—Election to be held March 28 to vote $100,000 bonds for erecting a courthouse. Address County Clerk.

Medicine Park, Okla.—State considering erection of a fish hatchery here to cost $30,000.

Okmulgee, Okla.—Election to be held March 14 to vote $125,000 bonds for erecting a courthouse.

Bakersfield, Cal.—High school bonds amounting to $75,000 have been sold.

California.—The $800,000 San Francisco State Building bonds have been sold by the State Treasurer, Sacramento.

Downey, Cal.—School Trustees propose selling $35,000 school bonds.

Independence, Cal.—State Archt., Sacramento, has about completed plans for $30,000 concrete and stone fish hatchery buildings to be erected in Oak Creek.

Long Beach, Cal.—Plans to be prepared by Horace W. Austin, 26 Elm Street, for two 2-story and basement brick grammar school buildings. Election to be held to vote $225,000 bonds for this purpose.

Santa Barbara, Cal.—Erection of a Carnegie library costing $50,000 is under consideration. C. A. Edwards, Pres. County Natl. Bank, interested.

Turlock, Cal.—Election to vote $50,000 bonds for erecting high school. Address Board Education.

Wasco, Cal.—Ernest J. Kump, Fresno, engaged to prepare plans for a high school school costing $45,000.

Thatcher, Ariz.—Citizens voted $40,000 bonds for erecting a school. John F. Nash, Clerk.

Ogden, Utah.—Trustees of Dee Hospital intend erecting nurses' home to cost about $25,000.

Jerome, Idaho.—School Board engaged Wayland & Fennell, Boise, to prepare plans for high school; cost $50,000.

Portage La Prairie, Man.—Election to be held in March to vote on erecting a stone and brick fireproof school, costing $65,000. A. E. Ireland, Secretary, School Board.

BIDS DESIRED.

Wallum Lake, R. I.—Until March 16, by Board of Control & Supply, Room 18, State House, Providence, for erecting a hospital and employees' building for advanced cases of tuberculosis at State Sanatorium at Wallum Lake. Richard D. Kimball Company, Engineers, 430 Industrial Trust Building, Providence; Walter F. Fontaine, Archt., Federal Building, Woonsocket.

Kings Park, N. Y.—Until March 3 by State Hospital Commission (E. S. Ellwood, Secy.), Albany, for construction, heating, plumbing and drainage and electric work for Employees Home at Kings Park State Hospital. Lewis F. Pilcher, State Archt., Capitol, Albany.

Scotia, N. Y.—Reported desired until Feb. 26, by J. J. Lusk, Clk Board Education, for erecting two-story and basement, 70 x 150 ft. school. Archt., C. G. Van Rensselaer, State and Jay Sts., Schenectady.

Breckenridge, Pa.—Reported desired until March 7, by John Girt, Secy. Board Education for erecting two-story and basement 48 x 150-ft. school. Probable cost, $35,000. Archt., J. H. Phillips, Trust Bldg., McKees Rocks, Pa.

Slatington, Pa.—Until March 1 (change of date from Feb. 21), by J. W. Snyder, Supervising Principal, constructing a two-story and basement high school, brick and stone, costing, with equipment, about $56,000. E. Z. Scholl, Archt., Reading.

Charleston, W. Va.—Until March 1, by State Board Control, for erecting brick, fireproof school, 140 x 38 ft., with chapel, 32 x 60 ft. H. Rus Warner, Archt., Charleston, W. Va.

Edison, Ohio.—Reported desired until March 9, by Jas. Lacey, Clk. Board Education, for erecting two-story and basement, 40 x 79-ft. high school. C. L. Inscho, Archt., 145 N. High Street.

Mingo, Ohio.—Reported desired until March 15 (readvertisement) by A. Aughinpaugh, Clk. Board Education, for erecting two-story addition to grade school; probable cost, $20,000. A. W. Stover & Co., Archts., Hartman Bldg., Columbus.

Salem, Ohio.—Until March 17, by Board of Education (Albert Hayes, Clerk), for furnishing material and erecting high school on Garfield Avenue. C. F. Owsley, Mahoning Bank Building, Youngstown, Archt.

Delphi, Ind.—Reported desired until April 24 by H. D. Good, Co. Aud., for erecting two-story and basement 118 x122 ft. courthouse. Elmer E. Dunlap, 909 State Life Bldg., Indianapolis, and 616 Citizens National Bank Bldg.

Huntington, Ind.—Until March 6 by J. A. Wetmore, Acting Superv. Archt., Treas. Dept., Washington, D. C., for erecting post office at Huntington.

Hinsdale, Ill.—Reported desired until March 1 by Board Education, for erecting two-story and basement, 150 x 170-ft. school. Perkins, Fellows & Hamilton, Archts., 6 N. Clarke Street, Chicago.

Chilton, Wis.—Until March 8, by Committee at Court House (Jos. Grassold, Chmn.), for erecting jail and Sheriff's residence. Foeller & Schober, Archts. Builders & Traders Exchange Bldg.

Madison, Wis.—Until Feb. 29 (readvertisement), by Lew F. Porter, Secy. Capitol Commission, for furnishing material and erecting a storage building for State Capitol at Madison.

Ottosen, Ia.—Reported desired until March 7 by L. J. Clave, Pres. Consolidated School Dist., for erecting two-story and basement, 82 x 92-ft. school. Probable cost, $40,000. Marten & Hoskins, Archts., Storm Lake, Ia.

Minneapolis, Minn.—Reported desired until March 13, by Board Education (Geo. F. Womrath, Bus. Mgr.), for addition to West Side high school. W. B. Ittner, Archt., 408 Bd. Educ. Bldg., St. Louis, Mo.

St. Paul, Minn.—Until March 13 by August Hohenstein, Purchasing Agent, for erecting Carnegie Library No. 2 on Goff Avenue and George Street.

Hays, Kan.—Until March 10 by State Board Administration, Topeka, for erecting a 3-story stone administration building and gymnasium at State Normal School at Hays. C. H. Chandler, State Archt., Topeka.

Carthage, S. D.—Reported desired until Feb. 29, for erecting two-story, brick school addition. F. C. W. Kuehn, Archt., Huron, S. D.

Houston, Tex.—Until March 6, by City Secretary, for erecting greenhouse for city, on the Wright Floral Gardens. Separate bids for plumbing. Maurice J. Sullivan, City Archt.

Pueblo, Col.—Reported desired until March 27, by J. Knox Burton, Comr. Finance and Supplies, for erecting municipal buildings and auditorium.

Brea, Cal.—Until Feb. 28 by Randolph School Dist. (L. H. Van Hoorebeke, Clk.) for erecting a two-story hollow tile grammar school. About $60,000 available. Elmore R. Jeffery and Frank R. Schaefer, 1202 Van Nuys Building, Los Angeles.

El Centro, Cal.—Until March 3, by Central Union High School District (V. G. Fawcett, Clerk), for erecting a 2-story 19-room, concrete, steel frame, terra cotta and brick school to cost $100,000. S. B. Zimmer, Archt., 8 El Centro National Bank Building.

Los Angeles, Cal.—Until March 3 (extension of date) by Board of Library Trustees (E. R. Perry, Clk.), for erecting a one-story and basement brick and hollow tile branch library at Avenue 26 and Workman Street; $35,000 available. Lester H. Hibbard, Architect, Marsh-Strong Building.

San Bernardino, Cal.—See "Prices and Lettings."

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Fairhaven, Vt.**—Contracts for erecting two-story school (bids opened Feb. 15) awarded by Fair Haven Graded School Dist. (A. Vail Allen, Chmn.) as follows: General contract, J. Fred Acker, Glens Falls, N. Y., $39,710; heating, also plumbing, Norton Hardware Co., Fair Haven, $6,020 and $1,795 respectively.

★**Montpelier, Vt.**—Contracts for erecting the library and building awarded as follows (bids opened Feb. 18): Granite, Marr & Gordan, Barre, $59,600; general contract, George T. Kelley, Yonkers, N. Y., $139,488; steam fitting, $8,969. Horace F. Graham, Secy. Commission.

★**Salem, Mass.**—Contract awarded Mack Brothers of Salem, for erecting Salem Hospital buildings on Highland Ave.; estimated cost about $250,000.

Stoneham, Mass.—Following are bids opened Feb. 15 by Selectmen for erecting police station: F. C. Alexander, Old South Building, Boston, $35,937; Morrison & Davis, Salem, $37,100; John Bowen, Roxbury, $37,490.

★**Seymour, Conn.**—Contract for erecting U. S. Post Office, reported awarded Frank M. Weakley, Portsmouth, Va., at $48,400.

★**Hornell, N. Y.**—Contract for erecting U. S. Post Office awarded George W. Stiles Construction Company, Chicago, Ill., at $61,863 and not to Sidney K. Eastwood, of Owego as previously stated.

★**Wildwood, N. J.**—Contract for erecting high school awarded as follows: General contract, Richman Construction Company, Moorestown, N. J.; heating, American Heating Company, Philadelphia, Pa.; plumbing, Koeneke Bros., Wildwood. W. C. Todd, Secy., Wildwood.

★**Lancaster, Pa.**—Contracts in connection with erecting $250,000 Boys' High School (bids opened Feb. 16) awarded by Board of Education as follows: Brick and stone, Herman Wohlson, Lancaster, at $159,998; heating and ventilating, and plumbing, Everts & Overdeer, Lancaster, at $20,100 and $10,000, respectively; electrical wiring, Joseph S. Miller & Company, Philadelphia, $5,890. C. Emlen Urban, Archt., Woolworth Building.

Pittsburgh, Pa.—Following are two bids opened Feb. 17 by James A. Wetmore, Acting Supervising Architect, Washington, D. C., for extension to power house in connection with the experiment station, Bureau of Mines, Pittsburgh: George B. Wills & Company, 101 Park Avenue, New York, N. Y., $84,615, and the George Hoggs Company, Pittsburgh, Pa., $88,000.

Indian Head, Md.—Following are bids opened Feb. 19 by Bureau of Yards & Docks, Navy Department, Washington, D. C. for erecting alterations to building No. 172 Naval Proving Grounds; John H. Nolan Construction Company, 1413 G St., N. W., Washington, D. C., $24,152; Specialty Engineering Company, Emerald and Cornwall Sts., Philadelphia, Pa., $28,500; and J. L. Robinson Construction Company, Knickerbocker Building, Baltimore, Md., $32,102.

★**Toledo, Ohio.**—Contract awarded William Gruenke of Toledo, for erecting addition to Ironville School at $33,720; heating, Bryce Heating & Ventilating Company, Spitzer Building, at $7,195.

★**Mishawaka, Ind.**—Contract for erecting consolidated school in north part of Penn Township awarded J. C. Montrage, Elkhart; probable cost $25,000.

Sioux City, Iowa.—Following are four lowest bids opened Feb. 7, by Board of Supervisors for general construction of the County Courthouse: George J. Grant Construction Company, Endicott Building, St. Paul, Minn., $528,877; George A. Fuller Company, 140 South Dearborn Street, Chicago, Ill., $535,200; Splady, Albee & Smith, Plymouth Bldg., Minneapolis, Minn., $535,716; Balkan Construction Company, 53 West Jackson Boulevard, Chicago, Ill., $535,827.

★**Sioux City, Iowa.**—Contract for erecting the court house awarded Splady, Albee & Smith, Minneapolis, Minn., at $535,000. W. L. Steel , Archt., United Bank Building.

★**Ashland, Kan.**—Contract awarded J. D. Parks, Ardmore, Okla., for erecting a school to cost $30,000. Mann & Gerow, Hutchinson, Archts.; Charles McCacland, Clerk Board of Education.

★**Great Bend, Kan.**—Contract for erecting brick school (bids opened Feb. 16) awarded Sharp Bros., Eldorado, Kan. Cost about $25,000. J. E. McMullen, President Board of Education.

San Bernardino, Cal.—Following are four lowest bids opened Feb. 14 by Board of Supervisors for erecting two story brick and concrete county hospital: W. E. Kier Construction Company, American National Bank Building, San Diego, $199,900 (modified bids also submitted). Cresmer Mfg. Company, Riverside, $211,489; C. McNiell, Santa Ana, $216,630; W. C. Crowell, Pasadena, $220,968. Lyman Farwell, Archt., Story Building, Los Angeles.

The above bids have been rejected by the County Supervisors and new bids will be asked on only a three-story and basement brick and concrete administration building, and two-story and basement brick and concrete service building. About $130,000 available. Lyman Farwell, Archt., 615 Story Building, Los Angeles.

PRIVATE BUILDINGS

PROPOSED WORK.

New Haven, Conn.—New Haven House Co., 1002 Chapel Street, intends adding a fourth story to the Taft Apartment House; cost $36,000.

Cortland, N. Y.—Cortland Theater is to be remodeled at a cost of $40,000. Address Dillon Bros., Cortland.

Great Neck, L. I., N. Y.—Patterson & Dula, 15 East Fortieth Street, New York, are architects for $35,000 colonial residence which William F. Piel of Woodmere intends erecting in Kensington, Great Neck.

New York, N. Y.—Plans filed for erecting following buildings: 21-story, brick, fireproof stores and office building at 2-10 East Forty-second Street for Oceanic Investing Co., cost $800,000, Montague Flagg, 2d, Archt., 109 Broad Street; 5-story brick tenement at 184th Street and Ryer Avenue for Faiella Construction Corporation, cost $65,000, William A. Faiella, Archt., 2398 Lorillard Place; two 5-story brick tenements at 181st Street and Morris Avenue for Infantino Realty Co., total cost $95,000, Lucian Pisciotta, Archt., 391 East 149th Street; 6-story brick tenement at Wilkins Avenue and Crotona Park East for Kleban Leader, Inc., cost $70,000, Goldner & Goldberg, Archts., 391 East 149th Street; 5-story brick tenement on Kingsbridge Road and Briggs Avenue for Kearns Realty Co., cost $60,000, Charles Schaefer, Jr., Archt. 401 Tremont Avenue; 5-story brick tenement on Vyse Avenue and Bronx Park South for G. & B. Realty Co., cost $60,000, Kreymborg Architectural Co., Archts., 1029 East 163d Street; alterations to 13-story, fireproof hotel at 129-135 West Forty-eighth Street for Bristol Hotel Realty Corporation, cost $300,000, Ewing & Chappell, Archts., 101 Park Avenue.

Jersey City, N. J.—The National Corporation of New Jersey, Jersey City, plans erecting a four-story brick apartment house at Harrison Avenue and Hudson Boulevard costing $35,000.

Morris Robbins, Jersey City, plans erecting two four-story brick apartment houses on Fairmount Avenue costing $50,000.

West Hoboken, N. J.—Emilio Viatto, West Hoboken, will erect a four-story brick apartment house on Mountain Road to cost $35,000.

West New York (P. O. Weehawken), N. J.—Benjamin Gordon, West New York, will erect a four-story brick apartment house at Monroe and Eighteenth Streets to cost $30,000.

Altoona, Pa.—Contract soon to be let by Pride of Mountain City Council No. 472, Jr. O. U. A. M., for erecting a fireproof lodge building costing $30,000.

Plans prepared by F. J. Shollar, Altoona, for three-story brick apartment house to be erected by Robert E. Walsh at a cost of $25,000.

Berwick, Pa.—Holy Trinity Lutheran Church intends erecting a $35,000 edifice.

Lancaster, Pa.—Plans being prepared by A. A. Richter, Sixth and Court Streets, Reading, for $30,000 Emanuel Lutheran Church.

Lehighton, Pa.—Lodge No. 650, Fraternal Order of Eagles, intends erecting three-story brick addition to present building, at 381 North First Street.

Lock Haven, Pa.—Church of Christ contemplates erecting new edifice costing $40,000.

Philadelphia, Pa.—Plans being prepared by Andrew J. Sauer, 1112 Chestnut Street, for five-story, brick, 50 x 100 ft. commercial building.

West Chester, Pa.—Eagles plan erecting three-story brick addition to club house.

Baltimore, Md.—Sparklin & Childs, 502 Law Building, are architects for the theater which Madison Amusement Co. will erect on Madison Avenue at a cost of $30,000.

Oliver B. Wight, 1122 Munsey Building, is preparing plans for a four-story brick and concrete garage to be erected on Cathedral Street and Mount Royal Avenue; cost $30,000.

Richmond, Va.—Richmond, Fredericksburg & Potomac R. R. (R. J. Rouse, Purchasing Agent, Richmond) has made an offer to city to erect a $2,000,000 passenger station in western part of city.

Welch, W. Va.—Contract will be let about March 15 for erecting four-story, brick and limestone lodge building for F. & A. M. Lodge No. 112; cost $25,000. Pedigo & Gary, Archts., Bluefield.

Savannah, Ga.—Joseph W. Heffernan, 409 Huntingdon Street E., reported interested in erecting a seven-story hotel on Bay Street; probable cost $150,000.

Jacksonville, Fla.—St. John's Parish reported contemplates erecting a parish house costing $30,000.

Jackson, Tenn.—Reported plans prepared for improving Southern Hotel (R. L. Burgess, Manager); cost $50,000.

Cleveland, Ohio.—City Ice Delivery Co., Saranac Road, will erect on Crawford Road and Blains Avenue a storage and delivery building costing $25,000.

Plans being prepared by Knox & Elliott, 1246 Rockefeller Building, for remodeling the Wigmore Coliseum on East Thirteenth Street, near Euclid Avenue, to cost about $250,000.

Carson Realty Co. (C. A. Carson, Pres.) will erect a 6 family apartment house at 1846 East Seventy-fifth Street costing $25,000.

Lorain Street Savings Bank Co. will erect a 3-story building at Lorain Avenue and Fulton Road this spring costing $60,000.

Cleveland Builders Supply Co., Leader-News Building, will erect a $30,000 supply station at Crossing Court and Cleveland & Pittsburgh R.R.

The Bohemian Old Folks Assoc. is planning erecting a $25,000 home at Warrensville Colony Farm. Lamar T. Beman, City Hall, Director of Public Welfare League, may be able to give further information.

Plans prepared by Walker & Weeks, 1900 Euclid Avenue, for an 8-story apartment house to be erected on East 107th Street and Wade Park, at a cost of $100,000, for Frank C. Newcomer, 1311 Schofield Building.

Plans being prepared by Hubbell & Benes, 4500 Euclid Avenue, for remodeling Wick House, at 3515 Euclid Avenue, recently purchased by Al Koran Temple, Nobles of the Mystic Shrine, into a lodge building; probable cost $200,000.

Portsmouth, Ohio.—First Baptist Church, Gallia and Waller Streets, contemplates erecting new edifice, costing about $25,000. Rev. B. F. Caudill, Pastor.

Indianapolis, Ind.—Reported Indianapolis Light & Heat Company (Thomas A. Wynee, Vice-President) intends erecting a new central power station on Kentucky Avenue station site. The new plant is to cost about $4,000,000, and will include $250,000 building of brick, concrete and steel. Most of the equipment, it is reported, has been contracted for with the General Electric Company of Schenectady, N. Y.

Indianapolis, Ind.—City Investment Co., Indianapolis, is reported taking steps to erect on East New York and Pennsylvania Streets an 8 or 10-story apartment house or hotel costing $200,000.

Lafayette, Ind.—Lafayette Life Insurance Co., Lafayette, is considering remodeling the Wallace Block at a cost of $25,000.

Des Moines, Iowa.—Tentative plans prepared for eight-story, 110 x 160 ft., steel and granite office building, contemplated for Bankers' Life Co., Equitable Building, Sixth and Locust Streets.

Newton, Kan.—Plans prepared by J. O. Parr, Security Building, Oklahoma City, Okla., for a three-story $40,000 Methodist Church. Rev. R. L. George, Pastor.

Wichita, Kan.—Plans prepared by Weary & Alford, Chicago, Ill., for a one-story and basement marble, concrete or granite bank building to be erected for Kansas National Bank of Wichita; cost $100,000.

North Platte, Neb.—Reported Northern Pacific R. R. (W. L. Darling, Ch. Engr., St. Paul, Minn.), will erect a station here costing $150,000.

Aberdeen, S. D.—Shriners of Aberdeen contemplating erecting a temple and public auditorium this spring.

Wessington Springs, S. D.—Masons are considering erecting a brick temple costing $25,000.

Hardin, Mont.—A. L. Mitchell of Hardin will erect three-story, fireproof hotel, costing $80,000.

Seattle, Wash.—Plans being prepared by Max Umbrecht, Arcade Building, and J. A. Creutzer, New York Block, associate architect, for proposed $350,000 vaudeville and moving picture theater, to be erected for Eugene Levy, of reinforced concrete, brick and terra cotta construction.

Contract will be let about March 1 for five-story and basement reinforced concrete apartment house, to be erected on Boren Avenue and Howard Street, for Goodwin Realty Company. Cost, $100,000. Lawton & Moldenhour, Archts., Alaska Building.

Seattle, Wash.—Contract will be let about March 5 by M. R. Wood and Charles Bruhn, Stuart Building, for erecting a three-story and basement brick and frame apartment house on Fifth Avenue and James Street, to cost $50,000.

Anaheim, Cal.—Plans prepared and contract will be let about March for erecting a three-story steel and brick bank and office building for First National Bank.

Los Angeles, Cal.—City has granted a lease to the Standard Oil Company (J. L. Quinn, Mgr.), on seven acres of tide lands at San Pedro Harbor, and it is reported to be the intention of the company to erect a warehouse and install tanks at a cost of $100,000. A wharf 500 ft. long and 20 ft. wide will be constructed by the city at San Pedro Harbor to be used by Standard Oil Company in conjunction with its oil loading station; cost $36,000.

Los Angeles Chautauqua Association is having sketches prepared by Arthur S. Heineman, 831 San Fernando Building, for a three-story concrete building, 310 x 350 ft., to be erected at Montecito Park.

Standard Leasing Company (W. H. Daum, Equitable Savings Bank Building, Mgr.) will erect a produce market on Sixth and Mill Streets.

Salt Lake R.R. (Arthur Maguire, Ch. Engr., Pacific Electric Building) will erect a $260,000 passenger station on Seventh Street.

Fred Dorn, Marsh-Strong Building, is architect for the four-story brick store, theater and hotel building to be erected at Seventh Street and Central Avenue for Frank Strong, Marsh-Strong Building.

Monrovia, Cal.—F. O. Eager, Monrovia, engaged to prepare plans for a motion picture plant, to cost $200,000, for Monrovia Feature Film Co.

Richmond, Cal.—The Odd Fellows Association intends erecting a $50,000 lodge hall.

Santa Barbara, Cal.—County National Bank (C. A. Edwards, Pres.) secured site on which it is proposed erecting a bank building.

BIDS DESIRED.

Westfield, N. J.—Reported desired until March 1, for erecting school and church for Holy Trinity (R. C.) Church, Rev. H. Watterson, Pastor, 502 Westfield Avenue. Probable cost, $75,000. Elliott Lynch, 347 Fifth Avenue, New York City.

Gastonia, N. C.—Until March 2 (change of date), by First National Bank, for erecting a seven-story building. Wilson & Sompayrac, Archts., Columbia, S. C.

Des Moines, Iowa.—Until March 8, by Proudfoot, Bird & Rawson, Archts., 810 Hubbell Bldg., for erecting 12-story and basement 68 x 133 ft. brick and concrete fireproof newspaper and office building for the Register and Tribune, Seventh and Locust Streets. Cost $250,000.

Salina, Kan.—Reported desired until March 1, for erecting edifice for St. Lutheran Congregation. Probable cost $40,000. E. O. Brostrom, 300 Brent Building, Kansas City, Archt.

North Platte, Neb.—Until March 13, by Board Education (A. F. Streitz, Secy.), for erecting a three-story 66 x 169 junior high school building on the High School Campus, North Platte. Separate bids for heating, plumbing, electric wiring, etc.

St. Louis, Mo.—Reported desired until March 1, for a two-story 50 x 165 ft. addition to laundry of J. Arthur Anderson, 3960 Sixty-second Street. Probable cost $40,000. Chas. H. Wray, Archt, Chemical Building, St. Louis.

Montreal, Que.—Reported desired until March 14 for erecting school for Sacred Heart, Papineau Avenue. Marchand & Keroak, Archts., 164 S. James Street, and Doucet & Morissette, 294 St. Catherine Street, E., Montreal.

PRICES AND LETTINGS.

★*Indicates award of contract.*

New York, N. Y.—Homer A. Reid, 345 Fifth Avenue, is Consulting Engineer for a two-story reinforced concrete garage being erected by D. L. Dean on West 152d and West 153d Streets west of Broadway.

★**Philadelphia, Pa.**—Contract awarded Fleischman Co., 7 W. Forty-fifth Street, New York, N. Y., for erecting a four-story brick terra cotta and concrete department store for Blauner & Co., 833 Market Street. Hoffman Co., Globe Theater Building, Philadelphia, Archts.

★Contract awarded Thomas C. Trafford, 2335 N. Fifteenth Street, for erecting a stone church and Sunday-school building for Bishop Foss, Memorial Methodist Church, at Logan, a suburb of Philadelphia. Neff & Thames, Archts., 1213 Filbert Street, Philadelphia.

★Contract awarded by McIlvain & Company to Metzger & Fisher, Denckla Building, for erecting 12-story, 65 x 80 ft., fireproof, reinforced-concrete store and office building at Sixteenth and Sansom Streets.

★**Baltimore, Md.** — Contract awarded Charles L. Stockhausen Co., Inc., Marine Bank Building, for erecting building at Mount Royal Avenue and Cathedral Street for Lyric Realty Co., at $28,000. Wyatt & Nolting, Archts., 1012 Keyser Building.

★**Maryland.**—Contract for erecting a four-story hotel at Chesapeake Haven for Chesapeake Hotel Co. awarded E. E. & A. L. Flounders, Media, Pa.

★**Toledo, Ohio.**—H. J. Spieker & Co., 409 Michigan Street, reported contractors for two-story office and sales building to be erected at Canton and Shepard Streets for American Plumbers' Supply Company; cost about $76,000. Thomas F. Huber, Archt., Spitzer Building.

★**St. Louis, Mo.**—Contract for erecting Church of Divine Science on Wyoming Street awarded Hartman Building & Contracting Company of St. Louis; cost $30,000.

★**Pocatello, Idaho.**—Contract awarded Alexander Mathers, Pocatello, for erecting two-story and basement, fireproof, business building for First National Bank at Center and Arthur Streets; cost $90,000.

NEW INDUSTRIAL PLANTS

PROPOSED WORK.

Danielson, Conn.—A three-story, 275 x 150 ft. mill is to be erected for the Connecticut Mills Company, costing $75,000.

Oswego, N. Y.—Hayes Knitting Company, West Seneca and Water Streets, reported planning erection of two-story concrete mill.

New Castle, Pa.—Burton Powder Company will erect plant extensions costing $1,000,000.

Philadelphia, Pa.—Plans being prepared for a four-story, 45 x 90 ft., addition to plant of Charles Eneu Johnson Co., 509 South Tenth Street.

Contract soon to be let for erecting for Hafleigh & Company, American and Somerset Streets, a brick, steel and concrete power house. Engineer, W. E. Dyer, Land Title Building.

Monks & Johnson, 78 Devonshire Street, Boston, Mass., are architects for five-story, reinforced-concrete and brick manufacturing building, to be erected for Splitdorf Electrical Company.

Baltimore, Md.—Baltimore Dry Dock & Shipbuilding Company has applied to Board of Estimates for approval of plans for yards, shops and docks, which this company will erect at a cost of $500,000. Holden A. Evans, President & General Manager.

Havre de Grace, Md.—The Maryland Metal Crosstie Co., Munsey Building, Baltimore, contemplates erecting a 200 x 400-ft. factory here.

Cleveland, Ohio.—Reported Linde Air Products Co., East Seventy-second Street and Bittern Avenue, plans erecting additions to factory.

Steel Products Company, 2206 Clarkwood Road, is planning additions to the factory, estimated to cost about $50,000.

Dayton, Ohio.—Edgemont Machine Company, National Avenue and Neibert Street, intends enlarging plant.

Toledo, Ohio. — Acklin Stamping Co. (Graff M. Acklin, President), 1645 Dorr Street, considering tentative plans for a five-story concrete addition.

Kankakee, Ill.—Kankakee Tile & Brick Company will erect addition to plant to cost approximately $85,000.

Minneapolis, Minn.—Reported Maxwell Motor Sales Corporation (F. W. Warrington, Local District Manager), will erect an assembly plant at Twenty-sixth and University Avenues, S. E. Definite plans have not yet been decided upon.

Billings, Mont.—Ernest B. Joyce, Billings, is reported interested in the erection of a packing plant here, to cost $500,000.

Galveston, Tex.—Plans being prepared by Cooke & Company, Houston, for a brick and concrete building as an addition to plant of Houston Ice & Brewing Company; cost $30,000.

Muskogee, Okla.—Midland Valley R.R. Co. (C. Kaighn, Ch. Engr.) will rebuild shops recently destroyed by fire.

Seattle, Wash. — American Can Co. (Henry W. Phelps, Vice-President), 447 W. Fourteenth Street, New York, N. Y., contemplates erecting branch factory here to cost about $350,000.

Antioch, Cal.—The Antioch Paper Mills will improve the plant at a cost of $30,000. D. H. Patterson, Superintendent.

Casa Grande, Ariz. — See "Water Works."

Ray, Ariz.—Reported Ray Hercules Copper Co. (C. E. Adams, General Manager, Ray, Ariz.) is planning a large crushing plant here, and will erect a concentrating plant at Kelvin, six miles south of Ray.

Welland, Ont.—Canadian Steel Foundries, Ltd., Welland, will spend $100,000 in improving plant.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**New York, N. Y.**—Contract awarded Turner Construction Company, 11 Broadway, for constructing a two-story 146 x 55 ft. reinforced concrete building; also two one-story buildings, for the John E. Smith's Sons Company.

★**Philadelphia, Pa.**—Contract awarded S. W. Marks, Cleveland, Ohio, for erecting eight-story, 100 x 400 ft., steel and concrete addition to Baldwin Locomotive Works at Eighteenth and Hamilton Streets; cost about $500,000.

★Contract awarded Herman Voight, Twenty-eighth and Thompson Streets, for erecting one-story, brick, 105 x 170 ft. addition to plant of Midvale Ice Manufacturing Company; cost $30,000.

★**South Bethlehem, Pa.** — Contract awarded Westinghouse, Church, Kerr Company, 37 Wall Street, New York, for the machine shop to be erected here for the Bethlehem Foundry & Machine Works, plans for which have been approved by the State.

★**Wilmington, Del.**—Contract awarded Fred. A. Havens, 845 N. Nineteenth Street, Philadelphia, Pa., for erecting for Harlan & Hollingsworth Co. a steel lumber storage building costing $40,000 and a steel blacksmith shop costing $30,000.

★**La Salle, Ind.**—Contract awarded Massillon Bridge & Iron Company, Massillon, Ohio, for 1025 tons of structural steel for plant of German-American Cement Company.

★**Medford, Ore.**—Contract awarded Dyer Company, 2031 Euclid Avenue, Cleveland, Ohio, for a sugar factory for Oregon-Utah Sugar Company (Alexander Nibley, Secretary), to be erected in Rogue River Valley, near Medford. Cost, about $600,000.

★**Los Angeles, Cal.**—Contract awarded Leonardt & Peck, 721 H. W. Hellman Building, for erecting the plant at Santa Fe Avenue for American Can Company, 718 Los Angeles Investment Building. Cost not including structural steel $110,000.

MISCELLANEOUS

PROPOSED WORK.

Wall—Greenfield, Mass.—At the town meeting next month the citizens will consider the building of a wall from the top of Turners Falls Road over Rock Mountain to the suspension bridge across Connecticut River at foot of grade. Two roads are under consideration, one 30 ft. wide costing $36,000 and the other 50 ft. wide costing $74,400. Address Town Clerk.

Rifle Range—New Haven, Conn.—The Winchester Repeating Arms Co. will build a rifle range of concrete footing and brick walls, 168 x 178 ft. deep, at a cost of $21,800.

Municipal Improvements—Pass Christian, Miss.—Citizens voted $96,000 municipal improvement bonds.

Snow Sheds—Seattle, Wash.—Reported Chicago, Milwaukee & St. Paul Ry. (C. F. Loweth, Ch. Engr., Chicago, Ill.) will build 3 miles of concrete snow sheds during the coming summer in the Lake Keechelus County, east of the summit of Snoqualmie Pass.

Coal Handling Equipment—Astoria, Ore.—Engineer of the Port of Astoria Commission has been authorized to purchase coal handling equipment to be installed at Pier No. 2, of the municipal docks; cost about $40,000.

BIDS DESIRED.

Street Signs—New York, N. Y.—Until March 2, by Marcus M. Marks, Pres. borough of Manhattan, for furnishing, delivering and erecting steel street signs; security $40,000.

Gravel Hauling—Ocean City, N. J.—By Sutton & Corson Co., 739 Asbury Avenue, Ocean City, to sublet approximately 20,000 cu. yd. of gravel haul an average distance of 3½ miles, advertised in Engineering Record.

Asphalt, Brick, Etc.—Pittsburgh, Pa.—Until March 9, by City Controller, for asphalt, brick, cast-iron water pipe, cement, sewer pipe and castings, etc., for Department of Supplies. F. P. Booth, Director Department Supplies.

Steel Cells, Etc.—Cincinnati, Ohio.—Until March 14, by New Court County Building Commission (Geo. O. Deckebach, Secy.), for furnishing material and installing steel cells and jail equipment for new court house and county jail.

Cincinnati, Ohio.—See "Public Buildings."

Road Oil—Cleveland, O.—Reported desired until March 2, by Commissioner Purchase and Supplies for road oil for Division of Parks.

Fire Escapes—Indianapolis, Ind.—Until Feb. 29, by School Commissioners, for fire escapes, stone, etc., for schools Nos. 4, 6, 7, 18, 36 and 45. J. E. Cleland. Bus. Mgr.

Crushed Stone, Etc.—Saginaw, Mich.—Reported desired until Feb. 29, by John W. Ederer, County Road Commissioner, for supplying crushed stone gravel, cement, etc., for year 1916.

Road Oil, Etc.—New Ulm, Minn.—Until March 7 by William Backer, City Clk., for furnishing f.o.b. cars New Ulm 20,000 gal. asphalt road oil. Also same time and place separate bids for furnishing f.o.b. cars New Ulm one road oiler with pressure distributer, capacity 500 and 600 gal. Separate prices desired on the 500 and 600 gal. distributer, as only one will be purchased. F. D. Minium, City Engr.

Railroad Supplies—Seattle, Wash.—Until March 6, by Alaskan Engineering Commission (C. E. Dole, Purchasing Agent, Seattle), for furnishing 14,850 gros ston open-hearth steel rail, 50,000 pairs 24 in. angle splice bars, 220,000 nut locks, etc.

Road Oil—Fresno, Cal.—Until March 6 by Board of Supervisors for approximately 100,000 bbl. road oil.

Hoists and Spiral Chutes—Los Angeles, Cal.—Until March 1, by Board Harbor Commission (C. H. Matson, Secy.), for hoists and spiral chutes for five-story harbor warehouses.

Stone—Montreal, Que.—Until March 1, by Montreal Quarry & Constr. Co., for extracting stone at Caughnawaga (rubble stone) machinery and accessories supplied by the company; about 1000 tons may be extracted daily.

Railroad Supplies—St. Elias, Alaska.—Reported desired until March 10, by Lighthouse Inspector, Dist. No. 16, Ketchikan, for constructing lighthouse at St. Elias, to include pipe railings, a one-ton portable swing derrick, etc.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★Structural Steel—New York, N. Y.—Contract awarded American Bridge Company, 30 Church Street, by Degnon Contracting Company, 30 East Forty-second Street, successful contractors for the Sect. 2A of Route 12, of the Fourth Avenue Subway, Brooklyn, for 300 tons of steel needed in the contract.

★Grand Stand and Bleachers—St. Paul, Minn.—Contract for constructing grand stand and bleachers at Lexington Park for the St. Paul Baseball Club awarded J. W. Baumeister, St. Paul; cost about $70,000.

Cement—Ventura, Cal.—Lowest bid submitted to County Supervisors for furnishing 15,000 tons of cement was from California Portland Cement Co., American National Bank Building, Los Angeles, at $1.73 per bbl. Riverside Portland Cement Co., Kerchoff Building, Los Angeles, bid $1.77 per bbl. Los Angeles Stone Co., Baker-Detweiler Building, Los Angeles, bid on 100,000 tons of gravel f.o.b. cars at 34 cts. per ton and on 50,000 tons of sand at 12 cts. per ton.

Proposals

For Proposals Advertised, See Pages 40a, 41, 42 and 43.

WATERWORKS.

Bids Close.		See Eng. Record.
Feb. 28.	Improv., Macon, Ga. .... Adv. Feb. 19.	Feb. 19
Feb. 29.	Reservoirs, Etc., Athens, Ohio	Feb. 26
Feb. 29.	Pipe, Columbus, Ohio....	Feb. 26
Mar. 1.	Water Works, Colville, Wash.	Feb. 12
Mar. 1.	Water Works, Bayard, Neb.	Feb. 12
Mar. 1.	Water Works, Everett, Wash.	Feb. 12
Mar. 1.	Pump Station, Ottawa, Ont. .... Adv. Feb. 19, 26.	Feb. 19
Mar. 1.	Addition, Malvern, Ark..	Feb. 26
Mar. 1.	Steel Tower, Etc., Collingwood, Ont.	Feb. 26
Mar. 2.	Reservoir, Washington, D. C. .... Adv. Feb. 5.	Feb. 5
Mar. 2.	Pipe, Arcadia, Cal.......	Feb. 26
Mar. 6.	Well, New Bern, N. C... Adv. Feb. 12.	Feb. 12
Mar. 6.	C.-I. Pipe, Albany, N. Y.	Feb. 19
Mar. 7.	Addition, Kiowa, Kan...	Feb. 26
Mar. 7.	Deep Well, New Ulm, Minn.	Feb. 26
Mar. 8.	Pumping Station, Fort Bliss, Tex. .... Adv. Feb. 12 to 26.	Feb. 12
Mar. 8.	Tunnel, Milwaukee, Wis. Adv. Feb. 19, 26.	Feb. 19
Mar. 8.	Reservoir, Durham, N. C. Adv. Feb. 26.	Feb. 26
Mar. 8.	Pumps, Malta, Mont.....	Feb. 26
Mar. 10.	Waterworks, Jones, Okla.	Feb. 26
Mar. 13.	Mains, Etc., Shaker Heights (P. O. Cleveland), Ohio	Feb. 26
Mar. 14.	Mains, etc., Crofton, Neb.	Feb. 19
Mar. 15.	Well, Fairbury, Ill....... Adv. Feb. 26.	Feb. 26
Mar. 20.	Water Works, Polson, Mont. .... Adv. Feb. 26.	Feb. 26
Mar. 22.	Add. to Pump Sta., New Orleans, La.	Feb. 5
Mar. 22.	Centrifugal Pump. Mach., Lancaster, Pa........... Adv. Feb. 26.	Feb. 26
Mar. 27.	Water Works, Wilson, N. C...................... Adv. Feb. 26.	Feb. 26
Mar. 30.	Water Works, South Boston, Va..................... Adv. Feb. 26.	Feb. 26
Apr. 1.	Mains, Cullman, Ala.....	Jan. 15
———	Pipe Line, Trinity, Tex. Adv. Feb. 5.	Feb. 5

SEWERAGE AND SEWAGE DISPOSAL.

Bids Close.		See Eng. Record.
Feb. 28.	Montclair, N. J.......... Adv. Feb. 12.	Feb. 12
Feb. 28.	Randolph, Wis.	Feb. 19
Feb. 29.	Kendallville, Ind......... Adv. Feb. 5.	Feb. 5
Feb. 29.	Kansas City, Mo..........	Feb. 26
Feb. 29.	Strawberry Point, Iowa..	Feb. 26
Feb. 29.	Iola, Kan.	Feb. 26
Mar. 1.	Chrisman, Ill.	Feb. 19
Mar. 1.	Boston, Mass.	Feb. 26
Mar. 2.	North Bergen, N. J......	Feb. 26
Mar. 2.	Cleveland, Ohio	Feb. 26
Mar. 3.	Chardon, Ohio............	Feb. 26
Mar. 6.	Polsom, Mont. .... Adv. Feb. 5.	Feb. 5
Mar. 6.	Savannah, Ga. .... Adv. Feb. 12, 19.	Feb. 12
Mar. 7.	Billings, Mont.	Feb. 12
Mar. 7.	Tonkawa, Okla.	Feb. 19
Mar. 7.	Crawfordsville, Ind.......	Feb. 26
Mar. 7.	Martinsville, Ind..........	Feb. 26
Mar. 8.	Bad Axe, Mich............	Feb. 26
Mar. 9.	Fort Wayne, Ind..........	Feb. 19
Mar. 9.	La Crosse, Wis...........	Feb. 26
Mar. 14.	Newark, N. J............ Adv. Jan. 22, Feb. 5, 19.	Jan. 22
Apr. 1.	Sheboygan Falls, Wis. ...	Feb. 19
Apr. 4.	Billings, Mont.	Feb. 19

BRIDGES.

Bids Close.		See Eng. Record.
Feb. 29.	Dayton, Ohio.	Feb. 12
Mar. 1.	Columbus, Ind.	Feb. 19
Mar. 1.	Paterson, N. J...........	Feb. 19
Mar. 1.	Nebraska.	Feb. 19
Mar. 1.	Mount Holly, N. J.......	Feb. 26
Mar. 1.	Burlington, N. J.........	Feb. 26
Mar. 2.	Illinois	Feb. 12
Mar. 2.	Wahpeton, N. D.........	Feb. 19
Mar. 2.	Nevada, Iowa.	Feb. 19
Mar. 2.	Hastings, Neb............	Feb. 26
Mar. 2.	Mobile, Ala.	Feb. 26
Mar. 3.	Seattle, Wash.	Feb. 5
Mar. 3.	Sisseton, S. D............	Feb. 26
Mar. 4.	Berkeley Springs, W. Va.	Feb. 5
Mar. 6.	Tucson, Ariz.	Feb. 5
Mar. 6.	Kansas City, Kan. ...... Adv. Feb. 19, 26.	Feb. 19
Mar. 6.	Fort Dodge, Iowa........	Feb. 19
Mar. 6.	Newport, Wash...........	Feb. 19
Mar. 6.	Fairfax, Mo.	Feb. 26
Mar. 6.	Santa Barbara, Cal......	Feb. 26
Mar. 7.	Columbus, Ohio	Feb. 12
Mar. 7.	West Palm Beach, Fla...	Feb. 19
Mar. 7.	Georgetown, Del.	Feb. 19
Mar. 7.	Brainerd, Minn.	Feb. 19
Mar. 7.	Grand Forks, N. D.......	Feb. 19
Mar. 7.	Casper, Wyo.	Feb. 19
Mar. 7.	Fort Scott, Kan.........	Feb. 26
Mar. 7.	Indiana	Feb. 26
Mar. 8.	Indiana.	Feb. 19
Mar. 8.	Nelson, Neb.	Feb. 19
Mar. 8.	Arcadia, Fla.	Feb. 26
Mar. 9.	La Salle, Ill. .... Adv. Feb. 12.	Feb. 12
Mar. 9.	Fairbury, Neb. .... Adv. Feb. 12, 19.	Feb. 12
Mar. 9.	Red Oak, Iowa...........	Feb. 19
Mar. 10.	Nebraska.	Feb. 19
Mar. 10.	Wayne, W. Va..........	Feb. 26
Mar. 11.	Hamilton, Ohio.	Feb. 19
Mar. 15.	Dayton, Ohio .... Adv. Feb. 19, 26.	Feb. 19
Mar. 17.	Wayne, Neb.	Feb. 19
Apr. 29.	Johnson Creek, Wis.....	Feb. 26

PAVING AND ROADS.

Bids Close.		See Eng. Record.
Feb. 29.	Petersburg, Va.	Feb. 19
Feb. 29.	Virginia	Feb. 26
Feb. 29.	Topeka, Kan.	Feb. 26
Feb. 29.	Davenport, Iowa	Feb. 26
Mar. 1.	Fort Madison, Iowa.......	Feb. 5
Mar. 1.	Parkersburg, W. Va.....	Feb. 12
Mar. 1.	Globe, Ariz.	Feb. 12
Mar. 1.	Ravenna, Ohio	Feb. 12
Mar. 1.	Sidney, Ind.	Feb. 12
Mar. 1.	Maryland .... Adv. Feb. 19.	Feb. 19
Mar. 1.	Columbus, Ind.	Feb. 19
Mar. 1.	Appleton, Wis.	Feb. 19
Mar. 1.	Marietta, Ohio	Feb. 26
Mar. 1.	Fargo, N. D..............	Feb. 26
Mar. 1.	Portage, Wis.	Feb. 26
Mar. 1.	Long Island City, N. Y..	Feb. 26
Mar. 1.	Paterson, N. J...........	Feb. 26
Mar. 1.	Cleveland, Ohio	Feb. 26
Mar. 2.	Hibbing, Minn.	Feb. 5
Mar. 2.	Montreal, Que.	Feb. 12
Mar. 2.	Flemington, N. J......... Adv. Feb. 19, 26.	Feb. 19
Mar. 2.	Indiana.	Feb. 19
Mar. 2.	Carroll, Iowa.	Feb. 19
Mar. 2.	New York, N. Y.	Feb. 26
Mar. 2.	Jersey City, N. J........	Feb. 26
Mar. 3.	El Monte, Cal............	Feb. 26
Mar. 3.	Louisville, Ky.	Feb. 26
Mar. 3.	Duluth, Minn.	Feb. 26
Mar. 6.	Huntsville, Ala.	Jan. 29
Mar. 6.	Portland, Ind.	Jan. 29
Mar. 6.	Atchison, Kan.	Feb. 12
Mar. 6.	Maysville, Ky. .... Adv. Feb. 19.	Feb. 19
Mar. 6.	Camden, N. J...........	Feb. 19
Mar. 6.	Los Angeles, Cal........	Feb. 19
Mar. 6.	Indiana.	Feb. 19
Mar. 6.	Lynchburg, Va. .... Adv. Feb. 19, 26.	Feb. 19
Mar. 6.	Canton, Miss.	Feb. 19
Mar. 6.	Caruthersville, Mo. ...... Adv. Feb. 26.	Feb. 26
Mar. 6.	Flora, Miss.	Feb. 26
Mar. 6.	Madison, Ind.	Feb. 26
Mar. 6.	Bakersfield, Cal.	Feb. 26
Mar. 6.	Newark, Ohio.	Feb. 26
Mar. 7.	Davenport, Wash.	Jan. 22
Mar. 7.	Richland Center, Wis.... Adv. Feb. 12, 19.	Feb. 12
Mar. 7.	Indiana.	Feb. 19
Mar. 7.	Goshen, Ind.	Feb. 19
Mar. 7.	Arcadia, Fla.	Feb. 26
Mar. 7.	Oakland, Iowa	Feb. 26
Mar. 7.	St. Louis, Mo...........	Feb. 26
Mar. 7.	Sunbury, Pa.	Feb. 26
Mar. 7.	St. Cloud, Minn..........	Feb. 26
Mar. 7.	Chicago Junction, Ohio...	Feb. 19
Mar. 8.	Indiana	Feb. 5
Mar. 8.	Indiana.	Feb. 19
Mar. 8.	Sullivan, Ill.	Feb. 26
Mar. 8.	Johnson Creek, Wis.....	Feb. 26
Mar. 8.	Atlantic City, N. J......	Feb. 26
Mar. 9.	Burlington, N. C.........	Feb. 26
Mar. 9.	Indiana	Feb. 26
Mar. 10.	Indiana.	Feb. 19
Mar. 10.	Seattle, Wash.	Feb. 26
Mar. 11.	Appleton, Wis.	Feb. 12
Mar. 11.	Indiana.	Feb. 19
Mar. 13.	Ontario, Cal.	Feb. 26
Mar. 14.	Danville, Ill. .... Adv. Feb. 12 to 26.	Feb. 12
Mar. 14.	Indiana	Feb. 26
Mar. 15.	Danville, Ill. .... Adv. Feb. 12 to 26.	Feb. 12
Mar. 15.	Chicago, Ill. .... Adv. Feb. 26.	Feb. 26
Mar. 16.	Danville, Ill. .... Adv. Feb. 12 to 26.	Feb. 12
Mar. 18.	Watertown, N. Y........	Feb. 12
Mar. 18.	Indiana	Feb. 26
Mar. 20.	Bolivar, Mo.	Feb. 12
Mar. 20.	De Land, Fla............	Feb. 19
Mar. 30.	Morgantown, W. Va.....	Feb. 26
Apr. 1.	Charelston, W. Va.	Feb. 19
———	Binghamton, N. Y. ...... Adv. Feb. 12, 19.	Feb. 12

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS.

Bids Close.		See Eng. Record.
Feb. 28.	Lock Gates, New Glasgow, N. S...............	Feb. 12
Feb. 29.	State Canal Work, Albany, N. Y.	Feb. 5
Feb. 29.	Dredging, New York, N. Y. .... Adv. Feb. 5 to 26.	Feb. 5
Feb. 29.	Ditch, Jackson, Minn....	Feb. 12
Feb. 29.	Levee, New Orleans, La..	Feb. 19
Feb. 29.	Ditches, Algona, Iowa...	Feb. 26
Mar. 1.	Ditch, Bucyrus, Ohio	Feb. 19
Mar. 1.	Dredging, New York, N. Y.	Feb. 26
Mar. 3.	Drainage, Brownsville, Tenn.	Feb. 26
Mar. 3.	Retaining Wall, Williamstown, Mass.	Feb. 26
Mar. 4.	Drainage, Hahnaman, Ill.	Feb. 19
Mar. 6.	Drainage, Largo, Fla.... Adv. Feb. 12 to 26.	Feb. 12
Mar. 6.	Dredging, Hartford, Conn. Adv. Feb. 5 to 26.	Feb. 5
Mar. 6.	Dredging, Boston, Mass. Adv. Feb. 26.	Feb. 26
Mar. 6.	Reclamation Flats, Boston, Mass............... Adv. Feb. 26.	Feb. 26
Mar. 7.	Dredging, New York, N. Y. .... Adv. Feb. 12 to 26.	Feb. 12
Mar. 7.	Riprap, Tompkinsville, N. Y.	Feb. 19
Mar. 7.	State Canal Work, Albany, N. Y.............	Feb. 26
Mar. 7.	Dams, Etc., Barstow, Tex.	Feb. 26
Mar. 8.	Ditch, Redwood Falls, Minn.	Feb. 19
Mar. 9.	Ditch, Moorehead, Minn..	Jan. 22
Mar. 9.	Ditches, Alexandria, Minn.	Feb. 26
Mar. 10.	Breakwater, Racine, Wis. Adv. Feb. 12 to 26.	Feb. 12
Mar. 10.	Irrigation, Fort Laramie, Wyo. .... (2 Props.) Adv. Feb. 12.	Feb. 12
Mar. 11.	Ditches, Blue Earth, Minn.	Feb. 26
Mar. 13.	Levee, Vincennes, Ind. ..	Feb. 19
Mar. 14.	Dike, Jefferson City, Mo. Adv. Feb. 19, 26.	Feb. 19
Mar. 14.	State Canal Work, Albany, N. Y............. Adv. Feb. 19, 26.	Feb. 19
Mar. 14.	Drainage Ditches, Doniphan, Mo.	Feb. 26
Mar. 15.	Breakwater, Newport, R. I.	Feb. 19
Mar. 15.	Irrigation, Malta, Mont..	Feb. 26
Mar. 15.	Dredging, Seattle, Wash.	Feb. 26
Mar. 16.	Dredging, Etc., New Bedford, Mass.	Feb. 19
Mar. 23.	Irrigation, St. Ignatius, Mont. .... Adv. Feb. 26.	Feb. 26
Mar. 23.	Revetment, Kansas City, Mo. .... Adv. Feb. 26.	Feb. 26
Mar. 24.	Breakwater, Conneaut, Ohio. .... Adv. Feb. 26.	Feb. 26
Mar. 24.	Dredging, Detroit, Mich. Adv. Feb. 26.	Feb. 26
Mar. 28.	Drain, North Branch, Mich.	Feb. 26

PUBLIC BUILDINGS AND SCHOOLS.

Bids Close.		See Eng. Record.
Feb. 28.	Baldwin, L. I., N. Y..... Adv. Feb. 12.	Feb. 12
Feb. 29.	Guide Rock, Neb.........	Jan. 29
Feb. 29.	Miami, Okla.	Jan. 29
Feb. 29.	Martinsburg, W. Va.....	Feb. 5
Feb. 29.	Ashby, Minn.	Feb. 19
Feb. 29.	Madison, Wis.	Feb. 26
Feb. 29.	Carthage, S. D..........	Feb. 26
Mar. 1.	Industrial, W. Va.	Feb. 5
Mar. 1.	Normal, Ill.	Feb. 5
Mar. 1.	Oshkosh, Wis.	Feb. 5
Mar. 1.	Bridgeport, Neb.	Feb. 12
Mar. 1.	Lakeview, Mich.	Feb. 19
Mar. 1.	Amsterdam, N. Y.	Feb. 19
Mar. 1.	Seattle, Wash.	Feb. 19
Mar. 1.	Hinsdale, Ill.	Feb. 26
Mar. 1.	Salina, Kan.	Feb. 26
Mar. 1.	Charleston, W. Va.......	Feb. 26
Mar. 1.	Slatington, Pa.	Feb. 26
Mar. 2.	Rockford, Ill.	Feb. 12
Mar. 2.	Vincennes, Ind.	Feb. 19
Mar. 3.	Kings Park, N. Y.......	Feb. 26
Mar. 3.	Los Angeles, Cal.........	Feb. 26
Mar. 3.	El Centro, Cal...........	Feb. 26
Mar. 4.	Palmyra, Ohio	Feb. 12
Mar. 4.	Seabreeze, Fla.	Feb. 12
Mar. 6.	Lake Helen, Fla.........	Jan. 29
Mar. 6.	Huntington, Ind.	Feb. 26
Mar. 6.	Houston, Tex.............	Feb. 26
Mar. 7.	Harrisburg, Pa.	Jan. 22
Mar. 7.	Bethlehem, Pa.	Feb. 5
Mar. 7.	Alameda, Cal.	Feb. 19
Mar. 7.	West Richfield, Ohio. ...	Feb. 19
Mar. 7.	Lincoln, Ill.	Feb. 19
Mar. 7.	Breckenridge, Minn.	Feb. 26
Mar. 7.	Ottosen, Iowa	Feb. 26
Mar. 8.	Lubbock, Tex.	Feb. 12
Mar. 8.	Chilton, Wis.	Feb. 26
Mar. 9.	Edison, Ohio	Feb. 26
Mar. 10.	Kalispell, Mont.	Feb. 5
Mar. 10.	Dollivar, Iowa.	Feb. 19
Mar. 10.	Hays, Kan.	Feb. 26
Mar. 13.	Oklahoma City, Okla. ...	Feb. 5
Mar. 13.	Lafayette, Ga.	Feb. 19
Mar. 13.	Hazelton, Pa.	Feb. 19
Mar. 13.	St. Paul, Minn...........	Feb. 26
Mar. 13.	North Platte, Neb.......	Feb. 26
Mar. 13.	Minneapolis, Minn.	Feb. 26
Mar. 14.	Antigo, Wis.	Feb. 5
Mar. 15.	Gilbert, Minn.	Feb. 12
Mar. 15.	Ft. Bliss, Tex. .... Adv. Feb. 19, 26.	Feb. 19
Mar. 15.	Mingo, Ohio	Feb. 26
Mar. 16.	New Smyrna, Fla.......	Feb. 19
Mar. 16.	Wallum Lake, R. I......	Feb. 26
Mar. 17.	Charles City, Iowa.......	Feb. 12
Mar. 17.	Salem, Ohio	Feb. 26
Mar. 18.	Ft. Terry, N. Y.......... Adv. Feb. 19, 26.	Feb. 19
Mar. 20.	Austin, Minn.	Jan. 22
Mar. 22.	Mattoon, Ill.	Feb. 12
Mar. 22.	Aberdeen, Wash.	Feb. 19
Mar. 23.	Wilmington, N. C	Feb. 19
Mar. 24.	Taylorville, Ill.	Feb. 19
Mar. 25.	Seattle, Wash.	Feb. 19
Mar. 27.	Pueblo, Colo.	Feb. 26
Apr. 24.	Delphi, Ind.	Feb. 26
Mar. 29.	Aberdeen, Wash.	Feb. 19

PRIVATE BUILDINGS.

Bids Close.		See Eng. Record.
Mar. 1.	Erie, Pa.	Feb. 12
Mar. 1.	Indianapolis, Ind.	Jan. 29
Mar. 1.	St. Louis, Mo...........	Feb. 26
Mar. 1.	Westfield, N. J..........	Feb. 26
Mar. 2.	Gastonia, N. C.........	Feb. 26
Mar. 8.	Des Moines, Iowa........	Feb. 26
Mar. 14.	Montreal, Que.	Feb. 26
Mar. 15.	Marcellus, N. Y.	Feb. 19
Apr. 1.	Cleveland, Ohio	Jan. 8
Apr. 1.	Minneapolis, Minn.	Feb. 19

NEW INDUSTRIAL PLANTS.

Bids Close.		See Eng. Record.
Apr. 15.	Manila, P. I.............	Jan.. 2

MISCELLANEOUS.

Bids Close.		See Eng. Record.
Feb. 28.	Counters, Gates, Etc., Boston, Mass. .... Adv. Jan. 29, Feb. 5.	Jan. 29
Feb. 29.	Maneuver Boats, Wheeling, W. Va. .... Adv. Feb. 5 to 26.	Feb 5
Feb. 29.	Elevator, Martinsburg, W. Va.	Feb. 5
Feb. 29.	Fire Escapes, Indianapolis, Ind.	Feb. 26
Feb. 29.	Crushed stone, etc., Saginaw, Mich.	Feb. 26
Mar. 1.	Tower, Honolulu, T. H..	Jan. 22
Mar. 1.	Cement, Etc., Hamilton, Ont.	Feb. 12
Mar. 1.	Hauling Chips and Road Oil, Maryland .... (2 Props.) Adv. Feb. 19, 26.	Feb. 19
Mar. 1.	Broken Stone, Montreal, Que.	Feb. 26
Mar. 1.	Hoist, Etc., Los Angeles, Cal.	Feb. 26
Mar. 2.	Electric Railway, Boston, Mass. .... Adv. Feb. 12 to 26.	Feb. 12
Mar. 2.	Street Signs, New York, N. Y.	Feb. 26
Mar. 2.	Road Oil, Cleveland, Ohio.	Feb. 26
Mar. 3.	Pipe, Etc., Panama......	Feb. 19
Mar. 4.	Projectile Hoists, Washington, D. C. .... Adv. Feb. 12 to 26.	Feb. 12
Mar. 6.	El. Ry. Franchise, Martinez, Cal.	Feb. 19
Mar. 6.	Electric Railway, San Diego, Cal.	Feb. 19
Mar. 6.	Sulphate of Alumina, Washington, D. C...... Adv. Feb. 19, 26.	Feb. 19
Mar. 6.	Railroad Supplies, Seattle, Wash.	Feb. 26
Mar. 6.	Road Oil, Fresno, Cal....	Feb. 26
Mar. 7.	Road Oil and Oiler, New Ulm, Minn...............	Feb. 26
Mar. 8.	Road Oil, Indianapolis, Ind.	Feb. 19
Mar. 9.	Elevator, Albany, N. Y.. Adv. Feb. 19, 26.	Feb. 19
Mar. 9.	El. Rys., New York, N. Y.	Feb. 26
Mar. 9.	Cement, Etc., Pittsburgh, Pa.	Feb. 26
Mar. 10.	Railroad Supplies, St. Elias, Alaska	Feb. 26
Mar. 13.	Hoistways, Etc., Cincinnati, Ohio	Feb. 19
Mar. 13.	Elevator, Etc., Omaha, Neb.	Feb. 19
Mar. 14.	Cells, Etc., Cincinnati, Ohio	Feb. 26
Mar. 14.	El. Rys., Toronto, Ont...	Feb. 26
Mar. 22.	Garbage Disposal, Lincoln, Neb. .... Adv. Feb. 26.	Feb. 26
Apr. 1.	Memorial, Fort McHenry, (P. O. Baltimore, Md.).	Nov. 20
———	Funding Bonds, Lufkins, Tex. .... Adv. Feb. 26.	Feb. 26
———	Hauling Gravel, Ocean City, N. J.............. Adv. Feb. 26.	Feb. 26

CONTRACTING NEWS

Of Special Interest to Engineers, Contractors, Builders and Manufacturers of Engineering and Building Supplies

BOTH exports and imports for the first seven months of the current fiscal year have broken all previous records, exports reaching $2,181,000,000 and imports $1,097,000,000. The balance in our favor on this showing is about 2½ times the favorable balance of trade for any like period in the past five years. Domestic commerce is keeping up the improvement shown in the last few months, as is indicated by large bank clearings and heavy freight movements. The increased traffic on the railroads is largely responsible for the purchase to Feb. 27 of 600 locomotives—a third as many as were bought during the entire year of 1915.

While the rising prices of structural steel may have caused the postponement of some construction, there is, on the other hand, according to *The Iron Age*, a marked eagerness to get building work under way before present options expire in anticipation of still greater difficulty in securing steel after April 1. At least 6000 tons of building work has been brought out in the last few days by this consideration in the New York territory alone. This expectation is based on good grounds, as 75,000 tons of rails have been sold already for 1917 delivery, and considerable ship-building material for the second quarter of 1917 has been contracted for at an advance of $2 a ton over the market price. It is evident that steel, at least, will go up before it goes down, and the great strength of the steel market argues well for continued expansion in other lines.

Structural material has advanced to a minimum of $2.25 per 100 lb., Pittsburgh, and $2.95 warehouse delivery. Plates are very strong at $3.15 on the same basis, and $3.50 warehouse delivery. Quantities of both products are being bought from warehouses at the advance figures because mills are sold up.

Quotations on steel bars are entirely nominal at $2.25 Pittsburgh, and in consequence iron bars for reinforcing have advanced to $2.40. No. 28 black sheets and No. 28 Bessemer galvanized sheets are unchanged, but very stiff, at $2.60 and $4.75 respectively per 100 lb., Pittsburgh. No. 28 galvanized open-hearth sheets have already advanced to $4.85, Pittsburgh.

Cast-iron pipe, 6-in., Class B and heavier, advanced again to $29.50 per ton, tidewater. Lap-welded black pipe, 2½ to 6-in., is $54 per ton, carload lots, Pittsburgh, for steel and $72 for iron pipe, while galvanized is $87 for steel and $110 for iron, the advances being $4 to $6 per ton.

Lead is firm after continued advances, having reached $6.37½ per 100 lb., New York, and $6.30, East St. Louis, for 25-ton lots.

Portland cement is still quoted on a basis of $1.05 per bbl. mill base, Lehigh district, to dealers without sacks. The labor situation, however, promises to be acute. With a shortage already beginning to be felt, it is doubtful that the mills can keep up with the spring demand, and prices are expected to advance soon.

Wholesale prices, New York, on building materials are now: Hudson common brick, $8.50 per thousand; crushed trap rock $1.10 per cu. yd. for 1½-in. and $1.00 for ¾-in., gravel, 1½-in., 85 cents, ¾-in., 80 cents, and gravel passing subway specifications 95 cents. Cow bay sand is 40 cents per cu. yd.

The Eastern and Southern lumber mills, which were gaining on their order files in January, are now falling behind steadily. Unfilled orders at 156 of these mills amount to nearly 20,000 cars. On the Pacific coast, at 80 mills, orders for the second full week of February exceeded the cut, which was in turn exceeded 10½ per cent by shipments. The severe weather has resulted in this section in taking out of the available supply at least 425,000,000 ft. which would normally have been cut at this season. This is almost 10 per cent of the annual normal output. The high price of steel is said already to be resulting in greater use of lumber. While no great advances are to be expected till demand grows with the opening of spring, the technical position of the lumber mills is growing in strength with every week. New York wholesale lumber prices per 1000 ft. have been recently, for yellow pine, 8 to 12-in., $21@$25.50; 14 to 16-in., $28@$32; for hemlock, mixed cargoes, $20; and for 9-in. spruce, 16 ft. long, $28.

Buildings

The lowest bid received at Springfield, Mass., for construction additions to a school was $129,000. The general contract for the new American Express Company building in New York City, which requires 4000 tons of steel, has been placed. A contract for constructing a $100,000 bank building has been awarded at Binghamton, N. Y. The construction of a reinforced-concrete hospital building has been contracted for at Philadelphia. Two warehouses contracted for at Minneapolis will cost $150,000. The lowest bid received for constructing the public auditorium at Portland, Ore., Feb. 18, was $317,000. Bids will be opened next week for constructing an armory at Yonkers, N. Y.

Plans have been filed in New York City for a $200,000 factory and for a $260,000 apartment house. Plans are being prepared in Brooklyn, N. Y., for a $250,000 theater. Philadelphia architects are working on the plans for the $1,250,000 convention hall and the $3,500,000 library to be built in that city. Plans are being prepared in Cleveland for a $200,000 mercantile building. A private school to cost $200,000 is to be built in Chicago. The University of Chicago has received the sum of $200,000 for erecting a new divinity school building. Plans for a $150,000 church have been approved at Bloomington, Ind. A club house proposed at Wichita, Kan., will cost $150,000. A warehouse destroyed by fire at Dubuque, Ia., is to be replaced at a cost of $150,000. Plans are being prepared for a $250,000 lodge building at Tulsa, Okla. The court house at Wichita Falls, Tex., for which plans are being prepared, will cost $200,000. Building construction estimated to cost $500,000 is being planned by the Northern Pacific Railroad Company at St. Paul. Improvements contemplated by the Northwestern Telephone Company in St. Paul and Minneapolis will cost $2,500,000.

Bridges and Roads

The Bessemer & Lake Erie Railroad has contracted for 10,000 to 14,000 tons of steel for its bridge over the Allegheny at Pittsburgh. The Union Pacific Railroad has awarded the steel contract for its new $1,000,000 bridge over the Missouri River at Council Bluffs, Iowa. A contract for the steel work of the Kansas City Southern bridge over the Kaw River, requiring 1300 tons of steel, has been awarded at Kansas City, and bids for the substructure will be opened next Saturday. Bids are desired for constructing a $60,000 bridge at Rock Island, Ill. A $100,000 bridge contract will be let next month in Indianapolis. The Canadian Northern Railroad has received permission from the War Department to bridge the Baudette River near Spooner, Minn.

The lowest bid received for road construction at Cheviot, Ohio, was $71,000. An $80,000 paving contract has been awarded at Liberty, Iowa. Bids have been opened in Minneapolis for a large quantity of wood paving blocks. A paving contract amounting to $108,000 has been awarded at Seattle. Bids will be opened March 28 at Sumter, N. C., for paving work for which $225,000 is available. Bids will be opened March 25 at De Land, Fla., for constructing 36 miles of roadway, including 200,000 sq. yd. of pavement. Wallace, Idaho, desires bids for paving work to cost $120,000.

A large amount of new construction has been recommended by the paving commission of New Haven, Conn. Paving work to cost $115,000 has been approved at Baltimore. County road bonds amounting to $100,000 have been sold at Georgetown, Ky. Another Kentucky road-bond issue of $300,000 has been sold at Wickliffe. The expenditure of a like sum of money for road improvements is under consideration at Somerset, Ky. County road bonds amounting to $250,000 have been sold at Rogersville, Tenn. Plans have been ordered prepared for paving work to cost $205,000 at Cleveland. Paving work to cost $200,000 is proposed at Lima, Ohio. Beloit, Wis., will let a contract this month for constructing 97,000 sq. yd. of paving. Plans are to be prepared for road work costing $155,000 at Houston, Tex.

Waterworks and Sewers

The lowest bid received at New York City for lining a section of the city aqueduct tunnel was $126,660. Bids have been opened in Cincinnati for cast-iron pipe to cost $81,000. The lowest bids received at Houston, Tex., for constructing two sewer sections totaled $315,000. Bids have been received at Rock Island, Ill., for considerable sewer work. Bids are to be opened next week for a waterworks system at Jacksonville, Fla.

Plans are being prepared for an intercepting sewer system to be contracted for next month at Binghamton, N. Y. A sewer system costing $110,000 is proposed at Pitman, N. J. A waterworks system being considered at Logan, W. Va., will cost $100,000. Plans have been approved at Toledo for a $165,000 sewer. Sewers costing $350,000 are to be constructed this year at Indianapolis. The cost of the sewer system proposed at Marshalltown, Iowa, is estimated at $350,000. Plans are being prepared for sewers to cost $850,000 at Fresno, Cal.

Miscellaneous

The lowest bid received Feb. 24 in New York City for a track-laying contract on the Lexington Avenue subway was $276,000. A contract for flood-abatement work at Olean has been let by the New York State Superintendent of Public Works at $179,000, and the low bid received on another state canal contract Feb. 29 was $726,000. A grading and masonry contract for 7 miles of line for the Philadelphia & Reading Railroad has been awarded at Harrisburg, Pa. A contract for grading a yard and re-grading 7 miles of line has been awarded by the Seaboard Air Line at Hamlet, N. C. The construction of a 100-mile drainage ditch has been contracted for at Goodridge, Minn. Bids are desired in New York City for the superstructure of the Forty-sixth Street pier. Bids are desired at Philadelphia for constructing a freight house in connection with the Pennsylvania Railroad's part of the South Philadelphia improvement. Concrete snow sheds costing $2,000,000 are to be built by the Great Northern Railroad near Tacoma, Wash. The construction of 140 miles of railroad is contemplated near Holbrook, Ariz.

WATERWORKS

PROPOSED WORK.

Boston, Mass.—The construction of a high-pressure fire pumping station in the Charles River Basin is under consideration. Address Mayor.

Perry, N. Y.—Contract will be let in March for constructing the 1,000,000-gal. slow sand filter plant, 350,000-gal. reservoir, both of concrete, and a 1,250,000-gal. centrifugal pumping outfit. Charles C. Hopkins, Rochester, Engineer. Address Village Clerk.

Harrisburg, Pa.—Farley Gannett and E. Clark Cowden of Harrisburg, engaged by Harrisburg Country Club to make a survey of the proposed new site of 140 acres north of State Capitol to investigate water supply sources, means of sewage disposal and roads. Report to be submitted to the Club April 4. Robert G. Goldsboro, Chmn. Building Committee.

Logan, W. Va.—Council is considering constructing a municipal water works. Probable cost $100,000.

Plant City, Fla.—City Council considering extensions to the water works costing $71,000 and installing a municipal electric light plant costing $50,000. Engineers, Jaudon Engineering Co., Savannah, Ga.

Ville Platte, La.—City reported considering issuing bonds for constructing water works and electric light plant.

Bowling Green, Ky.—Plans being prepared for the sedimentation basin to be constructed at the water works at a cost of $20,000. F. J. Nolan, City Clerk.

Mayfield, Ky.—Reported city is taking steps to purchase plant of Mayfield Water and Light Co. Address City Clerk.

Indianapolis, Ind.—It is proposed to construct about six 4 and 6-in. centrifugal pumps driven by motors for pumping out certain manholes of watershed sewers, a number of gate valves will be installed in connection with this work, and total cost about $15,000.

Kewanee, Ill.—Citizens voted $70,000 bonds for water works improvements. Address City Clerk.

Kalona, Iowa.—Election soon to be held to vote $25,000 bonds for constructing water works and sewers.

Lawrence, Kan.—If water works plant is purchased by city, cost to improve same will be about $175,000. Address W. W. Cleland, Water Works Supt.

Newton, Kan.—Water works improvements consisting of 7½ miles 14 and 16-in. pipe, with valves and specials, are contemplated. W. B. Rollins & Company, Engineers, 439 Midland Building, Kansas City, Mo.

Kansas City, Mo.—Upper House has passed an ordinance appropriating $37,000 for purchase of c. i. water pipe.

Robstown, Tex.—Citizens defeated the $20,000 bond issue for installing water works.

Winnsboro, Tex.—See "Sewerage and Sewage Disposal."

Cleveland, Okla.—Election to be held March 15 to vote $100,000 bonds for constructing water works. Address City Clerk.

Coyle, Okla.—City Council contemplating installation of water works and an electric light plant.

Stratford, Okla.—Citizens voted to issue bonds for installing water works and electric light plant.

Aberdeen, Wash.—J. L. Stannard, Lewis Bldg., Portland, Ore., engaged to examine and report as to the best diversion point on Wiskah River from which to derive a supply of water for the proposed gravity water system which is to be installed this year.

Canby, Ore.—S. A. Cobb, Oregon City, engaged to prepare plans for water system, requiring pumping plant, standpipe, and distributing system; cost $20,000.

San Diego, Cal.—Election soon to be held to vote $100,000 bonds toward improving the water works. The citizens will also vote on diverting an additional $175,000 bonds for the purpose the same have been voted.

Oatman, Ariz.—The Mohave-Oatman Water Company will construct water works and sewerage system in the Oatman Mining District, Mohave County, running through Oatman, Oatman City, Mazona, Carter, Ryan Addition, Oldtrails and South Oatman, at a cost of between $250,000 and $300,000, and will let contracts in about 90 days. Water will be pumped from wells on the east bank of Colorado River, through a 10-in. pipe to an intermediate reservoir of 2,500,000 gals. capacity, a distance of 9½ miles to a height of 1,762 feet. From here an 8-in. pipe will run through various town sites to main reservoir in Oatman, also 2,600,000 gal. capacity, a distance of 3 miles to a height of 625 feet. A 4-in. lateral will be connected from the intermediate reservoir to Black Range townsite, a distance of 4 miles, and another to the Times townsite, a distance of 3 miles, which supply will be by gravity. The pumping plant will deliver 800 gals. per minute raised to the intermediate reservoir from which point water will be repumped to Oatman the total lift for the two pumping stations being 2,400 feet and a distance of 12½ miles. Sewer will be 14 in. and will run 5 miles. Daniel Cahill, President; E. Pritchard Smith, Vice-President and General Manager, and D. L. Mayhew, Secretary and Treasurer.

BIDS DESIRED.

Batavia, N. Y.—Until March 23, by I. J. Carmichael, City Clerk, for water works pumping station and filter plant, sewage pumping station and electric light generators, advertised in Engineering Record. Chester & Fleming, Engineers, Pittsburgh, Pa.

New York, N. Y.—Until March 21 by Board of Water Supply, for Contract 120, constructing granite building for Hudson Drainage chamber and a brick and concrete stone building for Croton Lake drainage chamber, advertised in Engineering Record.

Atlantic City, N. J.—Until March 9, by Board of Commissioners, for furnishing c.-i. pipe and special castings, advertised in Engineering Record. Harry Bacharach, Director Parks and Public Property.

Jacksonville, Fla.—Until March 10, by Board Port Commissioners, for water works system, including pump house, reservoir, etc., advertised in Engineering Record.

Birmingham, Ala. — By Birmingham Water & Light Plant (James Weatherly, City Commissioner in Charge), for a 300 kw. direct connected generator 2300 volt, 60 cycle, 3 phase, working under 80 lb. steam pressure non-condensing.

Berwyn, Ill.—Until March 7 by Board Local Improvements (Oscar N. Lindahl, Secy.) for c.-i. water supply pipe in Sixty-second and Greenwood Avenues and other streets.

Rochelle, Ill.—Until March 10, by W. B. McHenry, Mayor, for furnishing two electric driven centrifugal pumps and accessories. W. H. Williams, City Clerk.

Wheaton, Ill.—Until March 18, by City Council, for furnishing and erecting an internal combustion engine advertised in Engineering Record. La Verne J. Ruddock, City Engr. Lewis Elsworth, City Clk.

Ely, Minn.—Until March 21, by Arthur Knutson, City Clk., for furnishing material and constructing reinforced concrete coagulation and settling tank.

Houston, Tex.—Until March 16, by E. S. Bonney, City Secy., for furnishing pumps, electric motors, blowers and Diesel engines with all necessary appurtenances to be used in connection with sewage disposal plant. E. E. Sands, City Engr.

Seattle, Wash.—Report desired until March 10 by Board of Public Works for furnishing and installing 1324 ft. 42-in. water pipe to be carried under Lake Washington Canal at 7th Avenue N. E. Cost $15,000.

Salt Lake City, Utah—Until March 15 by Gordon Snow, City Recorder, for 6-in. water main extension to distributing system; cost $32,000.

St. Marys, Ont.—Until March 31 by H. M. Miller, Supt. of Waterworks for a 2,000,000 gal. centrifugal pump to cost about $4,000.

Panama—Until March 17 by Major F. C. Boggs, Corps Engrs. U. S. A., General Purchasing Officer, Panama Canal, Washington, D. C., for circular 1019, malleable iron castings, steel castings, well tubing, pipe fittings, flush pipes, valves, etc.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Springfield, Mass.**—Contracts for furnishing material f.o.b. cars for the year awarded as follows by Board of Public Works: C.-i. pipe, Warren Foundry & Machine Co., New York, N. Y.; gate valves, Kennedy Valve Co., East Water Street, Elmira, N. Y,; service boxes. Hayes Mfg. Co., Erie, Pa.; hydrants, R. D. Wood & Co., 400 Chestnut St., Philadelphia, Pa.; brass goods, Glauber Brass Mfg. Co., 4917 Superior Avenue, Cleveland, Ohio.

★**Hartford, Conn.** — Contract awarded Goulds Mfg. Co., Boston, Mass., for centrifugal pumps to be used in the Shelton Street Station at $3,884.

New York, N. Y.—Following are unofficial totals of four lowest bids opened Feb. 24 by Board of Water Supply, Municipal Building, New York, for lining with brick masonry portion of the Eastview Tunnel Contract 169: A. L. Guidone & Son, Inc., 52 Vanderbilt Avenue, $126,660; Santor Construction Co., 234 West Forty-first Street, $127,716; J. J. Hart, Peekskill, N. Y., $134,855, and William Heyman 687 East 238th Street, and F. Willetts, 1887 Vyse Avenue, $139,135.

★Following are two bids opened Feb. 16 by Board of Water Supply, Municipal Building, for furnishing and delivering bronze gate valves for the city tunnel of the Catskill Aqueduct in city of New York: American Manganese Bronze Co., Holmesburg, Philadelphia, $12,845 (awarded contract), and Exeter Machine Works, Pittston, Pa., $18,000.

★**Charleroi, Pa.**—Contract awarded by Local Water Company for constructing new reinforced concrete settling basin for filter plant to Pihl & Miller, Pittsburgh, Chester & Fleming, Engineers, Pittsburgh. The company also intends making other extensive improvements this season.

Cincinnati, Ohio.—Following are four lowest bids opened by Public Service Director Feb. 23 for laying 36-in. water main in Eastern Avenue from Main Pumping Station to Strader Avenue: Crumley, Jones & Crumley, Cincinnati, $19,448; Kirchner Construction Co., 229 W. Ninth Street, $25,200; James J. Brown, Cincinnati, $27,030; Thurber & Browning, Cincinnati, $27,224.

Following are four lowest bids opened Feb. 23 for the laying of c.-i. pipes in various city streets for 1916: W. H. Bertsch, Cincinnati, $37,647; Crumley, Jones & Crumley, $38,070; James J. Brown, $38,378; Thomas J. Scully, Cincinnati, $41,930.

Following are two bids received for manufacturing the c.-i. water pipe for the 36-in. loop main: United States Cast Iron Pipe & Foundry Co., Addyston, $60,660; R. D. Wood & Co., Camden, N. J., $65,700.

★**Sylvania, Ohio.**—Contract for constructing water works, not including pumps (bids opened Feb. 18) awarded T. C. Brooks & Sons of Jackson, Mich., at $24,727. Their bid on some of the items is as follows: 155.43 tons of 4-in. c.-i. pipe, $32 per ton; 218.38 tons 6, 8 and 10-in. pipe, $29 per ton; 11.21 tons special castings, $60 per ton; 76 gate valves and boxes f.o.b. cars Sylvania and 42 4-in. and 5-in. hydrants f.o.b. cars at a total of $1,944; unloading and laying pipe, valves, hydrants, etc., total $6,665; elevated steel tank, 60,000 gal., $3,850, and 50,000 gal. $3,600. A. D. Cook of Lawrenceburg, Ind., secured the contract for the 2 pumps. They bid $3,175 200 g.p.m. and $2,700 100 g.p.m. The W. J. Sherman Co., Engineers, Toledo, Ohio.

Cincinnati, Ohio.—Following are two bids opened Feb. 23 by Director of Public Service for manufacture of c.-i. pipe, etc., for water mains in Eastern Avenue, between Main Pumping Station and Strader Avenue: (a) United States Cast Iron Pipe & Foundry Co., Addyston, Ohio, $81,010; (b) R. D. Wood & Co., Camden, N. J., $88,680.

	(a)	(b)
1,960 tons 36-in. pipe, hub and spigot, Class C	$27.60	$30.00
40 tons 36-in. to 60-in. special castings, hub and spigot, Class C	90.00	90.00
10 tons 4-in. pipe, hub and spigot, Class C	30.60	34.00
500 tons 6-in. pipe, hub and spigot, Class C	27.60	31.00
40 tons 8-in. pipe, hub and spigot, Class C	27.60	31.00
25 tons 10-in. pipe, hub and spigot, Class C	27.60	31.00
25 tons 12-in. pipe, hub and spigot, Class C	27.60	31.00
50 tons special castings, hub and spigot, 12 in. in diameter and less	70.00	70.00
50 tons miscellaneous castings	70.00	89.00

★**Chicago, Ill.**—Contract awarded Lakeside Bridge & Steel Co., North Milwaukee, Wis., for furnishing for the Mayfair pumping station 700 tons of steel.

★**Rockford, Ill.**—Contracts awarded by City Council as follows for supply of pipe, fittings and lead to be used by Water Department for the year: American Cast Iron Pipe Co., Twenty-ninth Avenue and Sixteenth Street, Birmingham, Ala., 400 tons 6, 8 and 10-in. pipe, 260 tons 12-in. pipe and 30 tons special fittings at $28.15 per ton for pipe and $55 per ton for fittings. Rensselaer Valve Co., Van Schaik Island, Troy, N. Y., for valves, fire hydrants and other appliances, at $4,272; 73,500 lb. lead pipe and 36,000 lb. pig lead, to Windsor Manufacturing Co., 670 Clinton Street, Milwaukee, Wis, at $6.77 per hundred pounds for pipe and $6.42 for pig lead.

★**Lander, Wyo.**—Contract awarded Sam Jensen of Lander for 2500 ft. pipe at $5,350. W. E. Hardin, Mayor.

St. Louis, Mo.—Following are lowest bids opened recently by Board Public Service for constructing a 6-mile pipe line from pumping station at Bissell's Point to the reconstructed Compton Hill Reservoir: Joint bid by Jersey Pipe Corporation and the Inland Construction Company of St. Louis on steel pipe at $246,166 and joint bid by U. S. C. I. Pipe & Fdry. Company and the American Construction Company of St. Louis at $281,829 for c. i. pipe.

★**Marshfield, Ore.** — Contract awarded Redwood Manufacturing Co., San Francisco, Cal., for constructing a 250,000-gal. wood tank. R. H. Corey, General Manager Coos Bay Water Co.

★**San Diego, Cal.** — Contract awarded the Pacific Tank & Pipe Co., San Francisco, by the City Council for 10,000 ft. of 36-in. and 6000 ft. of 24-in. wood stave pipe between Upper Otay Reservoir and Lower Otay Outlet at $30,374. Other bidders: Redwood Lumber Co., $30,965; Benson Lumber Co., $33,194; lowest bid on steel pipe was from the Western Pipe & Steel Co., Los Angeles, at $33,600.

SEWERAGE AND SEWAGE DISPOSAL

PROPOSED WORK.

Binghamton, N. Y.—Detailed plans and specifications being prepared in office of city engineer for the intercepting sewer system, contract for which is to be let about April. Bonds will be sold in March.

Fredonia, N. Y.—Reported construction of a sewage disposal plant is under consideration.

Pitman, N. J.—Detailed information for the proposed sewer system will not be completed for about two months, the cost of the system and two disposal plants has been estimated at about $110,000. Remington & Vosburg, Camden, Engrs.; J. E. Peterson, Borough Clerk.

Kennywood Park, Pa.—Chester & Fleming, Pittsburgh, engaged to prepare plans for sewage disposal plant for Kennywood Park Assoc.

New Bethlehem, Pa.—Borough officials have applied to State Board of Health for permission to construct a sanitary sewer system. A. L. Bouton, Engineer.

Philipsburg, Pa.—Construction of a sewage disposal plant under consideration. Address R. P. Howell, Commissioner.

Newport News, Va.—City Council Highway and Sewer Committee recommends $100,000 bond issue for street and sewer improvements.

Atlanta, Ga.—City work for the year 1916 includes approximately $500,000 for paving work, $75,000 sewers, $60,000 bridge repair, $25,000 sidewalk and $25,000 asphalt repair work. K. W. Brittan Asst. Chief of Construction.

Shreveport, La.—Council is about to appoint an engineer to prepare plans for proposed sewer extension.

Lexington, Ky.—Contract soon to be let for constructing the sewer in North Limestone Street from Main to Third Streets. W. H. McCorkle, Comr. Public Works; J. White Guyn, City Engineer.

Brewster, Ohio.—All bids opened Feb. 19 for constructing sewage disposal plant and extensions to sewers rejected; new bids to be asked. L. S. Lash, Village Clerk; W. J. Sherman Co., Engrs., The Nasby, Toledo.

Cincinnati, Ohio.—Contract soon to be let by Charles Hornberger, Director Public Service, for constructing relief sewers in the ravine west of Edwards Road and in Observatory Avenue between Roseland and Linwood Avenues. Estimated cost $31,380.

Toledo, Ohio.—State Board of Health has approved the plans for the Upton Avenue sewer to cost $165,000. Address Director Public Service.

Youngstown, Ohio. — Mayor Carroll Thornton, in his message to Council, urges immediate attention be given to a sewage disposal plant.

Indianapolis, Ind.—Probably next year the city will construct a new sewage disposal plant costing about $1,500,000.

This year the city will build about $350,000 worth of sewers 10 in. to 6½ ft. Address City Engineer.

Logansport, Ind.—Plans and specifications prepared for the Eastend Sewer. Address Board of Works.

Princeton, Ind.—The sewer system will require a small septic tank and 20,000 lin. ft. 6, 8 and 10-in. pipe. H. J. Tuttle, City Engr.

Oakwood, Mich. — Reported construction of a sewerage system is under consideration. Address Village Clerk.

Aurora, Ill.—City Council has passed ordinance providing for constructing settling sewer tank costing $25,000.

Champaign, Ill.—It will probably be six months or a year before anything definite is decided upon about the construction of the sewerage system. F. C. Lohmann, City Engineer.

Kalona, Iowa.—See "Water Works."

Marshalltown, Iowa.—The cost of constructing a sewer system has been estimated at $288,519, with $69,600 additional for intercepting sewer. W. H. Steiner, City Engineer.

Concordia, Kan.—A sewer district for Elmhurst addition will be formed and $10,000 bonds issued for construction of sanitary sewers. Black & Veatch, Engrs., Kansas City, Mo. Address City Clerk.

Lincoln Center, Kan.—Preliminary plans being prepared by W. B. Roloins & Co., 433 Midland Building, Kansas City, Mo., for a sewerage system and sewage disposal plant requiring about eight miles of pipe and costing $35,000.

Anson, Tex.—Reported a sewage disposal plant is under consideration. Address J. S. Lindsey, County Judge.

Canadian, Tex.—Henry E. Elrod, Southwestern Life Building, Dallas, engaged to prepare plans for the sewer system; probable cost, $25,000.

Childress, Tex.—Reported plans submitted to State Sanitary Engineering Department for the proposed sewer system costing approximately $30,000. Address City Clerk.

Henry E. Elrod, Southwestern Life Building, Dallas, Tex., Engineer for Sewer System.

Ennis, Tex.—Plans approved by State Sanitary Department for a sewage disposal plant contemplated here to handle 1,500,000 gal. sewage daily. Address City Clerk.

Greenville, Tex. — Reported construction of a sewage disposal plant and extension to the sewer system under consideration. A. D. Dick, City Engineer.

Henderson, Tex. — City Council has granted franchise to A. Wood to complete sewer system. Plans soon to be submitted to the State Sanitary Engineering Department for approval.

Kerens, Tex.—The Mayor has submitted to the State Sanitary Department plans for approximately 2 miles of sewers. A. B. Duran, Engineer, Corsicana.

Portland, Tex.—Bartlett and Rainey of San Antonio are engineers for the sewer system.

Sherman, Tex.—Contract soon to be let for the disposal plant, plans for which have been prepared; cost $32,000. Karl M. Mitchell, City Manager.

Venice, Tex.—Reported construction of a sewer system under consideration. Address City Clerk.

Houston, Tex.—The following are the unit prices of the three bids opened Feb. 17 by City Commission for construction of storm sewers in Euclid Avenue from Westheimer Road to Buffalo Bayou: (a) Horton & Horton, Houston, $263,994; (b) H. C. Gass, Houston, $272,728; (c) T. J. Shea, $396,399.

	(a)	(b)	(c)
100 cu. yd. extra excavating	$2.00	$1.00	$1.60
1,000 ton-mile hauling	0.30	0.30	0.25
500 man-hour extra work labor	0.30	0.40	0.30
300 team-hour extra work teams	0.70	0.70	0.70
175 M ft. timber in foundations, per M ft	22.00	30.00	20.00
500 M ft. timber ordered left in trenches, per M ft	17.00	18.00	22.00
10 cu. yd. extra Class 1 concrete	11.00	14.00	8.50
10 cu. yd. extra Class II concrete	14.00	16.00	9.00
10 cu. yd. extra Class III concrete	16.00	16.00	12.00
10 cu. yd. extra brick masonry	15.00	16.00	15.00
1,000 lb. extra castings	0.05	0.10	0.06
1,000 lb. extra reinforcing steel	0.10	0.10	0.08
500 cu. yd. road gravel	2.50	2.00	2.00
500 cu. yd. road shell	2.25	2.00	2.00
5 standard manholes, Type "A" (ea.)	50.00	45.00	45.00
30 ft. extra depth manhole, Type "A"	6.00	5.00	5.00
17 standard manholes, Type "B," 24 ft. deep (ea.)	130.00	200.00	530.00
150 ft. extra depth manhole, Type "B," over 24 ft.	16.00	10.00	28.00
Supplying and setting 30 catchbasins, Type "A" (ea.)	35.00	35.00	30.00
Supplying and setting 28 standard inlets, Type "B" (ea.)	24.00	26.00	25.00
Supplying and setting 10 standard inlets, Type "C" (ea.)	65.00	70.00	60.00
Outfall complete, as per plan	6,700	8,000	11,000
10 lin. ft. 120-in. pipe, 0-12 ft. deep	22.00	24.00	49.60
10 lin. ft. 120-in. pipe, 12-14 ft. deep	23.00	25.00	49.60
10 lin. ft. 120-in. pipe, 14-16 ft. deep	24.00	26.00	49.60
10 lin. ft. 120-in. pipe, 16-18 ft. deep	25.00	27.00	49.60
10 lin. ft. 120-in. pipe, 18-20 ft. deep	26.00	28.00	49.60
10 lin. ft. 120-in. pipe, 20-22 ft. deep	26.60	29.00	49.60
10 lin. ft. 120-in. pipe, 22-24 ft. deep	28.00	30.00	49.60
10 lin. ft. 120-in. pipe, 24-26 ft. deep	28.50	31.00	49.60
25 lin. ft. 120-in. pipe, 26-28 ft. deep	30.00	32.00	49.60
1,000 lin. ft. 120-in. pipe, 28-30 ft. deep	30.80	33.00	49.60
1,000 lin. ft. 120-in. pipe, 30-32 ft. deep	32.00	34.00	49.60
1,000 lin. ft. 120-in. pipe, 32-34 ft. deep	33.00	35.00	49.60
1,000 lin. ft. 120-in. pipe, 34-36 ft. deep	34.00	36.00	49.60
1,000 lin. ft. 120-in. pipe, 36-38 ft. deep	35.20	37.00	49.60
10 lin. ft. 120-in. pipe, 38-40 ft. deep	37.00	38.00	49.60
10 lin. ft. 120-in. pipe, 40-42 ft. deep	39.00	39.00	49.60
100 lin. ft. 114-in. pipe, 24-26 ft. deep	26.75	26.00	49.60
1,000 lin. ft. 114-in. pipe, 26-28 ft. deep	28.40	27.00	49.60
80 lin. ft. 114-in. pipe, 28-30 ft. deep	30.00	28.00	49.60
40 lin. ft. 108-in. pipe, 22-24 ft. deep	25.00	23.00	38.00
600 lin. ft. 108-in. pipe, 24-26 ft. deep	26.00	24.00	38.00
40 lin. ft. 108-in. pipe, 26-28 ft. deep	27.00	25.00	38.00
20 lin. ft. 90-in. pipe, 20-22 ft. deep	20.00	17.00	21.40
140 lin. ft. 90-in. pipe, 22-24 ft. deep	21.00	18.00	21.40
20 lin. ft. 90-in. pipe, 24-26 ft. deep	22.00	19.00	21.40
10 lin. ft. 27-in. pipe, 6-8 ft. deep	3.00	2.40	2.70
500 lin. ft. 27-in. pipe, 8-10 ft. deep	3.25	2.70	3.00
120 lin. ft. 27-in. pipe, 10-12 ft. deep	3.50	3.00	3.30
10 lin. ft. 27-in. pipe, 12-14 ft. deep	4.00	3.30	3.80
200 lin. ft. 27-in. pipe, 14-16 ft. deep	5.00	3.60	4.25
200 lin. ft. 27-in. pipe, 16-18 ft. deep	5.50	3.90	5.10
10 lin. ft. 27-in. pipe, 18-20 ft. deep	6.00	4.20	5.45
10 lin. ft. 27-in. pipe, 20-22 ft. deep	7.25	4.50	5.80
20 lin. ft. 27-in. pipe, 22-24 ft. deep	7.50	4.80	6.25
50 lin. ft. 24-in. pipe, 0-6 ft. deep	2.35	2.60	2.50
50 lin. ft. 24-in. pipe, 6-8 ft. deep	2.60	2.80	2.65
100 lin. ft. 24-in. pipe, 8-10 ft. deep	3.00	3.00	2.90
200 lin. ft. 24-in. pipe, 10-12 ft. deep	3.40	3.20	3.25
200 lin. ft. 24-in. pipe, 12-14 ft. deep	3.90	3.40	3.70
80 lin. ft. 24-in. pipe, 14-16 ft. deep	4.50	3.60	4.20
10 lin. ft. 21-in. D. S. vitr. pipe, 0-6 ft. deep	2.25	2.50	2.20
280 lin. ft. 21-in. D. S. vitr. pipe, 6-8 ft. deep	2.35	2.70	2.25
200 lin. ft. 21-in. D. S. vitr. pipe, 8-10 ft. deep	2.65	2.90	2.60
10 lin. ft. 21-in. D. S. vitr. pipe, 10-12 ft. deep	3.25	3.00	2.80
50 lin. ft. 18-in. D. S. vitr. pipe, 0-6 ft. deep	1.75	1.70	1.80
50 lin. ft. 18-in. D. S. vitr. pipe, 6-8 ft. deep	2.00	1.90	1.80
50 lin. ft. 18-in. D. S. vitr. pipe, 8-10 ft. deep	2.60	2.10	2.00
600 lin. ft. 15-in. D. S. vitr. pipe, 0-6 ft. deep	1.25	1.35	1.25
300 lin. ft. 15-in. D. S. vitr pipe, 6-8 ft. deep	1.50	1.50	1.35
100 lin. ft. 15-in. D. S. vitr. pipe, 8-10 ft. deep	2.00	1.65	1.50
100 lin. ft. 12-in. D. S. vitr. pipe, 0-6 ft. deep	1.15	1.00	0.85
100 lin. ft. 12-in. D. S. vitr. pipe, 6-8 ft. deep	1.40	1.10	0.85
1 36-in. D. S. vitr. pipe joint in manhole	10.00	7.00	10.00
1 33-in. D. S. vitr. pipe joint in manhole	8.00	6.00	8.00
1 30-in. D. S. vitr. pipe joint in manhole	7.00	5.00	7.50
1 27-in. D. S. vitr. pipe joint in manhole	6.00	4.00	7.00
1 24-in. D. S. vitr. pipe joint in manhole	5.00	3.50	6.00
1 21-in. D. S. vitr. pipe joint in manhole	4.50	3.00	5.00
1 18-in. D. S. vitr. pipe joint in manhole	3.00	2.50	4.00
1 15-in. D. S. vitr. pipe joint in manhole	2.00	2.00	2.50
1 12-in. D. S. vitr. pipe joint in manhole	1.50	1.50	2.00

Houston, Tex.—The following are the unit prices of three lowest bids opened Feb. 17 for construction of the Hill Street storm sewer system: (a) Lucius Taylor, $51,382; (b) F. C. Youmans Constr. Co., $51,602; (c) Horton & Horton, $52,534.

	(a)	(b)	(c)
100 cu. yd. extra excavating	$1.00	$1.00	$1.50
500 ton-mile hauling	0.25	0.30	0.30
200 man-hour extra work labor	0.30	0.35	0.30
100 team-hour extra work teams	0.70	0.70	0.70
10 M ft. timber in foundations	25.00	30.00	25.00
100 M ft. timber ordered left in trenches	18.00	18.00	10.00
10 cu. yd. extra Class I concrete	9.00	10.00	12.00
10 cu. yd. extra Class II concrete	10.00	11.00	14.00
10 cu. yd. extra Class III concrete	12.00	12.00	15.00
10 cu. yd. extra brick masonry	12.50	12.00	15.00
100 lb. extra castings	0.05	0.07	0.05
100 lb. extra reinforcing steel	0.10	0.07	0.10
300 cu. yd. road gravel	2.25	1.95	2.25
300 cu. yd. road shell	2.00	1.75	2.00
9 standard manholes, Type "A" (ea.)	45.00	40.00	45.00
10 extra depth manholes, Type "A" (ft.)	5.50	7.00	6.00
16 standard manholes, Type "B" (ea.)	45.00	50.00	50.00
140 extra depth manholes, Type "B" (ft.)	6.00	7.00	9.00
56 catchbasins, supplying and setting, Type "A" (ea.)	27.50	30.00	30.00
10 standard inlets, supplying and setting, Type "B" (ea)	25.00	25.00	24.00
6 standard inlets; supplying and setting, Type "C" (ea.)	60.00	60.00	65.00
Outfall complete, as per plans	1,450.00	700.00	995.00
20 lin. ft. 66-in. pipe, 14-16 ft. deep	9.00	8.00	9.60
600 lin. ft. 66-in. pipe, 16-18 ft. deep	9.25	8.00	9.65
600 lin. ft. 66-in. pipe, 18-20 ft. deep	9.50	10.50	10.20
30 lin. ft. 66-in. pipe, 20-22 ft. deep	10.00	15.00	11.50
40 lin. ft. 60-in. pipe, 12-14 ft. deep	7.50	7.80	7.75
500 lin. ft. 60-in. pipe, 14-16 ft. deep	7.50	8.00	7.85
600 lin. ft. 60-in. pipe, 16-18 ft. deep	8.00	8.75	8.30
400 lin. ft. 60-in. pipe, 18-20 ft. deep	9.00	9.50	8.80
40 lin. ft. 60-in. pipe, 20-22 ft. deep	9.00	15.00	10.00
100 lin. ft. 51-in. pipe, 12-14 ft. deep	6.25	5.60	6.40
500 lin. ft. 51-in. pipe, 14-16 ft. deep	6.50	5.90	6.65
100 lin. ft. 51-in. pipe, 16-18 ft. deep	6.50	6.20	7.60
20 lin. ft. 48-in. pipe, 0-6 ft. deep	4.50	4.30	4.00
100 lin. ft. 48-in. pipe, 6-8 ft. deep	5.00	4.30	4.15
200 lin. ft. 48-in. pipe, 8-10 ft. deep	5.00	4.40	4.50
200 lin. ft. 48-in. pipe, 10-12 ft. deep	5.50	4.90	5.00
100 lin. ft. 48-in. pipe, 12-14 ft. deep	5.50	5.15	5.50
100 lin. ft. 48-in. pipe, 14-16 ft. deep	6.00	5.50	6.00
40 lin. ft. 48-in. pipe, 16-18 ft. deep	6.00	5.90	6.75
40 lin. ft. 48-in. pine, 18-20 ft. deep	6.50	6.45	7.10
200 lin. ft. 36-in. pipe, 6-8 ft. deep	3.25	2.85	3.20
300 lin. ft. 36-in. pipe, 8-10 ft. deep	3.25	3.10	3.40
40 lin. ft. 36-in. pipe, 10-12 ft. deep	3.75	4.00	3.80
100 lin. ft. 33-in. pipe, 6-8 ft. deep	3.00	2.60	2.75
400 lin. ft. 33-in. pipe, 8-10 ft. deep	3.00	2.75	3.10
120 lin. ft. 33-in. pipe, 10-12 ft. deep	3.00	3.20	3.40
50 lin. ft. 30-in. pipe, 0-6 ft. deep	2.00	2.40	2.50
250 lin. ft. 30-in. pipe, 6-8 ft. deep	2.50	2.60	2.65
30 lin. ft. 30-in. pipe, 8-10 ft. deep	2.60	3.25	3.00
100 lin. ft. 24-in. pipe, 0-6 ft. deep	2.25	2.25	2.30
300 lin. ft. 24-in. pipe, 6-8 ft. deep	2.25	2.60	2.45
40 lin. ft. 24-in. pipe, 8-10 ft. deep	2.25	2.75	3.00
100 lin. ft. 18-in. D. S. vitr. pipe, 0-6 ft. deep	1.75	1.65	1.60
100 lin. ft. 18-in. D. S. vitr. pipe, 6-8 ft. deep	1.75	1.80	1.65
100 lin. ft. 18-in. D. S. vitr. pipe, 8-10 ft. deep	1.75	2.10	2.10
800 lin. ft. 15-in. D. S. vitr. pipe, 0-6 ft. deep	1.00	1.20	1.15
700 lin. ft. 15-in. D. S. vitr. pipe, 6-8 ft. deep	1.15	1.30	1.25
100 lin. ft. 15-in. D. S. vitr. pipe, 8-10 ft. deep	1.00	1.60	1.75
300 lin. ft. 12-in. D. S. vitr. pipe, 0-6 ft. deep	0.85	1.00	0.90
300 lin. ft. 12-in. D. S. vitr. pipe, 6-8 ft. deep	1.00	1.15	1.05
1 24-in. D. S. vitr. pipe joint in manhole	5.00	4.00	6.00
1 21-in. D. S. vitr. pipe joint in manhole	4.00	3.50	4.00
1 18-in. D. S. vitr. pipe joint in manhole	3.00	3.00	3.00
1 15-in. D. S. vitr. pipe joint in manhole	3.00	2.50	2.00
1 12-in. D. S. vitr. pipe joint in manhole	2.00	1.50	1.50
Days, time to complete	120	120	120

Victoria, Tex.—State Sanitary Department has approved plans and estimates for a 1,600,000 gal. daily capacity sewage treatment plant and incinerator. Cost approximately $22,000. L. A. Gueringal, City Engineer.

Winnsboro, Tex.—Contract soon to be let for constructing the municipal water works and sewerage system to cost $25,000. Will E. Stevenson, Engr., Bowie; Gordon Alvis, City Secretary.

Calexico, Cal.—Improvements to the sewer system include 7000 ft. of 8-in. vitrl. pipe and a septic tank. Contract to be let as soon as bonds are sold. E. B. Browne, City Clerk.

Fresno, Cal.—B. E. Cronkite, City Engineer, is preparing plans for 7½ miles of storm sewers and 10½ miles of sanitary sewers, brick and concrete, 18 to 54 in. to cost about $350,000 and $500,000 respectively. Election may be held in May or June to vote bonds.

Merced, Cal.—Election to be held April 10 to vote $12,000 bonds for sewer extensions.

Midvale, Utah.—City Council is considering creating a sewer district which will require about three miles of sewers. Final action will be taken March 14.

BIDS DESIRED.

Boston, Mass.—Until Mar. 6, by Metropolitan Water & Sewerage Board, for 20,000 ft. 6, 8 and 10-in. vitr. sewer pipe, etc.

Lakeville, Conn.—Until March 27 by Sewers Committee of Lakeville Fire District, town of Salisbury, at Roberts Hall, Lakeville, for furnishing material and constructing pipe sewers and disposal works advertised in Engineering Record. Engineers, City-Wastes Disposal Company, 156 Fifth Avenue, New York.

Batavia, N. Y.—See "Water Works."

Cleveland, Ohio.—Reported desired until March 9, by Commission Purchase and Supplies for constructing sewers in portions of ten streets.

Cleveland Heights (P. O. Warrensville), Ohio.—Reported desired until Mar. 7, by H. H. Canfield, for constructing sewers, etc., in Greyton and Roxboro Roads. F. A. Pease Engr. Co., 804 Marshall Building, Cleveland.

Columbus, Ohio.—Until March 21, by G. A. Borden, Director Public Service, for constructing Third Avenue relief sewer, Contract No. 1, outlet section, requiring about 4010 lin. ft. 84 in. and 190 lin. ft. 24 in. sewer, outlet at river, 18 manholes, etc.; also, same time separate bids for Section 2 of this sewer, requiring 2190 lin. ft. 42 in. and 180 lin. ft. 20 in. sewer, 7 manholes, etc.

Berwyn, Ill.—Until Mar. 7, by Board Local Improvements (Oscar N. Lindahl, Secy.), for constructing vitr. pipe sewers in Greenwood and Winfield Aves., and W. 26th and other streets.

Oshkosh, Wis.—Reported desired until March 14, by Board Public Works for constructing sewers in Bablitz Avenue, Twenty-third, Twenty-fourth, Spruce and other streets.

Reported desired until March 7, by Wm. Faber, Pres. Bd. Trus. County Asylum, for constructing sewer, system to consist of 9340 ft. of 12 and 40 in. sewer, manholes, etc.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Brooklyn, N. Y.—Lowest bid opened Feb. 21 by the Borough President for constructing a sewer in Yarmouth Street, from Jamaica Avenue to Ashland Street, Jamaica, submitted by the Green Construction Co., Long Island City, at $20,864.

★**Yonkers, N. Y.**—Contract awarded by Board Contract and Supply to Frank J. Kelly, Yonkers, for constructing house and storm water sewer in portion of Kimball Avenue at $13,744.

★**Camden, N. J.**—Contract for sewer pipes, manhoes, etc., for the year 1916 (bids opened Feb. 21) awarded by A. L. Sayers, Street Commissioner, to A. Ward & Son, 524 Trenton Avenue.

★**Lexington, Ky.**—Contract awarded P. P. O'Neill & Bro. of Lexington, for extending northern main sewer, $9,205.

Los Angeles, Cal.—Following are four lowest bids opened recently for constructing sewer in Gower Street: J. P. Glick, 460 Concord Street, $22,222; P. S. Tomich, $24,000; John Sutalo, $24,148, and Mike Chutuck, $24,780.

★**El Centro, Cal.**—Contract for constructing four concrete septic tanks each 40 x 20 ft. awarded James Kennedy, Washington Building, Los Angeles, at $18,647 (bids opened Feb. 16 by City Clk.). Next three bidders: H. H. Peterson, $21,420; Rice & Dutcher, $24,885, and Mercereau Bridge & Construction Co., $26,567. Olmsted & Gillelen, Engineers, 1112 Hollingsworth Building, Los Angeles.

BRIDGES

PROPOSED WORK.

Weston, Mass.—The concrete bridge costing $50,000 to be constructed across Charles River will have one 35-ft. and two 30-ft. spans. John R. Rablin, Engineer, Metropolitan Park Commission, 14 Beacon Street, Boston.

Providence, R. I.—An election will probably be held to vote $125,000 bonds for constructing bridges along State highways.

Aurora, N. Y.—The Assembly passed bill legalizing $17,500 bond issue for bridge over Cazenovia Creek.

Johnson City, N. Y.—Towns of Union and Vestal considering building a bridge across Susquehanna River to connect Johnson City and Willow Point.

Utica, N. Y.—Common Council voted to issue $26,000 improvement bonds to pay city's share of cost of the Pleasant Street Viaduct.

Atlanta, Ga.—See "Sewerage and Sewage Disposal."

Bonifay, Fla.—Citizens of Holmes County will vote March 21 on issue of $25,000 bonds for erecting bridge and building highway from present ferry crossing across county to Walton County line.

Jasper, Miss.—Bridge and road bonds for $15,000 will be sold March 6 by County Board Supervisors, Dist. No. 3 (T. Q. Brame, Clk.).

Akron, Ohio.—See "Railroads."

Akron, Ohio.—Bridge bonds for $25,000 will be sold March 20 by Board County Commissioners (U. G. High, Clk.)

Bloomfield, Ind.—Contract about to be let by County Commissioners for constructing 80-ft. steel span at east end of White River Bridge and a 100-ft. span at west end of Eel River Bridge.

Ft. Wayne, Ind.—Reported Bd. of Works and County Commisisoners considering constructing an additional span to south end of McCombs Street Bridge.

Indianapolis, Ind.—Bridge costing $100,000 is to be constructed over Fall Creek at Senate Avenue and 19 small bridges costing $50,000 are to be constructed. Contract to be let about April.

Detroit, Mich.—Bd. Supervisors authorized city of Detroit to construct a temporary bridge to Belle Isle.

Urbana, Ill.—A steel and concrete bridge costing $8,000 is to be constructed over Boneyard. Contract will not be let until about June. Address City Engineer.

Milwaukee, Wis.—Council Committee on Railroads and Bridges reported in favor of constructing a bridge over Milwaukee River, from Biddle to Cedar Street.

Spooner, Minn.—The Canadian Northern Railroad has received permission from the War Department to construct bridge across Baudette River, plans for which are being prepared by the company's engineers at Winnipeg, Man.

St. Paul, Minn.—Reported city directed the Great Northern Ry. Co. (A. Hoagland, Ch. Engr., St. Paul) and Northern Pacific R. R. Co. (W. L. Darling, Ch. Engr., St. Paul), to rebuild east span of Seventh Street Bridge; cost, about $6,500.

Steel City, Neb.—County Commissioners at Fairbury voted to repair 150 ft. bridge over Blue River, recently destroyed by floods.

Clayton, Mo.—Contract about to be let by County Court for constructing a bridge over Meramec River.

New Castle, Tex.—Oklahoma City & South Canadian Bridge Co. (Charles Smith, Pres., New Castle) will construct a bridge over South Canadian River between Tuttle and New Castle, cost about $60,000.

Richmond, Tex.—See "Paving and Roads."

Everett, Wash.—County Commissioners considering constructing a bridge over Snohomish River to Smith Island at 18th St., cost about $35,000.

Oregon.—Reported State Highway Dept. at Salem completed plans and specifications for constructing following bridges: Concrete viaduct at McMinnville in Yamhill County, cost $14,000; steel span 160 ft. between Athey's Island and mainland over Williamette Slough below Wheatland, cost $13,000; a 100-ft. steel span over Rock Creek at Verona, Columbia County, and a 50-ft. girder bridge over Tide Creek near Deer Island. Chas. B. Wilson, Clerk Yamhill County at McMinnville, and E. D. Cleveland, Clerk Columbia County at St. Helens.

Los Angeles, Cal.—An agreement has been made between the Pacific Electric Railway Company, City Council, and the property owners to jointly construct a $35,000 bridge across tracks at Sherman Way and West Boulevard. Railroad to share one-half the cost.

BIDS DESIRED.

Waynesville, N. C.—Until March 7, by County Commissioners (Geo. W. Haynes, Clk.) for constructing 4 bridges in Haywood County.

Jackson, Miss.—Reported desired until March 6, by W. W. Downing, Chancery Clk., for following bridge work: Steel approach and floor systems on Baker's Creek; steel or concrete bridge 1¼ miles south of Pocahontas, steel approaches to Lime Kiln Creek bridge one mile south of Pocahontas.

Mayfield, Ky.—Until March 13 by Fiscal Court of Graves County, at Mayfield, for furnishing material and erecting ten concrete bridges and three steel bridges on Mayfield to Paris Road, also separate bids for furnishing all cement, reinforcing steel, f.o.b. cars Mayfield. Hollie Ford, County Road Engineer, Mayfield. Robert C. Terrell, State Commissioner of Public Roads, Frankfort, Ky.

Barberton, Ohio.—Reported desired until March 9, by U. G. High, Clk. Co. Comrs., for substructure and superstructure of Mud Run bridge on High Street and Culvert on Norton Avenue.

Cincinnati, Ohio.—Reported desired until March 10, by County Commissioners (Albert Reinhardt, Clk.) for concrete bridge on Rugler Mill Road, near Allendale.

Lancaster, Ohio.—Reported desired until March 7, by O. F. Myers, Clk. County Comrs., for steel superstructure for George, Wooster and Maple Grove School bridges.

Elkhart, Ind.—Reported desired until March 10, by City Clerk, for 26,000 sq. yd. pavement either brick, asphaltic concrete, sheet asphalt bitulithic, or cement concrete, 18,000 ft. curb and 15,000 cu. yd. excavation; estimated cost $65,600. L. M. Russell, City Engr.

Illinois.—Until March 21 by Zane Arbuckle, County Superintendent of Highways, Marshall, for constructing the Neff's Ford bridge, including supporting present 80-ft. steel span during construction, building new 80-ft. steel span, 14-ft. roadway, building one new plain concrete pier on pile foundations and one reinforced concrete abutment on pile foundations and replacing present 80-ft. steel span on new pier; reinforcing steel in substructure 7500 lbs. Engineer's estimate, including piles, $4,560.

Rock Island, Ill.—Reported desired until April 8, by Joint Committee, Board of Supervisors, of Rock Island and Henry Counties, at Rock Island, for constructing Colona Bridge across Rock River, concrete construction. Probable cost, $60,000.

Pocahontas, Iowa.—Until March 16, by L. O'Donnell, Co. Aud., for constructing seven bridges as follows: 32 ft. skew I beam bridge concrete floors and abutments, Sherman Township, 32 ft. I beam bridge with wood floor and concrete abutments in Cummins Township, 20 ft. skew I beam bridge with concrete floors and abutments in Grant Township, 20 ft. skew slab bridge with concrete abutments in Grant Township, 32 ft. skew I beam bridge with concrete floors and abutments in Grant Township, 16 ft. I beam bridge with concrete floors and abutments in Swan Lake Township, 16 ft. slab bridge with concrete abutments in Swan Lake Township, 20 ft. slab bridge with concrete abutments in Sherman Township, and 20 ft. slab bridge with concrete abutments in Sherman Township. County will furnish the lumber for floors of the two bridges with wood floors, at Havelock, Iowa.

Toledo, Iowa.—Until March 7 by County Auditor for twelve concrete and steel bridges at an estimated cost of $39,000. A. R. Hebenstreet, County Engineer.

Waseca, Minn.—Until March 20, by Theodore Peterson, Co. Aud., for constructing five standard reinforced concrete culverts, 10 x 6 box culvert, 30 ft. long, town of Iosco, 8 x 4 26 ft. long, also 4 x 4 26 ft. long, both in town of Byron, 10 x 6 26 ft. long, New Richland, 8 x 6 26 ft. long, in Otisco.

Alma, Kan.—Until March 7, by L. B. Burt, County Clerk, for constructing 41 concrete bridges and culverts for the county.

Emporia, Kan.—Reported desired until March 8, by B. F. Cross, Co. Clk., for constructing joint bridge over Rock Creek. Bids desired on arch design and concrete girders with stone abutments.

Pittsburg, Kan.—Reported desired until March 24, by County Commisisoners, Pittsburg, for erecting steel bridge over Tippecanoe River, near Pittsburg; four spans, total length 512 ft.; concrete wings and abutments, reinforced concreted floor, etc. Probable cost, $30,000. H. D. Good, Co. Auditor.

Yates Center, Kan.—Reported desired until March 7, by T. T. Davis, Co. Clk., for constructing two reinforced concrete piers at Durand bridge.

Butte, Neb.—Reported desired until March 10, for constructing bridge over Niobrara River, one steel truss, 170 ft. span, 16 ft. roadway on concrete piers and abutments and steel piles. S. A. Richardson, Co. Clerk.

Minden, Neb.—Reported desired until March 14, by A. H. Broman, County Clk., for constructing steel and reinforced concrete bridges for the county during the year.

Steele, N. D.—Until March 31, by Board County Commissioners, for constructing galvanized and concrete culverts. J. C. McWhinney, Co. Aud.

Gettysburg, S. D.—Reported desired until April 4, by E. E. Twomey Co., Aud., at Gettysburg, for galvanized iron culverts for county.

Kansas City, Mo.—Until March 11 for constructing substructure of Ohio Avenue Bridge over Kaw River for the Kansas City Southern Ry. (C. E. Johnston, Ch. Engr., Kansas City, Mo.). Contract for superstructure has been awarded American Bridge Company and requires about 1300 tons of steel. Waddell & Son, 800 Graphic Art Building, Kansas City, are consulting Engineers. The bridge is to be steel costing $200,000 and consists of three spans two 300-ft. skew spans and one 215-ft. spread skew span.

Houston, Tex.—Until March 24, by H. L. Washburn, Co. Aud., for constructing reinforced concrete bridge and approaches across Brogs Bayou. W. V. Burnell, Co. Engr.

Littleton, Colo.—Reported desired until March 6 by Theo. Taylor, County Clerk, for constructing a 63-ft. truss bridge with concrete floor and 60-ft. reinforced concrete arch bridge over Sandy Creek south of Littleton.

Randle, Wash.—Reported desired until March 11, by County Commissioners, Chehalis, for a 210-ft. steel bridge over the Cowlitz River at Cora 8 miles above Randle. J. D. Neville, Co. Engr.

South Bend, Wash.—Reported desired until March 8 by W. E. Lovering, Co. Aud., for constructing a 60-ft. span Luten type reinforced concrete arch on National Park Highway over Half Moon Creek at Lebam; also constructing a 120-ft. span steel bridge and about 830 lin. ft. trestle approach for proposed East Raymond bridge, over Willipaca River.

Santa Barbara, Cal.—Until April 3, by Board of Supervisors, for constructing two reinforced concrete girder bridges across San Antonio Creek in Fifth Road Dist., at Station 399, plus 25 and 382 plus 60. Cost about $11,500.

Boise, Idaho.—Reported desired until March 18, by Idaho State Highway Commission (Geo. R. Barker, Secy.), for constructing steel bridge 301 ft. long over Malad River on the Idaho-Pacific States Highway.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Maine.**—Following are bids opened Feb. 23 by State Highway Commission, Augusta, for constructing steel bridge 263-ft. span at New Sharon:

★Superstructure—(a) Plank floor, (b) wood block floor: Groton Bridge Company, Groton, N. Y., (a) $17,400 (awarded contract), (b) $19,650; United Construction Company, Albany, (a) $20,588; (b) $22,500; Berlin Construction Company, New Britain, Conn., (a) $21,128, (b) $23,906; Spaulding Construction Company, Suffield, Conn., (a) $22,470, (b) $24,450.

★Abutments—James H. Ken, Rumford, $7,192 (awarded contract); Cyr Brothers, Waterville, $7,975; Doran & Fellows, Mercer, $8,205; Small & Ingalls, Bar Harbor, $8,795.

Albany, N. Y.—Following are two bids opened Feb. 24 by W. W. Wotherspoon, State Superintendent Public Works, Albany, for constructing steel plate girder bridge over Erie Canal at Clinton Street, Whitesboro: M. Fitzgerald, Hoosick Falls, N. Y., $9,472; E. J. Cunningham, 324 Mary Street, Utica, $11,038.

★**Oakmont, Pa.**—Contract for furnishing from 10,000 to 14,000 tons steel for Bessemer & Lake Erie R. R. Co. bridge over Allegheny River, awarded to American Bridge Co., Frick Building, Pittsburg.

★**Harriman, Tenn.**—Contract for constructing concrete bridge about 800 ft. long over Emeroy River at Harriman awarded by County Court (bids opened Feb. 10) to Luten Bridge Co., Nashville, at $56,400.

★**Elizabethtown, Ky.**—Contract for constructing a bridge 558 ft. long at Wooldridges Ferry awarded to Champion Bridge Co., Wilmington, Ohio, at $22,229.

★**Atlantic, Iowa.**—Contract for constructing twenty bridges along Atlantic Northern Railroad, awarded to Camper Constr. Co., Omaha, Neb.

★**Council Bluffs, Ia.**—Union Pacific R. R. Co. awarded contract for steel for bridge over Missouri River at Council Bluffs to American Bridge Co., 30 Church St., New York, N. Y., estimated cost of bridge $1,000,000.

★**Decorah, Iowa.**—Contract for constructing 10 "I" beam span bridges with concrete abutments for county awarded to Dubuque Boat & Boiler Works at Dubuque at $14,269.

★**Mason City, Ia.**—Contract for bridge work in Cerro Gorde County awarded to C. A. Holvik, Mason City, at $21,600.

Mt. Pleasant, Iowa.—Contract for constructing 83 concrete bridges and culverts awarded Standard Construction Company, Davenport. H. N. Wright, County Auditor.

★**Gretna, Neb.**—Contract for constructing bridge over Elkhorn River about 3 miles west of Gretna awarded to Monarch Engineering Co., Falls City, at $11,843.

★**North Platte, Neb.**—Contract for constructing bridge over South Platte River for county awarded to East St. Louis Bridge Co., East St. Louis, Ill., at $20,000.

★**Dallas, Tex.**—Contract for 435 tons of steel for viaduct awarded Virginia Bridge & Iron Company, Roanoke, Va.

★**Seattle, Wash.**—Contract for constructing Stossel bridge to be steel construction with 209-ft. span awarded by County Commissioners to Weymouth Constr. Co., Pier No. 1, at $18,500, according to county's specifications.

All bids opened by County Commissioners Feb. 21 for constructing 294-ft. span steel bridge at Falls City rejected. Lowest bid submitted by A. Levergren & Co., 3826 Eastern Ave., at $39,800.

★**Victoria, B. C.**—Contract for constructing bridge for Canadian Pacific Ry. Co. over Selkirk Arm on line from Patricia Bay to Indian Reserve awarded to S. Doe, of Victoria, at about $20,000.

PAVING AND ROADS

PROPOSED WORK.

New Haven, Conn.—Paving Commission filed with the Mayor report which provides for paving about 54 streets.

Long Island City, L. I., N. Y.—Plans prepared by State Highway Commission at Albany for improving Rockaway Blvd. where it passes through Nassau County from Hook Creek to Broadway, Lawrence, calling for a 50-ft. roadway with a 20-ft. asphalt strip in center.

Mount Vernon, N. Y.—The Mayor is reported in favor of issuing $250,000 bonds for repaving streets, of which not more than $30,000 shall be issued in any one year.

Perry, N. Y.—Paving of Main Street with brick, distance of ½ mile, being considered by city.

Silver Creek, N. Y.—The Assembly passed a bill legalizing bonds for improving Park Pl. and Central Ave.

Utica, N. Y.—Common Council considering paving 10 streets.

Whitney Point, N. Y.—Taxpayers considering paving Main and Collins Streets, estimated cost $18,000. Amos M. Johnson, Village President.

Altoona, Pa.—City Council passed ordinance providing for paving of Twenty-seventh Avenue, between North Ninth and Maple Avenues.

Ambler, Pa.—See "Sewerage and Sewage Disposal."

Lebanon, Pa.—City Council considering paving two miles of streets.

South Bethlehem, Pa.—Election to vote $150,000 paving bonds is under consideration. Thomas Ganey, Borough Secretary.

Baltimore, Md.—Board of awards has approved paving specifications which will cost about $115,000.

Newport News, Va.—See "Sewerage and Sewage Disposal."

Roanoke, Va.—The remacadamizing of rock road from the Montgomery to Botetourt line and the issuing of $100,000 bonds for Salem Dist. for constructing 21 miles of macadam roads reported being considered. Roanoke County branch of Virginia Road Builders Asso. said to be interested.

Shelby, N. C.—Members of No. 2 Township voted $40,000 bonds for road work. Address J. J. Lattimore, Shelby.

Columbia, S. C.—Election will probably be held April 11 in Richland County to vote bonds for road improvements.

Atlanta, Ga.—See "Sewerage and Sewage Disposal."

Clearwater, Fla.—Road improvement bonds amounting to $715,000 will be sold March 7, by County Commissioners. (C. W. Wiecking, Clerk.)

Key West, Fla.—Citizens of Monroe County will probably vote a bond issue for constructing roads on Key Largo, Big Pine Key, Mattacumbie and Cape Sable.

Mobile, Ala.—The Mobile-Baldwin highway is to cost about $105,000, and will include two draw-bridges over Tensaw and Spanish Rivers, also about seven miles of dredging. Harry L. Fisher, Mobile County Engineer, Mobile.

Jasper, Miss.—See "Bridges."

Chattanooga, Tenn.—About $100,000 will be spent in Hamilton County during 1916 for road improvements.

Lawrenceburg, Tenn.—Election will probably be held in county to vote $350,000 bonds for road improvements.

Memphis, Tenn.—Jefferson Davis Highway Asso. organized to construct a highway from Memphis to New Orleans.

Rogersville, Tenn.—About $250,000 bonds sold by Hawkins County for constructing roads.

Georgetown, Ky.—About $100,000 Scott County road bonds sold.

Henderson, Ky.—Election will probably be held to vote $400,000 bonds for constructing roads in Henderson County.

Hopkinsville, Ky.—Citizens will vote March 18 on question of issuing $400,000 bonds for improving roads of Christian County.

New Castle, Ky.—Reported Citizens of Henry County will vote on issue of $300,000 bonds for road improvements.

Somerset, Ky.—Pulaski Fiscal Court considering spending $300,000 for road improvements.

Wickliffe, Ky.—About $300,000 Ballard County Road bonds sold.

Canton, Ohio.—Paving bonds for $38,800 will be sold March 13 by Samuel E. Barr, City Aud.

Comrs. Stark County and Sugar Creek Township voted to construct Justus-Beach City Rd., about 3 miles long, and the remaining unpaved link in the Canton-New Philadelphia highway in Stark County.

Cincinnati, Ohio—City Council will submit either at the April or August election bond issue for $1,500,000 for street improvements, including improvement of Madison Road, Eastern and Fairbanks Avenues, Quebec Road and Freeman and Central Avenues, chiefly with wood blocks, macadam and Tarvia.

City Council, Feb. 23, adopted resolutions to pave with concrete on portions of Glen Parker Avenue and Handasyde Court and limestone Glen Armand Avenue. City Engineer, Frank S. Krug. City directed to prepare estimates of cost. Charles F. Hornberger, Dir. Public Service.

Cleveland, Ohio.—City Council voted tax in favor of proposed Prospect Ave. Boulevard to link East Side Park System with downtown business district. Plans provide for removal of tracks from Prospect Ave., curving street into Carnegie Ave. at E. 55th St., and extending Carnegie Ave. through from E. 89th St. to Fairmount Boulevard.

County Engineer directed to prepare plans for paving Lake Rd.; estimated cost, $205,000.

Cleveland Heights, Ohio.—F. A. Pease, Engineer, Cleveland, is planning a new road from Mayfield and Lee Roads to Willoughby.

Defiance, Ohio.—It is proposed to pave Harrison, Jackson and Third Sts., about 25,000 sq. yds. All material under asphalt prices will be considered, curbing concrete or sandstone, foundation concrete. Carl A. Smith, County Surveyor.

Elyria, Ohio.—State Highway Commission at Columbus approved plans for improving about 9 miles of Lake Rd. in Lorain County.

Lima, Ohio.—City Council reported in favor of paving twenty-three streets at cost of $200,000.

Lisbon, Ohio.—Commissioners of Columbiana County considering spending about $600,000 for road improvements.

McConnelsville, Ohio.—City Council considering paving 9th and 10th Sts. with brick and Kennebec Ave. with macadam.

New Philadelphia, Ohio.—About $44,000 will be spent by Tuscarawas County for road improvements.

Piqua, Ohio.—City Council voted to pave portions of Washington, Clark Avenues, South, West Ash, North Streets and Broadway.

Salem, Ohio.—City Engineer submitted to City Council plans and estimates of cost for paving West Dry St., brick with concrete base and stone curb, cost $3.27 per ft. frontage and brick with sand cushion at $2.77 per ft. frontage.

Springfield, Ohio.—Paving bonds for $15,391 will be sold April 3, by W. J. Barrett, City Aud.

Steubenville, Ohio.—An appropriation of $42,000 has been made to Jefferson County by State Highway Commission at Columbus for road improvements in county.

Tiffin, Ohio.—Reported Clinton Township Trustees considering spending about $80,000 for road improvements.

Toledo, Ohio.—County Commissioners decided to pave Treadway Road, distance of 2⅛ miles, with concrete, at cost of $27,000; also Helfrich Road, distance of 1½ miles.

Warren, Ohio. — Commissioners of Trumbull County in favor of constructing 5 miles of improved roadway north and south from Brookfield Center, cost about $50,000.

Warren, Ohio. — Street improvement bonds for $21,000 will be sold March 25 by Geo. T. Hecklinger, City Aud.

Wooster, Ohio.—County Engineer submitted to County Commissioners plans for paving 2⅛ miles of road leading from east end of paving on West Salem-Congress Road.

Anderson, Ind.—Bd. Public Works voted to resurface Meridian Street and Ohio Avenue with asphalt; cost, $25,993.

Bedford, Ind.—County Treasurer sold $11,500 Shawswick Township and $14,000 Marion Township gravel road bonds.

Columbus, Ind.—About $21,600 Bartholomew County free gravel road bonds sold.

Columbus, Ind.—Construction of a 3-mile concrete road within city limits reported contemplated, cost about $45,000.

Indianapolis, Ind.—City will lay about 30 miles of pavement this year. Address City Engineer.

County Commissioners will build 20 miles concrete road, 6½ miles bituminous concrete, 6-in. waterbound macadam, 6 miles of gravel road. Contracts will be let at different times after March 1.

Lawrenceburg, Ind.—The County Commissioners have authorized an issue of $21,600 bonds for constructing a gravel road in Lawrenceburg Township.

Hesperia, Mich.—About $20,000 bonds sold for constructing good roads in Denver Township.

Albion, Ill.—Citizens will vote in April on issue of $16,000 bonds for road improvements in county.

East Moline, Ill.—Council passed ordinances for brick paving on Seventeenth Street, Eighteenth to Nineteenth Avenues, Eighth, Ninth, Tenth and Eleventh Streets, Sixteenth to Seventeenth Avenues, estimated cost $29,547. Also brick paving on Thirteenth Street, Eighteenth to Twentieth Avenues, cost $7,025.

Dixon, Ill.—An election will probably be held to vote on constructing an 18-ft. concrete highway from this city to Palmyra Township at a cost of $60,000. V. N. Taggett, County Engineer, has made a preliminary survey and estimates cost at $46,000.

Kankakee, Ill.—City Council voted to pave Evergreen Avenue with asphalt and Maple Street with brick, the latter to cost about $22,400.

Moline, Ill.—Council is considering paving Thirteenth Street District with asphalt at a cost of $35,647. Lyle Payton, City Engineer.

Paris, Ill.—County will pave about four miles with brick, township and state highway. K. W. Barr, Superintendent of Highways, Edgar County, Paris.

Quincy, Ill.—An election will probably be held to vote $1,180,000 bonds for constructing hard surface roads in Adams County.

Rock Island, Ill.—Reported the paving of Eighth Avenue from Ninth to Nineteenth Avenues at a cost of $22,559 is under consideration by the Board of Local Improvement.

Springfield, Ill.—The Supervisors are said to be considering calling an election to vote $1,500,000 bonds to provide hard roads through the county.

Sterling, Ill.—Board of Local Improvements has passed three paving projects, total cost estimated at $133,000.

Urbana, Ill.—About 17,000 sq. yds. of brick pavement on 6-in. Portland cement foundation is to be laid. Address City Engineer.

Indianola, Iowa.—A. H. Gilliland, Engineer, Indianola, is preparing plans for about three and one-half miles of paving for the city.

Minneapolis, Minn.—The Elwell bonds amounting to $530,603 which are to be used for street improvement have been sold. Address City Clerk.

Tentative plans for road and bridge work in Hennepin County in 1916 will require about $325,000.

Minneapolis, Kan.—Plans being prepared for laying 30 blocks of paving. Election to be held.

Winlock, Neb.—Contract will be let about May for 1 mile of one course concrete paving on 1st Street. Cost $12,000. R. W. Fletcher, Engineer, Winlock. L. R. Quillen, Clerk.

Mandan, N. D.—About 32,000 sq. yds. of paving on concrete base will be laid on 2d Avenue N. W. and 3d Avenue N. W. Blatch & Griffin, Mandan, Engineers; W. H. Sutz, City Auditor.

Sioux Falls, S. D.—City Council has authorized paving about nine miles of street.

Beaumont, Tex.—The Attorney General has approved a $190,000 bond issue for Jefferson County.

El Paso, Tex.—In report submitted to City Council, City Engineer estimates cost of paving Alameda Avenue at $92,708.

Houston, Tex.—Plans and specifications to be prepared by County Engineer for paving Harrisburg Road, cost about $175,000.

County Commissioners Court considering constructing a road from Humble to Moonshine, estimated cost $80,000.

Houston, Tex.—Specifications approved by City Council for paving Main Street, from McKinney Avenue to San Antonio and Aransas Pass Ry. tracks, estimated cost, $170,000.

Richmond, Tex.—Election to be held March 6 in Road Dist. No. 6 to vote $20,000 bonds for constructing bridge over Big Creek, also vote on issue of $80,000 for road improvements in Dist. No. 12. Address County Clerk.

Centralia, Wash.—Contract will soon be let for constructing cement sidewalks on South Towner Avenue and Summa, Jackson and Madison Streets. Caleb Berry, City Engineer.

Everett, Wash.—Preliminary field work for year's road improvements in the county is now under way. County Commissioners authorized sale of $750,000 bonds for this year's work. Greater portion of roads to be improved will be one course concrete paving, mostly 16 ft. wide, but one or two cases for a short distance 9 ft. wide. Thickness 7 in. in center and 5 in. at sides. W. C. Bickford, County Engineer.

Montesano, Wash.—Reported Bd. County Commissioners will soon let contract for constructing East Hoquiam Road; cost, $20,000. George D. Robertson, County Engineer.

Mt. Vernon, Wash.—County Commissioners voted to construct 3 miles hard surface pavements. A. L. Strong, County Engineer.

Okanogan, Wash.—About 5 miles of permanent highway will be graded and surfaced with crushed rock or gravel; cost, $12,000. Horace S. Smith, County Engineer.

Raymond, Wash.—City Council has passed resolution calling for hard surfacing of 1½ miles of highway between Raymond and South Bend; estimated cost $25,000.

Seattle, Wash.—Contracts soon to be let for paving approximately 25 miles of King County highway and the grading and graveling of about 13 miles. About 10 miles of the paving with brick or concrete from city limits at 14th Avenue S., Seattle, to Des Moines, cost $180,000; paving from Botherell to Snohmish County line $10,000; grading and graveling 7 miles between Black Diamond and Franklin and Howard cost $56,000; between Black Diamond and Maple Valley, $60,000. The last contract calls for heavy cuts and railroad under crossings. A. P. Denton, County Engineer.

Seattle, Wash.—City Council considering paving Thackery Place; cost $14,428; and paving Latona Avenue, cost $9,843.

City Council voted to grade and pave road to Rainier Valley, distance of 3 miles, cost about $205,000.

Spokane, Wash.—Contract soon to be let by the County Commissioners for constructing Permanent Highway No. 11-A extending 5.6 miles from Meadow Lake to Cheney, bids on asphalt macadam, asphaltic concrete on macadam, base macadam on asphaltic concrete base, and for "Stradamant"; cost about $50,000. Charles A. McClung, Deputy County Engineer, Spokane.

Sultan, Wash.—Town Council voted to pave Main St., cost $10,000.

Waterville, Wash.—Plans being considered for surfacing with crushed rock or gravel about 4 miles of permanent highway, cost about $20,000. Bids will be received about June 1. Robert T. Foster, County Engineer.

Pendleton, Ore.—Reported Umatilla County will vote at spring election on issuing $980,000 bonds for road improvements. Willard Bradley, County Engineer.

Fresno, Cal.—Election soon to be held to vote $3,000,000 bonds for constructing permanent good roads in the county. About 300 miles of permanent highway contemplated. Address County Clerk.

Hanford, Cal.—City Trustees engaged Edward M. Lynch of Glendale to prepare specifications for paving six streets.

Los Angeles, Cal.—Homer Hamlin, City Engineer, recommends appropriating $10,000 for oiling five miles of roadway, $6,000 for pipe, etc., for culvert, $10,000 for street building equipment for VanNuys section, etc.

Road Commissioner F. H. Joyner has been commissioned by the Board of Supervisors to survey three miles of road from Playa Del Ray and Manhattan preparatory to repaving.

Kingsbury, Cal.—Contracts soon to be let for 15,400 sq. yds. concrete pavement on Simpson Street. John C. Bates, Engineer, Fresno; H. E. Verdee, City Clerk.

Pomona, Cal.—A committee has been appointed, of which D. Crookshank is chairman, to determine street improvements and street protection needs, preparatory to holding an election to vote approximately $200,000 bonds.

San Diego, Cal.—Board of Supervisors will appoint a committee to secure data as to county's needs in regard to highways and bridges. An election will probably be held to vote about $750,000 bonds for these improvements. George Butler, County Engineer.

San Francisco, Cal.—Persia Ave., Iowa, Folsom and Madrid Sts. are to be paved with asphalt, Genesee and 18th Sts. with a combination of brick and asphalt, 24th St. with basalt pavement, and 17th Ave. with broken rock pavement, by city.

Turlock, Cal.—City Council voted to pave Lander Ave.

Yuba City, Cal.—Reported Citizens of Reclamation Dist. No. 1001 petitioned County Bd. Supervisors for permission to bond district for $150,000 to provide for constructing a highway along Sacramento River levee from Vernon to Sacramento.

Phoenix, Ariz.—City Commission has voted a resolution to pave six blocks on Second Avenue and seven blocks on Roosevelt Avenue, and probably seven blocks on the latter street.

Logan, Utah.—County Commissioners considering constructing a road from Logan to Ogden by way of south end of Cache Valley through Paradise and Avon to Ogden Valley.

BIDS DESIRED.

Brooklyn, N. Y.—Until March 10 by L. H. Pounds, Borough Pres., for paving on portions of Seventeenth Avenue, Seventy-first Street, constructing sidewalks on portions of Thirteenth Avenue and Crosby Avenue, in all about 18,430 sq. ft. cement sidewalks, 4,310 sq. yds. asphalt, etc., furnishing and delivering 50,000 iron slag paving blocks, to be delivered at various municipal asphalt plants and Corporation Yards. Total security $5,100.

Elizabeth, N. J.—Reported desired until March 8 for 39,439 sq. yds. bituminous pavement on concrete base. J. L. Bauer, Co. Engr.

Flemington, N. J.—Until March 23 by Board Chosen Freeholders, Flemington, for improving Hoffman Lower Valley Road, 1.67 miles, and Clinton-West Portal Road, First Section, 2.8 miles, with water bound macadam. Advertised in Engineering Record. Grant Davis, Engineer, Whitehouse Station.

Merchantville, N. J.—Until March 6, by Arnold H. Moses, Chmn. Com. Pub. Wks. and Service, Camden, for paving of tracks and strip 3 ft. wide on each side of tracks on portions of Maple Avenue, on Moorestown Pike, lying between the borough line, Merchantville, with bituminous and granite block pavement on concrete foundation, in all about 10,437 sq. yd., and 26,838 lin. ft. of granite blocks. J. J. Albertson, Engr., Camden.

Baltimore, Md.—Until March 8, by Board of Awards at office of City Register, for grading, curbing and paving with asphalt twenty-five streets, in all approximately 55,000 yds. Probable cost $115,000.

Portsmouth, Va.—Until March 8, by L. P. Slater, City Clk., for street paving and curbing advertised in Engineering Record.

Huntington, W. Va.—Reported desired until April 6, by County Court, for constructing ten miles of brick paving on the Mason County Line on the Ohio River Road. Probable cost $200,000. Oliver & Maupin, Engr. Co., County Engrs.

Sumter, S. C.—Until March 28, by City Clerk, for street paving, about $225,000 available, advertised in Engineering Record. W. Loring Lee, Engineer, Sumter.

De Land, Fla.—Until March 25, by County Commissioners, at office of Saml. D. Jordan, County Clk., De Land, for improving highways in De Land-Lake Helen Special Road and Bridge Dist., advertised in Engineering Record. J. B. McCrary, Co. Engrs., 1408 Third National Bank Bldg., Atlanta, Ga.

Frankfort, Ky.—Until March 9, by Crawford Lee, Clk. County Fiscal Court, for improving State Aid Road, beginning at finished portion about 1½ miles south of city limits and running about 7½ miles to Shelby County line.

Louisville, Ky.—Until March 8 by Board Public Works, (Roger G. McGrath, Secy.) for oiling approximately ¼ gal. per yd. 1,700,000 sq. yd. macadam streets, and covering 100,000 sq. yd.

Cincinnati, Ohio.—Until March 9 by Charles F. Hornberger, Dir. Public Service, for improving Reading Road from Mitchell Avenue to Paddock Road with 7,800 sq. yds. wood block. City Engineer estimates cost at $34,443.

Cleveland, Ohio.—Until March 22, by Board County Commissioners (E. G. Krause, Clk.), for improving sections of Som Center Road Nos. 1 and 2, and Ridge Road No. 4. W. A. Stinchcomb, Co. Surv.

Cleveland, Ohio.—Reported desired until March 8, by Commissioner of Purchase, for paving and curbing portions of 28 streets.

Dayton, Ohio.—Reported desired until March 9, by County Commissioners, for constructing brick road on the Shakerton Pike, from city limits one mile out into the country.

Elyria, Ohio—Until March 9 by Director Public Service for about 17,100 sq. yd. brick, asphalt, asphalt block, wood or other paving material.

Indiana—By County Commissioners for constructing road as followa:

Until March 7:

Bloomington, for constructing three gravel roads, two in Clear Creek Township and one in Perry Township. W. F. Kinser, Co. Aud.

Until March 8:

Bloomington, for constructing roads in Indian Creek, Perry, Rickard and Clear Creek townships. W. F. Kinser, Co. Aud.

Until March 10:

Warsaw, constructing concrete road in Jackson Township. V. D. Mock, Co. Aud.

Indianapolis, constructing concrete road in Center Township. Leo K. Fesler, Co. Aud.

Until March 18:

Washington, for pike roads in Washington, Veale and Madison townships. J. G. Clark, Co. Aud.

Columbus, gravel and crushed stone road in Columbus Township. W. H. Scott. Co. Aud.

South Bend, Ind.—By Board Park Commissioners (Irvin W. Jackson, Chmn.) until March 17, for paving and curbing Niles Boulevard, from Howard to Crosby streets.

Marshall, Mich.—Until March 20, by Board Road Commissioners of Calhoun County, at Marshall, for constructing two miles of concrete road 16 ft. wide. Alex. McKay, County Engineer, 303 Ward Building, Battle Creek.

Berwyn, Ill.—Until March 7 by Board Local Improvements (Oscar N. Lindahl, Secy.) for constructing cement sidewalks in Sixty-third Court Sixty-third Avenue and other streets. Cost $17,320.

Chicago, Ill.—Until March 6, by Department Public Works (W. R. Moorhouse, Comr.) for furnishing and delivering city, f.o.b., cars on such tracks as shall be designated by Comr. Pub. Wks. approximately 600,000 paving bricks. Also same time and place separate bids for furnishing and delivering at Municipal Asphalt Plant. one 5-ton tandem road roller for use of Bureau of Streets.

Oak Park, Ill.—Until March 7, by Board Local Improvements (B. C. Branstadt, Secy.) for paving with asphaltic concrete with granite curbs, etc., on portions of Fillmore, Twelfth and other streets.

Beloit, Wis.—Until March 14 by Public Works Committee (George P. Haynes, Chmn.) for furnishing material and improving portions of twenty-five streets, including Broad, Bluff, North College and other streets, in all about 97,000 sq. yds. paving, 55,000 lin. ft. combined curb and gutter, 400 lin. ft. covered gutter. Bids will be considered on vitr. brick, sheet asphalt, asphaltic concrete and one course reinforced concrete, all on 5-in. concrete base.

Waukesha, Wis.—Until March 30, by Bd. Public Works, for macadamizing portions of various streets advertised in Engineering Record.

Creston, Iowa.—Until March 9 by Carl Davenport, City Clerk, for constructing 50,000 ft. curbing and 60,000 yds. street paving. Bids will be considered on concrete, asphaltic concrete, brick block, vertical fiber brick, sheet asphalt, bitumated concrete and Hassam. Theo. S. DeLay, City Engineer.

Forest City, Iowa.—Until March 15 by G. B. Chryst, Town Clerk, for about 25,000 sq. yds. pavement and 16,500 lin. ft. combined curb and gutter. Bids will be considered on Portland cement concrete, one and two course; asphaltic concrete, Topeka and course aggregate specifications; Barber and independent asphalts; brick block, 18 per cent and 22 per cent abrasion old standard rattler; vertical fiber brick 2½ and 3-in. bituminous concrete, bitulithic, sheet asphalt, Barber and independent; various kinds of concrete curb and combined curb and gutter will be considered. Theo. S. DeLay, Consulting Engineer, Creston, Iowa.

Grinnell, Iowa.—Until March 6, by A. C. Harriman, City Clk., for furnishing material and constructing cement walks for year beginning April 1.

Glenwood, Minn.—Until March 20, by County Board, for constructing roads. Jobs Nos. 1 to 6 inclusive. Cost, $18,111. Ole Irgens, Co. Aud.

Marshall, Minn.—Reported desired until March 21, by E. S. Shepard, County Auditor, for graveling State Rural Highway No. 54, including 19,880 cu. yd. gravel, estimated cost $19,976.

Winona, Minn.—Until March 27, by George W. Hofmann, City Recorder, for furnishing and delivering one road roller weighing from 7 to 10 tons.

Kearney, Neb.—Reported desired until March 8 for vertical fiber brick, asphaltic concrete or monolithic brick in Dist. No. 11, in all about 14,000 sq. yds.

Fargo, N. D.—Until March 8, by A. R. Watkins, City Aud., for paving and curbing portions of Sixth Avenue North, Eighth and One-half Street North and other streets in Paving Dist. No. 1, with other asphalt, bitulithic, bituminous concrete, creosoted block or vitr. brick.

Minot, N. D.—Until March 20, by A. D. Hagenstein, City Aud., for 24,844 yd. paving.

Sioux Falls, S. D.—Until March 15, by Board City Commissioners, for paving portions of Main Avenue, Eleventh Street, Twelfth Street, Spring Avenue and other streets, in all about 79,573 sq. yd.

Eldorado, Ark.—Until March 21, by Board (C. H. Murphy, Chmn.) for 24,600 sq. yd. concrete or asphaltic concrete pavement on Washington, Jackson and Main Sts., including concrete curb. John MacCrea, Little Rock, Engineer.

San Antonio, Tex.—Reported desired until March 6 by City Council for paving portions of numerous streets. Specifications call for bitulithic, asphalt concrete, concrete and other similar paving materials.

Ephrata, Wash.—Reported desired until March 7, by C. T. Sanders, Clk. Board County Commissioners, for constructing following roads, surfacing only County Road No. 411 about 6½ miles, County Road No. 414, 3⅛ miles, Permanent Highway No. 7, one mile, County Road at Beverly running east 2½ miles over County Road No. 856. F. H. Stardling, Co. Engr.

Washington.—Reported desired until March 20 by William R. Roy, State Highway Comr., Olympia, for surfacing with gravel or crushed rock about 7½ miles of Pacific Highway from Toledo southerly in Lewis County.

Wallace, Idaho.—Reported desired until March 13, by City Council, for paving residential section; probable cost $120,000.

Leamington, Ont.—Reported desired until March 10, for paving portions of Russell, Mill and Talbot Streets, in all about 16,069 sq. yd. R. M. Selkirk, Town Clk.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Maine.—Following are bids opened Feb. 23 by State Highway Commission, Augusta, for state road improvements:

★Jackman—Rockwood Road—Clearing and grubbing right of way, 31 miles: Murray Bros., Bangor, $16,116 (awarded contract); Marco Laworgna, Canton, Me., $17,282; James H. Ken, Rumford, $18,948, and Pope D. McKinnon, Bangor, $28,620.

Concrete road in Saco, 3.48 miles: Forgione & Romano, Portland, 48,748; David Sheehan, Lynn, Mass., $50,796; Hassam Paving Company, Worcester, Mass., $55,881; Powers Bros., Brockton, Mass., $66,211. (No contract awarded yet.)

★Concrete road in Scarboro, .64 miles, awarded Forgione & Romano, Portland, at $8,965.

★Concord, N. H.—Contract awarded by Frederic E. Everett, State Highway Department, for oil to be used on the state roads this year to Alden Speare & Sons Company, Boston. Contract calls for about 500,000 gals. of oil to cost approximately $30,000.

Rochester, N. Y.—Two lowest bids opened by Bd. Contract & Supply for asphalt repairs for year 1916 submitted by Whitmore, Rauber & Vicinus and Warren Bros. Co., each submitting bid at 74 cts. per sq. yd.

Yonkers, N. Y.—Following are lowest bids opened recently by Board of Contract & Supply for improving Kimball Avenue on various kinds of pavement: J. Canepi, Yonkers, $37,684 for macadam and $39,276 for Telford macadam; Warren Brothers Co., 50 Church St., New York, N. Y., $59,303 for bitulithic on bituminous base and $61,001 on concrete base; J. O. Weston, Yonkers, $62,650 and $67,959 for granite block, according to kind; 62,650 vitr. brick; $57,346 Hassam, and 64,775 bitulithic.

Bloomfield, N. J.—Lowest bid opened Feb. 21 by Town Council for furnishing road oil for the year submitted by Logan & Hathaway, 9 Clinton Street, Newark, at 7.7 cts. and 8¼ cts. for non-asphaltic; and Standard Oil Company, Newark, 8 cts. non-asphaltic, 6.4 cts. asphaltic, 40 to 45% or 60%. Raymond F. Davis, Town Clerk.

★Lavalette, N. J.—Contract for improving Magee, Brooklyn, Washington, Camden, Guyer, Band and White Sts. reported awarded to J. W. Butcher, Asbury Park, at $22,875.

★Greensboro, N. C.—Contract for constructing concrete road from Greensboro to High Point awarded R. G. Lassiter at about $11,000 per mile.

Tallahassee, Fla.—Contract for constructing sand clay surface highway 24 ft. wide with 15 ft. hard surface from Georgia line to Jefferson County line part of Dixie Highway, distance of about 31 miles, awarded by County Commissioners to Bryson & Bryson, Jacksonville, at $58,907; other two lowest bidders, J. B. McCrary Co., $68,907; Worthington Constr. Co., $60,696.

★Tampa, Fla.—Contract awarded Edwards Construction Company, Tampa, for 17 miles of concrete curb in Virginia Park subdivision at 23 cts. per lin. ft.

★Vicksburg, Miss.—Contract for paving portions of Catharine, Walnut and other streets (bids opened Feb. 21) awarded by city to Southern Paving & Construction Company, First Natl. Bank Bldg., Chattanooga, Tenn. A. M. Paxton, City Clerk.

★Knoxville, Tenn.—Contract for paving State Street with asphalt from Church Avenue to Commerce Ave. (bids opened Feb. 21) awarded Murray Construction Company, Knoxville, at $20,000. J. B. McCalls, City Engr.

★Knoxville, Tenn.—Contract for paving State St. with asphalt awarded by City Commission to Murray Constr. Co., Knoxville, at $16,017.

Cheviot, Ohio.—Lowest bid opened by County Commissioners at Cincinnati for paving Harrison Pike with granite submitted by Kirchner Constr. Co., 221 W. 9th St., Cincinnati, at $71,168.

★La Porte, Ind.—Contract awarded Western Construction Company, South Bend, for about 2 miles of asphalt paving on Michigan and Indiana Aves.

★Peru, Ind.—Contract for constructing Milton Kras Road in Peru Township awarded Ray W. Sullivan, Peru, at $11,450.

★Flint, Mich.—Contracts for paving supplies awarded by city as follows (D. E. Newcombe, City Clerk): Barber Asphalt Paving Company, Woolworth Bldg., New York, N. Y., Natural asphalt (Bermudez) $28.44 per ton, and "C" asphalt (Trinidad) $21.37 per ton; U. S. Asphalt Refining Company, 90 West St., New York, N. Y., asphalt, petroleum base, $17.37 per ton; Kelley Island Lime & Transport Company, Leader Building, Cleveland, Ohio, limestone dust, $3.95 per ton; J. P. Burroughs & Son, Flint, binder stone, $1.30 per ton; United Fuel & Supply Company, asphalt sand, $1.32 per cu. yd.; Asphalt Block Paving Company, 841 Ohio Building, Toledo, Ohio, asphalt block. $1.11½ per sq. yd.; Carey Company, expansion cushion (price given is per 100 lin. ft.), 1 in. x 4 in., $5.02; ¾ in. x 4 in., $3.76; ½ in. x 4 in., $2.52; J. P. Burroughs & Son, Flint, drain tile per M lin. ft., $24.60; Indian Refining Company, 17 Battery Pl., New York, N. Y., residuum, $13.68 per ton.

★Chicago Heights, Ill.—Following are bids opened Feb. 21 by Board of Local Improvements (M. H. McCoy, Engr.) for 13,000 sq. yds. brick paving: Chicago Heights Contracting Company, Chicago Heights, Ill., $31,574, and E. H. Ashdown & Company, Chicago Heights, $32,598.

★Oconomowoc, Wis.—Contract for improving Silver Lake, Walnut and other streets with Texaco (bids opened Feb. 21) awarded Nelson-Webor Construction Company, Oconomowoc, at $12,156.

★Wausau, Wis.—Contract for paving with brick on Forest Street and Grand Avenue awarded Cinducline Paving Company, Forest Park, Ill., at $30,000.

★Cherokee, Iowa.—Contract for 90,000 sq. yds. paving and 21,000 lin. ft. concrete curb and gutter awarded Bryant Asphalt Paving Company, Waterloo, at $1.59 per sq. yd. for asphaltic concrete, Class A on 5-in. concrete base, and curb and gutters at 59 cts. William Shardlow, City Clerk.

★Denison, Ia.—Contract for paving thirty-two blocks with concrete awarded by City Council to M. L. Flynn Paving Co., Sioux City, at $1.27½ per square yard.

★Liberty, Iowa.—Contract for paving awarded Feb. 21 as follows: C. B. McNamara Company, Dubuque, 15,000 sq. yds. brick paving No. 2 brick Purington block, 4 in. concrete base, $1.46 per sq. yd.; 20,000 sq. yds. No. 1 brick block Purington, 5-in. base, $1.83 per sq. yd.; 1,100 sq. yds. concrete alley paving, 6 in., $1.30 per sq. yd.; 27,000 lin. ft. curb and gutter, 24-in. apron, 1 to 2½ mix, 48 cts. per lin. ft.; 8,400 cu. yds. grading, 30 cts.; 6,700 cu. yds. grading, 45 cts.; total, $80,125. Benton R. Anderson, Consulting Engineer, Marion.

★Missouri Valley, Iowa. — Contract awarded H. R. Newton, Missouri Valley for 43,820 sq. yd. brick block paving, bituminous filler at $2.06 per sq. yd. total cost about $96,000. S. R. Williams, City Clerk.

Minneapolis, Minn.—Following are bids opened Feb. 17 by city for creosoted wood paving blocks (a) on 100,000 sq. yds only; (b) on first 175,000 sq. yds.; (c) on second 175,000 sq. yds. Prices given are on 3½-in. and 4-in. respectively; Chicago Creosoting Company, 30 N. La Salle St., Chicago, Ill., (a) $1.55 and $1.75; A. W. Van Hafften, (a) $1.60 1/5 and $1.69½, 18 cts. additional for rail block, 3 cts. lin. ft. filler strip; Republic Creosoting Company, 1614 Merchants Bank Bldg., Indianapolis, Ind., (b) $1.46 and $1.63½; $1.61 on 5½-in. rail block, 2 cts. per lin. ft. filler strip; (c) $1.49¼ and 1.67; and $1.78½ on 4-in. rail block; Kettle River Company, 1111 Plymouth Bldg., Minneapolis, Minn., (b) $1.46⅞ and $1.64⅞, 13 cts. additional for rail block and 2 cts. filler strip; (c) $1.60⅛ and $1.68⅛, and 13 cts. additional for rail block.

★Eldorado, Kan.—Contract for 30,000 sq. yds. brick or asphalt concrete pavement on Washington and Starr Sts., including 18,000 lin. ft. concrete curbing, awarded A. Jaicks Company, Kansas City, Mo. They bid for oil asphaltic concrete $50,370; Natural Lake asphaltic concrete, $52,245; vitr. brick block, $76,469, and vertical fiber brick, $69,269. F. E. Devlin, Engineer, Newton.

★Horton, Kan.—Contract for brick paving (bids opened Feb. 21) awarded Stanton & McGuire Construction Company, Leavenworth, at $11,692. Other bidders: E. W. Geiger Construction Company, Leavenworth, $11,785, and Edward Jones, Kansas City, Mo., $12,373. James D. Fowler, City Engineer.

★Seattle, Wash.—Contract for grading 32d Ave. West awarded by Bd. Public Works to Washington Paving Co., L. C. Smith Bldg., Seattle, at $108,978.

★South Bend, Wash.—Contract awarded by County Commissioner to Hall & Coulter, South Bend, as follows for draining, grading and clearing about 2½ miles of Mill Creek Road (bids opened Feb. 9): Sect. "A," $3,066; Sect. "B," $4,241, and Sect. "C," $3,937. W. E. Lovering, County Auditor.

★Washington.—Contract for constructing Sunset Highway in Kittitas County awarded by State Highway Commission at Olympia to Martin Holm, Ellensburg, at $22,090.

STREET CLEANING AND GARBAGE DISPOSAL

PROPOSED WORK.

Des Moines, Iowa.—Council considering the question of garbage disposal. Address Mayor.

Duluth, Minn.—Reported construction of an incinerating plant costing $60,000 is contemplated. Address Commissioner Public Works.

BIDS DESIRED.

Winona, Minn.—Until March 27, by George W. Hofmann, City Recorder, for furnishing and delivering one dustless pick-up street sweeper.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★Swissvale, Pa.—Contract for collection and disposal of garbage awarded American Reduction Co., 1942 Forbes Street, Pittsburgh, Pa., at $5,100. (Bids opened Feb. 17.)

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS

PROPOSED WORK.

Water Power Plant—Oswego, N. Y.—John A. Bensel, Bernardsville, N. J., engaged to have charge of the development of the municipal water power plant at Dam No. 6. John D. Higgins (Mayor), Chairman Municipal Water Service Commission.

Bulkhead—Atlantic City, N. J.—City Commissioners have decided to bulkhead with concrete ¼ mile of frontage circling Inlet Park. Bulkhead to be broad enough to promenade.

Hydro-Electric Plant—Newton, N. C.—Reported Southern Power Co., 200 Fifth Avenue, New York, is considering the building of a hydro-electric plant on the Catawba River.

Drainage — Humboldt, Tenn. — L. T. Berthe, Charleston, Mo., engaged to prepare preliminary surveys and plans for drainage of lands along Middle Fork of Forked Deer River, about twenty square miles probably.

Flood Protection—Columbus, Ohio.—Alvord & Burdick, 84 Dearborn Street, Chicago, Ill., submitted a report to Franklin County Conservancy Board on the flood protection of all exposed territory of the Scioto Valley, from Delaware to Chillicothe, including Columbus. Total cost estimated at $10,125,000.

Seawall—Quincy, Ill.—City Council is considering $75,000 bond issue for constructing waterway terminals to include seawall.

Dock—Ft. Dodge, Iowa.—Plans being prepared for a municipal dock which is to be constructed by the city at Des Moines River at a cost of $100,000. Address Mayor.

Drainage—Madison, S. D.—Contract will be let about July for constructing drainage system in Lake and Moody Counties, main ditch to be 9 miles long, 4 ft. to 8 ft. at bottom, 5 to 13 ft. deep, about 250,000 cu. yd. excav.; also includes ten branches, mostly tile, approximately 10 miles in all. Charles A. Trimmer, Consulting Engineer, Madison.

Wharf Bonds—Houston, Tex.—Attorney General has approved city's $1,500,000 wharf and harbor bonds and $500,000 drainage bonds.

Hydro-Electric Plant—Everett, Wash.—Reported J. L. Fountain, 12 Avenue N, E. Seattle, has applied to county auditor at Everett for 10,000 cu. ft. of flow per second on Sauk River. It is stated that Mr. Fountain represents a syndicate which will construct a hydro-electric plant on the site.

Drydock and Breakwater — Tacoma, Wash.—The Tacoma Smelting Company, Tacoma, is having plans prepared for a slag breakwater 1000 ft. long and 40 ft. wide, extending into Commencement Bay; also for a drydock to be included in the project. Approximate initial expenditure $1,000,000; total expenditure $4,500,000.

Irrigation—Tacoma, Wash.—J. B. Hawthorne of Dobbie & Hawthorne Company, Bank of California Building, Tacoma, has completed plans for irrigation of 26,000 acres of land on prairie, south of Tacoma, with water from Puyallup River. Construction will start this summer. Cost $250,000.

Flood Control—Los Angeles, Cal.—Engineer Regan authorized to prepare an estimate of the flood control work. The Board of Supervisors has deferred arrangements for the voting of $3,600,000 bonds for this work.

Irrigation—Modesto, Cal.—No action will be taken until about September on the construction of the concrete spillway at end of Lateral No. 6, Modesto Irrigation District (C. S. Abbott, Secy.).

Irrigation — Redding, Cal. — Reported contract soon to be let for constructing the Anderson Cottonwood Irrigation System. This work to be let as follows: Head gate and tunnel, excavation of main canal in two sub-divisions, excavation of lateral, projection of syphons and the concrete head gate. The intake includes a tunnel 2400 ft. in length, the main canal will be 39 miles long; at the mouth of the tunnel the canal will be 46 ft. wide and 6 ft. deep. Address Board of Directors, Anderson Cottonwood Irrigation District.

Drainage—Logan, Utah.—Contract will be let about March for constructing drainage system for Logan Land & Drainage Co. to cost $60,000. About 200,000 ft. of tiling and two pumps will be included in the work. Brown & Kleinschmidt, Engineers, Salt Lake City; A. F. Candon, Mgr.

BIDS DESIRED.

State Canal Work, Albany, N. Y.—Until Mar. 8, by W. W. Wotherspoon, State Superintendent of Public Works, Albany, for improving Three Mile Harbor in Suffolk County, consisting of 34,000 cu. yd. excav.; engineer's estimate, 25 cts. per cu. yd.; total, $8,500.

Pier—New York, N. Y.—Until March 10 by R. A. C. Smith, Commissioner of Docks, for Contract No. 1488, Classes 1 and 2, for building a freight shed with appurtenances on the pier at foot of W. Forty-sixth Street, North River, Borough Manhattan. Security $200,000.

Dredging—Tompkinsville, N. Y.—Until March 30, by J. T. Yates, Inspector General Lighthouse Depot, Tompkinsville, for dredging in and around basin, General Lighthouse Depot, Tompkinsville.

Ditch—Peru, Ind.—Reported desired until March 11 by E. O. Deeds, Drainage Comr., for constructing Bell Ditch, to consist of 8958 ft. 16, 18, and 20-in. drain tile, etc. Berne Welch, Co. Aurv.

Dredging—Chicago, Ill.—Until Apr. 1, by U. S. Engineers' Office, 508 Federal Bldg., Chicago, Ill., for dredging in Chicago River, Ill., advertised in Engineering Record.

Drainage—Racine, Wis.—Reported desired until Mar. 11, by Comrs. of Norway and Dover Drainage Dists., for tile drains in the town of Dover, ditch No. 11, about 4800 of 8 to 15-in. tile, and Cox lateral 4500 ft. 12 and 16-in. titlc. P. J. Hurtgen, Engr., Burlington, Wis.

Drainage—Fort Dodge, Ia.—Until March 14 by Joint Drainage District No. 105 in Greene County and 212 in Webster County for drainage to consist of 83,279 ft. of 6 to 42-in. tile, 3000 cu. yds. excav., etc. Bids desired on cement tile, clay tile, or clay segment block. S. J. Melson, Engr. in Charge of Construction, Jefferson.

Drains—Fort Dodge, Iowa.—Until March 10 by J. L. Hanrahan, Co. Aud., for constructing drain 197 near Gowrie, to consist of 180,200 cu. yds. open work, also tile drains. D. W. Gibbs, Engr.

State Canal Work—Albany, N. Y.—Following are unit figures of four lowest bids opened Feb. 29 by W. W. Wotherspoon, State Superintendent, for Contract 47-A, Erie Canal, Section 8, constructing canal from southeast corner of Town of Galena to New York Central R.R. crossing at Lyons, length 14.46 miles: (a) Engineer's estimate, $1,001,179; (b) Central Dredging Co., Cleveland, Ohio, $726,634; (c) Great Lakes Dredge & Dock Co., Buffalo, N. Y., $756,353; (d) Henry P. Burgard, Buffalo, N. Y., $765,288; (e) Sherman Statler Co., Lyons, N. Y., $828,296.

	(a)	(b)	(c)	(d)	(e)
Clearing (lump sum)	$1,000.09	$1,000.00	$1,000.00	$1,200.00	$1,000.00
1,864,500 cu. yd. excavation	0.50	0.329	0.349	0.35	0.39
220 cu. yd. forming embankment	0.15	0.15	0.15	0.18	0.15
103 M ft. sheeting and bracing	50.00	50.00	50.00	50.00	45.00
32.3 M ft. sawed lumber (hemlock)	50.00	50.00	50.00	50.00	60.00
1.2 M ft. sawed lumber (white oak)	80.00	80.00	80.00	80.00	80.00
18 M ft. sawed lumber (yellow pine)	60.00	60.00	60.00	70.00	60.00
1,330 cu. yd. lining	1.50	1.50	1.50	1.50	1.25
320 lin. ft. round timber in cribs	0.15	0.15	0.15	0.18	0.16
410 cu. yd. stone filling in cribs	1.60	1.80	1.50	1.50	1.50
7,240 cu. yd. second-class concrete	7.00	7.00	6.80	8.00	6.80
7,100 cu. ft. removing concrete	0.50	0.50	0.50	0.60	0.50
10,500 sq. ft. steel sheet piling, first quality	1.16	1.38	1.15	1.30	1.30
28,900 sq. ft. steel sheet piling, second quality	0.30	0.36	0.30	0.25	0.30
840 cu. yd. second-class riprap	2.50	2.75	2.50	2.50	2.50
19,900 lin. ft. foundation piles	0.25	0.25	0.25	0.05	0.05
6,200 lb. structural steel	0.05	0.06	0.05	0.05	0.05
100 lb. metal reinforcement	0.04	0.04	0.04	0.048	0.04
1,850 lb. iron castings, plain	0.04	0.04	0.04	0.04	0.04
87,200 lb. metal in taintor gate	0.07	0.084	0.08	0.08	0.07
880 lin. ft. wooden fence	0.25	0.25	0.25	0.25	0.25
Maintaining highway traffic (lump sum)	100.00	100.00	100.00	120.00	100.00
Removing bridge floor (lump sum)	75.00	75.00	75.00	80.00	75.00
Repairs to upper lock gates (lump sum)	2,500.00	2,500.00	2,600.00	3,000.00	1,500.00
Cofferdams, pumping, bailing, etc., (lump sum)	3,200.00	3,840.00	3,200.00	3,800.00	3,600.00

★**State Canal Work—Albany, N. Y.**—Following are unit figures of the four lowest bids opened Feb. 24 by W. W. Wotherspoon, State Superintendent Public Works, Albany, for flood abatement work in Olean: (a) James M. Hamilton & Co., Gardiner, N. Y., $179,268 (awarded contract); (b) John Young, 509 Bastable Building, Syracuse, $211,696; (c) Central Dredging Co., Cleveland, Ohio, $226,150, and (d) Walsh Construction Co., Davenport, Iowa, $231,416.

	*(a)	(b)	(c)	(d)
Clearing (lump sum)	$960.00	$300.00	$1,000.00	$2,000.00
600,000 cu. yd. excavation	0.23	0.27	0.298	0.305
900 cu. yd. second-class concrete	7.80	8.00	7.00	8.00
10,000 cu. yd. fourth-class riprap	1.68	2.80	2.50	1.75
9,000 lb. metal reinforcement	0.048	0.07	0.05	0.04
2,000 lb. structural steel	0.048	0.07	0.10	0.05
5 sluice gates, 5 x 6 ft., each	96.00	600.00	600.00	600.00
1 sluice gate, 20 x 30 in	30.00	110.00	200.00	150.00
7 24-in. low-pressure valves, each	180.00	105.00	100.00	100.00
1 16-in. low-pressure valve	120.00	61.00	76.00	60.00
27 12-in. low-pressure valves, each	60.00	34.00	50.00	30.00
3 6-in. low-pressure valves, each	30.00	17.50	25.00	12.00
160 ton cast-iron pipe	48.00	35.00	35.00	60.00
25 M ft. sheet piling	120.00	40.00	50.00	60.00
Removing State Street dam (lump sum)	600.00	600.00	1,000.00	1,000.00
Removing Fifteenth Street bridge (lump sum)	360.00	200.00	600.00	2,000.00
Moving buildings (lump sum)	1,200.00	1,500.00	1,000.00	4,500.00

Drainage—Garner, Ia.—Reported desired until Mar. 7, by E. P. Hanson, Co. Aud., for constructing drainage ditch No. 58 in all about 41,257 ft. 6 to 32-in. tile.

Ditch—Bemidji, Minn.—Reported desired until March 7 by County Comrs. for constructing Judicial Ditch No. 30. Probable cost $244,142.

Ditch—Mankato, Minn.—Reported desired until March 9 by C. L. Kennedy, Co. Aud., for constructing tile ditch No. 42. Probable cost $21,060.

Ditches—Olivia, Minn.—Reported desired until March 20 by J. L. Johnson, Co. Aud., for ditches Nos. 33, 65, 68 and 69. Total cost $26,572.

Ditch—Wheaton, Minn.—Reported desired until March 7 by J. T. Erickson, Co. Aud., for constructing ditches 38, 40, 41, 42 and 44. Probable total cost $38,405.

Drainage—Lawrence, Kan.—Until March 8, by Maple Grove Drainage Dist. (Vernon M. King, Secy.) for sewers, ditches, levees, etc. Cost $9,500. E. H. Dunmire, Engr. of Dist.

Irrigation—St. Ignatius, Mont.—Until Mar. 29, by U. S. Reclamation Service, St. Ignatius, for constructing canals and structures on Flathead Project, involving about 1300 lin. ft. vitr. pipe, 3500 cu. yd. excav., 31,500 lb. structural and reinforcing steel, etc., about 2 miles southeast of Arlee.

Lock Gates—New Glasgow, N. S.—Until March 13 by R. C. Desrochers, Secy. Dept. Public Works, Ottawa, for lock gates and their equipment at East River Lock, N. S., near New Glasgow.

PRICES AND LETTINGS.

★*Indicates award of contract.*

State Canal Work—Albany, N. Y.—See "Bridges."

★**State Canal Work—Albany, N. Y.**—Following are four lowest bids opened Feb. 24, by W. W. Wotherspoon, State Superintendent Public Works, Albany, for constructing the flood abatement work in Olean, N. Y.: James M. Hamilton & Co., Gardiner, N. Y., $179,268 (awarded contract); John Young, 509 Bastable Building, Syracuse, $211,696; Central Dredging Co., Cleveland, Ohio, $226,150, and Walsh Construction Co., Davenport, Iowa, $231,416.

★**Ditch — Duluth, Minn.** — Contract awarded E. W. Coons Company, Hibbing, for constructing Ditch No. 4 in Alborn District, excavating about 651,000 cu. yd. of earth and rock and grading 70 miles of roadway at $102,517.

★**Ditch — Goodridge, Minn.** — Contract awarded American Drainage Co. of Thief River Falls for constructing judicial ditch No. 34, which is about 100 miles in length, draining three townships.

★**Spillway Gates—Seattle, Wash.**—Contract for spillway gates (bids opened Feb. 16). awarded S. B. Harding, Chicago, Ill., at $10,016.

★**Dock—Seattle, Wash.**—See "Private Buildings."

★**Irrigation—Los Angeles, Cal.**—Contract awarded by Board of Supervisors to Los Angeles Manufacturing Company, Los Angeles, for steel pipe, specification No. 4, for San Fernando Valley Irrigation System at $251,375.

ELECTRIC RAILWAYS

PROPOSED WORK.

Brooklyn, New York.—The Public Service Commission, 154 Nassau St., New York, has approved the plans of their chief engineer, Alfred Craven, for the connection between the 4th Ave. subway, and the Fulton Street elevated line

Bethlehem, Pa.—Lehigh Valley Transit Co. (H. R. Fehr, Gen. Mgr., Allentown) considering double tracking line between Bethlehem and Easton.

Wilmington, Del.—Reported Wilmington, Philadelphia Traction Co. will change from storage battery system to overhead contact system on line from New Castle to Delaware City; other improvements are contemplated.

Bluefield, W. Va.—Construction of an electric railway from Bluefield to Pocahontas coal fields being considered. Bluefield Chamber Commerce said to be interested.

East Cleveland, Ohio.—Councils of East Cleveland and Cleveland Heights will construct a steel railway on Noble Road between Euclid Avenue and Maufield Road for J. L. Free Land Company, 1004 Prospect Avenue, Cleveland. Cost $40,000 per single track mile.

Battle Creek, Mich.—Michigan Railway Co. received franchise from Council to construct an extension in Post Addition.

Detroit, Mich.—Detroit United Ry. Co. plans to build 18 miles of extensions to Detroit city lines and will double-track about 9 miles of interurban lines.

Hancock, Mich.—Plans being made by Houghton County Traction Co. (Gardner Rogers, Mgr., Houghton) to extend line from Hancock to Dollar Bay.

Greenville, Ill.—Construction of an interurban line from Greenville to connect with tracks of company at Granite City is contemplated.

Murphysboro, Ill.—Plans being considered by Rapid Transit Co. to construct a life from Murphysboro to Mt. Vernon.

Muskegon, Mich.—It is reported that Muskegon Traction & Lighting Co. is planning extensions and improvements to system during present year; cost, $35,000.

BIDS DESIRED.

Toronto, Ont.—Until March 14, by Bd. Control, City Hall, for supply and delivery of special track work for St. Clair Ave. carhouse.

PRICES AND LETTINGS.

★*Indicates award of contract.*

New York, N. Y.—Unofficial total of the lowest bid opened Feb. 24 by Public Service Commission for First District, 154 Nassau Street, for tracklaying in Lexington Avenue subway, including Lexington Avenue, Jerome Avenue and 149th Street loop (city to furnish rails and other track materials) was submitted by Empire Construction Co., 51 East Forty-second Street, at $276,433.

★**Cincinnati, Ohio.**—Contract for 3000 tons of steel shapes for an elevated structure for the West End Traction Co., awarded Lackawanna Bridge Co., Bell and Abbey Streets, Buffalo, N. Y.

★**San Francisco, Cal.**—Contract for furnishing and installing electrical conductors and appurtenances for Church St. Municipal Railway awarded by Bd. Public Works to E. Earl Browne.

RAILROADS

PROPOSED WORK.

Central, S. C.—Reported Southern Ry. (B. Herman, Ch. Engr., Washington, D. C.) will let contract early in spring for double tracking from Central, S. C., to Comelia, Ga., Dist.

Augusta, Ga.—Hamilton Miller of Augusta is reported interested in organization of Augusta & North Ry. which intends building a line from Augusta to the Seaboard Line at North, S. C., a distance of about 60 miles. The present plan is to use the tracks of the Augusta-Aiken electric line to Aiken and construct a line about 36 miles long from Aiken to North.

Jester, Ala.—Reported Chattahoochee Valley Ry. Co. (J. T. Barker, Gen. Mgr., West Point, Ga.) will extend line from Jester, Ala., to point between Opelika and Columbus, probably to Smith's Station on line of Central of Georgia.

Akron, Ohio.—County and the officials of the Pennsylvania, Baltimore & Ohio and the Erie Railroads are considering the building of a subway at Kenmore Avenue to cost $40,000 and the construction of two viaducts, one over tracks of Pennsylvania and B. & O. Railroads at Wuchter crossing in Tallmadge Township, and the other at Center Street in Barberton. The county to pay 40% of the cost and the R. R. Companies 60%. Address County Clerk.

St. Paul, Minn.—The Minneapolis & St. Louis R.R. Co. (R. G. Kenly, Ch. Engr., Minneapolis) intend replacing with heavier steel rails 55 miles of the company's track between St. Paul and Albert Lea and between Minneapolis and Peoria, Ill.

Black Rock, Ark.—L. C. Hudson, Railroad Contractor of Memphis, Tenn., is reported interested in a company which intends constructing a railroad from Black Rock in Lawrence County on the Frisco on through Sharp and Izard Counties to Guion on White River division of Iron Mountain R. R.

Oklahoma, Okla.—Charter granted to Okimulgee Northern Ry. Company, to build 12 miles of road from Okmulgee to Coalton, at a cost of $300,000. Incorporators: Lee Clark, Frank L. Hale of Kansas City, Mo. J. A. Price, Okmulgee.

Port Angeles, Wash.—C. C. Donovan, construction engineer of the Chicago, Milwaukee & St. Paul Ry. Co. (C. F. Loweth, Ch. Engr., Chicago, Ill.) has completed arrangements for constructing 7 miles of extension of Seattle, Port Angeles & Western R. R. from Port Angeles west to Twin River and Deep Creek section.

Tacoma, Wash.—Great Northern R. R. (A. H. Hogeland, Ch. Engr., St. Paul, Minn.) will spend between $2,000,000 and $3,000,000 in the construction of concrete snowsheds in the Cascade Mountains. A concrete wall will be constructed for fully 12 miles.

San Francisco, Cal.—Reported Butte, Boise & San Francisco R. R. Company has secured right of way to this city and plans include double tracking for 32 miles out of San Francisco. L. O. Leonard, President of the company.

Holbrook, Ariz.—Navajo Southern R.R. Co. (W. H. Clark, Secy., Holbrook) reported contemplating a road through Sitgreaves national forest via Snowflake, Ariz., to Fort Apache, a distance of 140 miles.

BIDS DESIRED.

Philadelphia, Pa.—Until March 28 by C. A. Shand, Ch. Eng. Pennsylvania Railroad, Room 607 Broad St. Station, for Contract No. 11B inbound freight house and automobile platform in the Federal St. Yard, Philadelphia, work appurtenant to Sotuh Philadelphia track elevation advertised in Engineering Record.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Harrisburg, Pa.** — Contract awarded James McGraw Co., Commercial Trust Building, Philadelphia, for grading and masonry work for new track of Philadelphia & Reading R.R. from Rutherford yards to Harrisburg, a distance of about seven miles.

★**Hamlet, N. C.** — Contract awarded Vaughan Construction Co. of Roanoke, Va., for grading yards of the Seaboard Air Line R. R. here for the shops of the road; also the contract for seven miles of grade division on East Carolina division.

PUBLIC BUILDINGS AND SCHOOLS

PROPOSED WORK.

Lee, Mass.—Building Committee appointed to secure plans for proposed $35,000 school. Address Town Clerk.

Weston, Mass.—The town is contemplating erecting a $95,000 Town Hall. B. Loring Young, Chairman Committee.

Wallingford, Conn.—Contract will be let about March for erecting the two-story fireproof high school, steel, stone and brick construction, costing $115,000. John T. Simpson, Newark, N. J., Architect; Alfred B. Morrill, Superintendent of Schools.

Bath, N. Y.—Contract will be let about April for erecting a two and one-half story brick and concrete fireproof school to cost about $30,000. Otis Dockstader & Son, Elmira, Architects; Thomas Shannon, Secretary, Board of Education.

Dunkirk, N. Y.—Steps being taken to erect Newton Memorial Hospital. Address County Clerk.

Lackawanna, N. Y.—Board of Education has decided to erect eight rooms each to Schools Nos. 2, 3 and 4, and an addition to high school; total cost $70,000.

Lake Placid, N. Y.—Plans of Demers, Mosley & Campaigne, Illuminating Building, Troy, selected by Board of Education, for proposed three-story and basement, fireproof, reinforced concrete, steel, brick, stone or terra cotta high school; probable cost, $125,000.

Lockport, N. Y.—Steps being taken to erect proposed $100,000 County Tuberculosis Hospital. Frank E. Carlton, Chairman Building Committee.

Hackensack, N. J.—R. O. Bentley, Chairman School Committee, submitted report to Board of Education recommending purchase of site on Beech and Second Streets for erecting new high school to cost $185,000; also for extension to School No. 4, Fairmount, costing $43,000.

Rutherford, N. J.—Board of Education sold $40,000 bonds for erecting new Sylvan Street School.

Vineland, N. J.—Board of Education will erect a school costing $28,000.

Bethlehem, Pa.—E. R. Bitting of South Bethlehem, engaged to prepare plans for eight-room school to be erected at Ninth and Calypso avenues. Address School Board.

Birdsboro, Pa.—School Board passed resolution authorizing $50,000 bonds for school improvements.

Danville, Pa.—Erection of high school costing about $75,000 under consideration. Address School Board.

Johnstown, Pa.—Andrew P. Cooper, Uniontown, engaged to prepare plans for Central School, to cost approximately $100,000. Citizens recently voted $225,000 school bonds. Address School Board.

New Brighton, Pa.—Erection of a $100,000 high school contemplated. Address Board of Education.

Palmerton, Pa.—School Board has decided to erect eight room fireproof school in the West End.

Philadelphia, Pa.—Plans being prepared by John T. Windrim, Commonwealth Building, for stone and concrete Convention Hall to be erected for city at Twenty-second Street and the Parkway; cost about $1,250,000.

Plans are being prepared by Horace Trumbauer, Land Title Building, for three-story stone, concrete and steel library to be erected at Nineteenth and Vine Streets; cost about $3,500,000.

Philadelphia, Pa.—Albert Kelsey, Perry Bldg., Philadelphia, has been instructed to prepare plans for a group of buildings for Corson College for Girls to be erected at Erdenheim Farms.

Pittsburgh, Pa.—Board of Public Education has authorized purchase of land for 2 grade schools, a high school and for additions to 2 other high schools.

Pottsville, Pa.—Erection of three-story brick almshouse, costing $30,000 contemplated. Address County Clerk.

Delmar, Del.—Erection of a school, costing about $125,000 under consideration.

Baltimore, Md.—Plans being prepared by Ellicott & Emmart, Union Trust Bldg., for a chapel to be erected at Goucher College. Cost $25,000. Wm. V. Guth, President.

Roanoke, Va.—Election to vote on $300,000 bonds for erecting new schools contemplated. Address City Clerk.

Warwood, W. Va.—Architects selected by Richland District Board of Education for proposed $65,000 central school.

Hamilton, Ala.—Frederick Ausfeld, Bell Building, Montgomery, engaged to prepare plans for rebuilding Sixth District Agricultural School, recently destroyed by fire; cost about $30,000.

Lake Charles, La.—The School Board is having plans prepared for a $125,000 school. Address School Board.

Bristol, Tenn.—School Board has purchased site on Alabama and Woodlawn streets and intends erecting $50,000 high school.

Winchester, Ky.—John W. Crone, Winchester, engaged to prepare plans for $30,000 general hospital.

Akron, Ohio.—Additions to City Hospital, to include maternity building, pathological laboratory and nurses' home contemplated; probable cost $175,000.

Amherst, Ohio.—Election to be held March 28 to vote $50,000 bonds for erecting high school. J. B. Arcey, Clk. Board of Education.

Atwater, Ohio.—Citizens voted $24,000 bonds to erect centralized school. Address School Board.

Boardman, Ohio.—Citizens of Boardman Township voted $30,000 bonds for erecting additional school. Address Township Clerk.

Coalton, Ohio.—School bonds for $35,000 will be sold March 18 by W. F. Darling, Clk. Board Education.

Eaton, Ohio.—Hiestand, Richards, McCarty & Bulford, Hartman Building, Columbus, selected to prepare preliminary plans for proposed $250,000 county courthouse.

Grand Rapids, Ohio.—Citizens voted $45,000 bonds to erect school. Address School Board.

Lorain, Ohio.—Advisory Board of Hospital Trusteees decided to erect administration section and a southern wing at St. Joseph's Hospital, probably of brick and stone, costing about $60,000. H. F. Ford, Archt., Honecker Building.

New Philadelphia, Ohio—J. C. Lewis of New Philadelphia, retained to prepare plans for proposed Dover township centralized school.

Ravenna, Ohio.—Erection of a high school at Clinton and East Main streets contemplated. Address Board of Education.

Reading, Ohio.—School bonds amounting to $60,000 sold by Board of Education.

Indianapolis, Ind.—Contract will be let in March for erecting tuberculosis hospital to coat about $70,000. W. E. Russ, Archt., Merchants Bank Building.

Warsaw, Ind.—School bonds amounting to $40,000 have been sold. Flint E. Bash, Secretary School Board.

Ithaca, Mich.—Gratiot County Supervisors voted $40,000 bonds to rebuild poor house destroyed by fire.

Menominee, Mich.—School Board approved issuing $165,000 bonds for school improvements.

Rockford, Mich.—Election soon to be held to vote $50,000 bonds to erect new school. Address Board of Education.

Chicago, Ill.—Sum of $200,000 has been given to University of Chicago for erecting new Divinity School building.

Mattoon, Ill.—Contract will be let after March 15 by Memorial Methodist Hospital Trustees (S. W. Phillips, Pres.) for erecting brick, two-story, 56 x 116 ft., fireproof building.

Cadott, Wis.—Volkman & Hancock of Eau Claire reported architects for $25,000 high and grade school to be erected here.

Grantsburg, Wis.—Citizens voted $25,000 bonds for erecting high school. Address School Board.

Milwaukee, Wis.—Robert A. Messmer, Majestic Building, engaged to make investigations and report on cost of repairing and remodeling County Insane Hospital. W. E. McCarty, Chairman County Board.

Rice Lake, Wis.—Volkman & Hancock of Eau Claire selected to prepare plans for 10-room, semi-fireproof grade school; cost $35,000.

Superior, Wis.—Reported County Trustees and Poor Commission will consider plans March 1 for a $25,000 building to be erected at the Poor Farm.

Burlington, Iowa.—City Hall improvement bonds amounting $30,000 sold by Board of Aldermen.

Cherokee, Ia.—Contract about to be let for erecting $30,000 brick addition to State Insane Hospital. Beuttler & Arnold, Archts, Security Building, Sioux City.

Ottumwa, Iowa.—Election to be held March 13 to vote $125,000 bonds to erect new buildings and equipment for the high school. Address, Board of Education.

Gaylord, Minn.—A courthouse is to be erected here. Address County Clerk.

Minneapolis, Minn. — The Hiawatha School is to be 1 story, not fireproof, plans being prepared by R. V. L. Haxby, Board of Education, City Hall. Rose & Harris, 470 Auditorium Building, Mechanical Engineers.

Red Wing, Minn.—Election to be held March 14 to vote $100,000 bonds for erecting high school.

Rochester, Minn.—Election to be held March 14 to vote $125,000 school bonds. Address Board of Education.

St. Paul, Minn.—The Midway General Hospital Company will erect a $100,000 hospital at 389 Snelling Avenue. I. C. Simmons, President, Board of Trustees.

Winnebago, Minn.—The citizens are considering erecting a new City Hall and paving main streets this year. Address the City Clerk.

Concordia, Kan.—W. T. Schmitt, Oklahoma City, Okla., engaged to prepare plans for high school. Election to be held in April to vote $100,000 bonds to erect this school. Harry Davies, Pres. Bd. Educ.

Omaha, Neb.—University of Omaha intends erecting this summer a $100,000 classroom and laboratory building. D. E. Jenkins, Pres.

Dickinson, N. D.—The idea of erecting a new city hall has been abandoned for the present. R. C. Hill, City Auditor.

Forsyth, Mont.—Dedrick & Piper of Billings engaged to prepare plans for $50,000 high school.

Joplin, Mo.—County Tuberculosis Hospital Commission, Joplin National Bank, Fourth and Main Streets, has selected plans prepared by Rose & Peterson of Kansas City, Kan., for proposed County Tuberculosis Hospital, to be two stories and basement, of reinforced concrete and masonry construction and floors of reinforced concrete covered with wood or a substitute composition. Site not yet decided upon.

Fert Stockton, Tex.—Plans being prepared for high school, for which citizens voted $50,000 bonds.

Roscoe, Tex.—Election to be held March 28 to vote $100,000 bonds to erect a court house. Address County Clerk.

Wichita Falls, Tex.—Sanguinet & Staats, Ft. Worth, architects for 4-story fireproof courthouse to cost about $200,000.

Chickasha, Okla.—Plans being prepared for a $70,000 high school. Address Board Education.

Colfax, Wash.—Beezer Brothers, Northern Bank Building, engaged to prepare plans for four-story reinforced-concrete and hollow tile hospital building to be erected for Sisters of St. Teresa; cost about $150,000.

Baker, Ore.—Lawrence & Holford, Chamber of Commerce Building, Portland, selected to prepare plans for $100,000 high school.

Portland, Ore.—Contract will be let about March 20 by F. A. Naramore, Supt. of Schools, for erecting first unit of Franklin School consisting of two buildings, one two-story, 68 x 131 ft., main building, brick and terra cotta, other building, 70 x 205 ft., combination mill and reinforced concrete. Cost $120,000.

Roseburg, Ore.—Election to be held March 11 to vote $75,000 bonds to replace high school building destroyed by fire. Address School Board.

San Bernardino, Cal.—Contract will be let about March 20 by Board of Supervisors for erecting the county hospital. L. Farwell, Clerk.

Santa Ana, Cal.—School Board considering calling an election to vote bonds for a high school, also $25,000 bonds for kindergarten building. Address Clerk Board of Education.

Taft, Cal.—High School District sold $60,000 bonds for new building.

Woodland, Cal.—Election to be held about March 28, to vote $200,000 bonds to erect County Courthouse. Address County Clerk.

Salt Lake City, Utah.—Board of Education has adopted report of committee recommending purchase of site on Second East and Tenth South Streets for proposed school in First Ward.

BIDS DESIRED.

Providence, R. I.—Until March 13, by Board Contract & Supply (Jos. H. Gainer, Mayor and Chmn.) for erecting Charles Street school. Probable cost $175,000.

New York, N. Y.—See "Water Works."

Yonkers, N. Y.—Until March 10 (readvertisement), by Col. Franklin W. Ward, Secretary State Board Armory Commissioners, Albany, for erecting armory for Company "G," 10th Infantry, N. G. N. Y., at Yonkers, advertised in Engineering Record. Lewis F. Pilcher, State Architect, Albany.

Ft. Lee, N. J.—Reported desired until March 13 by J. H. Mannix, Clk. Board Education, for erecting 4-room addition and alterations to school. Probable cost $35,000. Ernest Sibley, Archt., Palisade, N. J.

Creighton, Pa.—Reported desired until March 9 by F. N. Burke, Secy. Board Education, East Deer Creek Township, for erecting 2-story and basement 60 x 60-ft. school. Probable cost $20,000. John H. Phillips, Archt., Trust Building, McKees Rocks, Pa.

Philadelphia, Pa.—Until March 13, Committee on Property of the Board of Education (Wm. Dick, Secy.) for erecting addition containing six classrooms to school at Thirteenth and Porter Streets, twelve room addition to school at Eighth and Wolf Streets and twelve room addition to school on Twenty-third and Cambria Streets.

Indian Head, Md.—Until April 15 by F. H. Harris, Chief Bureau Yards and Docks, Navy Department, Washington, D. C., for constructing a storehouse at the Naval Proving round, Indian Head, Md.

Daytona Beach, Fla.—Reported desired until March 6, by Board Public Instructions, De Land, for reinforced concrete school. Marks & Sheptall, 210 Clark Bldg., Jacksonville, Archts.

Jackson, Miss.—Until March 13 by Board of Education (Edward L. Bailey, Secy.) for erecting a school on N. State Street. Harry N. Austin, Archt., Jackson.

Alliance, Ohio.—Reported desired until March 20 by Edwin Diehl, Clk. Board Education, for alterations and additions to following schools: Franklin School, 2-story and basement, 56 x 64 ft. Also separate bids for Seneca School, 2-story and basement, F. L. Packard, Archt., 16 E. Broad St., Columbus; Lincoln School, 2-story and basement, 93 x 81 ft., and Mt. Union School, 2-story and basement. Archt., W. T. Mills Co., 49 N. High Street, Columbus.

Antioch, Ohio.—Reported desired until March 7 by J. W. Lentz, Clk. Board Education, for erecting 2-story and basement 65 x 50-ft. grade school. Probable cost $20,000. Matheny, Allens & Mounts, Archts., Huntington National Bank Building, Columbus.

Braceville, Ohio.—Reported desired until March 18 by Board Education (R. C. Hatfield, Clk.) for erecting 2-story and basement, 75 x 64-ft. centralized school. Probable cost $23,500. W. C. Owens & Co., Archts., 449 Leaders News Building, Cleveland.

Nevada, Ohio.—Reported desired until March 15 by H. E. Dwire, Clk. Board Education, for erecting 2-story and basement, 80 x 61-ft. school. Howard & Merriam, Archts., 8 E. Broad Street, Columbus.

Niles, Ohio.—Until March 23, by Charles F. Schout, Clerk Board Education, Howland Township, R. F. D. No. 1, Niles, for furnishing material and erecting two fireproof schools in Howland Township. Separate bids for plumbing, heating, ventilating, carpentry, etc. Robert J. Keich, Archt., 409 Western Reserve Bank Bldg., Warren.

Urichsville, Ohio.—Until March 27 by Board Education (W. V. Moody, Clk.) for erecting fireproof grade school. Separate bids for heating, plumbing, etc. J. E. Lewis, Archt., New Philadelphia.

Huntington, Ind.—Until March 30 (not March 6, as previously stated), by James A. Wetmore, Acting Superv. Archt., Treas. Dept., Washington, D. C., for erecting U. S. post office at Huntington.

Montezuma, Ind.—Reported desired until March 23 by Frank Arn, Trustee, for erecting high and grade school addition, 2-story and basement, 120 x 41 ft. Layton Allen, Lombard Building, Indianapolis, Archt.

Ypsilanti, Mich.—Reported desired until April 1, by Smith, Hinchman & Grylls, Archts., 710 Washington Arcade, Detroit, for erecting a two-story, 170 x 170 ft. library for Michigan State Normal School. Probable cost, $75,000.

Danville, Ill.—Reported desired until March 16 by John R. Moore, Co. Clerk, for erecting 3-story and basement 42 x 70 ft. jail. Probable cost $30,000. L. F. Stuebe, Archt., 415 Adams Building.

Normal, Ill.—Until March 21 by State Board Education (C. L. Capen, Pres.) at State Normal Univ. Normal for erecting women's dormitory on grounds of the Illinois State Normal University, Normal. J. B. Dibelka, State Archt., 130 N. Fifth Avenue, Chicago.

Alta, Iowa.—Until March 28 by Board Education, Alta Consolidated School Dist., for erecting school. Advertised in Engineering Record. Smith & Keffer, Archts., 610 Youngerman Bldg., Des Moines.

Holstein, Ia.—By Board Education (T. M. Watts, Secy.) for furnishing material and erecting high school. Separate bids for heating, ventilating, plumbing, etc. Applications for plans received until March 6. Trunk & Gordon, Archts., St. Joseph, Mo.

Eveleth, Minn.—Reported desired until April 1, by W. T. Bray, Archt., Duluth, for erecting two-story, 96 x 225 ft. high school. Probable cost $200,000.

Minneapolis, Minn.—Until March 10, by Board Education (Geo. F. Womrath, Bus. Mgr.), for erecting addition, including heating, ventilating, etc., addition to Horace Mann School. Stebbins & Haxby, Archts., 450 Auditorium Bldg., and Rose & Harris, Engrs., 470 Auditorium Bldg.

Warren, Minn.—Until March 9, by Aug. A. Johnson, Clk. Independent School Dist. No. 2 for erecting school. Separate bids for heating, plumbing, electric wiring, etc. Kirby T. Snyder, Archt., Minneapolis.

Weir, Kan.—Until March 9 by Board of Education for erecting a 2-story, brick, stone and steel school, to cost $24,000. G. J. Munn & Co., Archts., Pittsburg, Kan.

Stuart, Neb.—Until Mar. 21, by School Board, Dist. 44, (H. L. Thomas, Secy.), for furnishing material and erecting high school. Separate bids for heating, ventilating, plumbing, etc. R. A. Bradley & Co., Archts., Exchange National Bank Building.

Minot, N. D.—Until March 15, by St. Joseph Hospital Assoc. of St. Paul, Minneapolis, Grand Forks, and Minot, for erecting hospital at Minot. Alternate bids will be taken on combination tile, and reinforced concrete floors, reinforced concrete beams and columns with gypsum plaster, etc. J. C. Woodruff, Archt., Minot.

Valley City, N. D.—Until April 6, by James A. Wetmore, Acting Supervising Archt., Treas. Dept., Washington, D. C., for erecting U. S. post office at Valley City.

Harlem, Mont.—Until March 22, by Department of Interior, Office of Indian Affairs (Cato Sells, Comr.), Washington, D. C., for constructing work for Fort Belknap School, consisting of laundry, brick quarters, etc.

Houston, Tex.—Reported desired until March 8, by J. W. Lyle, County Superintendent, for erecting Brooke Smith School. Fred. C. Teich, Archt., 617 Union Bank Bldg.

Orange, Tex.—Until March 7 by R. B. Bradbury, Pres. School Board, for erecting two high schools. C. H. Page & Bro., Archts., Austin.

Seattle, Wash.—Reported desired until March 8 by Commissioners Port Seattle, for erecting one-story reinforced concrete building for compressor plant of storage building. Probable cost, $30,000.

Tacoma, Wash.—Reported desired until March 22, by H. B. Hendly, Chmn. Board Directors School Board, for erecting concrete and steel gymnasium for Stadium High School, to contain two departments, one for boys, 99 x 59 ft., and girls, 99 x 51 ft. Cost, $52,000 and $70,000 respectively. Heath & Gove, Archts., National Realty Bldg., Tacoma.

San Bernardino, Cal.—Until March 20 (readvertisement), by Board of Supervisors (L. R. Patty, Clk.), for erecting hospital buildings, including three-story and basement brick and concrete administration building and two-story brick and concrete service and ward building; about $130,000 available. Lyman Farwell, Archt., 615 Story Bldg., Los Angeles.

Safford, Ariz.—Until March 6, by Benj. Blake, Co. Clk., for erecting court house. Lesher & Kibbey, Archts., Phoenix.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Feeding Hills, Mass.—Following are four lowest bids opened Feb. 16 by County Commissioners at Springfield for erecting training school: Keeler & Wales, Springfield, $88,622; W. H. Falvey & Son, Springfield, $91,000; John J. O'Neill Company, Holyoke, $91,500; M. Maloney, Springfield, $92,438. All bids rejected. Total cost must not exceed $100,000.

Springfield, Mass.—Following are four lowest bids opened Feb. 21 by City Property Committee (Giles Blague, Chmn.) for erecting additions and alterations to Howard Street School: J. G. Roy & Son, $129,364; W. H. Falvey & Son, $130,000; Sarubbi Building & Construction Co., $130,678, and W. A. Newton & Co., $133,000. Bidders all of Springfield, Mass.

Batavia, N. Y.—Following are four lowest bids opened Feb. 24 by Acting Supervising Architect, Washington, D. C., for constructing U. S. Post Office—(a) limestone, (b) sandstone: George C. Rossell, Rochester, (a) $57,993; W. F. Martens & Co., (a) $59,150; Thomas W. Cissell, Wooster, Ohio, (a) $59,770, (b) $61,000; The Durolithic Co., New York, (a) $59,876, (b) $60,676; W. C. Fissell Co., New York, (b) $61,275; George W. Stiles Construction Co., Chicago, Ill., (b) $63,800.

★Binghamton, N. Y.—Contract awarded Schaefer Construction Co., 5 West Thirty-first Street, New York, for erecting addition to court house (bids opened Feb. 24) at $65,679.

★Passaic, N. J.—Contract for erecting addition to Passaic General Hospital awarded W. H. Whyte Construction Company, of Hackensack, at $50,800. Crow, Lewis & Wickenhoefer, Archts., 200 Fifth Avenue, New York.

★Philadelphia, Pa.—Contract awarded F. L. Hoover & Son, 1023 Cherry Street, for erecting two-story and basement brick, terra cotta, reinforced concrete and marble hospital building at 4035 Arch Street for Philadelphia Hospital for Women. Walter Smedley, Archt., Stephen-Girard Building.

★Wheeling, W. Va.—Contract awarded Newport Contracting & Engineering Co. of Newport News, Va., for erecting a fireproof power house at dams Nos. 16 and 17, Ohio River at $36,026.

★Ashland, Ky.—Contract for erecting the U. S. Post Office awarded R. T. Farnsworth & Co. of Owensboro, Ky., at $69,200.

★Lexington, Ky.—Contract for erecting South Ashland school awarded Congleton Lumber Company, Lexington, at $23,029; plumbing and heating to S. A. Reynolds, Lexington, at $4,115.

★Marion, Ind.—Contract awarded Engineering Company, Wabash R. R. and Winter Street, Ft. Wayne, for 200 tons of steel required in the High School to be erected this spring.

★Highland Park, Mich.—Contract for erecting school on Oakland Avenue awarded Linsell Construction Company, 370 Fort Street W., Detroit; cost about $80,000.

★Sioux City, Iowa.—Contract for 825 tons of steel for the court house has been awarded Minneapolis Steel & Machinery Co., Minnepaolis, Minn.

★Washington, Iowa. — Contract for erecting U. S. Post Office awarded G. W. Stiles Construction Co., Rookery Building, Chicago, Ill., at $46,500.

★Denton, Tex.—Contract for erecting high school awarded A. W. Flynt, Fort Worth, at about $41,000. Sanguinett & Statler, Archts., Fort Worth. W. G. McCormick, Secy. School Board.

★La Porte, Tex.—Contract for erecting school (bids opened Feb. 21) awarded by School Board (Geo. Van Pelt, Secy.) to D. B. Ridpath, La Porte, at $25,600.

★Portland, Ore.—Contract for erecting a public auditorium awarded Hans Pederson, Alaska Building, Seattle, Wash., at $320,262.

Los Angeles, Cal.—Lowest bid opened Feb. 17 by Board Education for erecting concrete, frame and brick high school submitted by Los Angeles Planing Mill Co., 812 Industrial Street, at $434,931. John C. Austin, Archt., Baker-Detwiler Bldg.

PRIVATE BUILDINGS

PROPOSED WORK.

Cambridge, Mass.—Plans being prepared by Edward T. P. Graham, 20 Beacon Street, Boston, for five-story, brick and terra cotta theater, store and office building, to be erected on Massachusetts and Brookline Avenues, for Louis W. Reycroft; cost about $450,000.

Gardiner, Mass.—The Gardiner Auto Company intends erecting a three-story business block 167 x 80 ft. with a two-story garage in the rear, both brick construction.

Bridgeport, Conn.—Reported Remington Arms & Ammunition Co., Seaview Avenue, will erect 40 brick houses for the 1000 employees.

New Haven, Conn.—R. W. Foote, 185 Church Street, has prepared plans for 3-story and basement building and for an additional story for the office building of United Illuminating Co.

Brooklyn, N. Y.—Plans reported being prepared by Thomas Lamb, 644 Eighth Avenue, New York, for $250,000 vaudeville theater to be erected on Myrtle Avenue and Madison Street for Levy Brothers.

Plans completed by W. T. McCarthy, 16 Court Street, for four-story and basement brick apartment building to be erected at Ditmas Avenue and East Twenty-first Street; cost $55,000.

Plans filed for two 4-story apartment buildings to be erected on Willoughby and Throop Avenues for Madison Construction & Improvement Co.; total cost $100,000. Shampan & Shampan, Archts., 772 Broadway, Brooklyn.

Plans completed by Maximilian Zipkes, 405 Lexington Avenue, New York, for 5-story apartment building to be erected on present site of Samaritan Hospital, at Seventeenth Street and Fourth Avenue, for Lazarius Rosenberg, 189 Montague Street. Cost $50,000.

Jamestown, N. Y.—Plans adopted for new passenger station to be erected here for Erie Railroad (R. S. Parsons, Ch. Engr., 50 Church Street, New York); estimated cost $100,000.

New York, N. Y.—Plans filed for erecting following buildings: 14-story fireproof apartment hotel at 19 West Sixty-ninth Street for Waitt Realty Corporation, cost $260,000, Schwartz & Gross, Archts., 347 Fifth Avenue; 4-story fireproof stable, garage and storage building for Cushman's Sons, Inc., at 14-18 Lawrence Street, cost $50,000, Charles Stegmayer, Archt., 168 East Ninety-first Street.

Plans being prepared by Gronenberg & Leuchtag, 303 Fifth Avenue, for 5-story and basement apartment house to be erected for Charles M. Rosenthal, at Davidson and Burnside Avenues; cost, $100,000.

Atlantic City, N. J.—Plans being prepared by Price & McLanahan, 1418 Walnut Street, Philadelphia, Pa., for two-story brick and steel garage to be erected for Traymore Hotel Company.

Short Hills, N. J.—Charles A. Rich, 320 Fifth Avenue, New York, is architect for addition to be erected to Christ Episcopal Church; cost about $40,000. Rev. C. Malcolm Douglas, Pastor.

Chester, Pa.—The Nest of Owls reported taking steps to erect a $40,000 building.

Ellwood City, Pa.—G. S. Young of Ellwood City plans erecting a two-story, brick store building on Fifth Street, to cost about $30,000.

Harrisburg, Pa.—Harrisburg Country Club (Frank J. Brady, Secy.) selected site on Fort Hunter Farm for new club house to cost about $22,000.

Penbrook, Pa.—M. I. Kast, 222 Market Street, Harrisburg, is architect for one-story and basement, limestone edifice, to be erected on Main Street for United Brethren Church; cost $35,000. Rev. H. M. Miller, Pastor.

Philadelphia, Pa.—A $50,000 annex is to be erected at the West Branch of the Philadelphia Y. M. C. A. building. Address Secretary.

Pittsburgh, Pa.—Revised plans being prepared by Cram & Ferguson, 32 West Forty-second Street, New York, and Thomas Hannah, Keenan Building, Pittsburgh, associate architects, for proposed $80,000 addition to Edgewood Presbyterian Church, Swissvale Avenue, Edgewood. Contract will be let about March 15.

Tarentum, Pa.—Preliminary plans being prepared by Press C. Dowler, Arrott Building, Pittsburgh, for $100,000 bank, office and lodge building to be erected on East Sixth and Corbet streets, for People's National Bank.

Wellsville, Pa.—First Church (Scientist) contemplates erecting new edifice, to cost $70,000. Rev. William G. Reagle, Pastor. George D. Ingram, Chairman Building Committee.

Wind Gap, Pa.—Plans being prepared by George E. Savage, Witherspoon Building, Philadelphia, for a $40,000 brick edifice and Sunday School building to be erected for Reformed Lutheran Church.

Baltimore, Md.—Contract soon to be let for erecting a residence and garage costing $35,000. George R. Callis, Jr., 55 Knickerbocker Building, architect.

Plans completed by Baldwin & Pennington, 601 Professional Building, for the Sacred Heart Roman Catholic Church to be erected at Mt. Washington; cost $30,000.

Alexandria, Va.—Site on George Washington Park, formerly Shooters Hill, selected by George Washington Masonic National Memorial Association for proposed Masonic Memorial Temple.

Glendon, W. Va.—Revised plans being prepared by A. C. Higginbotham, Morrison Building, Charleston, for Children's Home to be erected for Methodist Episcopal Church; cost $30,000.

Richmond, Va.—Plans being prepared by Charles M. Robinson, Tenth and Main streets, for seven-story professional building for use of physicians, surgeons and dentists to be erected at Fifth and Franklin streets; cost approximately $150,000.

Pence Springs, W. Va.—Plans being prepared by Bates & Ritter of Portsmouth, Ohio, for $75,000 hotel contemplated here.

Augusta, Ga.—Plans being prepared by G. Lloyd Preacher, Augusta, for $75,000 brick apartment house contemplated on Greene Street for United Apartment Company.

Atlanta, Ga.—Morgan & Dillon, Grant Building, are architects for proposed enlargement of All Saints Episcopal Church; $25,000 available. Rev. W. W. Memminger, Pastor.

Brookhaven, Miss.—Methodist Church contemplates erecting $30,000 edifice. Rev. J. M. Morse, Pastor.

Cincinnati, Ohio—Plans being prepared by Elzner & Anderson, Ingalls Building, for $50,000 residence and garage to be erected for George B. Wilson on Madison Road and Vista Avenue, East Walnut Hills.

Cleveland, Ohio.—Plans being prepared by Flanigan Co., Vickers Building, for a mercantile building to be erected at St. Clair Avenue and East Third Street for the Walton Realty Co., 961 Rose Building; cost $200,000.

McNutt-McCall Realty Co., 604 Hickox Building, plans erecting a $26,000 apartment house on Euclid Heights Boulevard, Cleveland Heigths.

Plans prepared by J. W. Corbuser, Lennox Building, for a $30,000 brick and stone edifice to be erected for the Church of the Ascension.

Adams Express Co. plans erecting a $50,000 building at E. Seventeenth Street and St. Clair Avenue this spring.

Coshocton, Ohio.—Plans being prepared by E. E. Pruitt, Hartman Building, Columbus, for new edifice to be erected for Park Avenue United Brethren Church; cost $40,000.

Dayton, Ohio.—J. P. Vance, Louis Block, is architect for four-story brick building to be erected at Third and Webb Streets for Laymon Building Company.

Holy Rosary Roman Catholic Church, North Dayton, contemplates erecting new edifice on Hart Street and Notre Dame Avenue; cost about $85,000. Rev. J. B. Frohmiller, Pastor.

Toledo, Ohio—Plans being prepared by Spier & Gehrke, Chamber of Commerce Building, Detroit, Mich., for $35,000 sandstone edifice for St. Mark's Lutheran Church.

Bloomington, Ind.—Rev. M. H. Bogeman has approved plans for a $150,000 stone Roman Catholic Church.

Decatur, Ind.—The Adams County Creamery Company, Decatur, will erect a brick and steel building costing $25,000.

South Bend, Ind.—The Church of Christ (Scientist) has approved plans for a $90,000 granite edifice.

Vincennes, Ind.—Contract about to be let for $50,000 Masonic Temple to be erected at Fifth Street and Broadway for Lodge No. 1, F. and A. M.

Champaign, Ill.—Salvation Army planning to erect a barracks, estimated to cost $40,000.

Chicago, Ill.—Quadrangle Club of the University of Chicago contemplates erecting new club house at Fifty-seventh Street and University Avenue, costing $100,000.

Directors of the Jewish Training School, Twelfth Place and Clinton Street, intend erecting new Jewish school to cost $200,000. Joseph K. Arnold, President.

G. W. Stewart, 29 South La Salle Street, intends erecting two apartment houses on Mildred and Mariana streets; total cost $200,000.

Hoopeston, Ill.—The Lodge of Moose is planning the erection of a chapel.

Joliet, Ill.—Public Service Company, 308 Van Buren Street, considering erecting two or three-story office building, to cost about $35,000.

Milwaukee, Wis.—Martin Tullgren & Sons, 133 Second Street, are architects for three-story and basement brick apartment building to be erected on Fourteenth and Cedar Streets for J. S. Reeves; cost about $35,000.

Dubuque, Iowa.—A. A. Cooper Wagon & Buggy Company, Third and Main Streets, is planning to rebuild warehouse destroyed by fire; cost about $150,000.

Duluth, Minn.—The Methodists are said to be planning a $100,000 hospital. Dr. John Kaufman, pastor First M. E. Church, may be able to give information.

Minneapolis, Minn.—Mrs. John R. Van Derlip and Dr. Angus W. Morrison have donated $50,000 to erect an art school for the Minneapolis Association of Fine Arts.

The Minneapolis General Elctric Company will erect an addition to their building on Fifth Street. General Manager, R. F. Pack.

The Maytag Manufacturing Company, 743 Washington Avenue N., will erect at 513 Washington Avenue a six-story office building, estimated to cost $50,000.

The McMichael Investment Company, 91 Thirteenth Street South, will erect a two-story brick lodging house, estimated cost $60,000. Henry Oswald of the Minneapolis Brewing Company may be able to give further information.

The Northwestern Telephone Co. (M. L. Lane, Commercial Superintendent) intends enlarging Minneapolis branch at a cost of $1,500,000. Improvements are also to be made in St. Paul by the company at a cost of $1,000,000.

St. Paul, Minn.—A Building Committee has been appointed with E. P. Davis, 301 Ryan Building, to secure plans for new St. Paul Academy to be erected on Randolph Street and Fairview Avenue.

The Northern Pacific Railroad Company (A. H. Hogeland, Ch. Engr., St. Paul), planning erecting a number of buildings at a cost of $500,000, the principal ones being a coach yard and power house to cost $100,000; commissary department building, cost $100,000, to be used jointly by the N. P. and the G. N. railroads; an ice house and a foreman's building.

Preliminary plans prepared by Thomas Holyoke, Endicott Building, for new edifice to be erected on Summit Avenue for Macalester Presbyterian Church; cost about $45,000. Rev. F. D. McRae, Pastor.

D. H. Bradley, 1017 Laurel Avenue, intends erecting 6-story apartment hotel on Eleventh and Cedar Streets; probable cost $100,000.

A chapel costing $80,000 is to be erected at St. Thomas College.

F. G. Leslie Co., 252 E. Fourth Street, will erect a warehouse at Ninth and Wacouta Streets to cost $200,000.

Mrs. Francis B. Olson, 304 Scandinavian American Bank Building, will erect a $40,000 apartment house at Nelson Avenue and Lewis Street.

The Masons are considering erecting a new temple costing $80,000.

Wichita, Kan.—Elks propose erecting club house costing $150,000. C. P. Hale, Chmn. Bldg. Com.

Topeka, Kan. — The Masons propose erecting a library and office building costing $100,000.

Directors of Commercial Club have accepted the plans of J. C. Holland, Mills Building, for the $60,000 addition to the city auditorium.

Plans being prepared by J. F. Stanton, 835 Kansas Avenue, for a $45,000 business building for the Lux Mercantile Co., to be 2 stories, fireproof.

Fargo, N. D.—Wilde Lodge of Odd Fellows is considering erecting a three-story building at Fifth Street and Second Avenue North. Victor J. Baldwin, secretary.

Clayton, Mo.—R. Wehmeyer, 219 St. Ferdinand Avenue, St. Louis, will erect two-story, brick business building on Central Avenue, to cost about $25,000.

Kansas City, Mo.—Kansas City Paper House (James A. Carpenter, President), 607 Wyandotte Street, intends erecting seven-story and basement, steel and concrete, fireproof building at Seventh and May Streets; cost about $120,000.

St. Louis, Mo.—University Club, Grand and Washington Streets, considering erecting eleven-story store, office and club building; probable cost $335,000.

Stix, Baer & Fuller Dry Goods Co., Sixth Street and Locust Avenue, intends erecting eight-story, steel, fireproof building, costing about $300,000.

Henry Heil, president of Henry Heil Chemical Company, 212 South Fourth Street, plans erecting two-story, store and flat building on Grand Avenue and Wyoming Street, to cost about $50,000.

Beaumont, Tex.—State Railroad Commission has approved the revised plans of Texarkana & Fort Smith Ry. (R. H. Gaines, Ch. Engr., Texarkana, Tex.) for the passenger station to be erected here at a cost of $70,000.

Galveston, Tex.—Plans being prepared for a $30,000 building for the Knights of Pythias to be erected at Winnie and Twenty-second Streets. Charles Theobold is a member of the committee.

San Angelo, Tex.—J. W. White of Mason reported interested in a six-story building contemplated on Lasker block.

Waco, Tex.—Plans being prepared by M. W. Scott & Co., Waco, for improvements to be made to the building of the Cooper Grocery Co., at a cost of $30,000.

Oklahoma, Okla.—Alexander Drug Co., 226 West First Street, contemplates erecting a building, 140 x 150 ft., at Sixth and Santa Fé Streets; number of stories not decided upon.

Williamson-Halsell Frazier Co., 1-7 West First Street, will erect a 5-story, brick, fireproof addition to present building at West First and Santa Fé Streets; cost $60,000.

Tulsa, Okla.—Plans being prepared for $250,000 lodge building to be erected for Adkar Temple of the Mystic Shrine.

Spokane, Wash.—E. H. Stanton Co., 0212 Bernard Street, intends erecting five-story, 100 x 150 ft., reinforced concrete and steel addition to storage plant; cost $175,000.

Portland, Ore.—Reported Orpheum Theater & Realty Co. (Morris Meyerfield, Jr., President), 147 O'Farrell Street, San Francisco, Cal., contemplates erecting Orpheum Theater here, to cost about $425,000.

Reported B. Marcus Priteca, Pantages Building, Seattle, Wash., has been engaged to prepare plans for a reinforced concrete and steel truss natatorium, 200 x 180 ft., to be erected in this city for M. Scbubach of Seattle; cost $250,000.

Los Angeles, Cal.—Plans to be prepared by W. J. Saunders, Laughlin Building, for a group of concrete and brick market buildings, to be erected by force account, near Sixth and Mill Streets, for Standard Leasing Co., 401 Equitable Building.

C. F. Borton, 806 Hibernian Building, architect and builder, contemplates erecting a 4-story brick apartment house, 60 x 145 ft., on Clay and Olive Streets.

Porterville, Cal.—The Mount Whitney Power & Light Company, E. G. Shore, local superintendent, will erect a brick concrete and steel substation, 40 by 60 ft.

San Francisco, Cal.—Walter D. Bliss, of Bliss & Faville, Balboa Building, is architect for nine or ten-story office building which the Southern Pacific Company intends erecting on Market and Stewart Streets.

Whittier, Cal.—Plans being prepared by John J. Frauenfelder, 1116 Story Building, Los Angeles, for a reinforced concrete, granite, marble and tile mausoleum, 85 x 100 ft., for the Whittier Heights Cemetery Association; cost about $75,000.

Ogden, Utah.—Ogden Furniture & Carpet Company, 2430 Washington Avenue, will spend $30,000 for enlarging present building.

Winnipeg, Man.—Reported Manitoba Soldiers' Association plans erecting Soldiers' Home, costing about $500,000.

BIDS DESIRED.

Portsmouth, N. H.—Until March 14 by Building Committee Army & Navy Assoc. (W. L. Hill, U. S. Navy, Chmn.) for erecting 3-story brick building for the said association, 40 x 85 ft. brick exterior walls, steel frame, wooden joists, hardwood floors, and metal lath and plaster. Separate bids for heating and plumbing and electric work.

Jerseyville, Ill.—Reported desired until Mar. 15, for erecting church for Baptist Congregation. Probable cost $50,00. A. T. Simmons, First National Bank Bldg., Bloomington, Ill., Archt.

Kankakee, Ill.—Until Mar. 25, by C. B. Sawyer, Chmn. Bldg. Com., for erecting lodge and club house for Order of Elks. Chas. P. Rawson, Archt., Chicago.

Elmore, Minn.—Until March 9, by J. S. McQuarie,, Cashier First Natl. Bank Bldg., for erecting bank building. Louis F. Dow Co., Archts., St. Paul.

Glenwood, Minn.—Until March 17, by C. O. Wollman, Secy. Bldg. Com. Norwegian Lutheran Congregation, for erecting brick and stone edifice for Lutheran Congregation. Separate bids for heating, ventilating, electrical work, etc. W. L. Alban, Archt., 347 Endicott Bldg., St. Paul.

Pipestone, Minn.—Reported desired until Mar. 10, for erecting two story and basement 50 x 78 ft. bank and office building for First National Bank. P. J. Linhoff, 906 Germania Life Bldg., St. Paul, Archt.

Dartmouth, Ont.—Until Mar. 15, by J. W. Pugsley, Secy. Dept. Rys. and Canals, Ottawa, for buildings on the Dartmouth Branch Line.

Moose Jaw, Sask.—Reported desired until Apr. 1, by T. C. Macnabb, Div. Engr. C. P. R. Co., Moose Jaw, in connection with building Stanard A 2, stations at Admiral, Scotsguard and Meyronne-Shunavon Sub-Division, Sask.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Binghamton, N. Y.**—Contract awarded by Peoples Trust Co. to Parsons Construction Co. of Binghamton for erecting 5-story stone and granite bank building on Court and Collier Streets; cost about $100,000.

Brooklyn, N. Y.—See "Electric Railways."

★**New York, N. Y.**—Contract awarded Cauldwell Wingate Company, 381 Fourth Avenue, for erecting 15-story fireproof building at 63 Broadway, for American Express Company and the Hays Foundry & Iron Company, 15 Madison Square North, contract for the steel work, about 1300 tons. Remick, Aspinwall & Tucker, Archts., 8 West Fortieth Street, Archts.

★**Bloomsburg, Pa.**—Contract awarded by Barger, Bains & Munn Co. to A. J. Harter of Nescopeck for erecting two buildings, one 73 x 40 ft. and the other 50 x 132 ft.

★**Johnstown, Pa.**—Contract for erecting edifice and parsonage for Walnut Grove United Brethren Church awarded Hess Brothers, Johnstown, at $29,916. Rev. J. J. Funk, Pastor.

★**Sharpsburg, Pa.**—Contract for erecting church for St. Mary's Parish awarded Charles S. Smith, 6501 Center Street, Pittsburgh, and structural steel to John Eichlay, Jr., Company of Pittsburgh; cost about $100,000. Peter Dederichs, Archt., Chamber of Commerce Building, Detroit, Mich.

★**Baltimore, Md.** — Contract awarded Cogswell-Koether Company, care architect, at $90,000 for erecting the Maryland City Garage. C. N. Friz, 1523 Munscy Building, Architect.

★James J. O'Connor, 427 East Lexington the storage warehouse of the Monumental Street, is builder and Charles M. Anderson, 334 N. Charles Street, architect, for a 6-story reinforced concrete addition to Storage Company, Dolphin Street and Park Avenue; cost, $24,600.

★**Wilmington, Del.**—Contract awarded A. S. Reed & Brother Company, 815 Shipley Street, for erecting five-story, brick, terra cotta and steel building for Ford-Massey Furniture Company, at $39,973. John J. Kennedy, Archt., Ford Building.

★**Dayton, Ohio.**—Contract for erecting 12-story office building at 45 South Main Street awarded Ferro-Concrete Construction Co., Richmond and Harriet Streets, Cincinnati; cost about $60,000.

★**Champaign, Ill.**—Contract awarded A. W. Stoolman, Champaign, for erecting University Baptist Church at $25,315.

★**Peoria, Ill.**—Contract awarded William Allen & Co., Peoria, for erecting building costing $50,000 for National Duroc Jersey Record Assoc.

★**Minneapolis, Minn.**—Contract awarded by the Minneapolis Iron Store Company to J. L. Robinson Company, 611 South Seventh Street, for erecting two warehouses at Sixth Avenue and Washington Avenue North, at about $150,000.

★**Bismarck, N. D.**—Contract awarded Meinecke Building Company of Fargo, for a $100,000 hotel to be erected here.

★**Devils Lake, N. D.**—Contract awarded W. C. Fosburg, Devils Lake, for erecting a three-story store and office building for Baird, Rice & Haley.

★**Seattle, Wash.**—Contract for first unit of the proposed railroad and steamship terminals at foot of Pike Street awarded by Union Terminals, Ltd., to Pearson Construction Co., New York, Block, and include a 5-story reinforced concrete dock, 1000 ft. long, and a manufacturing loft; cost $500,000. The complete project includes an office building and hotel. Howells & Stokes, Archts., Henry Building.

★**Portland, Ore.**—Contract awarded by Portland Mausolsum Company for erecting granite, reinforced concrete, marble, steel and bronze mausoleum on Taylor's Ferry Road, adjoining Riverview Cemetery, to Parker & Banfield, 104 Grand Avenue; cost, $50,000.

★**Los Angeles, Cal.**—Contract for general construction of 2-story concrete clinical building on Castelar Street for O. T. Johnson and Parent Teachers Association, to R. S. Martin, 509 N. Marguerita Avenue, Alhambra, at $22,000.

★**Los Angeles, Cal.**—Contract awarded L. F. S. Syndicate, 621 Investment Building, to design and erect a 4-story brick apartment house at 538 South Fremont Street for Mrs. Bart; cost about $50,000.

★**Kingman, Ariz.**—Contract, not including plumbing and heating, for 3-story, reinforced concrete addition to Beale Hotel awarded Albrecht Anderson, Phoenix, at $32,358. Lescher & Kibbey, Archts., Phoenix.

NEW INDUSTRIAL PLANTS

PROPOSED WORK.

Mattapan (P. O. Boston), Mass.—The Peerless Knitting Co. plans erecting another addition, to cost $60,000.

Bristol, Conn.—The Garrigus Machine Co., Riverside Ave., will erect a two-story and basement brick addition, 80 x 96 ft.

The Bristol Brass Co., Bristol, is to lay a floor of wood block on 6-in. concrete base in the new sheet brass mill and foundry. The sheet mill is 180 x 300 ft. and foundry 60 x 300 ft. Same requirements and specifications as to wood block street paving.

Hartford, Conn.—Contract soon to be let for erecting five-story, reinforced concrete factory for Underwood Typewriter Company, 581 Capitol Avenue.

New York, N. Y.—Plans filed for 12-story fireproof factory to be erected at 30-38 East Thirty-third Street for Wallace Construction Co., Inc., 37 East Twenty-eighth Street; cost $200,000. Schwartz & Gross and B. N. Marcus, associate architects, 347 Fifth Avenue.

Connellsville, Pa.—Reported Casparis Stone Company, Clinton Building, Columbus, Ohio, will spend about $250,000 in erecting plant here for manufacture of bluestone.

Erie, Pa.—State has approved plans for the Metrical Meter Works for the American Meter Company to be erected in Erie.

Olyphant, Pa.—G. D. Dery Silk Manufacturing Co. contemplates erecting three-story, brick, mill addition at Lincoln Avenue and Main Street.

Pottsville, Pa.—Reported Atlas Powder Co. will rebuild plant at Mount Carbon, recently destroyed by fire.

Steelton, Pa.—Reported Schwab interests are contemplating enlarging plant here and at Sparrows Point, Md.

Baltimore, Md. — Reported Jones & Lamb Co., 106 South Street, will erect a packing house, to cost about $200,000.

Great Falls, S. C.—J. E. Sirrine, Greenville, is preparing plans for a cotton mill to be erected here.

Baton Rouge, La.—The Standard Oil Co. of Louisanna contemplates extensions to the refinery here, including building of 100 high-pressure stills.

Chattanooga, Tenn.—Plans being prepared by J. E. Sirrine, Greenville, S. C., for a cotton mill to be erected here.

Nashville, Tenn. — Plans completed for seven-story, 80 x 80 ft., reinforced concrete addition to cold storage plant of Noel & Company at Johnston and Tenth Streets.

Cleveland, Ohio.—Ocoee Woolen Mill Company reported incorporated with W. H. Durkee, Superintendent of Cleveland Woolen Mills, C. & P. Ry. and Clarkwood Avenue, as manager, and intends erecting woolen mill.

Columbus, Ohio.—Lamneck Company, 1136 Mount Vernon Avenue, intends erecting a 40 x 100 ft. factory at 164 West Naghten Street, to cost about $30,000.

Dover, Ohio.—Reported Immel Feed & Milling Company will rebuild plant on Cherry Street, destroyed by fire.

Youngstown, Ohio.—Reported Barrett Company (R. E. Wilson, 2216 Market Street, Manager) contemplates erecting plant for manufacture of roofing and other tar products.

Fort Wayne, Ind.—Four buildings will be erected this summer at Fort Wayne plant of the General Electric Co.

Indianapolis, Ind. — The Indianapolis Public Elevator Co., recently incorporated, intend erecting a large elevator near the tracks of the Belt Line. W. H. Benedict, Cruse Realty Co., East Market Street, may be able to give additional information.

Kokomo, Ind.—The Ford Brass Works, Kokomo, is planning a one-story steel and brick 50 x 265-ft. addition.

St. Paul, Minn.—Japan Tea Company (Fred B. Anderson, President), 183 West Seventh Street, intends erecting coffee roasting plant at Sixth and Franklin Streets.

St. Louis, Mo.—Chevrolet Motor Co. (Russell E. Gardner, Pres.), Second and Rutger Streets, will erect $100,000 addition to plant.

Seattle, Wash.—Elliott Bay Yacht & Engine Co., West Seattle, contemplates constructing a shipbuilding plant at West Waterway Turning Basin, at foot of Chelan Avenue; cost $250,000. Plans include a 200 x 260 ft. drydock and 60 x 100 ft. gridiron modern machine shop, etc.

Astoria, Ore.—Astoria Flour Mills Company (E. W. Smith, President), Astoria, intends spending about $100,000 in improving and enlarging plant to include erection of warehouse and installation of new machinery.

Portland, Ore. — Inman - Poulson Co. (Johan Poulson, Secy.-Treas.) will rebuild plant, recently destroyed by fire, and install new machinery.

Alhambra, Cal.—R. M. Farrel, President Los Angeles & Riverside Mfg. Company, is interested in organizing a company for the purpose of erecting a cotton mill to cost $700,000 to include six buildings; also an ice and cold storage plant, 200 x 24 ft.

Prescott, Ariz.—Stoddard Mines Company is preparing to erect a 150-ton flotation plant at Stoddard, near Mayer, at a cost of about $50,000, to be used for treating gold ore. C. M. Stoddard, Gen. Mgr., Prescott.

Dos Cabezas, Ariz.—Reported Mascot Copper Co. is planning rebuilding power plant recently destroyed by fire. T. N. McCally, Pres., Mascot.

Vancouver, B. C.—Crown-Willamette Paper Company, Alaska Commercial Building, San Francisco, Cal., reported interested in reorganization of Pacific Mills, Ltd. (J. H. Lawson, Pres., Vancouver), and erection of a paper and pulp factory at Ocean Falls, B. C., near Vancouver.

BIDS DESIRED.

Lansing, Mich.—Until Mar. 12, by H. E. Smith, Consulting Engr., 103 Capital National Bank Bldg., for erecting a reinforced-concrete cupola house and for steel construction of a foundry building, etc., for Novo Engine Co., Lansing. Total building, 120 x 300 ft.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Wissinoming, Pa.**—Contract awarded by Peuckert & Wunder, 310 Chestnut Street, Philadelphia, to Philip Halbach Contracting Co., Twenty-sixth and Thompson Streets, Philadelphia, for erecting an experimental building at the National Ammonia Co.'s plant at Wissinoming. Building to be concrete and metal and all windows of rolled steel.

★**Augusta, Ga.**—Contract awarded W. W. Griffin Construction Company of Atlanta, for erecting eight-press cotton seed oil mill for Swift Oil Mills; cost about $200,000.

★**Columbus, Ga.**—Contract for erecting plant of Hardaway-Cargill Company reported awarded Southern Ferro Concrete Company of Atlanta; total cost, including equipment, about $50,000.

★**Cleveland, Ohio.**—Contract for erecting $24,000 addition to factory of Kilby Manufacturing Company, 4623 Lakeside Avenue, awarded John Donnelly Construction Company, 1471 East Fifty-fifth Street. Massillon Bridge Company, Massillon, will furnish steel.

★**San Antonio, Tex.**—Contract awarded by the International & Great Northern Railroad to American Construction Co. of Houston for erecting shops here. Electrical work to Martin Wright of San Antonio and plumbing to Braden & Hudson Co. of San Antonio.

★**San Antonio, Tex.**—Contract awarded by Great Northern R.R. to American Construction Co., Houston, for erecting shops here: Plumbing, Braden & Hudson Co., San Antonio, and electric work to Martin Wright, San Antonio.

★**Seattle, Wash.** — Contract awarded Grant, Smith & Company, Henry Building, Seattle, for erecting reinforced concrete buildings and elevators to increase capacity of Fisher Flouring Mills Company, from 2000 to 6000 bbl. per day.

★**Shawinigan Falls, Quebec.**—Contract awarded Raymond Concrete Pile Co., New Birks Building, Montreal, for the foundation and new addition to plant of the Belgo-Canadian Pulp & Paper Co., Ltd.

MISCELLANEOUS

PROPOSED WORK.

Stadium—Philadelphia, Pa.—George E. Nitzsche, Recorder of the University of Pennsylvania, has prepared plans for a stadium which it is reported is planned to be erected at Woodlawn Ravine at a cost of $750,000.

Conduits—Baltimore, Md.—A loan of $1,500,000 has been asked to complete the conduit system in the city. Raleigh C. Thomas, Chief Engineer Electrical Commission.

Park Bonds—Massillon, Ohio.—Park bonds for $25,000 reported to be sold March 30 by City Auditor.

BIDS DESIRED.

Stone, etc.—Buffalo, N. Y.—Until March 9, by Department Public Works (Arthur W. Kreinheder, Supt.), for stone, macadam, etc., for year ending June, 1917.

Cement Stone, Etc.—Long Island City, L. I., N. Y.—Until Mar. 6, by Maurice E. Connolly, Pres. Queens Boro., for furnishing material and delivering 6000 cu. yd. gravel or broken stone chips, 200,000 gal. asphaltic oil, 900 net tons limestone, 13,300 cu. yd. sand, 30,000 cu. yd. broken stone, 600,000 gal. light road oil, 600 tons asphaltic cement, etc.

Cement—New York, N. Y.—Until Mar. 6, by Burdette G. Lewis, Comr. Dept. Corrections, for furnishing and delivering 1500 bbl. Portland cement, in bags.

Boilers for Sale—Poughkeepsie, N. Y.—Until March 16, by Board of Public Works for purchase of three 70-hp. Delaney return Tubular dome top boilers advertised in Engineering Record.

Road Oil—South Orange, N. J.—Until Mar. 7, by Township Committee (Edw. R. Arcularius, Clk.), for furnishing approximately 40,000 gal. road oil, f.o.b. South Orange.

Concrete Platform—Jacksonville, Fla.—Until March 13, by Committee Public Works (S. C. Harrison, Jr., Chmn.) for furnishing material and constructing a reinforced concrete unloading platform at foot of Ocean St.

Subway—Akron, Ohio.—See "Railroads."

Structural Steel, Lorain, Ohio.—Until March 27, by Lighthouse Inspector, Buffalo, N. Y., for furnishing structural steel and metal work, also for fourth order lantern for delivery at Lorain, Ohio, advertised in Engineering Record.

Cement—Chicago, Ill.—Until Mar. 6, by Department Public Works (W. R. Moorhouse, Comr.), for furnishing city, f.o.b. cars and by team, approximately 15,000 bbl. Portland cement.

Ash and Coal Conveyor, Etc.—Chicago, Ill.—Until Mar. 7, by Department of Health (John Dill Robertson, Comr.), separate bids, as follows: Furnishing, fabricating, delivering and erecting an ash and coal conveyor for dryers' houses Nos. 4 and 6 at municipal reduction plant; conveying machinery for said houses; for furnishing and delivering and erecting elevating and conveying machinery for said dryer house and new extractor building at the municipal reduction plant.

Cell Fronts, Etc.—Lockport, Ill.—Until Apr. 4, by John Lambert, Pres. Penitentiary Commission, 863 The Rookery, 209 S. La Salle Street, Chicago, for furnishing steel window guards and cell fronts required in one cell house of 248 cells, at New Illinois State Penitentiary, near Lockport. W. Carbys Zimmerman, Archt., 1101 Steinway Hall, Chicago.

Railroad Supplies—Seattle, Wash.—Reported desired until March 15 by C. E. Dole, Purchasing Agent, Alaska Engineering Commission, Bell Street Dock, Seattle, for supplies as follows: Cement, asbestos roofing, drill steel, blasting machines, relaying rails, etc., for Government railroad construction in Alaska.

Cranes—Vallejo, Cal.—Until Mar. 11, by Bureau Yards and Docks, Navy Dept., Washington, D. C., for furnishing three locomotive cranes at the Navy Yard, Mare Island.

Chimney—Toronto, Ont.—Until Mar. 7, by T. L. Church (Mayor), Chmn. Bd. Control, registered post only, for constructing radial brick chimney and foundations for refuse incinerating plant on Don Roadway.

Cement, Etc.—Vancouver, B. C.—Reported desired, until Mar. 6 by James Stuart, City Purchasing Agent, for cement, sand, gravel, castings, etc., for a period of one year.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Road Oil—Concord, N. H.**—See "Paving and Roads."

Cement — Minneapolis, Minn.—Following are four lowest bids opened Feb. 8 by city for furnishing Portland cement for year 1916: Mill City Lime & Cement Co., 212 Lumber Exchange, 50,000 bbls., $1.56 per bbl. f.o.b. cars Minneapolis, 5 per cent per bbl. 10 days, 2¼ per cent 30 days; P. G. Speakes Co., 2845 Second Avenue, S., 20,000 bbls., $1.68 per bbl., f.o.b. R. R. siding Minneapolis; Northwestern Lime Co., 25,000 bbls., $1.98 per bbl., f.o.b. cars Minneapolis, 5 per cent discount per bbl., and Landers, Morrison & Christenson, 315 Lumber Exchange, 125,000 bbls., $1.98 per bbl., f.o.b. cars Minneapolis, 5 per cent discount per bbl.

Boat Station—Galveston, Texas.—The lowest bid opened Feb. 15 by supervising architect, Treasury Department, Washington, D. C., for constructing boat station at the U. S. Quarantine Station, Galveston, submitted by William Moore, Texas City, at $17,654.

Proposals

For Proposals Advertised, See Pages 48, 49, 50 and 51.

WATERWORKS.

Bids Close.		See Eng. Record.
Mar. 6.	Well, New Bern, N. C... Adv. Feb. 12.	Feb. 12
Mar. 7.	Addition, Kiowa, Kan...	Feb. 26
Mar. 7.	Deep Well, New Ulm, Minn.	Feb. 26
Mar. 7.	Pipe, Berwyn, Ill.........	Mar. 4
Mar. 8.	Pumping Station, Fort Bliss, Tex. .... Adv. Feb. 12 to Mar. 4.	Feb. 12
Mar. 8.	Tunnel, Milwaukee, Wis. Adv. Feb. 19, 26.	Feb. 19
Mar. 8.	Reservoir, Durham, N. C. Adv. Feb. 26.	Feb. 26
Mar. 8.	Pumps, Malta, Mont.....	Feb. 26
Mar. 9.	C.-I. Pipe, Atlantic City, N. J. .... Adv. Mar. 4.	Mar. 4
Mar. 10.	Waterworks, Jones, Okla.	Feb. 26
Mar. 10.	Port System, Jacksonville, Fla. .... Adv. Mar. 4.	Mar. 4
Mar. 10.	Pipe, Seattle, Wash.....	Mar. 4
Mar. 10.	Pumps, Rochelle, Ill.	Mar. 4
Mar. 13.	Mains, Etc., Shaker Heights (P. O. Cleveland), Ohio	Feb. 26
Mar. 14.	Mains, etc., Crofton, Neb.	Feb. 19
Mar. 16.	Well, Fairbury, Ill....... Adv. Feb. 26.	Feb. 26
Mar. 15.	Mains, Salt Lake City, Utah	Mar. 4
Mar. 16.	Pipes, Etc., Houston, Tex.	Mar. 4
Mar. 17.	Pipe, Etc., Panama......	Mar. 4
Mar. 18.	Engine, Wheaton, Ill..... Adv. Mar. 4.	Mar. 4
Mar. 20.	Water Works, Polson, Mont. .... Adv. Feb. 26.	Feb. 26
Mar. 20.	Pipe, Chisholm, Minn....	Mar. 4
Mar. 21.	Tank, Ely, Minn.........	Mar. 4
Mar. 21.	Contract 120, New York, N. Y. .... Adv. Mar. 4.	Mar. 4
Mar. 22.	Add. to Pump Sta., New Orleans, La.	Feb. 5
Mar. 22.	Centrifugal Pump. Mach., Lancaster, Pa........... Adv. Feb. 26.	Feb. 26
Mar. 23.	Water Works, Batavia, N. Y. .... Adv. Mar. 4.	Mar. 4
Mar. 27.	Water Works, Wilson, N. C.................... Adv. Feb. 26, Mar. 4.	Feb. 26
Mar. 30.	Water Works, South Boston, Va.................. Adv. Feb. 26, Mar. 4.	Feb. 26
Apr. 1.	Maine. Cullman, Ala.....	Jan. 15
———	Pipe Line, Trinity, Tex. Adv. Feb. 5.	Feb. 6

SEWERAGE AND SEWAGE DISPOSAL.

Bids Close.		See Eng. Record.
Mar. 6.	Polsom, Mont. .... Adv. Feb. 5.	Feb. 5
Mar. 6.	Savannah, Ga. .... Adv. Feb. 12, 19.	Feb. 12
Mar. 7.	Billings, Mont.	Feb. 12
Mar. 7.	Tonkawa, Okla	Feb. 19
Mar. 7.	Crawfordsville, Ind.......	Feb. 26
Mar. 7.	Martinsville, Ind..........	Feb. 26
Mar. 7.	Cleveland Heights (P. O. Warrensville), Ohio.....	Mar. 4
Mar. 7.	Berwyn, Ill.	Mar. 4
Mar. 7.	Oshkosh, Wis.	Mar. 4
Mar. 8.	Bad Axe, Mich...........	Feb. 26
Mar. 9.	Fort Wayne, Ind.........	Feb. 19
Mar. 9.	La Crosse, Wis..........	Feb. 26
Mar. 9.	Cleveland, Ohio.	Mar. 4
Mar. 14.	Oshkosh, Wis.	Mar. 4
Mar. 14.	Newark, N. J............ Adv. Jan. 22, Feb. 5, 19, Mar. 4.	Jan. 22
Mar. 21.	Columbus, Ohio.	Mar. 4
Mar. 23.	Batavia, N. Y........... Adv. Mar. 4.	Mar. 4
Mar. 24.	Wapokoneta, Ohio	Mar. 4
Mar. 27.	Lakeville, Conn. .... Adv. Mar. 4.	Mar. 4
Apr. 1.	Sheboygan Falls, Wis. ...	Feb. 19
Apr. 4.	Billings, Mont.	Feb. 19

BRIDGES.

Bids Close.		See Eng. Record.
Mar. 6.	Kansas City, Kan. ...... Adv. Feb. 19, 26.	Feb. 19
Mar. 7.	Columbus, Ohio	Feb. 12
Mar. 7.	West Palm Beach, Fla...	Feb. 19
Mar. 7.	Georgetown, Del.	Feb. 19
Mar. 7.	Brainerd, Minn.	Feb. 19
Mar. 7.	Grand Forks, N. D.......	Feb. 19
Mar. 7.	Casper, Wyo.	Feb. 19
Mar. 7.	Fort Scott, Kan.........	Feb. 26
Mar. 7.	Indiana	Feb. 26
Mar. 7.	Yates Center, Kan.......	Mar. 4
Mar 7.	Toledo, Iowa	Mar. 4
Mar. 7.	Waynesville, N. C........	Mar. 4
Mar. 7.	Lancaster, Ohio	Mar. 4
Mar. 7.	Alma, Kan.	Mar. 4
Mar. 8.	Indiana.	Feb. 19
Mar. 8.	Nelson, Neb.	Feb. 19
Mar. 8.	Arcadia, Fla.	Feb. 26
Mar. 8.	Emporia, Kan.	Mar. 4
Mar. 9.	La Salle, Ill. .... Adv. Feb. 12.	Feb. 12
Mar. 9.	Fairbury, Neb. .... Adv. Feb. 12, 19.	Feb. 12
Mar. 9.	Red Oak, Iowa..........	Feb. 19
Mar. 8.	South Bend, Wash.......	Mar. 4
Mar. 9.	Barberton, Ohio	Mar. 4
Mar. 10.	Nebraska.	Feb. 19
Mar. 10.	Wayne, W. Va..........	Feb. 26
Mar. 10.	Butte, Neb.	Mar. 4
Mar. 10.	Cincinnati, Ohio	Mar. 4
Mar. 11.	Hamilton, Ohio.	Feb. 19
Mar. 11.	Kansas City, Mo.........	Mar. 4
Mar. 11.	Randle, Wash.	Mar. 4
Mar. 13.	Mayfield, Ky.	Mar. 4
Mar. 14.	Minden, Neb.	Mar. 4
Mar. 15.	Dayton, Ohio .... Adv. Feb. 19 to Mar. 4.	Feb. 19
Mar. 16.	Pocahontas, Iowa	Mar. 4
Mar. 17.	Wayne, Neb.	Feb. 19
Mar. 18.	Boise, Idaho	Mar. 4
Mar. 20.	Waseca, Minn.	Mar. 4
Mar. 21.	Illinois	Mar. 4
Mar. 24.	Houston, Tex.	Mar. 4
Mar. 24.	Pittsburgh, Kan.	Mar. 4
Mar. 31.	Steel, N. D.	Mar. 4
Apr. 3.	Santa Barbara, Cal......	Mar. 4
Apr. 4.	Gettysburg, S. D.........	Mar. 4
Apr. 8.	Rock Island, Ill..........	Mar. 4
Apr. 29.	Johnson Creek, Wis.....	Feb. 26

PAVING AND ROADS.

Bids Close.		See Eng. Record.
Mar. 6.	Maysville, Ky. .... Adv Feb. 19.	Feb. 19
Mar. 6.	Lynchburg, Va. .... Adv. Feb. 19, 26.	Feb. 19
Mar. 6.	Caruthersville, Mo. ...... Adv. Feb. 26, Mar. 4.	Feb. 26
Mar. 7.	Davenport, Wash.	Jan. 22
Mar. 7.	Richland Center, Wis.... Adv. Feb. 12, 19.	Feb. 12
Mar. 7.	Indiana.	Feb. 19
Mar. 7.	Goshen, Ind.	Feb. 19
Mar. 7.	Arcadia, Fla.	Feb. 26
Mar. 7.	Oakland, Iowa	Feb. 26
Mar. 7.	St. Louis, Mo............	Feb. 26
Mar. 7.	Sunbury, Pa.	Feb. 26
Mar. 7.	St. Cloud, Minn..........	Feb. 26
Mar. 7.	Chicago Junction, Ohio...	Feb. 19
Mar. 7.	Ephrata, Wash.	Mar. 4
Mar. 7.	Kearney, Neb.	Mar. 4
Mar. 7.	Berwyn, Ill.	Mar. 4
Mar. 7.	Oak Park, Ill.............	Mar. 4
Mar. 8.	Indiana	Feb. 5
Mar. 8.	Indiana.	Feb. 19
Mar. 8.	Sullivan, Ill.	Feb. 26
Mar. 8.	Johnson Creek, Wis.....	Feb. 26
Mar. 8.	Atlantic City, N. J......	Feb. 26
Mar. 8.	Elizabeth, N. J..........	Mar. 4
Mar. 8.	Fargo, N. D.............	Mar. 4
Mar. 8.	Louisville, Ky.	Mar. 4
Mar. 8.	Kearney, Neb............	Mar. 4
Mar. 8.	Baltimore, Md.	Mar. 4
Mar. 8.	Portsmouth, Va. .... Adv. Mar. 4.	Mar. 4
Mar. 8.	Cleveland, Ohio.	Mar. 4
Mar. 9.	Burlington, N. C.........	Feb. 26
Mar. 9.	Indiana	Feb. 26
Mar. 9.	Cincinnati, Ohio	Mar. 4
Mar. 9.	Creston, Iowa	Mar. 4
Mar. 9.	Frankfort, Ky.	Mar. 4
Mar. 9.	Elyria, Ohio	Mar. 4
Mar. 9.	Dayton, Ohio	Mar. 4
Mar. 10.	Indiana.	Feb. 19
Mar. 10.	Seattle, Wash.	Feb. 26
Mar. 10.	Leamington, Ont.	Mar. 4
Mar. 10.	Elkhart, Ind.	Mar. 4
Mar. 10.	Brooklyn, N. Y..........	Mar. 4
Mar. 11.	Appleton, Wis.	Feb. 12
Mar. 11.	Indiana.	Feb. 19
Mar. 13.	Ontario, Cal.	Feb. 26
Mar. 13.	Wallace, Idaho	Mar. 4
Mar. 13.	Hastings, Neb.	Feb. 26
Mar. 14.	Danville, Ill. .... Adv. Feb. 12 to 26.	Feb. 12
Mar. 14.	Indiana	Feb. 26
Mar. 14.	Beloit, Wis.	Mar. 4
Mar. 15.	Forest City, Iowa........	Mar. 4
Mar. 15.	Danville, Ill. .... Adv. Feb. 12 to 26.	Feb. 12
Mar. 15.	Chicago, Ill. .... Adv. Feb. 26.	Feb. 26
Mar. 15.	Sioux Falls, S. D........	Mar. 4
Mar. 16.	Danville, Ill. .... Adv. Feb. 12 to 26.	Feb. 12
Mar. 17.	South Bend, Ind.........	Mar. 4
Mar. 18.	Watertown, N. Y........	Feb. 12
Mar. 18.	Indiana	Feb. 26
Mar. 18.	Indiana	Mar. 4
Mar. 20.	Bolivar, Mo.	Feb. 12
Mar. 20.	De Land, Fla............	Feb. 19
Mar. 20.	Minot, N. D.............	Mar. 4
Mar. 20.	Glenwood, Minn.	Mar. 4
Mar. 20.	Washington	Mar. 4
Mar. 20.	Waukesha, Wis. .... Adv. Mar. 4.	Mar. 4
Mar. 20.	Marshall, Mich.	Mar. 4
Mar. 21.	Eldorado, Ark.	Mar. 4
Mar. 21.	Marshall, Minn.	Mar. 4
Mar. 22.	Cleveland, Ohio	Mar. 4
Mar. 23.	Flemington, N. J........	Mar. 4
Mar. 25.	De Land, Fla............ Adv. Mar. 4.	Mar. 4
Mar. 27.	Road Roller, Winona, Minn.	Mar. 4
Mar. 28.	Sumter, S. C............ Adv. Mar. 4.	Mar. 4
Mar. 30.	Morgantown, W. Va.....	Feb. 26
Apr. 1.	Charelston, W. Va.	Feb. 19
Apr. 6.	Huntington, W. Va......	Mar. 4
———	Binghamton, N. Y. ...... Adv. Feb. 12, 19.	Feb. 12

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS.

Bids Close.		See Eng. Record.
Mar. 6.	Drainage, Largo, Fla.... Adv. Feb. 12 to 26.	Feb. 12
Mar. 6.	Dredging, Hartford, Conn. Adv Feb. 5 to 26.	Feb. 5
Mar. 6.	Dredging, Boston, Mass. Adv. Feb. 26.	Feb. 26
Mar. 6.	Reclamation Flats, Boston, Mass................ Adv. Feb. 26.	Feb. 26
Mar. 7.	Dredging, New York, N. Y. .... Adv. Feb. 12 to Mar. 4.	Feb. 12
Mar. 7.	Riprap, Tompkinsville, N. Y.	Feb. 19
Mar. 7.	State Canal Work, Albany, N. Y..............	Feb. 26
Mar. 7.	Dams, Etc., Barstow, Tex.	Feb. 26
Mar. 7.	Tile Ditch, Garner, Iowa.	Mar. 4
Mar. 7.	Ditch, Bemidji, Minn....	Mar. 4
Mar. 8.	Ditch, Redwood Falls, Minn.	Feb. 19
Mar. 8.	State Canal Work, Albany, N. Y..............	Mar. 4
Mar. 8.	Drainage, Lawrence, Kan.	Mar. 4
Mar. 9.	Ditch, Moorehead, Minn..	Jan. 22
Mar. 9.	Ditches, Alexandria, Minn.	Feb. 26
Mar. 9.	Ditch, Mankato, Minn...	Mar. 4
Mar. 10.	Breakwater, Racine, Wis. Adv. Feb. 12 to 26.	Feb. 12
Mar. 10.	Irrigation, Fort Laramie, Wyo. .... (2 Props.) Adv. Feb. 12.	Feb. 12
Mar. 10.	Pier, New York, N. Y....	Mar. 4
Mar. 10.	Drains, Fort Dodge, Iowa	Mar. 4
Mar. 11.	Ditches, Blue Earth, Minn.	Feb. 26
Mar. 11.	Drains, Racine, Wis.....	Mar. 4
Mar. 11.	Ditch, Peru, Ind.........	Mar. 4
Mar. 13.	Levee, Vincennes, Ind. ..	Feb. 19
Mar. 14.	Dike, Jefferson City, Mo. Adv. Feb. 19 to Mar. 4.	Feb. 19
Mar. 14.	State Canal Work, Albany, N. Y.............. Adv. Feb. 19 to Mar. 4.	Feb. 19
Mar. 14.	Drainage Ditches, Doniphan, Mo.	Feb. 26
Mar. 14.	Drainage, Fort Dodge, Iowa	Mar. 4
Mar.15.	Breakwater, Newport, R. I.	Feb. 19
Mar. 15.	Irrigation, Malta, Mont..	Feb. 26
Mar. 15.	Dredging, Seattle, Wash.	Feb. 26
Mar. 16.	Dredging, Etc., New Bedford, Mass.	Feb. 19
Mar. 20.	Ditches, Olivia, Minn....	Mar. 4
Mar. 23.	Irrigation, St. Ignatius, Mont. .... Adv. Feb. 26.	Feb. 26
Mar. 23.	Revetment, Kansas City, Mo. .... Adv. Feb. 26, Mar 4.	Feb. 26
Mar. 24.	Breakwater, Conneaut, Ohio. .... Adv. Feb. 26, Mar 4.	Feb. 26
Mar. 24.	Dredging, Detroit, Mich. Adv. Feb. 26, Mar 4.	Feb. 26
Mar. 28.	Drain, North Branch, Mich.	Feb. 26
Mar. 29.	Irrigation, St. Ignatius, Mont.	Mar. 4
Mar. 30.	Dredging, Tompkinsville, N. Y.	Mar. 4
Apr. 1.	Dredge, Chicago, Ill..... Adv. Mar. 4.	Mar. 4

PUBLIC BUILDINGS AND SCHOOLS.

Bids Close.		See Eng. Record.
Mar. 7.	Harrisburg, Pa.	Jan. 22
Mar. 7.	Bethlehem, Pa.	Feb. 5
Mar. 7.	Alameda, Cal.	Feb. 19
Mar. 7.	West Richfield, Ohio. ...	Feb. 19
Mar. 7.	Lincoln, Ill.	Feb. 19
Mar. 7.	Breckenridge, Minn.	Feb. 26
Mar. 7.	Ottosen, Iowa	Feb. 26
Mar. 7.	Antioch, Ohio	Mar. 4
Mar. 7.	Orange, Tex.	Mar. 4
Mar. 8.	Lubbock, Tex.	Feb. 12
Mar. 8.	Chilton, Wis.	Feb. 26
Mar. 8.	Seattle, Wash.	Mar. 4
Mar. 8.	Houston, Tex.	Mar. 4
Mar. 9.	Edison, Ohio	Feb. 26
Mar. 9.	Creighton, Pa.	Mar. 4
Mar. 9.	Weir, Kan.	Mar. 4
Mar. 9.	Warren, Minn.	Mar. 4
Mar. 10.	Kalispell, Mont.	Feb. 5
Mar. 10.	Dollivar, Iowa.	Feb. 19
Mar. 10.	Hays, Kan.	Feb. 26
Mar. 10.	Minneapolis, Minn.	Mar. 4
Mar. 10.	Yonkers, N. Y.......... Adv. Mar. 4.	Mar. 4
Mar. 13.	Oklahoma City, Okla. ...	Feb. 5
Mar. 13.	Lafayette, Ga.	Feb. 19
Mar. 13.	Hazelton, Pa.	Feb. 19
Mar. 13.	St. Paul, Minn...........	Feb. 26
Mar. 13.	North Platte, Neb.......	Feb. 26
Mar. 13.	Minneapolis, Minn.	Feb. 26
Mar. 13.	Fort Lee, N. J..........	Mar. 4
Mar. 13.	Jackson, Miss.	Mar. 4
Mar. 13.	Philadelphia, Pa.	Mar. 4
Mar. 13.	Providence, R. I.........	Mar. 4
Mar. 14.	Antigo, Wis.	Feb. 5
Mar. 16.	Gilbert, Minn.	Feb. 12
Mar. 15.	Ft. Bliss, Tex. .... Adv. Feb. 19 to Mar. 4.	Feb. 19
Mar. 15.	Mingo, Ohio	Feb. 26
Mar. 15.	Nevada, Ohio	Mar. 4
Mar. 15.	Minot, N. D.............	Mar. 4
Mar. 16.	New Smyrna, Fla.......	Feb. 19
Mar. 16.	Wallum Lake, R. I......	Feb. 26
Mar. 16.	Danville, Ill.	Mar. 4
Mar. 17.	Charles City, Iowa.......	Feb. 12
Mar. 17.	Salem, Ohio	Feb. 26
Mar. 18.	Ft. Terry, N. Y.......... Adv. Feb. 19 to Mar. 4.	Feb. 19
Mar. 18.	Braceville, Ohio	Mar. 4
Mar. 20.	Austin, Minn.	Jan. 22
Mar. 20.	Alliance, Ohio	Mar. 4
Mar. 21.	Stuart, Neb.	Mar. 4
Mar. 21.	Normal, Ill.	Mar. 4
Mar. 22.	Mattoon, Ill.	Feb. 12
Mar. 22.	Aberdeen, Wash.	Feb. 19
Mar. 22.	Alta, Iowa .... Adv. Mar. 4.	Mar. 4
Mar. 22.	Tacoma, Wash.	Mar. 4
Mar. 22.	Harlem, Mont.	Mar. 4
Mar. 23.	Wilmington, N. C	Feb. 19
Mar. 23.	Montezuma, Ind.	Mar. 4
Mar. 23.	Niles, Ohio	Mar. 4
Mar. 24.	Taylorville, Ill.	Feb. 12
Mar. 25.	Seattle, Wash.	Feb. 19
Mar. 27.	Pueblo, Colo.	Feb. 26
Mar. 27.	Urichsville, Ohio	Mar. 4
Mar. 29.	Aberdeen, Wash.	Feb. 19
Mar. 30.	Huntington, Ind.	Mar. 4
Mar. 30.	San Bernardino, Cal.	Mar. 4
Apr. 1.	Eveleth, Minn.	Mar. 4
Apr. 1.	Ypsilanti, Mich.	Mar. 4
Apr. 4.	Lockport, Ill.	Mar. 4
Apr. 6.	Valley City, N. D........	Mar. 4
Apr. 15.	Indian Head, Md........	Mar. 4
Apr. 24.	Delphi, Ind.	Feb. 26

PRIVATE BUILDINGS.

Bids Close.		See Eng. Record.
Mar. 8.	Des Moines, Iowa........	Feb. 26
Mar. 9.	Elmore, Minn.	Mar. 4
Mar. 10.	Pipestone, Minn.	Mar. 4
Mar. 14.	Montreal, Que.	Feb. 26
Mar. 14.	Portsmouth, N. H.......	Mar. 4
Mar. 15.	Marcellus, N. Y.	Feb. 19
Mar. 16.	Jerseyville, Ill.	Mar. 4
Mar. 15.	Dartmouth, Ont.	Mar. 4
Mar. 17.	Glenwood, Minn.	Mar. 4
Mar. 25.	Kankakee, Ill.	Mar. 4
Apr. 1.	Cleveland. Ohio	Jan. 8
Apr. 1.	Minneapolis, Minn.	Feb. 19
Apr. 1.	Moose Jaw, Sask.........	Mar. 4

NEW INDUSTRIAL PLANTS.

Bids Close.		See Eng. Record.
Mar. 12.	Lansing, Mich.	Mar. 4
Apr. 15.	Manila, P. I.............	Jan.. 2

MISCELLANEOUS.

Bids Close.		See Eng. Record.
Mar. 6.	Sulphate of Alumina, Washington, D. C...... Adv. Feb. 19 to Mar. 4.	Feb. 19
Mar. 7.	Road Oil and Oiler, New Ulm, Minn..............	Feb. 26
Mar. 7.	Road Oil, South Orange, N. J.	Mar. 4
Mar. 7.	Chimney, Toronto, Ont..	Mar. 4
Mar. 7.	Ash and Coal Conveying Machinery, Chicago, Ill.	Mar. 4
Mar. 8.	Road Oil, Indianapolis, Ind.	Feb. 19
Mar. 9.	Elevator, Albany, N. Y.. Adv. Feb. 19 to Mar. 4.	Feb. 19
Mar. 9.	El. Rys., New York, N. Y.	Feb. 26
Mar. 9.	Cement, Etc., Pittsburgh, Pa.	Feb. 26
Mar. 9.	Stone, etc., Buffalo, N. Y.	Mar. 4
Mar. 10.	Railroad Supplies, St. Elias, Alaska	Feb. 26
Mar. 11.	Cranes,, Vallejo, Cal.....	Mar. 4
Mar. 13.	Hoistways, Etc., Cincinnati, Ohio	Feb. 19
Mar. 13.	Elevator, Etc., Omaha, Neb.	Feb. 19
Mar. 13.	Lock Gates, New Glasgow, N. S...............	Mar. 4
Mar. 13.	Concrete Platform, Jacksonville, Fla.	Mar. 4
Mar. 14.	Cells, Etc., Cincinnati, Ohio	Feb. 26
Mar. 14.	El. Rys., Toronto, Ont...	Feb. 26
Mar. 15.	Railroad Supplies, Seattle, Wash.	Mar. 4
Mar. 16.	Boilers For Sale, Poughkeepsie, N. Y........... Adv. Mar. 4.	Mar. 4
Mar. 22.	Garbage Disposal, Lincoln, Neb. .... Adv. Feb. 26.	Feb. 26
Mar. 27.	Structural Steel, Lorain, Ohio .... Adv. Mar. 4.	Mar. 4
Mar. 27.	Street Sweeper, Winona, Minn.	Mar. 4
Mar. 28.	Railroad Work, Philadelphia, Pa. .... Adv. Mar. 4.	Mar. 4
Apr. 1.	Memorial, Fort McHenry, (P. O. Baltimore, Md.).	Nov. 20
———	Funding Bonds, Lufkins, Tex. .... Adv. Feb. 26.	Feb. 26
———	Hauling Gravel, Ocean City, N. J............... Adv. Feb. 26.	Feb. 26

SEARCHLIGHT SECTION

Official Proposal Announcements

Price, $2.40 an inch.—Copy can be received until
Thursday 10 a. m. for issue mailed the next morning

Bids open March 25, 1916.

IMPROVED HIGHWAYS, VOLUSIA COUNTY, FLORIDA

DE LAND, FLA.

Sealed proposals will be received by the Board of County Commissioners of Volusia County, Florida, at the office of the County Clerk in the Court House at De Land, Florida, for the construction of Improved Highways in the De Land-Lake Helen Special Road and Bridge District of Volusia County, Florida.

Said proposals will be received until 2 P. M., March 25, 1916, at which time they will be opened and read publicly. Award of contracts will be made as soon thereafter as practicable.

The approximate quantities are as follows:

189,899—Lin. ft. roadway—35.97 miles.
61,398—Cubic yards excavation
64—Lineal feet 24-in. drains
5—Lineal feet 18-in. drains
96—Lineal feet 15-in. drains
34—Lineal feet 12-in. drains
255—Lineal feet concrete header
4,890—Lineal feet granite curb
200,933—Square yards pavement.
123,013—Square yards shoulders
374,568—Lineal feet curb
190.74—Cubic yards class "A" concrete
321.22—Cubic yards class "B" concrete
27,393—Pounds steel

Each bid must be accompanied by a certified check on a State or National Bank of Florida or on a National Bank of any other State for 5 per cent of the amount bid, drawn to the order of the County Clerk, Samuel D. Jordan.

Plans and specifications may be seen at the office of the County Clerk, DeLand, Florida, and at the office of the Engineers in Atlanta, Ga. Copies of specifications may be obtained from either the County Clerk or the Engineers upon receipt of $1.00, which will be returned when specifications are returned in good shape.

Copies of plans may be obtained from the Engineers for $10.00 to cover their actual cost.

All money deposited for specifications will be refunded where bonafide bids are made.

A surety bond for 25 per cent of contract price will be required of successful bidders.

The right is reserved to reject any and all bids, or waiving formalities to accept any bid that may be to the best interest of the Board.

BOARD OF COUNTY COMMISSIONERS,
MAYNARD M. BOND, Chairman.
SAMUEL D. JORDAN, County Clerk.
The J. B. McCRARY CO., Engineers,
1408-17 Third National Bank Building,
Atlanta, Ga.

Bids open March 15, 1916.

CONCRETE BRIDGES

Bids will be received until noon, Wednesday, March 15th, 1916, on the following:

Webster Street Bridge over Mad River, Keowee Street Bridge over Mad River, and Fifth Street Bridge over Miami River, Dayton, Ohio.

Sealed proposals for the work will be received until noon, March 15th, 1916, by the Director of Public Service of the City of Dayton, Ohio, and then publicly opened.

A full description of this work, and a statement of information necessary for bidders, was printed in the Feb. 19th issue of this journal.

Postpaid copies of plans and specifications for any one of these bridges may be secured from the Director of Public Service of the City of Dayton by sending two dollars ($2.00) for any one set, or six dollars ($6.00) for the three. Payments made for plans and specifications will not be refunded.

By direction of

J. E. BARLOW,
Director of Public Service of the City of

Bids open March 9, 1916.

NOTICE TO CONTRACTORS

ELECTRIC ELEVATORS

ALBANY, N. Y.

Sealed proposals for electric elevators in connection with the alterations and additions to State House, Albany, N. Y., for the Court of Appeals, will be received by the Trustees of Public Buildings, Executive Chamber, Capitol, Albany, N. Y., until 2.30 o'clock P. M., on Thursday, March 9th, 1916, when they will be publicly opened and read. Proposals shall be enclosed in an envelope furnished by the State Architect, sealed and addressed, and shall be accompanied by a certified check in the sum of five per cent (5%) of the amount of bid. The contractor to whom the award is made will be required to furnish surety company bond in the sum of fifty per cent (50%) of the amount of contract within thirty (30) days after official notice of award of contract and in accordance with the terms of specification No. 2292. The right is reserved to reject any or all bids. Drawings and specifications may be consulted at the New York office of the Department of Architecture, Room 1224, Woolworth Building, and at the Department of Architecture, Capitol, Albany, N. Y. Drawings and specifications and blank forms of proposal may be obtained at the Department of Architecture, Capitol, Albany, N. Y., upon reasonable notice to and in the discretion of the State Architect, LEWIS F. PILCHER, Capitol, Albany, N. Y.

February 16, 1916.

Bids open March 10, 1916.

WATER WORKS

JACKSONVILLE, FLA.

Sealed proposals will be received by the Board of Port Commissioners of the City of Jacksonville at their office, Room 407 Realty Building, until noon, March 10, 1916, and then opened publicly for furnishing all materials and for the construction of that portion of a water-works system shown in red on the plans. Each proposal may include any of the items below or all of them, excepting that electric motor and pump to which it is connected shall be included in one proposal. Likewise the gasoline engine and pump to which it is connected shall be in one proposal.

Item 1.
Reinforced concrete pump house, two concrete fire hose houses or pits, and concrete foundations for machinery.
Item 2.
Concrete reservoir.
Item 3.
One (1) centrifugal fire pump and electric motor and its connections.
Item 4.
One centrifugal fire pump and gasoline engine and its connections.
Item 5.
Fire hydrants and valves.
Item 6.
Cast iron pipe and fittings.
Item 7.
Construction.
Item 8.
Includes all of Items 1, 2, 3, 4, 5, 6 and 7.

Plans and specifications are on file at the office of the General Manager.

Each bid shall be secured by a certified check for 10 per cent of its amount to guarantee that the bidder will enter into contract within ten days after being awarded the contract.

The Board of Port Commissioners reserves the right to reject any or all bids.

Bids open March 10, 1916.

NOTICE TO CONTRACTORS

ARMORY

YONKERS, N. Y.

Sealed proposals for construction work of armory for Company "G," Tenth Infantry, N. G. N. Y., Yonkers, N. Y., will be received by Col. Franklin W. Ward, Secretary, State Board of Armory Commissioners, 158 State Street, Albany, N. Y., until 3 o'clock p. m., on Friday, March 10, 1916, when they will be publicly opened and read. Proposals shall be enclosed in an envelope furnished by the State Architect, sealed and addressed, and shall be accompanied by a certified check in the sum of five per cent (5%) of the amount of proposal. The contractor to whom the award is made will be required to furnish surety company bond in the sum of fifty per cent (50%) of the amount of contract within thirty (30) days after official notice of award of contract and in accordance with the terms of specification No. 2342. The right is reserved to reject any or all bids. Drawings and specifications may be consulted at the Department of Architecture, Capitol, Albany, N. Y., and at the New York office of the Department of Architecture, Room 1224, Woolworth Building. Drawings and specifications and blank forms of proposal may be obtained at the Department of Architecture, Capitol, Albany, N. Y., upon the deposit of a certified check in the sum of $10, made payable to the State of New York for each set of plans and specifications, which check will be returned if plans and specifications are sent back in good condition to the State Architect, Lewis F. Pilcher, Capitol, Albany, N. Y.

Feb. 23, 1916.

Bids open March 23, 1916.

NOTICE TO CONTRACTORS.

ROAD IMPROVEMENTS

FLEMINGTON, N. J.

Notice is hereby given that sealed bids will be received by the Board of Chosen Freeholders of Hunterdon County, N. J., for the improvement

First—The Hoffmans-Lower Valley Road. Length 1.67 miles.

Second—The Clinton-West Portal Road, first section, 2.80 miles, in the County of Hunterdon, with water bound macadam, and opened and read in public at the Freeholders' Rooms in Flemington, N. J., on the twenty-third day of March, 1916, at the hour of eleven o'clock a. m.

Drawings, specifications and forms of bids, contract and bond for the proposed work prepared by Grant Davis, County Engineer, and approved by the State Commissioner of Public Roads have been filed at the office of said engineer at White House Station, N. J., and of said commissioner at the State House, Trenton, N. J., and may be inspected by prospective bidders during business hours.

Bidders will be furnished with a copy of the specifications and blue prints of the drawings by the engineer on proper notice and payment of cost of preparation. Bids must be made on the standard proposal forms in the manner designated therein and required by the specifications, must be enclosed in sealed envelopes, bearing the name and address of the bidder on the outside, addressed to the Director of the Board of Chosen Freeholders, and must be accompanied by a certified check or cash for $1,000.00 for each bid and be delivered at the place and on the hour above named. The standard proposal form is attached to the specifications, copies of which will be furnished on application to engineer.

By order of the Board of Chosen Free-

Bids open March 14, 1916.

NOTICE TO CONTRACTORS.

PASSAIC VALLEY SEWERAGE COMMISSIONERS

NEWARK, N. J.

Notice is hereby given that the Passaic Valley Sewerage Commissioners have designated Tuesday, the fourteenth day of March, nineteen hundred and sixteen, at two o'clock in the afternoon, as the time when they will meet at their usual place of meeting, Essex Building, Clinton Street, Newark, New Jersey, to receive proposals in writing, for constructing a part of Section 4 of the Outfall Sewerage Works, consisting of Sedimentation Basins, Effluent and Intake conduits, and all appurtenant work—all located in the City of Newark, Essex County, New Jersey.

Particulars that may enable Contractors to judge of the character or the work are given below:

APPROXIMATE QUANTITIES.

Item 1.—Earth excavation and refilling, in trench, for effluent and intake conduits, and appurtenant work, including regrading and disposal of surplus material, complete ....2,720 Linear Feet
Item 2.—Earth excavation and refilling for sedimentation basins, Venturi meter chamber, and all other structures, excavating for and maintaining mosquito ditches; and all other excavations save those included under Item 1; for all regrading and disposal of surplus material; and for all appurtenant work, etc. ....Lump Sum
Item 3.—Rock excavation in open excavations ....100 Cubic Yards
Item 4.—Concrete masonry, Class A, 1:2:4, with Portland cement, 20,000 Cubic Yards
Item 5.—Concrete masonry, Class B, 1:2½:5, with Portland cement mortar, 48,000 Cubic Yards
Item 6.—Boulder concrete masonry, Class C, with Portland cement, 1,000 Cubic Yards
Item 7.—Brick masonry, with Portland cement mortar... .....200 Cubic Yards
Item 8.—Timber piles, in place, 200,000 Linear Feet
Item 9.—Steel for reinforcement, etc., in place ....2,800,000 Pounds
Item 10.—Broken stone road surfacing, 8,000 Sq. Yards
Item 11.—Surface drains, vitrified pipe, complete, in place..........Lump Sum
Item 12.—Gallery piping; cast iron piping system for 20 in. sludge and 6 in. water mains, and 4 in. wrought iron air main, including all valves, specials, connections, etc., complete, in place. Lump Sum
Item 13.—Sludge main, 20 in., hub and spigot, cast iron pipe, including manhole pipes, plug drain valves and specials, complete, in place...........Lump Sum
Item 14.—Gate valves, six 60 in., and including all 60 in. cast iron piping in Venturi meter chamber in place, complete ....Lump Sum
Item 15.—Sluice gates, twenty-four, 24 in. x 36 in., including gate hoists, stem guides, etc., in place, complete, Lump Sum
Item 16.—Sluice gates for effluent controlling house; two, 5 ft. x 10 ft. and four, 6 ft. x 8 ft., with operating mechanism, complete and in place.......Lump Sum
Item 17.—Miscellaneous iron castings, such as floor plates, pressure covers, stop plank grooves, etc., complete and in place ....50,000 Pounds
Item 18.—Air compressors in administration wing, including all electric wiring, piping, etc., complete and in place, Lump Sum
Item 19.—Electric wiring and lighting system in sedimentation basin galleries and elsewhere, complete and in place, Lump Sum

Drawings, form of contract and specifications, and blank form for proposal, may be obtained at the Commissioners' office from William M. Brown, Chief Engineer.

The Commissioners reserve the right to reject any or all bids.

PASSAIC VALLEY SEWERAGE COMMISSIONERS.
JOSEPH H. QUIGG, Clerk.

CONTRACTING NEWS

Of Special Interest to Engineers, Contractors, Builders and Manufacturers of Engineering and Building Supplies

BANK clearings for February established a new record for the month and have been exceeded in the history of the country only by the clearings for the preceding four months. They represent an advance of 86 per cent over the low level of August, 1914, and of 34 per cent over February, 1914. Trade was more active last month than in January, and the report of the Federal Reserve Board for February shows continued improvement in every district and very prosperous conditions in several. The inability of the railroads to handle freight is the only unfavorable feature reported, and this in itself is an indication of the great volume of business. Although the railroads up to Jan. 1 have shown a decrease in earnings from the peak of October, the decrease is seasonal and to be expected. Business is yet beyond capacity and promises to continue so. Embargoes in the Eastern territory have been increased recently, and it will be months before the transfer elevators of these roads can be cleared. There is less and less talk of the uncertain character of the present industrial activity.

Of course, it takes time for this prosperity to make itself felt in construction work. However, capital involved in new incorporations last month was greater than in years, and industrial corporate financing was very heavy. It is said that the U. S. Steel Corporation will spend out of its record net earnings $50,000,000 for new construction this year. There are positive signs that railroad construction is on the upturn, though still far below normal. The increasing buying of steel for the strengthening and replacement of bridges and the enlarged terminal facilities for several Eastern roads under contract or contemplated are among these signs. The activity in fabricated steel is growing throughout the country despite higher prices and in the face of the fact that no large requirements for rapid-transit roads, such as kept the market alive last year, are included in the current business.

The steel industry continues to make large inroads on the labor market, and it was reported recently that one company was having difficulty in finding 3000 machinists in Philadelphia and was dragging the country for 15,000 additional men. As indicated last week, the cement mills, especially in the Eastern territory, fear that they will be unable to increase their present output because it is impossible to secure additional labor. The New York State Department of Labor reports that January payrolls in the state carried 18 per cent more employees and 28 per cent more wages than was the case a year ago. While employment in the building trades in that state has shown the usual seasonal falling off, the percentage of employment is still much higher than at the end of January in either 1914 or 1912.

Buildings

Contracts were awarded for quite a number of small school buildings last week. A contract for erecting a $250,000 laboratory and store at Pensacola, Fla., has been awarded. The construction of a $200,000 mill building has been contracted for at Ridgedale, Tenn. The erection of an armory contracted for at Akron, Ohio, will cost $142,000. A general contract for the court house at Wilmington, Ohio, has been let at about $200,000. The construction of a hotel building to cost $400,000 has been contracted for at Columbus, Ohio. Bids are reported desired for constructing a $200,000 bank building at New Albany, Ind.

A large amount of additional building construction came in sight last week. An electric light company at Worcester, Mass., is to build a $250,000 addition to its power plant. Plans have been prepared for a $200,000 residence at Great Neck, L. I. Plans are being prepared for a large sugar refinery in Brooklyn, N. Y. Plans are being prepared for a $275,000 store in New York City, and plans have been filed in the same city for a $200,000 mercantile building. Plans are being prepared for a $150,000 power house at Dover, N. J. The construction of a $300,000 chemical plant is contemplated at Niagara Falls, N. Y.

Plans are being prepared for a $200,000 college building at Morgantown, W. Va. A contract is to be let shortly for a $200,000 auditorium at Black Mountain, N. C. Plans are being prepared for a $200,000 building for Ohio State University at Columbus. Plans have been prepared for a $1,250,000 office building at St. Paul. The Omaha Board of Education has sold $500,000 school bonds. At El Paso, Tex., a contract is to be let for erecting a $300,000 store building, and plans are to be prepared for a $200,000 cathedral. An architect has been selected for a college building to cost $300,000 at Spokane, Wash. It is reported that a company is being formed to construct an $8,000,000 chemical factory and dye works near Los Angeles.

Bridges and Roads

A contract for erecting the superstructure of the Union Pacific bridge over the Missouri River at Omaha has been awarded. Bids were to be opened March 10 for the construction of a $250,000 bridge at Worcester, Mass. Bids are desired for constructing a new bridge and for removing and replacing an old bridge at Bridgeport, Conn. Bids are desired for a $180,000 railroad bridge over the Schuylkill River at Poplar Neck, Pa. The bridge work at Miami, Fla., will be relet, all bids having been rejected. The bridge at Mankato, Minn., will cost $100,000 and is to be let March 27. An appropriation of $240,000 has been made for the North Avenue bridge at Milwaukee.

Paving work last week showed a good seasonal increase in activity. Contracts amounting to $105,000 were approved by the Board of Awards at Baltimore. County and city paving contracts amounting to $94,000 have been awarded at Cincinnati. Paving work to cost $65,000 has been contracted for at Georgetown, Ill. A paving contract amounting to $95,000 has been let at Spencer, Iowa. A large asphalt paving contract has been awarded at Macon City, Iowa. Paving work to cost $100,000 has been contracted for at Douglas, Ariz. Highway contracts amounting to $60,000 have been bid on at Los Angeles.

Bids are desired at Newark, N. J., for 53,000 sq. yd. of paving. Paving work to cost $100,000 was to be let March 10 at Asheville, N. C. Bids are to be opened to-day for constructing 28 miles of road in Pontotoc, Miss. Bids will be opened early next month for constructing 13 miles of asphalt road at Jonesboro, Ark. Bids will be received March 25 for laying 54,000 sq. yd. of paving at Racine, Wis.

New paving, repairs and sidewalks to be constructed this year at Buffalo will cost $1,330,000. Road bonds amounting to $143,000 have been sold at Trenton, N. J. Plans for paving work to cost $115,000 have been approved at Baltimore. Street improvements contemplated at South Bend, Ind., will cost $305,000. Contracts for 122,000 sq. yd. of paving are to be let early in the week by Milwaukee. Road bonds totaling $800,000 have been sold at San Antonio. A section of the Columbia highway near The Dalles, Ore., will be constructed by the State Highway Commission at a cost of $430,000.

Waterworks and Sewers

Water-main construction and water pipe contracted for at Cincinnati will cost $174,000. Waterworks extensions costing $60,000 have been contracted for at Bloomington, Ind. A contract for steel water pipe amounting to $251,000 has been awarded at Los Angeles. Bids are desired at Lafayette, Ind., for sewer work to cost $73,000.

Sewer construction recommended at Lynn, Mass., will cost $800,000. Buffalo will spend $330,000 this year for sewer construction. A contract for constructing a sewer system including 47,000 ft. of pipe will be let soon at Alton, Ill. The city of Omaha has sold $200,000 sewer bonds. The construction of a filtration plant at Great Falls, Mont., for which $150,000 has been voted will be contracted for this month. A sewer to be rebuilt at Portland, Ore., will cost $250,000. The sum of $105,000 has been voted at Covina, Cal., for constructing waterworks. Plans have been prepared for sewers to cost $108,000 at Richmond, Cal.

Miscellaneous

The construction of another subway section has been contracted for in Boston at $364,000. A contract for building 12 miles of railroad has been awarded at Ebensburg, Pa., and another railroad contract for 8 miles of line has been awarded at Chester, Va. The construction of a breakwater to cost $119,000 has been contracted for at Manistee, Mich. Jetty work to cost $237,000 has been contracted for at Dallas, Tex.

Bids are desired March 18 at Buffalo for considerable grade crossing elimination work. Part of the plans for a $400,000 pier development at Norfolk have been approved by the War Department. Plans are to be prepared for railroad crossings costing $250,000 at Chillicothe, Ohio. It is reported from Columbia, Mo., that the construction of an electric railway from St. Louis to Kansas City is under consideration. Park improvements to be made at Houston, Tex., will cost $250,000.

WATERWORKS

PROPOSED WORK.

Hartford, Conn.—Water Bd. decided to proceed at once with laying of a pipe line from 30-in. main in Park Street by way of Lafayette and Trinity Streets across Park River, to connect with 24-in. main in Jewell Street, estimated cost $12,850.

Gratz, Pa.—Franchise granted to Johnson Construction Company, Harrisburg, for constructing water works and an electric light plant.

Pennsylvania—Permits issued by State Department of Health, Harrisburg, relative to water works as follows:

Beaver Falls (Beaver Valley Water Co.)—Approving plans for temporary changes in coagulant and filter equipment.

Cecil Twp., Washington Co. (Pittsburgh Coal Co.)—Approving plans for water filtration and softening plant.

Verona (Suburban Water Co. of Allegheny Co.)—Approving plans for additional filter unit.

Hummelstown (Hummelstown Consolidated Water Co.)—Requiring improvements at filter plant.

Middletown (Middletown and Swatara Consolidated Water Co.)—Requiring improvements at filter plant.

Scranton, Pa.—Scranton Gas & Water Co. plans to lay 16-in. high-pressure water supply main on Lackawanna Avenue, Franklin Avenue and Mulberry Street, cost about $15,000. During summer company will complete installation of meters for domestic consumers in Archbald and Winton; cost $12,000.

Mount Rainier, Md.—See "Sewerage and Sewage Disposal."

South Charleston, W. Va.—Contract soon to be let for constructing water works to cost $30,000. Arthur Giessler, Engineer, 6103 Reibold Building, Dayton, Ohio.

Charleston, W. Va.—Engineer engaged by city to prepare plans and specifications for water plant and submit estimates of cost; also estimate value of West Virginia Water & Electric Co.'s plant.

Hickory, N. C.—Citizens voted $10,000 bonds for water works extension.

Pass Christian, Miss.—Municipal improvements including water works, street paving, city hall and street electric lighting are contemplated. Bonds will be sold March 11. Xavier A. Kramer, Engineer, Mahnolia; W. A. Terrell, City Clerk.

Knoxville, Tenn. — Improvements to water works are contemplated, to include 15,000,000-gal. pump, extension of water mains to suburbs, installation of meters and general rebuilding of water plant; probable cost $500,000. Address Supt. Water Works.

Rogersville, Tenn.—Committee (W. D. Harmon, Chairman) appointed to investigate proposition to construct water works.

Cleveland, Ohio.—City Finance Director, C. J. Neal, has sold $500,000 water works bonds.

Dennison, Ohio.—Dennison Water Supply Co. will install another 1,000,000-gal. filtration unit at pumping station south of Dennison.

Greenwich, Ohio.—At the Municipal Water and Light Plant improvements are to be made at the water works, including new suction line, new pump, lower pumps, addition to building, new spillway, excave reservoir, and new steam line from boilers to pumps. Provided plans are approved by State Board of Health. F. Daniels, City Clerk.

Portsmouth, Ohio.—The Water Works Advisory Committee decided to recommend a reinforcement of present city mains with a second or duplicate line connecting pumping station with city.
City Council voted March 1 to issue $40,000 bonds for constructing and extending water works. Louis A. Zucker, City Clerk.

Ravenna, Ohio.—Bonds for $40,000 for water works improvements will be sold March 27 by W. H. Linton, Director of Public Service. It is proposed to construct a diversion dam, 3½ miles of conduit and water treatment plant.

Springfield, Ohio.—George Cotter, Supt. Water Dept., in his annual report recommends steps be taken to extend city's water supply.

Akron, Ind.—Town Board is considering plans and approximate cost of installing water works.

Wadena, Minn.—City Council reported considering extensions to water works and a sewerage system, cost $11,000 and $25,000 respectively.

Arma, Kan.—The water works system will cost $9,000 and will include 11,550 ft. 4 in. c. i. pipe valves, fittings, etc., 11 hydrants, 4 double nozzle. Albert C. Moore, Engineer, Frisco Building, Joplin, Mo.; Sam Buchanan, City Clerk.

Pawnee City, Neb.—Election to be held to vote on issuing bonds for constructing extensions to water system and a sewer system.

Unadilla, Neb.—Election will probably be held to vote bonds for constructing water works.

Denton, Mont.—Town Council considering constructing water works.

Great Falls, Mont.—Reported contract for constructing filtration plant for city water system, for which $150,000 bonds were recently voted, will be let early in March.

Houston, Tex.—Attorney General has approved the following city bonds: $36,000 water works; $34,000 paving, and $30,000 bridges.

Sherman, Tex.—Engineer engaged to investigate water works, including water supply, and make recommendations relative to more economical operation, construction of a reservoir, etc. Karl M. Mitchell, City Manager.

Texarkana, Tex.—Texarkana Water Corporation will spend $30,000 in improvements, including mains.

Cleveland, Okla.—The proposed water works will include 20,000 ft. 10-in. c. i. steel flow line, 500,000-gal. receiving reservoir, 500,000-gal. filter plant, 100,000-gal. tank or tower 100 ft. high, 35,000 ft. pipe in distributing system, 4 turbine pumps with motor, etc. Election to be held March 15. Albert C. Moore, Engineer, Frisco Building, Joplin, Mo.; David Heller, City Clerk.

Dewar, Okla.—Ordinance passed authorizing issuance of $40,000 bonds for constructing water works. Address J. W. Fowler, Pres. Bd.

Ringling, Okla.—Citizens Feb. 25 voted in favor of issuing $50,000 bonds for constructing water works. Contract will be let about April. McIntosh & Wallam Co., Engrs., State Natl. Building, Oklahoma, Okla. Frank F. Kilch, Pres. Board of Trustees.

Alamogordo, N. M.—Election to be held April 4 to vote $150,000 bonds for water works. John R. DeMien, Recorder.

Springer, N. M.—Election to be held April 4 to vote $32,000 bonds for constructing water works. Address Village Clerk.

Olympia, Wash.—Water works bonds amounting to $110,000 have been sold.

Seattle, Wash.—City Utilities Committee of City Council recommends appropriating $10,000 from water fund for reconstruction of Cedar River Pipe Line No. 1.
City Utilities Commission of City Council recommended issuance of $50,000 water bonds for constructing standpipe and water pumping station at Maple Leaf Reservoir. Mains and hydrants to be improved; cost about $80,000.

Portland, Ore.—Reported St. Johns Water Works & Lighting Co. accepted city's offer for plant.

Covina, Cal.—Citizens voted $105,000 bonds for constructing water works. F. E. Trask, Engineer, 616 Union Oil Building, Los Angeles.

Oceanside, Cal.—City Trustees will sell $12,000 bonds for installing iron water mains where wood pipe is now used.

Richmond, Cal.—The Directors of the Municipal Water District have adopted the report of J. H. Dockweiler, Engineer, San Francisco, for the establishment of a municipally owned Water System, estimating cost at $2,742,000. The engineer recommends that water be brought from Marin water district and piped under the bay at Point San Pablo; also favors purchase of the distributing system of the People's Water Company.

San Diego, Cal.—Election to be held March 13 to vote $275,000 bonds for constructing Upper-Lower Otay pipe line, restoration of concrete Duluza conduit, restoration of pumping plants in Missouri Valley, and reconstruction of pipe lines in Sweetwater and Otay Valleys, including bridges to carry the pipe lines. H. M. Lockwood, Mgr. of Operations.

Santa Maria, Cal.—Citizens voted $72,000 bonds to acquire and improve Domestic Water Co.'s system.

BIDS DESIRED.

New York, N. Y.—Until March 16, by William Williams, Commissioner of Water Supply, Gas & Electricity, for furnishing, delivering, unloading, stacking and storing c. i. pipe, specials and valves and double-nozzle fire hydrants in Boroughs of Brooklyn and Richmond. Total security, $20,100.

Atlantic City, N. J.—Until March 16, by Department of Parks and Public Property for gate and check valves advertised in Engineering Record.

Macon, Ga.—Until March 20 by Board Water Commissioners for one steam-driven centrifugal pump of 5,000,000 gal. capacity; also one horizontal triple expansion crank and flywheel pumping engine of 5,000,000 gal. capacity, advertised in Engineering Record.

Baltimore, Md.—Until March 29 by Board of Awards for furnishing and delivering valve and meter box castings, vitr. pipe and concrete, pipe and rings, to Water Department, advertised in Engineering Record.

Indian Head, Md.—Until Apr. 8 by Bureau Yards and Docks, Navy Dept., Washington, D. C. (William M. Smith, Acting Ch.) for Spec. No. 2217, for high-pressure fire system at the Naval Proving Grounds, Indian Head, Md.

Washington, D. C.—By Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing supplies as follows: Brooklyn, N. Y., Sch. 9382, horizontal centrifugal pumps; Boston, Mass., Sch. 9397, miscellaneous c. i. pipe fittings; Mare Island, Cal., Sch. 9401, miscellaneous malleable iron fittings; Philadelphia, Pa., Sch. 9398, pressure reducing valves, and Charleston, S. C., Sch. 9384, electric traveling hoist.

Lakeland, Fla.—Reported desired until March 27 by Board Bond Trustees (R. Boulware, Secy.) for constructing water reservoir, piping, valves, etc. Schofield Eng. Co., Commercial Trust Building, Philadelphia, Pa., Engrs.

Ocala, Fla.—Until March 30 by City Council (George A. Nash, Pres.) for constructing water plant and electric light and power system. Twombly & Henney, Engrs., 55 Liberty Street, New York City.

New Ulm, Minn.—Until March 20 (extension of date) for new pump head and repairs to old pump head. Address City Engineer.

Emporia, Kan.—Until March 24, by Fred H. Smith, City Clk., for furnishing material and improving water works to consist of steel tank and tower, testing pumps, valves, filter house, etc. Black & Veatch, Engrs., 507 Inter-State Bldg., Kansas City.

Canton, Mo.—Reported desired until March 20, by Henry Cluskey, Town Clk., for furnishing material and improving water works to consist of 10,825 lin. ft. of 4 and 6-in. water pipe, 7000 lb. c. i. specials, 18 hydrants, etc. A. P. Davis, Consulting Engr., Windsor, Mo.

Drummondsville, Que.—Reported desired until March 12 by Walter A. Moisam, Town Clk., for constructing pumping station and gravity filters.

London, Ont.—Reported desired until March 15 by Public Utilities for water supply and service mains in various streets.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Hartford, Conn.**—Contract for furnishing meters awarded by Water Board to Hersey Mfg. Co., Boston, Mass.

★**Lewiston, N. Y.**—Contracts for water works improvements (bids opened Feb. 15), awarded as follows: C. i. pipe, U. S. C. I. Pipe & Foundry Company, 71 Bway, New York, $14,661; laying pipe, John Peteossi Company, Rochester, N. Y., $9,186; pumps, Root Neal Company, Buffalo, $920; standpipe, Chicago Bridge & Iron Wks., 30 Church Street, New York, $3,525; valves, Ludlow Valve Mfg. Company, Troy N. Y. F. E. Guard, Village Clerk.

★**Rochester, N. Y.**—Contract for supplying corporation cocks for Water Works Bureau for season of 1916 awarded by Board Contract and Supply to H. Mueller Mfg. Co., Decatur, Ill. U. S. Cast Iron Pipe & Foundry Co., 957 East Ferry Street, Buffalo, submitted bid at $60 per ton for supplying special castings and $29 per ton for supplying pipe for Water Works Bureau.

★**Beaver, Pa.**—Contract awarded Pittsburgh-Des Moines Steel Company, Fourth and Ross Streets, Pittsburgh, for a 40,000-gal. steel water tank for county home near Bellowsville, at $3,425.

★**Greenville, Pa.**—Contract awarded by Greenville Water Company for 250,000 gal. steel tank for high service district to Chicago Bridge & Iron Works of Greenville. Chester & Fleming, Engrs., Pittsburgh.

★**Lake Charles, La.**—Contracts awarded as follows by Lake Charles Ry., Light & Water Works Co. for improvements: Reservoir 200,000 gal. capacity, reinforced concrete, to H. S. Seaby; three 8-in. wells, 700 ft. deep, to Lane & Bowler Co., and pipe, to Ahrens & Ott Mfg. Co.; cost $25,000.

Athens, Ohio.—Following are three lowest bids opened Feb. 29 by Director of Public Service for constructing reservoir for the water works: Charles P. Kircher, Athens, $27,966; Wilson & Beckler, Athens, $28,984, and Bart Davidson, Athens, $29,000. Furnishing and laying water mains, 6-in. pipe: Shartle Machine Co., Columbus, $10,811; Bart Davidson, Athens, $11,367, and Monarch Construction Co., Columbus, $12,564.

★**Attica, Ohio.**—Contract for improvements to water works, including pipe line, filtration plant, etc. (bids opened Feb. 24), awarded Kines Omlor Company, Fostoria; Frank Stutzman, Village Clerk.

★**Cincinnati, Ohio.**—Contracts awarded Feb. 29 by City Board of Control as follows: Laying water mains in various streets for year 1916 to W. H. Bertsch, Cincinnati, at $37,647; manufacturing pipe for 36-in. loop main, and also pipe for 36-in. main in Eastern Avenue, awarded U. S. Cast Iron Pipe & Foundry Co., Eddystone, at $65,700 and $81,010, respectively.

★**Cleveland, Ohio.**—Contract awarded by Board of Control for tile and concrete floor in Division Avenue Pumping Station to Cleveland Fireproof Construction Co., 650 Rockefeller Building, at $8,570. (Bids opened Feb. 23.)

★**Dayton, Ohio.**—Contract for erecting stand pipe (bids opened Feb. 28) awarded Chicago Bridge & Iron Co., Chicago, Ill., at $22,800, 90 days. Other bidder, Pittsburgh-Des Moines Bridge Co., $23,100, 270 days. F. H. Wright, Superintendent.

★**Bloomington, Ind.**—Contract for constructing extension to water works to consist of about 17,500 ft. 12-in. mains to connect old with new plants and build additional pumping station awarded to Thomas Hardin of Olney, Ill., at $59,777. Bids opened Feb. 24 by Leonard Springs Water Co.

★**Ligonier, Ind.**—Contract for 400 water meters (bids opened Feb. 24) awarded Pittsburgh Meter Co., East Pittsburgh, Pa. R. E. Nament, City Clerk.

★**Kewaunee, Wis.**—Contract for water works awarded Gray Robinson Construction Company, Manitowoc. James W. Cain, City Clerk.

★**Oshkosh, Wis.**—Council passed ordinance appropriating $50,000 additional toward construction of the filtration plant, and contracts for said plant have been awarded Larsen Construction Company, Oshkosh, for filtration building at $55,500, and for cover of reservoir at $11,800; Roberts Filter Manufacturing Company, Darby, Pa., $40,000 for filtration appliances and accessories; Wausau Iron Wks., Wausau, elevated tank at $7,950.

★**Mason City, Iowa.**—Contract for furnishing 18,000 ft. 6-in., 2800 ft. 8-in. and 5400 ft. 10-in. Class B pipe awarded U. S. C. I. Pipe Co., 30 Church Street, New York, at $29.25 per ton. Next three bidders: American C. I. Pipe Co., 1 Broadway, New York, $30.26; Hawkeye Supply Co., Mason City, $30.25; Glamorgan Pipe & Fdry. Co., Lynchburg, Va., $31. W. A. Judd, Supt. Water Works.

★**Los Angeles, Cal.**—Contract for furnishing steel pipe for laterals in Los Angeles Water District No. 3 awarded by Board of Supervisors to Los Angeles Mfg. Co., 2500 Leonard Street, at $251,375. Other bidders: Baker Iron Works, $310,865; Western Pipe & Steel Co., $319,198, and Lacy Mfg. Co., $322,734. All bids opened same time for steel pipe have been rejected; new bids will be asked.

★**Los Angeles, Cal.**—Contract awarded American Cast Iron Pipe Co., Birmingham, Ala., for furnishing 1600 tons c.-i. pipe at $38.30 per ton for 4-in., 16-ft. lengths; $35.30 for 6-in., 16-ft lengths; $34.30 for 8-, 10-, 12-in., shorter lengths.

★**Ottawa, Ont.**—Contracts for water works supplies awarded as follows: Special pipe castings to Thomas Lawson & Son, Ottawa; lead pipe, McKinley & Northwood, Ottawa; valves, McDougalle, Ltd, Ottawa, and General Supply Company, Ottawa; c. i. pipe National Iron Wks., Toronto; brass work, General Supply Company, Ottawa. R. L. Haycock, Water Works Engr.
★Contract reported awarded Thomas McLaughlin, Somerset Street, Ottawa, for pump house and sub-station for Water Works Department. R. L. Haycock, Water Works Engr.

SEWERAGE AND SEWAGE DISPOSAL

PROPOSED WORK.

Lynn, Mass.—Special Joint Sewage Committee, consisting of State Dept. of Health and Municipal Council, recommends extending present outfall sewer nearly 3 miles to a point 2-3 mile southwest of Bass Point with an intervening pumping station to take care of 50,000,000 gals. per day. Outfall sewer to be 60 in. in diameter; estimated cost $800,000.

Buffalo, N. Y.—During the coming year about 10 miles of sewers costing $330,000 will be laid. George H. Norton, City Engineer.

Buffalo, N. Y.—City Council voted to ask new bids for constructing extension of Seneca-Swan Street sewer. Bid at $110,000 recently accepted withdrawn.

Cooperstown, N. Y.—Election will probably be held on March 14 to vote $20,000 bonds for constructing sewer system. Address Village Clerk.

Hamburg, N. Y.—Construction of a sewage disposal plant is under consideration. D. C. Pierce, Chmn. Committee.

Rochester, N. Y.—Construction of a separate sewage disposal plant for the Twenty-third Ward, formerly Charlotte, is under consideration. Address City Engineer.

Bay Head, N. J.—Remington & Vosburg, Camden, are engineers for the proposed sewerage system. Cost, $60,000.

Sussex, N. J.—Mayor Lawrence appointed a commission with Charles E. Stickney member to engage engineer to investigate methods for installing sewer system.

Lansdale, Pa.—Contract soon to be let for constructing a sewer system costing $225,000. Address City Clerk.

Pennsylvania.—Permits issued by State Board of Health, Harrisburg, for following sewer improvements:
Doylestown Township, Bucks County (National Farm School)—Sewage treatment.
Potter Township, Beaver County (Overseers of the Poor)—Sewage treatment.
Jersey Shore—Approving plans for sanitary sewer system and pumping station.
Lebanon—Approving plans for additions to sewage treatment works.
Mt. Pleasant—Approving plans for sewer extensions.
Philadelphia — Approving plans for sewer extensions.
Scranton (Hospital for Contagious Diseases)—Approving plans for treatment works.
East Conemaugh—Requiring comprehensive sanitary sewer plans.
Oakhurst — Requiring comprehensive sanitary sewer plans.
Lewistown—Approving plans for sewage treatment.

Hughestown (P. O. Pittston), Pa.—Borough Council considering constructing sewer to extend from Centre Street, along Parsonage Street, to connect with Pittston city sewer; cost $20,000.

Mt. Rainier, Md.—House passed bill authorizing construction of waterworks and sewerage system in Mt. Rainier.

Savannah, Ga.—Bonds for $400,000 will be sold March 16 by city (W. J. Pierpont, Mayor) for house drainage and storm sewer system.

Copperhill, Tenn.—Election to be held about April to vote on constructing a sewer system. A. S. Clarke, City Clerk.

Flint, Mich.—No bids received March 2 for constructing sewers, work will be done by day labor. D. E. Newcombe, City Clk.

Alton, Ill.—Contract will be let about May 1 for constructing sewer system, including 41,320 ft. 6 to 24 in. pipe and 6155 ft. 33 to 66-in. segment block sewer. T. H. Landon, City Engineer.

Alton, Ill.—Board Local Improvements is considering plans for East End Sewer; estimated cost $103,977. Sewer will require 34,000 ft. main sewer and 12,000 ft. laterals. T. H. Landon, City Engineer.

Chrisman, Ill.—Contract will be let some time in April for constructing sewer system to cost $11,000. C. P. Lycan, Designing Engineer, Paris; J. B. Lindley, Superintendent of Streets; Frank McCuddy, City Clerk.

Milwaukee, Wis.—Election to be held in April to vote $1,560,000 bonds to complete the sewage disposal plant and $75,000 bonds for a municipal street-lighting system.

Delphos, Kan.—Preliminary plans being prepared by Black & Veatch, Consulting Engineers, Kansas City, Mo., for Imhoff tank and sand filters for proposed sewer system.

Ellis, Kan.—W. E. Hulse & Company, Hutchinson, are engineers for the proposed sewer system. N. T. Payne, City Clerk.

Ainsworth, Neb.—Election to be held in May to vote $19,000 bonds to construct a sewerage system.

Grand Island, Neb.—Plans completed by Grant & Fulton of Lincoln for constructing sewerage and drainage system for city; cost about $250,000.

Omaha, Neb.—City has sold $200,000 sewer bonds (address City Engineer), and $50,000 park bonds (address J. B. Hummel, City Commissioner).

Pawnee City, Neb. — See "Water Works."

Kahoka City, Mo.—Election will probably be held to vote bonds for constructing sewer system. E. T. Archer & Company, Consulting Engineers, Kansas City, Mo. Albert McKee, City Clerk.

Anson, Tex.—Henry Exall Elrod, Southwestern Life Bldg., Dallas, engaged to prepare plans for a sewage disposal plant for the Jones County sewer system.

Dallas, Tex.—Election to be held April 4 to vote $300,000 bonds for constructing storm sewers and culverts.

Gatesville, Tex.—Attorney General at Austin has approved the $22,500 sewer bond issue.

Palestine, Tex.—City officials considering construction of a sewer system. P. E. McDonnell, Engineer.

Stamford, Tex.—Henry E. Elrod, Southwestern Life Building, Dallas, engaged to prepare plans and supervise construction of a disposal plant for Stamford Sewer Company.

Walla Walla, Wash.—Construction of sewerage system in northeastern section of city, covering Lennon, Ennis and Brown additions, contemplated by City Commissioners. M. A. Power, City Clerk; W. H. Rehorn, City Engineer.

Astoria, Ore.—City Council voted to construct sewerage and drainage systems in Sewerage and Drainage Dist. No. 2, requiring installation of 6 to 12 in. salt glazed vitrified pipe. Olof Anderson, City Auditor.

Portland, Ore.—Reported steps to be taken at once to reconstruct Tanner Creek trunk sewer; estimated cost $250,000. Address Commissioner Public Works.

East San Diego, Cal.—Election will probably be called soon by City Trustees for issuing bonds to construct sewer system.

Lompoc, Cal.—Haviland & Tibbetts, Alaska Commercial Building, San Francisco, Cal., are making preliminary survey for installation of sewer system. Probable cost $40,000.

Pasadena, Cal.—Clarence P. Day, Engineer, Boston Bldg., is preparing plans for sub-dividing 65 acres on San Gabriel Boulevard into high-class residential lots for Harry G. Holabird & Company, Los Angeles. Improvements will consist of macadam streets, cement curbs, gutter and walks, conduits for light, power and telephone wires, and septic tank and sewerage system. S. J. Ornum of Pasadena is engineer for sewer system.

Richmond, Cal.—Preliminary plans prepared for the proposed storm water and sanitary sewers to include 1,700 ft. 24-in. pipe sewer, 1300 ft. 3 ft. 6 in. to 4-ft. circular, 7000 ft. 3 ft. 8 in. x 4 ft. 6 in. to 4 ft. 2 in. x 5 ft. 3 in., egg shaped, and 2100 ft. 3 ft. 8 in. x 8 ft. rectangular concrete sewers; cost, $108,000. H. D. Chapman, City Engineer.

San Diego, Cal.—Residents of Ocean Beach District have petitioned city council to form sewer district to be bonded for $50,000 for constructing sewers. Address George Cormwell, City Engineer.

Peterborough, Ont.—Plans not yet completed for the sewage disposal plant. R. H. Parsons, City Engineer. S. R. Armstrong, City Clerk.

BIDS DESIRED.

New Bedford, Mass.—Until March 22 by Mayor and Board Aldermen and Committee on Roads, Bridges and Sewers for constructing sewage well and pump station for Intercepting Sewer System. William F. Williams, Consulting Engr., Room 203 Municipal Bldg.

Brooklyn, N. Y.—Until March 16 by L. H. Pounds, Borough President, for constructing sewers in Chester, Seventy-eighth Streets, Riverdale, Hegeman and Twentieth Avenues. Security $3,100.

Buffalo, N. Y.—Until March 15, by Arthur W. Kreinheder, Superintendent, Department of Public Works, for constructing 10, 12 and 24-in. tile sewer in Downing Street, 10 and 12-in. sewer in Algonquin Street, and 15-in. tile sewer in Stevens Street.

New York, N. Y.—Until March 30, by Douglas Matthewson, Pres. Bronx Borough, for constructing concrete and vitr. pipe sewers and appurtenances in portions of Westchester Avenue, Blondell Avenue, property of N. Y., N. H. & H. R. R., East Chester Road, and numerous other streets. Total security $450,000.

Newark, N. J.—Until March 16, by Board Street & Water Commissioners (M. R. Sherrerd, Ch. Engr.), for constructing sewers in High and River Streets.

Louisville, Ky.—Until March 17, by Board Public Works (Roger G. McGrath, Secy.), for construoting sewers in F Street and Brandies Avenue. Samples of vitr. block must be submitted.

Lakewood, O.—Until March 30, by N. C. Colabish, Director Public Works, for constructing a sewage treatment plant advertised in Engineering Record.

La Fayette, Ind.—Until April 5. by E. J. Vaughan, City Clerk, for sanitary sewers, 18.211 ft. 15 to 36-in. vitri. pipe, segment block or reinforced concrete; cost $73,819. H. B. Overesch, Jr., City Engr.

Logansport, Ind.—See "Paving and Roads."

Michigan City, Ind.—Until March 21, by Board Public Works for constructing sewers in Eleventh, Oak, and other streets.

Keota, Iowa.—Until March 22 (readvertisement), by W. F. Stoutner, Town Clerk, for constructing about 1½ miles of 8 and 10-in. sanitary sewers, 12 concrete or brick manholes, 6 flush tanks with fittings and piping complete. Iowa Engineering Co., Engineers, Clinton, Iowa.

Iola, Kan.—Until 5 P. M., March 13 (readvertisement), by F. R. Bartlett, City Engineer, to be opened March 14, for 7035 ft. 8-in. vitr. pipe, manholes, etc.

Lincoln, Neb.—See "Paving and Roads."

Houston, Tex.—Until March 16, by City Secretary, for furnishing pumps, electric motors, blowers, and Diesel oil engines with necessary appurtenances to be used in connection with the sewage disposal plant. E. E. Sands, City Engr.

Long Beach, Cal.—Reported desired until March 14, by H. C. Waughop, City Clk., for constructing vitr. clay pipe sewers in about thirty-eight streets.

Brantford, Ont.—Until March 13, by Ald. Geo. Ward, Chmn. Bd. Public Works, for road oil and sewer pipe for year 1916. T. Harry Jones, City Engr.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★Hartford, Conn.—Contract for two centrifugal sewage pumps for Sheldon Street pumping station awarded Goulds Mfg. Co., Boston, Mass., at $3,884 (bids opened Feb. 15). R. N. Clark, City Engineer.

★Youngstown, Ohio.—Reported contract awarded Deli & Serafina, Youngstown, for constructing sewer in Market St., at $10,480.

★Kendallville, Ind.—Following are four lowest bids opened February 29 by Common Council for constructing the south side and west side district sanitary sewer, requiring about 21,891 ft. 8 to 24 in. vitr. tile sewer, 45 manholes, 20 flush tanks, 140 house drains, etc., and a sewer lift (a) sewer system; (b) sewer lift: McLaughlin Contracting Company, Pittsburgh, Pa. (a), $26,219 (awarded contract); Moreno Brooks, Burkham Construction Company, St. Louis, Mo. (b), $3,370 (awarded contract); P. O'Leary & Sons, Terre Haute, Ind. (a), $26,702; (b) $3,600; John F. Hipskin, Richmond, Ind. (a), $27,998; (b) $3,400; H. D. Hallet, Aurora, Ill. (a), $27,852; (b) $5,000; Willis E. Sawyer City Engineer.

Anna, Ill.—Lowest bid opened by State Board of Administration, Springfield, for constructing a septic tank at Anna State Hospital, submitted by Hoeffken Brothers of Belleville, at $9,100.

★Strawberry Point, Iowa. — Contract awarded O. G. Kringle, Dubuque, for constructing sewers (bids opened Feb. 29), at $17,324. Next three lowest bidders: A. C. Comstock, Cedar Rapids, $17,537; R. C. de La Hune, Cedar Rapids, $17,683, and Wm. Danforth, St. Paul, Minn., $17,745. G. F. Scofield Acting Town Clerk.

★Pierce, Neb.—Contract for constructing sewerage system awarded Norfolk Bridge & Construction Co., Norfolk, Bruce & Sturdeven, Engineers, 430 Bee Building, Omaha.

★Houston, Tex.—Contract for constructing Second Ward sewer system awarded Freund & Quay, Houston, at $98,382. (Bids opened Feb. 7.)

★Contract for constructing Scott Street sewer awarded Houston Construction Company, Houston, at $17,189.

Los Angeles Cal.—Following are four lowest bids opened recently by city for constructing sewer in Normal Avenue: Mike Chutuk, 3107 Upper Boulevard, $18.980; B. Z. Wucetich, $20,500; Peter S. Tomich $22,000, and Adam Dalmatin, $22,021.

BRIDGES

PROPOSED WORK.

Buffalo, N. Y.—Public Service Commission approved of agreement between New York Central and International Ry. Co. for two bridges over which Buffalo & Niagara Falls line will cross the Central tracks.

Frankfort, N. Y.—Citizens Feb. 29 voted $11,600 bonds for repairing bridges on Moyer Creek Road. Address Board of Supervisors.

Warren, Pa.—Reported County Commissioners have applied to State Water Supply Commission for permission to construct a bridge across Allegheny.

West Chester, Pa.—County Commissioners propose constructing several new bridges and repairing and reconstructing several other bridges throughout the county.

Cumberland, Md.—Bill has passed the House authorizing city of Cumberland to hold an election March 21 to vote $60,000 bonds for constructing a bridge across Wills Creek at Valley Street, also bridge across Wills Creek at Baltimoro Street.

Charleston, W. Va.—All bids opened by County Commissioners Feb. 19 for constructing steel bridge over Elk River at Queen Shoals rejected. According to reports, new bids will probably be received later in season.

Miami, Fla.—See "Prices and Lettings."

Chattanooga, Tenn. — William C. Spiker, Candler Building, Atlanta, Ga., retained as construction engineer on finishing the $1,000,000 Market Street Bridge over Tennessee River, at Chattanooga.

Cleveland, Ohio.—County Commissioners have sold $500,000 bonds for initial start on subway approach to high-level bridge nearing completion over Cuyahoga River.

Dayton, Ohio.—City Bonds amounting to $304,000 have been sold, including $115,000 for Keowee St. bridge and $50,000 for workhouse.

Sidney, Ohio.—Reported Big Four R. R. (C. A. Paquette, Ch. Engr., Cincinnati, Ohio), will rebuild bridge at North Street over Miami River.

Somerville, Ohio.—A concrete bridge 240 ft. long, 18 ft. wide, is to be constructed over Seven-Mile Creek at Somerville; cost, $18,000. Fred Hammerle, County Surveyor, Hamilton.

Milwaukee, Wis.—Common Council Feb. 28 passed ordinances appropriating $240,000 for the new North Avenue bridge and $50,000 for an animal house in Washington Park Zoo.

Iowa City, Iowa.—Bridge is to be constructed over railroad tracks on College St. Rock Island R. R. Co. and city said to be interested.

Duluth, Minn.—City Commissioners (W. H. Borgen, Clerk) agreed to erect bridge over Chester Creek during 1917; cost $40,000.

Poplar Bluff, Mo.—The bridge to be constructed across Black River will consist of a span 150 c. to c. with approaches. Contract will not be let until about June or July. E. C. Nickey, County Surveyor and Highway Engineer.

Houston, Tex.—See "Water Works."

Buffalo, Okla.—All bids opened Feb. 21 by County Commissioners for constructing bridges rejected; new bids to be asked. E. S. Hubbard, County Clerk.

Modesto, Cal.—County Board of Supervisors considering the building of a bridge across Stanislaus River at Burneyville, also 5 or 6 miles of highway between Oakdale and San Joaquin Counties.

Arizona. — State Board of Control, Phoenix, has approved loan of $12,500 to Santa Cruz County for constructing a 200-ft. concrete bridge over Santa Cruz River, to be constructed under direction of Lamar Cobb, State Engineer, Phoenix, and will be done by day labor. Total cost, $25,000.

Ottawa, Ont.—Contract soon to be let for constructing superstructure of direct lift bridge at Pretonia Avenue. F. C. Askwith, City Engr.

BIDS DESIRED.

Bridgeport, Conn.—Until April 6, by Board Contract & Supply, for constructing substructure, superstructure and approaches for Grand Street Bridge; also separate bids for removal of old bridge and constructing new substructure and superstructure at East Washington Avenue over Pequonnock River, advertised in the Engineering Record. J. B. Strauss, Consulting Engr., Chicago, Ill.

New York, N. Y.—See "Paving and Roads."

Staunton, Va.—Until March 23 by Board Supervisors for superstructure of five steel bridges, advertised in Engineering Record. R. W. Moore. Superintendent of Roads, Rooms 3 and 4, New County Building, Staunton.

Atlanta, Ga.—Until March 22 by W. E. Chambers, Purchasing Agent, Atlanta, for bridge repair work for year 1916.

Morganfield, Ky.—Until March 21, by Board Drainage Commissioners of Fiscal Court, Morganfield, address to John Bingham, Co. Clk., for constructing seven steel highway bridges in connection with Dennis O'Nan Public Ditch, advertised in Engineering Record. Norman R. Orcutt, Ch. Engr., Drainage Commission, Morganfield.

Illinois—Until March 13, by State Highway Department, Springfield for constructing bridge as follows:

Ottawa, La Salle County—Pleasant Hill Bridge, reinforced concrete, 2 spans, each 45 ft., 18-ft. roadway, in Serena Township. Engineer's estimate, $6,600. Geo. Farnsworth, Co. Supt., Ottawa.

Rockford, Ill.—Until April 10, by H. J. Gallagher, Chairman Street & Alley Committee for constructing a reinforced concrete bridge over Rock River at Chestnut Street, advertised in Engineering Record. Edwin Main, City Engineer.

Primghar, Iowa.—Reported desired until March 21, by Board County Supervisors for bridge work for year 1916.

Buffalo, Minn.—Reported desired until March 21, for culverts in various sizes for year 1916. John A. Berg, Co. Aud.

Mankato, Minn.—Until March 27 by F. W. Bates, City Clerk, for constructing a reinforced-concrete arch bridge at Main St., between Mankato and North Mankato, consisting of five 90-ft. spans, with 32-ft. roadway and two 6-ft. sidewalks. Cost, $100,000. Donald D. Price, Consulting Engineer, 219 First Natl. Bank Bldg., Lincoln, Neb.

Redwood, Minn.—Reported desired until Mar. 21 by L. P. Larson, Co. Aud., for 360,000 cu. yd. excav., 50,600 cu. yd. gravel surfacing and 5500 lin. ft. concrete culverts, 11 reinforced concrete bridges, etc.; probable cost $127,000. O. L. Kipp, Co. Engr.

Wichita, Kan.—Until March 20, by M. H. Barrett, County Clerk, for constructing bridge 70 ft. span in Salem Township; cost $4,000. E. V. Moore, Co. Engr.

Kearney, Neb.—Reported desired until March 20 by J. H. Dean, Co. Clerk, for bridge constructing and repairs during year 1916.

Hatton, N. D.—Reported desired until April 5, for concrete and wooden bridges for year 1916. Nels O. Hanson, Co. Aud.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★Connecticut—Contract awarded by the State Highway Commission, Hartford, to McHarg-Barton Co., 171 Madison Avenue, New York, for constructing a Strauss bascule bridge over Saugatuck River in Westport, for $36,500.

Albany, N. Y.—Only bid opened March 7 by W. W. Wotherspoon, State Superintendent Public Works, for constructing foot bridge between the north and south walls of Lock No. 3 on Cayuga and Seneca Canal, at Seneca Falls, submitted by Lupfer & Remick, 594 Ellicott Square, Buffalo, at $4,388. Engineer's estimate $4,001.

Honeoye Falls, N. Y.—Lowest bid opened by Town Board, Feb. 23, for constructing concrete, steel arch bridge over Honeoye Creek, submitted by Leary Constr. Co., Rochester, at $4,746.

★Mount Holly, N. J. — Contracts awarded Averill-Matthews Company, 917 Essex Building, Newark, at $11,769, for constructing reinforced-concrete bridge at Broad Street, Burlington (bids opened March 1 by Board of Freeholders, Mount Holly).

★Jenkintown, Pa. — Contract reported awarded by Philadelphia & Reading Ry to T. F. O'Reilly, St. Louis, Mo., for the grading and masonry work for girders of steel bridge 130 ft. long with 24-ft. roadway and 6 ft. sidewalk to be constructed at Jenkintown. Penn Steel Co. has contract for steel.

Charleston, W. Va. — See "Proposed Work."

★Miami, Fla.—Contract awarded Virginia Bridge & Iron Company, Roanoke, Va., for constructing the superstructure of the two bridges over Miami River, one at Twelfth Street and one at Avenue D.. Bids for the concrete and structural work have been rejected and new bids will be asked. W. B. Moore, City Clerk; Harrington, Howard & Ash, Consulting Engineers, 1012 Baltimore Avenue, Kansas City, Mo.

★Dayton, Ohio. — Contract awarded Shook & Boothe, Youngstown, for constructing concrete substructure for bridge 174 over Great Miami River, Jefferson Township, known as West Carrollton Bridge, to replace present substructure, at $31,077.

★Steubenville, Ohio.—Contract awarded American Bridge Company, 30 Church Street, New York, by Ohio & West Virginia Bridge Company for the single track bridge to be constructed over Ohio River at plant of the La Belle Iron Works. About 5000 tons of structural steel will be required.

★Ida Grove, Iowa.—Contracts awarded by County as follows March 2: to Iowa Bridge Co., Des Moines, for one 16-ft. I-beam bridge, 15-ft. abutments, concrete floor; a 60-ft. pony truss, 16-ft. abutments, concrete floor and abutment; a 5 x 6 x 50-ft. box culvert, three 24 x 18-ft. I-beam spans, steel only (delivered), two 28 x 18-ft. I-beam spans, steel only (delivered), at a total cost of $9,746. C. A. Woodworth, County Engineer.

★Nevada, Iowa.—Contract awarded Cole Bros., Ames, for constructing 114 concrete bridges and one steel bridge (bids opened March 2) at $34,440. F. E. King, County Auditor.

★Omaha, Neb. — Contract awarded American Bridge Co., 30 Church Street, New York, N. Y., for erecting Union Pacific R.R. bridge across Missouri River.

★Great Falls, Mont.—Contract awarded Des Moines Bridge & Iron Works, Des Moines, for furnishing and erecting a highway and pipe bridge for Sun River Irrigation Project, Mont., at $9,000.

★Orange, Tex.—Contract awarded Austin Brothers of Dallas for constructing a 2-span steel bridge over Beard's Bayou on Center Beaumont Road at $7,616.

★Orange, Tex.—Contract for constructing two-span steel bridge over Beard's Bayou on Center Beaumont Rd. awarded by County Commissioners Court to Austin Bros., of Dallas, at $7,616.

★Ventura, Cal.—Contracts awarded by Board of Supervisors as follows for furnishing steel for bridges: Clinton Bridge Company, Clinton, Ia., 358,000 lbs. for Saticoy Bridge, at $15,882; Missouri Valley Bridge Company, Denver, Colo., 200,000 lbs. for Sespe Bridge, at $9,223.

PAVING AND ROADS

PROPOSED WORK.

Hartford, Conn.—Street Commissioners considering the paving of Ridgefield Street with concrete at a cost of $11,555.

Buffalo, N. Y.—During the year about 330,000 yds. of paving costing $1,100,000 will probably be laid, also 68,450 yds. concrete sidewalks costing $40,000 and 170,000 yds. asphalt paving repaired at a cost of $190,000. George H. Norton, City Engineer.

Camden, N. J.—City Council considering constructing a boulevard from Baird avenue and Cooper River to Twenty-seventh and Federal Streets.

Lakewood, N. J.—Citizens voted to issue $30,000 bond for constructing streets through business section of city and for improving roads leading into city.

Mount Holly, N. J.—Board Freeholders, Mount Holly, having plans prepared for repair to Camden Pike from Moorestown to Camden County line, 3 miles, estimated cost $30,000, and for Church Street, Moorestown, ½ mile, cost $10,000. Both modern pavements. James Logan, County Engr.

Trenton, N. J.—Road improvement bonds amounting to $143,547 have been sold by the Board of Freeholders.

Baltimore, Md.—Board of Awards approved specifications by Commissioner for Opening of Streets for paving this year in the Annex. There are about twenty-five streets and sheet asphalt will be used at a cost of about $115,000.

Cumberland, Md.—The House passed bill authorizing Allegany County to issue $22,000 bonds for construction of roads in Allegany County.

Brevard, N. C.—Citizens of Brevard Township have applied to County Commissioners to call an election to vote $40,000 bonds for road improvements.

Leesburg, Ga.—Election to be held March 23 to vote $25,000 bonds for repairing public roads and $50,000 for erecting a court house here. Address James Morgan, Clerk County Commissioners.

Ringgold, Ga.—Citizens of Catoosa County will vote March 18 on issuing $64,000 bonds for constructing and improving roads.

De Land, Fla.—The Supreme Court has declared valid the $350,000 road bond issue in the county. Address County Commissioners.

Kissimmee, Fla.—Election to be held some time in April to vote $250,000 bonds to create a special road and bridge district, and make road improvements. The Third District, which is not included in this election, has already been granted permission to hold an election and vote $150,000 bonds to build a sand asphalt road from canal between St. Cloud and Kissimmee to the Brevard County line. J. L. Overstreet, Clerk County Commissioners.

Lake City, Fla.—Bd. of Bond Trustees engaged Cleveland Horne, of Jasper, as engineer for street pavements for Lake City.

Birmingham, Ala. — Julian Kendrick, City Engineer, directed to prepare ordinance for paving with asphalt and asphaltic concrete Tenth Street S. from First to Thirteenth Avenue, Seventh Avenue North from Fourteenth to Nineteenth Street; Twenty-fifth Street N. from Eighth to Twelfth Avenue, Twenty-first Street S. from Eighth to Tenth Avenue, Humboldt Avenue from Twentieth to Twenty-second Street; estimated cost $35,000.

Lafayette, La.—Police Jury accepted plans for constructing 5 miles gravel road 16 ft. wide in 5th Ward, cost $33,000.

Grenada, Miss.—At good roads convention citizens of the hill country of Mississippi voted to construct the Jefferson Davis Highway through Northern Mississippi. Address County Clerk, Grenada.

Chattanooga, Tenn.—County Commissioners will construct this year two miles concrete road, 20 ft. wide, 6 in. side, 8 in. center; also 15½ miles oiled roads and 18 miles macadam and gravel roads, mostly macadam.

Jackson, Tenn.—Reported city is considering improving a number of streets with first-class pavement.

Barbourville, Ky.—Paving of principal streets of city with brick is contemplated.

Lexington, Ky.—Court of Appeals has approved the $60,000 Fayette County road bond issue.

Lexington, Ky. — Turnpike improvement bonds for $300,000 will be sold March 15 by County Court (F. A. Bullock, Judge).

Alliance, Ohio.—Alliance-Louisville Improvement Co. incorporated to construct portions of Market Rd. No. 14.

Bucyrus, Ohio.—At recent election it was voted to issue $47,000 bonds for improving Lincoln Highway into and through Bucyrus, brick to be used.

Canton, Ohio.—Paving bonds for $125,000 will be sold March 17 by County Commissioners.

Canton, Ohio.—City Council sold $45,000 street improvement bonds.

Chillicothe, Ohio.—County Commissioners contemplate constructing several miles of brick road in Rose County during coming summer, also a mile or two of macadam.

Cincinnati, Ohio.—Contract soon to be let by Charles F. Hornberger, Director Public Service, for improving Dayton Street, from Freeman to Whiteman Streets, with bitulithic and an 8-in. water main. City Engineer estimates cost at $21,580.

City Engineer Frank S. Krug estimates cost of improving Western Avenue from Liberty Street to McLean Avenue with granite on old concrete and surface of new concrete at $47,800. This improvement depends on election April 25.

Findlay, Ohio. — Road improvement bonds for $37,500 will be sold March 29 by County Commissioners.

Hamilton, Ohio.—Plans and estimates submitted to City Council by City Engineer for paving Franklin Street and Eaton Avenue; cost about $15,000.

Lima, Ohio.—Election to be held April 25 to vote on paving 43 streets with brick or asphalt, including Jefferson, Bellefontaine and Jackson. City's portion $75,000. A. L. Metheney, Service Director; James I. Heffner, City Clerk.

Marysville, Ohio.—Plans and specifications being considered for constructing Moore-Williamson Pike in Washington Township by County Commissioners, distance of 4 miles; cost, $13,302.

Springfield, Ohio.—Election will be held April 25 to vote $349,700 bonds for city's share of cost for road improvements.

Tiffin, Ohio.—It is proposed to pave Apple and Perry Sts., about 12,700 sq. yds., with brick on concrete foundation and 7,200 lin. ft. sandstone curb and gutter. Address City Engineer.

Troy, Ohio. — County Commissioners considering constructing section of Dixie Highway in Miami County.

Wooster, Ohio.—It is proposed to pave about 12 miles with tar bound macadam or brick (monolithic construction). R. Barrett, County Engineer.

Crawfordsville, Ind.—Coal Creek Township road bonds amounting to $15,000 have been sold.

Frankfort, Ind.—Contract will be let about April 15, by C. M. Cokee, City Clerk, for 24,625 sq. yd. paving on South and 13,880 sq. yd. on Catterlin Streets. Bids to be submitted on brick, concrete, asphaltic concrete or bitulithic macadam, and 8300 lin. ft. cement curb. R. H. Boynton, City Engr.

South Bend, Ind.—City Engineer estimates the cost of street improvements as follows: Eddy Street at $155,112; Indiana Avenue, $65,550, and Michigan Avenue, $83,748.

Wabash, Ind.—County Treasurer has sold $23,900 road bonds.

Alton, Ill.—T. H. Landon, City Engineer, has completed survey for paving of Edwards Street, estimating cost at $84,000.

Illinois.—In Lee County during 1916 about 6 miles of macadam, 4 miles gravel, 6 miles brick and 1½ miles concrete pavement probably will be laid. B. Neighbour, County Superintendent of Highways.

Peru, Ill.—Contract will be let probably in April for paving with brick on cinder foundation with concrete curbs on Third and Seventh Streets at a cost of $50,000. S. D. Porter, Engineer, La Salle; William Wagner, City Clerk.

Rock Island, Ill.—Petitions filed with County Court for paving Twentieth Street from Seventh to Eighteenth Avenues; estimated cost, $35,311.

Sterling, Ill.—Contract will be let about May 1 by city for 40,000 sq. yds. brick pavement on 4 and 6 in. concrete, including cement curb and gutter. Cost $120,000. E. O. Hills, Engineer, Fulton. A. J. Platt, Mayor.

Urbana, Ill.—Reported Coler Avenue is to be paved this spring. Engineer estimates cost at $39,736. A. M. Danely, Member Board Local Improvements.

Elkhorn, Wis.—It is proposed to pave about 2 miles. A. C. Oleson, City Clerk.

Milwaukee, Wis.—Contracts will be let about March 15, by F. G. Simmons, Commissioner of Public Works, for about 90,400 sq. yd. asphalt, 10,700 sq. yd. brick and 21,600 sq. yd. bituminous concrete pavement.

Milwaukee, Wis.—Contracts will be let by Commissioner of Public Works about March 13 for about 90,400 sq. yd. asphalt, 10,700 sq. yd. brick and 21,600 sq. yd. bituminous concrete pavements.

Agreement reached between city and county to co-operate in improving about 5 miles of the road on Oklahoma Avenue from Chicago Road to First Avenue. H. J. Kuelling, County Highway Commissioner.

New London, Wis.—It is proposed to pave 30,000 sq. yd. with concrete on Beacon, South Pearl and Shawana Streets; cost $38,000. H. R. Albert, Engineer, Green Bay; C. J. Thompson, City Clerk.

Britt, Iowa.—Resolution introduced by Town Council for about 50,000 yd. of street paving and 30,000 ft. curbing. Various types of pavement under consideration. Further action to be taken March 24. James E. Verrall, Town Clerk; Theo. S. DeLay Town, Engineer, Creston.

Indianola, Iowa.—About 3⅝ miles of road one course concrete brick block or asphalt concrete are to be laid on North Second, B, C Streets, First and Askland Avenues, including 31,500 ft. concrete curbing. A. H. Gilliland, City Engineer, Indianola.

Perry, Iowa.—Council ordered 30,000 sq. yd. asphaltic brick block or concrete pavement. Charles E. Wilson, City Engineer.

Sioux City, Iowa.—City Council considering paving streets in Heights addition with concrete; cost, about $30,000.

Sioux City, Iowa.—Contracts about to be let by City Council for paving Perry Creek Road, cost $41,603, and for Stone Park Boulevard, cost $16,799.

St. Paul, Minn.—City Council voted to pave Wacouter and Canada Sts. and Prior Ave., cost about $43,000.

Winona, Minn.—County Commissioners reported to have sold $50,000 road bonds and will construct highway improvements.

Kansas City, Kan.—About $40,000 will be spent in the county for good roads. Frank Halcomb, County Clerk.

Newton, Kan.—City intends issuing $97,000 paving bonds.

Beatrice, Neb. — City Commissioners considering paving. 57 blocks.

Lincoln, Neb.—City Council authorized 33 blocks of paving.

Maysville, Mo.—Election tò be held March 15 to vote bonds for paving about ten blocks with brick on concrete foundation, in all about 13,000 sq. yd. C. E. McCrae, Consulting Engineer, Kansas City, and E. W. Pierce, Maysville Local Engineer; A. D. Hewitt, City Clerk.

York, Neb.—About $60,651 paving bonds sold by city.

Ft. Smith, Ark.—The Arkansas Jefferson Highway Asso. organized to construct a road from Missouri boundary to Louisiana line. L. R. Putnam, Pres., Fayetteville.

Stuttgart, Ark.—Contract will be let in the spring for 10,000 sq. yds. paving, including Main St. and Maple Avenue. Material not yet decided upon. Address City Clerk.

Cisco, Tex.—Election to be held March 25 to vote $60,000 bonds for highway improvements. J. M. Williamson, Mayor.

Edna, Tex.—Road District No. 1 bonds for $55,000 will be sold March 13 by County Commissioners Court. Address A. W. Bagby, County Judge, Edna.

El Campo, Tex.—Citizens of Road Dist. No. 2 will vote on April 1 on issue of $75,000 bonds for road improvements.

Galveston, Tex.—City Council approved plans and specifications of City Engineer for paving of Main Street; cost $170,000.

Houston, Tex.—See "Water Works."

Hutto, Tex.—Election to be held March 25 to vote $50,000 bonds for road improvements, approximately 16 miles to be macadamized.

Mt. Pleasant, Tex.—Road bonds for $225,000 will be sold March 20 by W. L. Keene, County Clerk. About 75 miles of permanent road to be laid.

Pittsburgh, Tex.—Election to be held March 16 to vote $100,000 road bonds in Camp County. Address County Clerk.

San Antonio, Tex.—Road bonds amounting to $800,000 have been sold.

Tyler, Tex.—Attorney General at Austin has approved the $100,000 Smith County road bond issue.

Tyler, Tex.—Attorney General at Austin has approved the $100,000 bond issue for Smith County Road District No. 2.

Bellingham, Wash.—Reported Board of Public Works about to let contract for clearing, grubbing, grading, constructing concrete curbs and gutters on Ellis street, cost $13,300. W. H. North, City Engineer.

Sedro-Woolley, Wash. — City Council voted to pave Third Street, Jameson Avenue, Township, Talcott and Sixth Streets. C. S. Smith, City Clerk.

Tacoma, Wash.—City Council considering paving Pacific Avenue Highway, about one mile. Plans prepared by W. C. Raleigh, City Engr.

Washington.—Contract will soon be let by State Highway Commission, Olympia, for grading, bridging and surfacing with gravel 12.5 miles permanent highway between Lind and Ralston in Adams County, cost $54,165.

The Dalles, Ore.—The Columbia Highway between Hood River and Mosier is to cost $430,000, and will be constructed under the supervision of the County Court at The Dalles and the State Highway Commission, Salem. G. E. Ross, Auditor, State Highway Commission, Salem.

Anaheim, Cal.—Contract for 66,000 sq yds. sheet asphalt paving costing $90,000 will be let about April. O. E. Steward. City Engineer.

Los Angeles, Cal.—City will spend $62,000 for street and roads in newly annexed San Fernando Dist. and $17,000 in Palms Dist. Homer Hamlin, City Engineer.

An ocean front highway is to be constructed between Redondo and Santa Monica; estimated cost, $52,000. County to share cost. Address County Clerk, Los Angeles.

Modesto, Cal.—See "Bridges."

Oakdale, Cal.—It is proposed to pave 10,000 sq. yd. on "F" Street with asphalt concrete, cost $12,000. Charles Harlowe, Jr., Engineer, Oakdale; R. L. Acker, City Clerk.

San Diego, Cal.—City granted lease to National Paving Company, Kansas City, Mo., on tidelands with proviso that $16,000 be expended in constructing a paving plant before Oct. 1.

Election to be held to vote bonds for repairing highways and bridges. Cost of highways exclusive of bridges has been estimated by George Butler, County Surveyor, at $701,000. Address Board of Supervisors.

Phoenix, Ariz.—City Commission has ordered City Engineer to prepare plans for paving 9 blocks on North Fourth Street.

BIDS DESIRED.

Massachusetts.—Until March 14, by State Highway Commission, 15 Ashburton Place, Boston (Wm. D. Solner, Chmn.), for 6300 ft. of State Highway at North Andover.

Worcester, Mass.—Until Mar. 17, by Worcester Street Department for road oil for the year 1916. Albert T. Rhodes. Street Commissioner.

Albany, N. Y.—Until March 28, by State Commission of Highways. Albany (Edwin Duffy, Comr.), for bituminous material "A," "T" and cold patch asphaltic emulsion in different counties comprising Divisions Nos. 1 to 9, inclusive, bituminous material contracts Nos. 1 to 25, inclusive, advertised in Engineering Record.

Brooklyn, N. Y.—Until March 16, by L. H. Pounds, Borough Pres., for furnishing and delivering 180,000 gal. of refined asphalt in liquid form, and 200 tons refined asphalt in containing packages, to be delivered to the asphalt plant, Seventh Street, facing Gowanus Canal.

Buffalo, N. Y.—Until March 18, by Arthur W. Kreinheder, Superintendent Department of Public Works, for repair of asphalt pavements maintained by the Department of Public Works from January 1, 1916, to December 31, 1916, inclusive, with a maintenance guarantee to December 31, 1917, inclusive.

Until March 22, by Department Public Works (Arthur W. Kreinheder, Supt.). for paving portions of Meadow View Place, Edison Street, Hubbel Avenue, and repaving Delaware and Delavan Avenues.

New York, N. Y.—Until March 16, by Fred. J. H. Kracke. Bridge Commissioner, Manhattan Borough, for repairs to asphalt pavement on the bridges over the Harlem River. Security, $3,000.

Glen Ridge, N. J.—Until March 13, by Borough Clerk, for furnishing and applying non-asphaltic road oil on streets of borough during year 1916, in all about 40,000 gal. oils.

Montclair, N. J.—Until March 27, by Harry Trippett. Town Clerk, for furnishing asphalt for use in penetration macadam road construction, during 1916; furnishing asphalt distribution equipment to be used in constructing penetration asphalt macadam roads and laying road oil; also separate bids for furnishing road oil for use in oiling streets during year 1916; all three proposals advertised in Engineering Record.

Newark, N. J.—Until March 30, by Board Street & Water Commissioners for paving and repaving as follows: Broad and Commerce Streets, 16,500 sq. yd. 4-in. wood block pavement and 5400 lin. ft. granite curb and 550 lin. ft. header; Mulberry, Front, South, Commerce, River and Ogden Streets and River Road, 36,800 sq. yd. new granite pavement, and 12,211 lin. ft. granite curb, 6200 lin. ft.

bluestone curbing, and 1050 headers; also same time and place separate bids for paving with asphalt on Brookdale Avenue and Mead Street, and with brick on Silver Street.

Easton, Md. — Until March 21, by County Commissioners (Jos. B. Harrington, Clerk), for section of State Aid Highway in Talbot County, along Claiborne Road, between McDaniel Station and Claiborne, a distance of about 1¾ miles. Frank W. Seth, County Road Engr.

New Orleans, La.—Until March 27, by Highway Department of Board of State Engineers, Room 104, New Orleans Court Building, New Orleans, for constructing with gravel a section of the Marksville Platte Highway, Avoyelles Parish, La., a distance of about three miles. W. E. Atkinson, State Highway Engineer.

Cincinnati, O.—Until March 13, by Director of Public Service, for improving Knott Street from Reading Road to Maples Avenue, about 2660 sq. yd. wood block or bitulithic. City Engineer estimates cost at $13,272 for wood block and $11,178 for bitulithic.

Columbus, Ohio.—Until March 28, by Board County Commissioners (John Scott, Clk.), for improving portions of Harbor Road, in Clifton, Mifflin and Sharon Townships, and macadamizing the Lane Road in Perry Township.

Ironton, Ohio.—Until March 20, by Director Public Service (F. A. Ross, Clerk), for paving portions of Sixth Street with brick, and Gold Alley with concrete.

Lorain, Ohio.—Until March 22, by Director Public Service (L. B. Johnston, Clk.), for improving West Erie Ave. by grading, curbing and paving with vitr. brick or asphalt.

Salem, Ohio.—Reported desired until April 3, for paving on East Main Street, in all about 6620 sq. yd. vitr. brick block on 6-in. concrete base. Probable cost $14,000. Address Director Public Service.

Warren, Ohio.—Until March 17, by City Clerk, for paving N. Saird Avenue and E. Market Street, about 14,390 sq. yd., and for sewers in E. Market, E. South, Walnut, Beaver and Market Streets in all 8702 lin. ft. 10 to 24-in. pipe. H. S. McKibben, City Engr.

West Salem, Ohio.—Until March 20, by County Auditor, for 2⅛ miles of brick (monolithic construction) or bituminous pavement.

Indiana.—By County Commissioners for constructing county roads as follows:

March 18:
Indianapolis, two gravel county line roads. Leo K. Fesler, Co. Aud.
March 30:
New Albany, 16,325 ft. county road in New Albany Township. Emile Duqaauier, Co. Aud.

Indianapolis, Ind.—Until March 15, by Board Public Works, for improving portions of Meridan, Palmer and other streets and Parkway Boulevard. Separate bids until March 16, for improving Burdsal Parkway and North Drive.

Logansport, Ind.—Until March 14, by Board Public Works (Frank V. Guthrie, Chmn.), for improving Erie Ave., to include paving, curbing, sewers, manholes, etc.

Richmond, Ind.—Until March 16, by B. A. Bescher, City Clerk, for 5500 sq. yd. asphalt, brick, concrete or wood block on Fifth and S. Ninth Streets. Fred C. Charles, City Engineer.

Elgin, Ill.—Until March 15, by city, for paving on N. Gifford Street, 7776 sq. yd. asphalt concrete; on Grove Street, 11,800 sq. yd. brick with asphalt filler laid on old concrete foundation, and Prairie Street, 1060 sq. yd. Hillside brick and 1788 sq. yd. brick pavement, also 1292 lin. ft. concrete curb and 4822 lin. ft. combined curb and gutter. Morgan H. Brightman, City Engr.

Appleton, Wis.—Until March 14, according to official reports, by A. C. Remly, City Engineer, for 10,000 yd. brick, asphalt or concrete pavement.

Racine, Wis.—Reported desired until March 25, by P. H. Connolly, Chairman Board of Public Works, for paving on portions of Douglas Avenue, Asylum Avenue, Jones and a number of other streets, in all approximately 54,521 sq. yd. paving, of which 26,003 yd. will be brick and remainder either brick, sheet asphalt or reinforced concrete; also 25,073 lin. ft. combined curb and gutter.

Clear Lake, Ia.—Until March 15, by E. B. Stillman, City Clerk, for 27,000 sq. yd. cement, brick, asphalt or "Tarvia" on Second and Division Streets; cost $140,000.

Clinton, Iowa.—Until March 16 by C. J. Northrup, City Clk., for 37,000 sq. yd. vertical fiber brick, vitrified brick, asphaltic concrete or concrete paving, and 8000 lin. ft. combined curb and gutter.

Eagle Grove, Iowa.—Until March 14, by D. Middleton, City Clerk, for 27,000 sq. yd. either asphaltic concrete or Portland cement concrete or sheet asphalt, on Lincoln Avenue and other streets.

Mason City, Iowa.—Until March 13 by City for 47,000 sq. yd. reinforced concrete paving. F. P. Wilson, City Engineer.

Monticello, Iowa.—Until Mar. 16 by C. J. Northup, City Clk., for street paving, to consist of 37,000 sq. yd. vertical fiber brick, vitr. brick, asphaltic concrete or concrete paving, 8000 lin. ft. curb and gutter. J. G. Thorne, Consulting Engr., 317 Howes Blk., Clinton, Iowa.

Redwood Falls, Minn.—Until March 21, by L. P. Larson, Co. Aud., for improving, by grading, graveling, culverts, bridges, etc., State Rural Highway No. 50, estimated cost $9,938; State Rural Highway No. 74, estimated cost $22,723; State Rural Highway No. 93, estimated cost $47,742; other roads, estimated cost $28,000.

Sigourney, Iowa.—Until March 23, by City Council, for paving with either brick or concrete, about 13,500 sq. yd. and 4400 lin. ft. combined curb and gutter, advertised in Engineering Record. A. M. Meas, Town Clerk.

Kansas City, Kan.—Until March 20 by Frank Holcomb, County Clerk for macadamizing about 1¼ miles of Rutledge Lemon Road.

Sherbrooke, N. D.—Reported desired until April 3, by G. J. Mustad, County Auditor, for turnpiking approximately 6.19 miles together with culverts, walls, etc., about 13,906 cu. yd. earth excavation.

Huron, S. D.—Until April 3, by S. S. Oviatt, City Auditor, for approximately 16,000 sq. yd, pavement, advertised in Engineering Record. J. B. Sullivan, City Engr.

Jonesboro, Ark.—Until April 6 by Board County Commissioners (John R. Turney, Secy.) for 13 miles of asphalt road with a gravel base and three miles gravel road, in all about 67,000 cu. yd., with necessary bridges, culverts, etc. Lund & Hill, Engrs., Little Rock.

Pomeroy, Wash.—Reported desired until April 1, by Harry St. Georg, City Clerk, for paving with concrete, wood block, brick, bitulithic, asphaltic concrete, or similar material, approximately 28,000 sq. yd., including 7500 ft. curb and gutter, 7600 cu. yd. excav., etc.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★Maine.—Contract awarded by State Highway Commission, Augusta, for constructing 3.84 miles of concrete road in Saco (bids opened Feb. 23) as follows: 1.4 miles to Forgione & Romano, Portland, at $12,777; 2.44 miles to David J. Sheehan, Lynn, Mass., at $36,875.

★Buffalo, N. Y.—Contracts awarded Erie Construction Company for brick paving on Skilleen Street subway, Saratoga and Garden Sts. and Lackawanna Ave., in all 8,340 sq. yd.; asphalt on Exeter St., about 3,631 sq. yd. to German Rock Asphalt & Cement Company, Ltd., Morgan Bldg.; brick, 5,976 sq. yd. on Durham Ave. to Constantine Construction Company, 240 Dewey Ave., and block stone on West Ferry St., 3,065 sq. yds., to Joseph F. Stabell Co., 1127 Niagara St.

Long Island City, L. I., N. Y.—Following are unit figures of four lowest bids opened March 1 by Maurice E. Connolly, President Queens Borough, for repaving 4th and 6th Avenues and other streets: (a) 9,800 lin. ft. cement curb, (b) 2,900 cu. yd. concrete, (c) 17,400 sq. yd. asphalt concrete pavement, (d) 50 cu. yd. stone gutter, (e) total: Cleveland Trinidad Asphalt Paving Company, Flushing, L. I., (a) 60 cts.; (b) $4.75; (c) 67 cts.; (d) 26 cts.; (e) $30,345; Sicilian Asphalt Paving 41 Park Row, New York, (a) 60 cts.; (b) $5.55; (c) 80 cts.; (d) 60 cts.; (e) $35,925; Borough Asphalt Company, 1301 Metropolitan Ave., Brooklyn, (a) 60 cts.; (b) $5.10; (c) 90 cts.; (d) 50 cts.; (e) $36,355; Uvalde Asphalt Paving Company, 1 Broadway, New York City, (a) 60 cts.; (b) $5.60; (c) 85 cts.; (d) 50 cts.; (e) $36,935.

Following are lowest bids opened by James A. Dayton, Commissioner of Public Works, for furnishing material to Bureau Highways as follows: 6000 cu. yd. gravel or broken stone, Frederick Starr Contracting Co., 1784 Broadway, New York City, $10,260; furnishing and spreading 200,000 gal. asphaltic oil, Standard Oil Co., $13,700; 900 tons limestone or inorganic dust, Peace Bros., Flushing, $6,660; 13,300 cu. yd. sand, Charles A. Myers Contracting Co., 3989 Whiteplains Avenue, $12,103; 30,000 cu. yd. broken stone, Peace Bros., $65,700; 600,000 gal. light road oil, in tank cars, Standard Oil Co., $33,480; 600 tons asphaltic cement, Warner-Quinlan Asphalt Co., 79 Wall Street, New York City, $11,568.

Camden, N. J.—Following are three lowest bids opened March 6 by Board of Freeholders for paving: (a) Moorestown Pike, from city line to borough of Merchantville and from east borough line of Merchantville to Burlington County line; (b) Merchantville portion: C. Humphrey, 173 Main Street, Hackensack, (a) $64,587; (b) $50,739; J. T. Shanley & Company, 26 Exchange Place, Jersey City, (a) $67,521; (b) $52,036; W. Penn Corson, Camden, (a) $62,639; (b) $43,612.

★Pennsylvania—State Highway Department at Harrisburg awarded contracts as follows for road machines (bids opened Feb. 23): 37 machines to Good Road Machinery Company, Kennett Square, Pa.; 38 machines to Austin Western Road Machinery Company, Philadelphia; and 10 machines each to Brinker Supply Company, Pittsburgh and Galion Iron Works & Mfg. Company, Galion, Ohio.

★Baltimore, Md.—Bd. of Awards awarded contracts for paving as follows: Hollins St. and Frederick Ave. with asphalt to Patrick Flanigan & Son, 120 E. Lexington St., at $49,961, and Guilford Ave., Sharp, Dallas, Dock Ostend and Entaw Sts., to P. Reddington & Sons, 321 St. Paul St., at $55,000.

Jamestown, Tenn.—Following are unit figures of two bids opened March 1 by County Highway Commission for grading and macadamizing 34 miles of road and constructing steel bridges: (a) Saloman Contracting & Engineering Co., Harriman, Tenn. (b) Bennett & Maloney, Brown & Mitchell Bros., Pikeville, Tenn. (W. 1. Smith, Engineer, Jamestown):

	(a)	(b)
145 acres, clearing	$15.00	$15.00
50 acres, grubbing	30.00	30.00
115,375 cu. yd. earth excav.	0.235	0.235
19,375 cu. yd. solid rock ex.	0.75	0.75
1100 cu. yd. 3d-cl. masonry.	7.00	7.00
920 cu. yd. box cul. msnry.	4.00	4.50
400 cu. yd. head wall masonry	2.50	3.60
150 cu. yd. paving	1.50	1.60
650 cu. yd. riprap	1.50	1.25
17,625 M. ft. lumber	20.00	22.00
1260 lin. ft. 15 in. corrugated pipe, hauled and laid (not furnished)	0.25	0.38
690 lin. ft. 18 in. corrugated pipe, hauled and laid (not furnished)	0.30	0.56
558 lin. ft. 20 in. corrugated pipe, hauled and laid (not furnished)	.35	.75
232 lin. ft. 24 in. corrugated pipe, hauled and laid (not furnished)	.40	.86

★Louisville, Ky. — Contracts awarded by Board Public Works as follows: Asphalt on Deerwood Avenue from Schwartz to Morris Aves., and on Hill Street, from Eighteenth to Twenty-fifth Streets, to Bickel Asphalt Paving Company, Louisville, at $25,033, and on Stoll Street from Frankfort Avenue to L. & N. tracks, and on Brandeis Street from Preston Street to Flat Lick Road to Louisville Asphalt Company, Louisville, at $16,695.

★Board of Public Works awarded contracts for paving as follows (bids opened Feb. 23): Bickel Asphalt Paving Co., Louisville, Bardstown Street, with asphalt, at $13,578; Broadway, with asphalt, to Louisville Asphalt Co. of Louisville, at $10,353; Twenty-eighth Street, with vitrified brick, to L. R. Figg Co., Louisville, at $12,188.

★Cincinnati, Ohio. — County Commissioners Feb. 29 awarded contract for paving Harrison Pike with granite through the village of Cheviot to the Kirchner Construction Co., Cincinnati, Ohio, at $71,168.

Following are four lowest bids opened Feb. 28 by Charles F. Hornberger, Public Service Director, for improvement of Vine Street, from Court to Twelfth Street, with 3600 sq. yd. of wood block: M. F. Quill, Cincinnati, $22,987; Kirchner Construction Co., Cincinnati, $23,182; Scully Brothers, Cincinnati, $23,697; Henkel & Sullivan, Cincinnati, $24,060. City Engineer Frank S. Krug's estimate is $23,670. Bids include construction of steel bridge across canal; prices range from $4,500 to $6,275.

★Contract awarded by City Board of Control to Henkel & Sullivan, Cincinnati, for improving Central Avenue from Third to Fourth Streets with granite at $10,687.

★Mt. Gilead, Ohio.—Contracts for road improvements awarded by County Commissioners as follows (bids opened Feb. 25): Taylor Wrenn Road Improvement, Forest Construction Co., Forest, Ohio, at $11,432, and Fargo-Sipe Road Improvement, W. H. Miller, Cardington, at $19,673. C. O. Higgins, County Auditor.

★Norwood, Ohio.—Contract for paving Hopkins Avenue west of Bell Pl. with granite awarded O. E. Robinson at $22,265.

★Ft. Wayne, Ind.—County Commission awarded contracts for constructing three macadam roads, as follows: Flaugh Rd. in Madison Township to Charles W. Elingat $5,592; Springer or Lower Huntington Rd. in Wayne Township to J. C. Connor & Sons, $12,349; Fogel Rd., Eel River Township, Ellison & Co., $12,195.

★Georgetown, Ill.—Contract awarded Foulkes Construction Co., Terre Haute, Ind., for paving in Westville and Georgetown and in township north and south from these towns, at $52,925 for work in township and Westville and $12,340 in Georgetown.

Joliet, Ill.—R. F. Conway Paving Co., 133 West Washington Street, Chicago, lowest bidder for paving with asphalt on Ottawa Street, at $14,505.

★Rock Island, Ill.—Contract for paving Eighth Avenue, Ninth to Nineteenth Streets, with brick block on 5-in. concrete, and concrete curb and gutter, awarded McCarthy Improvement Co., Davenport, Iowa. Wm. McConochie, Mayor.

★Milwaukee, Wis.—Contracts awarded by F. G. Simmons, Commissioner of Public Works, as follows: To F. P. Coughlin Company, Milwaukee, Ring Street from Richard to Second Streets, George Street from Richards to North Streets, and Kenwood Boulevard from Bartlett to Oakland Streets, with asphalt, at a total cost of $23,334; Nineteenth Street from Greenfield to Rogers Streets, bituminous concrete to White Construction Company, Milwaukee, Wis., at $27,141.

★Davenport, Iowa.—Following are four lowest bids opened Feb. 29, by Allen R. Boudinot, City Engineer, for repaving Harrison Street: T. J. McCarthy, $30,652 (awarded contract); Independent Construction Company, $30,732; Little Construction Company, $31,204, and D. J. Ryan Construction Company, $31,612. (Bidders all of Davenport.)

★Mason City, Iowa.—Contract awarded Feb. 28 by the City for approximately 160,000 sq. yd. Trinidad sheet asphalt paving to Bryant Asphalt Paving Company, Waterloo.

★Mason City, Iowa.—Contract for 60,000 yd. concrete pavements, 150,000 sq. yd. sheet asphalt pavements, awarded by city to Bryant Asphalt Paving Company, Waterloo, at about $400,000 (bids opened Feb. 28).

★Spencer, Iowa.—Contract for 43,000 sq. yd. paving and approximately 27,260 lin. ft. curbing awarded Bryant Asphalt Paving Co., Waterloo, the bid as follows on various kinds of materials: Portland cement concrete pavement, $1.60; asphalt concrete, $1.57; Trinidad sheet asphalt or Bermudez, $1.62; on curbing, 6 x 18 in., 36 cts., and 6 x 24-in., 41 cts.; combined curb and gutter, 6 in., 60 cts., 8-in., 63 cts.; resetting curb, 25 cts.; 8000 cu. yd. excav., 50 cts.; 42 inlet basins, $15 each; 88 catch basins, $35 each; 2200 lin. ft. 8-in. pipe sewer, 70 cts. E. O'Keefe, City Engineer. (Bids opened Feb. 23.)

★Council Grove, Kan.—Contract awarded by City Commissioners to E. A. Ballweg & Company, Emporia, Kan., for brick paving at $43,000. H. A. Rowland, Consulting Engineer, McPherson.

★Lyons, Kan.—Contract for 11,000 sq. yd. pavement (bids opened Feb. 21) awarded Watts & Amerman, Salina, at $1.78 per sq. yd., 3-in. brick on 4-in. concrete base. R. S. Turner, Clerk.

★Ottawa, Kan.—Contracts for paving awarded by city as follows: First Street, 2,000 yd. excav., 3,330 ft. curb and gutter and 4,600 yd. 4-in. brick grout filler on 5-in. concrete gase, to A. L. Cook, Ottawa, at $11,300, and Ninth Street to N. E. Stucker, Ottawa, for 2,000 yd. excav., 3,670 ft. curb and gutter, 4,700 yd. 3-in. brick asphalt filler and 4-in. concrete base, at $10,280. Claude S. Pugh, City Engineer.

★Omaha, Neb.—Contract for paving with vitri. brick on Center Street from Thirty-sixth to Fifty-fourth Streets awarded C. E. Fanning, Bee Building, at $2.18 per sq. yd.

★Higginsville, Mo.—Contract for 10,000 sq. yd. fibre brick paving (bids opened Feb. 21) awarded F. D. Martin Construction Company, Ft. Scott, at $1.73 per sq. yd. Ralph A. Huscher, City Clerk.

★Dallas, Tex.—Contract for paving Tremont St. awarded by city to Vibrolithic Co. of Dallas, at $13,392.

★Port Lavaca, Tex.—Contract awarded R. L. Simms for surfacing streets at a cost of $16,000.

★Seattle, Wash. — Contract for constructing 3 miles of highway between Renton and Newcastle awarded by County Commissioners to George Bandaret, Renton, at $17,400 for a 16-ft. roadway.

Los Angeles, Cal.—Following are four lowest bids opened recently by Board of Supervisors:

For 1.4 miles of road work on Whittier Avenue near Montebello, Road Dist. No. 99, were: S. C. Contracting Company, 421 Washington Building, $15,895; James L. Frazer, Long Beach, $15,885; E. A. Clayton, $15,990, and Coast Construction Company, $16,127.

For 3.63 miles of grading, paving and culverts on Norwalk-Puente Mills Road, Road District No. 64, involving 5718 cu. yd. excav., 19,169 lin. ft. shaping, 42,575 sq. yd. 4-in. concrete and 4-in. disintegrated granite pavements; 15,320 ft. expansion joints, etc. (county to furnish 6265 bbl. cement): Fred Hoffman, 111 E. Twelfth Street, Long Beach, $45,000; Coast Construction Company, 353 South Hill Street, $45,336; S. C. Contracting Company, 421 Washington Building, $46,327, and Rogers Bros. Company, 604 Hibernian Building, $47,400.

★Douglas, Ariz.—Following are three bids opened recently for paving Tenth Street and G Avenue about 42,843 sq. yd. (a) price per sq. yd.; (b) total: Warren Bros. Co., Boston, Mass. (a), $2.35 (bitulithic) (b) $99,836 (awarded contract); California Arizona Construction Co., Los Angeles, Cal. (a), $2.38; (b) $101,117; Toohey & Sons (a), $2,.40; (b) $103,501.

STREET CLEANING AND GARBAGE DISPOSAL

PROPOSED WORK.

Belvidere, Ill.—City Council voted to construct a garbage incinerator.

BIDS DESIRED.

Wilkes-Barre, Pa.—Until March 24, by Fred H. Gates, City Clerk, for cleaning 45 miles of paved streets, advertised in Engineering record. Martin C. Murray, Supt. Dept.

Mansfield, Ohio.—Until March 15 by O. Hursh, Dir. Pub. Service, at office of Secretary Board Control, for constructing garbage crematory.

Elgin, Ill.—Until March 15 by William F. Sylla, City Clerk, for constructing incinerating garbage disposal plant, a total daily capacity of 15 tons, two separate units.

Madison, Wis.—Until April 1, by City Clerk, for constructing an incineration plant. Plans prepared by City Engr.

Fresno, Cal.—Until March 20, by W. H. Ryan, City Clerk, for constructing an incinerating plant for disposal of garbage for period of 10 years.

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS

PROPOSED WORK.

Dam—Victory, Vt.—Survey made for reservoir and dam site to be constructed here by Turners Falls Power & Electric Company, Turners Falls, Mass. Probable cost, $100,000.

Pier—Brooklyn, N. Y.—All bids opened Feb. 9, by Commissioner Docks, New York, for constructing Pier at W. 8th St., Dreamland Park, Brooklyn. Contract 1494 has been rejected.

Dredging — Buffalo, N. Y. — Dredging costing $19,525 may be contracted for during 1916. George H. Norton, City Engineer.

Flood Protection Work—Erie, Pa.—Election soon to be held to vote on bond issue for flood protection work which consists of covering Mill Creek about 2 miles, enclosing stream in a concrete tube 18 x 22 ft., and estimated cost $1,000,000. Farley Gaunnett, Designing Engineer, Harrisburg; B. E. Briggs, City Engineer; F. Hanlon, City Clerk.

Pier—Norfolk, Va.—War Dept. approved plans for constructing a pier 1500 ft. long and 75 ft. wide out into Chesapeake Bay at Cape Henry, to cost from $80,000 to $100,000. Construction of a long trestle and stone breakwater for pier's protection to cost $300,000 is also contemplated in connection with the work, but plans have not yet been approved. Col. J. P. Jervey, Corps Engrs., U. S. A.

Wharf Improvements — Chattanooga, Tenn.—Municipal wharf and terminal improvements bonds amounting to $100,000 have been sold. Tentative plans prepared. Nothing further will be done about this work until about May 1. Address City Engineer.

Drainage—Calhoun, Ky.—S. B. Robertson, Secretary, writes that it is proposed to construct a drainage system. Two contracts have been awarded to J. N. Forgy, Owensboro, and five additional contracts will soon be let, date not yet set.

Hydro-electric Plant—Birmingham, Ala.—The Alabama Power Company intends making extensive improvements in this district within the next 10 years, including construction, improvements and extensions. A steam power plant is contemplated on Warrior River, capacity 20,000 kw., cost $1,500,000. Plans to be made immediately for another unit at the hydro-electric station at Lock 12 on Coosa River. This station, together with erection of piers and cranes where the Louisville & Nashville R. R. crosses Coosa River to handle heavy machinery will cost about $750,000. Other improvements will include the development of power on Coosa and Tennessee Rivers.

River Improvement—Akron, Ohio.—The construction of a segmental pipe sewer and concrete box culvert is contemplated. J. A. Gehres, Engineer, City Hall. C. C. McCue, City Clerk.

Dams, etc.—Dayton, Ohio.—In a report submitted to Miami Conservancy Directors by Morgan Engineering Co., Birmingham, Ala., provide for constructing five retarding basins for dry reservoirs, will be formed by dams built across valleys of Miami, Mad and Stillwater Rivers on Twin and Lorain Creeks.

Ditch Improvement—Bemidji, Minn.—The Board of County Commissioners will issue $1,500,000 ditch improvement bonds.

Ditches—Long Prairie, Minn.—Contract will be let about May 25 by County Commissioners for constructing ditches No. 29, 30 and 31 to cost $14,000. W. H. Poore, Engineer, Staples; E. M. Berg, County Auditor.

Drainage—Falls City, Neb.—Board of Supervisors of Drainage District No. 1 authorized the Secretary to let contract for engineering work necessary for drainage work on Rulo bottoms.

Levees—Newport, Ark.—C. H. Miller, of Miller Engineering Company, Little Rock, has been engaged to report on constructing levees. Address Levee Commissioners.

Levees—Newport, Ark.—C. H. Miller of Miller Engineering Co., Little Rock, engaged by Newport Levee Commission to report on construction of a levee system along White River.

Drainage—Port Arthur, Tex.—Surveys being made for constructing levees, canals, ditches, pumping station, etc., at a cost of $175,000. J. F. Coleman, Engineer, 920 Hibernian Building, New Orleans.

Irrigation — Deschutes, Ore. — About $800,000 will be required to complete the Central Oregon Irrigation District but the work is done by force account and no bids asked. C. M. Redfield, Chief Engineer of District.

Pier—Santa Monica, Cal.—Charles L. D. Looff, of Long Beach, and owner of Luna Park, Seattle, Wash., will construct a pleasure pier, 700 x 200 ft., this spring, near municipal pier, and will construct amusement devices on ocean front.

BIDS DESIRED.

Jetty Construction—New York, N. Y.—Until April 10, by U. S. Engrs. Office, 707 Army Building, 39 Whitehall Street, New York, N. Y., for sand pit and jetty construction in Great South Bay (Patchogue River), N. Y., and dredging in Browns Creek, N. Y., advertised in Engineering Record.

Wharf, Etc. — Savannah, Ga.—Until March 28 by James A. Wetmore, Acting Supervising Architect, Treas. Dept., Washington, D. C., for erecting a detention barracks, boathouse, gangway, wharf, etc., for U. S. Quarantine Station, Savannah.

Cribbing—Lorain, Ohio.—Until March 29 by Board County Commissioners (F. L. Ellenberger, Clk.) for furnishing material and constructing the protection cribbing on the East Side structure of the Erie Avenue bridge in Black River, at Erie Avenue.

Protection of Flood Wall—Portsmouth, Ohio.—Until March 31 by Director Public Service (John E. Fritz, Clk.) for protection of Flood Wall at intersections of Second and Scioto Streets, "The Point."

Dam—Shawano, Wis.—Until March 28, by Electric Light and Water Works Commission, for constructing concrete dam 230 ft. long and 13 ft. high, with concrete flumes, draft tubes, core walls, and abutments brick power house, and earth dykes, advertised in Engineering Record. Engineers, Power Engineering Co., Corn Exchange Building, Minneapolis, Minn.

Ditch—St. Paul, Minn.—Until March 20 by State Drainage Commission at office of J. A. O. Preus, State Auditor, for constructing Sand Hill River State Ditch Improvement, to be known as State Ditches Nos. 6 and 7, in all about 217,779 cu. yd. excav., suitable for floating dredge, together with bridges, etc. Total cost $27,500.

Irrigation — Fort Shaw, Mont. — Until March 20, by U. S. Reclamation Service, Fort Shaw, for furnishing approximately 575 lin. ft. 96 in. continuous wood stave pipe for Sun River Project, Mont.

River Improvements—Kansas City, Kan.—Until March 20 by Frank Holcomb, County Clerk, for removing obstructions from Kansas River between James Street bridge and West Kansas Avenue Bridge. R. L. McAlpine, County Engineer.

Irrigation — Harlingen, Tex. — Until March 11, by Directors of Cameron County Irrigation District No. 1 at Harlingen, for engine and pumping plant complete with foundations and all auxiliaries ready to run with a capacity of from 36,000 to 60,000 gal. of water per minute, with a maximum lift of 22 ft. F. H. Brown, Secretary District.

Ditch—Oklahoma, Okla.—Reported desired until April 10, by M. Cornelius, Co. Clk., for constructing drainage ditch to convert channel of North Canadian River.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Dredging — Hartford, Conn.—Following are unit figures of two bids opened March 6 by U. S. Engineer's Office, New London, for maintenance dredging in Connecticut River below Hartford (about 100,000 cu. yd.)—(a) per cu. yd., (b) total: Hartford & New York Transportation Co., Hartford, (a) 14 cts., (b) $14,000 (recommended for award); Bay State Dredging & Contracting Co., 247 Atlantic Avenue, Boston, Mass., (a) 28 cts., (b) $28,000.

State Canal Work—Albany, N. Y.—See "Bridges."

★**Dredging—New York, N. Y.**—Contract awarded Morris & Cummings Dredging Company, New York, for dredging in Raritan River, South River and Raritan Bay, N. J., at $20,000 (bids opened Feb. 10 by U. S. Engineer's Office).

Pier—New York, N. Y.—See "Proposed Work."

Dredging—Boston, Mass.—Following are four lowest bids opened March 8 by Directors of Port of Boston for dredging in Mystic River off Mystic wharf—(a) price per cu. yd. for dredging and disposing of material, (b) total for 450,000 cu. yd.:

	(a)	(b)
Maryland Dredging & Contracting Co., Baltimore, Md.	$0.1185	$53,325.00
Morris & Cumings Dredging Co., 17 State Street, New York	0.1289	58,005.00
Coastwise Dredging Co., Norfolk, Va.	0.129	58,050.00
Bowers Southern Dredging Co., Galveston, Tex.	0.13	58,500.00

Reclamation of Flats—Boston, Mass.—Following are unit figures of four lowest bids opened March 8 by Directors of the Port of Boston for reclamation of flats, East Boston—(a) price per cu. yd. dredging and placing material upon flats; (b) total for 1,000,000 cu. yd.:

	(a)	(b)
Atlantic Gulf & Pacific Co., Park Row Building, New York	$0.1547	$154,700.00
Morris & Cumings Dredging Co., 17 State Street, New York	0.178	178,000.00
Bay State Dredging & Contracting Co., Boston	0.18	180,000.00
Bowers Southern Dredging Co., Galveston, Tex.	0.18	180,000.00

State Canal Work—Albany, N. Y.—Following are unit figures of the only bid opened March 7 by W. W. Wotherspoon, State Superintendent Public Works, for improvement of Chadakoin River, known as Chautauqua Lake Outlet, in city of Jamestown: (a) Engineer's estimate, $89,252; (b) George L. Maltby, 101 East Fourth Street, Jamestown, $92,074:

	(a)	(b)
Cofferdam, pumping, etc., (lump sum)	$2,000.00	$4,000.00
Clearing (lump sum)	100.00	100.00
70,600 cu. yd. excav.	0.60	0.62
1,325 cu. yd. embankm.	0.15	0.15
75 M ft. sheeting and bracing	50.00	50.00
2.6 M ft. sawed lumber	60.00	60.00
1,000 lin. ft. foundation piles	0.35	0.25
20.5 M ft. wooden sheet piling	50.00	50.00
3,550 cu. yd. second-class concrete	7.50	7.00
450 cu. yd. second-class riprap	2.50	2.50
430 cu. yd. third-class riprap	2.50	2.50
110,000 lb. structural steel	0.055	0.06
17,000 lb. machinery	0.14	0.20
85 lin. ft. wrought-iron pipe railing	1.50	1.50
5,500 lb. metal reinforcement	0.04	0.04
1,900 sq. ft. steel sheet piling	0.90	0.75

★**Ditch—Bucyrus, Ohio.**—Contracts for constructing Mud Run joint county ditch between Marion and Crawford Counties, awarded as follows: Machine work on open ditch to Smith & Snouffer, Marion; team work, J. E. House, Wapakoneta; and tile work, Akron Vitrified Clay Mfg. Company, Akron. Total cost $18,990.

Dredging—Cleveland, Ohio.—Great Lakes Dredging & Dock Company, 1630 Williamson Building, only bidder for excavation 260,000 cu. yd. from upper Cuyahoga River at 16.95 cts. per yd. for excav. and depositing on outer lake front, round trip 24 miles, and 15.9 cts. per yd. near foot of East Ninth Street, round trip distance about 12 miles.

★**Water Gate—Indianapolis, Ind.**—Contract awarded Jacob Vogel, Indianapolis, for furnishing back-pressure water gate in manhole at Harding Street, and Kentucky Avenue at $4,120.

★**Breakwater—Manistee, Mich.**—Following are four lowest bids opened Feb. 21, by U. S. Engineer's Office, Grand Rapids, for constructing breakwater, and shore connections, etc.: John Ginzel, 404 Buhl Building, Detroit, $119,587 (awarded contract); East Shore Dredging Company, Muskegon, $128,800; Greiling Bros. Company Green Bay, $131,596, and The T. A. Gillespie Company, Pittsburgh, Pa., $159,492.

★**Drain—Sunfield, Mich.**—Contracts for constructing Collier and Mud Creek drain awarded as follows, total cost $28,000: Fred Milbourne, dredge work; Beach Bros., bridge work, and Byrom Stockwell, cement work (bidders all of Charlotte; bids opened Feb. 23).

★**Ditches — Algona, Iowa.** — Contract awarded R. L. Cox, Webster City, at $14,545 for constructing ditches and drains in District No. 125. Next three bidders: John Nordstrom, Algona, $15,280; B. E. Norton, Algona, $15,595; and Berkland & Little, Eagle Grove, $15,660. C. H. Beardsley, County Auditor.

★**Ditches—Charles City, Iowa.**—Contract for constructing drainage ditches (bids opened Feb. 26 by County Commissioner), including 2000 roads of tile awarded P. A. Thompson, Greene; estimated cost $18,500. G. S. Wacker, Engr., Charles City.

★**Ditch—Jackson, Minn.**—Contract for repairing County Ditch No. 3 (bids opened Feb. 29), opon work, to A. Rydeen, Windom, 12 cts. per cu. yd., and tile work, Schoel Bros., Worthington at $9,999. P. D. McKeller, County Auditor.

★**Irrigation—Great Falls, Mont.**—See "Bridges."

★**Levee — Varner, Ark.** — Contract awarded Lannin Bros. & Tansey, Texarkana, for removing 450,000 yd. of dirt in Linnwood and Auburn Levee District at 22 cts. per yd.

★**Jetty Work—Dallas, Tex.**—Contract for jetty work at Sabine Pass, Tex., awarded Charles T. Pickton, Rockport, Tex., at $237,740 (bids opened Feb. 21 by U. S. Engr., Dallas).

★**Drainage—Aberdeen, Wash.**—Contract awarded Mark Richardson, 3434 Fourteenth Avenue, Seattle, for clearing right of way and constructing ditches, drains and tidegates in Drainage District No. 1, cost $11,300.

★**Irrigation—Sequim, Wash.**—Contract for constructing about 7 miles of ditch awarded by Highland Irrigation District to McDonald & Jones, 410 Glove Building, Seattle, at $18,353. Work includes 19.29 acres clearing and grubbing, 49,176 cu. yd. earthwork, 100 cu. yd. rock, 3044 lin. ft. flume, 80 M ft. trestle, 15,687 M ft. road crossing, 12 lateral gates and openings, 1 head gate, 1 stop gate, etc. Next three lowest bidders: Zindorf & Lindral, Seattle, $19,928; Sloan Bros., Seattle, $20,696, and Burnett Construction Co., Seattle, $21,316. Frank H. Dyer, Secretary District. Thomas Watson, 410 Globe Block, Seattle, Engr.

ELECTRIC RAILWAYS

PROPOSED WORK.

New Orleans, La.—Algiers Ry. & Lighting Co. contemplates improving power plant.

Nashville, Tenn.—Nashville, Hartsville & Red Boiling Springs Ry. Co. incorporated to construct a line from Hartsville through Lafayette to the springs. Capital, $50,000. Among incrporators: John C. Shofer and Howard Andrews.

Morganfield, Ky.—Monganfield-Uniontown Electric Railroad Co. incorporated to construct an electric railway from Morganfield to Uniontown. Rights of way secured. Capital, $125,000. S. B. Anderson and Walter B. McLean of Memphis said to be interested.

Newport, Ky.—Preliminary surveys being made by Newport & Alexandria Interurban R.R. for proposed line from corporate line of Newport. The line will follow Licking Pike to 3-mile creek, then along creek valley to Alexandria Pike, and to parallel the pike to Alexandria.

Janesville, Wis.—Janesville & Madison Traction Co., Madison, plans to construct a railway from Janesville to Portage via Madison. G. Pickhardt, Madison, Pres.

Scotts Bluff, Neb.—Reported Wilkinson & Vandees of Denver, Colo., will construct an electric railway from Scotts Bluff to Gering.

Columbia, Mo.—Reported interests connected with Keokuk & Hamilton Power Co. contemplates constructing an electric railway from St. Louis to Kansas City via St. Charles and Fayette, about 250 miles.

McAlester, Okla. — Choctaw Ry. & Lighting Co. plans extensive improvements to system.

Hillsboro, Ore.—Hillsboro, Cynthiana & Bainbridge Traction Co. contemplates constructing in the spring an electric railway.

San Francisco, Cal.—Public Utilities Commission of Board of Supervisors on Feh. 23 voted to recommend setting aside $275,000 for constructing tracks and overhead trolley system from Twin Peaks Tunnel's Market Street entrance to junction of Sloat and Junipero Serra Boulevards.

Tolchaco, Ariz.—Plans being considered to construct an electric railway from Tolchaco into Oatman Dist. E. L. Mayvew, Oatman, is interested.

Boise, Idaho.—Reported Boise R. R. Co. will spend $90,000 for improvements to road.

PRICES AND LETTINGS.

★*Indicates award of contract,*

★**Brooklyn, N. Y.**—Public Service Commission for First District, New York, has authorized the N. Y. Municipal Ry. Corporation to award the contract for constructing Coney Island terminal to the Lord Construction Company, 105 W. Fortieth Street, New York, at $1,279,274. Three next bidders: Post & McCord, $1,337,140; Snare & Triest, $1,435,953; and Wilson & English, $1,438,387. Company is to furnish all materials, contractor to construct station, including track laying, etc.

★Contract for track installation of Lexington Avenue Subway, the Jerome Avenue branch and the 149th Street loop awarded by Public Service Commission to Empire Construction Company, 51 East Forty-second Street, at $276,433. (Bids opened Feb. 24.)

★**Boston, Mass.**—The following are unit prices of four lowest bids opened March 2 by Boston Transit Commissioners, 14 Beacon Street, for Section F, Dorchester Tunnel, Contract No. 599: (a) T. A. Gillespie Co., 363 Dorchester Avenue, $363,744 (awarded contract); (b) Coleman Bros., Boston, $401,443; (c) Hugh Nawn Contracting Co., 82 Savin Street, Roxbury, $433,443; (d) Lou B. Cleveland, Cleveland Building, Watertown, $437,692.

	*(a)	(b)	(c)	(d)
65,000 cu. yd. earth excavation, open cut method...	$2.70	$3.00	$3.00	$3.40
600 cu. yd. old masonry removed.................	2.75	6.00	6.00	6.00
16,000 cu. yd. concrete..........................	7.95	8.80	10.60	8.40
60 cu. yd. cinder concrete.......................	6.00	5.00	8.00	7.00
400 cu. yd. mortar................................	8.40	11.00	12.00	10.00
200 cu. yd. concrete with small stone............	8.25	16.00	12.00	10.00
2,800 sq. yd. granolithic.........................	1.60	1.00	1.60	1.80
1,700 lin. ft. casing, steel columns..............	1.00	1.25	2.60	2.00
200 cu. yd. brick masonry........................	18.00	16.00	18.00	18.00
670 lin. ft. laying 8-in. vitr. pipe for invert drain.	0.35	0.40	0.50	0.76
2,600 lin. ft. laying 6 to 15-in. vitr. pipe for sewers.	0.43	0.60	0.60	1.00
300 lin. ft. laying 18 to 27-in. vitr, pipe for sewers	1.00	1.00	1.00	2.00
2,000 lin. ft. laying 3 and 4-in. vitr. and c.-i. pipe..	0.20	0.20	0.25	0.60
600 ton setting steel, 6 lb. or less per ft...........	7.00	8.00	8.00	10.00
700 ton setting steel, more than 6 lb. per ft......	12.00	13.00	12.00	18,00
4,000 sq. yd. Portland cement plaster..............	0.25	0.40	0.40	0.40
60 cu. yd. neat cement grout......................	15.00	14.00	17.00	20.00
100 cu. yd. grout mixed, 1:1½.....................	12.00	9.00	12.00	15.00
200 cu. yd. grout mixed, 1:4.......................	9.00	7.00	6.00	10.00
60,000 sq. yd. prepared textile and asphalt..........	0.36	0.38	0.40	0.35
6,000 sq. yd. regrading streets.....................	0.76	0.60	1.00	1.00
Supporting and protecting buildings, risks, etc......	5,000.00	6,000.00	4,000.00	10,000.00

New York, N. Y.—Following are unit figures of the four lowest bids opened Feb. 24 by Public Service Commission for First District, 154 Nassau Street, for laying tracks on the Lexington Avenue subway, including Lexington and Jerome Avenues and 149th Street loop: (a) Empire Construction Co., 61 E. Forty-second Street, $276,433; (b) T. H. Reynolds, 1480 Broadway, $304,101; (c) Ward & Tully, Inc., Tenth Avenue, Brooklyn, $346,127; (d) Terry & Tench Co., Inc., Grand Central Terminal, $372,084.

Item	(a)	(b)	(c)	(d)
6—1 cu. yd. for concrete masonry, in place, north of Type II track..............................	$8.00	$10.00	$15.00	$10.00
9-D—5 cu. yd. removal of concrete masonry for new catchbasins in Type II track......................	10.00	30.00	25.60	26.00
17-E—35 net-ton, furnished and delivered to the works, c.-i. pipe, tees, elbows and other connections......	60.00	50.00	69.00	60.00
25—7 net-ton, furnished and delivered to the works, c.-i. hand hole frames and covers.................	60.00	60.00	100.00	100.00
1017—13,300, furnished and delivered to the works, 9-in. channels, 13¼ lb., 3 in. long, punched, each........	0.19	0.20	0.20	0.18
1025-A (a)—3, furnished, delivered and installed, complete, concrete bumping posts, each...............	470.00	300.00	400.00	420.00
1025-A (b)—2, furnished, delivered and installed, complete, timber bumping posts, each.................	370.00	200.00	350.00	550.00
1026—45,000 lin. ft., furnished, delivered and installed, complete, hand rail..............................	0.60	0.56	0.64	0.65
1027—680 M ft. installation of plank works, complete...	10.00	12.00	12.00	13.00
1028—41,000 installation of anti-creepers, complete, each	0.06	0.07	0.05	0.06
1050 (a)—102,000 lin. ft. installation of Type I track (2000 ft. R-Tan), complete.......................	0.73	0.56	0.88	0.95
1050 (b)—2,150 lin. ft. installation of Type I track (701 ft. R-2000 ft. R), complete..................	0.95	0.90	1.25	1.60
1050 (c)—7,900 lin. ft. installation of Type I track (701 ft. R. and less), complete...................	1.10	1.16	1.50	1.75
1052 (a)—18,500 lin. ft. installation of Type II track (2000 ft. R-Tan), complete.......................	3.16	3.90	3.85	4.50
1052 (b)—100 lin. ft. installation of Type II track (701 ft. R-2000 ft. R), complete..................	3.50	4.40	4.50	5.25
1052 (c)—450 lin. ft. installation of Type II track (701 ft. R and less), complete....................	4.00	4.65	4.60	5.60
1053 (a)—53,000 lin. ft. installation of Type III track (2000 ft. R-Tan), complete......................	0.70	0.90	0.85	0.88
1053 (b)—6,300 lin. ft. installation of Type III track (701 ft. R-2000 ft. R), complete..................	0.85	1.20	1.10	1.60
1053 (c)—3,700 lin. ft. installation of Type III track (701 ft. R. and less), complete..................	1.25	1.25	1.30	2.00
1053 (d)—11,000 lin. ft. installation of Type III track at and adjoining stations, complete................	0.70	0.90	0.84	0.88
1053 (e)—13,500 lin. ft. installation of Type III track on superelevated (2000 ft.-Tan)......................	0.80	1.00	0.97	0.90
1056 (a)—4,600 lin. ft. installation of Type IV track (2000 ft. R-Tan), complete.......................	1.69	2.60	3.00	1.70
1058 (a)—2,000 lin. ft. installation of Type VI track (2000 ft. R-Tan), complete.......................	0.75	1.20	0.80	0.90
1058 (b)—1,000 lin. ft. installation of Type VI track (701 ft. R-2000 ft. R), complete..................	1.00	1.70	1.25	1.40
1058 (c)—100 lin. ft. installation of Type VI track (701 ft. R. and less), complete..................	1.50	1.90	1.55	2.20
2042-A Installation of spec'l work, Portion 42, complete.	883.66	1,600.00	1,600.00	2,600.00
2045-A Installation of spec'l work, Portion 45, complete.	360.95	616.00	600.00	1,000.00
2049-A Installation of spec'l work, Portion 49, complete.	229.72	380.00	600.00	660.00
2050-A Installation of spec'l work, Portion 50, complete.	229.72	380.00	500.00	650.00
2051-A Installation of spec'l work, Portion 51, complete.	245.31	380.00	600.00	660.00
2052-A Installation of spec'l work, Portion 52, complete.	488.35	675.00	1,000.00	1,600.00
2053-A Installation of spec'l work, Portion 53, complete.	246.31	380.00	600.00	650.00
2054-A Installation of spec'l work, Portion 54, complete.	161.18	280.00	360.00	360.00
2055-A Installation of spec'l work, Portion 55, complete.	376.81	640.00	800.00	850.00
2056-A Installation of spec'l work, Portion 56, complete.	606.12	826.00	900.00	1,300.00
2057-A Installation of spec'l work, Portion 57, complete.	725.85	1,225.00	1,100.00	1,650.00
2058-A Installation of spec'l work, Portion 58, complete.	703.77	1,225.00	1,200.00	1,500.00
2059-A Installation of spec'l work, Portion 59, complete.	263.60	400.00	400.00	660.00
2060-A Installation of spec'l work, Portion 60, complete.	197.47	370.00	350.00	400.00
2061-A Installation of spec'l work, Portion 61, complete.	528.11	1,000.00	1,200.00	1,150.00
2062-A Installation of spec'l work, Portion 62, complete.	563.04	1,050.00	1,200.00	1,660.00
2063-A Installation of spec'l work, Portion 63, complete.	193.90	400.00	300.00	400.00
2064-A Installation of spec'l work, Portion 64, complete.	199.67	400.00	500.00	400.00
2066-A Installation of spec'l work, Portion 66, complete.	444.35	820.00	1,000.00	1,000.00
2067-A Installation of spec'l work, Portion 67, complete.	436.54	880.00	1,000.00	1,000.00
2068-A Installation of spec'l work, Portion 68, complete.	1,680.80	2,550.00	3,000.00	2,500.00
2069-A Installation of spec'l work, Portion 69, complete.	569.02	940.00	1,100.00	1,050.00
2070-A Installation of spec'l work, Portion 70, complete.	593.70	940.00	1,000.00	1,050.00
2071-A Installation of spec'l work, Portion 71, complete.	796.13	900.00	1,100.00	1,060.00
2072-A Installation of spec'l work, Portion 72, complete.	810.75	1,250.00	1,500.00	1,300.00
2073-A Installation of spec'l work, Portion 73, complete.	718.32	1,100.00	1,200.00	1,300.00

Additional expense, loss, risk and damage, (c) 5 per cent.

RAILROADS

PROPOSED WORK.

Yonkers, N. Y.—Committee appointed by Council to investigate grade crossings on Putnam Division of New York Central R. R. submitted a report to Council recommending that the city engineer be directed to prepare plans and specifications for the elimination either by overhead or underground construction of the grade crossings at Dunwoodie and Nepperhan.

Bernardsville, N. J.—Plans and specifications being prepared for regrading roadbed of Pennsylvania and New Jersey R.R., cost about $60,000. Frank B. Allen, Bernardsville, member Board Directors.

Mays Landing, N. J.—Agreement has been reached between the Freeholders and the West Jersey & Seashore R. R. on the cost of changing county road from south to north side of tracks to eliminate three grade crossings. Cost, $25,000.

Orange, N. J.—Reported agreement has been reached between city and Lackawanna R. R., whereby 21 grade crossings in the city will be eliminated.

Trenton, N. J.—Pennsylvania R. R. Company (Alex. Shand, Chief Engineer, Broad Street Station, Philadelphia) will eliminate grade crossings at Clinton Avenue, also at Whiteheads Road to include concrete and steel work, and cost $60,000 to $70,000.

Lansdale, Pa.—Philadelphia & Reading R.R. Co. (S. T. Wagner, Ch. Engr., Philadelphia) considering constructing a subway under railroad property at Lansdale; cost about $30,000.

Lake Toxaway, N. C.—Preliminary surveys completed for 7 miles of main line logging railroad for the Moltz Lumber Co. of Lake Toxaway. R. S. Brown, Engineer, Asheville.

Macon, Ga.—Installation of electric block system on Atlanta Division of Central of Georgia Ry. (C. K. Lawrence, Chief Engineer, Savannah) is contemplated; cost about $250,000.

Morganfield, Ky.—Uniontown Southern R.R. Co. incorporated to construct line from Uniontown to Morganfield, Sturgis, Paducah and Memphis. Capital, $150,000. S. B. Anderson, Memphis, Tenn., said to be interested.

Chillicothe, Ohio.—City Engineer directed to prepare plans and estimates for overhead railroad crossings to cost about $250,000.

Cleveland, Ohio.—Preliminary work under way on the west side for the eliminating of grade crossings on Nickel Plate R.R. (E. E. Hart, Ch. Engr., Cleveland), between Fulton Road and Detroit Avenue.

Bicknell, Ind.—Chicago, Indianapolis & Louisville R. R. Company (A. S. Kent, Ch. Engr., Chicago, Ill.), is reported considering building a line through Apraw Falls, Monroe City and Petersburg.

Joliet, Ill.—The Rock Island Railroad Co. and City considering elevating west side tracks.

Great Falls, Mont.—Reported Chicago, Milwaukee & St. Paul Ry. Co. (C. F. Loweth, Ch. Engr., Chicago, Ill.) will lay 70 miles track on roadbed between Choteau and Agawam; also extend line from Grass Range to Winnit during coming summer.

Great Falls, Mont. — Reported Great Northern Ry. Co. (A. H. Hogeland, Ch. Engr., St. Paul, Minn.) will construct a railroad from Grass Range to Winnit, paralleling proposed road to be built by Chicago, Milwaukee & St. Paul Ry. Co.

Cotter, Ark.—Missouri Pacific Ry. (E. A. Hadley, Ch. Engr., St. Louis, Mo.), is reported taking steps to construct the Cotter-Rush Mineral Belt Ry., which is to cost about $10,000 per mile, and is to be built between Cotter and Rush, a distance of about 20 miles.

Fort Worth, Tex.—The reballasting of the Cotton Belt track from Wylie to Fort Worth, estimated by the engineers to cost approximately $324,000. Roadbed will be ballasted 18 in. with burnt clay at an estimated cost of $4,500 per mile.

BIDS DESIRED.

Buffalo, N. Y.—Until March 18, by Grade Crossing Commission, Room 436 Ellicott Square (Wm. H. Fitzpatrick, Chairman), for masonry, paving and other necessary work necessary for constructing subways, approaches and sewer through Delaware, Lackawanna & Western R.R. from Doat Street through Moeller Street., Warring Avenue, Gissel Street, into Bailey Avenue, advertised in Engineering Record.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Ebensburg, Pa.**—Contract for constructing 12 miles of railroad for Cambria & Indiana R.R. Co. in Cambria County, awarded to A. L. Anderson & Bros.

★**Chester, Va.** — Contract awarded Vaughan Construction Company, Roanoke. for constructing the Chester & Hopewell R. R. from Chester to Hopewell, a distance of 8 miles.

PUBLIC BUILDINGS AND SCHOOLS

PROPOSED WORK.

Belchertown, Mass.—State Board of Insanity, Boston, has decided to erect Western Massachusetts School for the Feeble-Minded at Belchertown; appropriation $50,000.

Providence, R. I.—The high school is to be 3-story fireproof, and cost about $400,000, but nothing will probably be done toward erecting same for the next 6 months or a year. J. O. Winslow, Superintendent Schools; Hoppin & Field, Archts,, 32 Westminster St.

New Haven, Conn.—Board of Education working tentative plans for a $200,000 commercial high school.

Wallingford, Conn.—John Simpson, 1224 Essex Building, Newark, N. J., is preparing specifications for the proposed high school to be two story and basement with sub-basement, steel, concrete, brick and stone, and cost $114,000. Alfred B. Morritt, Secy. Bldg. Com.

Baldwinsville, N. Y.—Competitive plans desired until March 20 by Board of Education (R. B. Orvis, Secy.) for a 10 room 1 story grade school advertised in Engineering Record.

Binghamton, N. Y.—Board of Supervisors passed resolution favoring purchase of new site for County Tuberculosis Hospital.

Purchase, N. Y.—Preliminary plans being prepared by Donn Barber, 101 Park Ave., New York, for a Community Center House, a gift to the town from William A. Reid, to be erected on Purchase St. and Harrison Ave.; probable cost, $100,000.

Camden, N. J.—Contract soon to be let for erecting the stone library according to plans by Karcher & Smith, 1420 Chestnut Street, Philadelphia, Pa.

Montclair, N. J.—A $160,000 addition to St. Vincent's Baby Hospital reported contemplated.

Morristown, N. J.—Revised bids being received for high school.

Contract will be let this summer by All Souls Hospital Trustees for erecting a new building costing $150,000. Francis Hasselman, 30 East Forty-second Street, New York, N. Y., Archt.

Newark, N. J.—School bonds amounting to $1,019,000 sold. Address the Mayor.

Red Bank, N. J.—Election to be held March 21 to vote $145,000 bonds to erect an eight-room addition to Shrewsbury Avenue School and a sixteen-room annex to High School. Address Board of Education.

Summit, N. J.—Reported Board of Education has decided to ask Board of School Estimate for $236,600; of this sum $210,000 will be spent for erecting and equipping proposed high school on Maple Street and $24,000 to erect and furnish four-room addition to East Summit School.

Altoona, Pa.—Mayor Charles E. Rhodes in his annual message recommends erecting a new city hall at cost of $100,000.

Ebensburg, Pa.—No bids opened Feb. 25 by County Commissioners for erecting additions to Courthouse.

Kittanning, Pa.—Agreement reached between the city and the State Armory Commissioners, Harrisburg, whereby a $45,000 armory is to be erected here.

Kutztown, Pa.—Election to be held to vote $40,000 bonds for school.

Lancaster, Pa.—School bonds for $250,000 will be sold March 28 by city.

Lewistown, Pa. — Reported erecting $100,000 high school is under consideration. Address Board of Education.

Myerstown, Pa.—Plans to be prepared for a building to be erected at Albridge College for which there is $48,364 available. Rev. A. M. Sempsel, Reading. Field Secretary, United Evangelical Church, may be able to give additional information.

New Brighton, Pa.—Board of Education engaged W. G. Eckles of New Castle, to prepare plans for proposed $100,000 high school.

Philadelphia, Pa.—Tentative plans being prepared by Duhring, Okie & Ziegler, Bailey Bldg., for a 7-story hospital which Howard Hospital Trustees contemplate erecting.

Pittsburgh, Pa.—Trustees of Mercy Hospital considering erecting a wing at Main Building costing $60,000.

Taylor Allderdice, Chairman of the Committee on Architects, has submitted report to Board of Public Education recommending selection of following architects: Edward Stotz, Monon Bank Bldg., for addition to Fifth Ave. High School; Kiehnel & Elliott, Keenan Bldg., for Greenfield School to be erected at Greenfield Ave. and Alger St.; Robert M. Trimble, Ferguson Bldg., for Perry School, to be erected at Perrysville Ave. and Semicir St.; Edward B. Lee, 346 Fourth Ave., for addition to Peabody School, and Press C. Dowler, Arrott Building, for addition to Beechwood School.

Pottsville, Pa.—C. T. Mould, Pottsville, is architect for the almshouse. Address County Comptroller.

Swissvale, Pa.—Erection of two-story, fireproof school, costing $180,000, under consideration. Address School Board.

Turtle Creek, Pa.—Board of Education will select plans about April 1 for proposed 24-room school to be erected at Penn and Sycamore Streets; probable cost, $255,000.

Wilcox, Pa.—Hersh & Hersh of Altoona are architects for proposed school to replace building recently destroyed by fire. Address Board of Education.

Wilkes-Barre, Pa.—State School Building Commissioners at Harrisburg, approved plans prepared by Robert Ireland, School Architect, for proposed two-story, eighteen-room school; cost about $75,000.

Wymore, Pa.—Election will probably be held to vote $45,000 bonds for erecting high school.

Farnhurst, Del.—Contract about to be let for alterations and addition to State Hospital at Farnhurst; cost $65,000. Leon Wilde Crawford, Architect, Wilmington.

Roanoke, Va.—Mayor signed ordinance authorizing election March 28 to vote $300,000 school improvement bonds. Address City Clerk.

Morgantown, W. Va.—Plans being prepared by Paul A. Davis, 3d, 1713 Sansom Street, Philadelphia, Pa., for two-story, brick and stone college building to be erected at West Virginia University; cost $200,000.

Hickory, N. C.—Citizens voted $25,000 bonds for erecting third public school. Address City Bd. Education.

Raleigh, N. C.—Raleigh Township school bonds amounting to $100,000 sold. Address Mayor, Raleigh.

Leesburg, Ga. — See "Paving and Roads."

Newman, Ga.—Citizens March 2 voted $55,000 bonds for erecting school buildings. Address City Clerk.

Mobile, Ala.—School bonds for $150,000 will be sold March 27 by George E. Stone, County Treas., Mobile.

Nashville, Tenn.—Contract will be let about May by Board of Education for erecting addition to high school to cost $200,000.

Barboursville, Ky. — Reported erection of gymnasium and science hall at Union College contemplated.

Jackson, Ky.—Erection of jail, costing $40,000, under consideration. Address County Clerk.

Akron, O.—Plans reported being prepared for new city hall to cost $300,000. Address City Clerk.

Atwater, Ohio.—School bonds for $24,000 will be sold March 25, by H. H. Woolf, Clk. Board Education.

Bristolville, Ohio.—Miller & Son, Youngstown, are architects for the fireproof school.

Chillicothe, Ohio.—Six County District Hospital Trustees approved the tentative plans prepared by Frank L. Packard, Columbus for the hospital, to cost $35,000. R. D. Alexander, Secy. Board.

Circleville, Ohio.—Board of Education engaged Frank L. Packard, Columbus, to prepare plans for proposed high and grade school to replace Everetts Building.

Columbus, O.—Plans being prepared by J. N. Bradford, Brown Hall, Ohio State University, for a three-story Art Building of two wings contemplated on Fifteenth Avenue; cost about $200,000.

Dayton, Ohio.—See "Bridges."

Martins Ferry, Ohio.—Site at Third and Hanover Streets selected for new city hall; probable cost $46,000. Address City Clerk.

Oakwood, Ohio.—Plans prepared by Dexter & McCluer, Canby Building, Dayton, for five-room and auditorium school addition; appropriation $40,000. Address Board of Education.

Summerfield, Ohio.—Steps being taken to erect second grade high school here. Address School Board.

Columbus, Ind.—Specifications prepared by D. A. Bohlen & Son, Majestic Building, Indianapolis, for proposed $100,000 Bartholomew County Public Hospital.

Huntington, Ind.—Plans being considered by the School Board for a high school.

South Bend, Ind.—Freyermuth & Maurer, Warner Building, engaged to prepare plans for school to be erected on Sample Street; cost approximately $100,000.

South Bend, Ind.—Plans prepared by Freyermuth & Maurer, Warner Building, for the proposed 1-story 17-room school have been accepted by the School Board; cost, $100,000.

East Lansing, Mich. — Engineering building of Michigan Agricultural College seriously damaged by fire.

Highland Park, Mich.—Erection of a general hospital and a hospital for contagious diseases being considered. Address Village Clerk.

South Haven, Mich.—Election to vote $50,000 bonds for erecting a city hall and armory contemplated. Address City Clerk.

Chicago, Ill.—Contract to be let in about thirty days for erecting a police station. C. W. Kallal, City Architect.

Longview, Ill.—Contract will be let about March or April for erecting the 2-story semi-fireproof high school to cost including equipment about $22,000. Ralph J. Hales, Secy. Board of Education.

Potomac, Ill.—Township High School is to be erected costing $40,000. Address Township Clerk, Potomac.

Urbana, Ill.—Trustees considering erecting field laboratory for Department of Horticulture at the University of Illinois. J. M. White, Supervising Architect.

Waukegan, Ill.—Citizens voted $90,000 bonds for erecting new schools. Address Board of Education.

Stoughton, Wis.—Citizens voted $35,000 bonds for purchase of site and erecting eight-room grade school. Address School Board.

Superior, Wis.—Plans being prepared by Radcliffe & Crumpton, Superior, for grade school. L. A. Nichols, Secy. School Bd.

Milwaukee, Wis.—See "Bridges."

Dow City, Iowa.—E. S. Barber, Denison, is architect for proposed school.

Fort Dodge, Iowa.—Plans of E. O. Damon, Jr., of Fort Dodge, accepted for the county home. J. L. Hanrahan, County Auditor.

Waukon, Iowa.—School bonds amounting to $65,000 sold. Address School Board.

Charles A. Dieman, Granby Block, Cedar Rapids, Mich., is architect for proposed $50,000 high school.

Webb, Iowa.—Contract soon to be let for erecting 3-story fireproof brick school costing, including equipment, $45,000. J. P. Grieves, Secy. Board Education.

Deer Wood, Minn.—Aitkin Crow Wing County Tuberculosis Sanatorium Board decided to erect $30,000 sanatorium near Deer Wood. Auditor of Aitkin County, Aitkin, may be able to give further information.

David City, Neb.—Plans being prepared by R. A. Bradley & Co., Hastings, for the high school. H. O. Schaaf, Clerk School Board.

Havelock, Neb.—Citizens voted $35,000 bonds for erecting high school.

Oakland, Neb.—Election to be held March 14 to vote $48,000 bonds for rebuilding high school destroyed by fire. Address School Board.

Omaha, Neb.—Board of Education sold $500,000 school bonds.

Butte, Mont.—Board of School Trustees considering election to vote $65,000 bonds to rebuild Madison School, recently destroyed by fire.

Independence, Mo.—Citizens voted $75,000 bonds to erect high school. Address Board of Education.

Ennis, Tex.—City Commissioners will hold an election April 4 to vote $30,000 bonds for erecting a school.

Denton, Tex.—Plans being prepared by E. E. McAnally, Dallas, for a $125,000 dormitory to be erected at the College of Industrial Arts.

San Antonio, Tex.—Captain B. Jordan, officer in charge of the Arsenal, is preparing plans for a storehouse for which Congress has appropriated $90,000.

Waurika, Okla.—Election will probably be held in August to vote $100,000 bonds to erect and furnish court house.

Seattle, Wash.—Edgar Blair, 1426 Jackson Street, retained to prepare plans and specifications for a nine-room addition to Madrona School; cost about $60,000. Reuben W. Jones, Secretary School Board.

Spokane, Wash.—Archibald G. Rigg, 521 Peyton Building, is architect for administration building to be erected at Wentworth College, to be 2-story and basement brick and concrete and cost $300,000.

Portland, Ore.—Erection of a $100,000 building at the University of Oregon School of Medicine contemplated. Dr. K. A. J. Mackenzie, Dean.

Merced, Cal.—Election will probably be held to vote $150,000 bonds for purchasing site, erecting and equipping school. Address A. W. Meany, Principal of school, Union High School District.

Salt Lake City, Utah.—School bonds for $200,000 will be sold March 14 by Board of Education (L. P. Judd, Clk.).

BIDS DESIRED.

Arkadelphia, Ark.—Until April 19, by James A. Wetmore, Acting Supervising Architect, Washington, D. C., for constructing U. S. Post Office, advertised in Engineering Record.

Pittsburgh, Pa.—Until March 13 at office of Adjutant General of Pennsylvania by State Armory Board (Benj. W. Demming, Secy.), Harrisburg, for erecting artillery armory on Emerson Street.

Schuylkill Haven, Pa.—Until March 13 by School Board (I. W. Tyson, Secy.) for erecting high school. Frank X. Reilly, 112 S. Center Street, Pottsville, Pa., Archt.

West Chester, Pa.—Reported desired until March 13, by Pennsylvania State Armory Board (Benjamin W. Deming, Secy.), Harrisburg, for erecting two-story and basement brick stone reinforced concrete and steel, 64 x 38-ft., and 59 x 80-ft. armory for West Chester. Philip H. Johnson, Archt., Land Title Building, Philadelphia.

Binghamton, N. Y.—Until Mar. 15 by State Hospital Commission (E. S. Elwood, Secy.), Albany, for heating work and addition to boiler plant and equipment at Binghamton State Hospital advertised in Engineering Record.

Dobson, N. C.—Until March 28 by Board County Commissioners (J. B. Sparger, Chmn.) for erecting court house and jail, advertised in Engineering Record. Harry Barton, Archt., Greensboro.

Durham, N. C.—Until March 21, by Bd. of Education, for erecting two schools, fireproof. C. Howard Lloyd, Architect, Harrisburg, Pa.

Columbia, S. C.—Until March 28, by State Board Health, at office of Wilson & Sompayrac, Archts., 1404-6 Palmetto Bldg., for erecting Ward 2 for women of the State Sanitorium, State Park, S. C.

Hamilton, Ala.—Until March 25, by Secretary Board Trustees Sixth District Agricultural School, for erecting the three-story brick and concrete building to cost $25,000. Fredk. Ausfeld, Archt., Montgomery,

New Orleans, La.—Until April 26, by Sewerage and Water Board, Room 508 City Hall Annex (F. S. Shields, Secretary), for erecting office building. Toledano, Wogan & Bernard, Architects, Perrin Building.

Dayton, Ohio.—Until April 4, by Board of Education (C. J. Schmidt, Clk.) for erecting the Edwin Joel Brown School on Fairview Ave. Messrs. Albert Pretzinger & Edw. P. Musselman, Archts., 1155-1162 Reibold Bldg., Dayton.

North Olmstead, O.—Until March 24, by A. C. Reed, Clk. Board Education, for enlarging and repairing the Coe Ridge School and the Butternut School. Cost, $35,000.

Huntington, Ind.—Until March 17, by School Trustees (C. C. Griffith, Secy.) for erecting a high school. Elmer E. Dunlap, Archt., 909 State Life Building, Indianapolis.

Warsaw, Ind.—Until March 23 by School Board (F. Bash, Secy.), for erecting a brick school costing $50,000.

Iron River, Mich.—Until March 14, according to later official reports, by D. B. Henley, Secy. Board Education, for erecting a ten-room grade school.

Pelican Rapids, Mich.—Until March 20, by Board Education Independent School Dist. No. 10, for erecting high school. Separate bids for plumbing, heating and venilating work. E. F. Broomhall, Archt., 710 Alworth Bldg., Duluth, Minn.

Rudd, Iowa.—Reported desired until March 17, by School Bd., for three-story brick 60 x 80 ft. school; probable cost $20,000. J. G. Ralston, Archt., Waterloo.

Sloan, Iowa.—Until March 28, by Board of Education (M. B. Hills, Pres.), for 2-story and basement brick and stone, 90 x 126 ft. school. Probable cost $40,000. Beuttler & Arnold, Archts., 609 Security Building, Sioux City.

Falls City, Neb.—Until April 7 by James A. Wetmore, Acting Supervising Archt., Washington, D. C., for constructing complete (including mechanical equipment and approaches) U. S. Post Office at Falls City.

Seattle, Wash.—Reported desired until March 15, by Reuben W. Jones, Clk. School Board, for erecting addition to Lowell Grammar School. Probable cost, $75,000. Edgar Blair, School Archt.

Until March 31, by Board Regents, University of Washington, Henry Bldg., for erecting concrete and steel 3-story Political Science and Commerce building on the University Campus. Probable cost, $105,000. Bebb & Gould, Archts., Denny Bldg., Seattle.

Los Angeles, Cal.—(Readvertisement.) Until March 16, by Board of Education (Wm. A. Sheldon, Secy.), for erecting the high school, not including heating and ventilating. John C. Austin, Archt.

Prescott, Ariz.—Until April 12, by Board of Supervisors (Ray T. Belcher, Clk.), for erecting fireproof court house, separate bids to be received on plumbing, heating, electric wiring metal windows, metal doors and trim. $200,000 available.

Vancouver, B. C.—Reported desired until March 23, by Board Public Works, Ottawa, Ont., for erecting freight shed on the Government Wharf.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Hanover, N. H.**—Contract for erecting general storehouse at Dartmouth College awarded H. P. Cummings Construction Co., Ware, Mass., at about $35,000.

★**Swampscott, Mass.** — Lowest bid opened March 4, by Board of Selectmen for erecting the library was submitted by C. S. Cunningham & Sons Constr. Company, 101 Tremont Street, Boston, at $18,200.

★**Southampton, L. I., N. Y.**—Contract awarded Donnelly & Corrigan, Windmill Lane, Southampton, for erecting addition to Southampton Hospital; cost about $77,000.

★**Rochester, N. Y.**—Contracts for erecting School No. 37 awarded by Board of Education (J. S. Mullan, Secy.; bids opened Feb. 21), as follows: Carpentry, William F. Maas, 124 Railroad Avenue, $27,205; masonry, Curran & Swartout, 28 S. Union St., $35,000; plumbing, Wright & Alexander Company, 283 State St., $4,400.

All bids opened same time and place as above for heating and ventilating in above school; also flooring, have been rejected and new bids to be asked on new specifications.

★**Syracuse, N. Y.**—Contract awarded Smith & Caffery Co., 1421 North Salina Street, for reinforced steel work for John Slocum College of Agriculture, to be erected on Campus of Syracuse University.

★**Lebanon, Pa.**—Contracts for erecting fireproof school awarded as follows: General contract to Beard Construction Co., Colonial Trust Building, Reading; heating, B. G. Carpenter Co., Reading; plumbing, Shellenberger & Co., Wilkes-Barre. J. H. Seltzer, Secretary Board of Education.

★**Philadelphia, Pa.**—Contract for erecting 3-story and basement brick, stone and reinforced concrete school at Allegheny Avenue and B Street, awarded Melody & Keating, 1218 Chestnut Street; cost about $228,000.

★**Pittsburgh, Pa.**—Contracts reported awarded as follows, for erecting two-story brick and stone dining hall at City Hospital, Marshalsea: General construction, Wilson Construction Company, Pittsburgh; heating, Burns-Fleming & Company, 815 Forbes Street; electric work, Morganstern Electric Company, 325 Second Avenue.

★**Washington, D. C.**—Contract awarded recently by Commissioners D. C. for erecting addition to Powell School No. 157 to Burgess & Parsons, McLachlen Building, Washington, at $59,990 (bids opened Dec. 30).

★**De Funiak Springs, Fla.**—Contract for erecting high school (bids opened Feb. 24) awarded John Novene & Co., Chicago, Ill., at $43,850. D. N. Trotman, County Superintendent.

★**Akron, Ohio.**—Contract for erecting armory auditorium awarded Clemmer & Johnson Co., Hicksville, at $142,194. Karl I. Best, Archt., Columbus.

★**Olmstead Falls, Ohio.**—Contract for erecting school on Dutch Road (bids opened Feb. 28), awarded Drummond & Miller, Cleveland, at $47,000; plumbing, Brainerd Plumbing Company, Cleveland, at $3,500, and heating, Bryce Heating & Ventilating Company, Toledo, at $8,884. F. N. Gallagher, Clerk Board of Education.

★**Wilmington, O.**—Contract for general construction of Clinton County Courthouse awarded Western Building Company, Iroquois Building, Buffalo, N. Y., and Caldwell & Iseminger, of Middletown, for mill and carpenter work; cost about $200,000. Weber, Werner & Adkins, Archts., Merchants' Library Building, Cincinnati.

Brazil, Ind.—Lowest bid opened Feb. 21 by School Board for erecting Senior High School submitted by James I. Barnes, of Logansport, at $54,990.

★**Grand Rapids, Mich.**—Contracts for erecting Calvin College awarded as follows: General construction, Dyke & Yonkman of Holland; heating, Knee Heating Company, Grand Rapids; plumbing, Dennison, Dykman Company, Grand Rapids; lighting, Roseberry-Henry Electric Company, 41 Pearl Street, N. W.; cost about $130,000.

★**Sycamore, Ill.**—Following are four lowest bids opened by Board of Education (George A. James, Clk.), for erecting a school: General contract—Singer & Nelson, Sycamore, $58,782 (awarded contract); August Olson, Sycamore, $59,015; Skeglund & Wedburg, De Kalb, $59,984; John Moroff & Son, $60,450. Contract for heating, plumbing, etc., awarded Arthur W. Murray Company, Hoopeston, at about $12,265.

★**Belmond, Iowa.**—Contract for erecting high and grade school (bids opened Feb. 23) awarded as follows: General contract to Standard Construction Co., Minneapolis, Minn., $57,326; heating and ventilating, J. P. Adamson & Co., St. Paul, Minn., and plumbing, Richter Plumbing Co., St. Paul, Minn., at $3,212.

★**Oakdale, Iowa.**—Contract awarded by State Board of Control, Des Moines (bids opened Feb. 25), to Theodore Stary & Co. of Cedar Rapids, at $58,600 for erecting addition to State Tuberculosis Hospital at Oakdale.

★**Duluth, Minn.**—Contract awarded to Lounsbury & McLeod, Duluth, to erect Morgan Park School at $116,000.

★**New Richland, Minn.**—Contracts for erecting high school (bids opened Feb. 7) awarded as follows: General contract to David Comb & Sons, Lumber Exchange Building, Minneapolis, at $22,975; heating, J. M. Madden, Minneapolis, $7,305, and plumbing, Worthington & Company, Minneapolis, at $1,327. M. T. Tosseland, Superintendent of Schools.

Two Harbors, Minn. — Lowest bid opened recently for erecting the high school addition submitted by J. L. Klippen, Duluth, at $46,936.

★**Paris, Tex.**—Contract awarded Feb. 24 by City Council for erecting Third Ward School to T. T. Reddick of Fort Smith, Ark., at about $36,000.

★**Ellensburg, Wash.**—Contract for erecting U. S. Post Office awarded Thomas E. Young & Company, Empire Building, Seattle, at $53,915.

Brea, Cal.—Four lowest bids opened recently by Board of Education for erecting two-story ten-room and auditorium hollow tile and brick grammar school were as follows: Harvey Garber, Huntington Beach, $44,888; George A. Daniels, Pasadena, $46,180; Barkelew & Gould, 1017 East Twenty-first Street, $47,472, and Cresmer Mfg. Company, Riverside, $48,279. Thomas Haverty Company, 517 S. Los Angeles Street, Los Angeles, submitted lowest bid for plumbing, at $4,375, and Hoagland Lakin Electric & Engineering Company, Los Angeles, the lowest for heating, at $3,190. Jeffery & Schaefer, Archts., Van Nuys Building, Los Angeles.

★**Seattle, Wash.**—Contract awarded H. D. Stewart, American Bank Building, for erecting 1-story compressor building for East Waterway Terminal Project at $21,668.

★**San Pedro, Cal.**—Contract for erecting three-story concrete hospital for Sisters of Mercy awarded P. H. Berg, 412 Severance Building, Los Angeles. Charles F. Durr, State Bank Building, Archt.

PRIVATE BUILDINGS

PROPOSED WORK.

Montpelier, Vt.—McDowell & Henderson, Burlington, have prepared plans for a theater for the Leland Estate; cost, $27,000.

Haverhill, Mass.—Massachusetts Northeastern Street Railway Co. (R. D. Hood, Engineer Maintenance of Way, Haverhill) will rebuild car house destroyed by fire.

Lawrence, Mass.—Edward T. J. Graham, 20 Beacon Street, Boston, is architect for $100,000 parochial school to be erected on Summer and Jackson Streets for Holy Rosary Parish. Rev. Mariano Milenese, Pastor.

Worcester, Mass.—All Saints Church Corporation will erect a $50,000 parish house on Irving Street. C. G. Washburn, Chmn. Committee in Charge.

The Worcester Electric Light Co. is to double the Webster Street power station and add additional equipment, at a cost of $250,000.

Hartford, Conn.—Peter A. Frasse & Co., Sullivan and Canal Streets, New York, is taking steps, according to reports, to erect a modern steel finishing warehouse here.

Dunkirk, N. Y.—Order of Passionist Fathers having plans prepared for a group of preparatory college buildings to be two-story and basement and erected at Hemlock Grange at an estimated cost of $200,000.

Great Neck, L. I., N. Y.—Preliminary sketches being prepared by Palmer, Hornbostel & Jones, 63 William Street, New York, for a residence group, consisting of dwelling, garage and outbuildings to be erected for Thomas J. Stewart; cost about $200,000.

Mount Vernon, N. J.—H. T. Lindeberg, 2 West 47th Street, New York, is architect for residence to be erected by Seth Thomas.

New York, N. Y.—Plans being prepared by John P. Boyland, 2526 Webster Avenue, for five-story apartment house to be erected on Grand Boulevard and the Concourse for W. A. J. Building Corporation.

Plans being prepared by Walter Haefeli, 245 West 55th St., for 12-story brick, terra cotta and limestone store and loft building to be erected at 44-50 East 32nd St. for Hasco Building Company, 245 West 55th St.; estimated cost, $275,000.

Plans filed for erecting following buildings: Two 5-story brick apartments on Broadway and 205th St. for Alexander Grant Construction Company; total cost, $100,000; Neville & Bagge, Archts., 105 West 40th St.; 8-story fireproof hotel at 317 West 45th St. for Vincent Astor; cost, $160,000, Tracy & Swartwout, Archts., 244 Fifth Ave.; 12-story fireproof store and loft building at 101 East 16th St. for Edgewood Realty Company; cost, $150,000, George and Edward Blum, Archts., 505 Fifth Ave.; 12-story store and showroom building at 509 Fifth Ave. for Sturges Estate; cost, $200,000, Herman Lee Meader, Archt., 4 West 33rd St.; two 5-story brick tenements at Anderson Ave. and 162nd St. for Anderson Building Corporation; total cost $100,000, Goldner & Goldberg, Archts., 391 East 149th St.

Plans prepared by Guy Lowell, 225 Fifth Avenue, for a residence which Morton F. Plant intends erecting at Fifth Avenue and Eighty-sixth Street, cost approximately $300,000.

James S. Maher, 431 West Fourteenth Street, is architect for fireproof market building which John J. Gillen proposes erecting at Tenth Avenue and Fourteenth Street.

Plattsburg, N. Y.—Competitive plans being received by C. C. Merrihew, Chairman Bldg. Com., F. & A. M., for a 4-story and basement brick stone and steel Masonic Temple, to cost $50,000.

Troy, N. Y.—Contract about to be let for erecting school on Third Street for St. Mary's Parish; cost about $100,000. M. L. and H. G. Emery, Archts., 42 North Pearl Street, Albany.

Pitman, N. J.—Methodist Church will erect $65,000 edifice.

Rahway, N. J.—Y. M. C. Association (John A. Overton, Secretary) contemplating erecting new building, to cost about $50,000.

Ardmore, Pa.—Contract soon to be let for erecting stone bank building for the Merion Title & Trust Company. Furness Evans & Company, Archts., Provident Bldg., Philadelphia.

Braddock, Pa.—Sts. Peter and Paul Greek Catholic Church intends erecting new edifice, costing $100,000.

Easton, Pa.—Joseph M. Hitzel, proprietor of Franklin Hotel, Easton, reported interested in company which intends erecting ten-story combination hotel and store building on Northampton and Fourth Streets.

Harrisburg, Pa.—New edifice to be erected for Messiah Lutheran Church; cost $75,000.

Lancaster, Pa.—Contract will soon be let for three-story brick, reinforced concrete and steel, 80 x 280 ft. warehouse, to be erected here for Bayuk Brothers, Third and Spruce Streets, Philadelphia. E. Allen Wilson, Archt., 1208 Chestnut Street, Philadelphia.

Lehighton, Pa.—Plans prepared for a $25,000 lodge building for the Order of Elks.

Malvern, Pa.—Contract soon to be let for erecting one and two-story stone church and rectory for St. Patrick's R. C. Church. Paul A. Monaghan, Archt., Drexel Bldg., Philadelphia.

Nazareth, Pa.—Plans are being prepared by Boyd & Stewart, Century Building, Pittsburgh, for $40,000 Y. M. C. A. building.

Philadelphia, Pa.—Plans being prepared by Ballinger & Perrot, 1211 Arch Street, for a 4-story stone addition to be erected to parochial school for St. Peter's R. C. Church at Fifth Street and Girard Avenue.

Contract about to be let for erecting 13-story brick, stone, steel and concrete apartment house at Thirteenth and Spruce Streets, for John Stafford, 1112 Chestnut Street.

Plans being prepared for church, chapel and Sunday School building which the First Christian Church (Scientist) intends erecting at Tenth Street and Northeast Boulevard.

Roman Catholic Diocese contemplates erecting Boys' High School at Forty-ninth and Chestnut Streets. Archbishop Prendergast may be able to give information.

Pittsburgh, Pa. — Preliminary sketches being prepared by W. G. Wilkins & Co., Westinghouse Building, for 12-story, brick, terra cotta, fireproof office building contemplated on Duquesne Way and Barker Place for Atlantic Refining Co.; probable cost $200,000.

W. A. Ullom, House Building, is architect for edifice to be erected for New Covenant Mission on Crawford Street; cost about $30,000.

Union Storage Company, Second Street and Liberty Avenue, will replace Twenty-fifth Street storage warehouse recently destroyed by fire, with a storage plant at Fortieth Street and Allegheny Valley R. R. in Lawrenceville Dist.

Boyd & Stewart, Century Building, are architects for Y. M. C. A. building to be erected at Ben Argyle; cost $35,000.

Scranton, Pa.—A church costing about $30,000 contemplated at Gibson Street and Taylor Avenue for Cathedral Parish.

Sharpsburg, Pa.—St. Mary's R. C. Church plans erecting a $200,000 edifice. Address Pastor.

West Chester, Pa.—West Chester Methodist Episcopal Church will erect a stone church and Sunday school building. Wesley Lesher Blithe, Archt., 608 Chestnut Street, Philadelphia.

Baltimore, Md.—Contract will soon be let for erecting six-story, brick, stone, concrete and terra cotta, 69 x 141 ft., Y. W. C. A. building. Joseph Evans Sperry, Archt., Calvert Building.

A chapel costing $25,000 is to be erected at Goucher College. (Dr. W. W. Guth, President.)

Washington, D. C.—Plans being prepared by Wyatt & Nolting, Keyser Building, Baltimore, Md., for $3,000,000 combination hotel and office building to be erected on site of old Arlington Hotel for Arlington Corporation.

Logan, W. Va.—Reported Chesapeake & Ohio Railroad (F. I. Cabell, Ch. Engr., Richmond, Va.) contemplates erecting passenger depot here; probable cost, $60,000.

Black Mountain, N. C.—Contract soon to be let for erecting a granite reinforced-concrete and steel auditorium for the National Festival Chorus Club of America; cost $200,000. Louis G. Ashbury, Archt., Charlotte.

New Orleans, La.—The Southern Telephone & Telegraph Company reported contemplating erecting a $300,000 building here. Address the Manager.

Nashville, Tenn.—Contract soon to be let for erecting exchange building for Cumberland Telephone & Telegraph Company to cost $225,000. Address George J. Yundy, Chief Engineer Southern Bell Telephone & Telegraph Company, Atlanta, Ga.

Cincinnati, Ohio.—Harry Hake, Telephone Building, is preparing plans for exchange building to be erected at Woodburn Avenue and Locust Streets for Cincinnati Telephone Company.

Cleveland, Ohio.—Plans filed for three-story, brick, apartment house to be erected at 1036 East 123d Street for Leeward Realty Co.; cost $25,000. B. W. Corning, Archt., 1332 Schofield Building.

Plans prepared for $50,000 building to be erected at 735 Woodland Avenue for Federal Coffee Mills, Cleveland.

Plans prepared by Mead & Hamilton, 1002 Garfield Building, for $35,000 residence to be erected by J. B. Crouse, National Lamp Works, at Fairmont Boulevard and Marlborox Road this spring.

Isaac Margolin, 7012 Hough Avenue, will erect an apartment house on Linwood Avenue and East Seventy-third Street costing $30,000.

Plans prepared by James Graham, 1836 Euclid Avenue, for a residence for S. P. Shane, 2040 East 100th Street, to be erected at 2484 Stratford Road; cost $25,000.

Ezra Brudno, 501 Society for Savings Building, will erect a 3-story commercial and apartment building at Hough Avenue and East Ninety-third Street; cost $35,000.

Kalish Realty Company, 541 Engineers' Building, will erect an apartment house and store building at Saranac Road and Pepper Avenue, to cost $30,000.

Brooklyn Catholic Club is considering erecting a 3-story club house on Pearl Road; cost $30,000.

Plans completed by Forest City Engineering Company, 512 Hippodrome Building, for store and apartment house to be erected at Superior Avenue and East 110th Street for J. P. Stotter, 313 Leader-News Building; cost $30,000.

Plans being prepared by A. F. Janowitz, Permanent Building, for apartment buildings to be erected at Central Avenue and E. Fortieth Street for Louis A. Katz, cost $120,000.

Reported Pasadena Apartment Company will erect $40,000 addition to apartment house at 9400 Euclid Avenue.

George L. Miller, Riegal Avenue and E. 116th Street, plans erecting a $40,000 apartment.

Nathan Nudelman, Linwood Avenue, to erect a $55,000 store and apartment building.

Columbus, Ohio.—Mariott, Allen & Hall, 20 East Broad Street, are architects for brick and limestone auditorium to be erected for Plymouth Congregational Church; estimated cost $35,000. Rev. W. A. Warren, Pastor.

Middletown, Ohio.—Lafayette Lodge No. 37, Knights of Pythias, contemplates erecting new building. A. B. Shetter, Chairman Building Committee.

Norwalk, Ohio.—Tentative plans prepared by Langdon & Hohly, Nicholas Building, Toledo, for 3-story brick temple, which the Norwalk Masonic Temple Co. contemplates erecting at est Main and Church Streets; cost approximately $40,000.

Norwood, Ohio.—Plans being prepared by Oscar Schwartz, Provident Bank Building, Cincinnati, and Oscar Young, associate architects, for 2-story apartment building to be erected at Ro ston and Warren Avenues, for Ross Schroyer; cost $25,000.

Bloomington, Ind.—Plans being prepared for a 2-story brick office building for the Showers Bris Furniture Company, Bloomington.

Indianapolis, Ind.—Indianapolis Light & Heat Co., 48 Monument Place, intends erecting a new plant which will include a building costing $250,000.

Muncie, Ind.—Banner Furniture Company, Muncie, will erect a two-story brick and tile building, 80 x 169 ft.; cost $50,000.

Detroit, Mich.—Joseph P. Jogerst, Temple Building, is architect for 7-story, reinforced concrete, brick and stone store and hotel to be erected on Lafayette Boulevard and First Street.

Scovel Memorial Presbyterian Church contemplates erecting $50,000 edifice at Grand River and McGraw Avenues. Rev. James D. Jeffrey, Pastor.

Marquette, Mich.—Plans being prepared by Charlton & Kuenzl, Camp Building, Milwaukee, Wis., for a 3-story, 50 x 100-ft. fireproof brick and stone building to be erected here for J. M. Longyear; cost, $70,000.

Charlton & Kuenzl, Camp Building, Milwaukee, Wis., are architects for 3-story 40 x 80-ft. Knights of Pythias Lodge Hall, to cost $30,000.

Maywood, Ill.—Graham, Burnham & Company, Railway Exchange Building, Chicago, are architects for proposed two-story clubhouse to be erected for Speedway Park Association; cost $100,000.

Rock Island, Ill.—See "New Industrial Plants."

Urbana, Ill.—Plans being prepared for passenger station which Cleveland, Cincinnati, Chicago & St. Louis R. R. (C. A. Paquette, Ch. Engr., Cincinnati, Ohio) will erect at a cost of $45,000.

Elks considering erecting $40,000 lodge building.

Milwaukee, Wis.—Plans are to be prepared by Schnetzky & Son, 712 Germania Building, for a 10-story concrete and terra cotta store building to be erected on Grand Avenue along Milwaukee River front on Henry Wehr property.

Holy Angels Roman Catholic Church will erect a two-story school house and church of brick at Eleventh Street and Atkinson Avenue, costing $34,000.

Washburn, Wis.—Walter F. Smith of the Gem Theater is reported considering the erection of an auditorium probably of reinforced-concrete and steel.

Duluth, Minn.—Plans being prepared by Holstead & Sullivan, Palladio Building, for a Roman Catholic Church and parochial school, to be erected at Woodland.

St. Paul, Minn.—J. F. Sperry, 1517 Grand Avenue, is reported interested in syndicate which intends erecting 8-story fireproof building at 6th and St. Peter Streets, plans for which have been prepared; cost $1,250,000.

St. Paul, Minn.—Plans reported prepared by Wyvill & Stewart, 600 Pittsburgh Building, for proposed 8-story Minnesota Building, to be erected at 7th and 6th Streets, on the old Cathedral site; estimated cost $1,250,000.

Topeka, Kan.—A fourth story will be added to the Chesterfield Hotel, costing $25,000. Fred Ross and Wood Fowler, Proprietors.

Omaha, Neb.—Reported erecting 8-story athletic club building costing $300,000 is under consideration. G. W. Haverstick, U. S. National Bank, Chmn. Finance Committee.

Jamestown, N. D.—Plans being prepared by J. A. Shannon, Devils Lake, for a $40,000 Masonic Temple to be erected this summer. Contract will be let about April 1.

Joplin, Mo.—Austin Allen, Joplin, is architect for proposed $150,000 annex to Connor Hotel (W. R. Baker, Manager), Fourth and Main Streets.

Kansas City, Mo.—Plans prepared by Smith, Rea & Lovitt, Finance Building, for 5-story and basement, steel and concrete building to be erected at Fifth and Walnut Streets for William D. Oldham.

St. Louis, Mo.—Plans prepared by Clymer & Drischler, Wainwright Building, for brick, terra cotta, reinforced concrete and steel tire and automobile building to be erected on Lindell Boulevard and Sarah Street, for Charles G. Bittel, President of Bittel-Leftwich Tire Service Company; cost about $100,000.

El Paso, Tex.—Contract soon to be let for erecting $300,000 annex to building of Everybody's Department Store. I. M. Mayer, General Manager.

Hubbell & Greene, N. Texas Building, Dallas, engaged to prepare plans for the $200,000 Scottish Rite Cathedral.

Houston, Tex.—Reported P. S. Griffith, 1211 Louisiana Street, will erect at Milam and Dallas Streets a $40,000 apartment house.

Medford, Ore.—Plans being prepared by F. C. Clark of Medford, for three-story 70 x 100 ft. brick and marble hotel and store building, to be erected on West Main and First Streets, for Dr. E. B. Pickle and associates.

Covina, Cal.—Contract will probably be let in March by John F. Blee, Archt., 515 Union League Bldg., Los Angeles, for erecting a 3-story concrete and brick administration building, 112 x 84 ft., and two 2-story brick and concrete dormitories, each 80 x 43 ft., for Mason's Orphans Home. Cost about $75,000.

Los Angeles, Cal.—Contract will be let about April 1 by Los Angeles Union Terminal Co. (Benjamin Johnson, President), for erecting at 7th Street and Central Avenue two 2-story produce market buildings, each 1250 x 100 ft., and one 6-story warehouse, 1250 x 75 ft., all of reinforced-concrete with steel sash and glass. Address John Parkinson, Architect, Security Building.

Contract will be let about April 1 by Mayberry & Parker, Archts., Pacific Electric Building, for erecting two concrete warehouses at San Pedro Harbor for Los Angeles Harbor Warehouse Company, one to be 3-story, 81 x 175 ft., and one 1-story, about 50 x 200 ft.

Idaho Falls, Idaho.—R. Kletting, Felt Building, Salt Lake City, Utah, is architect for two-story, 140 x 140 ft., steel and concrete mercantile building which R. W. Salisbury of Salt Lake City, Utah, contemplates erecting here; probable cost $75,000.

Winnipeg, Man.—T. Eaton Co. of Toronto, Ont., contemplates erecting two 12-story buildings on Graham Street; total cost about $3,000,000.

BIDS DESIRED.

Hackensack, N. J.—Reported desired until March 15 by Coleman Gray, 236 Moore Street, for erecting moving picture and vaudeville theater at 144 Main Street; probable cost $40,000.

Philadelphia, Pa.—Until Mar. 15, for erecting two-story and basement brick and reinforced-concrete 70 x 150 ft. parochial school on Lancaster Avenue and Media Street, for St. Gregory's R. C. Church. E. F. Prendagast, Archbishop. George I. Lovatt, Archt., Walnut Street.

New Albany, Ind.—Reported desired until March 15 by Joseph & Joseph, Archts., 809 Republic Building, Louisville, Ky., for erecting 8-story, 80 x 120 ft., bank and office building for German American Bank & Trust Co.; probable cost $200,000.

Cochrane, Wis.—Until March 25, by Bd. Directors Farmers & Merchants Bank (A. W. Hofer, Cashier), for erecting a two-story and basement bank building. Wm. Halsey Stevens, Archt., 63 West Fourth Street, Winona, Minn.

Britt, Iowa.—Until March 15, by Commercial State Bank for erecting building for said bank. J. H. Jeffera, Archt., Mason City.

Des Moines, Iowa.—Until April 1, by F. A. Harris, Archt., 211 Crocker Bldg., for erecting a brick church. Separate bids for plumbing and heating.

Duluth, Minn.—By Secretary Y. M. C. Assoc. for erecting boys' building. German & Jensen, Archts., Duluth.

Minneota, Minn.—Until March 25, by H. J. Tollemans, Cashier Farmers & Merchants National Bank, for erecting two-story fireproof bank building. Separate bids for plumbing, heating and electrical work. W. L. Alban, Archt., 347-251 Endicott Bldg., St. Paul.

Jamestown, N. D.—Until April 1, for erecting three-story and sub-basement for local Masonic Lodge. Probable cost, $40,000. J. A. Shannon, Archt., Devils Lake.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**New York, N. Y.**—Contract for alterations to building on southwest corner of Eighth Avenue and Forty-second Street awarded Clark & Appelman, 419 East Sixteenth Street. Cost about $25,000.

★Contract for 1400 tons of steel for the Bloomingdale addition awarded to Hay Foundry & Iron Works, 15 Madison Square.

★Contract awarded Passaic Structural Steel Co., 30 Church Street, for 700 tons of steel for Palmer loft building, 509 Fifth Avenue; to Harris Silvers Baker Co., 151 W. 42d Street, 1100 tons for loft building at 64th Street and 11th Avenue, for Wallace estate; 900 tons for Hasco loft on E. 32d Street; 1900 tons for Pinchot loft building on 64th Street; 800 tons for Girard loft building on W. 40th Street; and to Hedden Iron Construction Co., 875 tons for Korn loft at 4th Avenue and 16th Street.

★**Cresson, Pa.**—Reported contract for erecting St. Mary's Home for Girls awarded J. C. Ivory, Altoona, at $75,000.

★**Philadelphia, Pa.**—Contract awarded Stacey Reeves & Sons, 2011 Market Street, for erecting 15-story brick, stone and steel building at Sixteenth and Walnut Streets; cost about $275,000. Charles E. Oelschlager, Architect, Harrison Building.

★**Gastonia, N. C.**—Contract for erecting seven-story bank building for First Natl. Bank awarded Francis Wood Company, Richmond, Va. J. N. Boyle, Cashier.

★**Birmingham, Ala.**—Contract awarded by Collins & Co. to Carroll-Blake Construction Co., American Trust Building, for erecting reinforced-concrete warehouse at 1st Avenue and 24th Street; estimated to cost $75,000.

★**Memphis, Tenn.**—Contract awarded James Alexander Construction Co., Memphis, for erecting a store and office building at Main Street and Madison Avenue; cost $40,000.

★**Cleveland, Ohio.**—Contract for erecting 8-story brick addition to parochial school of St. James R. C. Church, Detroit and Granger avenues, awarded Gaines Duff Construction Co., 603 Marshall Building. Probable cost, $50,000.

★**Columbus, Ohio**—Contract reported awarded S. D. Peacock, 8 East Commerce Street, Cincinnati, for erecting 11-story, steel, brick and stone Seneca Hotel at Grant Avenue and Broad Street; cost about $400,000.

★**Grand Rapids, Mich.** — Contract awarded H. L. Stevens & Co., 910 South Michigan Avenue, Chicago, Ill., for erecting Hotel Browning at Sheldon Avenue and Oakes Street, S. E., for Alvah W. Brown; cost approximately $350,000.

★**Clinton, Ill.**—Contract for erecting parochial school awarded A. W. Stoolman, Champaign; cost about $60,000.

★**Urbana, Ill.**—Contract awarded A. W. Stoolman, Champaign, for erecting University of Illinois Baptist Church at $25,315.

★**Omaha, Neb.** — Contract awarded Grant Parsons, 601 Barker Block, for erecting a photo play theatre for World Realty Co., to be steel frame and fireproof, equal to four stories high, seating capacity 1500.

★**Pasadena, Cal.**—Contract awarded Frank Graves & Son, Stimson Building, Los Angeles, for erecting 2-story and basement concrete chemistry building, 64 x 126 ft., for Throop Institute of Technology; cost $75,000. Elmer Grey, Archt., 811 Wright & Callender Building, Los Angeles.

NEW INDUSTRIAL PLANTS

PROPOSED WORK.

Skowhegan, Me.—Bell Brothers of Salem, Mass., have decided to erect a two-story, 225 x 40 ft., shoe factory here.

Springfield, Mass.—W. J. Hyland, Dwight Street, will erect a 2-story concrete factory, 68 x 203 ft., on Liberty Street.

Addison, Conn.—Glastonbury Knitting Co., Addison, is to erect a 4-story and basement, 60 x 65-ft. brick mill.

Bridgeport, Conn.—Forest Steel Co. will rebuild buildings destroyed by fire.

Central Village, Conn.—The Central Worsted Co. will erect a 2-story brick factory addition, 140 x 40 ft. Charles Bragg, manager.

Windsor Locks, Conn.—Anchor Paper Co. will rebuild plant recently destroyed by fire.

Brooklyn, N. Y.—Greater New York Ice Co., foot of Twenty-fourth Street, intends erecting three-story ice plant on Thirty-eighth Street and Fourth Avenue.

Plans and specifications being prepared for a ten-story, 100 x 150 ft. sugar refinery of steel frame, fireproof construction, with brick curtain walls and floors of reinforced-concrete to be erected on South Third Street for American Sugar Refining Company, 17 Wall Street, New York.

Niagara Falls, N. Y.—Isco Chemical Company (Eben C. Speiden, vice-president), Niagara Falls, intends erecting a $300,000 plant at Union Street and Royal Avenue, to consist of six two-story reinforced concrete buildings, main building 150 x 100 ft.

Directors of Shredded Wheat Company, 424 Buffalo Avenue, approved plans for $100,000 concrete wheat elevator to be erected on Erie Avenue.

Rochester, N Y.—Rochester Folding Box Company 10 Commercial Street, plans erecting new plant in Twenty-third Ward.

Watervliet, N. Y.—Plans being prepared by Ludlum Steam Pump Co., Spring Street Road, for a steel frame and sheet iron covering shop building, 100 x 600 ft., to be erected on Spring Road, town of Colonie.

Camden, N. J.—Victor Talking Machine Company will erect a reinforced concrete steel and brick tower in connection with the cabinet factory. Ballinger & Perrot, Archts., 1211 Arch St., Philadelphia, Pa.

Dover, N. J.—Plans being prepared by W. S. Barstow & Company, 60 Pine Street, New York, for one-story 60 x 90 ft. power house for Pennsylvania Utilities Company, 25 Broadway, New York, to be erected on Essex Street; cost $150,000.

Millville, N. J.—W. F. Taubel Co., Fairview and Franklin Streets, intends erecting hosiery finishing mill, to cost $150,000.

Newark, N. J.—Reported American Synthetic Dyes Co., Avenue R, will erect a 50 x 175 ft. steel and hollow tile addition, with reinforced concrete floors, and equipped with retort tanks; cost about $22,000.

Plainfield, N. J.—Plans being prepared for a two-story reinforced-concrete factory to be erected for Vitaphone Company, 1112 North Avenue. W. C. Simpson, Purchasing Agent.

Chester, Pa.—Reported the Light Railway Equipment Co. will enlarge plant at Fifth and Ward Streets.

Donora, Pa.—United States Steel Corporation reported contemplating erecting plant, 200 x 600 ft., for refining of zinc oxide.

Fortyfort (P. O. Kingston), Pa. — The Jenkins Kirby Packing Company will erect a four-story factory, a garage and a two-story potato house and a power house with wing. McCormick & French, Archts., Wilkesbarre.

New Castle, Pa.—Reported contracts soon to be let by United States Steel Corporation for construction of 200 by-product coke ovens and ten open-hearth furnaces at New Castle and Shenango Valley plants.

Philadelphia, Pa.—Pennsylvania Shipbuilding Co., 507 East Tulpehocken Street, will erect a shipbuilding plant on Delaware River. George S. Hoell, Secy. & Treas.

Wicaco Screw & Machine Company, Inc., has had plans prepared by Herman Muller, 1416 S. Penn Square, for a two-story, brick and reinforced-concrete building, 67 x 81 ft.

Pittsburgh, Pa.—Reported E. G. Barber, 821 Heberton Avenue, of Independent Packing Co., is seeking site on Enterprise Street on which to erect $60,000 cold storage plant.

Baltimore, Md.—Bethlehem Steel Co. intends making extensive improvements in plant recently purchased from Maryland Steel Co. at Sparrows Point.

Plans being prepared for a plant which the Davison Chemical Co., Garrett Building, intends erecting at Curtis Bay, to produce sulphuric acid from brimstone rock, with a total capacity of about 30,000 tons a year; cost approximately $200,000. Contract for iron and steel has been let.

Baltimore Sheet & Tinplate Co., recently incorporated, will erect 12 hot mills.

Williamson, W. Va.—Reported Williamson Water, Light & Power Co. will erect an ice factory, cold storage plant and electric light station; cost $50,000.

Landis, N. C.—Linn Mills Co., Landis, contemplate erecting addition 100 x 100 and 42 x 100 ft. to plant; cost $100,000.

Chattanooga, Tenn.—C. E. James, of Chattanooga, contemplates erecting an iron and steel plant costing $2,000,000.

Chillicothe, Ohio.—Mead Pulp & Paper Company, Chillicothe, contemplates erecting several new buildings.

Cleveland, O.—The damage by fire to plant of the Cleveland Twist Drill Co. was very small, only small outhouse or shed destroyed.

Gary, Ind.—The U. S. Steel Corporation it is reported has decided to erect a tube plant here, including ore docks, ore yards, blast furnaces, converting mills, power station, water works, sheared plate mills, universal plate mills, butt mills, job shops and all auxiliary departments. Other improvements include enlarging plant at Milwaukee, Wis., new construction at Youngstown and construction of a ten bar mill at McDonald, near Girard, Ohio.

Bay City, Mich. — Reported International Mill & Timber Co. will rebuild plant recently destroyed by fire.

Waukegan, Ill.—Reported Wilder-Manning Tanning Co. contemplates erecting $250,000 addition to tannery on Water Street.

Sheboygan, Wis.—Jung Shoe Co., Virginia Avenue and Eighth Street, intends erecting three-story, 30 x 135 ft., factory addition.

Minneapolis, Minn.—Northbrup, King & Company, 26 Hennepin Avenue, plans erecting a $400,000 seed storage and laboratory plant in district between Central Avenue and Great Northern tracks on Jackson Street.

Corsicana, Tex. — Corsicana Cotton Mills will erect a 2-story brick mill; cost $100,000.

Houston, Tex.—Cheek-Neal Coffee Co., Houston, intends erecting $100,000 addition to plant.

Oklahoma, Okla.—Larkin Packer Co., Bartlesville, will erect a two-story fireproof brick and concrete building on East Grand Street for manufacturing and distributing plant.

Centralia, Wash.—Reported Gerlinger Motor Car Co., 692 Washington Street, Portland, Ore., proposes erecting assembling plant here.

Meacham, Ore. — Reported Dupont Powder Co. will erect a powder factory near Meacham.

Pendleton, Ore.—Reported Blewett Harvester Co. of Spokane, Wash., intends erecting factory here.

Los Angeles, Cal.—Alta Planing Mills Company, 830 McGarry Street, will erect a 4-story brick furniture factory at Twenty-second Street and Santa Fe Avenue for Van Vorst & Berman Company, 1332 East Sixth Street; cost about $60,000.

Bulkley-Rider Tractor Company, Eighteenth and Main Streets, plans erecting a factory having a daily capacity of twelve tractors.

Julius Koebig, engineer and chemist, 841 Title Insurance Building, is reported forming a company to construct an $8,000,000 chemical and dye works in Southern California. Units will be constructed consecutively as follows: Alkali works, tar manufactory, tar refinery, manufactory for immediates and coal tar dye works.

U. S. Metal Products Company, 750 Keller Street, will erect a group of concrete and metal factory buildings in Vernon Industrial Dist.

Campbellford, Ont.—Reported Northumberland Paper & Electric Co., Ltd., will rebuild paper mill, recently destroyed by fire.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Springfield, Mass.**—Contract awarded by John A. Murphy Co., 138 Wilbraham Avenue, to Fred T. Ley & Co., Springfield, for erecting a 2½-story, 75 x 134-ft. brick factory on Shillingford Street; cost about $30,000.

★**Hartford, Conn.**—Contract awarded by Pratt & Whitney Manufacturing Co. to Thomas Malcolm, 118 Asylum Street, for erecting 4-story and basement brick and steel factory addition; cost $75,000.

★Contract awarded by Underwood Typewriter Co. to J. H. Grozier Co., Hartford, Conn., for addition aggregating 221,700 sq. ft. of floor space, including three wings 6 stories high and a 266-ft. extension to main factory, brick, cement and steel. Estimated cost $400,000.

★**New York, N. Y.**—Contract awarded Turner Construction Company, 11 Broadway, for erecting at Neried Street and Bronx Boulevard, for the Otto Higel Company, a three-story and basement manufacturing building, 235 x 54 ft. of reinforced-concrete with brick curtain walls; cost $80,000. Timmis & Chapman, Archts., 315 Fifth Ave.

★**Niagara Falls, N. Y.**—Contract for erecting 2-story brick addition to plant of Defiance Paper Co. on Walnut Avenue awarded H. G. Christman Co. of Detroit, Mich.; estimated cost $50,000.

★**Camden, N. J.**—Contract awarded by Lindholm Metal Stamping Company, to Mockett Construction Company, Sixth and Market Streets, for erecting two additional factory buildings, one 28 x 44 ft., and the other 21 x 129 ft.

★**Newark, N. J.**—Contract awarded American Concrete Steel Company, 27 Clinton Sreet, for erecting a group of six-story reinforced-concrete buildings and a power house at plant of Splitdorf Electrical Co., 98 Warren Street; cost about $100,000.

★**Philadelphia, Pa.**—Contract for constructing 3-story concrete and steel factory building for Dill & Collins Co. awarded to Wm. Steel & Sons Co., 1600 Arch Street, at $50,000.

★**Pensacola, Fla.**—Contract awarded C. H. Turner & Co., of Pensacola, for erecting laboratory and store, to consist of five buildings at plant of Newport Rosin & Turpentine Company; cost, $250,000.

★**Binghamton, Tenn.**—Contract awarded Burrell Engineering & Construction Company, Chicago, Ill., for erecting a reinforced concrete elevator and grain storage tanks; cost $40,000. W. F. Schulz, Engineer, Memphis.

★**Ridgedale, Tenn.**—Contract awarded T. S. Moudy & Company, James Building, Chattanooga, for erecting a three-story reinforced-concrete, 133 x 244 ft. mill building for the Thatcher Spinning Mills. Probable cost $200,000. J. E. Sirrine, Engineer, Greenville, S. C.

★**Ashland, Ky.** — Contract awarded United Engineering & Foundry Co., 234 South Phelps Street, Youngstown, O., for installing a 36-in. blooming mill in connection with the open hearth plant of Ashland Iron & Mining Co.

MISCELLANEOUS

PROPOSED WORK.

Park Improvements—Belleville, N. J.—Contract soon to be let by Essex Park Commission, Newark, for grading, drainage, etc., for the new county park in Belleville, for which there is $40,000 available.

Park Bonds—Jersey City, N. J.—Park bonds, amounting to $800,000, sold.

Municipal Bonds—Reading, Pa.—City will issue $150,000 bonds for municipal improvements.

Conduit—Baltimore, Md.—The system of conduits for electric wires are laid by day labor and the materials required, such as terra cotta conduit, fibre conduit, sand and gravel castings, etc., are contracted for annually. During 1916, 16,750,739 duct feet were laid and about $1,000,000 will be required to complete the system in the outlying districts.

Park Improvements—Wilmington, Del.—Reported Wilmington & Philadelphia Traction Company planning to spend $100,000 for improvements to their parks here.

Subway—Miami, Fla.—City Council directed B. H. Klyce, City Engineer, to prepare estimates of cost of building a subway under railroad tracks at Ninth Street.

Subway—Cleveland, O.—See "Bridges."

Stadium—Cleveland, Ohio.—The cost of a stadium in Kingsbury Park has been estimated by Director of Public Service at $225,000.

Transmission Line—Muncie Ind.—Muncie Electric Company (Thomas English, Mgr.), will build about 16 miles of transmission line.

Transmission Lines—Cooper, Tex.—Cooper Electric Company is contemplating constructing two transmission lines, each 5 miles long, to Klondike and Enloe. E. D. Broadhead, Secy. and Mgr.

Park Improvements — Houston, Tex. — The park improvements to be made here include shelters, comfort stations, swimming pools, gardens, artificial lakes, etc., and will cost a total of $250,000. Maurice J. Sullivan, Archt. for Buildings, City Hall; George Kessler, Archt. for Park Work.

Park Improvements—Muskogee, Okla.—Election soon to be held to vote $30,000 bonds for park improvements.

Lumber—Aberdeen, Wash. — Contract soon to be let by City Council for furnishing lumber and steel to be used in constructing 23-mile pipe line for Aberdeen's municipal water system; cost estimated at $393,817.

Coal Handling Device—Astoria, Ore.—Bonds for $75,000 sold by Port of Astoria Commission. Improvements contemplated include completion of grain elevator and construction of coal handling device on Pier 2; cost about $147,500.

Tunnel—Prescott, Ariz.—Reported Bradshaw Development Company preparing to drive 10,000-ft. tunnel near Crown King. G. A. Wheeler, Chicago, Engr.

Transmission Lines—Haileyburg, Ont.—Northern Ontario Light & Power Company, Haileyburg, is planning extending transmission lines from Cobalt to Kirkland Lake, a distance of 70 miles.

Subway—Toronto, Ont.—The building of a foot subway under Grand Trunk Ry. tracks at Ashdale Avenue and grading approaches thereto under consideration. Cost, $33,370. Address Commissioner of Works.

BIDS DESIRED.

Painting Fence and Bridges—New York, N. Y.—Until March 15 by William Williams, Commissioner Water Supply, Gas and Electricity for painting fence around the Jerome Park reservoir and three bridges in the Croton Watershed.

Stone, Etc.—New York, N. Y.—Until March 16 by Park Board, Cabot Ward, Pres., for furnishing and delivering grit, broken stone and screening, refined car tar, sand, etc.

Stairway — New York, N. Y.—Until March 15 by Marcus M. Marks, Pres., Manhattan Borough, for constructing stairway at 138th Street and Riverside Drive, together with all work incidental thereto. Security $1,000.

Cement—Pittsburgh, Pa.—Until March 21, by John P. Moore, County Controller, for furnishing 7,000 bbl., more or less, Portland cement for repairs and constructing of county structures during year ending March 31, 1917. G. Chalfant, Co. Engr., Room 308, Court House.

Lamp Posts—Washington, D. C.—Until March 31 by Commissioners of District (Oliver P. Newman, Chmn.) for furnishing and delivering c.-i. lamp posts.

Mail Handling Devices—New Orleans, La.—Until April 18 by James A. Wetmore, Acting Supervising Archt., Treas. Dept., Washington, D. C., for mail handling devices, etc., in the U. S. Post Office and Court House at New Orleans.

Steel Pipe and Fittings—Chicago, Ill.—Until March 17 by Department Public Works (W. R. Moorehouse, Comr.) for furnishing and delivering to city at shafts of the Wilson Avenue tunnel steel pipe and fittings.

Hoists and Chutes in Warehouse—Los Angeles, Cal.—Until March 15, by Board of Harbor Commission (C. H. Matson, Secy.), for furnishing and installing hoists and spiral chutes for 5-story harbor warehouse.

Cement—San Diego, Cal.—Until March 31, by Maj. G. B. Pillsbury, Corps Engrs., U. S. A., 723 Central Bldg., Los Angeles, for furnishing approximately 8000 bbls. Portland cement, 10,600 tons crushed rock and 5400 tons sand and mortar screenings for gun and batteries.

Steel Towers—Cordova, Alaska.—Until April 22 by Bureau Yards and Docks, Navy Dept., Washington, D. C. (William M. Smith, Acting Ch.), for Spec. No. 2215 for two 300-ft. steel towers at U. S. Naval Radio Station, Cordova.

Castings, Etc.—Panama.—Until March 20 by Major F. C. Boggs, Corps Engrs., U. S. A., General Purchasing Officer, Panama Canal, Washington, D. C., for Circular 1020—Malleable iron and steel castings, electric motors, hydrometers, etc.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Subway — Memphis, Tenn.** — Contract awarded Hedges - Weaver - Weeks Co., Springfield, Mo., for constructing a subway on Indiana Avenue for Arkansas & Memphis Ry., Bridge & Terminal Co.; cost $50,000.

Road Oil—Tulare, Cal.—County Supervisors awarded contract for road oil as follows: 30,000 bbl. 75 gravity, to Standard Oil Company at 65 cts, per bbl.; 30,000 bbl. 65 or 70 gravity to Union Oil Company, 60 cts. per bbl.; and 20,000 bbl. to S. S. Seague at 58 cts. per bbl.

Lumber — Alaska. — Following bids opened by C. E. Dole, Purchasing Agent, Alaska Engineering Commission, Bell Street Wharf, Seattle, Wash., for furnishing 1500 M ft. of lumber for railroad construction in Alaska: H. A. Dent, Port Alberni, B. C., $30,794; J. M. Farrell, Seattle, $32,182; Schwager & Nettleton, Seattle, $33,491, and St. Paul & Tacoma Lumber Co., Tacoma, $33,676.

Proposals

For Proposals Advertised, See Pages 40a, 41, 42 and 43.

WATERWORKS.

Bids Close.		See Eng. Record.
Mar. 14.	Mains, etc., Crofton, Neb.	Feb. 19
Mar. 15.	Well, Fairbury, Ill. Adv. Feb. 26.	Feb. 26
Mar. 15.	Mains, Salt Lake City, Utah	Mar. 4
Mar. 15.	Pump Station, Etc., Drummondville, Que.	Mar. 11
Mar. 16.	Pipes, Etc., Houston, Tex.	Mar. 4
Mar. 16.	Pipe, Valves, Etc., New York, N. Y.	Mar. 11
Mar. 16.	Valves, Atlantic City, N. J. Adv. Mar. 11.	Mar. 11
Mar. 17.	Pipe, Etc., Panama	Mar. 4
Mar. 18.	Engine, Wheaton, Ill. Adv. Mar. 4.	Mar. 4
Mar. 20.	Water Works, Polson, Mont. Adv. Feb. 26.	Feb. 26
Mar. 20.	Pipe, Chisholm, Minn.	Mar. 4
Mar. 20.	Pipe, Etc., Panama	Mar. 11
Mar. 20.	Pipe, hydrants, Etc., Canton, Mo.	Mar. 11
Mar. 20.	Pumps, New Ulm, Minn.	Mar. 11
Mar. 20.	Pumps and Engines, Macon, Ga. Adv. Mar. 11.	Mar. 11
Mar. 21.	Tank, Ely, Minn.	Mar. 4
Mar. 21.	Contract 120, New York, N. Y. Adv. Mar. 4, 11.	Mar. 4
Mar. 22.	Add. to Pump Sta., New Orleans, La.	Feb. 5
Mar. 22.	Centrifugal Pump. Mach., Lancaster, Pa. Adv. Feb. 26.	Feb. 26
Mar. 23.	Water Works, Batavia, N. Y. Adv. Mar. 4.	Mar. 4
Mar. 24.	Steel Tank Tower, Etc., Emporia, Kan.	Mar. 11
Mar. 27.	Water Works, Wilson, N. C. Adv. Feb. 26, Mar. 4.	Feb. 26
Mar. 27.	Water Works, Lakeland, Fla.	Mar. 11
Mar. 29.	Valves, Etc., Baltimore, Md. Adv. Mar. 11.	Mar. 11
Mar. 30.	Water Works, South Boston, Va. Adv. Feb. 26, Mar. 4.	Feb. 26
Mar. 30.	Water Works, Ocala, Fla.	Mar. 11
Apr. 8.	High Pressure Fire System, Indian Head, Md.	Mar. 11
Apr. 1.	Mains, Cullman, Ala.	Jan. 15
———	Pipe Line, Trinity, Tex. Adv. Feb. 5.	Feb. 5

SEWERAGE AND SEWAGE DISPOSAL.

Mar. 14.	Oshkosh, Wis.	Mar. 4
Mar. 14.	Newark, N. J. Adv. Jan. 22. Feb. 5, 19, Mar. 4.	Jan. 22
Mar. 14.	Long Beach, Cal.	Mar. 11
Mar. 15.	Buffalo, N. Y.	Mar. 11
Mar. 16.	Savannah, Ga.	Mar. 11
Mar. 16.	Brooklyn, N. Y.	Mar. 11
Mar. 16.	Houston, Tex.	Mar. 11
Mar. 16.	Newark, N. J.	Mar. 11
Mar. 17.	Louisville, Ky.	Mar. 11
Mar. 21.	Columbus, Ohio.	Mar. 4
Mar. 21.	Michigan City, Ind.	Mar. 11
Mar. 22.	New Bedford, Mass.	Mar. 11
Mar. 22.	Keota, Iowa	Mar. 11
Mar. 23.	Batavia, N. Y. Adv. Mar. 4.	Mar. 4
Mar. 24.	Wapokoneta, Ohio	Mar. 4
Mar. 27.	Lakeville, Conn. Adv. Mar. 4.	Mar. 4
Mar. 30.	New York, N. Y.	Mar. 11
Mar. 30.	Lakewood, Ohio Adv. Mar. 11.	Mar. 11
Apr. 1.	Sheboygan Falls, Wis.	Feb. 19
Apr. 4.	Billings, Mont.	Feb. 19
Apr. 5.	La Fayette, Ind.	Mar. 11

BRIDGES.

Mar. 14.	Minden, Neb.	Mar. 4
Mar. 15.	Dayton, Ohio Adv. Feb. 19 to Mar. 11.	Feb. 19
Mar. 16.	Pocahontas, Iowa	Mar. 4
Mar. 16.	New York, N. Y.	Mar. 11
Mar. 17.	Wayne, Neb.	Feb. 19
Mar. 18.	Boise, Idaho	Mar. 4
Mar. 20.	Waseca, Minn.	Mar. 4
Mar. 20.	Kearney, Neb.	Mar. 11
Mar. 21.	Illinois	Mar. 4
Mar. 21.	Redwood, Minn.	Mar. 11
Mar. 21.	Morganfield, Ky. Adv. Mar. 11.	Mar. 11
Mar. 21.	Primghar, Iowa	Mar 11
Mar. 21.	Buffalo, Minn.	Mar. 11
Mar. 22.	Atlanta, Ga.	Mar. 11
Mar. 23.	Staunton, Va. Adv. Mar. 11.	Mar. 11
Mar. 24.	Houston, Tex.	Mar. 4
Mar. 24.	Pittsburgh, Kan.	Mar. 4
Mar. 27.	Mankato, Minn.	Mar. 11
Mar. 31.	Steel, N. D.	Mar. 4
Apr. 3.	Santa Barbara, Cal.	Mar. 4
Apr. 4.	Gettysburg, S. D.	Mar. 4
Apr. 5.	Hillsboro, N. D.	Mar. 11
Apr. 6.	Bridgeport, Conn. Adv. Mar. 11.	Mar. 11
Apr. 8.	Rock Island, Ill.	Mar. 4
Apr. 10.	Rockford, Ill. Adv. Mar. 11.	Mar. 11
Apr. 29.	Johnson Creek, Wis.	Feb. 26

PAVING AND ROADS.

Bids Close.		See Eng. Record.
Mar. 14.	Danville, Ill. Adv. Feb. 12 to 26.	Feb. 12
Mar. 14.	Indiana	Feb. 26
Mar. 14.	Beloit, Wis.	Mar. 4
Mar. 14.	Logansport, Ind.	Mar. 11
Mar. 14.	Eagle Grove, Iowa	Mar. 11
Mar. 14.	Massachusetts	Mar. 11
Mar. 15.	Forest City, Iowa	Mar. 4
Mar. 15.	Danville, Ill. Adv. Feb 12 to 26.	Feb. 12
Mar. 15.	Chicago, Ill. Adv. Feb. 26.	Feb. 26
Mar. 15.	Sioux Falls, S. D.	Mar. 4
Mar. 15.	Clear Lake, Iowa	Mar. 11
Mar. 15.	Elgin, Ill.	Mar. 11
Mar. 15.	Indianapolis, Ind.	Mar. 11
Mar. 16.	Danville, Ill. Adv. Feb. 12 to 26.	Feb. 12
Mar. 16.	Brooklyn, N. Y.	Mar. 11
Mar. 16.	Clinton, Iowa	Mar. 11
Mar. 16.	Richmond, Ind.	Mar. 11
Mar. 16.	Monticello, Iowa	Mar. 11
Mar. 16.	Indianapolis, Ind	Mar. 11
Mar. 17.	South Bend, Ind.	Mar. 4
Mar. 17.	Worcester, Mass.	Mar. 11
Mar. 18.	Watertown, N. Y.	Feb. 12
Mar. 18.	Indiana	Feb. 26
Mar. 18.	Indiana	Mar. 4
Mar. 18.	Buffalo, N. Y.	Mar. 11
Mar. 18.	Indiana	Mar. 11
Mar. 20.	Bolivar, Mo.	Feb. 12
Mar. 20.	De Land, Fla.	Feb. 19
Mar. 20.	Minot, N. D.	Mar. 4
Mar. 20.	Glenwood, Minn.	Mar. 4
Mar. 20.	Washington	Mar. 4
Mar. 20.	Waukesha, Wis. Adv. Mar. 4.	Mar. 4
Mar. 20.	Marshall, Mich.	Mar. 4
Mar. 20.	West Salem, Ohio	Mar. 11
Mar. 20.	Kansas City, Kan.	Mar. 11
Mar. 20.	Ironton, Ohio	Mar. 11
Mar. 21.	Eldorado, Ark.	Mar. 4
Mar. 21.	Marshall, Minn.	Mar. 4
Mar. 21.	Redwood Falls, Minn.	Mar. 11
Mar. 21.	Easton, Md.	Mar. 11
Mar. 22.	Cleveland, Ohio	Mar. 4
Mar. 22.	Lorain, Ohio	Mar. 11
Mar. 22.	Buffalo, N. Y.	Mar. 11
Mar. 23.	Flemington, N. J. Adv. Mar. 4, 11.	Mar. 4
Mar. 23.	Sigourney, Iowa Adv. Mar. 11.	Mar. 11
Mar. 24.	Appleton, Wis.	Mar. 11
Mar. 25.	De Land, Fla. Adv. Mar. 4, 11.	Mar. 4
Mar. 27.	Road Roller, Winona, Minn.	Mar. 4
Mar. 27.	New Orleans, La.	Mar. 11
Mar. 27.	Montclair, N. J. (3 Props.), Adv. Mar. 11.	Mar. 11
Mar. 28.	Sumter, S. C. Adv. Mar. 4, 11.	Mar. 4
Mar. 28.	Columbus, Ohio	Mar. 11
Mar. 28.	Albany, N. Y. Adv. Mar. 11.	Mar. 11
Mar. 28.	Racine, Wis.	Mar. 11
Mar. 29.	Findlay, Ohio	Mar. 11
Mar. 30.	Morgantown, W. Va.	Feb. 26
Mar. 30.	Newark, N. J.	Mar. 11
Mar. 30.	Indiana	Mar. 11
Apr. 1.	Charelston, W. Va.	Feb. 19
Apr. 1.	Pomeroy, Wash.	Mar. 11
Apr. 3.	Sherbrooke, N. D.	Mar. 11
Apr. 3.	Salem, Ohio	Mar. 11
Apr. 3.	Huron, S. D. Adv. Mar. 11.	Mar. 11
Apr. 6.	Jonesboro, Ark.	Mar. 11
Apr. 6.	Huntington, W. Va.	Mar. 4
———	Binghamton, N. Y. Adv. Feb. 12, 19.	Feb. 12

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS.

Mar. 14.	Dike, Jefferson City, Mo. Adv. Feb. 19 to Mar. 11.	Feb. 19
Mar. 14.	State Canal Work, Albany, N. Y. Adv. Feb. 19 to Mar. 11.	Feb. 19
Mar. 14.	Drainage Ditches, Doniphan, Mo.	Feb. 26
Mar. 14.	Drainage, Fort Dodge, Iowa	Mar. 4
Mar.15.	Breakwater, Newport, R. I.	Feb. 19
Mar. 15.	Irrigation, Malta, Mont.	Feb. 26
Mar. 15.	Dredging, Seattle, Wash.	Feb. 26
Mar. 16.	Dredging, Etc., New Bedford. Mass.	Feb. 19
Mar. 20.	Ditches, Olivia, Minn.	Mar. 4
Mar. 20.	Ditches, St. Paul, Minn.	Mar. 11
Mar. 20.	Irrigation, Fort Shaw, Mont.	Mar. 11
Mar. 21.	Protection Wall, Portmouth, Ohio	Mar. 11
Mar. 23.	Irrigation, St. Ignatius, Mont. Adv. Feb. 26.	Feb. 26
Mar. 23.	Revetment, Kansas City, Mo. Adv. Feb. 26 to Mar. 11.	Feb. 26
Mar. 23.	Levee, Vincennes, Ind. Adv. Mar. 11.	Mar. 11
Mar. 24.	Breakwater, Conneaut, Ohio. Adv. Feb. 26 to Mar. 11.	Feb. 26
Mar. 24.	Dredging, Detroit, Mich. Adv. Feb. 26 to Mar. 11.	Feb. 26
Mar. 28.	Drain, North Branch, Mich.	Feb. 26
Mar. 28.	Wharf, Etc., Savannah, Ga.	Mar. 11
Mar. 28.	Dam, Shawano, Wis. Adv. Mar. 11.	Mar. 11
Mar. 29.	Irrigation, St. Ignatius, Mont.	Mar. 4
Mar. 29.	Cribbing, Lorain, Ohio	Mar. 11
Mar. 30.	Dredging, Tompkinsville, N. Y.	Mar. 4
Apr. 1.	Dredging, Chicago, Ill. Adv. Mar. 4. 11.	Mar. 4
Apr. 10.	Jetty Construction, New York, N. Y. Adv. Mar. 11.	Mar. 11
Apr. 10.	Ditch, Oklahoma City, Okla.	Mar. 11
May 6.	Leasing Land and Water for Power Purposes, Louisville, Ky. Adv. Mar. 11.	Mar. 11

PUBLIC BUILDINGS AND SCHOOLS.

Bids Close.		See Eng. Record.
Mar. 14.	Antigo, Wis.	Feb. 5
Mar. 14.	Iron River, Mich.	Mar. 11
Mar. 16.	Gilbert, Minn.	Feb. 12
Mar. 15.	Ft. Bliss, Tex. Adv. Feb. 19 to Mar. 11.	Feb. 19
Mar. 15.	Mingo, Ohio	Feb. 26
Mar. 15.	Nevada, Ohio	Mar. 4
Mar. 15.	Minot, N. D.	Mar. 4
Mar. 15.	Binghamton, N. Y. Adv. Mar. 11.	Mar. 11
Mar. 15.	Seattle, Wash.	Mar. 11
Mar. 16.	New Smyrna, Fla.	Feb. [illegible]
Mar. 16.	Wallum Lake, R. I.	Feb. 26
Mar. 16.	Danville, Ill.	Mar. 4
Mar. 16.	Los Angeles, Cal.	Mar. 11
Mar. 17.	Charles City, Iowa	Feb. 12
Mar. 17.	Salem, Ohio	Feb. 26
Mar. 17.	Huntington, Ind.	Mar. 11
Mar. 17.	Rudd, Iowa	Mar. 11
Mar. 18.	Ft. Terry, N. Y. Adv. Feb. 19 to Mar. 11.	Feb. 19
Mar. 18.	Braceville, Ohio	Mar. 4
Apr. 19.	Arkadelphia, Ark. Adv. Mar. 11.	Mar. 11
Mar. 20.	Austin, Minn.	Jan. [illegible]
Mar. 20.	Alliance, Ohio	Mar. 4
Mar. 20.	Plans, Baldwinsville, N. Y. Adv. Mar. 11.	Mar. 11
Mar. 20.	Pelican Rapids, Mich.	Mar. 11
Mar. 21.	Stuart, Neb.	Mar. 4
Mar. 21.	Normal, Ill.	Mar. 4
Mar. 21.	Durham, N. C.	Mar. 11
Mar. 22.	Mattoon, Ill.	Feb. 12
Mar. 22.	Aberdeen, Wash.	Feb. 19
Mar. 22.	Alta, Iowa Adv. Mar. 4, 11.	Mar. 4
Mar. 22.	Tacoma, Wash.	Mar. 4
Mar. 22.	Harlem, Mont.	Mar. 4
Mar. 23.	Wilmington, N. C	Feb. 19
Mar. 23.	Montezuma, Ind.	Mar. 4
Mar. 23.	Niles, Ohio	Mar. 4
Mar. 23.	Vancouver, B. C.	Mar. 11
Mar. 23.	Warsaw, Ind.	Mar. 11
Mar. 24.	Taylorville, Ill.	Feb. 19
Mar. 24.	North Olmstead, Ohio	Mar. 11
Mar. 25.	Seattle, Wash.	Feb. 19
Mar. 25.	Hamilton, Ala.	Mar. 11
Mar. 27.	Pueblo, Colo.	Feb. 26
Mar. 27.	Urichsville, Ohio	Mar. 4
Mar. 28.	Dobson, N. C. Adv. Mar. 11.	Mar. 11
Mar. 28.	Sloan, Iowa	Mar. 11
Mar. 28.	Columbia, S. C.	Mar. 11
Apr. 28.	New Orleans, La.	Mar. 11
Mar. 29.	Aberdeen, Wash.	Feb. 19
Mar. 30.	Huntington, Ind.	Mar. 4
Mar. 30.	San Bernardino, Cal.	Mar. 4
Mar. 31.	Seattle, Wash.	Mar. 11
Apr. 1.	Eveleth, Minn.	Mar. 4
Apr. 1.	Ypsilanti, Mich.	Mar. 4
Apr. 4.	Lockport, Ill.	Mar. 4
Apr. 4.	Dayton, Ohio	Mar. 11
Apr. 6.	Valley City, N. D.	Mar. 4
Apr. 7.	Falls City, Neb.	Mar. 11
Apr. 12.	Prescott, Ariz.	Mar. 11
Apr. 15.	Indian Head, Md.	Mar. 4
Apr. 24.	Delphi, Ind.	Feb. 26

PRIVATE BUILDINGS.

Mar. 14.	Montreal, Que.	Feb. 26
Mar. 14.	Portsmouth, N. H.	Mar. 4
Mar. 15.	Marcellus, N. Y.	Feb. 19
Mar. 15.	Jerseyville, Ill.	Mar. 4
Mar. 15.	Dartmouth, Ont.	Mar. 4
Mar. 15.	New Albany, Ind.	Mar. 11
Mar. 15.	Hackensack, N. J.	Mar. 11
Mar. 15.	Philadelphia, Pa.	Mar. 11
Mar. 15.	Britt, Iowa	Mar. 11
Mar. 17.	Glenwood, Minn.	Mar. 4
Mar. 25.	Kankakee, Ill.	Mar. 4
Mar. 25.	Cochrane, Wis.	Mar. 11
Mar. 25.	Minneota, Minn.	Mar. 11
Apr. 1.	Des Moines, Iowa	Mar. 11
Apr. 1.	Los Angeles, Cal.	Mar. 11
Apr. 1.	Jamestown, N. D.	Mar. 11
Apr. 1.	Cleveland, Ohio	Jan. 8
Apr. 1.	Minneapolis, Minn.	Feb. 19
Apr. 1.	Moose Jaw, Sask.	Mar. 4

NEW INDUSTRIAL PLANTS.

Apr. 15.	Manila, P. I.	Jan. [illegible]

MISCELLANEOUS.

Mar. 14.	Cells, Etc., Cincinnati, Ohio	Feb. 26
Mar. 14.	El. Rys., Toronto, Ont.	Feb. 26
Mar. 15.	Railroad Supplies, Seattle, Wash.	Mar. 4
Mar. 15.	Garbage Disposal, Mansfield, Ohio	Mar. 11
Mar. 15.	Stairway, New York, N. Y.	Mar. 11
Mar. 15.	Painting Fences, Etc., New York, N. Y.	Mar. 11
Mar. 15.	Hoists in Warehouse, Los Angeles, Cal.	Mar. 11
Mar. 15.	Garbage Incinerator, Elgin, Ill.	Mar. 11
Mar. 16.	Boilers For Sale, Poughkeepsie, N. Y. Adv. Mar. 4, 11.	Mar. 4
Mar. 16.	Stone, Etc., New York, N. Y.	Mar. 11
Mar. 17.	Steel Pipe, Etc., Chicago, Ill.	Mar. 11
Mar. 18.	Railroad Work, Buffalo, N. Y. Adv. Mar. 11.	Mar. 11
Mar. 18.	Mail Handling Devices, New Orleans, La.	Mar. 11
Mar. 20.	Garbage Incinerator, Fresno, Cal.	Mar. 11
Mar. 21.	Cement, Pittsburgh, Pa.	Mar. 11
Mar. 22.	Garbage Disposal, Lincoln, Neb. Adv. Feb. 26.	Feb. 26
Mar. 24.	Street Cleaning, Wilkes-Barre, Pa. Adv. Mar. 11.	Mar. 11
Mar. 27.	Structural Steel, Lorain, Ohio Adv. Mar. 4.	Mar. 4
Mar. 27.	Street Sweeper, Winona, Minn.	Mar. 4
Mar. 28.	Railroad Work, Philadelphia, Pa. Adv. Mar. 4, 11.	Mar. 4
Mar. 31.	Lamp Posts, Washington, D. C.	Mar. 11
Mar. 31.	Cement, San Diego, Cal.	Mar. 11
Apr. 1.	Memorial, Fort McHenry, (P. O. Baltimore, Md.).	Nov. 20
Apr. 22.	Steel Towers, Cordova, Alaska	Mar. 11
———	Funding Bonds, Lufkins, Tex. Adv. Feb. 26.	Feb. 26

SEARCHLIGHT SECTION

Official Proposal Announcements

Price, $2.40 an inch.—Copy can be received until
Thursday 10 a. m. for issue mailed the next morning

Bids open March 25, 1916.

IMPROVED HIGHWAYS, VOLUSIA COUNTY, FLORIDA

DE LAND, FLA.

Sealed proposals will be received by the Board of County Commissioners of Volusia County, Florida, at the office of the County Clerk in the Court House at De Land, Florida, for the construction of Improved Highways in the De Land-Lake Helen Special Road and Bridge District of Volusia County, Florida.

Said proposals will be received until 2 P. M., March 25, 1916, at which time they will be opened and read publicly. Award of contracts will be made as soon thereafter as practicable.

The approximate quantities are as follows:

189,899—Lin. ft. roadway—35.97 miles.
61,398—Cubic yards excavation
64—Lineal feet 24-in. drains
6—Lineal feet 18-in. drains
96—Lineal feet 15-in. drains
34—Lineal feet 12-in. drains
255—Lineal feet concrete header
4,890—Lineal feet granite curb
200,933—Square yards pavement.
123,013—Square yards shoulders
274,668—Lineal feet curb
190.74—Cubic yards class "A" concrete
321.22—Cubic yards class "B" concrete
27,393—Pounds steel

Each bid must be accompanied by a certified check on a State or National Bank of Florida or on a National Bank of any other State for 5 per cent of the amount bid, drawn to the order of the County Clerk, Samuel D. Jordan.

Plans and specifications may be seen at the office of the County Clerk, DeLand, Florida, and at the office of the Engineers in Atlanta, Ga. Copies of specifications may be obtained from either the County Clerk or the Engineers upon receipt of $1.00, which will be returned when specifications are returned in good shape.

Copies of plans may be obtained from the Engineers for $10.00 to cover their actual cost.

All money deposited for specifications will be refunded where bonafide bids are made.

A surety bond for 25 per cent of contract price will be required of successful bidders.

The right is reserved to reject any and all bids, or waiving formalities to accept any bid that may be to the best interest of the Board.

BOARD OF COUNTY COMMISSIONERS,
MAYNARD M. BOND, Chairman.
SAMUEL D. JORDAN, County Clerk.
The J. B. McCRARY CO., Engineers,
1408-17 Third National Bank Building,
Atlanta, Ga.

Bids open March 15, 1916.

CONCRETE BRIDGES

Bids will be received until noon, Wednesday, March 15th, 1916, on the following:

Webster Street Bridge over Mad River, Keowee Street Bridge over Mad River, and Fifth Street Bridge over Miami River, Dayton, Ohio.

Sealed proposals for the work will be received until noon, March 15th, 1916, by the Director of Public Service of the City of Dayton, Ohio, and then publicly opened.

A full description of this work, and a statement of information necessary for bidders, was printed in the Feb. 19th issue of this journal.

Postpaid copies of plans and specifications for any one of these bridges may be secured from the Director of Public Service of the City of Dayton by sending two dollars ($2.00) for any one set, or six dollars ($6.00) for the three. Payments made for plans and specifications will not be refunded.

By direction of
J. E. BARLOW,
Director of Public Service of the City of Dayton, Ohio.

Bids open March 22, 1916.

SCHOOL BUILDING

ALTA, IOWA.

Notice is hereby given that the Board of Education of the Alta Consolidated School District of Alta, Iowa, will receive sealed proposals for the construction of a new school building at Alta, in accordance with plans and specifications made by Smith & Keffer, architects, 610, Youngerman Building, Des Moines, Iowa.

Plans may be seen at Alta, Iowa, and bidders desiring the exclusive use of a set of plans and specifications may secure the same upon application to Smith & Keffer, accompanied by a certified check for fifty dollars ($50.00) as a guarantee for the safe return of the plans and specifications. Said check will be returned if the plans are returned with proposal.

The plans will be ready on or before the 1st day of March, 1916, and bids will be received by J. Jay Parker, Secretary, at Alta, Iowa, until 12 o'clock noon, on the 22d day of March, 1916. A certified check of four thousand dollars ($4,000.00), payable to the treasurer of the Consolidated School District of Alta, Iowa, must accompany each proposal; such check to be forfeited to the said school district of Alta, Iowa, in case the bidder fails to give a good and sufficient surety bond and sign a contract within ten days in case it is awarded to him.

The Board reserves the right to reject any and all bids submitted, and in awarding the contract, the reputation of the bidder will be taken into consideration as well as the amount of his proposal.

In addition to the above bids, sealed proposals will be received from plumbing and heating contractors for the plumbing and heating of the new building. The same general conditions to apply as those provided for the general contract, and a certified check for twelve hundred and fifty dollars ($1,250.00) must accompany each sealed proposal.

J. JAY PARKER,
Secretary.
Dated at Alta, Iowa, February 15, 1916.

Bids open March 28, 1916.

STREET PAVING

SUMTER, S. C.

Sealed bids will be received at the City Clerk's office until six (6 P. M.), March 28th, 1916, for Street Paving. Two Hundred and Twenty-five Thousand Dollars available. Specifications will be ready March 4th. Plans on file at the Engineer's office, Sumter, S. C.

(Signed) D. M. BLANDING,
Clerk & Treas.
Engineer, W. LORING LEE.

Bids open April 3, 1916.

NOTICE OF STREET IMPROVEMENT

HURON, S. D.

Sealed bids will be received by the city auditor until 1 o'clock p. m., April 3, 1916, for approximately 16,000 sq. yd. of pavement. Selection will be made after the opening of bids on brick, bitulithic, reinforced concrete, asphaltic concrete, sheet asphalt, and creosoted wood blocks.

Certified check in the sum of $1,500, payable to the city treasurer, must accompany each bid. Copies of plans and specifications may be obtained from the city engineer by application. A deposit of three dollars must accompany such application.

S. S. OVIATT,
City Auditor.
J. B. SULLIVAN,
City Engineer.
Dated Huron, S. D., Feb. 29, 1916.

Bids open March 16, 1916.

NOTICE TO CONTRACTORS.

HEATING WORK, ETC.

BINGHAMTON, N. Y.

Sealed proposals for heating work and addition to boiler plant and equipment at Binghamton State Hospital, Binghamton, N. Y., will be received by the State Hospital Commission, Capitol, Albany, N. Y., until 2.30 o'clock p. m., on Wednesday, March 15, 1916, when they will be publicly opened and read. Proposals shall be enclosed in an envelope furnished by the State Architect sealed and addressed and shall be accompanied by a certified check in the sum of five per cent (5%) of the amount of proposal. The contractor to whom the award is made will be required to furnish surety company bond in the sum of fifty per cent (50%) of the amount of contract within thirty (30) days after official notice of award of contract and in accordance with the terms of specification No. 2321. The right is reserved to reject any or all bids. Drawings and specifications may be consulted at the Binghamton State Hospital, at the New York office of the Department of Architecture, Room 1224, Woolworth Building and at the Department of Architecture, Capitol, Albany, N. Y. Drawings and specifications and blank forms of proposal may be obtained at the Department of Architecture, Capitol, Albany, N. Y., upon reasonable notice to and in the discretion of the State Architect, Lewis F. Pilcher, Capitol, Albany, N. Y.

E. S. ELWOOD, Secretary,
State Hospital Commission.
Dated Feb. 28, 1916.

Bids open March 16, 1916.

GATE VALVES AND CHECK VALVES

DEPARTMENT OF PARKS AND PUBLIC PROPERTY,

CITY OF ATLANTIC CITY, N. J.

Sealed proposals for making and furnishing gate valves and check valves for the City of Atlantic City will be received by the Board of Commissioners of Atlantic City, when called for at the Chambers of the Board in the City Hall, during a meeting to be held by that body on the 16th day of March, A. D. 1916, at which time and place, during the session of said Board, the proposals will be opened and publicly read.

The materials to be made and furnished under the proposals embrace approximately:

18 20-in. gate valves with bell ends.
3 16-in. gate valves with bell ends.
18 12-in. gate valves with bell ends.
7 12-in. gate valves with flange ends.
64 8-in. gate valves with bell ends.
60 8-in. gate valves with flange ends.
2 6-in. gate valves with bell ends.
2 6-in. gate valves with flange ends.
14 12-in. check valves with flange ends.
8 8-in. check valves with flange ends.
4 6-in. check valves with flange ends.

Each proposal must be accompanied by a certified check drawn upon a National or State bank or a trust company, and to the order of the City Treasurer, for the sum of five hundred dollars ($500.00).

Specifications, plans and blank forms of proposal can be obtained upon application to L. Van Gilder, Engineer and Superintendent of Water Department at his office in Atlantic City.

The Board of Commissioners expressly reserves the right to reject any or all bids as it may deem best for the public interest.

HARRY BACHARACH,
Director of Parks and Public Property.

Bids open March 23, 1916.

NOTICE TO LEVEE AND SEWER CONTRACTORS

VINCENNES, IND.

Sealed proposals will be received by Jacob S. Spiker, Constructing Commissioner, at his office in the Noble Block, in the City of Vincennes, Ind., until 3 o'clock p. m., on March 23, A. D. 1916, for the construction of the William H. Brevoort et al Levee System and the Sewers through the same, according to the plans and specifications and profiles now on file with the Clerk of the Knox Circuit Court of Knox County, Indiana, and in the office of Jacob S. Spiker, the Constructing Commissioner.

The Levee System consists of twenty-one miles along the Wabash River, ten miles along White River and six miles along River Dushee and Plass Ditch, with an aggregate amount of earthwork of 1,684,350 yd., forty-four reinforced concrete and cast-iron pipe sewers with flood gates, moving ten buildings and furnishing and driving 25,000 ft. of sheet piling. Complete plans and specifications and blank proposals can be obtained of the Superintendent of Construction, for $12.50: specifications and blanks alone, $1.50.

Certified check required, 5 per cent of amount of bid. Bond of successful bidders twice the amount of contract, to be approved by constructing commissioner and Judge of the Knox Circuit Court.

Right reserved to reject any or all bids or part of bid. Contracts to lowest and best bidder or bidders will be awarded within ten days after date for receiving bids.

JACOB S. SPIKER,
Constructing Commissioner.

Bids open March 16, 1916.

BOILERS FOR SALE

POUGHKEEPSIE, N. Y.

. Proposals are invited until 4 p. m., March 16, 1916, for the sale of three 70-h.p. Delaney Return Tubular Dome Top boilers, 6 ft. 0" x 16 ft. 0" with 80 3" tubes, 6" steam stop valves, Crosby spring safety valves, pressure gauges, water columns and other mountings. Ordinary fixed grates 5 ft. 0" x 6 ft. 3". Insured at 100 lbs. working pressure, in use 20 years. To be sold as standing in building at dock on Hudson River.

It will be necessary to make an opening and remove the boilers through the side of the brick building. Proposals to be a net price for the boilers with the brick work satisfactorily replaced after removal.

A certified check for thirty dollars ($30.00) must accompany each proposal.

BOARD OF PUBLIC WORKS,
Poughkeepsie, N. Y.

Bids open March 28, 1916.

THE PENNSYLVANIA RAILROAD COMPANY.

WORK APPURTENANT TO SOUTH PHILADELPHIA TRACK ELEVATION

Sealed proposals for work under the following contract will be received at the office of the Chief Engineer, Room 607, Broad Street Station, Philadelphia, until March 28, 1916, at 12 o'clock noon.

Viz.: CONTRACT No. 11-B—INBOUND FREIGHT HOUSE AND AUTOMOBILE PLATFORM IN FEDERAL STREET YARD, PHILADELPHIA, PA.

Plans, specifications and blank forms for bidding may be obtained at the office of the Chief Engineer, Room 607, Broad Street Station.

The right is reserved by the Pennsylvania Railroad Company to reject any or all bids.

A. C. SHAND,
Chief Engineer.
E. B. TEMPLE,
Asst. Chief Engineer.

EDWARD J. PEARSON has resigned his position as first vice-president of the Texas & Pacific Railway to accept an appointment as a vice-president of the New York, New Haven & Hartford, with headquarters in Boston. He will have charge of all matters relating to construction, operation and maintenance. Mr. Pearson was graduated from the civil engineering department of Cornell University in 1883, after which he entered the service of the Northern Pacific as an assistant engineer on construction work. In 1885 he was appointed supervisor of bridges, buildings and water supplies on the Minnesota division of that road, in which position he remained for five years. In 1892 he was appointed principal assistant engineer on the Chicago & Northern Pacific and the Wisconsin Central lines, and 1894 found him in the operating department of the Missouri & Yellowstone division. In 1904 he became chief engineer of the Northern Pacific, which position he filled for seven years. He was elected first vice-president of the Missouri Pacific in 1911 and in April of 1915 he became first vice-president of the Texas & Pacific Railway. He has studied railway construction and operation, and has paid particular attention to terminal work in Chicago, St. Louis, Kansas City and New Orleans.

WILLIAM MULHOLLAND, chief engineer of the Board of Water Commissioners of Los Angeles, Cal., visited Seattle, Wash., March 13, at the request of A. H. Dimock, city engineer of that city, for the purpose of making an examination of the Cedar River basin, and to make a report on the most feasible method of sealing the north bank of the river so that the new masonry dam can be made available for use. Late in 1915 Frederic P. Stearns, consulting engineer, of Boston, and R. H. Thomson, former city engineer of Seattle, visited the basin and made special investigations. They will make their recommendations following Mr. Mulholland's examination. The three engineers were engaged as experts by the city council of Seattle, on the advice of the city engineer.

RUSSELL E. HARRISON, formerly assistant city engineer of Grand Rapids, Mich., has resigned to become vice-president and general manager of the L. A. Boulay Company, civil and sanitary engineers, of Toledo, Ohio. Mr. Harrison was graduated from the civil engineering department of the University of Michigan in 1906. He spent the summers of 1902 and 1903 in the signal department of the Michigan Central Railroad, and, during the summer of 1904, was draftsman for the Wabash Railroad. He then spent one year as draftsman and instrument man with Gardner S. Williams, consulting engineer, of Ann Arbor, Mich., and, in 1906, he became draftsman and field assistant with Riggs & Sherman, consulting engineers, of Toledo. January, 1907, found him assistant engineer on bridge and building construction with A. H. Smith, consulting engineer, of that same city, in whose service he remained until his appointment as resident engineer in charge of municipal construction with the Riggs & Sherman Company in May, 1908. In November, 1909, he was appointed designing engineer in the city engineer's office at Grand Rapids, where his work was on storm water and sanitary sewers, special discharge and suction lines for the new high-service waterworks pumping station and a preliminary design for a trunk sewer. He became resident engineer in charge of the construction of a filtration plant for Grand Rapids in August, 1910, and later was made assistant city engineer, which position he held up to the time of the present appointment.

AARON LLOYD has been appointed superintendent of construction for the new State bridge at Spring City, Pa.

WILLIAM ELBRING has been named by the St. Louis County Court as the consulting engineer to direct the making of preliminary plans for road building work to be done in that county. Mr. Elbring is at present county surveyor.

SAMUEL C. LANCASTER, consulting highway engineer and builder of the Columbia Highway in Oregon, delivered an illustrated lecture on that road before the Chicago Association of Commerce, March 8.

W. W. K. SPARROW, assistant chief engineer of the Missouri Public Service Commission, and author of the valuation report on the Mississippi River & Boone Terre Railway, abstracted on page 386 of this issue, has been appointed valuation engineer of the Chicago, Burlington & Quincy, effective April 1, with headquarters at Chicago. Mr. Sparrow was born in Ireland in 1879. He was an articled pupil to B. A. Wise, chief engineer of the Belfast & Northern Counties Railway from 1896 to the end of 1898. For the next ten years, until 1908, he was engaged in various railroad work in the employ of the Cape Government Railways and the Chartered Company of Rhodesia. He then came to the United States and was for three years with Waddell & Harrington, consulting engineers, of Kansas City, Mo., engaged on steel and reinforced-concrete design. From July, 1912, to September, 1913, he was associated with Hans Von Unwerth, consulting engineer, also of Kansas City. In the latter month he was made assistant chief engineer of the Missouri Public Service Commission.

HENRY J. HORN, formerly vice-president of the Boston & Maine, and lately engaged as consulting engineer in special railroad work, has been elected to membership in the corporation of the Massachusetts Institute of Technology. Mr. Horn was graduated from the civil engineering department of the institute in 1888. He spent his summers in the employ of several roads and after graduation entered the service of the Chicago, St. Paul & Kansas City Railway, as assistant engineer. He left that company in March, 1889, and held positions in the engineering departments of several roads until April, 1904, when he was appointed general manager of the Northern Pacific, which position he held until October, 1907. He was engaged in commercial business until May, 1910, when he became assistant general manager of the Chicago, Burlington & Quincy. He held this position for only a few months, and was appointed assistant to the president of the New York, New Haven & Hartford in December, 1910. A month later he was made vice-president of that road and in June, 1912, he was appointed vice-president of the Boston & Maine. He resigned from the vice-presidency of the New York, New Haven & Hartford on Feb. 1, 1913, and since then has been a special consulting engineer, with offices in Brookline, Mass.

RICHARD S. LEA, consulting engineer, of Montreal, has accepted a nomination on the proposed board of engineers to investigate the construction of the Great Winnipeg Water District aqueduct. Mr. Lea's associates on the committee will probably be J. G. Sullivan, chief engineer of the Western lines of the Canadian Pacific and Col. Henry N. Ruttan, consulting engineer.

F. HERBERT SNOW, chief of the engineering division of the Pennsylvania Public Service Commission, Harrisburg, Pa., has been appointed lecturer on public utilities at Pennsylvania State College. He will give a series of 10 lectures on public utilities to the seniors in the school of engineering.

CHARLES E. HEWES, formerly city engineer of Alhambra, Cal., has been made city manager, an office created under the recently adopted commission form of government.

ROBERT L. WOOD has resigned as city engineer of El Monte, Cal., to accept a position with the St. Louis & Iron Mountain Railway at Monroe, La.

MATTHEW J. SCAMMEL, superintendent of blast furnaces for the Sparrows Point Plant of the Maryland Steel Company, has been appointed general manager of that plant, to be effective June 1.

ALBERT MCMAHON, city engineer for Menasha, Wis., has also been engaged as city engineer for Neenah.

Obituary Notes

THEODORE VOORHEES, president of the Philadelphia & Reading Railway Company died at Elkins Park, a suburb of Philadelphia, March 12. He was born in 1847 and was graduated from Rensselaer Polytechnic Institute in 1869. He then entered the engineering department of the Delaware, Lackawanna & Western Railroad where he served for four years, after which he was successively superintendent of the Syracuse, Binghamton & New York Railroad for two years, in the transportation department of the Delaware & Hudson Canal Company at Albany for three months, and superintendent of the Saratoga & Champlain Division of the Northern Railroad department of the same company from March, 1875, to October, 1885. In October of the latter year Mr. Vorhees went to the New York Central & Hudson River Railroad as assistant general superintendent, which position he held until March 1, 1890, when he was made general superintendent. In 1891 he became also general superintendent of the Rome, Watertown & Ogdensburg Road, and he held the two positions until the time of his appointment as first vice-president of the Philadelphia & Reading, Feb. 1, 1893. He joined The American Society of Civil Engineers May 6, 1885. The success of his work is said to have been the result of his adopting the policy of making every man on his road feel that the company's interest was his own.

HENRY T. KENDALL, civil engineer, and former member of the firm of Kendall Brothers, of Reading, Pa., died March 6 at the age of seventy-three. Mr. Kendall was born in Reading, and served in the 50th Pennsylvania Volunteers during the Civil War. After the war he was graduated from the Philadelphia Polytechnic College, and became associated with his brother Joseph V. Kendall. He retired from active work ten years ago.

ROBERT M. JONES, well known engineer of Denver, Col., died suddenly March 1 at Carlsbad, N. M., after a short illness. He had been in Carlsbad several months repairing the Tansill dam on the Pecos River when he was fatally stricken. Mr. Jones was born in Wayne, Ohio, in 1853, and began his engineering work as a U. S. deputy surveyor locating townships and territorial boundaries in New Mexico, Indian Territory and Wyoming. In 1880 he applied the Burt solar attachment to the transit and patented the Jones latitude arc for observing latitude at any time of day. In 1883 he built a steam power plant at Laramie, Wyo., and for several years devoted his efforts to erecting many similar structures. Mr. Jones was one of the first to see the possibilities of hydroelectric development, and, having the courage of his convictions, he financed the construction of the Big Cottonwood hydroelectric plant during the panic of 1893. This plant was designed to supply power to Salt Lake City, and, although it was one of the first, it is still operating as a part of the Utah system. The Cottonwood plant was followed by the "Jordan Narrows" structure south of Salt Lake City and the plant of the Pike's Peak Power Company which was described in Engineering Record on page 50 of the issue of July 19, 1902. Mr. Jones located, designed and constructed the first plant of the Nevada-California Power Company after which he erected a specially designed structure for the Black Hills Traction Company. Since 1906 he maintained an office in Denver, acting as engineer in examination and design of many hydroelectric projects throughout the West and Mexico, and for several years, he gave much of his time to the development of a process for making hollow reinforced-concrete poles, piles and pipe.

CONTRACTING NEWS

Of Special Interest to Engineers, Contractors, Builders and Manufacturers of Engineering and Building Supplies

PROMISE of better activity in building construction than in some time is seen in the steadily-growing orders and inquiries for structural steel. Last week orders placed and work bid on are said to have amounted to 55,000 tons, while new prospective contracts developed during the week will require 50,000 tons additional. For the New York metropolitan district alone plans now on the boards of architects are estimated to require 30,000 to 40,000 tons of steel.

Surplus bank reserves in New York are lower and loans are far in excess of last year's figures. These conditions may mean advances in money rates. A factor contributing to them has been the large amount of surplus funds invested in securities formerly held in Europe and sent back in part payment for our unusual exports. The unprecedented balance of trade in our favor which resulted in the absorption of capital in this way is now being cut down, however, by steadily-growing imports.

The last monthly crop report of the Secretary of Agriculture estimates the total value of all crops for 1915 at $6,788,905,000, nearly 8 per cent more than in 1914 and more than 12 per cent above the preceding five-year average. Thus the chief source of the money available for investment in public and private enterprises requiring construction work is in the best condition of our history.

It has been estimated by the *Railway Age Gazette* that the railroads of the country earned 3.09 per cent on their property investment in the last half of 1915, and that, if the recent rate of increase in net operating income is maintained to the end of the fiscal year, an average return of less than 5 per cent on the property investment will be realized. This estimate is based on the fact that summer and fall earnings always exceed those of the winter and spring months. It shows that still further improvement must take place before extended new construction can become general. Such construction is needed to keep pace with the growth of the country, and it is to be hoped that developments will give it precedence over the proposed increase in the wages of the best-paid class of railroad employees.

Buildings

The volume of building work continued to grow during the past week. The contracts awarded include: $150,000 loft building and $150,000 telephone exchange, New York City; $220,000 high school, Morristown, N. J.; ten-story industrial building and $125,000 theater, Philadelphia; $125,000 store building, New Orleans; $200,000 institute building, St. Louis; $157,000 courthouse, Rockford, Ill.; $550,000 grain elevator, Minneapolis, and $200,000 hotel, Omaha.

Among the new projects on which bids are desired are: $330,000 school, Butler, Pa.; $250,000 bank building, Elyria, Ohio; $255,000 court house, Portland, Ind., and $200,000 cathedral, Sioux Falls, S. D.

The following work now in the hands of architects and engineers is noted: $200,000 factory, Maspeth, L. I.; $135,000 club house, Morristown, N. J.; $250,000 apartment house, Washington, D. C.; $300,000 warehouse, $150,000 store and $350,000 power house, New York City; $350,000 hotel, Washington, D. C.; twelve-story office building, Atlanta, Ga.; $150,000 factory, Cleveland; $350,000 school, Gary, Ind.; $140,000 railway station, Butte, Mont.; $250,000 bank building and $150,000 office building, Portland, Ore.

Among the public buildings for which bonds have been sold are a $225,000 court house at Wichita Falls, Tex., a $300,000 municipal building at Pueblo, Col., and school buildings for which $250,000 bonds have been sold at Circleville, Ohio. Other proposed building construction noted includes: New railroad freight house and improvements costing $2,000,000 at Providence, R. I.; $150,000 lodge building, Baltimore; $200,000 high school, Scranton, Pa.; $250,000 college building, Cincinnati; $350,000 cold storage warehouse and $150,000 bakery, Cleveland; $750,000 lodge building, Indianapolis; $125,000 apartment house, St. Louis, and additional buildings for the University of California at Berkeley to cost $580,000.

Bridges and Roads

A contract has been awarded for the substructure of the railroad bridge at New London, Conn. A contract for the temporary bridge to Belle Isle at Detroit, which had to be readvertised because the county commissioners had not approved the first plans, has just been awarded at $100,000. Bids have been opened in Kansas City for the construction of the $600,000 Central Avenue bridge. The lowest bid received for building the Lake Washington Canal bridge at Seattle was $296,000. Bids are to be opened April 6 for the bridge work readvertised at Miami, Fla.

A commission has been appointed by the Governor to take charge for New Jersey of building the $18,000,000 bridge between Philadelphia and Camden. The cost of the bridge over the Potomac River at Washington is fixed at not more than $1,000,000 by the bill authorizing it, which has passed the House of Representatives. The House has also authorized the construction of a county bridge over the Ohio River at McKees Rocks, Pa. A county bridge costing $135,000 is contemplated at Duboistown, Pa. A railroad bridge planned at Freeport, Tex., will cost $200,000. Bridge construction recommended by the city engineer of Spokane will cost $360,000.

Paving work is increasing with the opening of the season, and the number of counties voting or considering large road bond issues indicates that construction in this line will again be active this summer. Contracts reported let include: Elizabeth, N. J., bituminous on concrete base, $79,000; Atlantic City, boulevard, $280,000; Baltimore (bids opened), asphalt paving, $94,000; Topeka, Kan., brick paving, $106,000; Indianapolis, wood paving blocks, $511,000; Seattle (bids opened), grading and paving, two contracts, $166,000, and Burlingame, Cal., paving 67 blocks, $247,000.

Bids are reported desired on the following paving and road work: Bayonne, N. J., $200,000; Hazleton, Pa., street paving, $89,000; Wheeling, W. Va., 10 miles county road paving, $200,000; Morristown, Tenn., 40 miles highway improvements; South Bend, Ind., street paving, $153,000; and Sioux City, Iowa, 37,000 sq. yd. of concrete paving.

A contract for additional paving work to be let next month at Bayonne, N. J., will amount to $200,000. Altoona, Pa., is ready to pave twenty-three city blocks. County road bonds in the sum of $350,000 have been sold at Winchester, Tenn. Jackson, Tenn., is to let a contract next month for 55,000 sq. yd. of paving on concrete base. The Minnesota State Highway Commission will spend $1,500,000 this year on road work.

Waterworks and Sewers

Atlantic City, N. J., has bought cast-iron pipe for fire mains costing $58,000. Waterworks construction contracted for at Malvern, Ark., will cost $96,000. The lowest bid received at Milwaukee for building the extension to the Linwood Avenue intake tunnel was $480,000. Contracts amounting to $54,000 for constructing the Ottawa pumping station have been awarded. Bids are desired on 12,000 tons of cast-iron pipe at Rochester, N. Y., and for building a filtration plant at Florence, Ala. Buffalo is to complete its high-pressure water system at a cost of $150,000. Waterworks improvements costing $376,000 have been authorized at Cleveland. The Denver (Col.) Union Water Company is planning improvements that will cost $100,000. The estimated cost of the water system proposed at Hamilton, Mont., is $71,000.

The lowest bids received for the sewer work at Savannah, Ga., total $253,000. The lowest bid received at Chicago for the stock yards intercepting sewer was $91,000. Bids are desired at Madison, Ill., for sewer work to cost $155,000 and at Billings, Mont., for constructing storm sewers to cost $54,000. The following proposed sewerage work was reported last week: Rochester, N. Y., $100,000 sewer; Warren, Pa., $100,000 trunk sewer; Zanesville, Ohio, trunk sewer, $216,000; Taylorville, Ill., sewer system, $83,000; Des Moines, Iowa, pumping station, sewage disposal plant and sewer extensions, $1,000,000; Minneapolis, new sewer construction, $600,000; Madison, Mo., sewer system, $160,000.

Miscellaneous

The lowest bid received for a subway station-finish contract in New York City was $344,000. A low bid of $573,000 was received for constructing the Forty-sixth Street pier shed in New York City. A contract for building 8 miles of railroad has been awarded at Cannon, Ky. Bids will be opened April 14 in New York City for the removal of Coenties Reef, which was recently authorized by Congress.

A bill authorizing the appropriation of $600,000 for harbor improvements at Boston has passed the Massachusetts Legislature. Two new railroad companies have been incorporated, one to construct 21 miles of line near Shelby, N. C., and one to build a 41-mile road from Frankfort to Ben Davis, Ind. A contract for building a $400,000 wharf will be let soon at Houston, Tex. Plans have been completed at Tacoma, Wash., for dredging work to cost $200,000.

WATERWORKS

PROPOSED WORK.

Buffalo, N. Y.—Senate cities Committee reported favorably the Greiner bill authorizing Buffalo to issue $500,000 bonds for water and sewer construction.

Council authorized a bond issue of $150,000 to complete the downtown high pressure water mains.

Bridgeton, N. J.—Council authorized issue of $30,000 bonds for laying high pressure water mains in industrial section of city.

Rockaway, N. J.—Borough Council has decided to install water meters. Address Borough Clerk.

Johnsonburg, Pa.—State Board of Health has ordered installation of filtration plants at Johnsonburg Paper Mills and several central Pennsylvania tanneries.

Pennsylvania.—State Department of Health at Harrisburg granted permit to Jenner Quemhoning Coal Company of Conemaugh Township to construct water works.

Hagerstown, Md.—Washington County Water Company will issue $550,000 additional stock for building a reservoir on South Mountain.

Takoma Park, Md.—The report to enlarge water system accepted. Election to be held to vote $25,000 bonds for the improvement. Address City Clerk.

Nashville, N. C.—Bonds amounting to $45,000 have been authorized for water works, sewers system and electric light plant. Address City Clerk.

Winchester, Ky.—City Council voted in favor of municipal water works.

Canton, Ohio.—W. F. Hobush, Chairman Water Committee, submitted ordinance to Council recommending issuing of $50,000 bonds for immediate enlargement of the mains.

Cincinnati, Ohio.—Election to be held April 25 to vote $400,000 bonds for completion of the high pressure water service system.

Cleveland, Ohio.—City Council has authorized Thomas Farrell, Director of Public Utilities, to spend $376,000 for water works improvements, including 4300 tons pipe, cost $124,700; 280 tons special castings, $15,800; removing water works upper crib and submerging lower crib, $35,000; riveted steel pipe, $15,000; adjustable valve boxes, $10,000; pig lead, $22,000; jute packing, $20,000; stop valves, $20,000; fire hydrants, $12,000; 60-in. suction piping, $8,000; wash water pumps, air compressor and forced lubricating system for Division Avenue pumping system, $50,000; grading, $20,000.

Cleveland, Ohio.—All bids opened Feb. 23 for an air compressor for the Division Avenue Pumping Station rejected. R. J. Logan, Contract Clerk.

Germantown, Ohio.—Proposed to install water works. Eighteen hundred inhabitants. Franchise may be granted. Address A. L. Wetz, Mayor.

Ironton, Ohio.—Witmer & Co., Buffalo, N. Y., are engineers for the proposed water works. F. A. Ross, Clerk Director Public Service.

Ohio City, Ohio.—Citizens considering municipal water works. Address City Clerk.

Bad Axe, Mich.—All bids opened March 8 for furnishing material for one 2-story sedimentation tank and one four-section filter, 45,830 lin. ft. 6 to 15 in. pipe, etc., have been rejected and new bids will be asked about March 29. James A. Burgess, City Recorder.

Escanaba, Mich.—Preliminary plans and specifications being prepared by Burns & McDonnell, Interstate Bldg., Kansas City, Mo., for water works to cost $443,000. Election to be called.

Menominee, Mich.—City has taken over the plant of the Menominee Water Company and will take steps at once to install a filtration plant costing $85,000. M. B. Lloyd, Mayor.

Rock Island, Ill.—Contract soon to be let by Council for constructing a 100,000-gal. elevated tank for the water works.

Bayard, Neb.—New bids to be asked for water works. All bids opened March 1 rejected. Selzer & Finley, Engineers, Scottsbluff.

Sterling, Neb.—Election to be held March 24 to vote $25,000 bonds to construct water works.

Ellendale, N. D.—Council will call an election to vote $9,000 bonds for installing a water system.

Kadoka, S. D.—Construction of municipal water works is under consideration. Address City Clerk.

Glendive, Mont.—Plans being prepared by Burns & McDonnell, Engrs., Kansas City, Mo., for filtration plant and water works improvements to cost $65,000. Bond election May 15.

Hamilton, Mont.—Sawyer Bros., Spokane, Wash., estimate cost of constructing water system from $71,150 to $86,300, according to pipe used.

Galveston, Tex.—Contract soon to be let for two oil engine driven generators to supply current for operating three new wells at Alta Loma. Cost of generators $18,000. E. M. Shay, City Commissioner.

Oklahoma, Okla.—Benham Engineering Company of Oklahoma engaged as consulting engineers on the proposed water works. An election to be held soon to vote bonds for construction.

Stroud, Okla.—Benham Engineering Company, Oklahoma, engaged to prepare plans and report on the construction of the water works and lighting system; cost $20,000, and also construction of a sewer system, cost $25,000.

Denver, Colo.—Denver Union Water Company (D. G. Thomas, Ch. Engr.) reported planning improvements costing $100,000.

Seattle, Wash.—Contract soon to be let for water mains in Shilshole Avenue and other streets to cost $20,000. Address Board Public Works. (L. B. Young, Chmn.).

A. H. Dimock, City Engineer, completed plans for an auxiliary water and fire protection system for Ranier Beach District costing $50,000, to include steel water tower and tank 119 ft. high. Contract soon to be let by Board of Public Works (L. B. Young, Chmn.).

Eastside, Ore.—Reported town is considering municipal water works costing $20,000.

Los Angeles, Cal.—Board of Public Works will ask new bids on the 1100 tons of standard bell and spigot c. i. water pipe and for gate valves.

Oceanside, Cal.—City has sold $12.000 bonds to be used to lay water mains.

Emmet, Idaho.—Reported City Council plans extensions to water system.

North Vancouver, B. C.—City Council has included in the budget $15,000 for the municipal water works.

BIDS DESIRED.

New York, N. Y.—Until March 20 by William Williams, Commissioner of Water Supply, Gas and Electricity, for furnishing, delivering and laying water mains and appurtenances in Sharrotts Road, Meisner, Fairmont and Ocean Avenues, and other streets in Borough of Richmond; security $14,000.

Until March 20 by Marcus M. Marks, President Manhattan Borough, for constructing receiving basins adjacent to northeast corner of Columbus Avenue, W. 101st Street and 13 other points in borough (2 contracts). Contract 1 provides for constructing all basins north of Fifty-ninth Street. Separate bids for basins at southwest corner 181st. Street and other streets. Total security $3,700.

Rochester, N. Y.—Until March 22 by Board Contract & Supply (F. X. Pifer, Clk.) for furnishing about 12,000 tons 37-in. c. i. pipe and special castings, and for hauling and laying complete about 10 miles of 37-in. c. i. pipe conduit; also same time and place separate bids for furnishing, hauling and laying with appurtenances 37-in. lock bar steel pipe for Conduit III.

Asbury Park, N. J.—Until March 21, by Board Commissioners, for driving an 8-in. well about 1150 ft. Harry B. White, City Clk.

Greenville, Pa.—By Greenville Water Company for a 10-in. high-pressure force main, high-service pumping station, and motor-driven triplex pump. Chester & Fleming, Engineers, Pittsburgh.

Harrisburg, Pa.—Until March 20 by Harry F. Bowman, City Commissioner Superintendent Public Safety, for furnishing 6000 ft. 6, 8 and 10-in. pipe, 12 fire hydrants, 12 5-in., 5 8-in. and 4 10'-in. valves, 200,000 lb. alum, etc.

Norristown, Pa.—Until April 3, by Trustees State Hospital, for concrete surfacing of reservoir. W. W. Bibbert, 415 Hale Building, Philadelphia, Engr.

Washington, D. C.—By Bureau Supplies and Accounts, Navy Department, Washington, D. C.: Brooklyn, N. Y., Sch. 9409—miscellaneous pumps; Portsmouth, N. H., Sch. 9416, 7100 lb. brass pipe; Philadelphia, Pa., Sch. 9419, 27,000 ft. steel pipe; Charleston, S. C., 14,200 c. i. plugs; Washington, D. C., Sch. 9413, 6000 ft. steel conduit.

South Boston, Va.—Until April 10 (extension of date from March 30), by Mayor and Board of Aldermen, for furnishing material and installing pumping station and filter plant building, auxiliary pumping station, coagulating basin, etc. Anderson & Christie, Inc., Consulting Engineers, Charlotte, N. C.

Ocala, Fla.—Until March 30 by City Council for constructing a combined electric power and water plant, advertised in Engineering Record. Trombley & Henney, Engineers, 55 Liberty Street, New York. H. C. Sistrunk, City Clerk.

Florence, Ala.—Until April 10 by City Clerk for constructing a filtration plant, advertised in Engineering Record. Knight & Quayle, Consulting Engrs., Chattanooga, Tenn.; C. E. Jordan, Commissioner of Public Property.

Cincinnati, O.—Until March 29, by Geo. F. Crawford, Secy. Dir. Pub. Service, for laying c. i. pipe, special castings, valves, etc. Separate bids for high-pressure fire system, etc.

St. Paul, Minn.—Until March 27 for two motor-driven pumps, 5000 gal. capacity per minute. Aug. Hoehnstein, Purchasing Agent.

Willmar, Minn.—Until March 27 by City Council for approximately 4000 ft. standard c.-i. water mains, gate valves, hydrants, etc.

Rector, Ark.—Until April 11, by Board Commisisoners Sewer Improvement Dist. No. 1 and Water Works Improvements Dist No. 1 for water works and sewers advertised in Engineering Record. Frank L. Wilcox, Engr., Syndicate Trust Building, St. Louis, Mo.

Aberdeen, Wash.—Until March 22 by P. F. Clark, City Clerk, for furnishing following: 250,000 ½-in. mild steel bands for 28-in. wood stave pipe; 250,000 malleable iron band shoes; 25,000 lb. 1½-in. x 14 ga. band iron; 2000 M ft. pipe staves 1½ in. thick; 135 2, 3 and 4-in. gate valves; 135 2, 3 and 4-in. air and vacuum valves; five 30-in. direct-pressure sluice gates. Project the gravity water supply about 22.5 miles, 28-in. wood stave pipe 1½ stave, ½-in. bands concrete or timber dam intake, 30 x 100 ft. timber, settling basin and screening chamber. Bids for construction to be called for as soon as plans completed. Cost $400,000. Louis D. Kelsey, City Engineer.

St. Mary's, Ont.—Reported desired until March 31 by Superintendent City Water Works for 2,000,000-gal. centrifugal pump.

Panama.—Until March 31 by Major Earl I. Brown, Corp Engrs., U. S. A., General Purchasing Agent, Panama Canal, Washington, D. C., for Cir. 1022 for steel and iron pipe.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**North Collins, N. Y.** — Contracts awarded as follows for constructing water works (bids opened Feb. 23), construction of well and pumping station, and furnishing and laying universal joint pipe, setting hydrants, valves, and valve boxes to Desiderio & Sattler, Rochester; furnishing and erecting pumping machinery to Rumsey Pump Company, Ltd., Seneca Falls; furnishing hydrants, valves and valve boxes to Renaselaer Valve Company, Troy; steel standpipe to Chicago Bridge & Iron Works, Chicago, Ill. A. H. Kimble, Village President.

Washington, D. C. — Only bid opened March 6, by U. S. Engineer Office, Washington, for furnishing 400 tons sulphate of alumina submitted by Universal Trading Company, 171 Broadway, New York, at $98.49 per ton in bags, allowance 6 cents for each bag returned; time 10 days.

Following are four bids opened March 2, by Commissioners, D. C., for constructing a cover of concrete or other material over Reno reservoir for the water department: Fred Drew & Company, $16,200; J. L. Marshall, $16,603; Melton Construction Company, $17,230, and West Construction Company, Baltimore, Md., $19.860 (bidders of Washington, D. C., unless otherwise stated).

★**New York, N. Y.**—Following are unit figures of the four lowest bids opened Feb. 24 by Water Board, Municipal Building, for Contract 169, lining with masonry a portion of the Eastview Tunnel of the Catskill Aqueduct, in Town of Mount Pleasant, Westchester County: (a) A. L. Guidone, Inc., 52 Vanderbilt Avenue, $126,660 (awarded contract); (b) The Santor Construction Co., Inc., Times Building, $127,716; (c) John J. Hart, Peekskill, N. Y., $134,855; (d) William Heyman and Frank Willetts, 15 Exchange Place, Jersey City, N. J., $139,135.

	*(a)	(b)	(c)	(d)
Care of water (lump sum)	$8,500.00	$5,317.00	$2,200.00	$500.00
2,000 lin. ft. of groove, cutting grooves in side wall for intercepting water	0.30	0.45	0.05	0.20
40,000 sq. ft. furnishing and placing sheet-metal water-stop	0.15	0.08	0.06	0.09
10,000 sq. ft. furnishing unused sheet-metal water-stop	0.09	0.025	0.03	0.02
86,000 sq. ft. bituminous waterproofing	0.16	0.25	0.1575	0.16
50 cu. yd. excavating concrete masonry	20.00	6.00	15.00	21.00
7,000 bbl. Portland cement	2.00	2.03	2.12	3.00
400 cu. yd. concrete masonry	12.00	5.86	11.00	10.00
1,750 lin. ft. of tunnel brick masonry	36.00	41.00	50.00	47.50
2,000 lin. ft. drilling holes in rock or masonry	0.80	0.45	0.25	0.60
2,500 lin. ft. steel pipes for grouting, etc.	0.60	0.23	0.20	0.40
800 connection, making connections for grout.	1.00	1.45	1.00	2.00
600 cu. yd. mixing and placing grout	12.00	5.25	6.00	5.00
400 ton sand for grout	2.50	1.40	2.30	4.00
15,000 lb. 2½-in. galvanized-steel vent-pipe	0.10	0.10	0.10	0.14
Cleaning up (lump sum)	500.00	100.00	1,000.00	1,000.00

★**Atlantic City, N. J.**—Following are bids opened March 9 by Atlantic City Water Department for c.-i. pipe high-pressure fire service: (a) U. S. Cast Iron Pipe & Foundry Co., Chicago, Ill., $57,988 (awarded contract); (b) Warren Foundry & Machine Co., Elizabeth, $58,356; (c) R. D. Wood & Co., Philadelphia, Pa., $58,847; (d) Standard C. I. Pipe & Foundry Co., 30 Church Street, New York, $68,749. (L. Van Gilder, Engr. and Supt.)

	*(a)	(b)	(c)	(d)
1125 tons 20-in. c.-i. pipe, per ton	$29.75	$29.95	$29.99	$31.10
550 tons 12-in. c.-i. pipe, per ton	29.75	29.95	30.49	31.10
18 tons 8-in. c.-i. pipe, per ton	29.75	30.50	30.49	31.10
15 tons 6-in. c.-i. pipe, per ton	29.75	30.60	30.49	31.10
9 tons 8-in. flange pipe, per ton	75.00	76.00	75.99	70.00
100 tons special casting, per ton	65.00	65.00	66.49	70.00

Milwaukee, Wis.—Lowest bid opened March 8 by F. G. Simmons, Commissioner of Public Works, for constructing the extension to Linnwood Avenue intake water tunnel an additional 2500 ft. under Lake Michigan submitted by O'Brien & Jackson, Folsom Street, at $480,000.

★J. B. Forrestal, Milwaukee, and Edw. O'Donnell, Milwaukee, awarded contracts for laying water pipe during year as needed; their joint bid aggregated about $30,000.

★**Kinney, Minn.**—Contract for constructing filter plant (bids opened Feb. 22) awarded New York Continental Jewel Filtration Co., 15 Broad Street, New York, at $2,550. John McGrath, Village Clerk.

★**Malvern, Ark.**—Contract awarded J. L. McCrary, Little Rock, for constructing water works and sewers (bids opened March 1 by Commissioner Water Wks. Imp. No. 10); cost $96,000.

★**Texarkana, Ark.** — Contract awarded American Pipe & Construction Co., 112 North Broadway, Philadelphia, Pa., for extending mains and installing new pipes for Texarkana Water Co.; cost $30,000.

★**Glendale, Cal.** — Contracts awarded American C. I. Pipe Co., Sheldon Building, San Francisco, for furnishing 6000 ft. Class B water pipe as follows: 385 tons 20-in. and 600 tons 8-in., $36.60 per ton and $69 per ton for Stanley c.-i. specials.

★**San Diego, Cal.**—Contract awarded Pacific Tank & Pipe Co., San Francisco, for furnishing 15,200 ft. 30-in. wood stave pipe. Allen H. Wight, City Clerk.

★**Ottawa, Ont.**—Contracts for constructing the pumping station on Lemieux Island: Building—Doran & Dwhie, Ottawa, $54,000; valves—General Supply Co., Ottawa, $7,667; c. i. pipe, etc.—Victoria Fdry. Co., Ottawa, $9,223; plumbing—Gauthier & Co., Ottawa, $3,375.

SEWERAGE AND SEWAGE DISPOSAL

PROPOSED WORK.

Agawam, Mass.—At annual town meeting $30,000 was appropriated for constructing a sewer system. Address Board of Selectmen.

Rochester, N. Y.—State Engineer has approved plans prepared by Department of Engineering for a sewer to drain lowlands in Genesee Valley Park. The work will be done by the State; cost about $100,000.

Hopewell, N. J.—Plans and specifications being prepared for sewerage system and sewage disposal plant. Address Borough Clerk.

Madison, N. J.—Improving of the joint sewage disposal plant of towns of Madison-Chatham is under consideration. Address Town Clerk.

Ardmore, Pa.—Lower Merion Township sewer bonds amounting to $40,000 sold.

Ferndale, Pa.—Council taking steps to construct a sanitary sewer system.

Kittanning, Pa.—Borough Council has directed plans prepared for a sewage disposal plant. Wade Mast, Borough Engineer.

Pittston, Pa.—Borough Council of West Pittston considering constructing the Ninth District sewer at a cost of $30,000.

Steelton, Pa.—Highway Com. instructed to confer with Pennsylvania Steel Company and Pennsylvala R.R. on plans for an intercepting sewer to replace old Pennsylvania canal; cost $25,000. W. P. Callaghan, Borough Engineer.

Warren, Pa.—Plans about completed for the trunk sewer system; probable cost $100,000. Address City Clerk.

Hagerstown, Md.—Council considering the construction of a sewerage system and disposal plant.

Bill has passed the House providing for the establishment of a sewerage system and disposal plant and authorizing the Mayor and Council to issue $75,000 bonds for said purpose.

New Iberia, La.—Sewer bonds for $90,000 will be sold March 18 by Charles Provost, Secy. Board First Sewerage Dist.

Canton, Ohio.—See "Paving and Roads."

Cincinnati, Ohio.—Frank S. Krug, City Engineer, estimates cost of constructing relief sewers in Avondale East and west of Reading Road in territory between Melish Hale and Harvey Aves. at $36,272.

Greenville, Ohio.—City Council voted to construct storm water sewers, including 60 and 36-in pipe and laterals 18 to 24-in. pipe; cost, $45,000.

Maumee, Ohio.—Village Council considering disposal of sewage. Address Village Clerk.

Zanesville, Ohio.—Carl R. Spencer, City Engineer, has revised plans and estimates cost of constructing the Chap Run sewer at $216,542, city's portion to be $108,000.

Detroit, Mich.—Constructing of sewage disposal plant reported under consideration. Address Commissioner of Public Works.

Madison, Ill.—Sheppard & Morgan, of Edwardsville, are engineers for the proposed sewer system to cost $150,000.

Rock Island, Ill.—Council rejected all bids opened recently for constructing the west end storm drain.

Des Moines, Iowa.—City Engineer recommends improvements to sewerage system, including construction of pumping station at Twenty-sixth Street and a sewage disposal plant; probable total cost $1,000,000.

Minneapolis, Minn.—Council Committee recommends $600,000 new sewer construction. Carl Ilstrup, City Engineer.

Ellis, Kan.—Plans will be completed about April 1 by W. E. Hulse & Company, Hutchinson, for the proposed sewer system. N. T. Payne, City Clerk.

Madison, Mo.—Plans being prepared for a sewerage system to cost about $160,000. F. A. Garesche, Mayor.

Coleman, Tex.—Improvements contemplated to the sewer system. W. I. Coulson, Manager Coleman Sewer Co.

Venus, Tex.—Attorney General has approved $10,000 sewer bonds.

Stroud, Okla.—See "Water Works."

Los Angeles, Cal.—Board Supervisors appointed Commission of Sanitation Engineers (A. H. Koebig, Chmn.), to make survey of county sewer situation.

Taylorville, Ill.—J. W. Dappert, City Engineer, is preparing plans for a sewer system for the southwest, west, north and northeast parts of the city. Estimated cost, $83,684.

BIDS DESIRED.

Salisbury, Conn.—Reported desired until March 27 by Albert B. Roberts, Chmn. Sewer Committee, for pipe sewers and disposal works, to include 22,900 ft. 8-in. to 15-in. vitr. pipe sewer, 1900 ft. 8-in. to 14-in. c.-i. sewer, sewage disposal works, piping, etc. City Wastes Disposal Co., 156 Fifth Avenue, Engr., New York, N. Y.

Oswego, N. Y.—Until March 24 by Department Public Works (Charles W. Linsley, Commissioner) for sewer construction advertised in Engineering Record.

Port Washington, L. I., N. Y.—Until March 31 by Sewer Commissioners at Mullon's Hall, Port Washington, for furnishing material and constructing about 10 miles of vitri. pipe sewers 8 to 24 in., with necessary branches, manholes, flush tanks and appurtenances, together with one pumping station and disposal works consisting of an Emscher settling tank, etc., advertised in Engineering Record. Carl H. Watson, Engineer, Great Neck, L. I., N. Y.

Lyndhurst, N. J.—Reported desired until May 20 for constructing sewers. Probable cost $20,000. Address Bowe & Wessells, Engrs., Rutherford.

Hazelton, Pa.—Until about April 15 by W. D. Gerlack, Superintendent Street and Public Improvements, for constructing sewer 2800 lin. ft. stone, concrete or other approved construction, size 24 to 54 in.; cost $22,000. B. E. Youngman, City Engineer.

Washington, Pa.—Until March 20 by Council Chamber for constructing sanitary sewers in Ewing, Broad and other streets, and main sanitary sewer on Third Street. John Griffith, Boro. Secy.

Eustis, Fla.—Until April 10, by Charles L. Armsby, Town Clerk, for constructing, paving and storm sewerage system, including Imhoff tank, sludge drying bed and pneumatic ejector station.

Ada, Ohio.—Reported desired until April 1 for constructing sewers. Probable cost $40,000. J. T. Smull, City Engr.

Ann Arbor, Mich.—Until April 6 by Board Public Works for constructing 1700 lin. ft. segment block sewer 30 to 39 in. and 300 lin. ft. vitr. pipe sewer 24 in. Manley Osgood, City Engineer.

Chicago, Ill.—Until March 22, by Board Local Improvements (Edw. J. Glackin, Secy.), for constructing sewers in East Fortieth Street, Newland, Kongee Avenue and other streets. Also separate bids until March 23, for sewers in Bryn Mawr, North Cicero, and Drexel Avenue, and other streets, together with manholes, catchbasins, etc.

Madison, Ill.—Reported desired until April 10 for 35,000 ft. tile sewers. Probable cost $155,000. W. Champion, Secy. Board Local Improv.

Madison, Wis.—Until March 31 by H. C. Buser, Acting City Clerk, for constructing vitr. clay pipe sewer in addition to Patterson Street sewer district and in West End sewer district, and vitr. clay pipe and c.-i. pipe sewers in West End Intercepting Sewer, in all 30,209 lin. ft. 6 to 22-in. vitr. pipe and 5983 ft. 24-in. c.-i. pipe, 83 manholes, 39 lampholes, etc.

Randolph, Wis.—Until March 27 by Board Village Trustees for constructing system of sanitary sewers, in all about 17,650 lin. ft. 8, 10 and 12-in. tile pipe and 1370 ft. 8-in. c.-i. pipe, together with flush tanks, sewage disposal plant, etc. J. O. Jones, Village Clk.

North Milwaukee, Wis.—Reported desired until April 1 for constructing sewer system. Probable cost $14,000. H. C. Webster, City Engr. .

Sheboygan Falls, Wis.—Reported desired until March 25 by F. R. Kroeger, City Clk., for 11,200 ft. 8 to 15-in. tile sewers. J. Donahue, Engr., York Building, Sheboygan Falls.

Kenwood Park, Iowa.—Until March 21 by C. M. Doolittle, City Clerk, for constructing a sewer system.

Northwood, Iowa.—Until March 21 by T. E. Admundson, Town Clk., for 27,581 lin. ft. 6 to 12-in. vitr. pipe sewers, Sect. A, and 5100 lin. ft. 10 and 12-in. vitr. pipe sewers in Sect. B, including flush tanks, manholes, etc.

Litchfield, Minn.—Reported desired until March 30 by F. O. Holm, Village Recorder, for constructing 7 miles of 8 and 10-in. sewers and a sewage lift.

St. Paul, Minn.—Reported desired until March 20 for about 13,000 sewer bricks and 10,000 ft. sewer pipe. Aug. Hohenstein, Pur. Agent.

Billings, Mont.—Reported desired until April 7 by E. Sneckenberger, City Engr., for constructing storm sewers, pipes from 18 to 54 in. Probable cost $54,000.

Rector, Ark.—See "Waterworks."

Amarillo, Tex.—Reported desired until May 1 for constructing sewerage system and sewage disposal plant. Probable cost $10,000. M. H. Hardin, City Engr.

Tonkawa, Okla.—Until March 27 (readvertisement) by E. H. Stalmaker, City Clerk, for constructing Sanitary Sewer, District No. 4, including 1900 ft. 8-in. and 5610 ft. 6-in. pipe, manholes, flush tanks, etc.

Walla Walla, Wash.—Reported desired until March 21, by M. A. Power, City Clk., for constructing 9160 ft. of 6- to 15-in. sewers. W. H. Rehorn, City Engr.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Savannah, Ga.—Following are four lowest bids opened March 6 by Mayor and Aldermen (E. R. Conant, Chief Engineer) for constructing drainage—(a) Division A east side portion, (b) Division B west side portion: Vitr. pipe all circular sewers 8 to 24 in. and sectional reinforced pipe of Lock Joint Pipe Co.'s type for all circular sewers 30 to 60 in.: Obenshain Brothers, Center Mouches, N. Y., (a) $121,124; Sullivan, Long, Hagerty, Dysard Co., Bessemer, Ala., (a) $125,621, (b) $150,595; Gadsden Contracting Co. and Guild & Co., Savannah, Ga., (a) $127,954, (b) $132,289; Municipal Engineering Co., Atlanta, (a) $129,053; M. O'Herron & Son, Baltimore, Md., (b) $172,000.

Houston, Tex.—Following are bids opened March 6 by City Council for constructing sewers:

Crockett Street: W. Waldo, 902 Union National Bank Building, $21,149; Hardman & Nelson, $21,633; H. M. Miller, $22,230, and Horton & Horton, Pierce Ave. and Travis Street, $23,128.

Taum Avenue: Hardman & Nelson, Houston, $15,576; E. M. Scheflow, $15,861; H. M. Miller, $16,054, and J. J. Blond & Son, $16,225.

★**Seattle, Wash.**—Contract awarded by Board Public Works for constructing sewers in Fairmount Avenue and other streets to City Contracting Co., 1319 Twenty-first Avenue, at $49,768.

Chicago, Ill.—Following are unit figures of the four lowest bids opened Feb. 10 by Trustees of Sanitary District of Chicago for constructing the stock yards intercepting sewer: (a) Ready & Callaghan Coal Co., 133 W. Washington Street, (total for a) $91,377, (total for b) $104,051; (b) Marquette Construction Co., 133 W. Washington Street, (a) $129,247, (b) $143,959; (c) T. J. Forschner Contracting Co., Chicago, (a) $132,916; (d) John W. Farley, Chicago, (a) $140,879.

No. of Item	(a)	(b)	(c)	(d)
1—(a) 162 lin. ft. concrete sewer, 9 ft. diameter, with footing	$32.66	$68.00	$45.00	$60.00
1—(b) 162 lin. ft. brick and concrete sewer, 9 ft. diameter, with footing	25.63	74.00	52.00	64.00
2—(a) 608 lin. ft. concrete sewer, 9 ft. diameter.	21.79	32.00	31.00	38.60
2—(b) 608 lin. ft. brick and concrete sewer, 9 ft. diameter	23.08	37.00	35.50	42.50
3—(a) 2,675 lin. ft. concrete sewer, 7 ft. diameter	14.23	23.00	21.60	19.26
3—(b) 2,675 lin. ft. brick and concrete sewer, 7 ft. diameter	18.61	27.00	25.50	24.00
4—(a) 6 manholes	39.00	50.00	90.00	50.00
4—(b) 6 manholes	35.00	60.00	90.00	50.00
5—Cofferdam across west arm (lump sum)	3,000.00	3,240.00	1,500.00	10,000.00
6—Connection to West Thirty-ninth Street conduit (lump sum)	570.00	1,950.00	1,450.00	1,000.00
7—Connection at Robey Street (lump sum)	3,181.00	3,800.00	3,300.00	4,000.00
8—Connection at Ashland Avenue (lump sum)	7,159.00	8,000.00	12,000.00	10,000.00
9—40 lin. ft. tile pipe for connection, 18 in.	0.50	2.60	2.50	2.00
10—28,000 sq. ft. tile lining	0.166	0.11	0.20	0.12
11—316,000 lb. reinforcing steel	0.036	0.03	0.045	0.06
12—10,100 lb. structural steel	0.04	0.06	0.06	0.08
13—19,500 lb. cast-iron pipe	0.04.25	0.06	0.06	0.05
14—170 rods removal of tie rods	0.10	1.00	13.50	6.00
15—5,000 lb. replacing tie rods	0.04	0.05	0.06	0.06
16—5,400 lin. ft. anchor piles or other piling furnished	0.17	0.20	0.20	0.25
17—5,400 lin. ft. anchor piles or other piling driven	0.14	0.40	0.60	0.50
18—15 M ft. cribwork on piling	94.16	100.00	100.00	80.00
19—5 cu. yd. additional excavation, earth	0.75	0.75	0.75	0.76
20—5 cu. yd. additional excavation, rock	3.00	3.00	3.00	3.00
21—5 cu. yd. additional concrete, Class A	8.00	8.00	8.00	8.00
22—5 cu. yd. additional concrete, Class B	7.00	7.00	7.00	7.00
23—5 cu. yd. additional brick work	9.00	9.00	9.00	9.00
24—5 M ft. plank foundations	25.00	26.00	25.00	25.00
25—5 M ft. sheeting	20.00	20.00	20.00	20.00

BRIDGES

PROPOSED WORK.

Woodsville, N. H.—Towns of Newbury, Vt., and Haverhill, N. H., have voted to jointly construct a bridge across Connecticut River between towns of Wells River, Vt., and Woodville, N. H., to cost probably $50,000. E. B. Greer, Selectman, Newbury.

Harmon, N. Y.—Plans being prepared by Charles MacDonald, Jr., County Engineer, Tarrytown, for constructing a reforced concrete arch bridge on a concrete foundation over Croton River at Harmon.

White Plains, N. Y.—Plans being prepared by Charles MacDonald, Jr., County Engineer, Tarrytown, for a reinforced concrete arch bridge over Bronx River on cement and pile foundation.

Audubon, N. J.—Camden County Bd. Freeholders, at Camden, approved plans and specifications for cement arch bridge on White Horse Pike, which spans Newton Lake between West Carrollton and Audubon. A roadway 40 ft. wide with sidewalks 26 ft. wide is provided for.

Camden, N. J.—Governor submitted to Senate names of Delaware River Bridge & Tunnel Commission, of which Samuel T. French of Camden is a member, to have charge of building bridge between Camden and Philadelphia, Pa.

McKees Rocks, Pa.—The U. S. House passed bill authorizing construction of bridge over Ohio River from Woods Run, Pittsburgh, to McKees Rocks. Pittsburgh, county seat.

Washington, D. C.—The House passed a bill providing for constructing bridge over Potomac River at Georgetown to replace Aqueduct bridge; cost not to exceed $1,000,000. The bill made allowances of $150,000 and $25,000 respectively for obtaining plans and keeping old structures, in condition for traffic while new bridge is being constructed.

Fairmont, W. Va.—Plans being prepared by S. B. Miller, City Engineer, for constructing concrete bridge over Monongahela River; cost $360,000. The improvement to be made if bond issue is voted favorably.

De Land, Fla.—Bridges and paving bonds for De Land-Lake Helen Special Road and Bridge District for $350,000 will be sold March 24 by Samuel D. Jordan, Clk. Board County Commissioners.

Ocean Springs, Miss.—Election to be held in the county to vote $85,000 bonds for constructing bridges across Pascagoula River. Address County Clerk.

Bloomington, Ind.—County Council appropriated $10,600 for bridges.

Danbury, Wis.—Election to be held April 4 to vote on constructing a bridge across St. Croix River to have three 70-ft- spans. A. R. Hiest, State Engineer, Madison, prepared plans. Andrew Gelland, Yellow Lake, may be able to give information.

Macedonia, Iowa.—Reported Bd. Supervisors at Council Bluffs, considering constructing a steel bridge with cement floor and cement abutments; probable cost $10,000.

Lawrence, Kan.—Kansas City, Kaw Valley & Western Interurban Ry. Co. filed with State Utilities Commission at Topeka plans for strengthening bridge over Kaw River.

Nelson, Neb.—All bids opened March 8 for constructing and repairing all county bridges for year 1916 rejected and county will do their own work. E. E. Hedgcock, County Clerk.

Cotter, Ark.—Cotter, Rush & Mineral Belt R.R. Co. will construct a steel bridge 170 ft. long. with 950 ft. piping, and 14 wooden bridges on concrete piers. R. P. Sharpe, Engineer, Cotter.

Spokane, Wash. — Construction of 6 bridges to replace old structures and strengthening other bridges, at estimated cost of about $360,000, recommended by Morton McCartney, City Engineer, to City Commission.

Portland, Ore.—Reported Southern Pacific Ry. (W. Hood, Chief Engineer, San Francisco) will construct with their own forces viaduct at Holgate Street, to consist of four 75-ft. steel spans; cost $75,000.

BIDS DESIRED.

Spring Lake, N. J.—Until April 6 by George D. Cooper, County Engineer, Red Bank, for constructing a reinforced concrete highway bridge over Wreck Pond, Ocean Boulevard, between Spring Lake and Sea Girt; cost $20,000. John T. Simpson, Engineer, 620 Essex Street, Newark.

Lewisburg, Pa.—Until April 1 County Commissioner, Lewisburg, for constructing twin arch bridge over Laurel Run, Hartley Township. Walter Frick, Engineer, Lewisburg.

Hinton, W. Va.—Until March 30 by County Court (J. M. Carden, Clerk) at Hinton for improving roads and constructing a 100-ft. steel bridge. R. P. Davis, State Road Bureau, Morgantown.

Miami, Fla.—Until April 6 by W. B. Moore, City Clerk, for constructing piers and reinforced concrete portions and for erecting double leaf bascule spans for 2 bridges over Miami River and for constructing 2 temporary bridges, advertised in Engineering Record. Harrington, Howard & Ash, Consulting Engineers, 1012 Baltimore Avenue, Kansas City, Mo.

Barbourville, Ky.—Until April 1 by Fiscal Court for constructing six 30-ft. span, 12-in. I-beam bridges, and one 24-ft. span, 12-in. I-beam bridge. Thomas Hubbard, County Road Engr.

Columbus, Ohio.—Until April 10 by County Commissioners (John Scott, Clk.) for a number of concrete box culverts in Franklin Township.

Delphi, Ind.—Until March 24, by Commissioners Carroll and White Counties, for constructing bridge across Tippecanoe River, superstructure for same, and removing old span abutment and concrete pier. H. D. Good, Delphi County.

Plymouth, Ind.—Until April 4 by Arthur W. Thomas, County Engineer, for constructing various bridges including Bollenbacher Bridge, four-panel steel truss, 56-ft. span; Jesse Barts Bridge, three-panel truss, 42 ft.; Froelich Bridge, three-panel truss, 46-ft. span; Zimmer Bridge, deck girder, 32-ft. span, including reinforced-concrete substructure; dump bridge, 12-ft. span; Miller Bridge, flat-top, I beam, 9 ft. 6-in. span, and Leaper Bridge, 12-ft. span, flat top I-beam concrete.

Michigan.—Until March 24 by Frank F. Rogers, State Highway Commissioner, Lansing, for constructing a 60-ft. span, reinforced concrete arch, with 66 ft. width overall, in Section 2 T, 6 N. R., 12 W., Wyoming Township, on Grandville Avenue Road, which is also the State Trunk Line crossing Plaster Creek. The bridge is to be built jointly by Board County Road Commissioners, of Kent County, the State Highway Dept. and the Grand Rapids, Holland & Chicago Ry.

Chicago, Ill.—Until March 23 by John McGillen, Clk. Sanitary Dist. of Chicago, Room 700, 910 South Michigan Avenue, for erecting Burr Oak Avenue bridge, to consist of erection and of the superstructure, including reinforced concrete floor of steel highway bridge across the Calumet Sag Channel of Sanitary Dist. of Chicago, in Worth Township, known as Burr Oak Avenue Bridge. Steel to be furnished by Sanitary Dist., and weighs 280 tons.

Illinois.—By State Highway Department for constructing bridges as follows:

March 24:

Ottawa, Bundy bridge, reinforced concrete 30 ft., 16-ft. roadway, in Mount Carroll Township. Engineers estimate, $3,275.

La Salle, Ill.—Until March 24 (readvertisement), by George L. Farnsworth at Court House, Ottawa, for constructing Shippingsport Bridge in town of La Salle. Plans by State Highway Department, Springfield.

Green Bay, Wis.—Until March 22 for constructing a bascule bridge, two spans, 50 ft. each, concrete pile foundation, over Duck Creek; cost $12,000. William Conway, Division Engineer, Green Bay, may be able to give further information.

Neillsville, Wis. — Reported desired March 21 for a 50-ft. skewed plate girder bridge, 18-ft. roadway, in town of Sherman; Farming bridge in Eaton, two-span bridge with abutment and tubular pier, present 75-ft. span will be replaced with new 72-ft. 6-in. riveted truss span, 16-ft. roadway, and other smaller bridges throughout the county. W. G. Thoma, County Highway Comr., Neillsville, and J. E. Gillespie, Div. Engr., Grand Rapids.

Waukesha, Wis.—Reported desired until March 24 for Big Bend bridge in town of Vernon, four 35-ft. spans, 18-ft. roadway; Main Street bridge in Mukwongonago, 35-ft. deck girder span, 30-ft. roadway; Menominie Falls, Main Street, across Menominie River, 45-ft. clear span, reinforced concrete bridges and other bridges throughout the county. Address County Commissioners, Waukesha, or Chas. J. Hahn, County Highway Com., Delafield.

Wausau, Wis.—Reported desired until March 29 for constructing a 100-ft. truss span bridge on concrete abutments in town of Day. E. D. Clapp, Co. Highway Comr.

Centerville, Iowa.—Until March 24 by J. B. McNeal, County Auditor, for constructing various bridges and culverts, costing in all $21,315. A. H. Withington, County Engineer.

Humboldt, Iowa.—Until April 5 by H. U. Legrud, County Engineer, for constructing 12 bridges.

Sibley, Iowa. — Until March 22 by County Auditor for erecting 113 permanent bridges and culverts, etc.

Mora, Minn.—Until April 4 by A. V. Sanders, Co. Aud., for constructing State bridge No. 1885 on State Road No. 1, Section 14, superstructure 75 ft., riveted low truss spans, 18-ft. roadway, reinforced concrete floor on reinforced concrete abutments and pedestal pier in town of Grass Lake. Separate bids asked on bridge complete and for steel alone.

Hastings, Minn.—Until April 11 by P. A. Hoffman, Co. Aud., for iron culverts for the yesr 1916.

Lakin, Kan.—Until April 5, by C. S. Smith, Co. Clk., for constructing reinforced concrete bridge across Arkansas River one mile south of Lakin, to consist of 2 plain concrete abutments and 15 concrete piers on 30-ft. wood piles; superstructure is composed of 16 reinforced concrete T girders, each 35 ft. long and 18 ft. roadway.

Sharon Springs, Kan.—Until March 21, by E. R. Ellison, Co. Clk., for constructing reinforced concrete 30 ft. through girder span 16 ft. roadway over Pond Creek about two miles west of Wallace, in Wallace Township.

Syracuse, Kan.—Until April 4, by Max Van Hall, Co. Clk., for Hill Road bridge substructure consisting of two plain concrete abutments and superstructure of 30 ft. reinforced concrete through girder span 16 ft. roadway, in Syracuse Township.

Also for Sand Creek bridge, one mile north of Kendall substructure, 2 plain concrete abutments and the superstructure, one 60-ft. steel span with 16-ft. roadway.

Kearney, Neb.—Reported desired until March 21 by Board Supervisors (J. H. Dean, Clk.) for repairing and constructing bridges.

Langdon, N. D.—Reported desired until April 3 by County Commissioners for furnishing metal culverts for year 1916.

Rugby, N. D.—Reported desired until March 21 for constructing metal culverts for the year 1916. O. A. Spillum, Co. Aud.

Marshall, Tex.—Until April 10, by W. O. Wilson, Mayor, for constructing a reinforced concrete viaduct over railroad yard, advertised in Engineering Record. E. E. Smith, Consulting Engineer, 2073 Railway Exchange Building, St. Louis, Mo.; T. E. Hillard, City Engr.

Acme, N. M.—Until April 3 by County Commissioners at Roswell for constructing a wooden trestle public highway bridge on creosoted pile bents over Pecos River near Acme Bridge, to be about 800 ft. long. Eccles & Vauchelet, Engineers, Roswell.

McMinnville, Ore.—Reported desired until March 27, by C. B. Wilson, Co. Clk., for constructing a steel bridge, also for constructing a reinforced concrete bridge. H. W. Herring, Co. Engr.

St. Helens, Ore.—Reported desired until April 7, by A. F. Barnet, Co. Clerk, for constructing a 100 ft. steel span near Veronia, one 67 ft. steel span near Clatskamie, one 50 ft. steel span at Deer Island and one 50 ft. steel span at Delena. L. J. Van Orshoven, Co. Engr.

PRICES AND LETTINGS.

★Indicates award of contract.

★New London, Conn. — Contract awarded by New York, New Haven & Hartford R. R. for constructing abutments and piers for bridge over Thames River at New London to Holbrook, Cabot & Rollins, Boston, Mass.

★Honeoye Falls, N. Y.—Contract for constructing concrete steel arch bridge over Honeoye Creek (bids opened Feb. 23 by Town Board) awarded Leary Construction Co., Rochester, at $4,746. E. G. Brooks, Town Clk.

Berkeley Springs, W. Va.—Following are four lowest bids opened March 4 by County Court for constructing bridge over Sleepy Creek: A. W. Ensign Co., Inc., Harrisburg, at $5,264; Concrete Steel Bridge Co., Clarksburg, W. Va., $5,890; Monongahela Valley Engineering Co., Morgantown, W. Va., $5,943, and Luten Bridge Co., York, Pa., $6,293. R. P. Davis, Bridge Engineer, West Virginia Road Bureau, Morgantown.

★Detroit, Mich. — Contract awarded Candler Dock & Dredge Co., 305 Moffat Building, Detroit, for constructing temporary pile timber and steel bridge from mainland to Belle Isle, at $99,999. Other bidders: Benjamin Douglass Construction Co., Ann Arbor, $104,704, and George R. Cooke, Detroit, $105,000.

★Fort Dodge, Iowa.—Contract for road and bridge work in the year 1916 (bids opened March 6) awarded by County Commissioners to M. M. Stark & Co., Des Moines, at $16,852.

★Toledo, Iowa. — Contracts for constructing twelve concrete and steel bridges awarded by Board of Supervisors as follows (bids opened March 7): Des Moines Bridge & Iron Company, Des Moines, A. P. Munsen, Marion, Iowa, and Waterloo Construction Company, Waterloo, Iowa; total cost $39,284. , A. R. Hebenstreet, County Engr.

★Brainerd, Minn.—Contract for constructing iron and steel culverts during 1916 awarded Berger Mfg. Company, Minneapolis. C. W. Mahlum, County Auditor.

Kansas City, Kan.—Following are bids opened March 6 by F. M. Holcomb, County Clerk, for constructing the Kansas River Central Avenue Bridge and approaches providing for highway and street car traffic and comprising about 1450 ft. of steel structure and about 1650 ft. of reinforced concrete structure. Construction includes shifting a portion of steel viaduct and removing an existing bridge and portions of approaches to it:

Contract No. 1: American Bridge Co., Waldheim Building, Kansas City, Mo., $257,467; McClintic-Marshall Construction Co., St. Louis, Mo., $241,234 (cash only), and Missouri Valley Bridge Co., $200,160.

Contract No. 2: American Bridge Co., $193,746 (will not take alone); Kansas City Bridge Co., Kansas City, Mo., $196,309, and Missouri Valley Bridge Co., Leavenworth, Kan., $192,661.

Contract No. 3, Plan A and B respectively: American Bridge Co., $170,042 and $171,171 (will take with 1 only); Mid-West Construction Co., Kansas City, Mo., $206,275 and $207,674; Pacific Bridge Co., $208,210 and $209,606, and Kansas City Bridge Co., Kansas City, Mo., $212,143 and $213,568. Harrington, Howard & Ash, Engineers, Kansas City, Mo.

★Grafton, N. D.—Contract for constructing 18 bridges and repair of others in Walsh County awarded Fargo Bridge & Iron Co., Fargo, at $25,910. Other bidders: Nollman & Brye Co., $31,978; Twin City Bridge Co., $25,362; M. A. Adams & Co., $28,200.

★Grand Forks, N. D.—Contract for constructing steel and concrete bridges during year awarded Jardine & Anderson, Fargo; Joseph A. Ingram, County Engineer.

★Wahpeton, N. D.—Contract for constructing steel bridge across Boise de Sioux River (bids opened March 2 by County Commissioners) awarded Great Northern Bridge Co., Minneapolis, Minn. They bid $6,770 for concrete floor and $5,360 for wood floor. F. A. Burlon, County Auditor.

★Sisseton, S. D.—Contract for constructing bridges during 1916 awarded as follows (bids opened March 3 by County Commissioners): Steel bridges to Great Northern Bridge Company, Minneapolis, Minn.; concrete to St. L. Allingham, Sisseton, S. D., and culverts to Wheeler Corrugating Company, Minneapolis, Minn. O. E. Lien, County Auditor.

Everett, Wash.—Following are four lowest bids opened Feb. 21 by County Commissioners for constructing concrete bridge, known as Pilchuck Bridge (Luten, Arch): Jarves & Burkheimer, Seattle, $7,096; L. H. Goerig, Seattle, $7,463; Baxcroft Morgan, Everett, $7,555, and Chas. G. Huber, Tacoma, $7,900.

Seattle, Wash.—Following are four lowest bids opened by Bd. Public Works March 3 for constructing bascule bridge over Lake Washington Canal at Eastlake Avenue:

Substructure (a) concrete placed under water, (b) concrete dry: Beers Bldg. Co., L. C. Smith Bldg. (a) and (b), $124,331; Washington Paving Co., L. C. Smith Bldg. (a), $140,759, (b) $155,998; Booker, Kiehl & Whipple, Central Bldg. (a), $162,000, (b) $164,669; J. M. Clapp, Burke Bldg. (b), $163,855; Jahn Contr. Co., Pioneer Bldg. (a), $157,528.

Superstructure (a) electric equipment, (b) electric equipment without alternating current: Booker, Kiel & Whipple, Central Bldg. (a), $182,950, (b) $188,150; J. B. Wood, Seattle (a), $185,079; Standifer-Clarkson Co., Northwest Bank Bldg., Portland, Ore. (a), $186,101, (b) $191,101; Beers Bldg. Co., L. C. Smith Bldg. (b), $185,748, and Washington Paving Co., L. C. Smith Bldg. (a), $181,525, (b) $187,225.

Substructure and superstructure (a-1) direct current concrete in wet, (b-1) direct current concrete in dry, (a-2) alternating current concrete in wet, (b-2) alternating current concrete in dry: Beers Bldg. Co., L. C. Smith Bldg. (a-1), $296,554, (b-1) $303,654, (a-2) $296,554, (b-2) $303,654; Jahn Contracting Co., Pioneer Bldg. (a-1), $353,466, (b-1) $360,366, (a-2) $356,741, (b-2) $363,641; Booker-Kiehl-Whipple, Central Bldg. (a-1), $344,950, (b-1) $350,150, (a-2) $347,619, (b-2) $352,819; J. M. Clapp, Burke Bldg. (a-1), $348,337, (b-1) $355,337, (a-2) $345,383, (b-2) $352,383.

★Contract for steel rails for Ballard and Fremont bridges awarded by Bd. Public Works to Seattle Frog & Swith Co. at $7,075.

★San Rafael, Cal.—Contract for constructing five concrete bridges awarded by City Council to Joseph Kappermann of San Rafael at $15,000.

★Tucson, Ariz.—Contract for constructing two-span steel and concrete bridge across Santa Cruz River at Congress Street awarded Midland Bridge Co., Kansas City, Mo., at $41,980.

PAVING AND ROADS

PROPOSED WORK.

Springfield, Mass.—Water Street is to be repaved at a cost of $30,000 and the cement paving on Boston Road completed at a cost of $32,000. F. H. Clark, Supt. Streets.

Batavia, N. Y.—Common Council authorized about 2 miles of paving this spring, including brick and asphalt, on Ellicott Street, and waterbound macadam on Lincoln Avenue.

Morristown, N. J.—Contract soon to be let by County Board of Freeholders for constructing 2 sections of road between Dover and Succasunna Plains. Mendham Road also to be let soon. Frederick S. Smith, County Engineer, Morristown.

Newton, N. J.—Sussex County Board Freeholders reported considering constructing 6-mile road from Layton to Brick House.

West Hoboken, N. J.—Board of Chosen Freeholders, Jersey City, will resurface Hudson Boulevard in West Hoboken.

Altoona, Pa.—Contract soon to be let for paving about 23 city blocks. Address Frank E. Rooney, Commissioner Highways.

Pittsburgh, Pa.—Plans prepared by N. S. Sprague, Supt. of Bureau of Engineering for constructing new road from Chartiers Avenue to present paving line. Cost, $80,000.

Uniontown, Pa.—Grand Jury authorized County Commissioners to hold an election to vote $400,000 bonds for improving 18 miles of highway.

Rockville, Md.—Bill has passed the Senate, authorizing County Commissioners to issue $10,000 bonds for constructing a public road from State Road near Glenmont to Northwest Branch, known as Kemp-Mill-Colesville Road, and $14,000 for building and improving public road from Wheaton to Four Corners, known as Wheator Four Corners Road.

Huntington, W. Va.—City Council considering constructing 15 miles concrete sidewalks: cost $50,000.

Lewisburg, W. Va.—Election to be held April 8 in Williamsburg District to vote $100,000 bonds and in Lewisburg and White Sulphur Districts to vote $250,000 bonds.

West Union, W. Va.—Citizens March 7 voted $200,000 bonds for constructing roads. Hiram Hutson, Clerk County Court.

Asheville, N. C.—Contract will be let about April by the city for 15,000 yd. bituminous macadam pavement, cost $15,000; 15,000 yd. concrete pavement, cost $18,000, and 5000 yd. cement walks, cost $7,500. Addres City Clerk.

Aurora, N. C.—Citizens of No. 2 Township voted $40,000 bonds for constructing roads.

Beaufort, S. C.—Paving and bridge bonds for $10,000 will be sold April 5, by County Commissioners (W. H. Hull, Clk.).

Atlanta, Ga.—Paving of 2 miles of Montgomery Pace's Ferry road between Piedmont Avenue and Briarcliffe Road being considered. R. H. Hope said to be interested.

De Land, Fla.—See "Bridges."

Birmingham, Ala.—Council repealed ordinance providing for paving with asphalt and asphaltic concrete on portions of Twelfth and Tenth Streets, and Eleventh Avenue, at an estimated cost of $26,000 Julius Kendrick, City Engineer

Shreveport, La.—Election to be held in the county to vote on building 25 miles of good roads. J. T. Bullem, Parish Engineer, Shreveport.

Indianola, Miss.—Citizens of Sunflower County considering constructing 180 miles concrete roads; cost about $750,000.

Pontotoc, Miss.—Contract reported soon to be let for constructing good roads in Districts 3 and 4. Address Good Road Commission, Pontotoc.

Dyersburg, Tenn.—About 12.000 to 15,000 sq. yd. are to be paved on Tucker, Oak, Gordon and other streets with asphalt concrete and tar macadam, on concrete foundation, and 8000 lin. ft. concrete and granite curb. Cost $50,000. L. E. Carne, Mayor.

Jackson, Tenn.—Contract will be let about April 30 by H. M. Harris, Commissioner of Streets, for paving about 55,000 sq. yd. vitr. brick on concrete on portions of Highland Avenue, Royal and Poplar Streets. Marshall K. White, Asst. City Engr.

Madisonville, Tenn.—Citizens voted in favor of $325,000 bonds for macadamizing 80 miles of road. Nothing further will be done about the matter until about May. John B. Pennington, County Court Clerk.

Sevierville, Tenn.—Citizens voted $10,000 bonds for paving. R. B. Robertson, City Recorder. Bonds will be sold about April 15.

Winchester, Tenn.—About $350,000 road bonds sold by County Highway Commission for constructing 125 miles macadam roads.

Carlisle, Ky.—About $70,000 is to be spent by the county this season on good roads. Address County Clerk.

Lebanon, Ky.—Construction of roads in Marion County, to cost about $250,000, is contemplated.

Akron, Ohio.—Paving bonds for $146,330 will be sold March 31 by County Commissioners (U. G. High, Clk.).

Canton, Ohio.—It is proposed to pave with asphalt on concrete base, including stone curbing, on Fifth Avenue, Northwest, at a cost of $30,000. W. E. Sarver, City Engineer.

Election to be held April 25 to vote $413,000 bonds for paving, constructing two intercepting sewers, dredging and straightening east creek. W. E. Saner, City Engineer; W. E. Jackson, City Clerk.

Chagrin Falls, Ohio.—Paving bonds for $17,809 will be sold April 11 by F. E. Lanson, Village Clk.

Cincinnati, Ohio. — City Council approved following approximate estimate of cost submitted by Frank S Krug: Improving portion of Arrow Avenue with reinforced concrete, $13,019; Maple Leaf Avenue, bituminous macadam, $16,853.

Eaton, Ohio.—Contract will be let about June by the Village Trustees for 40,000 sq. yd. paving and 6500 lin. ft. combined curb and gutter. Bids will be considered on brick, asphalt, reinforced concrete, bituminous concrete and bithulithic. A. L. Reid, Village Engineer, Eaton.

Euclid, Ohio.—Paving bonds for $10,026 will be sold March 27, by H. S. Dunlop, Village Clk.

Kenton, Ohio.—Paving bonds for $60,000 will be sold March 20 by Ulrich J. Pfeiffer, Co. Aud.

Norwood, Ohio.—City Council will spend $20,000 for street improvements.

Ravenna, Ohio.—Paving bonds for $110,000 will be sold March 27 by M. J. Kelley, County Auditor.

Election to be held March 28 to vote bonds for improving Randolph-Atwater Road, cost $57,000—5 miles, and St. Joe-Suffield Road, cost $60,000—5 miles, with concrete, about 62,000 sq. yd. in all. B. F. Betchelder, Chief Engineer Portage County Improvement Association.

Troy, Ohio. — County Commissioners will sell $59,200 bonds for paving Troy-Dayton Pike from Monroe Township line to Montgomery County, distance of 5.3 miles.

Utica, Ohio.—Paving bonds for $22,568 will be sold April 3 by B. J. Smith, Village Clk.

Wauseon, Ohio.—Paving bonds for $45,000 will be sold March 21, by County Commissioners (W. W. Ackerman, Clk.).

Fort Wayne, Ind.—Bd. Public Works voted to pave 19 streets; estimated cost $170,000.

Indianapolis, Ind.—City Engineer B. J. T. Jeup has been directed to prepare resolutions for paving portions of various streets, including Ashland Avenue, Bellefontaine Street and Birchwood Avenue.

Jeffersonville, Ind.—Petitions filed for improving of about 1 1/3 miles of William Straw Road. George W. Stoner, County Auditor.

Madison, Ind.—City Council considering paving ten blocks on Walnut Street.

Muncie, Ind.—County will build about 30 miles gravel road including necessary small bridges, 7 miles bituminous macadam, 10 miles each water bound macadam and brick, and 2 miles concrete. Contracts to be let after May 1. S. H. Weber, County Engineer.

Noblesville, Ind.—About $14,000 road bonds sold by County Treasurer.

South Bend, Ind.—Reported new bids to be received by County Commissioners for constructing Beebe Road southeast of Mishawaka; estimated cost $18,613.

Washington, Ind.—Council has authorized the paving of Main Street from West Sixth Street to East Second Street with brick; also is considering constructing concrete sidewalks at a cost of $75,000.

Fremont, Mich.—Citizens of Dayton Township voted an appropriation of $50,000 for constructing roads during coming year.

Houghton, Mich.—Contract will be let about April 15 for constructing roads to cost about $100,000. Randolph Martin. Road Engineer, Houghton County.

Decatur, Ill.—Council is reported considering paving West Division and Monroe Streets; estimated cost $32,761; and West Green, West King and Van Dyke Streets; estimated cost $58,953.

Dixon, Ill.—Citizens voted $82.000 bonds for road improvement outside city limits. Major portion will be used to pave with brick Lincoln Highway from east to west township lines on both sides of Dixon.

Sterling Township is considering an election to vote $60,000 bonds for road improvements in Lincoln Highway. Address Clerk, Sterling Township, Dixon.

City Council passed ordinances to pave portions of several streets, including concrete on East Third, East Fourth and other streets, at a cost of $32,068; vitr. brick on Depot Avenue and Fourth Street at a cost of $6,369; and concrete on Fourth, Sixth Streets, Van Buren Avenue and Jackson Avenue, at a cost of $10,671.

About $21,000 will be spent in county and State aid roads; one-half to be brick and rest probably concrete. L. B. Neihbor, County Supt. Highways, Dixon.

Freeport, Ill.—Bd. Local Improvements voted to pave portion of Fifth Ward with brick; estimated cost, $51,213. Charles S. Hepner, City Engineer.

Mattoon, Ill.—County will spend $120,000 to construct hard roads, gravel, rock and macadam being considered. George W. Hogue, Town Clk.

Board Local Improvements considering paving portion of North Twenty-first Street at a cost of $11,200.

Nachusa, Ill.—Town will construct about 2 miles of either gravel or macadam road in Lincoln Highway.

Des Moines, Iowa.—Construction of a 35-mile brick paved road from Des Moines to Ames is being considered. Ames-Des Moines Good Roads Assoc. said to be interested.

Hastings, Minn.—About $55,000 will be available for road improvements in Dakota County. Contract for constructing the east and west road from South St. Paul to Mendota is about to be let by County Bd.

Minneapolis, Minn. — Council ordered $175,000 of new paving under five-year assessment.

St. Paul, Minn.—City Council voted to pave Prior Avenue with creosote block, cost about $24,926; also pave Canada Street.

State Highway Commission will spend about $1,500,000 in roads and bridge building this year.

Clay Center, Kan.—City Council considering paving 25 blocks.

Kansas City, Kan.—City expects to spend $100.600 for paving this spring, with cluding concrete, bitulithic, asphalt con-concrete, bitulithic, asphalt concrete, brick and rock asphalt. Wm. Barclay, City Engineer.

Beaumont, Tex.—County Road bonds amounting to $190,000 have been sold. Address County Clerk.

Falfurrias, Tex.—Election to be held March 25 by County for issuing $30,000 road bonds. About 30 miles of road to be constructed.

Honey Grove, Tex.—Road District No. 4 has voted $250,000 bonds for road improvements.

Sweetwater, Tex.—Citizens Monroe County on March 1 voted $325,000 bonds to macadamize 90 miles of roads.

Poteau, Okla.—Reported a bond issue of $500,000 for road improvements in Le Flore County contemplated. J. H. Cruthis said to be interested.

Bellingham, Wash.—Plans and specifications prepared by C. M. Adams, County Engineer, for paving Northwest Diagonal Road; cost from $74.448 to $123,480, according to material used.

Everett, Wash.—Contract will be let about March 24 by County Commissioners for hard-surfacing 16-mile section of road from Everett to King County line at Bothell; estimated cost $12,000 per mile.

Ladner, Wash.—City Council will spend $20,000 for street improvements during spring and summer.

Seattle, Wash.—Streets and Sewer Committee recommended for adoption resolution providing for paving Rainier Avenue with brick block; cost $76,236; paving Bailey Avenue and other streets; cost $30.000.

Plans and specifications prepared by A. H. Dimock, City Engineer, submitted to Bd. Public Works for pacing Seventh Avenue N. with asphalt or brick; cost $20,000; also for grading and concrete walks, Thirty-ninth Avenue S.; cost $25,000.

Plans and specifications submitted to State Highway Dept. at Olympia, for approval by A. P. Denton, County, Engr., for paving with brick ten miles Parmanent Highway from city limits to Seattle at Fourteenth Avenue South to Des Moines. Contract to be let soon by Commissioners (Byron Phelps, Clerk); cost, $180,000.

Seattle, Wash.—City Council voted to pave Rainier Avenue with brick; cost $76,236.

Eugene, Ore.—Citizens of Lane County will probably vote on issue of $700,000 bonds for constructing 40 miles hard surface roads.

San Francisco, Cal.—Construction of a boulevard 80 ft. wide from Railroad Avenue to Hunter's Point about 1¾ miles is contemplated by city.

San Francisco, Cal.—Bd. Supervisors voted to pave Douglass Street with asphalt.

Harrison, Idaho. — Construction of a highway between Harrison and Wallace, including a 1100-ft. trestle, is contemplated; cost about $10,000. Commercial Club said to be interested.

BIDS DESIRED.

Albany, N. Y.—Until March 20 by Board of Contract and Supply (Isidore Wachsman, Secy.) for improving portions of Euclid, Lenox and Myrtle Avenues, repaving Beaver Street with asphaltic concrete, granite blocks or creosoted wood block; also for sewer in Delaware, John and Rawson Streets.

Brooklyn, N. Y.—Until March 22 by L. H. Pounds, Borough President, for improving portions of Amboy, Barrett, Cleveland, Douglass and numerous other streets, in all about 15,780 sq. yd. asphalt, together with curbing, sidewalks, etc.; also 50,000 gal. asphaltic road oil and one steam asphalt road roller. Total security $11,200.

New York, N. Y.—Until March 22 by R. A. C. Smith, Commissioner of Docks, Manhattan Boro., for Contract No. 1496, furnishing material and repairing asphalt pavement on Marginal Street, and piers North, East and Harlem Rivers, in all about 11,000 sq. yd. Security $6,000.

Until March 23 by Marcus M. Marks, President Manhattan Boro., for repairing sheet asphalt and asphalt block pavement until May 15, 1916, on all streets and avenues where the guarantee of maintenance has expired in the Borough of Manhattan, within the limits bounded by Twenty-third Street, North River, Fifty-ninth Street and East River, when and where directed by Chief Engineer of Highways, together with all the work incidental thereto, in all about 20,000 sq. yd. asphalt pavement, including binder course. Security $6,000.

Bayonne, N. J.—Until March 28 by City Commissioners for asphalt, bituminous concrete and granite block pavement on 17 streets. Probable cost $200,000. George Hoffman, City Recorder.

Paterson, N. J.—Until March 21 by Board Public Works for resurfacing and repairing asphalt streets. H. J. Harder, City Engineer.

West Orange, N. J.—Until March 21 by Town Council for laying concrete or flag sidewalks for year 1916. George W. Foster, Town Clk.

Hazleton, Pa.—Until about April 15 by W. D. Gerlach, Superintendent Streets and Public Improvements, for 40,000 sq. yd. brick or approved material on Broad Street and Diamond Avenue, on concrete foundation, with stone or concrete curb; cost $89,000. B. E. Youngman, City Engineer.

Philadelphia, Pa.—Until March 28, by Department Public Works, Bureau of Highways (William H. Connell, Ch.), for following improvements: Schedule A, grading, cost $170,000; B, asphalt paving, cost $120,000. Schedule C, Vitri. block pavement: D, bituminous paving, $3,500; E, asphalt repaving, $33.000; F, granite block repaving, $9,000. Schedule J, curb and footway work (owners to pay), cost $30,000, etc.

Baltimore, Md.—Until March 22 by Board of Awards at office of City Register for paving, etc., with cement concrete a number of alleys. R. M. Cooksey, Highway Engr.

Hinton, W. Va.—See "Bridges."

Wheeling, W. Va.—Reported desired until April 6 by County Court for paving 10 miles of road. Probable cost $200,000. Oliver & Maupin Engr. Co., Engrs.

Eustis, Fla.—See "Sewerage and Sewage Disposal."

Camden, Ala.—Reported desired until April 3 by County Commissioners (J. N. Stanford, Chmn.) for sand, clay or gravel roads in Wilcox County. Probable cost $25,000.

Morristown, Tenn. — Reported desired until April 1 by County Turnpike Commissioners (W. D. Bushong, Chmn.) for about 40 miles street improvement and highway improvements for Hamblen County. Work includes macadamizing, vitr. drain pipe, etc.

Frankfort, Ky.—Until March 23, by Fiscal Court (Crawford Lee, Clk.), for improving State Aid Road No. 37 B-1, known as the Frankfort and Shelbyville Road, about 1½ miles south of city limits, and running about 7½ miles to Shelbyville county line.

Bryan, Ohio.—Until April 4, by County Commissioners, for constructing the Elm Grove Grange Road No. J 1 in Pulaski Township, Williams County. Bids desired for whole of said job or separate bids for Sections No. 1 and No. 2. Bids requested for paving bottom course with limestone, slag or crushed bowlders 5 in. thick at center, 3 in. thick at edge, also alternate bids for improving with water-bound macadam, building necessary bridges, etc. Total cost, $46,215.

Canton, Ohio.—Until March 29, by County Commissioners for constructing Cairo-Hartville Road-brick and Alliance Lexington Road-macadam. U. C. Schick, County Clerk.

Cleveland, Ohio.—Until March 25, by Board County Commissioners (E. G. Krause, Clk.), for improving portions of Som Center Road No. 2 in Mayfield Township. Also separate bids March 29, for improving portions of Ridge Road No. 4. W. A. Stinchcomb, Co. Surveyor.

Galion, Ohio.—Reported desired until May 1 for paving Grove Avenue. Probable cost $30,000. A. F. Unckrich, Dir. Public Service.

Jefferson, Ohio. — Until March 27 by Board County Commissioners (B. E. Brainard, Clk.) for improving Morgan Road No. 4, in Morgan Township; also for improving Eagleville Road No. 2, in Austinburg Township.

Wooster, O.—Until March 21, by County Auditor, for improving West Salem Congress Road 1 mile south of West Salem and continuing south 2⅛ miles, bids desired on bituminous and monolithic type brick. Wade Fahr, Clk. Co. Comrs.

Youngstown, Ohio.—Until March 28 by County Commissioners (Frank H. Vogan, Clk.) for improving McGuffey Road, about 1.57 miles, with slag macadam.

Also same time and place as above for macadamizing about 5 miles of Damascus-Berlin center road slag macadam. E. S. Smith, County Highway Supt.

Also same time and place as above for constructing slag macadam road known as Section 5 of Damascus and Berlin Center Road in Goshen Township, a distance of about 2.01 miles.

Elkhart, Ind.—Until March 21 (readvertisement) by City Clerk for 26,000 sq. yd. pavement, 18,000 ft. curb and 15,000 cu. yd. excav.

Indiana.—By County Commissioners for constructing roads as follows:

April 3:

Rushville, 13,045 ft. roadway in Walker Township. Allen R. Holden, Co. Aud.

Rockport, 7.88 miles rock roadway in Carter Township. J. Frank Stocking, Co. Aud.

South Bend, Ind.—Until about April 4 by V. C. Sweeney, Clerk Board Public Works, for 61,966 sq. yd. asphalt, bitulithic, asphaltic concrete or brick on Eddy St. and Indiana and Michigan Aves., including 7,090 lin. ft. combined curb and gutter. Cost $153,298. F. J. Anderson, City Engineer.

Ontonagon, Mich.—Reported desired until March 31, by Township Board (John B. Haskins, Clk.), for constructing 6.664 miles gravel roads, tile or pipe culverts, headwalls, etc.

Chicafgo, Ill.—Until March 23, by Department Public Works (W. R. Moorhouse, Comr.), for furnishing and delivering approximately 1500 tons refined asphalt, 2000 tons refined oil asphalt, for use of Bureau of Streets.

Madison, Wis.—Until March 30 by H. C. Buser, Acting City Clerk, for paving portions of several avenues and streets, including East Johnson, Regent and other streets, with sheet asphalt or other materials.

Sheldon, Iowa.—Until March 22 by Scott Martin, City Clk., for 20,900 sq. yd. paving. Bids to be submitted on brick block, asphaltic concrete, Portland cement concrete, and bitulithic. K. G. Gaynor, Engr., United Bank Building, Sioux City.

Duluth, Minn.—Reported desired until March 31 for constructing 6.66 miles rock and gravel roads. J. B. Haskins, Clk. Township Board.

Elbow Lake, Minn.—Reported desired until April 3 by C. M. Nelson, Co. Aud., for grading and turnpiking State Roads Nos. 1 and 4, in all about 59,426 lin. ft. turnpiking, 67,000 cu. yd. grading, etc.

Eveleth, Minn.—Reported desired until May 1 for paving streets. Probable cost $20,000. C. H. Williams, City Clk.

St. Paul, Minn.—Reported desired until March 20 for 47,600 yd. yellow pine paving blocks, 4523 sq. yd. brick, 20,000 bbl. Portland cement, 670 tons asphaltic cement, crushed stone, etc. Aug. Hohenstein, Purchasing Agent.

Until April 3, by Board County Commissioners, for from 300 to 800 tons of road asphalt for penetration work furnished in double headed wooden barrels f.o.b. St. Paul or vicinity. Geo. J. Reis, Co. Aud.

Kearney, Neb.—Until March 30 (readvertisement) by T. N. Haryzell, City Clerk, for paving in District No. 11.

York, Neb.—Until March 23 by A. B. Chatterton, City Clerk, for 18,920 sq. yd. vertical fiber brick pavt. on Nebraska, Burlington and Blackburn Avenues, including 12,227 lin. ft. cement curb; cost $50,000. George W. Sears, Engineer, 101½ Lincoln Avenue.

Williston, N. D.—Reported desired until April 3 by G. G. Harvy, Co. Aud., for cement sidewalks and crossing for year 1916.

Montesano, Wash.—Until March 20 by W. D. Campbell, County Auditor, for clearing, grading, constructing culverts and surfacing with spread gravel, a distance of 22,248 ft. Cost $23,854. George D. Robertson, County Engineer.

Okanagon, Wash.—Until about April 1 by Horace E. Smith, County Engineer, for grading and surfacing with gravel permanent highway work, costing $12,000.

Palouse, Wash.—Reported desired until April 12, by J. J. Johnson, City Clk., for concrete paving in L. I. D., No. 3, in all about 19,000 sq. yd. Probable cost $30,000. Sawyer Bros., Engrs., Seattle.

Ritzville, Wash.—Reported desired until March 21, by Lottie Pahlow, City Clk., for grading, curbing and paving 12 blocks; work involves 19,000 sq. yd. concrete paving. Probable cost $30,000. Sawyers Bros., Engrs., Seattle.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★Connecticut.—Contract for constructing a concrete roadway on Hartford and New Haven Turnpike in North Haven awarded by State Highway Dept., Hartford, to Lane Construction Cor., Meriden, at about $26,000, for about 11,535 ft., and to Union Paving Co., Schenectady, N. Y., at about $33,000, for about 15,465 ft.

★Elmira, N. Y.—Contracts for paving 18,400 sq. yd. vitrified block pavement awarded by Board Public Works as follows (bids opened Feb. 24): West Water Street to Holleran Bros. of Elmira and East Church Street to Bison City Engineering & Contracting Co., Buffalo; total cost $35,000.

★Yonkers, N. Y.—Contract for paving Kimball Avenue with telford macadam awarded by Bd. Contract and Supply to Canepi Construction Co., Yonkers, at $39,276.

★Atlantic City, N. J.—Following are four lowest bids opened March 8 by County Commissioners for constructing Absecon-Atlantic City Boulevard, consisting of 106,546 sq. yds. surface paving together with embankment of 247,236 cu. yds.: Hill Dredging Co., Ventnor City, $280,321 (awarded contract); J .W. Ingersoll, Atlantic City, $292,332; Sutton & Corson Co., Ocean City, $298,642, and M. B. Markland, Atlantic City, $315,055. A. H. Nelson, County Engineer, 637 Guarantee Trust Building, Atlantic City.

★Camden, N. J.—Contract for paving Morrestown Pike (bids opened March 6 by Board of Freeholders) awarded Kelley-McFeeley Company, Camden, at $61,973. Fred W. George, Clk. of Board.

★Flemington, N. J.—Following are four lowest bids opened March 2 by County Commissioners for bituminous dressing on High Bridge-Califon Road, Bloomsbury-West Portal Road, Flemington-Frenchtown Road, in all about 100.000 sq. yds.: Logan & Hathaway, Newark, 8.75 cts. per sq. yd. (awarded contract); Atlantic Refining Co., 8.825 cts.; John P. Grettin, Trenton, 9.55 cts.; Standard Oil Co., New York, 9.75 cts. Grant Davis, County Engr., Whitehouse Station.

Baltimore, Md.—Following are unit figures of the four bids opened March 8 by Annex Improvement Commission (F. W. McKinney, Chief Engineer) for grading, curbing and paving with asphalt 25 streets, in all approximately 55,000 yds. Contract No. 141: (a) P. Flanigan & Sons, Lexington & Calvert Streets, $94,315; (b) Baltimore Asphalt Block & Tile Co., Monroe and Lorman Streets, $97,590; American Paving Co., Baltimore, $102,783; (d) Consolidated Engineering Co., Emerson Tower, $125,095.

	a	b	c	d
55,000 sq. yd. sheet asphalt	$1.17	$1.19	$1.35	$1.47
5100 sq. yd. vit. br..	1.95	2.00	2.13	2.25
31,000 lin. ft. curb...	.42	.40	.45	.55
400 sq. ft. cobble....	.40	.60	.72	.60
1200 lin. ft. gr. blk. hdr.	.20	.25	.36	.40
30,000 cu. yd. grading.	.22	.30	.10	.50

★Lynchburg, Va.—Contract for improving Main Street, including laying conduit system, and paving 10,500 sq. yd. awarded W. T. Jones, Lynchburg. H. L. Shaw, City Engineer.

★Richmond, Va.—Contract awarded L. R. Colbert, Massaponax, Va., for 2½ miles of macadam road from city limits to Three Chopt Road and 1½ miles west from Brook Road, at a total cost of $25,000.

★Staunton, Va.—Contract for constructing road 3½ miles long awarded by Augusta County Supervisors to Colvin & Gibson, of Culpeper, at $14,537.

★Parkersburg, W. Va.—Contracts for paving (bids opened March 1) awarded as follows: To C. Kennedy & Son, Parkersburg, 4960 cu. yd. excav., 38 cts.; 15,405 sq. yd. vitr. brick, 4-in. concrete base, cement filler, $1.60; 9114 lin. ft. plain concrete curb, 6 x 18 in., 28 cts.; 600 lin. ft. 6 x 18 in. protection concrete curbing, 45 cts.; curb reset, 20 cts.; relined curb, 5 cts.; 4-in. drain tile, 15 cts.; total, $29,745. Other bidders: E. A. Freshwater & Sons, Chester, $30,931, and R. M. Hudson Construction Company, Charleston, $32,039. To E. A. Freshwater & Sons, Chester, 6743 cu. yd. excav., 40 cts.; 19,116 sq. yd. vitr. brick on 5-in. concrete base, cement filler, $1.70; 8430 lin. ft. plain 6 x 18 in. concrete curb, 25 cts.; 1140 lin. ft. 6 x 18 in. protection concrete curb, 35 cts.; reset curbing, 18 cts.; relined curb, 12 cts.; 4-in. drain tile, 20 cts.; total, $37, 538. Other bidders: C. Kennedy & Son, Parkersburg, W. Va., $38,389, and Kelley & Meyer, Portsmouth, Ohio, $39,090. Contract for concrete pavement (bids opened March 1) awarded as follows: 9622 sq. yd. to C. Kennedy & Son, Parkersburg (they bid $1.19, $1.22 and $1.24 per sq. yd.), and 8487 sq. yd. to W. C. Peters, Marietta, Ohio (they bid $1.19 and $1.20). The curbing bid on is one coarse type of construction, with the face and top spaded and the exposed edges finished by scouring with a wooden float. T. L. Higgs, City Engineer.

★Canton, Miss.—Contract for 20 miles of gravel road in District No. 2 (bids opened March 6) awarded Owens Construction Company, Longview, Tex. Xavier A. Kramer, Engineer, Magnolia.

Cincinnati, Ohio.—Following are four lowest bids opened March 11 by Public Service Director Charles F. Hornberger, for improving Reading Road from Mitchell Avenue to Paddock Road, with wood block: (a) City Engineer's estimate, $33,743; (b) Edward Ryan, Cincinnati, $29,789; (c) Henkel & Sullivan, Cincinnati, $30,831; (d) Kirchner Construction Co., Cincinnati, $31,097; (e) M. F. Quill, Cincinnati, $32,441.

	(a)	(b)	(c)	(d)	(e)
400 cu. yd. grading and excavation	$0.45	$0.30	$0.40	$0.40	$0.25
350 lin. ft. drains, 20-in. pipe	2.60	2.50	2.40	1.00	2.75
251 lin. ft. drains, 20-in. pipe Inl. Con	1.00	1.00	1.00	1.00	0.90
20 T Bran. 20-in. pipe	1.50	1.50	1.40	1.50	1.00
6 manholes readjusted	3.00	2.00	2.00	6.00	3.00
2 inlets, Plan No. 1	40.00	30.00	35.00	35.00	40.00
7 inlets, Plan No. 3	45.00	45.00	40.00	35.00	45.00
3,000 lb. castings	0.03	0.03	0.03	0.03	0.03
1,650 cu. yd. concrete, Class 3 (8-in. Th.)	5.00	4.00	4.50	3.00	4.80
2,400 lin. ft. granite curb	1.00	1.00	1.10	0.80	1.00
260 lin. ft. granite cir. curb	1.50	1.50	0.02	1.00	1.50
100 lin. ft. curb reset and redressed	0 25	0.20	0.02	0.30	0.20
80 cu. yd. broken or crushed stone	2.00	0.02	0.02	0.01	1.25
1,800 sq. ft. cement walks	0.15	0.12	0.14	0.15	0.13
4 street signs	15.00	15.00	14 00	15.00	15.00
80 sq. yd. asphalt paving	1.50	1.50	0.02	0.50	1.50
40 sq. yd. granite pavement (P. F.)	3.00	3.00	3.00	2.00	3.00
7,800 sq. yd. wood block pavt. oil A or B	2.50	2.25	2.30	2.80	2.40
100 sq. yd. wood block repaving	0.60	0.60	0.60	1.00	0.75
3 manholes remodeled	10.00	10.00	10.00	25.00	10.00
7 cu. yd. concrete, Class 1	8.00	8.00	7.00	9.00	8.00
17 cu. yd. brick masonry	14.00	14.00	12.00	0.20	12.00

★**Columbus, Miss.**—Contract for constructing 9½ miles gravel roads in Artesia Seperate Road Dist. in western section of Lowndes County awarded to R. C. Searcy & Co. at about $30,000.

Chicago Junction, Ohio.—Lowest bids opened by Village Council for paving Maple Street with reinforced concrete with concrete curb and gutter, and Woodbine Street with brick, concrete or stone curb and gutter, submitted by Johnson & Ritz, Napoleon, at $13,668 and $7,323 respectively.

★**Cincinnati, Ohio.**—City Board of Control March 4 awarded contract to M. F. Quill, Cincinnati, for improving Vine Street with 3500 sq. yd. wood block at $22,987.

★**Fort Wayne, Ind.**—Contracts awarded by County Commissioners to J. C. O'Conner & Sons, Delphi, for macadam road in Allen County at $12,349.

Goshen, Ind.—Detail of lowest bid opened March 6 by J. W. Haverly, City Engineer, for paving on Seventh Street submitted by S. S. Saxon Company, McCormick Bldg., Chicago, Ill.: 23,500 sq. yd. Trinidad lake asphalt, $1.56; asphaltic concrete, $1.44; 8000 cu. yd. grading, 40 cts.; 9890 lin. ft. combination curb and gutter, 40 cts.; 2790 lin. ft. 6 x 16 in. cement curb, 28 cts.; 100 lin. ft. 10-in. pipe, 50 cts.; 1100 lin. ft. 8-in. pipe, 40 cts.; 5 manholes, $25; 20 new catch basins, $30; 16 catch basins reset, $5; 10 round iron inlets reset, $5; 30 new curb inlets, $10; 19 manholes reset, $5; 1000 lin. ft. cement marginal, 20 cts.; total, $46,516 sheet asphalt; $43,538 asphaltic concrete. Totals on other materials: Bitulithic, Western Construction Company, Lafayette, Ind., $53,517; W. W. Hatch & Sons, Goshen, Veedersburg brick block, $53,135; Terre Haute, $53,605; Metropolitan, $54,075; A. M. Smith, Elkhart, medal brick, $59,013; Nelsonville brick, $58,073, and Carlysle brick, $58,418.

★**Indiana,**—Following contract awarded by County Commissioners for road work in various counties (bids opened March 6):

Franklin, two gravel roads in Johnson County, to Edward Barnett of Bargersville and D. A. Brewer of Franklin, at $7,575 and $12,152 respectively.

Portland, 3 brick roads in Wayne Township, Jay County, to Frost & Spenkle of Portland at 16,530; Walter Swisher, Portland, $16.952 and Adam Bear of Lebanon, $16,841.

Versailles, crushed stone road in Shepley and Franklin Townships, Ripley County, to Jacobs & Horton of Madison at 16,549.

Williamsport, 14,826 ft. gravel roadway in Adams Township, Warren County, to J. McGinn & Son of Brazil at $11,243.

★**Madison, Ind.**—Contract for paving about 14,000 sq. yd. on Main Street (bids opened March 6) awarded Irving Shields, Greencastle. They bid $1.93 per sq. yd. for Dunn wire cut lug and $1.88 per sq. yd. for Carlisle repressed bricks. R. F. Lee, City Engineer.

★**Kalamazoo, Mich.**—Contract awarded Kalamazoo Construction Company, Kalabazoo, for constructing 6½ miles of trunk line gravel road at $39,348. H. C. Fleming, County Road Engineer.

Danville, Ill.—Following are lowest bids opened March 14 by County Commissioners for constructing divisions 2, 5 and 7 of the road work: Division 2, concrete road, 6 in. thick at side and 7 in. at center, 10 ft. wide, 20 miles long, Harding & Slatery, Crawfordsville, Ind., $104,500; Division 5, consisting of 18 miles of 10-ft. road, Prendergast Clark Construction Co., St. Louis, Mo. Type A, $124,800; Type B, brick road 2 in., side 3 in., center concrete base, $228,000. Type C, brick road 3 in., side 4 in. thickness, center concrete base, $234,000. Type D, brick road 4 in. thick at side with concrete base, $250,000. Division 7, 19 miles granite road, lowest bidder City Lime & Cement Co., Granite City, Ill.

★**Oak Park, Ill.**—Contract for paving Home and Clinton Avenues with asphaltic concrete awarded H. G. Goelitz of Oak Park. B. C. Brandstadt, City Secretary.

★**Sullivan, Ill.**—Contract for 5710 sq. yds. vitr. brick paving awarded Goggin Construction Co., Arcola, Ill. (bids opened March 6). F. Newbould, City Clerk.

★**Maryville, Wis.**—Contract for constructing 25,000 sq. yd. concrete sidewalks and 4500 lin. ft. curbs awarded Frederick Shaffer, Maryville (bids opened March 4), by Janssenn-Seltz Co.

★**Milwaukee, Wis.**—Contracts for constructing 11 miles of roads awarded by County Bd. Committee Highways at total cost of $99,517; 1530 sq. yd. paving on east end Silver Spring Road to John R. Griffith at $15,411; 25,400 sq. yd. on west end Silver Springs Road to E. N. Mathews at $24,572; Granville Road, 33,700 sq. yd. to Delta Constr. Co., Escanaba, Mich., at $52,764, and Lovers Lane 52,000 sq. yd. to Paul Golinik at $28,764.

★**Fort Madison, Iowa.**—Contract for paving 22,000 sq. yd. with brick and cement awarded by city to Burlington Constr. Co., Burlington.

★**Oakland, Iowa.**—Contract awarded John A. Beebe, Omaha, Neb., for constructing about 3 miles of concrete pavement (bids opened March 7 by E. F. Wentz, Clerk).

★**Minneapolis, Minn.**—Contract awarded Kettle River Company and Republic Creosoting Company, both of Minneapolis, for 350,000 sq. yd. of creosoted wood blocks 3½-in. yellow pine at $1.46 per sq. yd.

★**Topeka, Kan.**—The following are four bids opened Feb. 29 by E. M. Colville, City Clerk, for 46,000 sq. yd. brick paving: Ziegler Bros., Junction City, $106,295 (awarded contract); Ritchie Bros., Topeka, $108,942; Kaw Paving Company, Topeka, $112,064, and Capital City Bitr. Brick & Paving Company, Topeka, $112,455.

★**Fargo, N. D.** — Contract awarded James Kennedy, Fargo, for approximately 20,000 sq. yd. paving on 4th Street N., District No. 2; also in Road District No. 3, approximately 10,000 sq. yd. on Sixth Avenue and 10th Street N., at $1.98 per sq. yd. for bitulithic; total, $42,256. (Bids opened Mar. 1.) F. L. Watkins, City Auditor.

★**Kansas City, Mo.**—Contract for macadamizing Swope Parkway from Forty-ninth to Sixty-seventh Streets awarded by Park Bd. to Halpin Dwyer Constr. Co., Kansas City, at $94,000, and for curbing to Davidson Bros. Construction Co., Kansas City, at $10,340.

Pecos, Tex.—Contract awarded W. E. Hamilton, Ft. Stockton, for graveling about 21 miles and grading about 40 miles at $38,201.

Seattle, Wash.—Following are four lowest bids opened March 3 by Bd. Public Wks. (L. B. Youngs, Chmn.) for grading, curbing and paving:

Fifty-first Avenue S. E., grade and curb, Holt & Jeffery, Transportation Building, Seattle, $59,955; P. G. Dunn & Co., Zeigler Block, Spokane, $56,865, and Union Contr. Co., Seattle, $59,004.

Donald Street, grade and pave, Jahn Contr. Co., Pioneer Block, $109.939; T. Ryan Constr. Co., Lowman Building, $112,179, and P. J. McHugh Co., Third Ave N. and Mercer Street, $11,609.

★**Seattle, Wash.**—Contract awarded J. B. Romano for grading Orchard and other streets at $24,639.

★**Stevenson, Wash.**—Contract for constructing Underwood Road awarded by County Commissioners March 5 to General Construction Co. of Spokane, at $39,582.

Astoria, Ore—Following are lowest bids opened by City Council for paving as follows: Commercial Street, Porter & Conley, Portland, $23,612; Ninth and Tenth Streets, J. A. McEachern Company, Astoria, at $13,233 and $7,301 respectively.

★**Burlingame, Cal.**—Contract awarded by Board of Trustees to Federal Construction Company, San Francisco, for paving 67 blocks at $247,128.

STREET CLEANING AND GARBAGE DISPOSAL

BIDS DESIRED.

Madison, Wis.—Until March 31 by H. C. Buser, City Clerk, for constructing 2 refuse disposal plants.

Ashland, Ohio.—Until March 23 (readvertisement) by Earl Fox, Clerk Service Department for collection and disposal of garbage for period of 1 year.

Garb Disposal—Proposed.

Bay City, Mich.—City is considering constructing garbage disposal plant. Address City Clerk.

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS

PROPOSED WORK.

Harbor Improvement—Boston, Mass.—Legislature has passed bill authorizing city to appropriate $600,000 for improvement to Old Harbor bay off South Boston and Dorchester.

Piers—Brooklyn, N. Y.—Public Service Commission approved plans of New York Dock Co. for piers to be constructed at Joralemon and Montague Streets.

Pier—Atlantic City, N. J. — Alfred E. Burke of Philadelphia, Pa., Pres. Pier Realty & Holding Company, it is reported, contemplates extending Garden pier 1500 ft. seaword, including building of a lagoon, 50 ft. wide x 100 ft. long, over the ocean with ornamental buildings on either side, and crossed with bridges.

Beach Improvements — Beach Haven, N. J.—Council plans extensive beach improvements, to cost $25,000.

Drainage—Crowley, La.—Surveys being made for the proposed Fourth Ward Drainage Project in western part of Arcadia Parish; probable cost $100,000.

Drainage—Gueydan, La.—Citizens voted $234,000 bonds for constructing Gueydan Drainage District and contract will be let about May 1. Warren B. Reed, Engineer, Morgan City, La.; John G. Meelia, Secy. Drainage Board.

Dredging—Canton, Ohio.—See "Paving and Roads."

Ditch—Logansport, Ind.—County is reported considering constructing ditch north of city to drain land extending over many acres. Address County Auditor.

Drainage—Cairo, Ill.—The Alexander County Drainage District is proposed. L. T. Berthe, Engineer.

Ditch—Onawa, Iowa.—Trustees at Onawa considering enlarging the Harrison and Monona County Ditch at a cost of about $750,000 or $1,400,000.

Drainage — Earle, Ark.—About 40,000 acres to be drained in Drainage District No. 3, including about 55 miles of canal work and dredge work; estimated cost $200,000. H. A. Morrison, Secy. Dist., Earle.

Drainage—Mound City, Ark.—Commissioners of County Drainage District No. 8 (M. C. Pearce, Comr.) will construct drainage improvements costing about $120,000.

Seawall — Galveston, Tex. — City Engineer A. T. Dickey estimated cost of surfacing with mudshell proposed seawall improvement, fill along and near Gulf front from Sixth to Thirty-ninth Streets, at $24,000.

Wharf—Houston, Tex.—Contract soon to be let for constructing wharf No. 4, to cost $400,000. Dock will consist of reinforced concrete shed 663 x 100 ft., a platform 770 x 20 ft., loading platform and five railroad tracks, four sidetracks and one main line passing track. Wharf will be equipped with 20 ton traveling crane operated by electricity. S. S. Sands, City Engineer.

Bulkhead—Seattle, Wash.—Plans and specifications for bulkhead on Eastlake Avenue; cost $10,000.

Harbor Improvement—Umpqua, Ore.—Port Commission reported planning issuing $200,000 bonds for extending north jetty at mouth of the river.

Dredging—Los Angeles, Cal.—Dredging in San Pedro Harbor at Smith's Island will include 250,000 cu. yd. dredging and filling. S. A. Judd, Asst. Harbor Engineer.

BIDS DESIRED.

Dredging—New York, N. Y.—Until April 14 by U. S. Engineers Office, New York, for dredging and rock removal in Coenties Reef, East River, N. Y., advertised in Engineering Record.

Drainage—Holly Hill, S. C.—Until March 25 by Board Drainage Commissioners (M. L. Breland, Chmn.) for constructing canal for Rum Neck Drainage Dist., about 10 miles long, and about 14,740 cu. yd. excav.

Levee Improvement—Alexandria, La.—Until March 22 by Commissioners Red River Atchafalaya and Bayou Levee District (Howard B. Glat, Secy.) for constructing and placing a subaqueous lumber mat for bank protection in Rapides Parish, Red River, right bank; approximate length of bank to be protected 1100 ft.

Drainage—Waukegan, Ill.—Until March 29, by Drainage Commissioners (And. T. White, Chmn. Drainage Dist. No. I, Warren Township), for laying 24,960 ft. 24 to 6-in. tile, including excav., backfilling, etc.

Ditch—Aitkin, Minn.—Until April 3 by H. C. Beecher, Co. Aud., for 8.3 miles floating dredge work, 16 miles drag line work, in all 33,019 cu. yd.; constructing Class "A" and "B" bridges, corrugated steel culverts, etc.

Grading, Ditches, Etc.—Hastings, Minn.—Until April 11 by County Board for 2¾ miles grading, on the Mendota to South St. Paul Road, between S. R. No. 1 and the German Road, in all about 23,600 cu. yd. excav. reinforced concrete culvert, ditches, etc. P. A. Hoffman, Co. Aud.

Ditches—Walker, Minn.—Until April 1 by C. D. Bacon, Co. Aud., Cass County, for constructing Judicial Ditch No. 3, in Cass and Wadena Counties, consisting of 43,869 cu. yd. excav., 13 corrugated metal culverts, 5 timber highway bridges, 4.07 miles roadway to be constructed on waste bank of ditch. Estimated cost $30,629. Also separate bids same time and place for Judicial Ditch No. 4, consisting of 273,321 cu. yd. excav., 12 metal culverts, one reinforced concrete culvert, 3.387 miles roadway to be constructed on waste bank of ditch. Estimated cost $31,106. E. V. Willard, Engr., Old Capitol Building, St. Paul.

Drainage—Cuero, Tex.—Until April 3 by County Clerk for constructing drainage improvement and drainage ditch in DeWitt County, about 100,000 cu. yd. Address W. E. Dickerson, Engineer, Cuero.

Revetment Work—Seattle, Wash.—Until March 20 by Col. J. B. Cavanaugh, Corps Engrs., U. S. A., Burke Bldg., for revetting north bank of Portage River between Lake Union and Lake Washington, on the Lake Washington Government Canal project, including facing of slopes of the channel with concrete for a distance of about 900 ft. Cost about $10,000.

PRICES AND LETTINGS.

★*Indicates award of contract.*

State Canal Work.—Albany, N. Y.—Following are lowest bids opened March 14 by W. W. Wotherspoon, State Superintendent Public Works, for State canal work:

Contract No. 29-A, completing construction of canal from Sterling Creek on Oneida, Herkimer County line. Engineer's estimate $162,005, Eastover Construction Co., Inc., Utica, $185,106.

Contract 130, improving basin at entrance to Erie Canal at Lock No. 1, City of Albany; Engineer's estimate $9.000; Great Lakes Dredge & Dock Co., Albany, $7,140.

Contract 131, completing reconstruction of highway bridge crossing main channel of Hudson River at Schuylerville. Engineer's estimate $31,248, Spalding Construction Co., Suffield, Conn., $29,734.

Terminal Contract No. 34, constructing dock wall, an approach to the terminal and appertaining structures on east side of Oswego River between Schuyler and Cayuga Streets, Oswego. Henry P. Burgard Co., Buffalo, $90,984.

★**State Canal Work—Albany, N. Y.**—Contract for dredging for flood abatement work in Chautauqua Lake Outlet through city of Jamestown reported awarded George L. Maltby, Jamestown, at $92,074.

Breakwater—Racine, Wis.—Following are unit figures of four lowest bids opened March 10 by U. S. Engineers, Milwaukee, for constructing reinforced concrete caisson breakwater and removing old timber crib pier at Racine Harbor: (a) Greiling Bros. Company, Green Bay, $47,759; (b) The Edward Gillen Dock Dredge & Construction Company, Racine, $49,751; (c) East Shore Dredging Company, Muskegon, Mich., $55,904, and (d) Great Lakes Dredge & Dock Company, Chicago, Ill., $66,000.

	(a)	(b)	(c)	(d)
7,500 cu. yd. trench excavation, scow measurement	.50	.45	.50	.45
6,000 tons stone for sub-foundation; per ton of 2,000 lbs.	$1.50	$1.30	$1.75	$2.10
9,300 tons stone for main foundation, riprap and caisson filling; per ton of 2,000 lbs	1.60	1.70	1.75	2.90
Sinking 15 caissons; each	250.00	200.00	400.00	275.00
132 cu. yd. concrete filling in caissons	7.00	4.50	7.00	6.10
1,565 cu. yd. concrete superstructure on caissons	7.00	6.50	7.00	7.30
Removing 300 lin. ft. old pier	15.00	30.00	25.00	19.00

★Dredging—New York, N. Y.—Contract awarded John & Joseph McSpirit, Jersey City, N. J., for dredging in Keyport Harbor, N. J., at $8,000; bids opened for dredging in Shrewsbury River have been rejected.

Pier—New York, N. Y.—Following are unit figures of four lowest bids opened March 10 by R. A. C. Smith, Commissioner of Docks, for constructing pier at West Forty-sixth Street, Borough Manhattan: (a) construction of pier, (b) 13,400 sq. yd. asphalt; (c) total: Post & McCord, 101 Park Avenue, (a) $558,450, (b) $1.16, (c) $573,450; Snare & Triest Co., 233 Broadway, (a) $567,600, (b) $1.10, (c) $582,340; W. F. Plass & Brother, 145 West Eighteenth Street, (a) $573,000, (b) $1.10, (c) $587,740; P. J. Brennan & Sons, 624 Madison Avenue, (a) $580,300, (b) $1.10, (c) $595,040.

★Dock—Port Henry, N. Y.—Contract for constructing steel and concrete dock 1000 ft. long, 250 ft. wide, storage capacity 350,000 tons at Port Henry awarded by Witherbee, Sherman Co., Port Henry, to New York State Dredging Co., 17 Battery Place, New York, N. Y.

★Drainage—Largo, Fla.—Contract for constructing drainage work in Lake Largo-Cross Bayou Drainage District (bids opened March 6 by Board of Supervisors) awarded Edgar Chapman, Plant City, at 13.2 cts. per cu. yd., about 374,032.7 cu. yd. in all, and $687 for spillway; total $50,059. Next three lowest bidders: Hullyer & Sperring, Jacksonville, $51,470; George R. Foster, Jacksonville, $56,372, and Lowe & Toney, Jacksonville, $59,372. Isham Randolph & Co., Engineers, Jacksonville.

★Guard Gate—Sault Ste. Marie, Mich.—Contract for furnishing 200 tons of steel for constructing guard gate of fourth lock at Sault Ste. Marie, awarded Wisconsin Bridge & Iron Company, Milwaukee, Wis., at $13,018.

★Drain—Ft. Dodge, Iowa.—Contract for constructing drain 197 near Gowrie awarded as follows: Open work (about 183,000 cu. yd.) to J. W. Boyer, Ft. Dodge, at 9.45 cts. per cu. yd.; labor, Jensen & Thomas, Dayton, Iowa, $12,626; and tile, Arthur McHose, Gowrie, cement tile, $23,840. (Bids opened March 1.)

★Ditch—Bemidji Minn.—Contract for constructing Judicial Ditch No. 30 (bids opened March 7) awarded Kohler Construction Company, Frazee and Construction Company, Duluth, at $15,508 and $23,922 respectively. J. L. George, County Auditor.

★Ditch—Mankato, Minn.—Contract for constructing tile ditch No. 42 (bids opened March 9) awarded North Star Concrete Co., Mankato, at $19,350. C. L. Kennedy, County Auditor.

Irrigation—Fort Laramie, Wyo.—Following are lowest bids opened March 10 by U. S. Reclamation Service, Fort Laramie:

For structures for Fort Laramie Canal, North Platte Project, Neb.-Wyo., Fort Laramie Unit, Schedule No. 1, Laramie River Siphon and Deer Creek Siphon; Engineer's estimate, $60,280; lowest bidder, Security Bridge Co., Minneapolis, Minn., $39,877; Schedule No. 2—three culverts—Engineer's estimate, $17,865; lowest bidder, MacArthur Bros. Co., Chicago, $18,265.

Earthwork—Fort Laramie Canal, Station 526 to Station 830, North Platte Project, Neb.-Wyo., Specification 326: MacArthur Bros., Chicago, Ill., submitted lowest bid on all schedules as follows: Schedule I, $33,460; Engineer's estimate, $54,890. Schedule II, $32,465; Engineer's estimate, $46,800. Schedule III, $53,420; Engineer's estimate, $90,510. Schedule IV, $34,260; Engineer's estimate, $45,400.

★Levee improvements—Cummins, Ark.—Contract awarded Linna Bros. & Tansey, Texarkana, for levee work in Linwood and Auburn Levee Districts; cost $80,000.

★Drainage — McCrory, Ark. — Contract for 2,000,000 cu. yd. excav. in Bayou DeView Drainage Dist. No. 1 of Cross, Woodruff and Jackson counties awarded to Northern Construction Co., Elkhart, Ind.; $150,000 drainage bonds for the district have been sold. Newsom Eng. Co., engineers, Wynne, Ark. (bids opened Feb. 15 by Co. Comrs.).

ELECTRIC RAILWAYS

PROPOSED WORK.

Fort Fairfield, Me.—Surveys have been made for railway to be constructed from Fort Fairfield to Limestone, about 12 miles. Fort Fairfield Board of Trade said to be interested.

Torrington, Conn.—Litchfield County Company is planning constructing a trolley line from Torrington to Waterbury. A. J. Patton & Co., Waterbury, interested.

Doylestown, Pa.—Plans being considered to construct a line from Doylestown to Boyerstown via Perkasie, Trumbauersville and Pennsburg. Reported Perkasie Board of Trade endorsed the project.

Erie, Pa.—Northwestern Electric Service Co. will construct 3½ miles of extension to connect present northern and middle divisions of railway, near Cambridge Springs.

Janelew, W. Va.—Reported plans being made to construct a railway from Janelew to Berlin, connecting with Monongahela Valley Traction Co.'s line at Janelew. Line will be extended to Lorentz and Buckhannon. Mayor Goodloe Jackson, of Janelew, may be able to give further information.

Wheeling, W. Va.—Plans being considered by Pan-Handle Traction Co. for constructing an extension from Short Creek to Pennsylvania State line.

Cleveland, Ohio.—Fielder Sanders, City Traction Commissioner, has asked City Council for permission to extend Cleveland Railway Co.'s line on West Twenty-fifth Street 1½ miles on Pearl Road; cost $24,800.

Oak Park, Ill.—Chicago & West Towns Ry. Co. applied to Trustees of Oak Park for a franchise.

Hutchinson, Minn.—Tentative plans have been filed with Secretary of State, St. Paul, for extension of the Electric Short Line R. R. (John Westerdahl, Ch. Engr., Minneapolis), from Hutchinson through Thorp and Clare City to Dawson, Minn., a distance of 75 miles.

Emma, Mo.—Emma Creamery Co. is reported interested in construction of an electric line from Sweet Springs to Emma.

Martinez, Cal.—City Trustees granted 50-year franchise to Martinez-Concord Interurban Ry. Work to start in thirty days.

Pocatello, Idaho.—Pocatello Traction & Interurban Co. asked City Council of Pocatello for a franchise.

Winnipeg, Man.—Board Control of Winnipeg is considering constructing several car lines. G. J. Brown, City Clerk.

Calgary, Alta.—City Council approved an expenditure of $20,000 for additional feeder cable for Calgary Street Ry.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★Barboursville, Ky.—Contract for grading 8 miles of Cumberland & Manchester R. R. beginning at Cannon, awarded to T. J. Anderson, Knoxville, Tenn. M. E. S. Posey, Ch. Engr., Barboursville.

RAILROADS

PROPOSED WORK.

Edgemere, L. I., N. Y.—The Public Service Commission for First District, 154 Nassau Street, New York, and the Long Island Railroad will March 27 consider the elimination of grade crossings on Far Rockaway Branch in Edgemere, being Grand View, Sea View and Frank or Gleason Avenues.

Shelby, N. C.—Shelby Northern Ry. Company incorporated by Odes M. Mull of Shelby, W. N. Dodd of Greenville, S. C., and others for the purpose of constructing a railroad through Cleveland County from Shelby via Fallston, Beam's Mill and Belwood to Cesar, a distance of 21 miles.

Cravens, Tenn.—Nashville, Chattanooga & St. Louis Ry. (H. McDonald, Ch. Engr., Nashville) will construct a 3-mile extension from Cravens to Alton Park.

Frankfort, Ind.—The Indianapolis & Frankfort R. R. Co. principal office in Richmond, incorporated to construct a railroad between Ben Davis and Frankfort, Ind., to be 41 miles long, connecting with St. Louis Division of Vandalia R. R. at Ben Davis, Ind., and with Michigan Division of Vandalia R. R. at Frankfort, a cut-off approximately 9.6 miles long, is also proposed from Ben Davis to a connection with the Vincennes Division of the Vandalia R. R. at Mooresville, Ind.

Texarkana, Ark.—Iron Mountain Route will make extensive improvements during 1916 in South Arkansas, including ballasting, placing new rails, building side tracks, improving rolling stock and other general improvements. Some of the work is under way. E. A. Hadley, Ch. Engr., St. Louis, Mo.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★Cannon, Ky.—Contract awarded T. J. Anderson, Knoxville, Tenn., for grading 8 miles of the Cumberland & Manchester R.R., beginning at Cannon.

Alaska—Lowest bid opened by C. E. Cole, Purchasing Agent, Alaska Ry. Commission, Bell Street Wharf, Seattle, Wash., submitted by Colorado Fuel & Iron Company, Denver, Colo., as follows: Steel rails, $444,386; splice bars, $28,935; track spikes, $35,000; track bolts, $5,500.

New York, N. Y.—Following are unit figures of the four lowest bids opened March 9 by Public Service Commission for First District, 154 Nassau Street, for station finish on Broadway section, Route 5, Sections 1 to 4 inclusive, in Borough of Manhattan: (a) D. C. Serber, 1123 Broadway, $344,716; (b) The Snare & Triest Co., 233 Broadway, $257,480; (c) Louis Weichsler, 1133 Broadway, $369,069; (d) North Eastern Construction Co., 225 Fifth Avenue, $375,249.

Item		(a)	(b)	(c)	(d)
501	20,700 sq. ft. tile w. g., 3 x 6 in. (a) straight	$0.56	$0.60	$0.63	$0.59
	240 sq. ft. tile w. g., 3 x 6 in. (b) 1-in. rad.	1.15	1.40	1.70	1.21
	2,350 sq. ft. tile w. g., 3 x 6 in. (c) 2½-in. rad.	1.26	1.40	1.60	1.32
	160 sq. ft. tile w. g., 3 x 6 in. (d) 20-in. rad.	1.05	0.90	1.10	1.10
501A	15,430 sq. ft. tile w. g., 3 x 6 in. + 6 x 6 in. (a) straight	0.57	0.64	0.64	0.60
	15 sq. ft. tile w. g., 3 x 6 in. + 6 x 6 in. (b) 1-in. rad.	1.15	1.50	2.00	1.21
	1,080 sq. ft. tile w. g., 3 x 6 in. + 6 x 6 in. (c) 2½-in. rad.	1.26	1.40	1.59	1.32
	10 sq. ft. tile w. g., 3 x 6 in. + 6 x 6 in. (d) 20-in. rad.	1.15	0.90	1.50	1.10
502	23,340 sq. ft. tile w. g., 4¼ x 4¼ in. (a) straight	0.56	0.60	0.63	0.59
	30 sq. ft. tile w. g., 4¼ x 4¼ in. (b) 1-in. rad.	1.15	1.40	1.50	1.21
	960 sq. ft. tile w. g., 4¼ x 4¼ in. (c) 2½-in. rad.	1.26	1.40	1.60	1.32
	20 sq. ft. tile w. g., 4¼ x 4¼ in. (d) 20-in. rad.	1.05	0.90	1.50	1.10
503	28,000 sq. ft. tile w. g., 6 x 6 in. (a) straight	0.57	0.62	0.65	0.60
	110 sq. ft. tile w. g., 6 x 6 in. (b) 1-in. rad.	1.15	1.40	1.25	1.21
	1,200 sq. ft. tile w. g., 6 x 6 in. (c) 2½-in. rad.	1.26	1.40	1.55	1.32
	80 sq. ft. tile w. g., 6 x 6 in. (d) 20-in. rad.	1.15	0.90	1.50	1.21
509	280 lin. ft. tile bead w. g., (a) 1-in. rad.	0.47	0.25	0.25	0.45
510	2,770 sq. ft. tile S. V. Col. not. W. P. (a) straight	1.00	1.00	1.08	1.06
	20 sq. ft. tile S. V. Col. not. W. P. (c) 2½-in. rad.	1.02	1.10	1.50	1.07
511	13,500 sq. ft. tile V. or S. V. Col. W. P. (a) straight	0.98	1.00	1.05	1.00
	100 sq. ft. tile V. or S. V. Col. W. P. (b) 1-in. rad.	1.20	1.00	1.50	1.27
	460 sq. ft. tile V. or S. V. Col. W. P. (c) 2½-in. rad.	1.20	1.00	1.18	1.27
	50 sq. ft. tile V. or S. V. Col. W. P. (d) 20-in. rad.	1.20	1.00	1.50	1.27
513	10,510 sq. ft. mosaic and tile bands, col.	1.26	1.35	1.30	1.27
514	1,360 sq. ft. name tablets, mosaic and tile col.	1.32	1.35	2.85	1.39
515	260 initial letter plaques, mosaic and tile col., each	1.32	1.35	2.00	1.39
516	240 sq. ft. tablets, mosaic and tile col. destination, etc.	1.32	1.35	2.90	1.39
518	300 sq. ft. faience (a) plaques	7.50	6.00	5.50	7.87
521	22,700 sq. yd. plastering (arches) (b) concrete	0.63	0.78	0.74	0.65
522	6,000 sq. yd. plastering (flats) (a) brick or H. T.	0.63	0.55	0.57	0.64
	17,470 sq. yd. plastering, (b) concrete	0.63	0.65	0.57	0.65
	15 sq. yd. plastering, (c) metal lath.	0.77	1.00	1.00	0.79
523	14,700 sq. ft. cement work, (a) wainscots and bases	0.10	0.17	0.20	0.10½
	156,200 sq. ft. cement work, (c) 3-in. floor finish	0.11½	0.11½	0.12	0.15
	36,200 sq. ft. cement work (d) finish, concrete or H. T.	0.09	0.11	0.08	0.10
	20 sq. ft. cement work, (e) panels for signs	0.11	0.20	0.35	0.50
524	34 cu. ft. concrete work (a) copings	1.00	1.50	0.75	0.80
	260 cu. yd. concrete work (b) foundations	7.80	8.00	8.00	8.15
	260 cu. ft. concrete work (c) reinforced-conc., not copings, etc.	0.88	0.90	0.57	0.60
	1,090 cu. ft. concrete work, (d) protection concrete	0.88	0.70	0.63	0.60
	590 cu. ft. concrete work, (e) street landings	0.61	0.70	0.32	0.30
525	130 cu. yd. cinder fill	0.80	1.00	4.35	0.60
526	7,600 lin. ft. concrete (a) self-supporting stairs	1.10	0.95	1.15	1.20
	170 sq. ft. stairs and landings (b) self-supporting landings	0.55	0.60	0.65	0.60
	4,800 lin. ft. stairs and landings (c) supported stairs	0.83	0.75	0.90	0.84
	2,750 sq. ft. stairs and landings (d) supported landings	0.44	0.20	0.51	0.60
	50 cu. ft. stairs and landings (e) supporting columns	0.65	1.20	1.00	0.60
	8,000 sq. ft. stairs and landings (f) non-slip tread	0.83	0.90	0.74	0.96
	3,250 lin. ft. stairs and landings (g) wall strings	0.13	0.22	0.28	0.25
	900 lin. ft. stairs and landings (h) exposed stair finish	0.13	0.25	0.28	0.15
	1,330 sq. ft. stairs and landings (i) finish—street landings	0.10½	0.20	0.12	0.12
527	15,580 cu. ft. brick work (c) common brick	0.44	0.45	0.52	0.54
528	650 cu. ft. hollow tile work (a) 2 in.	0.86	0.50	0.74	0.86
	16,000 cu. ft. hollow tile work (b) 3 in.	0.61	0.40	0.48	0.84
	11,000 cu. ft. hollow tile work (c) 4 in.	0.50	0.38	0.39	0.67
	75 lin. ft. hollow tile work (d) 4½ x 13 in. flue	0.50	0.60	0.35	0.34
529	30 sq. yd. metal lath (a) without furring	0.50	0.70	1.00	1.40
	5 sq. yd. metal lath (b) with metal furring	0.75	2.00	1.50	2.37
530	6 ticket booths (b) Type "B," each	1,000.00	1,030.00	900.00	851.40
	13 ticket booths (e) Type "E," each	1,000.00	1,200.00	950.00	909.70
	2 ticket booths (g) Type "G," each	500.00	810.00	350.00	316.70
	4 ticket booths (h) spec. types, ea.	900.00	965.00	800.00	770.00
531	10 news stands (a) Type "A," each.	700.00	865.00	675.00	632.50
	1 news stand (b) Type "B," each.	3,000.00	1,860.00	2,700.00	2,582.80
	2 news stands (c) Type "C," each.	3,000.00	2,310.00	2,760.00	2,582.80
	2 news stands (d) Type "D," each	3,000.00	2,465.00	2,775.00	2,824.80
532	8 doors (a) Type "A," each	77.00	83.00	80.00	77.00
	10 doors (b) Type "B," pair	150.00	128.00	155.00	148.50
	75 doors (d) Type "D," each	71.00	68.00	75.00	71.50
	6 doors (e) Type "E," each	77.00	71.00	80.00	77.00
	65 doors (f) Type "G," pair	100.00	62.00	105.00	99.00
	10 doors (g) Type "J," each	59.00	80.00	80.00	77.00
	266 sq. ft. doors (h) Type "K"	6.60	4.50	6.60	6.60
	7 doors (i) Type "Q," each	37.40	38.00	25.00	22.00
	4 doors (j) Type "JJ," each	144.00	120.00	80.00	77.00
	35 sq. ft. doors (l) Type "L"	6.60	4.50	6.80	6.60
	6 doors (m) Type "M," each	77.00	76.00	81.00	77.00
	3 doors (o) Type "P," each	22.00	49.00	25.00	22.00
533	600 sq. ft. windows (a) double hung.	4.50	3.95	4.60	4.40
	30 sq. ft. windows (a) hinged	4.50	3.70	5.00	4.40

534	30 hardware (a) door checks, each.	4.13	4.00	4.35	4.13
	80 hardware (b) door stops, each...	2.60	2.30	2.70	2.59
	15 hardware (c) rubber covered chains, each....................	1.70	1.60	2.00	1.70
	30 hardware (d) push plates, each..	2.70	2.50	3.00	2.70
	30 hardware (e) door pulls, each...	3.63	3.30	4.00	3.63
	30 hardware (f) kick plates, pair...	8.14	7.40	8.50	8.14
536	1,110 lin. ft. railings (a) Type "FS," including posts, straight........	3.25	4.80	3.40	5.28
	5 lin. ft. railings (b) Type "FS," including posts, curved.........	3.35	6.60	4.00	5.28
	1,840 sq. ft. railings (c) Type "GS," including posts, curved.........	0.48	0.70	0.60	0.48
	260 lin. ft. railings (e) Type "LS," including posts, curved.........	3.35	5.60	3.65	5.50
	900 sq. ft. railings (f) Type "BS," including posts, curved.........	0.71	1.30	0.64	1.10
	110 lin. ft. railings (g) pipe..........	1.42	1.30	1.60	1.10
537	200 lin. ft. gates (a) low sliding.....	9.00	10.80	10.00	9.35
	40 lin. ft. gates (b) high sliding.....	11.70	13.00	14.00	13.75
	45 lin. ft. gates (c) folding.........	3.90	8.60	4.80	6.60
	12 lin. ft. gates (d) swing..........	3.35	8.00	4.00	11.00
	4 gates (e) turnstiles (exit), each.	195.00	210.00	225.00	165.00
	30 gates (f) gate control (single), each	18.15	37.00	21.00	28.60
	6 gates (h) floor boxes (additional), each....................	7.15	6.50	9.00	5.50
	800 lin. ft. gates (l) 2¼-in. galv. w.-i. pipe (gate ropes).........	0.31	0.30	0.35	0.28
	40 lin. ft. gates (m) 1-in. square steel tubing (gate ropes).......	0.50	1.10	0.85	0.56
	45 gates (p) c.-i. gate posts and cross frames, per gate.........	52.25	40.00	60.00	36.30
	5 gates (r) steel gate posts and cross frames, opening..........	25.30	34.00	30.00	38.50
538	385 sq. ft. ventilator grilles and frames (vent flues)............	2.31	2.10	2.65	3.30
539	2 c.-i. vent posts, each............	162.00	175.00	190.00	110.00
540	5 signs (a) post at street level (illum.), each...................	276.00	175.00	315.00	137.50
	2 signs (b) on brackets above street level (illum.), each.............	53.00	60.00	60.00	137.50
	22 signs (c) frames over platform (illum.), each..................	108.00	76.00	115.00	44.00
	8 signs (cc) frames upon platform (illum.), each..................	97.00	83.00	110.00	82.50
	130 sq. ft. signs (d) frames (enameled sign) on low railing.......	2.23	2.20	2.60	1.65
	120 sq. ft. signs (e) frames (enameled sign) in high-low grille...	1.68	1.70	1.95	1.66
	280 lin. ft. signs (f) reflectors (approaches)	1.98	2.15	2.25	1.10
	1,360 sq. ft. signs (g) plates enameled.	0.38	0.55	0.44	0.65
	100 vert. in. signs (h) copper letters	0.11	0.65	0.20	0.11
	70 sq. ft. signs (k) frames, direction signs......................	1.43	3.20	1.65	1.65
542	540 lin. ft. street railings (a) Type "K"	7.69	8.00	8.50	9.90
	210 lin. ft. street railings (b) Type "K"	7.59	8.50	8.50	11.65
	6 street railings (c) Type "SK," each	233.00	270.00	270.00	412.50
	125 lin. ft. street railings (v) Type "V"	6.40	9.60	7.15	9.90
542A	800 sq. ft. sheet metal work (a) ceilings	0.91	0.25	0.60	0.28
	600 sq. ft. sheet metal work (b) drip pans	0.91	0.40	0.60	1.10
543	70 lin. ft. steel (a) ladders..........	2.07	2.00	2.30	3.30
	60 sq. ft. steel (b) ladder platforms.	1.30	2.00	1.50	1.65
	10,000 lb. steel (e) shapes—lintels......	0.04¼	0.05	0.04½	0.07
	4,000 lb. steel (f) shapes—miscellaneous	0.05	0.06	0.05	0.08
	40 steel (g) ladders—track to platform	11.00	12.00	12.25	22.00
543A	1,000 lb. iron castings—miscellaneous.	0.05½	0.06	0.06	0.08
544	4,020 lin. ft. oak handrails............	0.55	0.65	0.70	0.35
546	7,400 lin. ft. platform edge (d) wooden facia	0.11	0.25	0.28	0.28
	3,000 platform edge (e) drilling holes, per hole	0.33	0.35	0.40	0.33
547	Rough plumbing work (a) stations (lump sum)...............	6,915.00	13,000.00	8,300.00	10,460.00
	Rought plumbing work (b) enclosures (lump sum)...........	563.00	350.00	750.00	492.00
548	56 plumbing fixtures (a) water cl. bowls, each...................	56.00	48.00	58.00	57.00
	28 plumbing fixtures (b) lavatories, stations, each..................	40.60	34.00	43.00	36.00
	3 plumbing fixtures (c) lavatories, signal towers, etc., each........	37.40	31.00	40.00	34.00
	28 plumbing fixtures (d) urinals, each	83.00	80.00	85.00	89.00
	2 plumbing fixtures (e) slop sinks, toilet, wall, each................	72.00	68.00	78.00	79.00
	4 plumbing fixtures (f) slop sinks, toilet, pipe connections, each..	74.00	64.00	77.00	82.00
	8 plumbing fixtures (g) slop sinks, closets, each....................	78.00	62.00	82.00	89.00
	60 plumbing fixtures (h) floor drains, each....................	13.60	13.00	14.00	17.00
	3 plumbing fixtures (j) pump water closets, each....................	108.00	96.00	113.00	118.00
549	400 lin. ft. 1-in. supply pipe, in place.	0.22	0.55	0.23	0.22
550	2,000 sq. ft. structural glass and soapstone (aa) ¾-in. gl. wall trim and w. coat.....................	1.54	1.60	1.73	2.39
	1,870 sq. ft. structural glass and soapstone (b) ¾-in. gl. pipe, ch. partitions	1.76	1.80	2.00	2.39
	580 sq. ft. structural glass and soapstone (c) ¾-in. gl. shelves....	1.65	1.60	1.75	2.39
	1,260 sq. ft. structural glass and soapstone (d) ¾-in. gl. stall partitions	1.93	1.60	1.72	2.65
	130 sq. ft. structural glass and soapstone (e) 1-in. glass floor slabs.	2.75	2.50	2.90	3.30
	500 lin. ft. structural glass and soapstone (f) curved cor. and angles gl.	1.43	1.60	1.72	1.50
	20 sq. ft. structural glass and soapstone (g) soapstone wall trim and w.. coat....................	0.88	1.50	1.00	0.92
	40 sq. ft. structural glass and soapstone (h) soapstone pipe, chm. partitions	0.88	1.50	1.00	0.92
	10 sq. ft. structural glass and soapstone (i) soapstone shelves.....	0.88	1.50	1.00	0.92
	150 sq. ft. structural glass and soapstone (j) soapstone stall partitions	0.88	1.30	1.00	0.92
	15 sq. ft. structural glass and soapstone (k) soapstone floor slabs.	0.88	2.00	1.00	1.00
	20 lin. ft. structural glass and soapstone (l) soapstone curved cor. and angles.....................	1.65	1.00	1.00	1.00
551	150 cast work in toilets (a) posts, each	10.75	13.00	12.50	8.25
	420 lin. ft. cast work in toilets (b) top rails.........................	1.10	1.10	1.30	1.10
	10 cast work in toilets (c) wall flanges, each....................	1.65	2.20	2.00	2.20
	30 cast work in toilets (d) register faces, each....................	10.75	9.00	13.00	2.20
	15 cast work in toilets (e) c.-i. vent louvres, each..................	13.20	12.00	16.00	6.60
552	9,660 lb. steel angles, plates, etc., supporting	0.07	0.08	0.08	0.09
554	11,230 lin. ft. elec. conduits (a) ¾-in...	0.13⅜	0.14	0.15	0.14⅗
	3,835 lin. ft. elec. conduits (b) 1-in....	0.18¼	0.20	0.20	0.19
	1,250 lin. ft. elec. conduits (c) 1½-in..	0.24	0.24	0.25	0.24⅕
	525 lin. ft. elec. conduits (d) 2-in....	0.33	0.34	0.35	0.35
	100 lin. ft. elec. conduits (e) 2½-in..	0.44	0.45	0.45	0.46
	100 lin. ft. elec. conduits (f) 3-in....	0.55	0.56	0.60	0.58
	1,350 lin. ft. elec. conduits (g) ¾-in., flexible	0.16	0.16	0.16	0.16
554A	50 special conduit fittings (rem. covers), each..................	0.77	0.90	0.80	0.80
555	455 c.-i. outlet boxes, each..........	0.44	0.50	0.46	0.46
556	30 c.-i. pull boxes (a) 6 x 6 x 6 in., each	1.40	1.50	1.50	1.44
	15 c.-i. pull boxes (b) 12 x 12 x 6 in., each	4.40	4.60	4.60	4.60
	15 c.-i. pull boxes (c) 18 x 12 x 6 in., each	6.00	6.60	6.30	6.33
	10 c.-i. pull boxes (d) 24 x 18 x 6 in., each	9.35	9.00	10.00	9.78
	12 c.-i. pull boxes (e) 12 x 6 x 4 in., hinged cover and lock, each....	7.70	7.50	8.00	8.10
	35 c.-i. pull boxes (f) 6 x 6 x 4 in., each	1.27	1.40	1.30	1.32
	10 c.-i. pull boxes (g) 12 x 6 x 4 in., each	3.30	3.30	3.45	3.46
	30 c.-i. pull boxes (h) 4 x 4 x 4 in., each	0.83	1.10	0.90	0.86
	30 c.-i. pull boxes (i) 8 x 8 x 4 in., each	2.20	2.20	2.30	2.30
557	70 c.-i. heater boxes, each..........	11.00	11.00	11.50	11.50
558	13 steel panel board boxes (d) 32 x 5 13/16 x 49 in. to 60, each......	17.00	16.00	18.00	17.82
	3 steel panel board boxes (e) 32 x 5 13/16 x 37 in. to 48, each......	13.40	14.00	15.00	13.32
	2 steel panel board boxes (f) 32 x 5 13/16 x 25 in. to 36, each......	11.00	13.00	12.00	11.00
559	8 steel switchboard boxes, each...	30.80	30.00	32.00	30.80
561	47,600 sq. ft. painting (a) 2 coats—iron, steel.....................	0.02½	0.017	0.02	0.02⅗
	136,000 sq. ft. painting (b) 3 coats—iron, steel.....................	0.03	0.026	0.03	0.03⅖
	415,600 sq. ft. painting (c) 2 coats—plaster, cement................	0.01¾	0.016	0.02	0.01⅘
	690 painting (d) letters and numerals, each.....................	0.11	0.50	0.10	0.11⅕
	500 sq. ft. painting (f) gratings, existing	0.11	0.12	0.10	0.11⅕
601A	Const. new entrance n. w. cor. Canal Street and Broadway, (lump sum)	1,700.00	3,100.00	1,500.00	3,000.00
601B	Connection to Hudson Terminal Building (lump sum)...........	800.00	2,200.00	5,000.00	1,500.00

New York, N. Y.—Following are unit figures of the bids opened March 9 by Public Service Commission for First District, 154 Nassau Street, for station finish on Route 50, Hunters Point Avenue Station, Borough of Queens: (a) Degnon Contracting Co., 30 East Forty-second Street, $32,219; (b) A. L. Guidone & Son, Inc., 52 Vanderbilt Avenue, $37,352; (c) The Snare & Triest Co., 233 Broadway, $41,259.

Item		(a)	(b)	(c)
501	800 sq. ft. tile w. g. 3 x 6 in. (a) straight...........	$0.58	$0.60	$0.70
	10 sq. ft. tile w. g. 3 x 6 in. (b) 1 in. rad..........	1.18	1.00	1.40
	100 sq. ft. tile w. g. 3 x 6 in. (c) 2½ in. rad........	1.28	1.50	1.40
502	10,900 sq. ft. tile w. g. 4¼ x 4¼ in. (a) straight......	0.60	0.60	0.75
	10 sq. ft. tile w. g. 4¼ x 4¼ in. (b) 1 in. rad......	1.19	1.00	1.40
	750 sq. ft. tile w. g. 4¼ x 4¼ in. (c) 2½ in. rad....	1.30	1.55	1.40
	70 sq. ft. tile w. g. 4¼ x 4¼ in. (d) 20 in. rad.....	1.08	1.00	0.90
509	60 lin. ft. tile bead w. g. (a) 1 in. rad.............	0.49	0.20	0.30
511	630 sq. ft. tile V. or S. V. Col. W. P. (a) straight...	1.25	1.25	1.10
	10 sq. ft. tile V. or S. V. Col. W. P. (b) 1 in. rad...	1.24	1.25	1.10
	10 sq. ft. tile V. or S. V. Col. W. P. (c) 2½ in. rad.	1.24	1.25	1.10
	10 sq. ft. tile V. or S. V. Col. W. P. (d) 20 in. rad..	1.24	1.25	1.10
513	1,840 sq. ft. mosaic and tile bands—col...............	1.36	1.38	1.60
514	480 sq. ft. name tablets mosaic and tile—col........	1.36	1.38	1.50
515	55 initial plaques (a) walls, each.................	1.36	1.55	2.00
	112 initial plaques (b) columns, each..............	1.36	1.55	1.50
516	50 sq. ft. tablets, destination, etc................	1.36	1.38	1.50
521	4,000 sq. yd. plastering (arches) (b) concrete........	0.48	0.75	1.00
522	350 sq. yd. plastering (flats) (a) brick or H. T......	0.48	0.55	0.90
	1,300 sq. yd. plastering (b) concrete.................	0.48	0.55	0.70
	10 sq. yd. plastering (c) metal lath...............	0.70	0.90	1.00
523	3,400 sq. ft. cement work (a) bases..................	0.10	0.25	0.20
	13,900 sq. ft. cement work (c) 3-in. floor finish........	0.145	0.17	0.14
	630 sq. ft. cement work (d) on concrete—H. T.....	0.09	0.12	0.12
524	75 cu. ft. concrete work (a) copings..............	0.82	0.80	1.30
	10 cu. yd. concrete work (b) foundations..........	7.25	12.00	12.00
	10 cu. ft. concrete work (c) reinf. concrete........	0.55	0.60	1.00
	10 cu. ft. concrete work (d) protection...........	0.45	0.90	1.00
	40 cu. ft. concrete work (e) street landings.......	0.30	0.60	0.80
526	800 lin. ft. concrete stairs, etc. ((a) self supp. stairs	1.18	1.35	1.20
	200 sq. ft. concrete stairs, etc. (b) self supp. landgs.	0.60	0.80	0.75
	300 lin. ft. concrete stairs, etc. (c) supp. stairs.....	0.75	1.30	1.00
	530 sq. ft. concrete stairs, etc. (f) non-slip treads..	1.08	0.85	1.00
	140 lin. ft. concrete stairs, etc. (g) wall strings.....	0.21	0.40	0.40
	150 lin. ft. concrete stairs, etc. (h) exposed finish..	0.13	0.20	0.40
	85 sq. ft. concrete stairs, etc. (i) finish street ldg..	0.12	0.15	0.50
527	1,360 cu. ft. brick (c) common.......................	0.54	0.60	0.60
528	20 cu. ft. hollow tile (a) 2 in......................	0.82	0.80	0.60
	2,360 cu. ft. hollow tile (b) 3 in......................	0.65	0.60	0.50
	150 cu. ft. hollow tile (c) 4 in......................	0.50	0.50	0.60
	20 lin. ft. hollow tile (d) 4½ x 13 in. flue...........	0.75	0.40	1.00
529	10 sq. yd. metal lath (a) without furring..........	0.65	0.55	1.00
530	1 ticket booth (e) Type "E".........................	1,025.00	1,000.00	1,900.00
531	1 news stand (g) Type "A".........................	740.00	650.00	1,070.00
532	2 doors (a) Type "A," each.........................	75.00	75.00	85.00
	7 doors (d) Type "D," each.........................	70.00	70.00	68.00
	1 door (e) Type "E"...............................	76.00	67.00	71.00
	4 doors (f) Type "G," pair.........................	97.25	50.00	62.00
	8 sq. ft. (h) Type "K"...........................	6.45	4.00	5.00
	1 door (i) Type "Q"...............................	21.50	35.00	40.00
	2 doors (k) batten, each..........................	10.75	25.00	25.00
	1 door (m) Type "M"...............................	75.50	70.00	76.00
533	100 sq. ft. windows (a) double hung................	4.30	3.75	4.00
	100 sq. ft. windows (n) temporary..................	0.90	0.50	0.60
534	3 hardware (a) door checks, each..................	4.05	4.25	5.00
	10 hardware (b) door stops, each..................	2.55	2.25	2.50
	2 hardware (c) rubber covered chains, each......	1.70	1.50	1.50
	2 hardware (d) push plates, each..................	2.65	3.00	2.50
	2 hardware (e) door pulls, each..................	3.60	3.85	3.50
	2 hardware (f) kick plates, pair..................	8.00	8.50	7.50
536	125 lin. ft. railings (a) Type "FS," incl. posts......	3.40	5.00	6.00
	70 lin. ft. railings (e) Type "LS," incl. posts......	3.60	6.25	6.00
	120 sq. ft. railings (f) Type "BS," incl. posts......	0.65	1.60	1.70
	10 lin. ft. railings (g) pipe........................	1.55	1.50	2.30

Route 50, Hunters Point Avenue Station, Borough of Queens—Continued.

537	15	lin. ft. gates (a) low sliding	9.60	12.00	12.00
	2	(f) gate control (single), each	19.90	42.00	40.00
	2	(h) floor boxes (additional), each	7.75	7.00	12.00
	50	lin. ft. (i) 1¼ in. galv. w.-i. pipe (gate ropes)	0.35	0.30	0.60
	10	lin. ft. (m) 1 in. steel tubing (gate ropes)	0.60	1.50	1.20
	2	(p) cast-iron posts and frames, per gate	56.50	42.00	45.00
539	1	vent posts, cast iron	75.00	185.00	170.00
540	10	sq. ft. sign (e) frames (enam. sq. low. rail.)	1.85	2.25	3.00
	40	lin. ft. sign (f) reflectors (approaches)	2.10	2.75	2.60
	100	sq. ft. sign (g) plates (enameled)	0.40	0.50	0.80
	10	sq. ft. sign (h) frames, direction signs	1.60	4.25	4.00
542	110	lin. ft. street railings (a) Type "K"	8.16	10.00	10.00
543	100	lb. steel (e) shapes—lintels	0.05	0.07	0.07
	500	lb. steel (f) shapes—miscellaneous	0.055	0.085	0.08
	4	steel (g) ladders—track floor—platform, each	11.90	23.00	15.00
543A	500	lb. iron castings—miscellaneous	0.06	0.08	0.07
544	300	lin. ft. oak handrails (a) new	0.70	0.80	0.60
	100	lin. ft. oak handrails (c) restoring old	0.33	0.40	0.40
546	1,000	lin. ft. platform edge (d) wooden facia	0.30	0.60	0.30
	700	(e) drilling holes in F, per hole	0.15	0.30	0.35
547		Rough plumbing work (a) station (lump sum)	890.00	2,150.00	2,000.00
548	4	plumbing fixtures (a) w. c. bowls, each	44.30	65.00	50.00
	2	plumbing fixtures (b) lavatories (station), each	22.70	50.00	40.00
	1	plumbing fixtures (c) lavatories (signal towers)	21.60	45.00	35.00
	2	plumbing fixtures (d) urinals, each	88.50	100.00	85.00
	1	plumbing fixture (g) slop sinks, closets	63.75	80.00	65.00
	1	(h) floor drain	9.75	18.00	16.00
549	120	lin. ft. 1-in. supply pipe	0.28	0.35	0.70
550	100	sq. ft. structural glass (aa) ¾-in. wall trim, etc.	1.62	1.50	1.89
	85	sq. ft. (b) ¾-in. pipe chamber partitions	1.90	1.70	2.00
	35	sq. ft. (c) ¾-in. shelves	1.62	1.60	1.80
	90	sq. ft. (d) ¾-in. stall partitions	1.62	1.80	1.80
	10	sq. ft. (e) 1-in. slab floor	2.70	2.60	3.00
	30	lin. ft. (f) curved corners and angles	1.62	1.50	1.70
551	10	cast-iron work (a) posts, each	11.90	15.00	15.00
	30	lin. ft. in toilets (b) top rails	1.25	1.25	1.60
	2	(d) register faces and frames, each	11.90	8.50	18.00
	1	(e) cast-iron louvres, vent	14.50	12.00	18.00
552	1,000	lb. steel angles, plates, etc., supporting	0.07	0.08	0.09
554	250	lin. ft. electric conduits (a) ¾ in	0.18	0.25	0.24
	100	lin. ft. electric conduits (b) 1 in	0.25	0.27	0.30
	50	lin. ft. electric conduits (c) 1½ in	0.30	0.35	0.40
	50	lin. ft. electric conduits (d) 2 in	0.37	0.40	0.50
	50	lin. ft. electric conduits (g) flexible	0.17	0.20	0.30
554A	10	special conduit fittings (rem. cover), each	9.75	2.00	2.00
555	12	c.-i. outlet boxes, each	0.86	1.40	1.50
356	1	c.-i. pull box (c) 18 x 12 x 6 in	16.20	12.00	15.00
	1	c.-i. pull box (e) 12 x 6 x 4 in., hinged cover	10.80	6.00	15.00
557	4	c.-i. heater boxes, each	9.50	13.50	16.00
558	1	steel panel board box, 24¾ x 6 x 51½ in	8.20	30.00	20.00
561	100	sq. ft. painting (a) 2 coats—iron and steel	0.02	0.02	0.05
	100	sq. ft. painting (b) 3 coats—iron and steel	0.0325	0.03	0.06
	44,550	sq. ft. (c) 2 coats—plaster and cement	0.0225	0.025	0.03

PUBLIC BUILDINGS AND SCHOOLS

PROPOSED WORK.

Lynn, Mass.—Plans completed about April 1 for the grammar school. Address Clerk, Board of Education.

New Bedford, Mass.—Governor McCall has signed the bill allowing New Bedford to erect a new police station at a cost of $150,000.

Saugus (P. O. Lynn), Mass.—School House Building Committee (Frank P. Bennett, Sr., Chairman) recommends erecting 12-room junior school in the rear of present high school; cost $75,000.

Mindana, P. I.—Contract will be let about July for erecting a reinforced concrete school costing $25,000. T. W. Scheldemantel, District Engineer, Misamis-Bukidnon District, Mindana.

New Britain, Conn.—Resolution adopted providing for issue of $25,000 bonds for purchase of sits on Lee and North Streets for new school. George A. Quigley, Mayor.

Southport, Conn.—School Board petitioned to erect school; probable cost $50,000.

Buffalo, N. Y.—Council voted in favor of preparing plans and specifications for a new detention home.

Kenmore, N. Y.—High School is to be enlarged and improved. Carlton W. Clapp, President, Board of School Trustees.

Lockport, N. Y.—Plans being prepared by Phelps & Obenhack, Gluck Building, and Wright Kremers, 311 Falls Street, both of Niagara Falls, Associate Archts., for proposed $100,000 County Tuberculosis Hospital.

Patchogue, L. I., N. Y.—Site donated by Mrs. Ruth Litt on South Ocean Avenue and South Baker Street accepted for proposed high school to cost about $150,000. Address Board of Education.

Van Etten, N. Y.—Considine & Haskell, Elmira, engaged to prepare plans for two-story brick High School.

East Orange, N. J.—It is proposed to erect a 3-story 17-room addition to Elmwood School, 75 x 140 ft., and cost $85,000, not including equipment. Ghuilbert & Betelle, Archts., 665 Broad Street, Newark; W. Clapp, Secy. Board Educ.

Jersey City, N. J.—State Board Education has approved plans for School No. 16, to be erected on Washington and Sussex Streets. J. T. Rowland, Archt., 100 Sip Avenue.

West Orange, N. J.—Election to be held March 21 to vote $100,000 bonds for purchase of site and erecting new school at Eagle Rock Avenue and Valley Way, Fifth Ward, and an addition to Hazel Avenue School, First Ward. Address Board of Education.

Altoona, Pa.—Julian Millard of Altoona submitted plans to Trustees of Mercy Hospital for four-story fireproof addition at Eighth Avenue and Twenty-sixth Street.

Hoboken, N. J.—Plans prepared by Fagan & Briscoe, 95 River Street, Hoboken, for an addition to the high school; cost, $125,000.

Easton, Pa.—Dr. S. S. Goldwater, Superintendent of Mount Sinai Hospital, Fifth Avenue and One Hundredth Street, New York, engaged to advise the committee having in charge preparation of specifications and plans for proposed Easton Hospital.

Jeannette, Pa.—School Board considering selection of site for proposed high school.

Lititz, Pa.—Citizens voted $95,000 bonds for erecting new school. Address Board of Education.

Mahanoy City, Pa.—Mahanoy Township planning to erect $40,000 school. Address Township Clerk.

Palmerton, Pa.—Election to be held March 28 to vote $30,000 bonds to erect brick school. Address D. Costeubader, Secy. School District.

Scranton, Pa.—Erection of Junior High School in West Scranton contemplated; probable cost $200,000. Address School Board.

Cedar Spring, S. C.—Edwards & Sayward, Atlanta, Ga., selected to prepare plans and specifications for School for Deaf and Blind; to cost $50,000.

Atlanta, Ga. — Reported steps being taken to erect Henrietta Egleston Hospital for Children. Dr. W. W. Memminger, 15 North Avenue, may be able to give further information.

New Castle, Pa.—C. C. and A. L. Thayer, New Castle, engaged to prepare plans and specifications for addition to the Thaddeus Stevens School; cost about $40,000.

Birmingham, Ala.—Steps reported being taken to erect auditorium. Address City Clerk.

Mansfield, La.—Two schools are to be erected, one at Stonewall costing $25,000 and one at Longstreet costing $30,000. Address Secretary School Board.

Gulfport, Miss.—N. W. Overstreet of Jackson will prepare plans and specifications for new $100,000 court house for Harrison County.

Greeneville, Tenn.—Brown, Burnett & Loggins of Bristol selected to prepare plans for court house; appropriation $50,000.

Jackson, Ky.—Plans approved for jail, to cost approximately $40,000. Address County Clerk.

Athens, Ohio.—Reported contract soon to be let for erecting $40,000 Children's Home.

Bryan, Ohio.—Citizens March 7 voted $120,000 bonds for erecting auditorium, gymnasium and ten-room grade school. Address Board of Education.

Chillicothe, Ohio.—Green Township School bonds for $33,000 have been sold. E. S. Matheney, Columbus, has prepared plans for the building. Address Clerk of Township.

Cincinnati, Ohio.—Contract will be let about May by Trustees University of Cincinnati for erecting the Medical College building, to be brick, concrete and stone, 3-story and cost $250,000. Samuel Hannaford & Sons, Cincinnati, Archts.

Plans for 2-story brick, concrete and terra cotta addition to McKinley School, Eastern Avenue, have been approved by Board of Education. Cost, $50,000. Charles W. Handman, Business Manager, 511 W. Court Street.

Circleville, Ohio.—Saltcreek Township school bonds sold for $25,000. Address Clerk of Township.

Coalton, Ohio.—It is proposed to erect a 2-story fireproof high school costing $30,000. Contract will be let about April 1. Frank L. Packard, Archt., Hayden Building, Columbus; Edw. T. Evans, Pres. Coal Township Rural Board Education.

Findlay, Ohio.—Bonds amounting to $50,000 for erecting school in Butler District sold. Address Secretary, Butler District Board of Education.

Lebanon, Ohio.—Commissioners of Warren County sold $65,000 County Infirmary bonds.

New Matamoras, Ohio.—Election to be held to vote $45,000 bonds for erecting new school. Address Board of Education.

Struthers, Ohio.—Citizens of Poland Township voted $35,000 bonds to erect eight-room school and two-room addition to Poland Center School. Address Township Clerk.

Zanesville, Ohio.—Election to be held in April to vote $165,000 bonds for erecting market house and city hall. Address City Clerk.

Moores Hill, Ind.—Trustees of Moores Hill College voted to rebuild Moores Hall, destroyed by fire.

Warsaw, Ind. — Bonds amounting to $40,000 sold for erecting grade school. Address Board of Education.

Grand Rapids, Mich.—Christian Psychopathic Hospital Association intends erecting at Fourth Street and Bristol Avenue, N. W., two hospital buildings, one for women and the other for men, of brick and tile construction, and floors of reinforced concrete with marble surface.

Antigo, Wis.—City Council authorized Board of Education to engage an architect to prepare plans for the high school.

Menomonee Falls, Wis.—Plans prepared by Herbst & Hufschmidt, Coswell Building, Milwaukee, for two-story and basement brick grade school; cost about $30,000.

Superior, Wis.—E. S. Radcliffe, Superior, engaged to prepare plans for a 1½-story county poor house; cost, $25,000.

Cedar Rapids, Iowa.—School Board contemplates erecting additions to Polk and Harrison schools; probable cost $100,000.

Inwood, Iowa.—Plans being prepared by Beuttler & Arnold, Security Building, Sioux City, for two-story, brick and stone, fireproof school; cost about $35,000.

Hibbing, Minn.—County Commissioners at Duluth reported will soon engage architect to prepare plans for proposed court house at Hibbing, cost $100,000. Charles Kauppi, Chairman Committee.

Proctor, Minn.—Plans completed for High School to be erected on site adjoining present East Side School. Address Board of Education.

St. Paul, Minn.—Reported contract will soon be let for erecting nurses' home, costing about $40,000, and a tuberculosis ward, to cost $35,000, for City and County Hospital.

Directors of the Charles T. Miller Hospital of St. Paul are considering erecting a children's hospital.

Columbus, Kan.—Thomas W. Williamson Co., 735 Kansas Avenue, Topeka, engaged to prepare plans for two-story and basement, semi-fireproof brick and concrete school to replace Cherokee County High School, recently destroyed by fire.

Wichita, Kan.—Erection of jail costing $100,000 under consideration. Address County Clerk.

Bismarck, N. D.—Plans being considered by Bismarck Evangelical Hospital trustees for a $30,000 nurses' dormitory.

Devils Lake, N. D.—Plans being prepared for the first unit of the school; cost, $30,000. Address Clerk of School Board.

Drake, N. D.—Plans adopted by School Board for 12-room brick school; cost, $35,000.

Moberly, Mo.—Citizens voted $100,000 school bonds. Address School Board.

Abilene, Tex.—About $40,000 available for the girls' dormitory to be erected at Simmons College.

Wichita Falls, Tex.—Court House bonds amounting to $225,000 have been sold.

Wilson, Okla.—School Board contemplates calling election to vote $25,000 for erecting school.

Enid, Okla.—Election to be held April 4 to vote $100,000 bonds for erecting a convention hall. Address City Clerk.

Pueblo, Col.—Bonds amounting to $300,000 for erecting municipal building sold. Address City Clerk.

Aberdeen, Wash.—See "Walla Walla, Wash."

Sumner, Wash.—Erection of a 12-room fireproof school costing about $30,000 under consideration. Address School Board.

Oxnard, Cal.—Plans for proposed school to be prepared by Allison & Allison, 1405 Hibernian Building, Los Angeles, to be 1 story 6 room and hollow tile. Election to be held March 18 to vote $51,000 bonds for site and building.

Palo Alto, Cal.—Site is being selected for union high school. Address Board of Education.

Taft, Cal.—High School Board selected O. L. Clark, Bakersfield, to prepare plans for the $60,000 school.

Thatcher, Ariz.—Board of Supervisors, Safford, sold $40,000 school building bonds. Benjamin Blake, Clk of Board.

Tucson, Ariz.—Plans soon to be prepared for the school of mines building to be erected at the University of Arizona. About $175,000 available.

Salt Lake City, Utah. — Two grade schools, fireproof and two stories high, including 12 class rooms, manual training science, rest room and principal office, in addition, will be erected. Architect not selected yet. P. Judd, Clerk Board Education.

North Toronto, Ont. — Reported new plans to be prepared for Separate School to be erected on Broadway Avenue. Address Separate School Board.

Toronto, Ont.—Building Committee has decided to recommend to Board of Education spending of $30,000 on enlarging the Robert Land School.

BIDS DESIRED.

Boston, Mass.—Until April 6, by Board Trustees Public Library (J. H. Benton, Pres.), for erecting addition to Central Library on Balgden Street, Boston. Jos. McGinnis, Archt., 16 Arlington Street, Boston.

Torrington, Conn. — Reported desired until March 20 by J. Calhoun, Secy. School Commissioners, for erecting school at Riverside and Highland Avenues. Probable cost $55,000.

Brooklyn, N. Y.—Until March 30, by State Hospital Commission (E. S. Elwood, Secy.), for erecting two buildings known as Chronic Building and Reception Hospital, at Long Island State Hospital, Brooklyn. Lewis F. Pilcher, State Archt., Albany.

Brooklyn, N. Y.—Until March 27, by Department Public Charities (John H. Kingsbury, Comr.), for furnishing material and erecting a laundry building for Kings County Hospital. Security $29,500.

Newark, N. J.—Until March 29, by Board Education (R. D. Argue, Secy.), for erecting Speedway Avenue school.

Rutherford, N. J.—Reported desired until March 30 by Board of Education (C. P. Perham, Clk., 103 W. Passaic Avenue) for erecting two-story and basement school. Probable cost $40,000. Rasmussen & Wayland, Archts., 1133 Broadway, New York City.

Butler, Pa.—Until about May 25 by Trustees Butler School District (H. L. Graham, Secy.) for erecting 3-story, 280 x 200 ft. fireproof stone and brick school, costing $330,000. W. G. Eckles, Archt., New Castle.

Cresson, Pa.—Until March 28, by Dr. Samuel G. Dixon, Commissioner of Health, 1900 Race Street, Philadelphia, for dining building extension, subdivision of attic of West Ward Building and residence for medical director.

Grundy, Va.—Reported desired until March 28 by County Supervisors (L. H. Looney, Chmn.) for erecting court house. Probable cost $45,000.

Middlebourne, W. Va.—Until April 10, by County Court (J. E. Smith, Clk.), for erecting county infirmary building on County Farm about 3½ miles southeast of Middlebourne, S. W. Ford & Co., Archts., Clarksburg, W. Va.

Knoxville, Tenn.—Reported desired until March 20 by City Commissioners for addition to Moses School. Probable cost $40,000. R. F. Graf & Son, Archt.

Camden, Ohio.—Until March 31, by G. W. Hornsher, Clk., for erecting an eight-room school with auditorium, gymnasium, etc. E. Rufus Thompson, Archt., 524 Belmont Avenue, Youngstown.

Kenmore, Ohio.—Until March 31 by Board Education (I. W. Fiscus, Clk.) for furnishing material and erecting Lawnsdale school. National Eng. Co., Archt., Marshall Building, Cleveland.

Reading, Ohio.—Until April 6 by George W. Fricke, Clk. Board Education, for furnishing material and erecting school on South Street. Garber & Woodward, Archts., 2803 Union Central Bank Bldg., Cincinnati.

Urbana, Ohio.—Until April 8 by Board Education (B. F. Dixon, Clk.) for erecting grade and high school. Separate bids for ventilating, heating and plumbing. F. S. Rusk & Cree Sheets, Archts., 145 N. High Street, Columbus.

Youngstown, Ohio.—Until April 7 by Board of Education (W. N. Ashbaugh, Dir.) for furnishing material and erecting fireproof school in Steelton Dist. Stanley & Scheibel, Archts., Wick Building. Also separate bids for fireproof school in Pine Hollow Dist. E. R. Thompson, Belmont Avenue, Archt.

Columbus, Ind.—Until April 7 by Hospital Trustees for erecting county public hospital. D. A. Bohlen & Son, Archts., Majestic Building.

Indianapolis, Ind.—Reported desired until March 28 by T. A. & V. H. Winterrowd, 332 American Central Life Building, for erecting shop and warehouse, 2 stories, 158 x 131 ft., for Board Education. John E. Cleland, Bus Mgr., Wimmer Building, 66 W. New York Street.

Largo, Ind. — Reported desired until March 30 by M. J. Ragan, School Trus., for erecting Township high and grade school, 2 stories and basement. Elmer E. Dunlap, 616 Citizens National Bank Building, Kokomo, and 909 State Life Building.

Portland, Ind.—Reported desired until April 1 by K. Davis, Chmn. County Commissioners, for erecting three-story and basement, 90 x 160 ft., court house; probable cost $275,000. McLaughlin & Hulsken, Archts., 610 Savings Bank Building, Lima, Ohio.

Detroit, Mich.—Until April 4, by Board Education (Chas. A. Gadd, Secy., 50 Broadway), for furnishing material and erecting a 20-room school on Holmur Avenue. Separate bids for heating, ventilating, electric wiring, etc.

Lakeview, Mich.—Until April 15 by Board Education (Scott Swarthout, Secy.) for furnishing material and erecting a 10-room school. Jens C. Petersen, Archt., State Bank Bldg., Traverse City.

Ypsilanti, Mich.—Until March 30 by State Board Education (Fred. L. Keeler, Secy., Lansing) for erecting library at Michigan State Normal College, Ypsilanti. Separate bids for plumbing, heating, electric wiring, etc. Smith, Hinchman & Grylls, Archts., 710 Washington Arcade, Detroit.

Dorchester, Wis.—Reported desired until March 25 for erecting 2-story and basement, 60 x 70 ft., grade school. Probable cost $20,000. Raeuber & Mehner, Archts., 55 S. Main Street.

Galva, Iowa.—Until April 11 by Board Directors Galva Consolidated Independent School Dist. in Ida and Sac Counties, at office of I. E. Baumgardner, Pres., Galva, for erecting a school, including heating and plumbing. Marten & Hoskins, Archts., Storm Lake.

Holstein, Iowa.—Until March 21 by Board Education (T. M. Watts, Secy.) for furnishing material and erecting high school. Separate bids for heating, ventilating, plumbing, etc. Trunk & Gordon, Archts., St. Joseph, Mo.

Gemmell, Minn.—Until April 15 by Independent School Dist. No. 2 (W. D. Kuntz, Clk.) for erecting a one-story and basement, 53 x 70 ft., consolidated school. Probable cost $20,000. W. P. Allred, Ferguson Building, Duluth.

Argentine, Kan.—Reported desired until April 3 by W. A. Seymour, Secy. Bd. Educ., Library Building, for erecting a 2-story and basement library, 50 x 75 ft. probable cost $25,000. Rose & Peterson, Barker Building, Kansas City, Kan.

Columbus, Kan.—Reported desired until April 11 by County High School Board Trustees for erecting 3-story brick school.

North Platte, Neb.—Until March 20 by A. F. Streitz, Secy. Board of Education, for erecting 3-story brick school, 65 x 168 ft., costing $50,000. B. M. Reynolds, Archt., North Platte.

Sapulpa, Okla.—Until May 6, by H. H. Harbison, Chmn. Building Committee, plans for a Carnegie Public Library to cost $22,500, advertised in Engineering Record.

Eugene, Ore.—Until about April 16 by Trustees University of Oregon for erecting the educational building at the University, to be three-story brick and terra cotta and cost $40,000. Lowman & Holford, 1021 Chamber of Commerce, Portland.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Morristown, N. J.**—Contracts awarded by Board of Education for erecting High School as follows: General construction, P. F. Kenny Company, 33 Old Broadway, New York, $167,446; heating and ventilating, Teran Mahney & Munro Company, 601 First Avenue, New York, $38,883; plumbing, Jaehnig & Peoples, 221 Thirteenth Avenue, Newark, $10,042; electrical work, Dean Electric Company, 27 Bank Street, Morristown, $6,713.

★**Mahanoy City, Pa.**—Contract for erecting High School awarded Jacob A. Nagle, Allentown; cost about $80,000.

★**Slatington, Pa.** — Contract awarded Edward F. Peters, Allentown, for erecting school at $53,855.

South Bethlehem, Pa.—Following are four lowest bids opened March 7, by Supervising Architect, Washington, D. C., for constructing U. S. Post Office (a) limestone; (b) sandstone: Charles McCaul Company, Philadelphia, Pa. (a) $71,893, (b) $72,793; G. W. Stiles Construction Company, Chicago, Ill. (b) $73,462; Thomas W. Cissell, Worcester, Mass. (a) $71,500, (b) $72,500; W. F. Brent, Norfolk, Va. (a) $67,573, (b) $68,173; Wise Granite & Construction Company, Richmond, Va. (a) $71,800.

★**Charleston, W. Va.**—Contract for erecting $60,000 addition to St. Francis Hospital on Laidley Street, awarded W. A. and J. A. Abbott, of Charleston.

★**Raleigh, N. C.**—Contract for erecting 2-story brick school awarded J. M. Kennedy, care School Board. Cost, including heating and plumbing, $48,000. G. Rosenthal, Secy. School Board, P. O. Box 386.

★**Shelby, N. C.**—Contract for constructing U. S. Post Office awarded Chandler & Campbell Construction Co., Chattanooga, Tenn., at $47,600.

★**Yazoo City, Miss.**—Contract for erecting high school awarded Burks Construction Co. of Hattiesburg, at $30,190.

★**Delaware, Ohio.**—Contract for erecting Brown Township, Delaware County, centralized school awarded Martin Construction Company, 74 West Washington Street, Chicago, Ill.

★**Brazil, Ind.**—Contract awarded March 1 by School Board to William Urban of Brazil for erecting Senior High School, at $57,143.

★**Vincennes, Ind.**—Contract for erecting high school (bids opened March 1) awarded by Board of Education (J. M. McCay, Secy.), to F. F. Willis, Vincennes, at $102,300.

★**Buckley, Ill.**—Contract for erecting edifice for Evangelical Lutheran Church (bids opened March 3) awarded H. J. Kaiser, Fort Wayne, Ind., at $31,974. J. M. Gross, Secy. Bldg. Com.

★**Rockford, Ill.**—Following are four lowest bids opened March 2 by County Commissioners for erecting addition to court house and jail:

General Contract—C. E. Carson Co., Chicago, Ill., $149,925 (awarded contract); English Brothers, $157,750; W. M. Allen Son & Company, $158,011, and Hanson Brothers, $158,854.

Plumbing—Dailey & O'Brien, Peoria, $19,500 (awarded contract); John O'Neill & Sons, $21,655; J. Albin Nilson, $22,000; W. T. Delahunty & Co., $22.500.

Heating—Dailey & O'Brien, $19,500 (awarded contract); Hanley-Casy Co., $20,887; G. A. Sandeen & Co., $20,960; Rockford Sodeman Heating & Plumbing Co., $21,647. Steel Work—Van Dorn Iron Works Co., Cleveland, Ohio, $41,281 (awarded contract); Pauly Jail Bldg. Co., St. Louis, Mo., $43,300, and Stewart Iron Works, $43,987.

Oshkosh, Wis.—Following are lowest bids opened March 1 by Board of Regents, Madison, for erecting the superstructure of the first unit of the addition to the Oshkosh Normal School: General construction, J. B. Cullen Company, Janesville, $69,850; plumbing and heating, American Htg. Company, Superior, $4,297 and $7,500 respectively.

★**Ashby, Minn.**—Contract awarded National Construction Co., Alexandria, for erecting high school (bids opened Feb. 29). L. J. Hauge, Secy. School Board.

★**El Centro, Cal.**—Following are bids opened recently for erecting 2-story concrete, steel and terra cotta high school: George Herz, El Centro, $80,318 (awarded contract); Brown & DeCew, San Diego, $84,995, and H. H. Peterson, Imperial, $90,643. S. B. Zimmer, Archt., El Centro, Natl. Bank Building.

PRIVATE BUILDINGS

PROPOSED WORK.

Brattleboro, Vt.—Herbert G. Barber, Attorney General of Vermont, will erect a fireproof 5-story 100 x 127 ft. business building costing $100,000.

Cambridge, Mass.—The Oranam Council of Knights Columbus have had plans prepared by Matthew Sullivan, Boston, Mass., for a three-story and basement building costing $60,000.

Fall River, Mass.—James E. O'Conner, care of Fall River Natl. Bank, will erect a 5-story brick business building on Main Street; cost $75,000.

Albert Steiger Company, 345 Main Street, will erect a brick store building on Main Street to cost $100,000.

Middletown, Conn.—Middletown Natl. Bank intends erecting a brick and marble bank building, 107 x 36 ft. W. P. Crabtree, Archt., New Britain.

Buffalo, N. Y.—Contract soon to be let for 6-story concrete warehouse which Frederick F. Nye, of the Cold Spring Storage Co., 1432 Main Street, intends erecting at Main and Balcom Street; cost approximately $100,000.

Brooklyn, N. Y.—Plans prepared by Parfitt Brothers, 26 Court Street, for Congregational Home for the Aged of New York, four stories, fireproof, brick, concrete and steel, to be erected at 123 Linden Avenue; cost $100,000.

Ludlow & Peabody, 101 Park Avenue, New York, retained to prepare plans for proposed Y. M. C. A. building for Carlton Avenue Branch at Carlton Avenue and Fulton Street.

Maximilian Zipkes, 405 Lexington Avenue, New York, completed plans for 5-story store and apartment building to be erected at Seventeenth Street and Fourth Avenue for L. Rosenberg, 189 Montague Street; cost $50,000.

New York, N. Y.—Plans filed for erecting following buildings: 5-story brick tenement at 170th St. and Haven Ave. for Charles Lippman; cost $50,000, J. M. Felson, Archt., 1133 Broadway; two 5-story brick tenements at 138-150 Haven Ave. for Alto Realty Company, Inc.; total cost $200,000; Rouse & Goldstone, Archts., 38 West 32d St.; 8-story fireproof warehouse at 641 West 21st St. for Mrs. Mary Sherman; cost $90,000; Paul C. Hunter, Archt., 191 Ninth Ave.; 12-story fireproof warehouse at 104 Greene St. for Peter W. Rouss; cost $300,000; Low-Parker Engineering Co., Archts., 45 Broadway; 6-story fireproof store and loft building at 27 West 33d St., for Farmers Loan & Trust Company: cost $150,000; J. Francis Burrowes, Archt., 410 West 34th St.; 5-story fireproof steam power house at 172 Water St. for Kenneth Stevenson; cost $370.000; Starrett & Van Vleck, Archts., 8 West 40th St.; 5-story brick tenement at 166th St. and Woodycrest Ave. for Bagot Realty Company; cost $75.000; Wortmann & Braun, Archts., 114 East 28th St.; 5-story brick tenement at 197th St. and Briggs Ave. for Mittner Bros., Inc.; cost $60,000; John P. Boyland, Archt., 2526 Webster Ave.; three 5-story brick tenements at 184th St. and Grand Ave. for Mercedes Building Company; total cost $150,000; John P. Boyland, Archt., 2526 Webster Ave.; two 5-story brick tenements at 165th St. and Bryant Ave. for Washington Place Building Company; total cost $110,000. Gronenberg & Leuchtag, Archts., 303 Fifth Ave.

Plans completed by Kenneth M. Murchison, 101 Park Avenue, for an eight-story annex to Santos Building at Pine and Front Streets.

Whitestone (P. O. Flushing), L. I., N. Y.—Revised plans being prepared by James S. Maher, 431 West Fourteenth Street, New York, for three-story brick parochial school containing 12 classrooms and auditorium for St. Luke's Roman Catholic Church; cost $100,000. Rev. Thomas J. O'Brien, Pastor.

Jersey City, N. J.—H. Uslan, Jersey City, will erect a 4-story brick apartment house on Prospect Street and Baldwin Avenue to cost $40,000.

Passaic, N. J.—North Reformed Church, Jefferson Street and Hamilton Avenue, plans erecting Bible school and parish house addition, to cost about $25,000. Rev. Willard Dayton Brown, Pastor.

Harrisburg, Pa.—Bell Telephone Company plans to erect an office building. Shirley B. Watts, Local Manager.

Monessen, Pa.—Plans being prepared by J. A. Lohman, Monessen, for a public market house contemplated on Donner and First Sts.; probable cost $50,000.

Philadelphia, Pa.—Presbyterians of Philadelphia propose erecting a new edifice for the Ontario Presbyterian Congregation on Ontario and H Streets.

Pittsburgh, Pa.—Plans being prepared by Ellsworth Dean, 331 Fourth Avenue, for remodeling and enlarging East End Christian Church, at Highland Avenue and Adler Street; cost $40,000.

Plans being prepared by Janssen & Abbott, Century Building, for six-story and loft building to be erected at Liberty Avenue and Twelfth Street; cost about $50,000.

West Leesport, Pa.—Plans completed for $65,000 edifice to be erected for Berne Union Church.

Baltimore, Md.—James R. Edmunds, Jr., 12 East Read Street, is architect for $100,000 country house to be erected in Worthington Valley for C. Wilbur Miller, Garrett Building.

Knights of Pythias Lodge, Gay and Lexington Streets, intends erecting new building at Charles and Preston Streets, to cost about $150,000. Richard Lee Laws, Chairman Building Committee.

Plans filed by C. Warner Stork, The Rochambeau Apartments, for a 4-story brick and terra cotta apartment house to be erected on University Parkway and 37th Street, at an approximate cost of $45,000.

Wilmington, Del.—J. J. Kennedy, Ford Building, is architect for 5-story brick, reinforced and terra cotta store building to be erected at 612 Market Street for Baunstein & Co.

Fairmont, W. Va.—Contract will soon be let for erecting one-story stone Presbyterian Church to cost about $75,000. W. H. Nicklas, Archt., 1900 Euclid Avenue, Cleveland, Ohio.

Milburn, Heister & Co., Union Saving Bank Building, Washington, D. C., engaged by Fairmont Hotel Co. to prepare plans for a hotel 150 rooms, to cost $350,000. Plans will be completed in about 60 days.

Huntington, W. Va.—West Huntington Methodist Church will erect brick and stone church and Sunday School building on Jefferson Avenue; cost $30,000.

Moundsville, W. Va. — St. Francis Xavier's Roman Catholic Church contemplates erecting one and two-story brick and stone church on Jefferson Street; probable cost $46,000.

Wheeling, W. Va.—Plans prepared by F. F. Faris, Schmulbach Building, for $25,000 edifice to be erected for Trinity Lutheran Church.

Plans are being prepared for church and parish house to be erected for St. Paul's Methodist Episcopal Church; cost $40,000.

Atlanta, Ga.—Barnwell & Barnwell, Chattanooga, Tenn., are architects for 12-story 90 x 125 ft. office building for Volunteer State Life Insurance Company, and F. E. Markel, Atlanta, Ga., engineer for mechanical work.

Louisville, Ky.—Audubon Country Club, Prestonia, considering plans for rebuilding clubhouse recently destroyed by fire.

Canton, Ohio.—Tentative plans prepared for proposed $50,000 building to be erected for Elks Lodge.

Lakewood, Ohio.—J. W. C. Corbrusier, Lennox Building, Cleveland, is architect for $30,000 brick and stone edifice to be erected for Episcopal Church of the Ascension.

Lima, Ohio.—Lodge No. 54, B. P. O. Elks, intends erecting $50,000 addition.

Indianapolis, Ind.—Scottish Rite Masons propose erecting this summer or fall a stone temple at North and Meridian Streets costing $750,000.

Michigan City, Ind.—St. Stanislaus Polish Congregation will erect a church on Washington and Ann Streets to cost $75,000. Rev. Joseph Bolka, Pastor.

South Bend, Ind.—The Knights of Pythias propose erecting a $75,000 lodge building. Address Crusade Lodge, K. of P.

Detroit, Mich. — A Roman Catholic Church, to be known as St. Theresa, will be erected at Quincy and Blaine Avenues, to relieve St. Leo's Parish; cost about $30,000.

Belleville, Ill.—White Antler Lodge No. 1221, Loyal Order of Moose, contemplating erecting $35,000 clubhouse.

Chicago, Ill.—Plans prepared for 3-story store and apartment building to be erected at Drexel Boulevard and Forty-seventh street for Sherman T. Cooper, 8 South Dearborn Street; cost $200.000.

Plans prepared by Alfred L. Alschuler, 28 East Jackson Boulevard, for 10-story, 143 x 125-ft. mercantile building, to be erected at Jackson Boulevard and Racine Avenue for Eiger & Bros.; cost $200,000.

Sterling, Ill.—Sterling Wholesale Grocery Company will erect a 2-story and basement 60 x 160 ft. brick and tile warehouse.

Milwaukee, Wis. — Preliminary plans being prepared, by Fitzhugh Scott, 424 Jefferson Street, for three-story and basement, 80 x 84 ft. residence to be erected on Terrace Avenue for Dr. Charles E. Albright; cost about $80,000.

Rhinelander, Wis.—Plans prepared by H. T. Liebert, Wausau, for four-story, 50 x 140 ft. hotel, with tile and terrazza floors, which the Rhinelander Hotel Co. (E. O. Barstow, Secretary) intends erecting.

Fort Madison, Iowa. — Fort Madison Produce and Storage Co. will erect new building, to cost about $40,000.

Sioux City, Ia.—Plans approved for new edifice to be erected for Trinity Lutheran Church; cost $80,000.

St. Paul, Minn.—Tentative plans prepared by Charles A. Pear, 509 Pittsburgh Building, for four-story and basement lodge building contemplated by Loyal Order of Moose.

Plans prepared by Charles S. Frost, 105 S. La Salle Street, Chicago, Ill., for proposed passenger station approved by Directors of St. Paul Union Depot Co. (W. C. Armstrong, Ch. Engr.).

L. T. Leach, 1522 North Meridian Street, Indianapolis, Ind., has had plans prepared for a combined store, office and theater building to be erected on Sixth, Seventh and St. Peter Streets, St. Paul.

Lincoln, Neb.—Plans approved for a $200,000 Masonic temple by the Masonic Temple Building Assoc.

Butte, Mont.—Reported plans completed for brick and stone depot, concrete foundations, which the Chicago, Milwaukee & Puget Sound Railway Co. (C. F. Loweth, Ch. Engr., Chicago, Ill.) intends erecting; cost $140,000.

Kansas City, Mo.—Kansas City Club, (Charles S. Winters, Secy.), 12th and Wyandotte Sts., intends erecting ten or twelve story building.

H. D. Lee Mercantile Company, Kansas City, contemplates erecting ten-story mercantile building.

Helena, Ark.—Plans to be prepared by S. J. Weigel, Central Bank Bldg., Little Rock, for a flat to be erected by B. C. Founcey; cost $25,000.

Shawnee, Okla.—Pioneer Telephone & Telegraph Co., Bell and Main Streets, will erect two-story office and exchange building, costing $100,000.

Tacoma, Wash.—Reported plans being prepared by B. Marcus Priteca, Pantages Building, Seattle, for Pantages Theatre, which Alexander Pantages intends erecting on site of old Star Theatre; cost about $70,000.

Portland, Ore.—Contract will be let about April 1 for proposed $100,000 labor temple to be erected on Fifth and Main Streets under direction of Central Labor Building Association. Houghtaling & Dougan, Architects, Henry Building.

R. F. Wassel, 204 East Fifteenth Street, will erect apartment house at Fourteenth and Clay Streets, costing $125,000.

Specifications about completed for $250,000 bank building to be erected on Sixth and Stark Streets for United States National Bank.

Porterville, Cal.—Plans prepared by B. E. Remmel, 251 Kearney Street, San Diego, for brick theater to be erected this spring for Mrs. Edith Williams; cost $50,000.

San Bernardino, Cal.—Contract will be let about May 1 for erecting two wings about 65 rooms, bath house, garage for fifty cars and alterations to Arrowhead Hotel (George Nickerson, Prop.); cost $100,000.

Selma, Cal.—Plans to be prepared by Robert H. Orr, 1301 Van Nuys Bldg., Los Angeles, for a brick church for First Christian Congregation.

Tucson, Ariz.—Steinfeld & Co. will erect a hardware and warehouse building costing $40,000.

Vancouver, B. C.—Plans prepared for 4-story, 100 x 132-ft. theatre and office building to be erected on Broadway and Main Street for National Amusement Co. (W. P. Nichols, Managing Director), Vancouver; cost $80,000.

BIDS DESIRED.

Philadelphia, Pa.—Reported desired until March 21 by Andrew J. Sauer, Architect, 1112 Chestnut Street, for erecting a 5-story fireproof commercial building, 50 x 108 ft., for R. A. Heyman & Bro.

Suffolk, Va.—Reported desired until April 15 by Rosell Edward Mitchell, Archt., Norfolk, for erecting 7-story bank and office building for National Bank of Commerce. Probable cost $85,000.

Fairmont, W. Va.—Reported desired until March 30 by W. H. Nicklas, Archt., 608-1900 Euclid Building, for erecting one story and basement, 80 x 120 ft., edifice for the First Presbyterian Congregation. Probable cost $75,000.

Akron, Ohio.—Reported desired until May 1 by Harvey Baker, Chmn., Building Committee, 1114 Sixth Avenue, Akron, for erecting one and two-story, 90 x 100 and 30 x 40-ft. church and parsonage for Arlington Street Baptist Congregation. Probable cost $50,000. A. B. Jennings, Archt., 324 Broadway, New York City.

Elyria, Ohio.—Reported desired until April 1 for erecting 10-story and basement, 45 x 70 ft., bank and office building for Lorain County Banking Co. Probable cost $250,000. Walker & Weeks, Archts., 1900 Euclid Building, Cleveland.

Monroe, Wis.—Reported desired until March 20, for erecting 2-story and basement brick school and sisters' residence for St. Victor's Catholic Congregation. Rev. Thomas Dempsey, Pastor. Frank H. Kemp, Archt., Beloit.

Garner, Iowa.—Until March 22, by Farmers' National Bank (Isaac Sweigard, Pres.), for erecting bank building. Broaten & Mincey, Archts., 212 First National Bank Bldg., Mason City, Iowa.

Slayton, Minn.—Until March 24, by O. L. Vite, for erecting a moving picture theater. W. E. E. Greene, Archt., Luverne.

Cogswell, Neb.—Until March 25, by Farmers' & Merchants' Bank (A. B. Carlson, Cashier), for erecting a brick bank on Lot 6 in Block 7.

Sioux Falls, S. D.—Reported desired until April 1 by Bishop O'Gorman for erecting cathedral, 177 x 121 ft. Probable cost $200,000. E. L. Masqueray, 595 Endicott Arcade, St. Paul.

Clinton, Okla.—Until March 22, by Lon L. Covin, Clinton Amusement Co., for erecting theater at Clinton. Baily & Baily, Archts., 616 Colcord Building, Oklahoma, Okla.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Albany, N. Y.**—Contract for 1400 tons of steel required for Ten Eyck Hotel awarded Ferguson Steel & Iron Co., 1399 Bailey Avenue, Buffalo.

★**Gallup, N. M.**—Contract awarded William Simpson, Construction Company, 527 Marsh Story Building, Los Angeles, Cal., to erect concrete, brick, steel and frame roundhouse, power house, machine shops, etc., for Atchison, Topeka & Santa Fé Ry., cost about $115,000.

★**New York, N. Y.**—Contract awarded Gillies-Campbell Co., 101 Park Avenue, for erecting 6-story, 100 x 100 ft., brick telephone exchange building at 208 East Seventy-ninth Street for New York Telephone Co., 15 Dey Street; cost $150,000. McKenzie, Voorhees & Gmelin, Archts., 1123 Broadway.

★Contract awarded William Crawford, 5 East Forty-second Street, for erecting 4-story, 74 x 145 ft., brick and concrete loft building at King and Washington Streets for Eugene Langdon Estates, 155 Madison Avenue, Morristown, N. J.; cost $150,000. Warren & Wetmore, Archts., 164 East Forty-seventh Street.

★**Bala, Pa.**—Contract awarded William J. McShane, 413 South Thirteenth Street, Philadelphia, for erecting three-story, stone parochial school for St. Matthias Roman Catholic Church. George I. Lovatt, Archt., 416 Walnut Street, Philadelphia.

★**Philadelphia, Pa.**—Contract awarded by John Wanamaker to William Steele & Sons, 1600 Arch Street, for erecting a garage and distribution station.

★Contracts for erecting ten-story, 80 x 160 ft., stone, brick, terra cotta, concrete and steel service building at 329 South Broad Street, for Pennsylvania Taximeter Company awarded as follows: General construction, Cramp & Company, Denckla Building; plumbing, Louis Wanner, Jr., 1723 Ludlow Street; electrical work, Cates & Shepard, 1516 Sansom Street; steam heating and vacuum cleaning apparatus, Philadelphia Steam Heating Company, Juniper and Cherry Streets. Carl P. Berger, Archt., Penn Square Building.

★Contract awarded William H. Eddleman & Sons, 453 Green Lane, Roxborough, Philadelphia, for erecting five-story, concrete and steel warehouse for John Lang Paper Company at Twenty-fourth and Wood Streets; cost $40,000.

★Contract awarded Ketcham & McQuade, 1029 Brown Street, for erecting brick, stone, concrete and terra cotta theatre building at Germantown Avenue and Venango Street for J. Effwager; cost $125,000. Hoffman Company, Archts., Globe Theatre Building.

★**Wilmington, Del.**—Contract for erecting 2-story brick, steel and concrete stable, 32 x 102 ft. at Thirteenth and Lincoln Streets for William Freihofer Baking Company, awarded Philip Haibach Contracting Company, Twenty-sixth and Thompson Streets, Philadelphia. Peuckert & Wunder, Archts. & Engrs., 310 Chestnut Street, Philadelphia, Pa.

★**New Orleans, La.**—Reported contract awarded Realty Construction Company of Birmingham, Ala., for erecting annex to Maison-Blanche department store, Canal and Dauphine Streets; cost $125,000.

★**Cincinnati, Ohio.**—Contract awarded Roche-Bruner Building Co., 609 Johnston Building, for erecting six-story building for S. P. Nelson & Sons, on Fourth Street; cost about $45,000.

★**Zanesville, Ohio.**—Contract reported awarded R. H. Evans & Co., Columbus Savings & Trust Building, Columbus, for erecting five-story Knights of Pythias Lodge building; cost $70,000. Harry Meyer, Archt., 601 Peoples Bank Building.

★**Elkhart, Ind.**—Contract awarded J. C. Bontrager, Elkhart, for erecting a brick 3-story office building on Marion and Main Streets, to cost $35,000.

★**Omaha, Neb.**—Contract awarded Selden-Breck Construction Company, 1820 Douglas Street, for erecting 7-story fireproof hotel on Farnam and Nineteenth Streets, for Dr. Harold Gifford. Cost, complete, about $700,000.

★**St. Louis, Mo.**—Contract for erecting St. Vincent's German Catholic Orphan Home awarded Ratermann Building & Construction Co., 1943 St. Louis Avenue; cost approximately $200,000.

★Contract awarded Murch Brothers Construction Company, Railway Exchange Building, for erecting two-story and basement, 48 x 64 ft. Bell telephone exchange building for Southwestern Telegraph & Telephone Company at Elm and Lockwood Avenues, Webster Groves; cost $30,000.

★**Helena, Ark.**—Contract awarded H. F. Doyle, Cotton Plant, for erecting a fireproof reinforced concrete warehouse for Interstate Grocer Company; cost, $35,000.

★**Los Angeles, Cal.**—Contract awarded Atlas Building Company, 911 Haas Building, for a 4-story brick apartment house at Seventh and Rampart Streets, for J. H. Smalies and C. C. C. Tatum.

NEW INDUSTRIAL PLANTS

PROPOSED WORK.

Skowhegan, Me.—Clyde H. Smith, Skowhegan, is architect for the shoe factory to be erected by Bell Brothers.

Baltic, Conn.—Plans prepared for 3-story, 84 x 220-ft. mill, to be erected by Baltic Mills Company.

Middletown, Conn|—Russell Mfg. Company is planning erecting a two-story 80 x 200 ft. reinforced concrete addition.

Norfolk, Conn.—Norfolk Mfg. Company, Norfolk (H. A. Denney, Pres.), will erect a two-story brick factory, 50 x 100 ft., to manufacture steel clamps, etc.

Brooklyn, N. Y.—F. W. Wurster & Co., 375 Kent Avenue, contemplates erecting brick and concrete iron working plant at Kent Avenue and South Sixth Street; probable cost $60,000.

Maspeth (P. O. Flushing), L. I., N. Y.—Plans prepared by Joseph W. Weiss, 16 Court Street, Brooklyn, for four-story brick and concrete factory to be erected on Grand Street for Van Cott Realty Co.; cost $200,000.

Ossining, N. Y.—Charles G. Washburn, Middle Dock, Ossining, contemplates erecting one-story, 500 x 150 ft. brick factory; cost about $50,000.

Gloucester, N. J. — Welsbach Company, Gloucester, will erect a three-story brick, concrete and steel fluid factory.

Perth Amboy, N. J.—Contract will soon be let for erecting 4-story brick, reinforced concrete and steel, 80 x 100 ft., cigar factory for Bayuk Bros. E. Allen Wilson, Architect, 1208 Chestnut Street, Philadelphia, Pa.

Jenkinstown, Pa.—Cambria Steel Company will make extensive improvements.

Johnstown, Pa.—Midvale Steel & Ordnance Co. reported contemplating extensive improvements to plant of Cambria Steel Co., recently taken over.

New Castle, Pa.—Reported extensive improvements contemplated by Carnegie Steel Company to the local plant.

Philadelphia, Pa.—Plans being prepared by Frank E. Hahn, 1112 Chestnut Street, for five steel, brick and concrete buildings to be erected at Mifflin Street wharf for Mifflin Chemical Corporation.

Ballinger & Perrot, Methodist Building, are architects for six-story, brick and stone factory to be erected for William P. Datz & Brothers, Sixth and Summer Streets.

Frostburg, Md.—Plans of George F. Sansbury, Cumberland, approved for three-story addition to Parker Hosiery Mills.

Wilmington, Del. — Reported National Tube Company, Pennsylvania Building, Philadelphia, Pa., will erect plant here.

Augusta, Ga.—Contract soon to be let by Augusta Compress & Warehouse Co. for erecting compress and warehouse buildings; also concrete truck ways and sprinkler equipment. G. Lloyd Preacher, Archt., Augusta.

Berryton, Ga.—Reported Berryton Mills will erect two-story, 120 x 100 ft., mill addition costing $20,000, and will install 6000 spindles with accompanying machinery costing $65,000.

Fostoria, O.—Seneca Wire & Manufacturing Co., Fostoria, intends erecting additional buildings and installing additional equipment.

Warren, Ohio.—Reported Trumbull Steel Co. contemplates erecting open hearth steel plant here.

Fort Wayne, Ind.—Horton Manufacturing Co. (J. C. Peters, President), Fort Wayne, contemplates enlarging plant.

Rock Island, Ill.—Tri-City Railway Co. of Illinois (J. Mundy, General Superintendent, Matherville) intends erecting car shops here, 2 stories, of brick, steel and concrete construction; estimated cost about $80,000. Erection of an inn costing $100,000 also contemplated.

Springfield, Ill.—The Sangamo Electric Company, Eleventh Street and Converse Avenue, will erect a brick and stone factory costing $100,000; 75 per cent. of the walls will be of glass with steel sashes. Contract for steel awarded Jerome Burtle Company, Springfield.

Beloit, Wis.—Berlin Machine Works (Porter B. Yates, President) contemplates erecting 2-story, 283 x 265-ft. brick and steel fireproof addition at Roosevelt and Barrett Avenues.

Milwaukee, Wis.—Plans being prepared by Armond D. Koch, 1045 Wells Building, for brick and steel factory which the Wisconsin Iron & Wire Works, 186 East Water Street, intends erecting on Booth and Franklin Streets; cost about $40,000.

St. Louis, Mo.—Lowell Bleachery, 3807 Laclede Avenue, will erect four-story bleaching house at 500 East Schirmer Street; cost $48,000.

Foreman, Ark.—Erection of $2,000,000 cement plant contemplated here. C. E. Oxford, 220 South State Street, Chicago, Ill., may be able to give information.

Paragould, Ark.—House-Jones Grain Company will erect a 110 bbl. capacity flour mill and a grain warehouse.

Denver, Colo.—Mountjoy & French, Chamber of Commerce Building, are architects for five-story brick and stone addition to be erected to plant of Beatrice Creamery Company, at Eighteenth and Wynkoop Streets.

Seattle, Wash.—Reported Chevrolet Automobile Co. will erect a distributing and assembling plant here. W. S. Dulmage, Distributor Northwest District, Seattle, may be able to give information.

Los Angeles, Cal.—R. H. Arnold, 830 McGarry Street, will erect a 3-story and basement brick factory at Ninth and McGarry Streets, to be leased to California Orange Jelly Company. W. J. Wilson, Mgr.

Tucson, Ariz.—Tuscon Copper Mining & Milling Company (M. King, local agent, Tucson), will erect a concentration plant at the Chist mine, 10 miles from Oracle, in the Catalinas. A smelter will be erected later.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Providence, R. I.**—Contract awarded Turner Construction Co., 11 Broadway, New York for erecting 4-story, 40 x 160 ft., reinforced concrete and brick curtain walls machine shop for Beaman & Smith Co., 20 Gordon Avenue. Jenks & Ballou, Archts.

★**Niagara Falls, N. Y.**—Monarch Engineering Co., Buffalo, secured contract for tanks and machinery for the two fireproof concrete wheat storage buildings for the Shredded Wheat Co. at their plant.

★**Jersey City, N. J.**—Contract awarded Turner Construction Co., 11 Broadway, New York, for erecting 7-story, 75 x 100 ft., reinforced concrete addition to plant of Union Terminal Cold Storage Co., Thirteenth and Provost Streets.

★**Newark, N. J.** — Contract awarded Frederick Kilgus, 13 South Sixth Street, for erecting chemical manufacturing plant on Blanchard Street for Seaboard Chemical Co.; cost $36,000. Frederick A. Phelps, Archt., 920 Union Building.

★**Trenton, N. J.**—Contract awarded Harrison C. Rea Company, 1027 Wood Street, Philadelphia, Pa., for erecting three-story, reinforced concrete and steel mill for W. F. Taubel.

★**Philadelphia, Pa.** — Contract awarded E. E. Hollenbach, Inc., Fifteenth and Race Streets, for erecting two-story, reinforced-concrete and steel machine shop for Earle Gear & Machine Company, at Stenton and Wyoming Avenues.

★**Seattle, Wash.**—Contract awarded H. D. Stewart, American Bank Building, for erecting a compressor building at Spokane Street at $21,668. J. R. West, Chief Engineer Port Commission (bids opened March 1).

MISCELLANEOUS

PROPOSED WORK.

Park Improvement — Boston, Mass.—Plans prepared for improvement of Strandway, in South Boston; cost $575,000. Plans contemplate reclamation of 75 acres of land, creation of 66 acres for a playground, construction of roadway to connect Columbia Road with Old Colony Boulevard and readjustment of sewer outlets. Address Mayor, Boston.

New York, N. Y.—Board of Estimate voted $150,000 to be used by Health Commissioner Gacen Emerson in work of exterminating mosquito breeding places in marsh lands about Jamaica and Flushing Bays in Brooklyn and Queens.

Park Bonds — Massillon, Ohio. — Park bonds for $25,000 will be sold April 10, by R. J. Krisher, City Auditor.

Subway—Montreal, Que.—Reported constructing a subway under Lachine Canal on Wellington Street is under consideration by Board of Control. If built the cost will be about $1,200,000 and will probably be shared between city of Montreal, Dominion Government, city of Verdun and Tramways Company.

BIDS DESIRED.

Road Oil — Waterbury, Conn.—Until March 21 by Board Public Works (W. E. Kennedy, Supt. of Streets) for furnishing 175,000 gal. asphaltic road oil, to be delivered on request of Superintendent of Streets, Waterbury, Street Dept. Siding, in tank cars, of either 6000 or 10,000 gal. capacity.

Road Oil, etc.—New York, N. Y.—Until March 27, by Douglas Mathewson, Pres. Boro. Bronx, for furnishing and delivering 7000 cu. yd. grit, 400,000 gal. tar road oil and 2000 cu. yd. paving sand.

Road Oil—West Orange, N. J.—Until March 31 by George W. Foster, Town Clk., for 100,000 gal., more or less, road oil, delivered at Erie Freight Yard, West Orange.

Hoists and Tanks—Washington, D. C. Until March 21, by Bureau Supplies and Accounts, Navy Department, Washington, D. C., for delivering chain hoists and steel tanks at Navy Yard.

Pipe, Crushed Rock, Etc.—Charleston, S. C.—Until April 14, by Street Department, for furnishing city of Charleston for year 1916 with terra cotta pipe, bricks, crushed rock, iron casting, etc.

Cement.—Louisville, Ky.—Until April 15, by U. S. Engineer Office, Louisville, for furnishing and delivering American Portland cement for Dam 43 Ohio River, advertised in Engineering Record.

Road Oil, etc.—Dayton, Ohio.—Until April 1, by County Commissioners (Walter H. Aszling, Clk.), for 5220 cu. yd. excav., 800 lin. ft. guard rail and 7000 gals. road oil.

Fire Escapes—Lowellville, Ohio.—Until March 27 by W. J. Maurice, Clk. Board Education, for fire escapes, etc., for School Dist. W. G. Eckles, Archt., New Castle, Pa.

Cement—Chicago, Ill.—Until March 21, by Thos. O'Connor, Fire Marshall, for furnishing building cement to city for use of Fire Dept. of year ending Dec. 31, 1916.

Road Oil—Chicago, Ill.—Until March 23, by Department Public Works (W. R. Moorhouse, Comr.), for furnishing and delivering Grade "A" and Grade "B" road oil for use of Bureau of Streets.

Excavating, etc.—Chicago, Ill.—Until March 21, by West Chicago Park Comrs. (Timothy Cruise, Chmn.), for excav. approximately 204,000 cu. yd. clay and 67,000 cu. yd. black soil and doing certain grading in Austin Park site.

Road Oil.—St. Paul, Minn.—Until April 3, by County Commissioners for 50,000 gal. or more 40 per cent asphalt oil to be furnished f.o.b. St. Paul or vicinity. Geo. J. Reis, Co. Aud.

Road Grader, Etc.—Windom, Minn.—Until Mar. 31 by Ole Osland, Chmn. County Comrs., at office of S. A. Brown, Co. Aud., for one elevating road grader, corrugated culverts, etc.

Elevators—Talmage, Cal.—Reported desired until March 28 by W. F. McClure, State Engr., Forum Building, Sacramento, for electric elevators, etc., for Mendocino State Hospital at Talmage.

Road Oil—Barrie, Ont.—Until March 30 by J. S. Laing, Town Egr., for road oil for year 1916.

Motor Driven Flushers—Ottawa, Ont.—Until March 28 by Secretary Board Control, addressed to Chairman and Members of Board Control, for two motor-driven flushers. F. C. Askwith, Acting City Engr.

Crushed Stone—Toronto, Ont.—Reported desired until March 28 for annual supply of crushed stone and treated wood block. R. C. Harris, Works Commissioner.

PRICES AND LETTINGS.

★Indicates award of contract.

★Cement — Ventura, Cal. — Contract awarded California Portland Cement Co., American Bank Building, Los Angeles, for furnishing 75,000 bbl. cement at $1.33 per bbl.

★Lumber—Alaska.—Contract for furnishing 1500 M ft. of lumber for use of the Alaska Railway Commission, Bell Street Wharf, Seattle, Wash., in construction of the Government Railroad in Alaska awarded J. M. Farrell, Leary Building, Seattle, at $32,197.

Proposals

For Proposals Advertised, See Pages 46 and 47.

WATERWORKS.

Bids Close.		See Eng. Record.
Mar. 20.	Water Works, Polson, Mont. Adv. Feb. 26.	Feb. 26
Mar. 20.	Pumps and Engines, Macon, Ga. Adv. Mar. 11.	Mar. 11
Mar. 21.	Tank, Ely, Minn.	Mar. 4
Mar. 21.	Contract 120, New York, N. Y. Adv. Mar. 4, 11.	Mar. 4
Mar. 21.	Well, Asbury Park, N. J.	Mar. 18
Mar. 22.	Add. to Pump Sta., New Orleans, La.	Feb. 6
Mar. 22.	Centrifugal Pump. Mach., Lancaster, Pa. Adv. Feb. 26.	Feb. 26
Mar. 22.	Pipe, Etc., Aberdeen, Wash.	Mar. 18
Mar. 22.	Pipe, Etc., Rochester, N. Y.	Mar. 18
Mar. 23.	Water Works, Batavia, N. Y. Adv. Mar. 4.	Mar. 4
Mar. 24.	Steel Tank Tower, Etc., Emporia, Kan.	Mar. 11
Mar. 27.	Water Works, Wilson, N. C. Adv. Feb. 26, Mar. 4.	Feb. 26
Mar. 27.	Water Works, Lakeland, Fla.	Mar. 11
Mar. 27.	Mains, Etc., Willmar, Minn.	Mar. 18
Mar. 27.	Pumps, St. Paul, Minn.	Mar. 18
Mar. 29.	Valves, Etc., Baltimore, Md. Adv. Mar. 11.	Mar. 11
Mar. 29.	Mains, valves, etc., Cincinnati, O.	Mar. 18
Mar. 30.	Water Works, South Boston, Va. Adv. Feb. 26, Mar. 4.	Feb. 26
Mar. 30.	Water Works, Ocala, Fla.	Mar. 11
Mar. 30.	Water Works, Ocala, Fla. Adv. Mar. 18.	Mar. 18
Mar. 31.	Waterworks, St. Mary's Ont.	Mar. 18
Mar. 31.	Pipe, Etc., Panama	Mar. 18
Apr. 8.	High Pressure Fire System, Indian Head, Md.	Mar. 11
Apr. 1	Mains, Cullman, Ala.	Jan. 15
Apr. 3.	Reservoir, Norristown, Pa.	Mar. 18
Apr. 10.	Filtration Plant, Florence, Ala. Adv. Mar. 18.	Mar. 18
Apr. 11.	Water works, Rector, Ark. Adv. Mar. 18.	Mar. 18
———	Pipe Line, Trinity, Tex. Adv. Feb. 5.	Feb. 5

SEWERAGE AND SEWAGE DISPOSAL.

Bids Close.		See Eng. Record.
Mar. 21.	Columbus, Ohio	Mar. 4
Mar. 21.	Michigan City, Ind.	Mar. 11
Mar. 21.	Walla Walla, Wash.	Mar. 18
Mar. 21.	Northwood, Iowa	Mar. 18
Mar. 21.	Kenwood Park, Iowa	Mar. 18
Mar. 22.	New Bedford, Mass.	Mar. 11
Mar. 22.	Keota, Iowa	Mar. 11
Mar. 22.	Chicago, Ill.	Mar. 18
Mar. 23.	Batavia, N. Y. Adv. Mar. 4.	Mar. 4
Mar. 23.	Chicago, Ill. Mar.	Mar. 18
Mar. 24.	Wapokoneta, Ohio	Mar. 4
Mar. 24.	Oswego, N. Y. Adv. Mar. 18.	Mar. 18
Mar. 25.	Sheboygan Falls, Wis.	Mar. 18
Mar. 27.	Lakeville, Conn. Adv. Mar. 4.	Mar. 4
Mar. 27.	Randolph, Wis.	Mar. 18
Mar. 27.	Salisbury, Conn.	Mar. 18
Mar. 27.	Tonkawa, Okla.	Mar. 18
Mar. 30.	New York, N. Y.	Mar. 11
Mar. 30.	Lakewood, Ohio Adv. Mar. 11, 18.	Mar. 11
Mar. 30.	Litchfield, Minn.	Mar. 18
Mar. 31.	Madison, Wis.	Mar. 18
Mar. 31.	Port Washington, N. Y. Adv. Mar. 18.	Mar. 18
Apr. 1.	Sheboygan Falls, Wis.	Feb. 19
Apr. 1.	North Milwaukee, Wis.	Mar. 18
Apr. 1.	Ada, Ohio	Mar. 18
Apr. 4.	Billings, Mont.	Feb. 19
Apr. 5.	La Fayette, Ind.	Mar. 11
Apr. 5.	Ann Arbor, Mich.	Mar. 18
Apr. 7.	Billings, Mont.	Mar. 18
Apr. 10.	Eustis, Fla.	Mar. 18
Apr. 10.	Madison, Ill.	Mar. 18
May 1.	Amarillo, Tex.	Mar. 18
May 20.	Lyndhurst, N. J.	Mar. 18

BRIDGES.

Bids Close.		See Eng. Record.
Mar. 21.	Illinois	Mar. 4
Mar. 21.	Redwood, Minn.	Mar. 11
Mar. 21.	Morganfield, Ky. Adv. Mar. 11.	Mar. 11
Mar. 21.	Primghar, Iowa	Mar 11
Mar. 21.	Buffalo, Minn.	Mar. 11
Mar. 21.	Sharon Springs, Kan.	Mar. 18
Mar. 21.	Rugby, N. D.	Mar. 18
Mar. 21.	Neillsville, Fla.	Mar. 18
Mar. 21.	Kearney, Neb.	Mar. 18
Mar. 22.	Atlanta, Ga.	Mar. 11
Mar. 22.	Green Bay, Wis.	Mar. 18
Mar. 22.	Sibley, Iowa	Mar. 18
Mar. 23.	Staunton, Va. Adv. Mar. 11, 18.	Mar. 11
Mar. 23.	Chicago, Ill.	Mar. 18
Mar. 24.	Houston, Tex.	Mar. 4
Mar. 24.	Pittsburgh, Kan.	Mar. 4
Mar. 24.	Delphi, Ind.	Mar. 18
Mar. 24.	La Salle, Ill.	Mar. 18
Mar. 24.	Lansing, Mich.	Mar. 18
Mar. 24.	Waukesha, Wis.	Mar. 18
Mar. 24.	Centerville, Iowa	Mar. 18
Mar. 27.	Mankato, Minn.	Mar. 11
Mar. 27.	McMinnville, Ore.	Mar. 18
Mar. 29.	Wausau, Wis.	Mar. 18
Mar. 30.	Hinton, W. Va.	Mar. 18
Mar. 31.	Steel, N. D.	Mar. 4
Apr. 1.	Lewisburg, Pa.	Mar. 18
Apr. 1.	Barbourville, Ky.	Mar 18
Apr. 3.	Santa Barbara, Cal.	Mar. 4
Apr. 3.	Langdon, N. D.	Mar. 18
Apr. 3.	Acme, N. M.	Mar. 18
Apr. 4.	Gettysburg, S. D.	Mar. 4
Apr. 4.	Syracuse, Kan.	Mar. 18
Apr. 4.	Mora, Minn.	Mar. 18
Apr. 5.	Hillsboro, N. D.	Mar. 11
Apr. 5.	Lakin, Kan.	Mar. 18
Apr. 5.	Humboldt, Ia.	Mar. 18
Apr. 5.	Spring Lake, N. J.	Mar. 18
Apr. 6.	Bridgeport, Conn. Adv. Mar. 11.	Mar. 11
Apr. 6.	Miami, Fla. Adv. Mar. 18.	Mar. 18
Apr. 7.	St. Helen, Ore.	Mar. 18
Apr. 8.	Rock Island, Ill.	Mar. 4
Apr. 10.	Rockford, Ill. Adv. Mar. 11.	Mar. 11
Apr. 10.	Marshall, Tex. Adv. Mar. 18.	Mar. 18
Apr. 10.	Columbus, Ohio	Mar. 18
Apr. 11.	Hastings, Minn.	Mar. 18
Apr. 29.	Johnson Creek, Wis.	Feb. 26

PAVING AND ROADS.

Bids Close.		See Eng. Record.
Mar. 20.	Waukesha, Wis. Adv. Mar. 4.	Mar. 4
Mar. 21.	Eldorado, Ark.	Mar. 4
Mar. 21.	Marshall, Minn.	Mar. 4
Mar. 21.	Redwood Falls, Minn.	Mar. 11
Mar. 21.	Easton, Md.	Mar. 11
Mar. 21.	Ritzville, Wash.	Mar. 18
Mar. 21.	Wooster, O.	Mar. 18
Mar. 21.	Elkhart, Ind.	Mar. 18
Mar. 21.	Paterson, N. J.	Mar. 18
Mar. 21.	West Orange, N. J.	Mar. 18
Mar. 22.	Cleveland, Ohio	Mar. 4
Mar. 22.	Lorain, Ohio	Mar. 11
Mar. 22.	Buffalo, N. Y.	Mar. 11
Mar. 23.	Flemington, N. J. Adv. Mar. 4, 11.	Mar. 4
Mar. 22.	Sheldon, Iowa	Mar. 18
Mar. 22.	Brooklyn, N. Y.	Mar. 18
Mar. 22.	New York, N. Y.	Mar. 18
Mar. 22.	Baltimore, Md.	Mar. 18
Mar. 23.	Sigourney, Iowa Adv. Mar. 11.	Mar. 11
Mar. 23.	York, Neb.	Mar. 18
Mar. 23.	New York, N. Y.	Mar. 18
Mar. 23.	Chicago, Ill.	Mar. 18
Mar. 23.	Frankfort, Ky.	Mar. 18
Mar. 24.	Appleton, Wis.	Mar. 11
Mar. 25.	De Land, Fla. Adv. Mar. 4, 11.	Mar. 4
Mar. 25.	Cleveland, Ohio	Mar. 18
Mar. 27.	Road Roller, Winona, Minn.	Mar. 4
Mar. 27.	New Orleans, La.	Mar. 11
Mar. 27.	Montclair, N. J. (3 Props.), Adv. Mar. 11.	Mar. 11
Mar. 27.	Jefferson, Ohio	Mar. 18
Mar. 28.	Sumter, S. C. Adv. Mar. 4, 11.	Mar. 4
Mar. 28.	Columbus, Ohio	Mar. 11
Mar. 28.	Albany, N. Y. Adv. Mar. 11, 18.	Mar. 11
Mar. 28.	Racine, Wis.	Mar. 11
Mar. 28.	Philadelphia, Pa.	Mar. 18
Mar. 28.	Youngstown, Ohio	Mar. 18
Mar. 28.	Bayonne, N. J.	Mar. 18
Mar. 29.	Findlay, Ohio	Mar. 11
Mar. 29.	Cleveland, Ohio	Mar. 18
Mar. 29.	Canton, Ohio.	Mar. 18
Mar. 30.	Morgantown, W. Va.	Feb. 26
Mar. 30.	Newark, N. J.	Mar. 11
Mar. 30.	Indiana	Mar. 11
Mar. 30.	Kearney, Neb.	Mar. 18
Mar. 30.	Madison, Wis.	Mar. 18
Mar. 30.	Hinton, W. Va.	Mar. 18
Mar. 31.	Ontonagon, Mich.	Mar. 18
Mar. 31.	Duluth, Minn.	Mar. 18
Apr. 1.	Charleston, W. Va.	Feb. 19
Apr. 1.	Morristown, Tenn.	Mar. 18
Apr. 1.	Pomeroy, Wash.	Mar. 11
Apr. 3.	Sherbrooke, N. D.	Mar. 11
Apr. 3.	Salem, Ohio	Mar. 11
Apr. 3.	Huron, S. D. Adv. Mar. 11.	Mar. 11
Apr. 3.	St. Paul, Minn.	Mar. 18
Apr. 3.	Indiana	Mar. 18
Apr. 3.	Elbow Lake, Minn.	Mar. 18
Apr. 3.	Williston, N. D.	Mar. 18
Apr. 3.	Utica, Ohio	Mar. 18
Apr. 3.	Camden, Ala.	Mar. 18
Apr. 4.	South Bend, Ind.	Mar. 18
Apr. 4.	Bryan, Ohio.	Mar. 18
Apr. 6.	Jonesboro, Ark.	Mar. 11
Apr. 6.	Huntington, W. Va.	Mar. 4
Apr. 6.	Wheeling, W. Va.	Mar. 18
Apr. 12.	Palouse, Wash.	Mar. 18
May 1.	Galion, Ohio	Mar. 18
May 1.	Eveleth, Minn.	Mar. 18
———	Binghamton, N. Y. Adv. Feb. 12, 19.	Feb. 12

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS.

Bids Close.		See Eng. Record.
Mar. 21.	Protection Wall, Portmouth, Ohio	Mar. 11
Mar. 22.	Levee Work, Alexandria, La.	Mar. 18
Mar. 23.	Irrigation, St. Ignatius, Mont. Adv. Feb. 26.	Feb. 26
Mar. 23.	Revetment, Kansas City, Mo. Adv. Feb. 26 to Mar. 18.	Feb. 26
Mar. 23.	Levee, Vincennes, Ind. Adv. Mar. 11.	Mar. 11
Mar. 24.	Breakwater, Conneaut, Ohio. Adv. Feb. 26 to Mar. 18.	Feb. 26
Mar. 24.	Dredging, Detroit, Mich. Adv. Feb. 26 to Mar. 18.	Feb. 26
Mar. 25.	Drainage Canal, Holly Hill, S. C.	Mar. 18
Mar. 28.	Drain, North Branch, Mich.	Feb. 26
Mar. 28.	Wharf, Etc., Savannah, Ga.	Mar. 11
Mar. 28.	Dam, Shawano, Wis. Adv. Mar. 11.	Mar. 11
Mar. 29.	Irrigation, St. Ignatius, Mont.	Mar. 4
Mar. 29.	Cribbing, Lorain, Ohio	Mar. 11
Mar. 29.	Drainage, Waukegan, Ill.	Mar 18
Mar. 30.	Dredging, Tompkinsville, N. Y.	Mar. 4
Apr. 1.	Dredging, Chicago, Ill. Adv. Mar. 4 to 18.	Mar. 4
Apr. 1.	Drainage Ditches, Walker, Minn.	Mar. 18
Apr. 3.	Drainage, Cuero, Tex.	Mar. 18
Apr. 3.	Ditch, Aitkin, Minn.	Mar. 18
Apr. 10.	Jetty Construction, New York, N. Y. Adv. Mar. 11, 18.	Mar. 11
Apr. 10.	Ditch, Oklahoma City, Okla.	Mar. 11
Apr. 11.	Grading, Etc., Hastings, Minn.	Mar. 18
Apr. 14.	Dredging, New York, N. Y. Adv. Mar. 18.	Mar. 18
May 6.	Leasing Land and Water for Power Purposes, Louisville, Ky. Adv. Mar. 11.	Mar. 11

PUBLIC BUILDINGS AND SCHOOLS.

Bids Close.		See Eng. Record.
Mar. 20.	Plans, Baldwinsville, N. Y. Adv. Mar. 11.	Mar. 11
Mar. 21.	Stuart, Neb.	Mar. 4
Mar. 21.	Normal, Ill.	Mar. 4
Mar. 21.	Durham, N. C.	Mar. 11
Mar. 21.	Holstein, Iowa	Mar. 18
Mar. 22.	Mattoon, Ill.	Feb. 12
Mar. 22.	Aberdeen, Wash.	Feb. 19
Mar. 22.	Alta, Iowa. Adv. Mar. 4, 11.	Mar. 4
Mar. 22.	Tacoma, Wash.	Mar. 4
Mar. 22.	Harlem, Mont.	Mar. 4
Mar. 23.	Wilmington, N. C.	Feb. 12
Mar. 23.	Montezuma, Ind.	Mar. 4
Mar. 23.	Niles, Ohio	Mar. 4
Mar. 23.	Vancouver, B. C.	Mar. 11
Mar. 23.	Warsaw, Ind.	Mar. 11
Mar. 24.	Taylorville, Ill.	Feb. 19
Mar. 24.	North Olmstead, Ohio	Mar. 11
Mar. 25.	Seattle, Wash.	Feb. 19
Mar. 25.	Hamilton, Ala.	Mar. 11
Mar. 25.	Dorchester, Wis.	Mar. 18
Mar. 27.	Pueblo, Colo.	Feb. 26
Mar. 27.	Urichsville, Ohio	Mar. 4
Mar. 27.	Brooklyn, N. Y.	Mar. 18
Mar. 28.	Dobson, N. C. Adv. Mar. 11, 18.	Mar. 11
Mar. 28.	Sloan, Iowa.	Mar. 11
Mar. 28.	Columbia, S. C.	Mar. 11
Apr. 28.	New Orleans, La.	Mar. 11
Mar. 28.	Indianapolis, Ind.	Mar. 18
Mar. 28.	Cresson, Pa.	Mar. 18
Mar. 29.	Aberdeen, Wash.	Feb. 19
Mar. 29.	Newark, N. J.	Mar. 18
Mar. 30.	Huntington, Ind.	Mar. 4
Mar. 30.	San Bernardino, Cal.	Mar. 4
Mar. 30.	Ypsilanti, Mich.	Mar. 18
Mar. 30.	Largo, Ind.	Mar. 18
Mar. 30.	Rutherford, N. J.	Mar. 18
Mar. 30.	Brooklyn, N. Y.	Mar. 18
Mar. 31.	Seattle, Wash.	Mar. 11
Mar. 31.	Kenmore, Ohio	Mar. 18
Mar. 31.	Camden, Ohio.	Mar. 18
Apr. 1.	Eveleth, Minn.	Mar. 4
Apr. 1.	Ypsilanti, Mich.	Mar. 4
Apr. 1.	Portland, Ind.	Mar. 18
Apr. 3.	Argentine, Kan.	Mar. 18
Apr. 3.	Clark, S. D.	Mar. 18
Apr. 4.	Lockport, Ill.	Mar. 4
Apr. 4.	Dayton, Ohio.	Mar. 11
Apr. 4.	Detroit, Mich.	Mar. 18
Apr. 5.	Reading, Ohio	Mar. 18
Apr. 6.	Valley City, N. D.	Mar. 4
Apr. 6.	Boston, Mass.	Mar. 18
Apr. 7.	Falls City, Neb.	Mar. 11
Apr. 7.	Youngstown, Ohio	Mar. 18
Apr. 7.	Columbus, Ind.	Mar. 18
Apr. 8.	Urbana, Ohio	Mar. 18
Apr. 10.	Middlebourne, W. Va.	Mar. 18
Apr. 11.	Columbus, Kan.	Mar. 18
Apr. 11.	Galva, Iowa	Mar. 18
Apr. 12.	Prescott, Ariz.	Mar. 11
Apr. 15.	Indian Head, Md.	Mar. 4
Apr. 15.	Gemmell, Minn.	Mar. 18
Apr. 15.	Lakeview, Mich.	Mar. 18
Apr. 19.	Arkadelphia, Ark. Adv. Mar. 11, 18.	Mar. 11
Apr. 24.	Delphi, Ind.	Feb. 26
May 25.	Butler, Pa.	Mar. 18
May 6.	Sapulpa, Okla. Adv. Mar. 18.	Mar. 18

PRIVATE BUILDINGS.

Bids Close.		See Eng. Record.
Mar. 21.	Philadelphia, Pa.	Mar. 18
Mar. 22.	Garner, Iowa	Mar. 18
Mar. 22.	Clinton, Okla.	Mar. 18
Mar. 24.	Slayton, Minn.	Mar. 18
Mar. 25.	Kankakee, Ill.	Mar. 4
Mar. 25.	Cochrane, Wis.	Mar. 11
Mar. 25.	Minnesota, Minn.	Mar. 11
Mar. 25.	Cogswell, Neb.	Mar. 18
Mar. 30.	Fairmont, W. Va.	Mar. 18
Apr. 1.	Des Moines, Iowa	Mar. 11
Apr. 1.	Los Angeles, Cal.	Mar. 11
Apr. 1.	Jamestown, N. D.	Mar. 11
Apr. 1.	Cleveland, Ohio	Jan. 9
Apr. 1.	Minneapolis, Minn.	Feb. 19
Apr. 1.	Moose Jaw, Sask.	Mar. 4
Apr. 1.	Sioux Falls, S. D.	Mar. 18
Apr. 1.	Elyria, Ohio	Mar. 18
Apr. 15.	Suffolk, Va.	Mar. 18
May 1.	Akron, Ohio	Mar. 18

NEW INDUSTRIAL PLANTS.

Bids Close.		See Eng. Record.
Apr. 15.	Manila, P. I.	Jan. 2

MISCELLANEOUS.

Bids Close.		See Eng. Record.
Mar. 21.	Cement, Pittsburgh, Pa.	Mar. 11
Mar. 21.	Road Oil, Waterbury, Conn.	Mar. 18
Mar. 21.	Excav., Etc., Chicago, Ill.	Mar. 18
Mar. 21.	Cement, Chicago, Ill.	Mar. 18
Mar. 21.	Tanks, Washington, D. C.	Mar. 18
Mar. 22.	Garbage Disposal, Lincoln, Neb. Adv. Feb. 26.	Feb. 26
Mar. 23.	Road Oil, Chicago, Ill.	Mar. 18
Mar. 23.	Disposal of Garbage, Ashland, Ohio	Mar. 18
Mar. 24.	Street Cleaning, Wilkes-Barre, Pa. Adv. Mar. 11, 18.	Mar. 11
Mar. 27.	Structural Steel, Lorain, Ohio. Adv. Mar. 4.	Mar. 4
Mar. 27.	Street Sweeper, Winona, Minn.	Mar. 4
Mar. 27.	Fire Escapes, Lowellville, Ohio	Mar. 18
Mar. 27.	Road Oil, etc., New York, N. Y.	Mar. 18
Mar. 28.	Railroad Work, Philadelphia, Pa. Adv. Mar. 4 to 18.	Mar. 4
Mar. 28.	Elevators, Talmage, Cal.	Mar. 18
Mar. 28.	Crushed Stone, Toronto, Ont.	Mar. 18
Mar. 28.	Flushers, Ottawa, Ont.	Mar. 18
Mar. 30.	Road Oil, Barrie, Ont.	Mar. 18
Mar. 31.	Lamp Posts, Washington, D. C.	Mar. 11
Mar. 31.	Cement, San Diego, Cal.	Mar. 11
Mar. 31.	Road Grader, Windom, Minn.	Mar. 18
Mar. 31.	Road Oil, West Orange, N. J.	Mar. 18
Mar. 31.	Garbage Disposal, Madison, Wis.	Mar. 18
Apr. 1.	Memorial, Fort McHenry, (P. O. Baltimore, Md.)	Nov. 29
Apr. 1.	Road Oil, Dayton, Ohio	Mar. 18
Apr. 3.	Road Oil, St. Paul, Minn.	Mar. 18
Apr. 14.	Pipe and Rock, etc., Charleston, S. C.	Mar. 18
Apr. 15.	Cement, Louisville, Ky. Adv. Mar. 18.	Mar. 18
Apr. 22.	Steel Towers, Cordova, Alaska.	Mar. 11
———	Funding Bonds, Lufkins, Tex. Adv. Feb. 26.	Feb. 26

SEARCHLIGHT SECTION

Official Proposal Announcements

Price, $2.40 an inch.—Copy can be received until
Thursday 10 a. m. for issue mailed the next morning

Bids open March 30, 1916.

SEWAGE TREATMENT PLANT

LAKEWOOD, OHIO.

Sealed proposals will be received at the office of the Director of Public Works, City Hall, Lakewood, Ohio, until 12 o'clock noon, Central Standard time, on the 30th day of March, 1916, and then publicly opened and read, for the construction of a Sewage Treatment Plant.

The work to be done includes the construction of concrete screen and grit chambers, concrete sedimentation tanks, concrete channels, sludge drying beds, industrial equipment, screen house, pump house and pumping equipment, dikes, and all appurtenances.

Bids will be made upon the work as a whole, and must be made in accordance with the plans and specifications on file in the office of the Director of Public Works.

Copies of the plans, proposal forms, specifications and form of bonds and contract, can be seen at the office of the City Engineer, City Hall, Lakewood, Ohio, or at the office of the Consulting Engineer, R. Winthrop Pratt, Hippodrome Building, Cleveland, Ohio; or may be obtained by prospective bidders upon depositing twenty ($20.00) Dollars, which sum will be refunded on return of the plans and specifications within ten (10) days after the contract has been awarded, if same are in good condition when returned. Extra copies of the specifications may be obtained from the City Engineer or the Consulting Engineer, upon payment of two ($2.00) dollars for each copy, which sum will be refunded if returned copies are in good condition.

Each proposal shall contain the full name of every person, firm or corporation interested in the same and shall be accompanied by a certified check for ten (10) per cent of the amount of proposal or by a bond for the same amount, with surety or sureties satisfactory to the Director of Public Works.

The contract bond will be for fifty (50) per cent of the amount of the contract.

Bidders may submit alternate proposals for constructing sedimentation tanks in accordance with their own designs, and such proposals must be accompanied by a statement explaining the theory of design and reasons to show that such tanks would be as efficient as those called for by the plans prepared by the City of Lakewood. Bids on alternate designs of tanks must be on the unit price basis for all materials entering into the construction of such tanks.

The City reserves the right to reject any or all bids, waive any informalities in the bids received, and to accept any bid which it deems most favorable to the City of Lakewood, Ohio.

THE CITY OF LAKEWOOD, OHIO.
By N. C. COTABISH,
Director of Public Works.

Bids open March 28, 1916.

THE PENNSYLVANIA RAILROAD COMPANY.

WORK APPURTENANT TO SOUTH PHILADELPHIA TRACK ELEVATION

Sealed proposals for work under the following contract will be received at the office of the Chief Engineer, Room 607, Broad Street Station, Philadelphia, until March 28, 1916, at 12 o'clock noon.

Viz.: CONTRACT No. 11-B—INBOUND FREIGHT HOUSE AND AUTOMOBILE PLATFORM IN FEDERAL STREET YARD, PHILADELPHIA, PA.

Plans, specifications and blank forms for bidding may be obtained at the office of the Chief Engineer, Room 607, Broad Street Station.

The right is reserved by the Pennsylvania Railroad Company to reject any or all bids.

A. C. SHAND,
Chief Engineer.
E. B. TEMPLE,
Asst. Chief Engineer.

Bids open March 28, 1916.

NOTICE TO CONTRACTORS

BITUMINOUS MATERIALS

STATE OF NEW YORK, OFFICE OF THE STATE COMMISSION OF HIGHWAYS, ALBANY, N. Y.

Pursuant to the provisions of Chapter 30, Laws of 1909, as amended by Chapter 646, Laws of 1911, and Chapter 80, Laws of 1913, sealed proposals will be received by the undersigned at the office of the State Commission of Highways, 65 Lancaster Street, Albany, N. Y., at 1 o'clock P. M., on Tuesday, March 28, 1916, for furnishing and delivering bituminous materials "A," "T" and cold patch asphaltic emulsion in the different counties comprising Divisions Nos. 1, 2, 3, 4, 5, 6, 7, 8 and 9, Bituminous Material Contracts Nos. 1 to 25, inclusive. Tables and specifications showing the approximate quantities may be seen and obtained at the office of the Commission in Albany, N. Y. The special ettention of bidders is called to the fact that separate proposals will be received for each Division for furnishing and delivering bituminous materials "A," "T" and cold patch asphaltic emulsion as designated in detail by Divisions on tables prepared for that purpose.

Each proposal must be accompanied by a draft or certified check issued by a national or state bank in good credit within the state and payable at sight to the order of the State Commission of Highways, for an amount equal to at least 5 per centum of the amount of the proposal which such draft or check accompanies. This draft or check will be held by the Commission until the contract is executed and the bond is filed.

The successful bidder on each proposal will be required to give a bond for 50 per centum of the amount of the contract, such bond to be executed by a surety company to be approved by the Commission. The bond is for the purpose of insuring the delivering of the bituminous material as called for by the Commission.

The right is reserved to reject any or all bids.

EDWIN DUFFEY,
Commissioner.
I. J. MORRIS,
Secretary.

Bids received until March 23, 1916.

SUPERSTRUCTURE—STEEL BRIDGES

STAUNTON, VA.

Bids will be received by the Board of Supervisors of Augusta County, Va., at the Courthouse, at 12 o'clock noon on March 23rd, 1916, for the superstructure of five (5) steel bridges. Details and Specifications can be had from R. W. Moore, Supt. of Roads, Rooms 3 and 4, New County Bldg., Staunton, Va.

Feb. 23, 1916.

Bids open March 24, 1916.

STREET CLEANING BIDS

WILKES-BARRE, PA.

Sealed bids will be received until 12 o'clock noon, Friday, March 24, 1916, by Fred H. Gates, City Clerk, Wilkes-Barre, Pennsylvania, for furnishing all labor and appliances and cleaning forty-five miles of paved streets in the city of Wilkes-Barre. Bidding bond and certified check required. Specifications and bidding blanks will be furnished upon application to Fred H. Gates, and all bids should be plainly endorsed "Bids for Street Cleaning" and addressed to Fred H. Gates, City Clerk. The City Council reserves the right to reject any or all bids received.

MARTIN C. MURRAY,
Superintendent of the Department of Streets and Public Improvements.

Bids open March 28, 1916.

COURTHOUSE AND JAIL

DOBSON, N. C.

Sealed bids will be received by the Board of County Commissioners at Dobson, N. C., on the 28th of March, 1916, for the building of a new courthouse and jail at Dobson. The plans and specifications for these buildings can be had by applying to Harry Barton, Architect, at Greensboro, N. C., after the 6th of March, 1916. The Board reserves the privilege of rejecting all bids.

This February 22, 1916.

J. B. SPARGER,
Chairman.

Bids open April 6, 1916.

READVERTISEMENT.

BRIDGES

MIAMI, FLA.

Sealed bids will be received by Mr. W. B. Moore, City Clerk of Miami, Florida, up to 7.30 p. m., April sixth, and then publicly opened, for the construction of the piers and reinforced concrete portions, and for the erection of double-leaf bascule spans for two bridges over the Miami River in Miami, Florida, and for the construction of two temporary bridges. Contracts already have been let for the manufacture and delivery of the superstructure, structural steel work and machinery. With the exception of the bascule spans, both bridges are of concrete and reinforced concrete. The principal quantities are approximately as follows:

Concrete—Twelfth Street bridge, 2,700 cu. yds.; Avenue D bridge, 2,100 cu. yds.

Reinforcing Steel—Twelfth Street bridge, 90,000 pounds; reinforcing steel, Avenue D bridge, 80,000 pounds.

Structural Steel—Twelfth Street bridge, 350,000 pounds; structural steel, Avenue D bridge, 420,000 pounds.

A bid will be received for the construction of a temporary bridge at Twelfth Street and a bid will be received for the construction of a temporary bridge at Avenue G. The two temporary bridges are of timber construction.

The work will be let under four contracts to one or more contractors. Contract No. 2 will provide for constructing the temporary bridge at Twelfth Street; Contract No. 3 will provide for constructing a temporary bridge at Avenue G; Contract No. 4 will provide for constructing concrete work and erection of the steel work at Twelfth Street; Contract No. 5 will provide for the construction of the concrete bridge and erection of the steel work at Avenue D.

Plans and specifications are on file with the City Clerk of Miami, or can be secured by applying to Harrington, Howard and Ash, consulting engineers, 1012 Baltimore Avenue, Kansas City, Missouri, upon payment of $15.00, of which $10.00 will be returned when the plans and specifications are returned in good order. No alternate plans will be considered.

The contractor will be paid in cash on monthly estimates amounting to Ninety Per Cent (90%) of the work done. All proposals or bids must be accompanied by a certified check drawn on some responsible bank or trust company, payable to W. B. Moore, City Clerk, Miami, for a sum not less than Ten Per Cent (10%) of the aggregate of the proposal. The successful bidder will be required to furnish a performance bond equal to the contract price. The right is reserved to reject any and all bids and to waive informalities.

HARRINGTON, HOWARD AND ASH.
Consulting Engineers,
Kansas City, Mo.

Plans received till April 6, 1916.

PUBLIC LIBRARY PLANS

SAPULPA, OKLAHOMA.

Tentative plans for inspection by Carnegie Corporation of New York, for a Public Library, cost not to exceed $22,500, are solicited by the undersigned. Plans to be submitted in the form of blue prints, or similar rolls. Do not send plans mounted on card board. Building to be erected in Sapulpa, Oklahoma. Plans to be submitted before the 6th day of April, 1916.

H. H. HARBISON,
Chairman Building Committee.

Bids open March 24, 1916.

CONSTRUCTION OF SANITARY SEWERS

DEPARTMENT OF WORKS,
OSWEGO, N. Y.

Sealed proposals will be received by the Department of Works up to 2 p. m., March 24, 1916, and then opened for the following sewer construction:

1695 ft. of 8-in. vitrified tile sewer, with the necessary Y branches, manholes, flush ends, etc.

Plans and specifications and any further information on the above work may be obtained from the City Engineer of the City of Oswego, N. Y.

The work will be done under one contract and proposals submitted therefor must be accompanied by a certified check for 10 per cent of the amount of the proposal.

The Department of Works reserves the right to reject any and all bids.

CHARLES W. LINSLEY,
Commissioner of Works.
March 14, 1916.

Bids open March 31, 1916.

PORT WASHINGTON SEWER DISTRICT

PORT WASHINGTON, L. I.

Sealed proposals will be received by the Sewer Commissioners of the Port Washington Sewer District at Mullon's Hall, Port Washington Station, N. Y., up to three (3) p. m., on the 31st day of March, 1916, for furnishing all material and doing all work necessary to complete the construction of about ten (10) miles of vitrified pipe sewers from 8 in. to 24 in. in size with the necessary branches, manholes, flush tanks and other necessary appurtenances, together with one (1) pumping station and disposal works, consisting of an Emscher settling tank, disinfection house, outfall sewer and the necessary devices for connecting and operating same.

Plans, specifications and forms of proposal can be *seen* at the office of the Sewer Commission, at Port Washington, Long Island, and *obtained* at the office of Carl H. Watson, C. E., at Great Neck Station, Long Island, between the hours of 10 a. m. and 3 p. m., on the days of March 20, to March 28, upon the payment of twenty-five dollars ($25.00) cash, of which fifteen dollars ($15.00) shall be refunded, if they are returned within five (5) days after opening of bids, complete and in good condition.

Each bid must be accompanied by a certified check on a solvent bank or trust company for twenty-five thousand dollars ($25,000). The Commission reserves the right to reject any or all bids or waive all informalities in the bids received and to accept any bid which it deems to be most favorable to the interest of the Sewer District.

PORT WASHINGTON SEWER DISTRICT,
BOARD OF SEWER COMMISSIONERS,
FRANK B. SMITH, Chairman.
HENRY SEAMAN, Treasurer.
CHARLES MULLON, Secretary.
CHARLES N. WYSONO,
Counsel.
CARL H. WATSON, C.E.,
Designing and Supervising Engineer.

Asphalt Impregnated Paving Brick

Aspha-bric, a new product in the paving field, occupied the center of the stage at the recent exhibit held in connection with the American Road Builders' Convention in Pittsburgh. The product is made by impregnating No. 2—that is, underburned—paving brick with asphalt. The process is similar to the creosoting of wood, the brick being subjected to high heat under a vacuum, and then being treated with the hot asphalt. Samples shown at Pittsburgh show a very excellent penetration. The asphalt content varies from about 5 to 7 or 8 per cent.

The rattler tests of these brick show a great reduction in loss. Whereas the unimpregnated specimens, of the same degree of burning, show losses running from 20 per cent in the rattler to practically 100 per cent, the loss of the treated specimens is cut down to 12 or 13 per cent.

Two specimens from the rattler, a whole brick and a half brick, subjected to a temperature of 225 deg. Fahr., showed no loss of weight after 48 hours.

No test of the brick in service has yet been made, so that the action under climatic and traffic conditions is not known. Judging by specimens shown at Pittsburgh the bricks acquire a considerable toughness through the asphalt treatment.

Seconds treated by merely boiling in asphalt have been laid, it is said, with success in Los Angeles and in San Francisco.

The production cost at the plant, including the brick, the asphalt and the treatment, is said to average $10.20 per thousand.

The promotion of the product is being handled by the Aspha-bric Corporation, of which John Baker, Jr., the well known asphalt dealer, is president. Offices are located in the Whitehall Building, New York, and in the Otis Building, Chicago.

Hydraulic Cement Is By-Product of Potash Plant

After about eight years experimental work, subsequently followed by several months operation in a practical demonstrating plant at Catasauqua, Pa., where a large cupola was available, it is now proposed to enter the commercial field with the Brown process for the production of hydraulic cement as a by-product in the manufacture of potassium salts from feldspar and limestone. A 20-ton-per-day potassium salt plant is being constructed at Buffalo, N. Y., which will produce daily 1000 bbl. of cement. The process is covered by several United States and foreign patents, three patents being issued in 1915.

The methods employed are to use crushed limestone and feldspar, or other potassium silicate rocks in such proportions that the resultant fused mass will carry approximately 50 per cent of lime. The materials are placed in the furnace without drying or grinding and are thoroughly fused and maintained at a temperature of 1300 deg. C., at which temperature the potassium salts are volatilized and carried along with the furnace gases. These gases are used for raising steam in the waste-heat boilers, which steam furnishes all the power required for the operation of the plant. After the gases are cooled down sufficiently, *i. e.*, to about 400 deg. Fahr., the entrained potassium salts are collected in cyclone collectors, or Cottrell apparatus, and the last traces of the potassium salts are sent through wet washers, thereby saving practically all of the volatilized potassium salts.

After the potassium salts are volatilized, the molten material issues from the furnace in a stream which is similar in appearance to molten slag, but has properties widely different from the slag of a blast furnace. This material is granulated and treated with salt solutions of such a nature that when it has been granulated and becomes cold it bears a striking similarity to Portland cement clinker. When the clinkers are ground and mixed with a small percentage of gypsum, or other materials for regulating the set, the cement is ready for use.

The technical investigation and experimental work were done under the direction of H. E. Brown, consulting engineer, of New York City, to whom the patents were issued.

Lumber Man Advocates Better Selling Methods

Manufacturers, wholesalers and retailers of lumber should join in advocating to the public the employment of the proper woods for all uses where timber products are best suited to the purpose of the customer. This statement was made by R. S. Kellogg, secretary of the National Lumber Manufacturer's Association, at the meeting of the National Wholesale Lumber Dealer's Association held March 15 at Philadelphia. "Advertising," said Mr. Kellogg, "is the chief means by which the lumber business can realize its possibilities." He went on to point out that the advertising must be honest if it is to accomplish anything. Timber products must be advocated for those uses where they are superior to other materials, and never for uses in which they cannot compete in cost and service with other products. Furthermore, it was stated, producers, wholesalers and dealers should unite to advertise for a given use that wood which is best fitted for the purpose, as the sale of an inferior wood to a consumer not only hurts the firm that made the sale, but leaves the buyer with a lower estimate of timber products in general than he would have if he had been properly served. "The knowledge of the use of timber products now being spread by the manufacturers should," said Mr. Kellogg, "be supplemented by activity on the part of the dealers in their own communities." Dealers should, he pointed out, make themselves authorities on building construction, be in a position to advise wisely where and how wood should be used, and be prepared to give prompt and economical service.

Business Notes

E. P. Worden, formerly of the Fred M. Prescott Steam Pump Works, Milwaukee, has been appointed chief engineer of Henry B. Worthington, Harrison, N. J.

P. P. Bourne, formerly chief engineer of Blake & Knowles Steam Pump Works, East Cambridge, Mass., is again associated with the International Steam Pump Company at 115 Broadway, New York.

The United States Cast Iron Pipe & Foundry Company will remove its Southern sales and traffic offices from Chattanooga, Tenn., to 1002 American Trust and Savings Bank Building, Birmingham, Ala., April 1.

The Buffalo Contractors Plant Corporation is the new name under which the Contractors Plant Manufacturing Company of Buffalo will operate in the future. The new company will add other contractors' equipment to the old line of hoisting engines and derricks. William M. Hind will continue as general manager.

The Merchant & Evans Company, Philadelphia, simultaneously with its 50th anniversary has moved into a new modern office and warehouse adjoining its works on Washington Avenue between Twentieth and Twenty-first Streets. Enlargement was necessary because of the rapid growth of business in recent years.

R. Martens & Company, Inc., 24 State Street, New York City, has prepared a 24-page booklet that goes quite fully into trade possibilities and conditions in Russia. The text deals with the resources, the character of the people and the marked improvements that have occurred in living conditions in that country during recent years.

The Asbestos Protected Metal Company of Pittsburgh, has opened a new office in the Hurt Building, Atlanta, Ga., with J. R. Nichols as manager. Mr. Nichols is an engineer who has been associated with the company for a number of years at the Chicago office. T. R. Galey will be manager of the Asbestos Protected Metal Company's new office in the Praetorian Building, Dallas, Tex.

The Federal Bridge Company of Waukesha, Wis., announces that hereafter the concern will be known as the Federal Bridge and Structural Company. The change was made when it was discovered that another concern was operating under the same name in Des Moines, Iowa. The new name better indicates the nature of the company's business, which is in steel work of all classes.

The Employees of the Westinghouse Interests held their annual banquet under the auspices of the Westinghouse Club at Pittsburgh March 11. William L. Saunders, chairman of the board of directors of the Ingersoll-Rand Company of New York City and chairman of the Naval Consulting Board, was the principal speaker, taking as his subject "Industrial Preparedness for Peace and War."

The Rodd Company has incorporated and opened offices at 1401 Commonwealth Building, Pittsburgh, Pa., and will act as general agent of the Ohio Wood Preserving Company, Pittsburgh Wood Preserving Company, Michigan Wood Preserving Company of Pittsburgh and the Compressed Wood Preserving Company of Cincinnati. In addition, special plant and engineering equipment will be handled.

The I. P. Morris Company of Philadelphia has just secured a contract for a 19,500-hp. vertical shaft, single-runner turbine, to operate under a head of 68 ft., at a speed of 100 r.p.m., for the lock 12 development of the Alabama Power Company, on the Coosa River. The unit is to be 2000 hp. greater in capacity than the four existing I. P. Morris units in the same station, the head and speed for all five units being the same.

H. F. Wardwell, formerly home office manager of the Detroit Steel Products Company, has been appointed general sales manager. He succeeds P. A. Smith, who recently resigned to enter another line of business. Mr. Wardwell is a graduate of Cornell University in architecture. He was with Albert Kahn previous to becoming connected with The Detroit Steel Products Company as an estimator, subsequently becoming head of that department. During the past few years he has acted as special company representative on large building jobs.

Trade Publications

The following companies have recently issued trade literature:

Link-Belt Company, Chicago, catalog 250, 64 pages, portable wagon and truck loaders.

Chicago Pneumatic Tool Company, Chicago, bulletin E-38, 4 pages, Duntley Universal electric hammer drill.

Thew Automatic Shovel Company, Lorain, Ohio, catalog, 12 pages, Thew electric railway, electrically operated shovels, and an explanation of their operating principles.

A. S. Cameron Steam Pump Works, 11 Broadway, New York, bulletin 110, duplex packed and compounds packed piston boiler feed and tank pumps, center packed plunger power pumps and parts.

Blaw Steel Construction Company, Pittsburgh, catalog 14, 96 pages, complete line of Blawforms for concrete construction as used in sewers, aqueducts, subways, retaining walls, buildings, reservoirs, tanks, roads and sidewalks, and curbs and gutters.

Coatesville Boiler Works, Coatesville, Pa. Bulletin 18, 8½ x 11 in.; 8 pages, illustrated. Describe the Coatesville vertical fire-tube boiler which has for its claims a fire-door opening without seam or rivets, a forged steel mud ring, a scale precipitating and settling chamber, a protector to the crown sheet, and tubes arranged in straight rows both ways for easy cleaning. This boiler is built in 18 sizes from 6½ to 57 hp.

CONTRACTING NEWS

Of Special Interest to Engineers, Contractors, Builders and Manufacturers of Engineering and Building Supplies

THE SUSPENSE in regard to whether building operations would go forward at a normal rate in the face of the high price of steel and other materials seems to be at an end. New York is showing signs of especial activity, the real estate market being much improved, and February building permits issued in seventy-six leading cities show a 20 per cent gain in value over those for the same month of 1915. This situation and the car requirements of the railroads are having their effect on the lumber industry. In the Western States, where fir is chiefly produced, shipments and orders at 65 leading mills far exceeded production during the second week of March. In the past two weeks the Eastern and Southern producers were harder hit by the car shortage, and while orders kept ahead of production shipments fell behind. All these factors are stiffening the lumber market. Contractors and engineers can no longer count on buying lumber at any price for quick delivery, and figuring will now have to be done well in advance on the larger orders.

Railroad earnings continue to show very large gains over those of last year, and the railroads continue to be heavy buyers of locomotives, cars and rails. Orders are now being placed at a good rate for rails to be rolled next year. The steel business is still expanding, and unfilled orders on the books of the U. S. Steel Corporation at the end of last month established a new high record. The report announcing this figure states that improvements to the Corporation's properties costing $70,000,000 have been decided on for the current year and that $91,200,000 remains to be spent on projects previously authorized.

Buildings

Contracts were let last week for a $165,000 school at Providence, R. I., for a twenty-eight story hotel in New York City and for the $237,000 addition to the postoffice at Oklahoma City. Bids are desired for erecting a $375,000 cold-storage plant at Madison, Wis., and for building a $200,000 high school at Walla Walla, Wash.

The new work proposed includes the following: plans filed in New York City for a $225,000 factory, $600,000 apartment building, $250,000 telephone exchange; architect engaged, $250,000 ice plant, Hoboken, N. J.; plans being prepared, $2,000,000 oil refinery, Lincoln Park, N. J.; plans being prepared, $225,000 school, Ridgewood, N. J.; $250,000 church and $1,000,000 cathedral proposed, Greensburg, Pa.; improvements to steel plant, $1,000,000, Farrell, Pa.; $1,000,000 chemical plant proposed, Terre Haute, Ind.; contract for steel work to be let, $1,000,000 athletic club, Milwaukee, Wis.;- $500,000 building proposed, Sioux City, Iowa; plans completed, $250,000 hotel, Wichita, Kan.; architects employed, $1,000,000 hotel, Dallas, Tex.; architects employed, $200,000 school building, Idaho Falls, Idaho.

Bridges and Roads

Six large bridge contracts are reported this week. They include the $213,000 bridge let at Worcester, Mass.; the $117,000 bridge at Dayton, on which, with two smaller bridges, bids were opened March 15; the $600,000 Central Avenue bridge and the sub-structure for the Kansas City Southern bridge, both over the Kaw River at Kansas City; a $155,000 bridge at Hamilton, Ohio; and the $303,000 Eastlake Avenue bridge at Seattle. Plans are also being prepared for a $150,000 concrete viaduct at Birmingham, Ala.

Contracts awarded last week for paving and road work include: Danville, Ill., concrete and brick roads, nine contracts, $1,169,000; Mason City, Iowa, grading and paving, $90,000; Oakland, Tex., 21 blocks concrete paving; Seattle, street paving, $110,000; Bakersfield, Cal., concrete road work, $85,000; Fresno, Cal., street paving, $100,000. In addition, bids were opened at Buffalo for paving work to cost $87,000, at Beloit, Wis., for 97,000 sq. yd. of paving, and at Los Angeles for the road work to cost $62,000.

Bids will be opened for road and paving work soon in the following cities: London, Ont., 55,000 sq. yd. asphalt on concrete base, March 30; Dover, N. J., 38,000 sq. yd. of paving, April 11; Marysville, Tenn., 75,000 miles road work, March 30; Bartow (April 18) Sarasota (April 20) and Bronson (April 10), Fla., 24 to 29 miles each of paved roads.

Proposed road work includes: repaving Queensboro Bridge, New York City, $144,000; paving work exceeding $2,000,000, Cincinnati; bonds sold for $94,000 paved road, Cleveland; brick road work, $250,000, Abingdon, Ill.; street paving, $103,000, Logansport, Ind.; $300,000 road bonds sold, Lexington, Ky.; street widening, $150,000, St. Louis; road work, $150,000, Houston, Tex. It is stated that road and bridge work contemplated by the Bureau of Public Works at Manila for 1916 will cost approximately $2,350,000.

Waterworks and Sewers

The lowest bid received at Newark, N. J. for the settling basins for the Passaic sewer was $780,000. A low bid of $96,000 was received at St. Paul for constructing a sewer. Sewer work amounting to $300,000 has ben contracted for at Houston, Tex. The laying of water mains contracted for at Salt Lake City will cost $85,000. Bids are desired for building 18 miles of sewers ranging from 8 in. to 54 in. at Jacksonville, Fla., and for constructing a $57,000 sewage-disposal plant at Xenia, Ohio.

Proposed work noted includes: $100,000 sewer system, Little Falls, N. J.; $200,000 trunk sewer, Akron, Ohio; $273,000 sewer system, Logansport, Ind.; $600,000 water works improvements, Everett, Wash.; and $500,000 storm-sewer system, Fresno, Cal.

Miscellaneous

A contract for land reclamation involving 1,000,000 cu. yd. of fill has been awarded at Boston, and a $300,000 railroad contract has been awarded at Potter, Ark. Bids will be opened April 11 for another section of the Dorchester tunnel in Boston. Bids are desired at Duluth for constructing a $127,000 drainage ditch.

Park improvements costing $600,000 are under consideration at Atlantic City. It is reported that the International Railway Company at Buffalo will make improvements costing $1,150,000. Street railway improvements that will cost $1,500,000 are planned in St. Paul. It is reported that a 55-mile railroad extension is to be built near Lewistown, Mont. It is stated that harbor improvements are being planned at Los Angeles, the first unit of which, it is estimated, will cost $1,500,000.

WATERWORKS

PROPOSED WORK.

Cohoes, N. Y.—Improvements contemplated to the water works including metering of supply pumps and improvements to water works station, and installation of electrically driven pumps.

Dunbar, Pa.—See "Sewers and Sewage Disposal."

Kensington, Md.—Senate passed bill authorizing bond issue for water works here.

Mount Rainier, Md.—Senate passed bill authorizing bond issue for constructing water works here.

Rising Sun, Md.—Senate passed bill providing bond issue for constructing water works and municipal improvements here.

Shreveport, La.—John B. Hawley, Fort Worth, Tex., engaged as engineer for the water works and sewer system.

McKeesport, Pa.—City Council voted to purchase three pumps with capacity of 15,000,000 gal., divided into 4, 5 and 6 million gal. units.

Barnesville, Ohio.—About $25,000 water works improvement bonds sold by city.

Toledo, Ohio.—Repairs to water works contemplated. Address Director Public Service.

Wooster, Ohio.—Waterworks improvement bonds for $14,000 will be sold April 5 by Fred E. Faber, City Aud.

River Forest (Post Office Chicago), Ill.—Election to be held April 8 to vote on new water works equipment costing $7,000. William McMunn, Engr., 112 West Adams Street, Chicago; A. S. Hatch, Village Clerk.

Ft. Madison, Iowa.—Citizens Water Co. will construct a reservoir.

Lawrence, Kan.—Election soon to be held to vote $175,000 bonds for water works.

Norfolk, Neb.—Citizens voted $10,000 bonds for water works.

Syracuse, Neb.—Election soon to be held to vote $17,000 bonds for water works and electric light plant.

Lake Norden, S. D.—Citizens voted $20,000 bonds for constructing water works and an electric light plant. Address City Clerk.

Wessington, S. D.—City Council considering constructing water works.

Bozeman, Mont.—Reported City Council has passed resolutions for issuing $250,000 bonds, money to be used to redeem outstanding water works bonds and for extending, improving and enlarging the present system and acquiring an auxiliary system from Bozeman Creek.

Harlowton, Mont.—Citizens voted $15.000 bonds for extending water works. S. K. Campbell. City Clerk: George E. Baker, Consulting Engineer, Whitehall.

Helena, Mont.—City Health Dept. has recommended to Council installation of a liquid chlorine plant for filtration purposes at the head works of city water supply.

Reported installation of water works system in East Helena is under consideration.

St. Louis, Mo.—All bids opened by Bd. Public Service for constructing 5-mile pipe line from Bissell's Point to reconstructed Compton Hill Reservoir rejected.

Malvern, Ark.—Water bonds for $65,700 and sewer bonds for $28,800 will be sold March 25 by Commissioners Water Works Improvements Dist. No. 10 and Sewer Improvement Dist. No. 11 (G. E. Mattison, Chmn.).

Barstow, Tex.—Tri State Engineering Company, 318 First Natl. Bank Bldg., El Paso, engaged to prepare surveys and plans and specifications for water works system and desired correspondence in connection with materials, tools, etc., necessary for construction of the system. Trenching machines or excavators, meters, pumping machinery pipe, oil, Diesel engines, pumps, etc. The supply is secured from wells water lifted 100 ft., driven a mile and stored in cement reservoir and piped by gravity under head of 350 ft., 12 miles to distributing mains.

Coleman, Tex.—Henry E. Elrod, Southwestern Life Building, Dallas, engaged to prepare plans for a reinforced concrete reservoir.

Sabinal, Tex.—Sabinal Water & Ice Company is reported on contemplating improvements including one two-stage centrifugal pump, 250 gal. per minute, under 160 ft. head and motor.

Clovis, N. M.—Plans being prepared for improvements and extensions to water works and lighting plant; estimated cost, $35,000. Burns & McDonnell, Engrs., Interstate Building, Kansas City, Mo.

Everett, Wash.—Plans completed about April 15 for the water works improvements to cost $600,000. Burns & McDonnell, Engrs., Interstate Building, Kansas City, Mo. Bonds have been sold.

San Diego, Cal.—Contract will be let in April for furnishing material for a 36-in. wood stave pipe line between Dulzura Creek and Upper Otay, about 5 miles. George Cromwell, City Engineer, and H. M. Lockwood, City Manager.

Buhl, Idaho.—Reported Council contemplates improving water works at a cost of $50,000, including a new pumping plant, reservoir and filtration plant.

Seattle, Wash.—C. L. Evans, Commissioner Projected Water District No. 2, outlined plans before the City Utilities Committee of City Council for project to supply district between the north city limits and Snohomish County with water.

Stevenson, Wash.—Water works franchise granted to Stevenson Water Co. by the County Commissioners to lay water pipe lines along public highways of county in vicinity of Stevenson.

Portland, Ore.—Contract will soon be let by Waterworks Dept. for furnishing 300 tons of 6-in., 350 tons 12-in. c.i. pipe; 10 tons special casting; 15 tons lead; 100 6-in. gate valves, and 100 cast frames and covers. Address City Auditor.

Manila, P. I.—See "Paving and Roads."

BIDS DESIRED.

Boston, Mass.—Until March 27, by Supply Department (D. Frank Doherty, Supt.) for furnishing to the Public Works Department Water Service, high pressure fire service, 50 tons 8 in. c.-i. pipe, 90 tons 12 in. c.-i. water pipe, bell and spigot, according to specifications and contract.

Ilion, N. Y.—Until April 11 by Board Water Commissioners for constructing reinforced concrete covered filter beds, clear water basin and control house, advertised in Engineering Record. J. D. Ringwood, Engr., City Hall.

New York, N. Y.—Until April 11 by Board Water Supply, Municipal Building, for Contract 169, advertised in Engineering Record.

Pontotoc, Miss.—Reported desired until March 27 for c.-i. pipe, Class "B," and fittings; also lead and other material for water works. A. W. Kearly, Mgr. Pontotoc Water Works Co.

Coshocton, Ohio.—Chester & Fleming, Pittsburgh, Pa., engaged to prepare plans for 3,000,000 gal. vertical triple expansion pumping engine. Contract to be let soon after April 1.

Cincinnati, Ohio.—Until March 30 by Board Park Commissioners (William Hodgkinson, Secy.) for reinforced concrete and cement work, plumbing and electrical work in connection with the Third Street Reservoir Playground. A. Lincoln Frechheimer, Archt., 1534 Union Trust Building, Cincinnati.
Until April 3, by Osarke S. Johnson, Secy. to Dir. Pub. Service, for cleaning c.-i. pipe, special castings, valves and other miscellaneous work for water distribution system of Cincinnati.

Cleveland, Ohio.—Reported desired until March 28 by Commissioner of Purchase & Supplies for valves for Department of Public Utilities, Division of Water.

South Charleston, Ohio.—Until March 31, by Board Trustees Public Affairs, for constructing water works, advertised in Engineering Record.

Versailles, Ind.—Until April 1, by Otto C. Busehing, Town Clerk, for constructing gravity water works system.

Chicago, Ill.—Until March 28, by Board Local Improvements (Edw. J. Glackin, Secy.), for water supply pipe in South Carpenter, West Bishop, West Fifty-fifth and numerous other streets.

Rochelle, Ill.—Until April 3, by W. B. McHenry, Mayor, for furnishing electrically driven pumping machinery and accessories. W. H. Williams, City Clerk.

Bayard, Neb.—Until April 1 (readvertisement), by Village Clerk, for constructing water works to consist of one 8-in. well, 350,000 gals. per day, a 250-gal. triplex single acting pump, 140-ft. head, a 50,000 gal. steel tank on 35-ft. tower, 7483 ft. 8, 6 and 4-in. Matheson steel joint main hydrant, valves, etc. Selzer & Finley, Engrs., Scottsbluff, Neb.

Norfolk, Neb.—Until April 17, by P. F. Stafford, City Clerk, for water system extensions in Water Extension Dists. Nos. 21 to 32 inclusive, advertised in Engineering Record.

Beresford, S. D.—Until April 3, by Frank Bruehler, City Aud. for one air compressor pump, total lift required 360 ft.; one power pump, total lift required, 192 ft.; quantity of water desired, 250 to 400 gals. per minute. Pumps to be operated by a 25-hp. oil engine furnished by city.

Henryetta, Okla.—Until March 28 by City Clerk for constructing 5½ miles of flow line, intake, pump house, 1,000,000 gal., rapid sand filter. M. A. Berman, City Engr.

Bandon, Ore.—Until April 5, by J. S. Sawyer, City Engr., for furnishing material for repair and extension to water system, to consist of 51,634 ft. 4 to 14-in. pipe, gate valves, hydrants, fittings, etc.

Panama.—Until April 8 by Maj. Earl I. Brown, Corps Engrs., U. S. A., General Purchasing Officer Panama Canal Commission, Washington, D. C., for Cir. 1023—Malleable iron castings, steel and iron pipe, lead pipe, etc.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Lewiston, N. Y.**—Contract for furnishing and installing filters awarded by city to Norwood Engineering Co. of Lawrence, Mass., at $7,600.

★**Rochester, N. Y.**—Contract for supplying water pipe for year 1916 awarded by Bd. Contract & Supply to U. S. Cast Iron Pipe & Foundry Co. of Buffalo at $25,600.

★**Atlantic City, N. J.**—Contract for furnishing gate and check valves (bids opened March 16 by City Commissioners awarded Rensselaer Valve Mfg Co., Troy. at $10,661. About 95 gate valves, 6, 8, 12, 16 and 20-in. (Bell ends) and 59 6, 8 and 12-in. (flange ends), 26 check valves, 6, 8 and 12-in. flange ends. Next three bidders: A. P. Smith & Company, $11,798; R. D. Wood Company, Philadelphia, Pa, $12,113, and Ludlow Valve Company, $13,616.

★**New Brunswick, N. J.**—Contract for two 5,000,000 gal. tubine driven centrifugal pumps, head 150 ft., steam pressure 165¾, duty 10,000,000 ft. lb. awarded Thomas J. Radley, Inc., 143 Liberty Street, New York, at $14,100; foundation to be built by city (bids opened Feb. 1). Contract for c. i. pipe awarded Standard Pipe & Fdry. Co., Bristol, Pa., for $28.75 per ton of 2000 lb., specials at 3 cents per lb. f.o.b. New Brunswick. Other bidders: Donaldson Iron Co., $30.20; Warren Foundry & Machine Co., $29.20; U. S. Cast Iron Pipe & Foundry Co., $29.35. Asher Atkinson, City Engr.

★**Washington, D. C.**—Contract for constructing cover over Reno reservoir for Water Department, Washington, D. C., awarded Edgar H. Mosher, Washington, D. C., at $15,190.

★**Nashville, Tenn.**—Contract for supplying 900 Empire water meters awarded by City Commission to National Meter Co., Nashville. About $10,000 appropriated for meters.

★**Athens, Ohio.**—Contracts for water works improvements award by city as follows: Laying water mains to and from reservoir, to Bart Davidson of Athens, at $11,367; constructing reservoir, to Charles P. Kircher of Athens, at $27,966.

★**Youngstown, Ohio.** — Following contracts for water works supplies for 1916 awarded by Bd. Control March 11 as follows: Fire hydrants, to R. D. Wood & Co., Philadelphia, Pa., at $28.45 each; to U. S. Cast Iron Pipe Co., Pittsburgh, Pa., for 100 or less tons c.-i. pipe, at $30.62 per ton, for pipe 6 to 20 in. and $33.62 for 4 in.; to Wilkoff Co., Youngstown, 50 tons or less pig lead, at $7.35 per 100 lb.; to Morgan Mfg. Co., 250 or less valve boxes; to Darling Pump & Mfg. Co., Williamsport, Pa., for 150 or less gate valves.

★**Berwyn, Ill.**—Contract for water supply pipe in 62d and Greenwood Aves. (bids opened March 7), awarded H. D. Hallet, Aurora. Oscar N. Lindahl, Secy. Board Local Improvements.

★**Sheboygan, Wis.**—Contract for furnishing a pump of 1,000,000 gal. capacity awarded by Water Commission to Allis-Chalmers Co., Milwaukee, at $29,335.

Minneapolis, Minn.—Lowest bid opened March 10 by City for furnishing corporation cocks submitted by Janney Semple Hill & Company, 1st Ave. S. and 2d St., at 56 cts. for 3,600 ⅝-in., 71 cts. for 300 ¾-in. and by C. A. Smith Mfg. Company, for 1,000 ¾-in. curb stop cocks at $1.47 f. o. b. Minneapolis.

★**Houston, Tex.**—Contract awarded J. G. Brown Co. for pumps, electric motors, etc., at North Main Street water works, for which $22,000 has been appropriated.

★**Jones, Okla.**—Contract for constructing waterworks and electric light plant awarded Rowlett & Kirby, Oklahoma, at $8,350 (bids opened March 10). Chester A. Keyes, Clerk.

★**Seattle, Wash.**—Contract for laying water mains on Wyoming Avenue awarded by Bd. Public Works to Nilson & Co. at $12,347.

Anaheim, Cal.—Contract for constructing siphon at Horseshoe Bend for Anaheim Union Water Co. awarded Western Reinforced Concrete Pipe Co., Los Angeles, at $10,000.

Los Angeles, Cal.—Council has rescinded former action and awarded contract to Hunter Brokerage Company, 933 Security Bldg., for furnisihng 1100 tons c. i. pipe, various sizes, for Public Service Department at $37,600.
Lowest bid opened by Board of Supervisors for furnishing gate valves submitted by Smith Booth Usher Company, Los Angeles.

★**Salt Lake City, Utah.**—Contract for furnishing, laying watermains awarded by City Commission to Wheelwright Constr. Co., Ogden, at $85,060.

SEWERAGE AND SEWAGE DISPOSAL

PROPOSED WORK.

Little Falls, N. J.—Citizens voted authorizing Township Committee to issue $100,000 bonds for constructing sewerage system and disposal plant. Plans prepared by H. J. Garder, City Engineer, Paterson, and have been approved by the State Board of Health.

Dunbar, Pa.—Borough Council reported considering bond issue for constructing sewers, water works and paving streets.

New Castle, Pa.—Cost of constructing connecting sewer on East Side estimated at $25,000. C. H. Milholland, City Engineer.

Sayre. Pa.—State Department of Health at Harrisburg, issue decree requiring borough of Sayre to construct sewage disposal plant.

West Middlesex, Pa.—Construction of a sewer system is contemplated by Town Trustees.

Wheatland, Pa.—Construction of a sewer system is contemplated by Town Trustees.

Newark, Del.—Sewer Commission and Town Council considering improvements to the sewer system for the benefit of Delaware College and to cost $9,000.

Hagerstown, Md.—House of Delegates passed bill authorizing Hagerstown to construct a sewerage system. Bonds to amount of $750,000 to be issued for same.

Shreveport, La.—See "Water Works."

Columbus, Ohio.—In a report to City Department Public Service, F. H. Eno, Prof. Dept. Engineering, Ohio State University, recommended improvements to sewer system.

Lorain, Ohio.—Contract will be let about July for constructing a sewer in Reid Avenue costing $17,000, including 1,200 ft. 12-in. vitri. pipe and 1,670 ft. 42 and 60-in. brick sewer. C. M. Osborn, City Engineer.

Urbana, Ohio.—Citizens March 14 voted $9,900 bonds for constructing sewers. Emmett F. Sweetman, City Engineer.

Logansport, Ind.—Improvements planned for this year include sanitary sewer system to drain southeast section from Fifth Street to Spencer Park and from Broadway to Wabash River, estimated cost $273,000; asphalt paving on West Broad, cost $18,500; Wheatland Avenue, $33,000; Linden Avenue, $37,500, and Race Street, $14,000. Paving of Erie Avenue with concrete and including sewer, to cost approximately $60,000, is under consideration. Address City Clerk.

Dearborn, Mich.—Expenditure of about $90,000 for improving and enlarging sewerage system being considered by city.

Sioux City, Iowa.—City will construct pumping station and install sewers in Crescent Park, a suburb of Sioux City.

Williamsburg, Iowa.—Preliminary surveys being made for sewerage system. Address Town Clerk.

Bemidji, Minn.—Council reported to be considering constructing sewer extensions, to cost $12,000. T. W. Sawnson, City Engineer.

South St. Paul, Minn.—See "Water Works."

Bozeman, Mont.—Reported City Council has passed resolution calling for issue of $70,000 bonds for extending, improving and enlarging sanitary and storm sewer system.

Harlowton, Mont.—Citizens will vote April 4 to issue $25,000 bonds for constructing sewerage system and disposal plant. S. K. Campbell, City Clerk; George E. Baker, Consulting Engineer, Whitehall.

Malvern, Ark.—See "Water Works."

Myrtle Point, Ore.—Contract soon to be let by city for constructing sewer system, to cost $18,700.

Riverside, Cal.—City purchased site for sewage disposal works and sewer farm.

Ogden, Utah.—City Commission considering constructing a sewerage system in the Third Ward.

BIDS DESIRED.

Boston, Mass.—See "Paving and Roads."

Albany, N. Y.—Reported desired until April 20 by Isidore Wachsman, Secy. Board Contract and Supply, for constructing sewers in Delaware, John and Rawson Streets.

Binghamton, N. Y.—Until April 19, by W. Earl Weller, City Engineer, for Section No. 1 of the sewer, estimated to cost $150,000. George L. Robinson, Engineer, 37 East Twenty-eighth Street, New York.

Buffalo, N. Y.—Until April 1 (readvertisement), by Arthur W. Kreinheder, Superintendent Department Public Works, for constructing an 8-foot brick sewer in Swan and Seneca Streets, between Hamburg Street and Hydraulic Street; also same time and place separate bids for constructing a 6-foot reinforced concrete sewer and outlet protection in Babcock Street, between Prenatt Street and north channel line of Buffalo River.

Long Island City, L. I., N. Y.—Until March 27 by Maurice E. Connolly, Pres. Borough of Queens, for constructing reinforced concrete, plain concrete and vitr. pipe sewers in Kingsland Avenue, Alburis Avenue, Toledo, Van Dam and numerous other streets, together with receiving basins, manholes, etc. Security $30,250.

Ocean Beach, L. I., N. Y.—Until April 4 by Lederle & Provost, Engineers, 39 W. Thirty-eighth Street, New York, for constructing sewers and sewage treatment works.

Montclair, N. J.—Until April 10 by Harry Trippett, City Clerk, for concrete and vitr. pipe storm sewer in Church Street, advertised in Engineering Record.

Maryland.—See "Paving and Roads."

Washington, D. C.—Until March 28, by Commissioners D. C., for constructing sewers, approximately 1250 lin. ft. trunk sewer and 900 lin. ft. concrete in old sewer, advertised in Engineering Record.

Lillington, N. C.—Until March 27, by J. B. Baggett, Mayor, for constructing sewerage system, to consist of approximately 15,000 ft. terra cotta pipe, 20 bbl. cement, 34,000 hard bricks, 10 flush tank syphons, manholes, etc. J. B. McCrary, Co. Engr., Third National Bank Bldg., Atlanta, Ga.

Jacksonville, Fla.—Until April 14 by Board Bond Trustees for constructing 18 miles sanitary and storm sewers, 8 to 54 in., ordinance No. N58, advertised in Engineering Record. L. D. Smoot, Comr. Pub. Wks.

Jacksonville, Fla.—Until April 14 by Board Bond Trustees for furnishing material for sanitary and storm sewers, ordinance N58, including 54,744 ft. 8 to 24-in. vitr. sewer pipe, 9318 ft. 8 to 24-in. c. i. pipe, and 3283 ft. 16, 18, 24 and 36-in. c. i. culvert pipe and 22,797 ft. 27 to 54-in. reinforced concrete pipe and 253 c. i. manhole frames and covers, advertised in Engineering Record.

Cleveland, Ohio.—Until March 30 by Board Purchase and Supplies for constructing sewers in Vashti, Cardwell, Helens and Taft Avenues and other streets.

Marion, Ohio.—Until March 29 by H. A. Stevens, Clk. Dir. Pub. Service, for furnishing material and constructing sanitary sewers in Uhler and Pennsylvania Avenues, Chester and other streets.

Xenia, Ohio.—Until April 27 by C. W. Whitmer, Director Public Service, for constructing an Imhoff sewage disposal plant, including 2300 ft. 20-in. pipe, 11 manholes, 1200 cu. yd. concrete; cost $57,000. J. P. Shumaker, City Engineer.

Ann Arbor, Mich.—Until April 5, by Board Public Works, for constructing storm sewer in Miller Avenue, advertised in Engineering Record. Mauley Osgood, City Engr.

White Fish Bay, Wis.—Reported desired until April 3, by E. J. Martel, Village Clerk, for furnishing maps, profile and general plans for sewer system.

New London, Wis.—Reported desired until April 15, by E. J. Johnson, City Clerk, for constructing sanitary sewers in Dorr Street and Beacon Avenue.

Anthony, Kan.—Until March 30, by W. R. Canaan, City Clerk, for furnishing material and constructing main and intercepting sewers and sewage disposal works and lateral sewers in District No. 1. Black & Veatch, Engrs., Inter State Bldg., Kansas City, Mo.

Clay Center, Kan.—Until March 28, by City Clerk, for furnishing material and constructing storm sewer.

Norton, Kan.—Reported desired until March 27 by the State Board of Control, Topeka. for sewage treatment plant at State Sanatorium, Norton.

Watertown, S. D.—Until Apr. 17 by Charles Harman, City Auditor, for furnishing and erecting two centrifugal sewage pumps, with motors, control equipment and other appurtenances, advertised in Engineering Record. Metcalf & Eddy, Consulting Engineers, Harris Trust Building, Chicago, Ill. F. W. Schreiber, City Engr.

Billings, Mont.—Reported desired until April 5 by E. S. Judd, City Clk., for constructing storm sewer involving 9400 ft. of sewer. Probable cost $65,000. E. M. Sneckenberger, City Engr.

Childress, Tex.—Reported desired until April 1 for constructing sewerage system and sewage disposal plant. Probable cost $30,000. R. G. Carraway, City Engr.

Venus, Tex.—Contract soon to be let for constructing sewer system and sewage disposal plant, costing $12,000. J. D. Carter, Consulting Engineer, Dallas.

El Centro, Cal.—Until March 27, by L. Northcutt, City Clerk, for constructing a brick outfall sewer. Olmsted & Gilian, Engrs., 1112 Hollingsworth Bldg., Los Angeles.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Providence, R. I.**—Contracts for constructing sewers awarded by Bd. Contract and Supply as follows: McDonough and Hawkins Streets, to W. B. Shaw, at $10,630 and $24,708 respectively; Ardoene Street, to Charles Crankshaw of Providence, at $11,993.

★**Wildwood, N. J.**—Contract for constructing a sewage treatment plant consisting of sanitation R. W. Process of sewage treatment, awarded James McLinden & Company, of Anglesea. Subcontract awarded Sanitation Corporation of New York, N. Y., for the sewage treatment.

★**Philadelphia, Pa.**—Contract for extending Indian Creek sewer in Sixty-ninth Street from Cobb's Creek to Girard Avenue awarded to J. E. Brenneman, 1523 S. Front Street, at $47,818.

★**De Ridder, La.**—Contract for constructing sewerage system awarded by city to Sutherland Constr. Co., Kansas City, Mo., at about $35,000.

★**Mansfield, Ohio.**—Contract for constructing additions and improvements to sewage disposal plant awarded to Ohio Valley Contr. Co., Cincinnati.

★**La Crosse, Wis.**—Contract for constructing trunk sewer on Mississippi Street, the first unit of sewer system in southeastern section of city, to consist of 3093 ft. concrete sewer, egg-shaped, 46 in. wide, 69 in. high, 422 ft. 40 in. wide and 60 in. high, 8 manholes, 23 catchbasins and 91 house connections awarded by Bd. Public Works to Giblin, Petersen & Screen of Chicago, Ill., at $40,937.

★**Woodward, Iowa.**—Contracts for improvements at State Epileptic Colony, at Woodward, awarded by State Bd. Control, Des Moines, March 3, as follows: Sewage tank, to Des Moines Bridge & Iron Co., Des Moines, at $16,000, and for sewers, to Empire Constr. Co. of Des Moines, at $4,975.

St. Paul, Minn.—Lowest bid opened by City Contracting Committee for constructing Capital Avenue sewer submitted by O'Neil & Preston or St. Paul, at $96,000.

Newark, N. J.—Following are unit figures of the four lowest bids opened March 14 by Passaic Valley Sewerage Commissioners for part of Section 4, sedimentation basins and effluent and intake conduits: (a) Arthur McMullen Co., New York, N. Y., $787,080; (b) Cavanaugh Contracting Co., New York, N. Y., $816,000; (c) Mason & Hanger Co., New York, N. Y., $843,581; (d) William J. Coughlin, Jersey City, N. J., $876,100.

	(a)	(b)	(c)	(d)
2720 lin. ft. earth excavation and refilling, in trench, for effluent and intake conduits, etc.	$11.50	$20.00	$28.00	$20.00
Earth excavation and refilling for sedimentation basins, Venturi meter chamber, etc. (lump sum)	26,000.00	60,000.00	43,103.00	27,000.00
100 cu. yd. rock excav. in open excavations	1.00	5.00	5.00	10.00
20,000 cu. yd. concrete masonry, Class A, 1:2:4, with Portland cement	7.50	7.50	7.40	8.50
48,000 cu. yd. concrete masonry, Class B, 1:2½:5, with Portland cement	6.40	6.50	6.50	7.00
1000 cu. yd. boulder concrete masonry, Class C, with Portland cement	5.00	6.00	6.50	6.00
200 cu. yd. brick masonry, with Portland cement mortar	10.00	14.00	16.00	22.00
200,000 cu. yd. timber piles, in place	0.21	0.24	0.27	0.26
2,800,000 lb. steel for reinforcement, etc., in place	0.04	0.03	0.032	0.042
8000 sq. yd. broken stone road surfacing	0.76	0.50	0.90	0.85
Surface drains, vitrified pipe, complete, in place (lump sum)	500.00	500.00	1,000.00	760.00
Gallery piping—20-in. c.-i. sludge main, 6-in. water mains and 4-in. w.-i. air mains, etc. (lump sum)	40,000.00	40,000.00	31,644.05	31,700.00
Sludge main—20-in. hub and spigot, c.-i. pipe, manhole pipes, plug drain valves, etc. (lump sum)	8,000.00	10,000.00	9,381.60	9,100.00
Gate valves—Six 60-in and including all 60-in. c.-i. piping in Venturi meter chamber, etc. (lump sum)	22,000.00	20,000.00	26,585.22	23,400.00
Sluice gates—24-24 x 36-in., including gate hoists, stem guides, etc., in place, complete (lump sum)	9,250.00	7,000.00	9,372.00	9,000.00
Sluice gates for effluent controlling house—2-5 x 10 ft., and 4-6 x 8 ft., with operating mechanism (lump sum)	15,000.00	11,000.00	15,152.50	14,200.00
50,000 lb. miscellaneous iron castings, floor plates, pressure covers, stop plank grooves, etc.	0.06	0.02	0.05	0.055
Air compressors in administration wing, including all electric wiring, piping, etc. (lump sum)	4,000.00	3,300.00	4,683.00	4,000.00
Electric wiring and lighting system in sedimentation basin galleries, etc. (lump sum)	3,750.00	1,500.00	3,000.00	6,000.00

★**Houston, Tex.**—Contracts for constructing sewers awarded as follows by the city: To Horton & Horton of Houston, for storm sewer on Euclid Avenue and laterals in Jackson Avenue and on Missouri Avenue, at $263,994 (bids opened Feb. 17); Hardman & Nelson, Houston, storm sewer on Tuam Avenue, $15,577; W. Waldo, 902 Natl. Bank Bldg., storm sewer on Crockett Street and laterals on Henderson and Silver Streets, at $21,149 (bids opened March 7).

★**Peterborough, Ont.**—Contract for furnishing sewer pipe for 1916 awarded by Bd. of Works to R. Hicks & Co., at 70 per cent. off list price.

BRIDGES

PROPOSED WORK.

New York, N. Y.—F. J. H. Kracke, Bridge Comr., has been granted by Board of Estimate and Apportionment $144,000 for reconstructing present wood block pavement on Queensboro Bridge.

Carbondale, Pa.—Delaware & Hudson Co. (James McMartin, Ch. Engr., Albany) plans constructing viaduct at intersection of Dundaff and Fallbrook Streets.

Duboistown, Pa.—Reported construction of county bridge joining Duboistown and Newberry and costing $135,000 is contemplated. Attorney Charles F. Budelspacher, Duboistown, may be able to give information.

Pennsylvania.—Permits issued by State Water Supply Commission as follows:

Bessemer & Lake Erie Railroad Co., to replace bridge across Little Shenango River, at Greenville, Mercer County.

Baltimore & Ohio Railroad Co., to construct Bridge No. 19-B, across Wills Creek, 4.8 miles west of Somerset-Bedford County line and 1.6 miles east of Glencoe, Somerset County. Bridge No. 9, Connellsville Division, across Wills Creek, 7 miles north of Pennsylvania-Maryland State line and 0.7 mile south of Hyndman, Bedford County. Bridge No. 8, Connellsville Division, across Wills Creek, 2.8 miles north of Pennsylvania-Maryland State line and 0.2 mile north of Cook's Mills, in Bedford County. Bridge No. 7, across Gladden Run, 1.1 miles south of Cook's Mills and 1.5 miles north of Pennsylvania-Maryland State line, in Bedford County.

Commissioners of Union County, to construct bridge across Laurel Run, 3 miles above mouth, in Hartley Township, Union County.

Commissioners of Wayne County, to construct bridge over Carley Brook, 2 miles above its mouth, in Texas Township, Wayne County.

J. H. & C. K. Eagle, Inc., to construct culvert across and walls along Coal Run, in the borough of Shamokin, Northumberland County.

Birmingham, Ala.—Julius Kendrick, City Engineer, will prepare plans for concrete viaduct at Twenty-first Street. Estimated cost $150,000.

Gadsden, Ala.—Press reports state that new concrete span will be constructed over Wills Creek on Gadsden and Attalla road by County Highway Commission.

Kingston, Tenn.—Bridge bonds for $50,000 to be sold April 3 by D. H. Evans, Clk. Bridge Committee.

Waukegan, Ill.—Plans and specifications have been prepared for concrete viaduct over ravine at Sheridan Road at an estimated cost of $35,000. J. J. Dietmeyer, Comr. Streets and Public Improvements.

Milwaukee, Wis. — Reported approximately $60,000 will be spent for concrete bridges in Milwaukee County during 1916. H. J. Kuelling, County Highway Commissioner.

Bemidji, Minn.—Council reported considering constructing $10,000 bridge across Mississippi River. T. W. Sawnson, City Engineer.

Freeport, Tex.—Houston & Brazos Valley R. R. (G. S. Waid, Gen. Mgr., Houston) reported planning constructing bridge over Brazos River at Freeport, to cost about $200,000.

Spokane, Wash.—City Council has decided to reconstruct Division Street bridge with concrete instead of steel, at estimated cost of about $131,000. Morton MacCartney, City Engr.

San Diego, Cal.—See "Paving and Roads."

Santa Barbara, Cal.—Reported Board of Supervisors will ask new bids for constructing (a) 3-hinged skew concrete bridge and (b) three-hinged arch concrete bridge over Gaviota Creek in Fourth Road District. Lowest bid opened March 6 for (a) was from J. C. Lillis, Santa Barbara, at $12,900, and (b) from E. A. Garland, Santa Barbara, at $13,690.

Ft. Apache, Ariz.—Steel bridge over Black River at Ft. Apache and Rice Station, between Graham and Navajo Counties, destroyed by the floods; also bridge over White River in same district.

Manila, P. I.—See "Paving and Roads."

BIDS DESIRED.

Watertown, N. Y.—Reported desired until March 31 by E. W. Sayles, City Engineer, for constructing reinforced concrete bridge over Black River, 336 ft. long, 18-ft. roadway, 3 to 5 piers.

West Chester, Pa.—Until April 3, by Isaac Y. Ash, Co. Controller, for constructing following bridges: Concrete and steel I-beam bridge over Chester Creek, East Goshen Township; stone arch bridge over Broad Run, West Bradford Township; three-arch stone masonry bridge over Beaver Creek, Cain Township, and two-arch stone masonry bridge over Octoraro Creek, West Sudsbury Township.

Bryson City, N. C.—Until April 3 for constructing 280-ft. steel bridge and approaches over Little Tennessee River at Judson. County Commissioners to erect superstructure and Swain Highway Commissioners to erect substructure. T. M. Howerton, Engr., Bryson City.

Irwinton, Ga.—Reported desired until April 4, by Board County Commissioners (B. I. Stevens, Chmn.), for erecting steel bridge with concrete piers, etc., across Commissioners Creek, three miles from Irwinton.

Sarasota, Fla. — See "Paving and Roads."

Jacksonville, Fla.—Until April 3, by Committee on Public Works of Board Bond Trustees, for furnishing material and constructing reinforced concrete bridge over McCoys Creek, between Cedar and Clay Streets.

Barbourville, Ky.—Until April 4, by Fiscal Court, for six 30-ft. span 12-in. I-beam bridges and one 24-ft. span 12-in. I-beam bridge. Thos. Hubbard, Co. Road Engr.

Youngstown, Ohio. — Reported desired until April 12 by County Commissioners for constructing concrete bridge on west drive in Lincoln Park, to be 70 ft. long, with a span of 35 ft. Probable cost $5,000.

Reported desired until April 3, by Board County Commissioners, for McCartney Road bridge over Lincoln Park, to be 70 ft. long with sidewalk on either side. Probable cost $5,000. Separate bids for floor slabs and railings on bridge at Station No. 95, on North Lima Poland Road, and on bridges at Station Nos. 30 and 40 on McGuffey Street extension and Station Nos. 47 and 60 same road.

Dakota City, Iowa.—Until April 5, by J. G. Devine, County Auditor, for constructing 12 bridges. H. N. Legreid, County Highway Engineer, Humboldt.

Des Moines, Iowa.—Until April 4 for constructing a 150-ft. reinforced concrete culvert 10 ft. wide. Address T. M. McCurdy, City Clk.

Estherville, Iowa.—Until April 4, by Bd. of Supervisors, for constructing following bridges: 26-ft. span and 18-ft. roadway; two I-beam 30-ft. span, 16-ft. roadway; 30-ft. span and 18-ft. roadway, all I-beam bridges with concrete slab floors, and concrete deck girder, two 40-ft. span 17-ft. roadway. Chas. A. Root, Co. Aud.

Primgham, Iowa.—Reported desired until April 3 by J. B. Stamp, Co. Aud., for bridge and road work for year 1916.

Sheldon, Iowa.—Reported desired until April 3 by County Supervisors for bridge and road work for coming season.

Tama, Iowa.—Reported desired until April 4, for constructing culvert 150 ft. long. Address J. M. McCurdy, City Clerk.

Stuntz, Minn.—Reported desired until April 5, by Town Board, for constructing five concrete bridges on Koivu Road.

Newton, Kan.—Reported desired until April 3 by C. A. Young, County Clerk, for constructing a 31 ft., 60 ft., 75 ft. pile bridge, 9 concrete culverts.

St. Johns, Kan.—Reported desired until April 3, by County Commissioners, for two concrete and steel bridges 40 ft. wide and one 20 ft.

Wakeeny, Kan.—Reported desired until April 3, by County Commissioners, for constructing 60 ft. steel or concrete bridge, also abutments for bridge. C. H. Bronson, County Clk.

Washington, Kan. — Reported desired until April 7 by W. McKelvey, City Clk., for constructing two bridges, one 350-ft. span bridge and one 1100-ft. span.

Canton, N. D.—Until April 6, by Frank J. V. Kiebert, County Auditor, for various standard size road culverts, advertised in Engineering Record.

Hayville, N. D.—Reported desired until April 5, for constructing steel and concrete bridges for year 1916.

Sykeston, N. D.—Reported desired until April 4, Harry Harding, Co. Auditor for corrugated metal culverts for year 1916.

Billings, Mont.—Reported desired until March 27, for constructing culverts for year 1916. Address F. E. Williams, County Clerk.

Perryville, Mo.—Reported desired until April 4, by County Commissioners, care of Thomas J. Killian, Road and Bridge Commissioner, for steel joist bridge with tubular piers and abutments over drainage ditch 96 ft. span.

Galveston, Tex.—Until April 10 by John M. Murch, Co. Aud., for constructing a temporary county road bridge across Galveston Bay.

Okanogan, Wash.—Reported desired until April 4, by F. A. Grainger, Clerk Board County Commissioners, Conconully, for furnishing material and constructing a highway bridge over the Okaogan River at Riverside. Bids desired separately on superstructure, substructure and timber trestle approaches. H. E. Smith, County Engineer.

Portland, Ore.—Reported desired until April 7, by J. B. Yeon, County Roadmaster, for constructing concrete viaducts Nos. 2, 3, 4 and 5 on the St. Helens Road.

Ventura, Cal.—Until April 6, by Board of Supervisors, for combination steel and timber bridge 150 ft. span with concrete end piers and 96 ft. concrete pile trestle over San Antonio Creek, near La Crosse Station. April 7, steel bridge six 129-ft. spans, five concrete piers, 60 ft. concrete pile trestle over Santa Clara River, near Satcoy (county furnishes all structural steel in 6 spans); also a steel bridge, one 240-ft. span, and 2 approach spans with concrete piers across Sespe Creek, one mile west of Fillmore (county furnishes steel); separate bids until April 8 for combination steel and timber bridge of one 200-ft. span, across Ventura River, near Oanet Station.

Cookstown, Ont.—Until March 27, by F. G. Campbell, Co. Engr., and Frank Barber, Consulting Engr., 57 Adelaide Street, Toronto, for constructing concrete abutments for a steel bridge over Nottawasaga River, between town of Essa and Sunnidale.

Arthur, Ont.—Until March 27, by Edward Gainer, Township Clerk, Arthur, for constructing a 70 ft. concrete arch truss bridge on the Sixteenth Con. of Peel. Bowman & Connor, 31 Queen Street, W. Toronto, Engineers.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Worcester, Mass.**—Following are four lowest bids opened March 14 for constructing Lake Quinsigamond Bridge: C. W. Blakeslee & Sons, New Haven, Conn., $213,304 (awarded contract); T. A. Gillespie Company, New York, $214,683; H. P. Converse & Company, Boston, $221,684; and Fred T. Ley Company, Springfield, $224,871. Samuel H. Pitcher Company, Engineers, 418 Main St., Worcester.

★**Reading, Pa.**—Contract awarded by Reading Railway to Fehr & O'Rourke, Reading, for encasing with concrete stone bridge over Irish Creek and placing of railings on both sides.

★Contract reported awarded by Pennsylvania R. R. to H. Focht & Company, Reading, for constructing a double track arch concrete bridge 1200 ft. long over Schuylkill River, at Poplar Neck, Pa.

★**Columbus, Ohio.**—Contracts for reconstructing and removing 3d Avenue bridge over Olentangy River, bids opened March 7) awarded as follows: Superstructure, Calital Construction Company, Columbus, $8,340; substructure, Coshocton Construction Company, Coshocton, $13,220; approaches G. B. McPherson, Grove City, $5,439. John Peake, County Surveyor.

Dayton, Ohio.—Lowest bids opened March 15 by City Commissioner for constructing (a) West Fifth Street bridge, (b) Webster Avenue, (c) Keowee Avenue bridge were: Dravo Contracting Co., Diamond Bank Bldg., Pittsburgh, Pa., (a) $116,930; C. F. Rickeldorfer Construction Co., Circleville, (b) and (c), $59,265 and $61,014 respectively.

Hamilton, Ohio.—Lowest bid received March 11 by County Commissioners for constructing Columbia bridge at Wood Street, submitted by A. J. Yawger Co., 450 North Belmont Street, Indianapolis, Ind., for concrete at $117,465 on county's plans and at $114,690 on plans submitted; from Central States Bridge Co., 601 Beecher Street, Indianapolis, Ind., on steel bridge, 10 bids on county's plans, from $59,985 to $71,496.

★**Bluffton, Ind.**—Contracts awarded by County Commissioners for constructing bridges, most of cement construction, as follows: James A. Crosbie, Bluffton, 25; W. M. Allen, Markle, 2; I. J. Wolcale, Markle, 1.

★**Decatur, Ind.**—Contracts awarded by Board of Commissioners of Adams County for building bridges in Adams County to Tapps Construction Company and Burk Construction Co., both of Ft. Wayne, at $20,000.

★**Belvidere, Ill.**—Contracts for bridges awarded by Board of Supervisors as follows: To Northern Steel & Concrete Co., Freeport, $5,999; Galena Tile Roof & Construction Co., $3,007.

★**Havana, Ill.**—Contract awarded by Board of Supervisors to T. L. Blackburn, Lincoln, at $16,950, for constructing extension to Oakford bridge over Sangamon River.

★**Johnson Creek, Wis.**—Contract for constructing concrete bridge over village creek awarded by Village Board to Whitewater Bridge Company, Whitewater, at $4,600.

★**Kansas City, Kan.**—Contract for constructing Central Avenue bridge awarded by County Commissioners as follows: To Missouri Valley Bridge & Iron Works, Leavenworth, Kan., for building bridge and constructing approaches, at $392,661, and to Mid West Construction Co., Kansas City, for concrete work, at $207,674.

★Contract for constructing substructure of bridge across Kaw River at Ohio Avenue for Kansas City Southern Ry. Co. (C. E. Johnston, Chief Engineer) awarded Kansas City Bridge Co., Kansas City, Mo.

★**Butte, Neb.**—Contract for constructing bridge across Niobrara River, bids opened March 10) awarded Western Bridge & Construction Company, Omaha, at $25,553. G. A. Richardson, County Clerk.

★**Chehalis, Wash.**—Contract awarded by County Commissioners for constructing steel bridge over Cowlitz River near Cora Ferry to Weymouth Construction Co., Pier 1, Seattle, at $11,533.

Seattle, Wash.—Lowest bid opened by Board Public Works submitted by Weymouth Construction Company, Pier No. 1, at $13,533, for moving bridge at First Avenue South and Duwamish River.

★Contract awarded by Board of Public Works for constructing Eastlake Avenue bridge at Tenth Avenue to Beers Building Co., L. C. Smith Building, at $302,980. The company bid $124,331 on substructure and $178,649 on superstructure.

★**South Bend, Wash.**—Contract for constructing 120 ft. steel span and 830 ft. trestle near East River and for a concrete bridge, Luten Design, over Half Moon Creek at Lebam awarded to Cowlitz Bridge Co., Portland, at $8,617 and $3,544 respectively.

★**Santa Barbara, Cal.**—Contract awarded Krug & Co., Santa Barbara, for constructing concrete bridges across Zuca Creek, at $10,436.

PAVING AND ROADS

PROPOSED WORK.

Orangetown, N. Y.—About $18,443 is to be spent by Town Bd. for road and bridge improvements.

Silver Creek, N. Y.—The State Senate passed bill legalizing the $18,000 bond issue of Silver Creek to pay village's portion of improving Central Avenue and Park Place.

Syracuse, N. Y.—City Council voted to pave N. Beech Street, S. Wilbur Avenue, Taylor Street, Almond Street and Amherst Avenue.

Bayonne, N. J.—Contract will be let about April 18 by City Clerk for 95,000 sq. yd. asphalt and bituminous concrete pavement on Hobart Avenue and West Eighth Street to cost $200,000, including 14,000 lin. ft. bluestone curbing. Walter L. Clarkson, City Engineer.

Newark, N. J.—Board of Works adopted ordinance authorizing paving with wood block Roseville Avenue from Orange Street to Springdale Avenue. Morris R. Sherrerd, City Engr.

Governor signed bill at Trenton reappropriating $200,000 for State's share for improving certain roads in Essex County.

Chester, Pa.—Council adopted ordinance providing for paving 6 miles of streets in various parts of the city.

Pennsylvania.—Contract soon to be let by State Highway Department, Harrisburg, for constructing Kittanning-Ford City Road. R. J. Cunningham, State Highway Comr.

Virginia—Elections to be held in various counties on dates as follows for road improvement bond issues:

Hancock County, Poe District, $50,000, March 25.
Wetzel County, Church District, $240,000, April 15.
Marion County, Paw Paw District, $360,000, March 21.
Monongalia County, Grant District, $300,000, April 15.
Ritchie County, Clay District, $240,000 (date not set).
Randolph County, Leadsville District, $220,000, March 25.
Barbour County, Barker District, $130,000, April 11.
Wood County, Clay District, $42,000; Tygart District, $30,000, and also $70,000 in this county, all on April 22.
Reane County, Spencer District, $240,000, April 8; Geary District, $100,000, May 13.
Wayne County, $950,000, June 6.
Logan County, Logan District, $200,000, April 22.
Raleigh County, Town District, $300,000, and Trap Hill District, $175,000; Shady Springs District, $135,000, and Slab Fork District, $210,000, all April 1.
Greenbier County, Williamsburg District, $92,000, and Lewisburg District, $153.500, both April 15, and White Sulphur District, April 8.
Marion County, Lincoln District, $650,000, April 8.
Ritchie County, Murphy, $190,000, April 8.

Asheville, N. C.—County Commissioners appropriated $30.000 for improving roads in West Asheville and authorized work to start at once on improving Ridgecrest Road with 8-in. macadam base and surfaced with asphalt; cost about $75,000.

Graham, N. C.—County Comrs. considering constructing road from Burlington to Orange County line.

Americus, Ga.—Citizens voted $30,000 bonds for street improvements. Address City Clerk.

Palatka, Fla. — Citizens of Putnam County voted $80,000 bonds for hard surfacing road from Palatka to Orange Springs.

Columbus, Miss.—Board of County Supervisors plan public highways improvements costing $50,000.

Alexandria, La.—Ordinances for constructing sidewalks and curbs on a number of streets were adopted by the City Council.

Knoxville, Tenn.—The County Road Commission authorized appropriation of $10,000 for maintenance and repair of roads.

Hartford, Ky.—Election to be held May 20 to vote $300,000 bonds for improving public highways.

Lexington, Ky.—Fayette County will lay about 5 miles of asphalt pavement.

Monticello, Ky.—Citizens of county are considering voting $180,000 bonds for constructing improvements to roads.

Akron, Ohio.—Paving bonds for $146.330 will be sold March 31 by U. G. High, Clk. Board County Commissioners.

Bowling Green, Ohio.—Trustees of Plain Center, Middleton and Perrysburg Townships and Commissioners of Wood County have decided to improve Dixie Highway, between Bowling Green and Perrysburg. County to pay $35,000 of cost and the State $45,000.

Bryan, Ohio.—Road improvement bonds for $111.000 will be sold April 4 by County Commissioners.

Crooksville, Ohio.—Street improvement bonds for $19,680 will be sold March 27 by C. L. Harper, Village Clk.

Findlay, O.—Paving bonds for $37,620 will be sold by R. O. Mungen, City Aud., April 19.

Lima, Ohio. — County Commissioners contemplate improving all highways leading into Lima. Estimated cost $100,000.

Ravenna, Ohio. — Road improvement bonds for $48.000 will be sold by County Commissioners, April 1.

Urbana, Ohio.—Citizens March 14 voted $10,000 bonds for paving portion of Main Street and $8,000 bonds for improving existing streets. Emmett F. Sweetman, City Engineer.

Indianapolis, Ind.—Bd. Pub. Wks. voted to pave Fairfield Avenue, from Central Avenue to the Indiana State Fair grounds, and several other streets.

New Albany, Ind.—County Council appropriated $42 000 for improving public highways in Franklin and Georgetown Townships.

Fremont, Mich.—Highway improvement bonds amounting to $50.000 will be sold March 28 by John M. Rottier, Clerk, Dayton Township, R. F. D. No. 2, Fremont. About 22 miles of gravel roads to be built.

Bloomington, Ill.—Paving with brick about 1½ miles in Fifth Ward is contemplated by Bd. Local Improvements.

Bradford. Ill.—Town will construct about 9 miles of gravel road.

Monmouth, Ill.—Board of Supervisors passed resolution to improve 8 state aid roads in the county this summer. including grading and oiling; about $36.000 available. Route 12 is also to be improved and is to be brick on concrete foundaton. Charles L. McClanahan, Superintendent County Highways.

Sumner, Ill.—Citizens of Petty Township, Lawrence County, voted to issue $40,000 bonds for constructing rock and gravel roads.

Jefferson, Iowa.—City Council ordered 42 blocks paved.

Minnesota.—State Highway Commission at St. Paul has apportioned the $1,500,000 road and bridge funds among the various counties, including $35.000 each to Hennepin, Ramsey and St. Louis; $30,000 to Winona; $27.000 to Itasca; $23,000 to Blue Earth: $25.000 to Beltrami! $22,500 to Cass and $22,000 to Dakota.

St. Paul, Minn.—City Council voted to pave Mississippi River Boulevard from Summit Avenue to Minneapolis city limits, with asphaltic concrete and concrete curbing. Estimated cost, $45,000.

Lincoln, Neb.—Paving bonds for $127,380 will be sold March 31 by Theodore H. Berg, City Clk.

Norfolk, Neb.—Citizens March 10 voted $30,000 bonds for paving intersections.

Mitchell, S. D. Approximately 62 miles of highway will be graded and improved this year in Davison County.

Billings, Mont.—Citizens of Yellowstone County voted $175,000 bonds for constructing 47 miles of gravel roads.

Clinton, Mo.—City intends laying about 1 mile of asphalt paving. W. I. Matfield, City Engineer.

Independence. Mo.—Contract soon to be let by Highway Engineer for macadamizing Pleasant Road. Roadway will be 18 ft. wide.

St. Louis, Mo.—Mayor signed bill authorizing widening of Twelfth Street, from Hickory Street to Park Avenue. Estimated cost $150,000.

Galveston, Tex.—Citizens voted $875,000 bond issue of which $250,000 is for improvements of streets and public grounds and other properties of the city for which a 1916 program is now being worked out.

Denver, Col. — Approximately $200.000 will be spent this year for roads leading out of Denver by State Highway Commission. South Golden Road is to be hard-surfaced.

Ephrata, Wash.—All bids received by County Commissioners for surfacing 6½ miles of highway No. 6A, near Quincy, rejected, as being too high. Lowest bid $18,156. No bids received on No. 8 highway, near Warden. Commissioners considering having work done by the district.

Mount Vernon, Wash.—Following brick paving is contemplated for this year: Hard-surfacing Second Street 1600 ft; Third Street 600 ft.; Mortgomery Street 100 ft.; Fourth Street 2400 ft. L. J. Cayfield, City Engineer.

Seattle, Wash.—A. H. Dimock, City Engineer, filed plans and specifications with the Board of Public Works for paving Harrison Street. Estimated cost $25,000.

Spokane; Wash.—County Commissioners plan hardsurfacing and grading a number of roads during 1916; $350,000 is available. J. W. Strack, County Engr.

Astoria, Ore.—All bids received by City Council for paving Commercial Street from Seventeenth Street to Twenty-second Street rejected as being too high. New bids will be received. Olof Anderson, City Clerk.

Clatskanie, Ore.—City Council reported to have passed ordinance for paving Nehalem Avenue from Bridge Street to the Presbyterian Church. Estimated cost $13,000.

Fairfield, Cal.—Citizens voted $48,500 bonds for grading and macadamizing streets. Address City Clerk.

Fresno, Cal.—Election to be held in May to vote $2,000,000 bonds for constructing highways. D. M. Barwell, County Clerk.

Modesto, Cal.—Bd. Supervisors (John Clark, Chmn., Stockton) is considering calling an election to vote bonds for highways in Stanislaus County.

Novata, Cal. — Paving main business at $12,000 is contemplated. Fred W. Sweetser, Town Supervisor.

Tucson, Ariz.—Commission adopted resolutions of intention to pave North Stone Avenue, University and North Fourth Avenues, in all about 2 miles.

Highway bonds for $300,000 will be sold April 10 by Board Supervisors (A. L. Hitch, Clk.).

Yuma, Ariz.—Council considering paving Main, First, Second Streets; also considering constructing two levees costing $18,000.

BIDS DESIRED.

Boston, Mass.—Until March 27 at office of Metropolitan Park Commission, 14 Beacon Street (John R. Rablin, Engr.), for improving road in Alewife Brook Parkway, to consist of 10,800 sq. yd. roadway surfacing, 2900 sq. yd. walks, 2045 lin. ft. 10 and 12-in. vitr. drain, 27 catch-basins, manholes, etc.

Springfield, Mass.—Until March 30, by F. H. Clark, Supt. of Streets and Engineering, for furnishing trap rock, sidewalks, granite block paving, pipe, etc., for Dept. of Streets and Engineering.

Westerly, R. I.—Until April 4, by Town Council, for reconstructing Watch Hill Road, advertised in Engineering Record.

Meriden, Conn.—Until April 4, by Board Public Works, for street paving, advertised in Engineering Record.

New York, N. Y.—Until March 31, by Wm. Williams, Commissioner Water Supply, Gas & Electricity, for filling and grading the ground owned by city between Sedgwick Avenue and the N. Y., N. H. & H. R. R., at High Bridge, Borough Bronx; security $2,000.

Dover, N. J.—Until April 11, by Board Chosen Freeholders (W. H. Hosking, Clerk), Morristown, for improving road known as Blackwell Street and Sussex Turnpike Road in town of Dover, Randolph Township, 10,497.73 ft. long with bituminous concrete pavement, Type B. C., Grade A (amiesite) surface on macadam foundation 26,688 sq. yd.; also for improving road known as Sussex Turnpike Road in Townships of Randolph and Roxbury, about 5,615.57 ft. bituminous concrete pavement, Type B. C., Grade A (amiesite) surface upon macadam foundation, estimate amount of surface pavement 11,403.64 sq. yd.

Freehold, N. J.—Reported desired until April 5 by Board Freeholders (Charles E. Close, Clk.) for improving Pinckney Road at Red Bank and Shrewsbury; constructing first section of Freehold-Adelphia Road, reconstructing second section of Keyport-South Amboy Road; replanking Claypit Creek bridge in Middletown Township; constructing bridge at Bergen's Mill cutoff, etc.

Paterson, N. J.—Until April 5, by Board Chosen Freeholders (George W. Botbyl. Clerk), for repairing, remacadamizing. etc., portions of East Sixteenth, East Fifth, East Main, East Eighteenth and numerous other streets, and asphalt concrete repair on portions of Market, East Eighteenth and other streets.

Maryland.—Until April 11, by State Road Commission, 601 Garrett Building, Baltimore, for paving as follows: Contract No. BC-17, Section 11, approximately 2000 lin. ft. sewer; Contract No. BC-17. Section 12, approximately 6000 cu. yd. exvac., advertised in Engineering Record.

Charlestown, W. Va.—Until March 31 by B. A. Wise, City Manager, for grading, curbing and paving twelve squares. Address J. M. Clark, City Engr.

Gastonia, N. C.—Until April 12 by Board County Commissioners (A. J. Smith, Clk.) for tarvia binding and repair work on macadam road leading from Gastonia to St. Mary's College, about 10 miles.

Bartow, Fla.—Reported desired until April 18 for constructing 240 miles road, brick asphalt and asphalt concrete considered. H. S. Jaudson Engr. Co., Atlanta and Savannah, Ga., Engrs.

Bronson, Fla.—Reported desired until April 10 by A. P. Hardee, County Clerk, for constructing roadway system in Special Road and Bridge Dist. No. 1, Lebanon-Inglis, 29.5 miles road, 155,000 sq-yd. pavement, 60,000 cu. yd. excav., etc.

Sarasota, Fla.—Reported desired until April 20 by County Board for constructing roads and bridge in Sarasota Venice District, to consist of 28 miles of sand asphalt and 19 miles graded roads; also bridge over Sarasota Bay. Bonds for this work will be sold April 17.

Dothan, Ala.—Reported desired until March 31 for constructing road from point near Dothan toward Crosby, a distance of 15 miles. W. R. Koonce, Co. Engr.

Marysville, Tenn.—Until March 30 by County Commissioners (R. L. Beit, Secy.) for improving roads in Blount County, approximately 75 miles grading and 70 miles macadam chert or gravel.

Earlington, Ky.—Reported desired until April 3 for constructing one mile macadam paving. W. E. Roth, Mayor.

Batavia, Ohio.—Reported desired until April 15 for paving between Batavia and Chile. Probable cost $25,000. L. H. Lersh, Engr.

Cleveland, Ohio.—Until March 29, by Commissioners of Purchases and Supplies, for paving portions of Baxter, Harvard and Grace Avenues and other streets.

Columbus, Ohio.—Reported desired until April 4, G. A. Borden, Dir. Pub. Service, for paving on portions Dennison Ave., High and Jackson Sts., and other streets with asphalt or brick.

Jefferson, Ohio.—Until March 27 by Board County Commissioners (B. E. Brainerd, Clk.) for improving Morgan Road No. 4, in Morgan Township, and Eagle Road No. 2, in Austinburg Township.

Greensburg, Ind.—Until April 3, by County Commissioners, for a 10-ton double cylinder steam road roller with scarifier. John C. Barbe, Co. Aud.

Indiana.—By County Commissioners for constructing roads as follows:

March 29:
Anderson, gravel road in Lafayette Township, and two concrete roads in Anderson Township. E. T. Flahavin, Co. Aud.
April 3.
Paoli, constructing 10,296 ft. gravel on macadamized roads in Orangeville and French Lick Townships. E. A. Palmer, Co. Aud.
Kentland, constructing two macadam roads in Lake and Lincoln Townships. S. R. Sizelove, Co. Aud.
April 4:
Goshen, East Lincoln Avenue Road with brick or gravel in Elkhart Township. A. R. Bemenderfer, Co. Aud.
Winamac, improving roads in White Post, Jefferson, Beaver and Salem Townships. W. E. Munchenburg, Co. Aud.
Washington, constructing two pike roads in Washington Township. J. G. Clark, Co. Aud.
Noblesville, concrete and gravel road in Jackson Township. W. O. Horton, Co. Aud.
Decatur, macadamized roads in Root and Union Townships. T. H. Baltzell, Co. Aud.
Wabash, constructing roads in Lagro and Noble Townships. F. P. Kircher, Co. Aud.
April 5:
Huntington, constructing roads in Jefferson and Jackson Townships. O. E. Evlston, Co. Aud.
April 6:
Columbus, crushed stone roads in Rockcreek, Hawcreek, Clay and Flatrock Townships. W. H. Scott, Co. Aud.

Lawrenceburg, Ind.—Until April 3, by County Commissioners, for steam or oil-burning road roller, 10 tons, with scarifier, etc., H. E. Lutherbeck, Aud.

North Vernon, Ind.—Until April 14 by Charles W. Miles, City Engineer, for 4732 sq. yd. brick, bitulithic, asphaltic concrete, asphalt, concrete or waterbound macadam on Walnut Street.

South Bend, Ind.—Until April 4, by Department Public Works, for paving Michigan Street and Indiana Avenue, advertised in Engineering Record.

Bergland, Mich.—Reported desired until March 31 by Township Board (John B. Haskins, Clk.) for constructing 6.6 miles of rock and gravel roads.

Coldwater, Mich.—Until April 10, by Branch County Road Commissioners, for constructing 1 mile of concrete road. Road to be built according to State specification for Class F road with 16-ft. metal top and 24-ft. grade.

Hartford, Mich.—Until April 10, by Elmer D. Conklin, Village Clerk, for grading and paving Main Street with vitr. brick. Wm. J. Cleary, City Engr.

Houghton, Mich.—Until April 15 by Board County Commissioners for construction of macadam on following sections of road: Dollar Bay to Lake Linden, 7 miles; Lake Linden to Calumet, 3 miles, and Calumet to Allouez, 3 miles. R. Martin, Engr., Houghton.

Sheridan, Mich.—Until April 15, by Township Board (John M. Beem, Clk), for constructing 4½ miles of road in Newaygo County.

Chicago Heights, Ill.—Until March 28, by Board Local Improvements, for 46,500 sq. yd. asphaltic concrete pavement on 6-in. concrete base, and 32,500 lin. ft. concrete combined curb and gutter, and 1278 crossing curb. M. H. McCoy, Engr. of Board.

Dixon, Ill.—Until April 6 for brick highway construction advertised in Engineering Record for which $82,500 bonds have been sold. Address F. D. Palmer, Town Clerk.

Edwardsville, Ill.—Reported desired until April 1 by Town Highway Commissioners (Jesse F. Yates, Chmn.), for constructing 6000 ft. concrete road.

Geneva, Ill.—Until March 31, by Board Local Improvements for brick pavement concrete curb and gutter and storm water sewer in State St., asphalt and brick pavement in 3rd St. A. L. Stimple, City Clk.

Washburn, Wis.—Reported desired until March 28 by Board Public Works (James A. Sheridan, Pres.) for paving on First Avenue, East Avenue and Bayfield Street. Bids on brick, sheet asphalt, asphaltic concrete, bitulithic and creosoted wood block.

Burlington, Iowa.—Until March 30, by Robert Kloppoch, City Clerk, for brick pavement on Seventh and Market Streets, and with concrete on Aetna Street and alley No. 2. C. E. Waterhouse, City Engineer.

Sheldon, Iowa.—Reported desired until April 3 by County Supervisors for road work for year.

Perry, Iowa.—Until March 27 by Charles E. Wilson, Engineer, Perry, for 30,000 sq. yd. brick, concrete, asphaltic, creosoted block on concrete foundation, including 7920 lin. ft. curb and gutter.

Sac City, Iowa.—Reported desired until April 3, by C. C. Johnson, City Clerk, for grading, curbing and paving various streets. Bruce & Standeven, Engrs., Omaha, Neb.

Ortonville, Minn.—Reported desired until March 28, by A. V. Randall, County Auditor, for improving State roads in all about 60,350 lin. ft. turnpiking, 25,930 cu. yd., grading, etc.

St. Paul, Minn.—Until April 3 by August Hohenstein, Purchasing Agent for paving materials for Canada St., including 1044 bbls. Portland cement, 60,130 tons asphaltic cement, 66,143 tons limestone dust, 2725 sewer brick, etc., and for Como Avenue 2422 sq. yds. vitr. brick paving blocks, 8254 sq. yds. 3½ in. creosoted yellow pine blocks, 2117 bbls. Portland cement, 30,275 lbs. asphalt filler, 57,778 lbs. patch filler, 4000 sewer brick, etc. Snelling Avenue 7638 sq. yds. 3½ in. creosoted yellow pine blocks, 1342 sq. yds. vitr. brick blocks, 1756 bbls. Portland cement, 1247 cu. yds. crushed rock and gravel for paving foundations, 53,466 lbs. pitch filler, 15,775 lbs. asphalt filler, 3195 sewer brick, etc.

St. Paul, Minn.—Reported desired until March 27, by Aug. Hohenstein, Purchasing Agent, for paving portions of Snelling Avenue, Hague and Sebly Avenues and other streets.

St. Paul, Minn.—Until April 3, by Board County Commissioners, for grading and improving Elwell Road, from Ramsey County line north to Station 67-63. Geo. J. Reis, County Auditor.

Stuntz, Minn.—Reported desired until April 5 by Town Board for improving two miles of Koivu Road in Township 56.

Wheaton, Minn.—Reported desired until April 4, by J. T. Erickson, County Auditor for paving State roads requiring 112,500 lin. ft., turnpiking, 9300 cu. yd. grading, etc.

Lincoln, Neb.—Reported desired until March 27, by Theo. H. Berg, City Clerk, for 5520 sq .yd. vertical fibre brick in District 342; cost $14,000, and 5190 sq. yd. sheet asphalt in District 336; cost $16,000. A. Dobson, City Engr.

Kearney, Neb.—Reported desired until March 28, by T. N. Hartzell, City Clerk, for paving portions of Twenty-seventh Street and in Districts Nos. 9 and 14.

Norfolk, Neb.—Until April 17, by P. F. Stafford, City Clerk, for paving in Dists. 3, 6, 8 and 9, advertised in Engineering Record.

Aneta, N. D.—Reported desired until April 3, by E. H. Lowen, City Auditor, for cement sidewalks, crosswalks and culverts for year 1916.

Carrington, N. D.—Reported desired until April 3, by H. L. Winterer, City Auditor, for constructing sidewalks and crosswalks for year 1916.

Center, N. D.—Until April 5 by Frank J. V. Kiebert, County Auditor, for horse road graders, fresnos, slips, road drags and road plows, advertised in Engineering Record.

Granville, N. D.—Reported desired until April 3, by G. J. Krogfoss, City Auditor, for sidewalk for year 1916.

Rugby, N. D.—Reported desired until April 3 by T. B. Torson, City Aud., for constructing various sidewalks for year 1916.

Wahpeton, N. D.—Reported desired until April 3, by S. H. Murray, City Auditor, for constructing walks, curbs and gutters for year 1916.

Madison, S. D.—Until about May 15 by Charles A. Trimmer, City Engineer, for 17,000 sq. yd. wood block, bitulithic, asphaltic concrete or sheet asphalt on Egan Avenue, on 5-in. concrete foundation.

St. Louis, Mo.—Until March 31, by Board Public Service, for reconstructing Chouteau Avenue from Jefferson Avenue, running south of Chouteau Avenue.

Dennison, Tex.—Reported desired until March 27 for constructing 13,000 sq. yd. 5-in. concrete base with 2-in. asphaltic wearing surface, etc. Robert Gerlach, City Secy.

Lawton, Okla.—Until April 18 by Department of Interior, Washington, D. C., for furnishing material and constructing driveways, crossings, sidewalks, curbs and gutters, etc.

Centralia, Wash.—Until April 5 by County Commissioners for Pacific Highway from west of Centralia to Lewis County line near Forest, to be three miles one course concrete 16 ft. wide in three contracts. J. D. Neville, County Engineer.

Chehalis, Wash.—Reported desired until April 5, by D. W. Montfort, Co. Aud., for constructing one course concrete road near Forest. Probable cost $15,700; one course concrete road near Toledo, probable cost $17,000; one course concrete road near Centralia, probable cost $14,006. The work involves about 30,000 sq. yd. paving, 55,800 sq. yd. subgrading, culverts, etc. J. D. Neville, Co. Engr.

Ephrata, Wash.—Reported desired until April 4, by C. T. Sanders, Co. Clk., for constructing Permanent Highway No. 1A, easterly 1½ miles; permanent highway at Quincy, running easterly 5½ miles, and north one mile to Winchester, and for permanent highway at Warden, westerly 2½ miles and north one mile. Last two roads for surfacing only.

Mt. Vernon, Wash.—Reported desired until April 4, W. V. Alexander, County Auditor, for constructing 1¾ miles of Permanent Highway, No. 3 A, consisting of concrete paving, etc. A. L. Strong, County Engr.

Pomeroy, Wash.—Reported desired until April 7, by Harry St. George, City Clerk, for paving with concrete, wood block, brick, bitulithic or similar material, approximately 28,000 sq. yd., including 7,500 lin. ft., curb, etc.

South Bend, Wash.—Reported desired until Apr. 4, by W. E. Lovering, Co. Aud., for grading and rock or gravel surfacing 1½ miles. Highway No. 3A, and clearing and grading 1¼ miles, Peninsula Highway. Chas. B. Nims, Co. Engr.

Fresno, Cal.—Until April 3, by W. H. Ryan, City Clerk, for furnishing about 10,000 bbl. road oil, 70 to 80 per cent gravity.

Los Angeles, Cal.—Reported desired until March 30 by Board Public Works for asphalt paving, curbs, gutters, etc., in Pico and four other streets.

Pocatello, Idaho.—Until April 6, by City Council for grading, graveling constructing curbs and gutters, etc., in Local Street Improvement District, No. 10, on North Harrison Avenue, to consist of 15,000 sq. yd. gravel surfacing, 2210 ft. combined curb and gutter, etc. J. H. Giles, City Engr.

London, Ont.—Until March 30 by Bd. of Control for (a) 55,000 sq. yd. asphalt pavement on concrete base, and (b) 2200 sq. yd. vitrified brick pavement on concrete base, advertised in Engineering Record. H. A. Brazier, City Engineer.

PRICES AND LETTINGS.

★Indicates award of contract.

Massachusetts.—Following are three lowest bids opened March 14 by Massachusetts Highway Commission, Boston, for building 6000 ft. of concrete road in town of North Andover: D. J. Sheehan, 424 Broadway, Lynn, $15,721; Alco Contracting Co., 178 North Street, Boston, $17,448, and Perini Construction Co., Ashland, $19,564.

★Contract for above highway awarded to D. J. Sheehan Company Lynn, at $15,721.

Buffalo, N. Y.—Following are four lowest bids opened March 11 by Bureau of Engineering for (a) Jefferson St. from Swan to Best Sts., 21,559 sq. yds., and (b) Broadway, Bailey Ave. to City Line, 7,647 sq. yds.: L. H. Gipp, 787 Richmond Ave., brick (a) $66,360, (b) $21,300; 3 in wood block, (b) $25,800; Erie Contracting Company, Morgan Bldg., brick (a) $68,700; (b) $22,560; H. P. Burgard Co., Buffalo, (a) $75,450; German Rock A. C. Company, Morgan Bldg., asphalt (a) $77,612, (b) $25,460.

★**Syracuse, N. Y.**—Contract for paving Oak Street from Highland Avenue to Roby Street awarded by Board Contract and Supply to Guy B. Dickinson, Union Bldg., at $25,834.

Elizabeth, N. J.—Following are four lowest bids opened March 8 by County Commissioners for 39,439 sq. yd. bituminous pavement on concrete base: H. B. Sproul Construction Company, Peekskill, N. Y., $79,513; Weldon Contracting Company, Rahway, $87,034; John W. Heller, South Orange, $90,244, and John C. Bentley, Hackensack, $92,693. J. L. Bauer, County Engineer.

★**Erie, Pa.**—Contract for paving Rasberry Street awarded by City Council to J. and M. Doyle Co. of Erie, at $10,270.

★City Council awarded contracts for supplies for Street Dept. for 1916 as follows: Asphalt, Warner Quinlan Co. of Syracuse, N. Y.; sand, Erie Sand & Gravel Co. of Erie and American Sand & Gravel Co. of Erie; limestone dust, M. C. & H. E. Mayer of Erie; gravel, Downing Sand & Gravel Co. and Mayer Bros. Constr. Co. of Erie; crushed stone, Wittman-Pfeffer Co. of Erie.

★**Flora, Miss.**—Contract for constructing 25 miles of gravel roads awarded Owens-Cunningham Construction Co., Longview, Tex.

★**Maysville, Ky.**—Contracts awarded by City Council for brick paving to R. L. Schoolfield of Newport, at $21,099, and to Vastine, Noland & Lowery, of Covington, at $43,472.

★**Cleveland, Ohio.**—Contracts for brick pavements awarded by Bd. Control as follows (Bids opened March 1): Thornwood and Hulda Avenues, Baldwin Bros. Co., Rose Building, $25,668; Hyde Court, Nordica, Columbia and other avenues, Roehl Bros., Thompson Boulevard and West Twenty-fifth Street, $40,814; Regent and Bragg Roads, Rieley Bros., Cleveland, $23,515; Barkwill Avenue, A. M. Pejsa Paving Co., $10,157; Columbia and Morrison Avenues, Cleveland Paving & Constr. Co., Citizens Building, $14,229.

★**Chicago Junction, Ohio.**—Contract awarded by Village Council to Johnson & Ritz, Napoleon, at about $25,000 for paving 1¼ miles with reinforced concrete.

★**Newark, Ohio.**—Contract awarded by Director Public Service to Federal Asphalt Paving Co., Hamilton, at $36,000, for paving streets with asphalt.

★**Ravenna, Ohio.**—Contracts awarded to Selfie & Woolf, Youngstown, for reconstructing with bituminous macadam Drakesbury-Windham Road and Painesville-Windham Road, at $42,302 and $56,812 respectively.

Elkhart, Ind.—Lowest bids submitted to Board of Works for paving Indiana Avenue were: Northern Construction Co., Elkhart, at $61,700 for brick; $48,000, concrete; and from $50,000 to $56,000 for asphaltic concrete. Andrews Co., Elkhart, at from $56,000 to $60,000 for sheet asphalt.

★**Goshen, Ind.** — Contract for paving West Lincoln Ave., Harrison Township, with Metropolitan block, awarded Brooks Bros. Construction Co., Fort Wayne, Ind., at $39,182.

★**Indianapolis, Ind.**—Contracts awarded as follows by Marion County Commissioners for constructing roads: Thompson macadam road 2½ miles from Southport to McKensey & Jenkins, Frankfort, $17,750; opening Raymond Street between Bethel and Keystone Avenues and improving same with concrete, to R. E. E. M. Construction Co., Evansville, at $14,818; building a one-mile concrete boulevard in Southern Avenue at south side of Garfield Park, to Harry Marberry, Seymour, at $27,250.

★**Portland, Ind.**—Contracts for improving three roads in Wayne Township awarded as follows: A. L. Jaqua brick road, to Adam Brothers, Lebanon, at $16,841; Wilson Frank brick road, to Walter Swhier, Portland, at $16,592; Arthur Black road, to Sprinkle & Frost, Portland, at $16,508.

★**Escanaba, Mich.**—Contract for about a mile of highway between South Park and city limits awarded by County Commissioners to Delta Contracting Co., Escanaba, at $2.01 per cu. yd. in place.

★**Danville, Ill.**—Following are contracts awarded by Board of Supervisors for constructing the Vermilion County, Ill., Bond issue Roads, 141 miles concrete and 28 miles brick (bids opened March 14, Divisions 2, 5 and 7) (March 15, Divisions 1, 4 and 9) (March 16, Divisons 3, 6 and 8). (P. C. McArdle, Superintending Engineer): Division 1, Harding & Slattery, Crawfordsville, Ind., $116,444; Division 2, Granite City Lime & Cement Company, Granite City, Ill., $172,393.44; Division 3, A. D. Thompson, Peoria, Ill., $113,053; Division, 4, Eclipse Constn. Co., Winnetka, Ill., $101,974.19; Division 5, Prendergast-Clark Constn. Company, St. Louis, Mo., $124,800; Division 6, M. J. Hanick, St. Louis, Mo., $129,825; Division 7, Granite Lime & Cement Co., Granite City, Ill., $132,947.60; Division 8, P. M. Johnston & Co., St. Elmo, Ill. ,$113,200; Division 9, Ewing Shields & Co., Joliet, Ill., $161,315.

Elgin, Ill.—Following are four lowest bids opened March 15 by City, for paving: Asphaltic concrete, Gifford St.: Engineer's estimate, $17,826; McCarthy Construction Company, $15,584; Ben Gross (Stanolind), Laporte, Ind., $15,827; (Texas asphalt), $16,069; White Construction Company, Chicago, $16,426; brick Grove Ave.: Engineer's estimate, $15,844; Logan & Giertz, Elgin, $15,719; Ben Gross, Elkhart, Ind., $16,570, and Illinois Hyd. & Constr. Co., Elgin (stone), $16,924.

Beloit, Wis.—Following are lowest bids on various kinds of pavement opened March 14 by city for paving 25 streets, including Broad, Bluff, North College and other streets, in all about 97,000 sq. yd. paving; 55,000 lin. ft. combined curb and gutter and 400 lin. ft. gy. covered gutter; (a) 100 to 10,000 sq. yd., (b) 10,000 to 25,000 sq. yd. (c) 25,000 sq. yd. and over; Good Road Construction Company, Chicago, Ill., sheet asphalt using Aztec (b) and (c), $1.18, 35 cts. for excav. and 35 cts. for curb and gutter; George Welch, Beloit, brick pavement using Barr block bituminous filler (a), $2.04, (b) $1.99, (c) $1.98; Purington block filler (a), $2.07, (b) $2.02, (c) $2.01; excav. (a), 45 cts.; (b) 42 cts, (c) 40 cts.; combined curb and gutter (a), 52 cts.; (b) and (c) 50 cts.; White Construction Company, Milwaukee, sheet asphalt, Mexican (a) $1.50, (b) and (c) $1.39; Trinidad (a), $1.60; (b) and (c), $1.49; asphaltic concrete using Mexican or Stranolind (a), $1.35; (b) and (c), $1.27; Trinidad (a), $1.45; excavation, (a), (b) and (c), 45 cts.; combined curb and gutter (a), (b) and (c), $1.37; T. W. Quinn, Madison, one course reinforced concrete (b), and (c), $1.31; excavation (b) and (c), 35 cts.; combined curb and gutter (b) and (c), 49 cts.; Commonwealth Improvement Company, Chicago, Ill., sheet asphalt, Stranolind (c), 49 cts.; asphaltic concrete, Stranolind (c), $1.36; excavation (c), 38 cts.; curbing (c), 45 cts.; Hudson Davis Construction Company, Chicago, Ill., sheet asphalt, Texico (c), $1.66; asphaltic concrete, Texico (c), $1.48; one course reinforced concrete (c), $1.57; excavation (c), 40 cts.; curbing (c), 45 cts. Lowest bids for the street railway pavement was from Commonwealth Improvement Company, Chicago, Ill., at $2.25 per sq. yd. for brick, and from George Welch, Beloit, for Portland cement concrete at $1.75. City Engineer.

★**Milwaukee, Wis.**—Contracts awarded as follows by Department Public Works for paving (bids opened March 13) brick pavement (1 job), Manger & McGucken, 33 Layton Bldg., $9,295; Asphalt—T. R. Caughlin Company, 534 Stock Exchange Bldg., Chicago, Ill. (2 contracts), total $89,625; White Construction Company 1006 Ry. Exchange Bldg. (3 contracts), total $48,017; Badger Construction Company, 1015 Ry. Exchange Bldg. (8 contracts), $107,599; Bitulithic concrete—Paul C. Kroeck, 1000 Humboldt Avenue (3 contracts), $43,962. Bids were opened on 21,600 sq. yds. bitulithic concrete, 10,700 sq. yds. brick and 90,400 sq. yds. asphalt.

★**Johnson Creek, Wis.**—Contract awarded Lehmann Bros., Watertown, for 13,019 sq. yd. pavement (bids opened March 8). Ernest Deibel, Village Clerk.

★**Richland Center, Wis.**—Contract for paving Haseltine, N. Church and E. Center Streets (bids opened March 7), awarded White Construction Company, Milwaukee, at $1.46 per sq. yd. for asphaltic concrete on 5-in. base; Trinidad Natural Lake asphalt about 33,813 sq. yds. and 11,782 ft. curb and gutter, cost $56,307. Three next lowest bidders: Butler Construction Company, Waukesha, $1.51; E. Bartlett, Watertown, $1.61, and Western Construction Company, La Crosse, $1.71. H. A. Abbott, City Engineer.

★**Forest City, Iowa.**—Contracts for paving and curb and gutter awarded as follows: 45,000 yd. bitulithic, James Horrabin, Des Moines, $1.89 per sq. yd.; 20,000 yd. Young Bros., St. Joseph, Mo. (Hassam), $1.60; Dearborn Construction Co., Waterloo, 12,000 ft. of curbing, 35 cts. and 42,000 ft. of combined curb and gutter 60 cents. Theo. F. DeLay, Engineer, Creston.

★**Mason City, Iowa.**—Contract awarded Dearborn Construction Co., Waterloo, for 47,000 sq. yd. granite top reinforced concrete paving projected joints, at $1.62 per sq. yd., and curbing 39 cts. per lin. ft. F. P. Wilson, City Engineer.

St. Paul, Minn.—Following are lowest bids opened by August Hohenstein, Purchasing Agent, for paving: W. J. Hoy, Metropolitan Building, asphalt concrete, Laurel Street, $28,702; Ashland Avenue, $28,004; Fourteenth Street, $12,878; Prescott Street, $9,409; creosote wood block, Eleventh Street, $15,980; brick, State Street, $9,800. McClure Contracting Co., McClure Building, creosote wood blocks, Grove Street, $17,280. Fielding & Shepley, 216 W. University Avenue, asphalt concrete, Hague Avenue, $28,154; creosote wood block, Victoria Street, $19,380; Portland Avenue, $47,441; and Como Avenue, $35,964.

★**Atchison, Kan.**—Contract for 8,000 sq. yd. brick pavement awarded Lain Construction Company, St. Joseph, Mo., and 10,000 sq yd. concrete pavement to W. F. Edgell, Leavenworth and Universal Concrete Company, St. Joseph, Mo. (Bids opened March 6.) Frank S. Altman, City Engineer.

Muskogee, Okla.—Lowest bid opened March 13 by City Commissioners for paving Seminole Avenue, District No. 10, submitted by Park-Moran at $55,327.

★**Seattle, Wash.**—Contract for grading and paving Donal Street awarded by Board of Public Works to Jahn Contracting Co., Pioneer Block, at $109,939.

★**Spokane, Wash.**—Contract awarded by County Commissioners for constructing Permanent Highway No. 1-B to Spokane Asphalt Macadam Paving Co., Spokane, at $30,200.

★**Stevenson, Wash.**—Following is the unit figure of the successful contractor, General Construction Co., Spokane, for Mill "A." Underwood Section of Skamania Highway Unit No. 1 (bids opened by Commissioners of Skamania County): 56 acres clearing, $35; 69,000 cu. yd. earth exc., 20 cts.; 9000 cu. yd. rock exc., 70 cts.; 26,000 cu. yd. loose rock exc., 35 cts.; 50 cu. yd. rock fill, hand placed, $1; 175 cu. yd. second-class gravel concrete, $8; 1630 sq. ft. expanded metal, in place, 8 cts.; 100 lb. steel and cast iron, in place, 6 cts.; 50 sq. yd. cobble paving, in place, $1; 6500 lin. ft. wood guard rail, in place, 20 cts.; 300 cu. yd. third-class masonry, dry, in place, $2; 7 M ft. timber and plank, in place, $25; 45,000 cu. yd. overhaul, per 100 ft., 2 cts.; 3000 cu. yd. gravel surfacing, in place, 70 cts.; 50 cu. yd. loose stone for drains, $1; 472 lin. ft. placing corr. iron pipe, 18 in., 25 cts.; 1416 lin. ft. placing corr. iron pipe, 12 in., 20 cts.; 21 acres grubbing, $60; total, $39,583.

★**Bakersfield, Cal.**—Contract awarded George S. Benson & Sons, Stimson Bldg., Los Angeles, for about 8 miles of road on Division 7, Section 4, of Bakersfield Taft Road, requiring 26,300 cu. yd. excav., 12,200 lin. ft. shaping roadbed, 70,563 sq. yd. concrete pavt., with bituminous surface, 35,940 ft. creosoted timber in bridges, etc., at $56,647. Next three lowest bidders: Lynn S. Atkinson, Story Bldg., Los Angeles, $56,877; A. C. McLea Construction Co., $57,267, and Marin Rock Co., $58,193.
★Contract awarded Robert Sherer & Co., Pacific Electric Bldg., Los Angeles, for grading, etc., on 6 miles of Division 10, Section 8, Bakersfield Mohave Road, involving 57,000 cu. yd. excav., 2230 ft. 18 to 36 in. corrugated iron pipe, 23,870 ft. creosoted timber in bridges, etc., at $29,882. Other bidders: George S. Benson & Sons, $29,882, and Marin Rock Co., $43,670.
★Contract awarded Castro & Blaisdell, Bakersfield, for grading, etc., on Division 9, Section 6, Bakersfield Glenville Road, involving 2800 cu. yd. excav., 12,130 sq. yd. concrete pavt., with bituminous surface, 24,650 ft., creosoted timber, etc., at $9,720.

Burbank, Cal.—Lowest bid opened for improving Grand Avenue and Tenth Street, in Road Dist. No. 63, submitted by E. A. Baker, 407 H. W. Hellman Building, Los Angeles, at $12,998. Work involves 19,037 sq. yd. concrete pavements, 11,725 lin. ft. cement curbs.

★**El Monte, Cal.**—Contract awarded S. C. Contracting Co., Washington Bldg., Los Angeles, for 110,000 sq. ft. oil macadam pavt., 6700 lin. ft. cement curb, 13,400 sq. ft. cement gutter, etc., at $13,021.

★**Fresno, Cal.**—Contracts awarded by City Trustees for bitulithic and Warrenite pavements, cement curbs, gutters and corrugated iron culverts on Ventura, Santa Fe Aves. and First St. to Worswick Street Paving Company and California Road & Street Improvement Company and Thompson Bros., all of Fresno; total amount, about $100,000.

Los Angeles, Cal.—Contract awarded Fred Hoffman, 111 East Twelfth Street, Long Beach, at $45,000, for 3.63 miles of Norwalk-Puente Road in Road District No. 54 and to S. C. Contracting Co., 421 Washington Bldg., at $15,895, for 1.4 miles of Whittier Avenue near Montebello Road District No. 99.
Following are four lowest bids opened March 6 by Board of Supervisors for Sect. C, Mint Canyon Road, involving 64,300 cu. yd. excav., 44,582 lin. ft. shaping roadbed, 99,071 sq. yd. concrete pavt., 18,840 lb. steel, etc. (county furnishing cement, oil, stone and sand): Oscar Ford, Riverside, $62,491; Ford & Stout, Bradbury Bldg., Los Angeles, $64,073; George S. Benson & Sons, Stimson Bldg., Los Angeles, $69,367, and J. S. Hilcnd, $73,112.

★**Ontario, Cal.** — Contract for about 512,000 sq. ft. concrete pavements, 35,000 lin. ft. cement curb and oil screenings surfacing on San Antonio Avenue awarded by County Commissioners to California-Arizona Constr. Co., 1700 E. Washington St., Los Angeles, at $51,880. (Bids opened March 13.)

★**Ventura, Cal.**—Contract for grading 2 miles of Ventura-Nordhoff Road, involving 50,700 cu. yd. excav., awarded E. A. Garland, Santa Barbara, at $10,908.
★Contract for furnishing 66,000 tons of coarse aggregate and 33,000 tons of sand for county highways awarded H. C. Feraud, at 38½ cts. and 17½ cts. per ton, respectively.

★**Phoenix, Ariz.**—Contract for paving 16,000 yd. on South Central Avenue with Tarvia macadam awarded by City Commission to California Arizona Construction Co. of Los Angeles, Cal., at $1.24 per yd.

STREET CLEANING AND GARBAGE DISPOSAL

PROPOSED WORK.

New Castle, Pa.—Construction of a municipal garbage disposal plant and collection of garbage at an estimated cost of $50,000 being considered by City Council. C. H. Milholland, City Engineer.

Newport, Ky.—Construction of a garbage reduction plant is contemplated by city; probable cost $35,000.

Elgin, Ill.—Lowest bid opened March 15 by City Clerk for constructing an incinerator submitted by Morse, Boulger Destructor Company, 39 Cortlandt St., New York, N. Y., at $7,450.

BIDS DESIRED.

Long Island City, L. I., N. Y.—Until April 3 by Maurice E. Connolly, Pres. Queens Borough, for reception, transportation and final disposition of garbage, rubbish, ashes and street sweepings in portion of Fifth Ward, Borough of Queens, during the months of April, May, June, July, August, September and October, 1916, furnishing and operating the necessary dumps, scows, etc., with the right of city of New York to renew said contract for said periods in years 1917, 1918 and 1919 upon the same terms and conditions excepting the provisions of renewal. Security $4,500.

Clarksdale, Miss.—Until April 4 by City Commissioners for furnishing material and constructing garbage incinerator of 12 tons capacity per day. W. N. Purcell, City Clk.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Ft. Wayne, Ind.**—Contract for constructing garbage incinerator awarded W. J. Edwards Company, 925 Monadnock Blk., Chicago, Ill.

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS

PROPOSED WORK.

Docks—New Brighton, S. I., N. Y.—Plans of R. A. C. Smith, Comr. Docks and Ferries, New York City, for erection of six piers between Canal and Grant Streets, Borough Richmond, approved by Sinking Fund Commission on March 18. Five piers to be 125 ft. wide and 1300 ft. long, the other 150 ft. wide, about 1250 ft. long, with 273 ft. slip room between them.

New Jersey.—Governor Fielder at Trenton signed bill providing for Wanaque Watershed development.

Drainage—New Jersey. — Governor Fielder at Trenton signed bill providing for reclamation of meadow land, Newark Bay and Hudson River water front bill.

Dredging—Trenton, N. J.—Governor Fielder signed bill providing an appropriation of $75,000 for waterway between Barnegat Bay and Manasquan Inlet.

Dredging—New Castle, Pa.—Widening of Neshannock Creek between Rosena Furnace dam and Jefferson Street Bridge estimated to cost $40,000. C. H. Milholland, City Engineer.

Pier—Baltimore, Md.—Canton Co. will erect a pier 75 x 500 ft. extending from foot of Third Street. Walter P. Brooks, President, Commerce and Water Streets.

Structural Steel—Wheeling, W. Va.—All bids opened Feb. 23 by the U. S. Engineer, Wheeling, for furnishing and delivering structural steel for service bridge, trestle, etc., have been rejected.

Dock—Ashland, Wis.—The Soo R. R. (C. N. Kalk, Ch. Engr., Minneapolis, Minn.), will construct a $1,500,000 concrete ore dock here.

Dock—Ashland, Wis.—Reiss Coal Co. is reported considering plans for improvements to its dock, at a cost of $100,000.

Ditch—Long Prairie, Minn.—Contract will be let in May for constructing County Ditch No. 32, about 38 miles in length including branches, 10 miles dredge work, balance dug by hand, 171,037 cu. yd. S. S. Sargeant, Engineer, Long Prairie; E. M. Berg, County Auditor.

Irrigation—Santa Maria, Tex.—Committee composed of Judge E. C. Porto, president of Santa Maria Irrigation Co., is securing petitions for presentation to County Commissioners to determine establishment of an irrigation district for public ownership of the canal lines. About $25,000 will have to be voted for improving of the canal lines, about 8 miles in length.

Dredging — Tacoma, Wash. — Don B. Roben, 3017 South Eleventh Street, engineer for Hylebos Creek Port Commission of Tacoma, reports plans completed for the dredging of Hylebos Creek a distance of 2 miles, using material for dike construction along bank for about 3 miles. About 237,000 cu. yd. will be used in dike, three and a quarter miles of drainage ditches will be constructed and eight sluices of reinforced concrete. Approximately 1075 cu. yd. of concrete and 74 tons of steel will be required. The dike will be 8 ft. wide at top. Cost, $200,000.

Dykes—Klamath Falls, Ore.—Don. J. Zumwalt, Klamath Falls, is engineer for the system of dykes, to cost $100,000. A. A. McLaffey, Secy. Dist.

Irrigation—Klamath Falls, Ore.—Directors Klamath Falls Drainage District about to let contract for dredger to construct dykes for said district. Citizens voted recently $100,000 bonds for said drainage district.

Jetties — Marshfield, Ore. — Port of Umpqua Commissioners (Warren P. Reed, Commissioner) passed ordinance providing for issue of $200,000 bonds for constructing jetty on Umpqua River. Capt. James S. Polhemus, Corps Engrs., U. S. A., Portland, Engr. in charge.

Jetty — Umpqua, Ore.—Citizens voted $200,000 bonds for constructing jetty at north entrance of Umpqua River.

Irrigation—Chico, Cal.—Board Trustees, Reclamation District No. 833, filed report with Board Supervisors; cost of construction and maintenance is estimated at $500,000.

Dredging—Long Beach, Cal.—Reported City Commission considering spending about $50,000 to dredge Los Angeles and Long Beach Harbors.

Dam, Etc.—Los Angeles, Cal.—The Sespe Light & Power Company, Los Angeles, has applied to the State Water Commission at Sacramento for permission to appropriate 125 second feet of water in Ventura County for power purposes. The company plans constructing a main canal and pipe line 9 miles in length and a diversion dam 175 ft. high, 2,200 ft. on top and 75 ft. on bottom, constructed of loose rock concrete, concrete masonry and riprap, with a waste-way around dam; a storage reservoir of 67,750 acre ft.

Irrigation — Sacramento, Cal. — E. R. Walker, 607 J Street, Sacramento, has applied to State Water Commission for permission to appropriate 200 second feet of water from South Fork of American River for agricultural purposes. The improvement includes a storage reservoir with a capacity of 50,000 acre feet, also a main canal some 35 miles in length. Land to be irrigated is in Sacramento and Placer counties.

Irrigation—Brawley, Nev.—Board Directors of Irrigation District authorized Chief Engineer to proceed with West Side main canal improvement, cost $14,828, also directed Chief Engineer to dig canal connecting Allison and Lawrence headings to carry water now carried in canal from East Side Heading. Cost estimated at $22,520.

Dredging—Manila, P. I.—See "Paving and Roads."

BIDS DESIRED.

Jacksonville, Fla.—Until April 8, by Board Port Commissioners (J. C. O'Dell, Gen. Mgr.), for constructing a marginal wharf 30 ft. wide and approximately 699 ft. long.

Ditch—Jasper, Ind.—Until April 6, by Clerk Jasper, Circuit Court, Jasper, for cleaning and repairing Jungles-Davis Ditch in Walker and Berkeley Townships, Jasper County.

Ditches—Waterloo, Iowa.—Reported desired until March 27 by Board Directors of Elkhorn Valley Drainage Dist. for constructing drainage ditches.

Ditch—Duluth, Minn.—Until April 1 by County Auditor for constructing county Ditch No. 4, estimated cost $137,000. P. J. McCauley, of Floodwood, engineer in charge.

Wharf, Etc.—Aransas Pass, Tex.—Until April 11 by U. S. Engrs. Office, Galveston, for constructing wharf at Aransas Pass.

Levees, Etc.—Port Arthur, Tex.—Until April 12 by city, for constructing about 200,000 cu. yd. levees, about 150,000 cu. yd. canal and ditch excavation, and about 150,000 M. ft. creosoted pine culverts and bridges. J. F. Coleman, Consulting Engineer, 920 Hibernia Building, New Orleans, La.

Quebec, Que.—Until April 15, by Acting Secretary of Quebec Harbor Commission (St. George Boswell Ch. Engr. and Gen. Supt.) for freight shed and grain galleries in northern extension of Princess Louise Embankment.

Wharf, Etc.—Honolulu, Hawaii.—Until May 1 at Custodian's Office, U. S. Quarantine Station, Honolulu, for removing the entire superstructure of the present disinfecting wharf, including all equipment, etc., at this station and reconstructing same on new foundations.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Dredging—Boston, Mass.**—Contract for dredging about 600,000 cu. yd. in Mystic River awarded by Bd. Harbor and Land Commissioners to Maryland Dredging Co., Baltimore, Md. (bids opened March 8). For unit figures see Engineering Record March 11.

★**Reclaiming Flats — Boston, Mass.**—Contract for reclamation of about 35 acres of harbor flats in East Boston (about 1,000,000 cu. yd.) awarded by Directors Port of Boston to Atlantic, Gulf & Pacific Co., New York, N. Y., at 15.47 cts. per cu. yd.

Rock Removal and Dredging in Harbor—New Bedford, Mass.—Following are four lowest bids opened March 16 by Col. John Millis, Corps Engrs., U. S. A., Newport, R. I., for rock removal and dredging in harbor at New Bedford: (a) Area "A," dredging 173,000 cu. yd., scow measure, per cu. yd.; (b) Area "B," rock removal, 4,887.5 cu. yd., place measure, per cu. yd.; (c) total: Bay State Dredging & Contracting Company, Boston (a), 14.9 cts.; (b), $3.25; (c), $41,661; J. S. Packard Dredging Company, Providence, R. I. (a), 14.3 cts.; (b), $3.85; (c), $43,655; Coastwise Dredging Company, Norfolk, Va. (a), 14.5 cts.; (b), $4; (c), $44,635; Eugene Breymann, Boston (a), 13 cts.; (b), $5; (c), $46,927.

Repairing Breakwater—Point Judith, R. I.—Following are four bids opened March 16 by Col. John Millis, Corps Engrs., U. S. A., Newport, for repairing Point Judith Breakwater, R. I., about 20,000 tons of 2000 lb. each; price given is per ton: Coast & Lakes Contracting Company, New York, N. Y., $2.48; Bay State Dredging & Contracting Company, Boston, Mass., $3.49; E. S. Belden & Son, Hartford, Conn., $3.73, and Estate of John Beattie, Leete's Island, Conn., $4.10.

State Canal Work—Albany, N. Y.—Following are bids opened March 14 for Contract 29-A: Erie Canal, Section 4, completing construction of canal from Station 5136 near Sterling Creek, Herkimer-Oneida County—(a) engineer's estimate, $102,005; (b) Eastover Construction Company, Utica, N. Y., $185,106; (c) Troy Public Works, Utica, N. Y., $190,085; (d) Scott Brothers, Rome, N. Y., $191,181.

	(a)	(b)	(c)	(d)
1 clearing (lump sum)	$300.00	$300.00	$300.00	$300.00
344,200 cu. yd. excavation	0.28	0.34	0.36	0.35
40 M ft. sheeting and bracing	55.00	40.00	56.00	40.00
69,300 cu. yd. farming embankment	0.20	0.20	0.20	0.20
3,300 cu. yd. cinder filling	1.00	1.00	1.00	1.10
1,090 cu. yd. lining	2.25	2.00	1.75	2.25
31.3 M. ft. sawed lumber (Y.P. or D.F.)	60.00	70.00	60.00	70.00
3,400 lin. ft. foundation piles	0.30	0.36	0.30	0.30
76 M. ft. wooden sheet piling	55.00	60.00	65.00	60.00
1,000 sq. ft. steel sheet piling	1.16	1.00	1.15	1.25
515 cu. yd. second-class concrete	7.60	8.00	8.60	8.60
680 cu. yd. second-class reinf. concrete	12.00	12.00	12.00	14.40
100 cu. ft. removing and replacing defective concrete	1.00	1.20	1.25	1.00
10,000 sq. ft. finishing concrete surfaces	0.25	0.30	0.25	0.25
2,370 cu. yd. laying wash wall	0.75	0.90	0.75	1.00
320 sq. yd. furnishing and laying first-class stone paving	4.00	4.80	4.00	4.80
2,190 sq. yd. laying first-class stone paving	1.00	1.00	1.00	1.20
200 cu. yd. furnishing and laying first-class rip-rap	3.75	4.50	4.00	4.50
400 cu. yd. laying first-class rip-rap	1.50	1.80	1.50	1.50
1,350 cu. yd. furnishing and laying third-class rip-rap	3.25	3.90	4.00	3.90
4,060 cu. yd. laying third-class rip-rap	1.00	1.00	1.00	1.00
2,020 lb. structural steel	0.15	0.16	0.15	0.15
15,800 lb. metal reinforcement	0.03	0.035	0.045	0.04
8,100 lb. iron castings, plain	0.03	0.035	0.03	0.04
1,380 lin. ft. wooden fence	0.25	0.30	0.25	0.30
16 M. ft. removing existing flooring	1.60	1.00	1.00	1.00
1 maintaining highway traffic (lump sum)	250.00	100.00	250.00	300.00
1 storehouse (lump sum)	500.00	600.00	500.00	600.00
1 cofferdams, pump, boiler and drain (lump sum)	2,000.00	2,000.00	2,000.00	2,400.00
1 cleaning up site of contract, removing plant and debris (lump sum)	1,500.00	1,500.00	750.00	1,500.00

State Canal Work—Albany, N. Y.—Following are unit prices of four lowest bids opened March 14 by W. W. Wotherspoon, State Superintendent Public Works, for Terminal Contract No. 30, constructing dock wall, an approach to terminal and appertaining structures on east side of Oswego River between Schuyler and Cayuga Streets, Oswego: (a) Engineer's estimate, $103,700; (b) Henry P. Burgard Co., Buffalo, $90,984; (c) H. S. Kerbaugh, Inc., Buffalo, $91,629; (d) T. A. Gillespie Co., Pittsburgh, Pa., $91,840; (e) Morrison & Quinn, Inc., Rochester, N. Y., $92,958.

	(a)	(b)	(c)	(d)	(e)
Clearing (lump sum)	$100.00	$100.00	$70.00	$80.00	$100.00
Cofferdams, pump., bail., etc. (lump sum)	21,000.00	20,000.00	18,225.00	16,536.00	20,000.00
23,700 cu. yd. excavation	0.80	0.50	0.64	0.54	0.70
77 M ft. sheeting and bracing	45.00	46.00	48.00	45.00	42.00
6,600 cu. yd. forming embankment	0.15	0.15	0.07	0.16	0.15
9.2 M ft. sawed lumber	60.00	60.00	60.00	60.00	60.00
2,650 cu. yd. stone filling	1.50	0.10	1.10	0.64	0.80
200 lin. ft. wooden fence	0.30	0.27	0.35	0.80	0.30
6,200 cu. yd. second-class concrete	7.00	7.10	6.50	7.16	6.25
330 cu. yd. first-class reinf. concrete	15.00	10.00	12.15	14.30	14.00
2,700 lin. ft. stone and tile drains	0.12	0.12	0.14	0.12	0.12
675 lb. structural steel	0.06	0.06	0.065	0.06	0.06
6,500 lb. iron castings, plain	0.04	0.04	0.045	0.045	0.04
730 lin. ft. malleable cast-iron nosing	1.25	1.25	1.28	1.15	1.25
41,750 lb. metal reinforcement	0.05	0.05	0.05	0.05	0.045
115 fender fastenings, each	1.00	1.00	1.20	1.20	1.00
15 lin. ft. wrought-iron pipe railing	1.00	1.00	1.00	0.80	1.00
524 lin. ft. metal curb protection	0.25	0.25	0.20	0.30	0.25
1,375 cu. yd. broken stone or gravel surf.	1.60	1.50	1.42	1.65	1.40
300 sq. yd. cobblestone paving	1.60	1.60	0.75	1.30	1.40

★**Dock—Buffalo, N. Y.**—Contract for reconstructing dock along Union Canal at South Buffalo reported awarded by Pennsylvania R.R. Co. to Great Lakes Dredge & Dock Co., Monroe Bldg., Chicago, Ill.

State Canal Work—Albany, N. Y.—Unit figures of lowest bidder for Contract 131 of the State Canal Work—reconstruction of highway bridge crossing the main channel of the Hudson River at Schuylerville, opened March 14 by W. W. Wotherspoon, State Superintendent Public Works, Albany: (a) Engineer's estimate, $3,248; (b) Spalding Construction Co., Suffield, Conn., $29,734.

	(a)	(b)
3000 cu. yd. excavation	$0.75	$0.50
232 cu. yd. lining	1.50	1.50
610 cu. yd. second-class concrete	8.00	7.60
155 cu. yd. fourth-class riprap	2.50	2.50
36 M ft. sawed lumber	65.00	65.00
22 M ft. wooden sheet piling	60.00	60.00
1700 lin. ft. foundation piles	0.30	0.30
730 lin. ft. wooden fence	0.25	0.25
360,000 lb. structural steel	0.049	.047
6 oil signal lamps, each	15.00	15.00
Removing existing superstructure (lump sum)	100.00	100.00
Cofferdams, etc. (lump sum)	1,200.00	1,400.00

★**Dredging—Cleveland, Ohio.**—Contract for dredging 260,000 cu. ft. from Upper Cuyahoga River awarded by Bd. Control (bids opened March 2) to Great Lakes Dredge & Dock Co., 1630 Williamson Building, cost $40,000.

★**Ditches—Blue Earth, Minn.**—Contract for constructing ditches (bids opened March 11) awarded by County Commissioners as follows: Ditch No. 43, Carl Knudsen, Blue Earth, $37,254; No. 42, G. E. Gilbertson, St. James, $53,000; and Judicial Ditch No. 11, Edward Nelson, Wells, $42,850. Jesse L. Herring, County Auditor.

Irrigation—Ft. Laramie, Wyo.—Following are the unit figures of lowest bids opened March 10 by U. S. Reclamation Service, Ft. Laramie, for Earthwork North Platte Project, Nebraska-Wyoming, Ft. Laramie Unit: (a) Engineer's estimate; (b) MacArthur Brothers, Chicago, Ill. (lowest bidder on all schedules). The totals are (a) and (b) respectively: Schedule I—$54,890 and $33,460; Schedule II—$46,800 and $32,465; Schedule III—$90,510 and $53,420; Schedule IV—$45,400 and $34,260.

Schedule I—Sta. 626 to 556. Excavation:

	(a)	(b)
Class 1—111,000 cu. yd	$.17	$.209
Class 2— 16,000 cu. yd	.60	.209
Class 3— 33,000 cu. yd	.80	.209
Overhaul 1000 station cu. yd. at 2 cts. per cu. yd. per 100 ft. station	.02	20.00

Schedule II—Sta. 656 to 647. Excavation:

	(a)	(b)
Class 1—160,000 cu. yd	$.17	$.169
Class 2— 8000 cu. yd	.60	.169
Class 3— 17,000 cu. yd	.80	.169
Overhaul 60,000 sta. cu. yd, at 2 cts. per cu. yd per. 100 ft. sta	.02	1,200.00

Schedule III—Sta. 647 to 725. Excavation:

	(a)	(b)
Class 1—147,000 cu. yd	$.17	$.225
Class 2— 30,000 cu. yd	.60	.225
Class 3— 17,000 cu. yd	.80	.225
Overhaul 16,000 sta. cu. yd. at 2 cts. per cu. yd. per 100 ft. sta	.02	320.00

Schedule IV—Sta. 746 50 to 830. Excavation:

	(a)	(b)
Class 1—220,000 cu. yd	$.17	$.142
Class 2— 8000 cu. yd	.60	.142
Class 3— 2000 cu. yd	.80	.142
Overhaul 80,000 sta. cu. yd. at 2 cts. per cu. yd. per 100 ft. sta	.02	1,600.00

Next three lowest bidders on Schedules 1, 2, 3 and 4 respectively are as follows: Winston Brothers Co., Minneapolis, Minn., $36,630, $32,750, $59,170 and $33,400; W. J. Hay Co., St. Paul, Minn., $46,475, $38,910, $77,015 and $36,160; Wood, Bancroft & Doty, Omaha, Neb., Schedule 3, $79,330; Yale & Reagan, Chicago, Ill., Schedule 1, $48,250; Schedule 2, $41,840; J. E. Hilton, Billings, Mont., Schedule 4, $36,100.

Irrigation—Ft. Laramie, Wyo.—Following are unit figures of the lowest bids opened March 10 by U. S. Reclamation Service, Ft. Laramie, Canal, North Platte Project, Nebraska-Wyoming: Schedule I (a) Engineers' estimate, $60,280; (b) Security Bridge Co., Minneapolis, Minn., $39,877; Schedule II (a) Engineer's estimate, $17,865; (b) MacArthur Brothers Co., Chicago, Ill., $18,265.

Schedule I—Laramie River siphon and Deer Creek siphon:

	(a)	(b)
1600 cu. yd. dry excav	$ .25	$ .375
7000 cu. yd. wet excav	3.00	1.60
2000 cu. yd. concrete	14.00	9.35
200,000 lb. placing reinforcing steel	.01	.0135
2000 lb. placing structural steel	.01	.0125
2800 cu. yd. backfilling	.20	.20
2900 sq. yd. 18 in. dry paving	2.00	1.48
1000 sq yd. 14 in. grouted paving	2.50	1.80

Schedule II— three culverts:

	(a)	(b)
3000 cu. yd. excav	$ .16	$ .30
1350 cu. yd. concrete	8.50	8.00
111,000 lb. placing reinforcing steel	.01	.015
1200 sq. yd. 18 in. dry paving	2.00	2.00
900 sq. yd. 14 in. grouted paving	2.50	2.50
500 cu. yd. backfilling	.30	.50

Next three lowest bidders: Schedule I—MacArthur Bros., Chicago, Ill., $48,710; Winston Brothers Co., Minneapolis, Minn., $54,590; Hoyt Hayden, Spokane, Wash., $63,605. Schedule II—Security Bridge Co., Minneapolis, Minn., $18,766; Winston Brothers Co., Minneapolis, Minn., $21,036; Hoyt Hayden, Spokane, Wash., $23,512.

★**Dike, Jefferson City, Mo.**—Contract for constructing dike on Missouri River above Jefferson City (bids opened March 14 by U. S. Engineer's Office, Kansas City, Mo.) awarded DeWitt & Shobe, Glasgow, Mo., as follows: 2,250 ft. high section dike, $14.40; 2,100 ft. low section dike, $13,000; bank protection, $4,000; total, $63,790.

★**Stone—Portland, Ore.**—Contract awarded Robert Wakefield of Portland, at $110,000, for furnishing stone for north jetty construction at mouth of Nehalem River, Ore.

Dredging—Los Angeles, Cal.—Following are bids opened recently by City Harbor Commission for dredging 250,000 cu. yds. at Smith's Island: S. G. Hinds, Pacific Electric Bldg., 8.4 cts. per cu. yd.; Standard American Dredging Company, 8.6 cts., and Los Angeles Dredging Company, 9.9 cts.

ELECTRIC RAILWAYS

PROPOSED WORK.

Jamestown, N. Y.—Reported work will begin in spring on constructing Youngsville & Jamestown Trolley Co. on line from Sugar Grove, Pa., to Jamestown, N. Y. R. L. Davis said to be interested.

Trenton, N. J.—Reported Trenton, Lakewood & Sea Coast Ry. Co. will soon begin construction of line along Ocean Avenue from Atlantic Avenue to Manasquan Inlet. A survey is being made for an extension from Trenton to Lakewood. George O. Vanderbilt, Trenton, said to be interested.

State College, Pa.—Lewistown & Reedsville Electric Ry. asked Council for a franchise to construct and operate a line in State College. C. E. Gossard, Supt., Lewistown.

Williamsburg, Va.—Reported E. G. Mercer and E. L. Mann, both of Richmond, contemplate constructing an electric railway from Williamsburg to site of proposed powder plant, distance about 7 miles.

Schlater, Miss.—Reported John H. Parsons, Pres. Southern Finance & Constr. Co., Memphis, Tenn., contemplates constructing an interurban railway to connect Schlater, Itta Bena, Greenwood and Black Hawk.

Cincinnati, Ohio.—Election to be held April 25 to vote $6,000,000 bonds to build a rapid transit loop and interurban railway entrance system. Address Director Public Service.

Mansfield, Ohio.—Mansfield Ry., Light & Power Co. is contemplating purchasing 3000 kw. turbine with condenser and cooling tower and a 500 kw., 60 cycle rotary converter.

South Bend, Ind.—Plans being made by Chicago, South Bend & Northern Indiana Traction Co. to double track line between South Bend and Elkhart.

Madison, Wis.—Contracts will be let in April, May and June for constructing 42-mile electric railway between Madison and Janesville for Janesville & Madison Traction Co. G. Pickhardt, 1004 Majestic Building, Milwaukee, Pres.

Minneapolis, Minn.—Contracts will soon be let by Minneapolis & Central Minnesota Ry. Co. for grading, ties, steel and poles for railway to be constructed between Minneapolis and St. Cloud. E. G. Potter, 318 Andrews Building, Pres.

St. Paul, Minn.—Improvements involving an expenditure of $1,500,000 are planned by Twin City Rapid Transit Co. of Minneapolis. Heavy 90 lb. rails with inter rail paving will be laid on Selby Avenue from Milton to Fairview Avenue.

Argenta, Ark.—Argenta Terminal Co., Little Rock, incorporated to construct a belt line 2½ miles long in Argenta. Capital $42,000. Among incorporators, A. C. Butterworth and C. C. Kavanaugh.

Fort Smith, Ark.—About $50,000 will be spent by Fort Smith Light & Traction Co. for improvements to system, including reconstruction of portions of Eleventh and Grand Avenues lines. New rails and 6-in. steel ties will be used.

McAlester, Okla. — Reported about $130,000 will be spent by Choctaw Ry. & Lighting Co. for improvements and extensions.

Martinez, Cal.—Martinez and Concord Interurban Ry. has applied to Railroad Commission for permission to construct the first unit of the proposed line from Martinez to Concord, Contra Costa County, a distance of 3.3 miles, and cost $83,241. The entire line is to be about 9 miles.

London, Ont.—London Street Ry. Co. plans to double track line on Dundas Street, E.

Toronto, Ont.—Engineers of Provincial Hydro-Electric Commission have submitted to Adam Beck plans and estimates covering seven radial railway lines in Western Ontario. Surveys and estimates of cost of construction, operation, etc., have been completed on following lines: Toronto, Port Credit & Oakville to Hamilton, this line to connect at Port Credit with Toronto-London line, already approved by voters of municipalities interested; Hamilton, Grimsby & St. Catharines to Niagara Falls; St. Catharines, Welland & Port Colborne; Dunnville, Port Colburne, Fort Erie, Bridgebury & Niagara Falls; Elmira, Waterloo, Berlin, Preston, Galt & Hamilton; Owen Sound, Chesley, Brussels, Seaforth, Woodham and Kirkton.

Lacombe, Alta.—Lacombe & Blindman Valley Electric Ry. Co. plans to complete line from Lacombe to Rimbey. J. C. Gibson, Toronto, Pres.

BIDS DESIRED.

Boston, Mass.—Until April 11, by Boston Transit Commission (B. Leighton Beal, Secy.) for building Section "J" Dorchester Tunnel, advertised in Engineering Record.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**New York, N. Y.**—Contract for completing construction of station finish at Hunters Point Avenue Station on the Queensboro subway in Queens awarded by the Public Service Commission for the First District, 154 Nassau Street, to Degnon Contracting Co., 30 E. Forty-second Street, for $32,219; and for construction of station finish on Sections Nos. 1 to 4 of Route No. 5, southern portion of Broadway subway, in Manhattan, to D. C. Serber, 1123 Broadway, at $344,716 (bids opened March 10). For unit figures see March 18 issue.

RAILROADS

PROPOSED WORK.

Providence, R. I.—Reported New York, New Haven & Hartford RR. Co. (Edw. Gagel, Ch. Engr., New Haven, Conn.) considering spending about $2,000,000 for improving terminals, including a freight house in West Exchange Street freight yard; cost about $700,000.

Buffalo, N. Y.—Reported International Railway Co. (Edgar J. Dickson, Gen. Mgr.) will spend $1,150,000 for roadbed, trackage and for general imrpovements and extensions to system.

Jersey City, N. J.—Lehigh Valley Harbor Terminal Co., Hoboken, incorporated to build a railroad from main line of Lehigh Valley R. R. near Chapel Street to piers on Jersey City waterfront. Cost, $100,000.

Baltimore, Md.—Baltimore & Virginia R. R. authorized to issue $1,000,000 stock and $500,000 to build a road connecting Baltimore to Anne Arundel and Calvert Counties and terminating at mouth of Patuxent River.

Nashville, Tenn.—Nashville, Hartsville & Red Boiling Ry. Co. applied for a charter to construct railway from Hartsville through Lafayette to Red Boiling Springs. Capital $50,000. Among incorporators John C. Shofner and Howard Andrews.

Uniontown, Ky.—Uniontown Southern R.R. Co., incorporated to construct a railroad from Uniontown to Paducah via Morganfield and Sturgis. Capital $150,000. Principal office, Morganfield.

Goldbar, Wash.—Reported Great Northtrn Ry. Co. (A. H. Hogeland, Ch. Engr., St. Paul, Minn.), will make extensive improvement in local freight yards, increase trackage, etc., this spring. Cost, $60,000.

Los Angeles, Cal.—The Hueneme Malibu & Southern Ry. (Frederick H. Rindge, Secy.), Trust & Savings Bldg., Los Angeles, has applied to State Railroad Commission for permission to purchase the assets of the old Hueneme Malibu & Port Los Angeles Ry. and agrees to build a line between Port Los Angeles and Ventura, a distance of about 40 miles.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Buffalo, N. Y.**—Contract for masonry, paving and other work necessary for constructing subways approaches, etc., at Delaware, Lackawanna & Western R. R. through Moeller St., Warring Ave. Gisel Street into Bailey Avenue (bids opened March 18) by Grade Crossing Commission, 435 Ellicott Sq., awarded John Johnson Construction Company, 765 Abbott Road, at $131,341.

★**Cotter, Ark.**—Contract for constructing Cotter, Rush and Mineral Belt RR. from Cotter to Rush, a distance of 15 miles, awarded to Burke Bros. Constr. Co., Ft. Smith, including constructing of all bridges, one a 160-ft. steel bridge over Crooked Creek; cost, including construction and equipment, about $300,000.

★**Portland, Ore.**—Contract awarded to Twohy Bros., Wells Fargo Bldg., Portland, for constructing a 260-mile railroad from Eureka, Cal., to Coos Bay, Ore., for the Southern Pacific Ry. Co.

★**Santa Lucia, Cuba.**—Contract for constructing a Lawson aerial tramway 6 miles long for the Matahambre Copper Mine near Santa Lucia awarded Ambursen Co.,

PUBLIC BUILDINGS AND SCHOOLS

PROPOSED WORK.

Derry, N. H.—Committee appointed to select site for proposed $25,000 school. Address Clerk School Board.

Andover, Mass.—Citizens voted $100,000 bonds for erecting new high school. Address Clerk, School Board.

Boston, Mass.—Mayor Curley has signed the bill providing for a loan of $124,000 for erecting a municipal building at Washington and Ash Stretts, Roslindale.

Lynn, Mass.—Sum of $50,000 has been given for erection and maintenance of Lynn Home for Children.

Pittsfield, Mass.—Special Committee appointed to investigate high school conditions in a report to City Council recommends site on Fenn Street for an additional high school and erecting 20-room school to replace present Tucker School.

Woonsocket, R. I.—Walter F. Fontaine, Woonsocket, selected by School Committee to prepare plans for eight-room school to be erected on High Street; cost $40,000.

Albany, N. Y.—Reported steps being taken to erect General Daniel Butterfield Memorial Science Hall at Union College, to be four stories, 120 x 52 ft., brick and stucco; cost $100,000.

Batavia, N. Y.—Gordon & Madden, 300 Sibley Block, Rochester, engaged to prepare preliminary sketches for new high school. Address Board of Education.

Elmira, N. Y.—Pierce & Bickford, 120 Lake Street, engaged to prepare plans for Chemung County Tuberculosis Hospital; cost not to exceed $22,000.

New York, N. Y.—Erection of a gymnasium costing about $100,000 contemplated for Fordham University.

Trustees of Columbia University approved plans for a school of dentistry. Nicholas Murray Butler, President.

Port Washington, L. I., N. Y.—Plans and specifications completed by Frank T. Cornell, Grand Central Terminal Building, New York, for two-story and basement, 16-room school addition; cost about $100,000.

Troy, N. Y.—Louis N. Millman, Stone Building, is architect for proposed Troy Academy, two stories and basement, brick, stone and concrete, to be erected on Fifteenth Street, at cost of $100,000.

Atlantic City, N. J.—Assembly passed a bill authorizing erection of a convention hall in Atlantic City.

Jersey City, N. J.—John T. Rowland, Architect, Board of Education, has been directed to prepare plans for a new school for No. 4, to have 40 rooms.

Morris Plains, N. J.—Governor Fielder, Trenton, signed bill providing for appropriation of $150,000 for constructing State Hospital at Morris Plains.

Newark, N. J.—Revised plans accepted by Committee on Buildings, Grounds and Supplies of the Board of Education for addition to John Catlin School on Ann Street; cost $127,000. Ernest F. Guilbert, Supervising Architect, City Hall. Plans for additions to Charlton Street School and East Side High School also consid-

New Barbadoes, Bergen County, N. J.—Citizens of Township of New Barbadoes voted $20,000 for purchase of site and $197,500 for erection of a high school, including furnishings, etc., also $45,750 for extension and improvement of School No. 4.

Trenton, N. J.—Assembly passed bill authorizing erection of a vocational school in Mercer County.

Trenton Junction, N. J. — All bids opened by Ewing Township Board of Education for erecting six-room and auditorium school have been rejected as being in excess of the appropriation. Revised plans to be prepared and new bids asked.

Clairton, Pa.—Erection of an additional school costing $150,000 contemplated. Address School Board.

Dunmore, Pa.—School Board contemplating calling election to vote $200,000 bonds for purchasing site and erecting high school.

Forty Fort (P. O. Kingston), Pa.—Architects selected to prepare plans for school; cost approximately $35,000. Address School Board.

Hazelton, Pa.—Plans being revised for the school; all bids opened March 13 rejected; lowest $93,000. D. T. Evans, Secy. Board Education.

Harrisburg, Pa.—Election to be held in the fall to vote bonds for erecting high school.

Ligonier, Pa.—State Legislature has appropriated $40,000 for a site and preliminary expenses for the Western Pennsylvania State Hospital for the Insane to be located near here.

Lititz, Pa.—E. Z. Scholl, Reading, is architect for 17-room brick and stone school to cost $75,000 which citizens recently voted in favor of erecting. E. E. Habecker, Sec'y School District.

Philadelphia, Pa.—Contract will soon be let for erecting five-story, brick, stone and terra cotta hospital and laboratory addition at Thirty-ninth and Filbert Streets for Presbyterian Hospital. John T. Windrim, Archt., Commonwealth Building.

Washington, D. C.—Commissioners D. C. decided upon site at Seventeenth and East Capitol Streets for proposed Eastern High School. Snowden Ashford, Municipal Architect.

All bids opened Feb. 15 by the Commissioners, D. C., for remodeling Central High School have been rejected.

Danville, Va.—Contract about to be let for erecting Southside High School on Grove Street; cost about $30,000. Address School Board.

Matewan, W. Va.—Pedigo & Garry of Bluefield engaged to prepare plans for two-story brick school; cost about $20,000. Address School Board.

Durham, N. C.—School bonds for $81,000 will be sold March 29 by George W. Woodward, City Clk. and Clk. Bd. of Aldermen.

Mocksville, N. C. — Reported Davie County court house, recently destroyed by fire, will be rebuilt. Address County Clerk.

Eatonton, Ga.—Citizens voted $30,000 bonds to erect new school. Roy D. Subbs, Mayor.

Poplarville, Miss.—Board of Supervisors selected N. W. Overstreet of Jackson to prepare plans for new courthouse to be erected here.

Boardman, Ohio.—Stanley & Scheible, Wick Building, Youngstown, engaged by Board of Education to prepare plans for eight-room school; probable cost, $30,000.

Cleveland, Ohio.—The Lake Side Hospital group and the Western Reserve University Medical School will be erected on Euclid Avenue and Adelbert Road. Samuel Mather, Lake Shore Boulevard, Chmn. Bldg Com.

Reported plans submitted to School Board for six-story High School of Commerce.

Eaton, Ohio.—The court house and jail will be two buildings, fireproof, stone and concrete, three stories, 74 x 146 ft. Richard McCarty & Bulford, Columbus, and H. H. Hiestanch, Eaton, Assoc. Archts. A. L. Reid, Chmn. County Court House Commission, Eaton.

Findlay, Ohio.—Citizens of Allen Township March 7 voted $45,000 bonds for erecting centralized school. Address Clerk School Board.

Girard, Ohio.—Citizens March 14 voted $70,000 bonds for erecting two schools, one at Morris Field and the other on Smithsonian Avenue. Address Secretary Board of Education.

Hicksville, Ohio.—Local Board of Education adopted resolution favoring consolidation of Hicksville and Hicksville Township schools and erecting new high school at probable cost of $40,000.

Mansfield, Ohio.—Plans prepared by Vernon Redding, Mansfield, for new City Hospital approved by Building Committee.

Oakwood, Ohio.—School bonds for $40,000 will be sold April 1 by Francis Parrott, Clk. and Treas., Oakwood Village School Dist., 20 Kuhns Building, Dayton.

Tiro, Ohio.—Citizens voted $38,000 bonds for erecting centralized school. Address Clerk School Board.

Danville, Ind.—School Board considering plans for school to cost $25,000.

Fort Wayne, Ind.—Erection of high school on south side under consideration. Address School Board.

Gary, Ind.—Plans to be prepared for a $350,000 school in Tolleston. The erection of a $350,000 school on West Fifth Avenue is under consideration. Address Superintendent of Gary Schools.

East Lansing, Mich.—Contract soon to be let by State Board of Agriculture, Lansing, for erecting new engineering hall and shops to replace the M. A. C. departmental buildings recently destroyed by fire. E. A. Bowd, State Archt., Lansing. Address State Board of Administration, Lansing.

Lake Linden, Mich.—Contract soon to be let for erecting high school; cost approximately $100,000. John D. Chubb, Archt., 109 N. Dearborn Street, Chicago, Ill.

Menominee, Mich. — School bonds amounting to $165,000 sold. Address Board of Education.

Casey, Ill.—Citizens voted $70,000 bonds for site and erection of district high school. Address Board of Education.

Champaign, Ill.—Site on Park Avenue selected for proposed hospital; probable cost $50,000. Rev. R. F. Flynn, Pastor of St. Mary's Roman Catholic Church, may be able to give further information.

Peoria, Ill.—School bonds for $175,000 will be sold April 3 by School Board Inspectors (E. B. Hazen, chmn.).

Milwaukee, Wis.—Election to be held in April to vote $840,000 bonds for school buildings and sites. Frank M. Harbach, Secretary School Board.

Platteville, Wis.—Van Ryn & De Gelleke, Caswell Block, Milwaukee, are architects for two-story and basement, brick and concrete, 107 x 128 ft., agricultural and physical training building to be erected at State Normal School.

Superior, Wis.—Contract will be let about April 1 by County Commissioners for erecting a 2-story fireproof reinforced concrete building for poor farm to cost $60,000. E. S. Radcliffe, Archt., Superior.

Atlantic, Iowa. — Reported Atlantic Hospital Association intends erecting on present site, at Fifth and Oak Streets, a two-story and basement, brick, fireproof hospital, costing $25,000.

Cedar Falls, Iowa.—State Board of Education March 10 authorized erection of Dormitory No. 2, for women, at the State Teachers College, to cost $100,000. Address State Board of Education, Des Moines.

Osceola, Iowa.—Citizens voted $100,000 bonds for site, erection and equipment of new school. Address Board of Education.

Pemberton, Minn. — Citizens voted $30,000 bonds to erect school. Address Board of Education.

Tower, Minn.—Citizens voted to erect an $80,000 school.

Virginia, Minn.—Carl Nystrom of Duluth engaged to prepare plans for high school to cost $344,170.

Waldorf, Minn.—Citizens voted $30,000 bonda to erect school. Address Board of Education.

Ottawa, Kan.—Board of Education has asked Mayor to submit to a vote the proposition to issue $100,000 bonds for a high school.

Winfield, Kan.—School Board March 7 sold $72,000 bonds for erecting manual training high school.

Omaha, Neb.—Board Education appointed following architects to prepare plans for schools: Druid Hill grade school, 12 rooms and auditorium, F. A. Henninger, 805 Omaha Natl. Bank Building; Clifton Hill, 16 rooms and auditorium, F. W. Clarke, 683 Brandeis Building; Park, 16 rooms and auditorium, T. R. Kimball, 503 McCague Building, Bancroft, 12 rooms and auditorium, John Latenser, Bee Building; Field, 8 rooms, George B. Prinz, 1033 Omaha Natl. Bank Building.

Bowman, N. D.—Jesse M. Warren, Haight Building, Seattle, Wash., engaged to prepare plans for two-story brick high school to be erected in Twin Butts School District No. 1; cost about $45,000. Contract will be let about April 1.

Fargo, N. D.—Trustees of St. Luke Hospital will erect a $50,000 addition to the hospital.

Missoula, Mont.—A 4-story, fireproof hospital is to be erected by Northern Pacific Beneficial Association (Dr. George M. Jennings) on site of present hospital.

Maplewood (P. O. St. Louis), Mo.—Citizens March 14 voted $100,000 bonds for erecting schools. Address Board of Education.

Chickasha, Okla.—Contract to let sometime in April for erecting the brick Junior High School for which $50.000 bonds have been sold. Address Superintendent of Schools.

Holdenville, Okla.—Erection of court house and jail under consideration. Address County Clerk.

Oklahoma City, Okla.—Plans and specifications for proposed $100,000 4-story brick and reinforced concrete addition to St. Anthony's Hospital accepted; also plans for chapel, power house and laundry approved.

Walla Walla, Wash.—Plans being prepared by Adj. Gen. Maurice Thompson, Commander of the State National Guard, Haight Building, Seattle, for two brick and concrete armories, one to be erected in Walla Walla and the other in Aberdeen.

Hood River, Ore.—Reported School Board will soon engage architect to prepare plans for a grade and high school costing about $75,000.

Roseburg, Ore.—Citizens voted $75.000 bonds to replace school destroyed by fire. Address School Board.

Alameda, Cal.—All bids opened for erecting Lincoln School rejected by Board of Education as being too high.

Berkeley, Cal.—The $1,800,000 University Building bonds have been appropriated as follows for additional building work on the University of California campus at Berkeley: $700,000 for Benjamin Wheeler Hall (under construction); second unit of group of agricultural buildings, $350,000; first unit of permanent buildings for chemistry, $160,000; new unit for heating and power, $70,000.

Downey, Cal.—School Trustees engaged John C. Austin, Baker Detwiler Bldg., Los Angeles, to prepare plans for school; $35,000 bonds have been voted.

Inglewood, Cal.—High School Trustees engaged Norman F. Marsh, Broadway Central Bldg., Los Angeles, to prepare plans for 2-story brick auditorium, seating capacity 1,100.

Modesto, Cal.—Citizens voted $40,000 bonds for erecting grammar school. Plans being prepared by De Remer & Hewitt, 624 Title Insurance Building, Los Angeles, for 8-room and auditorium building.

Citizens voted $160,000 bonds for erecting high school. Stone & Wright, Stockton, Archts.

Pasadena, Cal.—Election soon to be held to vote $75,000 bonds to erect intermediate school. Address Board of Education.

San Diego, Cal.—Board of Supervisors (John T. Butler, Clk.) contemplate calling an election to vote $100,000 bonds for erecting two buildings at Hospital for Insane and Tuberculosis Patients.

San Leandro, Cal.—Plans approved for two schools; one to be erected on present Ward School site at Dutton and Reid Avenues and the other at East Fourteenth Street and Estabrook Avenue; total cost about $85,000. Address Board of Education.

Salt Lake City, Utah.—School bonds amounting to $200,000 sold. Address Board of Education.

Idaho Falls, Idaho.—The Distinctive Homes Co., Leary Building, Seattle, Wash., selected by School Board to prepare plans for group of school buildings to cost about $200,000. Reported contract will be let about April 1.

Montpelier, Idaho.—Citizens March 14 voted $25,000 bonds to erect city jail. Address City Clerk.

La Prairie, Man.—Contract will soon be let for erecting a school; cost $78,500. F. R. Evans, 130 Selkirk Avenue, Winnipeg, Archt.

BIDS DESIRED.

Camden, N. J.—Reported desired until April 4 by Board Education for erecting a 2-story and basement brick high school. Paul A. Davis, 1713 Sansome St., Philadelphia, Pa., Archt.

Rydal, Pa.—Reported desired until March 29 for erecting 2½-story, 70 x 190-ft., with wing 55 x 75-ft., school. Horace Trumbauer, Land Title Building, Philadelphia, Pa., Archt.

Shenandoah, Pa.—Until April 12, by John C. Cuff, Secy., School Board, for erecting high school. Separate bids for heating, ventilating, etc. Austin L. Reilly, 58-59 Bennett Bldg., Wilkes Barre.

Wilcox, Pa.—Until April 1 by Jones Township School District (William H. Deversux, Secy.) for erecting a school, to cost $30,000. Hirsh & Hirsh, Archts., Altoona.

Elkins, W. Va.—Until May 8 by James A. Wetmore, Act. Superv. Archt., Treas. Dept., Washington, D. C., for erecting U. S. Post Office at Elkins.

Mount Airy, N. C.—Reported desired until April 10 for erecting high school. Northup & O'Brien, Archts., Winston-Salem.

Savannah, Ga.—Reported desired until April 5 by Auditorium Commission, for erecting municipal auditorium. Separate bids desired for ventilating, heating, wiring, etc. Henrik Wallin, Archt., 23 Abercom Street.

Nashville, Tenn.—Until April 3 by Building Committee (T. F. Bonner, Chmn.) for erecting and completing east wing of Hume-Fogg high school. William B. Ittner and Hibb & Southgate, Archts., Stahlman Building, Nashville, and Nashvills Buildera Exchange.

Berea, Ohio.—Until April 12 by A. H. Pincomb, Clk. Bd. Educ., Brook Park Village School Dist., Berea, for erecting a fireproof school at Berea and Five Points Roads. Separate bids for heating, ventilating, electric wiring, etc. W. H. Niclas, Archt., Euclid Building, Cleveland.

Cleveland, Ohio.—Until Apr. 10 by Clerk Board Education for furnishing material for erecting addition to East Technical High School at E. Fifty-fifth Street and Scoville Avenue. Separate bids for heating, plumbing, wiring, etc.

London, Ohio.—Until April 15 by W. F. Glass, Clk. Bd. Educ., for furnishing material and erecting centralized school. J. A. Jones & J. M. Maddux, Archts., 509 Dispatch Annex Building, Columbus.

Ohio.—Until April 18, by Ohio Board of Administration (C. C. Philbrick, Pres.), Columbus, for furnishing material and erecting at State Institutions dormitory buildings Design B2, A, B, C, D and E: A—Institute for Feeble Minded, Columbus. B—Institute for Feeble Minded, Custodial Farm, Orient. C—Columbus State Hospital, Columbus. D and E—Ohio State Hospital for Epileptics, Gallipolis. Bids desired on each building separately and an alternate proposal will be received on each building to apply only in case contractor is awarded contract for all five buildings Richards, McCarthy & Bulford, Archts., Hartman Bldg., Columbus.

Evansville, Ind.—Until April 26 by James A. Wetmore, Act. Superv. Archt., Treas Dept., Washington, D. C., for erecting U. S. Post Office at Evansville.

Portland, Ind.—Until April 27, by County Commissioners (Elmer Smith, Chairman), for erecting a court house, advertised in Engineering Record. McLaughlin & Hursker, Archts., Lima, Ohio.

Lakeview, Mich.—Until April 5 (not April 15, as previously stated) by Board Education (Scott Swarthout, Secy.) for erecting a 10-room school. Jens C. Petersen, Archt., State Bank Building, Traverse City.

Carbondale, Ill.—Until April 11 by Board Trustees Southern Illinois State Normal Univ. for erecting auditorium. Separate bids for heating, plumbing and electric wiring. J. B. Dibelka, State Archt., 130 N. Fifth Street, Chicago.

Eau Claire, Wis.—Until April 10, by Board Education, Emma Schroeder, Secretary, for erecting Second Ward School. Volkman & Hancock, Archts., 106½ Grand Avenue, Eau Claire, Wis.

Des Moines, Iowa.—Until April 3, by Board Education Independent School District of S. Ft. Des Moines (E. Charlesworth, sec'y.), for erecting a school at S. Ft. Des Moines. Separate bids for heating, etc. Smith & Keffer, Archts., 610 Youngerman Building, Des Moines.

Fort Dodge, Iowa.—Until April 18 by J. L. Hanrahan, County Auditor, for erecting county home, to cost $48,000. E. O. Damon, Architect, Fort Dodge.

Waukon, Iowa.—Reported desired until April 7, for erecting a school. Chas. A. Dieman, Archt., Cedar Rapids, Iowa.

West Liberty, Iowa.—Until April 17 by Board of Education (Theodore Jones, Secy.) for erecting a school costing $75,000. Proudfoot, Bird & Rawson, Archts., Des Moines.

Red Cloud, Minn.—Until April 4, by School Board, District No. 2, Webster County, for furnishing material and erecting a high school. Separate bids for heating, ventilating, etc. R. A. Bradley & Co., Archts., Exchange National Bank Bldg., Hastings.

St. Paul, Minn.—Reported desired until March 27 by City Purchasing Agent for erecting three Carnegie branch libraries. Probable total cost $75,000.

St. Paul, Minn.—Until April 3, by August Hohenstein, Purchasing Agent, for iron work, also separate bids for cut stone work for Ames School.

Wagner, S. D.—Reported desired until April 1, by N. G. Warren, Secretary Library Board, for erecting a Carnegie Library. Geo. Issenhuth, Archt., Huron, S. D.

Neosho, Mo.—Until March 28, by Board of Education for erecting a high school.

Smithville, Tex.—Until April 3, by C. C. Smith, City Secretary, for erecting city hall and fire station. C. C. Black, City Secretary.

Sapulpa, Okla.—Until April 6 (change of date), plans for a public library. H. H. Harbison, Chairman Bldg. Com.

Eugene, Ore.—Until March 29, by Executive Committee, Board Regents of Univ. of Oregon, for erecting Education Building for said Univ. Lawson & Holford, Archts., C. & W. Bldg., Eugene.

Roseburg, Ore.—Until April 24 bv James A. Wetmore, Act. Superv. Archt., Treas. Dept., Washington, D. C., for erecting U. S. Post Office at Roseburg.

Elmvale, Ont.—Reported desired until March 31 by W. J. McGuire, Secy., for erecting school for the Trustees of School Section No. 5, Flos Township. Probable cost $21,000. John Wilson, Archt., Collingwood.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Providence, R. I.—Following are four lowest bids opened March 13 by Board of Contract and Supply for erecting the Charles Street School: David J. Barry, 60 E. Manning Street, $139,000 (awarded contract); William H. Hamlyn & Son, 78 Mawney Street, $140,000; Hope Building Co., 87 Weybosset Street, $140,900, and Horton & Hemenway, Laurel Hill Avenue, $148,382. Contracts for heating and ventilating awarded William E. Doherty, 173 N. Main Street, at $16,300, and plumbing, Tierney Colgan Co., 552 Westminster Street, at $8,462.

★**Providence, R. I.**—Contracts for erecting school on Charles St. awarded as follows (bids opened March 13 by Board of Contract & Supply): General contract, D. J. Barry, Providence, $134,709; heating and ventilating, William E. Doherty, Providence, $16,300; plumbing, The Tierney Colgan Company, Providence, $8,462; electric work, Whalen & Butler, Pawtucket, $3,712. William R. Walker & Son, Providence, Archts.; W. C. Pelkey, City Clerk.

★**Mansfield Depot, Conn.**—Contract for erecting six buildings for Epileptic Colony at Mansfield Depot awarded Doyle & Murphy of Willimantic.

★**Batavia, N. Y.**—Contract for constructing U. S. Post Office awarded to George C. Rossell, Triangle Building, Rochester, at $57,993.

★**Little Falls, N. Y.**—Reported contract for steel work on municipal building awarded American Bridge Company, 30 Church St., New York. About 200 tons required.

New York, N. Y.—Following are three bids opened March 20 by C. B. J. Snyder, Superintendent School Buildings, for general construction of addition to and alteration in School 45, Borough of Bronx: James P. Rice, 479 Tremont Avenue, $108,959; H. C. Stowe Construction Company, $129,700, and P. J. Brennan & Son, 624 Madison Avenue, $122,750.

★**Scotia, N. Y.**—Contracts awarded by Board of Education for erecting school to Lewis & Burroughs, 437 State Street, Schenectady; plumbing and heating, Higgins & Gilgore, Scotia, probable cost, $60,000.

Yonkers, N. Y.—Lowest bid opened March 10 by State Board Armory Commissioners, Albany, for erecting armory, submitted by Kelly Construction Co., 45 Warburton Avenue, at $74,707.

★**Fort Lee, N. J.**—Contract awarded Kelly Construction Company, 45 Warburton Avenue, Yonkers, N. Y., for erecting two-story, brick, 29 x 78 ft. school on Whiteman Street; cost $35,000. Ernest Sibley, Archt., Palisade Park.

Allentown, Pa.—Lowest bid opened for erecting gymnasium and auditorium addition to Mosser School submitted by Ochs Construction Company, Allentown, at $27,297.

★**Brackenridge, Pa.**—Contract awarded by Board of Education for erecting eight-room school on Brackenridge Heights to O. O. Dershimer of Butler at $26,775.

★**Haverford, Pa.**—Contract awarded Stacy Reeves & Sons for erecting three-story 35 x 85 ft. addition to dormitories of Haverford College.

Ebensburg, Pa.—Lowest bid opened recently by County Commissioners for addition to and alteration in the court house submitted by King Lumber Company, Charlottesville, Va., at $85,400 for east wing; $49,500 each for north and south wing.

★**Philadelphia, Pa.**—Contracts awarded March 13 by Property Committee of the Board of Education for following school improvements:

★Erecting addition to Jenks School, Thirteenth and Porter Streets: General contract, Standard Construction Co., 225 North Clarion Street, $44,000; heating, A. McClintock, 1937 Ridge Street, $6,315.

★Addition to Key School, Eighth and Wolf Streets: General contract, Melody & Keating, Bailey Building, $67,443; heating, S. Faith & Co., 2427 Pennsylvania Avenue, $19,722; electrical work, Walker & Kepler, 531 Chestnut Street, $7,269; plumbing, Bulman Brothers, 2532 N. Fifth Street, $3,947; ventilating, Thompson Brothers, 125 North Fifth Street, $1,098.

★Addition to T. M. Pierce School, Twenty-third and Cambria Streets: General contract, Melody & Keating, Bailey Building, $59,209; heating, S. Faith & Co., 2427 Pennsylvania Avenue, $10,211; electrical work, Walker & Kepler, 531 Chestnut Street, $3,059; ventilating, J. P. Donnelly, 938 W. Huntington Street, $1,295; plumbing, Walters, Purks & Mellon, 1835 Ludlow Street, $1,073.

West Chester, Pa.—Lowest bid opened March 13 by Pennsylvania State Armory Board for erecting two-story, brick, stone, concrete and steel armory submitted by P. J. Hurley, 1233 Cherry Street, Philadelphia, at $36,790. Philip H. Johnson, Archt., Land Title Building, Philadelphia.

Industrial, W. Va.—Following are four lowest bids opened March 15 by State Board of Control, Charleston, for erecting school building at West Virginia Industrial Home for Girls at Industrial: Longest & Tessier Company, Greensboro, N. C., $41,700; Charles P. Kircher, Athens, Ohio, $43,750; the Acme Construction Company, Charleston, W. Va., $44,220; King Lumber Company, Charlottesville, Va., $45,900.

★**Lafayette, Ga.**—Contract for erecting courthouse awarded Cleghorn & Little of Anniston, Ala., at $77,600.

★**Seabreeze, Fla.**—Contract for erecting school awarded C. T. Dawkins of Jacksonville; cost $50,000.

Cincinnati, Ohio.—Following are bids opened March 14 by County Court House Building Commission for jail construction: (a) Five-ply, tool-proof chrome steel, (b) case-hardened steel, (c) special brand tool proof. Stewart Iron Works, Covington, Ky., submitted only lump bid, as follows: (a), $126,874; (b), $116,230; (c), $113,984. Cellwork: Stewart Iron Wks. (a), $107,490; (b), $96,846; (c), $94,500; Van Dorn Iron Wks., Cleveland (a), $117,981; (b), $112,124. Lowest bid for plumbing, Thomas J. Dyer Company, Cincinnati, $113,471.

★**Springfield, Ill.**—Contracts awarded by Board of Education as follows for erecting DuBois School: General contract and brick work to John Sime, 710 East Jefferson St., at $50,757 and $21,800 respectively; heating Illinois Plumbing Company, 307 S. 6th St., at $4.370.

Antigo, Wis.—Following are four lowest bids opened March 14 by Supervising Architect, Washington, D. C., for constructing U. S. Post Office—(a) limestone, (b) sandstone: James Devault, Canton, Ohio, (a) $60,100, (b) $60,500; W. G. Carter Co., Chicago, Ill., (b) $63,935; Anderson Straudberg Co., Chicago, Ill., (a) $60,575; G. W. Stiles Constr. Co., Rookery Building, Chicago, Ill., (b) $63,226; Thomas W. Cissel, Wooster, Ohio, (b) $62,200; Charles W. Guidele Co., Chicago, Ill., (a) $51,111; W. D. Lovell, Minneapolis, Minn., (a) $59,776.

★**Tomah, Wis.**—Sparta Sash & Door Co., Sparta, have secured contract to erect a building at the County Farm, at $29,625.

★**Two Harbors, Minn.**—Contract awarded L. J. Klippen, Duluth, for erecting high school, at $46,936. A. W. Terryberry, Duluth, Archt.

★**Norton, Kan.**—Contract for erecting school awarded Glenn C. Pearcy, Mankato, at $38,700.

★**Winfield, Kan.**—Bass & Frankenfield of Enid, Okla., have secured contract for erecting Manual Training School for S. W. K. College, to cost $70,000.

Kalispell, Mont.—Following are four lowest bids opened March 10 by Supervising Architect, Washington, D. C., for constructing U. S. Post Office—(a) limestone, (b) sandstone: W. D. Lovell, Minneapolis, Minn., (a) $89,558, (b) $90,300; Welch Bros. & Hannaman, Oakland, Cal., (a) $80,120, (b) $79,320; Olson & Johnson Co., Missoula, Mont., (a) $87,475, (b) $87,690; Thomas E. Young & Co., Seattle, Wash., (a) and (b) $88,331.

★**Brownsville, Tex.**—Contract for erecting high school awarded Walsh & Burney, San Antonio, at $53,000.

★**Lubbock, Tex.**—Contract for erecting court house (bids opened March 8) awarded by County Commissioners to Ralph P. Taylor, Texarkana, at $98,884. Samuel T. Davis, County Clerk.

★**Orange, Tex.**—Contract awarded W. P. Berry & Company, Lufkin, for erecting two schools at $82,057. R. Bradbury, Pres. School Board. (Bids opened March 7.)

★**Orange, Tex.**—General contract for erecting high school and negro ward school awarded W. P. Berry & Company, Lufkin, at $60,330 and $22,927 respectively; heating Dixie Heating and Ventilating Company, Houston, $6,335 and $4,545 respectively.

Oklahoma City, Okla.—Following are four lowest bids opened March 13 by Supervising Architect, Washington, D. C., for constructing extension to U. S. Post Office: Algernon Blair, Montgomery, Ala., $237,172; Dieter & Wenzel Constr. Co., Wichita, Kan., $248,045; W. H. Fissell, New York, N. Y., $257,000, and William H. Maxwell, Lakeside, Wash., $255,520.

★**Miami, Okla.**—Contracts for erecting Ottawa County Court House (bids opened Feb. 28) awarded as follows: General contract, Union Construction Co., Muskogee, $61,000; plumbing and heating, O. K. Plumbing Co., Miami, $5,879.

★**San Francisco, Cal.**—Contracts awarded by Board Public Works for erecting tuberculosis wing of new San Francisco Hosptal as follows: General construction, J. S. Hannah, Williams Building, $213,773; brickwork, Hoberg & Ludwig, 180 Jessie Street, $108,000; heating, Wittman, Lyman & Co., 341 Minna Street, $24,557; elevators, Otis Elevator Co., Beach and Stockton Streets, $12,990; plumbing, the Scott Co., 343 Minna Street, $44,570; electric work, Butte Engineering & Electric Co., 683 Howard Street, $25,728.

Safford, Ariz.—Following are four lowest bids opened March 6 for erecting court house: Lutgerding & Eagan, Phoenix, $40,400; J. M. Sparks, Bisbee, $40,527; Charles Foote, Duncan, $43,250, and Spezia & Spezia, Clifton, $43,800. Martin Layton, Clk. Board Supervisors.

PRIVATE BUILDINGS

PROPOSED WORK.

Springfield, Mass.—Gaginer & Augera, 327 Main Street, will erect a 4-story brick apartment house 40 x 66 ft. on Saratoga Street.

Henry F. Barrett, 318 Main Street, will erect a 4-story brick apartment house on School Street 50 x 108 ft.

Providence, R. I.—Reported improvements contemplated in this city by the New York, New Haven & Hartford R. R. (Edw. Gagel, Chief Engineer, New Haven, Conn.) will cost $2,000,000 and include a new freight house on West Exchange Street.

Hartford, Conn. — Contract about to be let for five-story brick and limestone building to be erected at 293 Asylum Street, for Joseph H. Gold and Harry Zinman. Burton A. Sellew, Archt., 756 Main Street.

Albany, N. Y.—Plans completed by Fuller & Robinson Company, 95 State Street, for four-story and basement reinforced concrete warehouse to be erected for Globe Warehouse Company, Inc., at Dongan Avenue and Westerlo Street.

Brooklyn, N. Y.—Plans being prepared by John Bagley Day, 1265 Broadway, New York, for three-story brick parochial school and convent to be erected at Nostrand and Newkirk Avenues for St. Jerome's Roman Catholic Church; cost about $100,000. Rev. Thomas S. Lynch, Pastor.

Plans being prepared by Ullrich & Hoffman, 373 Fulton Street, for nine-story apartment house to be erected at Henry and Pierrepont Streets for Eighty-two Pierrepont Street Corporation.

Plans filed for two 5-story apartment houses to be erected on Senator Street and Fourth Avenue for Boyd Realty Company; total cost $90,000. Shampan & Shampan, Archts., 772 Broadway.

Buffalo, N. Y.—Nest No. 6 of the Polish Falcons' Alliance will erect at Fillmore Avenue and Stanislaus Street a gymnasium to cost about $200,000.

Plans filed by Buffalo Cement Co., 110 Franklin Street, for 3-story store and apartment building, 60 x 99 ft., brick and concrete, to be erected at Main Street and Filmore Avenue; cost $36,000.

Peter H. Frank, 229 Depew Avenue, will erect 3-story brick and steel apartment building, 300 ft. frontage, on Elmwood Avenue near Summer Street; cost $175,000.

Huntington, L. I., N. Y.—Reported a fireproof building, costing $60,000, is to be erected on Main and Prospect Sts. for New York Telephone Company, 15 Dey Street, New York.

New York, N. Y.—Plans being prepared by Blanke & Timbe, 717 Equitable Bldg., Baltimore, Md., for St. Paul's Lutheran Church, to be erected at La Fontaine Avenue and 178th Street at a cost of $30,000.

Plans being prepared by George A. Boehm, 7 West Forty-second Street, and Starrett & Van Vleck, 8 West Fortieth Street, associate architects, for six-story reinforced concrete building, equipped with a sprinkler system, to be erected at 400 Fifth Avenue for United States Realty & Improvement Company; estimated cost $110,900.

Plans filed for erecting following buildings: 15-story fireproof studio apartments at 2-16 West Sixty-seventh Street for Hotel des Artistes, cost $690,000, Charles Rich & Frederick Mathesius, Jr., Associate Archts., 320 Fifth Avenue; 6-story private residence at 15 East Sixty-sixth Street for Harris Fahnestock, cost $80,000, Hoppin & Koen, Archts., 244 Fifth Avenue; 6-story fireproof store and warehouse at 161 Maiden Lane for Kennedy Estate, cost $50,000, John B. Snook Sons, Archts., 261 Broadway; 12-story private school at 52 East Seventy-eighth Street for Mrs. John O'Hara Cosgrove, cost $170,000, Harde & Hasselman, Archts., 56 West Forty-fifth Street; 12-story fireproof store and office building at 10 Cortlandt Street for L. E. Waterman Company, cost $100,900, Helmle & Corbett, Archts., 190 Montague Street, Brooklyn; 6-story fireproof telephone exchange building at 108th Street and Manhattan Avenue for New York Telephone Company, cost $250,000, McKenzie, Voorhees & Gmelin, Archts., 1123 Broadway.

★Hoggson Brothers, General Contractors, 485 Fifth Avenue, it is reported, will erect for Commonwealth Hotel Construction Corporation a 28-story, brick, limestone, granite and terra cotta hotel, probably in Times Square locality. Starrett & Van Vleck, 8 West Fortieth Street, and Beverly S. King and Shiras Campbell, 103 Park Avenue, associate architects.

Niagara Falls, N. Y.—Charles E. Obenhack, Gluck Building, engaged to prepare plans for four-story and basement, 48 x 92 ft., brick and limestone lodge building to be erected at Main Street and Ashland Avenue for Aerie No. 88, Fraternal Order of Eagles; estimated cost $25,000. George Wagner, Chairman Building Committee.

West New Brighton, S. I., N. Y.—Revised plans prepared by Fred L. Metcalf, 143 North Avenue, Plainfield, N. J., for two-story and basement, 124 x 155-ft. parochial school to be erected for Sacred Heart Roman Catholic Church; cost $100,000. Rev. Thos. J. Heapy, Pastor.

Morristown, N. J.—George B. Post & Sons, 101 Park Avenue, New York, selected to prepare plans for proposed stone and stucco club house to be erected for Morris County Golf Club; cost $135,000.

Weehawken, N. J.—Archilie Ermeti, Weehawken, will erect two 5-story apartment houses on Park Avenue, to cost $60,000.

Altoona, Pa.—Sixth Avenue Church of Brethren contemplating erecting new edifice at Sixth Avenue and Fifth Street to cost about $45,000. Rev. Walter Scott Long, Pastor. A. E. Wilt, Chairman Building Committee.

Berwyn, Pa.—Plans prepared for parochial school for St. Monica's R. C. Church.

Chester, Pa.—Louis H. Giele, 1123 Broadway, New York, is architect for Roman Catholic church to be erected here.

Farrell, Pa.—Bnai Zion Congregation will erect new synagogue at Spearman Avenue and Union Street, costing about $25,000.

Greensburg, Pa.—First Presbyterian Church planning to erect a $250,000 edifice and parsonage.

Harrisburg, Pa.—Harry Salkin of Saxton intends erecting a department store costing $30,000.

Contract soon to be let for erecting edifice for St. Mary's Croatian Catholic Church, South Second Street; cost about $25,000. Rev. Anthony Zuvich, Pastor. A. A. Richter, Archt., Sixth and Court Streets, Reading.

Contract soon to be let for erecting five-story, 100 x 109-ft. reinforced concrete laundry building for W. E. Ortle. W. W. Johnson and Thomas M. Kelkee, Archts., Harrisburg.

Hazleton, Pa.—Erection of $35,000 edifice contemplated by St. John's Primitive Methodist Church.

Philadelphia, Pa.—Plans prepared by Charles W. Bolton & Son, Witherspoon Building, for the Alpha Baptist Church.

Plans being prepared by A. J. Sauer & Co., 1112 Chestnut Street, for five-story, reinforced concrete and brick loft building to be erected at Seventeenth and Arch Streets for Roy Heyman & Brothers.

Contract about to be let for erecting four-story, reinforced concrete, brick and terra cotta building at Broad and Brown Streets for George Miller. Frank E. Hahn, Architect, 1112 Chestnut Street.

Frederick Webber, Morris Building, is architect for proposed 15-story apartment hotel to be erected at Nineteenth and Walnut Streets for Rittenhouse Square Realty Company.

Plans being prepared by Walter H. Thomas for a one-story stone church to be erected at Fifty-second and Spruce Streets for the Protestant Episcopal Church of the Mediator; cost about $100,000.

E. F. Durang & Son, 1200 Chestnut Street, are architects for three-story, granite high school to be erected at Forty-ninth and Chestnut Streets for Roman Catholic Diocese; cost $75,000.

Johnstown, Pa.—Pythian Lodges are reported considering erecting a 5-story building on Vine Street. Henry M. Rogers, Archt., Johnstown.

Phoenixville, Pa.—Plans being prepared by Henry L. Reinhold, Jr., 1309 Walnut Street, Philadelphia, for a home building for the Loyal Order of Moose.

Steelton, Pa.—Plans prepared by A. A. Reichter, Reading, for a $35,000 St. Mary's R. C. Church. Rev. Anthony Zuvich, Pastor.

Williamsport, Pa.—Reported Samuel Larrivee, Williamsport, will erect a 3-story brick store, office and apartment house on West Fourth and Pine Streets.

Wilmerding, Pa.—Plans being prepared for four-story, brick, tile and steel store and apartment building which F. A. Fuller, of Wilmerding, proposes erecting at Herman Street and Commerce Avenue; cost $50,000.

Baltimore, Md.—Piel Construction Co., 2519 Edmondson Ave., will build thirty-two two-story brick houses in West Lanvale Street; cost $80,000.

Bennings, D. C.—Potomac Electric Power Co. having plans prepared by Milburn, Heister & Co., Washington, for a pump house and freight shed.

Washington, D. C.—Plans prepared by B. Stanley Simmons, 1340 New York Avenut, N. W., for seven-story, fireproof, brick and stone apartment building to be erected at Nineteenth Street and Wyoming Avenue for John L. Barr; cost about $250,000.

Hunter & Bell, Southern Building, are architects for two-story apartment house to be erected for John L. Warren at T and Seventeenth Streets; cost approximately $24,000.

Seventh Day Adventists approved plans for erecting addition to Washington Missionary College, costing $47,000. Rev. R. T. Dowsett, Secy.

Norfolk, Va.—Site on Stockley Gardens and Raleigh Avenue, Ghent, selected for new synagogue to be erected for Ohef Sholom Congregation; probable cost $100,000.

Ghent Methodist considering plans for new edifice to cost about $75,000. Rev. G. C. Kelly, Pastor.

Atlanta, Ga.—Plans being prepared by Walker & Chase, Candler Building, for three-story brick apartment house which Fitzhugh Knox intends erecting on West Peachtree and Seventeenth Streets; cost about $40,000.

Griffin, Ga.—H. V. Kell Company, of Griffin, will erect a three-story fireproof store and warehouse building, brick and concrete mill construction, costing $30,000.

Savannah, Ga.—Contract will soon be let for erecting club house for Savannah Golf Club. M. E. Williams, Chairman Building Committee. E. W. Young, Archt., Saving Bank & Trust Building.

Miami, Fla.—Erection of a $100,000 Y. M. C. A. building contemplated. Dr. James M. Jackson, Chairman Building Committee.

New Orleans, La.—Emile Weil, Whitney Central Building, is architect for three-story, stone, terra cotta and brick building which the Benevolent Knights of America intend erecting at 627 North Street; cost $125,000.

Cleveland, Ohio.—Daniel M. Ely, Osborn Bldg., planning erecting an apartment house costing about $50,000 in Euclid. East 105th Street District.

Glengariff Realty Company (A. B. Smythe, Erie Bldg.) reported planning erecting at Euclid Avenue and Forty-sixth Street a cold storage warehouse and artificial ice rink costing $350,000.

Ward Baking Company reported planning erecting a bakery on East Fortieth Street costing $150,000.

Cleveland Trust Co. decided to rebuild six-story Graves Building at East Fourth Street and Prospect Avenue, recently destroyed by fire; cost $25,000.

St. George's Lithuanian Catholic Church, 1389 East Twenty-first Street, proposes erecting new church buildings to cost about $100,000. Rev. Joseph Halaburda, Pastor.

Diocese of Roman Catholic Church proposes erecting new cathedral on Euclid Avenue; probable cost $1,000,000.

Plans filed for erecting four-story, fireproof building at 733 Woodland Avenue for Federated Coffee Mills Co.; cost $25,000. Ernest Huberty, Archt., 8017 Whitethorn Avenue, N. E.

St. Emerich's Hungarian Catholic Church plans erecting a $40,000 edifice to replace building destroyed by fire. Rev. Joseph Peter, Pastor, 2312 Bridge Avenue.

Samuel Gurss, 1261 East Ninety-ninth Street, plans erecting a 3-story apartment house and store building on Cedar Avenue and East Ninetieth Street, to cost about $75,000.

David Rubin, 10709 Drexel Avenue, will erect two apartment houses on Fairchild Avenue and East 107th Street, to cost $80,000.

Terminal Hotel Co. reported planning erecting a hotel on Forest City House site. L. A. Murphy, Akron, may be able to give information.

Plans have been prepared by Forest City Engineering Co., 512 Hippodrome Building, for a 3-story store and apartment house to be erected on Superior Avenue and East 110th Street for J. P. Syotter, 331 Leader News Building.

Plans prepared by S. H. Weis, 1030 Schofield Building, for a 3-story $50,000 apartment house to be erected on Euclid Heights Boulevard for A. E. Dudley, 309 Schofield Building.

Apartment and store building to be erected at 12002 St. Clair avenue for Isaac Kaufman, 2346 E. Sixty-first Street, cost $25,000.

Plans being prepared by Walker & Weeks, 1900 Euclid Avenue, for 4-story addition to Y. W. C. A. building at Prospect Avenue and E. Eighteenth Street, cost $100,000.

Store, apartment and dance hall to be erected at 105th Street and Euclid Avenue for H. O. Oster, 10550 Euclid Avenue, cost $120,000. H. T. Jeffery, 1836 Euclid Avenue, Archt.

A 10-story addition to be erected this spring to Gilisy Hotel at E. Ninth Street and Vincent Avenue; cost, $250,000. George F. Hammond, 4220 Prospect Avenue, Archt. Robert Gill and W. L. Murphy said to be interested.

Bedford, Ind.—Masons contemplate erecting $50,000 Temple.

Elkhart, Ind.—Building costing $35,000 is to be erected in Elkhart for Dr. I. Wright Short of Elkhart.

Indianapolis, Ind.—St. Mark's English Lutheran Church will erect brick church at Prospect and Lunden Streets, to cost approximately $35,000. Rev. L. W. Sifferd, Pastor.

Mishawaka, Ind.—Reported Mishawaka Trust & Savings Company will erect a fireproof building to replace Guaranty Block, recently destroyed by fire.

Notre Dame, Ind.—Reported five new buildings are to be erected at the Notre Dame University. Father Cavanaugh, Pres. University.

Terre Haute, Ind.—Public Service Commission of Indiana directed Cleveland, Cincinnati, Chicago & St. Louis RR. Co. (C. A. Paquette, Ch. Engr., Cincinnati), to construct 650 ft. of train sheds during next six months at station in Terre Haute.

Adrian, Mich.—Plans being prepared by Osgood & Osgood, Widdicomb Building, Grand Rapids, Mich., for four-story, 120 x 60 ft., fireproof, brick and terra cotta Masonic Temple; cost $60,000.

Flint, Mich.—Garland Street Methodist-Episcopal Church contemplating erecting new church to cost approximately $75,000. Rev. W. G. Olmstead, Pastor.

Galesburg, Ill.—Hill Realty Company, Galesburg, will erect a 6-story office building 165 x 66 ft.

Milwaukee, Wis.—Contract will soon be let for 2000 tons of steel required for proposed twelve-story building which the Milwaukee Athletic Club, Wells Building, will erect at Broadway and Mason Street; probable cost $1,000,000.

John Hunholz, 2310 Vliet Street, will erect two $50,000 apartment houses at Oneida and Cass Streets.

Port Washington, Wis.—Plans prepared by Robert Messmer & Brothers, Majestic Building, Milwaukee, for two-story and basement 115 x 139 ft. brick school to be erected for St. Mary's Roman Cathalic Church; cost $45,000.

Superior, Wis.—M. S. and B. J. Cook, proprietors of the Grand Theater in Duluth, Minn., have secured a site at Eleventh Street and Tower Avenue, on which it is proposed erecting a vaudeville theater costing $100,000.

Grinnell, Iowa.—Erection of Masonic Temple contemplated on Main Street; cost about $40,000.

Sioux City, Iowa.—T. S. Martin Co., 515 Fourth Street, intends erecting 8-story, steel, store and office building on Fourth and Nebraska Streets; estimated cost $500,000.

Albert Lea, Minn.—A. P. Hanson, C. F. Stieler and F. W. Barlow, all business men of Albert Lea, will erect three business buildings on West Clark Street, two stories, brick and concrete construction.

Hutchinson, Minn.—Jorgenson Brothers will erect a fireproof hotel on site of old Merchants' Hotel; cost, $65,000.

Minneapolis, Minn.—The International Harvester Company will erect an 8-story warehouse with foundations for 12 stories at Washington and Seventh Streets, North.

Hewitt & Brown, 716 Fourth Avenue, South, are architects for the 11-story bank building to be erected for Metropolitan National Bank on Second Avenue and Sixth Streets, South.

Northwestern National Life Insurance Company will erect a 4-story addition to building at Eleventh Street and Nicollet Avenue.

Linstrom & Almars, Auditorium Bldg., are architects for the 3-story brick apartment house to be erected by Mrs. Thomas Lilly at 21 West Fourth Street; estimated cost, $40,000.

Topeka, Kan.—Plans being prepared by E. L. Tilton, 32 Broadway, New York, N. Y., for a library and office building which the Masons will erect at cost of $100,000. A. K. Wilson, Secy. Masonic Lodge.

Wichita, Kan.—Plans about completed by C. W. Terry, Michigan Building, Wichita, for a 6-story, brick, stone, terra cotta and reinforced concrete fireproof hotel, to cost $250,000. George W. Israel, Owner.

Big Timber, Mont.—Reported Salvation Army contemplates erecting a $100,000 story office and hotel building.

St. Louis, Mo.—Plans are being prepared by Mauran, Russell & Crowell, Chemical Building, for 14 or 15-story fireproof hotel with reinforced concrete floors to be erected on Washington Ave. and Ninth St.

Erection of 13-story, steel and concrete building contemplated at Eighth and Olive Sts.; probable cost $1,000,000. W. J. Holbrook, President of Holbrook-Blackwelder Company, 812 Olive St., may be able to give further information.

Daniel F. Addington, Eighteenth and Pine Streets, reported interested in a syndicate which intends erecting a bachelor apartment and store building at Taylor Avenue and Washington Boulevard, costing about $125,000.

John T. Milliken & Co., 316 Clark Avenue, intends erecting 14-story steel and concrete laboratory building on Third and Cedar Streets.

Dallas, Tex.—Methodists reported planning erection of $100,000 church.

American Exchange Natl. Bank is reported considering erecting a new building.

Dallas, Tex.—Frank O. Witchell, Dallas, is architect for the Adolphus Hotel annex, to be 10 story and cost $1,000,000.

Wells Fargo and American Express Companies contemplating erecting a building to cost approximately $50,000. G. A. Taft, Houston, Tex., General Superintendent.

Houston, Tex.—Plans and specifications being prepared by G. W. Collignon, Chronicle Building, for four-story, reinforced concrete, fireproof warehouse to be erected at 112 Milam Street for R. E. Paine and E. W. Gruendler; cost approximately $25,000.

Tulsa, Okla.—Plans being prepared for ten-story bank building to be erected at Third Street and Boston Avenue for Exchange National Bank.

Denver, Colo.—J. B. Benedict, Central Savings Bank Building, is architect for the three-story store and office building to be erected on Broadway and Tremont Streets by James H. Brown at a cost of $50,000.

William E. and Arthur E. Fisher, Ry. Exchange Building, are architects for the moving picture theater to be erected by Bishop Cass Investment Company at a cost of $100,000.

Centralia, Wash.—Plans being prepared by Roland E. Borkek, Savage-Scofield Building, Tacoma, for proposed $100,000 theater to be erected for Field & Hackett.

Seattle, Wash.—Beezer Brothers, Northern Bank Building, retained to prepare plans for four-story concrete store and loft building which J. T. Nestor, Nestor Building, will erect on Virginia Street and Sixth Avenue; cost $80,000.

Portland, Ore.—Lewis I. Thompson, Corbett Building, engaged by Portland Union Stockyards Co. to prepare plans for an administration building to be erected at Kenton; cost $150,000.

Reported First Christian Church (Scientist) will erect a church at Park and Columbia Streets, costing $75,000. R. E. Bristow, Chairman Building Committee.

Crockett, Cal.—Contract soon to be let for erecting branch bank building on Loring Avenue for Bank of Pinole; cost about $25,000.

Fresno, Cal.—Plans prepared by R. B. Hotchkin, Rowell Building, for a brick church for the First Church of Christ (Scientist); cost $60,000.

Long Beach, Cal.—J. Wesley Roberts and Franklin W. Roberts, J. Wesley Roberts Bldg., Los Angeles, contemplate erecting a brick apartment house at Hart Court and Ocean Avenue costing $65,000.

Modesto, Cal.—Modesto Farmers, Inc. (R. A. Carson, Mgr.), planning to erect a fireproof warehouse, 75 x 100 ft.; also addition to the 2 existing buildings.

Flagstaff, Ariz.—Masons said to be planning erecting $25,000 temple.

BIDS DESIRED.

Poughkeepsie, N. Y.—Until April 1, by John J. Hearn Construction Company, General Contractors, 69 West Forty-sixth Street, New York, sub-bids on school for St. Mary R. C. Church, Rev. John J. O'Brien, pastor; William J. Beardsley, Archt., Poughkeepsie.

Minneota, Minn.—Until April 1, by H. J. Tollemans Cashier Farmers & Mechants National Bank, for erecting a two-story fire-proof bank building. Separate bids for plumbing, electrical work, etc. W. L. Alban, Archt., 347-351 Endicott Building, St. Paul.

Oklahoma City, Okla.—Until March 28 for erecting 5-story and basement building for Williamson - Hallsell - Frasier Grocer Co. Layton & Smith, Archts., Majestic Building.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Brooklyn, N. Y.**—Contract awarded Turner Construction Company, 11 Broadway, New York, for erecting on Main and Water Streets a 12-story 100 x 120 ft. reinforced-concrete building for Robert Gair & Company.

★**Corona (P. O. Flushing), L. I., N. Y.**—Contract for erecting four-story brick convent for Sisters of St. Joseph on Alburtis Avenue reported awarded John J. Long, Corona; cost about $25,000.

★**Long Island City, L. I., N. Y.**—Contract awarded Standard Concrete Steel Company, 42 West Sixty-second Street, New York, for erecting a three-story building at Sherman and Harris Avenues for Pathescope Company of America.

★**New York, N. Y.**—Contract for erecting Pennsylvania R. R. Hotel on 7th Avenue and 33d St., awarded George A. Fuller Company, Fuller Bldg. Bids being taken on the steelwork, about 11,000 tons will be required.

★**Erie, Pa.**—Contract for erecting 10-story Ariel Building at Eighth and State Streets for Joseph B. Campbell awarded Henry Shenk Company, Erie, at $110,000. Alden & Harlow, Archts., 305 Fifth Ave., Pittsburgh.

★**Philadelphia, Pa.**—Contract awarded Doyle & Co., 1519 Sansom Streets, for erecting two-story, granite, steel and concrete, 60 x 140 ft., bank building at Twelfth and Chestnut Streets for Beneficial Saving Fund Society. Horace Trumbauer, Archt., Land Title Building.

Contract awarded Henry E. Baton, Twelfth and Sansom Streets, for erecting five-story, reinforced concrete and steel loft building at 1220 Spring Garden Street for B. Eschner; cost $45,000. Sauer & Hahn, Archts., 1112 Chestnut Street.

★Contract awarded E. E. Hollenback, Inc., Fifteenth and Race Streets, for erecting two-story, brick, stone and concrete, 78 x 70-ft. Sunday School building for Third United Presbyterian Church at Camac Street and Wyoming Avenue; cost $27,900.

★**Philadelphia, Pa.**—Contract awarded by Department of Public Works for paving 65th St. from Haverford to Lansdowne Ave. to J. A. Mullen, 5512 Vine St., at $9,997.

★**Baltimore, Md.**—Contract awarded H. P. Watts Company, Baltimore, for erecting bank building for Sun Life Insurance Company. Louis Levi, Archt., Real Estate Trust Building, Philadelphia, Pa.

★Contract for erecting Y. M. C. A. building awarded to George A. Fuller Co., Lexington and Liberty Streets, at about $100,000. Joseph Evans Sperry, Calvert Building, Architect.

★**Washington, D. C.**—Contract awarded Milburn Heister & Company, Washington, D. C., to R. P. Whitty & Company, Washington, D. C., for 2 additional stories for the American Federation of Labor office building at Ninth Street and Massachusetts Ave. N. W., cost $32,000.

★Contract for steel for the department store building for Lansburgh & Bro. at 7th and 8th Streets awarded by Milburn Heister & Company, Archts., Washington, to Barber & Ross, Washington, D. C.

★**Cleveland, Ohio.**—Contract awarded Robinson Contracting Company, 803 West Superior Avenue, for erecting a 3-story brick and terra cotta building for Dental School of Western Reserve University. Cost $65,000.

★Contract awarded Wells Bros. Company, Chicago, Ill., for erecting a 12-story brick, steel and stone hotel on Prospect Avenue and East 9th Street for the Free Hotel Company, 1004 Prospect Avenue. Victor De Braurere, Minneapolis, Minn., Archt.

Contract for erecting building to include a roller rink, dance hall and moving picture theater on Euclid Avenue, near 100th Street, awarded Paul Bros. Co., 615 Citizens Building, at about $125,000. S. E. Dettlebach, 1543 E. Boulevard, may be able to give further information.

★**Columbus, Ohio.**—Contract for erecting two-story fireproof building for Capital Motor Car Company at Fourth and Capital Streets awarded D. W. McGrath & Son, New First National Bank Building; cost, $30,000.

★**Lakewood, Ohio.**—Contract awarded Duff Construction Company, Marshall Bldg., Cleveland, for erecting 3-story brick parochial school addition for St. James' Catholic Church at Detroit and Granger Avenues.

★**Youngstown, Ohio.**—Contract awarded by James A. Campbell, President of the Youngstown Sheet & Tube Co., to Heller Brothers, 29 S. Phelps Street, for erecting fireproof, brick and stone residence and garage on Logan Avenue; probable cost $50,000.

★**Eau Claire, Wis.**—Contract awarded Wisconsin Construction Company, Chippewa Falls, for erecting edifice for Lake St. Methodist Church; cost $35,000.

Sioux City, Iowa.—Lowest bids received by City Council for paving (a) Perry Creek Road, estimated to cost $44,887; (b) Stone Park Boulevard, cost $18,000, (price given is per sq. yd.), were: Hanlon & Okes, (a) $1.67, (b) $1.57½; Jensen & Krage, Sioux City, (a) $1.69½, (b) $1.69½; M. L. Flinn Paving Company, Sioux City, (a) $1.69; Julius Overson, Sioux City, (b) $1.57.

★**Logan, Iowa.**—Contract for erecting United Brethren Church, awarded E. E. Hollenbach, approximate cost, $25,000.

★**Livingston, Mont.**—Contract awarded by A. W. Miles to Sound Construction & Engineering Co., Seattle, Wash., for erecting brick, tile and stone theater at Second and Callender Streets; approximate cost $50,000.

★**Denver, Colo.**—Contract for erecting fireproof four-story children's hospital awarded Peter Morrison, Denver, at $83,690. Maurice Biscoe, Archt., Exchange Building.

★**Winnipeg, Man.**—Dominion Bridge Company of Winnipeg has secured contract to furnish steel for new Eaton building; about $200,000 worth of steel will be required.

NEW INDUSTRIAL PLANTS

PROPOSED WORK.

Buffalo, N. Y.—William H. Donner, President of Donner Steel Company, Abbott Road, planning extensive improvements, including plant of New York State Steel Company, recently acquired.

Permit issued to Buffalo Union Furnace Co., foot of Hamburg Street, Buffalo, for erecting one-story steel addition to cast-house at plant on Buffalo River and Erie R. R.; cost $25,000.

Elmira, N. Y.—Contract will be let in April for erecting cold storage building for Empire Products Company at Gray Street and Railroad Avenue.

New York, N. Y.—Plans filed for 16-story fireproof factory to be erected at Rose and Frankfort Streets for John Black, 200 William Street: cost $225,000. Timmis & Chapman, Archts., 315 Fifth Avenue.

Niagara Falls, N. Y.—Walter McCullogh, Gluck Building, is engineer for a manufacturing plant for Isco Chemical Co. (M. Speiden, Mgr., Gluck Building), comprising main building 50 x 150 ft., 2-story, and six other 2-story buildings, reinforced concrete. Estimated cost, $300,000.

Sodus, N. Y.—Contract soon to be let by Sodus Packing Co. for erecting 2-story addition to plant, 50 x 125 ft.

Hoboken, N. J.—American Lead Pencil Co., Hoboken, will erect on Willow Avenue and Fifth Street a 10-story, 109 x 75 ft. reinforced concrete factory.

Fred Meystre, 84 Washington Street, retained to prepare plans for artificial ice manufacturing plant to be erected at Thirteenth and Monroe Streets for Hudson Consumers Ice Company (A. J. Volk, President), Thirteenth Street; approximate cost $250,000. Starr Engineering Company, 90 West Street, New York, N. Y., are engineers for the power plant and mechanical equipment.

Lincoln Park, N. J.—Preliminary plans being prepared by L. V. Van Leuven, Bayonne, for an oil refinery to be erected here for Vacuum Oil Company, 61 Broadway, New York, N. Y.; probable cost $2,000,000.

Conshohocken, Pa.—Lee Tire & Rubber Company intends erecting a 2-story 81 x 135 ft. factory.

Farrell, Pa. — Carnegie Steel Company intends making improvements costing $1,000,000.

Hazleton, Pa.—Benjamin Iron & Steel Company, South Pine and Buttonwood Streets, will erect a brick and steel factory, 85 x 200 ft. Max A. Greenburg, Mechanical Engineer, care company.

Phoenixville, Pa. — Thomas F. Byrne, Phoenixville, plans erecting three-story, 206 x 60 ft., mill addition.

Mauch Chunk, Pa.—Mauch Chunk Iron Works contemplates erecting a $60,000 foundry.

Philadelphia, Pa.—Koelle, Speth & Company, Twenty-sixth Street and Oxford Streets, are architects for five-story, brick, stone and concrete, 37 x 80-ft. factory to be erected at 705 Cherry Street for James F. Burns.

Contract about to be let for erecting five-story, reinforced concrete and brick addition to paint plant of Denny, Hilborn & Rosenbach, 230 North Twelfth Street. Andrew J. Sauer & Company, Archts., 1112 Chestnut Street.

Pittsburgh, Pa.—Carbon Steel Company, F and Thirty-second Streets, reported taking steps to secure additional ground adjoining present mill on which to erect extensions.

Wilkesbarre, Pa.—Jenkina-Kirby Packing Company has had plans prepared by McCormick & French, Second National Bank Building, for a 4-story, 56 x 114 ft. factory, one story, 27 x 66 ft. garage, and one story, 25 x 52 ft. power house.

Williamsburg, Va.—Reported E. I Du Pont de Nemours & Company, Wilmington, Del., contemplating erecting plant in vicinity near Williamsburg.

Baltimore, Md.—Plans being prepared for building for Baltimore Sheet & Tin Plate Co. to be erected on Baltimore Street and the Canton R.R. J. E. Aldred of Consolidated Gas, Electric Light & Power Co., Lexington and Liberty Avenues, is interested.

Reported Baltimore Copper Smelting & Rolling Works, Fourth Avenue and Fifth Street, Canton, planning extensive improvements and extensions.

Norfolk, Va.—Norfolk Hosiery & Underwear Company (Joseph B. Hecht, President), Norfolk, intends erecting plant costing $100,000.

Scotland Neck, N. C.—Crescent Hosiery Company, Scotland Neck, will erect a two-story, 110 x 60 ft., mill on present site.

Savannah, Ga.—Savannah Warehouse & Compress Company reported incorporated with Cannon & Barnwell, 230 Bay Street, East, and others, and intends erecting ten warehouses and three sheds for cotton compresses.

Chattanooga, Tenn.—Chattanooga Aseptic Cotton Company, Chattanooga, will erect a $75,000 plant.

Cleveland, Ohio.—George S. Rider & Company, 512 Century Building, is architect and engineer for a 2-story 249 x 160-ft. factory to be erected on East 72nd Street and the New York Central tracks by Properties Company. Present building is to be enlarged later; total cost, $150,000.

Reported Cleveland Wire Spring Company, 1281 East 38th Street, will erect a plant at Harvard Avenue and East 49th Street.

Aetna Rubber Company, 3125 Perkins Avenue, plans erecting a factory at New York Central tracks and East 79th Street, to cost $25,000.

Republic Structural Iron Works Company, East Fifty-third Street, reported contemplating erecting additional factory buildings on Lakeside Avenue to cost about $250,000.

Martins Ferry, Ohio.—Reported American Sheet & Tin Plate Co. contemplates spending about $75,000 in improving Laughlin plant here.

Terre Haute, Ind. — Reported Grasselli Chemical Company, Independence Street, near Broadway, Cleveland, Ohio, has purchased site on North Thirteenth Street and intends erecting chemical plant; probable cost $1,000,000.

Veedersburg, Ind.—The National Car Coupler Co. (J. W. Harrison, Gen. Mgr.) plans erecting an addition to main building and building for cleaning and shipping departments; cost about $75,000.

Manitowoc, Wis.—A. C. Clas, Colby-Abbott Building, Milwaukee, is architect for one-story, 76 x 143 ft., brick, concrete and steel foundry to be erected for Wisconsin Aluminum Foundry Co. A five-ton electric crane will be installed.

Minneapolis, Minn.—Plans being prepared by Barnett & Record Company, Flour Exchange, for 9-story addition to plant of Pillsbury Flour Mills Company.

Spokane, Wash.—Contract soon to be let for erecting addition to Millwood plant of Inland Empire Paper Company (R. S. Talbot, General Manager); probable cost $250,000.

North Portland, Ore.—Plans being prepared for seven-story, 80 x 122 ft., reinforced concrete cooler and curing building to be erected here for Union Meat Company (C. C. Colt, President), 283 Glisan Street, Portland; cost $150,000.

Los Angeles, Cal.—Harbor Commission (F. T. Woodman, Pres.) is reported considering constructing an industrial reservation on channel of west basin, Los Angeles inner harbor, to have steam and electric railway tracks, wide paved street and 4, 6 or 8-story building to be leased to various industries.

Upland, Cal.—Plans being prepared by Homer W. Glidden, 805 Wright & Callender Building, Los Angeles, for a 2-story hollow tile factory, 60 x 100 ft., for California Fruit Products Co. H. N. Bidwell, Chamber Commerce Building, Pasadena, Promoter.

Vancouver, B. C.—Reported Ford Motor Company of Detroit, Mich., contemplates erecting four-story, 173 x 250-ft. assembling plant at Fifth Avenue and Fir Street. W. G. Patrick, Manager Vancouver Branch.

Manila, P. I.—The sugar plant which the Central Sugar Board intended erecting in district of Isabel-Binalbagan is postponed indefinitely.

BIDS DESIRED.

Manayunk, Pa.—Reported desired until March 31 for erecting a four-story brick and concrete slow-burning construction 160 x 58 ft. factory for Fred Pearson & Co., Inc. W. E. S. Dyer, Archt., Land Title Bldg., Philadelphia.

Madison, Wis.—Reported desired until April 1 by Gardner & Lindberg, Archts., 140 S. Dearborn Street, Chicago, for erecting 4-story, 90 x 225 ft., packing and cold storage plant and warehouse for Farmers' Co-operative Packing Co. Probable cost $375,000.

Faribault, Minn.—Until March 27, by Faribault Packing Co., for erecting building for Faribault Packing Co.

Long Prairie, Minn.—Until April 4, by Board Directors Todd County Creamery Co. (Geo. Lano, Secretary), for erecting creamery building at Long Prairie. Creamery Engineering Co., Dassel, Minn.

Quebec, Que.—See "Hydraulic and River Improvements."

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**New Bedford, Mass.**—Contract awarded Locke Building & Construction Company, of Lawrence, for erecting a cotton yarn mill for Manomet Corporation, to be equipped with about 75,000 spindles.

★**Newburyport, Mass.**—Contract awarded E. W. Pitman Company, Lawrence, for erecting mill for American Tire Fabric Company.

★**Bridgeport, Conn.**—Contract awarded Turner Construction Company, 11 Broadway, New York, N. Y., for erecting for Bullard Machine Tool Company a 5 story 48 x 108 ft. manufacturing building reinforced-concrtte with brick curtain walls.

★**Shelton, Conn.** — Contract awarded Turner Construction Company, 11 Broadway, New York, for erecting a 4 story 40 x 80 ft. reinforced-concrete factory for O. K. Tool Holder Company.

West Cheshire, Conn.—By Charles H. Preston, Jr., Archt., Waterbury, for erecting a 1-story 38 x 140-ft. factory for storage and new mufflers having concrete floor, gravel roof, etc.; also a brick office building 38 x 40 ft. with fireproof vaults for the Connecticut Brass Company, Inc., West Cheshire.

★**Brooklyn, N. Y.**—Contract awarded Turner Construction Company, 11 Broadway, New York, for erecting 12-story factory for Robert Gair & Company, Main and Water Streets.

★**Niagara Falls, N. Y.**—Contract awarded Turner Construction Company, 11 Broadway, New York, for erecting a 3 story 80 x 210 ft. factory.

★**Bayonne, N. J.**—Contract awarded Turner Construction Company, 11 Broadway, New York, N. Y., for erecting a powerhouse for the Vacuum Oil Company, Bayonne, to be 22 x 50 ft. brick and reinforced-concrete.

★**Watsessing (P. O. Bloomfield), N. J.**—Contract for erecting factory addition for Westinghouse Lamp Works awarded Truss Concrete Steel Company, 110 West Fortieth Street, New York.

★**Marcus Hook, Pa.**—Contract awarded F. W. Van Loon, Denckla Building, Philadelphia, for erecting two-story, brick, concrete and steel, 100 x 200-ft. factory for Benzol Products Company; cost $50,000; also conveyor for same; cost $50,000.

Philadelphia, Pa.—Barclay, White & Company, 1530 Chestnut Street, secured permit to erect brick and concrete machine shop at Midvale Steel Company's plant; cost $125,000.

★Contract awarded Harrison C. Rea Company, 1027 Wood Street, for erecting one-story brick factory addition for Hess-Bright Manufacturing Company at Front Street and Erie Avenue; cost $40,000. Watson & Huckle, Archts., 1211 Walnut Street.

★Contract awarded George Kessler Contracting Company, Drexel Building, for erecting four-story, brick manufacturing and storage building on Ontario Street for Denstein Hair Company; cost $30,000.

★Contract awarded to Smith, Hardican & Company, 1606 Cherry Street, for erecting two-story, brick and concrete, 50 x 100-ft. factory at Keystone and Cottman Streets for E. H. Gilmer & Company. Harry C. Eisenbise, Archt., Pennsylvania Building.

★**Washington, D. C.**—Davis Construction Company, Union Trust Building, reported contractors for two-story and basement brick and concrete printing shop to be erected for Judd and Detweiler, at Florida Avenue and Eckington Place; cost $35,000. Arthur B. Heaton, Archt., Wilkins Building.

★**Augusta, Ga.** — Contract awarded by Augusta Compress & Warehouse Company to A. J. Martin & Company, Augusta, for erecting compress and warehouse. Georgia-Carolina Brick Company, Augusta, has contract to furnish brick, about 3,000,000 being required. G. Lloyd Preacher, Archt., Augusta.

★**Bristol, Tenn.**—Contract awarded R. A. Wilson of Bristol for erecting packing plant for Aronhime Packing Company; cost about $35,000.

★**Detroit, Mich.**—Contract awarded by Ford Motor Company to George A. Fuller Company, Penobscot Building, for erecting six-story addition to plant; cost about $75,000.

★**Minneapolis, Minn.**—Contract awarded Thompson-Starret Construction Company, Chicago, Ill., for constructing concrete elevator of a capacity of 1,250,000 bu. at the Humboldt Avenue yards in North Minneapolis of the Soo Line. Cost $550,000.

★**Two Harbors, Minn.**—Strom Brothers of Two Harbors secured contract for foundation for the paint shop of the Duluth & Iron Range R.R. Cost of shop complete $40,000.

★**St. Louis, Mo.**—Contract awarded Woermann Construction Company, Century Building, St. Louis, for erecting 2 story steel, concrete and brick factory, 103 x 260 ft. at DeKalb and Potomac Streets, for Fred Medart Manufacturing Company.

MISCELLANEOUS

PROPOSED WORK.

Parkway—Atlantic City, N. J.—Atlantic City Riviera Parkway Company incorporated to build a parkway 8 miles long from Absecon to Oceanville. Joseph G. Kerney is one of the incorporators.

Parks, Etc.—Atlantic City, N. J.—Bd. City Commissioners considering spending $600,000 for improvements to include paving, widening boardwalk, improving parks and comfort stations.

Park, Haddonfield, N. J.—Borough Commissioners authorized election to vote $15,000 bonds for constructing park and boulevard around town.

Park—Paterson, N. J.—The Assembly passed bill providing for constructing playground in Paterson.

Tunnel — Trenton, N. J. — Assembly passed bill authorizing construction of a Trenton tunnel.

Conduits—Erie, Pa.—B. E. Briggs, City Engineer, directed to prepare data and draw up an ordinance for construction of a 12-duct low-tension conduit on south side of W. Tenth Street from Peach to Cascade Street, cost $10,000.

Playgrounds—Wilmington, Del.—Council approved a $65,000 bond issue for playgrounds.

Conduits, Etc. — Cleveland, Ohio. — Cleveland Telephone Co. (Allard Smith, Gen. Mgr.) will spend $1,500,000 in improvements this summer, including underground cables and conduits to cost $700,000; new Fairmount Exchange, cost $300,000; Eddy Exchange, $100,000; and Mario Exchange, $75,000, etc.

Park Bonds—Muskogee, Okla.—Citizens voted to issue $80,000 park bonds. Address City Clerk.

BIDS DESIRED.

Cement—Boston, Mass.—Until March 28, by Massachusetts Highway Commission (Wm. D. Sohier, Chmn.), for furnishing about 5200 bbls. Portland cement.

Traprock Screening, Etc.—Brooklyn, N. Y.—Until March 29 by L. H. Pounds, Boro. Pres., for 7300 cu. yd. broken trap rock, 3800 cu. yd. trap rock screening, etc.

Lamp-posts — Baltimore, Md. — Until March 29 by Board of Awards, at office of City Register, for plain iron gas lamp-posts. William Mohr, Supt. Lamps and Lighting.

Cincinnati, Ohio.—Until April 3, by Parke S. Johnson, Secy. Dir. Pub. Service, for constructing concrete steps on Sperger Avenue, Rankin Street, and at Third Street reservoir.

Asphalt, Etc.—Columbus, Ohio.—Reported desired until April 4 by L. J. Guthke, Secy. Board Purchases and Supply for 1500 tons sand, 120 tons refined asphalt, 8000 gals. flux for asphalt.

Retaining Wall—Sheridan, Wyo.—Until April 4 by James J. Withrow, Co. Clk., for constructing concrete retaining wall on West or Brook Street line of county court house grounds.

Cement—Chehalis, Wash.—Reported desired until April 5 by D. W. Montfort, Co. Aud., for furnishing 10,000 bbls. cement for use of county.

Purchase Copper Cable—Panama.—Until April 6, by Major Earl I. Brown, Corps Engrs. U. S. A., General Purchasing Officer, the Panama Canal, Washington, D. C., for purchase of copper cable, Cir. 1024, advertised in Engineering Record.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Cement—Washington, D. C.**—Contracts awarded as follows by U. S. Reclamation Service, Washington, D. C., for furnishing cement for use on Government irrigation projects: To U. S. Portland Cement Co., Denver, Col., 8000 bbl., f.o.b. cars at Concrete, Col., at $1.37 per bbl., with refund of 10 cts. per sack for sacks returned in good condition, the cement to be used on the North Platte irrigation project, Nebraska-Wyoming; to Union Portland Cement Co., Ogden, Utah, for 2800 bbl., f.o.b. cars at Devil's Slide, Utah, at $1.70 per bbl., with refund of 10 cts. per sack for sacks returned in good condition; this cement required for Boise project, Idaho.

Mail Lifts, etc.—Cincinnati, Ohio.—Otis Elevator Co., Washington, D. C., submitted lowest bid March 13 for installing new hoistways, hydraulic mail lifts, etc., in United States post office and Custom House at $16,780.

★Cement—Everett, Wash. — Contract for furnishing 125,000 bbl. cement awarded by County Commissioners to Washington Portland Cement Co. of Seattle at $1.75 per bbl. f.o.b. Everett.

★Cement — Peterborough, Ont. — Contract for furnishing cement for 1916 awarded by Bd. of Works to Peterborough Hardware Co. of Peterborough at $1.46 per bbl., 2 cts. storage.

★Forgings, Castings — Panama.—Contract for about 12,000 steel forgings and castings for Pacific Terminals and Dry Dock No. 1 in canal zone awarded by Panama Canal Commission, Washington, D. C., to J. C. Moyer & Co., Philadelphia, Pa.

★Steel Towers — Guam.—Contract for furnishing two 400-ft. steel towers at Naval Radio Station, Guam, awarded Constructing & Engineering Co., 1047 Folsom Street, San Francisco, Cal., at $38,614.

Proposals

For Proposals Advertised, See Pages 44, 45, 46 and 47.

WATERWORKS.

Bids Close.		See Eng. Record
Mar. 27.	Water Works, Wilson, N. C. Adv. Feb. 26, Mar. 4.	Feb. 26
Mar. 28.	Pump House, Etc., Henretta, Okla.	Mar. 25
Mar. 28.	C.-I. Pipe, Chicago, Ill.	Mar. 25
Mar. 29.	Valves, Etc., Baltimore, Md. Adv. Mar. 11.	Mar. 11
Mar. 29.	Mains, valves, etc., Cincinnati, O.	Mar. 18
Mar. 30.	Water Works, South Boston, Va. Adv. Feb. 25, Mar. 4.	Feb. 26
Mar. 30.	Water Works, Ocala, Fla. Adv. Mar. 18, 25.	Mar. 18
Mar. 30.	Cement Work at Reservoir, Cincinnati, Ohio	Mar. 25
Mar. 31.	Waterworks, St. Mary's Ont.	Mar. 18
Mar. 31.	Pipe, Etc., Panama	Mar. 18
Mar. 31.	Water Works, South Charleston, Ohio Adv. Mar. 25.	Mar. 25
Apr. 1.	Mains, Cullman, Ala.	Jan. 16
Apr. 1.	Water Works, Versailles, Ind.	Mar. 25
Apr. 1.	Water works, Bayard, Neb.	Mar. 25
Apr. 3.	Reservoir, Norristown, Pa.	Mar. 18
Apr. 3.	Pumps, Beresford, S. D.	Mar. 25
Apr. 3.	Pipe, Etc., Cincinnati, Ohio	Mar. 25
Apr. 3.	Pump machinery, Rochelle, Ill.	Mar. 25
Apr. 5.	Pipe, Etc., Bandon, Ore.	Mar. 25
Apr. 8.	High Pressure Fire System, Indian Head, Md.	Mar. 11
Apr. 8.	C.-I. Pipe, Etc., Panama.	Mar. 25
Apr. 10.	Filtration Plant, Florence, Ala. Adv. Mar. 18.	Mar. 18
Apr. 11.	Water works, Rector, Ark. Adv. Mar. 18, 25.	Mar. 18
Apr. 11.	Filter Beds, Etc., Ilion, N. Y. Adv. Mar. 25.	Mar. 25
Apr. 11.	Contract 164, New York, N. Y. Adv. Mar. 26.	Mar. 25
Apr. 17.	Extensions, Norfolk, Neb. Adv. Mar. 26.	Mar. 25

SEWERAGE AND SEWAGE DISPOSAL.

Bids Close.		See Eng. Record.
Mar. 27.	Lakeville, Conn. Adv. Mar. 4.	Mar. 4
Mar. 28.	Washington, D. C. Adv. Mar. 25.	Mar. 25
Mar. 28.	Clay Center, Kan.	Mar. 25
Mar. 29.	Marion, Ohio	Mar. 25
Mar. 30.	New York, N. Y.	Mar. 11
Mar. 30.	Lakewood, Ohio Adv. Mar. 11, 18.	Mar. 11
Mar. 30.	Litchfield, Minn.	Mar. 18
Mar. 30.	Cleveland, Ohio	Mar. 25
Mar. 30.	Anthony, Kan.	Mar. 25
Mar. 31.	Madison, Wis.	Mar. 18
Mar. 31.	Port Washington, N. Y. Adv. Mar. 18, 25.	Mar. 18
Apr. 1.	Sheboygan Falls, Wis.	Feb. 19
Apr. 1.	North Milwaukee, Wis.	Mar. 18
Apr. 1.	Ada, Ohio	Mar. 18
Apr. 1.	Childress, Tex.	Mar. 25
Apr. 1.	Buffalo, N. Y.	Mar. 25
Apr. 3.	White Fish Bay, Wis.	Mar. 25
Apr. 4.	Billings, Mont.	Feb. 19
Apr. 4.	Ocean Beach, L. I., N. Y.	Mar. 25
Apr. 5.	La Fayette, Ind.	Mar. 11
Apr. 5.	Ann Arbor, Mich. Adv. Mar. 25.	Mar. 25
Apr. 5.	Ann Arbor, Mich.	Mar. 18
Apr. 5.	Billings, Mont.	Mar. 25
Apr. 7.	Billings, Mont.	Mar. 18
Apr. 10.	Eustis, Fla.	Mar. 18
Apr. 10.	Madison, Ill.	Mar. 18
Apr. 10.	Montclair, N. J. Adv. Mar. 25.	Mar. 25
Apr. 11.	Maryland Adv. Mar. 25.	Mar. 25
Apr. 14.	Jacksonville, Fla. Adv. Mar. 25.	Mar. 25
Apr. 14.	Material, Jacksonville, Fla. Adv. Mar. 25.	Mar. 25
Apr. 15.	New London, Wis.	Mar. 25
Apr. 17.	Watertown, S. D. Adv. Mar. 25.	Mar. 25
Apr. 19.	Binghamton, N. Y.	Mar. 25
Apr. 20.	Albany, N. Y.	Mar. 25
Apr. 27.	Xenia, Ohio	Mar. 25

BRIDGES.

Bids Close.		See Eng. Record.
Mar. 29.	Wausau, Wis.	Mar. 18
Mar. 30.	Hinton, W. Va.	Mar. 18
Mar. 31.	Steel, N. D.	Mar. 4
Mar. 31.	Watertown, N. Y.	Mar. 25
Apr. 1.	Lewisburg, Pa.	Mar. 18
Apr. 1.	Barbourville, Ky.	Mar. 18
Apr. 3.	Santa Barhara, Cal.	Mar. 4
Apr. 3.	Langdon, N. D.	Mar. 18
Apr. 3.	Acme, N. M.	Mar. 18
Apr. 3.	Wakeeny, Kan.	Mar. 25
Apr. 3.	Jacksonville, Fla.	Mar. 25
Apr. 3.	Bryson City, N. C.	Mar. 25
Apr. 3.	Primghar, Iowa	Mar. 25
Apr. 3.	Sheldon, Iowa	Mar. 25
Apr. 3.	St. John's, Kan.	Mar. 25
Apr. 3.	Newton, Kan.	Mar. 25
Apr. 3.	West Chester, Pa.	Mar. 25
Apr. 3.	Youngstown, Ohio	Mar. 25
Apr. 4.	Gettysburg, S. D.	Mar. 4
Apr. 4.	Syracuse, Kan.	Mar. 18
Apr. 4.	Mora, Minn.	Mar. 18
Apr. 4.	Irwinton, Ga.	Mar. 25
Apr. 4.	Okanogan, Wash.	Mar. 25
Apr. 4.	Perrysville, Mo.	Mar. 25
Apr. 4.	Tama, Iowa	Mar. 25
Apr. 4.	Sykeston, N. D.	Mar. 25
Apr. 4.	Bartonville, Ky.	Mar. 25
Apr. 4.	Estherville, Iowa.	Mar. 25
Apr. 5.	Hillsboro, N. D.	Mar. 11
Apr. 5.	Lakin, Kan.	Mar. 18
Apr. 5.	Humboldt, Ia.	Mar. 18
Apr. 6.	Spring Lake, N. J.	Mar. 18
Apr. 5.	Stuntz, Minn.	Mar. 25
Apr. 5.	Haysville, N. D.	Mar. 25
Apr. 5.	Dakota City, Iowa.	Mar. 25
Apr. 6.	Bridgeport, Conn. Adv. Mar. 11.	Mar. 11
Apr. 6.	Miami, Fla. Adv. Mar. 18, 25.	Mar. 18
Apr. 6.	Ventura, Cal.	Mar. 25
Apr. 6.	Center, N. D. Adv. Mar. 25.	Mar. 25
Apr. 7.	St. Helen, Ore.	Mar. 18
Apr. 7.	Washington, Kan.	Mar. 25
Apr. 7.	Portland, Ore.	Mar. 25
Apr. 7.	Ventura, Cal.	Mar. 25
Apr. 8.	Ventura, Cal.	Mar. 25
Apr. 8.	Rock Island, Ill.	Mar. 4
Apr. 10.	Rockford, Ill. Adv. Mar. 11.	Mar. 11
Apr. 10.	Marshall, Tex. Adv. Mar. 18, 25.	Mar. 18
Apr. 10.	Columbus, Ohio	Mar. 18
Apr. 10.	Galveston, Tex.	Mar. 25
Apr. 11.	Hastings, Minn.	Mar. 18
Apr. 12.	Youngstown, Ohio	Mar. 25
Apr. 29.	Johnson Creek, Wis.	Feb. 26
May 1.	Amarillo, Tex.	Mar. 18
May 20.	Lyndhurst, N. J.	Mar. 18

PAVING AND ROADS.

Bids Close.		See Eng. Record.
Mar. 25.	De Land, Fla. Adv. Mar. 4, 11.	Mar. 4
Mar. 27.	Montclair, N. J. (3 Props.), Adv. Mar. 11.	Mar. 11
Mar. 28.	Sumter, S. C. Adv. Mar. 4, 11.	Mar. 4
Mar. 28.	Columbus, Ohio	Mar. 11
Mar. 28.	Albany, N. Y. Adv. Mar. 11 to 25.	Mar. 11
Mar. 28.	Racine, Wis.	Mar. 11
Mar. 28.	Philadelphia, Pa.	Mar. 18
Mar. 28.	Youngstown, Ohio	Mar. 18
Mar. 28.	Bayonne, N. J.	Mar. 18
Mar. 28.	Kearney, Neb.	Mar. 25
Mar. 28.	Ortonville, Minn.	Mar. 25
Mar. 28.	Washburn, Wis.	Mar. 25
Mar. 28.	Chicago Heights, Ill.	Mar. 26
Mar. 28.	Terrell, Tex.	Mar. 25
Mar. 29.	Findlay, Ohio	Mar. 11
Mar. 29.	Cleveland, Ohio	Mar. 18
Mar. 29.	Canton, Ohio.	Mar. 18
Mar. 29.	Cleveland, Ohio	Mar. 25
Mar. 29.	Indiana	Mar. 25
Mar. 30.	Morgantown, W. Va.	Feb. 26
Mar. 30.	Newark, N. J.	Mar. 11
Mar. 30.	Indiana	Mar. 11
Mar. 30.	Kearney, Neb.	Mar. 18
Mar. 30.	Madison, Wis.	Mar. 18
Mar. 30.	Hinton, W. Va.	Mar. 18
Mar. 30.	Burlington, Iowa	Mar. 25
Mar. 30.	Springfield, Mass.	Mar. 25
Mar. 30.	Marysville, Tenn.	Mar. 25
Mar. 30.	Los Angeles, Cal.	Mar. 26
Mar. 30.	London, Ont. Adv. Mar. 25.	Mar. 25
Mar. 31.	Ontonagon, Mich.	Mar. 18
Mar. 31.	Duluth, Minn.	Mar. 18
Mar. 31.	Dothan, Ala.	Mar. 25
Mar. 31.	Bergland, Mich.	Mar. 25
Mar. 31.	Charlestown, W. Va.	Mar. 25
Mar. 31.	New York, N. Y.	Mar. 25
Mar. 31.	St. Louis, Mo.	Mar. 25
Mar. 31.	Geneva, Ill.	Mar. 25
Apr. 1.	Charleston, W. Va.	Feb. 19
Apr. 1.	Morristown, Tenn.	Mar. 18
Apr. 1.	Pomeroy, Wash.	Mar. 11
Apr. 1.	Edwardsville, Ill.	Mar. 25
Apr. 3.	Sherbrooke, N. D.	Mar. 11
Apr. 3.	Salem, Ohio	Mar. 11
Apr. 3.	Huron, S. D. Adv. Mar. 11.	Mar. 11
Apr. 3.	St. Paul, Minn.	Mar. 18
Apr. 3.	Indiana	Mar. 18
Apr. 3.	Elbow Lake, Minn.	Mar. 18
Apr. 3.	Williston, N. D.	Mar. 18
Apr. 3.	Utica, Ohio	Mar. 18
Apr. 3.	Camden, Ala.	Mar. 18
Apr. 3.	Carrington, N. D.	Mar. 25
Apr. 3.	Rugby, N. D.	Mar. 25
Apr. 3.	Wahpeton, N. D.	Mar. 25
Apr. 3.	Aneta, N. D.	Mar. 25
Apr. 3.	Sac City, Iowa	Mar. 25
Apr. 3.	Sheldon, Iowa	Mar. 25
Apr. 3.	Earlington, Ky.	Mar. 25
Apr. 3.	Granville, N. D.	Mar. 25
Apr. 3.	St. Paul, Minn.	Mar. 25
Apr. 3.	Road Roller, Greenshurg, Ind.	Mar. 25
Apr. 3.	Road Roller, Lawrenceburg, Ind.	Mar. 25
Apr. 3.	Indiana	Mar. 25
Apr. 4.	Bryan, Ohio.	Mar. 18
Apr. 4.	Wheaton, Minn.	Mar. 25
Apr. 4.	South Bend, Wash.	Mar. 25
Apr. 4.	Mount Vernon, Wash.	Mar. 25
Apr. 4.	South Bend, Ind. Adv. Mar. 25.	Mar. 25
Apr. 4.	Ephrata, Wash.	Mar. 25
Apr. 4.	Meriden, Conn. Adv. Mar. 25.	Mar. 25
Apr. 4.	Westerly, R. I. Adv. Mar. 25.	Mar. 25
Apr. 4.	Indiana	Mar. 25
Apr. 4.	Columbus, Ohio.	Mar. 25
Apr. 5.	Stuntz, Minn.	Mar. 25
Apr. 5.	Chehalis, Wash.	Mar. 25
Apr. 6.	Freehold, N. J.	Mar. 25
Apr. 5.	Paterson, N. J.	Mar. 25
Apr. 5.	Road Machinery, Center, N. D. Adv. Mar. 25.	Mar. 25
Apr. 5.	Sheridan, Mich.	Mar. 25
Apr. 5.	Indiana	Mar. 25
Apr. 5.	Centralia, Wash.	Mar. 25
Apr. 6.	Jonesboro, Ark.	Mar. 11
Apr. 6.	Huntington, W. Va.	Mar. 4
Apr. 6.	Wheeling, W. Va.	Mar. 18
Apr. 6.	Pocatello, Idaho	Mar. 25
Apr. 6.	Dixon, Ill. Adv. March 25.	Mar. 25
Apr. 7.	Pomeroy, Wash.	Mar. 25
Apr. 10.	Bronson, Fla.	Mar. 25
Apr. 10.	Hartford, Mich.	Mar. 25
Apr. 10.	Coldwater, Mich.	Mar. 25
Apr. 10.	Los Angeles, Cal.	Mar. 25
Apr. 10.	Ventura, Cal.	Mar. 25
Apr. 11.	Maryland Adv. Mar. 25.	Mar. 25
Apr. 12.	Falouse, Wash.	Mar. 18
Apr. 12.	Gastonia, N. C.	Mar. 25
Apr. 14.	North Vernon, Ind.	Mar. 25
Apr. 15.	Houghton, Mich.	Mar. 25
Apr. 15.	Batavia, Ohio	Mar. 25
May 15.	Madison, S. D.	Mar. 25
Apr. 17.	Norfolk, Neb. Adv. Mar. 25.	Mar. 25
Apr. 18.	Bartow, Fla.	Mar. 25
Apr. 18.	Lawton, Okla.	Mar. 25
Apr. 20.	Sarasota, Fla.	Mar. 25
May 1.	Galion, Ohio	Mar. 18
May 1.	Eveleth, Minn.	Mar. 18
———	Binghamton, N. Y. Adv. Feb. 12, 19.	Feb. 12

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS.

Bids Close.		See Eng. Record.
Mar. 28.	Drain, North Branch, Mich.	Feb. 26
Mar. 28.	Wharf, Etc., Savannah, Ga.	Mar. 11
Mar. 28.	Dam, Shawano, Wis. Adv. Mar. 11.	Mar. 11
Mar. 29.	Irrigation, St. Ignatius, Mont.	Mar. 4
Mar. 29.	Cribbing, Lorain, Ohio	Mar. 11
Mar. 29.	Drainage, Waukegan, Ill.	Mar 18
Mar. 30.	Dredging, Tompkinsville, N. Y.	Mar. 4
Apr. 1.	Dredging, Chicago, Ill. Adv. March 4 to 25.	Mar. 4
Apr. 1.	Drainage Ditches, Walker, Minn.	Mar. 18
Apr. 1.	Ditch, Duluth, Minn.	Mar. 25
Apr. 3.	Drainage, Cuero, Tex.	Mar. 18
Apr. 3.	Ditch, Aitkin, Minn.	Mar. 18
Apr. 5.	Ditch, Jasper, Ind.	Mar. 25
Apr. 8.	Wharf, Jacksonville, Fla.	Mar. 25
Apr. 10.	Jetty Construction, New York, N. Y. Adv. Mar. 11 to 25.	Mar. 11
Apr. 10.	Ditch, Oklahoma City, Okla.	Mar. 11
Apr. 11.	Grading, Etc., Hastings, Minn.	Mar. 18
Apr. 11.	Wharf, Aransas Pass, Tex.	Mar. 25
Apr. 12.	Levee Work, Port Arthur, Tex.	Mar. 25
Apr. 14.	Dredging, New York, N. Y. Adv. Mar. 18, 25.	Mar. 18
Apr. 15.	Freight Sheds, Etc., Quebec, Que.	Mar. 25
May 1.	Wharf, Etc., Honolulu, Hawaii.	Mar. 25
May 6.	Leasing Land and Water for Power Purposes, Louisville, Ky. Adv. Mar. 11.	Mar. 11

PUBLIC BUILDINGS AND SCHOOLS.

Bids Close.		See Eng. Record.
Mar. 28.	Dobson, N. C. Adv. Mar. 11, 18.	Mar. 11
Mar. 28.	Sloan, Iowa.	Mar. 11
Mar. 28.	Columbia, S. C.	Mar. 11
Mar. 28.	Indianapolis, Ind.	Mar. 18
Mar. 28.	Cresson, Pa.	Mar. 18
Mar. 28.	Neosho, Mo.	Mar. 25
Mar. 29.	Aberdeen, Wash.	Feb. 19
Mar. 29.	Newark, N. J.	Mar. 18
Mar. 29.	Eugene, Ore.	Mar. 25
Mar. 29.	Rydal, Pa.	Mar. 25
Mar. 30.	Huntington, Ind.	Mar. 4
Mar. 30.	San Bernardino, Cal.	Mar. 4
Mar. 30.	Ypsilanti, Mich.	Mar. 18
Mar. 30.	Ypsilanti, Mich.	Mar 18
Mar. 30.	Rutherford, N. J.	Mar. 18
Mar. 30.	Brooklyn, N. Y.	Mar. 18
Mar. 31.	Seattle, Wash.	Mar. 11
Mar. 31.	Kenmore, Ohio	Mar. 18
Mar. 31.	Camden, Ohio.	Mar. 18
Mar. 31.	Elmvale, Ont.	Mar. 25
Apr. 1.	Eveleth, Minn.	Mar. 4
Apr. 1.	Wilcox, Pa.	Mar. 25
Apr. 1.	Wagner, S. D.	Mar. 25
Apr. 3.	Argentine, Kan.	Mar. 18
Apr. 3.	Clark, S. D.	Mar. 18
Apr. 3.	Nashville, Tenn.	Mar. 25
Apr. 3.	Des Moines, Iowa	Mar. 25
Apr. 3.	Smithville, Tex.	Mar. 25
Apr. 3.	St. Paul, Minn.	Mar. 25
Apr. 4.	Lockport, Ill.	Mar. 4
Apr. 4.	Dayton, Ohio.	Mar. 11
Apr. 4.	Detroit, Mich.	Mar. 18
Apr. 4.	Red Cloud, Minn.	Mar. 25
Apr. 4.	Camden, N. J.	Mar. 25
Apr. 5.	Reading, Ohio	Mar. 18
Apr. 5.	Lakeview, Mich.	Mar. 25
Apr. 5.	Savannah, Ga.	Mar. 25
Apr. 6.	Valley City, N. D.	Mar. 4
Apr. 6.	Boston, Mass.	Mar. 18
Apr. 6.	Sapulpa, Okla. Adv. Mar. 18.	Mar. 18
Apr. 7.	Falls City, Neb.	Mar. 11
Apr. 7.	Youngstown, Ohio	Mar. 18
Apr. 7.	Columbus, Ind.	Mar. 18
Apr. 7.	Waukon, Iowa.	Mar. 25
Apr. 8.	Urbana, Ohio	Mar. 18
Apr. 10.	Middlebourne, W. Va.	Mar. 18
Apr. 10.	Eau Claire, Wis.	Mar. 25
Apr. 10.	Mt. Airy, N. C.	Mar. 25
Apr. 10.	Cleveland, Ohio	Mar. 25
Apr. 11.	Columbus, Kan.	Mar. 18
Apr. 11.	Galva, Iowa	Mar. 18
Apr. 11.	Carbondale, Ill.	Mar. 25
Apr. 12.	Prescott, Ariz.	Mar. 11
Apr. 12.	Berea, Ohio	Mar. 25
Apr. 12.	Shenandoah, Pa.	Mar. 25
Apr. 15.	Indian Head, Md.	Mar. 4
Apr. 15.	Gemmell, Minn.	Mar. 18
Apr. 15.	Lakeview, Mich.	Mar. 18
Apr. 15.	London, Ohio.	Mar. 25
Apr. 17.	West Liberty, Iowa	Mar. 25
Apr. 18.	Columbus, Ohio.	Mar. 25
Apr. 18.	Ft. Dodge, Iowa	Mar. 25
Apr. 19.	Arkadelphia, Ark. Adv. Mar. 11, 18.	Mar. 11
Apr. 24.	Delphi, Ind.	Feb. 26
Apr. 24.	Roseburg, Ore.	Mar. 25
Apr. 26.	Evansville, Ind.	Mar. 25
Apr. 27.	Portland, Ind. Adv. Mar. 25.	Mar. 25
Apr. 28.	New Orleans, La.	Mar. 11
May 8.	Elkins, W. Va.	Mar. 25
May 25.	Butler, Pa.	Mar. 18

PRIVATE BUILDINGS.

Bids Close.		See Eng. Record.
Mar. 28.	Oklahoma City, Okla.	Mar. 25
Mar. 30.	Fairmont, W. Va.	Mar. 18
Apr. 1.	Des Moines, Iowa	Mar. 11
Apr. 1.	Los Angeles, Cal.	Mar. 11
Apr. 1.	Jamestown, N. D.	Mar. 11
Apr. 1.	Cleveland, Ohio	Jan. 9
Apr. 1.	Minneapolis, Minn.	Feb. 19
Apr. 1.	Moose Jaw, Sask.	Mar. 4
Apr. 1.	Sioux Falls, S. D.	Mar. 18
Apr. 1.	Elyria, Ohio	Mar. 18
Apr. 1.	Minneapolis, Minn.	Mar. 25
Apr. 1.	Poughkeepsie, N. Y.	Mar. 25
Apr. 15.	Suffolk, Va.	Mar. 18
May 1.	Akron, Ohio	Mar. 18

NEW INDUSTRIAL PLANTS.

Bids Close.		See Eng. Record.
Mar. 31.	Manayunk, Pa.	Mar. 25
Apr. 1.	Madison, Wis.	Mar. 25
Apr. 4.	Long Prairie, Minn.	Mar. 25
Apr. 15.	Manila, P. I.	Jan. 2

MISCELLANEOUS.

Bids Close.		See Eng. Record.
Mar. 27.	Structural Steel, Lorain, Ohio. Adv. Mar. 4.	Mar. 4
Mar. 28.	Railroad Work, Philadelphia, Pa. Adv. Mar. 4 to 18.	Mar. 4
Mar. 28.	Elevators, Talmage, Cal.	Mar. 18
Mar. 28.	Crushed Stone, Toronto, Ont.	Mar. 18
Mar. 28.	Flushers, Ottawa, Ont.	Mar. 18
Mar. 28.	Cement, Boston, Mass.	Mar. 25
Mar. 29.	Trap Rock, Etc., Brooklyn, N. Y.	Mar. 26
Mar. 29.	Lampposts, Baltimore, Md.	Mar. 25
Mar. 30.	Road Oil, Barrie, Ont.	Mar. 18
Mar. 31.	Lamp Posts, Washington, D. C.	Mar. 11
Mar. 31.	Cement, San Diego, Cal.	Mar. 11
Mar. 31.	Road Grader, Windom, Minn.	Mar. 18
Mar. 31.	Road Oil, West Orange, N. J.	Mar. 18
Mar. 31.	Garbage Disposal, Madison, Wis.	Mar. 18
Apr. 1.	Memorial, Fort McHenry, (P. O. Baltimore, Md.)	Nov. 29
Apr. 1.	Road Oil, Dayton, Ohio	Mar. 18
Apr. 3.	Road Oil, St. Paul, Minn.	Mar. 18
Apr. 3.	Concrete Steps, Cincinnati, Ohio	Mar. 25
Apr. 3.	Road Oil, Fresno, Cal.	Mar. 25
Apr. 3.	Garbage Disposal, Long Island City, L. I., N. Y.	Mar. 25
Apr. 4.	Garbage Disposal, Clarkadale, Miss.	Mar. 25
Apr. 4.	Retaining Wall, Sheridan, Wyo.	Mar. 26
Apr. 4.	Asphalt. etc., Columbus, Ohio.	Mar. 25
Apr. 5.	Cement, Chehalis, Wash.	Mar. 25
Apr. 6.	Copper Cable, Panama Adv. Mar. 25.	Mar. 25
Apr. 11.	El. Ry., Boston, Mass. Adv. Mar. 25.	Mar. 25
Apr. 14.	Pipe and Rock, etc., Charleston, S. C.	Mar. 18
Apr. 15.	Cement, Louisville, Ky. Adv. Mar. 18, 25.	Mar. 18
Apr. 17.	Sale of Dredge, Grand Rapids, Mich. Adv. Mar. 25.	Mar. 25
Apr. 22.	Steel Towers, Cordova, Alaska.	Mar. 11

SEARCHLIGHT SECTION

Bids open April 6, 1916.

READVERTISEMENT.

BRIDGES

MIAMI, FLA.

Sealed bids will be received by Mr. W. B. Moore, City Clerk of Miami, Florida, up to 7.30 p. m., April sixth, and then publicly opened, for the construction of the piers and reinforced concrete portions, and for the erection of double-leaf bascule spans for two bridges over the Miami River in Miami, Florida, and for the construction of two temporary bridges. Contracts already have been let for the manufacture and delivery of the superstructure, structural steel work and machinery. With the exception of the bascule spans, both bridges are of concrete and reinforced concrete. The principal quantities are approximately as follows:

Concrete—Twelfth Street bridge, 2,700 cu. yds.; Avenue D bridge, 2,100 cu. yds.

Reinforcing Steel—Twelfth Street bridge, 90,000 pounds; reinforcing steel, Avenue D bridge, 80,000 pounds.

Structural Steel—Twelfth Street bridge, 350,000 pounds; structural steel, Avenue D bridge, 420,000 pounds.

A bid will be received for the construction of a temporary bridge at Twelfth Street and a bid will be received for the construction of a temporary bridge at Avenue G. The two temporary bridges are of timber construction.

The work will be let under four contracts to one or more contractors. Contract No. 2 will provide for constructing the temporary bridge at Twelfth Street; Contract No. 3 will provide for constructing a temporary bridge at Avenue G; Contract No. 4 will provide for constructing concrete work and erection of the steel work at Twelfth Street; Contract No. 5 will provide for the construction of the concrete bridge and erection of the steel work at Avenue D.

Plans and specifications are on file with the City Clerk of Miami, or can be secured by applying to Harrington, Howard and Ash, consulting engineers, 1012 Baltimore Avenue, Kansas City, Missouri, upon payment of $15.00, of which $10.00 will be returned when the plans and specifications are returned in good order. No alternate plans will be considered.

The contractor will be paid in cash on monthly estimates amounting to Ninety Per Cent (90%) of the work done. All proposals or bids must be accompanied by a certified check drawn on some responsible bank or trust company, payable to W. B. Moore, City Clerk, Miami, for a sum not less than Ten Per Cent (10%) of the aggregate of the proposal. The successful bidder will be required to furnish a performance bond equal to the contract price. The right is reserved to reject any and all bids and to waive informalities.

HARRINGTON, HOWARD AND ASH.
Consulting Engineers,
Kansas City, Mo.

Bids open April 11, 1916.

NOTICE TO CONTRACTORS.

DORCHESTER TUNNEL

CITY OF BOSTON, MASS.

Sealed bids for building Section J, Dorchester Tunnel, in and near Dorchester Avenue and Boston Street, from about 80 ft. north of Dexter Street to about 30 ft. south of Italston Street, South Boston, will be received by the undersigned until 12 o'clock noon of Tuesday, April 11, 1916. The section is about 1000 ft. long. The structure will be mainly of reinforced concrete and structural steel. The work includes the Andrew Square Station. Specifications and forms of contract can be obtained at 15 Beacon Street, ninth floor. The right to reject any and all bids and to award the contract as is deemed to be for the best interest of the City of Boston is reserved.

By order of the
BOSTON TRANSIT COMMISSION,
B. LEIGHTON BEAL,
Secretary.

Official Proposal Announcements

Price, $2.40 an inch.—Copy can be received until Thursday 10 a. m. for issue mailed the next morning

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Bids open April 17, 1916.

SEWAGE PUMPING EQUIPMENT

WATERTOWN, S. D.

Sealed bids will be received by the undersigned until 7.30 p. m., of April 17, 1916, for the furnishing and erecting of two centrifugal sewage pumps with motors, control equipment and other appurtenances, at which time such bids will be publicly opened and considered by the Board of Commissioners of said city.

The amount of certified check required is $200. Detailed instructions to bidders, plans and specifications may be obtained at the office of the City Engineer, F. W. Schreiber, and Metcalf & Eddy, Consulting Engineers, Harris Trust Bldg., Chicago, and 14 Beacon Street, Boston. A deposit of $5 will be required for each set removed.

The City reserves the right to reject any or all bids or accept any bid, if it is deemed to be for the best interests of the City so to do.

CHARLES HARMAN,
City Auditor.

March 15, 1916.

Bids open April 14, 1916.

BIDS FOR SEWER MATERIALS

OFFICE OF ASSISTANT TO THE SECRETARY OF THE BOARD OF BOND TRUSTEES, CITY HALL.
JACKSONVILLE, FLA.

Sealed proposals will be received by the Board of Bond Trustees of the City of Jacksonville, until 8 o'clock p. m., Friday, April 14, 1916, at this office, for furnishing material in connection with the proposed construction of sanitary and storm sewers in accordance with Ordinance N-58.

All material shall be in accordance with plans and specifications therefor, on file in the office of the City Recorder and shall meet with the approval of the Sewer Committee of the Board of Bond Trustees. Specifications and information can be obtained at the office of the Commissioner of Public Works, Sewer Department. A certified check in the sum of two and one-half (2½%) per cent of the amount of bid payable to Gustav Muller, Acting Chairman, Board of Bond Trustees, must accompany each bid.

Bidders may bid on any or all material herein named.

The right is reserved to reject any or all bids.

LIST OF MATERIAL

These quantities are approximate only and the Board of Bond Trustees reserves the right to make any variations in same. Bidders may submit minimum amounts to which their bids shall apply.

VITRIFIED SEWER PIPE:

37,436 ft. 8-in.
1,948 ft. 12-in.
3,003 ft. 15-in.
4,353 ft. 18-in.
1,703 ft. 21-in.
6,301 ft. 24-in.
1,500 8-in. x 5-in. "Y."

CAST-IRON PIPE:

413 ft. 8-in.
1,031 ft. 12-in.
1,341 ft. 14-in.
673 ft. 16-in.
2,038 ft. 18-in.
508 ft. 20-in.
3,310 ft. 24-in.
4 12-in. 45-deg. bends.

CAST-IRON CULVERT PIPE:

195 ft. 16-in.
300 ft. 18-in.
474 ft. 24-in.
1,314 ft. 36-in.

REINFORCED CONCRETE PIPE:

1,816 ft. 27-in.
8,196 ft. 30-in.
997 ft. 33-in.
1,150 ft. 36-in.
1,371 ft. 39-in.
2,154 ft. 42-in.
4,312 ft. 45-in.
2,278 ft. 48-in.
431 ft. 51-in.
92 ft. 54-in.

CAST-IRON MANHOLE FRAMES AND COVERS: 253.

GUSTAV MULLER,
Acting Chairman of Board of
Bond Trustees.
L. D. SMOOT,
Commissioner of Public Works.
March 15, 1916.

Bids open April 5, 1916.

ROAD MACHINERY

CENTER, N. D.

Sealed bids for the following various kinds of road machinery will be received by the undersigned, the county auditor, at his office in Center, N. D., up to 2 o'clock p. m., of Wednesday, April 5, 1916, to wit:

Horse road graders, fresnos, slips, road drags and road plows.

Bids are to include prices on both large and small lots, f.o.b. any station on the North branch from Mandan, between Harmon and Hazen, both inclusive.

A certified check of $50.00 will be required with each bid and from parties to whom the contract will be awarded a satisfactory bond in the sum of $500 will be required. The certified checks of the unsuccessful bidders will be returned at once.

The right to reject any or all bids is hereby reserved by the Board of County Commissioners of Oliver County.

Please mark your envelopes with "Bids on road machinery."

Dated March 15, 1916.
FRANK J. V. KIEBERT,
County Auditor.

Bids open April 6, 1916.

ROAD CULVERTS

CENTER, N. D.

Sealed bids for the various standard size road culverts will be received by the undersigned, the county auditor, at his office in Center, N. D., up to 11 o'clock a. m., of Thursday, April 6, 1916.

Bids are to include prices on both large and small lots of culverts f.o.b. any station on the North branch from Mandan, between the stations of Harmon and Hazen, both inclusive.

A certified check of $50 is required with each bid and a bond in the sum of $500 will be required of the successful bidder. The checks of the unsuccessful bidders will be returned at once.

The Board of County Commissioners of Oliver County reserves the right to reject any or all bids.

Please mark your envelopes with "Bids on road culverts."

Dated March 15, 1916.
FRANK J. V. KIEBERT,
County Auditor.

Bids open April 4, 1916.

NOTICE TO CONTRACTORS.

PAVEMENTS

DEPARTMENT OF PUBLIC WORKS
SOUTH BEND, IND.

Notice is hereby given that sealed proposals will be received by the Department of Public Works of the City of South Bend, Ind., up to 10 a. m., of the 4th day of April, 1916.

27,916 sq. yd. of pavement on Michigan Street. Bids will be received on the following types of pavement; Asphalt, creosoted, wooden block, brick, bitulithic, on a 7-in. Portland cement concrete foundation.

34,050 sq. yd. of pavement on Indiana Avenue. Bids will be received on the following types of pavement: Brick, asphalt, asphaltic concrete or bitulithic, laid on a 5-in. cement concrete foundation.

Complete drawings and specifications of said work are now on file in the office of the Department of Public Works in the City Hall of South Bend, Ind.

BOARD OF PUBLIC WORKS.
E. M. MORRIS,
A. H. RICE,
JOHN B. WEBER.
VERONICA C. SWEENEY,
Clerk of the Board.

Bids open April 11, 1916.

SEWERAGE AND WATER WORKS CONSTRUCTION

NOTICE TO BIDDERS.

RECTOR, ARK.

Separate sealed bids addressed to "Board of Commissioners, Sewer Improvement District No. 1 and, Water Works Improvement District No. 1, Rector, Arkansas," and endorsed respectively, "Proposal for Sewer System," and "Proposal for Water Works," will be received until 8 p. m., April 11, 1916, at which time they will be publicly opened and read.

A certified check to accompany each of the above bids on the "Bank of Rector" for $2,000, payable to J. C. Rogers, Chairman, Board of Commissioners.

The sewer work consists approximately of six miles of 8 to 12-in. pipe, 4 to 16 ft. deep, 79 manholes, 25 flush tanks, and settling tank.

The water works consists approximately of five miles of 4 to 8-in. cast-iron water pipe, 42 hydrants, 31 valves with boxes, tower and tank, and pumping station with oil engine-driven triplex pumps.

Eighty-five per cent monthly estimates in cash, which is now available. The Board reserves the right to reject any or all bids. The wells for water supply are already completed. Bids for material and equipment will be received through general contractors only.

Sets of plans and specifications may be obtained from the engineer upon a deposit of $15 for sewers and $15 for water works. Specifications only, $5 deposit each. Any one plan, $5. All deposits to be refunded upon return of plans and specifications not later than April 21, 1916. A bid will be considered a return of the specification.

J. C. ROGERS, Chairman,
Board of Commissioners,
Sewer and Water Improvement,
District No. 1.
FRANK L. WILCOX, Engineer.
Syndicate Trust Bldg.,
St. Louis, Mo.

Bids open April 14, 1916.

BIDS FOR SEWERS

OFFICE OF THE ASSISTANT TO THE SECRETARY OF THE BOARD OF BOND TRUSTEES, CITY HALL.
JACKSONVILLE, FLA.

Sealed proposals will be received by the Board of Bond Trustees of the City of Jacksonville, until 8 o'clock p. m., Friday, April 14, 1916, at this office, for the construction of certain sanitary and storm sewers for the City of Jacksonville, Fla., in accordance with Ordinance N-58.

All work and material shall be in accordance with plans and specifications on file in the office of the City Recorder. Plans and further information can be obtained at the office of the Commissioner of Public Works, Sewer Department, upon payment of ten ($10.00) dollars.

The work will consist of approximately eighteen (18) miles of sanitary and storm sewers varying in size from eight (8") inches to fifty-four (54") inches.

The work will be divided into seven sections and bids will be received on each section separately, all as set out in the specifications.

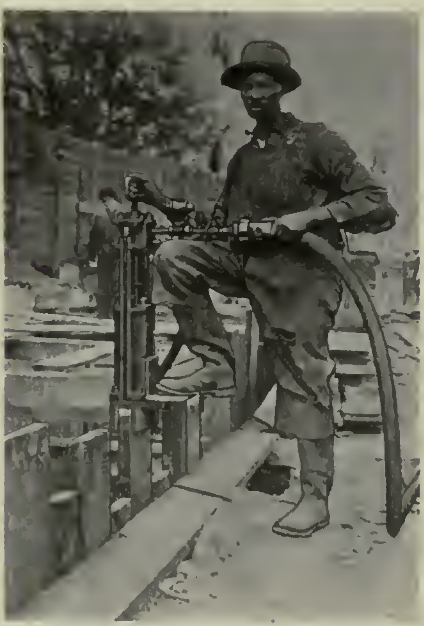
Each bid must be accompanied by a certified check for two and one-half (2½%) per cent of the total amount of the bids, made payable to Gustav Muller, Acting Chairman, Board of Bond Trustees. Said checks must be submitted with the bids.

The right is reserved to reject any or all bids.

GUSTAV MULLER,
Acting Chairman Board of
Bond Trustees.
L. D. SMOOT,
Commissioner of Public Works.
March 15, 1916.

Light, Readily Handled Hammers to Drive Sheeting

Light sheeting hammers that can be moved by hand or suspended with simple rigging are now being manufactured by National Hoisting Engine Company, of Harrison, N. J., for driving sheeting in close quarters and where hand driving has been resorted to in the past. The No. 7 hammer shown in the accompanying photograph weighs only 150 lb. but strikes 300 to 400 blows a minute. It drives 2-in. wood sheeting or light steel sheeting. The No. 6 hammer, weighing 650 lb., is designed to drive sheeting to within ¾ in. of a ranger. It strikes 275 blows a minute and will drive 3-in. wood sheeting or its equivalent in light steel sections.



STEP ON HAMMER ENABLES MAN TO ADD HIS WEIGHT TO REACTION OF BLOW

Either hammer can be run on 5 boiler horsepower. If air is used, the smaller hammer requires 50 cu. ft. of free air per minute and the larger 75 cu. ft. Many inexpensive rigging methods that have been used for suspending the heavier hammer are illustrated in a catalog recently issued describing the hammers.

Novel Hoisting Equipment for Inclined Railway

A novel hoisting equipment consisting of a specially-built hoist, a sheave car and a barney car has been used on a steep inclined track in building the rock crushing plant of the Temescal Rock Company in the Temescal Canyon near Corona, Cal. The rock quarry proper has been opened up considerably above the canyon floor and the drop between this level and the railroad below has been taken full advantage of in laying out the crushing and screening plants for economical operation by gravity. In order to install heavy machinery at the higher levels an inclined railroad, which would later be used in the operation of the plant to handle much lighter loads, was built. This machinery was taken to the top of the incline on the railroad cars on which it arrived at the site. The steel jaw for the main crusher shown going up in the photograph weighs more than 40 tons. In order to utilize for this service the regular hoist, which it was desirable to make of lighter capacity for economical operation later, two large sheaves were set at the head of the incline and a sheave car carrying one sheave and the bucket end of the line was used. This rigging gave three parts of line between the sheave car and the top of the incline. The sheave car was attached to the barney car by two 1¾-in. plow steel ropes passing underneath the railway car being hoisted.

The main hoist for this incline is a single-drum, two-speed electric hoist whose 66-in. main drum is provided with a very powerful post brake. The main drum is geared to the 75 hp. motor, which is equipped with a solenoid brake sufficiently powerful to bring the entire system to rest in case of failure of the current supply. Loads may be either hoisted or lowered electrically, as when a loaded car is being lowered against the resistance of the motor the latter acts as a generator, returning current to the power circuit. While the hoist was designed for a normal load of 19,500 lb. on a single line at 60 ft. per minute for slow speed and 7300 lb. on a single line at 160 ft. per minute for high speed, the actual performances have exceeded these amounts. Loads of 131,000 lb. have been hoisted to the quarry floor with the sheave car in use. The hoist equipment was designed and supplied by the Lidgerwood Manuafcturing Company, and the General Electric Company furnished the motor.

Systematic Manufacture Reduces Price of Hollow Steel Doors

An investigation of conditions under which hollow steel doors and trim were manufactured shows that the high cost of production was not due to expensive material so much as to the unstandardized demand. An analysis of several thousands of jobs handled by one factory previous to 1915 showed that more than 80 per cent of the special orders might have been standardized, thereby effecting an appreciable saving and putting these hollow steel doors within the reach of a larger number of builders.

The remedy for the excessive cost and restricted field was, therefore, to establish suitable standards of size and style. This has been done by the Solar Metal Products Company, of Columbus, Ohio, which concern was formerly the Watson Solar Window Company, of Chicago. The Chicago concern has been reorganized and, with a well-equipped plant at Columbus, Ohio, now offers hollow steel doors in standard styles and sizes at about one-half the former retail price.

Business Notes

Electro Bleaching Gas Company has removed its general offices to 18 East Forty-first Street, New York City.

The Laclede Steel Company of St. Louis has removed its general office to the Federal Reserve Bank Building.

Pulsometer Steam Pump Company will remove its general offices from 17 Battery Place, New York City, to 485 South Twenty-first Street, Irvington, N. J., to-day. A New York office will be retained at 35 Thomas Street, but the main business will be conducted from Irvington. Announcement is made of the appointment of W. P. Reiboldt as general superintendent of the company, effective April 1.

The Prest-O-Lite Company of Indianapolis has completed a large addition to the main factory, thereby adding 40,000 sq. ft. of floor space to the former space. The new building is 400 ft. long by 100 ft. wide, entirely of reinforced concrete and modern in every respect. Two rooms on the second floor each give 2500 sq. ft. of floor space which will be devoted to an office and a welfare room. The air is washed before being distributed and every modern convenience is to be found in the new building.

The Jeffrey Manufacturing Company of Columbus, Ohio, has organized a new department to handle the sale of a line of small rock and ore crushers, with which equipment the Jeffrey elevators, conveyors and screens are furnished. This new department will be in charge of L. A. Kling, former sales manager of the road machinery department of the Wheeling Mold & Foundry Company, who will sell the equipment mentioned through agents who are qualified to handle the goods. The products of Mr. Kling's department are said to be made especially for use in the road building, contracting, rock crushing and gravel plant fields.

Trade Publications

The following companies have recently issued trade literature:

Thew Automatic Shovel Company, Lorain, Ohio, catalog 9, 36 pages, types and design of Thew full circle swing steam shovels; their adaptation and their special advantages.

Southwark Foundry & Machine Company, Philadelphia, catalog, 44 pages, Southwark-Harris valveless engines, Diesel principle, showing layouts of installations and the more even turning moment of the two-cycle principle of operation on which these types of engines run as compared with the four-cycle type.

Association of Creosoting Companies of the Pacific Coast, Seattle, Wash., booklet, 27 pages; creosoting douglas fir bridge stringers and ties without loss in strength. This illustrated booklet is valuable for bridge engineers interested in the problems of timber maintenance. It gives the results of several series of tests made on bridge stringers, both natural and creosoted, with diagrams showing deflection under load. Results of spike pulling tests in ties are given. The text is clear and the diagrams and other illustrations exceptionally good. The booklet is the work of O. P. M. Goss, consulting engineer for the association.

SHEAVE CAR TRIPLED CAPACITY OF HOIST FOR RAISING CRUSHER MACHINERY

CONTRACTING NEWS

Of Special Interest to Engineers, Contractors, Builders and Manufacturers of Engineering and Building Supplies

INDUSTRIAL construction has broadened out from the building of munitions plants until it has included most of the important manufacturing lines. Building and structural work is active and is on a solid basis. While many lines of manufacturing are in a position to stand easily the present high prices and are consequently going ahead with building work, speculative building has been reduced in volume. This makes it likely that the first fall of prices will bring out a great deal of work now held in abeyance, so that no sudden decline in prices is looked for this year, especially in the structural steel market. Railroad buying of structural steel in small lots has been active and, according to *The Iron Age*, has been an important factor in the market during the past month. An enormous quantity of steel rails, estimated at almost 1,000,000 tons, has been ordered in the past few weeks, but equipment buying has been comparatively light. While conditions in the steel market are thought to indicate that the mills will be crowded for the entire year, there is less excitement, and rising prices seem to be confined to lines where stocks have been greatly depleted.

Structural material can hardly be bought for less than $2.50 per 100 lb., Pittsburgh, while some mills are selling at $3 and warehouse deliveries are $3.10. Plates are selling at a minimum of $3.50 per 100 lb., Pittsburgh, and orders have been placed at all the way from that figure to $5.25, the latter for urgent delivery. Warehouse prices have advanced to $4, and warehouses are out of many sizes.

Steel bars are very scarce and are quoted at $3 per 100 lb., Pittsburgh. The demand for iron bars to take their place has not developed as fast as was expected, and the price is still $2.40. No. 28 black sheets have advanced to $2.75, but galvanized sheets remain unchanged. Freight embargoes have prevented a much larger business being done in this line during the past month.

Cast-iron pipe, 6-in., class B and heavier, remains unchanged at $29.50 per ton, tidewater. Municipal demand is much lighter than private buying, which has been fair. Large advances have, however, been made by lap-welded pipe. Black iron pipe, 2½ to 6 in., is now $86 per ton, carload lots, Pittsburgh, while black steel pipe is $58. Galvanized pipe of the same grade has advanced to $126 per ton for iron and $95 for steel. Lead has gone up farther, to $7.95 per 100 lb., New York, and $8, East St. Louis, in 25-ton lots.

Cement prices remain unchanged, the net prices in carload lots f.o.b. the important centers being reported as follows: New York, $1.37; Pittsburgh, $1.41; Cleveland, $1.54; Chicago, $1.41; Detroit, $1.50; Milwaukee, $1.53; St. Paul, $1.68; Duluth, $1.56; Denver, $1.92.

Wholesale prices, New York, on building materials are now: Hudson common brick, $9; crushed trap rock, ¾ in., 95 cents per cu. yd.; gravel, 1½ in., 80 cents; ¾ in., 85 cents, and gravel passing subway specifications, 95 cents. Cow bay sand is now quoted at 45 cents per cubic yard.

Lumber orders continue considerably in excess of both production and shipments in the Southern and Eastern territory as well as in the Western states. New York lumber prices have advanced all the way around. The wholesale price per thousand ft. b.m. for yellow pine being $28.50 to $35 for 8 to 12 in., and $36 to $38 for 14 to 16 in. Hemlock, eastern mixed cargoes, is quoted at $21, an 9-in. spruce, 16 ft. long, at $31. No. 1 yellow pine, 2 x 12 in., 20 ft., is now $31, Chicago, and No. 1 hemlock of the same size, $30. Lumber mills on the west coast are expected to put new discount sheets in effect on May 1.

Buildings

Low bids amounting to $331,000 were received at Los Angeles for constructing a high school. Bids will be opened April 10 at Lincoln for constructing a $140,000 building for the University of Nebraska. The following proposed work is noted: $1,000,000 telephone exchange, proposed, Providence, R. I.; $300,000 high school, plans being prepared, Waterbury, Conn.; plans filed, $225,000 factory and $400,000 hotel, New York City; $500,000 hospital, erection contemplated, Brooklyn, N. Y.; $250,000 association building, being considered, Cincinnati; $900,000 hotel and theater, plans prepared, Chicago; eighteen-story office building, plans being prepared, Detroit; $250,000 court house, plans being prepared, Lincoln, Neb.; $1,200,000 smelting plant, proposed, Douglas, Ariz; $250,000 passenger station, to be built this summer, Tacoma, Wash.

Bridges and Roads

Bids have been received on the general contract for building a $247,000 bridge at Gary, Ind. Lowell, Mass., will open bids April 18 for constructing a reinforced-concrete bridge. It is reported that a new $200,000 bridge will replace that which collapsed March 21, at Johnstown, Pa. A railroad viaduct proposed at Birmingham, Ala., will cost $203,000. Engineers have been engaged to design a $250,000 bridge over the Cumberland River near Nashville, Tenn. A county viaduct under consideration at Earle, Ark., will cost $300,000. The cost of repairing flood-damaged bridges near San Diego will amount to $500,000, and the new bridges necessary will cost $600,000 in addition. An election to vote the necessary funds will be held May 16. The sum of $240,000 has been appropriated by the Legislature for constructing bridges in the Province of Quebec.

Road work was again active last week. Among the contracts awarded were the following: Baltimore, asphalt paving, $94,000; St. Cloud, Minn., wood block and bitulithic paving, 53,000 sq. yd.; Hastings, Neb., asphalt paving, $250,000; Winkelman, Ariz., road work, $100,000; Montreal, asphalt paving material, $116,000.

Bids are desired on the following work: Albany, N. Y., road work, 14 miles, April 20; Morristown, N. J., paving work, 38,000 sq. yd., April 11; Bradentown, Fla., road work, 47 miles, April 20; Bucyrus, Ohio, street paving, 100,000 sq. yd., April 25; Audubon, Iowa, street paving, 46,000 sq. yd., April 6; Marion, Iowa, 16 blocks stret paving, April 17; Storm Lake, Iowa, street paving, 60,000 sq. yd., April 4; North Platte, Neb., asphalt paving, $100,000, April 14.

Proposed paving work noted includes the following: 23 miles bituminous road, Providence, R. I.; $220,000 road bonds voted, Elkins, W. Va.; contracts soon to be let for road work costing $550,000, Charleston, W. Va.; highway to cost $150,000 recommended, Chattanooga, Tenn.; $400,000 road bonds voted, Hopkinsville, Ky.; $600,000 road bonds voted, Owensboro, Ky.; $208,000 road bonds sold, Columbus, Ohio; paving work to cost $75,000 to be let in April, Urbana, Ohio; brick road costing $153,000 to be built, Ashtabula, Ohio; 20 miles of hard surface road to be built, Cook County, Chicago; paving work to cost $250,000 contemplated, Vincennes, Ind.; engineer appointed for road work to cost $202,000, Beaumont, Tex.; paving costing $100,000, Alameda, Cal.

Waterworks and Sewers

The following waterworks construction is noted this week: New York City, bids opened total $104,000 for two drainage chambers; Atlantic City, N. J., bids desired for laying 3 miles of fire mains partly supported on piles; Canton, Ohio, $50,000 voted for extending water mains; Athens, Ohio, reservoir and pumping station costing $40,000 proposed.

The following sewer work is noted: Mount Vernon, N. Y., lowest bids, 3 sections of sewer work, total $126,000; Houston, Tex., $51,000 storm sewer contracted for; Brooklyn, N. Y., bids desired April 5, five sewer contracts, total security $196,000; Bad Axe, Mich., bids desired April 5 for building sanitary sewer systems; Anoka, Minn., bids desired, sewer construction to cost $55,000; Marlboro, Mass., sewer work costing $61,000 proposed; Rochester, N. Y., sewer work costing $120,000 being planned; Delmar, Ind., sewer construction under consideration, cost $110,000; Philadelphia, plans approved for intercepting sewers; Tuscon, Ariz., contract to be let, outfall sewer, cost $50,000; Seattle, construction of trunk sewer system costing $500,000 being considered.

Miscellaneous

The construction of an ore dock, the material for which will cost $500,000, has been contracted for at Buffalo. A contract amounting to $1,500,000 has been let for constructing a speedway and fair buildings at Harrisburg, Pa. Bids are desired at Redwood Falls, Minn., for drainage work to cost $147,000. Bids are also asked for building an 800-ft. concrete pier at Houston, Tex., and for constructing a 1000-ft. drydock at San Francisco.

Plans have been submitted to the Pittsburgh City Council by the Pittsburgh Subway Company for constructing rapid transit lines at a cost of $15,000,000 to $30,000,000. Drainage work to cost $300,000 will be started soon near Paducah, Ky. Drainage work costing altogether $650,000 is coming up in Arkansas at Marion and at Newport. Houston, Tex., has sold drainage and harbor improvement bonds amounting to $1,325,000. Surveys have been completed for a $1,000,000 railroad cutoff near Arnegard, N. D. A hydro-electric plant which it is reported will be built by the Great Northern Railway Company near Chelan, Wash., will cost $3,000,000. A permit has been issued for grade-crossing elimination work at Los Angeles to cost $166,000.

WATERWORKS

PROPOSED WORK.

Woonsocket, R. I.—Water Commission in a report to Common Council recommended appropriating $20,000 for erecting fireproof building at No. 1 reservoir, also construction of a pump 8,000,000 gal. daily capacity.

Dundee, N. Y.—Reported construction of water works system is under consideration. Address Village Clerk.

Perry, N. Y.—Citizens on March 21 voted in favor of constructing a filtration plant. C. C. Hopkins, Engineer, Cutler Bldg., Rochester. O. N. Boltine, Village Clerk.

Farmingdale, N. J.—West Monmouth Water Company, Farmingdale, incorporated to operate water works; capital, $100,000.

New Jersey.—Governor has authorized creation of the South Jersey Water Commission. Cities in North Jersey may now proceed to enter into an agreement for the development of the Wanaqua as a water supply and South Jersey cities develop the Wharton land or any other desirable water shed.

Beaver Falls, Pa.—Council plans issuing $40,000 bonds for reconstructing the water works and erecting a high-pressure tank in eastern portion of borough. Address Borough Clerk.

Erie, Pa. — Plans for constructing storage reservoir south of city and for increasing pumping facilities submitted to Water Commissioners by O. L. Schlumpf, Engr. of the Fleming-Chester Co. of Pittsburgh.

Freemansburg, Pa.—The Northampton Concity Water Company (E. W. Thayer, Secy., Easton) plans constructing water works here costing $25,000, to include pump of 70,000 gal. daily capacity, standpipe 100,000 gal., three miles of piping, 4 to 8 in. Contract soon to be let. C. M. Brady, Engineer, Easton.

New Castle, Pa.—New Castle Water Company is reported considering building a line from Neshannock Creek to the reservoir in Neshannock Township changing source of water supply from Shenango to Neshannock.

Baltimore, Md.—Board of Estimate has authorized installation of a liquial chlorinating plant at the Montebello filters to cost $1,800.

Mount Rainier, Md.—Harry Stevens, Union Trust Building, Washington, D. C., is engineer for the municipal water works proposed, at a cost of $100,000. Peter J. Hogan, Town Clerk.

Wilmington, Del.—Council decided to spend $600,000 on improvements to city water system, including new filters, water storage basins, additional reservoirs and new pumps.

Lake Charles, La.—Burns & McDonnell, Inter-State Building, Kansas City, Mo., are preparing plans for water works improvements and new water supply.

New Tazewell, Tenn.—City will spend $10,000 in extending water mains in near future.

Rodgersville, Tenn.—W. D. Harman is Chairman of Commission appointed to investigate and report on cost, etc., to install water works and sewer system.

Louisville, Ky.—In his annual report W. O. Head, Pres. Bd. Water Works, estimates cost of proposed improvementa at $647,000, to include 36-in. distributing main, cost $100,000; New River pumping station with one 30,000,000 gal. pump, $535,000; Wash Water Pump, Crescent Hill Filters, $10,000.

Winchester, Ky.—Edgar B. Kay, Prof. Engineering University of Alabama, engaged to ascertain value of plant of Winchester Water Works Co. and estimate cost of remodeling plant and extending mains to Kentucky River, distance of 4 miles.

Athens, Ohio.—It is proposed to install an 8,000,000-gal. pump and an 80,000,000-gal. reservoir at a cost of $40,000. Election to be held April 25. J. W. Barnett, City Engineer; R. O. Arnott, Mayor.

Canton, Ohio.—Council voted $50,000 bonds for extension of water mains.

Coshocton, Ohio.—City Council voted $20,000 to purchase a 3,000,000-gal. vertical pumping engine for installation at Water Works Pumping Station.

Wooster, Ohio.—Water bonds for $14,000 will be sold April 5 by Fred E. Paber, City Aud.

Indianapolis, Ind.—Terre Haute Water Works Company has been authorized by Public Service Commission to issue $70,000 common stock, of which $45,000 to pay for setting meters on various premises.

La Porte, Ind.—City will build a 4,000,000 gal. concrete reservoir. Address City Engineer.

Bluffs, Ill.—Election to be held this spring to vote $20,000 bonds for water works.

Hillsboro, Ill.—Steps being taken to construct two impounding reservoirs; plans provide for two 8-ft. dams. O. M. Hampton, City Clerk.

Virginia, Ill.—City Council voted to construct water works. Charles Cummings of Gardner, engineer in charge.

Madison, Wis.—Mead & Seastone, Madison, are engineers for the water works to include one 8,000,000-gal. high-service pumping engine, a 1,500,000-gal. concrete reservoir, two 200-hp. boilers, remodeling building and miscellaneous piping. Nothing further will be done about the matter until about May. L. A. Smith, Supt. Water Works.

Pleasantville, Iowa.—Constructing of water works costing $20,000 reported under consideration. Address City Clerk.

Lake Crystal, Minn.—Contract will be let probably in May for constructing water works, to cost $10,000. J. F. Druar, Engineer, 312 Commercial Building, St. Paul, Minn. U. P. Cobb, City Clerk.

Mankato, Minn.—City Engineer submitted to City Council plans for a new reservoir of 1,400,000 gal. capacity, of either reinforced concrete or masonry.

South St. Paul, Minn.—City Council considering water works and sewer system.

Thief River Falls, Minn.—Council is in favor of holding an election to vote $30,000 bonds for new water and light plant.

Thief River Falls, Minn.—Election soon to be held to vote $30,000 bonds for water and light improvements. Address City Clerk.

Wadena, Minn.—Citizens March 14 voted $11,000 bonds for extending water works including a new alternator and engine or turbine sixty-cycle, three-phase, 2300-volt of from 100 to 200 kw. capacity, and rebuild some of the mains and extend some. John Wilson, Engineer, Duluth; A. C. Murray, City Recorder.

Lawrence, Kan.—Bonds $75,000 for water works will be sold June 1. Citizens March 14 voted in favor of issuing these bonds for the purchase of the water works, and it is proposed to make general repairs. E. H. Dunmire, Engineer, Lawrence; W. C. Francis, Mayor.

Alliance, Neb.—Plans being prepared by Grant & Fulton, 505 Bankers Life Building, Lincoln, for reinforced concrete service reservoir to cost $8,000. Contract will be let about May 1.

Sterling, Neb.—Grant & Fulton, 505 Bankers Life Building, Lincoln, are engineers for the proposed water works to cost $25,000.

Milbank, N. D.—City contemplates installing purification plant.

Billings, Mont.—Billings Bench Water Users' Association will install a 96-in. siphon about 1,000 ft. long, costing $10,000, to take place of wooden flume. B. C. Lillis, Engineer for the Assoc.

Helena, Mont.—Reported approximately $10,000 will be spent on water works plant this summer, including installation of chlorination plant at reservoirs on Ten Miles.

Webster Groves, Mo.—Citizens voted to issue $32,000 bonds for fire apparatus and water system extension purposes.

Fort Worth, Tex.—City Commissioners decided to construct a new pumping plant at end of unfinished section of conduit between city and the reservoir at Lake Worth, fluming water down the river to that point and then pumping it through the conduit to the city; cost, $40,000.

Blackwell, Okla.—City contemplates making extensive improvements to water, electric light and sewer systems, and an election will be called to vote bonds for this purpose; approximately $60,000 will be needed. Benham Engineering Company, Oklahoma, Engineers.

Cordell, Okla.—City Commissioners considering constructing water works.

Fort Cobb, Okla.—Construction of water works and electric light plant is contemplated.

Pauls Valley, Okla.—Attorney General approved a bond issue of $16,000 for water works in Pauls Valley.

Wellston, Okla.—Bd. Trustees considering constructing water works.

Aberdeen, Wash.—Contract will be let in about six weeks for constructing the water works gravity system 24-in wood pipe. C. E. Fowler, Seattle, and L. D. Kelsey, Aberdeen, Engineers; P. F. Clark, City Clerk.

Colville, Wash.—Sawyer Brothers, Seattle, engaged to prepare plans for installation of water works extensions, to cost $10,000.

Everett, Wash. — Water bonds for $1,700,000 have been sold. City plans purchasing plant of Everett Ry., Light & Power Co., and spending $600,000 for improvements. H. Munn, Jr., City Engr.

Renton, Wash.—Reported City Council about to engage an engineer to make investigation of water works with a view to enlarging same. G. A. Harner, City Engineer.

Seattle, Wash.—City Council authorized installation of mains in portions of Orcas and Davis Streets; cost $14,482; Seventh Avenue N. and Rex Street; cost $40,122. Address L. B. Young, Chmn. Board Public Works.

Cost of installing water mains in Bangor Street estimated at $13,654. A. H. Dimock, City Engineer.

Contract soon to be let for 400 ft. 20-in. main 10 ft. below waterway bottom. C. B. Bagley, Secy. Board Public Works.

Oceanside, Cal.—J. B. Lippincott, 1134 Central Building, Los Angeles, engaged as consulting engineer by South Coast Land Co. to prepare plans for reconstructing pumping plant destroyed by recent floods. Work to include new wells, pumps, irrigation pipe, etc.; cost about $50,000.

San Diego, Cal.—H. N. Savage engaged by Sweetwater Water Co., San Diego, as consulting engineer to design and construct works required to restore and amplify the Sweetwater storage and distribution system, which was damaged by flood.

Santa Monica, Cal.—Election will be called to vote bonds to acquire four water companies, about $150,000 being available to make necessary connections for combining them.

Whittier, Cal.—Election to be held April 4 to vote $111,000 bonds for constructing water works. F. C. Roberts, Engineer, Sacramento.

Florence, Ariz.—Citizens voted $59,000 bonds for constructing municipal water works and electric light plant.

Roosevelt, Utah.—Citizens voted $12,500 bonds to purchase water works. E. F. Harmston, Engineer, Roosevelt; J. O. King, City Recorder.

Calgary, Alta.—The improving of the gravity system, at a cost of $300,000, is indefinitely postponed on account of financial difficulties. H. Sidenius, Designing Engineer, City Hall; George W. Craig, City Engineer.

BIDS DESIRED.

New York, N. Y.—Until April 5 by William Williams, Comr. Water Supply, Gas and Electricity, for furnishing Boroughs of Bronx and Brooklyn, Section 1, cross connecting existing trunk mains in southern boulevard and Mosholu Parkway, Borough of Bronx. Section 2, connecting distributing system to conduit of Catskill Aqueduct, Borough of Brooklyn. Security for Section 1 $7,000, and Section 2 $5,000. Also same time and place separate bids for connection high pressure fire service mains to Shafts 19, 22 and 23 of city tunnel Catskill Aqueduct, Boroughs of Manhattan and Brooklyn. Security $3,000.

Until April 7 by Wm. Williams, Comr. Water Supply, Gas & Electricity, for furnishing and delivering metal pipe, valves and fittings.

Until April 7 by William Williams, Comr. Water Supply, Gas and Electricity, for furnishing, delivering and laying water mains and appurtenances in Broadway, Amsterdam and Columbus Avenues, in Cathedral Parkway and W. 106th Street, Borough of Manhattan.

Until April 11 by Board Water Supply (George Featherstone, Secy.), Municipal Building, for Contract 171, surfacing with bituminous macadam and vitr. brick blocks, about 3 miles of highways at the Kensico reservoir in the town of Mount Pleasant, Westchester County.

Atlantic City, N. J.—Until April 13 by Board City Commissioners, for laying a c. i. high-pressure fire service main and appurtenances for city, advertised in Engineering Record. Harry Bacharach, Director Parks & Public Property.

McKeesport, Pa.—Until April 3 by City Council, for laying approximately 10,000 ft. 24-in. c. i. pipe line, advertised in Engineering Record. Leo Hudson, Engineer, 802 House Building, Pittsburgh. J. Monroe Smith, City Engineer.

Blackstone, Va.—Until April 14 for two centrifugal pumps, 500 g.p.m., two stage; a 60,000-gal. 100-ft. steel tank, 9000 ft. 4-in. c.-i. pipe, 1 air compressor 30 c.f.m., valves, fire hydrants, etc. Saville & Clairboine, Inc., Consulting Engrs., Richmond, Va.

Nashville, N. C.—Until April 7, by L. T. Vaughn, City Clerk, for furnishing material and machinery for water works, electric lights and sewer system, advertised in Engineering Record.

Charleston, S. C.—By Bureau Supplica and Accounts, Navy Dept., Washington, D. C., Sched. 9165, 18,700 ft. steel galvanized pipe.

Columbia, S. C.—Until April 4 by City Council for furnishing about 700 tons c.-i. water pipe and 15 tons special castings 6 to 12 in. diameter, 70 valves, 31 hydrants, etc. John McNeal, City Engr.

Lenoir City, Tenn.—Reported desired until April 8, by City Council, at office of W. U. Shipley, City Recorder, for repairing water works. Prof. J. A. Switzer, Engr., Knoxville.

Chicago, Ill.—Until April 3 by Department Public Works (W. R. Moorhouse, Comr.) for furnishing material and constructing and deliver on sidings at Sixty-eight Street Pumping Station valves and accessories.

Glasford, Ill.—Reported desired until April 3 by D. A. Howard, Village Clerk, for drilling and casing one deep well, about 1300 to 1400 ft. Fuller-Coult Co., Engrs., St. Louis.

Utica, Ill.—Reported desired until April 4 for constructing 60,000-gal. elevated steel tank. L. N. Sabo, City Clk.

Hayward, Wis.—Until April 11 at office of A. M. Johnson, Deputy City Clk., for furnishing material and erecting a 50,000-gal. steel tower and tank, a 400-gal. per minute low service pump, and 1500-gal. per minute fire pump.

Madison, Wis.—Until April 24 by Secretary Regents of University of Wisconsin, Madison, for constructing a pump house at the university. Address State Chief Engineer, Capitol Building, Madison, for plans.

Racine, Wis.—Reported desired until April 1, by Board Public Works, for water and sewer pipes in various streets. P. H. Connolly, City Eng.

Davenport, Iowa.—Reported desired until April 4, by Board Public Works for water and sewer pipes for year 1916.

Silver Lake, Minn.—Until April 15 by Village Council, for constructing the whole or portion of proposed water works system. Bernard Pawlak, Village Recorder.

Greensburg, Kan.—Reported desired until April 4, for constructing water works; probable cost, $30,000. Black & Veatch, Engrs., 507 Interstate Bldg., Kansas City, Mo.

Meade, Kan.—Reported desired until April 7 for reinforced concrete reservoir, 40-ft. diameter and 24 ft. deep. Black & Veatch, Engrs., 507 Interstate Bldg., Kansas City, Mo.

Harlowton, Mont.—Until April 20 by Council, for constructing water works, advertised in Engineering Record. Fred W. Barron, Mayor; George E. Baker, Consulting Engineer, Whitehall.

Three Forks, Mont.—Until April 12 by City Clerk for furnishing material and constructing water mains, reinforced concrete reservoir, including hydrants, valves, etc., advertised in Engineering Record. Swearingen & McCulloh, Engineer, Great Falls.

Lockhart, Tex.—Until April 18 by Citizens Water, Light & Power Company, for water works, electric light plant and ice plant, advertised in Engineering Record. Henry E. Elrod, Engineer, Dallas.

Halifax, N. S.—Reported desired until April 5, for 5000 ft. c.-i. pipe. F. W. W. Doane, City Engr.

Collingwood, Ont.—Until April 11 by Hugh A. Currie, Chmn. Water and Light Commission, for pumping machinery, comprising two motor-driven units, 1000 imperial gal. capacity each, pump well and connections. Chipman & Powers, Engrs., 204 Mail Building, Toronto.

Toronto, Ont.—Reported desired until April 11, by T. L. Church, Mayor, Chmn. Board Control, for electrically operated driving gear for operating 36-in. gate valves at Main Pumping Station, John Street.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Boston, Mass.**—Contract awarded Gibbey Foundry Company, at 2.475 cts. per lb., for 650,000 lb. iron castings, and to Hersey Mfg. Company, First Street, South Boston, for 5,675 ⅝, 1, 1½ and 3-in. water meters at a total cost of $34,354, and to Mechanics Iron Foundry Company, 38 Kemble Street, Roxbury, for 450,000 lb. No. 1 iron castings for water service of Public Works Department at 2.35 cts. per lb.; total, $10,575.

★**Easthampton, Mass.**—Contracts awarded by Board of Public Works for following: Sewer pipe and w. i. pipe, to C. C. Coates, of Easthampton; lead, Richards & Company, Boston; c. i. water pipe, Warren Company, New York.

New York, N. Y.—Unofficial total of lowest bid opened March 21 by Board of Water Supply for Contract 120 for construction of granite building for Hudson drainage chamber and a brick and concrete stone building for Croton Lake drainage chamber submitted by A. L. Guidone & Son, Inc., 42 Vanderbilt Avenue, at $104,262.

★**North Wales, Pa.**—Contract for erecting water tank awarded by North Wales Water Co. to Tibbet & Ward Co. of Phillipsburg, N. J., at $2,700.

Macon, Ga.—Morris Machine Works, Baldwinsville, N. Y., submitted lowest bid March 20 to Board Water Commissioners for one steam centrifugal pump, also crank and flywheel pumping engine at $9,512. J. E. Guilford, Secy. & Treas. Bd. Water Comrs.

★**Cincinnati, Ohio.**—Contract awarded by City Board of Control to Crumley, Jones & Crumley, Cincinnati, for laying 36-in. main in Eastern Avenue from main pumping station to Strader Avenue at $19,448.

★**Watertown, Ill.**—Contract for drilling well and building pump house at Watertown Hospital awarded by State Bd. Administration, Springfield, to P. H. Loeenz, Moline, at about $12,000.

★**St. Paul, Minn.**—Contract for furnishing water meters, in all about 2410, ⅝, ¾, 1, and 1¼ in. sizes, awarded Badger Meter Mfg. Company, Milwaukee, Wis., at a total of $15,055.

★**Canton, Mo.**—Contract awarded C. M. Hanes, Jerseyville, Ill., for improving water works at $13,000 (bids opened March 20). Henry Cluskey, Clerk.

Seattle, Wash.—Lowest bid opened recently by Board Public Works for furnishing 42-in. riveted steel water mains submitted by F. T. Crowe & Co., Globe Building, at $14,895.

★**Milwaukie, Ore.** — Contract awarded Giebisch & Joplin, Rothchild Building, Portland, for constructing water works extensions at $15,907.

Los Angeles, Cal.—Following are bids opened recently by Board of Public Service for furnishing 139 tons c. i. pipe: American C. I. Pipe Company, Sheldon Bldg., San Francisco, and U. S. C. I. Pipe & Foundry Company, Monadnock Bldg., San Francisco, each $35 per ton; H. R. Boynton Company, Los Angeles, $35.25, and R. E. Allen, $35.50 per ton.

★**McCammon, Idaho.**—Reported contract awarded by Council to Wheelright Brothers of Ogden, Utah, for constructing a municipal plant costing $21,492.

Drumondsville, Que.—Following are four lowest bids opened March 17 by Town Clerk for pumping station and filters: Roberts Filter Mfg. Company, Darby, Pa., two bids, $45,375 and $47,000; Arsenamet & Plamondon, Montreal, $47,780; Laurin & Leitch, 5 Beacon Hall Sq., Montreal, $47,900.

SEWERAGE AND SEWAGE DISPOSAL

PROPOSED WORK.

Marlboro, Mass.—Council has adopted a loan order of $61,000 for installation of a sewer system in Happy Hollow Section.

New Bedford, Mass.—In a report to Committee on Roads, Bridges and Sewers, City Engineer submitted a report on constructing a portion of a system of sewers to drain section of city between Brooklawn Park and Tarklin Hill Road.

Taunton, Mass.—Sewer bonds for $25,000 and water bonds for $15,900 have been sold. Address City Clerk.

Warren, R. I.—Contract soon to be let for constructing sewer to cost $40,000.

Brooklyn, N. Y.—Board of Estimate New York authorized preliminary work on the sewers in Collins Avenue and in Fresh Pond Road. Estimated cost of sewer $131,900.

Buffalo, N. Y.—Bill has passed the Assembly authorizing this city to issue $500,000 bonds for constructing sewers. Address Commissioner of Public Works.

Camden, N. Y.—Citizens voted to construct sewer system, vitrified and iron pipe; cost $10,500. Morrelle Vrooman of Gloversville, Engineer.

Rochester, N. Y.—Tentative plans for the draining of Genesee Valley Park provide for 3500 ft. 24-in. pipe, costing $39,000, and 12,000 ft. 24 to 54-in. concrete pipe, costing $90,000. Contract will probably be let this spring by W. W. Wotherspoon, State Superintendent of Public Works, Albany. Work includes the draining of park lands and for sewers to be flooded by Rochester Barge Canal. F. P. Williams, Division Engineer, State Engineer's Department, Rochester.

Pitman, N. J.—Council passed resolution authorizing $110,000 bond issue for constructing sewers. Address Mayor.

Greensburg, Pa.—Joint Sewerage Disposal Commission from Greensburg, Youngwood, South Greensburg and Southwest Greensburg boroughs engaged L. D. Tracy, 245 Fourth Avenue, Pittsburgh, as consulting engineer to make preliminary plans and estimates for sewage disposal plant.

Harrisburg, Pa.—City considering constructing a municipal sewage disposal plant.

Kittanning, Pa.—City Council directed Leo P. Hudson and Wade Mast, City Engr., to prepare plans for a sewage disposal plant.

Lewisburg, Pa—See "Sewerage and Sewage Disposal."

Monaca, Pa.—Constructing of sewer system and disposal plant is under consideration. Address Borough Clerk.

Philadelphia, Pa.—State Department of Health has approved the plans for the Frankford Creek intercepting sewer. This is the first step toward construction of the sewage disposal plant to cost $30,000,000 which is to be erected near Delaware and Erie Avenues. Address Director Public Works.

Woodlawn, Pa.—Plans being considered for a sewage disposal plant. Address Borougn Clerk.

Delmar, Md.—Reported construction of a sewerage system for Delmar, Md., and Delmar, Del., costing $110,000, is under consideration. Address Town Clerk.

Elkton, Md.—Bill has passed the Senate authorizing construction of sewer system here.

Frederick, Md.—Bill passed the Senate authorizing issue of bonds for constructing a sewer system here.

Savannah, Ga.—About $400,000 bonds sold by city for constructing extension of house drainage system.

Louisville, Ky.—Installation of septic tanks to take care of the sewage of the territory bounded by Beechmont, Oakdale and Southern Heights and cost $9,000 is reported under consideration. L. C. Lang may be able to give information.

Akron, Ohio.—Carl F. Beck, Director Public Service, recommends construction of a trunk sewer from Fairlawn to Wooster Avenue and installation of a pump there to force sewage over Sherbondy Hill into city sewage system; cost $200,000.

Cincinnati, Ohio.—City Council March 21 approved approximate estimates for constructing sewer in Mitchell and Clinton Springs Avenues and Reading Road at $23,340, and Clinton Springs Avenue at a cost of $1,620, and Humboldt Avenue at $13,195.

Ordinance passed by Cincinnati Council authorizing issue of $22,000 bonds for sewers in Prentice, Conover and other streets in city of Madisonville. J. Carroll, Acting City Clerk.

Cleveland, Ohio.—See "Paving and Roads."

Dayton, Ohio.—City Finance Director directed to sell $183,000 street and sewer bonds.

Urbana, Ohio.—Sewer bonds for $12,900 will be sold April 20. E. F. Sweetman, City Engr.

Wadsworth, Ohio.—Improvements and enlargements to sewage disposal plant being considered by City Council.

Youngstown, Ohio.—Contract soon to be let by Bd. Public Service for constructing Mill Creek sewer, to be 4½ miles long, and range in diameter from 27 to 68 in., of steel, reinforced concrete; probable cost $140,000.

Logansport, Ind.—Sanitary sewer system to drain southeast section of city from Fifth Street to Spencer Park and from Broadway to Wabash River is to be constructed by city, at a cost of about $273,000.

Detroit, Mich.—Commissioner of Department of Public Works has submitted to Council estimates for the construction of sewers in remote parts of the city include $46,739 for sewer in Mt. Elliott Avenue, $15,915 in Tireman Avenue, $34,350 for Cedar Line Avenue, and $35,000 for additional land at Irving School.

Contract soon to be let by Department of Public Works for completing the Morrell Street sewers.

Grays Lake, Ill.—Village Board considering installation of sewer system costing $25,016.

Murphysboro, Ill.—Sewer system about 5 miles, 8 to 18-in. vitr. pipe, is to be laid in northwestern part of city at a cost of $30,800. R. A. Rollo, City Engineer; K. O. Deason, City Clerk.

Brainerd, Minn.—City Council has voted $45,000 bonds for constructing new general sewer.

Grand Island, Neb.—Preliminary report made by Grant & Fulton, 505 Bankers Life Building, Lincoln, for tne part of combined and storm sewer system to cost $10,000.

Pawnee, Neb.—Election to be held April 4 to vote bonds for constructing sewer system to cost $21,343 and disposal plant $1,825. E. F. Archer & Co., 614 New England Building, Engineer; J. L. Meek, City Clerk.

Anaconda, Mont.—Election to be held April 25 to vote $40,000 bonds for constructing sewer drainage system in Third Street. Address City Clerk.

Amarillo, Tex. — See "Paving and Roads."

Anson, Tex.—Plans prepared by Henry E. Elrod, Dallas, for the sewage disposal plant have been submitted to State Sanitary Engineer.

Dublin, Tex.—City contemplates installing sewage disposal plant. Address Mayor.

Hillsboro, Tex.—Plans being prepared for sewage disposal plant, capacity 1,000,000 gal. F. C. Metzger, City Engineer.

Huntsville, Tex.—Sewage disposal plant is being considered. Address A. T. McKinney, City Attorney.

Itaska, Tex.—Citizens voted $15,000 bonds for sewer system.

Paris, Tex.—State Sanitary Engineer has approved plans for a sewage disposal plant costing approximately $10,000 to care for 1,500,000 gal. daily flow. C. E. McCuiston, Mayor.

Sherman, Tex.—Bartlett & Ranney, San Antonio, Engineers for sewage disposal plant of 2,000,000 gal. daily capacity.

Sweetwater, Tex.—Plans submitted to State Sanitary Engineer for sewage disposal plant (Imhoff) and sewerage system. Cost $34,800. About 8500 ft. 18 in., 3000 ft. 15 in. pipe will be needed. H. C. Hoard, Jr., Resident Engineer; M. H. Mathes, Consulting Engineer, Harrisburg.

Teague, Tex.—Alterations contemplated to the present sewage disposal plant. E. L. Dalton, Dallas, owner.

Oakesdale, Wash.—Sawyer Brothers, Seattle, engaged to prepare plans and specifications for a sewerage system, to cost between $20,000 and $30,000.

Seattle, Wash.—Plans and specifications for sewers in Twelfth Avenue, Northeast, and other streets submitted to Bd. Public Works by A. H. Dimock, City Engineer; cost $24,700.

Streets and Sewer Committee is considering the construction of a trunk sewer system in Ballard District to cost about $500,000.

Chino, Cal.—See "Paving and Roads."

Fresno, Cal.—City Trustees approved plans and specifications for a sanitary and storm sewer system to cost about $500,000. Bond to be voted for improvement. B. E. Cronkite, City Engr.

Hermosa Beach, Cal.—Reported city taking steps to install a sewerage system and disposal plant. Address City Engineer.

Hermosa Beach, Cal.—C. R. Sumner, City Engineer, directed to prepare estimates of cost of improvemnts to sewerage system including enlargement of sewage disposal plant.

Riverside, Cal.—Election will probably be held soon to vote $120,000 bonds for constructing extensions, enlarging and reconstructing the storm drainage system. Address City Clerk.

San Diego, Cal.—City Council voted to form an improvement district and issue bonds to construct a sewer system in Ocean Beach section; cost about $50,000. George Cromwell, City Engineer.

Watts, Cal.—Election is to be held April 10 to vote on constructing sewage disposal plant (Imhoff) to cost $125,000. V. R. Franklin, City Clerk.

Tucson, Ariz.—Contract soon to be let for constructing outfall sewer costing $50,000. Address City Manager.

Ogden, Utah.—City Engineer Joseph M. Tracy authorized to prepare plans for the sewer system proposed for territory north of Ogden River.

BIDS DESIRED.

Woonsocket, R. I.—Until April 18 by Board of Sewer Commissioners for about 4800 ft. of 8-in. and 900 ft. 10-in. sanitary sewer, advertised in Engineering Record. Frank H. Mills, City Engineer.

New Haven, Conn.—Until April 10 by F. L. Ford, City Engr., for constructing sewers and appurtenances in Read, Elizabeth and other streets.

Albany, N. Y.—Until April 3, by Board Contract & Supply (Isidore Wachsman, Secy.), for constructing sewers in Livingston Avenue and Lodge St.

Binghamton, N. Y.—Until April 26 (change of date), by Board of Contract & Supply, for constructing Section No. 1 of the main intercepting sewer, advertised in Engineering Record. W. Earl Weller, City Engineer.

Brooklyn, N. Y.—Until April 5 by Louis H. Pounds, Borough President, for constructing sewers and appurtenances in Thirty-ninth, E. Twenty-second, S. Sixty-second and other streets. Until April 12 same place as above for constructing sewers in Chauncey Street, under proposition "A," to consist of 3380 lin. ft. 114, 102, and 96-in. brick sewer, 5061 lin. ft. 15 and 12-in. pipe sewer; under proposition "B," 1621 lin. ft. 114-in. brick sewer in tunnel, 821 lin. ft. 114-in. brick sewer in open cut, 901 ft. 102-in. and 37 ft. 96-in. brick sewer, together with basins, manholes, etc. Security $80,000. Also separate bids for 2939 lin. ft. of 78 to 42-in. brick sewer, 460,000 ft. sheeting and bracing, 21,000 ft. of foundation planking, etc. Security $35,000. For sewers in Pacific Street and Troy Avenue, in all about 4180 lin. ft. 78 to 30-in. brick sewer, 1886 lin. ft. of 8 to 24-in. pipe, 750,000 ft. sheeting and bracing. 8500 ft. foundation plank, together with basins, manholes, etc. Security $50,000. Also constructing sewers with appurtenances in Myrtle Avenue. Security, $20,000. Sewers with appurtenances in Park and Tompkins Avenues. Security, $12,000.

Long Island City, L. I., N. Y.—Until April 10 by Maurice E. Connolly, Borough Pres., for constructing sewers, with appurtenances, in Alburtis and Roosevelt Avenues, Second Ward, Borough of Queens. Security $20,000.

New York, N. Y.—Until April 3 by Marcus M. Marks, Pres. Manhattan Boro., for alterations and improvements to W. Twenty-fourth, W. Thirty-third, E. and W. Twenty-eighth Street sewers. Total security $17,700.

Caldwell, N. J.—Until April 3 by Committee on Sewers for constructing sewers and appurtenances. Fred. R. Cook, Mayor.

Pittsburgh, Pa. — See "Paving and Roads."

Madison, N. C.—Reported desired until April 10, by Chas. L. Armsby, City Clk., for constructing sewers, sanitary sewer system and sewage disposal plant.

Nashville, N. C.—See "Water Works."

Charleston, S. C.—Reported desired until April 14 for furnishing 8 to 14-in. terra cotta pipe for year 1916. J. H. Dingle, City Engr.

Starke, Fla.—Until April 18 by Town Council at office of C. A. Futch, Town Clk., for constructing sanitary sewerage system and paving certain streets, to consist of 26,900 lin. ft. 6 to 12 in. terra cotta pipe, 2 sewage flush tanks, 2 sewage settling tanks, 14,328 sq. yd. pavement, 8705 lin. ft. curb, etc. J. B. McCrary Co., Engrs., 1408-17 Third National Bank Building, Atlanta.

Cleveland, Ohio.—Reported desired until April 5, by Commissioner Purchases & Supplies, for constructing and appurtenances in Walworth Run Avenue and W. Thirtieth Street.

East Chicago, Ind.—Reported desired until April 3 by M. R. Shock, Chmn. Board Public Works, for constructing sewers in various streets.

Fort Wayne, Ind.—Until April 6 by F. M. Randall, City Engineer, for 8000 ft. 12 to 20-in. vitr. pipe sewer in Spy Run, to cost $20,000.

Bad Axe, Mich.—Until April 5 (readvertisement) by James Burgess, City Recorder for furnishing material and constructing a sanitary sewerage system, one two-story sedimentation tank, siphon compartment and siphons, sludge, drying beds, etc., approximately 36,730 lin. ft. 6 to 15-in. pipe, 206 lin. ft. 8 to 12-in. pipe sanitary sewer, 91 masonry manholes and covers. Rolla W. Roberts, Engr., Saginaw.

New London, Wis.—Reported desired until April 5 for constructing sewers in several streets. C. J. Thompson, City Clk.

Oconomowoc, Wis. — Reported desired until April 3 by Board Public Works (H. A. Ernst, Chmn.) for constructing storm and sanitary sewers.

Brooklyn, Iowa.—Until April 7, by Frank Talbot, Town Clerk, for constructing 1055 lin. ft. 8 and 6-in. pipe, one sewage ejector pump, a well and discharge pipe. M. Tschirgi & Sons, Engrs., 712-713 American Trust Building, Cedar Rapids.

Davenport, Iowa.—Reported desired until April 4 by Board Public Works (J. W. Crowley, Comr.) for sewers and water service for year 1916.

Marengo, Iowa.—Reported desired until April 3, by John C. Baker, City Clk., for constructing sanitary sewer system and sewage disposal plant. Probable cost $48,000.

Anoka, Minn.—Reported desired until May 1 for constructing sewers. Probable cost $55,000. Address City Clerk.

Wabasha, Minn.—Until April 18, by J. M. Schouweiler, City Recorder, for constructing sewers in Main, Arch, Second and other street. J. F. Druar, Engr.

Ellis, Kan.—Reported desired until April 10, by City Clerk, for constructing sewer system. Probable cost, $30,000. W. E. Hulse & Co., Engrs., Hutchison.

Winner, S. D.—Until April 10, by City Auditor, for constructing sewer system, including 17,000 ft. brick or concrete sewer pipe 6 to 12 in., cost $18,000 for sewer and $3,000 for disposal plant. C. H. Green, Engineer, Spokane, Wash.

Winnsboro, Tex.—By Gordon Ames, City Secretary, for all kinds of pipe, etc., for sewer system; cost $15,000; disposal plant, $5,000; city is to do the work. William E. Stevenson, Engineer, Winnsboro.

Calexico, Cal.—Until April 4 by E. B. Browne, City Clerk, for furnishing 385 tons c. i. pipe, 4 to 14 in. in 10 to 16-ft. lengths; 1000 ft. 2-in., 1500 ft. 1-in., and 2000 ft. ¾-in. w. i. screw pipe; 400 ft. ⅝-in. lead pipe; 1200 lb. flange stop cocks; 390 couplings; 10 fire hydrants; 145 valves, etc.; also for constructing extensions to sanitary sewer and sludge system, involving approximately 15,075 ft. 8-in. vitrified pipe and 547 Y's, 4292 6-in. and 148 Y's; 36 manholes and flush tanks, etc.

PRICES AND LETTINGS.

★Indicates award of contract.

★Warren, R. I.—Contract for 40,000 ft. 8 to 12 in. sewer pipe awarded Yadesernia & Chilson, Franklin, Mass. Charles T. Chase, Engineer, Providence.

Mount Vernon, N. Y.—Following are four lowest bids opened March 21 by city for constructing a drain from Eastchester Creek to Twelfth Avenue and Third Street: (a) Section I, (b) Section II; (c) Section III, Nordone & Petrillo, Proctor Building; (a) $28,493, (b) $38,000, (c) $59,982, Gucerino Contracting Company, (a) $30,000, (b) $35,792, (c) $56,484; Gasparino & Company (a) $31,989, (c) $54,982; Cortesi & Merorn, (a) $34,000, (b) $41,375; James Circircia, 57 S. Sixth Avenue (b) $41,000; James Ferry & Son (c) $51,900.

★Macon, Ga.—Contract for sewering the Vineville branch awarded by Mayor and Council to Turner & Mangham at $28,312.

★Fort Wayne, Ind.—Contract for constructing 3426 ft. sewer in East End of city awarded J. B. Sheets Company, Fort Wayne.

★Kenwood Park, Iowa.—Contract for constructing sewerage system (bids opened March 21) awarded A. C. Brown, Caruthersville, Mo., at $29,985, and for two disposal tanks to Marion Concrete Company, Marion, Iowa, at $8,625. C. M. Doolittle, Clerk.

★Keota, Iowa.—Contract awarded D. E. Keller Co., Davenport, for constructing about 1½ miles of sewers (bids opened March 22).

Polson, Mont.—Lowest bid opened March 6 by city for constructing sewers was submitted by Security Bridge Company of Minneapolis, Minn., and their unit prices on some of the materials were as follows: 14,360 lin. ft. trench excav., 45 cts.; 600 lin. ft. trench excav. (river), $1.00; 14,960 lin. ft. backfilling, 5 cts.; 200 cu. yd. structures, etc., 50 cts.; furnishing 600 lin. ft. 18-in. c.-i. pipe, $3.75; laying 600 ft. 18-in. pipe, 20 cts.; 6193 line. ft. 8-in. vitr. pipe, 28 cts.; 1432 lin. ft. 10-in., 41 cts.; 4640 lin. ft. 15-in., 80 cts.; 1740 lin. ft. 18-in., $1.10; 164 yd. 8 x 6 in., $1.21; 48 10 x 6, $1.92; 92 15 x 6 in., $3.00; 15 18 x 6 in., $4.50; 1 15 x 15-in., $4.50; 1 18 x 18-in., $5.50; 14 T's 8 x 8-in., $1.10; 4 10 x 8, $1.50; 9 15 x 8-in., $2.50; 1 18 x 8-in., $5.00; 18 catch basins, $60.00; 34 manholes from $55.00 to $100.00, 9 flush tanks, $140.00, etc. Total, $25,719. Next three lowest bidders: Two Miracle of Kalispell, $25,956; C. H. Kelley of Kalispell, $26,504; R. M. Badsten & Co. of Butte, $27,087. Long & Olson, Engineers, Polson.

★Houston, Tex.—Contracts awarded as follows for furnishing machinery for the sewage disposal plant (bids opened March 16): The Goulds Mfg. Co., 1001 Carter Building, Item I—3 pumps, complete with motors, control, etc., 4100 gal. per min., 26 ft. head, at $5,262; Item II—2 pumps complete with motors, control, etc., 3000 gal. per min., 30 ft. head, at $2,746; A. M. Lockett & Co., 423 Southern Pacific Building, Item III—2 sludge pumps with motors, control, etc., 500 gal. per min., 50 ft. head, at $1,051; B. F. Sturtevant Co., 15 Damon Street, Boston, Mass., Item IV—4 blowers with motors, control, etc., 3750 cu. ft. per min., 5¼ lb. pressure, G. E. repair parts, at $11,865; Item V—1 blower, 3750 cu. ft. per min., 5¼ lb. pressure, at $1,575; S. E. & Pump Co., care of Bd. Public Works, Item VI—Diesel engine, 130-150 h.p., at $7,550. E. E. Sands, City Engineer.

★Contract for constructing storm sewer in Hill Street awarded to H. M. Miller, Houston, at $51,382.

★**Long Beach, Cal.**—Contract for constructing clay pipe sewer laterals in District No. 1, approximately 20,370 ft. 8-in. pipe, awarded Peter S. Tomich, 311 North Hill Street, at $11,970.

BRIDGES

PROPOSED WORK.

Waterbury, Conn.—City Engineer preparing plans for 50-ft. reinforced concrete viaduct, from State Street to William Street, over Southern Ry. yards.

Hunt, N. Y.—Citizens March 14 voted $25,000 bonds for constructing a bridge across Genesee River. George C. Schaffer, Engineer, Geneseo. Address, Town Clerk.

Heuvelton, N. Y.—Citizens voted $400,000 bonds for constructing reinforced concrete bridge over Oswegatchie River. Address Village Clerk.

Utica, N. Y.—City Council sold $26,000 bonds for constructing Pleasant Street viaduct.

Camden, N. J.—Bridge Committee Camden and Burlington County Boards Freeholders and Public Service Ry. Co. considering constructing a bridge over Pensauken Creek at Moorestown pike intersection. Address Clerk Board Freeholders, Camden.

Warren, N. J.—Road Committee of Board of Chosen Freeholders and the Delaware, Lackawanna & Western R. R. (G. J. Ray, Chief Eng., Hoboken) are considering the rebuilding of bridges at Buttermilk Bridge near Washington and North Main Street at Stewartsville. Concrete bridges are contemplated to replace these bridges.

Greenville, Pa.—Bessemer & Lake Erie R.R. (H. T. Porter, Ch. Engr., Greenville) to build bridge over Little Shenango River.

Johnstown, Pa.—A $200,000 bridge is planned to replace bridge crossing Conemaugh River which collapsed March 21. Johnstown, Franklin Borough, Cambria Steel Company, Pennsylvania R. R. and Johnstown Traction Company will pay cost of bridge.

Pennsylvania.—Permits issued by State Water Supply Commission:

Pennsylvania Coal & Coke Corporation, to make a change in channel of Porgrin Run, extending approximately 1000 ft. upstream, near the village of Nant-y-Glo, in Jackson Township, Cambria County.

Baltimore & Ohio Railroad Company, to construct a bridge over Laurel Hill Creek (Bridge No. 42) at Confluence, Somerset County.

Commissioners of Lancaster County, to construct new pier at bridge across Mill Creek, at Eshleman's Mill, 2 miles above junction with Conestoga Creek, in West Lampeter Township.

Pennsylvania Railroad Company, to make a change in superstructure of Bridge No. 0.46 (old No. 1) across Elk Creek, at Ridgway, Elk County. For permission to place a fill along the east bank of the Allegheny River, north of Valley Camp Station, in Allegheny County. To place a fill along the right bank of the Little Conemaugh River, just above Conemaugh Station, Cambria County. To construct bridge across Little Pucketa Creek, near Parnassus, in Lower Burrell Township, Westmoreland County. To replace present stone abutments with concrete at bridge over Spring Run, 710 ft. above mouth, in Boggs Township, Center County. To construct two additional piers and make change in superstructure of Bridge No. 32.01 (old No. 18), Bellefonte Branch, across Penns Creek, 843 ft. west of Paddy. Mountain Station, in Haines Township, Center County.

Bessemer & Lake Erie Railroad Company, to construct bridge across Allegheny River, 6000 ft. downstream from Cheswick, Allegheny County.

Commissioners of Fayette County, to construct pier under bridge across Redstone Creek 5.1 miles above its mouth, at Rowe's Run Station, Fayette County (Bridge No. 5). To construct bridge across Redstone Creek, 8 miles above its mouth, at Smock Station, Fayette County (Bridge No. 1). To construct round-nosed pier under bridge across Redstone Creek, 9 miles above mouth, at Rothrock Station (Bridge No. 12). To construct a round-nosed concrete pier under bridge across Redstone Creek, about 3.5 miles above month, at Brazneil, between Redstone and Jefferson Townships, Fayette County.

Philadelphia & Reading Railway Company, to replace existing wooden trestle over Brandywine Creek, in the City of Coatesville, Chester County.

Commissioners of Warren County, to construct bridge across the Allegheny River, between Hickory and Crescent Avenue, in the Borough of Warren.

West Penn Railways Company, to construct bridge across Dunbar Creek, 0.8 mile above mouth of stream and about 1.5 miles south of Connellsville, Fayette County.

Louis Werren, repairs to dam on Mill Creek, in Mill Creek Township, Erie County.

Scranton Gas & Water Company, to reinforce spillway section of the Elmhurst Dam, on Roaring Brook, in Roaring Brook Township, Lackawanna County.

Westinghouse Electric & Mfg. Co., to erect a foot bridge across Turtle Creek, 9000 ft. above mouth, in Turtle Creek Borough, Allegheny County.

Watsontown, Pa. — Commissioners of Northumberland and Union Counties will construct bridge over Susquehanna River between Watsontown and Whitebeer. Estimated cost $150,000. Address Clerk Northumberland County, Sunbury.

Cumberland, Md.—Citizens March 21 voted $60,000 bonds for constructing bridges. James P. Gaffney, City Engineer.

Palatka, Fla.—See "Paving and Roads."

Birmingham, Ala.—W. H. Courtenay, Chief Engineer of Louisville & Nashville R. R., estimates cost of constructing Weatherly Viaduct at $203,611; city's share, $50,903.

Yazoo City, Miss.—Board Supervisors plan building iron bridge with reinforced-cement foundation over Big Black River at Scotts Ferry.

Clarksville, Tenn.—City reported considering constructing bridge across Cumberland River. Address City Clerk.

Nashville, Tenn. — Nashville, Chattanooga & St. Louis Ry. Co., Nashville Ry. & Light Co. and city decided to construct a concrete viaduct to replace steel structure on Charlotte Pike; cost about $45,000.

County Court has engaged Ferland & Klyce, to prepare plans for bridges across Cumberland River at Hydes Ferry Pike; $250,000 bonds will be issued for this bridge.

Akron, Ohio.—County Bridge bonds for $25,000 have been sold. Address County Clerk.

Hamilton, Ohio.—Fred Hammerle. County Engineer, preparing plans and specifications for concrete bridge 111 ft. long and 18 ft. wide to be constructed at Stevens farm, Reilly Township; estimated cost $5,000.

Gary, Ind.—United States Steel Company, of Gary, will construct a steel and concrete bridge, 60 ft. wide, over Grand Calumet River on Buchanan Street; cost $247,000 (bids have been received on the general contract.) Subways are also to be constructed by this company under tracks of Lake Shore and B. & O. Railroads north of river, to be 60 ft. wide and high enough to permit passage of cars; also a car line is to be constructed from Fifth Avenue North to Buchanan Street, to the sheet and tin plate mills.

Jacksonville, Ill.—Contract will be let in April or May by city for resurfacing with Tarvia about ¾ to 1 mile of South Main Street; cost $23,000; ½ mile on East State Street; cost $11,000; and 4500 ft. resurfacing with asphalt on West State Street and brick between car tracks; cost, $50,000.

Jerseyville, Ill.—About $20,000 will be spent in this county this season for grading and oiling roads and for building highway bridges. C. E. Warren, County Superintendent of Highways.

Joliet, Ill.—See "Railroads."

Kankakee, Ill.—Kankakee and Will Counties propose constructing jointly across Kankakee River a steel bridge with stone abutments.

Winchester, Ill.—About $25,000 will be spent this year for grading and oiling roads. George H. Cannier, County Superintendent Highways.

Rice Lake, Wis.—Council is in favor of issuing $15,000 bonds for constructing a reinforced concrete bridge across Red Cedar River at Main Street.

Clarinda, Iowa.—It is proposed to construct following bridges: At Coin, an 80-ft. steel or concrete bridge with concrete floor and concrete abutment piers; at Blanchard, over Tarkio River, 90-ft. span same type, each to cost $5,000, and over Nodaway River, east of Clarinda, three-span steel and concrete, to cost $10,000 to $12,000. I. H. Taggart, County Engineer, Clarinda.

Des Moines, Iowa.—City Council passed ordinance authorizing plans prepared for North Street bridge.

Eldora, Iowa.—County Commissioners propose constructing about 60 miles of gravel roads. Bids will be asked shortly for grading and graveling about 30 miles. Address E. W. Dunn, County Engineer.

Duluth, Minn.—Contract soon to be let by Manager of Water and Light Department for constructing bridge over Tischer's Creek, costing about $9,000.

Junction City, Kan.—Commissioners of Geary and Morris Counties plan constructing reinforced concrete and steel bridge on county line across Clark's Creek near Skiddy. Address Clerk, Geary County, Junction City.

Earle, Ark.—County is considering constructing a viaduct from Arkansas end of New Memphis Bridge to St. Francis Levee, and cost about $360,000. J. B. Thompson, Judge County Court.

Cathlamet, Wash.—County Commissioners will soon award contract for constructing 120-ft. steel bridge over Grays River. Blanch Heron, County Auditor.

Newport, Wash.—All bids received by Commissioners of Pend Oreille County for constructing superstructure of suspension bridge at Metaline have been rejected; cost about $10,000. New bids will be called for soon. H. A. Sewell, County Engr.

Seattle, Wash.—The approaches to East Lake Bridge over Lake Washington Canal will be built by day labor and consist of 2100 ft. timber approach, including three Howe truss spans, two 100 ft. and one 48 ft., one plate girder span 49 ft. F. A. Rapp, City Engineer.

Astoria, Ore.—Reported Spokane, Portland & Seattle R. R. Co. (C. O. Jenks, Gen. Mgr., Portland) is having surveys made for a double track drawbridge to be constructed across Youngs Bay next year. Said plans will be submitted to Government Engineers.

Riverbank, Cal.—Atchison, Topeka & Santa Fe Ry. (A. F. Robinson, Bridge Engr., Chicago, Ill.) and State Highway Commission at Sacramento agreed jointly to construct an overhead crossing; cost about $10,000.

Chino, Cal.—Citizens March 15 voted $75,000 for street improvements and $55,000 for sewer system. Olmstead & Gillelen, 1112 Hollingsworth Bldg., Los Angeles, Engineers.

Los Angeles, Cal.—Construction of a concrete bridge to cost approximately $15,000, across Los Angeles River to connect Lake Shore Avenue, Los Angeles, with Brand Boulevard, Glendale, contemplated by City Council.

Oakland, Cal.—Chamber of Commerce and the City Councils of Oakland, Berkeley and Alameda are considering the abolishing of the old swing bridges across Oakland inner harbor from this city to Alameda and adopting the bascule type of bridge. At present there are two swing bridges, one used exclusively by Southern Pacific suburban service and the other caring for all other traffic, including trolleys.

San Diego, Cal.—Election to be held in the county May 16 to issue $500,000 bonds for repairing and reconstructing bridges damaged in January flood; $600,000 for new concrete, steel and timber bridges; and $1,089,800 for concrete highways. George Butler, County Surveyor.

Santa Barbara, Cal.—Board of Supervisors engaged Edward T. Flaherty, Knickerbocker Bldg., Los Angeles, and McCurdy Bros., Pacific Electric Bldg., Los Angeles, to prepare plans for two reinforced concrete bridges across Gaviota Creek in Fourth Road District, costing about $11,000 each.

Idaho—State Highway Commission (E. M. Booth, Chief Engineer), Boise, will build three reinforced-concrete bridges on highway east of Hansen. Cost, $15,000.

Quebec, Que. — Legislative Assembly voted $240,000 for constructing iron bridges in province.

Toronto, Ont.—Agreement reached between the City and the Grand Trunk Ry. (H. R. Safford, Chief Engr., Montreal, Que.) providing for construction of a new bridge at Bathurst Street.

BIDS DESIRED.

Lowell, Mass.—Until April 18, City Clerk, for constructing a reinforced concrete bridge over Merrimack River at Pawtucket Falls and for removal of present structure and alterations to present bridge over Northern Canal, advertised in Engineering Record. Charles J. Morse, Commissioner Streets and Highways.

Battenville, N. Y.—Until April 14, by R. L. Skinner, Town Superintendent, for constructing a bridge across Battenkill, advertised in Engineering Record.

Camden, N. J.—Until April 19, for constructing concrete arch bridge and restoring the road on the White Horse Pike over Newton Lake. J. J. Albertson, County Engr.

Ashley, Pa.—Until April 5 for constructing a bridge at Clifton Street over Wilkes-Barre & Hazleton R. R. For information, address Frederick Butts, Borough Engineer, 452 Miners Bank, Wilkes-Barre.

Lancaster, Pa.—Until April 10 by D. Swope, Clerk, Lancaster, for constructing a concrete bridge, 55-ft. span, over Canestoga Creek at Martins Mill, East Earl Township.

Wilkes-Barre, Pa.—Until April 5 by Borough Council for constructing a bridge above grade over Wilkes-Barre & Hazelton Ry. on Ashley Boulevard. Frederick Butts, Borough Engineer, 450 Miners Bank.

Bradentown, Fla.—Until April 20, by Robert H. Roesch, County Clerk, for constructing concrete bridges on concrete and steel or concrete and wooden bridges in the Sarasota-Venice Road and Bridge District. Charles A. Browne. District Engr. of Sarasota.

Nashville, Tenn.—Until April 18, by Board Commissioners (J. W. Dashiell, Secy.), for construction of reinforced concrete slab overhead bridge across over the tracks of the Nashville, Chattanooga & St. Louis Ry., known as the Charlotte Avenue Overhead Bridge.

Hazard, Ky.—Reported desired until April 4, by B. P. Combes, Clk. County Fiscal Court, for constructing two steel bridges, one over North Fork of Kentucky River at mouth of Leatherwood Creek.

Indiana.—By County Commissioners for constructing bridges as follows:

Until April 4:

Plymouth, for constructing a four-panel steel truss, 56 ft. span; three-panel truss, 46 ft. span; deck girder, 32 ft. span, and other small bridges.

Until April 6:

Bloomfield, for constructing one 80 ft. span and one 100 ft. span. E. Kidd, Co. Aud.

April 7:

Sullivan constructing five concrete bridges. W. S. Bicknell, Co. Aud.

April 15:

Danville, two steel and nine concrete bridges.

New Philadelphia, Ohio.—Reported desired until April 17, by County Commissioners for furnishing culvert pipe for year 1916. R. H. Nussdorfer, Co. Aud.

Steubenville, Ohio.—Reported desired until April 11, by County Commissioners for constructing reinforced concrete bridge over Goose Run on East Springfield and Amsterdam State Aid Road.

Youngstown, Ohio.—Reported desired until April 17, by County Commissioners (Frank H. Vogan, Clk.), for constructing reinforced concrete bridge about 70 ft. long on McCartney Road; also two concrete slab floors on two bridges in Coitsville Township. Myron Wood, Co. Treas.

Rock Island, Ill.—Contract for constructing Colona bridge, previously noted to be let April 8, has been indefinitely postponed. James H. Reed, County Superintendent of Highways, Cambridge.

Johnson Creek, Wis.—Until April 29 for constructing reinforced concrete arch bridge, 45 ft. clear span, in village of Johnson Creek. E. C. Stiehm, Village Pres.

Sheboygan, Wis.—Reported desired until April 6, by County State Road & Bridge Committee, for constructing four concrete bridges over Mullett River, known as Thackray, Franey, Bowman and Wade bridges.

Dubuque, Iowa.—Reported desired until April 5, by County Board Supervisors, for constructing 90 bridges and culverts. Probable cost $56,000.

Laura, Iowa.—Reported desired until April 4, by T. M. McCurdy, City Clk., for constructing reinforced concrete culvert 150 ft. long, 10 ft. wide.

Orange City, Iowa.—Until April 4 by D. H. Wissink, County Auditor, for constructing bridge No. 358 in Floyd and Holland Township, 80 x 18 ft. pony truss; No. 359, Rock Township, 22 ft. slab bridge; No. 461 Sherman Township, 28 ft. through girder; No. 462 West Branch and Welcome Township, 20 ft. skew, and No. 463, Garfield Township, 22 ft. skew slab bridge.

Concordia, Kan.—Reported desired until April 6, by Geo. C. Guilbert, County Clk., for bridge work. Probable cost, $15,000.

Kendall, Kan.—Reported desired until April 4, by Max Hall, Co. Clk., for constructing one 60-ft. and 30 30-ft. steel or concrete bridges.

Olathe, Kan.—Reported desired until April 4, by W. J. Moore, Co. Clk., for five steel and reinforced concrete bridges.

Lakota, N. D.—Reported desired until April 5, for constructing culverts for year 1916. Oscar Moen, Co. Aud.

Lusk, Wyo.—Until April 5, by Board County Commissioners (A. L. Miller Clk.), for furnishing material and constructing a steel bridge across Sage Creek, on the Lusk-Hat Creek Road.

Montesano, Wash.—Reported desired until April 17, by W. D. Campbell, Co. Aud., for constructing three bridges over Satsop River on the Olympic Highway, and one over Wishkah River and third over Wyanooche River. Geo. D. Robertson, Co. Engr.

Odessa, Wash.—Reported desired until May 1, by W. M. Nevins, City Clk., for constructing three different types of bridges. Bids desired for all-steel bridge with wood floor, one two-span steel bridge with concrete floor and a two-span concrete arch.

California.—Until April 17, by California Highway Commission, Forum Bldg., Sacramento, for constructing a bridge across Eel River south of Scotia, Humboldt County, comprising two steel truss spans, each about 302 ft. long, with two reinforced concrete approaches, total length 893 ft.

Santa Barbara, Cal.—Until April 3 by Board of Supervisors for constructing concrete bridge across Zaca Creek; cost $11,000.

★**Seattle, Wash.**—Following are unit figures ot the bids opened March 3 by Board Public Works for constructing the bascule bridge at Eastlake Avenue over Washington Canal (F. A. Rapp, Structural Engineer, City Engineer's Office). Substructure—(a) Beer's Building Co., 1627 Smith Building, $124,331 (awarded contract); (b) Washington Paving Co., Smith Building, $155,998; (c) Jahn Construction Co., Pioneer Building, $160,804. Superstructure—(a) $178,649 (awarded contract); (b) $181,525; (c) Booker, Kiehl & Whipple, Central Building, $175,649.

Substructure:	*(a)	(b)	(c)
9012 cu. yd. excavation	$3.25	$4.00	$5.00
10,049 cu. yd. 1:3:5 concrete in foundations placed in unwatered pits	6.60	8.50	7.50
1560 cu. yd. 1:2:4 concrete above water	8.00	8.00	10.00
269,000 lb. reinforcing steel	0.0325	0.041	0.044
270,000 lb. placing and painting structural steel, grillages, anchor bolts, including grouting	0.006	0.006	0.015
2 fir bumping logs, each	30.00	20.00	37.60
6600 lin. ft. peeled piles in protection	0.15	0.25	0.21
14 M ft. timber in protection works	32.00	30.00	27.60
560 lin. ft. chains on dolphins	0.65	0.40	0.35
1390 sq. ft. surface treatment, concrete	0.03	0.04	0.11
4 test piles, each	5.00	20.00	25.00
4 c.-i. manhole covers, etc., each	11.00	16.00	12.00
108 ladder rungs, each	0.30	0.55	0.12
8 steel ladders, lump sum	50.00	160.00	170.00
6 lin. ft. vitrified pipe for openings in masonry	1.00	1.00	1.15
8 eye bolts in shafts of anchor piers, each	2.00	5.00	2:00
4 checkered plates in sidewalk, each	14.00	25.00	11.50
270 sq. ft. expanded metal under bearings	0.10	0.10	0.17
180 sq. ft. woven wire gates and window guards	0.25	0.30	0.57
340 lin. ft. galvanized iron pipe railing	1.50	1.75	1.43
Wood partitions, lump sum	100.00	100.00	172.50
Doors, windows, hardware for operator's houses, lump sum	530.00	540.00	345.00
80 sq. yd. reinforced concrete partitions	2.00	2.50	1.60
152 sq. yd. walls and roofs of machinery houses, cement plaster on wire mesh	3.00	3.25	2.30
300 cu. yd. extra excavation below—36=base of pier	3.25	8.00	8.05
300 cu. yd. extra 1:3:5 concrete	6.50	11.00	7.50

Superstructure:	*(a)	(b)	(c)
243,000 lb. furnish and erect machinery	$0.127	$0.13	$0.1342
1,830,000 lb. furnish and erect structural steel	0.057	0.0577	0.0574
270,000 lb. furnish structural steel to be erected by substructure contractor	0.05	0.0485	0.0496
500 cu. yd. furnish, place and adjust gravel concrete counterweight	6.50	7.00	7.15
100 cu. yd. furnish, place and adjust cinder concrete counterweight	6.50	7.00	7.15
1 cu. yd. furnish and weigh gravel or cinder concrete test blocks	20.00	10.00	11.00
900 sq. yd. timber roadway floor on moving leaf	5.00	5.00	5.25
410 sq. yd. concrete roadway floor on fixed spans	3.75	3.50	3.50
450 sq. yd. timber sidewalk on moving leaf	1.10	1.25	1.00
12,500 lb. reinforcing bars in counterweights	0.0325	0.04	0.041
Electrical equipment, lump sum	17,400.00	17,900.00	18,300.00
Fixtures in two toilet rooms, lump sum	200.00	400.00	220.00
Meneely fog bell in place, lump sum	107.00	130.00	165.00
2 copper ball vessel signals, each	62.00	46.00	88.00
4 double arm roadway gates, each	310.00	360.00	385.00
14 oak buffer blocks, each	2.00	5.00	5.00

PRICES AND LETTINGS.

★Indicates award of contract.

★**Charleston, W. Va.**—Contract awarded by County Commissioners for constructing 150-ft., three span, reinforced concrete bridge over Davis Creek on Charleston-St. Albans Road to W. E. Beardslee, Clarksburg, at $8,499.

★**Morganfield, Ky.**—Contract awarded by Board Drainage Commissioners at Morganfield for constructing seven steel highway bridges in connection with Dennis O'Nan Ditch to Vincennes Bridge Company, Vincennes, Ind., at $8,500.

★**Dayton, Ohio.** — Reported contract awarded by City Commissioners for constructing Fifth Street, Keowee Street and Webster Street bridges to Pacific Bridge Co., Portland, Ore., at $239,027.

★**Delphi, Ind.**—Contract awarded East St. Louis Bridge Company, East St. Louis, Ill., for constructing bridges over Tippecanoe River. Bids opened by Comrs. Carroll and White Counties on March 24.

Chicago, Ill.—Lowest bid opened March 23 by Trustees Sanitary Dist., Chicago, for constructing Burr Oak Avenue Bridge submitted by Standish & Allan, Chicago, at $9,794.

★**Decatur, Ill.**—Contract awarded by County Board of Supervisors for constructing bridge across Sangamon River and erection of same.

★**Illinois.**—Contract for constructing bridge in Douglas Township, Iroquois County, awarded Continental Bridge Company, Pectone, Ill., at $6,300.

★**Sycamore, Ill.**—Contract for constructing Watson Bridge, 150-ft. span, reinforced concrete, awarded Northern Steel & Concrete Company, Freeport, at $5,999. W. C. Miller, County Superintendent Highways.

★**Green Bay, Wis.**—Contract for constructing Bascule bridge over Duck Creek (bids opened March 22) awarded Wausau Iron Works, Wausau, at $13,300. W. M. Conway, Division Engineer.

★**Centerville, Iowa.**—Contract for constructing bridges and culverts (bids opened March 24) awarded by County Commoissioners to B. S. Stanley, Centerville, at $19,771.

★**Buffalo, Minn.**—Contracts for culverts for year 1916 (bida opened March 21) awarded by county to Whiting Corrugation Company.

★**Omaha, Neb.**—Contract awarded by Union Pacific Ry. to American Bridge Company, St. Louis, Mo., for double track bridge to replace present structure over Missouri River, includes 5200 tons of steel to Decatur Bridge Company, of Decatur, at $16,000.

★**Seattle, Wash.**—Contract awarded by Board of Public Works for removing steel bridge across Duwamish River at First Avenue S. to Weymouth Construction Co., Pier No. 1, at $12,485.

★**Florence, Ariz.**—Contract awarded El Paso Bridge & Iron Company, El Paso, Tex., for constructing steel bridge across San Pedro River at Mercer crossing, at $8,985.

Idaho.—Lowest bid opened March 18 by Idaho State Highway Commission, Boise, for constructing steel bridge over Malad River on Idaho-Pacific State Highway submitted by H. W. Perham, of St. Anthony, at $23,900.

PAVING AND ROADS

PROPOSED WORK.

Athol, Mass.—At town meeting March 20, $10,000 was appropriated for paving portion of Exchange Street.

Beverly, Mass.—City Council sold $50,000 street improvement bonds. Address City Clerk.

Boston, Mass.—Public Works Department will construct streets in Boston, South Boston, East Boston, Brighton, West Roxbury, Dorchester and Roxbury under the $80,000 appropriation of last year.

Lowell, Mass.—Street extension bonds for $71,000 sold by city. Address City Clerk.

Bristol, R. I.—Street improvements costing $45,000 are to be made. Col. L. H. Callan, Commissioner.

Providence, R. I.—State Board of Public Roads plans constructing 23 miles bituminous road this season.

Rockville, Conn.—Public Works Committee plans macadamizing Prospect Street from Ellington Avenue to Union Street, and construct curbs, sidewalks and gutters on Grove Street.

New York.—Assembly passed bill appropriating $1,956,275 as State's share for repairing and improving town highways. Edwin Duffey, Commissioner Highways, Albany.

Camden, N. J.—Alfred Sayers, Street Comr., preparing plans for resurfacing Haddon Avenue from Federal to Lime Street and Federal Street from Broadway to Haddon Avenue with sheet asphalt.

New Jersey.—The Assembly passed bill providing bond issue of $7,000,000 for constructing state highways.

Newton, N. J.—Board of Chosen Freeholders proposes selling $28,000 bonds to cover county's share of cost of Newton-Sparta Rd.

Princeton, N. J. — Borough Council passed ordinances for paving with macadam and curb North Tulane Street.

Trenton, N . J.—Edwin A. Stevens, State Road Comr., will allow Mercer County $68,000 for improvements to old roads.

Ambler, Pa.—Town Council authorized $30,000 bond issue for street improvements.

Connellsville, Pa.—Plans prepared by S. M. Fost, City Engr., for paving Mountain Alley between Main and Apple Streets.

Dunbar, Pa.—See "Sewerage and Sewage Disposal."

Lewisburg, Pa.—Citizens March 18 voted in favor of $20,000 bond issue for paving and storm sewers. Walter Frick, Engineer, Lewisburg. H. M. Showalter, Borough Clerk.

Philadelphia, Pa.—Finance Committee plans boulevarding Vare Avenue along Schuylkill River to connect the Parkway with South Philadelphia. About $7,600 has been appropriated for surveys. Nothing further will be done until 1917. Address Director Public Works.

Reading, Pa.—City Council plans paving 29 streets under municipal improvement loan of $150,000.

Wilmington, Del.—Street Board will prepare estimates on paving Market Street and submit same to City Council.

Baltimore, Md.—Mayor signed ordinances authorizing widening Fort Avenue and closing number of streets for widening and parking of St. Paul Street from Lexington to Center Streets.

Pratt Street, from Light to Jones Falls, is to be regraded and resurfaced with old and new Belgian blocks. R. Mavin Cooksey, Highway Engineer.

Charleston, W. Va.—Contracts soon to be let by County Commissioners for grading 200 miles of roads. About $550,000 is available for permanent roads. H. M. Cline of Pineville, Member of County Court.

Elkins, W. Va.—Citizens of Leadville District, which includes Elkins, voted $220,000 bonds for constructing 22 miles permanent road. Address Clerk, Leadville District, Elkins.

West Virginia.—Elections to be held in various counties to issue bonds for constructing improved and permanent highways this spring. For dates of elections and counties see March 25 issue under Virginia.

Shelby, N. C.—It is proposed to pave with asphalt on Warren, Washington, Monroe and other streets in all about 35,000 sq. yd., including 6,000 lin. ft. concrete curbing, and cost $40,000. J. B. McCrary Company, Engineers, Atlanta, Ga. J. F. Gardner, Mayor.

Barnesville, Ga.—Paving bonds for $20,000 will be sold hy city. R. M. Turner, Mayor, April 10.

Bradentown, Fla. — Sarasota - Venice Special Road and Bridge bonds for $250,000 will be sold April 17 by Board County Commissioners (Robert H. Roesch, Clk.).

Bushnell, Fla.—Contract will be let about May for 30 miles of marl, rock and clay roads, costing $60,000. W. M. Francisco, Engineer, Zephyrhills. Address W. R. Yarhrough, Coleman, Fla.

Palatka, Fla.—Special Road and Bridge District bonds for $233,000 and $25,000 Bostwick Drainage Dist. bonds will be sold by Henry Hutchison, County Clerk Palatka.

Sarasota, Fla.—See "Bids Desired."

Gadsden, Ala.—Towns of Gadsden, Alabama City and Attalia are considering constructing a concrete roadway 40 ft. wide to connect these three towns.

Charleston, Miss.—Board of Supervisors proposes selling $200,000 bonds to construct 17 miles of highway through Tallahatchie County and to build east and west spurs from main roads.

Lexington, Miss.—Yazoo-Delta Highway Association (T. J. James, Pres., of Sharkey) proposes constructing highway from Memphis, Tenn., to Lexington, Miss., connecting there with "Air Line" Jefferson Davis highway.

Louisville, Miss.—Paving bonds for $30,000 for Township 14, Range 12, and Township 15, Range 12, of Supervisors District No. 1, will be sold April 4 by B. M. McCully, Clerk Board of Supervisors.

Boyce, La.—City Council will construct cement sidewalks in entire business district.

Crowley, La. — City Council granted paving of Third Street with gravel base, tarvia binding.

Bristol, Tenn.—Bonds will be sold in April for the concrete paving in District No. 2 to cost $24,000, to include Taylor, Georgia, Maryland and Spruce Streets. P. C. Rodgers, Engineer, Bristol; S. G. Keller, Commissioner Public Improvement.

Chattanooga, Tenn.—Special Committee reported to County Court in recommending building of Suck Creek Road into Marion County around base of Signal Mountain as a part of the Dixie Highway. The cost to Marion County would be about $73,870 and to Hamilton County $78,805. Address County Engineer.

Knoxville, Tenn.—City will spend this year $20,000 in improving streets. W. A. Brk, City Engineer.

Hopkinsville, Ky.—Citizens voted $400,000 bonds for road improvement. Address County Clerk.

Lexington, Ky.—Turnpike improvement bonds amounting to $300,000 have been sold by County Good Roads Commission. Roger H. Smith, Chairman Fayette County Commissioners.

Owensboro, Ky.—Citizens voted $600,000 bonds for constructing roads in Daviess County.

Shelbyville, Ky.—Fiscal Court of Shelby County appropriated $20,200 for maintenance of public highways.

Alliance, Ohio.—Paving bonds for $10,850 will be sold April 17 by Charles O. Silver, City Aud.

Ashtabula, Ohio.—County Commissioners, Jefferson, will build brick road, 16 ft. wide and about 6 miles long between Ashtabula and Geneva. Estimated cost $153,109.

Bryan, Ohio.—Paving bonds for $140,000 will be sold April 10 by County Commissioners. G. C. Beucler, Co. Aud.

Chillicothe, Ohio.—Election to be held to vote $150,000 bonds for improving county's main roadway and highways.

Cincinnati, Ohio. — Improvements contemplated to the following streets, cost given being approximate: Fairbanks Avenue, $202,000; Ludlow Avenue, $190,000; Quebec Road, $230,000; Eastern Avenue, $548,000; Madison Road, $285,000; Hamilton Avenue, $255,000; Grandin Road, macadam, $50,000; Central Avenue, granite and wood block, $178,000; Harrison Avenue, $60,900; Freeman Avenue, $156,000. Pavement is to be granite unless otherwise stated. An election is to be held April 25 to vote $1,638,000 as the city's share toward these improvements.

Cleveland, Ohio.—County Commissioners sold $94,136 bonds for improving 3¾ miles Ridge Road from Pleasant Valley Road to Royalton Road.

City Council decided to postpone until August the election to vote $3,500,000 bonds for extending and widening seventy-seven streets.

Mayfield Road will be widened and repaved from South Euclid to Warensville Center Road, and Lake Shore Boulevard will be widened 4 ft. from Euclid Beach to county line this summer. W. A. Stinchcomb, County Engineer.

City Council voted to pave sections of following streets: Vulcan Court, Edwin Court, McBride Avenue, West 110th Street, Alice Avenue, East 152nd, East 156th, Merrick Court and East Seventieth Street; also for paving and sewers on Shaker Boulevard.

Alex Bernstein, Dir. Public Service, reports to City Council that estimated cost of completing boulevard between Garfield and Woodland Hills Parks at $125,000, with cost for paving $175,000 additional.

About $250,000 street improvement bonds to be sold by County Comrs., Cleveland, for repaving part of Euclid Avenue, East Cleveland.

Street improvement bonds amounting to $1,916,500 will be sold by Clarence J. Neal, Director of Finance, on April 17.

County Commissioners sold $41,000 bonds for Son Center Road improvement.

Columbus, Ohio.—About $208,000 road improvement bonds sold by County Commissioners.

Dayton, Ohio.—Paving bonds for $200,000 will be sold April 13 by Walter H. Aszling, County Clk.

County Commissioners considering the following brick road construction: Paving of Cincinnati Pike from West Carrollton to Miamisburg, estimated cost $38,000; 1.29 miles of the New Troy Pike, north from Stop 10 on Dayton , Covington and Piqua traction line and 1.01 miles on same pike north from Vandalia, cost $33,000 and $25,100 respectively. Contracts will be let during April. County has applied to State Highway Commission for approval of the following roads: Dayton-Eaton Pike, 2 miles west from present terminus of brick, at $40,000; south from corporation line of Miamisburg, 1 mile, at $20,000; Salem Pike from Philadelphia Road to west line of Harrison Township, 1.4 miles, $25,200; Catalpa Road to Wolf Siding, $30,000; from Vandalia, 1 mile, cost $20,000.

Delaware, Ohio—Paving bonds for $50,000 will be sold April 20 by County Commissioners (Guy C. Shoemaker, Chmn.).

Fremont, Ohio.—County Commissioners adopted resolutions for improving 1.01 miles Fremont-Castalia Road with macadam, 1.09 miles Sandusky-Clyde Road macadam, and 1.1 miles Fremont-Port Clinton Road concrete.

Kenton, Ohio.—County Commissioners sold $60,000 improvement road bonds. Address County Clerk.

Lisbon, Ohio.—Herman Armstrong, County Road Superintendent, preparing plans for improving about 34 miles county roads, including part Lincoln Highway and inter-county roads.

Marion, Ohio.—County Commissioners voted in favor of issuing $30,000 road repair bonds.

Portsmouth, Ohio.—County Commissioners passed resolutions asking State Highway Commissioners to improve three miles paving east of Wellsburg on Ironton Pike.

Rock Creek, Ohio.—Paving bonds for $19,500 will be sold April 3 by J. E. Gladding, Village Clk.

Tiffin, Ohio.—Seneca County will spend $38,000 this year for improving and maintaining roads. Address County Commissioners.

Urbana, Ohio.—Road improvements bonds for $10,000 will be sold April 20. E. F. Sweetman, City Engr.

About 35,000 sq. yd. of brick and asphalt pavement is to be laid on concrete foundation, and includes stone and combined curb and gutter on Miami and Court Streets, at a cost of $75,000. Contract will be let about April 28 and bonds sold about April 26. Emmett F. Sweetman, City Engineer; H. M. Grow, City Clerk.

Warren, Ohio.—County Commissioners plan improving about three miles of Burton-Middleville Road; estimated cost $38,000.

Youngstown, Ohio.—Paving bonds for $40,600 will be sold April 10 by Frank H. Vogan, Clk. County Commissioners.

Zanesville, Ohio.—County Engineer will prepare plans for paving Zanesville-Dresden Road with macadam and tarvia binder, and Zanesville-Cincinnati Road with limestone macadam and tarvia binder.

Election to be held April 25 to vote $44,000 bonds for paving on Pine and Maple Streets with brick on concrete base. C. R. Spencer, Engineer, Zanesville; W. W. Roach, Director Public Service.

Bluffton, Ind.—It is proposed to pave all the streets in the business section, probably with brick. Address Mayor.

It is proposed to resurface 8 blocks of the city, probably with brick, build 1½ miles of macadam road in city and county, also 1 mile of gravel. T. C. Guldin, County Engineer.

Decatur, Ind.—City will pave 1¼ miles, 5 blocks to be Tarvia and the rest brick. Address City Engineer.

Evansville, Ind.—County Commissioners sold $12,865 bonds for constructing gravel roads in Perry Township. Newton W. Thrall, County Treas.

Ft. Wayne, Ind.—Highway improvement bonds for $10,000 will be sold Apr. 5 by William F. Ranke, County Treas.

Goshen, Ind.—Paving bonds for $43,500 will be sold April 5 by W. H. Winship, Co. Treas.

Indianapolis, Ind.—Highway improvement bonds for $44,000 will be sold April 3 by Ed. G. Sourbier, County Treasurer.

La Porte, Ind.—County will build 3½ miles monolithic brick and 10 miles water-bound macadam pavement. Contract to be let about June. H. M. Miles, County Engineer.

Logansport, Ind.—Paving of West Broadway, Linden and Wheatland Avenues and Race Street with asphalt contemplated by city. Total cost $103,000.

Madison, Ind.—Council has authorized improving of 6 blocks on Main Street at a cost of $40,000. Address City Clerk.

New Albny, Ind.—S. T. Mann, City Engineer, prepared estimates on constructing 40-ft. macadam roadway on East Market St. between East Fifth and East 13th Sts.

North Vernon, Ind.—Plans being prepared for 7,644 sq. yds. paving in central part of city, also 3,030 cu. yds. excav. and 1,973 lin. ft. curb. Charles W. Miles, City Engineer.

Plymouth, Ind.—Contract will be let about May 15 for constructing following gravel roads: Snyder Road No. 1, 2.93 miles, cost $13,105; No. 2, 3.77 miles, $16,995; No. 3, 3.66 miles, $17,370; No. 4, 4.57 miles, $41,060; Boggs Road, 4.23 miles, $21,204; Stephens Road, 3.32 miles, $18,139. For further information address Arthur W. Thomson, County Engineer, Plymouth.

South Bend, Ind.—City will build 3 miles concrete road and 3 miles brick and 25 miles gravel road. Address City Engineer.

Versailles, Ind.—Highway improvements bonds for $27,800 will be sold April 3 by John N. Hess, Co. Treasurer.

Vincennes, Ind.—About $250,000 paving contemplated here this year on Church, Vigo, Perry and other streets, and contracts will be let between April and September. H. T. Watts, City Engineer.

Detroit, Mich.—Reported construction of boulevard connecting Highland Park and Oakwood, a distance of 12 miles, to be known as Ford Highway, is contemplated. Robert Oakman, 56 Home Bank Building, reported interested.

Kalamazoo, Mich.—About 15,000 sq. yd. brick and 25,000 sq. yd. asphalt concrete pavement on concrete foundation and cement combined curb and gutter are to be laid on various streets, including Portage, Frank and Patterson Streets. A. Lenderink, City Engineer.

Michigan.—About 2650 miles good-road building reported contemplated during 1916 by State Highway Department, Lansing.

Abingdon, Ill.—About $250,000 will be spent on brick roads this season. A. L. Ritchey, City Engineer.

Byron, Ill.—Town contemplates appropriating $40,000 for permanent road building this spring.

Chicago, Ill.—Twenty miles of hard roads have been authorized for Cook County outside of Chicago and contract will soon be let. An additional 40 miles is under consideration. Several through-route roads started last year are to be completed, including roads south of Blue Island and south of Calumet, connecting Chicago with Lincoln Highway at Chicago Heights; Twelfth Street to the west; Arcade Avenue southwest to Spring Forest and Milwaukee Avenue to northwest. Longest road proposed is 24 miles, Dundee Higgins Road, connecting Chicago and Elgin, and another stretch on Lincoln Highway west of Chicago Heights. George A. Quinlan, County Highway Engineer. Construction will not start before July.

East Peoria (Peoria P. O.), Ill.—Village Trustees passed ordinance for constructing 1½ miles brick road on concrete base between this village and Peoria; cost $40,000.

Jacksonville, Ill.—About $20,000 will be spent by the county in grading and oiling roads. E. M. Henderson, County Superintendent of Highways.

Mattoon, Ill.—Citizens voted in favor of issuing $120,000 bonds for good roads in Mattoon Township. About $70,000 street paving is also proposed. Harry Shinn, Engineer, Mattoon.

Mt. Morris, Ill.—Citizens voted $25,000 road improvement bonds. Address Town Clerk.

Oregon, Ill.—Citizens of Lynnville Township, Ogle County, voted $32,500 bonds to construct hard roads and oil highways.

Paris, Ill.—It is proposed to pave 5 miles of country roads and 4 city streets with brick and concrete on concrete foundation with combination curb and gutter. K. J. Barr, Superintendent of Highways.

Petersburg, Ill.—City officials plan 4800 ft. of street paving, to cost approximately $14,000.

Quincy, Ill.—About $20,000 will be spent this season on a 15-ft. water-bound macadam pavement 3 miles long on State Street. L. L. Boyer, Supt. Highway.

Rock Island, Ill.—Board of Local Improvements recommends brick paving on Thirteenth Avenue, Twenty-fifth to Thirtieth Streets, estimated cost $18,551; Seventeenth Avenue, Twenty-fifth to Thirtieth Streets, and approximately 35-block district in east end of city; paving of Thirteenth Avenue from Twenty-fifth to Twenty-eighth Streets with brick, at $17,000.

Sterling, Ill.—Citizens of Sterling Township voted $60,000 bond issue for 3 miles of brick roadway, 18 ft. wide. This is part of the Lincoln Highway.

Shenandoah, Iowa.—Board Public Works plans paving about 40 blocks. Address City Clerk.

Faribault, Minn.—About $115,000 will be spent in the county this year on good roads. Address County Clerk.

Marshalltown, Iowa.—Council passed resolutions to pave 30 blocks and 9,600 ft. Lincoln Highway, about 63,000 sq. yd. paving and 25,000 ft. curb.

Minnesota.—About $7,453,451 will be spent throughout the State on good roads. It is proposed to grade 2000 miles and gravel 1000 miles. George W. Cooley, State Engineer, St. Paul, may be able to give further information.

St. Paul, Minn.—Council is reported to have approved report on paving Avon Street, including sewer and water connections, curbing, etc., at an estimated cost of $17,222; paving Holly Avenue at a cost of $26,446, and repaving present portions and paving new portion of Roberts Avenue at a cost of $47,673.

Clay Center, Kan.—It is proposed to pave about 40 blocks, including curbing and gutter; material not decided upon. C. B. Walsh, Engineer, Clay Center; E. R. DeBray, City Clerk.

Mound City, Kan.—Construction of about 60 to 70 miles of macadam road, costing about $4,000 per mile, is contemplated in this county. James M. Mundell, County Surveyor.

Norfolk, Neb.—Citizens voted $50,000 bonds for paving street intersections. Address City Clerk.

Billings, Mont.—Citizens of county voted $175,000 bonds for constructing roads. F. E. Williams, County Clk.; Arthur Boyer, County Engr.

Aurora, Mo.—Citizens of Aurora special road district voted $60,000 bonds for permanent roads.

Billings, Mo.—Special Road District bonds amounting to $40,000 sold. Address W. P. Sullivan, Butler.

Bolivar, Mo.—Special road district bonds for $25,000 have been sold. G. M. Upton, Commissioner, Bolivar.

Carthage, Mo.—City Engineer will prepare plans and specifications for improving about a mile of South Main Street with asphalt macadam.

Marionville, Mo.—Buck Prairie Special Road District voted $40,000 bonds for road improvement. Address J. Coleman, Marionville.

Millar, Mo.—Citizens voted $30,000 good road bonds, which have been sold. Address George Hebbs, Comr., Millar.

Monett, Mo.—Election to be held to vote $60,000 bonds for good roads in Monett Special Road District. Address H. W. Fly, Monett.

Seymour, Mo.—Road bonds for $30,000 for Special Road District will be sold April 20, by Charles W. Sheldon, Clerk.

Verona, Mo.—Reported issuing of $30,000 bonds for good roads is under consideration. Address Robert Mitchell, Vernon.

Pine Bluff, Ark.—Surveys being made for two highways in northern part of Jefferson County, one to be constructed from Arkansas River free bridge to Tucker and Sherrill, and other from said bridge to Altheimer and Humphrey. H. H. Humphreys, County Highway Engineer.

Alameda, Cal.—Council reported considering improving Central Avenue at a cost of $100,000. Address City Clerk.

Amarillo, Tex.—Contract soon to be let by Commissioners Court for 4 miles of sewers and 2 miles of street paving.

Austin, Tex.—Sidewalk paving bonds amounting to $25,000 sold.

Bastrop, Tex.—Election to be held April 18 to vote $30,000 bonds for road improvement in Cedar Creek Precinct. Address Clerk, Commissioners Court.

Beaumont, Tex.—George W. White, County Surveyor, has been appointed by County Commissioners as road engineer to have charge of building the new highways with the $202,164 road bonds.

Cooper, Tex.—Commissioners Court has authorized election April 29, to vote $200,000 road building bonds in Precinct No. 1.

Corpus Christi, Tex.—City intends constructing a macadam road from the city to Flour Bluff, a distance of 10 miles; costing $20,000. Address Secretary Commercial Club.

Cuero, Tex.—Attorney General has approved DeWitt County No. 2 $50,000 road system between Cuero and Yoakum with branches at Edgar and Concrete.

Edinburg, Tex.—Election to be held April 20 in the county to vote $250,000 bonds for constructing the Higalgo's portion of proposed Diamond Loop Highway.

Gilmer, Tex.—Commissioners Court authorized election April 18 to vote $300,000 bonds for road, District No. 2.

Greenville, Tex.—Commissioners Court has been asked to call an election in Hunt County to vote $1,000,000 bonds for constructing 180 miles good roads.

Houston, Tex.—County Commissioners propose following road improvements: Houston-Humble Road, paved with gravel and widened 16 to 24 ft., cost $52,000; Kuykemdall Road, shelled, 23,000 ft., cost $26,000; Moonshine Hill-Atascocita Road, paved with gravel, 20,000 ft., cost $22,200; East Montgomery Road, shelled, distance of 14,000 ft., cost $14,500.

Pittsburg, Tex.—Citizens of Precinct 1 of Camp County voted $100,000 bonds for hard surfaced roads.

Quitman, Tex.—Commissioners Court has ordered a special election for the purpose of voting $240,000 road bonds. It is planned to construct road between Winnsboro and Quitman, a distance of 16 miles, and also improve other roads throughout District No. 2. Address County Clerk.

Somerville, Tex.—Commissioners Court has designated April 28 to vote on $100,000 road bond issue for District No. 1, to cover approximately 27 miles. Address County Clerk.

Blackwell, Okla.—Plans, specifications and estimates for paving with vitr. brick blocks 21 blocks in business and residential districts have been adopted by City Council. Benham Engineering Co., Oklahoma, Engineers; approximate cost, $110,000.

Centralia, Wash.—About 35,000 sq. yds. of cement sidewalks are to be laid at a cost of $35,000. J. C. Berry, City Engineer.

Kennewick, Wash.—City Council will pave 20 blocks of city streets. M. E. Soth, City Engr.

Mt. Vernon, Wash.—Contract will be let about May 1 by L. J. Caufield, City Engineer, for paving, including hard surfacing Second and Third Streets, with concrete or asphalt with concrete base or bituminous paving, including 4500 lin. ft. concrete curbing; cost, $20,000.

North Yakima, Wash.—County Commissioners plan constructing 20 miles asphalt macadam compressed gravel road this spring and summer. O. E. Brashears, County Engineer. Estimated cost, $75,000.

Seattle, Wash.—Council authorized paving with brick block on Ranier Avenue., Dearborn St., at a cost of $76,237. Ninth Avenue West and West Halladay Street with asphalt at $9,068. Bailey Street, Twelfth Avenue, S., Vale Street, Thirteenth Avenue, S., and Stanley Avenue with asphalt; cost, $36,100. L. B. Young, Chmn. Board of Public Works.

Plans filed with Board Public Works for following paving: concrete walks on Division Street, cost $25,000; paving Harrison Street, cost $25,000 (approved); grading, etc., Forty-seventh Avenue, S., at $24,000; paving Olive Street, $20,000. A. H. Dimock, City Engineer, estimates cost of paving of West McGraw Street at $106,747.

Sedro Woolley, Wash.—A. O. Mosier will prepare plans for paving this year about 33 blocks, costing about $100,000. O. P. Reno, City Clerk.

Lewiston, Ore.—Highway improvement bonds for $150,000 will be sold by Frederick N. Fitch, City Secretary.

San Diego, Cal.—Election to be called about May 1 by Board of Supervisors to vote $1,400,000 bonds for concrete roads, $600,000 for concrete steel or reinforced concrete pile bridges, and $600,000 for rebuilding and repairing roads damaged by January floods. George Butler, County Surveyor.

San Francisco, Cal.—Board of Supervisors plans paving with brick and asphalt Twenty-fourth, Bacon, Missouri, Goettingen Streets and Faxon, Plymouth and Highland Avenues.

It is proposed to construct a boulevard paved with asphalt 80 ft. wide, about 10,750 ft. long, from Railroad Avenue to Hunters Point on concrete foundation, including 31,500 ft. concrete curbs and gutters. M. M. O'Shaughnessy, City Engineer.

Venice, Cal.—Board of Supervisors, Los Angeles, will construct a concrete highway between Venice and Redondo Beach, about 5 miles. F. J. Joyner, Road Commissioner, Los Angeles.

Flagstaff, Ariz.—Board of Supervisors will hold an election May 2 to vote $250,000 bonds for highway construction.

Phoenix, Ariz.—City Commission adopts plan for paving 3 blocks on North Central Avenue, 4 blocks on Second Avenue and 7 blocks on Roosevelt Street.

Ogden, Utah.—County Commissioners and State Highways Commission plan spending about $50,000 for highway improvements, using convict labor. E. R. Morgan, State Road Engineer, Salt Lake City.

Salt Lake City, Utah.—Contract will soon be awarded for resurfacing with asphalt First Street from West Temple to State Street and State Street to South Fourth Street. Address City Recorder.

City Commission and Capitol Commission plan paving North State Street to capitol and Second North Street from Main Street to City Creek Canyon; estimated cost, $33,700. Address Clerk of Commission.

Bancroft, Idaho.—Plans being prepared for constructing five miles of concrete sidewalks this summer. Address City Clerk.

Boise, Idaho.—Election soon to be held to vote $25,000 bonds for paving 16th, Main, Hays and Harrison Boulevards. Address City Clerk.

Idaho Falls, Idaho.—Streets and Alley Committee of City Council recommends constructing 10 miles sidewalk this spring.

Moncton, N. B.—Contract will be let in April for 13,111 sq. yd. bitulithic, creosoted block or asphalt pavement on Main Street on concrete foundation. John Edington, Engineer, Moncton; J. S. Magu, City Clerk.

Manila, P. I.—The following improvements contemplated by Bureau of Public Works during 1916, the cost is approximately (most of the work is let to local contractors): Highway bridges and culverts, $350,000; road work, $2,000,000; building work, $1,000,000; artesian well and other water supply, $200,000; dredging, $150,000; other harbor work, $100,000.

BIDS DESIRED.

Maine.—Reported desired until April 11, by Highway Commission Augusta, for constructing sections of State highway in Brunswick, Green, Lincolnville, Noblesville, Damariscotta, Northport, Cherryfield, and Edmunds.

Hartford, Conn.—Until April 17, by Board Contract and Supply (Joseph Buths, Secy.) for about 32,200 sq. yd. sheet asphalt wearing surface, etc., advertised in Engineering Record.

Albany, N. Y.—Until April 20, by State Commission of Highways, Albany, for improving highways in Onondaga, Saratoga and Ulster Counties, advertised in Engineering Record. Edwin Duffey, Highway Commissioner.

Long Island City, L. I., N. Y.—Until April 10, by Maurice E. Connolly, Borough Pres., for constructing sidewalks on Queens Boulevard, Orchard and other streets, in all about 33,900 sq. ft. cement sidewalks, 1,490 sq. yd. granite blocks, together with curbing, etc. Total security, $5,950.

New York, N. Y.—See "Waterworks."

New York, N. Y.—Until April 6, by Douglas Matthewson, Pres. Boro. Bronx, for constructing sidewalk, curbs, guard rail, etc., on portions of Kingsbridge Avenue, West 238th Street, Newbold Avenue and other streets, in all about 20,080 sq. yd.; two course concrete sidewalks, 5200 lin. ft. curb, etc. Total security, $11,150.

By William Oppenheim, 1057 Hoe Avenue, New York City, to sublet finishing of waterbound macadam road in Sullivan County.

Oswego, N. Y.—Until April 10, by Department Works, for 14,275 sq. yd. vitr. brick pavement, 1063 sq. yd. asphalt macadam, both on concrete foundation, and 5800 lin. ft. concrete combined curb and gutter, advertised in Engineering Record. Charles W. Linsley, Commissioner of Works.

Belvidere, N. J.—Until April 11 by Committee of Board Chosen Freeholders, Warren Co. (Morris L. Faust, Clk.), for constructing 4.107 miles, known as the Washington-Rutzville Road Section No. 1. Also separate bids for constructing 4.124 miles of bituminous macadam road, known as Hope-Bridgeville Road in Section No. 1. F. W. Salmon, Co. Engr.

Morristown, N. J.—Until April 11, by Board Chosen Freeholders, for improving with bituminous concrete Blackwell Street and Sussex Turnpike in town of Dover, Borough of Wharton and Township of Randolph, 26,588 sq. yd.; Sussex Turnpike in Randolph and Roxbury Townships, 11,403.64 sq. yd., advertised in Engineering Record. Simon E. Estler, Director of Board.

Franklin, Pa.—Reported desired until April 3, 14,000 sq. yd. wire cut brick. Address City Clerk.

Pittsburgh, Pa.—Until April 5, by Department Public Works (Robt. Swan, Dir.) for paving and curbing portions of Lelia, Russell and other streets, also for constructing sewers in Simonton Street and Shady Avenue, rebuilding bridge stairway and approaches Plum Way Foot Bridge and constructing pedestrian subway.

Charleston, S. C.—Reported desired until April 14, for constructing paving and sidewalks during year 1916. J. H. Dingle, City Engineer.

Bradentown, Fla.—Until April 20, by Robt. H. Roesch, County Clerk, for grading about 18.7 miles and by grading and surfacing with sand asphalt about 28 miles of road in Sarasota-Venice Road and Bridge District in all about 240,000 cu. yd. excav., 148,000 sq. yd. sand asphalt surface; 296,000 lin. ft. concrete curb, etc.

Lake City, Fla.—Until April 17, Board Public Works (J. W. Layne, Secy.), for 21,000 sq. yd. with either modified sheet asphalt or brick or both, and 23,000 lin. ft. concrete curb. C. R. Horne, Engr.

Lafayette, Ala.—Reported desired until April 24, by County Court, for constructing 16 miles of road.

Jackson, Tenn.—Reported desired until April 30, by H. M. Harris, Commissioner of Streets, for paving with vitri. brick on concrete base, portions of Highland Avenue, Royal and Poplar Streets, in all about 55,000 sq. yd.

Elkton, Ky.—Reported desired until April 15, for constructing 8 miles macadam. Probable cost, $24,000. A. B. Wilkins, County Judge.

Louisville, Ky.—Until April 6, by Department Public Works (Roger G. McGrath, Secy.), for constructing sidewalks on numerous streets.

Akron, Ohio.—Reported desired until April 11, by County Commissioners (U. G. High, Clk.), for grading, draining and curbing county roads known as Richfield Road, Mogadore Road and the waterbound macadam county road known as Payne Road.

Bucyrus, Ohio.—Until April 25, by City, for improving 12 streets, totaling about 100,000 sq. yd., advertised in Engineering Record. F. L. Niederheiser, City Engineer; M. J. Lutz, Director Public Service.

Cleveland, O.—Until April 12, by Board County Commissioners (E. G. Krause, Clk.) for grading, draining and improving Richmond Road No. 4. W. A. Stinchcomb, Co. Surv.

Medina, Ohio.—Reported desired until April 7 by Granger Township Commissioners for constructing 2 miles of brick road.

Ohio.—Until April 7, by Clinton Cowen, State Highway Commissioner, Columbus, for following road improvements including bridges and culverts and grading:

Ashland County.—Section "F," Savannah-Vermillion Road, Ruggles Township; concrete bridge and approaches; length, 168 ft.; cost, $7,059.

Ashtabula County—Section "K," Cleveland-Buffalo Road, Geneva and Saybrook Township, paving with brick 6.47 miles; cost, $147,405; Section "J," Jefferson-Anderson Road, Jefferson, Lenox and Dorset Townships; brick, 6.3 miles; cost $88,619.

Belmont County.—Section "N," Barnesville-Hendryburg Road, Warren and Kirkwood Townships; brick, 2.41 miles; cost, $57,608.

Columbiana County. — Section "Q," Cleveland and Liverpool Road, St. Clair Township; brick, .98 miles; cost, $20,121.

Darke County.—Section "E," Celina-Greenville Road, York Township; 3.08 miles; cost $46,850.

Erie County.—Section "O," Sandusky-Norwalk Road, Milan Township, brick; concrete, brick and waterbound macadam and brick and waterbound macadam will also be considered; 2.09 miles; cost, reinforced concrete and brick, $33,218; concrete, brick and waterbound macadam, $25,257; brick and waterbound macadam, $28,197.

Franklin County.—Section "M," Columbus-Sandusky Road, Clinton Township; brick, .72 miles; cost, $48,441.

Greene County.—Section "P," Dayton-Chillicothe Road, Beaver Creek Township; waterbound macadam; 2.21 miles; $13,300.

Guernsey County.—Section "L," Cambridge-Caldwell Road, Cambridge Township, bituminous macadam; 1.26 miles; cost, $13,029; Section "K," National Road, Willis and Oxford Townships, Lignin liquor and old surface treaded macadam, 7.48 miles; cost, $109,297.

Harrison County.—Section "P," Denison-Cadiz Road, Monroe Township; waterbound macadam, 3.59 miles; cost, $36,941.

Holmes County.—Section "H," Columbus-Millersburg Road, Hardy Township; reinforced concrete, 1.56 miles; $25,121.

Jefferson County.—Section "H," Steubenville-Cambridge Road, Cross Creek Township; waterbound macadam; 1.15 miles; cost, $14,931.

Madison County.—Section "E," Urbana-London Road, Somerford and Union Townships; reinforced concrete and brick; 3.28 miles; cost, $60,283.

Mahoning County.—Section "S," Akron-Canfield Road, Ellsworth Township; waterbound macadam; 2.46 miles; cost, $22,066; Section "P," Youngstown-Salem Road, Canfield Township; waterbound macadam; 1.5 miles; $12,863.

Montgomery County. — Section "O," Dayton-Troy Road, Butler Township; brick; 1.01 miles; $23,815; Section "N," Cincinnati-Dayton Road, Miami Township; brick; 1.47 miles; cost, $36,095; Section "M," Dayton-Troy Road, Butler Township; brick; 1.29 miles; $31,461.

Morrow County.—Section "G," Marion-Galion Road, Canaan Township; waterbound macadam and reinforced concrete; 2.46 miles; $26,016; Section "F," Mt. Gilead-Mt. Vernon Road, Gilead, Franklin and Harmony Townships; reinforced concrete; 5.89 miles; cost, $99,933; alternate bids will be considered on waterbound macadam; cost, $78,500.

Muskingum County. — Section "L," Zanesville-Caldwell Road, Wayne Township; bituminous macadam; 1.78 miles; cost, $27,472.

Ottawa County.—Section "F," Port Clinton-Marblehead Road, Danbury Township; either tar bound macadam or asphalt bound macadam; 3.5 miles; cost, either type, $28,000.

Portage County.—Section "W." Cleveland-Kent Road, Streetsboro Township; reinforced concrete; 2.74 miles; $37,880.

Sandusky County.—Section "O," Fremont-Port Clinton Road, Rice Township; reinforced concrete, 1.2 miles; cost, $17,644; Section "P," Sandusky-Clyde Road, York Township; brick; 1.09 miles; $25,336. Section "N," Gremont-Castalia Road, Townsend Township; waterbound macadam; 1.01 miles; $9,252.

Scioto County. — Section "K," Ohio River Road, Porter Township, with either tar bound macadam, asphalt bound macadam, brick on rolled foundation or brick on concrete foundation; 2.95 miles; cost, tar bound macadam, $36,893; asphalt bound macadam, $36,893; brick, on rolled foundation, $54,820; brick on concrete foundation, $65,012.

Seneca County.—Section "O," Tiffin-Bellevue Road, Adams Township; waterbound macadam; 1.59 miles; cost, $15,210; Section "P," Upper Sandusky-Bellevue Road, Scioto Township; waterbound macadam; 2.46 miles; $21,258.

Summit County.—Section "Q," Akron-Canton Road, Springfield Township; brick; 2.29 miles; $46,821; Section "P," Akron-Medina Road, Copley and Bath Townships; brick; 1.62 miles; $32,811.

Tuscarawas County.—Section "L," Newcomerstown-Uhrichville Road, Mill Township; brick; .82 miles; $15,573; Section "N," Canal - Dover - Millersburg Road, Dover Township; reinforced concrete; 1.64 miles; $25,480; Section "M," Canal-Dover-Wooster Road, Franklin Township; brick; 1 mile; $18,556.

Wayne County.—Section "N," Massillon-Wooster Road, East Union Township; brick; 5.83 miles; $86,120.

Williams County.—Section "L," West Unity and Montpelier Road, Superior Township; waterbound macadam and reinforced concrete; 1.94 miles; $21,213.

Lake County.—Section "A," Painesville-Warren Road; repair including culverts, regrading roadbed and paving with bituminous macadam; 1.52 miles; cost, $12,488.

Salem, Ohio.—Reported desired until April 13 for 6620 yd. brick pavement; probable cost $14,000. Address Director Public Service.

Fort Wayne, Ind.—Until April 4, by Board Public Works, for paving Clinton, Lillie, McCulloch and 16 other streets, in all about 4 1/3 miles.

Indiana. — By County Commissioners for constructing county roads as follows:

April 4:

Vincennes, for 8184 ft. gravel road, in Johnson Township. J. I. Muentzer, Co. Aud.

Bedford, 1948 ft. gravel or macadam road in Perry Township, and 7270 ft. in Indian Creek Township. Ezra W. Edwars, Co. Aud.

April 5:

Indianapolis, for three gravel roads, between Center and Warren Townships, and eight gravel roads in Center Township. Leo K. Fesler, Co. Aud.

Shelbyville, for 14,914 ft. gravel road in Hanover Township. F. W. Fagel, Co. Aud.

Until April 6:

Columbus, for crushed stone road in Rock Creek, Hawcreek Clay, and Flatrock Townships. W. H. Scott, Co. Aud.

Until April 15:

Danville, roads in Union and Liberty Townships. C. M. Havens, Co. Aud.

Bluffton, 4,784 ft. gravel road and 5,356 ft. stone and rock road in Rock Creek Township. C. T. Kain, Co. Aud.

Indianapolis, Ind.—Until April 5, by Board Pub. Wks., for paving Cornell Ave. from Twenty-seventh to Thirtieth Street, exclusive of car tracks.

Richmond, Ind.—Until April 6 by B. A. Bescher, City Clerk, for paving Richmond Avenue, about 12,260 sq. yd., either brick, asphalt, concrete or creosoted wood block. Fred R. Charles, City Engineer.

Groose Pointe, Mich.—Until April 3, by John Kerby, Village Clk., for reinforced concrete pavement on Moran Road, in all about 7300 ft.

Reeman, Mich.—Until April 15 by Sheridan Township Board at Reeman for constructing 4½ miles gravel roads in Newaygo County. John M. Beem, Township Clk., Reeman.

Saginaw, Mich.—Reported desired until April 11, by City Clerk, for paving eight streets. Probable cost, $76,000.

Elgin, Ill.—Until April 6, by City Clerk, for 27,050 sq. yd. brick pavement on concrete foundation; also 9700 lin. ft. concrete curb and gutter. Morgan H. Brightman, City Engr.

Berwyn, Ill.—Until April 18, by Board Local Improvements (Oscar N. Lindahl, Secy.), for 5 ft. cement sidewalks on Ridgeland Avenue and other streets, in Berwyn Special Assessment, No. 87; cost, $12,179.

Pontiac, Ill.—Until about May 1 for 8000 sq. yd. of brick pavement on concrete foundation. About 5000 sq. yd. of wood block are also to be laid at a later date. Total cost $30,000. J. C. Wade, Engineer, 318 Sterry Bldg.

Marinette, Wis.—Until April 18, by A. L. Hillis, City Engineer, for 11,000 sq. yd. reinforced concrete pavement.

Racine, Wis.—Reported desired until April 5, by James Mutter, County Highway, Comr., for Franksville Racine Road, about 8600 sq. yd. surfacing, Twelfth Street Road, 13,300 sq. yd. surfacing, and Corliss Union Road, 8,000 sq. yd. surfacing, etc.

Audubon, Iowa.—Reported desired until April 6, by W. W. Laubender, City Clerk, for 46,880 sq. yd. with either brick, cement concrete, asphalt, or rocmac, and 20,630 lin. ft. curbing.

Independence, Iowa.—Reported desired until April 4, by E. A. Bordner, Co. Aud., for 5000 sq. yd. gravel surface, 5000 cu. yd. rock excav., etc. R. W. Gearheart, Co. Engr.

Marion, Iowa.—Reported desired until April 17, by J. J. Wilson, City Clerk, for paving 16 blocks on Seventh Avenue, Ninth Avenue and Eleventh Street. H. R. Green, Engr., Cedar Rapids.

Nevada, Iowa.—Until April 11, by R. A. Davis, City Clk., with brick, asphaltic concrete or reinforced concrete, 21,000 sq. yd., and 1200 ft. curb.

Sigourney, Iowa.—Until April 5 (extension of date from March 23), by City Council, for paving with either brick or concrete, about 13,500 sq. yd. and 4400 lin. ft. combined curb and gutter. A. M. Mcas, Town Clerk.

Storm Lake, Iowa.—Until April 4 by J. E. Buland, City Clerk, for 60,000 sq. yd. of asphalt concrete or bitulithic pavement on Geneseo, W. Seneca and other streets, including 45,000 lin. ft. concrete curb; cost $100,000. Bruce & Stundeven, Engineers, Omaha, Neb.

Webster City, Iowa.—Until April 10, for constructing 15,000 sq. yd. brick, concrete and asphaltic concrete pavement and 9,000 lin. ft. curb and gutter. H. G. Vollmer, City Manager.

Bemidji, Minn.—Reported desired until April 4, by J. L. George, County Auditor, for constructing county roads Nos. 31, 87, 12 and 13.

Detroit, Minn.—Reported desired until April 4, by J. A. Warum, County Auditor, for 8½ miles grading, ditching and installing culverts.

Duluth, Minn.—Reported desired until April 6, by O. Halden, County Auditor, for constructing approximately 5½ miles of Gappa Road.

Until April 4 (readvertisement) by Commissioners Public Works, for paving with asphalt on East Superior Street from Sixteenth to Twenty-third Avenues. Lowest bid opened recently according to requirements was $49,474.

Elbow Lake, Minn.—Until April 3 by C. M. Nelson, Co. Aud., for 69,426 lin. ft. turnpiking, 67,000 cu. yd. grading, etc.

Moorehead, Minn.—Until April 10, by R. C. Price, City Clerk, for concrete, bituminous concrete, bitulithic, creosoted block and vitri. brick paving on Eighth Street, S., including 10,832 sq. yd. pavt., 5,864 lin. ft. straight curb, etc. A. M. Hopeman, Engineer, Moorehead.

Falls City, Neb.—Reported desired until April 14, by George Riechers, City Clk., for paving in Dist. No. 16. Probable cost, $19,520.

Havelock, Neb.—Reported desired until April 7, by A. J. Blount, City Clerk, for paving. Probable cost $5,219.

North Platte, Neb.—Until April 14 by O. E. Elder, City Clerk, for 45,000 sq. yd. brick, concrete and sheet asphalt pavement on Dewey, Locust and other streets, at a cost of $100,000, including 5700 lin. ft. concrete curbing. C. J. McNamara, Designing Engineer, McCabe Building.

Winlock, Neb.—Reported desired until May 1, for constructing one-mile concrete pavement. Probable cost, $12,000. Address City Clerk.

Grafton, N. D.—Reported desired until April 3, by J. H. Johnson, City Aud., for sidewalks, alley crossings and street crossings, etc., during year beginning May 1, 1916, and ending March 31, 1917.

Mayville, N. D.—Reported desired until April 3, by Henry Leum, City Auditor, for cement walks, Crossings, etc., for year 1916.

Tarkio, Mo.—Until April 3, by John G. Graham, City Clerk, for paving Fourth, Fifth, Maple and other streets at a cost of $16,000. J. E. Jenison, Engr., Tarkio.

Spokane, Wash.—Reported desired until April 7, by Alfred T. Anderson, County Auditor, for paving Permanent Highway 36,360 sq. yd. Bids desired on asphalt macadam, asphaltic concrete and macadam base, asphaltic concrete on oil bound base. J. W. Strack, County Engr.

Spokane, Wash.—Reported desired until April 7, by County Commissioners for constructing Empire Highway No. 13B, in all about 20,000 cu. yd. excav., 36,300 sq. yd. asphalt concrete on macadam base, asphaltic concrete on oil bound base. J. W. Starck, County Engr.

Stevenson, Wash.—Until April 15, by County Commissioners, for constructing Clarke County Line Cascade Section of State Road No. 8, in all about 5,505 ft. Chas. H. Nellor, Co. Aud.

Walla Walla, Wash.—Until April 4, by M. A. Powers, City Clerk, for 16,000 ft. W. H. Rehorn, City Engr.

Los Angeles, Cal.—Until April 10 by Board of Supervisors, Los Angeles, for constructing 1.68 miles of 5-in. oil macadam pavement on Base Line Road, near Whittier Road District No. 1. Also separate bids for 6.38 miles concrete pavement and grading on Workman Mill Road, near Whittier, in Road District No. 1, involving approximately 26,000 cu. yd. excav., 33,700 lin. ft. shaping roadbed, 16,270 lb. reinforced steel, 74,690 sq. yd. concrete pavt., etc., and estimated cost $35,400.

Ventura, Cal.—Until April 10 by Board of Supervisors for constructing 4-in. concrete pavement 16-ft. wide between Oxnard and Hueneme, 4.05 miles and 20 ft. between El Rio and Oxnard, 1.7 miles involving 30,392 lin. ft. shaping and rolling roadbed, 6510 cu. yd. concrete in culverts, 2400 lb. reinforced steel, etc.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Boston, Mass.—Following are three lowest bids opened March 27 by Metropolitan Park Commission, Boston, for grading and surfacing Alewife Brook Parkway in Arlington and Somerville: Kelly & Sullivan, 25A Cheery Street, Somerville, $25,608; J. H. Fannon, 27A Hinckley Street, Somerville, $27,595, and Rowe Contracting Co., Brighton, Mass., $28,008.

★**Worcester, Mass.**—Contract awarded by Albert Rhodes, Street Comr., for granite to be used for 1916 to Leonard F. Burrage, Leominster.

★**Providence, R. I.**—Contract for furnishing Tarvia for year 1916 awarded Barrett Company, Boston, Mass. W. C. Pelkey, Clerk Board Contract & Supply.

★**Buffalo, N. Y.**—Bid of German Rock Asphalt & Cement Company, Morgan Building, at $16,140 be accepted for the repaving of North Street with German Rock Company's Standard ssphalt, Spec. B on concrete base.

★Contract awarded by Superintendent Department Public Works for grading dirt streets, opening gutters, rounding roadways and surfacing with hard material awarded Forks Contracting Company, at $50,670.

★**New York, N. Y.**—Contract for repairing sheet asphalt and asphalt block pavements until May 15, 1916, where guarantee has expired in Borough of Manhattan, bounded by Twenty-third Street, North

River, Fifty-ninth Street and East River (bids opened March 21 by Marcus M. Marks, Borough President), awarded Uvalde Asphalt Paving Company, 1 Broadway; estimated cost $27,800.

Watertown, N. Y.—Following are bids opened March 18 by E. W. Sayles, City Engineer, for paving Franklin Street and Pacific Square with 3½-in. wood block on 8-in. concrete base: A. F. McConville, Ogdensburg, $28,174; Warren Bros. Company, Boston, Mass., $29,216; Franklin Construction Company, New York, $29,465; Morrison & Quinn, Rochester, $30,208.

★**Flemington, N. J.**—Following are four lowest bids opened March 23 by County Board of Freeholders for (a) constructing Lower Valley Road, and (b) Clinton West Postal Road: F. P. Meckes, Long Pond, Pa., $14,576 (awarded contract); Sinofoos & Poore, Riegelsville, Pa. (a) $15,666, and (b) $37,852(awarded contract); M. Irving Demarest, Sewaren (a) $16,391; C. H. Winans & Company, Elizabeth (a) $17,986; E. P. Arbogast, Stroudsburg, Pa. (b) $41,821; J. C. Bentley, Hackensack, N. J. (b) $42,063; Richards & Gaston, Somerville (b) $41,542. Grant Davis, County Engineer, Whitestone Station.

★**Erie, Pa.**—Contract awarded by City Council for paving Twenty-fourth Street, from Ash to Railroad Street, to Mayer Bros. Construction Co., Erie, at $24,370.

★**Northampton, Pa.**—Contract awarded March 16 to Miller & Son, of Northampton for following work during fiscal year 1916 (bids opened March 2), concrete street crossings 16c. per sq. ft.; concrete curb and gutter, 40c. per lin ft.; cement sidewalks, 10c. per sq. ft.; earth excavation for curb and sidewalks, 40c. per cu. yd.; furnace slag concrete sub-base; 5 in. thick, 85c.; street grading, 48c. per cu. yd.; concrete street paving, 6 in. at sides, 7½ in. at middle, Kahn armor plates with 6-13-074 Kahn road mesh and Carey joints, $1.46. J. H. Crossart, Town Engr.

★**Philadelphia, Pa.**—Contract awarded by Director of Department of Public Works for paving and repairing macadam roads in outlying sections of city to Paul J. Snyder & Co., Bailey Building, at $16,170.

★**Baltimore, Md.**—Contract awarded by Annex Improvement Commission (F. W. McKinney, Chief Engineer) for grading, curbing and paving with asphalt twenty-five streets, in all approximately 55,000 yd., to Patrick Flanigan & Sons, Livingston and Calvert Streets, at $94,315.

★Contract for concrete paving on alleys (bids opened March 22) awarded Consolidated Engineering Company, Calvert Bldg. R. M. Cooksey, Highway Engineer.

★**Portsmouth, Va.**—Contracts awarded by Common Council to F. J. McGuire, Norfolk, at $1.59 per sq. yd. for paving several streets with asphalt and at $1.35 per sq. yd. for paving Queen and Crawford Streets approach to ferry and terminals with rockmac.

Birmingham, Ala. — See "Miscellaneous."

★**Cincinnati, Ohio**—Contract awarded by Board of Control to Edward Ryan, Cincinnati, for paving Reading Road from Mitchell Avenue to Paddock Road, about 7800 sq. yd. wood block, at $29,789.

★**Cleveland, Ohio.**—Board of Control March 17 awarded contracts as follows: To Roehl Bros., Thompson Boulevard and West Twenty-fifth Street, for East Thirty-ninth and Ninetieth Streets, West Eighty-fourth, Eighty-eighth, Forty-third, Eighty-second, Eighty-sixth and Eighty-ninth Streets at a total of $44,466; C. E. Wilson & Son. East 123d Street, $10,906; Gould & Mayback, East 166th Street, $28,382; Roehl Bros., Thompson Boulevard and Clark Street; East Seventy-third, Sixty-seventh, Seventy-second and Sixty-sixth Streets., total $20,495; Cleveland Trinidad Paving Company, 420 Lakeside Avenue, N. E., Quincy Avenue, $29,554; Enterprise Paving & Construction Company, 8436 Broadway, East Seventy-fifth, Eighty-first and Eighty-second Streets and Malek Place, total $21,478.

★**Elyria, Ohio.**—Contract awarded by Director Public Service for paving Oxford Court with sheet asphalt to Hill & Hill, Elyria, at $9,717.

★**Fort Wayne, Ind.**—Contracts awarded by County Commissioners for macadamizing Row Road in Monroe Township, 11,400 ft. in length, to Ellison & Co., Monroeville, at $9,362, and Youse Road in Madison Township, 10,682 ft. long, to A. H. Fry, Madison, at $10,200.

★**Indianapolis, Ind.**—Contract awarded by Board of Public Works for 850,000 gal. road oil to Indian Refining Co., 17 Battery Place, New York, at $4.62 for each 100 gal. B. J. T. Jeup, City Engineer.

★**Warsaw, Ind.**—Contract awarded by County Commissioners for constructing three miles concrete highway south of Sidney to Brooks Construction Co., Fort Wayne.

★**Cadillac, Mich.**—Contract awarded for constructing concrete boulevard around north side Lake Cadillac to A. J. Murphy, Port Huron.

★**Eagle River, Mich.**—Contract for constructing trunk line road awarded Smith Byers & Sparks, Houghton, at $24,812. Carl G. Smith, Highway Engineer, Ahmeek.

★**Chicago, Ill.**—Contract awarded Barr Clay Company for 600,000 paving bricks. They bid $15.60 per thousand within Chicago switching district and $17.50 per thousand without. Contract for 5-ton tandem road roller awarded Barber Asphalt Company, 7 South Dearborn Street, at $1,695. A. W. Miller, Supt. Streets.

Lowest bid opened March 23 by A. W. Miller, Supt. of Streets, for furnishing 1500 tons asphalt, submitted by Sim Co., 2429 South Halsted Street, at $15.40 delivered in tank and $17.40 delivered in cartons.

★**Elgin, Ill.**—Contract for paving Grove Street, 11,800 sq. yd., awarded Logan & Giertz Construction Company, Elgin, at $1.33 per square yard for Burlington brick and $1.20 per square yard for new foundation, total $15,719. Other bidders, Ben Gross, La Porte, Ind., $16,570, and Illinois Hydr. Stone & Construction, Elgin, $16,924. North Gifford Street awarded McCarthy Improvement Com. pany, Davenport, Iowa, at $1.48 per square yard for 7776 sq. yd. asphaltic concrete pavement (Sarco), 45 cts. for 4822 lin. ft. curb and gutter, etc., total $15,694. Next three bidders: Ben F. Gross, LaPorte, Ind., $15,807; (Stanolind) and $16,040 (Texaco) F. P. Caughlin Company, Chicago, $16,309, and White Construction Company, Chicago, $16,426.

★**Rock Island, Ill.**—Contract awarded McCarthy Improvement Co., of Davenport, Iowa, for brick paving on Forty-fourth Street from Fourteenth to Eighteenth Avenues, at about $16,000.

★**Appleton, Wis.**—Lowest bid opened March 24 by A. C. Remley, City Engineer, for 10,000 yd. brick pavement, submitted by Grenunke Bros., Appleton, at $2.19 per sq. yd.

★**Manitowoc, Wis.**—Contract awarded Rasmussen & Sons Co., Oshkosh, Wis., for four blocks of asphalt paving, about 10,732 yd., at $1.72 per yd., and to Murphy Construction Co., Manitowoc, about 17,920 sq. yd. vitr. brick pavt., at $2.085 per sq. yd. Harry F. Kellut, City Attorney.

★**Marshfield, Wis.**—Contract awarded Cast Stone Construction Company, Eau Claire, for 14,000 sq. yd. reinforced concrete pavement at $1.60 per sq. yd., and Peterson Construction Company, Kenosha, for 16,000 sq. yd. vitr. brick at $2.10 per sq. yd.

Clear Lake, Iowa.—Following are bids opened March 15 by E. B. Stillman, City Clerk, for 27,000 sq. yd. pavement: Des Moines Asphalt Co., Des Moines, $1.725 and $2.58 Trinidad, Bermudez, creosote Perrington or concrete; Adams Co., Quincy, $1.58 tarvia; Ford Paving Co., Cedar Rapids, $1.76 Trinidad, $2.49 creosote block and $1.72 Othar or artific.

★**Eagle Grove, Iowa.**—Contract for concrete pavement on Lucas and Lincoln Avenues awarded Jensen & Krage, Sioux City, at 1.43½ per sq. yd. S. Middleton, City Clerk.

★**Forest City, Iowa.**—Contract awarded J. S. McLaughlin & Sons, Red Oak, Iowa, for 20,000 sq. yd. sheet asphalt paving at $1.66 per sq. yd and 16,762 lin. ft curb and gutter at 58c. Theo. S. Delay, Consulting Engineer, Creston.

★**McGregor, Iowa.**—Contract awarded by Board of Public Works for paving ¾ mile Main Street with brick to Lee Brothers, Dubuque, at $45,000.

★**Monticello, Iowa.**—Contract awarded F. K. Hahn, Cedar Rapids, for paving (bids opened March 16) 13,100 sq. yd. vertical fibre brick paving $1.76; 7,850 lin. ft. combined curb and gutter, 65 cts ; 600 lin. ft. curb (relined), 20 cts.; 450 lin. ft. curb bars, 15 cts.; 340 sq. yd. alley, $1.25; 1,000 sq. ft. walks (repairing), 15 cts.; 3,200 cu. yd. grading, 40 cts., etc ; total, $30,396. C. J. Northrop, City Clerk.

★**Sioux City, Iowa.**—Contract awarded by Board Public Works for paving 35,000 yd. to P. C. Hansen & Son, Atlantic, at about $60,000.

★**Duluth, Minn.**—Bid of Rogers & McLean, 422 Lyceum Bldg., at $63,257 for paving West First Street recommended by City Council for award.

★**St. Cloud, Minn.**—Contract awarded Hanlon & Okes, Minneapolis, for 35,862 sq. yd. creosoted block; and to General Contracting Company, Minneapolis, for 17,353 sq. yd. bitulithic. George C. Magnuson, City Clerk.

★**St. Paul, Minn.**—Contract for furnishing 47,600 yd. of yellow pine paving blocks (bids opened March 20) awarded Republic Creosoting Company, Minneapolis, at $1.48 per sq. yd.; other bidders: Kettle River Company, Minneapolis, $1.52½ and Ayer & Lord Tie Company, $1.53½. August Hohenstein, Purchasing Agent.

★**Hastings, Neb.**—Contract awarded Watts & Amoman at $1.54 per sq. yd. for 150,000 yd. sheet asphalt and 45c. per lin. ft. for 90,000 ft. combined curb and gutter. W. H. Fuller, City Engineer.

★**Anaconda, Mont.** — Contract awarded by City Council for paving Commercial Avenue, with asphaltum concrete with mixed base, to Clifton & Applegate, care of Betts & Bingham, Anaconda, at $36,156.

Little, Rock, Ark.—Lowest bid submitted to City Commissioners for paving in Street Improvement Districts Nos. 9 and 244 submitted by I. P. Shelby & Co., Little Rock, at $65,900.

★**Aransas Pass, Tex.**—Contract awarded by Commissioners San Patricio Independent Road District No. 3 to Southern Engineering Company, San Antonio and Corpus Christi, to build new roads, 24 miles in all, costing approximately $60,000, about 40 cts. per sq. yd.; one road is to be from Aransas Pass to Ingleside and another from Aransas Pass to within 3½ miles of Gregory. Roads will be Mathis adobe coated with crude petroleum and rolled.

Houston, Tex.—Following are bids opened March 10 by E. E. Sands, City Engineer, for paving Main Street from N. C. L. McKinney Avenue to G. H. & S. A. Ry.: Horton & Horton, Houston, wood block, $247,457 and $251,888, 5 and 10-year respectively, Uvalde block, 10-year guarantee, $188,588, and Westrumite, 6-year guarantee, $184,157; Texas Bitulithic Co., Union National Bank Bldg., bitulithic, five-year, $201,483; Lester Levy, nine bids, from $136,633 to $222,088, according to material used; Eureka Paving Co. of Houston, 12 bids, from $151,115 to $226,442.

★**Montesano, Wash.**—Following are four lowest bids opened March 20 by County Commissioners for constructing East Hoquiam Road and Permanent Highway No. 12, including culverts: Oliver & Oliver, Portland, Ore., $24,000; Nels Johnson, Hoquiam, two bids, $24,331 and $24,750 (awarded contract); Rowland Bros., Cosmopolis, $26,800 and $27,200; August Wallin, Aberdeen, $28,198 and $28,798. George Robertson, County Engineer; W. D. Campbell, County Auditor.

★**Ritzville, Wash.**—Contract awarded by County Commissioners for constructing Permanent Highway No. 2A to Chindall Co., Spokane, at $52,493. Other bids were: Cascade Construction Co., Seattle, $53,624; Spokane Asphalt Macadam Paving Co., Spokane, $53,125; H. C. Malott, Seattle, $54,100. O. J. DeSpain, County Engineer. J. L. Cross, County Aud.

★**Seattle, Wash.**—Contract for grading on Ranier Avenue awarded by Board of Public Works to Burnett Construction Co., 909 Second Avenue, S., at $80,415.

★**Washington.**—Contract awarded by State Highway Commission, Olympia, for surfacing 7½ miles on Pacific Highway from Toledo south in Lewis and Cowlitz Counties with gravel to Jarvis & Burkheimer, Liberty Bldg., Seattle, at $13,652. (Bids opened March 20.)

★**Burbank, Cal.**—Contract awarded by Board of Supervisors, Los Angeles, to E. A. Baker, 407 H. W. Hellman Building, Los Angeles, for constructing 5-in. concrete pavement, 28 and 30 ft. wide, and concrete curbs, on Grand Avenue and Tenth Street, Town of Burbank, Road Improvement District No. 63, at $12,998.

★**Los Angeles, Cal.**—Contract awarded California-Arizona Construction Company, 1700 East Washington Street, for 115,656 sq. ft. asphalt pavement on Manhattan Place at $12,691.

★Contract awarded Coast Construction Co., 353 S. Hill Street, for 125,000 sq. ft. concrete pavement, 57,300 sq. ft. cement walk, 8,800 ft. cement curb, etc., at $32,459.

★Contract for asphalt pavement on Stratford Road awarded B. Crites, 129 South Rio Street, at $9,688.

★**Globe, Ariz.**—Contract for constructing 8 miles of scenic highway in Gila River Canyon awarded Toohey & Johnson, Phoenix, at $105,000. Excavation will approximate 100,000 cu. yd., 75,000 being solid rock. M. R. Lesher, Chief Clerk, County Highway Department.

★**Phoenix, Ariz.**—Contract for approximately 20,863 sq. yd. pavt. and 9368 lin. ft. cement curb and gutter in Washington Street and Seventeenth Avenue, awarded California-Arizona Construction Co., 1700 East Washington Street, Los Angeles, Cal., at $37,250.

★**Winkelman, Ariz.**—Contract awarded Toohey & Johnson, Phoenix, for about 5 miles of road between Winkelman and Christmas, at $100,282.

Wallace, Idaho.—Following are bids opened March 14 by Council for paving the streets of District No. 4: C. M. Payne, Spokane, Wash., Diamond Surface, 4-in. concrete base, 1-in. binder, $1.51 per sq. yd., $1.64 per sq. yd. 5-in. base; Standard Asphalt Paving Co., Spokane, Wash., 3-in. wood block, on 4-in. concrete base, $2.69; Spokane bitulithic, 1½-in. surface on 4½-in. concrete base, $1.54; asphaltic concrete, 2-in. top, 3-in. foundation, $1.33; Warren Construction Co., Portland, Ore., light standard bitulithic, $1.64; bitulithic resurface, $1.54; standard bitulithic, $1.74; Nanaimo Paving Co., Vancouver, B. C., asphaltic concrete, 4-in. macadam base, 2-in. wearing surface, $1.36; asphaltic concrete, 2½-in. bituminous base, 1½-in. wearing surface, $1.16; asphaltic concrete, 3-in. bitulithic base, 2-in. wearing surface, $1.31; standard bitulithic, $1.84; light standard bitulithic, $1.73; bitulithic resurfacing, $1.65; Mitchell Brothers, Spokane, Wash., asphaltic concrete with bituminous base, $1.52; stradimot, 6-in. with base, $1.35; asphaltic concrete with macadam base, $1.35; Ledingham & Cooper, Vancouver, B. C., asphaltic concrete macadam base, $1.30; bituminous base, $1.42; Spokane Bitumas Paving Co., Spokane, Wash., bituminas, 3-in. bituminous base, $1.06½; on 5-in. concrete base with 1-in. binder, $1.42½; on 4-in. base with 1-in. binder, $1.30½; Clifton Applegate Co., Spokane, Wash., wood block, 4-in. concrete base, $3.15; asphaltic concrete, 5-in. crushed rock base, $1.40; asphaltic paving, 2½-in. bituminous base, $1.35; asphaltic concrete, 2-in. resurfacing base, $1.23; asphaltic concrete, 4-in. crushed rock base, $1.32; asphaltic concrete, 3-in. bituminous base, $1.42; Independent Asphalt Paving Co., Seattle, Wash., asphaltic concrete, bituminous base, $1.10; concrete base, $1.45; macadam base, $1.06; Oregon Engineering & Construction Co., asphaltic concrete resurfacing, 2-in. top, 2-in. macadam base, $1.26.

★**Montreal, Que.**—Contract awarded March 17 by Board of Control for 6,000 tons asphalt to Warner-Quinlan Asphalt Co., Syracuse, N. Y., at $19.33 per ton; total, $115,980.

STREET CLEANING AND GARBAGE DISPOSAL

PROPOSED WORK.

Providence, R. I.—City Council reported considering garbage disposal plant to cost $300,000. William C. Pelky, City Clerk.

Logansport, Ind.—Construction of a reduction plant instead of an incinerator, as previously contemplated, is being considered by city. Address City Clerk.

River Forest (Post Office Chicago), Ill.—Election to be held April 18 to vote on constructing an incinerator plant to cost $10,000. A. S. Hatch, Village Clerk.

College Station, Tex.—Contract soon to be let for a garbage incinerator, 10 to 15 tons capacity. Dr. Otto Ehlinger, College Station, is one of the committee in charge.

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS

PROPOSED WORK.

Dock—Providence, R. I.—City Council Harbor Committee is considering spending $300,000 on equipment of new municipal dock. William C. Pelkey, City Clerk.

Sea-wall—Providence, R. I.—Construction of a 600-ft. seawall at Henderson Street by city reported being considered; probable cost, $100,000.

Wharf and Shed—Providence, R. I.—New England Steamship Company intends erecting a concrete and iron 48 x 270-ft. wharf and 25 x 500-ft. freight shed on India Street.

Dredging—New York, N. Y.—War Department has recommended to Congress an appropriation of $510,000 for the further improvement of Newtown Creek at New York City, and its tributaries, Dutch Kills, Maspeth Creek, and English Kills.

Pier—Jersey City, N. J.—Lehigh Valley R. R. (E. B. Ashby, Ch. Engr., 143 Liberty Street, New York), plans constructing a freight terminal steamship pier and loft buildings costing about $5,000,000 in Jersey City. This improvement is contingent upon arrangement being made with city authorities regarding taxes and other rights.

Waterway—Trenton, N. J.—Governor has signed a bill appropriating $75,000 for inland waterway connecting Barnegat Bay and Manasquan Inlet.

Levee Work—Shrevesport, La.—Caddo Levee Board proposed spending $150,000 in reclamation project, dredging and canal. Address President Caddo Levee Board, Shrevesport.

Seawall—Bay St. Louis, Miss.—Waveland Seawall District Commissioners engaged David U. Morris, Mobile, Ala., to survey, plan and superintend construction of a seawall for the Waveland front. A reinforced concrete wall 6 ft. above mean low tide with wide base and a heel projecting outward is contemplated.

Drainage—Paducah, Ky.—County Commissioners have been directed to construct the Mayfield Drainage ditch, estimated to cost $300,000.

Drainage—Jacksonville, Ill.—Jacksonville Engineering Company, Jacksonville, engaged to prepare plans for the Scott County Drainage & Levee District calling for 138,000 yd. excav., 68,000 yd. levee work.

Drainage — Jacksonville, Ill.—Contract will be let in about 90 days for constructing the Hillview Levee and Drainage District to include one drainage pumping plant 60-in. centrifugal pump and 240,000 cu. yd. excav. Caldwell Engineering Company, Jacksonville, Engineers.

Drainage — Humboldt, Wis.—Contract will be let this spring for constructing part of the drainage district contemplated here. The entire district will include about 38 miles of open ditch. Steller Engineering Company, Engineers, 73 Loan & Trust Bldg., Milwaukee.

Drainage — Pensaukee, Wis. — Surveys now being made for Drainage district to consist of 10 miles of open ditch. Steller Engineering Company, Engineers, 73 Loan & Trust Bldg., Milwaukee.

Drainage—Sac City, Iowa.—Drainage work in Sac City is under consideration. Cost is estimated at $31,090, part drag line and part floater dredge work, possibly pumping plant will be put in if river section of ditch is rejected. Contract will be let about June 1. Seth Dean, Engineer, Glenwood.

Ditch—Grand Rapids, Minn. — Surveys completed for proposed ditch in Itasca County; cost $22,000. Address County Clerk.

River Improvements—Kansas City, Kan.—All bids opened March 20 by County Commissioners for removing obstructions from Kansas River between James Street Bridge and West Kansas Avenue Bridge have been rejected. Will readvertise. F. M. Holcomb, County Clerk.

Levee—Fremont, Neb.—Citizens of Valley voted to build a new levee from Valley west to edge of Douglas County to connect with Fremont District.

Drainage—Wentworth, S. D.—It is contemplated to drain 2300 acres of marsh land in Moody and Lake Counties, estimated excavation 249,060 cu. yd.; estimated cost $64,352. Charles A. Trimmer, Engr., Madison, S. D.

Drainage—Gregory, Mo.—Construction of a drainage system, levee and pump house in territory extending from bluffs to Mississippi River and from Gregory south to Fenway, Mo., in all about 10,000 acres, is contemplated at a cost of $225,000. B. F. Glahn of Palmyra, Attorney for district.

Rich Hill, Mo.—Jas. A. Flanning, of Butler, is engineer for the Lone Oak Levee District, which includes 260,000 cu. yd. excav. in 8 miles of levee; cost $25,000. J. F. Kern, Secy. District.

Drainage—Earle, Ark.—Commissioners of Drainage District No. 3 taking steps to arrange for a $240,000 bond issue for drainage work. Guy Bland of Crawfordsville is one of the commissioners.

Drainage—Marion, Ark.—Drainage District No. 3 is to be constructed at a cost of $250,000. Work is to be done by four dredge boats. W. E. Ayers, Engineer, Memphis, Tenn.; H. A. Morrison, Secy. District.

Drainage — Newport, Ark. — Reported County Commissioners considering drainage of Village Creek Basin at a cost of $400,000.

Levee—Ennis, Tex.—O. W. Finley, 512 West Tyler Street, Ennis, is engineer for the Ellis County Improvement District—District No. 2 is about 10 miles long—will reclaim 12,750 acres of bottom land. Bonds amounting to $93,000 have been sold for this project.

Seawall—Galveston, Tex.—Seawall and breakwater bonds for $25,000, causeway bridge $10,000 and Special Road 1913 bonds for $7,000 will be sold April 10 by John M. Murch, Co. Aud.

Seawall—Galveston, Tex.—Secretary of War, in a letter to Congress, recommended an appropriation of $303,500 for repairs and restoration of seawall, retaining and fill at Galveston and for urgent repairs to batteries used for defense of city.

Irrigation — Harlingen, Tex.—All bids opened March 11 for engine and pumping plant for Cameron County Irrigation District No. 1 rejected. Gordon Hill, Secy.

Drainage—Houston, Tex.—Improvement bonds for $1,325,000 have been sold, including $325,000 for harbor improvements and $400,000 for drainage.

Irrigation — McAllen, Tex. — The improvements to the Louisiana Rio Grande Canal System includes installation of new 36-in. pump at second lift, with engines and all necessary equipment. C. A. Phillips, City Clerk.

Drainage—Palestine, Tex.—Commissioners Court is taking steps to form the Anderson County Levee Drainage District No. 1. A levee 5½ miles long and 16 ft. high is to be built.

Hydroelectric Plant—Chelan, Wash.—Reported Great Northern Ry. Company (A. H. Hogeland, Ch. Engr., St. Paul, Minn.), is taking steps to construct a hydroelectric power plant at Lake Chelan, to cost $3,000,000.

Drainage — Everett, Wash. — Commissioners of Kellogg Marsh Drainage District engaged Perry Niles, care of Coast Engineering Company, Everett, to make surveys and plans for draining 5000 acres in District. Cost $100,000.

Irrigation—Okanogan, Wash.—The Aeneas-Bonaparte Irrigation Dist. of Okanogan proposes to issue bonds and irrigating 5000 acres; cost $225,000. Preliminary report submitted by W. C. Muldrow of Muldrow & Everett, Engrs., Okanogan.

Drain—Puyallup, Wash.—Contract soon to be let by city for constructing a concrete drain in south end of city costing $31,000. J. L. La Plante, City Clerk.

Erection of Elevator—Astoria, Ore.—Contract will be let about May for foundation and erecting the grain elevator and coal-handling equipment which have been purchased. F. J. Walsh, Chief Engineer, Port of Astoria Commission.

Irrigation—California.—Leon Bly 1350 Washington Street, San Francisco, has received permission from State Water Commission to use waters of Eagle Lake for irrigation purposes in Honey Lake Valley, Lassen County.

Irrigation—Cardiff, Cal.—Citizens voted in favor of establishing an irrigation district. Election to be held in 60 days to vote $100,000 bonds for constructing the system. Address City Clerk.

Drainage — Elsinore, Cal.—Board of Supervisors at Riverside voted to form a drainage district comprising about 10 square miles and embracing town of Elsinore to control flood waters of Lake Elsinore.

Irrigation—Hanford, Cal.—Stratford Irrigation District being formed for the purpose of developing water for irrigation from Kings River and tributaries; about 10,000 acres. L. L. Dennett of Modesto, Attorney.

Dam Improvements—Los, Angeles, Cal.—William Mulholland, Ch. Engr. Los Angeles Public Service Bd., engaged by city to inspect and report on improvements to impoundig basin back of Cedar River masonry dam.

Harbor Improvements—Los Angeles, Cal.—Preliminary plans being prepared by S. A. Jubb, Asst. Harbor Engineer, for bulkheads, fills and other improvements necessary for steamship terminal and industrial site on 3000 ft. of frontage on West Basin, San Pedro Harbor. Board of Harbor Commissioners contemplate spending $1,500,000 for the first unit and about $5,000,000 for complete terminal facilities.

Pier—Manhattan Beach, Cal.—Engineer engaged by City Trustees to prepare plans for pleasure pier to cost $90,000 plans for pavilion costing $20,000 to be prepared by Train & Williams, 226 Exchange Bldg., Los Angeles.

Levee — Porterville, Cal. — City and county officials and the Southern Pacific R. R., represented by F. M. Worthington, of Bakersfield, Supt. of the San Joaquin Division of the R. R., are considering the construction of levees and dams to protect Porterville and district from high water in the Tule River.

Irrigation—Turlock, Cal.—Directors of Turlock Irrigation District (R. V. Meikle, Ch. Engr.) are considering developing electric power for drainage and irrigation purposes, including 1600 hp. at Hickman drop in main canal, including 50 pumps for drainage purposes. Cost is estimated at $169,000.

Flood Protection—Safford, Ariz.—M. L. Marshall, Consulting Engineer in the office of the Secretary of the Interior, Washington, D. C., has completed an investigation of the flood conditions and prospects of flood control in Upper Gila Valley; probably $50,000 will be spent in experimental work in controlling floods along Gila River in this section.

Dam—Twin Falls, Idaho.—J. M. Burkett, Engineer, recommends to Council the construction of a rock filled dam with cement concrete core in preference to either a steel bridge or a simple rock fill dam for the proposed power plant for the city; estimated cost $10,000. Address City Clerk.

BIDS DESIRED.

Dredging—Boston, Mass.—Until April 5 by Board of Harbor and Land Commissioners, State House, Boston (William F. Williams, Chief Engineer), for dredging in Wellfleet Harbor a channel and basin requiring removal of about 55,000 cu. yd. material; also separate bids for Nobscusset Harbor, Dennis, dredging of channel and basin, requiring removal of about 40,000 cu. yd.

Dredging—Buffalo, N. Y.—Until April 26 by U. S. Engineer's Office, Buffalo, for dredging North (Buffalo River) entrance channel and Watson elevator site, Buffalo, advertised in Engineering Record.

Valves and Lock Operating Machinery—Pittsburgh, Pa.—Until April 26 by U. S. Engineers Office, Pittsburgh, for furnishing and erecting steel lock gates and furnishing valves and lock operating machinery for inner lock at Lock No. 4, Monongahela River, advertised in Engineering Record.

Riprap and Capstones—Wilmington, Del.—Until April 29 by U. S. Engineer Office, for furnishing and delivering about 14,300 tons riprap stone and 1500 tons capstones, advertised in Engineering Record.

Wharf—Jacksonville, Fla.—Until April 8, by Board Port Commissioners (J. C. O'Dell, Gen. Mgr.), for constructing a marginal wharf, advertised in Engineering Record.

Wharf—Jacksonville, Fla.—Until April 8 by J. C. O'Dell, General Manager Board Port Commissioners, for wharf material and construction, advertised in Engineering Record.

Ditches, etc.—Clay City, Ind.—Until April 5, by Guirl Drainage Co., for constructing main ditch, four laterals, three miles tile drains, one concrete and steel flood gate.

Ditch—Winamac, Ind.—Reported desired until April 8 by C. E. Paul for constructing F. Shine Ditch and branch, in all about 10,775 yd.; total length 4 miles.

Dredging—Manistee, Mich.—Until April 20 by U. S. Engineer's Office, Grand Rapids, for dredging in Manistee Harbor, Mich., advertised in Engineering Record.

To Sub-let Dredge Work—Chicago, Ill.—To sub-let 300,000 cu. yd. of drag line levee work and all Bucyrus machine, 75-ft. boom 2-yd. Page bucket, in good condition ready to start work; all new levee, no enlargement, advertised in Engineering Record. Address Box 2864, Engineering Record, 1570 Old Colony Building, Chicago, Ill.

Ditch—Kenilworth, Ill.—Reported desired until April 10, by Board Village Trustees (Chas. R. Bull, Pres.), for Skokie Ditch improvement, to consist of the partial reconstruction of two concrete bridges, concrete retaining wall, enlarging present ditch and all appurtenances.

Ditch—Woodstock, Ill.—Until April 8, by Commissioners, Hebron, Drainage Dist. No. 1, for constructing 2½ miles dredge ditch, approximately 54,000 cu. yd. and 28 miles of tile from 6 to 28 in. diam. C. L. Tryon, Engr., Woodstock. Estimated cost $43,000.

Ditches—Redwood Falls, Minn.—Until April 12, by L. P. Larson, Auditor Redwood County, Redwood Falls, for constructing County Ditch No. 21 and Judicial Ditches Nos. 14 in Redwood County and 15 in Redwood and Lyon Counties, including, approximately, 323,021 ft. 5 to 30-in. tile, 21 bulkheads, etc. Total cost $120,788, and dredge work for Nos. 14 and 15, Redwood and Lyon Counties, 269,574 cu. yd. excav., cost $26,957 additional. Ernest Shepard, Auditor Lyon County, at Marshall.

Ditch — Worthington, Minn. — Reported desired until April 4 for constructing drainage ditch. Probable cost $18,000. Gus. Swanberg, Co. Aud.

Wharf—Houston, Tex.—Until April 28, by City, for constructing a reinforced-concrete wharf, approximately 800 ft. long, advertised in Engineering Record.

Dock—San Francisco, Cal.—Until April 27, by Union Iron Works Dry Dock Co., 260 California Street, for constructing a concrete graving dock at Hunter's Point, San Francisco, 1000 ft. long x 120 ft. wide, with a depth of 40 ft. over sill at mean high water, advertised in Engineering Record. H. C. Holmes, Consulting Engr., 112 Market Street, San Francisco.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★Dock — Buffalo, N. Y. — Contract awarded Great Lakes Dredge & Dock Company, Monroe Building, Chicago, Ill., for constructing ore dock and stock yard for Donner Steel Company. It is reported that about $500,000 worth of material will be used in the dock.

★Pier — New York, N. Y. — Contracts awarded by Department of Docks and Ferries, New York, as follows: Pier at West Forty-sixth Street, Borough of Manhattan, to Post & McCord, 101 Park Avenue, at $573,450 (bids opened March 10), and for Contract 1496, repaving asphalt pavement on Marginal Street, to Uvalde Asphalt Paving Company, 1 Broadway, New York, at $1.37 per sq. ft., total 11,000 sq. ft. (Bids opened March 22).

Dredging and Rock Removal—New York, N. Y.—Lowest bid opened March 7 by U. S. Engineer, 39 Whitehall Street, New York, for dredging and removal of rock and boulders in Staten Island Sound, N. Y., and N. J., submitted by Atlantic Gulf & Pacific Company, Park Row Building, New York, at $1.24 per cu. yd., place measurement; about 160,000 cu. yd., place measurement.

Dredging, New York, N. Y.—Two bids opened Feb. 29 by U. S. Engineer's Office, Whitehall Building, New York, for dredging in Newark Bay and Passaic River, N. J., submitted by Bowers Southern Dredging Company, Galveston, Tex., at 14.25 cts. per cu. yd., scow measurement, and 16.7 cts. place measurement, and L. T. Gaylord, Park Row Building, New York, 13.3 cts., scow measurement; about 900,000 cu. yd. scow measurement.

★Drainage—Vincennes, Ind.—Contract for Hiram Brown drainage system in lower Decker Township awarded Thomas Jacobs at $15,950.

★Breakwater — Racine, Wis. — Contract for constructing reinforced-concrete caisson breakwater and removing old timber crib pier at Racine Harbor awarded Grelling Bros. Company, Green Bay, at $47,759.

Ditches — Olivia, Minn. — Lowest bid opened March 20, by County Auditor, for constructing ditches, was submitted as follows: Ditch No. 65, Carl Christiansen, Litchfield, $17,843; No. 68, M. J. Dowling, Olivia, $10,700, and No. 33, Bullard Bros., Montevideo, $3,069 for tile work and G. E. Brown, Litchfield, $12,002 for open work.

★Ditch—St. Paul, Minn.—Contract for constructing Sand Hill Ditch in Polk County awarded by State Board of Drainage, St. Paul, to Kohler Contracting Company, Frazee, at $25,880, and includes 4 steel bridges and a road on one side of the ditch.

Irrigation—Malta, Mont.—Following are two bids opened March 25 by U. S. Reclamation Service, Malta, for Schedule I on Bowdoin Canal Milk River Irrigation Project, Mont.: L. D. Dotson, Glasgow, $9,105, and James O'Connor, Malta, $9,452. No bids received on Schedule II.

★Revetment Work—Kansas City, Mo.—Contract for 5400 ft. revetment work on Missouri River (bids opened March 23), awarded by Lieut. Col. J. F. McIndoe, Corps Engrs., U. S. A., Kansas City, to Marshall & Rust, Kansas City, at $51,570.

★Dredging—Seattle, Wash.—Contract for dredging Lake Washington Canal from Locks at the Narrows to Lake Washington also removel of dams at Portage and Fremont (bids opened March 15 by Maj. J. B. Cavanaugh, Corps Engrs., U. S. A.), awarded Standard American Dredging Company, Oakland, at $86,650. Next three lowest bidders: Puget Sound Bridge & Dredging Company, Seattle, $122,760; Cascade Contract Company, $141,570, and Erickson Construction Company, $198,915.

★Dock — Seattle, Wash. — Contract awarded Hendrickson & Company, Globe Block, for reconstructing the Colman Dock, foot of Marion Street, structure, to be three stories, faced with sheet metal, and cost $40,000. J. M. Coleman, Colman Building, Owner.

★Jetty Construction — Atsoria, Ore. — Contract awarded Robert Wakefield, Portland, by U. S. Engineer's Office, Portland, for furnishing stone for jetty construction at mouth of Nehalem River, near Astoria, at $110,000.

ELECTRIC RAILWAYS

PROPOSED WORK.

Bangor, Me.—Bangor Ry. & Electric Co. is planning repairs and improvements on lines. State Street tracks in Bangor will be replaced with heavier rails. Old Town division will have new and heavy rails. New rails will be laid through Orono and at other points along line.

Holyoke, Mass. — Preliminary survey made by Holyoke Street Ry. Co. for extension of South Hadley Falls Line.

Plymouth, Mass.—Plans being considered by Plymouth & Sandwich St. Ry. Co. to construct an extension from Fresh Pond to Sagamore Beach.

Ephrata, Pa.—Reading & Ephrata St. Ry. Co. asked Council for a franchise to construct a line on West Main Street from Reading & Columbia RR. to Church Street and on Church Avenue to borough limits. This company proposes to construct a line from Ephrata to Reading via Stevens, Denver, Reinholds Station, Galen Hall and Wernersville.

Pittsburgh, Pa.—Pittsburgh Subway Company has submitted to Council plans for subway. The company plans constructing from Point District, Liberty Avenue and Ferry Street, along Oliver Avenue to Grant Street, thence to Webster Avenue and Fullerton Street, through Herron Hill to Grant Boulevard, then out Center Avenue to East End. Cost reported estimated at $15,000,000 to $20,000,000.

Sharon, Pa.—Mahoning & Shenango Ry. & Light Co. accepted the East Side St. Ry. franchise passed by Council on March 7.

Charlotte, N. C.—Piedmont & Northern Ry. Co. will build line between Gastonio and Spartanburg; distance 40 miles.

Smithville, Tenn.—Construction work will begin next month on Nashville & Eastern Electric Ry. The road will be built from Smithville to Lebanon. C. T. Edwards, Alexandria said to be interested.

Bowling Green, Ohio.—New boilers are to be installed in power plant of Lake Erie, Bowling Green & Napoleon Ry. Co.

Fort Wayne, Ind.—Extension of city line of Fort Wayne & Northern Traction line from Wabash City to City Park and to plant of Service Motor Truck Co. planned.

Madison, Ind.—Madison Light & Ry. Co. contemplates spending $13,000 on improvements to power house.

Highland Park, Mich.—Highland Park & Royal Oak RR. Co. of Detroit incorporated to construct railroad between Highland Park and Royal Oak. Among incorporators, Burnette F. Stephenson, Robert E. Barber and others.

Harrisburg, Ill.—Reported preliminaries pertaining to construction of Southern Illinois & St. Louis Ry. to connect Harrisburg, Marion, Pittsburg, Johnson City, West Frankfort and Herrin have been completed. Construction will begin soon after April 1. W. H. Schott, Chicago, Ill., Pres.

Great Falls, Mont.—Plans being made by Great Falls Street Ry. Co. to build extensions to north and south side lines.

Joplin, Mo.—Southwest Missouri R.R. Co. of Webb City will reconstruct 3 miles of track in Joplin.

Corpus Christi, Tex.—Corpus Christi Traction Co. accepted franchise granted J. H. Caswell and will immediately construct an interurban railway from Corpus Christi to Ward Island, 8 miles. A bond issue of $100,000 will be made. A. R. Ponder received contract for construction material.

Tulsa, Okla. — Reported that Sand Springs Ry. Co. contemplates constructing extension to Pawhuska, about 40 miles.

Eugene, Ore.—Plans being considered by Oregon Electric Ry. Co. of Portland to construct an extension of lines from Eugene to Springfield.

Los Angeles, Cal.—Permit issued to Pacific Electric Company (Geo. E. Pillsbury, Ch. Engr., Los Angeles) to elevate tracks at Main Street station, including remodeling of ground floor of Pacific Building at 6th and Main Streets, to cost $166,000. Steel will be furnished by American Bridge Company.

Granger, Utah.—Plans being considered by Salt Lake & Utah R.R. Co. of Salt Lake City for construction of a line from Granger to Pleasant Green.

Ogden, Utah.—The Ogden, Logan & Idaho Ry. Co. contemplates constructing 13 miles of new roadbed and track north of Hot Springs.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Rochester, N. Y.**—Contract awarded by Rochester Ry. & Light Company to Port Richmond Iron Works, Philadelphia, Pa. (I. P. Morris Company), for two 16,000-hp. turbines of vertical shaft single runner type, to operate under a head of 130 ft. at a speed of 180 revolutions per minute. These turbines will be controlled by I. P. Morris governors.

★**Akron, Ohio.**—Contract awarded H. D. McCutcheon & Company, Shannon Building, Pittsburgh, Pa., for constructing an electric railway from Akron to Youngstown for the Akron & Youngstown Electric Ry Company.

RAILROADS

PROPOSED WORK.

Rutherford, N. J.—Reported Erie R. R. (R. C. Falconer, Supt. Constr., 50 Church Street, New York, N. Y.) has agreed to spend $50,000 to improve the grade crossings between the boroughs of Rutherford and East Rutherford.

Woodbury, N. J.—West Jersey & Seashore R. R. (T. J. Skillman, Division Engr., Camden) is having plans prepared for tunnel under tracks at Cooper Street.

Alburtis, Pa.—Reading Railroad (S. T. Wagner, Chief Engineer, Philadelphia) is considering building a 14-mile spur on east Pennsylvania Division from Alburtis to Bethlehem.

Connellsville, Pa.—Western Maryland RR. Company (H. R. Pratt, Ch. Engr., Baltimore, Md.) having preliminary plans made for construction here, including yards and sidings.

Baltimore, Md.—Surveys made for construction of railroad from Baltimore to connect Calvert with Anne Arundel County for Baltimore & Virginia R.R. Co.

Hagerstown, Md.—Reported surveys being made for engine house yards and additional trackage which Norfolk & Western Railway Company intends making.

Manhattan, Va.—Reported Dr. H. U. Stephenson of Toano is interested in the railroad which has applied to State Corporation Commission for a charter to construct a railroad from Manhattan across York River from West Point to Newport News or Norfolk.

Fairmont, W. Va.—Western Maryland R. R. (H. R. Pratt, Ch. Engr., Baltimore, Md.), it is reported, intends soon letting contract for constructing 8 miles of railroad connecting Baltimore & Ohio R. R. at Hutchinson with the three coal mines of the Consolidated Coal Company on Bingaton Creek.

Spartanburg, S. C.—Southern Ry. (B. Herman, Chief Engr., M. W. & Structures, Washington, D. C.) will double track main line between Spartanburg and Central.

Atlanta, Ga.—About $7,000,000 bonds sold by Southern Ry. Co. (B. Herman, Ch. Engr., Washington, D. C.) to relocate, regrade and double track parts of Atlanta & Charlotte Air Line, a subsidiary road.

Chillicothe, Ohio.—Plans completed by Morgan W. Shuitt, City Engineer, for subway railroad crossing at N. & W. and B. & O. R. R. tracks on East Main Street.

Cleveland, Ohio.—Reported Baltimore & Ohio R. R. (F. L. Stuart, Ch. Engr., Baltimore, Md.) will this spring construct a 6-mile branch to Willow (suburb of Cleveland) and lay out a freight yard.

Auburn, Ill.—Chicago & Illinois Midland Ry. (H. M. Hallock, Gen. Supt., Taylorville, Ill.) considering building from Auburn to Waverly, a distance of 13 miles.

Joliet, Ill.—State Public Utilities Commission has ordered the Chicago & Alton R.R. to build a bridge at Chicago Street crossing south of city limits and provide a subway for highway traffic; also ordered the Atchison, Topeka & Santa Fé R.R. (C. F. Felt, Ch. Engr., Chicago, Ill.) to construct a bridge at both Chicago Street crossing and crossing of Patterson Road and Brandon Road, and to provide a subway for highway traffic. Improvements will cost $500,000.

Reserve, Wis.—It is reported that the Minneapolis, St. Paul & Sault Ste. Marie R.R. (C. N. Kalk, Ch. Engr., Minneapolis, Minn.) will construct a cutoff from the end of the spur here to meet the Wisconsin Central at Mellen, a distance of 100 miles.

Minneapolis, Minn.—Great Northern Railroad (A. H. Hogeland, Chief Engineer, St. Paul), has tentative plans for constructing a freight terminal within the local zone of Minneapolis also contemplates the grade reduction of the northern line.

St. Paul, Minn.—Minnesota Transfer Railway Co., Theo. Simerman, Engineer, St. Paul, has had plans prepared by their engineers for the revamping of trackage at a cost of about $50,000.

Arnegard, N. D.—Surveys completed for the New Rockford-Lewistown cutoff across North Dakota and Montana; cost is reported at $1,000,000. Road will start from Arnegard, N. D., and toward New Rockford and west from Newton.

Lewistown, Mont. — Reported Great Northern Ry. Co. (A. H. Hogeland, Ch. Engr., St. Paul, Minn.) will construct Lewistown & New Rockford line, first improvement to be a 55-mile stretch between Lambert and Circle, and will extend later to Lewistown, distance of 130 miles.
Chicago, Milwaukee & St. Paul Ry. Co. (C. F. Loweth, Ch. Engr., Chicago, Ill.) is reported preparing to lay rails on 70 miles of roadbed, graded into Choteau and Agawan.

Sheridan, Wyo.—Sheridan Sugar Company reported contemplates constructing 50 miles of railroad south from Sheridan, costing $1,000,000. Surveys under way.

Little Rock, Ark.—Arkansas Central R. R. (J. H. Wright, Pres., Fort Smith) is reported taking steps to construct a line from Little Rock to Susiaco via Rock Island R. R. through Logan County.

Galveston, Tex.—Gulf, Colorado & Santa Fe Railway Company (F. Merritt, Chief Engineer, Galveston), it is reported plans improvements costing $121,267, including track laying and surfacing at a cost of $30,046, and water stations, $75,765.
In addition to above improvements it is proposed to construct a gravity reservoir at Goldthwaite, Tex., to cost $73,015.

Wallula, Wash. — Reported Oregon-Washington R. R. & Navigation Company (J. R. Holman, Ch. Engr., Portland, Ore.), will erect a 10-stall roundhouse and enlarge trackage facilities here.

Baker, Ore.—The Sumter Valley Railway (E. B. Pengra, General Manager, Baker) reported contemplates extending line 50 miles this summer into Grant County.

Portland, Ore.—Reported Portland & Oregon City Railroad (Stephen Carver, Manager, Portland) plans constructing 10 mile extension south and east from Baker's Bridge; also to complete the equipment of the line already constructed.

San José, Cal.—Construction of a 6-ft. elevation of railroad track at the Alameda and a 14-ft. street subway being considered. State Railroad Commission said to be interested. Milton Maggini, City Engineer.

Tucson, Ariz.—Empire Zinc Co. is surveying a route for an aerial tram or narrow gage railroad from Twin Buttes R.R. to San Xavier mine, a distance of 8 miles. C. T. Brown, Mgr., Tucson.

Granger, Utah.—Salt Lake & Utah R. R. (W. R. Armstrong, Gen. Mgr., Salt Lake City) has applied for a franchise to construct a road from Granger to Pleasant Green.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Pittsburgh, Pa.**—Contract awarded King Bridge Company, Cleveland, Ohio, for 800 tons of structural steel shapes for Pennsylvania line west of Pittsburgh track elevations and bridge at Cincinnati.

★**Wamsutter, Wyo.**—Contract awarded Kilpatrick Bros. & Collins of Beatrice, Neb., for grading of a branch line from Wamsutter, Wyo., to Craig, Colo., a distance of 88 miles, for the Union Pacific R. R.

PUBLIC BUILDINGS AND SCHOOLS

PROPOSED WORK.

Beverly, Mass.—City sold $25,000 bathhouse bonds. Address City Clerk.

Chicopee, Mass.—State Legislature passed bill authorizing City to issue $200,000 bonds for a new high school.
Competitive plans will be received until April 24 for proposed new high school. Address School Board.

Lee, Mass.—Plans being prepared for a high school costing $35,000. Carl Wintzbach, Sec'y Bldg. Committee.

Northampton, Mass.—Nothing will be done in the near future to erect the city hall. J. J. Kennedy, Secretary City Commissioner.

Bristol, R. I.—School costing $65,000 to be erected. B. W. Wall, Secy. Committee.

Woonsocket, R. I.—A brick two-story and basement school costing $31,000 is to be erected. Contract will be let after April 7. W. F. Fontaine, Archt., Federal Bldg., Woonsocket; G. A. Smith, Clerk Com. on Bldgs., High Street School.

Ansonia, Conn.—Fred J. Trinder, Supervisor of State Trades School, Hartford, estimates cost of establishing trade school here at $77,000, including equipment. Sum of $250,000 was given to town for this purpose.

Hartford, Conn.—Board of Finance recommends an appropriation of $250,000 for extension of the Broad St. High School; also recommends appointing of Special Committee to report further on additional high school needs.

Waterbury, Conn.—Plans being prepared by Freneny & Jackson, Waterbury, for the 3-story 200 x 200-ft. brick high school costing $300,000. J. J. Fitzgerald, Secy. Board Education.

Brooklyn, N. Y.—Erection of $500,000 Jewish Hospital contemplated on Willoughby and Tompkins Avenues. Henry J. Nurick, 830 Putnam Avenue, reported interested.

Elmira, N. Y.—A gift of $30,000 has been given to Elmira College to erect a dining hall.

Hamilton, N. Y.—Contract will soon be let for erecting the one-story stone memorial chapel at Colgate University, to cost $100,000. Harding & Seaver, Archts., Pittsfield, Mass.

Irvington, N. Y.—Plans being prepared by Henry B. Herts, 345 Fifth Avenue, New York, for proposed Isaac L. Rice Memorial Hospital to be erected here.

Olean, N. Y.—Preliminary sketches and tentative plans submitted by Pierce & Pickford, 120 Lake Street, Elmira, to Board of Education for a $60,000 vocational school and gymnasium to be erected in rear of high school.

Bayonne, N. J.—School and playground bonds for $529,000 will be sold April 18 by Board Commissioners.

Dover, N. J.—School District bonds for $125,000 will be sold April 3, by Board Education. (Wm. Otto, Dist Clk.).

Hackensack, N. J.—Frank Eurich, 127 Summit Avenue, retained to prepare plans for high school; cost approximately $185,000. Address Board of Education.

Montclair, N. J.—Board of School Estimate approved $245,000 bond issue for school improvements. Address Board of Education.

Plainfield, N. J.—Bill has passed the Assembly authorizing city to borrow $150,000 bonds for erecting a new city hall.

Ridgewood, N. J.—Plans being prepared by Tracy & Swartwout, 244 Fifth Avenue, New York, N. Y., for three-story brick school and auditorium to be erected on Ridgewood Road; cost approximately $225,000. Hadley Ford, Secretary and Clerk, Board of Education.

Ventnor, N. J.—Plans being prepared for new grammar school to cost $100,000. Address Board of Education.

Washington, N. J.—Citizens voted in favor of $43,000 bonds to remodel and enlarge present school on Taylor Street. Address Board of Education.

West Orange, N. J.—Citizens March 21 voted $100,00 bonds for erecting addition to Hazel Avenue School in First Ward and purchase of site and erection of new school in Fifth Ward. Arthur Dillon, 3 West Twenty-ninth Street, New York, is preparing plans for said improvements. T. H. Powers Farr, President Board of Education.

Birdsboro, Pa.—Election to be held April 25 to vote $50,000 bonds for erecting school.

Butler, Pa.—No bids opened March 25 by Board of Education for erecting 3-story 200 x 280-ft. brick school. Contract will not be let before May or June. W. G. Eckles, Archt., New Castle.

Cresson, Pa.—Contract will be let about May or June by State Health Department, Harrisburg, for erecting 3-story $50,000 nurses' home at Cresson Sanitarium.

Dunlo, Pa.—Contract to be let for erecting 10-room fireproof school. Address Board of Education.

Elwood City, Pa.—School Board considering plans for erecting two-story brick school; cost about $50,000.

Kittanning, Pa.—Erection of new court house and remodeling jail under consideration. Address County Clerk.

Northampton, Pa.—Northampton Heights School Board considering plans for erecting new $50,000 high school.

Ogontz, Pa.—Plans prepared by Horace Trumbauer, Land Title Building, Philadelphia, for new school.

Pittsburgh, Pa.—Plans being prepared by S. F. Heckert, Bessemer Building, for three-story, 125 x 140 ft., brick and terra cotta laboratory for St. Francis Hospital, Forty-fifth Street; cost $50,000.
Edward F. Stotz, Monongahela Bank Building, is architect for three-story, brick, stone and terra cotta addition for Mercy Hospital; estimated cost about $50,000.

Shenandoah, Pa.—Plans prepared by Austin L. Reilly, Bennett Building, Wilkes-Barre, approved by Board of Education for proposed high school.

Trevorton, Pa.—Citizens voted $75,000 bonds for new school. Address Board of Education.

Tyrone, Pa.—Julian Millard, Altoona, preparing plans for $90,000 high school. Address Board of Education.

West Chester, Pa.—School Board voted to rebuild and enlarge Biddle Street School; cost about $50,000. J. George Becht, Secretary State Board of Education.

Wilkes-Barre, Pa.—Contract will be let about May 1 for erecting new Horner School; cost about $300,000. Boyd & Ingham, Archts., Vandergrift Building, Pittsburgh.

Yardley, Pa.—Citizens March 15 voted $30,000 bonds proceeds to be used to replace school recently destroyed by fire.

Wilkinsburg, Pa.—Contract soon to be let by Board of Education for erecting new school to replace Horner School recently destroyed by fire. Citizens authorized a $250,000 bond issue for this purpose. Boyd & Ingham, Archts., Vandergrift Bldg., Pittsburgh.

Newark, Del.—Contract will be let about April 1 for two 3-story and basement, stone and brick buildings to be erected at Delaware College. Day & Klauder, Archts., 925 Chestnut Street, Philadelphia, Pa.

Petersburg, Va.—Sum of $200,000 has been appropriated for school improvements, $140,000 to be used in erecting new high school and $60,000 for addition to grammar schools.

Fort Spring, W. Va.—Citizens voted $60,000 bonds to erect additional high school, to relieve congestion in the Walnut Hills High School.

Jacksonburg, W. Va.—Grant District Board of Education, New Martinsville, contemplates erecting three schools, costing $25,000 each at Smithfield and Jacksonburg.

Asheville, N. C.—City officials considering erection of high school; probable cost $150,000. Address the Mayor.

Belmont, N. C.—J. M. McMichael, of Charlotte, engaged to prepare plans for $25,000 school to be erected here.

Columbia, S. C.—The Supreme Court upheld action of State Legislature appropriating $100,000 for continuing the improvements at the State Hospital for Insane.

Cocoa, Fla.—Citizens voted $50,000 bonds for erecting high school in District No. 2, Brevard County. Address Clerk School Board.

Lake Charles, La.—School Board accepted plans prepared by Nolen & Torre, New Orleans, for three-story brick and terar cotta high school; cost about $126,000.

Mansfield, La.—Contract to be let about May 15 for erecting 2 brick schools costing a total of $38,000. Edward F. Neill, Archt., Shreveport; G. O. Housten, Secy. School Board.

New Orleans, La.—Sum of $200,000 has been given to City by Mrs. John Dibert for erecting Tuberculosis Hospital.

Pineville, La.—Baptist Men's Convention at Alexandria voted to erect a $25,000 boys' dormitory for Louisiana College.

Columbus, Miss.—City Council authorized issue of $50,000 high school bonds. Address Board of Education.

Tullahoma, Tenn.—Reported Ludlow & Peabody of New York engaged with H. C. Gibbs of Nashville, Local Manager, to prepare plans for proposed Vocational School for Girls to be erected near Tullahoma; $30,000 available.

Bryan, Ohio.—Contract will be let in May for erecting a 2-story 10-room school, including auditorium and gymnasium, and costing $95,000. William H. Nicklas, Archt., 1900 Euclid Avenue, Cleveland. Address Clerk of School Board.

Cleveland, Ohio.—Lamar T. Beman, Director of Public Welfare, has recommended to the Mayor that an election be held in August to vote $200,000 bonds for erecting additions to city tuberculosis sanitarium.

Walker & Weeks, 1900 Euclid Avenue, Cleveland, are architects for the grade and high school which the Board of Education of Cleveland Heights contemplates erecting, probably on Coventry Road and Euclid Heights.

East Liverpool, Ohio.—Reported steps being taken to erect municipal market house, city hall and fire station. Address City Clerk.

New Vienna, Ohio.—Weber, Werner & Atkins, Mercantile Library Building, Cincinnati, engaged to prepare plans for a school to cost $25,000.

Portsmouth, Ohio.—At election March 18 citizens voted $25,000 bonds for erecting centralized school in Sciotoville School District. Beecher Halstead, Secy. School Board.

Van Buren, Ohio.—Citizens voted to issue $45,000 bonds for erecting 2-story brick school. McLaughlin & Hulsken, Archts., Lima; George W. Connell, Clerk Board Education Allen Township, Van Buren.

Wheelersburg, Ohio.—V. T. Ritter, of Huntington, W. Va., engaged to prepare plans for $40,000 high school.

Youngstown, Ohio.—Board of Education sold $160,000 school bonds.

Huntington, Ind.—County Commissioners will erect a new county hospital costing $40,000. Address County Clerk.

Indianapolis, Ind. — Reported County Commissioners will let contract about May 1 for erecting proposed Tuberculosis Hospital; appropriation $80,000.

County Commissioners sold $50,000 Children's Guardian Home bonds and $80,000 Tuberculosis Hospital bonds.

South Bend, Ind.—Contract will be let about June 1 for erecting a brick and stone one-story 184 x 288 ft. school to cost $75,000. Address Superintendent of Schools. Freyermuth & Maurer, Archts., Warner Building.

Northville, Mich.—Contract will be let in April for erecting school costing $55,000, for which citizens March 21 voted in favor. Charles A. Dolph, Secy. Board Education.

Bement, Ill. — Citizens voted $55,000 bonds for erecting high school. William H. Steel, Secy. School Board.

Elgin, Ill.—County Board of Supervisors considering erecting a tuberculosis hospital costing $30,000.

Mendota, Ill.—Citizens voted to issue bonds for erecting school. G. C. Miller, Tower Building, Chicago, Archt.; C. P. Matdner, Secy. School Board.

Urbana, Ill.—Trustees University of Illinois approved plans for college of music to cost approximately $150,000. Other buildings contemplated include women's residence, hall, library building, and college of horticulture; aggregate cost about $350,000.

Antigo, Wis.—A two-story brick high school costing $80,000 is to be erected. Address Secretary Board of Education.

Independence, Iowa. — Citizens voted $25,000 bonds to erect city hall, for which plans have been accepted. Address City Clerk.

Urbana, Iowa.—Citizens voted $25,000 bonds to erect new school. W. Horn, President School Board.

West Liberty, Iowa.—Citizens voted $75,000 bonds to replace high school destroyed by fire. Plans are being prepared by Proudfoot, Bird & Rawson, Hubbell Building, Des Moines.

Duluth, Minn.—Shurick & Hanson, Torrey Building, are preparing plans for a $50,000 hospital for Lakeview Hospital corporation.

South St. Paul, Minn.—School Board is planning erecting '$25,000 school on site of Roosevelt School.

Thief River Falls, Minn.—Election soon to be held to vote $50,000 bonds for erecting addition to high school and for school improvements.

Waldorf, Minn.—Contract will be let about May by Board Education for erecting brick and stone school, costing, with equipment, $30,000. / Raymond Doyle; Waldorf, Clerk; F. W. Kinney, Archt., Plymouth Bldg., Minneapolis.

Lincoln, Neb.—Tentative plans being prepared by Berlinghoff & Davis, S. M. L. Building, for proposed ten-story court house; estimated cost about $250,000. Address County Clerk.

Oakland, Neb.—Citizens March 14 voted $48,000 bonds to erect new high school. Address School Board.

Webster, S. D.—Erection of a school costing about $65,000 under consideration. Address Clerk School Board.

Bismarck, N. D.—Election to be held to vote $40,000 bonds for erecting a school.

Carthage, Mo.—Citizens voted $90,000 bonds for erecting 2 ward schools. N. Johnson, Secy. Board of Education.

Carthage, Mo.—Citizens voted $90,000 bonds to erect two new schools. Address Secretary, Board of Education.

Joplin, Mo.—Smith, Rea & Lovitt, Finance Building, Kansas City, engaged to prepare plans for the High School. J. A. Becker, Pres. Board Education.

Moberly, Mo.—Two new schools and an addition to high school costing $100,000 are to be erected. No architect selected yet.

St. Louis, Mo.—Board of Education approved recommendation of Committee on Finance to erect a 22-room school to replace present Bates School at Spring Avenue and North Market Street; probable cost, $200,000.

Erection of new Mullanphy Hospital contemplated. Rev. James M. Sullivan, resident adviser and chaplain for the Sisters of Charity of St. Vincent de Paul may be able to give further information.

Pine Bluff, Ark.—City contemplates erecting a $50,000 library.

Bellville, Tex.—State Attorney General at Austin approved issue of $40,000 school bonds.

Fort Stockton, Tex.—School bonds for $50,000 will be sold April 8 by Board Trustees in and for Common School Dist. No. 1 (Howell Johnson, Co. Judge and Ex-Officio Supt. of Schools).

Lamesa, Tex.—Attorney General has approved the $43,000 Dawson County court house bonds.

Henryetta, Okla.—Citizens voted $40,000 school bonds. Address Clerk School Board.

Norman, Okla.—Citizens March 21 voted $40,000 bonds to erect school. Layton & Smith, Archts., Oklahoma. Charles S. Standley, Secy. Board Education.

Okmulgee, Okla.—Citizens March 14 voted $125,000 bonds to erect court house. Address County Clerk.

Spokane, Wash.—School Board considering following school improvements: Junior High School for Girls, $200,000; Junior High School for Boys, $200,000; addition to David Bemis School, $25,000; Adams School addition, $20,000; Lowell School addition, $20,000; Jefferson School addition, $25,000; Holmes School addition, $20,000; Frances Willard School addition, $30,000; North Central High School addition, $100,000; Lewis and Clark High School gymnasium, $50,000. E. A. Thomas, Clerk School Board.

Alameda, Cal.—Carl Werner and C. J. Rogers of Alameda are associate architects for proposed $110,000 Porter School. James Shanly, President of School Board and Chairman of Buildings and Grounds Committee.

Los Angeles, Cal.—Contract to be let in April by Board of Supervisors for erecting brick and concrete additions to psychopathic ward and dining room at county hospital to cost $25,000. George Low, County Architect.

Board of Education considering plans for schools to be erected in new industrial townsite, Torrance. Buildings costing $150,000 will be necessary and the first structure will cost $50,000.

Santa Ana, Cal.—Election to be held April 18 to vote $60,000 bonds for erecting an auditorium and $40,000 for a school on West Fifth Street. Address Clerk School Board.

Victorville, Cal.—High school bonds for $30,000 to be sold by Union High School District.

Thatcher, Ariz.—Plans for grammar school to be prepared by Lescher & Kibbey, Phoenix; cost $32,000.

Coeur d'Alene, Idaho.—Reported election will probably be held about April 15 to vote $55,000 bonds to erect new school Address School Board.

Sarnia, Ont.—School Board planning to erect new central school on present site of Lochiel Street School; cost $50,000.

BIDS DESIRED.

Lockport, N. Y.—Until April 11 by Board Education (Emmet Belnap, Clk.) for enlarging and improving the Lockport Union High School, including an auditorium. Probable cost $30,000. Separate bids for heating, ventilating, electric wiring, etc. William Neil Smith, Archt., 101 Park Avenue, New York City.

Camden, N. J.—Reported desired until April 5, by W. T. Bleakley, Secy. Board Education, for erecting 2-story and basement 166 x 261 ft. high school. Paul A. Davies, 3d, Archt., 1713 Sansom Street, Philadelphia, Pa.

Hyndman, Pa.—Until April 7, by M. H. Kramer, Secy. School Board, for erecting High School.

Hazelton, Pa.—Until about April 3 by D. T. Evans, Secy. Board Education, for erecting a 3-story reinforced concrete school to cost $100,000. E. E. Jereloman, Archt., 457 Franklin Street, Buffalo, N. Y.

Wilcox, Pa.—Until April 12, by Board Directors of Jones Township School District for erecting a high school. Hersch & Hersch, Archts., Central Trust Bldg., Altoona.

Danville, Va.—Until April 10, by School Board, for erecting a brick and terra cotta high school cost $30,000. Pritchett & Henderson, Archts., Dudley Bldg., Danville.

Savannah, Ga.—Later official reports state until April 12 by Auditorium Commission (W. J. Pierpont, Chmn.) for erecting municipal auditorium. Separate bids for heating, ventilating, etc. Henrik Wallin, Archt., 23 Abercorn Street.

Panama City, Fla.—Until April 15, by Board Public Instruction at office of F. A. Hathaway, Supt., 415 Masonic Temple, Jacksonville, for erecting a brick school at Panama Park. Separate bids for heating, plumbing, etc. H. J. Klutho, Archt., Jacksonville.

Bristolville, Ohio.—Until April 15 by R. B. Brockett, Clk. Board of Education, for furnishing material and erecting a fireproof school. Separate bids for heating, ventilating, plumbing, etc.

Fort Jennings, Ohio.—Until April 18, by Building Committee of Jenkins Memorial Hall, at office of Ferd. Heising, Township Clk., for furnishing material and erecting town hall. Separate bids for heating, ventilating, etc. W. B. Helmkamp, Archt., 904 Elmore Avenue, Akron.

Highland, Ohio.—Reported desired until April 14, by Board Education, for erecting 2-story and basement centralized school. Matheny, Allen & Mounta, Archts., Huntington National Bank Bldg., Columbus.

Lebanon, Ohio.—Until April 24, by Infirmary Building Commission (J. A. Runyan, Chairman), for furnishing material and erecting county infirmary building. Weber, Werner & Adkins, Archts., 1206-1207 Mercantile Library Building, Cincinnati.

Niles, Ohio.—Until April 20 (readvertisement) for erecting two fireproof schools. All bids opened March 23 rejected. Charles F. Schout, Clerk Board Education.

Strongsville, Ohio.—Until April 29, by R. Gibson, Clk. Board Education, for furnishing material and erecting addition to school on Wooster Pike. Prices for labor and material must be stated separately. W. I. Pepper, Archt., 1439 Winchester Avenue, Lakewood.

Warren, Ohio.—Until April 18, by O. W. Abbey, Clerk Board Education, for erecting fireproof school. Separate bids for heating, plumbing and ventilating. Robt. J. Keith, Archt., 409 Western Reserve Bank Building.

Westchester, Ohio.—Reported desired until April 6, by Board Education (O. C. J. Chamberlain, Pres.), for erecting centralized school, two story, 67 x 84 ft.; probable cost, $35,000.

Windfall, Ind.—Until April 6, by Trustees Wildcat Township, for furnishing material and erecting high school. Clarence Martindale, Archt., 1200 Fletcher Trust Bldg., Indianapolis.

Ann Arbor, Mich.—Reported desired until April 5, by Jas. Marks, Supt. Bldgs., for remodeling gymnasium of University of Michigan; probable cost, $35,000.

Springfield, Ill.—Until April 14, by State Board Live Stock Commissioners, for furnishing material and erecting power house, including boilers and equipment rendering and tankage. Separate bids for addition to hog sheds at laboratory grounds, near Springfield. Also separate bids for heating, plumbing, electric wiring. J. B. Dibelka, State Archt., 130 North Fifth Street, Chicago.

Cadott, Wis.—Reported desired until April 6, by R. B. Cunningham, Clk. Board Education, for erecting 2-story and basement, 64 x 94 ft. high, and grade school. Volkman & Hancock, Archts., 106½ Grand Avenue, Eau Claire.

Atlantic, Iowa.—Reported desired until April 3, by T. E. Nichols, City Clk., for erecting city hall; probable cost, $25,000. J. P. Luth, Archt., 516 Paxton Bldg., Omaha, Neb.

Audubon, Iowa.—Reported desired until April 11, by School Board (L. A. McGinnis, Secy.), for erecting high school. Proudfoot, Bird & Rawson, Archts., Des Moines.

Boone, Iowa.—Until April 14, by Board County Supervisors, for erecting court house, heating plant, electrical work, etc. Norman T. Vorse, Archt., S. & L. Bldg., Des Moines. J. R. Curry, Co. Aud.

Carpenter, Iowa.—Until April 20, by C. H. Thompson, Secy. School Board, for erecting a school. Separate bids for heating, plumbing, electrical work, etc. G. L. Lockhart, Archt., Endicott Bldg., St. Paul, Minn.

Forest City, Iowa.—Until April 20, by Board Education of Independent School Dist. (J. A. Peters, Secy.), for remodeling school, including heating, ventilating, etc. W. L. Alban, Archt., 347-351 Endicott Building, St. Paul, Minn.

Sheldon, Iowa.—Until April 14, by F. W. Bloxham, Secy. School Board Independent School Dist., for erecting a high and grade school, cost $80,000. Separate bids for heating, plumbing, electrical work, etc. G. L. Lockhart, Archt., Endicott Bldg., St. Paul, Minn.

Swaledale, Iowa.—Reported desired until April 3, by Consolidated School Dist. (L. E. Jenkins, Pres.), for erecting 2-story and basement school; probable cost, $35,000. Chas. A. Dieman, Co. Archt., 405 Granby Bldg., Cedar Rapids.

Clontarf, Minn.—Until April 17, by T. E. Foley, Clerk Board Education, for erecting new consolidated school. Separate bids for heating, plumbing, electrical work, etc. W. L. Alban, Archt., 347 Endicott Building, St. Paul.

Faribault, Minn.—Until April 11, by State Board Control at St. Paul, for alterations and improvements to center section of main building State School for Blind, including ventilating, heating, plumbing, etc. C. H. Johnston, Archt., 715 Capital Bank Building, St. Paul.

Margie, Minn.—Until April 18, by Board Education (D. B. Jewell, Clerk), for furnishing material for erecting a consolidated school, including heating, ventilating, etc. W. P. Allred, Jr., Archt., Duluth.

Muscotah, Kan.—Reported desired until April 5, by Board Education (R. A. Allison, Secy.), for erecting 2-story and basement 63 x 73 ft. grade and high school; probable cost, $20,000. W. H. Sayler, Archt., 606 Gumble Bldg., Kansas City, Mo.

Lincoln, Neb.—Until April 10, by Trustees of University of Nebraska, for erecting a 2-story and basement brick fireproof agricultural and engineering building at the University costing $140,000. Coolidge & Hodgdon, Archts., Chicago, Ill.; C. E. Chowins, Superintendent of Construction.

Red Cloud, Neb.—Until April 4, by School Board Dist. No. 2, Webster County, for furnishing material and erecting a high school. Separate bids for heating, ventilating, etc. R. A. Bradley & Co., Archts., Exchange National Bank Bldg., Hastings.

Devil's Lake, N. D.—Until April 11, by A. E. Parshall, Secy. Board Educa., for erecting brick and stone high school, costing $35,000. John Marshall, Archt., Devil's Lake.

Clark, S. D.—Reported desired until April 10, by Board Education, Clark Independent School Dist. No. 15 (W. M. Arpin, Clk.), for erecting a two-story brick school. Separate bids for plumbing, ventilating, etc. U. L. Freed, Archt., Watertown, S. D.

College Station, Tex.—Until April 10, by Board Directors Agricultural & Mechanical College (Dr. W. B. Bizzell, Pres.), for erecting a fireproof stock judging pavilion at College Station.

Portland, Ore.—Reported desired until April 6, by F. A. Naramore, Supt. School Properties, for erecting Franklin High School; probable cost $125,000.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Syracuse, N. Y.**—Contract for cut stone for four-story and basement Agricultural College to be erected at Syracuse University awarded to Patten Cut Stone Company, of Niagara Falls, at about $68,000. This building complete will cost $350,000. Prof. Earl Hollenbeck, Archt., Syracuse University.

★**Pittsburgh, Pa.**—Contracts awarded by State Armory Board, Harrisburg (bids opened March 13), for erecting Artillery Armory on Emerson Street as follows: General contract, Ley Construction Co., Park Building, $75,727; plumbing, W. N. Sauer Co., 804 Chestnut Street, $3,295; heating, Moss & Blakeley, Climax and Beltzhoover Avenues, $2,588; electrical work, Carter Electrical Co., Oliver Building, $2,400.

★**Schuylkill Haven, Pa.**—Contract for erecting school awarded Beard Construction Company, Reading, at $54,000.

★**Industrial, W. Va.**—Contract for erecting school building at West Virginia Industrial Home for Girls awarded Longest & Tessier Company, of Greensboro, N. C., at about $41,000.

★**Okeechobee, Fla.**—Contract awarded Hanner Brothers, of Orlando, for erecting $40,000 school. T. H. Tremble, Archt., Fellsmere.

★**Jackson, Miss.**—Contract for erecting school on North State Street awarded Stark & Cox, Jackson, at $22,500.

★**Clarksville, Tenn.**—Contract for erecting addition to High School awarded D. M. Crawford Co., Memphis, at $30,996; heating, ventilating and plumbing, to Noble Plumbing & Heating Co., Princeton, Ind., at $5,000.

★**Alliance, Ohio.**—Contract for erecting addition to South Lincoln Avenue School awarded Willing Brothers, of Bellevue, at $37,932.

★**Lorain, Ohio.**—Contract for erecting three-story addition to St. Joseph's Hospital awarded A. J. Leighton, Lorain, at $54,999. H. E. Ford, Archt., Lorain.

North Olmstead, Ohio.—Lowest bid opened March 24 by Board of Education (A. C. Reed, Clk.) for repairing Coe Ridge School submitted by F. L. Fuller & Company, Cleveland, at $35,018.

Dixon, Ill.—Lowest bid opened recently by State Board of Administration, Springfield, for erecting two kitchens at State Epileptic Colony submitted by W. M. Allen & Co., Peoria, at $55,467.

Charles City, Iowa.—Lowest bid opened March 17 by Supervising Architect, Washington, D. C., for constructing U. S. post office submitted by A. W. Lane, 19 South La Salle Street, Chicago, Ill., at $46,362 for limestone and from Charles Weitz's Sons, Des Moines, at $48,000 in sandstone.

★**Holstein, Iowa.**—Contract for erecting high school (bids opened March 21) awarded L. W. Dumas Construction Company, Columbia, Mo., at $42,691. F. N. Watta, Secy. Board Education.

★**Hays, Kan.**—Contract for erecting 3-story stone administration building at State Normal School (bids opened March 10) awarded to Sharp Brothers, Eldorado.

★**Seattle, Wash.**—Following are four lowest bids opened March 15 by School Board (Reuben W. Jones, Secy.) for erecting two-story, 8-room, brick, 61 x 209 ft. addition to Lowell School at Federal Avenue and Mercer Street: W. B. Lance, Northern Bank Building, $56,000 (awarded contract); Henrickson & Co., Globe Building, $59,000; H. Brandt, 2327 Fifth Avenue North, $68,850; Kiehl & Whipple, Central Building, $69,224.

Tacoma, Wash.—Following are four lowest bids opened March 22 by School Board for erecting two-story reinforced gymnasium at Stadium High School: Joe Hanson, 3210 North Sixteenth Street, $62,865; O. L. Tuell, Tacoma, $64,800; Bachelor & Gutel, Tacoma, $74,663; Far West Construction Company, Tacoma, $77,537. Heath & Gove, Archts., National Realty Building.

Los Angeles, Cal.—Following are four lowest bids opened March 16 by Board of Education for erecting 4-story reinforced-concrete and brick high school: Barber Bradley Construction Company, 1824 E. 15th Street, $353,240; Los Angeles Planing Mill Company, 1812 Industrial Building, $358,504; L. A. Atkinson, Story Building, $564,000; W. C. Crowell, Chamber of Commerce Building, Pasadena, $372,130. Lowest for heating: Western Heating Company, 517 Union League Building, $28,628. John C. Austin, Archt., Baker Detwiler Bldg.

Following are four lowest bids opened recently by Board of Education for erecting the 2-story brick-and-concrete school on Temple Street: G. C. Condon, Wesley Roberts Bldg., $28,576 (awarded contract); Barber Bradley Construction Company, 1824 E. 15th St., $30,790; M. S. Yesberg, 1650 Morton Avenue, $31,795, and G. Hanson, 1414 S. Vermont Avenue, $31,089.

San Bernardino, Cal.—Following are four lowest bids opened March 20 by the Board of Supervisors for erecting three-story brick and concrete county hospital: George M. Easton, 436 West Thirtieth Street, Los Angeles, $91,800; William C. Crowell, Chamber of Commerce Building, Pasadena, $97,720; Cresmer Mfg. Co., Riverside, $101,300; C. M. McNeill, Santa Ana, $103,960. Lyman C. Farwell, Archt., 615 Story Building, Los Angeles.

PRIVATE BUILDINGS

PROPOSED WORK.

Providence, R. I.—Providence Telephone Company, 112 Union Street, intends erecting an exchange on Washington Street to cost with equipment $1,000,000.

Brooklyn, N. Y.—Plans prepared by Parfitt Brothers, 26 Court Street, for Greek Orthodox Church of St. Constantine to be erected at 64 Schermerhorn Street of brick, terra cotta and limestone construction.

Plans filed for two 4-story apartment houses to be erected on Eighty-seventh Street and Fourth Avenue for Thomas P. Flanagan; total cost $80,0000. Shampan & Shampan, Archts., 772 Broadway.

Plans completed by Gronenberg & Leuchtag, 303 Fifth Avenue, New York, for three 4-story and basement apartment houses to be erected on Union Street and Schenectady Avenue for M. Solomon & Son; total cost $140,000.

Cooperstown, N. Y.—Orphanage of the Holy Savior contemplates erecting at Beaver and Pioneer Streets a school, to cost about $150,000.

New York, N. Y.—Plans filed for erecting following buildings: Twelve-story fireproof hotel on Ninety-fourth Street and Broadway for Broadway-Ninety-fourth Street Realty Company, Inc.; cost $400,000; Schwartz & Gross and B. N. Marcus, 347 Fifth Avenue, Assoc, Archts. Six-story fireproof store and loft building at 16 West Sixtieth Street, for Cooper Realty Company; cost $100,000; Sommerfeld & Steckler, Archts., 31 Union Square. Five-story brick tenement on Southern Boulevard and 176th Street, for J. H. M. Company, Inc.; cost $65,000; Goldner & Goldberg, Archts., 391 East 149th Street. Five-story brick tenement at Davidson and Burnside Avenues for Charles M. Rosenthal; cost $125,000; Gronenberg & Leuchtag, Archts., 303 Fifth Avenue. Five-story brick tenement at 170th Street and Ogden Avenue for Avoca Realty Company; cost $70,000. Two-story brick store and office building on Creston Avenue and Fordham Road for Level Realty Company; cost $75,000; William Koppe, Archt., 830 Westchester Avenue.

Plans being prepared by M. Del Gaudio, Tremont and Webster Avenues, for a church edifice to be erected on 138th Street and Lenox Avenue for Metropolitan Baptist Church; estimated cost $100,000. Rev. W. W. Brown, Pastor.

Rochester, N. Y.—Knights of Columbus planning to erect new building; probable cost $150,000.

Schenectady, N. Y.—Tentative plans prepared by Edward J. Atkinson, 434 State Street, for a $25,000 edifice to be erected for Broadway Methodist Episcocal Church. Rev. H. C. Pettey, Pastor.

Atlantic City, N. J.—Traymore Hotel Company (D. J. White, Pres.), Illinois Avenue, will erect a $2,000,000 building on site of old Windsor Hotel.

Elizabeth, N. J.—St. Mary's Roman Catholic Church contemplates erecting brick parochial school at 152 Race Street to cost about $100,000. Architect not yet selected. Rev. Francis O'Neil, Pastor.

Newark, N. J.—Plans completed for two-story depot to be erected on Broad Street for Central Railroad of New Jersey (J. O. Osgood, Ch. Engr., New York).

Plans completed by Louis Scisorek, 801 Union Building, for four-story brick apartment building to be erected for Barney Chinich and Joseph Densky at 93 Spruce Street; estimated cost about $35,000.

Easton, Pa.—Harry G. Seip, proprietor of Seip's Café, on South Third Street, intends erecting ten-story hotel on site adjoining café.

Philadelphia, Pa.—Plans being prepared by Walter Thomas Mayo, 1701 Chestnut Street, for four-story, brick, terra cotta and stone, 27 x 120 ft., apartment house, with two wings, each 40 x 100 ft., to be erected in Germantown.

Plans prepared by George E. Savage, Witherspoon Building, for a granite church which Ninth Presbyterian Church will erect as a memorial to John D. T. Liggett, with $50,000 donated by Craig N. Liggett.

Pittsburgh, Pa.—Reported Baltimore & Ohio R.R. Co. (F. L. Stuart, Ch. Engr., Baltimore, Md.) intends erecting $100,000 passenger station on Seventh and Ninth Streets.

Sharon, Pa.—Preliminary plans being prepared by E. E. Clepper, Sharon, for four-story and basement steel and concrete business building.

Baltimore, Md.—Plans prepared by Otto G. Simonson, Maryland Casualty Building, for Southern Hotel, to be erected at Light and German Streets and cost $1,250,000.

Atlanta, Ga.—C. E. Frazier, Candler Building, is architect for four-story and two basements nurses' home which A. W. Farlinger will erect at Scott and Alexander Streets to be leased to Atlanta Registered Nurses' Club; cost about $50,000.

J. R. Smith, 130 Peachtree Street, will erect three-story, concrete and brick, commercial building on Walton and Bartow Streets; cost $40,000.

Cartersville, Ga.—Contract soon to be let for erecting a three and one-half-story and basement, brick and terra cotta, bank building at Main aind Edwin Streets for Bank of Cartersville; cost $40,000. Ten Eyck Brown, Archt., Forsyth Building, Atlanta.

Macon, Ga.—Union Dry Goods Co. (W. J. Juhan, Pres.), Macon, intends erecting on Cherry Street a fireproof department store, to cost $150,000.

Marianna, Fla.—Reported First Baptist Church, recently destroyed by fire, will be rebuilt on new site on Green Street; probable cost $40,000.

Akron, Ohio.—Loyal Order of Moose planning erecting a $200,000 lodge building.

Cincinnati, Ohio.—Garber & Woodward, 2803 Union Central Bldg., preparing plans for a 5-story addition to Anna Louis Inn; cost, $100,000.

Erection of a $250,000 building for Catholic Young Men's Association contemplated. Rev. Henry Moeller, Archbishop of Cincinnati, may be able to give information.
mation.

Cleveland, Ohio. — Packard Cleveland Motor Car Co., 1900 East Nineteenth Street, planning erecting addition to garage on Prospect Avenue and East Twenty-first Street to cost $100,000.

Freeman & Gutentag, Park Building, is planning erecting a store and apartment house at Superior and Euclid Avenues to cost $100,000.

Investment Securities Co. (John J. Wood, Pres.), 221 Rockefeller Building, is planning erecting a store and apartment building at Superior Avenue and East 116th Street, to cost $35,000.

Columbus, O.—Plans being prepared by Richards, McCarty & Bulford, Hartman Building, for a $60,000 business building to be erected on East Broad Street for Miss Lina Hoster.

Lorain, Ohio.—A committee has been appointed to select site for new Eagles Lodge building.

Mansfield, O.—Masons planning to erect a four- or five-story Temple on West Third Street to cost $150,000.

Portsmouth, Ohio.—E. E. Pruitt, Hartman Building, Columbus, is architect for proposed Fourth Street Methodist Church; cost $40,000.

Wellsville, Ohio.—Plans being prepared by E. E. Pruitt, Hartman Building, Columbus, for a $70,000 church to be erected here.

Xenia, Ohio.—Tentative plans prepared for three-story, brick and stone Masonic Temple contemplated to cost about $40,000.

Bedford, Ind.—Elks will erect new $40,000 stone lodge building.

Cambridge City, Ind.—Directors of First National Bank, Main Street, decided to erect three-story bank and office building on present site.

Gary, Ind.—Leo E. Detsch, Gary, will erect a 2-story business and flat building on S. Broadway, costing $100,000.

Warsaw, Ind.—Reported Widaman & McDonald Company, Warsaw, intends erecting a motion-picture theatre, interurban freight and passenger station, and a new storeroom at a cost of $50,000.

Detroit, Mich.—Plans being prepared by Albert Kahn, 58 Lafayette Avenue, for 18-story fireproof office building which James Couzens, president of the Highland Park State Bank of Detroit, intends erecting at West Fort and Shelby Streets, to be known as the Finance Building.

Aurora, Ill.—Eugene Malmer, Aurora, is architect for improving and enlarging First Presbyterian Church, Fox and Fourth Streets, at cost of $22,000.

Chicago, Ill.—Samuel N. Crowen, 30 North La Salle Street, is architect for ten-story building to be erected at Lake Shore Drive and Ohio Street for Bowes Realty Company; cost about $350,000.

A $50,000 bank, store and office building is to be erected at Ashland Avenue and Fifty-first Street for Southwest Merchants' State Bank, 5105 South Ashland Avenue.

Plans prepared by C. W. and George L. Rapp, 69 West Washington Street, for a combined hotel and theater building contemplated at Lawrence Avenue and Broadway; cost approximately $900,000. Mort H. Singer, 125 North Clark Street, reported interested.

Permit granted to Baltimore & Ohio C. T. Ry. (F. L. Stuart, Ch. Engr., Baltimore, Md.) to construct a $40,000 roundhouse at 14th Street, near Chicago River.

Reported Division 241 of the Amalgamated Association of Street Railway Employees (William Quinlan, President), 138 N. La Salle Street, planning erecting six-story building at Ashland Boulevard and Van Buren Street; probable cost $150,000.

Madison, Wis.—The Madison General Hospital Association (C. B. Livingston, Manager) plans erecting this year a wing and in 1917 or 1918 a nurses' home and laundry building as an addition to present hospital both buildings to be 4-story tile, brick and concrete. Claude & Starke and Alvan E. Small, both of Madison, Assoc. Archts.

Hutchinson, Minn.—Silas Jacobson, Capital Bank Building, St. Paul, Archt. for hotel for Jordenson Bros., Hutchinson; probable cost $40,000.

Minneapolis, Minn.—Joseph A. Toms, 1720 Clinton Avenue, will erect a 3-story brick apartment house at Fifteenth Street and Third Avenue S., to cost $40,000.

Cataract Lodge, No. 2, A. F. and A. M., reported considering erecting a lodge hall and business building at 20 University Avenue S. E., to cost $100,000. W. H. J. Pearce, Lodge Secretary.

Minneota, Minn.—Contract will be let about April 1 by W. L. Alban, 347 Endicott Street, St. Paul, for erecting bank building for Merchants & Farmers National Bank; cost $30,000.

Red Wing, Minn.—Plans being prepared by A. F. Gauger, St. Paul, for a building to be erected by Goodhue County Co-operative Co., to cost $35,000.

St. Paul, Minn.—The Linnea Society of the twin cities will erect at Langdors Avenue and Gibbs Street a home for Aged Swedish people and girls, to cost $50,000.

Dale Bldg. Co., 16 South Street, will erect a 3-story brick apartment house on Dale and Grand Streets.

Plans prepared by Charles A. Pear, 509 Pittsburgh Building, approved by Loyal Order of Moose for four-story and basement lodge building.

Columbia, Mo. — L. W. Dumas, Jr., Construction Company, Columbia, will erect a 5-story hotel, 90 x 113 ft. N. Torbitt, Archt., 1002 Landers Bldg., Springfield.

St. Louis, Mo.—Albert B. Grovea, 314 North Fourth Street, is architect for five additional stories to be erected to present five-story building of Union Electric Light & Power Co., at Twelfth and Locust Streets, of fireproof brick, terra cotta, steel and reinforced concrete construction.

Earle, Ark.—Reported J. M. McBee of Earle contemplates erecting a $40,000 hotel.

Oklahoma City, Okla.—Chicago, Rock Island & Pacific R. R. (C. A. Morse, Ch. Engr., Chicago, Ill.) and St. Louis and Pacific Railroad, directed by Oklahoma Corporation Commission to erect a passenger station in vicinity of Hudson Avenue. These roads contemplate a seven-story building in connection with joint depot. Plans to be submitted to Commission by June 1, 1916, and building completed by Jan. 1, 1917.

Centralia, Wash.—Elks Lodge plans erecting a $40,000 building. B. H. Johnston, Chairman Building Committee.

Chehalis, Wash.—Reported erection of $100,000 Masonic Temple contemplated. Mayor J. T. Coleman is member of Building Committee.

Seattle, Wash.—Contract soon to be let for erecting three-story, brick, 55 x 103 ft., business building on Fourteenth Avenue and Forty-fifth Street for John S. Williams, 4743 University Boulevard.

Plans being prepared by John Graham, 656 West Galer Street, for eight-story, 253 x 256 ft., reinforced concrete department store to be erected at Sixth Avenue and Pine Street for Frederick & Nelson Co., Second Avenue and Madison Street; cost $750,000.

Contract will be let about June by Northwestern Mausoleum Co., Stuart Building, for erecting first unit of the $450,000 concrete mausoleum plans for which are being prepared by W. Marbury Somerville, White Building.

Tacoma, Wash.—Chicago, Milwaukee & St. Paul Ry. (C. F. Loweth, Ch. Engr., Chicago, Ill.) will this summer erect a passenger station at 25th and East "A" Streets, to cost $250,000.

Forrest City, Ore.—Methodists contemplate erecting a $25,000 edifice.

Chino, Cal.—San Antonio Orange Growers' Assoc. have plans for a packing house 100 x 150 ft., and a fireproof warehouse 100 x 150 ft., probably hollow tile and steel.

Los Angeles, Cal.—Plans being prepared by Frederick Noonan, Investment Bldg., for a 4-story brick apartment house to be erected at 722 South Hartford Avenue for Mrs. E. Head.

B. G. Adams, 907 Haas Bldg., is having plans prepared for a 4-story brick apartment house to be erected at Orange and Valencia Streets.

Contract will be let latter part of April by W. J. Saunders, Archt., 319 Homer Laughlin Building, for erecting four-story and basement concrete warehouse, 80 x 200 ft., at Second Street and Central Avenue, for E. P. Bosbyshell Company, 125 North Los Angeles Street.

Los Angeles, Cal.—See "Electric Railways."

San Francisco, Cal.—Plans being prepared by Cunningham & Politeo, First National Bank Building, for a moving picture theater, to be erected at Market and Fourth Streets. William L. Gerstle, Alaska Commercial Building reported interested.

Idaho Falls, Idaho.—W. F. Yager of St. Anthony reported to be planning the erection of a hotel here, estimated to cost about $50,000.

Rexburg, Idaho.—Reported Ricks Academy, Rexburg, contemplates erecting $40,000 auditorium and gymnasium addition.

Sandpoint, Idaho.—Reported plans being nrepared for a depot which Northern Pacific Ry. Co. (W. L. Darling, Ch. Engr., St. Paul, Minn.) will erect at a cost of $50,000.

BIDS DESIRED.

Madrid, Iowa.—By Board Trustees, Old People's Home (A. T. Jacobson, Secy.), for erecting two-story and basement, 40 x 102 ft., addition to said home.

Comfrey, Minn.—Until April 5, by Board Directors Comfrey Farmers' Co-operative Creamery Co., for furnishing material and erecting a creamery building.

Hastings, Minn.—Until April 12, by Jacob Hiniker, Chairman Building Com. St. Boniface Parish, for erecting brick school for said parish. Olin H. Round, Archt., 201-202 Oppenheim Building, St. Paul.

Long Prairie, Minn.—Until April 5, by Board Directors (Geo. Lano, Secy.) for furnishing material and erecting a creamery building at Long Prairie.

Protection, Kan.—Until April 20 by Building Committee of Methodist Episcopal Church (F. C. Lindsey, Secy.) for erecting a 2-story and basement edifice. Separate bids for heating, plumbing, electric wiring, etc.

Cooperstown, N. D.—Until April 6 by Building Committee (F. C. Potter, Secy.) for erecting masonic temple. Separate bids for heating and ventilating, plumbing, etc. Bert D. Keck, Archt., Crookston.

Wahpeton, N. D.—Until April 4, by Frank Benda, for erecting a brick meat market and office building. Haxby & Gillespie, Archts., Fargo.

Salt Lake City, Utah.—Until April 3, by H. S. McCann, Secy., Salt Lake Aerie No. 67, F. O. Eagles, for erecting club house.

PRICES AND LETTINGS.

★Indicates award of contract.

★Morris Park (P. O. Jamaica), L. I., N. Y.—Contract awarded Frank Drosch, 1466 Woodhaven Avenue, Woodhaven, for erecting one-story, brick and terra cotta, 60 x 123 ft. edifice for St. Benedict's Roman Catholic Church on Church and Atlantic Avenues; cost $70,000. Rev. P. J. Faheys, Pastor. T. H. Poole & Company, Archts., 13 West Thirtieth Street, New York.

★Westfield, N. J.—Contract awarded Thomas J. Waters Company, 271 West 125th Street, New York, for erecting brick church and school at New York Avenue and First Street, for Holy Trinity Roman Catholic Church: cost about $70,000. Rev. H. T. Watterson, 502 Westfield Avenue, Pastor. Elliott Lynch, Archt., 345 Fifth Avenue, New York, N. Y.

★Philadelphia, Pa.—Contract rsported awarded A. G. Steffen, 4601 Woodland Avenue, for erecting four-story and basement. 100 x 84 ft., stone hotel, at Fortieth and Walnut Streets, for A. L. Walker; cost $60,000.

★Clarksdale, Miss.—Contract awarded Nichols, Langford & Johnston of Louisville, Ky., for erecting six-story reinforced concrete, brick and stone bank and office building for Delta Bank & Trust Co.; cost about $150,000.

★Ashland, Ky.—Contract awarded Pelphrey & Davis, Ashland, for erecting addition to Ventura Hotel; cost $30,000. Gustave W. Drach, Archt., 1701 Union Trust Bldg., Cincinnati, Ohio.

★Louisville, Ky.—George H. Rommel & Co., Louisville, reported contractors for three-story, brick, fireproof creamery and office building for D. H. Ewing's Sons to be erected at Third and Kentucky Streets; estimated cost $80,000. John Bacon Hutchings & Sons, Archts., Columbia Building.

★Akron, Ohio.—Contract for erecting club house for B. P. O. Elks (bids opened March 18) awarded Akron Storage & Contracting Co., 146 N. Howard Street, at $61,700.

★Cincinnati, Ohio.—Contract awarded Ferro Concrete Construction Company, Richmond and Harriet Streets, for erecting a 4-story reinforced-concrete garage for the Graydon Estate at 6th and North Streets; estimated cost, $60,000. Elzner & Anderson, Ingalls Bldg., Cincinnati, Architects.

★Cleveland, Ohio.—Contract for erecting 4-story hotel for Euclid Logan Realty Company at 9507 Euclid Avenue awarded George K. J. Paul. Williard Hirsch, 1302 Swetland Bldg., Archt.

★Contract awarded by Cleveland Telephone Co. to George A. Rutherford Co., 2160 East Eighteenth Street, for erecting the new Fairmont exchange on Cedar and Coventry Roads, to cost about $350,000.

★Toledo, Ohio.—Contract awarded Gettins-Kopitke Company, Toledo, for erecting two-story brick, steel and terra cotta building on St. Clair Street; cost $40,000. Mills. Rhines. Bellman & Nordhoff, Archts., Ohio Building.

★Eau Claire, Wis.—Contract awarded Hoeppner-Bartlett Co., Eau Claire, for erecting three-story, 140 x 200 ft., brick and reinforced concrete storage building for Cary Transfer Co.; cost $75,000.

★Duluth, Minn.—Contract for erecting the boys' Y. M. C. A. building awarded George Lounsberry of Duluth at about $65,000.

★Spokane, Wash.—Contract awarded by Northwestern Mausoleum Co., Seattle, to F. E. Peterson, Spokane, for erecting a $250,000 mausoleum.

★Los Angeles, Cal.—Contract for erecting 4-story brick apartment house at Ingram and Whitmer Streets for B. G. Adams awarded L. T. Mayo, 530 Black Bldg., at $60,000.

★Ottawa, Ont.—Contract for erecting buildings on Dartmouth Branch Line Intercolonial Ry. awarded Maynard C. Denton and Maurice G. Condon of Digby, N. S. J. W. Pugilly, Secy. Department Railways and Canals.

NEW INDUSTRIAL PLANTS

PROPOSED WORK.

Franklin, N. H.—M. T. Stevens Company is having plans prepared for additions to their woolen mills.

Bondsville, Mass.—Boston Duck Company, Bondsville, intends erecting a 5-story brick 130 x 400-ft. mill, also a 3-story 69 x 121-ft. storehouse.

Malden, Mass.—A 3-story 40 x 200-ft. factory is to be erected in Malden by Ehrman Mfg. Company, Milford, N. H., to cost $80,000. Monks & Johnson, Archts., Boston, Mass.

Worcester, Mass.—The American Steel & Wire Company, Worcester, intends erecting a 2-story brick factory addition 55 x 140 ft.

Cranston, R. I.—United Wire & Supply Company is planning erecting a $150,000 plant on Elmwood Avenue.

Pawtucket, R. I.—A 2-story brick and steel 68 x 80-ft. addition is to be erected by the Jenckes Spinning Company, Pawtucket.

Woonsocket, R. I.—The Sudney Worsted Company (Lucien A. Jarrett, Mgr.) will erect a 2-story 77 x 120-ft. factory and 1-story 30 x 50-ft. boiler house and 2-story office building.

Bridgeport, Conn.—Reported city will erect a municipal ice and cold storage plant on Housatonic Avenue, to cost about $145,000. Citizens voted $200,000 bonds for establishment of plant. Vincent S. Whitney, Chairman, Municipal Ice and Cold Storage Plant Commission.

Buffalo, N. Y.—Plans filed by American Radiator Works for a 2-story brick foundry to be erected at the plant at 1741 Elmwood Avenue, costing $40,000.

Reported George J. Meyer Malting-Co., 1314 Niagara Street, intends erecting two 1,000,000 bushel capacity elevators off the foot of Main Street.

New York, N. Y.—Plans prepared by Lansing C. Holden, 103 Park Avenue, for five-story addition to plant of R. E. Dietz Co. at Greenwich and Laight Streets.

Plans filed for erecting following buildings: 12-story fireproof store and factory at 42 West Thirty-eighth Street for Felcourt Realty Corp., cost $225,000, George and Edward Blum, Archts., 505 Fifth Ave.; 12-story fireproof show rooms and factory at 16 West Thirty-ninth Street for John S. Weatherley, cost $140,000, Paul R. Allen, Archt., 37 West Thirty-ninth Street.

Ellwood City, Pa. — Reported United States Steel Corporation has appropriated $1,480,000 for Shelby steel tube plants here, to include erection of a $40,000 club house.

Hokendauqua, Pa. — Stockholders of Thomas Iron Co. voted to issue $400,000 additional bonds for improving plants at Hokendauqua, Alburtis and Hellertown.

Lancaster, Pa.—New Process Steel Co. intends enlarging their plant.

Lebanon, Pa.—Morris & Company, 2602 West Madison Street, Chicago, Ill., will erect branch packing plant here to include three warehouses and twenty-five smokehouses.

Pittsburgh, Pa.—Plans completed for a $500,000 plant to be erected on Neville Island for Independent Bridge Co. (P. E. Hunter, Pres., 829 Beaver Avenue).

Royersford, Pa.—Barclay, White & Co., Philadelphia, plans extensive improvements, including 2 additional stories and three 4-story wings, to plant of Progressive Knitting Mills.

Scranton, Pa.—Contract will be let about June for improvements to plant of the Scranton Steel & Iron Co., to be steel, brick and terra cotta and cost $48,000, and $20,000 additional for equipment. Charles F. Wood, Chief Engineer of Company; Edgar Louis Kenling, Pres.

Tyrone, Pa. — Wilson Chemical Co. (George C. Wilson, Owner) will rebuild factory destroyed by fire.

Washington, D. C.—A bill has passed U. S. Senate authorizing the Government to purchase or construct an armor plant at a cost of $11,000,000.

Sisterville, W. Va.—Reported Maiwurm Aluminum Corporation of Pittsburgh (H. W. McCoy, Vice-President, Sisterville) will erect aluminum plant here.

Fort Mill, S. C.—Fort Mill Manufacturing Co., Fort Mill, will build an addition to Mill No. 2 and install new spindles, carding machinery and 600 looms.

Brunswick, Ga.—Reported plant of Yaryan Rosin & Turpentine Co., recently destroyed by fire, will be rebuilt.

Columbus, Ga.—Meritas Mills, Columbus, affiliated with the Standard Oil Cloth Co. of New York, plans spending $270,000 for building additions and installing new machinery.

Athens, Ala.—Fulton Cotton Mill Co., Athens, will double capacity of plant by adding 7000 new spindles.

Greenville, Ala.—J. A. Kendrick of Greenville reported interested in $100,000 cotton mill to be erected here.

New Orleans, La.—Reported Busch Box Factory, recently destroyed by fire, will be rebuilt.

Cleveland, Ohio.—Reported Bethlehem Steel Company, 1266 Ontario Street, will erect a steel plant near Willow (suburb of Cleveland).

American Steel & Wire Company, Western Reserve Bldg., it is reported, intends erecting additions to plant in upper Cuyahoga River valley.

Reported Ajax Mfg. Co., 3830 Lakeside Avenue, is planning erecting a $30,000 addition.

Red Wing, Minn.—Kuhles & Stock Company, 355 Jackson Street, contemplates erecting a plant on University and Snelling Avenues to cost $100,000.

St. Paul, Minn.—Kuhlos & Stock Co., 355 Jackson Streets, contemplates erecting a plant at University Avenue, near Snelling Avenue, to cost $100,000.

Taylor, Tex.—Plans being prepared by Henry Struve, Taylor, for municipal abattoir to cost $15,000.

Pasco, Wash. — Reported Continental Milling Co. of Spokane plans erecting a 600-bbl. capacity flour mill here.

Anaheim, Cal.—Anaheim Citrus Fruit Assoc. contemplates erecting a $40,000 ice plant.

Los Angeles, Cal.—Cochise Machine Co., 404 Aliso Street, will erect a plant here.

Douglas, Ariz.—Calumet & Arizona Mining Co. will spend $1,200,000 in enlargements of smelting plant, including acid plant with capacity of 200 tons of sulphuric acid daily; cost $750,000; present roasting plant of 12 roasters will be doubled; electric plant increased 150 per cent; new blower engine installed; high power transmission line will be constructed, connecting smelter here with company's mines in Warren District. Harry Clark, Supt. of Construction, Douglas; John C. Greenway, General Manager, Warren.

Humboldt, Ariz.—Consolidated Arizona Smelting Company will enlarge flotation mill from 250 to 600 tons daily capacity.

Port Arthur, Ont.—Reported Saskatchewan Co-operative Elevator Co. (C. A. Dunning, General Manager, Regina, Sask.) will erect a terminal elevator here of 2,500,000 bushels capacity.

Renfrew, Ont.—Reported Renfrew Machinery Company will rebuild shell factory recently destroyed by fire.

Sarnia, Ont.—Imperial Oil Co. contemplates extensive improvements to plant here.

BIDS DESIRED.

Baltimore, Md.—Reported desired until Apr. 20 for erecting 3-story, 100 x 200 ft., reinforced concrete plant at Thirty-first Street and Eastern Avenue for Baltimore Oil Engine Co. A. W. Geise, Pres. Probable cost $60,000.

Faribault, Minn.—Until April 3, by Faribault Packing Company, for erecting packing plant. Cost reported at $150,000.

Lockhart, Tex.—See "Water Works."

PRICES AND LETTINGS.

★Indicates award of contract.

★Fall River, Mass.—Beattie & Cornell, Fall River, reported contractors for erecting cotton yarn mill of 12,600 spindles for Foster Spinning Company. J. H. Mayes of Charlotte, N. C., is architect and engineer.

★Brooklyn, N. Y.—Contract awarded Kennedy Construction Company, 215 Montague Street, for alterations to four-story brick factory at 36 South Ninth Street for Levine Bros., Inc.; cost $80,000. William Higginson, Archt., 13 Park Row, New York.

★Camden, N. J. — Contract reported awarded by Victor Talking Machine Co. to Irvin & Leighton, Twelfth and Cherry Streets, Philadelphia, Pa., for erecting a cabinet factory to cost $450,000.

★Newark, N. J.—American Concrete-Steel Company, 27 Clinton Street, has secured contract to erect three-story, 80 x 100 ft. reinforced concrete addition to plant of Crocker-Wheeler Company; cost about $50,000.

★Cincinnati, Ohio.—Contract awarded McMiller, Hulbert Block, for erecting 2½-story brick factory for Gruen Watch Co. on McMillen Street. G. C. Burroughs, Archt., Union Trust Building; cost $30,000.

★Decatur, Ind.—Contract awarded L. N. Cope & Son, Decatur, for erecting bag factory, at $40,473.

★Detroit, Mich. — Contract awarded Donovan Wire & Iron Works, Toledo, O., for 280 tons of steel for addition to plant of Detroit Steel Products Co.

★Grand Rapids, Mich.—Contract awarded by Grand Rapids Bread Company to C. Hoertz & Son, Grand Rapids, for erecting factory on Ionia Avenue and Prescott Street; cost, including equipment about $60,000.

★New Richmond, Wis.—Contract awarded by Inter-County Co-operative Packing Company to Madsen Brothers, Plymouth Building, Minneapolis, Minn., for erecting main building of packing plant, power house and concrete foundation for yard scales, at $52,300.

★Payson, Utah. — Contract reported awarded American Bridge Company, Denver, Col., for erecting terminal shops for Salt Lake & Utah Railroad Company; cost $40,000.

MISCELLANEOUS

PROPOSED WORK.

Park Improvements—Minneapolis, Minn.—All season's work contemplated this year will be mostly earthwork and dredging, and will be done by day labor and city's plant. A. C. Goodward, Park Engineer.

Park Improvements—Minneapolis, Minn.—Board of Park Commissioners considering the establishment of a park and playground at Nicollet Avenue and Forty-second Street. It is proposed to construct a lagoon and driveway (boulevard) 5 miles long; cost estimated at $200,000. No funds available, but site has been purchased.

Transmission Lines.—Dallas, Tex.—Texas Power & Light Company (T. R. Slater, Gen. Supt., 1322 Commerce Street) will construct a high-power transmission line through Dallas County; cost $50,000.

BIDS DESIRED.

Fire Escapes.—Boston, Mass.—Until April 4, by Schoolhouse Commissioners (Jos. Lomasney, Chairman), for erecting complete fire escapes on the Thos. N. Hart School, East Fifth Street, corner of H Street, South Boston.

Freight Handling Winches For Sale—Boston, Mass.—Until April 20 by Directors of the Port of Boston for purchase of any or all freight handling winches, as advertised in Engineering Record.

Road Oil—New Haven, Conn.—Until April 4 by Director Public Works for furnishing 100,000 gal. or more asphaltic road oil; also for furnishing 100,000 gal. of tar road oil to Department of Public Works. F. L. Ford, City Engr.

Road Oil, Etc.—New Brighton, S. I., N. Y.—Until April 4 by Calvin D. Van Name, Pres. Borough of Richmond, St. George, New Brighton, S. I., for 150,000 gal. tar road oil (light) for road surfacing, 22,000 gal. tar road oil (medium) for road surfacing, 22,000 gal. macadam road binder (liquid asphalt) for road surfacing and 22,000 gal. of macadam road binder (asphalt base) for road surfacing.

Road Oil — Hackensack, N. J.—Until April 3 by Hackensack Improvement Commission (E. J. Thompson, Clk.) for furnishing and spreading road oil or road tar on streets by means of pressure distributors. Covering approximately 300,000 sq. yd. roadway.

Fire Escapes—Pittsburgh, Pa.—Until April 12, by Board of Education (G. W. Gerwig, Secy.), for erecting fire escapes for Horace Mann, Harwood, Clayton and Andrews Schools.

Road Oil—Greenville, Miss.—Reported desired until April 4, by Wm. Urquhart, City Clk., for 50,000 gal. No. 5 liquid road oil.

Road Oil, Etc.—Beaver Dam, Wis.—Reported desired until April 5, by J. E. Fisher, Chairman Board Public Works, for from 30,000 to 70,000 gal. road oil and from 1000 to 5000 cu. yd. crushed stone.

Road Oil—Manitowoc, Wis.—Reported desired until April 3, by John J. Kelley, City Clk., for one or more tank cars of road oil.

Retaining Wall—Sioux Falls, S. D.—Reported desired until April 4, by Board Park Supervisors (W. J. Kinsella, Secy.), for constructing stone retaining wall and concrete steps.

Cement, etc.—Westmont, Que.—Until April 30, by Secretary Treasurer, for cement, sand crushed stone, sewer pipe, bricks, etc., for year beginning May 1, 1916, and ending April 30, 1917.

Asphalt—Kingston, Ont.—Until April 3, by R. J. McClelland, City Engr., for 30 tons, more or less, of refined asphalt, delivered in barrels, f.o.b. Kingston.

PRICES AND LETTINGS.

★Indicates award of contract.

★Excavation — Harrisburg, Pa.—Contract awarded Benett & Randall, Greensburg, for excavation work for speedway and fair buildings which Keystone State Fair Company will erect. Cost for excavation will be about $790,000. The entire cost for buildings, speedway and racetrack will be about $1,500,000. Graham, Burnham & Company, Chicago, Ill., Archts.

★Speedway — Birmingham, Ala.—Contract for constructing Birmingham Motor Speedway grandstand, repair pits, etc., of reinforced concrete and steel, with bitulithic top, awarded Henkel & Sullivan of Cincinnati, Ohio.

Crushed Rock—Minneapolis, Minn.—Two bids opened March 10 by K. E. Alexander, Purchasing Agent, for furnishing crushed granite for trap rock for season of 1916 submitted by Wisconsin Granite Company, Berlin, Wis., at $2.20 per cu. yd. f.o.b. cars Minneapolis, and Trap Rock Company, of Minneapolis, $1.45 per ton f.o.b. cars Minneapolis. Minnesota Crushed Stone Company, 1500 N. E. Johnson Street, bid $3.60 f.o.b. track M. & St. L. Ry. and $4.25 delivered by team. for filler for 1916.

★Removing Wreck—San Francisco, Cal.—Contract for removing wreck of City of Panama from San Francisco Bay awarded Malvin A. Taylor, East Oakland, Cal., at $9,280.

Engine for Destroyed.—Vallejo, Cal.—Lowest bid opened recently by Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing turbine engine for destroyed No. 69 now under construction, submitted by Mare Island Navy Yard at $119,000.

★Tramway—Santa Lucia, Cuba.—Contract for constructing a Lawson Aerial Tramway 6 miles long for Matahambre Copper Mine awarded Ambursen Company, 61 Broadway, New York, N. Y.

Proposals

For Proposals Advertised, See Pages 40a, 41, 42 and 43.

WATERWORKS.

Bids Close.		See Eng. Record.
Apr. 3.	C.-I. Pipe, McKeesport, Pa. Adv. Apr. 1.	Apr. 1
Apr. 4.	Pipe, Etc., Columbia, S. C.	Apr. 1
Apr. 4.	Steel Tank, Utica, Ill.	Apr. 1
Apr. 4.	Water Works, Greensburg, Kan.	Apr. 1
Apr. 4.	Pipe, Davenport, Iowa	Apr. 1
Apr. 5.	Pipe, Etc., Bandon, Ore.	Mar. 25
Apr. 5.	Mains, Etc., New York, N. Y.	Apr. 1
Apr. 5.	Pipe, Halifax, N. S.	Apr. 1
Apr. 7.	Reservoir, Meade, Kan.	Apr. 1
Apr. 7.	Pipe, New York, N. Y.	Apr. 1
Apr. 7.	Mains, etc., New York, N. Y.	Apr. 1
Apr. 7.	Water Works, Nashville, N. C. Adv., Apr. 1.	Apr. 1
Apr. 8.	High Pressure Fire System, Indian Head, Md.	Mar. 11
Apr. 8.	C.-I. Pipe, Etc., Panama.	Mar. 25
Apr. 8.	Repairing Water Works, Lenoir City, Tenn.	Apr. 1
Apr. 10.	Filtration Plant, Florence, Ala. Adv. Mar. 18.	Mar. 18
Apr. 11.	Water works, Rector, Ark. Adv. Mar. 18, 25.	Mar. 18
Apr. 11.	Filter Beds, Etc., Ilion, N. Y. Adv. Mar. 25, April 1.	Mar. 25
Apr. 11.	Contract 164, New York, N. Y. Adv. Mar. 25.	Mar. 25
Apr. 11.	Pump. Mach., Etc., Collingwood, Ont.	Apr. 1
Apr. 11.	Steel Tower, Etc., Hayward, Wis.	Apr. 1
Apr. 11.	Contract 171, New York, N. Y.	Apr. 1
Apr. 11.	Gate Valves, Etc., Toronto, Ont.	Apr. 1
Apr. 12.	Water Works, Three Forks, Mont. Adv. Apr. 1.	Apr. 1
Apr. 13.	Laying Mains, Atlantic City, N. J. Adv. Apr. 1.	Apr. 1
Apr. 14.	Water Works, Blackstone, Va.	Apr. 1
Apr. 15.	Water Works, Silver Lake, Minn.	Apr. 1
Apr. 17.	Extensions, Norfolk, Neb. Adv. Mar. 25, April 1.	Mar. 25
Apr. 18.	Water Works, Lockhart, Tex. Adv. Apr. 1.	Apr. 1
Apr. 20.	Water Works, Harlowton, Mont. Adv. Apr. 1.	Apr. 1
Apr. 24.	Pump House, Madison, Wis.	Apr. 1

SEWERAGE AND SEWAGE DISPOSAL.

Bids Close.		See Eng. Record.
Apr. 4.	Billings, Mont.	Feb. 19
Apr. 4.	Ocean Beach, L. I., N. Y.	Mar. 25
Apr. 4.	Davenport, Iowa	Apr. 1
Apr. 4.	Calexico, Cal.	Apr. 1
Apr. 5.	La Fayette, Ind.	Mar. 11
Apr. 5.	Ann Arbor, Mich. Adv. Mar. 25.	Mar. 25
Apr. 5.	Ann Arbor, Mich.	Mar. 18
Apr. 5.	Billings, Mont.	Mar. 25
Apr. 5.	New London, Wis.	Apr. 1
Apr. 5.	Bad Axe, Mich.	Apr. 1
Apr 6.	Cleveland, Ohio.	Apr. 1
Apr. 6.	Ft. Wayne, Ind.	Apr. 1
Apr. 7.	Billings, Mont.	Mar. 18
Apr. 7.	Brooklyn, Iowa	Apr. 1
Apr. 7.	Nashville, N. C. Adv. Apr. 1.	Apr. 1
Apr. 10.	Eustis, Fla.	Mar. 18
Apr. 10.	Madison, Ill.	Mar. 18
Apr. 10.	Montclair, N. J. Adv. Mar. 25.	Mar. 25
Apr. 10.	Winner, S. D.	Apr. 1
Apr. 10.	New Haven, Conn.	Apr. 1
Apr. 10.	Long Island City, L. I., N. Y.	Apr. 1
Apr. 10.	Ellis, Kan.	Apr. 1
Apr. 10.	Cleveland, Ohio.	Apr. 1
Apr. 11.	Maryland Adv. Mar. 25.	Mar. 25
Apr. 12.	Brooklyn, N. Y.	Apr. 1
Apr. 14.	Jacksonville, Fla. Adv. Mar. 25, April 1.	Mar. 25
Apr. 14.	Material, Jacksonville, Fla. Adv. Mar. 25, April 1.	Mar. 25
Apr. 15.	New London, Wis.	Mar. 25
Apr. 15.	Brooklyn, N. Y.	Apr. 1
Apr. 17.	Watertown, S. D. Adv. Mar. 25, April 1.	Mar. 25
Apr. 18.	Starke, Fla.	Apr. 1
Apr. 18.	Wabasha, Minn.	Apr. 1
Apr. 18.	Woonsocket, R. I. Adv. Apr. 1.	Apr. 1
Apr. 19.	Binghamton, N. Y.	Mar. 25
Apr. 20.	Albany, N. Y.	Mar. 25
Apr. 20.	Urbana, Ohio	Apr. 1
Apr. 26.	Binghamton, N. Y. Adv. Apr. 1.	Apr. 1
Apr. 27.	Xenia, Ohio	Mar. 25

BRIDGES.

Apr. 4.	Gettysburg, S. D.	Mar. 4
Apr. 4.	Syracuse, Kan.	Mar. 18
Apr. 4.	Mora, Minn.	Mar. 18
Apr. 4.	Irwinton, Ga.	Mar. 25
Apr. 4.	Okanogan, Wash.	Mar. 25
Apr. 4.	Perrysville, Mo.	Mar. 25
Apr. 4.	Tama, Iowa	Mar. 25
Apr. 4.	Sykeston, N. D.	Mar. 25
Apr. 4.	Bartonville, Ky.	Mar. 25
Apr. 4.	Estherville, Iowa.	Mar. 25
Apr. 4.	Orange City, Iowa	Apr. 1
Apr. 4.	Hazard, Ky.	Apr. 1
Apr. 4.	Laura, Iowa	Apr. 1
Apr. 4.	Kendall, Iowa	Apr. 1
Apr. 4.	Olathe, Kan.	Apr. 1
Apr. 4.	Indiana.	Apr. 1
Apr. 5.	Hillsboro, N. D.	Mar. 11
Apr. 5.	Lakin, Kan.	Mar. 18
Apr. 5.	Humboldt, Ia.	Mar. 18
Apr. 5.	Spring Lake, N. J.	Mar. 18
Apr. 5.	Stuntz, Minn.	Mar. 25
Apr. 5.	Haysville, N. D.	Mar. 25
Apr. 5.	Dakota City, Iowa	Mar. 25
Apr. 5.	Lusk, Wyo.	Apr. 1
Apr. 5.	Ashley, Pa.	Apr. 1
Apr. 5.	Wilkes-Barre, Pa.	Apr. 1
Apr. 6.	Bridgeoort, Conn. Adv. Mar. 11.	Mar. 11
Apr. 6.	Miami, Fla. Adv. Mar. 18, 25.	Mar. 18
Apr. 6.	Ventura, Cal.	Mar. 25
Apr. 6.	Center, N. D. Adv. Mar. 25, April 1.	Mar. 25
Apr. 6.	Concordia, Kan.	Apr. 1
Apr. 6.	Sheboygan, Wis.	Apr. 1
Apr. 6.	Indiana.	Apr. 1
Apr. 7.	St. Helen, Ore.	Mar. 18
Apr. 7.	Washington, Kan.	Mar. 25
Apr. 7.	Portland, Ore.	Mar. 25
Apr. 7.	Ventura, Cal.	Mar. 25
Apr. 7.	Indiana.	Apr. 1
Apr. 8.	Ventura, Cal.	Mar. 25
Apr. 8.	Rock Island, Ill.	Mar. 4
Apr. 10.	Rockford, Ill. Adv. Mar. 11.	Mar. 11
Apr. 10.	Marshall, Tex. Adv. Mar. 18, 25.	Mar. 18
Apr. 10.	Columbus, Ohio	Mar. 18
Apr. 10.	Galveston, Tex.	Mar. 25
Apr. 10.	Camden, N. J.	Apr. 1
Apr. 10.	Lancaster, Pa.	Apr. 1
Apr. 11.	Hastings, Minn.	Mar. 18
Apr. 12.	Youngatown, Ohio	Mar. 25
Apr. 11.	Steubenville, Ohio	Apr. 1
Apr. 14.	Battenville, N. Y. Adv. Apr. 1.	Apr. 1
Apr. 15.	Indiana.	Apr. 1
Apr. 17.	New Philadelphia, Ohio.	Apr. 1
Apr. 17.	Youngstown, Ohio	Apr. 1
Apr. 17.	California.	Apr. 1
Apr. 17.	Montesanon, Wash.	Apr. 1
Apr. 18.	Lowell, Mass. Adv. Apr. 1.	Apr. 1
Apr. 18.	Nashville, Tenn.	Apr. 1
Apr. 20.	Bradentown, Fla.	Apr. 1
Apr. 29.	Johnson Creek, Wis.	Feb. 26
Apr. 29.	Johnson Creek, Wis.	Apr. 1
May 1.	Amarillo, Tex.	Mar. 18
May 1.	Odessa, Wash.	Apr. 1
May 20.	Lyndhurst, N. J.	Mar. 18

PAVING AND ROADS.

Bids Close.		See Eng. Record.
Apr. 3.	Huron, S. D. Adv. Mar. 11.	Mar. 11
Apr. 4.	Bryan, Ohio.	Mar. 18
Apr. 4.	Wheaton, Minn.	Mar. 25
Apr. 4.	South Bend, Wash.	Mar. 25
Apr. 4.	Mount Vernon, Wash.	Mar. 25
Apr. 4.	South Bend, Ind. Adv. Mar. 25, April 1.	Mar. 25
Apr. 4.	Ephrata, Wash.	Mar. 25
Apr. 4.	Meriden, Conn. Adv. Mar. 25.	Mar. 25
Apr. 4.	Westerly, R. I. Adv. Mar. 25.	Mar. 25
Apr. 4.	Indiana	Mar. 25
Apr. 4.	Columbus, Ohio.	Mar. 25
Apr. 4.	Storm Lake, Iowa	Apr. 1
Apr. 4.	Bemidji, Minn.	Apr. 1
Apr. 4.	Walla Walla, Wash.	Apr. 1
Apr. 4.	Indiana.	Apr. 1
Apr. 4.	Ft. Wayne, Ind.	Apr. 1
Apr. 4.	Independence, Iowa.	Apr. 1
Apr. 4.	Duluth, Minn.	Apr. 1
Apr. 5.	Stuntz, Minn.	Mar. 25
Apr. 5.	Chehalis, Wash.	Mar. 25
Apr. 5.	Freehold, N. J.	Mar. 25
Apr. 5.	Paterson, N. J.	Mar. 25
Apr. 5.	Road Machinery, Center, N. D. Adv. Mar. 25, April 1.	Mar. 25
Apr. 5.	Sheridan, Mich.	Mar. 25
Apr. 5.	Indiana	Mar. 25
Apr. 5.	Centralia, Wash.	Mar. 25
Apr. 5.	Sigourney, Iowa	Apr. 1
Apr. 6.	Pittsburgh, Pa.	Apr. 1
Apr. 6.	Indiana.	Apr. 1
Apr. 5.	Indianapolis, Ind.	Apr. 1
Apr. 5.	Racine, Wis.	Apr. 1
Apr. 6.	Jonesboro, Ark.	Mar. 11
Apr. 6.	Huntington, W. Va.	Mar. 4
Apr. 6.	Wheeling, W. Va.	Mar. 18
Apr. 6.	Pocatello, Idaho	Mar. 25
Apr. 6.	Dixon, Ill. Adv. March 25.	Mar. 25
Apr. 6.	Elgin, Ill.	Apr. 1
Apr. 6.	New York, N. Y.	Apr. 1
Apr. 6.	Audubon, Iowa	Apr. 1
Apr. 6.	Duluth, Minn.	Apr. 1
Apr. 6.	Louisville, Ky.	Apr. 1
Apr. 6.	Richmond, Ind.	Apr. 1
Apr. 6.	Indiana	Apr. 1
Apr. 7.	Pomeroy, Wash.	Mar. 25
Apr. 7.	Medina, Ohio	Apr. 1
Apr. 7.	Ohio	Apr. 1
Apr. 7.	Havelock, Neb.	Apr. 1
Apr. 7.	Spokane, Wash.	Apr. 1
Apr. 7.	Spokane, Wash.	Apr. 1
Apr. 10.	Bronson, Fla.	Mar. 25
Apr. 10.	Hartford, Mich.	Mar. 25
Apr. 10.	Coldwater, Mich.	Mar. 25
Apr. 10.	Los Angeles, Cal.	Mar. 25
Apr. 10.	Ventura, Cal.	Mar. 25
Apr. 10.	Oswego, N. Y. Adv. Apr. 1.	Apr. 1
Apr. 10.	Long Island City, N. Y.	Apr. 1
Apr. 10.	Moorehead, Minn.	Apr. 1
Apr. 10.	Webster City, Iowa	Apr. 1
Apr. 11.	Maryland Adv. Mar. 25, April 1.	Mar. 25
Apr. 11.	Akron, Ohio	Apr. 1
Apr. 11.	Morristown, N. J. Adv. Apr. 1.	Apr. 1
Apr. 11.	Belvidere, N. J.	Apr. 1
Apr. 11.	Hartford, Conn. Adv. Apr. 1.	Apr. 1
Apr. 11.	Nevada, Iowa.	Apr. 1
Apr. 11.	Saginaw, Mich.	Apr. 1
Apr. 11.	Maine.	Apr. 1
Apr. 12.	Palouse, Wash.	Mar. 18
Apr. 12.	Gastonia, N. C.	Mar. 25
Apr. 12.	Cleveland, Ohio.	Apr. 1
Apr. 13.	Salem, Ohio	Apr. 1
Apr. 14.	North Vernon, Ind.	Mar. 25
Apr. 14.	North Platte, Neb.	Apr. 1
Apr. 14.	Charleston, S. C.	Apr. 1
Apr. 14.	Falls City, Neb.	Apr. 1
Apr. 15.	Houghton, Mich.	Mar. 25
Apr. 15.	Batavia, Ohio	Mar. 25
May 15.	Madison, S. D.	Mar. 25
Apr. 15.	Elkton, Ky.	Apr. 1
Apr. 15.	Reeman, Mich.	Apr. 1
Apr. 16.	Indiana	Apr. 1
Apr. 15.	Stevenson, Wash.	Apr. 1
Apr. 17.	Norfolk, Neb. Adv. Mar. 25, April 1.	Mar. 25
Apr. 17.	Marion, Iowa	Apr. 1
Apr. 17.	Lake City, Fla.	Apr. 1
Apr. 18.	Bartow, Fla.	Mar. 25
Apr. 18.	Lawton, Okla.	Mar. 25
Apr. 18.	Berwyn, Ill.	Apr. 1
Apr. 18.	Marinette, Wis.	Apr. 1
Apr. 20.	Sarasota, Fla.	Mar. 25
Apr. 20.	Seymour, Mo.	Apr. 1
Apr. 20.	Bradentown, Fla.	Apr. 1
Apr. 20.	Albany, N. Y. Adv. Apr. 1.	Apr. 1
Apr. 24.	Lafayette, Ala.	Apr. 1
Apr. 25.	Bucyrus, Ohio Adv. Apr. 1.	Apr. 1
Apr. 30.	Jackson, Tenn.	Apr. 1
May 1.	Galion, Ohio	Mar. 18
May 1.	Eveleth, Minn.	Mar. 18
May 1.	Pontiac, Ill.	Apr. 1
May 1.	Winlock, Neb.	Apr. 1
——	Binghamton, N. Y. Adv. Feb. 12, 19.	Feb. 12

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS.

Apr. 4.	Ditch, Worthington, Minn.	Apr. 1
Apr. 5.	Ditch, Jasper, Ind.	Mar. 25
Apr. 5.	Dredging, Boston, Mass.	Apr. 1
Apr. 5.	Ditches, Clay Center, Ind.	Apr. 1
Apr. 8.	Wharf, Jacksonville, Fla. Adv. Mar. 25, April 1.	Mar. 25
Apr. 8.	Ditch, Winamac, Ind.	Apr. 1
Apr. 8.	Ditch, Woodstock, Ill.	Apr. 1
Apr. 10.	Jetty Construction, New York, N. Y. Adv. Mar. 11 to April 1.	Mar. 11
Apr. 10.	Ditch, Oklahoma City, Okla.	Mar. 11
Apr. 10.	Ditch, Kenilworth, Ill.	Apr. 1
Apr. 11.	Grading, Etc., Hastings, Minn.	Mar. 18
Apr. 11.	Wharf, Aransas Pass, Tex.	Mar. 25
Apr. 12.	Levee Work, Port Arthur, Tex.	Mar. 25
Apr. 12.	Ditches, Redwood Falls, Minn.	Apr. 1
Apr. 14.	Dredging, New York, N. Y. Adv. Mar. 18 to April 1.	Mar. 18
Apr. 15.	Freight Sheds, Etc., Quebec, Que.	Mar. 25
Apr. 20.	Dredging, Manistee, Mich. Adv. Apr. 1.	Apr. 1
Apr. 26.	Lock Gates, Etc., Pittsburgh, Pa. Adv. Apr. 1.	Apr. 1
Apr. 26.	Dredging, Buffalo, N. Y. Adv. Apr. 1.	Apr. 1
Apr. 27.	Dock, San Francisco, Cal. Adv. Apr. 1.	Apr. 1
Apr. 28.	Wharf, Houston, Tex. Adv. Apr. 1.	Apr. 1
Apr. 29.	Riprap and Capstones, Wilmington, N. C. Adv. Apr. 1.	Apr. 1
May 1.	Wharf, Etc., Honolulu, Hawaii.	Mar. 25
May 6.	Leasing Land and Water for Power Purposes, Louisville, Ky. Adv. Mar. 11.	Mar. 11
————	Sublet Levee Work, Chicago, Ill. Adv. Apr. 1.	Apr. 1

PUBLIC BUILDINGS AND SCHOOLS.

Bids Close.		See Eng. Record.
Apr. 4.	Lockport, Ill.	Mar. 4
Apr. 4.	Dayton, Ohio.	Mar. 11
Apr. 4.	Detroit, Mich.	Mar. 18
Apr. 4.	Red Cloud, Minn.	Mar. 25
Apr. 4.	Camden, N. J.	Mar. 25
Apr. 4.	Red Cloud, Minn.	Apr. 1
Apr. 5.	Reading, Ohio	Mar. 18
Apr. 5.	Lakeview, Mich.	Mar. 25
Apr. 5.	Savannah, Ga.	Mar. 25
Apr. 5.	Ann Arbor, Mich.	Apr. 1
Apr. 5.	Muscotah, Kan.	Apr. 1
Apr. 5.	Camden, N. J.	Apr. 1
Apr. 6.	Valley City, N. D.	Mar. 4
Apr. 6.	Boston, Mass.	Mar. 18
Apr. 6.	Sapulpa, Okla. Adv. Mar. 18.	Mar. 18
Apr. 6.	Windfall, Ind.	Apr. 1
Apr. 6.	Cadott, Wis.	Apr. 1
Apr. 6.	Westchester, Ohio	Apr. 1
Apr. 6.	Portland, Ore.	Apr. 1
Apr. 7.	Falls City, Neb.	Mar. 11
Apr. 7.	Youngstown, Ohio	Mar. 18
Apr. 7.	Columbus, Ind.	Mar. 18
Apr. 7.	Waukon, Iowa.	Mar. 25
Apr. 7.	Hyndman, Pa.	Apr. 1
Apr. 8.	Urbana, Ohio	Mar. 18
Apr. 10.	Middlebourne, W. Va.	Mar. 18
Apr. 10.	Eau Claire, Wis.	Mar. 25
Apr. 10.	Mt. Airy, N. C.	Mar. 25
Apr. 10.	Cleveland, Ohio	Mar. 25
Apr. 10.	College Station, Tex.	Apr. 1
Apr. 10.	Lincoln, Neb.	Apr. 1
Apr. 10.	Danville, Va.	Apr. 1
Apr. 10.	Clark, S. D.	Apr. 1
Apr. 11.	Columbus, Kan.	Mar. 18
Apr. 11.	Galva, Iowa	Mar. 18
Apr. 11.	Carbondale, Ill.	Mar. 25
Apr. 11.	Lockport, N. Y.	Apr. 1
Apr. 11.	Audubon, Iowa	Apr. 1
Apr. 11.	Devils Lake, N. D.	Apr. 1
Apr. 11.	Faribault, Minn.	Apr. 1
Apr. 12.	Prescott, Ariz.	Mar. 11
Apr. 12.	Berea, Ohio	Mar. 25
Apr. 12.	Savannah, Ga.	Apr. 1
Apr. 12.	Hastings, Minn.	Apr. 1
Apr. 12.	Clontarf, Minn.	Apr. 1
Apr. 12.	Shenandoah, Pa.	Mar. 25
Apr. 12.	Wilcox, Pa.	Apr. 1
Apr. 14.	Highland, Ohio	Apr. 1
Apr. 14.	Boone, Iowa	Apr. 1
Apr. 14.	Sheldon, Iowa	Apr. 1
Apr. 14.	Springfield, Ill.	Apr. 1
Apr. 15.	Indian Head, Md.	Mar. 4
Apr. 15.	Gemmell, Minn.	Mar. 18
Apr. 15.	Lakeview, Mich.	Mar. 18
Apr. 15.	London, Ohio.	Mar. 25
Apr. 15.	Panama City, Fla.	Apr. 1
Apr. 15.	Bristolville, Ohio	Apr. 1
Apr. 15.	Danville, Va.	Apr. 1
Apr. 17.	West Liberty, Iowa	Mar. 25
Apr. 18.	Columbus, Ohio.	Mar. 25
Apr. 18.	Ft. Dodge, Iowa	Mar. 25
Apr. 18.	Margie, Minn.	Apr. 1
Apr. 18.	Fort Jennings, Ohio	Apr. 1
Apr. 18.	Warren, Ohio	Apr. 1
Apr. 19.	Arkadelphia, Ark. Adv. Mar. 11, 18.	Mar. 11
Apr. 20.	Niles, Ohio	Apr. 1
Apr. 20.	Carpenter, Iowa	Apr. 1
Apr. 20.	Forest City, Iowa	Apr. 1
Apr. 24.	Delphi, Ind.	Feb. 26
Apr. 24.	Roseburg, Ore.	Mar. 25
Apr. 24.	Lebanon, Ohio	Apr. 1
Apr. 26.	Evansville, Ind.	Mar. 25
Apr. 27.	Portland, Ind. Adv. Mar. 25.	Mar. 25
Apr. 28.	New Orleans, La.	Mar. 11
Apr. 29.	Strongville, Ohio.	Apr. 1
May 8.	Elkins, W. Va.	Mar. 25
May 25.	Butler, Pa.	Mar. 18

PRIVATE BUILDINGS.

Apr. 4.	Wahpeton, N. D.	Apr. 1
Apr. 5.	Comfrey, Minn.	Apr. 1
Apr. 5.	Long Prairie, Minn.	Apr. 1
Apr. 6.	Coopertown, N. D.	Apr. 1
Apr. 15.	Suffolk, Va.	Mar. 18
Apr. 20.	Protection, Kan.	Apr. 1
May 1.	Akron, Ohio	Mar. 18

NEW INDUSTRIAL PLANTS.

Apr. 4.	Long Prairie, Minn.	Mar. 25
Apr. 15.	Manila, P. I.	Jan. 1
Apr. 20.	Baltimore, Md.	Apr. 1

MISCELLANEOUS.

Apr. 4.	Garbage Disposal, Clarksdale, Miss.	Mar. 25
Apr. 4.	Retaining Wall, Sheridan, Wyo.	Mar. 25
Apr. 4.	Asphalt. etc., Columbus, Ohio.	Mar. 25
Apr. 4.	Road Oil, New Haven, Conn.	Apr. 1
Apr. 4.	Road Oil, Greenville, Miss.	Apr. 1
Apr. 4.	Road Oil, Etc., New Brighton, S. I., N. Y.	Apr. 1
Apr. 4.	Fire Escapes, Boston, Mass.	Apr. 1
Apr. 4.	Retaining Wall, Sioux Falls, S. D.	Apr. 1
Apr. 5.	Cement, Chehalis, Wash.	Mar. 25
Apr. 5.	Road Oil, Beaver Dam, Wis.	Apr. 1
Apr. 6.	Copper Cable, Panama. Adv. Mar. 25.	Mar. 25
Apr. 11.	El. Ry., Boston, Mass. Adv. Mar. 25, April 1.	Mar. 25
Apr. 12.	Fire Escapes, Pittsburgh, Pa.	Apr. 1
Apr. 14.	Pipe and Rock, etc., Charleston, S. C.	Mar. 18
Apr. 12.	Hardware for Laundry, Thellis, N. Y. Adv. Apr. 1.	Apr. 1
Apr. 15.	Cement, Louisville, Ky. Adv. Mar. 18 to April 1.	Mar. 18
Apr. 17.	Sale of Dredge, Grand Rapids, Mich. Adv. Mar. 25, April 1.	Mar. 25
Apr. 17.	Fire Equipment, Ashland, Ky. Adv. Apr. 1.	Apr. 1
Apr. 20.	Freight Handling winches for sale, Boston, Mass. Adv. Apr. 1.	Apr. 1
Apr. 22.	Steel Towers, Cordova, Alaska.	Mar. 11
Apr. 30.	Cement, Etc., Westmount, Que.	Apr. 1

SEARCHLIGHT SECTION

Official Proposal Announcements

Price, $2.40 an inch.—Copy can be received until Thursday 10 a. m. for issue mailed the next morning

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Bids open April 17, 1916.

NOTICE TO CONTRACTORS

EXTENSIONS TO WATER SYSTEM

NORFOLK, NEB.

Sealed proposals will be received by the City Clerk of the City of Norfolk, Neb., at his office up until 5 o'clock p. m., on the 17th day of April, 1916, for the construction of extensions to the city water system in Water Extension Districts Nos. 21 to 32 inclusive, as ordered by the Mayor and City Council of said city, said work to be performed in accordance with plans and specifications for same now on file in the office of the City Engineer.

Proposals shall be made upon the printed bidding-blanks which, together with plans, specifications, etc., may be obtained at the office of the City Engineer.

Each proposal shall be enclosed in a sealed envelope addressed to the City Clerk of the City of Norfolk, and shall be plainly marked on the outside thereof "Proposal for Water Main Extensions."

Each bid shall be accompanied by a certified check on some Nebraska bank, payable to the City of Norfolk, and for an amount equal to 5 per cent of the value of the work as shown by bid, as a guarantee of good faith on the part of the bidder.

To avoid delay, bidders are requested to be present at the opening of bids.

The Mayor and Council distinctly reserve the right to reject any or all bids or to waive any informality in any bid.

Following is the Engineer's estimate of the quantities and cost of the proposed work, which shall constitute the basis on which all bids shall be compared. No contract can be legally awarded which exceeds the amount of this estimate.

12,459 lin. ft. 4-in. c.-i. water main, Class C, laid per foot, at......	$0.70	$8,721.30
467 lin. ft. 6-in. c.-i. water main, Class C, laid per foot, at.......	0.88	410.98
2224 lin. ft. 8-in. c.-i. water main, Class C, laid per foot, at......	1.27	2,824.48
26 fire hydrants, each...	30.00	780.00
14 4-in. gate valves, in place, each, at........	9.00	126.00
1 6-in. gate valve, in place		14.00
3 8-in. gate valves, in place, each, at........	25.00	75.00
18 brick manholes, total 90 vert. ft., per ft., at.	3.50	315.00
18 c.-i. manhole covers, total 7200 lb., per lb., at	0.04	288.00
Tearing up 13 sq. yd. paving, per yd., at....	0.50	6.50
Furnishing and installing the following extra fittings: 65 pc. or 7328 lb., in place, per lb., at.	0.07	512.96
Total		$14,074.20

By order of the Mayor and City Council of the City of Norfolk, Neb., this 14th day of March, 1916.

Seal. P. F. STAFFORD,
City Clerk.

Bids open April 11, 1916.

NOTICE TO CONTRACTORS.

DORCHESTER TUNNEL

CITY OF BOSTON, MASS.

Sealed bids for building Section J, Dorchester Tunnel, in and near Dorchester Avenue and Boston Street, from about 80 ft. north of Dexter Street to about 30 ft. south of Ralston Street, South Boston, will be received by the undersigned until 12 o'clock noon of Tuesday, April 11, 1916. The section is about 1000 ft. long. The structure will be mainly of reinforced concrete and structural steel. The work includes the Andrew Square Station. Specifications and forms of contract can be obtained at 15 Beacon Street, ninth floor. The right to reject any and all bids and to award the contract as is deemed to be for the best interest of the City of Boston is reserved.

By order of the
BOSTON TRANSIT COMMISSION,
B. LEIGHTON BEAL,
Secretary.

Bids open April 18, 1916.

WATER WORKS, ELECTRIC LIGHT AND ICE PLANT

LOCKHART, TEXAS.

Proposals will be received by the Citizens' Water, Light & Power Company, of Lockhart, Tex., until noon, April 18, 1916, upon the following items. Bids may be submitted separately upon each item, or upon the entire plant, as a whole:

1 steel, hemispherical bottom tank, with tower.
1 concrete and iron pump house.
1 concrete and brick house for light and ice plant.
1 30-ton ice machine, installed complete.
1 100-kw. electric generating plant, installed complete.
400 tons Class B cast-iron pipe, 4 in, 6 in. and 8 in., laid.
50 standard fire hydrants, installed.
200 water meters, installed, ⅝ in. and ¾ in.
300 Michigan cedar poles, 30-35 ft., with fittings, set.
18 miles weatherproof wire, Nos. 4 to 10, strung.
250 electric service meters, placed.

All proposals should be addressed to W. B. Swearingen, president Citizens' Water, Light & Power Company, Lockhart, Tex.

Plans and specifications may be seen at the office of the Company, in Lockhart, or at the office of the engineer.

Plans and specifications may be procured of the engineer, upon payment of $10, to cover cost of printing, postage, etc. The Citizens' Water, Light & Power Company reserves the right to reject any or all bids.

HENRY E. ELROD,
Consulting Engineer,
907 Southwestern Life Building,
Dallas, Tex.

Bids open April 14, 1916.

BIDS FOR SEWERS

OFFICE OF THE ASSISTANT TO THE SECRETARY OF THE BOARD OF BOND TRUSTEES, CITY HALL.
JACKSONVILLE, FLA.

Sealed proposals will be received by the Board of Bond Trustees of the City of Jacksonville, until 8 o'clock p. m., Friday, April 14, 1916, at this office, for the construction of certain sanitary and storm sewers for the City of Jacksonville, Fla., in accordance with Ordinance N-58.

All work and material shall be in accordance with plans and specifications on file in the office of the City Recorder. Plans and further information can be obtained at the office of the Commissioner of Public Works, Sewer Department, upon payment of ten ($10.00) dollars.

The work will consist of approximately eighteen (18) miles of sanitary and storm sewers varying in size from eight (8") inches to fifty-four (54") inches.

The work will be divided into seven sections and bids will be received on each section separately, all as set out in the specifications.

Each bid must be accompanied by a certified check for two and one-half (2½%) per cent of the total amount of the bids, made payable to Gustav Muller, Acting Chairman, Board of Bond Trustees. Said checks must be submitted with the bids.

The right is reserved to reject any or all bids.

GUSTAV MULLER,
Acting Chairman Board of
Bond Trustees.
L. D. SMOOT,
Commissioner of Public Works.
March 15, 1916.

Bids open April 3, 1916.

NOTICE TO CONTRACTORS.

24-INCH CAST IRON FORCE MAIN

McKEESPORT, PA.

Sealed bids will be received by the McKeesport City Council on April 3, 1916, up to the hour of 2 p. m., Standard Eastern time, for laying approximately ten thousand (10,000) ft. of 24-in. cast-iron pipe line.

The contract will be divided into three (3) parts and the contractors may bid upon any one part or parts.

Each bid must be accompanied by a certified check equal in amount to 5 per cent of the total bid.

Bids must be made out on application blanks furnished by the engineer and addressed to John F. Alderin, Secretary to City Council, McKeesport, Pa., prior to the date and hour above given.

Plans, specifications and proposal blanks can be secured from the office of the engineer, Leo Hudson, 802 House Building, Pittsburgh, Pa., or from the office of the City Engineer, J. Monroe Smith, McKeesport, Pa.

The City Council reserves the right to reject any or all bids.

C. E. SOLES,
City Controller.
LEO HUDSON, Engineer,
802 House Building,
Pittsburgh, Pa.
March 22, 1916.

Bids open April 25, 1916.

STREET IMPROVEMENT

BUCYRUS, OHIO.

Sealed proposals for the improvement of twelve streets, totaling 100,000 sq. yd. in the City of Bucyrus, Ohio, will be received until 12 o'clock noon, Tuesday, April 25, 1916.

Specifications cover brick, concrete, asphalt and asphalt block. Part concrete foundation, part old macadam.

Plans and specifications can be seen and bidding blanks can be procured at the office of the City Civil Engineer, Bucyrus, Ohio.

Local certified check for $300 for each street, payable to M. J. Lutz, Director of Public Service.

F. L. NIEDERHEISER,
City Civil Engineer.
AUGUST BROEMEL,
City Clerk.

Bids open April 17, 1916.

SEWAGE PUMPING EQUIPMENT

WATERTOWN, S. D.

Sealed bids will be received by the undersigned until 7.30 p. m., of April 17, 1916, for the furnishing and erecting of two centrifugal sewage pumps with motors, control equipment and other appurtenances, at which time such bids will be publicly opened and considered by the Board of Commissioners of said city.

The amount of certified check required is $200. Detailed instructions to bidders, plans and specifications may be obtained at the office of the City Engineer, F. W. Schreiber, and Metcalf & Eddy, Consulting Engineers, Harris Trust Bldg., Chicago, and 14 Beacon Street, Boston. A deposit of $5 will be required for each set removed.

The City reserves the right to reject any or all bids or accept any bid, if it is deemed to be for the best interests of the City so to do.

CHARLES HARMAN,
City Auditor.
March 15, 1916.

Bids open April 11, 1916.

NOTICE TO CONTRACTORS.

FILTER BEDS, BASIN, CONTROL HOUSE, PIPING, ETC.

ILION, N. Y.

Sealed proposals will be received by the Board of Water Commissioners of the Village of Ilion, N. Y., at its office on Otsego Street, until 2 o'clock P. M., Tuesday, April 11, 1916, for the construction of reinforced concrete covered filter beds, clear water basin and control house, including the necessary piping, etc.

The work will consist of approximately 1300 cubic yards of reinforced concrete, 60 tons of steel reinforcement and 7000 cubic yards of earth excavation.

Plans and specifications may be seen at the above office or at the office of J. D. Ringwood, Engineer, in the City Hall.

Copies of the plans and specifications may be obtained upon request to the Clerk, and the payment of ten dollars; said amount to be refunded upon return of plans and specifications to the Clerk, in good condition.

All proposals must be made on blanks furnished by the Board of Water Commissioners, and be accompanied by a certified check for one hundred dollars as a guarantee that the proposer will enter into contract if his proposal is accepted.

The Board of Water Commissioners reserves the right to reject any or all bids.

By order of the Board of Water Commissioners.

G. O. RASBACH, Clerk.
Dated Ilion, N. Y., March 23, 1916.

Bids open April 10, 1916.

STREET PAVING

DEPARTMENT OF WORKS,
OSWEGO, N. Y.

Sealed proposals will be received until 2 p. m., April 10, 1916, and then opened by the Department of Works of the City of Oswego, N. Y., for the following pavement construction:

Approximately 14,275 sq. yd. vitrified brick pavement on concrete foundation.

1063 sq. yd. asphalt macadam on concrete foundation.

5800 lin. ft. concrete combined curb and gutter, together with the necessary catch-basins, manholes, sidewalks, etc.

Plans and specifications may be obtained from the City Engineer.

The work will be divided into three contracts and each bid must be accompanied by a certified check for ten per cent of the amount of the bid.

The Department of Works reserves the right to reject any and all bids.

CHARLES W. LINSLEY,
Commissioner of Works.
March 24, 1916.

Bids open April 20, 1916.

HIGHWAY IMPROVEMENTS

OFFICE OF THE STATE COMMISSIONER OF HIGHWAYS
ALBANY, N. Y.

Sealed proposals will be received by the undersigned at their office, No. 55 Lancaster Street, Albany, N. Y., at 1 o'clock p. m., on Thursday, the 20th day of April, 1916, for the improvement of the highways in the following counties:

Onondaga (two highways, 2.40, 5.12);
Saratoga (approximately 5.74);
Ulster (approximately 0.49).

Maps, plans, specifications and estimates may be seen and proposal forms obtained at the office of the Commission in Albany, N. Y., and also at the offices of the division engineers in whose divisions the roads are to be improved. The addresses of the division engineers and the counties in which they are in charge will be furnished on request.

The especial attention of bidders is called to "General Information for Bidders" in the itemized proposal, specifications and contract agreement.

EDWIN DUFFEY,
Commissioner.
I. J. MORRIS,
Secretary.

CONTRACTING NEWS

Of Special Interest to Engineers, Contractors, Builders and Manufacturers of Engineering and Building Supplies

THOSE who believed that the foreign trade of this country had reached its climax in December were surprised by the news, just issued by the Department of Commerce, that both exports and imports for the short month of February far exceeded even the recent high records. It is now considered probable that our exports for the current fiscal year will reach the astonishing total of $4,000,000,000, 60 per cent above the record year ended last June. A $1,300,000,000 trade balance has already piled up in our favor for the current fiscal year. Thus our foreign commerce, which induced the revival of domestic business and which has sustained the domestic market, promises to continue a powerful factor despite transportation problems. These include general increases in ocean freight rates during the past two years of from 200 to 900 per cent.

The opening of spring construction work promises well, with many contractors already busily gaged. Building work is very active even now in the Eastern territory. The volume of business to be expected is foreshadowed by increased early buying of both lumber and structural steel, in spite of freight conditions. Lumber orders are exceeding production generally throughout the country. More structural steel was bought last month than in the entire first quarter of 1915, bringing the total for the first three months of this year above that for the same quarter of any year since 1912.

Buildings

The large building contracts reported this week include: Philadelphia, $304,000 freight depot; Cleveland, $3,000,000 hotel; Indianapolis, $160,000 industrial plant; Huntington, Ind., $154,000 school; St. Paul, $250,000 office building; Winnipeg, $600,000 building.

That the volume of prospective work is increasing will be noted from the number of projects in excess of $200,000 listed below: Boston, $400,000 school building contemplated; New York City, plans filed for $450,000 college building; Poughkeepsie, N. Y., plans complete for $250,000 factory; Niagara Falls, Ont., $250,000 roundhouse and dock proposed; Bayonne, N. J., $250,000 addition to high school; Wilmington, Del., $300,000 library contemplated; Lancaster, Pa., $250,000 school bonds sold; Philadelphia, 1,000,000 bu. addition to grain elevator contemplated; Norfolk, Va., $250,000 city hall being considered; Akron, Ohio, architect engaged for $200,000 terminal; Milwaukee, architect engaged for $300,000 hospital; Detroit, $200,000 appropriated for hospital, and architect selected for $200,000 factory; St. Paul, $400,000 hotel contemplated; Wichita Falls, Tex., plans accepted, $225,000 court house; Ogden, Utah, architect engaged, $300,000 packing plant; Salt Lake City, plans being prepared, $200,000 apartment house; Portland, Ore., $400,000 steel plant contemplated; San Francisco, site purchased, $200,000 warehouse; Vancouver, B. C., plans completed for $1,000,000 passenger terminal.

Bridges and Roads

The building of a 1200 ft. viaduct has been contracted for at Kerney, N. J. A bridge contract amounting to $191,000 has been let at La Salle, Ill. A contract for the bridge at Mankato, Minn., has been let at $95,000.

Proposed bridge work includes the following: Philadelphia, plans approved for $325,000 bridge; Maryland, $200,000 appropriated for bridge at Ocean City; Norfolk, Va., $100,000 bridge contemplated; South Bethlehem, Pa., plans for $500,000 viaduct being prepared; Oregon, plans being prepared for 800-ft. draw bridge; Spokane, construction recommended, two concrete bridges, $100,000 and $135,000 respectively.

Paving work awarded shows a good increase over that reported last week, eight cities being noted, in which bids opened or contracts awarded on work costing more than $100,000. These are: Philadelphia, street grading contract awarded, $140,000; Baltimore, paving contract awarded, $119,000; De Land, Fla., 53 miles of paved roads awarded; Columbus, Ohio, road contract awarded, $167,000; St. Paul, paving contracts awarded, $160,000; Sioux Falls, S. D., paving contract awarded, $109,000; Houston, Tex., paving contract awarded, $142,000; Seattle, lowest bid received for paving work, $171,000.

Bids will be opened April 16 at McPherson, Kan., for laying 40,000 sq. yd. of pavement, and April 21 at Spokane for large contracts on a $325,000 road improvement project. The following proposed work is noted: New Jersey, bill passed providing for $7,000,000 road bond issue; West Virginia, four districts voted $754,000 road bonds; Tennessee, counties appropriated more than $2,800,000 for road work; Decatur, Ill., estimate complete, paving to cost $112,000; Mount Pleasant, Tex., $225,000 road bonds sold; Hanford, Cal., contract to be let, paving work to cost $140,000.

Waterworks and Sewers

The contract for extending the Linwood Avenue intake tunnel at Milwaukee has been awarded at $456,650. Other waterworks construction noted in this issue follows. Bids desired: Yoncalla, Ore., 9 miles pipe line and rock fill dam, May 15; Covina, Cal., May 1, waterworks costing $105,000. Proposed work: Albany, N. Y., ordinance approved authorizing $100,000 waterworks extensions; Brunswick, Md., ordinance passed authorizing $75,000 waterworks improvements; Wilmington, Del., engineer engaged to prepare plans for reservoir and additional filter plant; Canton, Ohio, contract to be let for enlarging waterworks at cost of $150,000; Zanesville, Ohio, engineer engaged to prepare plans for $250,000 waterworks extensions; Ironton, Ohio, plans prepared, waterworks to cost $250,000; Oklahoma City, Okla., report submitted on proposed $1,000,000 water supply.

The following sewer work is noted: New York City, low bids received on four sewer sections, $529,000, $90,000, $250,000 and $247,000 respectively. Oriskany, N. Y., bids desired April 19. sanitary sewer system and disposal plant; Lodi, N. J., bonds voted, $200,000 sewer system and disposal plant; Hammonton, N. J., $150,000 sewer bonds sold; Lima, Ohio, engineer engaged, relief sewer and disposal plant; Watts, Cal., plans being prepared, $125,000 sewer system.

Miscellaneous

Other work noted includes the following: Pier sheds for $2,000,000 warehouses contracted for, Norfolk, Va.; bids opened, $155,000 breakwater, Conneaut, Ohio; bids opened, levee work to cost $276,000, Vincennes, Ind.; contract to be let for $150,000 terrace surrounding Missouri state capitol building; engineer engaged to investigate water power proposition, Rochester, Minn.. $360,000 available; ditch work, Roseau, Minn., estimated cost $218,000; engineer engaged. $700,000 irrigation project, Calneva, Cal.

WATERWORKS

PROPOSED WORK.

Boston, Mass.—The Governor approved bill permitting city to construct high-pressure pumping station on edge of Charles River basin.

Sherborn, Mass.—Reported citizens voted to install waterworks.

Taunton, Mass.—See "Sewerage and Sewage Disposal."

Hartford, Conn.—As part of the new water supply of Hartford it is proposed to install a filtration plant in West Hartford.

Albany, N. Y.—Mayor approved ordinance authorizing $100,000 for extension of water system in accordance with plans filed April 5, 1915. Wallace Greenalch, Commissioner Public Works.

Geneva, N. Y.—Board Public Works considering enlarging filtration plant at a cost of about $26,500.

North Tonawanda, N. Y.—Citizens voted in favor of $40,000 bond issue for installing boilers, pumps and other equipment at pumping station on Tonawanda Island.

Troy, N. Y.—Superintendent of Water Works recommends installation of 13,000 meters for water system.

New Brunswick, N. J.—Plans about completed for a 6,000,000-gal. water filter plant. Asher Atkinson, City Engineer.

Orange, N. J.—Harry D. Wethling, Director Streets and Public Improvements, recommended immediate construction of a new reservoir and filtration plant.

Wildwood, N. J.—Commissioners voted to issue $13,000 bonds for additional equipment to city water works.

Brunswick, Md.—An ordinance has passed House of Delegates authorizing issue of $75,000 bonds for improving water works.

Wilmington, Del.—The Board Water Commissioners engaged George W. Fuller, 170 Broadway, New York, N. Y., to prepare plans and specifications for a 12,000-gal. rapid sand filter plant, also for a covered filtered water reservoir to be located in the city on Rodney Street. Plans and specifications may be completed about April 24, and bids for filter plant opened about May 8.

Wheeling, W. Va.—City Council considering a filtration plant.

Tavares, Fla.—Franchise granted to W. F. L. Barrett, of Houghton, Mich., to install electric light system, water works, ice factory and cold storage plant.

Barnesville, Ohio.—Morris Knowles, Pittsburgh, Pa., is engineer for water works improvements contemplated here which include filtration plant, power house, elevated tank and lay additional pipe line. F. Waldo Hiles, Clerk.

Dayton, Ohio.—Water and sewer bonds for $252,000 will be sold May 1 by Hugh E. Wall, City Accountant.

Lindsey, Ohio.—Construction of water works is contemplated by Village Council.

Ravenna, Ohio.—About $40,000 water works bonds sold.

South Charleston, Ohio.—All bids opened March 31 for constructing water works exceeded the amount available. S. B. Rankin, Clerk Board Public Affairs.

Wickliffe, Ohio.—Citizens voted to incorporate village of Wickliffe to make possible construction of water works.

Zanesville, Ohio.—The W. J. Sherman Company, 613 The Nasby, Toledo, engaged by city to prepare plans and specifications for extensive improvements to the municipal water works involving an expenditure of $250,000.

Aurora, Ill.—Election to be held April 18 to vote $75,000 bonds for improving pumping station. A. H. Laher, Supt. Water Works.

Chicago, Ill.—John Ericson, City Engineer, asked Council Finance Committee for $25,000 to make a survey of city's water system.

Tuscola, Ill.—Citizens voted $18,000 bonds to construct water works. Address City Clerk.

Chilton, Wis.—Citizens voted $45,000 bonds for constructing water works.

New Ulm, Minn.—All bids opened March 20 for new pump head and repairs to old pump head rejected as being too high. F. O. Minium, City Engineer.

Castlewood, S. D.—Estimate of cost being made for constructing water works. Address City Clerk.

Marlin, Texas.—See "Public Buildings."

Ardmore, Okla.—Installation of new machinery at pumping station is contemplated by city.

Lookeba, Okla.—Town Council considering constructing water works.

Oilton, Okla.—Ordinance passed authorizing issue of $25,000 bonds for constructing water works. Roy McFarland, City Clerk.

Williston, Okla.—Contract soon to be let for constructing water works to cost $17,000. Benham Engineering Company, Oklahoma, Engineers; O. H. Coxen, Town Clerk; J. E. Rea, Pres. Board Town Trustees.

Everett, Wash.—Contract to be let latter part of April or early in May for constructing the pipe line and reservoirs for additions to municipal water system. Cost of first unit estimated at $500,000. Burna & McDonnell, Engineers, Kansas City, Mo.; Hana Munn, Jr., City Engr.

Seattle, Wash.—Plans and specifications for water mains in Hudson Street filed with Board of Public Works by A. H. Dimock, City Engineer; cost $21,000.

All bids opened by Bd. Public Works, March 21, for furnishing 42-in. steel pipe rejected.

Portland, Ore.—Reported City Commission decided to postpone construction of proposed $100,000 intake at Bull Run headworks.

Roseburg, Ore.—City Council appointed a committee to investigate feasibility of installing municipal water works,, estimated cost $400,000.

Hemet, Cal.—Lake Hemet Water Company reported planning constructing a flume in the mountain to cost $75,000.

BIDS DESIRED.

Boston, Mass.—Until April 10 by Supply Department (D. Frank Doherty, Supt.) for furnishing the Public Works Department, Water Service, with 115 tons of 6-in. pipe with flexible joints. Also separate bids same place as above until April 11 for 800 post hydrant boxes, 800 gate boxes and 1000 meter boxes.

Lynn, Mass.—Until April 20, by Commissioners of Waterworks (Thos. Campbell, second chairman), for a 3,000,000-gal. horizontal centrifugal pump, also for a 200-hp. electric motor.

Cobleskill, N. Y.—Until April 17, by James L. Fuller, Chmn. Board Water Commissioners, for extending present 8-in. water main in North Grand Street, about 2270 ft., together with hydrants, gates, special castings, etc.

New York, N. Y.—Until April 18, by Board Water Supply, for Contract 95, furnishing, delivering and erecting nine electric traveling cranes from 5 to 20-ton capacity with equipment in chambers at Ashokan, Kensico and Hillview Reservoir. The work is located in the town of Olive, Ulster County, and town of Mt. Pleasant and City of Yonkers, Westchester County, N. Y.

Butler, N. J.—Until April 19, by A. W. Cuddeback, Engineer Butler Water Company, 156 Ellison Street, Paterson, for constructing reinforced concrete dam and laying about 12,000 ft. 12-in. c.-i. pipe near Butler for Butler Water Company, advertised in Engineering Record.

South Orange, N. J.—Until April 17, by Water Committee, (Geo. F. Seymour, Jr., Supt.), for laying approximately 7200 lin. ft. 8 in. c.-i. bell and spigot water pipe Class "C," hydrants, valves, etc. Also same time and place separate bids for 7200 lin. ft. 8-in. and 2200 ft. 6-in. cast iron coated bell and spigot water pipe Class "C."

Pittsburgh, Pa.—Until April 15, by City Controller, for furnishing water meters, water meter fittings, and water meter parts.

Jacksonville, Fla.—Until April 20, by Board Bond Trustees (Gustav Muller, Act. Chmn.), for furnishing and installing a water softening apparatus of 24,000 gal. capacity for use in connection with the City Electric Light Plant.

McCombs, Miss.—Reported desired until April 18, by Mayor and Board Selectmen, for 1500 ft. 4-in. water mains.

Cincinnati, Ohio.—Until April 17, by Chas. F. Hornberger, Service Director, for laying portion of 36-in. loop main in subway from Delta Avenue to Strader Avenue, to consist of 2060 lin. ft. of 4, 6, 8, 10 and 36-in. pipe, etc.

Middletown, Ohio.—Until May 1, by City Commissioners (John Kunz, Clk.), for constructing at Coty Water Works 2 electrically driven centrifugal pumps having a capacity of 2100 gals. per minute and one high-duty steam driven pumping unit having capacity of 3,000,000 gals. per 24 hours.

Chicago, Ill.—Until April 11, by Department Public Works (W. R. Moorehouse, Comr.), for furnishing and delivering at Mayfair pumping station a one steam direct turbine driven direct connected centrifugal sump pump, with necessary appurtenances.

Silver Lake,. Minn.—Reported desired until April 15, by Bernard Tawlak, Village Recorder, for furnishing material and constructing water works. J. A. Rowat, Engr., Willmar.

Lake Norden, S. D.—Until April 18 by R. C. Byrde, Town Clk., for constructing water works and electric light and power plant. W. C. Buck, Consulting Engr., Minneapolis, Minn.

Billings, Mont.—Reported desired until April 12, by F. E. Williams, County Clerk, for digging wells, laying mains, building tank and pump station.

Broadview, Mont.—Until April 12, by F. E. Williams, County Clerk, for constructing water works, to consist of laying supply lines, constructing elevated tank, installing pump house, distribution system, etc.

Wellston, Okla.—Until April 17, by Board Town Trustees, for furnishing material and constructing water works, to consist of 9666 lin. ft. of 6-in. and 14-in. c.-i. pipe, 4560 lin. ft. 2-in. wrought-iron pipe, a 30,000-gal. elevated tank, a 100 G. P. M. centrifugal pump, gate valves, hydrants, etc. Alternate bids for air compressor, power house building, a 100.000-gal. surface brick reservoir, etc. Benham Eng. Co., Colcord Building, Oklahoma City, Engrs.

Olympia, Wash.—Reported desired until April 10, by State Board Control, for constructing a 58-ft. square 8-ft. deep concrete reservoir, to be built at Port Orchard for the Washington Veterans' Home.

Seattle, Wash.—Until April 13, by C. E. Dole, Purchasing Agent, Alaskan Engineering Commission, for pipes and fittings, etc.

Yoncalla, Ore.—Reported desired until May 15, by City Recorder, for constructing water works to consist of 46,520 ft. of 6 and 8-in. wood or steel pipe, a concrete line reservoir of 100,000-gal. capacity concrete core·dam, rock filled, etc. M. B. Germond, Engr., Roseburg.

Covina, Cal.—Until about May 1, by City Clerk, for constructing water works to cost $105,000, including about 72,000 lin. ft. 3-ft. trench, 14,000 ft. 12-in. No. 12 steel riveted pipe, 13,200 ft. 6, 8 and 10-in. O. D. casing pipe, 44,645 ft. 2 and 4-in. S S pipe, 70 fire hydrants, one 12-in. and one 18-in. well each 400 ft. deep, a 2,000,000-gal. reinforced concrete reservoir, one 20 x 40 x 6-ft. reinforced concrete settling basin, pumping station building, 40 x 60-ft. iron and concrete, two triplex booster pumps, 200 ft. lift 2 sec.-ft. capacity, one 120-hp. Diesel oil engine, etc. F. E. Trask, Consulting Engineer, Los Angeles. If private plant is acquired these items will be revised.

Panama.—Until April 18, by Maj. Earl I. Brown, Corps Engrs., U. S. A., General Purchasing Officer Panama Canal, Washington, D. C., for steel pipe and other supplies.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Boston, Mass.**—Contract approved by Mayor for furnishing 350,000 lbs. I. B. iron castings to Water Service of Public Works Dept. awarded Central Foundry Company, 90 West Street, New York, at 2.364 cts. per lb., and also for 525,000 lbs. at 2.664 cts. per lb., and contract to R. D. Wood & Company, Philadelphia, for furnishing c.-i. pipe and special castings to Water Service Department of Public Works Department at following bid: 4-in., $37.74; 6-in., 8-in., 10, 12 and 16-in., each $29.24, and 30-in., $28.24; special castings, $57 per ton.

Fall River, Mass.—Following bids opened by Water Dept. for improvements to pumping station: Puleston & McDougall, 409 S. Main Street, $8,900; McNally Constr. Co., First National Bank Bldg., $9,200, and Corrigan & Palmer, 23 Rodman St., $9,500.

★**New York, N. Y.**—Contract awarded by Water Board, Municipal Building, New York, for Contract 120, to A. L. Guidone & Son, Inc., 52 Vanderbilt Avenue, at $104,262 (bids opened March 21).

★**Greenville, Pa.**—Contract awarded by Greenville Water Co. for high-service pumping station and 8 and 10-in. force mains to J. I. Dick, Scotsdale, Pa., pumping machinery to Aldrich Pump Co., of Allentown, Pa. Chester & Fleming, Engrs., Pittsburgh.

★**Lancaster, Pa.**—Contract awarded by City Council for improvements to water works as follows: Pumps, to Earle Gear Machine Co. of Philadelphia at $6,059, and for motors to Westinghouse Electrical Co. of Baltimore, Md., at $32,828. Bids opened March 22.

★**Lakeland, Fla.**—Contract for constructing water works (bids opened March 27) awarded by Board Bond Trustees (J. R. Boulware, Secy.) as follows: G. B. Greeson, Tampa, piping; Chapman Valve Company, Indian Orchard, Mass., valves; Southern Construction Company, Jacksonville power house (including foundations) and reservoir; Cameron Barkley Company, Tampa, steel pipe and fittings.

★**Cincinnati, Ohio.**—Contract awarded by City Board of Control March 31 for laying high-pressure mains in section bounded by Broadway, Main, Third and Eighth Streets, to Thurber & Browning, Cincinnati, Ohio, at $43,097.

★Contract for manufacturing pipe for above work awarded United States Cast Iron Pipe & Foundry Co., Addyston, Ohio, at $53,967.

Service Director Chas. F. Hornberger opened following bids, April 3, on cleaning 5160 lin. ft. 4-in., 33,170 lin. ft. 6-in. mains, 1300 lin. ft. 8-in., and 10,260 lin. ft. 10-in. water mains: National Water Main Cleaning Co., New York City, $9,978 (recommended for acceptance); American Water Main Cleaning & Construction Co., Louisville, Ky., $11,194.

Following bids opened April 3 by Charles F. Hornberger, Director Service, for underfeed stoker equipment for the River Pumping Station: Combustion Engineering Corporation, 11 Broadway, New York, $12,285; Jones Stoker Co., Chicago, Ill., $7,470.

★**Cleveland, Ohio.**—Contract awarded by Bd. Control for $136,035 worth of c.-i. pipe for city water works to United States Cast Iron Pipe & Foundry Co., Addyston, and for $17,466 worth of castings for city water works to Bowler Foundry Co., Cleveland; fire hydrants to Florence Iron Wks., Philadelphia, Pa., at $13,225.

★**Milwaukee, Wis.**—Contract for constructing extension of Linwood Avenue intake tunnel and Lake Shaft and for furnishing and placing submerged lake crib (bids opened March 8) awarded O'Brien & Jackson Co., National Life Building, Chicago, Ill., at $476,650, Next three lowest bidders: Prange Nakielcki Co., Majestic Building, $532,287; Hoag & Dall, Commercial Bank Building, Cleveland, O., $541,989, and Byrne Bros. Dredging & Engineering Co., 208 LaSalle Street, Chicago, Ill., $561,051. Fred G. Simmons, Commissioner Public Works.

★**Timpson, Texas.**—Contracts for constructing water works (bids opened March 27) awarded as follows: 75,000 gal. tank and tower to Pittsburgh Des Moines Steel Company, Dallas, Texas; pumping machinery 100 gp.m. deep well, pump, driven by 20-h.p. little Giant oil engine, to Gamer Company, Fort Worth; distributing system 6 and 8 in. c. i. pipe, Class "B," to Hamilton Bros. Construction Company, Houston, Henry E. Elrod, Engineer,- Southwestern Life Building, Dallas.

★**Aberdeen, Wash.**—Contracts for furnishing materials for water works (bids opened March 22) awarded city as follows: To Portland Wood Pipe Co., Portland, 250,000 ½-in. milled steel bands, 8 ft. 8½ in. approximate length per 100 lb., at $3.09; 250,000 malleable iron shoes for ½-in. bands, per 100 lb., $4.34; 25,000 lb. 1½-in. 14-gage band iron, per 100 lb., $3.25 (brand Portland wood pipe shoe); Crane Company, Seattle (brand Chabot air and vacuum valves), 2 in. automatic air and vacuum valves $6, and 4-in. $9; G. E. Steam Specialty Co., Aberdeen (Nelson gate valves), 2-in. $2.75; 3-in. $3.83 and 4-in. $5.17.

Lowest bidders on other materials not yet awarded were: 30-in. direct pressure sluice gates, Washington Pipe & Foundry Co., $163.30 (Ludlow sluice gates); 4-in. automatic air and vacuum valves, $31.25 (simplex air and vacuum valves); 2000 M. ft. finished pipe staves per M ft., Anderson & Middleton and Pacific Lumber Agency bid same, at $30; 55 M ft. lumber (no bids). Louis D. Kelsey, City Engineer.

★**Havana, Cuba.**—Contract awarded for a water supply system for Pogolti, a suburb of Havana, to Bernano Munez Co., 2 Arsenal Street, for $35,657.

SEWERAGE AND SEWAGE DISPOSAL

PROPOSED WORK.

Taunton, Mass. — Finance Committee sold $20,000 sewer bonds; also $15,000 water bonds.

Oriskany, N. Y.—Citizens voted $40,000 bonds for constructing sewer system.

Gloucester, N. J.—House passed bill enabling Gloucester to perfect its sewer system.

Hammonton, N. J. — About $117,000 sewer bonds sold by city.

Lodi, N. J.—Citizens March 28 voted to issue $200,000 bonds for constructing sewer system and disposal plant. Bowe & Wessells, East Rutherford, Engineers. J. A. McMahon, Borough Clerk.

Matawan, N. J.—Plans will be submitted to State Board of Health at Trenton about June for the proposed sewer system and disposal plant. George A. Johnson, 150 Nassau Street, New York, N. Y., Engr.

Pitman, N. J.—Mayor has approved ordinance providing for municipal sewer system to cost $110,000.

Erie, Pa.—Constructing of a storm water sewer in territory bounded by Twelfth, Chestnut, Myrtle Streets and bay being considered by City Council; cost $30,000.

Hanover, Pa.—Plans for constructing a sewer system and disposal plant for Hanover Township to be submitted to State Health Dept. at Harrisburg. Address Clerk Hanover Township, Hanover.

Lewiston, Pa.—Preliminary plans submitted to State Department of Health, Harrisburg, for the proposed sewage disposal plant, but nothing very definite has been done about the construction of the plant. G. A. Flink, Engineer, Harrisburg; J. Harry Saxton, City Clerk.

Marcus Hook, Pa.—Plans prepared by Pugh & Hubbard, Witherspoon Building, Philadelphia, for sewerage system for Linwood Heights section of Lower Chichester; cost about $25,000.

Pittston, Pa.—Contract about to be let for constructing extension to sewer system in 9th District, probable cost $30,000. Plans of borough engineer approved by council.

Waynesboro, Pa.—Plans being prepared for constructing a sewer 1000 ft. long. Address Borough Clerk.

Hagerstown, Md.—At election March 27 citizens voted to construct sewer system. J. B. Ferguson, City Engr.; Henry Davis, City Clk.

Towson, Md.—Senate passed bill providing for constructing a sewerage system for Baltimore County. Ezra B. Whitman, Engr., Baltimore.

Newark, Del.—Several extensions to the sewer system are proposed, as soon as right-of-way is secured. S. J. Wright, Chmn. Sewer Commission.

Coshocton, Ohio.—City Council directed City Engineer to make preliminary survey and estimate on cost of enlarging city's surface water sewer system.

Dayton, Ohio.—See "Water Works."

Delaware, Ohio.—State Bd. Health at Columbus and city officials will make a survey for a sewage disposal plant.

Lima, Ohio.—A. L. Metheany, Director of Service, engaged George W. Fuller, 170 Broadway, New York, N. Y., to make survey, investigation and recommendations relative to sewer relief and sewage disposal.

Urbana, Ohio.—About 4050 ft. 15, 18 and 24-in. pipe sewers will be laid at a cost of $9,000. E. F. Sweatman, City Engineer.

West Park, Ohio.—Sewer bonds for $106,872, and sidewalk, grading and draining bonds for $14,554 will be sold May 2 by Fred. Feuchter, Village Clerk.

Youngstown, Ohio.—George W. Fuller, 170 Broadway, New York, N. Y., in report to reduce pollution of Mahoning River, recommended if any thing is done regarding improvement that all cities from Warren to state line should co-operate. Warren, Niles, Girard, Youngstown, East Youngstown, Struthera and Lowellville to join in construction of sewage disposal plants.

Flint, Mich.—Sewer Committee submitted to Common Council estimates of cost at $40,504 for constructing storm and sanitary sewers. About 13 sewers to be constructed.

Arthur, Ill.—Town Officials considering constructing a sewer system and 2 miles of paving; estimated cost $50,000.

Elgin, Ill.—Reported a municipal engineer will be engaged to prepare plans for improvements in Elgin, to include street improvements, complete sewer system and routing of car lines. W. P. Topping of Commercial Club will be able to give further information.

Clarksville, Texas.—Henry E. Elrod, Southwestern Life Building, Dallas, engaged as engineer for the reconstruction of the sewage disposal plant.

Marlin, Texas.—See "Public Buildings."

Commerce, Okla.—City Council considering constructing sewer system.

Puyallup, Wash.—Contract soon to be let for constructing trunk sewer for east end of town. Plans prepared by G. D. Ball, City Engineer; cost $15,000.

Watts, Cal.—City Engineer preparing plans for sewer system to cost $125,000; an election to be held.

BIDS DESIRED.

Boston, Mass.—Until April 13 by B. Leighton Beal, Secy. Boston Transit Commission, for furnishing and delivering at 14 Cypher Street about 25 tons of c.-i. manholes, frames and covers.

Marlborough, Mass.—Until April 17, by Water & Sewage Commisisoners, for furnishing about 22,900 ft. 5 to 12-in. vitr. salt-glazed sewer pipe, etc., advertised in the Engineering Record.

Woonsocket, R. I.—See "Paving and Roads."

Binghamton, N. Y.—Until April 12 by Board of Contract and Supply for constructing sewers on Grand Boulevard, Mason and Ely Streets and Floral Avenue. W. Earl Weller, City Engineer.

Brooklyn, N. Y.—Until April 12, by L. H. Pounds, Borough President, for constructing sewers in Seventy-sixth, E. Fifteenth, Fifty-sixth Streets and Eighteenth Avenue.

Buffalo, N. Y.—Until April 15, by Department Public Works (Arthur W. Kreinheder, Supt.), for constructing sewers in Louisiana, Chicago and Ohio Streets.

Oriskany, N. Y.—Until April 19, by Board Village Trustees, for constructing sanitary sewer system and sewage disposal plant advertised in Engineering Record. A. M. Scripture, Engr., 8 Highby Ave., New Hartford.

New Brunswick, N. J.—Until April 11 by Asher Atkinson, City Engineer, for one mile of 12 to 20-in. sanitary sewers, to cost $11,000.

South Orange, N. J.—Until April 17 by Sewer Committee of the Board Trustees of Village for constructing sanitary sewer in Wyoming Avenue, requiring approximately 6170 lin. ft. 8-in. pipe 21 manholes, 4 flush tanks, etc. Ira T. Redfern, Village Engr., 11 South Orange Avenue.

Cincinnati, Ohio.—Until April 13, by Chas. F. Hornberger, Service Director, for constructing brick and concrete sewer in ravine from Oskam Avenue to Longfellow and Massasoit Streets, to consist of 2735 ft. 45, 48 and 54 in. Probable cost, $23,395. Frank S. Krug, City Engr.

Cleveland, Ohio.—Until April 13, by Commission of Purchase & Supplies, for constructing sewers in Shaker and North Boulevard and Sandusky Avenue.

Chicago, Ill.—Until April 13, by Board Local Improvements (Edward J. Glackin, Secy.), for constructing Rockwell Street sewer system.

New Lisbon, Wis.—Until April 14 by H. P. Gibson, City Clerk, for furnishing and laying 15,537 ft. 8 to 12-in. vitr. pipe sewers, 2 flush tanks, 29 manholes, 11 lampholes, 2830 lin. ft. 4 and 6-in. c.-i. water pipe 7 6-in. valves, 15 hydrants and about 7000 lb. special castings.

Des Moines, Iowa.—Until April 19, by Horace Susong, City Clk., for Close's Creek Sewer System No. 3369, all pipe 12 in. or less in diam. shall be No. 1 vitr. clay pipe, all pipe from 15 to 24 in. in diam. inclusive shall be double strength vitr. clay pipe, all 30 in. sewer will be double strength vitr. clay pipe, block construction, and vitr. brick construction, all 36 in. sewer. Bids will be received on both reinforced concrete construction, vitr. clay block construction, all 36 in. diam. Probable cost, $250,000.

Marengo, Iowa.—Until April 20 (readvertisement) by John C. Baker, City Clerk, for constructing sanitary sewer and sewage disposal plant. Through an error in the resolution no bids were opened April 3.

St. Paul, Minn.—Reported desired until April 10, by Aug. Hohenstein, Purchasing Agent, for constructing sewers in several streets.

Austin, Tex.—Until April 22, by P. W. Powell, Supt. Streets and Public Improv., for constructing storm sewer to carry the water of what is known as Little Shoal Creek, advertised in Engineering Record. The work is divided into three contracts, the largest of which will cost $35,000, the other two $5,000 each.

Long Beach, Cal.—Reported desired until April 11, by H. C. Waughop, City Clk., for constructing 30-in. brick pipe storm sewers in Hill St., including manholes, catch basins and other appurtenances.

Toronto, Ont.—Until April 11, by T. L. Church (Mayor), Chairman Board Control, for constructing sewers in Ethel and Lyod Avenues, McCormick and other streets.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Boston, Mass.—Contract awarded J. P. O'Connell Company, 174 Freeport St., at $10 per thousand for 430,000 sewer brick and $12.50 per thousand for 422,000 sidewalk brick.

★Buffalo, N. Y.—Contract for constructing Swan-Seneca Street sewer (bids opened April 1) awarded to Joseph F. Stabell Co., 1127 Niagara St., at $135,897.

Lowest bid opened for constructing Babcock-Prenatt Street sewer submitted by H. S. Kerbaugh, Telephone Bldg., at $18,990.

New York, N. Y.—Following are totals of four lowest bids opened March 30 by Douglas Matthewson, Pres. Bronx Borough, for sewers in Westchester and other avenues, including Wilson, Adle and Throop Avenues: William Baker, Inc., 26 Cortland Street, $529,145; J. C. Rodgers, Jr., 271 W. 125th Street, $593,372; Oscar Daniels Co., Woolworth Bldg., $615,873; T. A. Gillespie Co., 50 Church Street, $619,100.

In Westchester, Blondell and other avenues: Peter B. Stanton, 2337 Walton Avenue, $90,693; J. L. Sigretto, Fort Schuyler Road, $114,872; Brennan Contracting Co., $121,672, and DiMenna & Del Balso, $129,749.

In Seymour Avenue: Three bidders, Oscar Daniels Co., Woolworth Bldg., $249,933; Rodgers & Hagerty, 271 W. 125th Street, $283,197, and N. Y. & N. J. Contracting Co., 30 E. Forty-second Street, $354,784.

In Allentown, Wilson and other avenues: Three bidders, Oscar Daniels Co., Woolworth Bldg., $247,130; N. Y. & N. J. Contracting Co., 30 E. Forty-second Street, $359,168; Rodgers & Hagerty, 271 W. 125th Street, $347,659.

★Louisville, Ky.—Contract for constructing sewers in F and Brandeis Streets (bids opened March 17 by Board Public Works) awarded to J. H. Cahill Co., Louisville, at $11,000.

★Randolph, Wis.—Contracts for constructing sewerage system (bids opened March 27) awarded by city as follows: Sewers, about 17,650 lin. ft. 8 to 12-in. pipe to E. T. Sykes Co., Minneapolis, Minn., and tank to August Liedeman, Liedeman, Mich. J. O. Jones, Clerk.

★Clay Center, Kan.—Contract for constructing storm sewers (bids opened March 28) awarded E. D. Reed, Clay Center. E. R. De Bray, City Clerk.

★Polson, Mont.—Contract for constructing 15,000 lin. ft. sanitary sewers (bids opened March 6) awarded Security Bridge Company, Minneapolis, Minn., at $25,719.

★Houston, Tex.—Contract for constructing sewer in Crockett Street from Hickory to Taylor Streets awarded W. Waldo, Houston, at $21,149.

McMinnville, Ore.—Lowest bid opened recently by City Council for sewer improvements submitted by V. R. Dennis Construction Company, Portland, at $11,594.

★Havana, Cuba.—Contract awarded for sewering Pogolotti, a suburb of Havana, to Bernano Munez Co., 2 Arsenal Street, for $41,256.

BRIDGES

PROPOSED WORK.

Holyoke, Mass.—Plans being prepared for the Dwight Street bridge to be constructed of concrete and steel and cost $10,000. T. J. MacCarthy, City Engineer.

Ogdensburg, N. Y.—William Menser, Park Row Building, New York, is engineer for the viaduct to be constructed over tracks of the N. Y. Central R. R. (George Kittredge, Ch. Engr., Grand Central Station, New York). Plans have been approved by State Public Service Commission.

Philadelphia, Pa.—Director of Public Works approved plans for plate girder bridge over Schuylkill River at South Street to replace old bridge. Estimated cost $325,000.

South Bethlehem, Pa.—Plans are being prepared for bridge to be constructed by Lehigh Valley, Reading and Jersey Central Railroads over Lehigh River here to cost $500,000, to replace condemned bridge; plans also being prepared for elimination of grade crossings on these same roads.

Towanda, Pa.—The steel bridge across Susquehanna River at Athens, near Towanda, was destroyed by the high water on April 2. David A. Keefe, Engineer, 115 North Street, Athens.

Cumberland, Md.—Citizens voted $60,000 bonds for bridges over Wills Creek at Valley Street; also one at Baltimore Street. Address City Engineer.

Maryland.—See "Public Buildings and Schools."

Norfolk, Va.—City Council contemplates constructing bridge across James River between Belvidere Street and Virginia Avenue; cost $100,000. Address City Clk.

Clarksville, Tenn.—Election to be held, probably in August in the county to vote on constructing 2 bridges over Cumberland River. Address County Clerk.

El Dorado, Kan.—Contract will be let about June 8 by County Commissioner for constructing a three-span through girder reinforced concrete bridge on Gordon Road to cost $10,000. C. W. Buskirk, County Engineer.

Marshall, Texas.—Attorney General at Austin approved two bond issues for city —$50,000 for viaduct and $60,000 for public school.

Metaline, Wash.—New bids will not be asked by County Commissioners, Newport, for constructing bridge at Metaline. H. A. Sewell, County Engineer.

Spokane, Wash.—Morton Macartney, City Engineer, has submitted a report recommending replacing of one span in the combination wood and iron bridge at Boone Avenue, at a cost of $6,500; strengthening and repairing Washington Street viaduct and bridge at $10,000; building three concrete bridges, one at West Trent Avenue, cost $100,000; one at Division Street, cost $135,000, and the third at Post Street, cost $40,000. Also replacing of three other bridges at a cost of $27,000. An election is to be called to vote on bonds for these improvements.

Oregon.—State Highway Department, Salem, preparing plans and specifications for steel bridge, 800 ft. long, with overhead draw, across Willamette River, between Marion and Polk Counties.

Eureka, Cal.—County Commissioners considering constructing a cable of steel bridge across Osage Creek and Kings River; estimated cost $35,000. H. N. Pittman, County Judge.

North Toronto, Ont.—City Council voted $198,000 as city's share of the C. P. R. double-deck bridge over reservoir ravine. Address City Clerk.

BIDS DESIRED.

Connecticut.—Until April 12 by Charles J. Bennett, State Highway Commissioner, Hartford, for constructing a 3-ft. span I-beam reinforced concrete bridge at Queen Street, town of Southington, and a 16-ft. span concrete bridge on Norwalk Road, town of Danbury.

Corning, N. Y.—See "Paving and Roads."

Weaverland, Pa.—Until April 10, by County Commissioners, Lancaster, for constructing bridge at Weaverland, reinforced concrete, having one 55-ft. and one 18-ft. span, with concrete abutments and wingwalls, and 18 ft. roadway. F. H. Shaw, Consulting Engr., Lancaster.

Jacksonville, Fla.—Until April 17, by Committee on Public Works (S. C. Harrison, Jr., Chmn.), for constructing bridge over Hogans Creek at Julia Street.

Monroeville, Ala.—Reported desired until April 24, for constructing reinforced concrete culverts and bridges, also steel bridges on public roads. Carl Barker, Co. Engr.

Abbeville, La.—Reported desired until April 12, by Road Commission Third Ward (D. L. McPherson, Chmn.), for constructing reinforced concrete bridges and culverts. W. B. Knox, Engr., Abbeville.

New Orleans, La.—See "Paving and Roads."

Albany, Ky.—Until April 10, by Fiscal Court (J. G. Sloan, Clk.), for constructing steel highway bridge of 100-ft. span over Spring Creek on the Albany-Byrdstown Road.

Denison, Ia.—Until April 13 by Board of Supervisors for constructing an 80-ft., 90-ft. and a 60-ft. pony truss bridge with concrete floor and substructure; also for a number of concrete box culverts and steel beam spans; total cost, $55,000. H. B. Fishel, County Engineer; P. J. Portz, County Auditor.

Toledo, Iowa.—Until April 17, by Bert W. Posten, Co. Aud., for 5650 lin. ft. 36 in. corrugated culvert pipe and 1230 lin. ft. 30 and 36 in. c.-i. culvert pipe. H. R. Henenstreit, Co. Engr.

Toledo, Iowa. — See "Paving and Roads."

Bryan, Texas.—Until April 13, for constructing a system of roads and bridges in Brazos County Road Dist. No. 1. Address Abney & McCormick, Engrs. R. D. No. 1, Bryan.

St. Helens, Ore.—Reported desired until April 27, by County Commissioners, for constructing following bridges: 50-ft. steel bridge over Beaver Creek near Delena; 50-ft. steel bridge over Tide Creek near Deer Island; 100-ft. steel bridge over Rock Creek near Vermonia, and 67-ft. steel bridge over Clatskanie River near Clatskanie.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★New York, N. Y.—Contract for 300 tons of steel required for the Vanderbilt Avenue viaduct of the New York Central R. R. awarded Milliken Brothers, Inc., 111 Broadway.

★Kearney, N. J.—Contracts awarded by Public Service Railway Co., Newark, for constructing steel viaduct 1200 ft. long, with three 100-ft. spans, over Delaware, Lackawanna & Western R.R. near Stamford's Crossing as follows: Steel, American Bridge Co., 30 Church Street, New York, N. Y.; piling and building concrete foundation, Stillman-Delehanty-Ferris Co., 26 Exchange Place, Jersey City.

★Philadelphia, Pa.—Contract awarded according to reports by Philadelphia & Reading R. R. as follows: To Pennsylvania Steel Co., Morris Block, one-track deckplate girder span bridge to carry third track over Paxtang subway on Lebanon Valley and waterproofing same to Hydrax Felt & Engineering Co., 120 Liberty Street, New York; to P. McManasine, a 4-span concrete and I-beam bridge about 100 ft. long over Brandywine to Lukens Iron & Steel Co., Coatesville, and waterproofing same to H. W. Geshwind, Heed Block.

★Reading, Pa. — Contract reported awarded by Pennsylvania R. R. for constructing an 806-ft., double-track, five-arch concrete bridge over Schuylkill River at Angelica, to E. W. Cliff, Philadelphia.

★Virginia.—Contract awarded by State Highway Commission, Richmond, for constructing three bridges on Valley Turnpike, one at Mount Crawford, Rockingham County, and two near Mount Jackson, Shenandoah County, to Virginia Bridge & Iron Co., Roanoke, at $21,000.

★Decatur, Ill.—Contracts for constructing Spangler Bridge over Sangamon River awarded by County Commissioners as follows: Superstructure, Decatur Bridge Co., Decatur, $17,500; concrete work, J. M. Driscoll, $12,992; earth work, McCalman Construction Co., Decatur, $19,490.

★La Salle, Ill.—Contract for constructing Shippingsport Bridge in town of La Salle (concrete) awarded March 29 by County Commissioners Ottawa to Byrne Bros. Dredging & Engineering Co., 208 South La Salle Street, Chicago, at $191,000.

★Omro, Wis.—Following are 4 lowest bids opened at Oshkosh by County State Road and Bridge Committee for constructing a steel bridge over Fox River, at Omro: Wausau Iron Works, Wausau, $31,740 (tentatively awarded contract); Northwestern Bridge & Iron Co., of Milwaukee, $41,460; McMullen & Pitz, Manitowoc, $41,724, and Minneapolis Bridge Co., Minneapolis, Minn., $46,000.

★Mankato, Minn.—Following are four lowest bids opened March 27 by City Clerk for constructing reinforced concrete arch bridge across Minnesota River: Widell Co., Mankato, $94,990 (awarded contract March 28); Price Bros. Co., Grand Rapids, Mich., $107,000; Winston Bros. Co., Minneapolis, $115,000, and Western Engineering & Construction Company, Omaha, Neb., $116,743. Donald Price, Consulting Engineer, Lincoln, Neb.

Minneapolis, Minn.—Following are two bids opened March 23 by Purchasing Agent for steel girders for Third Avenue bridge approach: American Bridge Co., 30 Church Street, New York, $9,022 f.o.b. cars, Minneapolis; Minneapolis Steel & Machinery Co., Twenty-ninth and Minnehaha Streets, $9,600 f.o.b. west approach of bridge, $3.94 cwt. 122 tons.

★Fairbury, Neb. — Contract awarded Standard Bridge Co., Omaha, Neb., for constructing bridges for 1916. J. O. Marthers, County Clerk.

★Tekamaha, Neb.—Contract awarded March 29 by Burt Washington Drainage District, Tekamaha, to Minneapolis Steel Company, Minneapolis, Minn., for steel bridges and culverts and to Welton Reinforced Concrete Pipe Company, Wahoo, Neb., for concrete culverts. Towl Engineering Company, Engineers, City National Bank Bldg., Omaha.

McMinnville, Ore.—Following are four lowest bids opened March 27 by C. B. Wilson, County Clk., for (a) steel bridge, (b) concrete bridge designed by State Highway Department, Salem: Stebinger Bros., Portland (a) $10,792, (b) $12,753; John W. Ash, Corvallis (b), $12,528; L. O. Harold, Salem (a) $12,169, (b) $12,199; Standifer Clarkson, Portland (b), $13,687; Portland Bridge Co., Portland (a), $11,300; Beers Bldg. Co., Portland (a), $11,936

PAVING AND ROADS

PROPOSED WORK.

Bristol, R. I.—It is proposed to pave with tar macadam on High and Wood Streets at a cost of $40,000. L. H. Callan, Engineer, Bristol; B. W. Wall, City Secretary.

Providence, R. I.—About $60,000 will be expended for constructing new streets. Work will start last of April. J. H. Slade, Comr. Public Works.

Albany, N. Y.—Mayor approved ordinances for extending and improving Quail Street from Livingston Avenue to Manning Boulevard and appropriating $14,000 as city's share of expense.

Batavia, N. Y.—Surveys completed for county road from Alabama to Oakfield, eight miles in length, and surveys will be made for road from Darien Center to Alexander, six miles. Address County Clerk.

Brooklyn, N. Y.—Under supervision of L. H. Pounds, Boro. Pres., an approach is to be constructed to Mill Basin, consisting of curbing and paving with second-hand granite block on portions of Avenue N and Island Avenue; cost $22,600.

Castile, N. Y.—Town Board voted to construct 1 mile stone road from corporation line to Gainesville Township line. Address Town Clerk.

Dolgeville, N. Y.—Citizens voted to pave Faville Avenue and State Street at combined cost of $22,000. Address Town Clerk.

Hempstead, L. I., N. Y.—Town Board authorized expenditure of $121,650 for improving roads for coming year. Archibald G. Patterson, Town Superintendent.

Elizabeth, N. J.—Paving with asphalt on Caldwell Pl., Meadow and Front Streets and repaving and resurfacing eight streets, including Elizabeth Avenue, South, South Broad, Marshall and other streets is under consideration. Thomas E. Collins, City Engineer.

Fairview, N. J.—Town will pave Bullsferry Road at a cost of $53,000; state will contribute $20,000 toward cost.

Hammonton, N. J. — Town Engineer Remington estimates cost of paving with concrete on Bellevue Avenue at $30,000.

Jersey City, N. J.—Board of Chosen Freeholders, it is reported, will soon let contract for improving Patterson Plank Road.

New Jersey.—Bill has passed Legislature providing for a $7,000,000 bond issue for building of good roads throughout New Jersey. Address State Highway Commissioner, Trenton. An election is to be held in the fall to vote on issuing the bonds.

Erie, Pa.—County Commissioners plan constructing about 80 miles road; cost $1,200,000. Address County Clerk.

West Reading, Pa.—Citizens voted $23,000 bonds for paving Penn Avenue and $9,500 bonds for macadamizing and repairing principal side streets. Address City Clerk.

Maryland.—See "Public Buildings and Schools."

Portsmouth, Va.—Contract soon to be let by Norfolk County Bonding Commission for improving Indian Poll Road, Princess Anne Turnpike, Broad Creek Road and Indian River Road out of Norfolk; concrete, bituminous macadam and rockmac pavement to be considered. Also for improving Swamp Road from Berkley to Oak Grove. Address County Clerk.

Spotsylvania, Va.—County Commissioners sold $18,000 road bonds. Address County Clerk.

West Union, W. Va.—Paving bonds for $200,000 will be sold April 28 by County Court of Doddridge County (Hiram Huston, Clk.).

Panama City, Fla.—See "Hydraulic and River Improvements."

Tennessee. — Following appropriations made by counties for constructing improved highways: Rhea County (Dayton Court House), $250.000; Hamblen (Morristown C. H.), $150.000; Bedford (Shelbyville C. H.), $24,000; Morgan (Wartburg C. H.), $100.000; Union (Maynardville C. H.), $100,000; Franklin (Winchester C. H.), $350,000; Knox (Knoxville C. H.), $500,000; Hawkins (Rogersville C. H.), $450,000; Carter (Elizabethton C. H.), $365,000; Fentress (Jamestown C. H.), $150,000; Hamilton (Chattanooga C. H.), $85,000; Sullivan (Blountville C. H.), Cumberland (Crossville C. H.), $200.000; Pickett (Byrdstown C. H.), $50,000; Unicoi (Erwin C. H.), $100,000. Address County Clerk.

Akron, Ohio.—City Council passed ordinances authorizing issuing $73,120 bonds for street improvements.

Cleveland, Ohio.—Street paving bonds amounting to $1.008,000 will be sold April 17 by Sinking Fund Commission, Room 507, City Hall.

Cincinnati, Ohio.—County Commissioners plan improving Reading Road with brick through Reading Village. Road will be 37 ft. wide in business district and 20 ft. in outskirts of Reading Village. Address County Clerk.

County Commissioners sold $21,500 bonds for constructing Ludlow Hill Road. Address County Clerk.

Contract soon to be let by Director Public Service for paving with granite and laying 6-in. water mains in May Street from Oak to McMilan Streets at a cost of $19,955. Frank S. Krug, City Engineer.

County Commissioners approved estimates prepared by County Surveyor William Boeh for improving Pleasant Ridge Road at $12,096.

City Council approved Frank S. Krug, City Engineer's estimate of $14,592 as cost of improving Dewey Avenue from Liberty Street to Talbert Street with brick.

Cleveland, Ohio.—Harry L. Davis, Mayor, approved legislation for a $70,000 bond issue for widening, extending and paving parts of Hough, Wade Park, Benham, Almira, Schott, Lambert, Benwood and Wilbur Avenues and E. 115th, 123d, 138th, 111th and 108th Streets.

City Council considering a bond issue of $75,000 for construction of a boulevard to connect Woodland Hills and Garfield Parks.

Dayton, Ohio.—Paving bonds for $15,000 will be sold April 17 by Walter H. Aszling, Clerk County Commissioners. Also separate bids until April 27 for $17,750 bonds.

Jefferson, Ohio.—Paving bonds for $76,000 will be sold April 24 by Board County Commissioners (B. E. Brainerd, Clk.).

New Philadelphia, Ohio.—County Engineer has prepared plans and specifications for paving eight miles road. Address County Clerk.

Newark, Ohio.—Hudson Avenue will be resurfaced with sheet asphalt. Address City Engineer.

Ottawa, Ohio.—County Commissioners plan improving with water bound macadam 8 miles Ottawa Turnpike from city limits to Putnam County line. Address County Clerk.

Ravenna, Ohio.—About $62,000 Painesville-Ravenna County Road bonds sold.

West Park, Ohio.—See "See Sewerage and Sewage Disposal."

Bloomington, Ind.—Paving bonds for $23,000 reported to be sold April 9 by Rola F. Walker, Co. Treas.

Boonville, Ind.—Citizens of Boonville and Boonville Township voted in favor of constructing 23 miles of rock roads.

Covington, Ind.—Highway improvement bonds for $49,300 will be sold April 17 by Lee Philpott, Co. Treas.

Greenfield, Ind.—County Commissioners sold $10,300 bonds for improving roads. Address County Clerk.

Indianapolis, Ind. — Highway improvement bonds for $20,000 reported to be sold April 15 by Ed. G. Sourbier, Co. Treas.

Lawrenceburg, Ind. — About $21,600 county road bonds sold.

Winchester, Ind. — Highway improvement bonds for $27,600 reported to be sold April 10 by Elijah Puckett, City Treas.

Arthur, Ill.—See "Sewerage and Sewage Disposal."

Benton, Ill.—Citizens of Six-Mile Township voted $25,000 bonds for constructing hard roads. Address Clerk of Six-Mile Township, at Benton.

Decatur, Ill.—City Engineer completed estimates for paving East Main and Prairie Streets and parts of Calhoun and Jasper Streets at a cost of $112,063.

Elgin, Ill.—See "Sewerage and Sewage Disposal."

Janesville, Wis.—Paving with asphalt on Oakland Ave., and with brick on Franklin Street authorized. Nothing further done about the matter. C. V. Kuch, City Engineer; J. P. Hammarlund, City Clerk.

Leaf River, Ill.—Citizens voted $28,000 bonds for building and improving hard roads in Leaf River Township. Address Township Clerk.

Rock Island, Ill.—City Commission passed ordinances providing for paving and sidewalks; total estimated cost $19,661.

Farragut, Iowa.—County Commissioners, Sidney, contemplate improving northwest river road in Farragut. Address County Clerk.

Duluth, Minn.—Council authorized paving of Forty-fourth Avenue E. at a cost of $14,500. Lyonel Ayres, City Engineer.

Minneapolis, Minn.—Reported holding of an election to vote $2,000,000 bonds for constructing 120 miles of roads in Hennepin County is under consideration.

Billings, Mont.—Bonds for 47 miles of macadam highway reported to be sold April 17 by F. E. Williams, Co. Clk.

Fort Smith, Ark.—City is planning constructing about 12,000 sq. yd. of paving; material not decided upon. W. H. Evans, City Engineer.

Marion, Ark.—County Road District No. 1 will construct 25 miles of surfaced roads from Harahan Bridge to Riceville and other towns. J. B. Thompson, County Judge.

Cisco, Tex.—Citizens voted March 25 $60,000 road bonds. J. M. Williamson, Mayor.

Corpus Christi, Tex.—Election to be held April 22 to vote $10,000 bonds for good roads in Nueces County, Road District No. 9. Address County Clerk.

Mount Pleasant, Tex.—County road bonds for $225,000 have been sold. Address County Clerk.

Rio Grande City, Tex.—Citizens of the county voted March 27 in favor of issuing $60,000 bonds for road improvements. Contracts will be let by the County Commissioners' Court.

Taylor, Tex.—Hutto Precinct of Williamson County voted $50,000 bond issue for good roads.

Winnsboro, Tex.—Election to be held April 20 in the county to vote $240,000 bonds for building approximately 50 miles of gravel and macadamized roads.

Bellingham, Wash.—County Commissioners plan surfacing with concrete 3½ miles of road between Ferndale and Enterprise to connect with Northwest Diagonal Road. C. M. Adams, County Engineer.

City Council plans paving, this year, portions of following streets: Dakin and Main Streets, at $18,241; Indian Street, $10,550; G St., $15,655; James Street, $10,655; Ellis Street, $19,300. Bids will soon be asked. W. H. North, City Engineer.

Hanford, Cal.—Reported contract will be let this summer for about $140,000 paving with concrete base and asphalt wearing surface. Address Edward M. Lynch, Consulting Engineer, Lindsay.

San Diego, Cal.—City Engineer preparing specifications for asphalt macadam paving with concrete base. Address City Clerk.

Moscow, Idaho.—Reported contract soon to be let by City Council for paving in 3 districts, Deakin Avenue, North Jackson and Van Buren Streets, a total of 30,000 sq. yd.

BIDS DESIRED.

Connecticut.—Until April 12, by Charles J. Bennett, State Highway Commissioner, Hartford, for following reinforced concrete pavement: Town of Groton, about 14,980 lin. ft. pavement on Thames Street; Manchester, 2360 lin. ft. on North Main Street; Berlin, 3115 lin. ft. on Berlin Street; Stratford, 3828 lin. ft. on Main Street and East Broadway; Southbury, 10,035 lin. ft. 5-in. native stone macadam on Southbury Street; New Milford, 4565 lin. ft. native stone macadam on Chicken Hill.

Hartford, Conn.—Until May 1 by Board Water Commissioners, Hartford, for constructing through new country a gravel surface road about 2½ miles long east of East Branch Reservoir, in towns of New Hartford and Barkhamsted, advertised in Engineering Record. Caleb Mills Saville, Ch. Engr. of Board.

Woonsocket, R. I.—Until April 25 by Board of Aldermen for paving, including Contracts 1, 2, 3 and 4 and surface water drains. Contracts 1 and 2 advertised in Engineering Record. Frank H. Miles, City Engr.

Brooklyn, N. Y.—Until April 12, by L. H. Pounds, borough president, for paving on portions of Atkins Avenue, Bay Ridge Place, East 18th, Henry and numerous other streets, in all about 20,400 sq. yd. asphalt, 18,820 lin. ft. sidewalk, together with curbs, gutters, etc. Total security, $16,100.

Buffalo, N. Y.—Until April 14, by Department Public Works (Arthur W. Kreinheder, Supt.), for paving Montacute and Voorhes Avenues, Galveston Place and other streets. Until April 7, same place, separate bids for paving Gorski, Barnard and other streets.

Corning, N. Y.—Until April 27 by William O. Drake, Supt. Public Works, for removing old plank and floor joists and replacing same with creosoted joists plank and wood block paving for bridge over Chemung River, advertised in Engineering Record.

Long Island City, L. I., N. Y.—Until April 13 by Maurice E. Connolly, Pres. Queens Boro., for regulating, grading and paving for a width of 20 ft., centrally located, with a permanent pavement of sheet asphalt on a 6-in. concrete foundation, together with all work incidental thereto, in Rockaway Boulevard (Washington Beach), from Adirondacks Boulevard to beach 126th Street (Pelham Avenue). Fifth Ward of Borough of Queens, in all about 9050 sq. yd. sheet asphalt; also for furnishing and delivering as directed 40,000 wood blocks in Borough of Queens. Security $10,000.

Newton, N. J.—Until May 1 by Board of Freeholders at Newton (R. L. Slater, Clk.) for grading Ross's Corner Sussex Road in Townships of Frankford and Wantage, County of Sussex, advertised in Engineering Record.

Bayonne, N. J.—Reported desired until April 11, by City Engineer, for improving twenty streets.

Avella, Pa.—Until April 15, by Township Supervisors (L. M. Irwin, Secy.), for improving three sections of Township Road, in all about 11,474 ft., brick with slag base.

Baltimore, Md.—Until April 12, by Board Awards (John Hubert, Act. Pres.), for grading and paving with cement concrete numerous alleys.

Petersburg, Va.—Until April 14 by Secretary Chamber of Commerce, Petersburg, for constructing about 9 miles of road between Petersburg and City Point in Prince George County, advertised in Engineering Record. Information may be had from G. P. Coleman, State Highway Commissioner, Richmond.

Weston, W. Va.—Reported desired until April 24, by County Commissioners (Leander Troxell, Clk.). for improving roads leading out of Weston, including 5280 ft. Staunton and Parkersburg Turnpike, and 4350 ft. Weston and Beverly Turnpike.

Ashland, N. C.—Until April 10, by F. L. Conder, Secy. & Treas., for 15,000 to 25,000 sq. yd. concrete paving, and from 10,000 to 20,000 sq. yd. brick bitulithic, sheet asphalt, asphalt concrete (Topeka specification), or bituminous macadam, and about 5000 sq. yd. concrete foundation. B. M. Lee, City Engr.

Selam, Ala.—Reported desired until April 17, by County Court of Revenues, for grading and graveling road from Safford to Wilcox County line near Alberta on line of proposed Jackson Highway, about 5½ miles. W. O. Crisman, Co. Engr.

Benton, La.—Reported desired until April 11, by Bossier Parish Road Dist. No. 2, for constructing hard roads. Amount available, $50,000,

New Orleans, La.—Until April 24, by Highway Department of the Board of State Engineers, Room 104, New Orleans Court Bldg., New Orleans, for following work: Winn Parish—Winnfield, Jonesboro-Winnfield-Colfax Highways, 10.5 miles earth; Lafayette Parish—Lafayette-New Iberia Highway, 5 miles gravel; Caddo Parish—Section 3, Arkansas Highway, 5.4 miles gravel and stone; Caddo Parish—One concrete and three steel bridges. W. E. Atkinson, State Highway Engineer.

Shreveport, La.—Reported desired until April 13, by J. T. Bullen, Engr. Caddo Parish Police Jury, for constructing about 9 miles of road.

Hazard, Ky.—Until May 1, for constructing 1½ miles of pavement, with brick, concrete or macadam. W. M. Pursifull, Mayor.

Sheperdsville, Ky.—Reported desired until April 18, by W. C. Herps, County Road Engr., for constructing 13 miles of roads.

Akron, Ohio.—Until April 13, by Board County Commissioners (U. G. High, Clerk), for paving with brick Copley Road, Section 1, 1.84 miles and Section No. 3 of Arlington Road 2.82 miles. Edw. W. Paul, County Engineer.

Dayton, Ohio.—Until April 25, by County Commissioners (Walter H. Aszling, Clk.), for furnishing material and improving Shakertown Pike, to consist of 7177 ft. brick paving, constructing bridges, etc.

Ohio.—Reported desired until April 21 by Clinton Cowen, State Highway Commissioner, Columbus, for constructing brick highways in Bucyrus to consist of 1¾ miles on the Lincoln Highway, ½ mile on the Scioto Trail, and Marion Road 1¼ miles.

Warren, Ohio.—Until April 17, by County Commissioners (W. L. Hoffman, Clk.), for constructing the Churchill Hubbard Road, a distance of 2½ miles, 14 ft. wide, with a two-course slag with bituminous surface penetration method.

New Castle, Ind.—Until April 17, by L. M. Johnson, City Clerk, for grading Eighteenth Street and paving with sheet asphalt, asphaltic concrete, bitulithic or vitr. brick and curbing, advertised in Engineering Record.

Port Huron, Mich.—Reported desired until April 12 by Walter R. Stevens, Chmn. Board County Commissioners, for constructing about 1 mile slag bottom gravel top in Ira Township, 2½ miles 16-ft. limestone bottom cobblestone, top macadam, on Port Huron and Yale Trunk line, and 1¼ miles slag bottom, gravel top in Cotterville Township.

Chicago, Ill.—Until April 12, by Board Local Improvements (Ed. J. Glackin, Secy.), for paving numerous alleys and constructng sewers, adjusting manholes, etc., in Spaulding, North St. Louis and Tripp Avenues and other streets.

Chicago, Ill.—Until April 13, by Department Public Works (W. R. Moorhouse, Comr.), for paving the roadway, constructing sidewalks of the approaches to the Webster Avenue bridge; also grading approaches of the Dominick Street bridge constructing retaining walls, etc.

Moline, Ill.—Until April 10, by Board Local Improvements for 17,000 sq. yd. stone filled sheet asphalt on 5-in. concrete base, 5700 sq. yd. brick on 5-in. concrete base, 16,108 ft. concrete combined curb and gutter, and 1051 ft. straight concrete curb. Lyle Payton, City Engineer.

Britt, Iowa.—Until April 25, by Town Clerk, for constructing 15,500 ft. curbing and 26,600 yd. paving. Bids will be considered on concrete, asphaltic concrete. brick block, vertical fiber brick, sheet asphalt, bituminous concrete, wood block, and grouted macadam. Theo. S. Delay, Consulting Engineer, Creston.

Denison, Iowa.—Until April 12, by P. J. Portz, County Auditor, for about 15 miles of permanent earth road construction, approximately 120,000 cu. yd. H. B. Fishel, County Engineer.

Perry, Iowa.—Until April 10 (readvertisement), by Charles E. Wilson, City Engineer, for 30,000 sq. yd. brick, concrete asphaltic creosoted block on concrete foundation, including 7920 lin. ft. curb and gutter. All bids opened March 27 rejected.

Toledo, Iowa.—Until April 17 by County Commissioners, Toledo, for 10 miles of road grading. This is the first section of 53 miles which the county intends grading; county also intends letting contract in near future for constructing a bridge. A. R. Hebenstein, County Engineer.

Ivanhoe, Minn.—Until April 19 by Karl A. Hansen, Co. Aud., for grading State Road Nos. 2, 3, 12 and 13, to consist of 37,390 cu. yd. earth excavation, together with concrete culverts, etc.

Luverne, Minn.—Until April 18 by Olaf Skyberg, Co. Aud., for road work as follows: State Bridge No. 2224, on State Road No. 5, 4½ miles, 7750 lin. ft. turnpiking, 27,000 cu. yd. grading, 9 concrete culverts, etc.; State Road No. 4, 5 miles, 8900 cu. yd. graveling; State Road No. 2, 6½ miles, 23,600 lin. ft. turnpiking, 17,000 cu. yd. grading, and 10,130 cu. yd. graveling.

Rochester, Minn.—Until April 19 by Chas. S. Seed, Village Clk., for paving Main Street. Alternate bids on brick and asphaltic concrete.

St. Paul, Minn.—Reported desired until April 10, by August Hohenstein, Pur. Agent, for improving portions of Waconta, Edmund, Lansing and other streets. Oscar Clausen, City Engr.

McPherson, Kan.—Until April 16, by Ellen Lundstrom, City Clk., for 40,579 sq. yd. asphaltic concrete pavement and 29,348 ft. concrete combined curb and gutter. H. A. Rowland, City Engr.

Kansas City, Mo.—Until April 15, by Allen C. Southern Co. Surv. and Ex Officio Highway Engr., for grading and construction of concrete on road designated as Collings Road. Also separate bids same time for constructing subway under Missouri Pacific tracks on Blue Tank Road, to consist of 79,100 cu. yd earth excav., 10,000 cu. yd. solid rock excav., etc. Also separate bids same time for constructing with concrete and paving with macadam Pleasant Hill Road, in all about 45,500 sq. yd. macadam pavement, 23,000 lin. ft. 4-in. tile drains. 26,400 cu. yd. earth excav., etc.

Kansas City, Mo.—Until April 11, by Board Public Works (Edw. F. Webster, Act. Secy.), for paving on portion Madison Avenue, Thirteenth, Fourteenth and other streets.

Bryan, Tex.—Until April 10, by Commissioners Court, Houston, for constructing a system of roads and bridges in Brazos County Road District No. 1, including about 85 miles of earth and gravel roads and surfacing 5 miles with bituminous macadam or rock asphalt. J. T. Maloney, County Judge; Abney & McCormick, Engineers, Bryan, Tex.

Bryan, Texas.—See "Bridges."

Denver, Colo.—Until about April 15, by County Clerk, for about 50,000 sq. yd concrete or bituminous pavement on South Golden Road.

Blackwell, Okla.—Until April 21, by Clyde V. Butcher, City Clerk, for 38,400 sq. yd. brick block pavement on Main Street and Blackwell Avenue, on concrete foundation, including 14,320 lin. ft. concrete curbing. Cost $100,000. W. L. Burnham, Engineer, Oklahoma.

Everett, Wash.—Reported desired until April 17, by Max Weatherbee, Co. Aud., for constructing 13 miles permanent highway between Everett and Bothell, probable cost, $160,000; 4 miles of paving between Everett and Snohomish, probable cost $45,000. Also separate bids for 1 mile concrete road (Permanent Highway No. 23); 2½ miles grade and gravel road between Marysville and Arlington (Permanent Highway No. 22); 1½ miles of Vernon Road (Permanent Highway No. 24). Also separate bids April 24 for paving 3 miles north of Marysville, to cost $36,000. W. C. Bickford, Co. Engr.

Seattle, Wash.—Reported desired until April 24, by Byron Phelps, Co. Aud., for paving of extensions of Fourteenth Avenue, South Seattle, from Kings County Line to Des Moines. Bids desired on one course concrete brick block, or monolithic type brick, in all about 114,000 sq. yd., paving two bridges with asphalt, concrete, etc. Probable cost between $200,000 and $270,000.

Spokane, Wash.—Until April 21 and April 28, by County Commissioners, for permanent highway improvements, including asphaltic concrete, asphalt macadam pavement, on crushed rock foundation. In all about 23 miles are to be laid, at a cost of $325,000. Bids opened April 7 on part of the work. C. S. McClung, Chief Deputy County Engineer.

Anaheim, Cal.—Until April 13, by Edw. B. Merritt, City Clk., for constructing 327,450 sq. ft. 4½ ft. concrete base and 1½ in. asphalt wearing surface on West Bway.; also for 163,860 sq. ft. similar pavement on East Bway. Bids desired later for 102,130 ft. similar pavement at street intersections. O. S. Stewart, City Engr.

Los Angeles, Cal.—Until April 10, by Board of Supervisors (A. M. McPherrin, Clerk), for improving 2.57 miles of Coast Boulevard between Venice and El Segundo, 5 in. oil macadam paving, etc.; cost $13,307. Also 4.04 miles Pico Boulevard between Los Angeles and Venice, 66,795 sq. yd. concrete paving, etc.; cost $29,159.

Ventura, Cal.—Until April 14, by Board Supervisors (J. B. McCloskey, Clk.), for constructing 8 miles of Santa Paula—Fillmore Road, requiring 31,800 cu. yds. excav. 43,615 lin. ft. shaping roadbed, etc.

Lewiston, Idaho.—Until April 25 by Idaho State Highway Commission at office of Secy. Lewiston Highway Dist. Lewiston, for constructing about 1¼ miles of highway in city of Lewiston; also about 8¾ miless of State Highway from the north city limits of Lewiston northwetserly to Idaho-Washington state line.

Berlin, Ont.—Until April 13, for constructing approximately 6000 sq. yd. concrete paving. Herbert Johnston, City Engr.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Boston, Mass.**—Following are unit figures of the two lowest bids opened March 27 by Metropolitan Park Commission, 14 Beacon Street, Boston, for grading, surfacing and other work on Alewife Brook Parkway, from Massachusetts Avenue to Powder House Boulevard, Cambridge, to Somerville: (a) Kelley & Sullivan, 25a Cherry Street, Somerville, $25,608 (awarded contract); (b) James H. Fannon, 27a Hinckley Street, Somerville, $27,695:

	*(a)	(b)
7000 cu. yd. earth grading.	.35	.40
9000 cu. yd. filling material	.60	.69
1900 lin. ft. 10-in. vitr. pipe drain	.35	.35
145 lin. ft. 12-in. vitr. pipe drain	.45	.40
27 catch basins and manholes	30.00	35.00
600 lin. ft. straight edgestone	1.10	1.10
450 lin. ft. curved edgestone	1.35	1.35
2600 cu. yd. loam surfacing	.50	.60
10,800 sq. yd. roadway surfacing	.45	.45
2900 sq. yd. walk surfacing	.30	.40
250 cu. yd. concrete masonry, 1:3:6..............	7.00	8.00
220 cu. yd. reinforced concrete masonry, 1:2:4.....	12.00	15.00
1 reinforced concrete culvert,, 8 ft. x 4 ft. 9 in. x 102 ft..................	1,600.00	1,800.00
70 cu. yd. stone masonry..	5.00	6.00
520 lin. ft. galvanized iron fence	3.25	3.50

Albany, N. Y.—Following are lowest of bids opened March 28 by State Highway Commission, Albany, for furnishing and delivering bituminous materials "A" and "T": Binder "A," Barber Asphalt Paving Company, Woolworth Bldg., New York, $19,268. Bituminous Materials—Barber Asphalt Paving Company, Woolworth Bldg., New York, Contract No. 4, Division No. 2, $5,685; Contract No. 10, Division No. 4, $8,394; Contract No. 19, Division No. 7, $2,561; John Baker, Jr., 17 Battery Place, New York, Contract No. 7, Division No. 3, $4,590; Atlantic Ref. Company, Contract No. 13, Division No. 5, $18,290; Contract No. 16, Division No. 6, $7,846; Contract No. 23, Division No. 9, $3,894; Newton Paving Company, Contract No. 2, Division No. 1, $3,640; Headley Good Roads, Contract No. 5, Division No. 2, $27,627; Contract No. 8, Division No. 3, $5,237; Contract No. 11, Division No. 4, $6,180; Contract No. 14, Division No. 5, $3,148; Contract No. 17, Division No. 6, $6,059; Contract No. 20, Division No. 7, $5,683; Contract No. 22, Division No. 8, $12,519; Contract No. 24, Division No. 9, $7,800; bituminous material "T," Contract No. 3, Division No. 1, United Gas Improvement Company; Contract No. 3, Division No. 1, $27,085; Contract No. 6, Division No. 2, $7,593; Contract No. 9, Division No. 3, $6,828; Contract No. 12, Division No. 4, $889; Contract No. 15, Division No. 5, $9,276; Contract No. 18, Division No. 6, $42.40; Contract No. 21, Division No. 7, $6,855; Contract No. 25, Division No. 9, $42.90.

★**Buffalo, N. Y.**—Contract awarded Barrett Manufacturing Company, Marine National Bank Building, for Tarvia "B" bituminous dressing for macadam roads at $22,333.

Buffalo, N. Y.—Following are lowest bids opened March 22 by Board Public Works for paving (a) 4967 sq. yd. on Edison Street (b) Delaware Avenue from Gates Circle to Amherst Street, (c) Delaware Avenue from Hertel Avenue to City line, (d) Delavan Avenue from Grider Avenue to Bailey Avenue: Erie Contracting Co., D. S. Morgan Bldg., (a) $14,026, brick with Medina sandstone curb and $14,025 for Ohio sandstone curb; German Rock Asphalt Co., Inc., D. S. Morgan Bldg., for German Rock Company's standard asphalt, (a) $16,654, (d) $47,700; Henry P. P. Burgard Co., Buffalo, for standard asphalt as specified, (b) $85,450, (c) $40,950; Louis H. Gipp Construction Co., Buffalo, brick, (b) $77,700, (c) $33,980.

Newark, N. J.—Following are four lowest bids opened March 30 by Board Street & Water Commissioners for paving:

River Street, from North Canal to Mulberry Streets, with grouted granite on 6 in. concrete (repaving). Ralph Sangiovanni, 80 Hoyt Street, $31,569; Newark Paving Company, 133 First Street, $32,441; O'Gara & Maguire, 127 Frelinghuysen Avenue, $34,224; and Glenfield Construction Company, 141 South Eighth Street, $34,277.

Broad Street, from South to Poinier Streets, wood block on 6 in. concrete (repaving), McMahon Construction Company, 1287 Broad Street, $51,698; Newark Paving Company, 133 First Street, $53,438; O'Gara & Maguire, 127 Frelinghuysen Avenue, $53,545; and Glenfield Construction Company, 141 South Eighth Street, $59,697.

Brookdale Avenue from South Orange Avenue to Lindsley Avenue. 1½ in. asphalt on 6 in. concrete (paving). Northern Construction Company, Wiss Building, $15,540; Continental Public Works Company, New York, $16,800; Glenfield Construction Company, 141 South Eighth Street, $17,132, and W. T. S. Critchfield, Jersey City, $17,198.

Ogden Street, from Clay to Oriental Streets, with granite on 6 in. concrete base (repaving). Alex J. Milmoe, 75 Littleton Avenue, $45,552; Ralph Sangiovanni, 80 Hoyt Street, $46,426; Newark Paving Company, 133 First Street, $47,722; Glenfield Construction Company, 141 South Eighth Street, $48,585.

Elm Road from Tyler to Gotthardt Streets, with granite on 6 in. concrete base (paving), Jackson Contracting Company, 113 Vesey Street, $20,961; McMahon Construction Company, 1087 Broad Street, $21,808; Ralph Sangiovanni, 80 Hoyt Street, $21,929; and Glenfield Construction Company, 141 South Eighth Street, $22,136.

Mulberry Street from Market to Center Streets, with granite on 6 in. concrete (repaving), Newark Paving Company, 133 First Street, $21,685; O'Gara & Maguire, 127 Frelinghuysen Avenue, $22,150; Glenfield Construction Company, 141 South Eighth Street, $22,601; and Joseph Johnson Sons, Staten Island, N. Y., $24,557.

Vanderpool Street from Broad Street to Avenue B, napped reclipped granite on 6 in. concrete, Glenfield Construction Company, 141 South Eighth Street, $22,222; Newark Paving Company, 133 First Street, $22,760; O'Gara & Maguire, 127 Frelinghuysen Avenue, $23,057, and P. Jannaronne Belleville, $23,766.

Lowest bidders on other streets were: Commerce Street from Broad to Lawrence Streets, repaving with wood block on 6 in. concrete, Newark Paving Company, 133 First Street, $12,372; Front Street from Center Street to Saybrook Place, repaving with granite on 6 in concrete found., Alex J. Milmoe, 75 Littleton Avenue, $6,248; Silver Street from Stuyvesant Avenue to Sandford Avenue, brick paving on 6 in. concrete Newark Paving Company, 133 First Street, $6,812; Mead Street, from Silver Street to Ocean Avenue; Continental Public Works Company, New York City, $6,990.

★**Philadelphia, Pa.** — Contract reported awarded Edwin H. Vare, Betz Block, for grading Oregon Avenue from Thirteenth Street to Delaware Avenue at about $140,000. He bid 33 cts. per cu. yd. for the fill.

Contract awarded by Department Public Works for grading Front Street between Tioga Street to Erie Avenue to Eastern Paving Co., S. Eighth Street and Gray Ave., at $17,792.

★**Baltimore, Md.**—Contract awarded by Board of Awards for paving with sheet asphalt portions of seven streets, including Wilkens Avenue, Ramsay and other streets, to American Paving & Contracting Co., Montebello Avenue and Jenkins Lane, at $119,654.

★**Washington, D. C.**—Contract awarded by Commissioners of D. C. for paving with sheet asphalt Pennsylvania Avenue and M Street from Twenty-sixth to Twenty-ninth Street and Twenty-sixth Street from Pennsylvania Avenue to M Street to Cranford Paving Co., Washington, D. C., at about $40,000.

★**DeLand, Fla.**—Contract for paving (bids opened March 20) awarded by County Commissioners as follows: F. G. Proudfoot, 127 North Dearborn Street, Chicago, Ill., about 28 miles modified asphalt, and to Sou. Clay & Mfg. Company, Chattanooga, Tenn., about 25 miles grouted brick. Samuel C. Jordin, County Clerk.

★**Dothan, Ala.**—Contract for constructing road from point near Dothan toward Crosby (bids opened March 31) awarded Wolford & Brown, at $30,000. W. R. Kooner, County Engineer.

★**Maysville, Ky.**—Contract awarded by City Council for paving with Trinidad asphalt one mile of streets to Carey Reed & Co., Lexington, at $45,000.

★**Little Rock, Ark.**—Following are unit figures of four lowest bids opened March 15 for street improvements in Street Improvement District 244, Little Rock, and No. 9 in Pulaski Heights: (a) I. P. Shelby & Co., Little Rock, $65,964 (awarded contract; (b) Nick Play Construction Co. & McEachlin, Little Rock, $70,507; (c) R. Moberly, Little Rock, $74,341, and (d) Kaw Paving Co., Topeka, Kan., $86,042.

	*(a)	(b)	(c)	(d)
40,000 cu. yd. excavation..............................	$0.30	$0.35	$0.38	$0.50
41,300 lin. ft. 6 x 12 in. concrete curb..................	0.23	0.25	0.28	0.30
55,000 sq. yd. waterbound macadam, 6 in...............	0.55	0.60	0.62	...
55,000 sq. yd. asphaltic macadam, 7 in.................	0.75	0.77	0.78	0.90
20 cu. yd. concrete catchbasins........................	10.00	8.00	8.00	8.00
4,000 lb. cast iron..	.05	.05	.065	.04
290 ft. 15-in. culvert (tile)...............................	.65	.45	.60	.75
230 ft. 18-in. culvert (tile)...............................	0.80	0.75	0.80	1.06
1,160 ft. 24-in. culvert (tile)...............................	1.16	1.50	2.00	1.75
230 ft. 30-in. culvert (corrugated metal)............	2.30	2.76	4.63	2.65
50 ft. 36-in. culvert (corrugated metal)............	2.70	3.26	5.00	3.00
60 ft. 42-in. culvert (corrugated metal)............	3.25	4.00	6.80	3.46
900 ft. 6 to 8 in. sewer pipe lowered................	0.25	0.35	0.40	0.30
40 ft. rebuilding manholes...........................	1.00	2.60	1.33	3.00

★**Eldorado, Ark.**—Following are unit figures of four bids opened March 21 by Board (C. H. Murphy, Chmn.) for 24,500 sq. yd. concrete or asphaltic concrete pavement on Washington, Jackson and Main Streets, including concrete curb: (a) McEachin & McEachin, Little Rock, $32,423 (awarded contract); (b) P. F. Connolley & Co., Little Rock, $35,184; (c) C. S. Jackson & Co., Lake Charles, Louisiana, $35,372; (d) Gordon & Johnson, Monticello, Ark., $35,466.

	*(a)	(b)	(c)	(d)
4,500 cu. yd. excavation..............................	$0.30	$0.40	$0.41	$0.40
400 lin. ft. 10-in. vitrified pipe, 0-8................	0.35	0.50	0.57	0.50
400 lin. ft. 12-in. vitrified pipe, 0-6................	0.39	0.58	0.65	0.65
560 lin. ft. 15-in. vitrified pipe, 0-6................	0.50	0.75	0.80	0.80
20 catchbasins, each................................	10.00	20.00	22.00	20.00
12,780 lin. ft. concrete curb...........................	0.30	0.35	0.32	0.32
35 24-in. circular corners, each..................	2.00	2.00	1.00	3.00
38 18-in. circular corners, each..................	1.50	1.70	0.90	2.50
23,600 sq. yd. concrete pavement, 1-2-4 gravel........	1.05	1.12	1.13	1.14
23,600 sq. yd. concrete pavement, 1-1½-3 gravel......	1.12	1.23	1.22	1.215
23,600 sq. yd. concrete pavement, 1-2-4 stone.........	1.08	1.24	1.14	1.18
23,600 sq. yd. concrete pavement 1-1½-3 stone.......	1.17	1.36	1.24	1.255

★**Cincinnati, Ohio.**—Contract awarded by City Board Control, March 30, for paving Knott Street, 2660 sq. yd. bitulithic, to George Murdock, Norwood, Ohio, at $8,816.

★**Cleveland, Ohio.**—Contract awarded by Bd. Control for paving with brick E. 114th and E. 116th Streets to Baldwin Bros. Co., $46,795; E. Fifty-ninth Place, Sidaway Avenue and E. 123d and E. Sixty-fifth Streets, Rieley Bros., Arcade Bldg., at $25,557.

★**Columbus, Ohio.**—Contract for improving a portion of Harbor Roard awarded B. F. Patterson, 1214 Niel Avenue, at $167,000. John Scott, Clerk County Commissioners.

★**Lorain, Ohio.**—Contract for improving W. Erie Avenue (bids opened March 22) awarded Ohio Engineering Company of Lorain, at $55,630. A. J. Horn, Director Public Service.

★**Warren, Ohio.**—Contract awarded by City Council for paving East Market Street, from P. P. & F. Ry. to city limits, to Smith Engineering & Construction Co., at about $20,434.

★**West Salem, Ohio.**—Contract awarded Peters & Baird, Wadsworth, for 2⅛ miles of paving at $32,781. Wade Fahr, Clk. Co. Comrs.

★**Anderson, Ind.**—Contract for constructing gravel road in Lafayette Township (bids opened March 29) awarded George Hoppes, Anderson, at about $10,836. E. T. Flahaven, County Auditor.

★**Goshen, Ind.**—Contract for paving with asphalt on Seventh Avenue a distance of about 12 blocks, awarded S. S. Saxton Company, Chicago, Ill., at $1.56 per sq. yd.; total, $46,516. Bids opened March 6 by J. W. Haverly, City Engr.

★**Vincennes, Ind.**—Contract awarded by Board of Works for paving Eighth Street to Premier Construction Co., Indianapolis, at $43,807.

★**Chicago, Ill.**—Contract awarded by Board Local Improvements for paving Cornelia system, which includes a number of streets between Crawford Avenue and Central Park Avenue, to White Paving Co., at $128,950.

★**Waukegan,, Ill.**—Contract for laying 24,960 ft. 6 to 24-in. tile, etc. (bids opened March 29) awarded Arthur Birt, Decatur, at $10,495. A. L. White, Secy.

★**Burlington, Iowa.**—Contract for paving (bids opened March 30) awarded as follows: To Burlington Construction Company, Burlington, Seventh and Market Sts. Brick block at $1.90 per sq. yd. and Bevel block at $1.82, and Aetna Street, George Petersen, Burlington concrete at $1.16 per sq. yd. C. E. Waterhouse, City Engineer.

★**Sheldon, Iowa.**—Contract awarded by City Council for paving with concrete 15 blocks in residential district, to Dearborn Construction Co., Waterloo, at $1.34½ per sq. yd. for paving and 35 cts. per lin. ft. for curbing.

Duluth, Minn.—A. N. Nelson submitted lowest bid at $28,654 for one course reinforced concrete on Central Avenue and August A. Bodin & Son lowest on McGilvray nonskid pavement at $29,753.

★**St. Paul, Minn.**—Contracts awarded to Fielding & Shepley, 216 West University Avenue, as follows: Paving Portland Avenue from Dale Street to Lexington Avenue at $50,603; Victoria Street, $19,402; Hague Avenue, $29,837; Ashland Avenue, $30,842; Laurel Avenue, $30,265.

Lowest bid submitted to City Council for paving Selby Avenue from Victoria to Fairview Avenue by McClure Contracting Co., McClure Bldg., at $84,450.

★**Kearney, Neb.**—Contract for paving in District No. 11 (bids opened March 30) awarded George Parks Co., 2312 N Street, South Side, Omaha, at $1.94 per sq. yd. T. N. Hartzell, City Clk.

★**Lincoln, Neb.**—Contract for 6,520 sq. yds. fiber brick in District 342 (bids opened March 27) awarded Abel Construction Company, Lincoln, at $14,406. Theodore H. Berg, City Clerk.

★**Minot, N. D.**—Contract awarded Hanlon & Okes, Sioux City, Iowa, for 24,844 sq. yds. paving (bids opened March 20), by A. D. Hagenstein, City Aud.), for $82,103.

★**Sioux Falls, S. D.**—Contract awarded Western Construction Company, Sioux City, Iowa, for 68,921 sq. yds. asphalt concrete pavement at $1,59 per sq. yd. Walter C. Leyse, City Auditor.

★**Houston, Tex.**—Commissioners Court has awarded contract for paving Harrisburg Boulevard from Houston city limits to La Porte Road in Harrisburg to Lester Levy, of Dallas, Tex., at $141,927, using Texaco asphaltic concrete.

★Contract for paving Main Street from McKinney Avenue to G. H. & S. A. Ry., awarded Eureka Paving Company, Houston, at $154,280, using Texas Asphaltic Concrete.

★**Seattle, Wash.**—Contract awarded by Board Public Works for grading, planking, etc., of Michigan Street, to Holt & Jeffery, Transportation Building, Seattle, at $13,793.

Following are four lowest bids opened by Board Public Works for paving Beacon Avenue: P. J. McHugh, Third Avenue, N., and Mercer Street, $171,688; F. McLellan, Globe Building, $178,562; Washington Paving Company, L. C. Smith Building, $183,591; Independent Paving Co., Northern Bank Building, $184,982.

Spokane, Wash.—Following are four lowest bids opened by County Commissioners for constructing Meadow Lake-Cheney Extension (a) asphaltic concrete on macadam, (b) asphalt macadam: Standard Asphalt Paving Co., Spokane (a), $55,357; Spokane Bitumass Paving Co., Spokane (a), $57,684; Mitchell Bros. & Payne, Spokane (a), $58,417, (b) $46,635; Spokane Asphalt Macadam Paving Co., Spokane (a), $69,750, (b) $47,900.

★**Albany, Ore.**—Contract awarded by City Council for paving Main Street to J. W. Travis, Raleigh Hotel, Seattle, Wash., at $9,000.

★**Portland, Ore.**—Reported contract awarded by City Council for bitulithic pavement on crushed rock base and redress pavement, using old macadam base, on Sandy Boulevard to Oregon Independent Paving Co., Portland, at $10,172.

★**Los Angeles, Cal.**—Contract for 90,824 sq. ft. asphalt paving and 2420 sq. ft concrete and granite block gutter, etc., in West Pico Street awarded Coast Construction Company, 353 South Hill Street, at $15,613.

★**Santa Clara, Cal.**—Contract awarded by Town Trustees for completing state highway in Santa Clara and paving Homestead Road to City Improvement Co., San Francisco, at $35,047.

★**Wallace, Idaho.**—Contract awarded by City Council for paving with bitulithic portions of business and residential districts to Warren Construction Co., Portland, Ore., at $88,087.

STREET CLEANING AND GARBAGE DISPOSAL

BIDS DESIRED.

Washington, D. C.—Until April 20 by Commissioners D. C. for collection and disposition of ashes for a period of one and 2 years respectively from July 1, 1916, advertised in Engineering Record.

New Orleans, La.—Until April 11, by Department of Public Finances Accounting Division (A. G. Ricks, Comr.), for erecting a garbage incinerator of the type manufactured by the Decarie Incinerator Co., on Newton, Brookly and Rivers Streets, Algiers.

London, Ont.—Until April 14, by City Clerk, for (a) motor-driven street flusher, (b) road oil distributor, advertised in Engineering Record. H. A. Barzier, City Engineer.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Lincoln, Neb. — Following are bids opened March 22 by Council for constructing a garbage incinerator, 50 ton capacity: Herrington Incinerator Co., two units, $13,000; three units, $19,500, 37½ ton capacity; J. C. Derrough, Oklahoma, $14,980; Jones Bros., one unit, $14,500; four units, $28,000; Morse Boulger Destructor Co., 39 Cortlandt Street, New York, N. Y., $18,000; Nashville Bridge Co., Nashville, Tenn., $28,500; Borge Incinerator Corp., Flat Iron Building, New York, N. Y., 50 ton, 12 hours, $26,618; 50 ton, 24 hours, $18,900; Russell Engineering Co., St. Louis, Mo., four bids ranging from $19,770 to $37,106. DeCarie Incinerator Co., Minneapolis, Minn., $28,850.

Fresno, Cal.—E. M. Prescott of Fresno Brick & Tile Co. submitted the only regular bid for disposal of garbage, at 93 cts. per ton, under 10-yr. contract. He proposed constructing a plant.

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS

PROPOSED WORK.

Dredging—New York, N. Y.—Reported war Dept. asked Congress to appropriate $30,000 for removal of Craven Shoal in New York Harbor between Staten Island and Gravesend Bay.

Dredging—New York.—Governor Whitman signed bill reappropriating $8,776 for improving Three Mile Harbor.

Creek Improvement—Syracuse, N. Y.—Contract will probably be let soon after May 1 for improving Onondaga Creek from South Avenue to Courtland Avenue. Address Clerk Board Contract and Supply.

Drainage—Monroe, Ga.—Survey about completed for the Alcony River Drainage District, requiring about 70,000 cu. yd. excav. and 2 dipper dredges. Contract will be let early in May. W. S. Alexander, Engineer, Monroe.

Wharf—Panama City, Fla.—City Commission sold $20,000 bonds for constructing wharf and improving streets.

Canal—Alexandria, La.—Contract about to be let by Bd. State Engineers at New Orleans for enlarging 18 miles of state canal between Alexandria and Bayou Des Glaises; cost about $75,000.

Levees — Alexandria, La. — The Red River, Atchafalaya and Bayou Boeuf Levee Board voted to close the crevasse on the Atchafalaya River 6 miles below Melville. State to pay $75,000 and Levee Board to pay $25,000 of cost.

Levee Work — Memphis, Tenn.—Contracts soon to be let for about $80,000 worth of levee work in North Memphis District. J. H. Weatherford, City Engineer.

Dredging—Ashtabula, Ohio—City Council approved plans of City Engineer for deepening Ashtabula River.

Hydro-Electric Plant—Canton, Ohio.—Reported Central Power Co. will spend an additional $2,000,000 in extending high tension line to Fostoria, Tiffin, Newark and other Ohio cities.

Drainage—Jackson, Mich.—About 790,700 cu. yd. of earth will be excavated and 3 bridges—2 highway and one railroad—will be constructed in connection with the Grand River project in Jackson County. E. G. Hulse, Engineer, St. Johns; Clancey O. Worth, Special County Drain Commissioner.

Dredging—Belleville, Wis. — Reported the Richland Creek Drainage Dist. Commissioners, of whom E. P. Leuschner is a member, will report to County Court on deepening and straightening creek in Belleville; estimated cost $75,000.

Drainage—Madison, Wis.—Petitions being circulated for organization of the Baraboo River Drainage District, surveys and plans have been prepared by H. W. Tennant, Madison, for the reclamation of 12,000 acres.

Dam—Shawano, Wis.—No bids opened March 28 by Electric Light and Water Works Comn. for constructing concrete dam, power house and earth dykes. Contract may not be let until May. Engineers, Powers Engineering Co., Corn Exchange Building, Minneapolis, Minn.

Drainage — Cloquet, Minn. — District Court has authorized the establishment of the Carlton County Judicial Ditch No. 2. The ditch and laterals will drain about 18,000 acres and is estimated to cost $54,000. A complete system of roads will be constructed along the ditches. Address County Clerk.

Hydro Electric Plant—Rochester, Minn.—Hugh L. Cooper, 101 Park Avenue, New York, N. Y., will make an examination of the Zumbro water power proposition. Citizens recently voted $360,000 bonds for constructing hydroelectric plant near Zumbro Falls.

Ditch—Roseau, Minn.—Auditors of Beltrami and Roseau Counties estimate cost of Judicial Ditch No. 62 at $218,664.

Drainage—Gregory, Mo.—Edmund T. Perkins, Engineering Company, First Natl. Bank Bldg., Chicago, Ill., is engineer for drainage system which is to be constructed in Gregory Drainage District and is to consist of levees along Mississippi and Fox Rivers and a system of interior drainage. The drainage work will also include a pumping station.

Levee—England, Ark.—Plum Bayou Levee Dist., including counties of Pulaski, Lonoke and Jefferson will repair, and raise from 1 to 4 ft., 43 miles of present levee construction. Engs., Dickenson & Watkins, Little Rock.

Drainage—Marion, Ark.—Morgan Engineering Company, 606 Goodwyn Institute Bldg., Memphis, Tenn., has been retained to prepare plans for drainage district No. 8, Crittenden County, which embraces about 13,000 acres and is estimated to cost about $100,000. Contract will probably be let during the summer.

Drainage and Park—Port Arthur, Tex.—Attorney General has approved issue of $231,000 bonds for this city, $180,000 being for drainage, $25,000 for parks and $6,000 for an incinerator.

Bulkhead — Seattle, Wash. — Contract soon to be let by Bd. Public Works (C. B. Bagley, Secy) for constructing reinforced concrete bulkhead on East Lake Avenue, 320 ft. long, 6 ft. high, 1½ ft. wide at top and 4 ft. wide at the bottom. About 1,000 cu. yds. of concrete and 1,000 ft. 6-in. pipe involved; cost $10,000. A H. Dimock, City Engineer.

Dredging — Tacoma, Wash.—Contract will be let probably in May for constructing dikes and diches in Hylebos Creek Diking Dist. No. 1. Cost $113,000. Donald B. Roben, Engineer, Tacoma.

Irrigation—Wenatchee, Wash.—Directors of Wenatchee Reclamation District sold $160,000 district bonds.

Irrigation—Culver, Ore.—Citizens voted favorably on north unit of Deschutes Project, which provides for constructing an irrigation system for 100,000 acres of land along Deschutes River about 20 miles north of Madras. H. W. Gard and A. D. Anderson among directors. J. T. Hinkle of Hermiston said to be interested.

Irrigation—Portland, Ore.—R. W. Rea, 412 Spalding Building, Portland, engaged as project engineer of Ochoco Irrigation Dist. Surveys will be made at once. Construction work will include earth fill, dam and reservoir and store 40,000 acre-ft. of waters of Ochoco Creek.

Irrigation — Portland, Ore. — Reported citizens of North Unit Irrigation Dist., in Jefferson County, voted in favor of proposed reclamation project which involves 99,300 acres to be reclaimed at $55 per acre. A $1,000,000 concrete-lined canal is included in the project. Address Clerk of the district.

Drainage—Atwater, Cal.—Surveys completed by A. E. Cowell, County Surveyor of Merced County, for the proposed Atwater Drainage District, in which Charles Olsen and W. H. Osborn are interested.

Irrigation—Calneva, Cal.—W. L. Wales, Woodland, engaged as engineer for the Southern Lassen Irrigation District improvements. Cost $700,000. John F. Manck, Secretary District at Calneva.

Irrigation — Fresno, Cal.—George H. Baldwin of the California State Water Commission at Sacramento is surveying flow of Merced, Kings and Chowchilla Rivers near Fresno for the purpose of determining the approximate amount of water available in that portion of San Joaquin Valley for irrigation purposes. He will be located in Fresno for the present. The survey was made necessary by application of Panoche Canal Co. of San Francisco for permission to divert 1000 second feet at junction of San Joaquin River and Fresno Slough to be used for irrigating purposes for about 175 square miles of land lying between Los Banos and Mendota.

Irrigation — Los Banos, Cal.—Panoche Canal Co., a subsidiary of the Miller & Lux Corporation, Merchants Exchange Building, San Francisco, has applied to State Water Commission for permission to divert 1000 second feet of water at junction of San Joaquin River and Fresno Slough to irrigate a strip of land 30 miles long and 5 miles wide along west side of river between Los Banos and Mendota.

Irrigation—Los Angeles, Cal.—Los Angeles Municipal Improvement District No. 2 voted $390,000 bonds to construct an irrigation system in San Fernando Valley to take surplus water from Los Angeles city aqueduct. About $382,000 will be spent for steel pipe and accessories for construction work. William Mulholland, Engineer, Los Angeles Board Public Service, Knickerbocker Building.

Dam—Pleasant Valley, Cal.—J. D. Stewart, 2528 Reservoir Street, Los Angeles, and N. R. Castro, Pleasant Valley, it is reported, propose constructing a dam in the lake to increase storage capacity, about 400 acre-ft. Lake will be tapped by means of a tunnel.

Levee Work—San Diego, Cal.—W. W. Webb of Berkeley, U. S. Drainage Engineer, recommends in San Diego County the forming of drainage districts and the construction of inexpensive levees.

Drainage—San Jacinto, Cal.—Board of Supervisors has authorized formation of the Brownlands Drainage District comprising about 10,000 acres contiguous to San Jacinto River, deepening of channel and constructing levees, estimated to cost $90,000, is contemplated.

Dam—Florence, Ariz.—Florence-Casa Grande Consolidated Canal Co., preparing to construct permanent diversion dam on Gila River east of Florence.

Drainage—Hinckley, Utah.—About $40,000 Millard County Drainage Dist. No. 1 bonds sold. Reported contract will soon be let for constructing said system. John Reeve, Chmn. Drainage District.

Dock—Niagara Falls, Ont.—See "Private Buildings."

BIDS DESIRED.

Bulkhead—Boston, Mass.—Until April 14, by Directors Port of Boston (Robert E. Barrett, Acting Ch. Engr.), for construction of bulkhead along Norther Avenue extension, South Boston, advertised in Engineering Record.

Dredging—Buffalo, N. Y.—Until April 14, by Department Public Works (Arthur Kreinheder, Supt.), for dredging in Buffalo River.

Dredging—New York, N. Y.—Until May 4 by U. S. Engineer Corps, Room 802 Army Building, 39 Whitehall Street, New York, for dredging in Staten Island Sound, N. Y. and N. J., advertised in Engineering Record.

Drainage—New York, N. Y.—Until April 17, by Board Health (Eugene W. Scheffer, Secy.), for furnishing material and equipment necessary or required to ditch, drain, fill or otherwise improve certain areas in the salt marshlands and meadows located within the Boroughs of Brooklyn and Queens, including the island in Jamacia Bay.

Riprap — Tompkinsville, N. Y. — Until April 29 by J. T. Yates, Lighthouse Inspector, Tompkinsville, for furnishing and placing riprap at Long Beach Bar Light Station. Gardiners Bay, N. Y., and Little Gull Island Light Station, Long Island Sound Entrance, N. Y.

Dredging — Wilmington, Del. — Until April 26, by U. S. Engrs. Office, Old Federal Building, for dredging in Smyrna River.

Machinery for Dam—Wheeling, W. Va.—Until April 24 at U. S. Engineer's Office, Wheeling, for furnishing and delivering valve jacks and gate operating machinery at Dams Nos. 16 and 17, Ohio River.

Levee—Vincennes, Ind.—By MacArthur Bros. Co., to sublet 1,790,000 cu. yd. earth for drag lines and teams, on Wabash River levee at Vincennes, Ind, advertised in Engineering Record. Apply to MacArthur Bros. & Co., Continental & Commercial Bank Bldg., Chicago, Ill., or to A. W. Riney, Superintendent, Grand Hotel, Vincennes.

Drain — Carlton Center, Mich. — Until April 25, by Drainage Commissioners at Town Hall, Carleton Center, for constructing Little Thornapple River Drain in Townships of Woodland, Carlton and Irving, in Barry County and Boone in Kent County, and affecting land in townships of Odessa, Sebewa and Campbell in Ionia County. Total length 72,450 ft. and to be 16, 18, 20 and 22 wide on the bottom. Geo. Burgess, Special Co. Drain Comr., County of Barry, Hastings.

Dredging — St. Francisville, Ill. — Reported desired until April 20, by S. W. Seed, clerk, for dredging of ditches in England Pond Drainage Dist., requiring about 92,000 cu. yd. excav. Geo. C. Harvey, Engr., Mt. Carmel.

Ditch — Windom, Minn.—Reported desired until April 14 for Judicial Ditches Nos. 19, 24 and 26, tile; probable cost $20,059, $23,139 and $15,693 respectively. S. A. Brown, Co. Aud.

River Improvements—Kansas City, Kan.—Until April 17 (readvertisement) by County Commissioners for removing obstructions from Kansas River between James Street Bridge and West Kansas Avenue Bridge. F. M. Holcomb, County Clerk.

Irrigation—Ft. Shaw, Mont.—Until May 5 by U. S. Reclamation Service, Ft. Shaw, Mont., for constructing approximately 575 lin. ft. 96-in. continuous wood stave pipe for Sun River Project, advertised in Engineering Record.

Irrigation—Echo, Ore.—Reported desired by Frank Sloan, Secy. Paradise Irrigation Project, for constructing said project.

Irrigation—San Diego, Cal.—Until about April 15, by George Cromwell, City Engineer, for constructing 23,700 ft. 36-in. wood stave pipe line between Dul Zura Creek and Upper Otay, about 5 miles; cost $85,000.

Dredging—San Francisco, Cal.—Until April 29, by U. S. Engineer's Office, San Francisco, for dredging in Petaluma Creek.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Riprap — Tompkinsville, N. Y.**—Contract for furnishing and placing 11,000 ton riprap at West Bank light station awarded Bowker Contracting Co., 21 State Street, New York, N. Y., at $9,570, 120 days.

Pier—Jersey City, N. J.—Reported Pennsylvania R.R. has awarded to Post & McCord, 101 Park Avenue, New York, contract for structural steel work on proposed new pier at Greenville freight yard at $116,300.

★**Breakwater—Conneaut, Ohio.**—Following are four bids opened March 24 by U. S. Engineer's Office, Cleveland, for constructing rubble mound breakwater at Conneaut Harbor, Ohio—(a) approximately 111,200 ton stone for covering rubble mound breakwater and for core, riprap, etc.; (b) total: The Edw. Gillen Dock, Dredge & Construction Co., 1112 N. Erie Street, Racine, Wis., (a) $1.40 and (b) $155,680 (recommended for award); Coast & Lakes Construction Corporation, 25 Broad Street, New York, N. Y., (a) $1.41, (b) $156,792; Great Lakes Dredge & Dock Co., 1630 Williamson Building, Cleveland, (a) $1.58 and $1.70, (b) $177,916; Zenith Dredge Co., 303 Glencoe Building, Duluth, Minn., (a) $1.65, (b) $183,480.

Levee Work—Vincennes, Ind.—Following are four lowest bids opened recently by J. S. Spiker, Commissioner of Construction, for constructing the Brevoort system of levees along Wabash River: Roach & Stansel, Memphis, Tenn., $276,558; McArthur Bros., New York, $276,700; Fred M. Crane Co., Omaha, Neb., $278,653, and Winston Bros., Minneapolis, Minn., $283,037. Levee will be about 37 miles long.

★**Levee Work—Vincennes, Ind.**—Contract for above work awarded MacArthur Bros., New York, N. Y.

★**Docks—Two Harbors, Minn.**—Contract awarded to Strom Bros. of Two Harbors, at about $25,000 for constructing concrete slabs for bottoms and fronts of packets for steel and concrete ore dock No. 2 being constructed here for Duluth & Iron Range R.R.

Irrigation—St. Ignatius, Mont.—Only bid opened March 29 by U. S. Reclamation Service, St. Ignatius for constructing canals and structures on Flathead Project submitted by Percy M. Ross, Polson, Mont., at $13,945. E. F. Tabor, Project Manager.

★**Irrigation—Ft. Laramie, Wyo.**—Contracts awarded April 1 by U. S. Reclamation Service, Washington, D. C., for work on Ft. Laramie Project, as follows: (Bids opened March 10) Schedules 1, 2, 3 and 4, earthwork, MacArthur Bros. Co., Chicago, Ill., $153,605, also Schedule 2, three conduits, $18,265; Schedule 1, structures, Security Bridge Co., Minneapolis, Minn., $39,877.

★**Drainage Canal—Arkansas City, Ark.**—Contract for constructing the $1,000,000 Cypress Creek Drainage Canal in Desha and Chicot Counties reported awarded R. H. & G. A. McWilliams of Memphis, Tenn.

★**River Improvements—Seattle, Wash.**—Following are four lowest bids opened March 20 by Col. J. B. Kavanaugh, Corps Engrs., U. S. A., Burke Building, for revetment work on north bank of Portage River: Pearson Construction Co., $30,139 (awarded contract); Washington Paving Co., $30,996; W. T. Butler, $36,562, and W. P. Zindorf, $38,846 (bidders all of Seattle).

★**Irrigation — Hanford, Cal.** — Contract awarded Benj. F. Ford, and Fred H. Stout, 336 Bradbury Bldg., Los Angeles, for constructing the Lemoore Stratford unit.

★**Development Work—Tucson, Ariz.**—Contract for $200,000 worth of development work on 30 claims of Copper Chief Mining Co., in Quijota Mountains awarded Spillsbury Engineering Co., of Pittsburgh, Pa. Contracts call for diamond drill work, which will be done under direction of John Edwin Reade, of Spillsbury Co.

Seawall—Havana, Cuba.—The following are approximate bids opened by Secretary Public Works for 390 meters of concrete seawall at Havana. Juan Goveam, $71,500; Torrance & Portal, $72,000; Fermin Pinon, $84,000; Francisco Martinez, $85,000; Skinner & Fitzgerald, $103,000.

ELECTRIC RAILWAYS

PROPOSED WORK.

New York, N. Y.—Interborough Rapid Transit Co. plans to construct a substation 60 x 100 ft., one story, on River St., near 162d St.; estimated cost, $40,000. George Pegram, 165 Broadway, New York City, Ch. Engr.

Greenwood, Miss.—Peoples Interurban Co. organized to make surveys and plans for interurban railway to connect Greenwood, Schlater, Itta Bena and Black Hawk, to be built by Southern Finance & Constr. Co., Memphis, Tenn. J. H. Parson, Nashville, Tenn., Pres.

Ashland, Ky.—Ashland-Greenup Traction Co., incorporated to construct a line to connect Ashland, Russell and Greenup, 11 miles.

Ashton, Ill.—Lee County Central Electric Ry. Co. (G. H. T. Shaw, Ch. Engr., Lee Center) contemplates constructing an extension from a switch two miles west of Middlebury to Ashton.

Champaign, Ill.—Urbana & Champaign Ry. & Gas & Electric Co. (H. J. Pepper, Gen. Supt., Champaign) plans to install a 2500-kw. turbo-generator, 1000-hp. boiler, feed pump and boiler.

Chicago, Ill.—Chicago, Fox Lake & Northern Electric Ry. Co. contemplates constructing an electric railway from end of Ravenswood branch of Northwestern Elevated Railroad in northwestern part of Chicago to Palatine via Arlington Heights and Des Plaines.

Lexington, Ill.—Bloomington & Normal Ry. & Light Co. (M. G. Linn, Gen. Supt., Bloomington) will construct a substation in Lexington and rebuild distribution system in said city.

Maywood, Ill.—Reported the Aurora, Elgin & Chicago R.R. Co. (Edwin C. Faber, Gen. Mgr., Aurora) plan to construct a line from Maywood Speedway to Franklin Park through west end of Maywood, east end of Bellewood and Melrose Park.

Burlington, Iowa.—Plans being prepared by Burlington Ry. & Light Co. to construct a 45-mile transmission line to connect plants in Des Moines and Louisa Counties with Burlington.

Florence, Ore.—Southern Pacific Ry. Co. (F. L. Burckhalter, Ch. Engr., Portland) will construct 3-mile line from Cushman to Florence.

Oregon City, Ore.—Willamette Valley Southern Ry. Co. (J. L. Stacer, Ch. Engr., Oregon City) plans extensive improvements and repairs to system during 1916.

Pendleton, Ore.—Plans being prepared to construct an electric railway from Pendleton to Walla Walla, Wash. and from Cold Spring Landing through Pendleton to Bingham Springs. C. W. Lefler and E. W. McComas, Pendleton are interested.

RAILROADS

PROPOSED WORK.

Alburtis, Pa.—Reported the Philadelphia & Reading Ry. Co. (S. T. Wagner, Ch. Engr., Philadelphia) will construct a 14-mile cutoff from Alburtis to Bethlehem steel plant.

Bally, Pa.—Construction of extension of Colebrookedale branch of Philadelphia & Reading R. R. Co. (S. T. Wagner, Ch. Engr., Philadelphia), from Barto to Bally, distance of 1¼ miles, is contemplated.

Greenville, S. C.—Reported about 50 miles of roadbed of Southern Railway Co. (B. Herman, Ch. Engr., 1300 Pennsylvania Avenue, Washington, D. C.) will be double tracked.

Mississippi.—Lower house passed bill directing railroads to make safety improvements at grade crossing by erection of subways or viaducts; when cost exceeds $25,000, city requiring work done must participate in expense.

Hartsville, Tenn.—Nashville, Hartsville & Red Boiling Springs R. R. Co. organized to construct a railroad from Hartsville to Red Boiling Springs via Lafayette. J. C. Collins, of Nashville, Secy.

Memphis, Tenn.—Reported Missouri Pacific R. R. Co. (E. A. Hadley, Ch. Engr., St. Louis, Mo.), and Iron Mountain Ry. Co. plans to rearrange terminal facilities, yard tracks and roadhouse at Memphis; approximate cost $150,000.

Scranton, Ark.—Construction of extension of Fort Smith, Subiaco & Eastern R.R. (J. H. Wright, Secy. and Treas., Fort Smith) from Scranton to Dardanelle is contemplated.

Cardwell, Mo.—Paragould-Memphis R.R. Co. of Kenton received charter to construct a 9-mile standard gage railroad to connect Cardwell and Geneva. Capital $90,000. Incorporators: John W. Vail, C. A. Merryman and others.

Seattle, Wash.—Port of Seattle (C. E. Remsberg, Chmn.) instructed Port Engineer J. R. West to prepare plans for another set of tracks around the Bell Street warehouse; cost $20,000.

Spokane, Wash. — Reported Chicago, Milwaukee & St. Paul Ry. will construct branch line 9 miles long from Emerald Creek Valley, Idaho, to connect with Bonville branch in Fernwood.

Granger, Utah.—Salt Lake & Utah R.R. Co. (W. R. Armstrong, Gen. Mgr., Salt Lake City) received franchise from County Commissioners, subject to approval by County Attorney, for constructing a branch line extending from Granger to Pleasant Green.

Idaho.—Reported Chicago, Milwaukee & St. Paul R.R. Co. (C. F. Loweth, Ch. Engr., Chicago, Ill.) will extend Elk Branch into Idaho, a distance of about 25 to 30 miles.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Hutchinson, Pa.**—Reported contract awarded Miller Construction Co., Lock Haven, Pa., for constructing the Fairmont Bingamon R.R. from Hutchinson to Wyatt, a distance of 6 miles. This branch is part of the Western Maryland R.R.

★**Stockton, Ill.**—Contract for constructing 115 miles of railroad from Mt. Hope, Wis., to Stockton via Lancaster, Platteville and Shullsburg awarded to Railway Engineering & Equipment Co. of Chicago.

★**Lambert, Mont.**—Contract for constructing 25 miles of new road from Lambert west awarded by Great Northern Ry. Co. (A. H. Hogeland, Ch. Engr., St. Paul, Minn.) to A. Guthrie, Inc., Endicott Building, St. Paul, Minn.

★**Orange, Tex.** — Contract for constructing first unit of extension of Gulf, Sabine & Red River R.R., about 12 miles, awarded by Lutcher & Moore Lumber Co. to Cook & Richards of Crockett.

PUBLIC BUILDINGS AND SCHOOLS

PROPOSED WORK.

Concord, N. H.—Sum of $100,000 has been given to Middlesex School for erectting gymnasium. Bigelow & Wadsworth, Archts., 3 Hamilton Place, Boston, Mass.

Boston, Mass.—Erection of a school administration building at Jay Street and Joy Place contemplated; probable cost, $400,000. Address Board of Education.

Plans being prepared by H. H. Atwood, 61 Alban Street, Dorchester, for municipal building to be erected in Roslindale.

Springfield, Mass.—All bids opened recently for erecting addition to Howard Street School have been rejected by City Property Committee.

Revised plans to be prepared by Kirkham & Parlett, 25 Harrison Avenue, will be ready in about 6 weeks. Cost not to exceed $100,000.

Taunton, Mass.—Finance Committee of Council reported to be in favor of erecting an addition to high school.

Warwick, R. I.—At Town Meeting, question of issuing $85,000 bonds for school improvements will be considered.

New Britain, Conn. — School bonds amounting to $25,000 sold. George A. Quigley, Mayor.

Amsterdam, N. Y.—Board of Education contemplates erecting 2-story brick grade school on Academy Street, to cost approximately $80,000. Architect not yet selected.

New York Mills, N. Y.—Erection of a 2-story brick school costing about $75,000 contemplated. Address Clerk School Board.

New York, N. Y.—Plans filed for erecting four-story and basement building to be known as Students' Hall on Claremont Avenue for Barnard College; estimated cost $450,000. Arnold W. Brunner, Archt., 101 Park Avenue.

Rensselaer, N. Y.—Erection of a 20-room and auditorium school contemplated on Washington Avenue and Third Street; cost, approximately, $80,000. John G. Salt, Clerk Board of Education.

Bayonne, N. J.—Board of Education will erect an addition to high school to cost $260,000, and erect a new school to cost $146,000.

Elizabeth, N. J.—State has approved plans for the new alms house. Address City Clerk.

Newark, N. J.—Mayor approved plans for proposed new police headquarters.

Allentown, Pa.—Plans being prepared by Warren P. Laird, University of Pennsylvania, for Muhlenberg College, consisting of library, science buildings, auditorium, chapel, dormitories, gymnasium and professors' houses.

Beaver, Pa.—Reported new $100,000 building is to be erected in place of the present high school which has been condemned. Address Secretary Board of Education.

Chester, Pa.—Reported Dr. S. W. Pryor and associates intend rebuilding on York Street, Pryor Hospital recently destroyed by fire.

Ebensburg, Pa.—Walter R. Myton, Johnstown, is architect for proposed two-story, sixteen-room, brick school; cost, about $50,000. Address School Board.

Ellwood City, Pa.—Plans of Carlisle & Sharrar, Jenkins Arcade, Pittsburgh, approved for proposed City Hospital. J. W. Offut, Chairman Building Committee.

Harrisburg, Pa.—Erection of new court house under consideration. Address County Commissioners.

Lancaster, Pa.—School bonds amounting to $250,000 sold. Address Board of Education.

Palmerton, Pa.—Citizens March 28 voted to issue $35,000 bonds for erecting 8-room brick school. S. D. Costenbader, Secy. School Board.

Philadelphia, Pa.—School bonds for $2,500,000 will be sold April 17 by William Dick, Secretary, Board of Education.

Contract soon to be let for erecting convenience station in Westmoreland Park at Fifth Street and Allegheny Avenue.

Plans being prepared for 2-story and basement fireproof building to be erected at Falls of Schuylkill and for fire house and hose tower on Montgomery and Gerard Avenues by city.

Pittsburgh, Pa.—Site on Sandusky Street purchased for proposed William M. Singer Memorial Research Laboratory to be erected for Allegheny General Hospital.

Preliminary steps being taken to erect Sheraden-West End High School; cost not to exceed $265,000.

Swissvale, Pa.—C. Howard Lloyd, Telegraph Building, Harrisburg, retained by Board of Education to prepare plans for proposed high school, to cost $180,000.

Turtle Creek, Pa.—Citizens voted $200,000 bonds to erect new high school. Address Board of Education.

Frederick, Md.—Citizens reported in favor of erecting dormitory on Hood College grounds, costing about $50,000.

Maryland.—Legislature has passed on the following appropriations: For roads, $2,500,000, Baltimore to be given $540,000 of this sum; bridge over Sinepuxent Bay at Ocean City, $200,000; armories at Hyattsville, Westminster and Cambridge, $100,000; buildings at the Maryland Agricultural College, $174,000; dormitories at Frostburg Normal School, $26,000.

Baltimore, Md.—Senate passed bill providing for $1,000,000 bond issue for city schools.

Wilmington, Del.—Erection of $300,000 library at Tenth and Market Streets contemplated.

Plans being prepared for improving and enlarging Homeopathic Hospital.

Norfolk, Va.—State Legislature passed bill authorizing issue of $45,000 school bonds for Washington Magisterial District.

Erection of $250,000 city hall and market costing $90,000 being considered. Address City Clerk.

Clarksburg, W. Va.—S. W. Ford, Prunty Building, is architect for the proposed Clarksburg Hospital, to cost $150,000, but nothing definite will be done toward erection until about June. Dr. W. W. Showalter, Supt.

Ronceverte, W. Va.—Board of Education contemplates erecting 8-room and auditorium school, to cost $30,000.

Petersburg, W. Va.—School bonds for $200,000 will be sold April 12 by Finance Committee of Council. C. B. Gill, City Auditor.

Clearwater, Fla.—Court house, jail and funding bonds for $160,000 will be sold April 17 by County Commissioners. (C. W. Wiecking, Clerk).

Mobile, Ala.—Board of Revenue and Road Commissioners, Mobile, have sold $150,000 school bonds.

Bowling Green, Ohio.—Contract soon to be let for erecting State Normal School, to cost about $120,000. Howard & Merriam, Archts., 8 East Broad Street, Columbus.

Bryan, Ohio.—School bonds for $120,000 will be sold April 18 by F. A. Culbertson, Clerk Board Education.

Canfield, Ohio.—Architect engaged to prepare plans for $40,000 grade and high school. Address Board of Education.

Chillicothe, Ohio.—Plans being prepared by Major Best, State Architect, Columbus, for the memorial building to cost $75,000. Address Memorial Board.

Cincinnati, Ohio.—Tentative plans for an addition to the Windsor School approved by Building Committee of the Board of Education to cost $50,000. Dr. J. M. Withrow, Chairman.

Circleville, Ohio.—Citizens voted $130,000 bonds to erect new high school. Address Board of Education.

Cleveland, Ohio.—City Hall bonds for $425,000 will be sold April 10 by Sinking Fund Commission.

Trustees of Public Library purchased site at West Twenty-fifth Street and Mapledale Avenue for erecting $25,000 branch library.

City Council considering a $55,000 bond issue for constructing municipal bath house at St. Clair Avenue and East Fifty-fifth Street.

Derby, Ohio.—School bonds for $25,000 will be sold April 24, by Miles Green, Clk. Board Education.

Conesville, Ohio.—School bonds amounting to $25,000 sold by Board of Education.

Coshocton, Ohio.—Mayor Richardson submitted plans to Council for addition to City Hospital; estmated cost, $25,000.

Eaton, Ohio.—Courthouse bonds for $250.000 will be sold May 1 by Board of County Commissioners.

Lakewood, Ohio.—Councilmen passed a $30,000 bond issue for erecting fire station. Address City Clerk.

Middletown, Ohio.—School bonds for $31,000 will be sold April 18 by Board Education (W. H. Todhunter, Clerk).

Pleasant City, Ohio.—Matheny, Allen & Mounts, Harrison Building, Columbus, engaged to prepare plans for $40,000 school to be erected here.

Sciotoville, Ohio.—Board of Education considering plans for addition to high school; probable cost $25,000.

Steubenville, Ohio.—House Committee on Public Buildings and Grounds at Washington, D. C., reported in favor of an additional appropriation of $150,000 for constructing public building accommodations at Steubenville.

Tiltonsville, Ohio.—School bonds for $45,000 will be sold April 29, by Seth Williams, Clk. Bd. Educ. Grover Village School Dist., Jefferson County.

Huntington, Ind.—A $28,000 high school is to be erected in Rock Creek Township. George Brickley, Township Trustee.

M. D. Brinnesman & Sons, Huntington, are architects for the $25,000 school to be erected in Warren Township.

Lafayette, Ind.—Trustees of Purdue University have decided to rebuild armory, recently destroyed by fire, to cost $150,000.

Terre Haute, Ind.—Trustees of Indiana State Normal School considering plans for new $100,000 Science Hall.

Lieters, Ind.—Freyermuth & Maurer, South Bend, are architects for the school to cost $25,000.

Detroit, Mich.—Reported City Council appropriated $200,000 for erecting tuberculosis hospital.

Sturgis, Mich.—Citizens voted $120,000 bonds to erect new high school on present site. Address Board of Education.

Danville, Ill.—Board of Supervisors of Vermilion County voted to erect new cell house at the county jail, to cost $40,000.

Joliet, Ill.—School Board considering plans for erecting addition to high school.

Tuscola, Ill.—Selection of site for proposed high school to cost about $125,000 being considered. Address School Board.

Eau Claire, Wis.—George Awsemb, 14 East Jackson Boulevard, Chicago, Ill., is architect for the auditorium and armory, which is to cost $70,000. Address City Clerk.

La Crosse, Wis.—Board of Directors of Lutheran Hospital, Seventh Street and Norman Coulee Road, decided to erect four-story addition, costing $35,000.

Oshkosh, Wis.—Reported State Normal School recently destroyed by fire will be rebuilt. Address William Kittle, Secretary State Board of Normal Regents, Madison.

Bancroft, Iowa.—Citizens voted $35,000 bonds for erecting new school. Address School Board.

Ware, Iowa.—Citizens voted $40,000 bonds to erect new school. Address Clerk School Board.

Baudette, Minn.—School bonds for $40,000 will be sold April 15, by E. C. Middleton, Deputy Clerk Independent School Dist. 111, Beltrami County.

Bird Island, Minn.—W. L. Alban, Endicott Building, St. Paul, is preparing plans for a $65,000 school. Address H. M. Melke, Clerk School Board.

Owatonna, Minn.—Election soon to be held to vote $125,000 bonds for erecting high school. Address Secretary Board of Education.

Red Wing, Minn.—Citizens voted in favor of erecting a $125,000 high school and a $35,000 grade school.

Staples, Minn.—School costing about $50,000 is to be erected to replace high school recently destroyed by fire. Address Board of Education.

Warren, Minn.—Board of Education considering erecting a $50,000 high school.

Stafford, Kan.—Citizens voted $35,000 bonds to erect high school. Address School Board.

David City, Neb.—Bonds amounting to $60,000 for erecting high school sold. Address Board of Education.

Havelock, Neb.—School bonds amounting to $35,000 sold. Address Board of Education.

Fargo, N. D.—Contract will be let, probably in June, for erecting St. Luke's Hospital, fireproof, and cost $50,000. Paul Vik, Supt.

Miller, S. D.—Erection of $100,000 court house being considered. Address County Clerk.

Missoula, Mont.—Contract soon to be let for erecting fireproof four-story 48 x 150-ft. brick hospital for Northern Pacific Beneficial Assoc.; cost $85,000. Address H. B. Smith, Brokerage Building, St. Paul, Minn.

Norman, Okla.—Citizens voted $40,000 school bonds. Address School Board.

Fort Stockton, Texas.—Contract soon to be let for erecting three-story school; cost $50,000. Address George Burnett, Archt., Cameron Building, Waco.

Marlin, Texas.—Erection of $65,000 high school, installation of sewer system and extension of waterworks plant contemplated. Address The Mayor.

Marshall, Tex.—See "Bridges."

Paris, Texas.—The fire loss to this city on March 21 is estimated at between $10,000,000 and $15,000,000. Steps are being taken by the city and business firms to rebuild. The City Plan prepared some time ago by W. H. Dunn, Landscape Architect, of Kansas City, Mo., will be adopted by city. K. G. Tyler, City Engineer.

Plainview, Tex.—Plans of M. L. Waller, 209 W. Eighth Street, Fort Worth, accepted by Trustees Plainfield High School for $50,000 high school.

Wichita Falls, Tex.—Plans of Sanguinet & Staats of Fort Worth and C. J. Pater of Wichita Falls accepted for the $225,000 court house. Contract will be let after May 1.

Calumet, Okla.—Citizens voted in favor of erecting new school. Address Clerk School Board.

Chico, Cal.—Erection of a $100.000 high school contemplated. Address Board of Education.

San Bernardino, Cal.—All bids opened March 20 for erecting county hospital have been rejected by Board of Supervisors. L. R. Pratt, Clerk of Board.

Victorville, Cal.—Plans being prepared by Lester H. Hibbard, 634 Marsh Strong Building, Los Angeles, for a 1-story brick or hollow tile high school, for which $30,000 bonds will be sold.

Tucson, Ariz.—A central power and heating plant is to be erected at School of Mines of the University of Arizona, to cost, including equipment, about $95,000, work will be done by day labor; an engineering building, cost $175,000, is to be erected soon, also by day labor. R. S. King, Supt. of Construction.

Kimberly, Idaho.—Citizens voted to issue bonds for erecting 8-room, two-story and basement, brick and concrete school, for which plans are being prepared; cost $40,000.

BIDS DESIRED.

Boston, Mass.—Until April 14, by Revere Street School Committee, Albert S. Burnham, Chmn.) for erecting a school on Revere Street. Hall & Cook, Archts., 125 Tremont Street, Boston.

Newport, R. I.—Until May 15, by Jas. A. Wetmore, Acting Supervising Archt., Treas. Dept., Washington, D. C., for erecting post office and custom house at Newport.

Bristol, Conn.—Until April 10, by W. H. Cox, Chmn. Bristol High School Comn., for erecting high school. Separate bids for heating, ventilating, plumbing, etc.

Wallingford, Conn.—Until April 24, by A. B. Morrill, Secy. High School Bldg. Committee, Town Hall, for erecting fireproof high school; estimated cost $115,000. John T. Simpson, Archt., Essex Bldg., Newark, N. J.

Caldwell, N. J.—Until April 12, by Board Education, for erecting school.

Hoboken, N. J.—Until April 12, by City Commissioners, for erecting addition to high school, estimated to cost $75,000.

Newark, N. J.—Until April 26, by Board Education (E. D. Argue, Secy.) for construction and completion of addition to John Catlin School. Cost $127,000.

Newark, Del.—Reported desired until April 17, for erecting three-story brick and marble, 61 x 235 ft. building with wing 45 x 65 ft., for Delaware College. Separate bids for heating, ventilating, electrical work, elevators, etc. Day & Klauder, Archts., 925 Chestnut Street, Philadelphia, Pa.

Jacksonville, Fla.—Until April 15, by Board Public Instructions (F. A. Hathaway, Co. Supt.) for erecting a brick school building at Murray Hill, near Jacksonville. Mellen C. Greeley, Archt., Jacksonville.

Jackson, Ky.—Until April 18, by Alfred Russell, County Clerk, for erecting brick and stone jail, to cost $26,000.

Athens, Ohio.—Until April 21, by Board County Commissioners, for furnishing material and erecting Children's Home. Ritter & Bates, Archts, Portsmouth.

Columbus, Ohio.—Until April 15, by Bd. of Education, for erecting a two-story and basement school in Kinnikinick; fireproof, and cost $30,000. Matheny, Allen & Moments, Archts., 310 Huntington Bldg., Columbus.

Reported desired until April 16, by Ohio Board of Administration, for two and three-story brick and stone, 80 x 138 ft. dormitory building, for said Board. Richard McCarty & Bulford, Archts., Hartman Bldg.

Dover, Ohio.—Until April 25, by Board Education Dover Township Rural Dist. (G. F. Steeber, Clk.), for furnishing material and erecting a fireproof school. Bids desired as a whole or separately. Bids for labor and material must be stated separately. J. E. Lewis, 154 West High Street, New Philadelphia, Archt.

Evansville, Ind.—Until May 10 (extension of date from April 26) by Supervising Architect, Washington, D. C., for constructing U. S. Post Office at Evansville.

Huntington, Ind.—Until April 24, by County Superintendent of Schools, for erecting two-story and basement brick school. Separate bids for heating, ventilating, plumbing, etc.

Sharpsville, Ind.—Until April 18 by J. L. Romack, Trus. Liberty Township, for erecting a brick and stone school.

Lansing, Mich.—Until April 19, by A. M. Brown, Secy. State Board Agriculture, for furnishing material and erecting an engineering building, a wood-working building, machine shop, and a forge and foundry building for the Michigan Agricultural College, at East Lansing. Separate bids desired on each building. Edwyn A. Bowd, Archt., Lansing.

Anthon, Ia.—Reported desired until April 18, for erecting a school. Separate bids for plumbing, electric and wiring, etc. J. H. Craddock, Archt., Omaha, Neb.

Boxholm, Iowa.—Until April 24, by Board Education (Axel Westeen, Secy.), for erecting two-story high and grade school. Separate bids for plumbing, heating, electric wiring, etc. W. F. Germandt, Archt. Suite, 437-439 Keeline Bldg., Omaha, Neb.

West Liberty, Iowa.—Until April 17, by Theodore Jones, Secy Board Education, for erecting high school for which citizens recently voted $75,000 bonds. Proudfoot, Bird & Rawson, Archts., Des Moines.

St. Paul, Minn.—Reported desired until April 10 by Board Control for erecting another story on east ward of hospital; probable cost $30,000.

St. Paul, Minn.—Lowest bid, opened March 27, for erecting three Carnegie branch libraries, submitted by Cameron Company, Ryan Annex, at $66,050.

Emporia, Kan.—Reported desired until April 17, by Trustees of College of Emporia, for furnishing material and erecting an Administration building. J. H. Felt & Co., Archts., Kansas City, Mo.

Marquette, Kan.—Until about May 1, by Board of Education, for erecting a school for which the citizens, March 28, voted to issue $35,000 bonds. H. E. Bruce, Pres. Board Education.

Oakland, Neb.—Reported desired until April 12, by A. P. Wickstrom, Secy. Board Education, for erecting two-story school. Probable cost $50,000.

Osbabrook, N. D. — Reported desired until April 12, for erecting an eight-room concrete and hollow-tile school mechanical ventilation, and Kewaunee pneumatic tank water supply, etc. H. G. Lyken, Consulting Engr. Grand Forks.

Miles City, Mont.—Until April 15, by Miles City Hospital, at office of Miles City Chamber of Commerce, for erecting hospital and power house for Miles City.

Jefferson City, Mo.—See "Miscellaneous."

Houston, Tex.—Until April 10, by E. B. Bonney, City Secretary, for erecting gymnasium for North Side Junior High School, M. J. Sullivan, City Architect.

Liscomb, Tex.—Until April 10, by W. H. Seawell, County Judge, for furnishing material and erecting court house.

Henryetta, Okla.—Until April 19, by Board of Education (John F. Hefley, Secy.), for erecting school to cost $35,000. Hawk & Parr, Archts., Oklahoma.

Roseburg, Ore.—Until about May 1, by Roscoe M. Green, Clerk School District No. 4, Roseburg, for erecting a concrete, brick, steel and wood school, costing $70,000. F. Manson White, Archt., Portland.

Los Angeles, Cal.—Until April 13, by Board Education (Wm. A. Sheldon, Secy) for erecting one story and basement 6 room brick and concrete school on Marengo Heights. Probable cost $30,000.

Salt Lake City, Utah.—Until about May 20, by Board of Education (L. P. Judd, Clerk), for erecting two brick and concrete schools costing $50,000 each. C. S. McDonald, Archt., Salt Lake City.

Hamilton, Ont.—Until April 10, by Chester S. Walters, Mayor, for erecting nurses' home for Mt. Hamilton Hospital. Stewart & Witton, Archts., Hamilton Provident & Loan Chambers.

Toronto, Ont.—Reported desired until April 11, by Board Control, for erecting barn at the Jail Farm. Probable cost, $26,000.

PRICES AND LETTINGS.

★Indicates award of contract.

★Portsmouth, N. H.—Contracts for erecting three-story brick building for Army & Navy Association awarded as follows: General contract, Lord & Perkins; plumbing, John G. Sweetser; electrical work, Chadwick & Trefethen; total cost about $30,000. (Bidders all of Portsmouth.)

★Providence, R. I.—Contract for erect- the tuberculosis hospital awarded by Board of Control to Ernest Whitehead, Worcester, Mass., at $85.227; heating to John Stone, Fall River, Mass., at $11,723 and plumbing to E. J. Sullivan at $12,416.

★Torrington, Conn.—Contract for erecting school on Riverside Avenue awarded Louis Longhi & Brother of Torrington, at $37,910.

★Middletown, Conn.—Contract for remodeling the Memorial Chapel at Wesleyan University awarded Mylchreest Brothers, Middletown; cost, about $30,000.

★East Aurora, N. Y.—Contracts for erecting high school awarded as follows: General contract, George Schaff, Buffalo; heating and ventilating, Lewis & Capron, Chicago, Ill., and plumbing, George H. Van Keuren, East Aurora; total cost about $125,000.

★Philadelphia, Pa.—Contract awarded Fred A. Haven Co., 845 North Nineteenth Street, for erecting one-story, 89 x 38 ft., concrete stone and terra cotta, Public Library at Hunting Park and Wayne Avenues; cost $45,000.

★South Bethlehem, Pa.—Contract for erecting U. S. Post Office awarded Thomas W. Cissell, Wooster, Ohio, at $71,500.

★Wheeling, W. Va.—Contract for erecting two-story brick and concrete school awarded J. R. Butts & Son Company, Wheeling, at $90,000 for complete structure. F. Stanton, Clerk Board of Education.

★Durham, N. C.—Contract for erecting two school buildings awarded J. A. Jones Construction Company of Charlotte at $69,555.

Savannah, Ga.—E. Morgan, Savannah, submitted lowest bid for erecting buildings at U. S. Quarantine Station, Savannah, at $28,373.

★Cincinnati, Ohio.—Contract awarded March 31 by General City Hospital Commission for erecting medical school to Westlake Construction Company, Mercantile Building, St. Louis, Mo., at $250,000. Hannaford & Sons, Archts., Hulbert Block.

★Huntington, Ind.—Contract awarded William Everly, Indianapolis, for erecting high school at $153,930. Next three bidders: John A. Schumacher, Indianapolis, $157,600; Watson Stichban, Haskins, Ohio, $159,738, and Beusching, Tagerman & Co., Fort Wayne, $160,044.

Taylorville, Ill.—Following are four lowest bids opened March 24 by Supervising Architect, Washington, D. C., for constructing U. S. Post Office at Taylorville, (a) limestone, (b) sandstone: Balkin Construction Company, Monadnock Bldg., Chicago, Ill., (a) $46,370; W. G. Carter Company, Chamber of Commerce Bldg., Chicago, (a) $46,599 and (b) $47,983; Original Cabinet Company, Evanston, (b) $47,000; G. W. Stiles Construction Company, Rookery Bldg., Chicago, (b) $49,000; Anderson-Strandberg Company, Association Building, Chicago, (a) $46,466; B. S. Wahlman, Ishpeming, Mich., (b) $48,300; W. D. Lovell, Minneapolis, Minn., (a) $46,157.

★Antigo, Wis.—Contract for erecting U. S. Post Office awarded W. D. Lovell, Minneapolis, Minn., at $69,776.

★Alta, Iowa.—Contract for erecting school awarded Thomas Parks, Storm Lake, at $70,500; plumbing, L. S. Dlugosch, Storm Lake, $14,000.

★Charles City, Iowa.—Contract for constructing U. S. Post Office awarded A. W. Lane, 19 South La Salle Street, Chicago, at $46,362.

★New Hampton, Iowa. — Contract awarded Stark & Co. of Cedar Rapids for erecting four-story, 104 x 42 ft., brick hospital here for Servant Sisters of the Holy Ghost; cost about $60,000.

★Sloan, Iowa.—Dubel & Anderson, Sioux City, have general contract for erecting consolidated school, and Orr & Graves, Sioux City, for heating and plumbing; probable total cost about $65,000.

★North Platte, Neb.—Contract for erecting school (bids opened March 20) awarded by Board of Education (A. F. Streitz, Secy), to McMichall Bros., North Platte, at $60,325. Other bidder, F. C. McMichael, North Platte, $65,687.

★St. Charles, Mo.—Contract for erecting Niccolls Hall at Lindenwood College awarded Westlake Construction Co., Mercantile Building, St. Louis, at $65,000.

★Brea, Cal.—Contract for erecting two-story hollow tile school for Randolph School Dist. (bids opened March 24) awarded George A. Daniels, 910 Herkimer Street, Pasadena, at $42,489. Other bidders. B. D. Kronnick, 3901 Hill street, Los Angeles, $43,489; A. E. Bird, Santa Ana, $48,084; J. E. Preble, Santa Ana, $55,000. Elmore R. Jeffery and Frank R. Schaefer, Archts., 1201 Van Nuys Bldg., Los Angeles.

Walla Walla, Wash.—Following are bids opened March 24 by School Board for erecting (a) Ninth Street Grade School and (b) addition to High School: A. J. McLean, Walla Walla, (a) $46,740; (b) $101,566; A. C. Sweatt & Company, Spokane, (a) $63,000; (b) $105,194; J. J. Lawrence, Spokane, (a) $46,964.

★Contract for erecting above schools awarded J. A. McLean, of Walla Walla

★Los Angeles, Cal.—Contract for erecting four-story brick and concrete high school awarded as follows: General contract, Barber-Bradley Construction Company, 1824 East Fifteenth Street, at $395,652; heating and ventilating, Western Heating Company, Union League Bldg., $28,628; plumbing, Arthur Hess, Baker-Detweiler Bldg., $22,548; wiring, Southern California Electric Company, 625 South Main Street, $13,158; boilers, Western Heating Company, $5,785. John C. Austin, Archt., 1120 Baker-Detweiler Bldg.

★Tucson, Ariz.—Contract for erecting city hall awarded Weymouth Crowell, 2026 West Ninth Street, Los Angeles, at $47,520.

PRIVATE BUILDINGS

PROPOSED WORK.

Exeter, N. H.—Trustees of Phillips Exeter Academy purchased site on Court and Gilman Streets for proposed gymnasium to cost $100,000.

Boston, Mass.—Erection of a $125,000 club building for Bunker Hill Boys' Club, Charlestown, contemplated. Frank S. Mason, secretary.

Wakefield, Mass.—Masons contemplating erecting 2-story granite clubhouse for Golden Rule Lodge; cost about $30,000.

Providence, R. I.—Rhode Island Hospital Company is having plans prepared by York & Sawyer, 50 East Forty-first Street, New York, for a large fireproof addition to present building.

Hartford, Conn.—Reported competitive plans will be received until April 25 for Y. W. C. A. building. Francis R. Cooley, Chairman Building Committee.

Albany, N. Y.—Contract soon to be let by Fuller & Hobinson, 95 State Street, Archts., for erecting 4-story and basement warehouse, 136 x 233 ft., at Church, Dallius, Westerlo and Lansing Streets, concrete construction, for Globe Warehouse Co. (Thomas Ward, Pres.).

Albany, N. Y.—Building Committee of Ojibway Tribe No. 307, Improved Order of Red Men, recommends erecting 3-story store and lodge building on Quail and Sherman Streets, costing about $40,000.

Brooklyn, N. Y.—Contract soon to be let for erecting five-story and basement, fireproof addition at 144 Remsen Street, for Hamilton Club; cost about $60,000. William A. Boring, Archt., 32 Broadway, New York.

Plans being prepared for Young Men's Hebrew Association Building to be erected in Borough Park; estimated cost, $30,000. Asher Dann, 4920 Fourteenth Avenue, Borough Park, Chairman Building Committee.

E. M. Adelsohn, 1776 Pitkin Ave., is architect for 4-story brick store and loft building to be erected at 250 South Third Street for Lowell Construction Company.

Frank J. Helmle, 190 Montague Street, retained to prepare plans for proposed $150,000 golf clubhouse to be erected at Sheepshead Bay. Joseph T. McMahon, 188 Montague Street, reported interested.

J. J. Diemer and E. C. W. Dietrich, 118 East Twenty-eighth Street, New York, are associate architects for brick and stone edifice to be erected on Harman Street and St. Nicholas Avenue, for St. Andrews Lutheran Church; cost $35,000. Rev. Orlando S. Yerger, Pastor.

Buffalo, N. Y.—Lafayette Hotel Co., Washington and Clinton Streets, filed plans for 3-story banqueting hall addition to be erected on Ellicott Street; cost, $35,000.

Jamestown, N. Y.—Reported competitive plans being received by the Manufacturing Association, Jamestown (Cyrus Jones, Chairman, Building Committee), for 8-story brick furniture exposition building to be erected at Second and Washington Streets; cost, approximately $200,000.

New York, N. Y.—Plans being prepared by Holabird & Roche, 104 South Michigan Ave., Chicago, Ill., for 16-story building to be erected at 21 West Thirty-eighth St., for Lane Bryant.

Plans filed for erecting following buildings: 6-story brick apartment building at 341 West Forty-fifth Street for Forty-eighth Street Co., cost $140,000, Gronenberg & Leuchtag, Archts., 303 Fifth Avenue; two 6-story brick apartment houses on Washington Avenue and 173rd Street for V. R. Building Corp, total cost $150,000, Charles B. Meyers, Archt., 1 Union Square; four 5-story brick tenements on 190th Street and Wadsworth Avenue for Zagon Realty Co., Inc., total cost $160,000, Irving Margon, Archt., 370 East 149th Street; 2-story fireproof garage on Broadway and 152nd Street for Crompton Building Corp., cost $60,000, Homer A. Reid, Archt., 347 Fifth Avenue; 12-story fireproof store and loft building at 10 East Thirty-eighth Street for Charles Scribner, cost $150,000, Ernest Flagg, Archt., 109 Broad Street.

Erection of a theater on 161st Street and Melrose Avenue, reported contemplated by No. 837 Washington Avenue Realty Company; probable cost $125,000.

Plans being prepared for an eight or nine-story clubhouse which the Princeton Club, 121 East Twenty-first Street, intends erecting at Park Avenue and Fifty-eighth Street.

Maximilian Zipkes, 405 Lexington Avenue, engaged to prepare plans for two five-story apartment buildings which Number One Realty Company, 353 Fifth Avenue, intends erecting on Broadway and 184th St.

Plans prepared by Cross & Cross, 10 East Forty-seventh Street, for 15-story granite, brick and terra cotta office building to be erected at 60 Liberty Street, for William Henry Barnum and William Everdell, Jr.

Elizabeth, N. J.—Y. M. C. Association (E. B. Moore, President) contemplates erecting 4-story brick, 135 x 145-ft. building at 322 North Broad Streeet; cost, about $160,000.

Jersey City, N. J.—Jacob Welitoff, 13 Wegman Court, Jersey City, will erect a 6-story brick 100 x 70-ft. apartment house at Communipaw Avenue and Woodruff Street.

West New York, N. J.—Frank Weisberg and William Cadel, Eleventh Street, reported will erect four apartment houses on Park Avenue and Tenth Street, to cost a total of $145,000.

Duquesne, Pa.—Permit has been granted for enlarging freight station of Pennsylvania Railroad (Alex. C. Shand, Ch. Engr., Philadelphia) by erecting a three-story addition, costing $175,000.

Philadelphia, Pa.—Plans being prepared by A. J. Sauer & Co., 1112 Chestnut Street, for 4-story addition to George H. Sherwood & Son's loft building.

Pittsburgh, Pa.—Oakland Presbyterian Church has decided to erect new edifice at cost of about $30,000. Rev. William E. Howard, Pastor.

Plans being prepared by Harry S. Bair, Vandergrift Building, for a theater, lodge and billard hall, to be erected at Liberty Avenue and Mathilda Street. Cost, $40,000.

Reported plans completed for an annex to the station of the Pennsylvania R. R. (Alex. C. Shand, Ch. Eng., Philadelphia.)

South Bethlehem, Pa.—Plans being prepared by A. W. Leh, South Bethlehem, for a $30,000 church to be erected for First Evangelical Congregation.

Baltimore, Md.—Reported American Radiator Company, 1004 Munsey Building, will erect a warehouse on Carey and Wicomeco Streets.

Clyde N. Fritz, Munsey Bldg., is architect for 3-story apartment house to be erected near Druid Hill Park. Cost, $25,000.

Washington, D. C.—Horace W. Peasloe, 807 Seventeenth Street, N. W., is architect for photoplay house to be erected at Fourteenth and Irving Streets N. W., for Federal Amusement Co., Inc.; cost about $100,000.

Richmond, Va.—Revised plans completed for union passenger station to be erected in the West End, Chesapeake & Ohio Railway. F. I. Cabell, Ch. Engr., Richmond, reported interested.

Birmingham, Ala.—Steps being taken to erect new edifice for Ruhama Baptist Church to cost about $40,000. Rev. H. H. Hibbs, Pastor.

Shreveport, La.—Maple Camp, W. O. W., intends erecting two or three-story lodge building on Texas Avenue and Hope Street.; cost approximately $30,000.

Akron, Ohio.—Franz Warner, Hippodrome Building, Cleveland, engaged to prepare plans for $200,000 terminal building to be erected here for Northern Ohio Traction & Light Co. (E. D. Eckroad, Engr. Maintenance of Way, Akron).

Brewster, Ohio.—Reported plans being prepared for a $50,000 Y. M. C. A. building to be erected here for Wheeling & Lake Erie R.R. (W. L. Rohbock, Ch. Engr., Cleveland).

Cleveland, Ohio.—Plans prepared by Frank King, Permanent Building, for an 11-story, 20 x 120-ft., 100-room hotel for Lewis Maxa, to be erected on the Public Square, adjoining the Terminal Hotel. Estimated cost, $125,000.

Plans filed for two-story brick, steel, and concrete substation to be erected at 2497 East Fifty-fifth Street, for Illuminating Company; Cuyshoga Building; cost $35,000.

Howard P. Ellis, 1110 Euclid Avenue, and Frank M. Drew, 717 Euclid Avenue, are planning a theater 132 x 142 ft, on Vincent Avenue, near East Ninth Street, to cost $385,000. George B. Post, 101 Park Avenue, New York, N. Y., Archt.

Henry Bradlek, 1001 Illuminating Bldg., is architect for $25,000 motion-picture theater, to be built at 2236 West Fourteenth Street, by Thomas Urbansky.

Columbus, Ohio.—Plans being prepared by Richards, McCarty & Bulford, Hartman Building, for 2-story, brick, concrete, fireproof store and office building to be erected for Mutual Life Insurance Co.; cost, about $60,000.

Toledo, Ohio.—Trustees of St. Stephen's Evangelical Lutheran Church planning to erect new edifice on Broadway.

Bloomington, Ind.—Plans completed for $40,000 stone mausoleum which the Bloomington Mausoleum Company will erect in Rose Hill Cemetery.

Fort Wayne, Ind.—Council No. 451, Knights of Columbus, planning to erect lodge building, cost $60,000.

Detroit, Mich.—C. Howard Crane, 2323 Dime Bank Building, is architect for 3-story brick and terra cotta store and theater building to be erected on Woodward Avenue and Silbey Street for Detroit-Colonial Theater Co.

Masons intend erecting new Temple on Bagg Street and Second Avenue.

Iona, Mich.—Plans of Joseph E. Mills & Son, Kresge Building, Detroit, accepted for $30,000 Odd Fellows Lodge building to be erected on West Main St.

Chicago, Ill.—Plans prepared for Mary Daws Hotel for Women which Charles G. Daws, 125 West Monroe Street, intends erecting as a memorial to his mother; probable cost, $125,000.

Danville, Ill.—St. John's Evangelical Church and parsonage to be erected at a cost of $100,000. Address Pastor.

Peru, Ill.—St. Mary's Roman Catholic Church intends erecting new edifice to cost about $30,000. Rev. P. O'C. Culleton, Pastor.

Milwaukee, Wis.—Schmidt, Garden & Martin, 104 S. Michigan Avenue, Chicago, Ill., are architects for proposed four-story and basement, brick, concrete and steel hospital to be erected for Columbia Hospital Association on Frederick Avenue; cost about $300,000.

Albert Lea, Minn.—A. T. Hatterberg and James Otterson propose erecting on West William Streeet a modern fireproof building.

Bemidji, Minn.—Reported contract soon to be let by Morris Kaplan, Bemidji, for erecting 2-story store and office building, to cost $30,000.

Minneapolis, Minn.—Thorpe Bros., Andrus Building, will erect for the Goodrich Tire Company a 3-story brick 66 x 150-ft. building at Thirteenth Street and Harmon Place, to cost $60,000.

St. Paul, Minn.—Sperry Realty Company, 207 Pittsburgh Building, intends erecting $200,000 commercial building on Jackson and Grove Streets.

William B. Hatton, 681 St. Peter Street, is contemplating erecting a family hotel at 35 East Tenth Street, costing $400,000.

Omaha, Neb.—Reported Omaha Athletic Club plans erecting an eight or ten-story building, to cost approximately $400,000.

Kimball, S. D.—Milwaukee system will erect a new passenger station and freight depot here.

Nevada, Mo.—Knights of Pythias intend erecting convention hall to cost $35,000.

Helena, Ark.—S. J. Weigel, Central Bank Building, Little Rock, is preparing plans for a $25,000 apartment house which B. C. Founcey will erect.

Beaumont, Texas.—Plans completed for Y. M. C. A. building to be erected on Calder and Pearl Streets; cost $25,000.

Contract about to be let for erecting three-story business building for Phelan-Josey Grocery Company; cost $45,000. Cooke & Company, Archts., Beaumont.

Galveston, Tex.—Plans being prepared by Stowe & Stowe, 222 Twenty-second Street, for five-story reinforced concrete addition to store of Peter Gengler Co., on Postoffice Street.

Houston, Tex.—Plans completed by F. W. Steinman & Son, Beaumont, for a brick warehouse which B. Deutser Furniture Company, Beaumont, will erect in Houston; cost $25,000.

Seguin, Texas.—Contract soon to be let for erecting four-story, reinforced concrete hotel for Seguin Hotel Company, to cost approximately $30,000. L. M. J. Dielmann, Archt., 306 East Commerce Street, San Antonio.

Sterling, Col.—Robert Willison, 709 E. and C. Building, Denver, is architect for four-story, fireproof, brick and stone hotel contemplated here; probable cost $100,000. Guy Harrison, 306 Interstate Trust Building, reported interested.

Tacoma, Wash.—Reported Alexander Pantages, Pantages Building, Seattle, has decided on site at Ninth and Market Streets on which to erect a $125,000 theater and $80,000 office building. B. Marcus Priteca, Empire Building, Seattle, and Lundberg & Mahon, Provident Building, Tacoma, Assoc. Archts.

Astoria, Ore.—Andrew Young, Astoria, is having plans prepared for four-story, reinforced concrete business block; cost $50,000.

Palo Alto, Cal.—Ernest Wilson Confectionery Co., Palo Alto, engaged Arthur S. Heineman, 831 San Fernando Bldg., Los Angeles to prepare plans for a 3-story brick store, office and warehouse 100 x 30 ft.

San Francisco, Cal.—Zellerbach Paper Company, 534 Battery Street, purchased site at Montgomery and Francisco Streets and will erect a 5 or 6-story concrete warehouse; cost about $200,000.

Preliminary plans prepared by Charles P. Weeks, Mutual Bank Building, for 12-story and basement Class A office building to be erected at California and Montgomery Streets.

Plans being prepared by Theodore W. Lenzen, Humboldt Bank Building, for five-story and basement brick and steel hotel, to be erected on Mason and Post Streets, for C. J. Keenan; estimated cost $40,000.

Salt Lake City, Utah.—Plans being prepared by W. C. A. Vissing, 405 Continental Bank Bldg., for 4-story apartment house to be erected on Eighteenth Ward Square for Covey Investment Co.; cost approximately $200,000.

Vancouver, B. C.—H. H. McLeod, Gen. Mgr. Canadian Northern Ry. Co., reports plans for a depot on Flase Creek, Vancouver, completed, and if approved by city council, contract for construction will be let about the middle of May. Proposed structure will be 3 stories, 321 ft. long, average height between 50 and 60 ft., with center elevation of 96 ft., with a facade of 100 ft.; cost $1,000,000.

BIDS DESIRED.

Hartford, Conn.—Until April 25, by Y. W. C. A., for erecting a building; probable cost $300,000. Address Secretary.

Johnstown, Pa.—Until April 11 by Building Committee (Chas. H. McKeown, Chmn. Bldg. Com.) Johnstown Lodge, No. 48, L. O. O. M., for furnishing material and erecting building known as Moose Home. Geo. Aild, Archt., 402 Lincoln Bldg., Johnstown.

Philadelphia, Pa.—Reported desired until April 10, by Bunting & Shrigley, Archts., 603 Chestnut Street, for erecting four-story brick, stone and steel 37 x 95 ft. building for Logan Trust Co.

Reported desired until April 14 for erecting four and five story addition 47 x 80 ft. to office building of Schulte & Koerting Co., Twelfth and Thompson Streets. Chas. L. Blatchley, Engr., Drexel Bldg.

Suffolk, Va.—Reported desired until April 12, by John Kevan Peebles, Archt., Kevan Law Bldg., Norfolk, for erecting six-story and basement brick, stone, marble and concrete 35 x 88 ft. building for American Bank, Inc.

Lansing, Mich.—Until Apr. 17 by E. A. Bowd, Archt., Lansing, for erecting a warehouse and office building for the National Grocers Company.

Taylorville, Ill.—Until April 20 by H. M. Hallock, Gen. Supt. Chicago and Illinois Midland Ry., Taylorville, for erecting a brick segmental eight-stall engine house, machine shop and freight house building at Taylorville.

Hastings, Minn.—Until Apr. 19 by Jacob Hiniker, Chmn. Bldg. Com. St. Boniface's Parish, for erecting brick school for said parish. Olin H. Round, Archt., 201-202 Oppenheim Building, St. Paul.

New Richland, Minn.—Until Apr. 15 by Oscar W. Hanson, First State Bank, for erecting creamery building at Leomond, near New Richland.

Pratt, Kan.—Reported desired until April 10, by F. G. McCune, Archt., Winne Building, Wichita, for erecting two-story building for Jett Mercantile Co. Probable cost $40,000.

Wichita, Kan.—Reported desired until April 17, by L. F. Duggan, Dist. Commercial Supt. of Missouri & Kansas Telephone Co., for erecting reinforced concrete four-story and basement, 60 x 140 ft. building, at Fifth Street and Lawrence Avenue for said company.

San Bernardino, Cal.—Reported desired until May 1, by George Nockerson, Arrowhead Hotel, for addition to hotel. Probable cost $100,000.

Port Colborne, Ont.—Until April 15, by E. P. Johnson, Secy. St. James' Church, for erecting stone edifice at Port Colborne.

Timmins, Ont.—Reported desired until April 15, by Charles Pierce, for erecting theater. Probable cost $25,000.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Holyoke, Mass.**—Contract for erecting 2-story and basement building on Race Street for Holyoke Valve & Hydrant Company awarded Casper Ranger Construction Company, Springfield; cost $120,000.

★**New York, N. Y.**—Contract for erecting 3-story reinforced concrete storage-battery service building, 180 x 100 ft., at 627 West Twenty-third Street awarded Turner Construction Company, 11 Broadway. Louis E. Jallade, Archt., 37 Liberty St.

★Contract for 300 tons of steel for Christ Church, 332 West Thirty-sixth Street, awarded Eidlitz & Rose, 110 West Fortieth Street.

★Contract for 250 tons of steel for Henri Bendel store and loft building at 14 West Fifty-seventh Street awsrded Harris, Silvers & Baker, 151 West Forty-second Street.

★Contract awarded Levering & Garrigues, 552 West Twenty-third Street, for 1400 tons of steel for P. W. Rouss loft building on Greene Street.

Reported Jacobs & Youngs of Yonkers have secured a $78,000 contract on the nave of the Cathedral of St. John the Divine, Amsterdam Avenue and 113th Street. Cram & Ferguson, Archts., 33 W. Forty-second Street.

William Steele & Sons Company, 1600 Arch Street, Philadelphia, Pa., reported contractors for seven-story reinforced concrete garage and storage building to be erected on Broadway and Lafayette Street for John Wanamaker.

★**Southampton, L. I., N. Y.**—Contract awarded National Bridge Co., Review Avenue, Hunterspoint, for 600 tons of steel for hospital to be erected by Southampton Hospital Assoc.

★**Hackensack, N. J.**—W. H. Whyte Construction Co., 382 Railroad Ave., has secured general contract for erecting three-story brick nurses' home for Hackensack Hospital Association; cost $45,000. Crow, Lewis & Wickenhoefer, Archts., 200 Fifth Ave., New York.

★**West Hoboken, N. J.**—Contract awarded Hyman Golden, West New York, for erecting a 4-story brick store and apartment house on Harrison Place, at $48,000.

★**Altoona, Pa.**—Contract awarded P. S. Boyer, Altoona, for erecting three-story brick and reinforced concrete annex to P. O. S. of A. building on Eighth Avenue; cost $25,000.

★**Harrisburg, Pa.**—Contract for excavation and foundation for the freight station for Pennsylvania RR. awarded John L. L. Kuhn of Harrisburg. Estimated cost, $75,000.

★Contract for erecting Messiah Lutheran Church awarded Harry C. Wright of Steelton; cost $70,000.

★**Lancaster, Pa.**—Contract awarded J. P. Brenamen, Lancaster, for erecting two-story and basement, brick and concrete, 70 x 280 ft warehouse for Bayuk Brothers; cost $80,000.

★**Philadelphia, Pa.**—Contract awarded Stacy Reeves & Son, 2011 Market Street, for erecting five-story, brick, slow-burning construction, 67 x 47-ft. warehouse at Thirty-ninth Street and Powelton Avenue, for Powelton Storage Co.

Contract awarded to W. R. Dougherty, 1610 Sansom Street, for erecting 2-story, 74 x 149-ft., brick, stone and concrete parochial schol on Lancaster Avenue for St. Gregory's Roman Catholic Church; cost, $60,000.

★Turner Concrete Steel Company, 1713 Sansom Street, reported to have submitted lowest bid for erecting freight depot on Federal Street for Pennsylvania Railroad at $504,267.

★**Pittsburgh, Pa.**—Contract awarded by Rochester & Pittsburgh Coal Co. to Hyde Murphy Co., of Ridgway, for erecting 129 houses at their mining towns.

★**South Bethlehem, Pa.**—Contract for erecting seven-story fireproof addition to office building of Bethlehem Steel Company awarded Thompson-Starrett Co., 49 Wall Street, New York.

★**Baltimore, Md.**—Contract awarded B. F. Nennett Building Co., 1233 South Howward Street, for erecting garage at 1307 Cathedral Street, to cost $30,000. Oliver N. Wright, 1122 Munsey Building, Archt.

★**Washington, D. C.**—Contract awarded William P. Lipscomb & Co., 1405 F St., N. W., for erecting three-story and basement, fireproof brick bank building at 13½ and B Streets, S. W., for Citizens' Saving Bank. Milburn, Heister & Co., Archts., Union Saving Bank Building.

★**Fairmont, W. Va.**—Contract awarded John Kisner & Son, Fairmont, for erecting edifice for First Presbyterian Church; cost about $60,000.

★**Canton, Ohio.**—Contract for erecting five-story concrete addition for Canton Storage & Transfer Company, 538 Fourth Street, N. E., awarded E. E. Elford, Hayden Clinton Bank Building, Columbus.

★**Cleveland, Ohio.**—Contract awarded Crowell-Lundoff-Little Co., 1951 East Fifty-seventh Street, for a 700-room hotel, 12-story, fireproof, to cost $3,000,000, to be erected by Terminals Hotel Co. on Public Square, Superior Avenue and West Third Street. George B. Post & Sons, 30 Church Street, New York, Archts.

Reported Crowell-Lundoff-Little Co., 1951 E. Fifty-seventh Street, are engineers and contractors for 10 or 12-story warehouse, 90 x 116 ft., to be built at W. Ninth Street and St. Clair Avenue by William Edwards Co. (J. W. Roof, Pres.); cost about $350,000.

★**Coshocton, Ohio.**—Contract for erecting United Brethren Church at Park Avenue and Orchard Street awarded John Shaw, Coshocton; cost about $22,000.

★**Kankakee, Ill.**—Contract for erecting club house for Order of Elks (bids opened March 25) awarded Honde Construction Company, Bourbonnais, Ill. E. B. Sawyer, Chairman Building Committee Eagle Lodge No. 627.

★**Ottawa, Ill.**—Contract for erecting St. Francis Roman Catholic Church awarded Sinnott Brothers, Ottawa, at $24,452.

★**St. Paul, Minn.**—Permission issued for the raising of the general office building of the Omaha Ry. at Fourth and Rosahel Streets. General contract for the 8-story $400,000 building to be erected on this site awarded George A. Fuller Construction Co., 140 South Dearborn Street, Chicago, Ill. Lambert Bassindale, St. Paul, and Charles S. Frost, Chicago, Ill., Assoc. Archts.

Contract for erecting St. Paul Academy on Randolph Street and Snelling Avenue awarded Charles Skooglum, 502 Ryan Annex; cost, with equipment, approximately $53,000.

★**Hastings, Neb.**—Contract awarded John Hemphill, Hastings, for erecting fireproof theater and office building for Will Brach; cost, about $40,000.

★**Mott, N. D.**—Contract for erecting $25,000 garage and supply house for J. B. Little awarded Mott Construction Co., of Mott.

★**Los Angeles, Cal.**—Contract awarded Davidson Constr. Co., 16th and Tennessee Streets for erecting 5 story reinforced concrete warehouse, 77 x 140 ft., for H. R. Boynton Co.; cost about $70,000. W. J. Dodd, Archt., Brockman Bldg.

★**Oakland, Cal.**—Contract awarded California Steel Company, Oakland, for 675 tons of steel for the Gorgens Building.

★**San Francisco, Cal.**—Contract awarded Pacific Rolling Mills, Sharon Building, for 300 tons of atructural shapes for substation of the Great Western Power Company.

★**Pocatello, Idaho.**—Contract awarded Alex Mathers, Pocatello, for erecting warehouse for Neil F. Boyle Co., at about $35,365.

★**Brantford, Ont.**—Contract for erecting new station for Lake Erie & Northern Railway awarded Schultze Brothers, Brantford; cost, about $25,000.

★**Winnipeg, Man.**—Contract awarded Carter-Halls Aldinger Co. of Winnipeg for erecting the first unit of the T. Eaton Co.'s building; estimated cost, $600,000.

NEW INDUSTRIAL PLANTS

PROPOSED WORK.

Boston, Mass.—United Fruit Co., 900 Board of Trade Building, intends erecting sugar refinery in Charleston, to have a capacity of 1,000,000 bbl. yearly.

New Bedford, Mass.—Plans being prepared by Charles W. Praray, 303 Times Building, for 4-story, 75 x 100 ft., brick addition for Morse Twist Drill Company on Sixth Street.

Providence, R. I.—General Electric Company, Schenectady, N. Y., reported having plans prepared for a factory to be erected here.

Hoosick Falls, N. Y.—Plans prepared for four-story brick, 55 x 50-ft. addition to plant of Superior Manufacturing Co., Hoosick and Railroad Avenues; cost, $30,000.

New York, N. Y.—Plans filed for six and seven story fireproof factory to be erected at 418 West Sixteenth Street for National Biscuit Company; cost $60,000. J. R. Torrance, Archt., 409 West Fifteenth Street.

Poughkeepsie, N. Y.—The Schatz Mfg. Co. (H. A. Schatz, Treas.), Poughkeepsie, completed plans for building 60 x 200 ft. two-story and basement for manufacturing ball bearings; cost, with equipment, $250,000.

Rome, N. Y.—The Kent Vacuum Cleaning Co. (F. T. Kent, Pres.), Rome, having plans prepared for manufacturing plant.

Schenectady, N. Y.—Plans completed for additions to plant of General Electric Company, River Road.

Jersey City, N. J.—United Chemical Products Corporation, 472 York Street, incorporated to manufacture dyestuffs. Thomas Y. Blamon, 12 Waverly Place, Orange, Agent.

Trenton, N. J.—A. K. Bugbee Co., Trenton, will erect $200,000 plant for manufacture of automobiles.

Fullerton, Pa. — Plans being prepared for 3-story, cement and brick, 65 x 160 ft. silk mill to be erected for McBride Brothers (John McBride, Manager), Quarry Street.

Lancaster, Pa.—Follmer, Clogg & Co., Lancaster, is having plans prepared for an addition to the silk mill on Manor and Laurel Streets.

McKeesport, Pa.—National Tube Co., McKeesport, plans extending plant.

Oakdale, Pa.—Aetna Chemical Co. intends enlarging extensively plant at Aetna Chem, a new town near Oakdale.

Philadelphia, Pa.—Pennsylvania R. R. (Alex. C. Shand, Ch. Engr., Philadelphia) intends enlarging grain elevator at Girard Point, increasing capacity 1,000,000 bu.

Plans prepared for 4-story 82 x 37-ft. addition and 5-story addition 90 x 72 ft. to factory of Alexander Bros., at 410 North Fourth Street.

Pittsburgh, Pa.—Plains being prepared by W. G. Wilkins Co., Westinghouse Building, for 5-story, 60 x 100-ft., fireproof factory, to be erected on Chartiers Street, Northside, for National Casket Co.; estimated cost, $60,000.

Baltimore, Md. — Western Maryland Railway Company (H. R. Pratt, Ch. Engr., Baltimore.) it is reported, plans doubling capacity of new grain elevator recently completed at Port Covington.

Virginia.—Governor Stuart signed bill providing $25,000 for a State owned lime-producing plant to be located probably near Portsmouth.

Charleston, W. Va.—Reported Charleston Steel Company will erect a steel manufacturing plant at Cabin Creek Junction with an annual output of 20,000 tons.

Wheeling, W. Va.—Reported Portsmouth Steel Co. contemplating extensive improvements to plant here.

Orangeburg, S. C.—Erection of a packing house costing about $50,000 being considered. W. A. Livingston, Secretary Chamber of Commerce and Agriculture, may be able to give information.

Walterboro, S. C.—Reported J. A. Smith, of Bessemer City, N. C., and Walter Pringle, have purchased Walterboro Cotton Mills, and intend making improvements.

Augusta, Ga.—Reported newspaper plants of the Herald and Chronicle, recently destroyed by fire, will be rebuilt.

Tavares, Fla.—See "Water Works."

New Orleans, La.—Reported Jewel Tea Company, 1327 Washington Boulevard, Chicago, Ill., has purchased plant of Importers' Tea Co. on Tchoupitoulas Street and intends enlarging same.

Bristol, Tenn.—Reported Reynolds Corporation (R. S. Reynolds, president, Bristol), plans extensive improvements and enlargement of cleanser plant here.

Cleveland, Ohio.—Plans prepared by Matzinger & Lauffer, Lennox Bldg., for a $25,000 factory to be erected by the Climax Cleaner Mfg. Co., 2097 Columbus Road, on West 110th Street.

Zanesville, Ohio. — Griffith & Wedge Co., reported reorganized, and intends enlarging plant on South Fifth Street.

Wyandotte, Mich.—Reported Pennsylvania Salt Manufacturing Co. will rebuild plant recently destroyed by fire.

Waukesha, Wis.—Waukesha Pure Food Company reported incorporated with E. R. Estberg of Waukesha and others, and intends erecting factory on Elizabeth Street; probable cost $50,000.

West Bend, Wis.—Reported West Bend Woolen Mills intend enlarging plant.

Owatonna, Minn.—Plans being prepared for a plant for the Owatonna Packing Company, to cost $125,000.

Butte, Mont.—Du Pont Powder Co., it is reported, will soon erect plant here for manufacture of gelatine powders and dynamite; probable cost, $500,000.

Heafer, Ark.—E. M. Heafer of Bloomington, Ill., will erect a $50,000 tile factory here.

Beaumont, Tex.—Captain W. C. Tyrrel, Kyle Theater Building, has purchased site on Finis and Buford Streets and plans erecting paint factory; probable cost, $50,000.

Portland, Ore.—Reported Pacific Coast Steel Company, Portland, will establish a steel plant and rolling mill, costing $400,000.

San Francisco, Cal.—Reported Chalmers Motor Co. of Detroit, Mich., contemplates erecting branch assembly plant here.

Plans being prepared by Herman Barth, 12 Geary Street, for three-story packing house to be erected at Front and Pacific Street, of either brick and steel or reinforced concrete, for Frye & Co., of Seattle, Wash.

Ogden, Utah.—H. P. Henschein, Chicago, Ill., is architect for proposed improvements and enlargement of plant of Ogden Packing & Provision Co.; probable cost, $300,000.

Niagara Falls, Ont.—Michigan Central Ry. Co. (George H. Webb, Chief Engr., Detroit, Mich.), it is reported, will erect a round house and coal dock at Montrose Yards, plans for which are now being prepared. Cost $250,000.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Springfield, Mass.**—Fred T. Ley & Company, Inc., Springfield, reported contractors for one-story, 196 x 124 ft. cement, steel and wood dry kiln, to be erected at East Springfield plant of New England Westinghouse Company.
dition on Allen Street.

★**Buffalo, N. Y.**—Monarch Engineering Company, Chamber of Commerce Building, has contract for an additional tower and marine leg to new Connecting Terminal elevator. The contract also included another out-shore hopper and car spout.

★**Glenwood, N. Y.**—Contract for erecting two-story brick addition to plant of Habirshaw Electric Cable Company awarded Casper Ranger Construction Company, 101 Park Avenue, New York, at about $40,000.

★**Erie Pa.**—Contract awarded McClintic & Marshall Company, Morris Building, Philadelphia, for 400 tons of steel required for the factory building for the General Electric Company.

★**Manayunk, Pa.**—Contract awarded A. L. Fretz & Son, Chancellor Building, Philadelphia, for erecting four-story, 160 x 58-ft. brick and concrete, slow-burning construction, factory for Fred Pearson & Co., Inc. W. E. S. Dyer, Archt., Land Title Building, Philadelphia.

★**Philadelphia, Pa.**—Contract for removing old elevator "B" at Girard Point, having capacity of 350,000 bu., awarded by Pennsylvania R. R. to Fuhrer & Bros., 15 Brown Street.

★**Cincinnati, Ohio.**—Contract awarded by Lunjenheimer Co. to L. Schreiber & Sons Co., Norwood, for steel for new foundry, as well as for several other new additions to brass works at Beekman. Tremont and Knox Streets. Bert L. Baldwin & Co., 72 Perin Building, Archt.

★**Fort Wayne, Ind.**—Contract awarded Wells Brothers Company, 53 Jackson Boulevard, Chicago, Ill., for erecting five-story and basement, 427 x 75-ft. brick and reinforced concrete factory for General Electric Company on Wall Street.

★**Indianapolis, Ind.**—Contract awarded C. R. Pease Construction Co., Board of Trade Building, for erecting 3-story, 422 x 104 ft., reinforced concrete addition to plant of Link-Belt Company, Belmont Ave.; cost, about $160,000.

★**Oklahoma, Okla.**—Contract awarded by Williamson, Halsell & Frasier Co. to Holmboe Co., Oklahoma City, for erecting five-story and basement concrete and brick, fireproof factory on First Street; cost about $55,000.

MISCELLANEOUS

PROPOSED WORK.

Playground—Boston, Mass.—City Council passed on first reading an order authorizing city to issue $80,000 bonds for constructing a playground on Allston Street, Brighton.

Heating Plant—Providence, R. I.—City is having plans prepared for a central heating plant to cost $60,000. William C. Pelkey, Clk. Committee on City Property may be able to give information.

Parks—New Jersey.—Governor Fielder, Trenton, signed bill appropriating $100,000 for improvements to Interstate Palisades Park.

Monument—Passaic, N. J.—The House passed bill providing for appropriation of $10,000 for constructing a monument in Passaic.

Subway—Harrisburg, Pa.—City reported planning constructing a subway under tracks of Philadelphia & Reading Ry. at entrance to Cameron Parkway to cost $17,000. E. Z. Gross, Park Commissioner.

Stadiums—Cleveland, Ohio.—Harry L. Lewis, Mayor, announces work will be started this summer on concrete stadiums in Kingsbury and Brookside parks. F. H. Betz, City Architect, City Hall. At first about $25,000 will be spent in each park.

Subway—Toledo, Ohio.—Reported Dept. Public Service approved plans for Central Avenue subway under New York Central right-of-way. H. B. Reinsagen, Principal Asst. Engr. New York Central R.R. Co. lines west of Buffalo, Cleveland, Ohio.

Parks—Zanesville, Ohio.—Park bonds for $16,500 sold by city.

Parks — Altus, Okla.—About $10,000 bonds to be issued for park improvements.

BIDS DESIRED.

Fire Escapes — Boston, Mass.—Until April 11 by Schoolhouse Commissioners (Joseph P. Lomasney, Chmn.) for erecting and completing fire escapes on the Hyde School, Raymond Street, Roxbury.

Fences—New York, N. Y.—Until April 25 by Board Water Supply, Municipal Building, for contract 173, about 5 miles of wire fence, etc., advertised in Engineering Record.

Crane—New York, N. Y.—See "Waterworks."

Lamp Posts—New York, N. Y.—Until Apr. 15, by Wm. Williams, Comr. Water Supply, Gas & Electricity, for furnishing and delivering cast-iron lamp posts.

Removal of Rock—New York, N. Y.—Until April 13, by Park Board, Cabot Ward, Pres., for furnishing material and removal of earth and rock on the Jerome Avenue side of McCombs Dam Park, between Anderson and Woodcrest Avenues, in Borough of Bronx.

Road Oil—Irvington, N. J.—Until April 12, by Board Town Commissioners, for furnishing 30,000 gal., more or less, road oil for season 1916. Bids to state price per gallon in tank cars f.o.b. Lehigh Valley Railroad, Irvington. I. J. Casey, Town Engr.

Elevator—Parkersburg, W. Va.—Until April 20, by James A. Wetmore, Acting Supervising Archt., Treas. Dept., Washington, D. C., for remodeling the electric passenger elevator in U. S. Post Office, Parkersburg.

Air Compressor for Fog Signal—Detroit, Mich.—Until April 14 by Lighthouse Inspector, Detroit, for furnishing two oil engine driven air compressors for compressed air fog signal installation at Passage Island Light Station, Mich., advertised in Engineering Record.

Road Roller—Evansville, Ind.—Until April 20, for a steam or motor road roller and scarifier. C. P. Beard, Co. Aud.

Approaches, Steps, Etc.—Jefferson City, Mo.—Until May 4, by State Capitol Commission Board (J. Kelly Pool, Secy.), for constructing sections "A" and "B" of approaches, enclosures, steps and walls of basement of Missouri State Capitol Building, at Jefferson City. Probable cost, $150,000. Bids desired for sections "A" and "B" separately or for both sections "A" and "B" combined. Tracy & Swartout, Archts., 244 Fifth Avenue, New York, N. Y.

&Subway—Kansas City, Mo.—See "Paving and Roads."

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Tunnel—Jersey City, N. J.**—Contract awarded by Public Service Gas Co. to Arthur McMullen Co., 149 Broadway, New York, for constructing tunnel under Hackensack River at $62,500.

★**Cement—Pittsburgh, Pa.**—Contract for furnishing 7000 bbl. cement awarded Birmingham Supply Co. of Pittsburgh. They bid $1.81 in cloth sacks and $1.51 in paper bags in carload lots. Bids opened March 21 by County Controller.

★**Pier Sheds—Norfolk, Va.**—Contracts awarded by Norfolk & Western R. R. Co. for constructing pier sheds for two warehouses at Lambert's Point, as follows: Steel construction in connection with sheds to Virginia Bridge & Iron Co., Roanoke, Va.; general contracts for pier sheds to J. P. Pettyjohn & Co. of Lynchburg, Va., and for steel rolling doors for warehouses to Wilson Mfg. Co. of Norfolk, Va.; cost of warehouses about $2,000,000.

★**Cement—Chicago, Ill.**—Contract for furnishing 15,000 bbl. Portland cement (bids opened March 6) awarded Consumers Company, 220 S. State Street, at $1.66 per bbl. by car and $1.86 per bbl. by team. A. W. Miller, Superintendent of Streets.

★**Grading Sites—Houston, Tex.**—Contract for approximately 150,000 cu. yd. of grading for sites of two new sewage disposal plants awarded J. J. Bland & Son, Houston, at 24.5 cts. and 27.5 cts. per cu. yd.

★**Oil Tank Steamship—Oakland, Cal.**—Contract for constructing a tank steamship 425 ft. long, 57 ft. beam, 34 ft. deep, for Huasteca Petroleum Co., 120 Broadway, New York, N. Y., awarded to Moore & Scott Iron Wks., Oakland; cost $1,250,000.

★**Turbine—Utah.**—Contract awarded William Cramp & Sons Ship & Engine Building Company (I. P. Morris Company, representative), Philadelphia, Pa., for furnishing the Phoenix Construction Company (Electric Bond & Share Company) one 10,500-hp. turbine of the vertical shaft, single runner type to operate under a head of 90 ft. at a speed of 171.5 r.p.m. Turbine to be installed in Cove Development of the Utah Power & Light Company.

Proposals

For Proposals Advertised, See Pages 40a, 40b and 40c.

WATERWORKS.

Bids Close.		See Eng. Record.
Apr. 10.	Filtration Plant, Florence, Ala. Adv. Mar. 18.	Mar. 18
Apr. 10.	Reservoir, Olympia, Wash.	Apr. 8
Apr. 11.	Water works, Rector, Ark. Adv. Mar. 18, 25.	Mar. 18
Apr. 11.	Filter Beds, Etc., Ilion, N. Y. Adv. Mar. 25, April 1.	Mar. 25
Apr. 11.	Contract 164, New York, N. Y. Adv. Mar. 25.	Mar. 25
Apr. 11.	Pump. Mach., Etc., Collingwood, Ont.	Apr. 1
Apr. 11.	Steel Tower, Etc., Hayward, Wis.	Apr. 1
Apr. 11.	Contract 171, New York, N. Y.	Apr. 1
Apr. 11.	Gate Valves, Etc., Toronto, Ont.	Apr. 1
Apr. 11.	Sump Pump, Chicago, Ill.	Apr. 8
Apr. 11.	Meter Boxes, Etc., Boston, Mass.	Apr. 8
Apr. 12.	Water Works, Three Forks, Mont. Adv. Apr. 1.	Apr. 1
Apr. 12.	Water Works, Billings, Mont.	Apr. 8
Apr. 12.	Water Works, Broadview, Mont.	Apr. 8
Apr. 13.	Laying Mains, Atlantic City, N. J. Adv. Apr. 1.	Apr. 1
Apr. 13.	Pipe and Fittings, Seattle, Wash.	Apr. 8
Apr. 14.	Water Works, Blackstone, Va.	Apr. 1
Apr. 15.	Water Works, Silver Lake, Minn.	Apr. 1
Apr. 15.	Water Works, Silver Lake, Minn.	Apr. 8
Apr. 15.	Meters, Pittsburgh, Pa.	Apr. 8
Apr. 17.	Extensions, Norfolk, Neb. Adv. Mar. 25, April 1.	Mar. 25
Apr. 17.	Improvements, Cobleskill N. Y.	Apr. 8
Apr. 17.	Water Works, Wellston, Okla.	Apr. 8
Apr. 17.	Pipe, Cincinnati, Ohio	Apr. 8
Apr. 17.	Pipe, South Orange, N. J.	Apr. 8
Apr. 18.	Water Works, Lockhart, Tex. Adv. Apr. 1, 8.	Apr. 1
Apr. 18.	Water Works, Lake Norden, S. D.	Apr. 8
Apr. 18.	Mains, McCombs, Miss.	Apr. 8
Apr. 18.	Pipe, Panama	Apr. 8
Apr. 19.	C.-I. Pipe and Dam, Butler, N. J. Adv. Apr. 8.	Apr. 8
Apr. 20.	Water Works, Harlowton, Mont. Adv. Apr. 1, 8.	Apr. 1
Apr. 20.	Pump, Etc., Lynn, Mass.	Apr. 8
Apr. 20.	Water Softening Apparatus, Jacksonville, Fla.	Apr. 8
Apr. 24.	Pump House, Madison, Wis.	Apr. 1
May 1.	Pump, Middletown, Ohio.	Apr. 8
May 15.	Water Works, Yoncalla, Ore.	Apr. 8

SEWERAGE AND SEWAGE DISPOSAL.

Bids Close.		See Eng. Record.
Apr. 10.	Montclair, N. J. Adv. Mar. 25.	Mar. 25
Apr. 11.	Maryland Adv. Mar. 25.	Mar. 25
Apr. 11.	Toronto, Ont.	Apr. 8
Apr. 11.	New Brunswick, N. J.	Apr. 8
Apr. 11.	Long Beach, Cal.	Apr. 8
Apr. 12.	Brooklyn, N. Y.	Apr. 1
Apr. 12.	Brooklyn, N. Y.	Apr. 8
Apr. 13.	Chicago, Ill.	Apr. 8
Apr. 13.	Boston, Mass.	Apr. 8
Apr. 13.	Cincinnati, Ohio	Apr. 8
Apr. 13.	Cleveland, Ohio	Apr. 8
Apr. 14.	Jacksonville, Fla. Adv. Mar. 25, April 1.	Mar. 25
Apr. 14.	Material, Jacksonville, Fla. Adv. Mar. 25, April 1.	Mar. 25
Apr. 14.	New Lisbon, Wis.	Apr. 8
Apr. 15.	New London, Wis.	Mar. 25
Apr. 15.	Brooklyn, N. Y.	Apr. 1
Apr. 15.	Buffalo, N. Y.	Apr. 8
Apr. 17.	Watertown, S. D. Adv. Mar. 25, April 1.	Mar. 25
Apr. 17.	Washington, D. C. Adv. Apr. 8.	Apr. 8
Apr. 17.	South Orange, N. J.	Apr. 8
Apr. 17.	Marlborough, Mass. Adv. Apr. 8.	Apr. 8
Apr. 18.	Starke, Fla.	Apr. 1
Apr. 18.	Wabasha, Minn.	Apr. 1
Apr. 18.	Woonsocket, R. I. Adv. Apr. 1.	Apr. 1
Apr. 19.	Binghamton, N. Y.	Mar. 25
Apr. 19.	Des Moines, Iowa	Apr. 8
Apr. 19.	Oriskanny, N. Y. Adv. Apr. 8.	Apr. 8
Apr. 20.	Albany, N. Y.	Mar. 25
Apr. 20.	Urbana, Ohio	Apr. 1
Apr. 20.	Marengo, Iowa.	Apr. 8
Apr. 22.	Austin, Tex. Adv. Apr. 8.	Apr. 8
Apr. 26.	Binghamton, N. Y. Adv. Apr. 1, 8.	Apr. 1
Apr. 27.	Xenia, Ohio	Mar. 25
May 1.	Anoka, Minn.	Apr. 8

BRIDGES.

Apr. 10.	Rockford, Ill. Adv. Mar. 11.	Mar. 11
Apr. 10.	Marshall, Tex. Adv. Mar. 18, 25.	Mar. 18
Apr. 11.	Hastings, Minn.	Mar. 18
Apr. 11.	Steubenville, Ohio	Apr. 1
Apr. 12.	Youngstown, Ohio	Mar. 25
Apr. 12.	Abbeville, La.	Apr. 8
Apr. 12.	Connecticut	Apr. 8
Apr. 13.	Dennison, Iowa	Apr. 8
Apr. 14.	Battenville, N. Y. Adv. Apr. 1, 8.	Apr. 1
Apr. 15.	Indiana.	Apr. 1
Apr. 17.	New Philadelphia, Ohio.	Apr. 1
Apr. 17.	Youngstown, Ohio	Apr. 1
Apr. 17.	California.	Apr. 1
Apr. 17.	Montesanon, Wash.	Apr. 1
Apr. 17.	Jacksonville, Fla.	Apr. 8
Apr. 17.	Toledo, Iowa	Apr. 8
Apr. 18.	Lowell, Mass. Adv. Apr. 1, 8.	Apr. 1
Apr. 18.	Nashville, Tenn.	Apr. 1
Apr. 20.	Bradentown, Fla.	Apr. 1
Apr. 24.	Monroeville, Ala.	Apr. 8
Apr. 24.	New Orleans, La.	Apr. 8
Apr. 27.	St. Helens, Ore.	Apr. 8
Apr. 27.	Corning, N. Y. Adv. Apr. 8.	Apr. 8
Apr. 29.	Johnson Creek, Wis.	Feb. 26
Apr. 29.	Johnson Creek, Wis.	Apr. 1
May 1.	Amarillo, Tex.	Mar. 18
May 1.	Odessa, Wash.	Apr. 1
May 20.	Lyndhurst, N. J.	Mar. 18
Jun. 8.	El Dorado, Kan.	Apr. 8

PAVING AND ROADS.

Bids Close.		See Eng. Record.
Apr. 10.	Oswego, N. Y. Adv. Apr. 1.	Apr. 1
Apr. 11.	Maryland Adv. Mar. 25, April 1.	Mar. 25
Apr. 11.	Akron, Ohio	Apr. 1
Apr. 11.	Morristown, N. J. Adv. Apr. 1, 8.	Apr. 1
Apr. 11.	Belvidere, N. J.	Apr. 1
Apr. 11.	Hartford, Conn. Adv. Apr. 1.	Apr. 1
Apr. 11.	Nevada, Iowa.	Apr. 1
Apr. 11.	Saginaw, Mich.	Apr. 1
Apr. 11.	Maine.	Apr. 1
Apr. 11.	Benton, La.	Apr. 8
Apr. 11.	Bayonne, N. J.	Apr. 8
Apr. 11.	Kansas City, Mo.	Apr. 8
Apr. 12.	Falousa, Wash.	Mar. 18
Apr. 12.	Gastonia, N. C.	Mar. 25
Apr. 12.	Cleveland, Ohio.	Apr. 1
Apr. 12.	Brooklyn, N. Y.	Apr. 8
Apr. 12.	Baltimore, Md.	Apr. 8
Apr. 12.	Chicago, Ill.	Apr. 8
Apr. 12.	Denison, Iowa	Apr. 8
Apr. 12.	Connecticut	Apr. 8
Apr. 12.	Port Huron, Mich.	Apr. 8
Apr. 12.	Cleveland, Ohio.	Apr. 8
Apr. 13.	Salem, Ohio	Apr. 1
Apr. 13.	Shreveport, La.	Apr. 8
Apr. 13.	Berlin, Ont.	Apr. 8
Apr. 13.	Akron, Ohio	Apr. 8
Apr. 13.	Long Island City, L. I., N. Y.	Apr. 8
Apr. 13.	Anaheim, Cal.	Apr. 8
Apr. 13.	Chicago, Ill.	Apr. 8
Apr. 14.	North Vernon, Ind.	Mar. 25
Apr. 14.	North Platte, Neb.	Apr. 1
Apr. 14.	Charleston, S. C.	Apr. 1
Apr. 14.	Falls City, Neb.	Apr. 1
Apr. 14.	Petersburg, Va. Adv. Apr. 8.	Apr. 8
Apr. 14.	Buffalo, N. Y.	Apr. 8
Apr. 14.	Ventura, Cal.	Apr. 8
Apr. 15.	Houghton, Mich.	Mar. 25
Apr. 15.	Batavia, Ohio	Mar. 25
May 15.	Madison, S. D.	Mar. 25
Apr. 15.	Elkton, Ky.	Apr. 1
Apr. 15.	Reeman, Mich.	Apr. 1
Apr. 15.	Indiana	Apr. 1
Apr. 15.	Stevenson, Wash.	Apr. 1
Apr. 15.	Avella, Pa.	Apr. 8
Apr. 15.	Kansas City, Mo.	Apr. 8
Apr. 15.	Denver, Col.	Apr. 8
Apr. 16.	McPherson, Kan.	Apr. 8
Apr. 17.	Norfolk, Neb. Adv. Mar. 25, April 1.	Mar. 25
Apr. 17.	Marion, Iowa	Apr. 1
Apr. 17.	Lake City, Fla.	Apr. 1
Apr. 17.	Everett, Wash.	Apr. 8
Apr. 17.	Selma, Ala.	Apr. 8
Apr. 17.	Toledo, Iowa	Apr. 8
Apr. 17.	Warren, Ohio	Apr. 8
Apr. 17.	New Castle, Ind. Adv. Apr. 8.	Apr. 8
Apr. 18.	Bartow, Fla.	Mar. 25
Apr. 18.	Lawton, Okla.	Mar. 25
Apr. 18.	Berwyn, Ill.	Apr. 1
Apr. 18.	Marinette, Wis.	Apr. 1
Apr. 18.	Luverne, Minn.	Apr. 8
Apr. 18.	Sheperdsville, Ky.	Apr. 8
Apr. 19.	Ivanhoe, Minn.	Apr. 8
Apr. 19.	Rochester, Mich.	Apr. 8
Apr. 20.	Sarasota, Fla.	Mar. 25
Apr. 20.	Seymour, Mo.	Apr. 1
Apr. 20.	Bradentown, Fla.	Apr. 1
Apr. 20.	Albany, N. Y. Adv. Apr. 1, 8.	Apr. 1
Apr. 21.	Spokane, Wash.	Apr. 8
Apr. 21.	Blackwell, Okla.	Apr. 8
Apr. 21.	Ohio	Apr. 8
Apr. 24.	Lafayette, Ala.	Apr. 1
Apr. 24.	Everett, Wash.	Apr. 8
Apr. 24.	Seattle, Wash.	Apr. 8
Apr. 24.	Weston, W. Va.	Apr. 8
Apr. 24.	New Orleans, La.	Apr. 8
Apr. 25.	Bucyrus, Ohio Adv. Apr. 1, 8.	Apr. 1
Apr. 25.	Britt, Iowa	Apr. 8
Apr. 25.	Lewiston, Idaho	Apr. 8
Apr. 25.	Woonsocket, R. I. Adv. Apr. 8.	Apr. 8
Apr. 25.	Dayton, Ohio.	Apr. 8
Apr. 27.	Corning, N. Y. Adv. Apr. 8.	Apr. 8
Apr. 28.	West Union, W. Va.	Apr. 8
Apr. 28.	Spokane, Wash.	Apr. 8
Apr. 30.	Jackson, Tenn.	Apr. 1
May 1.	Galion, Ohio	Mar. 18
May 1.	Eveleth, Minn.	Mar. 18
May 1.	Pontiac, Ill.	Apr. 1
May 1.	Winlock, Neb.	Apr. 1
May 1.	Urbanna, Ohio	Apr. 8
May 1.	Hazard, Ky.	Apr. 8
May 1.	Hartford, Conn. Adv. Apr. 8.	Apr. 8
May 1.	Newton, N. J. Adv. Apr. 8.	Apr. 8
———	**Binghamton, N. Y.** **Adv. Feb. 12, 19.**	**Feb. 12**

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS.

Apr. 10.	Jetty Construction, New York, N. Y. Adv. Mar. 11 to April 1.	Mar. 11
Apr. 11.	Grading, Etc., Hastings, Minn.	Mar. 18
Apr. 11.	Wharf, Aransas Pass, Tex.	Mar. 25
Apr. 12.	Levee Work, Port Arthur, Tex.	Mar. 25
Apr. 12.	Ditches, Redwood Falls, Minn.	Apr. 1
Apr. 14.	Dredging, New York, N. Y. Adv. Mar. 18 to Apr. 8.	Mar. 18
Apr. 14.	Ditch, Windom, Minn.	Apr. 8
Apr. 14.	Dredging, Buffalo, N. Y.	Apr. 8
Apr. 14.	Bulkhead, Boston, Mass. Adv. Apr. 8.	Apr. 8
Apr. 15.	Freight Sheds, Etc., Quebec, Que.	Mar. 25
Apr. 15.	Irrigation, San Diego, Cal.	Apr. 8
Apr. 17.	Drainage, New York, N. Y.	Apr. 8
Apr. 17.	River Improv., Kansas City, Kan.	Apr. 8
Apr. 20.	Dredging, Manistee, Mich. Adv. Apr. 1, 8.	Apr. 1
Apr. 24.	Hyd. Machinery, Wheeling, W. Va.	Apr. 8
Apr. 25.	Drain, Hastings, Mich.	Apr. 8
Apr. 26.	Lock Gates, Etc., Pittsburgh, Pa. Adv. Apr. 1, 8.	Apr. 1
Apr. 26.	Dredging, Buffalo, N. Y. Adv. Apr. 1, 8.	Apr. 1
Apr. 26.	Riprap, Tompkinsville, N. Y.	Apr. 8
Apr. 26.	Dredging, Wilmington, Del.	Apr. 8
Apr. 27.	Dock, San Francisco, Cal. Adv. Apr. 1, 8.	Apr. 1
Apr. 28.	Wharf, Houston, Tex. Adv. Apr. 1.	Apr. 1
Apr. 29.	Riprap and Capstones, Wilmington, N. C. Adv. Apr. 1, 8.	Apr. 1
Apr. 29.	Dredging, San Francisco, Cal.	Apr. 8
May 1.	Wharf, Etc., Honolulu, Hawaii.	Mar. 25
May 4.	Dredging, New York, N. Y. Adv. Apr. 8.	Apr. 8
May 5.	Irrigation, Ft. Shaw, Mont. Adv. Apr. 8.	Apr. 8
May 6.	Leasing Land and Water for Power Purposes, Louisville, Ky. Adv. Mar. 11.	Mar. 11
———	Sublet Levee Work, Chicago, Ill. Adv. Apr. 1.	Apr. 1
———	Levee Grading, Vincennes, Ind. Adv. Apr. 8.	Apr. 8

PUBLIC BUILDINGS AND SCHOOLS.

Bids Close.		See Eng. Record.
Apr. 11.	Columbus, Kan.	Mar. 18
Apr. 11.	Galva, Iowa	Mar. 18
Apr. 11.	Carbondale, Ill.	Mar. 25
Apr. 11.	Lockport, N. Y.	Apr. 1
Apr. 11.	Audubon, Iowa	Apr. 1
Apr. 11.	Devils Lake, N. D.	Apr. 1
Apr. 11.	Faribault, Minn.	Apr. 1
Apr. 11.	Toronto, Ont.	Apr. 8
Apr. 19.	Henryetta, Okla.	Apr. 8
Apr. 12.	Prescott, Ariz.	Mar. 11
Apr. 12.	Berea, Ohio	Mar. 25
Apr. 12.	Savannah, Ga.	Apr. 1
Apr. 12.	Hastings, Minn.	Apr. 1
Apr. 12.	Clontarf, Minn.	Apr. 1
Apr. 12.	Shenandoah, Pa.	Mar. 25
Apr. 12.	Wilcox, Pa.	Apr. 1
Apr. 12.	Osnabrook, N. D.	Apr. 8
Apr. 12.	Oakland, Neb.	Apr. 8
Apr. 12.	Hoboken, N. J.	Apr. 8
Apr. 12.	Caldwell, N. J.	Apr. 8
Apr. 13.	Los Angeles, Cal.	Apr. 8
Apr. 14.	Highland, Ohio	Apr. 1
Apr. 14.	Boone, Iowa	Apr. 1
Apr. 14.	Sheldon, Iowa	Apr. 1
Apr. 14.	Springfield, Ill.	Apr. 1
Apr. 14.	Boston, Mass.	Apr. 8
Apr. 15.	Indian Head, Md.	Mar. 4
Apr. 15.	Gemmell, Minn.	Mar. 18
Apr. 15.	Lakeview, Mich.	Mar. 18
Apr. 15.	London, Ohio	Mar. 25
Apr. 15.	Panama City, Fla.	Apr. 1
Apr. 15.	Bristolville, Ohio	Apr. 1
Apr. 15.	Danville, Va.	Apr. 1
Apr. 15.	Columbus, Ohio	Apr. 8
Apr. 15.	Topeka, Kan.	Apr. 8
Apr. 15.	Jacksonville, Fla.	Apr. 8
Apr. 15.	Miles City, Mont.	Apr. 8
Apr. 16.	Columbus, Ohio	Apr. 8
Apr. 17.	West Liberty, Iowa	Mar. 25
Apr. 17.	Emporia, Kan.	Apr. 8
Apr. 17.	Newark, Del.	Apr. 8
Apr. 18.	Columbus, Ohio	Mar. 25
Apr. 18.	Fort Dodge, Iowa	Mar. 25
Apr. 18.	Margie, Minn.	Apr. 1
Apr. 18.	Fort Jennings, Ohio	Apr. 1
Apr. 18.	Warren, Ohio	Apr. 1
Apr. 18.	Anthon, Iowa	Apr. 8
Apr. 18.	Sharpsville, Ind.	Apr. 8
Apr. 18.	Jackson, Ky.	Apr. 8
Apr. 19.	Arkadelphia, Ark. Adv. Mar. 11, 18.	Mar. 11
Apr. 19.	Hastings, Minn.	Apr. 8
Apr. 19.	Lansing, Mich.	Apr. 8
Apr. 20.	Niles, Ohio	Apr. 1
Apr. 20.	Carpenter, Iowa	Apr. 1
Apr. 20.	Forest City, Iowa	Apr. 1
Apr. 21.	Athens, Ohio	Apr. 8
Apr. 24.	Delphi, Ind.	Feb. 26
Apr. 24.	Roseburg, Ore.	Mar. 25
Apr. 24.	Lebanon, Ohio	Apr. 1
Apr. 24.	Huntington, Ind.	Apr. 8
Apr. 24.	Boxholm, Minn.	Apr. 8
Apr. 24.	Wallingford, Conn.	Apr. 8
Apr. 25.	Dover, Ohio	Apr. 8
Apr. 26.	Evansville, Ind.	Mar. 25
Apr. 26.	Newark, N. J.	Apr. 8
Apr. 27.	Portland, Ind. Adv. Mar. 25.	Mar. 25
Apr. 28.	New Orleans, La.	Mar. 11
Apr. 29.	Strongville, Ohio	Apr. 1
May 8.	Elkins, W. Va.	Mar. 25
May 10.	Evansville, Ind.	Apr. 8
May 15.	Newport, R. I.	Apr. 8
May 25.	Butler, Pa.	Mar. 18

PRIVATE BUILDINGS.

Apr. 11.	Johnstown, Pa.	Apr. 8
Apr. 12.	Suffolk, Va.	Apr. 8
Apr. 14.	Philadelphia, Pa.	Apr. 8
Apr. 15.	Suffolk, Va.	Mar. 18
Apr. 15.	New Richland, Minn.	Apr. 8
Apr. 15.	Timmins, Ont.	Apr. 8
Apr. 15.	Port Colborne, Ont.	Apr. 8
Apr. 17.	Wichita, Kan.	Apr. 8
Apr. 17.	Lansing, Mich.	Apr. 8
Apr. 20.	Taylorville, Ill.	Apr. 8
Apr. 20.	Protection, Kan.	Apr. 1
Apr. 25.	Hartford, Conn.	Apr. 8
May 1.	Akron, Ohio	Mar. 18
May 1.	San Bernardino, Cal.	Apr. 8

NEW INDUSTRIAL PLANTS.

Apr. 15.	Manila, P. I.	Jan. 2
Apr. 20.	Baltimore, Md.	Apr. 1

MISCELLANEOUS.

Apr. 11.	El. Ry., Boston, Mass. Adv. Mar. 25 to Apr. 8.	Mar. 25
Apr. 11.	Garbage Disposal, New Orleans, La.	Apr. 8
Apr. 11.	Fire Escapes, Boston, Mass.	Apr. 8
Apr. 12.	Fire Escapes, Pittsburgh, Pa.	Apr. 1
Apr. 12.	Hardware for Laundry, Theills, N. Y. Adv. Apr. 1.	Apr. 1
Apr. 12.	Road Oil, Irvington, N. J.	Apr. 8
Apr. 13.	Removal of Rock, New York, N. Y.	Apr. 8
Apr. 14.	Pipe and Rock, Etc., Charleston, S. C.	Mar..18
Apr. 14.	Air Compressors, Detroit, Mich. Adv. Apr. 8.	Apr. 8
Apr. 14.	Street Flushers, London, Ont. Adv. Apr. 8.	Apr. 8
Apr. 15.	Cement, Louisville, Ky. Adv. Mar. 18, Apr. 8.	Mar. 18
Apr. 15.	Lamp Posts, New York, N. Y.	Apr. 8
Apr. 17.	Sale of Dredge, Grand Rapids, Mich. Adv. Mar. 25 to Apr. 8.	Mar. 25
Apr. 17.	Fire Equipment, Ashland, Ky. Adv. Apr. 1.	Apr. 1
Apr. 20.	Freight Handling Winches For Sale, Boston, Mass. Adv. Apr. 1.	Apr. 1
Apr. 20.	Elevator, Parkersburg, W. Va.	Apr. 8
Apr. 20.	Dredging, St. Francisville, Ill.	Apr. 8
Apr. 20.	Disposal of Ashes, Washington, D. C. Adv. Apr. 8.	Apr. 8
Apr. 20.	Road Roller, Evansville, Ind.	Apr. 8
Apr. 22.	Steel Towers, Cordova, Alaska	Mar. 11
Apr. 25.	Fences, Contract 173, New York, N. Y. Adv. Apr. 8.	Apr. 8
Apr. 30.	Cement, Etc., Westmount, Que.	Apr. 1
May 4.	Steps, Etc., Jefferson City, Mo.	Apr. 8

SEARCHLIGHT SECTION

Official Proposal Announcements

Price, $2.40 an inch.—Copy can be received until Thursday 10 a. m. for issue mailed the next morning

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Bids open April 14, 1916.

NOTICE TO BRIDGE CONTRACTORS

BATTENVILLE, N. Y.

Sealed proposals will be received by R. L. Skinner, Town Superintendent of Greenwich, N. Y., and John Wright, Town Superintendent of Jackson. P. O. address Cambridge, N. Y., at election room in the village of Greenwich at 1 o'clock, April 14, 1916, for the construction of a bridge across the Battenkill at Battenville. Contractors are asked to bid on their own designs for a bridge of 15 ton capacity, 16 feet wide in the clear and 130 feet span over all. All connections must be riveted and all plates must have a thickness of at least 6/16 inches. The design must provide for a 5 inch concrete floor, and must be approved by the New York State Commission of Highways before a contract is let. The contract when let will be for the bridge erected in place together with the furnishing of all reinforcing metal for the floor. The construction of the abutments and the floor will be by the town and outside of the contract. Each proposal must be accompanied by a certified check made payable to the Town Clerks of Greenwich and Jackson for an amount equal to 5 per cent of the amount of proposal. Checks will be held until contract is executed. Bond for full amount of contract will be required before contract is executed. Payment in full will be made for work within 30 days from the date work is accepted by County Superintendent of Highways. The right is reserved to reject any and all bids.

Bids open April 20, 1916.

HIGHWAY IMPROVEMENTS

OFFICE OF THE STATE COMMISSIONER OF HIGHWAYS
ALBANY, N. Y.

Sealed proposals will be received by the undersigned at their office, No. 55 Lancaster Street, Albany, N. Y., at 1 o'clock p. m., on Thursday, the 20th day of April, 1916, for the improvement of the highways in the following counties:

Onondaga (two highways, 2.40, 5.12):
Saratoga (approximately 5.74);
Ulster (approximately 0.49); together with a concrete bridge.

Maps, plans, specifications and estimates may be seen and proposal forms obtained at the office of the Commission in Albany, N. Y., and also at the offices of the division engineers in whose divisions the roads are to be improved. The addresses of the division engineers and the counties in which they are in charge will be furnished on request.

The especial attention of bidders is called to "General Information for Bidders" in the itemized proposal, specifications and contract agreement.

EDWIN DUFFEY,
Commissioner.
I. J. MORRIS,
Secretary.

Bids open April 25, 1916.

STREET IMPROVEMENT

BUCYRUS, OHIO.

Sealed proposals for the improvement of twelve streets, totaling 100,000 sq. yd. in the City of Bucyrus, Ohio, will be received until 12 o'clock noon, Tuesday, April 25, 1916.

Specifications cover brick, concrete, asphalt and asphalt block. Part concrete foundation, part old macadam.

Plans and specifications can be seen and bidding blanks can be procured at the office of the City Civil Engineer, Bucyrus, Ohio.

Local certified check for $300 for each street, payable to M. J. Lutz, Director of Public Service.

F. L. NIEDERHEISER,
City Civil Engineer.
AUGUST BROEMEL,
City Clerk.

Bids open April 18, 1916.

PROPOSAL FOR THE CONSTRUCTION OF A REINFORCED CONCRETE BRIDGE OVER THE MERRIMACK RIVER AT PAWTUCKET FALLS AND FOR THE REMOVAL OF THE PRESENT STRUCTURE; AND THE ALTERATION OF THE PRESENT BRIDGE OVER THE NORTHERN CANAL

CITY OF LOWELL, MASS.

Sealed proposals directed to the City Clerk will be received by the Municipal Council of Lowell, Mass., at City Hall, until 10 a. m., Tuesday, April 18, 1916, for the construction of a reinforced concrete bridge over the Merrimack River, at Pawtucket Falls, and for the removal of the present structure; and the alteration of the present bridge over the Northern Canal.

Plan and profile of the bridge site, together with general information regarding the proposed structure may be obtained from Mr. Stephen Kearney, City Engineer, Lowell, Mass., upon deposit of fifteen dollars ($15.00), which deposit will be refunded upon the return of all papers in fair condition.

All contractors will be required to submit with their proposals detail drawings and specifications giving full information regarding unit stresses and loading used in the design, all of which will be subject to the approval of the City Engineer.

Each bid must be accompanied by a certified check for the sum of five thousand dollars ($5,000), drawn to the order of the Treasurer of the City of Lowell.

The Municipal Council of the City of Lowell, Mass., reserves the right to reject any or all proposals or any part thereof.

Per order Municipal Council.

CHAS. J. MORSE,
Comm. of Streets and Highways.

Bids open April 20, 1916.

WATER WORKS SYSTEM

HARLOWTON, MONT.

Sealed proposals will be received by the Town of Harlowton, Meagher County, Mont., until 6 p. m., April 20, 1916, at the Council Chambers in Harlowton, Mont., for furnishing materials, machinery and constructing a complete water-works system for the said town, in accordance with plans and specifications on file in the office of the Town Clerk at Harlowton, Mont., and in the office of George E. Baker, the Consulting Engineer, at Whitehall, Mont.

This work includes furnishing motor or gasoline engine, pump, fire hydrants, gates, water-pipe, pump station, and equipment as shown on plans.

Each proposal must be accompanied by a certified check for five per cent (5%) of the amount of the bid, but to be not less than three hundred dollars ($300.00), made payable to the Town of Harlowton, Mont., as evidence of good faith. Specifications, form of proposal, contract and plans may be seen at the office of the Town Clerk in Harlowton, Mont., or will be mailed upon application to the Engineer, in Whitehall, Mont., accompanied by the payment of five dollars ($5.00) for the specifications and form of proposal and contract, and five dollars ($5.00) for the plans.

The right is reserved to reject any or all bids.

GEO. E. BAKER,
Consulting Engineer.
FRED W. BARRON, Mayor.
S. K. CAMPBELL, Town Clerk.

Bids open April 27, 1916.

NOTICE TO CONTRACTORS.

CONCRETE GRAVING DOCK FOR SAN FRANCISCO, CAL.

Sealed bids for the construction of a concrete graving dock at HUNTER'S POINT, SAN FRANCISCO, one thousand (1000) feet long by one hundred and twenty (120) feet wide, with a depth of forty (40) feet over sill at mean high water, for the UNION IRON WORKS DRY DOCK COMPANY, will be received at the offices of said company, No. 260 California Street, San Francisco, up to Thursday, April 27, 1916.

Plans and specifications prepared by Howard C. Holmes, Consulting Engineer, are on file and may be seen at the offices of—

Union Iron Works Dry Dock Company,
260 California St., San Francisco.

Howard C. Holmes, Consulting Engineer,
112 Market St., San Francisco.

Bethlehem Steel Corporation,
111 Broadway, New York.

Each prospective bidder may obtain one copy of said plans, specifications and other information by depositing certified check for One Hundred Dollars as a guarantee for their return.

Any further information will be furnished on application to

UNION IRON WORKS DRY DOCK COMPANY,
260 California St., San Francisco,
or to
HOWARD C. HOLMES,
Consulting Engineer,
Santa Marina Building,
112 Market St., San Francisco.

Bids open April 26, 1916.

INTERCEPTING SEWER

BINGHAMTON, N. Y.

Sealed proposals for the construction of Section One of the Main Intercepting Sewer will be received by the Board of Contract and Supply at its offices in the Municipal Building, Collier Street, Binghamton, N. Y., until 2:30 p. m., on Wednesday, April 26, 1916.

The work involves the furnishing and placing of approximately 400 lin. ft. of 6-in. V. T. pipe sewer, 400 lin. ft. of 12-in. V. T. pipe sewer, 1200 lin. ft. of 15-in. V. T. pipe sewer, 1300 lin. ft. of 18-in. V. T. pipe sewer, 4000 lin. ft. of 24-in. V. T. pipe sewer, 1500 lin. ft. of 36-in. monolithic concrete or reinforced concrete pipe sewer, 1100 lin. ft. of 42-in. monolithic concrete or reinforced concrete pipe sewer, 5000 lin. ft. of 48-in. monolithic concrete or reinforced concrete pipe sewer, four River Crossings and various other appurtenances.

Plans and specifications may be consulted and proposal blanks may be secured from the City Engineer, Municipal Building, Binghamton, N. Y. A charge of ten ($10) dollars will be made for each set of plans and specifications taken from the office. This money will not be refunded. Checks should be made payable to the Comptroller of the City of Binghamton.

A certified check for $7,500 shall accompany all bids.

Bidders are required to visit the site of the work before submitting bids. Proposal forms contain, under oath, a statement that this provision has been complied with and any proposal not containing such a statement will be rejected as informal.

W. EARL WELLER,
City Engineer.

Bids open April 14, 1916.

ROAD CONSTRUCTION

OFFICE OF THE STATE HIGHWAY COMMISSION,
RICHMOND, VA.

Bids will be received at the office of the Secretary of the Chamber of Commerce, Petersburg, Va., until 11 o'clock a. m., Friday, April 14, 1916, for the construction of about nine (9) miles of road between Petersburg and City Point, in Prince George County, Virginia.

Alternate bids on one course concrete pavement and bituminous concrete pavement on concrete base.

Plans and specifications on file at the Clerk's Office, Prince George, Va., at the office of the Secretary of the Chamber of Commerce, Petersburg, Va., and at this office.

Specifications furnished on application to the undersigned.

A certified check for $2,000 must accompany each bid.

An engineer will be in Petersburg, Va., on April 7, to go over the work with prospective bidders.

The right is reserved to reject any and all bids.

Address all bids to G. P. Coleman, Chamber of Commerce, Petersburg, Va.

G. P. COLEMAN,
State Highway Commissioner.
March 30, 1916.

Bids open May 1, 1916.

CONTRACT 16
BARKHAMSTED ROAD

HARTFORD, CONN.

Sealed proposals, addressed to the Board of Water Commissioners of the City of Hartford, will be received at the office of the Board, Municipal Building, Hartford, until 3 p. m., Monday, May 1, 1916, for the construction through new country of a gravel surface road about 2½ miles long east of the East Branch Reservoir, in the towns of New Hartford and Barkhamsted.

Plans and specifications may be obtained after April 10, at the office of the Chief Engineer, Pilgard Building, Hartford, Conn., on deposit of $5, which amount will be refunded if both the plans and specifications are returned in good order before June 1, 1916. No deposits will be returned after this date. Specifications used in making a bid will be considered as returned.

A certified check or cashier's check for $3,500 must accompany each bid, and the successful bidder will be required to furnish bonds in the sum of $35,000.

The right is reserved to reject any and all bids.

BOARD OF WATER COMMISSIONERS.
WALTER S. GARDE, President.
FRED D. BERRY, Secretary.
CALEB MILLS SAVILLE,
Chief Engineer.

Bids open April 11, 1916.

NOTICE TO CONTRACTORS.

DORCHESTER TUNNEL

CITY OF BOSTON, MASS.

Sealed bids for building Section J, Dorchester Tunnel, in and near Dorchester Avenue and Boston Street, from about 80 ft. north of Dexter Street to about 30 ft. south of Ralston Street, South Boston, will be received by the undersigned until 12 o'clock noon of Tuesday, April 11, 1916. The section is about 1000 ft. long. The structure will be mainly of reinforced concrete and structural steel. The work includes the Andrew Square Station. Specifications and forms of contract can be obtained at 15 Beacon Street, ninth floor. The right to reject any and all bids and to award the contract as is deemed to be for the best interest of the City of Boston is reserved.

By order of the
BOSTON TRANSIT COMMISSION.
B. LEIGHTON BEAL,
Secretary.

Big Mixers Put to Strenuous Test

The test to which the frames and trunnions of the two 4-yd. mixers made by the T. H. Smith Company of Milwaukee, for the Hardaway Contracting Company, were put, consisted of placing 16,385 lb. of pig iron in the 9½-ft. drum. Under this load the deflection of the frame at the center was only 1/32 in.

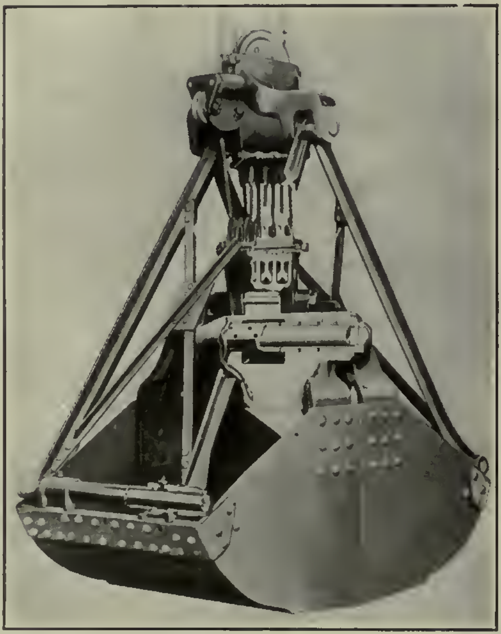
These mixers, which were described in last week's issue, are the largest ever constructed and are made entirely of steel. They are built in right and left-hand units, are driven by 150-hp. motors and each mixer is equipped with an individual sliding clutch pulley. The mixing chambers revolve at 12 r.p.m.

Simplified Design Reduces Weight of Clamshell Bucket

By combining a number of parts into one steel casting, providing all working parts with longer and larger bearings, protecting the bearings from dirt and grit, and insuring thorough lubrication, the Owen Bucket Company, of Cleveland, claims to have materially improved the Owen type of clamshell bucket.

The improved construction not only increases the strength, it is said, but also affords greater digging power, due to elimination of friction by lubricating.

The croshead is a one-piece, heavily ribbed steel casting, containing the upper closing line block, which is skewed to give fair leads to the closing line. The holding line block may be used with either single or double line. The crosshead is provided with guide sheaves and rollers which eliminate chaffing and protect the closing line regardless of the position of the bucket.



GUIDE SHEAVES AND ROLLERS ON THE CROSSHEAD PROTECT THE CLOSING LINES

The arms are cast steel, of star shaped construction and cross braced with T bars. The upper end is bushed for a large pin bearing and the lower end keyed to the arm shaft. High quality throughout the entire construction and stronger design with light weight are other features claimed by the manufacturer.

Drill Maker Celebrates Twenty-Fifth Anniversary

In honor of the completion of twenty-five years devoted to the manufacture of drills, Warren Wood of the Wood Drill Works, Paterson, N. J., gave a dinner April 1, at which many prominent citizens and officials of that city were present. From a modest beginning in the manufacture of rock drills and mining machinery, Mr. Wood has improved his plant until now it is said to be one of the best equipped in the country and turns out drills which, to quote the manufacturer, "can be cleaned with a sledge hammer, wiped off with a shovel and yet stay with you."

To Build Permanent Exhibition Building for American Manufacturers

Construction will soon be started on a 25-story structure at 132-134 West Forty-second Street, New York City, which will be a permanent exhibition building for American manufacturers. It will cost $1,000,000.

The Bush Terminal Company will own and operate the building upon a plan that is said to be a complete departure from anything that has ever been attempted. The company will maintain in the building a trained sales force, which will handle the business of many firms that otherwise would be without New York representation.

Plans for the building, which will be finished in a year, have been completed by Helmle & Corbett, architects of Brooklyn, and call for a modern fireproof type building with a 50-ft. frontage and a 90-ft. depth.

Issue Pamphlet on Use of Hydrated Lime for Concrete Roads

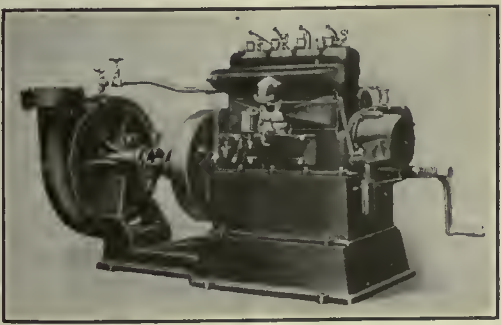
A discussion of the use of hydrated lime in concrete roads has been issued in pamphlet form by the National Lime Manufacturers' Association of Pittsburgh. No claim is made that the use of the material will prevent or overcome defects in concrete roads built under unfavorable conditions. It is stated, however, that the addition of hydrated lime will, to a great extent, overcome such defects as cracking and soft spots, and will generally improve the durability and wearing qualities of any properly constructed concrete road.

Statements of men of authority in the roads field, who have used hydrated lime, are included in the pamphlet.

High-Speed Centrifugal Pump Driven by Oil Engine

Portable and stationary centrifugal pump outfits, direct connected to four-cylinder, four-cycle engines which burn either gasoline or kerosene have recently been perfected by the Zin-Ho Manufacturing Company, of Chicago. These pumps are made in the ten sizes most commonly used, up to an 8-in. suction, and can be furnished in both multiple and single-stage types. When clear water is pumped, no separate cooling system is necessary but if the water is full of sand or clay, it is better to provide an extra water tank.

The pump which will probably receive the most call from contractors weighs about 375 lb., has a capacity of 250 gal. per minute against a 50-ft. head and operates at a cost of 25 to 35 cents per day. It has a 4-in. suction and a 3-in. discharge.



LIGHT 4-CYLINDER ENGINE DRIVES CENTRIFUGAL PUMPS

The company is also making a semi-portable air compressor in eight sizes for use on railroads where it is expensive to spur out a compressor car. These outfits range in weight from 2000 to 12,800 lb., and in capacity from 21 to 400 cu. ft. of free air per minute. The compressor is a duplex, single-stage vertical type run direct by a four-cycle, four-cylinder gasoline engine.

Business Notes

The **Lee Loader Company** will move its offices and factory to 2343 South La Salle Street, Chicago, April 20.

Yale & Reagan Company, general contractors, of Chicago, have removed their headquarters to the Conway Building.

James C. Miller has opened offices in the First National Bank Building, Syracuse, N. Y., under the name of Miller-Crippen Equipment Company, where he will continue to deal in contractors' equipment and machinery. He will also represent the Troy Wagon Works Company, of Troy, Ohio, in the State of New York.

Koehring Machine Company, of Milwaukee, Wis., has moved its Portland, Ore., office to 254 East Hawthorne Avenue and its Seattle office to 1208 Western Avenue. A complete stock of Koehring equipment and parts is maintained at these offices. The company also represents the Sterling Motor Truck Company and the C. H. & E. Company in the Northwest.

Trade Publications

The following companies have recently issued Trade literature:

..**William Powell Company**, Cincinnati, leaflet, 20 pages, White Star gate valve.

Kardong Brothers, Minneapolis, catalog, 8 pages, Star bar bender and Perfection form clamps.

Kolesch & Company, 138 Fulton Street, New York, folder, 4 pages, security tube for protecting and storing blueprint paper.

Bonney Supply Company, Inc., Rochester, N. Y., catalog, 16 pages, rapid car unloader, crushing plant and road building equipment.

Blaw Steel Construction Company, Pittsburgh, bulletin 69, 24 pages, Blaw steel forms in road, sidewalk, curbs, and curb and gutter construction.

Barber Asphalt Paving Company, Philadelphia, catalogue, 16 pages, Trinidad liquid asphalt for road surfacing, with specifications for cold and hot applications.

National Tube Company, Pittsburgh, booklet entitled, "The Prevention of Corrosion in Pipe," by F. N. Speller, a reprint of an address presented before the American Society of Heating and Ventilating Engineers.

Solar Metal Products, Columbus, Ohio, first of what is evidently to be a series of booklets entitled "A New Deal in Hollow Steel Doors," 8½ x 11 in.

Nordberg Manufacturing Company, Milwaukee, Wis., bulletin 27 A, 8 x 10½ in., 16 pages, describing high compression two-cycle oil engines.

Goheen Manufacturing Company, Canton, Ohio, booklet 8 x 10½ in., 16 pages, devoted to uses and advantages of Galvanum protect galvanized iron.

American Manganese Steel Company, Chicago, bulletin 65, Missabe manganese steel dippers, Vanderhoef fronts and repair parts for steam shovels and dipper dredges.

· **American Cement Tile Manufacturing Company**, Oliver Building, Pittsburgh, catalog, 40 pages, Bonanza cement tile rofing as applied to manufacturing plants, stations, etc. Description of terminal on Pacific Coast of Panama Canal, the shops and piers of which were roofed with this product.

The Atlantic Highway Digest is a new monthly magazine published by the Atlantic Refining Company, of Philadelphia, for the purpose of discussing the salient features of asphalt material and distributing information that will be helpful to all interested in using asphalt in road-building work. The publication is for free distribution among engineers and contractors.

CONTRACTING NEWS

Of Special Interest to Engineers, Contractors, Builders and Manufacturers of Engineering and Building Supplies

AS POINTED out in the editorial pages of this issue, the labor factor is the one which seems likely to limit the volume of construction work carried out in the coming season. From all indications, the prices of materials do not threaten to rise far enough to cause a serious curtailment of new work. There is plenty of capital available for construction, and the volume of work for which plans have been filed, together with the work which has been coming out more recently in response to easier conditions in the building materials market, indicate that there will be at least enough construction work to employ all the labor to be had. The railroad freight situation is slowly improving, and this improvement has brought out the fact that freight embargoes have been a bigger factor in stiffening the prices of building materials than was at first allowed for. This is especially true in New York territory. Lumber is moving more actively even in the South and East. The growing volume of lumber business is already slightly above normal for the season, following the largest winter business done in recent years. Buying of steel goes on, the U. S. Steel Corporation having a total of 9,331,000 tons in unfilled orders on its books at the end of March. This, another new record, shows a 760,000-ton gain in spite of record production.

Buildings

A contract for constructing a $600,000 college building has been let in New York City. The award of a $100,000 building contract is reported from Atlanta. At Sioux Falls, S. D., a contract for building a cathedral at a cost of $163,000 has been let. Bids are desired at Summit, N. J., for building a school to cost $200,000.

A good volume of proposed work noted includes among the larger projects the following: New York City, $200,000 apartment house, $225,000 tenement and $500,000 theater, plans filed; Rumford, Me., $200,000 addition to paper plant to be built; Newark, N. J., $1,000,000 annex to court house, preliminary plans finished; New Kensington, Pa., $200,000 club house, plans being prepared; Erie, Pa., $350,000 grain elevator, contract to be let; Ashville, N. C., architect engaged, $200,000 high school; Kingsport, Tenn., $500,000 paper mill proposed; Chicago, $600,000 theater, sketches prepared; Milwaukee, $300,000 store annex to be built; Clinton, Iowa, new stations and railroad improvements costing $500,000 proposed; Austin, Tex., plans submitted for $300,000 state school; Seattle, $1,500,000 hotel, architect engaged; Los Angeles, hospital buildings to cost $450,000, plans being prepared.

Bridges and Roads

A $117,000 bridge contract has been awarded at Hamilton, Ohio. The date of letting the bridge work at Bridgeport, Conn., has been postponed to May 6. Low bids received March 28 at Philadelphia for paving work total $238,000. The following paving contracts have been awarded: Uniontown, Pa., three road contracts, $127,000; Sumter, S. C., 160,000 sq. yd. sheet asphalt paving; Storm Lake, Iowa, paving work to cost $134,000; Seattle, paving work to cost $171,000; Martinez, Cal., road work to cost $70,000. Bids are desired at St. Louis for paving work to cost $81,000. McKinney, Tex., will open bids April 25 for paving work to cost $70,000.

The following prospective road and paving work is noted: Boston, bill passed providing $835,000 for paving; Lynn, Mass., $100,000 paving bonds sold; Johnstown, Pa., construction of concrete roads costing $145,000 decided on; Pennsylvania, state highway department completing plans for concrete road to cost $135,000; Somerset, Ky., $300,000 road bonds sold; Bellville, Ill., court decision permits $319,000 road work to go forward; Vincennes, Ind., contract to be let for paving work to cost $50,000; South Bend, Ind., $150,000 paving work decided on; Seattle, plans approved, road work to cost $100,000.

Waterworks and Sewers

The lowest bid received at Port Washington, L. I., for constructing a sewer system was $119,000. Sewer work to cost $71,500 has been let at Columbus, Ohio. New Brunswick, N. J., desires bids May 9 for constructing a filtration plant.

Sewer work to cost $181,000 has been authorized by the voters of Hartford, Conn. A contract will be let soon for a $350,000 sewer at Philadelphia, and plans have been approved by the state for the $1,500,000 disposal plant to be built at Torresdale. Salem, Ohio, is to spend $93,000 for high-pressure mains. Waterworks improvements costing $75,000 are to be made at Dover, Ohio. Milwaukee has voted $1,560,000 for constructing sewers and a disposal plant. A diversion tunnel authorized for a creek at Rosedale, near Kansas City, Kan., will cost $700,000.

Miscellaneous

A levee contract amounting to $100,000 has been awarded at Yancopin, Ark. It is reported from Passaic, N. J., that grade-crossing elimination work to cost $160,000 has been agreed upon. Additional pier and harbor construction work proposed by the Department of Wharves, Docks & Ferries at Philadelphia would cost in the neighborhood of $5,000,000. A dredging contract amounting to $150,000 will be let during the summer at Winchester, Ind. An engineer has been selected at Memphis, Tenn., for drainage and reclamation project involving 100,000 acres. Plans have been prepared at Milwaukee for a recreation pier, which, with other contemplated harbor improvements, will cost $2,500,000. Railroad track improvements proposed at St. Paul will cost $200,000. It is reported from Portland that grade-crossing elimination work, bridge renewals, extensions and line changes contemplated in connection with other improvements by the Oregon & Washington Railroad & Navigation Company will cost $2,000,000.

WATERWORKS

PROPOSED WORK.

Lowell, Mass.—Municipal Council voted to install water mains in the Oakland District to cost $30,000.

Woonsocket, R. I.—Board Water Commissioners (W. F. Norton, Chmn.) is planning installing an auxiliary pump at water works pumping station, daily capacity 8,000,000 gal.

Geneva, N. Y.—Election to be held on enlarging filtration plant, plans for which are being prepared; cost $28,000. J. W. Brennan, City Engineer; H. K. Seybolt, Superintendent Public Works.

Utica, N. Y.—All bids opened by Board Contract and Supply, March 30, for furnishing 25 hydrants rejected.

Jonestown, Pa.—State Board of Health, Harrisburg, has directed improvements made to filter plants at Jonestown and Wellsboro.

Lebanon, Pa.—Council decided to construct 2 miles water mains at a cost of $16,500; to install brick valve boxes at a cost of $1,100. Address City Clerk.

Punxsutawney, Pa.—Reported Council is considering municipal water works. William Gillespie, Borough Solicitor.

Waynesboro, Pa.—Farley Gannet, Consulting Engineer of Harrisburg, engaged to report on improvements to water supply and sewer system.

Maryland.—See "Paving and Roads."

Takoma Park, Md.—Citizens voted in favor of $25,000 bond issue for water storage reservoir and improving present system.

Washington, D. C.—All bids opened recently by Commissioners D. C. for furnishing 400 tons of sulphate of alumina, rejected.

Hickory, N. C.—Water bonds for $10,000 will be sold April 25 by John W. Ballew, City Manager.

Bristol—Tenn.—Vo.—Knight & Quale, 408 Times Bldg., Chattanooga, Tenn., engaged to study and report on water supply resources and service conditions in connection with improvements shortly to be made in this city.

Canton, Ohio.—Contract will be let in about 30 days for enlarging distributing system at a cost of $150,000, including 8 to 24-in. mains. George McCloskey, Director Public Service.

Dover, Ohio.—About $75,000 is to be spent by City Council for water works improvements, to include erection of stand pipe on Deis Hill, capacity 1,500,000 gal., install 2,000,000 gal. pump and lay 12 in. mains.

Ravenna, Ohio.—R. Winthrop Platt, Cleveland, is consulting engineer for proposed water works. W. H. Linton, Director Service.

Ironton, Ohio.—Plans prepared by J. F. Witmer Co. of Buffalo, N. Y., for constructing water works of 4,000,000-gal. capacity; probable cost $250,000. F. A. Ross, Clerk Director Public Service.

Portsmouth, Ohio.—Plans and specifications submitted to city by J. F Witmer Co. of Buffalo, N. Y., for repairs to reservoir. Samuel G. Harper, City Engineer.

Portsmouth, Ohio.—Water works bonds for $50,000 to be sold April 25. Louis A. Zucker, City Aud.

Salem, Ohio.—Reported $93,000 will be spent by city for fire protection system, to include installation of wells, mains and reservoirs.

South Charleston, Ohio.—Election to be held June 13 to vote on constructing water works. A. Geisler, Engineer, Dayton; S. B. Rankin, Clerk Board of Public Affairs.

Warren, Ohio.—City Council approved plans of Chester & Fleming of Pittsburgh, Pa., for water and pumping plant for Warren.

Youngstown, Ohio.—Contract soon to be let for two 15,000,000-gal. electrically driven centrifugal pumps for filter bed water supply and one 4,000,000-gal. pump for the water wash. John S. Lewis, Supt. Water Works Dept.

LaPorte, Ind.—Plans about completed for the concrete 3,500,000-gal. reservoir. L. Drew Goddard, City Engineer.

Michigan.—Ford and Trenton are considering constructing filtration plants. Address Village Clerk.

Wyandotte, Mich.—Charles H. Marr, Mayor, in favor of constructing filtration system to improve down river water supply.

Quincy, Ill.—Citizens, April 4, voted $130,000 bonds for constructing water works. Address City Comptroller.

Chilton, Wis.—Contract will be let about May 1 for constructing water works for which citizens recently voted $45,000 bonds.

Mineral Point, Wis.—Common Council voted to issue $15,000 water works improvement bonds, also extend water mains on Wisconsin, Seventh and State Streets.

Fort Madison, Ia.—Reported construction of water works is contemplated. Burns & McDonnell, Kansas City, Mo., Engr. Nothing further will be done until company is incorporated. (Peter Kern, Member of Committee).

Minneapolis, Minn.—Enlargement of filtration plant by one-third and an addition of a water softening plant, at a total cost of from $700,000 to $1,000,000, will be recommended to City Council by F. W. Cappelen, City Engineer. Plan provides for beginning work in 1918 and completion in 1920.

Dighton, Kan.—Election to be held May 16 to vote bonds for constructing proposed water works and light plant, to cost $28,000. W. B. Rollins & Co., 439 Midland Building, Kansas City, Mo., Engrs.; J. A. Radford, City Clerk.

Ottawa, Kan.—It is reported a new filtration plant and additional equipment will be added to municipal water and electric light plant at this place early in the spring.

Rosedale, Kan.—City Commissioners of Kansas City passed an ordinance allowing this city to construct a tunnel, reinforced concrete, for the diversion of the Turkey Creek waters into Kaw River under Greystone Heights. A ditch ½ mile long leading to tunnel, also half mile long, will be constructed; cost $700,000.

Yates Center, Kan.—Citizens voted $50,000 bonds for constructing system of water works; it is reported city will drill wells.

Bellwood, Neb.—Citizens April 4 voted to issue bonds for constructing water works. J. P. Deaney, Village Clerk.

Pawnee City, Neb.—Citizens voted to issue bonds for water and sewer extensions. E. T. Archer & Son, Engineers, Kansas City, Mo. Address City Clerk.

Bozeman, Mont.—Citizens voted April 2 to issue $175,000 bonds for sewer and water improvements. C. C. Widener, City Engineer.

Glendive, Mont.—Citizens will vote May 15 on issuing $65,000 bonds for constructing filtration plant.

Great Falls, Mont.—Burns & McDonnell, Kansas City, Mo., are engineers for the water purification plant, 10,000,000-gal. capacity, which is to be constructed here at a cost of $175,000.

Warm Springs, Mont.—Contract soon to be let by State Board of Examiners at Helena for constructing water works system at State Hospital for Insane at Warm Springs, cost $14,000. A reservoir will be constructed on Lost Creek, 4 miles from Warm Springs, and a 10-in. pipe line laid to the asylum.

Arkansas City, Ark.—The Lambe & Denmarke Light & Water Co. intends making improvements, costing $20,000, which will include one crude oil engine. 120 h. p.; ons generator, 100 kw., and equipment for same; 1000 lb. wire, electric meter and centrifugal pump; 300 to 400 gal. minute meter to drive pump; some c.-i. pipe, 6 in.

Galveston, Tex.—Attorney-General approved the recent city $875,000 bond issue.

Oklahoma, Okla.—In a report submitted to Bd. Commissioners for proposed water works extensions and storage plant to accommodate a population of 200,000, Guy V. McClure, City Engineer, estimates cost of improvement at $1,092.224.

Perry, Okla.—Ordinance passed authorizing issue of bonds for water works extensions. Address City Clerk.

Clovis, N. M.—Citizens voted bonds for constructing water works and light and sewer improvements, estimated to cost $35,000. Burns & McDonnell, Consulting Engineers, Kansas City, Mo.

Springer, N. M.—Citizens April 4 voted $32,000 bonds for constructing water works. W. R. Holly, Attorney.

Olympia, Wash.—City Council considering extending recently acquired water system to outlying districts. J. B. Waddell, City Engineer.

Raymond, Wash.—City Council engaged H. C. Herman, engineer, to investigate water system and make report and estimate of cost of extending pipe lines and other improvements.

Seattle, Wash.—City Council referred to City Utilities Committee the improvement of Forty-second Avenue South with trunk water mains; cost $348,015. A. H. Dimock, City Engineer. L. B. Youngs, Supt. Water.

Canby, Ore.—Election to be held May 18 to vote $18,000 bonds for constructing municipal water works. Address City Clerk.

Oregon City, Ore.—City Council reported will soon authorize Engineers Rand & White, Electric Bldg., Portland, to proceed with constructing proposed reservoir at Mountain View. Work involves 10,000 yd. excav., 1700 yd. concrete, cast-iron pipe, etc., and a 6000-gal. reservoir. Cost, $35,000.

Milwaukie, Ore.—Council intends installing meters at a cost of $5,000.

San Diego, Cal.—Citizens on March 31 voted on following three propositions: Diversion of $100,000 bond money from development fund of San Diego River for construction of Upper-Lower Otay Pipe Line and for Dulzura-Upper Otay Pipe Line; diversion of $75,000 from reservoir fund for reconstruction of Chollas and Bonita pipe lines, including bridges, and for restoration of Mission Valley pumping plants and wells; for issue of $100,000 bonds for restoring Dulzura concrete conduit.

Formation of a water district under state law, embracing all territory in and around San Diego and East San Diego, to be bonded for acquiring water and constructing distributing system, has been asked by 7000 petitioners, represented by A. J. Casebeer, Local Attorney.

Santa Maria, Cal.—Reported Railroad Commission has authorized Domestic Water Co. to sell plant to the city.

San Rafael, Cal.—Water district bonds for $2,250,000 will be sold April 12, by Director of Marin Municipal Water District.

Pocatello, Idaho.—Reported city is to purchase plant of local water company at cost of $290,000.

Sarnia, Ont.—R. DeL. Funct, Principal Asst. Engineer, engaged with F. W. Thorold of Toronto, and F. A. Dallyn of Ontario Provincial Board of Health, to make a report on water works improvements.

BIDS DESIRED.

Boston, Mass.—Until April 18, by Dept. of Supplies, Room 12, City Hall (Jos. F. Maclaughlin, Dir.), for cast iron water pipe and fittings, etc.

New York, N. Y.—Until April 19 by William Williams, Comr. Water Supply, Gas and Electricity, for furnishing, delivering, unloading, stacking and storing c.-i. pipe, special and valves, box castings, valves and double nozzle fire hydrants. Total security $20,900.

Rochester, N. Y.—Until April 19, by F. X. Pifer, Secy. Board Contract and Supply, for furnishing, hauling and laying complete with appurtenances about ten miles 37-in. lock bar steel pipe for Conduit 3. Also, same time and place, separate bids for furnishing 12,000 tons of 37-in. cast-iron pipe, and hauling and laying complete about ten miles 37-in. cast-iron pipe.

New Brunswick, N. J.—Until May 9, by Board City Commissioners, for constructing a mechanical filtration plant of 6,000,000 gals. per day capacity, with necessary appurtenances advertised in Engineering Record. Asher Atkinson, City Engineer; Eugene J. McLaughlin, City Clerk.

Harrisburg, Pa.—Until May 1 by H. F. Bowman, Supt. Safety, for laying water mains in Market and Twenty-second Streets, Hillsdale and Bellevue Roads.

Lebanon, Pa.—Until April 26, by Dan M. Sharp, City Clerk, for furnishing and laying approximately 10,600 ft. 6 and 12-in. c. i. water pipe, with valves, specials, etc., advertised in Engineering Record. Paul A. Volcker, City Engineer.

Washington, D. C.—By Bureau Supplies and Accounts, Navy Dept., Washington, D. C., for Sch. 9534, Mare Island, Cal., miscellaneous cast and malleable iron pipe fittings; Sch. 9541, Norfolk, Va., miscellaneous steel pipe, and Sch. 9532, Brooklyn, N. Y., valves for pumps, etc.

Youngstown, Ohio.—Until April 20 by Director Public Service (Dan J. Jones, Clk.) for furnishing material and remodeling filtration plant.

Chicago, Ill.—Until April 18, by Dept. Public Works (W. R. Moorhouse, Comr.), for furnishing, delivering structural steel and iron work for Central Park Ave. Pumping Station. Also separate bids same time and place for furnishing and delivering velocity water meters at its meter shop, 1330 Indiana Avenue, or Municipal Shops, Thirty-first Street and Sacramento Avenue.

Chicago, Ill.—Until April 20 by Department Public Works (W. R. Moorehouse, Comr.) for furnishing material to construct and deliver to Sixty-eighth Street Pumping Station one steam turbine-driven direct connected centrifugal sump pump, together with all appurtenances and accessories. Also separate bids for furnishing and delivering wrought-iron pipe f.o.b. Municipal Warehouse, W. Thirty-first Street and Sacramento Avenue.

Galesburg, Ill.—Until 6 P. M., April 17, by William Boutelle, City Clerk, for an air compressor, advertised in Engineering Record. F. M. Connolly, City Engineer.

Kewaunee, Wis.—Until April 18 by Board Public Works (Emil T. Seidenglanz, Chmn.) for two half million compound duplex pumps, condensing and noncondensing, and also one three-quarter million compound duplex pump, condensing and noncondensing, together with a suitable condenser. Bids desired also on any other class of pump that will be suitable and acceptable to City Council and their engineer.

Wittenberg, Wis.—Until April 19, by John England, Village Clerk, for furnishing one triplex power pump and one 16-h.p. kerosene engine. W. G. Kirchoffer, Engineer, 31 Vroman Bldg., Madison.

Cordova, Alaska.—See "Public Buildings and Schools."

PRICES AND LETTINGS.

★*Indicates award of contract.*

New York, N. Y.—Lowest bid opened April 7 by Board of Water Supply, Gas and Electricity for laying water mains in Broadway, Amsterdam Avenue and other streets submitted by Santore Construction Co., Times Building, at $54,935.

Utica, N. Y.—See "Proposed Work."

★**Ambrose, Pa.**—Contract for laying about 11,800 ft. 6 to 12 in. water pipe, 13 tons special castings, and valves, etc., awarded Robert Swan, Jr., Pittsburgh, at $6.312. (Bids opened March 31.)

★**Lansdale, Pa.**—Reported contract for furnishing new boiler in water plant awarded E. Keeler Company, of Williamsport, at $1,481.

★**McKeesport, Pa.**—Contract for laying 24 in. pipe line for Monongahela intake awarded by City Council to John W. Butler of Elizabeth Township at $12,098.

★**New York, N. Y.**—Following are unit figures of four lowest bids opened March 21 by Board Water Supply for Contract No. 120, construction of two superstructures for Hudson and Croton Lake Drainage Chambers, Towns of Fishkill, Dutchess County, and Yorktown, Westchester County: (a) A. L. Guidone & Son, Inc., 52 Vanderbilt Avenue, $104,262 (awarded contract); (b) Emerson Building Co., 103 Park Avenue, $104,621; (c) Di Menna & De Paolo, Inc., 391 E. 149th Street, $110,766; (d) Michael Straub, 14 Ward Avenue, Mamaroneck, N. Y., $114,819.

	*(a)	(b)	(c)	(d)
1,600 bbl. gray Portland cement	$2.00	$1.80	$1.90	$2.20
300 bbl. white Portland cement	3.75	3.43	3.70	3.80
1,200 cu. ft. replacement of concrete floor at Croton Lake Drainage Chamber	0.75	0.65	0.60	0.75
600 cu. yd. earth excavation and embankment	1.00	0.60	1.00	1.00
400 cu. yd. rock excavation and embankment	3.00	2.50	3.00	2.60
460 cu. yd. top-soiling, seeding and grassing	2.00	1.90	2.00	3.00
160 sq. yd. cobble gutters	4.50	1.35	1.00	1.40
40 lin. ft. wooden guard-rail	1.00	0.35	0.40	1,00
200,000 lb. structural steel	0.055	0.065	0.20	0.08
Crane for Hudson Drainage Chamber, lump sum	2,443.00	2,370.00	500.00	2,800.00
Crane for Croton Lake Drainage Chamber, lump sum	2,611.00	2,360.00	600.00	2,715.00
Hudson Drainage Chamber superstructure, wingwalls and facing of blow-off, exclusive of items 1 to 11, inclusive, lump sum	50,489.00	49,366.00	37,000.00	49,960.00
Croton Lake Drainage Chamber superstructure, exclusive of items 1 to 11, inclusive, lump sum	29,014.00	30,372.00	25,000.00	34,550.00

★**Wilson, N. C.**—Contracts for water works and sewer improvements (bids opened March 27) awarded as follows: To M. M. Elkin, building and concrete; New York Continental Jewell Filter Co., 15 Broad Street, New York, N. Y., filters; Canton Hughes Pump Co., Wooster, Ohio, pump; Chicago Bridge & Iron Co., Chicago, tank and sewer. R. J. Grantham, City Engineer.

★**Columbia, S. C.**—Contract for c.-i. water pipe specials, etc., awarded National C. I. Pipe Co., Birmingham, Ala., at $20,780. Other bidders: U. S. C. I. Pipe & Foundry Co., Chattanooga, Tenn., $21,130; American C. I. Pipe Co., Birmingham, Ala., $21,025, and General Pipe & Foundry Co., Atlanta, Ga., at $20,990. Contract for valves awarded Columbiana Iron Works, Chattanooga, Tenn., at $2,050. John McNeal, City Engineer.

★**Cincinnati, Ohio.**—City Board of Control awarded contract for cleaning 50,000 lin. ft. of water mains to the National Water Main Cleaning Co., 50 Church Street, New York, at $9,978 (bids opened April 3).

★**Glasford, Ill.**—Contract for drilling and casing a deep well (bids opened April 3) awarded C. P. Brant & Co., Chicago, at $3,588. D. A. Howard, Village Clerk.

★**Utica, Ill.**—Contract awarded Chicago Bridge & Iron Company, Chicago, for constructing 60,000-gal. elevated steel tank (bids opened April 4), at $3,272. Louis M. Sabo, Village Clerk.

★**Racine, Wis.**—Contracts awarded P. G. Pederson and H. C. Hanson, both of Racine, for water and sewer pipes (bids opened April 1). William Rodgers, Secretary Board Public Works.

Minneapolis, Minn.—Following are bids opened March 24 by H. E. Alexander, purchasing agent, for furnishing 1000 ¾-in. Minneapolis pattern curb cocks with nipples and sleeves: G. Lauber Brass Mfg. Company, $2.13 each, f. o. b. Minneapolis; United Brass Mfg. Company, Cleveland, Ohio, $2.25; A. P. Smith Mfg. Company, East Orange, N. J., $1.73, and H. Mueller Mfg. Company, 145 West Thirtieth Street, New York City, $1.72.

★**St. Paul, Minn.**—Contract awarded Northwestern Electric Company of St. Paul for De Laval Pump & Electric Equipment Company, Minneapolis, motor at $7,688.

★**Elkhart, Kan.**—Contract awarded Alamo Engine Supply Company, 1122 Farnam Street, Omaha, Neb., for constructing water works.

★**Bayard, Neb.**—Contract awarded J. S. Schwartz, Colorado Springs, Col., at $12,875, for constructing water works (bids opened April 1). George G. Cankelton, Village Clerk.

★**Portland, Ore.**—Following are three lowest bids opened by City Purchasing Agent for (a) 6-in. c.-i. pipe and (b) 12-in. c.-i. pipe: Oregon Iron & Steel Co., Portland, (a) $10,275, (b) $11,812 (awarded contract), American Cast Iron Pipe Co., Portland, (a) $10,800, (b) $12,600; U. S. Cast Iron Pipe Co., Portland, (a) $10,500, (b) $12,250.

SEWERAGE AND SEWAGE DISPOSAL

PROPOSED WORK.

Lenox, Mass.—W. S. Johnson of Boston engaged as consulting engineer for the proposed sewer system and disposal plant to be constructed at Lenoxdale. Probable cost $21,000.

Lowell, Mass.—Municipal Council, April 4, voted $10,700 for constructing sewers in Woburn Street.

New Bedford, Mass.—The city's force will build, this year, 15,000 ft. 8 to 42-in. pipe sewers and 400 ft. 48 x 60 ft. concrete sewers costing $82,000 in all. George H. Nye, City Engineer.

Providence, R. I. — Bill has passed House appropriating $10,000 for constructing sewerage system at State College.

Hartford, Conn.—Citizens, April 4, voted in favor of the following: $110,000 for Gully Brook conduit; $50,000 for constructing storm water conduit in South Street; $21,642 for sewer system between Uphill Street and City Line, west of Blue Hills Avenue, and $18,000 for bridge over Park River, south of Hamilton Street and north of Flatbush Avenue. Address City Clerk.

Lakeville, Conn.—Construction of sewage disposal plant contemplated at Connecticut School for Feeble Minded. The state to pay $15,000 of cost. Address State Bd. Control at Hartford.

Nyack, N. Y.—Sewer bonds for $50,000 to be sold April 17, by H. E. Smith, Village Clk.

Princeton, N. J.—Borough Council passed ordinance to construct sewers in Aiken Avenue, Prospect Avenue, and a short line of Library Place.

South Orange, N. J.—South Orange Township Committee passed on first reading ordinance providing for construction of sewage disposal plant.

Berwick, Pa.—City Council considering constructing sewage disposal plant.

Chester, Pa.—State Board of Health at Harrisburg has authorized Chester to make studies of sewage disposal.

Johnstown, Pa.—C. P. Collins, Sanitary Engineer, City Hall, reports plans being prepared for sanitary sewer to be constructed from site of proposed sewage disposal plant to above Cooperadale Bridges; cost about $200,000.

Lebanon, Pa.—The sewage disposal plant proposed here will not be installed until 1917. Address City Clerk.

About 12,000 ft. of 30 to 48-in. pipe sewer costing $80,000 will be laid and a channel 8000 ft. long, 30 to 40 ft. wide, of concrete, and costing $120,000 constructed. Election will be held in June. Address City Engineer.

Montoursville, Pa.—See "Paving and Roads."

Mt. Union, Pa.—State Board of Health, Harrisburg, has directed Mt. Union and Berwick to improve sewage disposal plants.

Philadelphia, Pa.—Contract soon to be let by Director Datesman, Department of Public Works, for constructing the upper section of Frankford intercepting sewer between Winghocking Creek, Tenth Street and Hunting Park Avenue, costing about $350,000. Plans for the Torresdale sewage disposal plant have been approved by State Health Commissioner. The cost of the Torresdale plant will be about $1,500,000 exclusive of site. The Torresdale plant will take sewage from Port Richmond, Germantown, Mt. Airy, Frankford and a large territory in Wissahickon District.

Maryland.—See "Paving and Roads."

Durham, N. C.—Contract will be let about May 15 by H. W. Keuffner, City Engineer, for constructing a 24-in. pipe line from sewage disposal plant, a distance of about 6½ miles. Gilbert C. White, Consulting Engineer, Durham.

Battle Creek, Mich.—Citizens April 3 voted in favor of issuing $50,000 bonds for street paving and $50,000 bonds for constructing sewers. Bonds will be sold April 24 by City Clerk; E. U. Hunt, City Engineer.

Madison, Ill.—Sheppard & Morgan, Edwardsville, preparing plans for 40,000 ft. 12 to 42-in. sewer, costing $144,000, and pumping plant $16,000.

Milwaukee, Wis.—Citizens, April 4, voted $1,560,000 bonds for constructing sewers and sewage disposal plant. T. Chalkley Hatton, City Hall, Milwaukee, Engineer; J. H. Towles, Secy. Sewerage Commission.

Lisbon, Iowa.—Sewer improvements contemplated. Address City Clerk.

Billings, Mont.—No bids opened by City Council April 5 for constructing storm water sewer system. Proceeding stopped by injunction. E. M. Sneckenberger, City Engineer.

Bozeman, Mont.—See "Water Works."

Harlowton, Mont. — Citizens voted, April 4, to issue $25,000 bonds for constructing sewerage system and sewage disposal plant. S. V. Campbell, Town Clerk.

Little Rock, Ark.—City contemplates an extension of the Pulaski Heights sewerage system. Preliminary surveys and estimates have been made. C. Levinson, City Engineer.

Corsicana, Tex.—Extensions to sewer system planned. George A. Durand, City Engineer.

Frost, Tex.—F. D. Ford of Italy, Tex., is engineer for proposed sewerage system.

Paris, Texas.—Citizens voted, April 4, to issue $10,000 sewerage system bonds, and $40.000 school bonds. Edward T. S. McCuestine, Mayor.

Sweetwater, Tex.—Election to be held May 10 to vote on constructing sewerage system to cost $15.000 and sewage disposal plant (Imhoff) at $35,000. H. C. Hord, Jr., City Engineer.

Yorktown, Tex.—Construction of sewer system in business district contemplated. About 2000 ft. of 6-in. pipe required. E. F. Virieck, Chmn. Committee on Sewers.

Afton, Okla.—Plans being prepared by Benham Engineering Company, Oklahoma, for the main sewers and sanitary lateral sewers proposed by city at a cost of $40,000.

Bremerton, Wash.—Supreme Court has authorized city to issue $20,000 bonds for constructing sewer system. E. J. McCall, City Clerk.

Enumclaw, Wash.—Reported sewer system is to be extended this summer. W. I. Lippard, City Engineer.

Portland, Ore.—Contract about to be let for constructing sewers in E. Seventy-ninth, E. Eightieth, E. Pine and E. Burnside Streets. Phil Dater, City Engineer, and A. L. Barbur, City Auditor.

Fresno, Cal.—Olmsted & Gillelen, 1112 Hollingsworth Bldg., Los Angeles, engaged as consulting engineers for proposed sanitary and storm sewer systems, preliminary plans for which have been completed by B. E. Cronkite, City Engineer. Sanitary system will approximate 10 miles and storm sewer system about 7 miles from 18 to 54 inches. It has not been decided whether brick or concrete will be used. Election will be held May 3 to vote $500,000 bond issue.

BIDS DESIRED.

Gloversville, N. Y.—See "Paving and Roads."

New York, N. Y.—Until April 19 by Marcus M. Marks, Pres. Borough Manhattan, for sewer drainage system, for improving drainage of roofs and streets on West Washington Market. Security $6,000. Also same time and place separate bids for alteration and improvement of sewer in Nineteenth Street between Sixth Avenue and Broadway. Security $11,200.

Yonkers, N. Y.—Until April 17, by Board Contract and Supply (Edw. P. Walsh, Secy), for constructing stormwater sewers in Marlborough Road, Hart and Hillside Avenues, and other streets. D. F. Fulton, City Engr.

Ridgefield, N. J.—Until April 19, by Mayor and Council, for constructing sewer system and sewage disposal plant in Borough of Ridgefield. Chas. F. Blood, Boro. Engr., Moresmere.

Lakewood, Ohio.—Until April 25, by Director Public Works, for constructing 24-in. c.-i. pipe siphon and outfall sewer, advertised in Engineering Record.

Niles, Ohio.—Until April 24, by Director Public Service for sewers in Vienna Avenue, Depot and Walnut Streets, and for ½ mile paving on Third Street, advertised in Engineering Record.

Urbana, Ohio.—Until April 27, by H. M. Crow, City Auditor, for 4400 ft. 15 and 18-in. pipe, and 1200 ft. 42-in. concrete sewer; total cost, $9,800. E. F. Sweetman, City Engineer.

Alton, Ill.—Until May 2, by Board Administration, Capitol Bldg., Springfield, for constructing a sewage treatment plant at Alton State Hospital, near Alton. W. S. Sheilds, Designing Engr., suite 1201 Hartford Bldg., Chicago.

Chicago, Ill.—See "Paving and Roads."

Chicago, Ill.—Until May 3, by Chicago Union Station Company, at office of Thomas Rodd, Chief Engineer, for furnishing material and constructing sewers in Harrison and Canal Streets, concrete retaining walls in Canal Street, concrete curb wall and concrete sidewalks in Canal, Van Buren and Harrison Streets, filling the streets to the permanent grade, etc., advertised in Engineering Record.

Chippewa Falls, Wis.—Reported desired until April 20 by J. A. Brooks, Chmn. Board Public Works, for constructing approximately 6,500 lin. ft. sewers.

Until April 21 by L. F. Felix, City Clk., for constructing approximately 2½ miles of vitr. pipe sewer from 12 to 24 in.

Hutchinson, Minn.—Until May 1 by City Council for constructing 4500 lin. ft. 8-in. sewer, manholes, flush tank, etc., and 1550 lin. ft. 4-in. water main, two fire hydrants, etc. F. N. Moore, City Clk.

Wessington, S. D.—Until May 1, by Charles A. Curtiss, City Auditor, for constructing sewers, etc., advertised in Engineering Record.

Austin, Tex.—No bids will be opened April 22 for constructing Little Shoal Creek storm sewer; matter has been postponed indefinitely. See advertising columns. P. W. Powell, Superintendent of Streets and Public Improvements.

Midvale, Utah.—Reported desired until April 18 by Hilma S. Bennett, City Recorder, for sewers and septic tanks, with outfalls. John L. Griffith. 1596 Tenth E Street, Salt Lake City, Engr.

Cordova, Alaska.—See "Public Buildings and Schools."

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**New Bedford, Mass.**—Contract for constructing a concrete pumping station for intercepting sewer system awardeded Benjamin F. Watkins, 520 Acushnut Avenue, at $16,775. William F. Williams, Engineer, Room 203 Municipal Building.

★**Lakeville, Conn.**—Contract for constructing 22,900 ft. 8 to 15-in. vitr. pipe sewers and for 1900 ft. 8 to 14-in. c.-i. sewer (bids opened March 27) awarded by Sewer Commission, Lakeville Fire Dist., Town of Salisbury (A. C. Roberts, Chmn.), to Sherman, Welsch & Wells, Kings Court, Poughkeepsie, N. Y. City Waste Disposal Co., 156 Fifth Avenue, New York, N. Y., Engrs.

★**Yonkers, N. Y.**—Contract for constructing relief sewer in Radford Street awarded by Bd. Contract and Supply to John O. Weston, 151 Napperham Avenue, at $53,350.

★**Newark, N. J.**—Contract for constructing sedimentation basins and effluent and intake conduits, part of Section 4 of the Passaic Valley, awarded April 11 by Passaic Valley Sewerage Commission to Arthur McMullen Co., 149 Broadway, New York, at $787,080 (bids opened March 14). For unit figures see Engineering Record of March 25.

★**Washington, D. C.**—Contract for constructing sewer work in the District awarded Warren F. Brenizer Company, Washington, D. C. (bids opened March 28).

★**Savannah, Ga.**—Contracts for drainage work (bids opened March 6) awarded as follows: To Obenshain Bros., Center Moriches, Long Island. P. O. 402, for east side portion, at $121,124, and to Gadsden Contracting Company, and Guild & Company, Savannah, Ga., for west side portion, at $132,289. E. R. Conant, Chief Engineer of City.

★**Brewster, Ohio.**—Contract for sewer extensions and sewage disposal plant (bids opened April 1) awarded C. O. Watner, Toledo, at $9,388. L. S. Lash, Village Clerk.

★**Columbus, Ohio.**—Contracts awarded by Director Board Public Service (bids opened March 21) for constructing sewers as follows: Third Avenue, to O'Donnell & Thornbury, Columbus, at $58,432, and for Star Avenue sewer to J. F. Ryerson, Columbus, at $13,157.

★**Lakewood, Ohio.**—Contract for constructing sewage treatment work (bids opened March 20) awarded Lowensohn & Ule, 10402 Parkgate Avenue, Cleveland, at $78,325. H. B. Ante, Secy. to Director Public Service.

★**Fort Wayne, Ind.**—Contract for constructing 8000 ft. 12 to 20-in. vitr. pipe sewers (bids opened April 6) awarded Moellering Construction Co., Fort Wayne, at $17,192. J. B. Sheets Co., Pittsburgh, Pa., bid $18,920. F. M. Randall, City Engineer.

Indianapolis, Ind.—The following are two bids opened by Board of Public Works for installing 11 sluice gates in sewers along White River and Fall Creek to prevent back water damage during floods: Jacob Vogel, $12,457, and A. Bruner, $10,990.

★**Bad Axe, Mich.**—Contract for constructing sewerage system (bids opened April 5) awarded Frontier Contracting Co., Buffalo, N. Y., at $38,981. Next three bidders: Star Construction Co., Detroit, Mich., $39.870; Oakland Construction Co., Pontiac, Mich., $41,214, and Meredith Construction Co., Detroit, $44,186. James A. Burgess, Recorder.

★**Racine, Wis.**—See "Water."

New York, N. Y.—Following are unit figures of four lowest bids opened March 30 by Douglas Mathewson, President Bronx Boro., for constructing sewers in Westchester, Blondell and Sacket Avenues and Eastchester Road and other streets: (a) Peter B. Stanton, 2337 Walton Avenue, $90,963; (b) J. L. Sigretto, Fort Schuyler Road, $114,872; (c) Brennan Contracting Co., 831 Girard Avenue, $121,672, and Di Menna & Del Balso, 2336 Cambreliine Avenue, $129,081.

		(a)	(b)	(c)	(d)
10	lin. ft. triple concrete sewer, 11 ft. x 8 ft.	$107.00	$78.15	$90.00	$91.00
45	lin. ft. double concrete sewer, 8 ft. x 6 ft. 6 in.	43.00	49.04	53.00	36.70
597	lin. ft. single concrete sewer, 12 ft. 9 in. x 8 ft.	39.00	38.20	37.00	37.40
100	lin. ft. single concrete sewer, 12 ft. 9 in. x 7 ft.	28.00	32.43	37.00	40.77
1,656	lin. ft. single concrete sewer, 11 ft. x 8 ft.	21.00	28.87	33.00	32.43
3	lin. ft. 18-in. vitr. pipe sewer	3.50	0.01	1.50	3.00
3	lin. ft. 15-in. vitr. pipe sewer	3.25	0.01	1.50	3.00
105	lin. ft. 12-in. vitr. pipe sewer	3.00	1.50	1.50	2.00
125	lin. ft. basin connections	1.25	1.50	1.50	1.00
150	lin. ft. 12 to 24-in. vitr. pipe drains	1.00	2.25	1.00	1.00
[illegible]46	spurs for house connections	0.50	0.50	1.00	1.00
150	lin. ft. risers	0.50	1.50	1.00	1.00
14	manholes	40.00	35.00	50.00	60.00
4	receiving basins, Type P.	175.00	125.00	140.00	150.00
4	receiving basins, Type C.	175.00	125.00	140.00	110.00
2	inlets, Type C.	100.00	50.00	50.00	50.00
5,000	cu. yd. rock excav.	1.00	3.00	2.50	3.50
750	cu. yd. concrete, Class B.	5.00	4.50	6.00	5.00
10	cu. yd. concrete, Class C.	5.00	4.50	6.00	5.00
12,000	lb. steel reinforcement bars	0.05	0.05	0.06	0.05
60	M ft. timber sheeting	35.00	0.01	35.00	40.00
1	overflow chamber	123.00	15,836.00	1,500.00	19,600.00
1,500	lin. ft. guard rail	0.15	0.30	0.20	0.20
50	cu. yd. dry rubble masonry	2.50	3.00	1.00	2.00

New York, N. Y.—Following are unit figures of three bids opened March 30 by Douglas Mathewson, President Bronx Boro., for constructing sewers in Allerton, Wilson, Adee and other avenues: (a) Oscar Daniels Co., Woolworth Building, $247,130; (b) Rodgers & Hagerty, 271 W. 125th Street, $347,659; (c) N. Y. & N. J. Contracting Co., 30 E. Forty-second Street, $359,168.

		(a)	(b)	(c)
772	lin. ft. single concrete sewer, 10 ft. 9 in. x 8 ft.	$46.00	$50.65	$57.25
801	lin. ft. single concrete sewer, 9 ft. 6 in. x 8 ft.	33.00	42.00	49.10
664	lin. ft. single concrete sewer, 9 ft. 3 in. x 8 ft.	36.50	51.15	60.60
1,136	lin. ft. single concrete sewer, 7 ft. 3 in. x 8 ft.	30.00	37.00	48.80
760	lin. ft. single concrete sewer, 7 ft. 6 in. x 7 ft.	27.00	34.15	43.20
536	lin. ft. single concrete sewer, 7 ft. x 7 ft.	25.50	33.60	37.80
539	lin. ft. single concrete sewer, 4 ft. 3 in. x 5 ft.	14.50	25.20	31.40
1,388	lin. ft. single concrete sewer, 4 ft. x 4 ft. 9 in.	14.50	23.20	28.46
520	lin. ft. single concrete sewer, 3 ft. 9 in. x 4 ft. 6 in.	5.50	22.50	27.20
260	lin. ft. single concrete sewer, 3 ft. 6 in. x 4 ft. 3 in.	13.00	22.05	26.40
258	lin. ft. single concrete sewer, 3 ft. 6 in. x 4 ft.	13.00	18.00	25.40
97	lin. ft. single concrete sewer, 3 ft.	10.00	11.55	19.10
258	lin. ft. 30-in. vitr. pipe sewer	7.00	11.20	16.60
80	lin. ft. 24-in. vitr. pipe sewer	6.00	9.25	13.80
55	lin. ft. 20-in. vitr. pipe sewer	5.50	5.85	12.65
157	lin. ft. 18-in. vitr. pipe sewer	5.00	5.40	12.00
559	lin. ft. 15-in. vitr. pipe sewer	4.00	4.25	10.20
825	lin. ft. 12-in. vitr. pipe sewer	3.00	3.95	10.60
925	lin. ft. basin connections	2.60	2.15	5.15
500	lin. ft. vitr. pipe drains, 12 to 24 in.	2.00	4.85	4.50
805	spurs for house connections	1.00	1.00	0.74
3,000	lin. ft. risers	1.80	1.45	1.50
68	manholes	50.00	117.15	104.00
19	receiving basins, Type B	150.00	156.05	206.00
22,500	cu. yd. rock excav.	1.00	2.20	0.01
360	cu. yd. concrete, Class B	5.50	9.00	8.10
170	cu. yd. concrete, Class C	5.50	7.20	8.45
2,000	lb. steel reinforcement bars	0.055	0.045	0.06
5	M ft. timber sheeting	40.00	40.00	20.00
600	lin. ft. guard rail	0.20	0.25	0.60
100	cu. yd. dry rubble masonry	1.50	6.00	4.50

New York, N. Y.—Following are three bids opened March 30 by Douglas Mathewson, President Bronx Boro., for constructing sewers in Seymour Avenue, between Eastchester Road and Allerton Avenue: (a) Oscar Daniels Co., Woolworth Building, $249,933; (b) Rodgers & Hagerty, 271 W. 125th Street, $283,197; (c) N. Y. & N. J. Contracting Co., 30 E. Forty-second Street, $354,784.

		(a)	(b)	(c)
1,889	lin. ft. single concrete sewer, 7 ft. 6 in. x 8 ft.	$31.00	$37.40	$49.50
447	lin. ft. single concrete sewer, 7 ft. 3 in. x 8 ft.	29.00	30.25	39.80
163	lin. ft. double concrete sewer, 7 ft. 6 in. x 8 ft.	49.00	49.50	63.25
17	lin. ft. double concrete sewer, 7 ft. 3 in. x 8 ft.	62.00	64.05	81.50
1,307	lin. ft. single concrete sewer, 12 ft. x 8 ft.	45.00	52.85	73.00
1,593	lin. ft. single concrete sewer, 11 ft. 3 in. x 8 ft.	45.00	48.55	68.50
21	lin. ft. single concrete sewer, 3 ft. 3 in.	10.00	18.05	27.10
42	lin. ft. single concrete sewer, 3 ft.	10.00	12.50	24.00
152	lin. ft. 30-in. vitr. pipe sewer	7.00	5.70	16.70
36	lin. ft. 24-in. vitr. pipe sewer	6.00	2.85	13.90
28	lin. ft. 20-in. vitr. pipe sewer	5.50	3.65	12.75
93	lin. ft. 18-in. vitr. pipe sewer	5.00	6.70	12.15
8	lin. ft. 15-in. vitr. pipe sewer	4.00	3.95	11.30
170	lin. ft. 12-in. vitr. pipe sewer	3.00	3.90	10.70
68	lin. ft. basin connections	2.60	2.00	5.20
500	lin. ft. 12 to 24-in. vitr. pipe drains	2.00	4.85	4.45
510	spurs for house connections	1.00	1.00	0.75
3,200	lin. ft. risers	1.80	1.15	1.50
41	manholes	40.00	130.00	150.00
6	receiving basins, Type B	150.00	175.00	208.00
23,500	cu. yd. rock excav.	1.00	1.00	0.01
23,500	cu. yd. concrete, Class B	5.50	8.40	8.15
35	cu. yd. concrete, Class C	5.50	7.20	8.30
6,500	lb. steel reinforcement bars	0.05	0.045	0.06
10	M ft. timber sheeting	30.00	40.00	20.00
1,225	lin. ft. guard rail	0.20	0.25	0.60
100	cu. yd. dry rubble masonry	1.50	6.00	4.50

★**Port Washington, L. I., N. Y.**—Following are unit figures of the four lowest bids opened March 31 for constructing sewerage works (Carl H. Watson, Engineer, Great Neck: (a) Engineer's estimate, $120,459; (b) J. L. Sigretto & Co., Surtis Avenue, Richmond Hill, L. I., $119,001 (awarded contract); (c) James Ferry & Sons, Inc., 2411 Madison Avenue, Baltimore, Md., $128,169; (d) N. Magini, 17 Cliff Avenue, Yonkers, $132,558; (e) Rosenthal Engineering & Contracting Co., 165 Hooper Street, Brooklyn, $134,990.

		(a)	(b)	(c)	(d)	(e)
5,100	lin. ft. 8-in. pipe, 0-8 ft.	$0.70	$0.50	$0.70	$0.75	$0.80
20,570	lin. ft. 8-in. pipe, 8-10 ft.	0.80	0.70	0.75	0.90	0.80
14,370	lin. ft. 8-in. pipe, 10-12 ft.	0.90	0.80	1.00	1.05	0.80
2,000	lin. ft. 8-in. pipe, 12-14 ft.	1.20	1.40	1.35	1.40	0.80
520	lin. ft. 8-in. pipe, 14-16 ft.	1.50	1.74	1.75	1.75	0.80
580	lin. ft. 8-in. pipe, 16-20 ft.	2.00	2.29	3.00	3.00	0.80
890	lin. ft. 10-in. pipe, 0-8 ft.	0.80	0.72	1.00	0.95	0.95
2,270	lin. ft. 10-in. pipe, 8-10 ft.	1.00	0.90	1.16	1.10	0.95
1,650	lin. ft. 10-in. pipe, 10-12 ft.	1.20	1.36	1.40	1.24	0.95
450	lin. ft. 10-in. pipe, 12-14 ft.	1.50	1.60	2.00	1.64	0.95
350	lin. ft. 12-in. pipe, 0-8 ft.	1.00	0.82	1.20	1.70	1.35
910	lin. ft. 12-in. pipe, 8-10 ft.	1.20	1.02	1.60	1.22	1.35
810	lin. ft. 12-in. pipe, 10-12 ft.	1.40	1.55	1.75	1.36	1.35
1,400	lin. ft. 12-in. pipe, 12-14 ft.	1.70	1.74	2.00	1.75	1.35
10	lin. ft. 15-in. pipe, 0-8 ft.	1.20	1.12	1.45	1.50	2.00
280	lin. ft. 15-in. pipe, 8-10 ft.	1.40	1.34	1.50	1.65	2.00
10	lin. ft. 15-in. pipe, 10-12 ft.	1.80	1.88	1.90	1.80	2.00
10	lin. ft. 15-in. pipe, 12-14 ft.	2.40	2.11	2.25	2.30	2.00
863	lin. ft. 18-in. pipe, 0-8 ft.	1.40	1.66	1.65	1.70	1.75
857	lin. ft. 18-in. pipe, 8-10 ft.	1.80	1.66	1.85	1.85	1.75
350	lin. ft. 18-in. pipe, 10-12 ft.	2.20	2.26	2.25	2.05	1.75
10	lin. ft. 18-in. pipe, 12-14 ft.	3.00	2.49	3.00	2.50	1.75
1,600	lin. ft. 24-in. pipe, 0-8 ft.	2.00	3.33	2.30	2.70	6.00
150	lin. ft. 24-in. pipe, 8-10 ft.	2.50	3.48	2.80	2.90	6.00
440	lin. ft. 24-in. pipe, 10-12 ft.	3.00	4.16	3.10	3.10	6.00
220	lin. ft. 24-in. pipe, 12-14 ft.	4.00	5.26	3.45	3.65	6.00
100	cu. yd. extra excav. in trenches	1.00	1.00	1.00	1.00	1.00
150	manholes, D. manholes	50.00	45.00	42.00	50.00	50.00
9	special manholes	100.00	60.00	75.00	75.00	125.00
300	ft. extra depth in manholes	5.00	4.00	4.00	4.50	6.00
60	flush tanks—flush manholes	60.00	50.00	65.00	88.00	75.00
3	lampholes	20.00	36.00	10.00	12.00	75.00
1,000	ft. deep house connections	0.30	0.20	0.30	0.45	0.75
10	M ft. timber foundations	50.00	30.00	45.00	35.00	65.00
10	cu. yd. extra concrete in sewers	8.00	7.00	9.00	6.00	10.00
20	M ft. sheathing and bracing	40.00	30.00	25.00	30.00	45.00
20	cu. yd. rock excavation	5.00	0.01	6.00	5.00	5.00
750	lin. ft. timber cradle work	2.00	2.40	3.00	0.50	5.00
10	ton cast-iron pipe and specials	50.00	0.01	40.00	40.00	75.00
200	ft. ¾-in. water pipe and connections	0.50	1.00	0.40	0.30	0.50
	Disposal Works, Pump. Sta. and Outfall:					
100	cu. yd. extra excavation	1.00	1.00	2.50	2.50	2.50
3,000	lin. ft. piling work	0.30	0.30	0.30	0.30	0.30
2	M ft. timber foundations	50.00	40.00	45.00	45.00	45.00
2	M ft. extra sheeting and bracing	40.00	40.00	45.00	45.00	45.00
10	cu. yd. extra concrete	15.00	8.00	12.00	12.00	12.00
500	lb. extra steel reinforcement	0.05	0.05	0.06	0.06	0.06
2,000	cu. yd. furnishing and placing earth	0.75	0.60	0.50	0.50	0.50
2,000	cu. yd. furnishing and placing mud	0.70	0.60	0.50	0.50	0.50
2,000	cu. yd. furnishing and placing cinders	0.50	0.50	0.50	0.50	0.50
1,000	cu. yd. furnishing and plac. stone or gravel	1.00	0.60	1.50	1.50	1.50
4,000	cu. yd. furnishing and placing rock fill	2.00	2.25	1.40	1.40	1.40

New York, N. Y.—Following are unit figures of the four lowest bids opened March 30 by Douglas Mathewson, President Bronx Boro., for constructing sewers in Westchester and Blondell Avenues and property of the N. Y., N. H. & Hartford R.R., between Poplar Street and Sackett Avenue and other streets: (a) William Baker, Inc., 26 Cortlandt Street, $529,145; (b) J. C. Rodgers, Jr., 271 W. 125th Street, $593,372; (c) Oscar Daniels Co., Woolworth Building, $615,873; (d) T. A. Gillespie Co., 60 Church Street, $619,100.

	(a)	(b)	(c)	(d)
1,656 lin. ft single concrete sewer, 11 ft. x 8 ft.	$30.00	$44.00	$39.00	$32.50
1,889 lin. ft. single concrete sewer, 7 ft. 6 in. x 8 ft.	17.00	41.00	29.00	23.90
10 lin. ft. triple concrete sewer, 11 ft. x 8 ft.	80.00	100.00	114.00	87.00
45 lin. ft. double concrete sewer, 8 ft. x 6 ft. 6 in.	43.00	60.00	75.00	41.00
163 lin. ft. double concrete sewer, 7 ft. 6 in. x 8 ft.	30.00	31.00	47.50	33.20
17 lin. ft. double concrete sewer, 7 ft. 3 in. x 8 ft.	39.00	60.00	66.00	31.50
597 lin. ft. single concrete sewer, 12 ft. 9 in. x 8 ft.	40.00	44.00	55.00	34.35
100 lin. ft. single concrete sewer, 12 ft. 9 in. x 7 ft.	32.00	50.00	55.00	35.40
1,307 lin. ft. single concrete sewer, 12 ft. x 8 ft.	29.00	41.00	43.00	34.70
1,593 lin. ft. single concrete sewer, 11 ft. 3 in. x 8 ft.	29.00	29.00	42.50	35.30
772 lin. ft. single concrete sewer, 10 ft. 9 in. x 8 ft.	29.00	28.00	43.00	36.25
801 lin. ft. single concrete sewer, 9 ft. 6 in. x 8 ft.	18.00	19.00	31.00	25.00
664 lin. ft. single concrete sewer, 9 ft. 3 in. x 8 ft.	20.00	20.00	33.00	25.60
1,583 lin. ft. single concrete sewer, 7 ft. 3 in. x 8 ft.	21.00	18.00	27.00	24.10
760 lin. ft. single concrete sewer, 7 ft. 6 in. x 7 ft.	18.00	15.00	26.00	22.80
536 lin. ft. single concrete sewer, 7 ft. x 7 ft.	16.00	16.00	24.00	23.20
539 lin. ft. single concrete sewer, 4 ft. 3 in. x 5 ft.	14.00	10.00	13.50	11.30
1,388 lin. ft. single concrete sewer, 4 ft. x 4 ft. 9 in.	11.00	8.00	13.00	9.00
520 lin. ft. single concrete sewer, 3 ft. 9 in. x 4 ft. 6 in.	11.00	7.50	12.50	8.00
260 lin. ft. single concrete sewer, 3 ft. 6 in. x 4 ft. 3 in.	11.00	7.50	12.25	8.70
258 lin. ft. single concrete sewer, 3 ft. 5 in. x 4 ft.	11.00	9.00	12.25	8.00
21 lin. ft. single concrete sewer, 3 ft. 3 in.	8.00	7.00	10.00	6.60
139 lin. ft. single concrete sewer, 3 ft.	10.00	8.00	10.00	5.90
410 lin. ft. 30-in. vitr. pipe sewer	8.00	6.00	8.00	5.60
116 lin. ft. 24-in. vitr. pipe sewer	5.00	5.00	6.60	3.10
83 lin. ft. 20-in. vitr. pipe sewer	4.00	4.00	6.00	2.30
253 lin. ft. 18-in. vitr. pipe sewer	4.00	4.00	5.25	2.00
570 lin. ft. 15-in. vitr. pipe sewer	4.00	3.00	4.00	1.70
1,100 lin. ft. 12-in. vitr. pipe sewer	4.00	2.50	3.30	1.30
1,118 lin. ft. basin connections	1.50	1.50	2.60	1.30
1,150 lin. ft. 12 to 24-in. vitr. pipe drains	0.01	1.00	2.00	2.00
1,461 spurs for house connections	0.60	1.00	1.00	1.30
6,350 lin. ft. risers	1.40	1.50	1.80	1.20
123 manholes	70.00	75.00	40.00	100.00
29 receiving basins, Type B	125.00	150.00	150.00	115.00
4 receiving basins, Type C	110.00	150.00	150.00	115.00
2 inlets, Type C	50.00	26.00	25.00	30.00
51,000 cu. yd. rock excav	2.25	2.00	1.00	3.00
1,310 cu. yd. concrete, Class B	5.50	6.00	3.00	7.00
215 cu. yd. concrete, Class C	5.00	6.00	5.50	7.00
20,500 lbs. steel reinforcement bars	0.0425	0.05	0.05	0.06
75 M ft. timber sheeting	50.00	30.00	40.00	60.00
1 overflow chamber	25,000.00	25,000.00	24,000.00	18,400.00
3,325 lin. ft. guard rail	0.20	0.20	0.20	0.40
250 cu. yd. dry rubble masonry	4.00	3.00	1.50	2.30

★**Anthony, Kan.**—Contract for constructing sewerage system and sewage disposal plant awarded Ely Construction Company, Wellington. (Bids opened March 30 by W. R. Canaan, City Clerk.)

★**Omaha, Neb.**—Contracts for constructing sewers awarded by city to J. J. Hanighen Co., Omaha, for Fifty-first Street sewer at $10,213; also to James Jensen, Omaha, at $11,334 for another sewer.

★**Venice, Tex.**—Contract for constructing sewer system awarded Winslett Eldridge Co. of Dallas. Bonds issued for $10,000.

★**McMinville, Ore.**—Contract for constructing sewer system (bids opened March 21) awarded V. R. Dennis Construction Company, McMinnville, at $11,594. A. C. Chandler, City Recorder.

BRIDGES

PROPOSED WORK.

Derby, Conn.—At a recent town meeting the Selectmen were authorized to construct the Shelton Bridge at a cost of $25,000 and construct sewer and other improvements in Water Street at a cost of $15,000.

Harmon, N. Y.—Contract soon to be let by Board of Supervisors, White Plains, for reinforced-concrete bridge to be constructed over Croton River on Albany Post Road, Harmon. Estimated cost, $38,000. Charles MacDonald, Jr., County Engineer, Tarrytown.

Heuvelton, N. Y.—Concrete Steel Engineering Company, Park Row Bldg., New York, engaged to prepare plans for the concrete bridge to be constructed across Oswegatchie River, at Heuvelton, to consist of three spans 75 to 100 ft., width 40 ft. and cost $40,000. Contract on superstructure will be let about May 1 by Town Board of Ogdensburg. N. W. Mayne, village clerk.

Bethlehem, Pa.—Commissioners of Lehigh and Northampton Counties plan spending $8,000 for repairing bridge across Lehigh River, in Bethlehem. Address Clerk, Northampton County, Easton.

Huntington, Pa.—County Commissioners plan constructing several bridges this summer; one a steel bridge 70 ft. long at Dublin Mills has been approved by Water Supply Commission. Plans for second bridge in Todd Township under consideration.

Johnstown, Pa.—Plans submitted to State Water Supply Commission, Harrisburg, for a two-span reinforced concrete bridge of Luten arch type, to be constructed across Stonycreek at Central Avenue, connecting Eighth Ward with Moxam, and to replace present steel bridge; estimated cost, $62,000. J. R. Crissey, City Engineer.

Pennsylvania. — State Water Supply Commission, Harrisburg, issued following permits:

Commissioners of Allegheny County, to construct highway bridge across Lake Run, 1.2 miles south of Gascola Station, in Patton Township; a highway bridge across Little Saw Mill Run, ¼ mile north of Banksville, Union Township; a highway bridge across Spring Garden Run, on Spring Garden Avenue, between Spring Garden Borough and Reserve Township; a highway bridge across Blue Run, 1 mile east of Dorseyville, Indiana Township, Allegheny County; highway bridge across Gourdhead Run, at Duncan Avenue, in Allison Park, Hampton Township.

Baltimore & Ohio R.R. Co., to change channel of Wilson Creek and its left branch, 5 and 6 miles from Rockwood, Somerset County; bridge across an unnamed tributary of George Creek, 1.8 miles southwest of Smithfield Station, Fayette County; bridge across Georges Creek, 1.6 miles southwest of Smithfield Station, in Fayette County; two trestle bridges across Wilson Creek and the right branch of same, 1½ and 2¼ miles above mouth of stream, about 2 miles north of Rockwood, Somerset County.

Supervisors of Greenwood Township, Clearfield County, to construct a bridge across Curry Run, ¾ mile west of Curry Run Station.

Commissioners of Blair County, to construct a reinforced concrete arch bridge across Little Juniata River, at a point near Hensheytown, in Antis Township; bridge across Sugar Run, near intake of Altoona City water main, in Allegheny Township.

Johnstown & Stony Creek R.R. Co., to construct a timber retaining wall and cinder fill along the channel line of Stony Creek, 14,000 ft. above its mouth in the Conemaugh River, in Johnstown.

Pennsylvania R.R. Co., to construct bridge over Spring Creek, 1200 ft. above its mouth, in Swatara Township, Dauphin County; make fill along the south bank of Buffalo Creek, approximately 3.8 miles northwest of mouth of said creek, west of Monroe, Buffalo Township, Butler County; construct bridge across Sloan's (or Haye's) Run, 2862 ft. southwest of Mosgrove Station, Rayburn Township, Armstrong County; change channel of Big Puckette Creek, about 3.4 miles east of junction with Allegheny River, at East Parnassus, in Lower Burrell Township, Westmoreland County, and Plum Township, Allegheny County.

Jones & Laughlin Steel Co. and Monongahela Connecting R.R. Co., to make a fill along the left bank of the Monongahela River, from a point 380 ft. north of South Thirty-fourth Street, to a point 1564 ft. south of the line between Pittsburgh and the Borough of St. Clair, Allegheny County.

Kramer & Rishel, to change course of and construct bridge over Naylor Creek, at Highland Park, Drexel Hill, Upper Darby Township, Delaware County.

East Broad Top R.R. & Coal Co., construct a bridge across (Great) Trough Creek, about ⅓ mile south of Huntingdon-Fulton County line, in Fulton County.

Pittsburgh Railways Co., construct pipe culvert over an unnamed stream, under Duquesne Viaduct No. 1, a short distance above mouth of stream, in Borough of Whitaker, Allegheny County.

Philadelphia & Reading Ry. Co., lessor of the Wilmington & Northern R.R. Co., to construct temporary falsework at their bridge across the Schuylkill River, 3200 ft. south of Cumru Junction, in Cumru Township, Berks County.

Pittsburgh & Lake Erie R.R. Co., to make a fill along the right bank of the Monongahela River, from 0.2 mile below Fayette City to 2.5 miles above same, in Fayette County.

Supervisors of North Annville Township, Lebanon County, to construct a bridge ¾ mile northwest of Annville Township line, in North Annville Township.

Commissioners of Chester County, to construct stone arch bridge across Broad Run, on the Strasburg Road, in West Bradford Township; a bridge across Beaver Creek, at Edges Mill, Cain Township; bridge over Chester Creek, near Duff's Mill, in East Goshen Township.

Supervisors of Amwell Township, Washington County, construct a bridge across Swort Branch of Tenmile Creek, 1 mile south of Amity.

Commissioners of Berks County, bridge across Tention Creek, 0.5 mile south of Lobacksville, in Pike Township.

Spring City, Pa.—Commissioners of Chester and Montgomery County planning to construct jointly a bridge across Schuylkill River between Spring City and Royersfork. Address County Clerk.

Maryland.—See "Paving and Roads.

Washington, D. C.—Secretary of War Dept. and Gen. William M. Black, Ch. Engr. of Army, Washington, D. C., indorsed general plan for monumental memorial bridge to be constructed across Potomac River from a point near Lincoln memorial in Potomac Park to United States reservation at Arlington, Va., as prepared by William H. Burr, in 1900. It is recommended that because of increase in cost of materials, cost of structure be increased from $4,860,000 to $6,000,000.

Ft. Lauderdale, Fla.—See "Paving and Roads."

Akron, Ohio.—Reported Northern Ohio Traction & Light Co. (B. L. Luke, Ch. Engr. Cuyahoga Falls), Pennsylvania R. R. and Baltimore & Ohio Ry. plan to build a viaduct from north end of North Main St. over Little Cuyahoga River valley to North hill as shorter route to Cuyahoga Falls. Estimated cost $1,000,000.

Anderson, Ind.—John Mueller, Newcastle, engaged as engineer for bridge over White River, at Ninth Street, to be constructed next year by County Commissioners, probably a 3 or 4 span structure.

New Trenton, Ind.—A three-span steel truss bridge, each span 170 ft., is to be constructed across Whitewater River at cost of $35,000. Address John U. Mueller, Consulting Engineer, New Castle.

Richmond, Ind.—John U. Mueller, Colonial Bldg., New Castle, is engineer for South G Street Bridge, estimated to cost $120,000.

Belleville, Ill.—See "Hydraulic Constructing and River Improvements."

Blanchard, Iowa.—County Commissioners at Clarinda will construct two bridges steel with concrete floor and concrete piers across Tarkios River, one at Cain and the other at Blanchard; I. H. Taggart, County Engineer; cost $5,000 each.

Des Moines, Iowa.—Plans completed for viaduct 300 ft. long, 60 ft. wide, to be constructed over Court Avenue, between E. Tenth and Eleventh Streets.

Keokuk, Iowa.—City Engineer directed to prepare plans for a concrete bridge to replace present Second Street bridge; cost $10,000.

Duluth, Minn.—City Council appropriated $9,000 for constructing concrete bridge over Tischer's Creek. L. Ayres, City Engineer.

Little Rock, Ark.—See "Electric Railways."

Spokane, Wash.—Special election will be held about middle of May to vote on $300,000 bonds for constructing city bridges. Address City Clerk.

Portland, Ore.—See "Railroads."

Oakland, Cal.—Col. Thomas Rees, United States Engineer of Rivers and Harbors for this coast has approved plans drawn by an association of bridge engineers for bridge connecting foot of Adeline Street, Oakland, with San Franciaco in vicinity of Third and Townsend Streets. Estimated cost $20,000,000. Address Secy. Chamber of Commerce.

San Diego, Cal.—Election to be held May 16 to vote bonds for following improvements: Repair and construction of roads, $500,000 (damaged by recent floods); construction of bridges, $400,000; construction of road on route of State Highway, $75,000 (the State has agreed to take over this approximate 60 miles of road and to maintain same); construct a concrete pavement, $1,126,000 (constitutes 38 miles inside incorporated cities on main road and 98.4 miles in county outside city); constructing two hospital buildings, $100,000. Fred Grumm, Deputy County Surveyor.

BIDS DESIRED.

Maine—See "Paving and Roads."

Bridgeport, Conn.—Until May 6 by Board Contract & Supply for constructing substructure, superstructure and approaches for Grand Street Bridge over Pequonock River, advertised in Engineering Record. J. B. Strauss, Consulting Engineer, Chicago, Ill.

Reading, Pa.—Until April 25, by County Commissioners (Harry D. Matthew, Chmn.) for constructing Brecknock Bridge over Allegheny Creek, reinforced concrete girder, of two spans, 30 ft. each, with roadway of 18 ft., in Brecknock Township. Also, same time and place, separate bids for Brown's Bridge over Trenton Creek, a reinforced concrete girder of 2 spans, each 30 ft., with 18-ft. roadway, in Pike Township.

Summersville, W. Va.—Until May 9, by P. N. Wiseman, County Clerk, for constructing 2 bridges, one across Birch River and one across Muddlity Creek.

Richmond, Ind.—Until April 22, by County Commissioners, for iron bridge over Nettle Creek, and concrete bridge 5 miles northwest of Cambridge City. Address County Surveyor.

Crookston, Minn. — Reported desired until April 25 for constructing bridges and culverts as follows: No. 2108, 30 ft., steel; No. 2109, 30 ft., steel; No. 2193, 23 ft. long, steel and concrete, and a number of small bridges throughout the county. H. J. Welte, Co. Aud.

Eagle Bend, Minn.—Alternate bids desired until May 1 by A. R. Tuller, Village Recorder, for bridge over Eagle Creek, Wykeman Township, to be either 40 ft. steel truss span, 18-ft. roadway, or two 20-ft. concrete slab spans, 18-ft. roadway. S. Rex Green, Highway Engr., Wadena.

Emporia, Kan.—Reported desired until Apr. 21 by H. A. Osborn, Co. Clk., for constructing following bridges: One across Neoaho River, cost $7,000, and one across Duff Creek, $3,800.

Manhattan, Kan.—Until May 9, by County Commissioner, Manhattan, for constructing following bridges: Randolph bridge, Randolph, a 260-ft. steel span, 16-ft. roadway, on concrete piers; Stockdale bridge, Stockdale, a 260-ft. span, 16-ft. roadway, on concrete piers, one concrete pier to be built at Garrison Bridge, Garrison. Total cost about $40,000.

Buffalo, Okla.—Until May 1, by E. S. Hubbard, County Clerk, for constructing five concrete bridges and one steel bridge with concrete abutments. C. W. Simonds, County Engineer.

Concrete, Wash.—Reported desired until May 2, by W. V. Alexander, Co. Aud., Mt. Vernon, for constructing a 186-ft. span concrete 18-ft. roadway, 31 ft. rise, over Baker River at Concrete. J. W. Bowerman, Mutual Life Bldg., Seattle, Consulting Engr. Probable cost, $20,000. A. L. Strong, Co. Engr.

Los Angeles, Cal.—Until May 1, by Board Supervisors (H. J. Lelande, Clk.), for furnishing material and constructing bridge over Ballona Creek on Mesa Drive Extension.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Watertown, N. Y.—Following are four lowest bids opened April 1 by city for constructing bridge across Black River: Di Menna & De Paola, 391 E. 149th Street, New York, $19,947; Morrison & Quinn, Rochester, $23,085; Lou B. Cleveland, Watertown, $23,473, and Foster Construction Co., Newark, N. J., $24,645. E. W. Sayles, City Engineer.

Camden, N. J.—Following are bids submitted April 10 to Board of Chosen Freeholders for constructing concrete bridge 66 ft. wide on White Horse Pike across Newton Creek, between West Collingswood and Oaklyn: Rees & Taylor, 144 East State Street, Trenton, $17,510; P. A. Hennessy, $14,672; Suburban Engineering Co., 15 West Thirty-eighth Street, New York, $15,625; Whittaker & Diehl, Harrisburg, Pa., $19,354; Integrity Construction Co., $14,173. J. J. Albertson, County Engineer.

★Freehold, N. J.—Contracts awarded by Board of Chosen Freeholders as follows (bids opened April 5): For constructing reinforced concrete bridge and approaches over Wreck Pond, Ocean Boulevard between Spring Lake and Sea Girt, to Owen J. Melee, Long Branch, at $22,000, and bridge at Bergens Mills cut-off on Freehold-Hightstown Road, to Monmouth Contracting Co., Red Bank, at $5,480, and at 45 cents per lineal foot for piling. George D. Cooper, County Engineer, Red Bank.

Monmouth Contracting Co., Red Bank, submitted lowest bid same time and place as above for making earth fill at Matawan Creek Bridge on Keyport-South Amboy Road, at $5,241.

★Albany, Ga.—Contract awarded by County Commissioners for constructing steel bridge 214 ft. long across Kinchafoone Creek on Dixie Highway to Southern Bridge Co., Birmingham, Ala., at $8,293.

★Hamilton, Ohio.—Contract awarded by County Commissioners for constructing Columbia bridge, steel and reinforced concrete, 720 ft. long, 34.5 ft. wide, at Wood Street, to A. J. Yawger, 450 North Belmont Street, Indianapolis, Ind., at $117,463.

Chicago, Ill.—Following are bids opened April 6 by Trustees Sanitary District of Chicago for double-track bridge at crossing of Chicago & Joliet Electric Ry. over Calumet Sag Channel at Lambert Station in Township of Lamont: (a) alternative one; (b) alternative two; (c) alternative three. Prices given are, respectively, furnishing, fabrication and delivery of all metal work for superstructure (lump sum); additional structural steel per lb., and additional iron castings per lb. Morava Construction Company, West 85th Street and Stewart Avenue (a), (b) and (c) the same: $6,345; .038 cts.; .025 cts; King Bridge Company, Cleveland, Ohio (c), $6,450 .04 cts., .055 cts; Chicago Bridge & Iron Company, 105th and Throop Streets (a), $7,400, 5 cts., 6 cts., (b) $7,300, 5 cts. and 6 cts.; (c) $7,200, .05 and .06 cts. Milwaukee Bridge Company, Milwaukee, Wis. (a), $7,680; .048, .055, (b) $7,400, .046, .055, (c) $6,640, .042, .055.

★Lincoln, Ill.—Bridge Committee of Bd. of Supervisors awarded contract to Decatur Bridge Co., Decatur, for constructing 7 steel and concrete bridges in county at $14,195.

★Atchison, Kan.—Contract awarded Lincoln Construction Company, Lincoln, for constructing 13 county bridges, at $11,578.

★Concordia, Kan.—Contract awarded by County Commissioners April 6 for 12 reinforced concrete bridges to the Western Bridge Co., Harrisonville, Mo., for $19,468. Bridges from 20 ft. to 70 ft. spans.

★Lakin, Kan.—Contract awarded by County Commissioners April 6 for constructing a concrete bridge across Arkansas River near Lakin, to Elkhorn Construction Co., Lincoln, Neb., for $24,900, consisting of 16 32-ft. girder spans, reinforced concrete.

★Austin, Tex.—Contract awarded by City Engineer for constructing reinforced concrete bridge to replace iron bridge over Shoal Creek at Twelfth Street to McCall-Moore Co., Waco; estimated cost $9,175.

★Littleton, Colo.—Contract awarded Levy Construction Co., Denver, for constructing 63-ft. truss bridge with concrete floors and 60-ft. reinforced concrete arch over Sandy Creek, south of Littleton. Theodore Taylor, County Clerk.

★Acme, N. M.—Contract for constructing bridge over Pecos River (bids opened April 3), awarded by Co. Commissioners to Midland Bridge Co., Kansas City, Mo., at $13,450.

★Okanogan, Wash.—Contract awarded by County Commissioners for construction of steel bridge at Riverside to Illinois Steel Co., 208 South La Salle Street, Chicago, Ill., at $10,995. (Bids opened April 4.)

★Santa Barbara, Cal. — Contracts awarded by Board of Supervisors as follows to A. A. Patterson, Santa Maria, for constructing bridges: Concrete bridge across Zaca Creek at Station 165 + 75, at $7,650; concrete girder bridge across San Antonio Creek at Station 382 + 60, at $4,731, and concrete girder bridge across San Antonio Creek at Station 399 + 25, at $4,790.

PAVING AND ROADS

PROPOSED WORK.

Amesbury, Mass.—Town Council voted to appropriate $15,000 for improving Elm Street. Address Town Clerk.

Boston, Mass.—Assembly passed bill providing $835,000 for repairing and reconstructing of streets of Boston.

Lowell, Mass.—City has appropriated $50,000 for paving several of the principal streets. Address Supt. of Highways.

Lynn, Mass.—City Council sold $100,000 street paving bonds. Address City Clerk.

Massachusetts. — Massachusetts Highway Commission, Boston, will construct about four miles of pavement on Washington Street, from Assinippi to Four Corners, in Hanover, costing $12,000 per mile.

Rhode Island—House Finance Committee, Providence, passed resolution to submit to people bond issue of $300,000 for repair and construction of state bridges and $38,500 for laying granolithic sidewalks, wooden block pavement on Washington Square, and a portion of Touro Street, and making additions and repairs to city's buildings on city wharf.

Derby, Conn.—Citizens at town meeting voted in favor of a $25,000 bond issue for constructing walks on the proposed Huntington Bridge; also $10,500 for grading Water Street.

Buffalo, N. Y.—City Council authorized repaving portions of Broadway with German Rock Company's standard asphalt, Spec. "B.," on concrete base and Jefferson Street, with standard asphalt as specified, .Spec. "B" on concrete base. Address City Clerk.

Canton, N. Y.—Town Board appropriated $12,125 for improving roads. Address Town Clerk.

Cape Vincent, N. Y.—Town Board plans spending $10,101 this summer for roads. Address Town Clerk.

Long Island City, L. I., N. Y.—Maurice Connolly, Borough President, plans spending $150,000 for road improvements.

Newfane, N. Y.—Town Board plans improving number of roads this spring. About $9,000 available this year for highway repairs.

Whitney Point, N. Y.—Citizens voted $18,000 bonds for paving Main Street with brick and widening Collins Street.

Camden, N. J.—It is proposed to pave about 12,000 sq. yd. on Haddon Avenue from Federal to Lime Streets with belgian block between tracks and asphalt shoulders. Belgian block will be done by Public Service Company and asphalt resurfacing by city. A. L. Sayers, Street Commissioner.

Collinswood, N. J.—Council approved two bond issues, aggregating $142,000, for paving Haddon Avenue, and repairs to other streets and to pay for proposed library site. Election will soon be held.

Mount Holly, N. J.—James Logan, County Engineer, is preparing plans for an 18 ft. wide water bound macadam road with bituminous surface from Mt. Holly to Lumberton, 6,000 ft. long, estimated to cost $13,000. Board of Freeholders have $150,000 available for road repairs.

Newark, N. J.—Board of Chosen Freeholders recommended improving Springfield, Bloomfield and South Orange Avenues, as well as a number of other thoroughfares. Address County Clerk.

Trenton, N. J.—Contract soon to be let for paving costing about $100,000. Address City Engineer.

County Board of Freeholders considering paving with some hard surface material Lincoln Highway between Lawrenceville and Princeton.

Altoona, Pa.—Council passed ordinances calling for paving 60 blocks. J. W. Shields, City Engineer.

Haverford, Pa. — Commissioners of Haverford Township propose construcing roads at a cost of $48,000.

Homestead, Pa.—County Commissioners at Pittsburgh and West Homestead Council plan improving Eighth Avenue, to Pittsburgh city line. This will provide a boulevard to downtown section of south side, and give good outlet to Homestead.

Johnstown, Pa.—County Commissioners and the State Highway Commissioner at Harrisburg have decided to construct several miles of concrete, brick surface road between Munday's and Johnstown, costing approximately $140,000.

Lebanon, Pa.—Council decided to survey a new sewer section and pave portions of Seventh, Lehman and Eighth Streets. Address City Clerk.

Montoursville, Pa.—Election to be held May 16 to vote $30,000 bonds to construct paving with state aid and build necessary sewers.

Penbrook, Pa.—Council agrees to pave Main Street at a cost of $26,861, cost to be shared by State, Harrisburg Railway Co. and Borough. B. F. Ober, Chairman Highway Committee.

Pennsylvania—State Highway Department, Harrisburg, completing plans for improving 7¼ miles of state road between Bridgeville and Canonsburg. Surface of road will be concrete except on extreme grades where brick paving will be used. Estimated cost $135,000. R. J. Cunningham, State Highway Commissionee.r

West Reading, Pa.—U. H. Dehart of Reading is engineer for paving Penn Avenue, for which citizens recently voted $35,000 bonds.

West Reading, Pa.—Contract will be let about June for paving Penn Avenue with brick on concrete foundation at about $23,000. Address City Clerk.

Williamsport, Pa.—About $15,000 will be spent in paving. George K. Harris, Supt. Public Improvements, Williamsport.

Baltimore, Md.—County Commissioners plan improving 2 miles of White House Road in Fifth District. Address County Clerk.

Centerville, Md.—Governor signed bill authorizing bond issue for roads in Queen Anne County.

Maryland.—Bills passed by Legislature for following improvements:

Authorizing Commissioners Montgomery County (Rockville county seat) to issue $40,000 bonds for constructing a road from Laytonsville to Gaithersburg; $15,000 for improving road between Darnestown and Seneca Mill, distance 3½ miles, and $25,000 for constructing Muncaster's Mill Road, leading from Norbeck; $15,000 for improving Dickerson-Martinsburg Road; $20,000 for constructing Poolesville Road from state road at Dawsonville to Poolesville, distance 4 miles; $15,000 for constructing public road from end of improved road at Old Germantown to State Road near Seneca Creek; $25,000 for constructing public road leading from Germantown to Dawsonville, distance 3½ miles.

Authorizing Mayor and Commissioners of Westernport to issue $20,000 bonds for improving water works and installing sewers.

Authorizing Commissioners of Queen Anne's County (Centerville county seat) to issue $60,000 bonds for improving roads, constructing bridges and culverts.

Authorizing Commissioners of Cecil County (Elkton county seat) to issue $100,000 bonds for road improvements; also $60,000 bonds for reconstructing courthouse.

Authorizing Common Council of Mount Rainier to issue $100,000 bonds for constructing water works and sewerage system.

Authorizing Potomac River & Baltimore Ry Co. and Washington, Newport News Short Line to construct a bridge over Potomac River at Riverside, in Charles County.

Authorizing Mayor and Council of Grantsville to issue $15,000 bonds for constructing water works and sewerage system.

Authorizing Commissioners of Wicomico County (Salisbury, county seat) to issue $112,000 bonds for additions and improvements to schools, constructing 2 lift bridges on south prong of Wicomico River in Salisbury at South Division and Camden Streets; also building bridges on north prong of Wicomico River in Salisbury and at Wetipquin Creek in Tyaskin District in Wicomico County; also for state aid roads in said county.

Authorizing Commissioners of Talbot County (Easton county seat) to issue $70,000 bonds for road and bridge improvements.

Authorizing Commissioners of Howard County (Ellicott City, county seat) to issue $10,000 bonds for constructing roads.

Authorizing an appropriation of $20,000 to be expended by State Roads Commission, 601 Garrett Building, Baltimore, for constructing a draw bridge to connect St. George's Island, St. Mary's County, with the mainland.

Authorizing Atlantic Realty Co. to construct a draw bridge over Sinepuxtent Bay, in Worcester County, with consent of County Commissioners, at Snow Hill; also directing the State Roads Commission, 601 Garrett Building, Baltimore, to build a bridge over Sinepuxtent Bay, in Worcester County, from mainland to Ocean City.

Authorizing Commissioners of Garrett County (Oakland county seat) to issue $30,000 bonds for erecting a high school in Oakland.

Authorizing construction of sewers, sewerage systems and sanitation in Baltimore County (Towson, county seat).

Rockville, Md.—Governor signed bill authorizing bond issue for road improvements in Montgomery County.

Accomac, Va.—Paving bonds for $10,000 will be sold April 25 by John D. Grant, Jr., Clk. Board County Supervisors.

New Cumberland, W. Va.—Citizens of Poe District voted $50,000 road improvement bonds. Address Clerk, Poe District, New Cumberland.

West Virginia.—Following districts have voted road bonds: West Union District, Doddridge County, $200,000 bonds; to be sold April 28 by Hiram Hutson, Clerk County Court, West Union.

Leadsville District, Randolph County, $220,000. Address Thaddeus Pritt, Clerk County Court, Elkins, W. Va.

Kingwood District, Preston County, $164,000. E. C. Everly, Clerk County Court, Kingwood.

Summers County, $170,000. Address J. M. Garden, Clerk County Court, Hinton.

Jane Lew, Lewis County, $15,000. George B. Waggoner, County Recorder, Jane Lew.

Poe District, Hancock County, $50,000. R. R. Hobbs, Clerk County Court, Chester.

Atlanta, Ga.—Board of Aldermen passed ordinance authorizing paving with asphalt portion of Highland Avenue. Address City Clerk.

Leesburg, Ga.—See "Public Buildings."

Florida—State Road Department, Tallahassee, will engage engineer to have charge of proposed roadwork for ensuing year.

Ft. Lauderdale, Fla.—Citizens voted $170,000 road and bridge bonds for District No. 2. Address County Clerk.

Panama City, Fla.—See "Hydraulic and River Improvements."

Sebring, Fla.—Election to be held May 12 to vote on paving Lake River Drive and other streets, at a cost of $50,000. George H. Dalgety, City Clerk.

Montgomery, Ala.—About $10,000 additional road contracts to be let by county. T. H. Edwards, County Engineer.

Birmingham, Ala.—County Engineer George H. Clark and Government Engineer W. W. Crossland preparing plans for Warrior River Highway.

Chattanooga, Tenn.—City Council plans paving Oak Street with asphalt; Long Street with concrete, and Whiteside Street with asphalt laid over present brick paving. Address City Clerk.

Edmonton, Ky.—Citizens March 25 voted $30,000 bonds for bridge and paving work in the county. Address County Court Clerk.

Frankfort, Ky.—City Council plans improving with Kentucky rock asphalt or brick on concrete foundation Holmes Street. Address City Clerk.

Georgetown, Ky.—On recommendation of Scott County Good Roads Association the Fiscal Court decided to construct 56 miles inter-county seat roads as follows: 14 miles Cincinati and Georgetown connecting Grant and Scott Counties; 9 miles Paris turn pike, 4 miles Lexington Pike, 9 miles Frankfort Pike, 6 miles Owenton and Stamping Ground Pikes, 6 miles Payne's Depot Pike, 8 miles Oxford Pike connecting Georgetown and Cynthiana. Address County Clerk.

Lagrange, Ky.—Road and bridge bonds for $35,000 reported to be sold April 15 by Fiscal Court of Oldham County. (W. D. Pinkston, Clerk.)

Owensboro, Ky.—Road bonds for $600,000 will be sold on May 1 by Daviess County Fiscal Court.

Somerset, Ky.—County Commissioners sold $300,000 road bonds. Address County Clerk.

Akron, Ohio.—County Commissioners issued $144,000 road bonds. Address County Clerk.

Canton, Ohio.—County Commissioners plan paving one mile of road from city's limits to Whipple Road. Either brick or macadam will be used. Address County Clerk.

Chillicothe, Ohio.—Contract soon to be let by Harry J. Siegfried, Director Public Service, for paving Western Avenue at an estimated cost of $17,500.

Cincinnati, Ohio.—County Commissioners approved estimates prepared by County Surveyor William Boeh for repairing Three Mile Road at $9,200; Taylor Creek Road, $11,851, and Cilley Road, in Miami Township, $10,000.

County Commissioners approved estimate of $11,850 submitted by County Surveyor William Boeh as cost of Wesselmann Road from Harrison Pike to Fagaly Road and ordered him to proceed with the plans. He was also ordered to prepare an estimate of the cost of improving with bituminous macadam and brick that portion of Springfield Pike which is to be used as part of the Dixie Highway.

Commissioners considering estimate of $10,000 submitted as the cost of improving Chilley Road and $9,000 for improvement of Three-Mile Road.

Cleveland Heights, Ohio.—Contract will be let about September for paving with brick or asphalt on Clarion, East Fairfax and other streets at a cost of $25,000. F. A. Pease, Engineer, Marshall Boulevard, Cleveland.

Findlay, Ohio.—U. K. Stringfellow, City Engineer, submitted to City Council estimates for paving Putnam Street, as follows: Brick, $15,570; wood block, $18,769; concrete, $13,319. Address City Clerk.

Fremont, Ohio.—It is proposed to pave about 34,000 sq. yds. with brick, including Hazel, Carbon, Franklin and other streets, at a cost of $86,000, including 19,000 lin. ft. sandstone curbing. Contract will be let about June. George W. Lesher, City Engineer; Jacob Gabel, Director Service.

Jefferson, Ohio.—Paving bonds for $122,000 will be sold May 1 by Board County Commissioners (B. E. Brainard, Clerk).

Mount Gilead, Ohio.—Paving bonds for $63,000 will be sold April 28 by County Commissioners. C. O. Higgins, Co. Aud.

Napoleon, Ohio.—County Commissioners sold $29,000 bonds for improving Harrison and Flatrock Townships roads. Address County Clerk.

Ohio.—Clinton Cowen, State Highway Commissioner, Columbus, states that approximately $2,600,000 will be distributed this year to various counties for roads.

Royalton (P. O. Breckville), Ohio.—Road bonds for $11,968 will be sold April 29 by S. W. Thomas, Clk.

Toledo, Ohio.—See "Miscellaneous."

Utica, Ohio.—City Council sold $22,561 paving bonds. Address City Clerk.

Cannelton, Ind.—Contract to be let in May for 70,000 ft. of concrete walks, all 5 ft. wide. Address City Clerk.

Elkhart, Ind.—City Engineer petitioned Board for Street Improvements to pave portions of Arcade Avenue, Sherman and other streets, costing $18,000. Address City Clerk.

Ft. Wayne, Ind.—County Commissioners sold $10,000 bonds for constructing stone roads. Address County Auditor.

Goshen, Ind.—County Commissioners sold $43,500 highway improvement bonds. Address County Auditor.

Indianapolis, Ind.—Board Public Works approved plans for paving portions of Southeastern Avenue and East Michigan Street at $21,000 and $44,000 respectively. Address City Clerk.

Richmond, Ind.—About 11 miles of concrete roads will be built in this county; contract to be let about July 1. Address L. C. Peacock, County Engineer.

South Bend, Ind.—Board Public Works passed resolution for paving Eddy Street and Mishawaka Avenue. Estimated cost $150,000. Address City Clerk.

Versailles, Ind.—County Commissioners sold $27,800 highway improvement bonds. Address County Clerk.

Vincennes, Ind.—Contract soon to be let for paving with asphalt about 3 miles of streets, including Church, Vigo and other streets, at a cost of $50,000. H. T. Watts, Engineer, Vincennes.

Winchester, Ind.—Contracts soon to be let by County Commissioners for following road work: After May 15 for 7 miles plain macadam; after June 15 for 2 miles monolithic brick.

Battle Creek, Mich.—See "Sewerage and Sewage Disposal."

Marquette, Mich.—About 15,000 sq. yd. of penetration macadam is to be laid by city. Address City Engineer.

Saginaw, Mich.—City Engineer estimates cost of paving portions of Seventh Street from Janes Avenue to Burt Street at $10,490; Washington Avenue from Tuscola Street to Janes Avenue $22,218 and State Street from Michigan Avenue to Bond Street at $22,445.

Belleville, Ill.—Local improvement issue for $319,000 to be used to build hard roads in this city has been confirmed by the court. Another protest made, but work is to start. W. S. Wolf, City Engr.

About 20 miles of State Aid Roads will be improved this year. Constructing of grading, drainage and bridges. D. O. Thomas, Co. Highway Supt.

An election may be held next fall on a $1,500,000 bond issue for road improvements in the county. D. O. Thomas, Co. Highway Supt.

East St. Louis, Ill.—Plans for paving State Street from Thirty-sixth to Eighty-ninth Street, about 3.6 miles, estimated cost $350,000, approved. Address City Clerk.

Appleton, Wis.—Citizens voted $700,000 bonds for constructing good roads. Address County Clerk.

Mason City, Iowa.—The North Iowa Pike Assoc. at Mason City decided to extend the highway from Sioux Falls, N. D., its present western terminus, northwest, to connect in the northern part of South Dakota with the National Parks highway from Minneapolis to Seattle.

Pocahontas, Iowa.—County is planning letting contract for about 25 miles of grading, consisting of approximately 80,000 cu. yd. of earthwork. A. L. Thornton, County Engineer, preparing plans, which will be ready about May 1.

Storm Lake, Iowa.—Contract will be let about May 1 by city for 40,000 sq. yds. to 50,000 sq. yds. paving and 15,000 lin. ft. concrete curb and gutter. J. E. Boland, City Solicitor.

Duluth, Minn.—Twenty-first Avenue, E., is to be paved at cost of about $10,227. L. Ayres, City Engineer.

Minneapolis, Minn.—County Commissioners considering a $2,000,000 bond issue for constructing permanent highways in rural sections. Address County Clerk.

Beatrice, Neb.—Contract will be let probably in May for constructing 26 blocks of paving on concrete foundation on North Tenth and North Thirteenth Streets. Election will be held on matter soon. H. M. Garrett, City Clerk.

Fremont, Neb.—Citizens voted $40,000 bonds to pave intersections. Address City Clerk.

Omaha, Neb.—Election to be held in Douglas County to vote $1,750,000 bonds for improving Lincoln Highway in Nebraska, to pave roads in Elkhorn, Waterloo, and into valley from Omaha, a distance of 25 miles. In addition, other roads in the county will be paved. Brick or macadam will be used.

Minot, N. D.—City Commissioners ordered plans and specifications for 25,000 sq. yd. of paving in business and residential sections. E. J. Thomas, City Engineer.

Billings, Mont.—Commissioners of Yellowstone County have appointed R. H. Murray, 322 Stapleton Building, Billings, Engineer-in-Chief, and John Edy, Asst. City Engineer, Billings, Chief Assistant in the construction of 47 miles of gravel highway across Yellowstone County.

Great Falls, Mont.—L. B. Everson, City Engineer, is preparing plans for constructing concrete sidewalks on Fourth, Fifth, Seventh, Ninth and Tenth Streets.

Alton, Mo.—Reported citizens of Koshkonong Special Road District voted $10,000 bonds for improving roads. Address Clerk Koshkonong District, Albion.

Missouri. — Citizens voted road improvements bonds as follows: Miller Special Road Dist., $30,000. Address Lawrence County Highway Engineer at Mt. Vernon. Seymour Special Road Dist., $30,000. Address R. C. Rhodes, Pres. Board, Seymour. Mt. Vernon Special Road Dist., $50,000. Address Lawrence County Highway Engineer at Mt. Vernon. Marionville Special Road Dist., $40,000. Address Pres. of Board, Marionville. Billings Special Road Dist, $30,000. Address Pres. of Board, Billings.

Ft. Smith, Ark.—It is proposed to pave 12,000 sq. yds. with asphaltic concrete on North Sixth Street. Cost $12,000. W. H. Evans, City Engineer.

Little Rock, Ark.—Contract soon to be let by city for paving portions of Ridgeway Street, District 246—Twenty-fourth, Twenty-sixth, Twenty-seventh, Fifteenth and Fourteenth Streets. It is estimated that about $500,000 will be spent on paving this season. C. Levinson, City Engineer.

Athens, Texas.—Attorney General at Austin approved $100,000 bond issue of Henderson County Road Dist. No. 1.

Bonham, Texas.—Attorney General at Austin approved $250,000 road bond issue for Fannin County Road Improvement Dist. No. 4.

Boston, Texas.—Commissioners Court appropriated $81,000 for highway extension work in Bowie County. Work to begin soon.

Georgetown, Texas.—Reported citizens of Hutton Precinct voted $50,000 bonds for macadamizing about 16 miles. Address Clerk Hutton Precinct, Georgetown.

Houston, Texas.—See "Miscellaneous."

Mineral Wells, Texas.—Attorney-General at Austin approved $10,500 street improvement bonds.

Orange, Tex.—County Commissioners approved $40,000 road and bridge bonds for special road district No. 2, precinct No. 1.

Texas.—It is proposed to construct the Diamond Loup Highway connecting cities of San Antonio, Corpus Christi, Brownsville and Laredo. Starr County (Riogrande, C. H.), has voted $60,000 bonds for building the highway through that county, and in other counties elections will be held soon, including April 21 in Port Aransas, Nueces County, to vote $10,000 bonds for building 14 miles between Port Aransas and Padre Island, and April 22 in Hidalgo County (Edwinburg, Court House), $250,000 bonds for the highway through that county; election soon in Nueces County (Corpus Christi, C. H.), to build highway from Corpus Christi to Flour Bluff, 12 miles; then a causeway across Corpus Christi drive a distance of 3 miles to Padre Island. Within two months an election to be held in Brooks County (Falfurrias, C.H.), to vote $200,000 bonds for highway through said county.

Centralia, Wash.—City Council has approved ordinance for street paving and construction of cement sidewalks in north part of city. Estimated cost, $13,000. C. W. Anderson, City Engineer.

Enumclaw, Wash.—City Council authorized paving of Griffin and Myrtle Avenues and Well and Cole Streets. W. I. Lippard, City Engineer.

Mt. Vernon, Wash. — City Council passed ordinance for paving and constructing 5 ft. concrete sidewalks on portions of Broadway, Second and other streets. One course 6-in. concrete pavement, 24 ft. wide will be laid. John W. Meehan, City Engineer.

Seattle, Wash.—State Highway Commission, Olympia, has approved plans for paving 5 miles of Bothell-Woodinville-Snohomish County line road with either monolithic brick, one course concrete, or No. 2 brick on 5-in. concrete base and 2 miles of Auburn-Enumclaw highway with concrete. Estimated cost, $100,000. Contract will soon be awarded by King County Commissioners. A. P. Denton, County Engineer.

City Council plans paving portions of First and Warren Avenues; cost, $44,591. Address City Clerk.

Board Public Works approved plans prepared by C. B. Bagley, City Engineer, for paving East Marginal Way; cost $150,000 and alley, Block 28—A. A. Denny's Addition, $20,000.

A. P. Denton, County Engineer, completed plans for grading and graveling 7.7 miles of Bond Road No. 9, between Franklin and Black Diamond, at $60,000, and for grading, clearing, etc., Mercer Island Road, at $9,000. Byron Phelps, County Auditor.

Walla Walla, Wash.—City Council passed ordinance for hard surfacing portions of Howard and other streets. Pavement will be 28 ft. wide. Contract soon to be let. W. R. Rehorn, City Engineer.

McMinnville, Ore.—City Council plans paving 25 blocks with either asphalt or cement. Address City Clerk.

Myrtle Point, Ore.—City Council plans paving 20 blocks this summer. Paving will be from 20 to 40 ft. wide. Contract will soon be awarded. Address City Clerk.

Fowler, Cal.—C. P. Jenson, Fresno, engaged by Town Trustees to prepare plans and specifications for 1⅛ miles of paved streets.

Fresno, Cal.—W. S. Farley, County Highway Engineer, has recommended the construction of about 325 miles of paved roads in the county at an approximate cost of $3,500,000.

Los Angeles, Cal.—Contract soon to be let by Charles Fiske, Jr., Engineer, 3001 Leward Avenue, for about 25,000 cu. yd. excav., 40,000 lin. ft. cement curbs, walks and gutters and 2500 ft. sewer in Stephenson Avenue for McCarthy Company.

Los Angeles, Cal.—Widening of present 16. ft. Cahuenga Pass Rd. through foothills north of Griffith Park recommended to Board of Public Works by Homer Hamlin, City Engineer; cost estimated at $38,400 for a 30 ft. roadway or $28,600 for a 24 ft. roadway and 30 ft. at curves.

Modesto, Cal.—County Board of Supervisors and Highway Advisory Committee plan paving 158.5 miles of road, extending from State highway to connect with all principal points of county. Estimated cost $1,500,000. Address County Clerk.

San Diego, Cal.—See "Bridges."

Clifton, Ariz.—Supervisors (A. L. Terry, Clk. of Bd.) petitioned to build 18 miles of road connecting Clifton with Mogollon district in southwestern New Mexico. Cost about $75,000.

Kingman, Ariz.—Mohave County highway bonds for $150,000 sold. J. W. Morgan, Clk. Board Supervisors.

Provo, Utah.—Cost for paving 50 miles state road, from Jordan Narrows to Utah-Juah County line estimated, for a strip 15 ft. wide, at $500,000. Address Secy., Commercial Club.

Salt Lake City, Utah.—Reported city will spend $7,500 and county $12,500 toward cost of improving roads in Big Cottonwood Canyon to protect water of stream from pollution.

Lewiston, Idaho.—City Council passed ordinance creating Improvement District No. 10. City Engineer will prepare plans, specifications and estimates for grading, draining, curbs, gutters, cement walks and paving to be done in this district.

Moscow, Idaho.—Reported City Council passed ordinances for paving Van Buren, A, B, and First Streets, about 21,000 sq. yds. Contract will soon be let. Address City Clerk.

Moscow, Idaho.—Contract soon to be let for paving Main and Jackson Streets. J. R. Strong, City Clerk.

BIDS DESIRED.

Maine.—Until April 25, by State Highway Commission, Augusta, for constructing ten sections of state highways, gravel and waterbound macadam, and repairing and constructing bridges, advertised in Engineering Record. Paul D. Sargent, Chief Engineer of Commission.

Boston, Mass.—Until April 17, by Department Public Works (Edward F. Murphy, Comr.), for laying Hassam block pavement in Alexander Street. Also until April 18, separate bids for artificial stone walks, steps and walls in Crown Path from Clairborne Street to Washington Street, Dorchester. Also separate bids for bitulithic macadam roadway and artificial stone steps in Wait Street.

Massachusetts.—Until April 18, by the Massachusetts Highway Commission at Boston for resurfacing roads in the following towns:
Luenburg, 3000 ft.
Reading, 5400 ft.
Dennis, 5000 ft.
Andover, 8600 ft.
Barnstable, 4200 ft.
Wayland and Sudbury, 18,000 ft.

Woonsocket, R. I.—Until May 2, by Bd. of Aldermen for paving advertised in Engineering Record. Frank H. Mills, City Engr.

New Haven, Conn.—Until April 18, by F. L. Ford, City Engineer, for laying wood block, sheet asphalt, Hillside brick, Hasam Bi-comac and bituminous macadam pavement on fourteen streets. Also separate bids same time and place for laying sheet asphalt wearing surface on waterbound macadam on five or more streets.

Albany, N. Y.—Until April 17, by Board Contract & Supply (Isidor Washman, Secy.), for repaving Washington Avenue and North Hawk Street with redressed granite block, curbs, etc., cost $20,000, and repaving Lancaster Street with granite blocks, asphalt, etc., cost $14,000, and paving Van Woert Street with second-class granite block, cost $2,500.

By Edwin Duffey, State Highway Commissioner, 55 Lancaster Street, Albany, on following dates for repairing highways, advertised in Engineering Record: Until April 28, repairing highways in various counties, also furnishing broken stone for maintenance work on Broken Stone Contract No. 72, Road No. 1025, Hamilton County; also until May 2 and May 5, for repairs in various counties.

Buffalo, N. Y.—Until April 20, by Department Public Works (Arthur W. Kreinheder, Supt.) for repaving portions of Main, Ontario, Sumner and other streets.

Gloversville, N. Y.—Until April 18, by Clarence J. Mahoney, City Clk., for 12,120 sq. yd. concrete paving, with bituminous wearing surface and 3308 lin. ft. 18 to 24-in. storm water sewers. Harry J. Hanmer, City Engr.

Long Island City, L. I., N. Y.—Until April 21, by Maurice E. Connolly, Pres. Queens borough, for regulating and grading the sidewalk and gutter space where necessary and crosswalks on the west side of Fourth Street, etc., in all about 5600 ft. cement sidewalks, with crosswalks, etc., and repairing streets with sheet asphalt in the First, Second, Third and Fourth wards, in all about 17,000 sq. yd. asphalt, etc. Total security, $10,600.

New York, N. Y.—Until April 19, by Marcus M. Marks, President Borough Manhattan, for regulating and repaving with sheet asphalt on concrete foundation, together with curbing, etc., on portions of streets within the area of West Washington Market, Loew, Haven and Benton Avenues and other streets, in all about 8,420 sq. yd. asphalt, etc.

Troy, N. Y.—Until April 18, by Board Contract & Supply (John J. McLaughlin, Secy.), for furnishing material and repairing with asphalt in city about 7000 sq. yd.

Belleville, N. J.—Reported desired until April 25, by Town Commission, for paving four streets in the Greylock Section, with asphalt block Little St. Tappan, Malone and Division Avenues and De Witte Avenue with bithulithic or warrenite.

Newark, N. J.—Until April 27, by Board Street and Water Commissioners, for paving portions of S. Sixteenth Street, in all about 3000 sq. yd. Telford paving with tarvia, and repaving portions of Roseville Avenue, in all about 15,000 sq. yd. wood block pavement, 5090 lin. ft. new 16 x 5-in. bluestone curb, etc.

Paterson, N. J.—Until April 18, by Board Public Works for laying sidewalks during year 1916. Colin M. McLean, City Street Commissioner.

Princeton, N. J.—Until April 17, by City Clerk, for paving Nassau Street, between Washington and Harrison Streets, with asphalt block.

Trenton, N. J.—Until April 19, by City Commission, for new driveways and resurfacing old driveways in Cadwalader Park. Leon D. Hirsch, City Clerk.

Washington, D. C.—Until May 1, by Commissioners, D. C. (Oliver P. Newman, Chmn.), for furnishing during the fiscal year beginning July 1, 1916, and ending May 1, 1917, all granite curbing.

Clarksdale, Miss.—Reported desired until April 18, by City Commissioners (A. C. Tuttle, Clk.), for constructing 52,000 sq. ft. sidewalk with curb and gutter, etc.

Cleveland, Ohio.—Until April 19, by Commissoner Purchase & Supplies, for grading, draining and paving Brooklyn, Holmes, Warsaw Avenues, East Boulevard, Waterloo Road, East Twenty-fourth, East Eighty-ninth and other streets.

Girard, Ohio.—Reported desired until April 19, by Village Council, for constructing and repairing all sidewalk for city.

New Philadelphia, Ohio.—Reported desired until April 19 by County Commissioners for improving Tuscarawas-New Philadelphia County Road No. 283, and constructing trestle bridge over Ohio Canal.

Niles, Ohio.—See "Sewerage and Sewage Disposal."

Piqua, Ohio.—Until April 25 by L. E. Chamberlin, Director Public Service, for improving portions of several streets, including curbing, guttering and paving, advertised in Engineering Record.

Booneville, Ind.—Until May 2, by August Bohn, City Clerk, for 23 miles of road with macadam; probable cost, $90,000. Louis Meyer, Engineer, Booneville.

Indiana.—By the County Commissioners for constructing county roads as follows:

April 29:

Greencastle, 2680 ft. macadam road in Jefferson and Mill Creek Township, 5335 and 9400 ft. macadam road in Cloverdale Township. Joseph M. Allen, Co. Aud.

May 1:

Portland, crushed stone road, in Bearcreek Township, and two brick roads in Wayne Township. John Bonifac, Co. Aud.

Rockport, 7.88 miles waterbound rock road in Carter Township. J. Frank Stocking, Co. Aud.

Salem, 14,928 ft. and 8100 ft. in Vernon and Washington Townships. Ira H. Rutherford, Co. Aud.

Greenfield, gravel road on line between Center and Jackson Townships, and bound macadam road on line between Center, Buck Creek and Sugar Creek Townships. H. J. Rhue, Co. Aud.

Until May 2:

Valparaiso, two miles gravel road in Pine Township. C. A. Blachly, Co. Aud.

Kokomo, 8962 ft. gravel road in Howard Township, 5310 ft. stone road in Taylor Township and 3000 ft. asphaltic concrete in Clay Township. William L. Benson, Co. Aud.

Decatur, macadamized roads in Preble Township. T. H. Baltzell, Co. Aud.

Marion, stone road in Jefferson Township, and stone tar binder road in Center and Franklin Townships. Mort McRae, Co. Aud.

Monticello, roads in Jackson, Union and Princeton Townships. A. G. Fisher, Co. Aud.

Goshen, brick road on line between Clinton and Benton, Elkhart and Jackson Townships. A. R. Bemenderfer, Co. Aud.

Noblesville, three roads in Jackson Township. W. O. Horton, Co. Aud.

Jasper, Ind.—Until April 24, by City Council for 3795 ft. concrete curb and gutter, and 13,405 sq. ft. concrete sidewalks on Clay Street and 23,596 ft. sidewalk on Sixth Street, etc. Address City Clk.

Michigan City, Ind.—Until April 18, by Board Public Works, for paving Elkton Street with asphalt brick, concrete or bitulithic. Alexander Spychalski, City Clk.

Plymouth, Ind.—Until April 28, by Arthur W. Thomson, County Engineer, for following gravel roads: Snyder Road, No. 1, 2.93 miles, cost $13,104; No. 2, 3.77 miles, $16,995; No. 3, 3.66 miles, $17,370; No. 4, 4.57 miles, $41,106; Boggs Road, 4.23 miles, $21,204, and Stephens Road, 3.32 miles, $18,139.

Winchester, Ind.—Until about May 1, by city, for 3500 sq. yd. brick pavement. Address City Clerk.

Until April 27, by County Commissioners, for 1.6 miles concrete road. Cost $31,700.

Menominee, Mich.—Reported desired until April 19, by Carl L. Anderson, County Clerk, for constructing 3 miles of waterbound macadam road, 16 ft. metal bed, on Trunk Line Road No. 1; also about 2 miles waterbound macadam road on County Road No. 4.

Chicago, Ill.—See "Sewerage and Sewage Disposal."

Chicago, Ill.—Until April 17, by Board Local Improvements (Edw. J. Glackin, Secy.), for paving with vitr. brick and Portland cement concrete a number of alleys, also for constructing tile pipe sewers, together with manholes, etc., in Ainslie, S. Bishop, Eighty-ninth and a number of other streets.

Until April 20, by Board Local Improvements (Edw. Glackin, Secy.), for improving numerous alleys, adjusting sewer manholes, constructing new brick catch basins, inlets, etc., in numerous streets.

Illinois.—Until April 19, by State Highway Commission, Springfield, for constructing following roads:

Belvidere, Boone County, 2700 ft. long concrete. Engineer's estimate, $6,876.

Poplar Bluffs, Boone County, concrete, 800 ft. long. Engineer's estimate, $1,733.

Hardin, Calhoun County, 2760 ft. waterbound macadam. Engineer's estimate, $3,077.

Taylorville, Christian County, earth road, 17,356 ft. Engineer's estimate, $7,660.

Pana, Christian County, 15,800 ft. earth road. Engineer's estimate, $7,707.

Rushville, Schuyler County, 3750 ft. Engineer's estimate, $6,982.

Marion Williamson County, earth road, 5270 ft. Engineer's estimate, $4,213.

Marinette, Wis.—Reported desired until April 17, by City Clerk, for 11,000 sq. yds. reinforced concrete pavement. A. L. Hillis, City Engr.

Eldora, Iowa.—Until April 20, by E. W. Dunn, County Engineer, for 35 miles of gravel roads. An additional 40 miles will be let about June 15.

Lincoln, Neb.—Until April 18, by H. E. Wells, Co. Clk., for grading and paving in Dist. No. 10, to include portions of Thirty-third, J, Thirty-seventh and other streets. County Surveyor estimates the cost of this work as follows: 3 in. vertical fiber brick asphalt filler, Class B, 1 yr. guarantee, $2 per sq. yd.; 3 in. vertical fiber brick asphalt filler, Class C, 1 yr. guarantee, $1.98 per sq. yd. Catch basins with covers complete, $25, etc. Total Class B, $23,233; total Class C, $17,146.

Mandan, N. D.—See "Miscellaneous."

Columbia, Mo.—Until April 18 by J. Paul Price, City Engineer, for paving Sexton Road with macadam Tarvia "X," about 11,688 sq. yd. and 9801 lin. ft. combined curb and gutter, estimated cost $17,622.

St. Louis, Mo.—Reported desired until April 21, by Board Public Service (E. R. Kinsey, Pres.), for improving portions of Washington, Newstead and Compton Avenues and Eichelberger Street. Probable estimated cost, $81,400.

Bartlett, Tex.—Until April 20 by City Council for approximately 27,200 sq. yd. street paving and 7600 lin. ft. curbing. Bids will be received on fiber vitr. brick, one-course concrete, asphaltic concrete and Uvalde rock asphalt. R. T. Smith, City Engineer.

McKinney, Tex.—Until about April 25, by H. A. Finch, Mayor, for 40,000 sq. yds. asphalt concrete paving, including 25,000 ft. curb and gutter, on Greenville, Tennessee and Louisiana Streets, at a cost of $70,000. Charles Schultz, City Engineer.

Golden, Col.—Until April 29, by Board County Commissioners, for constructing extension of West Colfax Avenue Road, 4.8 miles, advertised in Engineering Record. C. M. Lawrence, County Clerk.

Colfax, Wash.—Reported desired until May 1, by George H. Newman, Deputy Co. Aud., for grading, draining, bridging and macadamizing 7 miles Permanent Highway No. 10, near Pullman. John M. McCaw, Co. Engr.

Mt. Vernon, Wash.—Reported desired until May 2, by W. V. Alexander, Co. Aud., for constructing 1¼ miles concrete paving of Permanent Highway No. 4. A. L. Strong, Co. Engr.

Seattle, Wash.—Reported desired until May 2, by Board County Commissioners (Bryon Phelps, Clk.), for paving Permanent Highway No. 2C, 6280 ft. one-course concrete, from Bothell to Snohomish county line; 21,600 ft. from end of present brick highway west of Bothell to beyond Woodinville, of either concrete, No. 2 brick block or monolithic type brick. Probable cost $100,000. A. P. Denton, Co. Engr. Also until May 1, separate bids for grading and paving, one-course concrete, 2.54 miles, Permanent Highway No. 11A, between Auburn and Enumclaw. Probable cost $50,000.

Tropico, Cal.—Reported desired until April 19, by Nelson C. Burch, City Clerk, for paving on portions of Adams, St. Moore Ave., and Arcadia Avenue, in all about 75,000 sq. ft. macadam, 5100 lin. ft. cement curb, and 25,000 ft. cement walk.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Albany, N. Y.**—Contract awarded by Board of Contract and Supply for repaving with redressed granite on concrete foundation portion of Beaver Street to William F. Campion, at $13,270.

★**Buffalo, N. Y.**—Bid of German Rock Asphalt Co., Inc., D. S. Morgan Bldg., for repairing asphalt pavements during 1916 recommended to City Council for award. About 2,900,000 sq. yd. maintained.

★Contracts awarded by Board of Public Works for paving as follows: To German Rock Asphalt & Cement Company, Ltd., D. S. Morgan Bldg., asphalt on Algonquin Street, at $11,770; Dakota Street, $12,480; Tioga Street, $11,240; Constatine Construction Company, 240 Dewey Avenue, Sussex Street, brick, $10,200.

★**Rochester, N. Y.**—Contracts awarded by Board of Contract and Supply for asphalt repairs for current year to Whitmore, Rauber & Vicinus, 279 South Avenue, and Warren Brothers Co., at 74 cts. per square yard, contract being divided equally.

★**Yonkers, N. Y.**—Contract awarded by Board of Contract and Supply for regulating, paving and otherwise improving portions of Fillmore and Paulding Streets to Frank Cianfaglione, 129 Oak Street, at a total of $13,550.

Freehold, N. J.—Lowest bid submitted April 5 to Board of Chosen Freeholders for constructing with reinforced concrete one mile of first section of Freehold-Adelphia Road, by Hafeman Company, Freehold, at $19,187.

★**Harrisburg, Pa.**—Contract awarded by State Highway Department, Harrisburg, to Good Roads Machinery Co., Kennett Square, at an average bid of $12.25 for 90 steel drags (bids opened April 5). Bids opened same time and place for wooden drags and tool boxes rejected, being in excess.

Cincinnati, Ohio.—Following are the unit figures of four lowest bids opened April 7 by Service Director Charles F. Hornberger for improving Sixth Street from Elm Street to Sycamore Street with wood block: (a) City Engineer's estimate, $43,544; (b) Kirchner Construction Co., 221 W. Ninth Street, $36,789; (c) Henkel & Sullivan, 710 Mercantile Library Building, $38,664; (d) M. F. Quill, 808 Provident Bank Building, $39,129; (e) C. N. Danenhower, 414 Elizabeth Street, $39,540.

	(a)	(b)	(c)	(d)	(e)
500 lin. ft. 12-in. drains, inlet connections	$1.00	$0.20	$1.00	$1.00	$1.00
50 lin. ft. 12-in. drains, main sewer	2.00	2.50	2.00	2.50	2.00
80 lin. ft. 15-in. drains, main sewer	2.00	2.50	2.00	2.50	2.00
2 manholes complete	60.00	5.00	60.00	60.00	60.00
18 manholes readjusted	3.00	3.00	2.00	2.00	3.00
35 gutter inlets	30.00	5.00	25.00	25.00	30.00
6 inlets, Plan 1	40.00	20.00	35.00	35.00	40.00
19 inlets readjusted	5.00	5.00	5.00	5.00	5.00
6 standard traps	10.00	10.00	10.00	10.00	10.00
120,000 lb. castings	0.03	0.03	0.03	0.05	0.03
2,200 cu. yd. concrete, Class 3 (8-in. thick)	5.25	4.00	3.50	4.50	4.90
1,400 lin. ft. granite curbs	1.10	0.10	1.10	1.05	1.10
400 lin. ft. granite circular curbs	1.75	1.00	1.35	1.50	1.75
2,500 lin. ft. curb reset and redressed	0.25	0.05	0.20	0.03	0.25
2,400 sq. ft. cement walks	0.15	0.15	0.15	0.14	0.15
500 sq. yd. asphalt pavement	1.60	1.00	1.50	1.50	1.60
100 sq. yd. brick repaving	0.60	0.60	0.02	0.60	0.60
100 sq. yd. granite repaving	1.00	0.80	0.90	0.75	1.00
9,800 sq. yd. wood block pavement, oil A or B	2.50	2.50	2.47	2.30	2.17
450 lin. ft. steel protection plates	1.00	0.90	0.80	0.85	1.00
4 inlets converted to manholes	30.00	30.00	35.00	30.00	30.00

Philadephia, Pa.—Following are lowest bidders on bids opened March 28 by Department of Public Works, Bureau of Highways, for some of the schedules:

Schedule A—Grading—Total amount of low bids, $172,619; 425,600 cu. yd. grading, average unit price (including incidental work), 38.1 cts. per cu. yd.; Eastern Paving Co., Penn Square Building,; J. J. McHugh, 1430 S. Penn Square; Peoples Bros., 437 Commercial Trust Building; J. D. Dorney, 1204 E. Montgomery Avenue; G. Dobbins & Co., 8341 Germantown Avenue; M. H. Kelley, 1615 S. Twenty-second Street; Thomas Clasby & Son, 1323 Colwyn Street; A. W. Barnes, Righter and Hermit Streets; J. McMenamy, 512 Walnut Street; E. H. Vare, Lincoln Building.

Schedule E—Repaving Asphalt—13,700 sq. yd.; total amount of low bids, $37,611; average unit price (including incidental work), $2.737; Mack Paving & Construction Co., Twentieth and Sedgley Avenues; Barber Asphalt Paving Co., Land Title Building, Philadelphia Paving Co., 1345 Arch Street.

Schedule I—Resurfacing Waterbound Macadam, 16,321 sq. yd.; total amount of bids, $13,377; average unit price (including incidental work), 81.9 cts.: Dwyer & Co., 1524 Chestnut Street, and Anders & Snyder, Heed Building.

Schedule J—Curbing and Footway Work (property owners to pay); total amount of low bid, $12,868. George F. Clark, 1324 S. Forty-eighth Street.

★**Uniontown, Pa.**—Contract awarded by County Commissioners to Bell-Bockel Company, Altoona, for constructing roads in Connellsville Township at $26,754, Upper Tyrone Township $40,170, and Bullskin Township $59,948.

★**Charleston, W. Va.**—Contract awarded R. M. Hudson Paving & Construction Company, Charleston, for 12,794 sq. yds. brick paving and 13,111 ft. curb and gutter, at $38,636, and 2,302 sq. yds. asphalt concrete paving and 969 lin. ft. curb and gutter at $5,126 (bids opened April 1). J. M. Clark, City Engineer.

Huntington, W. Va.—Contract for constructing 9 miles of Cabell County Roads, of brick awarded Hatfield Construction Co., Huntington (bids opened April 6). R. S. Douthat, County Clerk.

★**Morgantown, W. Va.** — Contracts awarded by County Commissioners for constructing (a) Cheat River Road, (b) Beverly-Evansville Road, (c) Star City Road, (d) Van Voorhis Road, (e) Decker's Creek Road, as follows: McCormick Engineering Co., Morgantown, (c) $56,025; brick surface with concrete base, (d) $8,715, concrete; Hottell Construction Co., Pulaski, Va., (a) $69,193, brick surface with concrete base, (b) $30,304, brick with concrete base, (e) $28,607 concrete. (Bids opened March 30.)

Pineville, W. Va.—Following are lowest bids opened by County Commissioners for constructing four sections of earth road, aggregating about 45 miles, at a total cost of about $169,000; (a) excavation, (b) rubble masonry, (c) reinforced concrete:

Section I. — Henning & Hagerdon, Greensboro, N. C.: (a) 91,000 cu. yd., 42¾ cts; (b) 1000 cu. yd., $5; (c) 20 cu. yd., $16.50.

Section IV.—Winston & Company, Richmond, Va.: (a) 100,000 cu. yd., 53 cts.; (b) 800 cu. yd., $6; (c) 20 cu. yd., $16.

Section V.—Keeley Bros., Clarksburg, W. Va.: (a) 60,000 cu. yd., 49 cts.; (b) 700 cu. yd., $5.50; (c) 15 cu. yd., $15.

Section X.—T. Towles & Company, Princeton, W. Va.: (a) 60,000 cu. yd., 46 cts.: (b) 600 cu. yd., $6.50; (c) 10 cu. yd., $16.50.

★**Sumter, S. C.**—Contracts for street paving (bids opened March 28) awarded by city as follows: In all about 160,000 sq. yd. sheet asphalt: Simons Mayrant Co., Charleston, for concrete sidewalks at 80 cts., and concrete pavement at $1.25 per sq. yd.; Georgia Engineering & Construction Co., Augusta, Ga., brick paving, $1.48; Ely Construction Co., Chattanooga, Tenn., lake asphalt, at $1.53 per sq. yd., and $1.39 for well. D. M. Blanding, City clerk.

★**Montgomery, Ala.**—Contract for grading and graveling roads in Montgomery County awarded to Robert Woolfolk, of Montgomery, at $22,000. T. H. Edwards, County Engineer.

★**Cleveland, Ohio.**—Board of Control awarded contracts as follows for paving portions of West Fifty-eighth, Sixtieth, Sixty-second, Sixty-third and Eighteenth Streets, West Forty-seventh Place and East Ninety-third Street to Roehl Bros., Clark and West Twenty-fifth Streets, at $71,237, and to Rieley Bros., Arcade Building, for Baxter and Harvard Avenues, at $23,737.

★**Columbus, Ohio.**—Contracts awarded by Director Public Service for repaving with asphalt portion Dennison Avenue to Andrews Asphalt Paving Co., Hamilton, at $38,019, and for paving portion of Mingo Avenue to Monarch Construction Co., at $9,832.

★**Salem, Ohio.**—Contract for paving with vitr. brick on Main Street (bids opened April 3) awarded M. P. Connelly & Son, Youngstown. J. N. Russell, Director of Service.

Youngstown, Ohio.—Following are lowest bids submitted March 28 to County Commissioners for constructing (a) McGuffey Road, Coitsville Township, 1.57 miles, (b) Matthews Road, Boardman Township, 0.26 mile, (c) Damascus-Berlin Road, Berlin Township, Sections 3 and 4, 2.9 miles, (d) Damascus-Berlin Road, Berlin Township, Section 5, 2.01 miles, (e) Poland-North Lima Road, Springfield Township, 2.08 miles: K. J. Smith, Youngstown, (a) $11,504; Kennedy Bros., Youngstown, (b) $2,026, (d) $17,683, (e) $17,420, for macadam; J. D. Paxson, Salem, (c) $25,346.

★**Elkhart, Ind.**—Contract awarded Andrews Asphalt Paving Co., Hamilton, for 26,000 cu. yd. pavement, 18,000 ft. curb and 15,000 cu. yd. excav. at $58,000.

★**Elwood, Ind.**—Contract awarded by City Council for constructing about two miles cement walks to Davis Construction Co., Arcadia.

★**Ft. Wayne, Ind.**—Contracts for paving 19 streets awarded by Board of Public Works to Grace Construction Co., Moellering Construction Co. and Brooks Construction Co., all of Ft. Wayne.

★**Goshen, Ind.**—Contracts for paving (bids opened April 4 by Co. Comrs.) awarded as follows: East Lincoln Avenue, Elkhart Township, to Henry Cripe, Goshen, at $45,300; and Graveltown Road, Union Township, Northern Indiana Construction Company, Nappaneo, at $12,300. A. R. Bauenderfer, County Auditor.

★**Huntington, Ind.**—Contract awarded Charles McAfee, Bluffton, for Leader Lewis Road, Jefferson Township, at $8,456, and to Henry V. W. Parker Co., Hammond, for Henry Kress Road, Jackson Township, at $20,480. Ovid E. Eivston, County Auditor.

★**Mishawaka, Ind.**—Contract awarded H. W. Reed & Sons, Mishawaka, at $18,400, for constructing three miles of highway on Beebee Road from Austin's Corner east.

★**New Albany, Ind.**—Contract awarded by County Commissioners for constructing Bald Knob Road to W. F. Woodruff, Louisville, Ky., at $19,167.

★**Paoli, Ind.**—Contract for constructing 10,296 ft. gravel on macadam roads in Orangeville and French Lick Townships awarded Elwood Johnson, Campbellsburg. (Bids opened April 3.) E. A. Palmer, County Aud.

★**Eagle River, Mich.**—Contracts for constructing four roads awarded to following: Smith, Byers & Sparks Company Houghton, Mich., $24,812; Paul P. Roehm, Calumet, $19,756; Hall & Labby, Laurium, $5,818, and Parks & Labby, Mohawk, at $13,750. W. R. Bennetts, County Clerk.

★**Elgin, Ill.**—Contract for paving with Purington brick on Villa Street awarded Logan & Giertz Construction Co., Elgin, at $56,491. (Bids opened April 6 by City.)

★**Edwardsville, Ill.**—Contract awarded Albert Fahrig, Edwardsville, for constructing 6,000 ft. concrete road (bids opened April 1) at $8,900. Jesse F. Yates, Chmn. Town Highway Commission.

★**Geneva, Ill.** — Contract for paving State and Third Streets with brick and asphalt, awarded McCarthy Improvement Co., Davenport, Iowa, at $22,518, and to J. E. Salfisberg & Co., Aurora, $44,634. A. L. Stimple, City Clerk.

★**Clear Lake, Iowa.**—Contract for 27,000 sq. yds, paving awarded Bryant Asphalt Paving Company, Waterloo, at $1.71 sq. yd. (bids opened March 15).

★**Des Moines, Iowa.**—Contract awarded by City Council for constructing 24,000 yd. paving to Hassam Paving Co., 390 Main Street, Worcester, Mass.

★**Preston, Iowa.**—Contract awarded by City Council for constructing 20,000 yd. paving to Hassam Paving Co., 390 Main Street, Worcester, Mass.

★**Sac City, Iowa.**—Contract for paving with asphaltic concrete (Texaco) awarded National Paving Company, Omaha, Neb., at $36,600. C. C. Jameson, City Clerk.

★**Sigourney, Iowa.**—Contract for paving 13,000 sq. yds. awarded Burlington Construction Company, Burlington, Iowa, at $1.98 per sq. yd.

★**Storm Lake, Iowa.**—Contract awarded Moore Seig Construction Company, Waterloo, for 70,000 sq. yds. reinforced concrete paving and 43,000 lin. ft. concrete curb and gutter, at $1.52 per sq, yd. and 65 cts. per lin. ft. respectively. J. E. Buland, City Solicitor.

★**Duluth, Minn.**—Contract for paving E. Superior Street with asphalt awarded to General Contr. Co., of Minneapolis. at $47,575. L. Ayres, City Engineer.

★**Elbow Lake, Minn.**—Contract for grading and turnpiking State Roads, Nos. 1 and 4 (bids opened April 3) awarded Barrett & Co., Herman, Minn., at $20,334. Other bidder: Jamieson, Thoreen & Sandeen, Stillwater, $21,728. C. M. Nelson, County Auditor.

★**Lincoln, Neb.** — Contract awarded Abel Construction Co., Lincoln, at $1.96 per sq. yd. for 5,520 sq. yd. fibre brick pavement in District 342, total $14,405. Other bidders: Burke Cochrane Construction Co., Lincoln, $1.98 per sq. yd., total $14,606, and Roberts Construction Co., Lincoln, $2; total, $14,487. Theo. H. Berg, City Clerk.

★**Mayville, N. D.**—Contract for cement walks for the year awarded Hans Westsgood, Devils Lake, at 13.5 cts. per sq. ft. for walks and 25.5 cts. per sq. ft. for crossings.

★**Tarkio, Mo.**—Contract for paving Fourth, Fifth and Maple Streets (bids opened April 3), awarded Olson Schmidt Construction Company, St. Joseph, at $1.39 per sq. yd. for paving and 58 cts. per cu. yd. for curb and gutter. John G. Graham, City Clerk.

★**Little Rock, Ark.**—Contracts for paving awarded as follows by the city: District 235, bitulithic, to D. L. Cook, of Little Rock, at $35,000; contract District 246, Lee Avenue, asphalt, Shleby & Bateman, $70,000; Johnson Street, macadam, W. Heard, at $15,000.

★**El Paso, Tex.**—Contract awarded by County Commissioners for constructing 7 miles concrete road in Upper Rio Grande Valley to Lee Moor Contracting Co., Two Republics Building, at $77,368.

Bellingham, Wash.—Following are four bids opened by County Commissioners for paving Northwest Diagonal Road with two-course concrete, including (a) bridge paved with wood block, and (b) bridge paved with asphaltic concrete: K. Sauaet, Bellingham, (a) $68,765, (b) $66,990; Washington Paving Co., L. C. Smith Bldg., Seattle, (a) $68,903, (b) $67,125; Cascade Construction Co., Central Bldg., Seattle, (a) $71,200, (b) $69,700; Robert Clarkston, Bellingham, (a) $71,813, (b) $69,659. C. M. Adams, County Engineer.

★**Chehalis, Wash.**—Following are bids opened April 5 by D. W. Montfort, County Auditor, for constructing 3 miles of concrete road: (a) Permanent Highway No. 3A; (b) Permanent Highway No. 2C; (c) Improving No. 188: Albers & Son, (a) $13,096, (b) $14,404, (c) $16,440; Allred & James, (a) $14,950, (b) $16,350, (c) $17,750; Hendricks & Ward, Chehalis, (a) $12,400 (awarded contract), (b) $13,995 (awarded contract), (c) $17,630; T. H. Cochran & Sons, Portland, Ore., (a) $13,075, (b) $14,900, (c) $15,950 (awarded contract); Jarvis & Burkheimer, Liberty Building, Seattle, (c) $16,437. J. D. Neville, County Engineer.

★**Mount Vernon, Wash.** — Contract awarded Skagit Construction Co., Mount Vernon, for constructing 1¾ miles of Permanent Highway No. 3A (bids opened April 4) at $20,470. Next three bidders: L. P. Ervig, Anacortes, $21,615; Washington Paving Co., Tacoma, $21,812, and Bancroft & Morgan, Everett, $22,945. A. L. Strong County Engineer.

★**Pomeroy, Wash.**—Contract for paving Main Street with asphalt concrete, about 28,400 sq. yd., 7500 ft. curb and 10,000 yd. excav., awarded Clifton, Applegate & Co., Spokane, at $40,162. J. E. Tupper, City Engineer.

Ritzville, Wash.—Following are bids opened recently by City Council for paving 19,500 sq. yd.: Clifton Applegate Company, Spokane, 2-in. asphaltic concrete top, 3 in. asphaltic concrete base, $36,704; 4-in. crushed rock base, $35,924; Standard Asphalt Paving Company, Spokane, 1½-in. bituminous top, 4-in. bituminous base, $34,045; 2-in. bituminous top, 4-in. bituminous base, $35,605; 1½-bituminous top on 4-in. concrete base, $38,335; Cascade Construction Company, Central Bldg., Spokane, 2-in. bituminous top on 3-in. bituminous base, $38,030; on 4-in concrete base, $38,907; Sawyer Bros., White Bldg., Seattle and Spokane, Engrs.

★Contract awarded by County Commissioners for constructing 12 miles, involving graveling and construction of seven concrete spans from 16 to 70 ft. long to Carlson-Chindahl Co., Spokane, at $52,494. O. J. De Spain, County Engineer.

★**Ritzville, Wash.**—Contract awarded by City Council for constructing 12 blocks of 5-in. reinforced concrete pavement to Cascade Construction Co., Central Building, Seattle, $35,270.

★**Seattle, Wash.**—Contract awarded by Board Public Works for grading, paving, etc., Beacon Street, to P. J. McHugh, Third Avenue N., and Mercer Street, at $171,588.

Following are lowest bids submitted to Board Public Works for paving, grading, curbing, etc. (a) East Valley Street, (b) Juneau Street, (c) Thackery Place, (d) Latona Avenue: Cresman Contracting Co., 614 Madison Street (a) $8,474; H. Brice, Boston Block (b), $41,168; P. J. McHugh, Third Avenue N. and Mercer Street, (c) $18,242, (d) $8,457.

★**South Bend., Wash.**—Contract awarded by County Commissioners for constructing Permanent Highway No. 3-A with rock macadam to Hendricks & Ward, Chehalis, at $8,166.

★**Spokane, Wash.**—Contract for paving Normal Permanent Highway, No. 11-A, with asphaltic concrete on macadam base, awarded by County Commissioners to Standard Asphalt Paving Co., Spokane, at $55,357.

Astoria, Ore.—Following bids submitted to City Council for paving Commercial Street: J. A. McEachern Co., Inc., Bell Street Dock, Seattle, Wash., at $24,490; Porter & Conley, Portland, $26,430; Ward & Boyd, Astoria, $27,500; E. A. Gerding, Astoria, $27,500.

Clatskanie, Ore.—Following are bids submitted to City Council for paving Bridge Street and Nehalem Avenue: P. H. Cochrane & Sons, Portland, $12,499; Western Paving Co., Portland, $12,939; Robert Lee Wringer, Clatskanie, $13,361, and Warren Construction Co., Portland, $15,696.

Hanford, Cal.—Ford & Stout, Bradbury Bldg., St., Los Angeles, submitted lowest bid for constructing Highway No. 1, Division No. 2 and Highway No. 1, Division No. 6, involving 9,500 cu. yds. excav., 996,273 sq. ft. concrete base and Topeka wearing surface, at $39,795.

★**Los Angeles, Cal.**—Contract awarded Benjamin F. Ford and Fred H. Stour, 336 Bradbury Building, for constructing Lemoore Stratford Unit, including 2 miles of Stringtown Unit (bids opened March 25).

★**Martinez, Cal.**—Contract awarded by County Supervisors for paving 7.5 miles from Bryant to Walnut Creek to City Street Improvement Co., 166 Geary Street, San Francisco, at $70,586.

★**Rigby, Idaho.**—Contract awarded by Mayor for constructing 7 miles of cement sidewalks and a number of street crossing, to Tanner & Cragum, Idaho Falls, at $17,880.

★**Montreal, Que.**—Contract for furnishing 6000 tons of refined asphalt (bids opened Feb. 24) awarded Warner Quinlan Asphalt Company, New York, at $19.33 per ton. Other bidders, United States Asphalt Company, New York, $22, and Elder Ebana Asphalt Company, Montreal, Que., $23. L. N. Senecal, Secretary Board of Commissioners.

STREET CLEANING AND GARBAGE DISPOSAL

PROPOSED WORK.

Providence, R. I.—City Council has asked Legislature for permission to issue $300,000 bonds for constructing and equipping a garbage disposal plant. J. H. Garner Mayor and Chmn. Com.

Toledo, Ohio.—City Council voted to spend about $11,470 for cleaning streets.

Des Moines, Iowa.—Reported Council is considering granting a 10-year contract for disposal of garbage. The citizens, March 28, voted in favor of issuing $100,000 bonds for constructing a disposal plant.

Corsicana, Tex.—Improvements to crematory contemplated. George A. Durand, City Engineer.

BIDS DESIRED.

Pittsburgh, Pa.—Until April 19, by Board Education (Geo. W. Gerwig, Secy.), Fulton Building, for furnishing and installing sprinkling systems in the Thaddeus Stevens, Harwood, American Avenue, Westlake, Riverside High, Luckey, Chartiers and Esplon Schools.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Madison, Wis.—Following are four lowest bids opened by Incinerator and Finance Committee for constructing an incinerator garbage disposal plant—(a) single plant, (b) double plant, consisting of 2 buildings: De Carie Co., Minneapolis, Minn., (a) $18,760, (b) $18,300 on each building; McGuire-Hunter Co., (b) $9,230 each building; C. F. Walthers, (b) $16,032, $8,766, $9,386, $17,272 and $13,600 complete; Russell Engineering Co., St. Louis, Mo., (a) $17,880.

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS

PROPOSED WORK.

Wharf—Rhode Island—See "Paving and Roads."

Canal—Waterbury, Conn.—Charles H. Preston, Jr., Consulting Engineer, 136 Grand Street, estimates cost of constructing a canal between tide water, at Derby and Waterbury, a distance of 18 5-16 miles, at $1,000,000, to include 11 locks 23 to 30 ft. Mayor Martin Scully, of Waterbury, is in favor of building this tunnel, and will submit the plans to manufacturers of the Naugatuck Valley.

River Improvement—Albany, N. Y.—Tentative plans prepared by Frank R. Lanagan, City Engineer, for continuation of river-front improvements from Madison Avenue to Arch Street. Work will probably begin about spring of 1917; probable cost $300,000.

Dam—Harrisburg, Pa.—Farley Gannet, Harrisburg, engaged to construct a dam on estate of Gifford Pinchot in Pike County, Pa.

Piers—Philadelphia, Pa.—Dept. Wharves, Docks and Ferries for following improvements: Completion of McKean Street pier, $300,000; purchase of property and construction of piers between Chestnut Street and Fairmount Avenue and for improvements of piers at Penn Treaty Park, Allegheny Avenue and Bridge Street, Bridesburg, $1,350,000; for continuing bulkheading of Schuylkill River, $750,000, and for purchase of land and construction of piers in southern part of city, $7,600,000.

Drainage—Memphis, Tenn.—The Elliot & Harman Engineering Co. at Peoria, Ill., will act as consulting engineers and supervise construction of a drainage power plant to reclaim 100,000 acres of land between the White and Mississippi Rivers in Arkansas, about 150 miles south of Memphis. The pumping plant will have capacity of 60,000,000 gal. per hour. A levee 30 miles long and 25 ft. high will be built along White River.

Ditch — Warren, Ohio.—Surveys being made for ditch along Grand River in Ashtahula and Trumbull Counties to cost $150,000. About 12 miles long. R. E. Hempel of Warren and R. N. Case of Jefferson, engineers in charge of work.

Dredging — Winchester, Ind. — County will let contract about July 1 for dredging about 21 miles of Mississinewa River. Approximate cost, $150,000. A. Purdy Co., Engr.

Dam — Smyrna, Mich.—The dam at Smyrna, Mich., owned by Spencer Electric Light & Power Co. of Belding was destroyed by the high water in Flat River. A reinforced concrete dam is to be constructed to replace said dam. W. P. Hetherington, Secy., Belding.

Drainage—Belleville, Ill.—Commissioners of Richland Creek Drainage District filed report with County Court on the straightening and deepening of the creek including the constructing of 5 bridges, and a total estimated cost of $79,000.

Docks—La Crosse, Wis.—La Crosse Bd. of Trade and Common Council plans to construct a freight terminal warehouse and dock at Southern end of Riverside Park.

Pier—Milwaukee, Wis.—Plans prepared by Harbor Commission (Herman Bleyer, Secy.) for constructing recreation pier at Michigan Street. The lake front from south to north city limits will also be improved, central portion from Wisconsin Street to Illinois Steel Co.'s plant for harbor purposes and rest for park and driveway; cost of improvements about $2,500,000.

Drainage—Forest City, Iowa.—All bids opened March 31 for constructing ditch No. 61 rejected. Address County Auditor.

Wall, etc.—Anaconda, Mont.—Reported City Engineering Dept. completed plans for construction of a 20 x 200 ft. concrete wall across gulch at edge of city for a reservoir to control flood waters and serve as power for proposed municipal lighting plant.

Levee Work—Rich Hill, Mo.—Two miles of ditches, a 24-in. pump will be needed in levee construction there. James A. Flanning, Engineer, Butler; J. F. Kern, Secy. District.

Ditch—Eugene, Ore.—Preliminary plans for improving Amazon Ditch completed by City Engineer, provide for combination open ditch and covered concrete conduit; cost $50,000.

Irrigation—Prineville, Ore.—The North Unit Irrigation Dist. has been formed in Jefferson County with Headquarters at Prineville. Water supply will be taken from Upper Deschutes River basin; cost estimated at $5,000,000.

Dredging—Long Beach, Cal.—The report of Committee appointed to investigate means of reclamation of Long Beach Harbor favorably adopted. A $300,000 bond issue for removal of silt from Long Beach inner harbor and completion of inside passage that will connect Long Beach and San Pedro Harbors approved.

Dam — San Diego, Cal.—The United States Land Office granted permission to city of San Diego to construct a dam and impound the headwaters of San Diego River on El Capitan Grande Indian Reservation.

Hydro-Electric Plant—San Francisco, Cal.—State Water Commission at Sacramento granted application of Pacific Power Cor. for an appropriation from Leevining Creek in Mono Lake Basin for power purposes; estimated cost of improvement about $717,144.

BIDS DESIRED.

Maintaining Dredging — Bridgeport, Conn.—Until May 15, by U. S. Engineer Office, New London, for maintenance dredging in Bridgeport Harbor, Conn., advertised in Engineering Record.

Dredging—Buffalo, N. Y.—Until May 10 by U. S. Engineer, Buffalo, for dredging in Lake Erie entrance to Black Rock Harbor and Erie Basin, and in Black Rock Canal; Buffalo, advertised in Engineering Record.

Shed—New York, N. Y.—See "Public Buildings and Schools."

Riprap—Philadelphia, Pa.—Until April 28, by the Lighthouse Inspector, for furnishing and depositing 800 tons of large riprap at Ship John Shoal Light Station, Delaware Bay.

Dredging, Wilmington, Del.—Until May 8, by U. S. Engineer's Office, Wilmington, for dredging Raccoon Creek, N. J.; advertised in Engineering Record.

To Sub-let Dragline Levee Work—Chicago, Ill.—To sub-let 300,000 cu. yds. of dragline levee work and sell Bucyrus machine 75 ft. boom 2 yd., Page bucket, in good condition, ready to start work; all new levee work; no enlargement work. Address Box 6284 Engineering Record, 1570 Old Colony Building, Chicago, Ill.

Drainage—Lawrenceville, Ill.—Reported desired until April 20, by S. W. Seed, for redredging ditches in England Pond Drainage Dist., requiring about 92,000 cu. yd. excav. G. C. Harvey, Engr., Mt. Carmel.

Channel—Maple Park, Ill.—Reported desired until April 25, by M. O. Brien, Clk. Comrs. Union Drainage Dist. No. 3, for deepening and widening, etc., the present channel of district, to consist of 200,000 cu. yd. earth excav., etc. Hay & Lowman, Engrs., Sycamore, Ill.

Drainage Ditch—Des Moines, Iowa.—Until April 24 by F. J. Alber, Co. Aud., for constructing open ditch in Drainage District No. 13, consisting of 37,000 cu. yd. excavation, etc.

Ditch—Roseau, Minn.—Reported desired until April 21 for County Ditch No. 24; probable cost $9,352; excavation $6,161 (S. G. Bertilrud, Co. Aud.).

Ditch—St. Peter, Minn.—Until April 20 by W. H. Holz, County Auditor, for constructing Ditch No. 59, to consist of 25,388 ft. 8 to 26-in. tile, etc. Total cost $13,010.

Reclamation Work—Powell, Wyo.—Until May 3, by Department of Interior, U. S. Reclamation Service, Powell, Wyo., for constructing structures of the Shoshone Project, involving about 16,000 cu. yd. excav., 1500 yd. reinforced concrete, 5000 sq. yd. paving, etc. A. P. Davis, Ch. Engr.

Dam—Gonzales, Tex.—Until April 20, at office of Gonzales Water Power Co., for furnishing material and constructing dam on Guadalupe River at Gonzales. Frank S. Taylor, Consulting Engr., Scarsborough Building, Austin.

Weir Well House—Arcadia, Cal.—Until April 20, by Board City Trustees, for constructing four pump houses and two pair weir well houses. Geo. E. Grimes, City Clerk.

Irrigation — Anderson, Cal.—Reported desired until April 29, by Board Directors of Anderson-Cottonwood Irrigation District, Anderson, for constructing the irrigation system, including 13,000 bbl. cement, 3600 ft. c.-i. pipe, 36 to 42 in., 27,000 ft. metal flume and other material necessary for construction of system. The main canal is to be 36 miles long, and includes concrete dams, gate drops, siphons, bridges, flumes and fence crossings. Laterals will be about 36 miles in length.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Dredging—New Bedford, Mass.**—Contract awarded Bay State Dredging & Construction Company, Boston, for rock removal and dredging in New Bedford Harbor, Mass., at $41,661 (bids opened March 16 by Col. John Millis, Corps Engrs. U. S. A., New York City).

★**Breakwater—Point Judith, R. I.**—Contract awarded by U. S. Engineer, Newport, for repairing breakwater at Point Judith to Coast & Lakes Construction Company, 25 Broad St., New York, N. Y., at $49,600.

Savannah, Ga.—See "New Industrial Plants."

★**Power Plant—Kingsport, Tenn.**—Contract for 6000 cu. yd. excavation, 2000 yd. concrete masonry and installation of machinery for power plant and pumping station to be erected in Kingsport, awarded to Oliver-Hill Constr. Co. of Knoxville. Probable cost, $30,000.

★**Dredging—Detroit, Mich.** — Contract for dredging ship channel in Lake St. Clair, Mich. (bids opened March 24) awarded by U. S. Engineer, Detroit, to Great Lakes Dredge & Dock Company, Chicago, Ill., at $45,000.

Ditch—Woodstock, Ill.—Following are four lowest bids opened April 8 for constructing 2½ miles of dredge ditch: Springfield Drain Tile Company, Springfield, Ill., $28,915 (awarded contract); Arthur Birt, Mecca, Ind., $32,800; F. E. Ball & Company, Sycamore, Ill., $33,575, and National Drain Tile Company, Springfield, Ill., $33,936. Carpenter & Henderson, Woodstock, Ill., secured contract for open work.

★**Drainage—Forest City, Iowa.**—Contract for constructing drainage ditch No. 60 (bids opened March 31 by County Commissioners) awarded as follows: Labor on tile drain to Hanson Christianson Northwood, at $17,600; furnishing tile, National Sewer Pipe Company, Webster City, $23,623; furnishing segmental block, Plymouth Clay Products Company, Ft. Dodge, at $8,700; open work, Fred E. Smith, Clarion, 25 cts. per cu. yds. on excav.

★**Dredge Work—Aitkin, Minn.**—Contract for 8.3 miles of floating dredge work (bids opened April 3) awarded by County Commissioners to D. A. Foley & Company, Aitken, at $32,392. Other bidders: W. J. Gleason & Company, Aitkin, $34,517; and G. E. Gilbertson & Son, St. James, $42,516. H. C. Beecher, County Auditor.

★**Ditch—Duluth, Minn.**—Contract for constructing ditch No. 4, estimated to cost $137,000, awarded E. W. Coons Company, Hibbings, Minn.

★**Ditch—Walker, Minn.**—Contract for constructing Judicial Ditches Nos. 3 and 4 (bids opened April 1) awarded E. E. Griffith of Backus at $27,606; Northern Minnesota Drainage Company, Backus, $26,514; Berger Mfg. Company, Minneapolis, $3,490. C. D. Bacon, County Auditor.

★**Drainage Ditch—Worthington, Minn.**—Contract for constructing drainage ditch (bids opened April 3) awarded by County Commissionera to Parrish & Sedguley, Worthington, at $19,890. G. S. Wanberg, County Auditor.

★**Reclamation Service Work—Flathead, Mont.**—Contract awarded by U. S. Reclamation Service for work at the Flathead Irrigation Project, Mont., as follows: To Percy & Ross, Folsom, for earthwork and structures on the Mission, Post and Pablo divisions at $13,945 and to Minighan Machine Co., Chicago, Ill., for furnishing f.o.b. factory a dragline excavator at $7,233.

★**Revetment and Dike Improvement—Little Rock, Ark.**—Contract for revetment and pile dykes at Memphis, Helena and Louisiana branch of Iron Mountain R. R., near Yancopin, on Arkansas River, awarded by Missouri Pacific R. R. to Miller Engineering Company, Little Rock, at about $100,000.

★**Revetment—Yancopin, Ark.**—Contract for revetment and dykes on Memphis, Dallas & Gulf branch of Iron Mountain R. R. at Yancopin awarded to Miller Engineeering Co. of Little Rock, at about $100,000.

★**Spillway Gates—Seattle, Wash.**—Contract awarded by U. S. Engineers, Seattle, to D. B. Harding, Chicago, Ill., for spillway gates at $10,984.

★**Pier—San Francisco, Cal.**—Contract for repairs to Pier No. 44, at Second Street, awarded to S. B. Peterson Co., 742 Market Street, at $28,966.

ELECTRIC RAILWAYS

PROPOSED WORK.

Yardville, N. J.—Supreme Court at Trenton ordered Mercer County Traction Cor. to construct a line from Yardville to North Crosswicks. Peter E. Hurley, Gen. Mgr., Trenton.

Ephrata, Pa.—Reading and Ephrata Street Railway Co. received a franchise from Council to construct a line in Ephrata.

Lewistown, Pa.—Preliminary surveys being made by Lewiston & Reedsville Electric Co. for a railway extension from Reedsville terminal across Seven Mountains via Milroy, Potters Mills and Bellefonte to State College.

Williamstown, Pa.—Lykens Valley Ry. Co. plans extensive improvements to its line.

Tampa, Fla.—Plans being made to construct a line from Tampa to Lakeland via Plant City and Gary. E. J. Binford, of Tampa, is intsrested.

Birmingham, Ala.—W. A. Spencer of Wylam and W. W. Shortridge of Birmingham are President and Secretary respectively of a company planning constructing of a railroad, probably electric, from Birmingham to Warrior River.

Mt. Olivet, Ky.—Construction of an electric railway from Mt. Olivet to Cincinnati is contemplated. W. C. Meyers, of Mt. Olivet, is interested.

Shelbyville, Ky.—J. W. Cudgell, Shelbyville, is preparing plans for an electric railway to be constructed from Frankfort to Shelbyville, distance 20 miles. W. W. Lindsey, Detroit, Mich., is interested. Kentucky Traction & Terminal Co. will co-operate in construction of line.

Elkhart, Ind.—Reported St. Joseph Valley Railway will begin construction in spring on a 9-mile extension, from either Montpelier or Pioneer.

Indianapolis, Ind.—Indianapolis Traction & Terminal Co. will lay new tracks in Indiana Avenue from West Street to Fall Creek.

Boone, Ia.—Ft. Dodge, Des Moines & Southern Ry. Co. will electrify Crooked Creek R. R., recently purchased, and make connections with interurban railway at Ft. Dodge.

Perry, Iowa.—Plans completed by Iowa Railway & Light Co. (William G. Dows, Pres. and Gen. Mgr., Cedar Rapids), for construction of a power house in Perry.

Red Lodge, Mont.—Surveys being made for an electric railway to be constructed between Red Lodge and Columbus, via Bear Creek, 40 miles. D. E. Thompson, Lincoln, Neb., is interested.

Little Rock, Ark.—Little Rock, Pine Bluff & Eastern Traction Co. plans to begin construction soon on line from Argenta and Little Rock to Pine Bluff, distance of 45 miles. It is proposed to reconstruct Main Street bridge at Little Rock.

Sacramento, Cal.—Clear Lake Suspended Monorail Co. incorporated to construct a 24-mile line from Sacramento to Lakeport, to be suspended monorail type. Capital, $50,000. Directors: L. H. Briggs, Kelseyville, Andrew Smith of Fenley and others.

Oatman, Ariz.—Mohave-Oatman Water Company, (D. L. Mayhew, Secy.) will sonn award contract for constructing 24 miles of electric railway with mileage, to be increased to 75 miles, including power plants and gas plant, with 28 miles of main pipe, total cost about $2,000,000.

Boise, Idaho.—Boise Bruneau Railway Co. plans to construct an electric railway from Boise to Bruneau. D. Miller, Kansas City, Mo., Pres., and B. F. Olden, Boise., Treas.

BIDS DESIRED.

New York, N. Y.—Until April 27, by Public Service Commission for First District, 154 Nassau Street (Oscar S. Straus, Chairman), for supply of fifteen portions of special work (frogs and switches) for use in construction of rapid transit railroad. Broadway Line.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Youngstown, Ohio.**—Contract for reconstructing about 2½ miles tracks on Wilson Avenue and E. Federal Street for Mahoning & Shenango Ry. & Light Co. awarded to Stone & Webster Engineering Corp., 147 Milk Street, Boston, Mass.

RAILROADS

PROPOSED WORK.

New Haven, Conn.—Engineers of New York, New Haven & Hartford R. R. Co. (Edw. Gagel, Ch. Engr., New Haven, Conn.) estimate that between $25,000,000 and $30,000,000 will be expended by road in next 5 years for improvements.

Passaic, N. J. — Reported Delaware, Lackawanna & Western R. R. Co. (G. J. Ray, Chief Engineer, Hoboken) and City Commissioners have agreed on a plan to eliminate Passaic and Van Houten Avenue grade crossings in Passaic. Track to remain at present level supported on concrete bases, streets to be regraded to pass beneath; cost about $160,000; company to pay $125,000.

Norfolk, Va.—Manhattan, Toano & Norfolk Ry. Co. chartered to construct 67 mile railroad from Norfolk to West Point. Capital, $100,000. H. U. Stephenson, Pres., and F. H. Sprague, Gen. Mgr.

Atlanta, Ga.—See "Miscellaneous."

Cincinnati, Ohio.—Pennsylvania Railroad officials will soon submit to Asst. City Engineer Frank H. Raschig, in charge of bridges, detailed plans for concrete viaduct eliminating the Delta Avenue grade crossing. Bids on the construction work, which is estimated at $452,000, will be advertised within a month or two.

Plans being completed by Asst. City Engineer Raschig for a $140,000 concrete viaduct eliminating Pennsylvania Railroad crossing at Erie Avenue, Madisonville.

Clinton, Ia.—See "Private Buildings."

St. Paul, Minn.—Reported Chicago Great Western R. R. Co. (C. G. Delo, Chief Engineer, Chicago, Ill.) will spend $200,000 for improvements, including track system in St. Paul.

Liberal, Kan.—E. J. Thayer, of Liberal, and W. P. Byers, of Dombey, Okla., are among the incorporators of the Oklahoma, Kansas & Northern R. R., which has applied for incorporation papers and intends constructing a railroad from Liberal to Beaver, Okla., a distance of 40 miles.

Whitefish, Mont.—Great Northern Ry. (A. H. Hogeland, Ch. Engr., St. Paul, Minn.) will construct new tracks and 15 additional stalls for roundhouse here costing $60,000; also spend $27,000 in improvements at Essex.

Portland, Ore.—Reported about $3,650,000 is to be spent by Oregon, Washington Railroad & Navigation Co. (J. R. Holman, Ch. Engr., Portland) for improvements, including 112 miles rail renewals, $250,000; shop improvements and tools, Albina, $75,000; concrete lining North Portland tunnel, $310,000 (now under way); elimination grade crossings, $500,000; line changes, $250,000; completion Vale extension from Riverside to Harriman, $920,000; bridge renewals, $200,000; passing track extensions, $125,000; miscellaneous improvements, $1,020,000.

Prineville, Ore.—Citizens voted $100,000 bond issue for constructing a municipal railroad to connect with Oregon Trunk Line near Redmond.

BIDS DESIRED.

Anchorage, Alaska.—Until June 15, at office of Alaskan Engineering Comn., Anchorage, for furnishing and delivering standard railroad cross-ties and piling to be used in construction of the Alaskan Railroad as follows: Class 1, 100,000 standard cross-ties to be used in construction of section of line across north shore Turnagain Arm; Class 2, 150,000 in construction of Mantanuska Junction northward to Willow Creek; Class 3, 2000 standard pilings in lengths 25 to 40 ft., etc. Information, specification, etc., may be had from Alaskan Engineering Commission, Seward.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Freeport, Pa.**—Contract for work on section of 8 miles extension of Pittsburgh & Shawmut R. R. between Cadogan and Freeport awarded to J. H. Corbett, of Kittanning. Work involves handling of about 20,000 cu. yd. earth and loose rock to the mile. There will be two stations.

★**Mobile, Ala.**—Contract awarded by New Orleans, Mobile & Chicago R.R. Co. (W. F. Owen, Receiver) to C. G. Kershaw Contr. Co. of Birmingham, Ala., for grading Walnut Cut-off between Walnut and Brownfield, Miss., about 150,000 cu. yd. L. W. Duffee, Locating Engineer (present address Walnut, Miss.), is in charge of the work.

PUBLIC BUILDINGS AND SCHOOLS

PROPOSED WORK.

Proctor, Vt.—Erection of new high school contemplated; cost not to exceed $50,000. Address School Board.

Boston, Mass.—Plans completed by Joseph McGinnis, 16 Arlington Street, for remodeling houses of Engine 1 and Ladder 5, on Dorchester Street, South Boston; estimated cost about $38,000.

Brockton, Mass.—Brockton Hospital Company intends erecting a 3-story brick and wood hospital costing $65,000 at Center Street. Wells & Dana, Archts., 29 Central Street, Boston.

Fall River, Mass.—Tentative plans for tuberculosis hospital under consideration; probable cost $150,000. Address City Clerk.

Pittsfield, Mass.—Building Committee approved plans of W. T. Towner, 366 Fifth Avenue, New York, N. Y., for proposed three-story, 116 x 59 ft., marble school.

Somerville, Mass.—School Committee has voted to erect four junior high schools, the first to be erected in West Somerville, to cost $85,000.

Rhode Island.—See "Paving and Roads."

Hartford, Conn.—Citizens April 5 voted $250,000 bonds for erecting high school on Broad Street. Mayor Lawler has appointed a High School Plan and Building Commission, of which Robert H. Fox is a member, to have charge of the work.

New London, Conn.—Trustees of Memorial Hospital planning to erect modern hospital building to cost $150,000.

Plans will soon be prepared by Lawrence Free Public Hospital for a $50,000 building.

Kings Park, N. Y.—Governor Whitman signed bill authorizing the Commissioners of the Land Office to grant a site to the Trustees of Kings Park Free Library on which to erect a free library.

Belleville, N. J.—Board of Education selected John Noble Pierson & Son of Perth Amboy to prepare plans for proposed nine-room addition to Silver Lake School.

Dover, N. J.—Board of Education April 3 sold $125,000 bonds for erecting proposed fireproof high school. Competitive plans will be received until April 25.

Montclair, N. J.—Council reported in favor of issuing $245,000 school bonds, recommended by Board of School Estimate for school improvements, to include a six-room auditorium addition to Cedar Avenue School, costing $115,000, and a six-room and auditorium addition to Watchung Avenue School, costing $90,000.

Newark, N. J.—Tentative plans prepared for $1,000,000 court house annex, to consist of an 8-story office building with foundations to allow for additional floors. Building Committee of the Board of Freeholders has authorized Director Ernest E. Ityman to appoint a commission to take charge of the work.

Repairs to City Hall, costing $54,000 contemplated. Address the Mayor.

Newton, N. J.—Rasmussen & Wayland, 1133 Broadway, New York, N. Y., retained to prepare plans for three-story brick school; cost $75,000. Harvey S. Hopkins, Secretary Board of Education.

Pennsgrove, N. J.—Citizens voted $36,000 bonds to erect school. Address Secretary School Board.

Pompton Lakes, N. J.—Rasmussen & Wayland, 1133 Broadway, New York, N. Y., engaged to prepare plans for two-story brick school to be erected on Lenox Avenue; cost $40,000. Address Board of Education.

Trenton, N. J.—School Board, April 10, rejected bids for $25,000 school because they exceed amount available. District meeting to be held April 21 to vote an additional $9,000 for school with auditorium. Present plans call for 6-room building with no auditorium. F. C. Leaming, Trenton, Chmn. Bldg. Com.

Altoona, Pa.—Election to be held May 16 to vote $100,000 bonds for erecting city hall. M. W. Craine, Building Inspector, prepared plans.

Johnstown, Pa.—Tentative plans prepared for new hospital which Directors of Mercy Hospital contemplate erecting at a cost of $500,000 in the Eighth Ward.

Turtle Creek, Pa.—Contract will be let in about 6 weeks for erecting the high school on Penn and Sycamore Streets to cost $200,000. E. R. Smith, Secy. School District.

Tyrone, Pa.—School Board will erect, in 1917, the 2-story brick high school costing $80,000.

Yardley, Pa.—Heacock & Hokanson, Bailey Building. Philadelphia, are architects for one-story brick school, to cost $30,000. Address Board of Education.

Maryland.—See "Paving and Roads."

Wilmington, Del.—Enlargement and improvement of Alexis I. du Pont School contemplated; probable cost $60,000. Address Board of Education.

Washington, D. C.—Plans completed for a group of five hospital buildings and a service building, each probably two stories high, to be erected at an initial cost of $150,000, consisting of administration building, nurses' home, psychopathic, surgical and medical wards. Snowden Ashford, Municipal Architect.

Huntington, W. Va.—Chamber of Commerce reported to be in favor of proposed $300,000 school bond issue. Address Board of Education.

Richwood, W. Va.—Citizens voted $40,000 bonds to erect a school. W. S. Ford of Clarksburg, Engineer. Address Secretary Board of Education.

Asheville, N. C.—W. H. Lord, Asheville, engaged to prepare plans for high school to cost, including architect's fees, etc., $200,000. Contract will be let soon after May 20.

Augusta, Ga.—Reported Board of Education considering plans for rebuilding Tubman High School and Houghton School, destroyed by fire.

Leesburg, Ga.—Citizens voted $50,000 court house bonds and $30,000 road improvement bonds. Address City Clerk.

Mobile, Ala.—Citizens voted $150,000 bonds for school improvements, and it is the intention of the school board to erect a number of schools in the county. Address Clerk County School Board.

Baton Rouge, La.—Citizens, March 28, voted $125,000 school bonds, proceeds to be used for erecting two new white schools, a negro school and improving and enlarging present overcrowded buildings. Address Clk. Board Education.

Mansfield, La.—School bonds for $24,000 will be sold April 26 by Paris School Board at Mansfield. G. O. Houston, Supt. of Schools.

Jackson, Miss.—Senate passed bill authorizing the Capitol Commission to repair old state house and to issue $125,000 bonds for construction.

Nashville, Tenn.—All bids opened April 3 for erecting east wing to Hume Togg High School exceeded the appropriation. Plans being revised. Address Board of Education.

Beloit, Ohio.—Citizens voted $25,000 bonds for erecting, equipping new school. Address Clerk, School Board.

Bowling Green, Ohio.—Howard & Merriam, 8 East Broad Street, Columbus, preparing plans, to be completed in about 3 weeks, for the state Normal School, to cost $150,000.

Canfield, Ohio.—Citizens voted $35,000 bonds for erecting new high school. Address Clerk Board of Education.

Marietta, Ohio.—Plans of G. W. Hovey of Marietta approved for proposed Carnegie Library to be erected on Fifth and Washington Streets.

Martins Ferry, Ohio.—School Board has authorized calling of election April 27 to vote $125,000 bonds for erecting an intermediate school on high school site.

Nevada, Ohio.—School bonds for $39,000 reported to be sold April 22 by H. E. Dwire, Clerk Board Educ., Nevada Village School Dist.

Oakwood, Ohio.—Bonds amounting to $40,000 sold by Board of Education for erecting addition to present school. Plans have been prepared by Robert E. Dexter, 401 Canby Building, Dayton, and contract will soon be let.

Reily, Ohio.—Citizens of Reily Township, Butler County, voted $30,000 bonds to erect high school here. Address Township Clerk.

Seville, Ohio.—Citizens voted to erect new school according to plans by Althouse & Jones. Mansfield bonds will be sold May 1 and contract let soon after. E. R. Alexander, Clk. Board Education.

Wheelersburg, Ohio.—Schol bonds for $35,000 will be sold April 27 by J. F. Shela, Clerk and Treas. of Rural School Dist.

Ft. Wayne, Ind.—Plans prepared for two-story brick school. Address Board of Education.

Ypsilanti, Mich.—No contract awarded April 1 for erecting library at Michigan State Normal School Building; matter postponed.

Urbana, Ill.—Plans completed for $5,000,000 library 500 ft. long x 400 ft. wide, to be erected at University of Illinois.

La Crosse, Wis.—See "Hydraulic Construction and River Improvements."

La Crosse, Wis.—State Engineer at Madison authorized to prepare plans for $80,000 physical education building to be erected at La Crosse Normal School.

Milwaukee, Wis.—Sites and Plans Committee of the School Board approved plans for 12-room school to be erected on Greenbush Street and Lincoln Avenue.

Oshkosh, Wis.—State Board of Education, Madison, authorized plans ror second unit of new building to be erected at Oshkosh Normal School to replace building destroyed by fire.

Racine, Wis.—Citizens voted $50,000 bonds for erecting new armory. Address State Armory Board, Madison.

Dubuque, Ia.—Perkins, Fellows & Hamilton, 6 North Clark Street, Chicago, Ill., are architects for dining hall to be erected on Louisa Street for Dubuque German College and Seminary, to be known as the Common; cost about $60,000.

Seymour, Iowa.—Citizens voted $40,000 bonds to erect grade school. Address School Board.

Grand Meadow, Minn.—Citizens voted $35,000 bonds for erecting high school to replace building destroyed by fire. Stebbins & Haxby, Architects, Minneapolis. Address Clerk School Board.

Minneapolis, Minn.—Erection of an additional wing to Sanford Hall, the women's dormitory at University of Minnesota, contemplated.

Red Cloud, Minn.—See "Prices and Lettings."

Red Wing, Minn.—Contract will be let in about 6 weeks for erecting high school and grade section of brick, cement, etc., to cost $135,000. Bell & Bentley, Archts., 518 Security Building, Minneapolis. Andrew Lindgren, Secy. Board of Education, Red Wing.

Staples, Minn.—Contract will be let in about a month for erecting the brick and tile school to cost $60,000. E. F. Bromhall, Archt., Alworth Building, Duluth; F. H. Knickerhecker, Secy. Board Education.

St. Paul, Minn.—Reported State Board of Control intends erecting $30,000 building for Women's Reformatory.

Tower, Minn.—Tentative plans being prepared by W. T. Bray, Fidelity Building, Duluth, for two-story, 80 x 145 ft., brick school to cost $80,000. Address School Board.

Ottawa, Kan.—Citizens voted $120,000 bonds for erecting high school and a new public school.

Plattsmouth, Neb.—Citizens voted $50,000 bonds to erect high school.

Crosby, N. D.—Citizens voted $50,000 bonds for erecting new courthouse. Address County Clerk.

Webster, S. D.—Citizens voted $65,000 bonds to erect school. Address School Board.

Billings, Mont.—Contract about to be let for erecting 150 x 250-ft., semi-fireproof public auditorium here. Dedrick & Piper, Archts., Billings.

Maplewood (P. O. St. Louis), Mo.—School Board selected site on Pennsylvania and Lohmeyer Avenues for proposed $40,000 school for which citizens recently voted bonds.

Moberly, Mo.—Ludwig Abt of Moberly is architect for proposed three school buildings, costing $100,000. Address Board Trustees School District.

Springfield, Mo.—The School Board (George Peperdine, Pres.) contemplates erecting two ward schools to cost $25,000 each.

Austin, Tex.—Atlee B. Ayres, Bedell Building, San Antonio, submitted plans to Governor Ferguson for new State School for the Blind, for which the Legislature appropriated $300,000; also for the husbandry buildings to be erected at the Agricultural and Mechanical College, to cost $40,000.

Ennis, Tex.—Citizens April 4 voted $30,000 bonds for erecting a school. Address Clerk School Board.

Floydada, Tex.—Attorney-General at Austin approved school bonds amounting to $50,000 for Lockey Independent School District of Floyd County.

Paris, Tex.—See "Sewerage and Sewage Disposal."

Plainview. Tex.—Reported Seth Ward Methodist College recently destroyed by fire will be rebuilt.

Port Arthur, Texas.—Contract will be let in May for erecting school: probable cost $250,000. Address W. B. Ittner, Archt., Board of Education Building, St. Louis, Mo.

School bonds amounting to $450,000 sold. Address Secretary School Board.

Ardmore, Okla.—Citizens April 3 voted $40,000 bonds for erecting school. Bonds sold. G. H. Prince, Clerk Board Education.

Okmulgee, Okla.—Court house and jail bonds for $125,000 to be sold April 24 by Martin Ryan, County Treas.

North Powder, Ore. — Tourtelotte & Hummel, Rothschild Building, Portland, engaged to prepare plans for nine-room and auditorium school costing $25,000, for which bonds were recently sold.

Fresno, Cal.—Julius E. Krafft & Sons, Phelan Building, San Francisco, engaged by Directors of Burnett Hospital to prepare plans for new $75,000 hospital to be erected on site adjoining present building, Fresno and S Streets, fireproof and Class A construction.

Los Angeles, Cal.—Plans being prepared by A. C. Martin, 430 Higgins Building, for three-story and basement, 140 x 30 ft., reinforced concrete and brick addition to Angeles Hospital, Trinity and Washington Streets; cost about $40,000.

Plans being prepared for a series of buildings which are to be erected for the tubercular patients at the County Hospital, at a cost of $450,000, and will include a 5 or 6-story service building, fireproof, connected to administration building of hospital by a 2-story corridor; a one-story corridor 1100 ft. in length will be extended from this corridor, providing 10 wards for patients. Address Clk. Bd. Supervisors.

San Diego, Cal.—See "Bridges."

San Francisco, Cal. — Erection of a school on Thompkins Avenue and Falsom Street, in the Bernal Heights District, under consideration; estimated cost $28,000. Address Board of Education.

Public Buildings Committee of Board of Supervisors reports sum of $100,000 available for erecting Central Emergency Hospital at Ivy Avenue and Polk Street.

Twin Falls, Idaho.—Burton E. Morse, Twin Falls, is architect for school, for which citizens recently voted $40,000 bonds. G. E. Bryant, Clerk Board, Education.

BIDS DESIRED.

Portland, Me.—Until April 24, by John T. Fagan, Clk. Portland High School Bldg. Commission, 85 Exchange Street, for furnishing material and erecting a high school. Separate bids for heating, ventilating, plumbing, etc. Miller & Mayo, Archt., 502 Fidelity Bldg.

Massachusetts.—Until April 24 by State Armory Commission at office of Adjutant-General, State House, Boston, for erecting two armory buildings, one on Main Street, Woburn, and the other on Pleasant Street, Taunton. Jas. E. McLaughlin, 88 Tremont Street, Boston, Architect.

New Bedford, Mass.—Reported desired until April 30, by J. L. Gibbs, Supt. Pub. Bldgs., for erecting boathouse for Hazelwood Park. Probable cost $50,000. Louis E. Destremps, 251 Main Street, Archt. Geo. H. Nye, City Engr.

New York, N. Y.—Until April 20, by R. A. C. Smith, Commissioner of Docks, for Contract No. 1509, furnishing labor and material required for building freight shed with appurtenances, including plumbing and heating, on bulkheads and piers at foot of W. Fifty-sixth and Fifty-seventh Streets, North River, in Borough of Manhattan. Total security for building, except plumbing, heating, etc., $200,000; for installing heating, $6,000, and plumbing, $4,400.

Carbondale, Pa.—Until April 28 by Board Directors, Carbondale School Dist. (Thos. L. Scott, Secy.) for furnishing material and erecting high school on Lincoln Avenue. Separate bids for heating, ventilating, electrical work, etc. Owen McGlynn, Archt., 85-88 Simon Long Building, Wilkes-Barre.

Ebensburg, Pa.—Until April 17, by School Board (A. J. Apel, Secy.) for erecting a 2-story brick and hollow tile school. Walter R. Myton, Archt., 1204 First National Bank Bldg., Johnstown.

Pittsburgh, Pa.—Until April 19, by Board Education (Geo. W. Gerwig, Secy.), Fulton Building, for structural steel for Westinghouse High School. Geo. S. Orth & Bros., Archts., Farmers' Bank Bldg.

Uniontown, Pa.—Until April 25 by School Board (C. L. Davidson, Secy., Cooper-Lackey Bldg.), for erecting the Park School. John H. Harman, Archt., 632 First National Bank Building.

Until April 22, by Harry W. Altman, Archt., 306 First National Bank Bldg., Uniontown, for erecting a fireproof brick and concrete high school at York Run, Pa., in School District of Georges Township, Fayette County.

Indian Head, Md.—Until April 29, by Bureau Yards & Docks, Navy Dept., Washington, D. C., for constructing extension, of corrugated steel on wood frame, with concrete foundation, for building No. 102, Naval Proving Ground, Indian Head.

Norfolk, Va.—Until May 13, by Bureau Yards and Docks, Navy Department, Washington, D. C. (F. R. Harris, Ch.), for Spec. No. 2224 for constructing a brick building on concrete foundations at the Navy Yard, Norfolk, to be used for a disinfecting plant.

Eatonton, Ga.—Until about May 1, by Board of Education for erecting brick school to cost $25,000. C. E. Choate, Achitect, 11 The Prada, Atlanta, Ga.

Boardman, Ohio.—Until April 25, by Geo. H. Davidson. Clk. Board Education, for furnishing material and erecting a school. Stanley & Scheibel, Archts., Room 1301-06 Wick Building, Youngstown.

Conesville, O.—Until May 3 by Board Education (C. E. Cornell, Pres.) for erecting a school. Frank L. Packard, Archt., Columbus.

Spencer, Ohio.—Reported desired until April 19 by Morris J. Walters, Clk. Board Education, for erecting school. Althouse & Jones, Archts., Mansfield.

Lebanon, Ind.—Until April 29, by A. L. Abston, Trustee, Perry Township, at Lebanon, R. F. D. No. 3, for erecting joint and grade high school.

Oaklandon, Ind.—Until May 2 by County Commissioners, Indianapolis, for erecting a tuberculosis hospital here. William E. Russ, Archt., 1405 Merchants Bank Building, Indianapolis.

Rensselaer, Ind.—Until May 1, by County Hospital Trustees (J. D. Allman, Chmn.), for erecting hospital.

Wacousta, Mich.—Until April 25, by Board Education (J. W. Bush, Secy.) for erecting a school. Separate bids for heating, ventilating, plumbing, etc. Thos. Ernest White, Archt., 312 City National Bank Bldg., Lansing.

Joliet, Ill.—Until April 24 by Board School Inspectors, District No. 86, of Joliet (J. F. Skeel, Clk.), for erecting new grade school known as F. E. Marsh School. John D. Chubb, Archt., 1303-1309 North Dearborn Street, Chicago.

Fall City, Wis.—Reported desired until April 22 by Board Education for erecting 2-story and basement, 57 x 77 ft., brick and tile combined high and grade school. Chas. G. Moore, Archt., Eau Claire.

Douds Leando, Iowa.—Until May 4 by Consolidated Independent School Dist. (F. M. Gilbert, Secy.) for furnishing material and erecting a school. H. W. Underhill & Co., Archts., Bryant Building, Kansas City, Mo.

Little Sioux, Iowa.—Until May 2 by Independent School Dist. (T. J. Lanyon, Secy.) for furnishing material and erecting a school. H. W. Underhill & Co., Archts., Bryant Building, Kansas City, Mo.

Mason City, Ia.—Reported desired until April 26 by R. L. James, Secy. Board Dir. School Board, for erecting high school in Cerro Gordo County.

Selma, Iowa.—Until May 5 by the Consolidated Independent School District, Selma (R. L. Schlotter, Secy.), for furnishing material and erecting a school. H. W. Underhill & Co., Archts., Bryant Building, Kansas City, Mo.

Sheldon, Iowa.—Reported desired until April 24 (change of date) by F. W. Bloxham, Secy. School Board Independent School Dist., for erecting a high and grade school, cost $80,000. Separate bids for heating plumbing, electrical work, etc. G. L. Lockhart, Archt., Endicott Building, St. Paul, Minn.

Brainerd, Minn.—Until May 2 by C. D. Mahlum, Co. Aud., for erecting jail and Sheriff's residence for Crow Wing County at Brainerd. Separate bids for heating, plumbing, electrical work, etc. Alden & Harris, Archts., 809-810 Commerce Building, St. Paul.

Clontarf, Minn.—Until April 22 (extension of date), by T. E. Foley, Clerk Board Education, for erecting new consolidated school. Seperate bids for heating, plumbing, electrical work, etc. W. L. Alban, Archt., 347 Endicott Building, St. Paul.

Little Falls, Minn.—Until May 17, by James A. Wetmore, Acting Supervising Archt., Treasury Dept., Washington, D. C., for erecting, complete, the U. S. post office at Little Falls.

Gaylord, Minn.—Until May 1 by Fred Hoppenstedt, Co. Aud., for erecting, heating, plumbing, etc., court house and Sheriff's residence. Burner & Macomber, McKnight Building, Minneapolis.

Emporia, Kan.—Reported desired until April 17 by Trustees Emporia College for erecting brick and limestone administration building for said college. Felt & Co., Grand Avenue Temple, Kansas City, Mo., Archts.

Norton, Kan.—Reported desired until May 1 by Board Education (F. M. Duvall, Clerk) for erecting 2-story and basement 80 x 112 ft. brick, steel and reinforced-concrete fireproof high school. Probable cost $40,000. C. D. Trumbull & Co., Archts., Manhattan.

Oakland, Neb.—Reported desired until April 18 by Board Education (W. F. Wichstorm, Secy.) for erecting school in. Dist. No. 14. Separate bids for heating, plumbing, electric wiring, etc. Berlinghof & Davis, Archts., 610-13 Security Mutual Life Building, Lincoln.

Elm Mott, Tex.—Until April 22 by Trustees Independent School Dept. for erecting a school. Address O. C. Elliott, Elm Mott, Tex.

Durango, Col.—Until May 18, by James A. Wetmore, Acting Supervising Archt., Treasury Dept., Washington, D. C., for erecting, complete, the U. S. post office at Durango.

Wenatchee, Wash.—Until May 19, by James A. Wetmore, Acting Super. Archt., Treas. Dept., Washington, D. C., for erecting complete U. S. Post Office at Wenatchee.

Los Angeles, Cal.—Until April 21, by Everett R. Perry, Clk. Library Board, Metropolitan Building, for erecting two-story brick branch library, 100 x 60 ft., at Santa Monica Boulevard and Madison Avenue. C. H. Russell, Archt., 1106 Story Building.

Napa, Cal.—Until April 17 by W. F. McClure, State Engr., Sacramento, for erecting cottages for men and women for Napa State Hospital.

Fort Huachuca, Ariz.—Until May 15 by Constructing Quartermaster for erecting two double captain's quarters, four stable guard and shop buildings, administration building, Q. M. corps barracks and laundry at this post advertised in Engineering Record.

Cochrane, Ont.—Until Apr. 25 by School Board (W. McD. Douglas, Secy.), for erecting school. Contractors to view present building and price to include wrecking and salvage.

Cordova, Alaska.—Until May 20, by Bureau of Yards & Docks, Navy Department, Washington, D. C., for constructing one concrete and two wooden buildings; also water and sewer system at the Naval Radio Station, Cordova.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**New York, N. Y.**—Levering & Garrigues, 552 West Twenty-third Street, secured contract for steel for five-story brick students' building to be erected at 119th Street and Broadway for Barnard College; cost $600,000. Buchman & Fox, 30 East Forty-second Street, and Arnold W. Brunner, 101 Park Avenue, associate architects.

Camden, N. J.—Following are four lowest bids opened by Board of Education for erecting high school: W. Beaumont, $349,000; Thomas Reilly, $351,427; Warren Moore & Co., $350,783; Henry L. Brown, $366,666. Bidders of Philadelphia, Pa.

Cresson, Pa.—Reported H. L. Brown, 1714 Sansom Street, Philadelphia, submitted lowest bid for erecting nurses' building and physicians' residence at State Hospital here.

★**Nazareth, Pa.**—Contract awarded by School Board to Henry W. Roth of Nazareth for enlarging high school; cost about $25,000.

★**Philadelphia, Pa.**—Contract awarded by city for erecting one-story, brick, 58 x 106-ft. power house at Southampton Street, west of Meetinghouse Road, to Peoples Brothers, Inc., Commercial Trust Building; cost $37,000.

★**Pittsburgh, Pa.**—Contract awarded W. B. Bennett, 742 N. Negley Avenue, for erecting 3-story and basement loft building at Ellsworth and Center Avenues, East Liberty, to cost $30,000.

★**West Chester, Pa.**—Contract for erecting brick and stone armory for Company I, 6th Regiment, National Guard, awarded William H. Jones, West Chester, at $25,749.

★**Farnhurst, Del.** — Contract awarded Anderson & Son, Wilmington, for erecting addition to Delaware State College at $46,000.

★**Chatsworth, Ga.**—Contract for erecting two-story and basement fireproof courthouse awarded H. J. Carr & Co., Atlanta; cost about $44,500. Alexander Blair, Archt., Macon.

★**Huntsville, Ala.**—Contract for erecting two-story and basement high school on West Clinton Street awarded Baxter Brothers, Huntsville, at $28,089.

★**Cambridge, Ohio.**—Reported W. C. Handshy & Son, Zanesville, secured contract at $22,029 for erecting Arts and Recreation building at Cambridge, a gift to the city by Charles S. McMahon.

★**Dayton, O.**—Following are four lowest bids opened April 4 by Board of Education for erecting Edwin Joel Brown School in North Riverdale: Structural Concrete Company, 1105 U. B. Building, $127,000 (awarded contract); A. Bentley & Sons Company, 111 W. Monument Street, $128,539; Dawson Construction Company, Pittsburgh, Pa., $131,230; Ohio Building & Construction Company, Cincinnati, $136,600. Plumbing to M. J. Gibbons & Co., 20 W. Third Street, at $10,224.

★**Nevada, Ohio.**—Contract for erecting reinforced concrete school awarded W. C. Handshy & Son, of Zanesville, at $29,800.

★**Urichsville, Ohio.**—Contract for erecting 10-room school on Trenton Avenue awarded Shower & Taylor, Crooksville, at $32,252; heating and ventilating, Columbus Heating & Ventilating Co., 425 W. Town Street, Columbus, $2,815.

★**Westchester, Ohio.**—Contract for erecting Centralized School (bids opened April 6) awarded George B. Hucks, South Charleston, at $24,000. C. J. Chamberlin, President Board of Education.

★**Columbus, Ind.**—Contracts awarded as follows for erecting county public hospital (bids opened April 7): General contract, Dunlap & Co., Columbus, $54,495; elevator, Otis Elevator Co., Indianapolis, $2,187; heating, F. A. Clegg & Co., Louisville, Ky., $5,885; plumbing, Clarke & Bros., Indianapolis, $4,975. C. M. Keller, Secy. Bartholomew County Hospital.

Huntington, Ind.—Following are four lowest bids opened March 30 by Supervising Architect, Washington, D. C., for constructing U. S. Post Office: (a) limestone; (b) sandstone: Charles W. Gindele Co., Chicago, Ill., (a) $72,000; Anderson-Strandberg Co., Chicago, Ill., (a) $74,000; William Everly, Indianapolis, Ind., (a) $71,853, (b) $73,100; G. W. Stiles Construction Co., Chicago, Ill., (a) $74,700, (b) $78,700; R. S. Moore, Lafayette, (b) $78,488; W. G. Carter Co., Chicago, $78,275.

★**Taylorville, Ill.**—Contract for erecting U. S. Post Office awarded Original Cabinet Co., Evanston, at $46,100.

★**Oshkosh, Wis.**—Following are four lowest bids opened March 1 by Bd. Regents of Normal School, at Madison, for concrete and general work on Normal School at Oshkosh: J. P. Cullen Constr. Co. of Janesville, $69,476 (awarded contract April 7); Immel Construction Co. of Fond du Lac, $79,643; C. R. Meyer & Sons Co., of Oshkosh, $76,505, and Appleton Constr. Co. of Appleton, $71,340. Awards on other work as follows: Downey Heating & Supply Co. of Milwaukee, heating and ventilating, at $7,700; American Heating Co., of Superior, plumbing, at $4,297; George F. Rohn, of Milwaukee, electric wiring, $3,660; Northwestern Marble & Tile Co., of Minneapolis, Minn., for tile and marble work, $8,550.

★**Atlantic, Iowa.**—Contract for erecting city hall (bids opened April 3) awarded Charles Bauer & Son, Omaha, Neb., at $30,158. T. E. Nichols, City Clerk.

★**Byron, Minn.** — Contract awarded George J. Hoffman, Rochester, for erecting school, at $32,000.

Red Cloud, Minn.—All bids opened April 4 for erecting high school have been rejected. Lowest submitted was $38,680. New bids will be received in about a month. C. J. Pope, Secy. Board of Education.

★**St. Paul, Minn.**—Contract for erecting Public Libraries Nos. 1, 2 and 3 awarded Cameron Company, Ryan Building, St. Paul, at $68,250,

Aberdeen, Wash.—Following' are four lowest bids opened April 3 by Supervising Architect, Washington, D. C., for constructing a U. S. Post Office, (a) limestone; (b) sandstone: T. E. Young & Co., Seattle, (a) $74,526; (b) $74,161. Harding F. Allan, Seattle, (a) $75,300; (b) $74,700. John Wallin, Tacoma, Wash., (a) $75,776; (b) $75,818. Henrikson & Co., Seattle, (a) $74,708; (b) Wilkinson, $74,050, and Tinino, $73,858.

Pomeroy, Wash.—S. G. Morin of Spokane submitted lowest bid for erecting high school at $60,719.

Seattle, Wash.—Following are four lowest bids opened March 31 by Board of Regents, University of Washington, Henry Building, for constructing Political Science and Commerce Building: (a) excavation, (b) concrete work, (c) structural steel: H. D. Stewart, American Bank Building, (a) $2,974, (b) $38,513, (c) $19,492; C. L. Creelman, Seattle; (a) $3,954, (b) $40,469; W. T. Butler, Seattle, (b) $38,909, (c) $19,750; Henry Brice, Seattle, (a) $4,500; Finne & Gjarde, Seattle, (a) $5,060, (b) $41,377, (c) $20,360; MacRae Brothers, Seattle, (c) $21,000.

★**Eugene, Ore.**—Contract awarded by Board of Regents, University of Oregon, for erecting educational building for said University, to N. E. Hoover of Albany, at about $30,000.

PRIVATE BUILDINGS

PROPOSED WORK.

Burlington, Vt.—Roman Catholic Diocese contemplating erecting high school building and quarters for all Catholic Societies of Burlington; probable cost $75,000.

Gardner, Mass.—Reported B. N. Michaelman of Gardner will erect brick theater building on Parker Street; cost $45,000.

Holyoke, Mass.—Plans completed by Oscar Beauchemin, Senior Bldg., for five-story apartment house to be erected at Walnut and Essex Streets, for John B. Beauvais; cost about $60,000.

Contract about to be let for remodeling and enlarging moving-picture theater on Main Street for Bijou Theater Co.; cost about $65,000. Oscar Beauchemin, Archt., Senior Building.

Webster, Mass. — H. J. Sternberg, School Street, will erect three-story brick block and connecting garage, to cost $80,000.

New Haven, Conn.—Plans approved for proposed $30,000 building for Young Men's Hebrew Association, 284 Crown Street. Address Chairman Building Committee.

Baldwin, L. I., N. Y.—Reported plans prepared by Caretto & Foster, 30 East Forty-second Street, New York, for 2-story steel, brick, stucco and terra cotta passenger station which the Long Island Railroad (J. R. Savage, Ch. Engr., Jamaica, L. I.) contempiates erecting here.

Buffalo, N. Y.—Plans being preparted for 15-story addition, steel, brick and terra cotta, to be erected to Hotel Touraine, at Delaware Avenue and Johnson Park (John McHowie, Mgr.).

Long Island City, L. I., N. Y.—Plans filed for five-story brick tenement house which Frank Zovanovec, 70 Wilson Avenue, intends erecting on Academy Street, Astoria, cost $90,000.

New York, N. Y.—George McCabe, 95 Fifth Avenue, is architect for five-story, 25 x 100-ft. lodging house which B. Flynn proposes erecting; cost $30,000.

Edwin F. Rush has engaged E. C. Horn Sons, 1476 Broadway, to prepare plans for a theater, 75 x 100 ft., which he intends erecting at 148 West Forty-eighth Street, adjoining the Cort Theater; estimated cost $150,000.

William D. Kilpatrick, 149 Broadway, and James H. Cruikshank, 55 Liberty Street, contemplate erecting 10 or 12-story commercial building for exporting concerns at Pearl and Water Streets; probable cost about $350,000.

Erection of a West Side Jewish Community Center, to cost $250,000, contemplated on West Eighty-sixth Street and Columbus Avenue. Joseph H. Cohen, President of Beth Israel Hospital, 70 Jefferson Street, may be able to give information.

Plans filed for erecting following buildings: 5-story brick tenement on 153rd Street and St. Nicholas Place., for R. B. Realty Company, cost $75,000, Sass & Springsteen, Archts., 38 Union Sq.; 6-story brick store and apartment building on Sherman Avenue and Dyckman Street for Maxon Realty Company, Inc., cost $90,000, Andrew J. Thomas, Archt., 2526 Webster Avenue; 6-story brick apartment on Washington Avenue and 172nd Street, for One Seventy-Two Building Company, cost $200,000, Gronenberg & Leuchtag, Archts., 303 Fifth Avenue; 12-story fireproof theater, store and studio building at 1614 Broadway and 748 Seventh Avenue, for Barney Estate Company; cost $500,000, Lord & Hewlett and William Lazink, associate architects, 345 Fifth Avenue; one 6-story and two 5-story brick tenements on Grand Concourse and 170th Street, for Grand Concourse and Boulevard Company; total cost $225,000, George & Edward Blum, Archts., 505 Fifth Avenue; two 5-story brick tenements on Broadway and 238th Street, for 5780 Broadway Building Company, Inc., total cost $110,000, Goldner & Goldberg, Archts., 391 East 149th Street; 7-story concrete and brick warehouse on Southern Boulevard and 141st Street, for Atlantic Warehouse, Inc., cost $160,000, Timmis & Chapman, Archts., 315 Fifth Avenue; 6-story brick garage on 150th Street and Jackson Avenue, for Pasquale Santini, cost $50,000, Goldner & Goldberg, Archts., 391 East 149th Street; 7-story fireproof addition to Boys' Club Building, at 281 East Tenth Street, cost $130,000, Townsend, Steinle & Haskell, Inc., Archts. 1328 Broadway.

Syracuse, N. Y.—Syracuse Motor Car Company, 235 West Genesee Street, plans erecting garage, salesroom and service station buildings on West Genesee and West Willow Streets; total cost about $90,000.

Newark, N. J.—Plans being prepared by Hyman Rosensohn, 800 Broad Street, for three-story, 42 x 94 ft., brick school building, to be erected at 60 Morton Street, for Talmud Torah Association; cost $40,000.

Altoona, Pa.—Plans being prepared for a moving picture theater to be erected by Gamble Bros. Theatrical Company on Seventh Avenue and Twelfth Street, at a cost of $50,000.

W. H. & L. C. Wolfe, Altoona, automobile distributors, will erect a 3 story brick and concrete building, costing $30,000.

Elizabethtown, Pa.—Exchange Bank intends erecting a $25,000 building.

Harrisburg, Pa.—M. I. Kast, Commonwealth Trust Building, is architect for 5-story brick apartment house which J. Hervey Patton, 1924 N. Third Street, will erect at 711 N. Second Street; cost $30,000.

Homestead. Pa.—Contract soon to be let for erecting $35,000 Knights of Malta building.

McKeesport, Pa.—H. Rushton, 201 Lincoln Avenue, Pittsburgh, and T. J. Lewis of McKeesport reported interested in erecting at Sinclair and Ringgold Streets a public market to cost $100,000.

New Kensington, Pa.—Plans being prepared by Janssen & Abbott, Century Building, Pittsburgh, for two-story fireproof club house which the Aluminum Company of America intends erecting on Freeport Road; probable cost about $200,000.

Norristown, Pa.—Watson & Huckel, 1211 Walnut Street, Philadelphia, for preparing plans for church for Trinity Lutheran Church.

Philadelphia, Pa.—Plans prepared by John T. Windrim, Commonwealth Building, for 8-story building to be erected on Eleventh and Girard Streets for Girard Estate and leased to N. Snellenburg & Company.

Contract soon to be let for erecting 3-story, stone, fireproof Boys' High School at Forty-ninth Street and Chestnut Street for Archbishop Prendergast. E. F. Durang & Son, Archts., 1200 Chestnut Street.

P. J. Getz, 2249 North Fourth Street, is architect for three and four-story brick and stone school and church to be erected on Mascher and Master Streets, for Sacred Heart Roman Catholic Church.

Pottstown, Pa.—Contract soon to be let for erecting two-story and basement, brick and stone, 41 x 146 ft. office building, for McClintic-Marshall Company, of Pittsburgh. W. G. Wilkins Company, Archts., Westinghouse Building, Pittsburgh.

Plans being prepared by John T. Windrim, Commonwealth Building, Philadelphia, for three-story, brick and stone building to be erected for Bell Telephone Company.

Sewickley, Pa.—Plans being prepared by Alden & Harlow, 305 Fifth Avenue, Pittsburgh, for a $30,000 residence which is to be erected here this summer for S. S. Liggett.

Tamaqua, Pa.—Three-story brick and terra cotta bank building is to be erected for the Tamaqua National Bank. Benjamin R. Stevens, Archt.

Warren, Pa.—Tentative plans prepared by Brockway & McNeil, Warren Savings Bank Building, for three-story and basement, brick and concrete, Y. W. C. A. building; cost approximately $50,000.

York, Pa.—Union Lutheran Church plans erecting a $100,000 edifice. Rev. W. H. Feldman, Pastor.

★**Baltimore, Md.**—Morrow Bros., 1201 Fidelity Building, secured contract to erect department store for Hutzler Bros. at Saratoga Street and Kimmel Alley; cost $125,000. Baldwin & Pennington, Archts., 601 Professional Building.

Plans being prepared by R. M. Hunter, Annapolis, for three-story school building, to be erected at Severna Park for Prof. Teiel.

Washington, D. C.—Holmes & Son, 107 F Street, N. W., will erect a concrete and steel bakery, costing $50,000.

Harry Wardman, 1430 K Street, N. W., proposes erecting ten apartment houses, each seven stories high, in the Woodley Park section.

Harrisonburg, Va.—Contract soon to be let for erecting five-story People's Bank building; cost $70,000.

Richmond, Va.—West End Methodist Church, Twenty-fifth and Hull Streets, contemplates erecting new edifice on Midlothian Turnpike, to cost approximately $26,700.

Anderson, S. C.—Officials of Charleston & Western Carolina Railroad (A. W. Anderson, Gen. Mgr., Augusta, Ga.) have appropriated $40,000 for erecting freight depot on South Main Street.

Jacksonville, Fla.—Plans being prepared for new industrial home to be erected at Clay and Ward Streets for Salvation Army, 516 West Church Street.

Mobile, Ala.—Mobile County Club members have authorized issue of $75,000 bonds, proceeds to be use to erect a new club house and to lay out land in building lots. Address Secretary of Club.

Knoxville, Tenn.—J. B. Pound of Chattanooga reported interested in Knoxville Hotel Company, which proposes erecting 10-story hotel at Gay Street and Church Avenue.

Louisville, Ky.—Directors of Louisville Auditorium Association (Peter Lee Atherton, 517 Atherton Building, President) considering selection of site for proposed $300,000 auditorium.

Cincinnati, Ohio.—Walter D. Randall of Champion Coated Paper Company, will erect a $60,000 residence in College Hill. James Gamble Rogers, 470 Fourth Avenue, New York, N. Y., Archt.

Bagshaw Feature Film Company, 814 Mercantile Library Building, reported contemplating erecting moving picture studio.

Cleveland, Ohio.—George M. Steffens, 1027 Williamson Building, will erect a $25,000 apartment house at 2057 East 105th Street.

Plans prepared by C. W. Hopkinson, 900 Rose Builing, for a 2-story, 70 x 165 ft., store and apartment house to be erected at Euclid Avenue and East 101st Street by H. McIntosh, Jr., Guardian Savings & Trust Co.; cost $75,000.

Plans prepared by Hubbell & Benes, 4600 Euclid Avenue, for a $40,000 addition to Laurel School, at 10001 Euclid Avenue. W. A. Harshaw, 11440 Juniper Road, owner.

Nathan Feigenbaum, 7507 Cedar Avenue, is planning erecting a $30,000 store and apartment house at Cedar Avenue and E. Forty-sixth Street.

Dr. T. W. Blanton, 7703 Woodland Avenue, contemplates erecting a 2-story store and office building at Woodland Avenue and E. Eighty-sixth Street.

Chamber of Commerce is reported considering erecting a new home to cost probably $2,500,000 on Mall site. Bascom Little, 501 Citizens Building, Pres.

Middletown, Ohio.—Plans approved for gymnasium to be erected for Holy Trinity Parish; cost $35,000. Rev. Edward Hickey, Pastor.

Tiffin, Ohio.—Plans prepared for $50,000 edifice to be erected for First Presbyterian Church.

Indianapolis, Ind.—Reported Railroadmen's Building and Savings Association (J. E. Pierce, 402 Saks Building, Secretary) plans erecting two-story store and office building on Virginia Avenue; cost about $50,000.

Detroit, Mich.—Rogers, Bonnah & Chaffee, Penobscot Building, are architects for 14-story Hotel Norton to be erected at Jefferson Avenue and Griswold Street for Jefferson Hotel Co.; cost about $300,000.

Jackson, Mich.—Peoples National Bank, Main and Mechanic Streets, intends erecting new eight-story bank and office building on present site.

Plans being prepared by Leonard H. Field, Jr., of Jackson, for a twenty-suite apartment house, to be erected on Wildwood and Steward Avenues, for Cuen-Reynolds Company; estimated cost $80,000.

Alton, Ill.—Plans completed for proposed Masonic Temple; probable cost $35,000.

Chicago, Ill.—Reported Illinois Central R.R. (A. S. Baldwin, Ch. Engr., Chicago) contemplates erecting an eight-story fireproof office building west of Woodlawn Station on Sixty-third Street; probable cost at least $500,000.

Sketches prepared by Irving Pond, of Pond & Pond, 64 East Van Buren Street, for proposed nine or ten-story theater and club building contemplated by Chicago Woman's Club; probable cost $600,000.

Reported plans prepared for apartment building which Fred Becklenberg, 29 South La Salle Street, intends erecting at Pine Grove Avenue and Gary Place; probable cost $120,000.

J. M. Browarsky, 30 North La Salle Street, intends erecting store, theatre and apartment building at Cicero and West End Avenues; cost about $200,000.

Rock Island, Ill.—The Tri-City Railway Company at offices in Davenport, Iowa (Joseph F. Porter, President), approved plans for proposed inn to be erected in this city; estimated cost $50,000.

Milwaukee, Wis.—Schuchardt & Judell, 428 Jefferson Street, are architects for three-story and basement, brick, concrete and steel, 40 x 120-ft. warehouse to be erected for Banner Coffee Company; cost about $40,000.

A nine-story, 75 x 150 ft. theater, store and office building, with 3-story annex office and store building, is to be erected at Third and Wells Streets; cost $300,000. Kirchoff & Rose, Archts., Majestic Bldg.

Clinton, Ia.—Chicago & Northwestern Railway Company (W. H. Finley, Ch. Engr., Chicago, Ill.) plans to spend sum of $500,000 during the next three years for a new passenger station and a new freight depot, a subway under the tracks and general rearrangement of tracks and yard facilities.

Austin, Minn.—J. N. Nicholson is Chairman of Committee considering erecting a $50,000 Y. M. C. A. building.

Minneapolis, Minn.—Trustees of William Hood Dunwoody Industrial Institute, Grant and Fourth Avenues, S., considering plans for proposed group of buildings, first unit to cost about $300,000. F. M. Crosby, Chairman Building Committee.

Chamber of Commerce plans erecting a $1,000,000 building on site of present Chamber of Commerce building, and erecting a $100,000 annex in the rear.

St. Paul, Minn.—Hartford & Hausler, Pioneer Building, preparing plans for a 6 story building, costing $65,000.

Plans being prepared by Hartford & Hausler, Pioneer Building, for a 4 story and basement labor temple, costing about $100,000.

Kansas City, Kan.—Reported Union, Rotary and Mercantile clubs propose erecting a club house costing $50,000.

Grand Island, Neb.—Elks will erect a $40,000 building. C. H. Mench, President.

Jamestown, N. D.—Plans filed for the Northern Pacific R. R. depot, to cost $125,000.

Butte, Mont.—Louis Dreibeibis, 429 North Main Street, will erect 3-story concrete and brick store and rooming house on East Park Street; cost about $30,000.

Great Falls, Mont.—G. H. Shanley, Great Falls, engaged by H. P. Brown to prepare plans for two-story, 50 x 100 ft. business building to be erected at 310 Central Avenue, to be known as the Brown-Dunn Block, cost $60,000. Reported contract will be let about April 25.

Kansas City, Mo.—Henry J. Rahe, 3600 Flora Avenue, will erect a 6-story concrete building for the Rahe Automobile Training School, cost about $82,000.

Springfield, Mo.—Gubble Bros., of Kansas City, Kan., contemplate erecting a hotel or office building on Public Square; cost about $75,000. Also plan erecting a moving picture and vaudeville house in Springfield; cost $25,000. Contract for foundation awarded.

St. Louis, Mo.—Congregation of B'nai Amoona Church, Garrison and Lucas Avenues, intends erecting new synagogue at Vernon and Academy Avenues; cost about $75,000.

Ft. Smith, Ark.—Yale Theater Co. (L. W. Brophy, Pres.), Muskogee, Okla., contemplates erecting a $50,000 theater in Ft. Smith.

El Paso, Texas.—About $75,000 will be spent by A. Mathias & Co., Broadway and East Overland Street, for construction of a 6-story building on San Jacinto Street.

Fort Worth, Tex.—Erection of a Masonic Temple to cost at least $200,000 contemplated.

Galveston, Texas.—Plans complete by C. D. Hill & Co., Sumpter Bldg., Dallas, and contract soon to be let for constructing 2 or 3 story brick business building for Fred C. Hunter, of Galveston.

Seattle, Wash.—Plans to be prepared by H. Ryan, Northern Bank Building, for an 8 story, 60 x 120 ft. apartment house, to be erected at Boren Avenue and John Street, by the Coast Exchange Investment Co; cost $200,000.

A. Warren Gould, American Bank Building, engaged to prepare plans for $1,500,000 hotel and office building reported contemplated on Second Avenue and James Street by owners of the Butler Hotel and Railway Exchange Building.

Portland, Ore.—See "Railroads."

Portland, Ore.—Plans being prepared by Whitehouse & Fouilhoux, Wilcox Building, for two-story and basement brick and concrete store building to be erected on Lownsdale and Washington Streets for M. G. Thorsen; cost $25,000.

San Francisco, Cal. — Macdonald & Kahn, Rialto Building, will erect for Dr. Hartland Law an 8 or 9-story apartment house on Stockton and California Streets; probable cost $150,000.

Visalia, Cal.—Swartz & Swartz, Rowell Building, Fresno, engaged to prepare plans for three-story, brick store and lodge building, to be erected at Main and Locust Streets, for Elks; cost about $60,000.

Masonic Lodge contemplates erecting, this summer, a three-story brick temple adjoining Elks building; cost about $60,000.

Rigby, Idaho.—Architects engaged by Mormon Church State Authorities to prepare plans for $30,000 state tabernacle to be erected here this summer.

New Westminster, B. C.—Plans to be prepared by Moscrop & Whitburn, New Westminster, for a 3 story steel and reinforced concrete theater and business block on Columbia Street for Alhambra Theater & Hotel Company; cost $150,000.

BIDS DESIRED.

Mankato, Minn.—Until April 22 by Mankato State Bank for remodeling present bank building by erecting additional two stories and basement of brick. Separate bids for heating, electric wiring, marble work, etc.

Topeka, Kan.—Reported desired until April 25 by Masonic Grand Lodge (A. K. Wilson, Grand Secy., New England Building) for erecting 2-story and basement, 75 x 120 ft., fireproof library and office building at Eighth and Harrison Streets. Probable cost $100,000. Ed. L. Tilton, 32 Broadway, New York, N. Y., Archt.

Flandreau, S. D.—Until April 27, by Rev. G. E. Kelly, Chmn. Building Committee, for erecting church. W. E. E. Greene, Archt., Luverne, Minn.

Los Angeles, Cal.—Until April 20, by Morgan, Walls & Morgan, 1134 Van Nuys Building, for erecting 5-story reinforced concrete garage, service and storage building, 100 x 150 ft., at Eleventh and Hope Streets, for M. H. Newmark.

PRICES AND LETTINGS.

★Indicates award of contract.

★Newburyport, Mass.—Contract awarded H. P. Cummings Construction Company, Ware, for erecting a 1-story and basement, 75 x 125-ft. power plant for Newburyport Gas & Electric Company. Hubert S. Kimball, Engineer, 111 Devonshire Street, Boston.

★Providence, R. I.—Contract awarded by Emery Bros. to William Williams, 86 Weybosset Street, for erecting theatre on Washington, Empire and Aborn Streets. W. R. Walker & Son, Archts., 17 Custom House.

★New York, N. Y.—Contract awarded Underpinning & Foundation Company, 290 Broadway, for foundation work at 53-57 West Twenty-third Street; standard Hercules steel pile construction will be used. Wm. Birkmire, Archt., 1133 Broadway.

★W. J. Taylor Company, 5 East Forty-second Street, has general contract for erecting 9-story brick and limestone apartment building at 156-166 East Sixty-sixth Street; cost $500,000. Steel contract let to Passaic Structural Steel Company, Straight Street, Paterson, N. J. Walter B. Chambers, Archt., 109 Broad Street.

★Saratoga Springs, N. Y.—Contract awarded George B. Wills & Company, 101 Park Avenue, New York, for erecting one-story, brick and marble bank building at Broadway and Church Street for Adirondack Trust Company; cost $75,000. Alfred Hopkins, Archt., 101 Park Avenue, New York.

★Yonkers, N. Y.—Contract awarded Lynch & Larkin, 195 Riverdale Avenue, for erecting three-story, limestone and stone Masonic Temple, at South Broadway and Guion Street, at $75,831.

★Brownsville, Pa.—Contract for erecting roundhouse for Monongahela Railroad awarded W. F. Trimble & Sons, 1719 Penn Avenue, Pittsburgh.

★Harrisburg, Pa.—Contract awarded Cranford & Stephenson, Harrisburg, for erecting concrete and steel laundry building for William E. Orth; cost $50,000.

★Philadelphia, Pa.—Contract awarded Turner Concrete Steel Company, 1713 Sansom Street, for constructing inbound freight house and automobile platform in Federal Street yard (bids opened March 28). E. B. Temple, Asst. Ch. Engineer, Pennsylvania RR., Philadelphia.

★Contract awarded Thomas C. Trafford, 1613 Sansom Street, for two-story, stone, concrete, 112 x 117 ft, church and Sunday School building to be erected at Thirteenth and Rockland Streets for Methodist Episcopal Church; cost $48,000.

★Augusta, Ga.—Contract awarded Carson Construction Company of Savannah for erecting 164 x 110 ft. cotton seed warehouse for Southern Cotton Oil Company; cost approximately $24,000.

★Black Mountain, N. C.—Contract for erecting auditorium for National Festival Chorus of America awarded Elliott & Co., of Hickory; probable cost $200,000.

★Atlanta, Go.—H. D. Watts Company, Baltimore, Md., has secured contract for erecting four-story building for Southern Express Company; probable cost $100,000.

★Youngstown, Ohio.—Contract for erecting residence on Logan Avenue for Richard Garlick, awarded Heller Brothers Company; 29 South Phelps St.; probable cost $50,000.

★South Bend, Ind.—Contract for erecting clubhouse for South Bend Country Club awarded Hilton Hammond of South Bend at $39,700.

★Sioux Falls, S. D.—Contract for constructing St. Joseph Roman Catholic Cathedral awarded O. H. Olson, of Stillwater, Minn., at $163,277.

★Fort Worth, Tex.—Contract awarded by H. W. Williams & Co. to Buchanan & Gilder, Fort Worth, for erecting five-story and basement building at Front and Calhoun Streets; cost $100,000. Sanguinett & Staats, Archts., First National Bank Building.

Pullman, Wash.—Frank V. Roth of Pullman submitted lowest bid for erecting Emerson Mercantile Building at Main and Adler Streets at $34,890.

★Fresno, Cal.—Contract for erecting brick, steel, granite and plastered edifice at Calaveras and N Streets for First Church of Christ (Scientist) awarded Trewhitt & Shields of Fresno, at about $45,000. Robert Hotchkin, Archt., Fresno.

★San Francisco, Cal.—Contract for erecting five-story garage addition at Treat Avenue and Twenty-first Street, for Ford Motor Company, awarded Clinton Construction Company, San Francisco, at $126,877.

NEW INDUSTRIAL PLANTS

PROPOSED WORK.

Rumford, Me.—Maine Coated Paper Company, Rumford, will erect $200,000 addition to plant.

Bondsville, Mass.—Boston Duck Co., Bondsville, will erect an additional mill, five stories, 400 x 130 ft., also a three-story, 121 x 68-ft. stock or storehouse; cost about $350,000.

Pittsfield, Mass.—Eaton, Crane & Pike Company, Mill Street, planning to erect 60 x 152-ft. addition.

New Haven, Conn.—William Schollhorn Company, New Haven, will erect a 4-story, 40 x 40-ft. addition.

Waterbury, Conn.—Charles H. Preston, Jr., Waterbury, is architect for a brick factory with steel truss roof, 100 x 160 ft. concrete floors, steel sash, also a boiler house, 25 x 30 ft., a coaling station of brick 20 x 80 ft. and a railroad trestle for the A. H. Wells & Company, Inc., of Waterbury.

Buffalo, N. Y.—Barcalo Mfg. Company, 225 Louisiana Street, intends erecting a 3-story brick addition to plant at Louisiana and Kentucky Streets and Erie R.R.; cost $35,000. E. J. Barcalo, Pres.

Plans filed for a 2-story reinforced concrete warehouse addition to plant of Cyphers Incubator Company, Dewey Avenue and N. Y. Central R. R. Belt Lines; cost $35,000.

New York, N. Y.—Plans being prepared by S. J. Kessler, 1037 Teller Avenue, Bronx Borough, for an ice plant which the Community Ice Co. intends erecting on Stebbins Avenue and Freeman Street; cost approximately $175,000.

Watervliet, N. Y.—Plans being prepared by Thornton W. Price, Woolworth Building, New York, for additions to plant of Ludlow Steel Company.

Hoboken, N. J.—Franklin M. Small, 265 Broadway, New York, N. Y., engaged to prepare plans for ten-story, 60 x 100-ft. reinforced concrete factory to be erected at 500 Willow Avenue for American Lead Pencil Company.

Clairton, Pa.—F. F. Marquard, of Sharon, to be in charge of by-product plant of U. S. Steel Company.

Columbia, Pa.—United States Lock & Hardware Company, Columbia, plans addition to its plant; also Triumph Manufacturing Company plans for additions to double capacity of plant.

Erie, Pa.—Contract soon to be let for erecting reinforced concrete grain elevator for Erie & Western Transportation Company (W. W. Farley, Manager); cost approximately $350,000.

Philadelphia, Pa.—Revised plans prepared by Day & Zimmerman, 611 Chestnut Street, for a factory which Nitrogenous Chemical Co. will erect at Thirty-seventh and Tasker Streets.

Pittsburgh, Pa.—People's Engine Products Co. of Pittsburgh, incorporated at Dover, Del., and intends locating plant in the Ohio Valley.

Union Furnace, Pa.—Union Furnace Manufacturing Company (J. King McLanahan, Hollidaysburg, Pres.) plans rebuilding plant destroyed by fire.

Baltimore, Md.—Reported Bethlehem Steel Co. has purchased plant of Baltimore Sheet & Tin Plate Co., and intends enlarging same extensively.

Linde Air Products Company (G. W. Mead, Pres.), Forty-second Street Building, New York, will construct a plant here for manufacture of oxygen and other products for use in welding purposes.

Havre de Grace, Md.—Plans being prepared by Thornton W. Price, Woolworth Building, New York, N. Y., for a steel factory for the Maryland Metal Cross Tie Company.

Washington, D. C.—House Naval Committee reported favorably April 5 on Senate bill providing for erection or purchase of an armor plant.

Suffolk, Va.—Plans completed by J. K. Peebles, Kevan Law Building, Norfolk, for rebuilding peanut factory of Lummis Peanut Company, destroyed by fire; cost $30,000.

Kingsport, Tenn.—R. B. Embree of Bristol reported interested in a syndicate which intends erecting paper pulp plant here, to cost about $500,000.

Cincinnati, Ohio.—Zettel & Rapp, 607 Johnston Building, commissioned to prepare plans for one-story brick and steel addition, with 28,500 sq. ft. of floor space, to plant of R. K. LeBlond Machine Tool Co., at Edwards & Madison Roads, Hyde Park.

Plans being prepared for factory building to be erected on McMillan Street for D. Gruen Sons Company, 301 Johnston Building; cost about $50,000.

Cleveland, Ohio.—W. W. Hedges, 1216 Schofield Building, is architect for $350,000 manufacturing building to consist of three units, each four stories and basement, of reinforced concrete and brick, to be erected at Superior Avenue and East Twenty-fifth Street, for Adolph E. Berstein, 503 Leader-News Building, and James H. Rook, 508 Williamson Building.

West Carrollton, Ohio.—Plans prepared by Cleveland Construction Company, Citizens Bldg., Cleveland, for electric machinery for the plant of the Miami Paper Company; a 1500 kw. G. E. turbine has been purchased and four 200 kw. motors will be installed for operating Jordans and five 100 kw. motors will operate the heaters, also four constant speed motors will be installed for operating paper machines. A new power house is to be erected and exhaust steam will be used in paper-making process.

Youngstown, Ohio.—Plans being prepared by Ernest McGeorge, 854 Leader-News Building, Cleveland, for a plant which the Gschwind Furnace Company, recently incorporated with W. W. Watson, President, proposes erecting.

Detroit, Mich.—Plans completed by Albert Kahn, 58 Lafayette Avenue, and Ernest Wilby, associate architects, for 3-story reinforced concrete, brick and stone truck factory with reinforced concrete floors to be erected on Lafayette and St. Paul Avenues for Standard Motor Truck Company; cost, including equipment, about $200,000.

Milwaukee, Wis.—Plans completed by Armond D. Koch, 1045 Wells Building, for new plant to be erected for Wisconsin Iron & Wire Works, 186 East Water Street, to consist of four units, part mill construction, of brick, concrete and steel, 140 x 249 ft.

Plans being prepared by A. C. Clas, Colby-Abbott Building, for five-story, 25 x 125-ft., brick and reinforced concrete addition to plant of O. C. Hansen Company, 291 Milwaukee Street.

Minneapolis, Minn.—The Washburn-Crosby Milling Co., Chamber of Commerce Building, plans erecting additional building near plant, including 3,000,000 bu. grain elevator, tank construction, concrete, fireproof.

Minneapolis, Minn.—American Flour & Cereal Mills Company contemplates erecting rye flour mill here to cost $100,000. Thomas L. Clark, 2540 Elliott Avenue, reported interested.

St. Louis, Mo.—Monsanto Chemical Company (John F. Queeny, President), 1800 South Second Street, intends erecting two additional buildings for manufacture of chemicals; total cost about $100,000.

Best-Clymer Manufacturing Company, Virginia Avenue and Davis Street, plans extensive enlargement of plant.

Ennis, Tex.—L. W. Roberts, Jr., of Atlanta, Ga., engaged by Cotton Mill Committee of the Chamber of Commerce to prepare plans and estimates for proposed cotton mill to be erected here at a cost of about $200,000.

Beaumont, Tex.—Contract will soon be let for erecting 2-story brick building for W. C. Tyrrell for manufacture of paints. F. W. Steinman of Beaumont, Architect. Cost about $50,000.

Seattle, Wash.—Standard Furniture Company, Second Avenue and Pine Street, has engaged L. L. Mendell, Oriental Building, to prepare plans for 3 or 4-story, 120 x 270-ft. reinforced concrete and mill constructed furniture factory to be erected on Fourth Avenue South and Walker Street; cost $60,000.

Tacoma, Wash.—Reported Gregory Furniture & Manufacturing Company (Edwin Gregory, Pres.) affiliated with the Standard House Furnishing Company of Tacoma and will construct and operate a furniture factory here.

Portland, Ore.—Reported plans being prepared in Chicago office of Swift & Co. for a 7 story concrete cooler bulding, to be erected at their branch here, the Union Meat Co.; cost $150,000.

Winnipeg, Man.—R. Siderfin and E. B. Eadie, both of Winnipeg, reported interested in Great Lakes Terminal Elevator Company, recently incorporated at Ottawa, and intends erecting terminal elevator at the head of lakes.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Palmer, Mass.**—Contract awarded J. W. Bishop & Company, of Worcester, for erecting four-story and basement, 132 x 325 ft. brick mill for Boston Duck Company.

★**Woonsocket, R. I.**—Contract awarded by Sydney Worsted Company to J. N. Bouvier & Son, 189 Sayles Street, for erecting two-story, 100 x 50-ft. brick ad-

★**Lockport, N. Y.**—Reported B. D. Schuyler, 76 Prospect Street, has contract for rebuilding plant of Fibre Corporation, destroyed fire; cost approximately $40,000.

★Contract awarded Marion Bros., Rochester, for erecting brick and steel addition to automobile factory on Grand Street for Covert Motor Vehicle Company; cost $70,000. Steel contract sublet to F. L. Houghes Company, Rochester.

★**Syracuse, N. Y.**—Reported contract awarded W. J. Burns Company, Syracuse, on the percentage basis, for erecting a brick and reinforced concrete factory to automobile plant of the H. H. Franklin Mfg. Company, on W. Marcellus Street. Robert J. Reidpath & Son, Archts., Buffalo.

★**Millville, N. J.**—Contract awarded Harrison C. Rea Company, 1027 Wood Street, Philadelphia, Pa., for erecting two-story, reinforced concrete hosiery mill for William F. Taubel, Inc.; cost $70,000.

★**Trenton, N. J.**—Wm. F. Taubel awarded contract to Harrison & Rea Company, Philadelphia, Pa., to erect a three-story brick and concrete plant on Grand Street to cost $80,000.

★**Media, Pa.**—Contract awarded W. W. Linsay & Company, Harrison Building, Philadelphia, for erecting addition to plant of Congoleum Company at $135,000.

★**Philadelphia, Pa.**—Contract awarded Hennebique Construction Company, Drexel Building, for erecting one-story, reinforced concrete, 251 x 261 ft. manufacturing building at Sixth Street and Tabor Road for Philadelphia Textile Machinery Company; cost, $100,000.

★**Sanford, N. C.**—R. P. Gibson of Rocky Mount reported contractor for munitions plant which the National Dye & Munitions Company proposes erecting here; probable cost $10,000,000.

★**Savannah, Ga.**—Contracts awarded by Savannah Warehouse & Compress Company for erecting warehouses and compress shed to Chandler & Campbell Company of Chattanooga, Tenn., and for construction of the wharf on the river front to Dave Power of Savannah.

★**Cleveland, Ohio.**—Jordan Motor Car Co. (E. S. Jordan, Pres.) will erect a $50,000 factory, first unit of plant, on E. 152d Street, near Nickel Plate R R. Crowell-Lumdoff-Little Co., 1951 E. Fifty-seventh Street, will be engineers and contractors.

★**St. Bernard, Ohio.**—Elmwood Castings Co. awarded contract for new addition to its factory to McClintic-Marshall Co. of Pittsburgh, Pa. The building will be 114 x 200 ft., steel and concrete.

★**Youngstown, Ohio.**—Contract for proposed shop extensions and enlargement of plant of Trussed Concrete Steel Company awarded Hunter Construction Company, 407 Dollar Bank Building.

★**Beloit, Wis.**—Contract awarded Newton Engineering Company, Milwaukee, Wis., for making improvements to plant of Gardner Machine Company, 410 Bushnell Avenue, South Beloit, to cost about $75,000.

★**Millwood, Wash.**—H. J. Skinner, Eagle Building, Spokane, has secured general contract for steel, brick and reinforced concrete paper mill to be erected here for Inland Empire Paper Co.; cost, $48,000.

★**Logan, Utah.**—Contract awarded by Union Knitting Mills Company to Hyde & Thompson, of Logan, for erecting new factory at First, West and Center Streets; cost $40,000.

MISCELLANEOUS

PROPOSED WORK.

Heating Plant—Providence, R. I.—City to erect a central heating plant to heat 4 high schools. Estimated cost $60,000. Mayor Gainer, Chmn. of Committee in Charge.

Monument—Bridgeport, Conn.—Reported Perry Memorial Arch will be erected at Seaside Park, probably at Park Avenue entrance; probable cost $75,000. Address the Mayor.

Coal Handling Dock—Buffalo, N. Y.—Buffalo Fuel Company (Harry Yates, pres.), Marine Bank Bldg., will erect, on Buffalo River, a coal trestle with coal-handling machinery equipment for supplying coal to lake steamers.

Park—Jersey City, N. J.—Reported a playground is to be constructed on old reservoir site at Central Avenue, Sherman Place and Summit Street; probable cost $90,000. A. H. Moore, Park Commissioner.

Conduits—Baltimore, Md. — Governor signed bill authorizing $1,000,000 bond issue for conduits for Baltimore.

Boilers in Steamboat—Baltimore, Md.—Harbor Board (H. K. McKay, Harbor Engineer) is preparing plans and specifications for four large marine boilers in the Steamboat Annapolis to be 12 ft. inside diameter of shell by 11 ft. over heads, built according to U. S. Inspection Service rules for steam boilers, with a pressure of 80 lb. Each boiler will have 3 Morrison suspension furnaces (or equal), 38 in. inside diameter x ⅜ in. thick, and to contain 60 sq. ft. of grate surface in each boiler, 240 sq. ft. in the 4 boilers; each boiler to have 190 standard gage 3 in. tubes furnished with the necessary manholes and stay.

Underpass — Atlanta, Ga. — The Aldermanic Board on April 6 passed a paper carrying an appropriation of $20,000 for construction of South Pryor Street underpass, between Ridge and University Avenues, provided the Southern Ry. Co. will set aside $35,000 for their portion of the work.

Swimming Pool, Etc.—Chattanooga, Tenn.—Knight & Quayle, 408 Times Building, engaged by Chattanooga Golf & Country Club to prepare plans and specifications for a swimming pool, filtration and sterilization of the supply for same.

Park Improvement—Cleveland, Ohio.—County Council voted $141,000 for parks and improving boulevards.

Park Improvements—Toledo, Ohio.—City Council passed ordinance appropriating $750,000 from recent bond issue for buying land for park and boulevard purposes.

Parks—Houston, Tex.—About $30,000 is to be spent by City Council for cleaning, grubbing and building roads in Hermann Park.

BIDS DESIRED.

Walls, Etc.—Boston, Mass.—Until April 21, by Park and Recreation Department (John H. Dillion, Chmn.), for grading, drainage, loam walks, walls, etc., at Ward 19 Playground.

Fire Escape — Boston, Mass. — Until April 18, by Schoolhouse Commissioners (Jos. P. Lomasney, Chmn.), for erecting and completing fire escapes on the Emerson School, Prescott Street, East Boston.

Road Machinery—Brookline, Mass.—Until April 17, by Michael Driscoll, Supt. of Streets, for furnishing one double engine macadam roller weighing approximately 17 tons, equipped with a road loosening device attached to one end of rear axle and so arranged that it can be operated when the roller is traveling either backward or forward.

Automatic Sprinkling System—Hartford, Conn.—Until May 2 by Board of Contract and Supply (Joseph Buths, Secy.) for equipping almshouse with automatic sprinkling system, fire doors, fire walls, etc.

Road Oil—New Haven, Conn.—Until April 17 by F. L. Ford, City Engineer, for furnishing the carbureted water gas or oil gas tar road oil required by Department Public Works for year 1916.

Road Oil, Etc.—Albany, N. Y.—Until April 17 by Board Contract and Supply (Isidore Washman, Secy.) for furnishing and erecting an ash handling equipment for Bureau of Water and delivering and supplying road oil for the Bureau of Parks.

Cement—New York, N. Y.—Until April 20 by Board Health (Eugene W. Scheffer, Secy.) for furnishing and delivering as required 1500 bbl. Portland cement to the Tuberculosis Sanitarium at Otisville, Orange County, N. Y.

Concrete Mixer—Montclair, N. J.—Until April 24, by Edgar S. Closson, Town Engineer, for furnishing a concrete mixer, advertised in Engineering Record.

Road Oil—Rutherford, N. J.—Until April 28, by Borough Council, for furnishing and applying, under directions of Superintendent Public Works, 30,000 gals. of road oil, to be spread at an average of 1-5 gallon per sq. yd., and under a pressure of thirty pounds. F. A. Stedman, Borough Clk.

Removing Wreck—Philadelphia, Pa.—Until April 24, by U. S. Engineer's Office, for removing the wrecks of the schooners Carrie Haley and Ethel, lying sunken in Delaware Bay, near Ship John Light. George A. Zinn, Col. Corps Engrs.

Cement, etc.—Washington, D. C.—Until May 1, by Commissioners District of Columbia, for furnishing and delivering during the fiscal year, beginning July 1, 1916, and ending June 30, 1917, following material: Asphalt paving blocks, repressed vitr. paving blocks, sewer invert bricks, Portland cement, road oils, tars, etc.

Ventilating Apparatus—Richmond, Va.—Until May 3, by James A. Wetmore, Acting Supervising Archt., Treas. Dept., Washington, D. C., for a ventilating apparatus, plumbing, etc., in U. S. Post Office, court house and custom house.

Crushed Stone—Fort Wayne, Ind.—Until April 18, by Will Johnson, County Auditor, for crushed stone by cubic yards of different sizes in such quantities as the board may determine, f.o.b. cars, delivered at following stations: Williams, Hoagland, Fort Wayne, Bentley and a number of other stations.

Concrete Work—Chicago, Ill.—See "Sewerage and Sewage Disposal."

Tunnels—Dixon, Ill.—Reported desired until April 25, by Frank D. Whipp, State Fiscal Supervisor, Springfield, for constructing concrete, brick or tile tunnels and accessories on site of State Colony for Epileptics, near Dixon. James Dibelka, State Archt., 130 North Fifth Avenue, Chicago.

Road Oiling Machine—St. Peter, Minn.—Reported desired until April 24 by M. E. Stone, City Clk., for a 600-gal. capacity road oiling machine, to be delivered by June 1.

Cement — Leavenworth, Kan. — Until April 18, by Department of Justice, office F. H. Duehay, Supt. of Prisons, Washington, D. C., for furnishing and delivering at the U. S. Penitentiary, Leavenworth, 4000 bbl. Portland cement.

Terracing—Mandan, N. D.—Until May 15 by Lee Nichols, Co. Aud., for grading and terracing Court House Hill, advertised in Engineering Record.

Concrete Walks, Etc.—Mandan, N. D.—Until May 15 by Lee Nichols, Co. Aud., for constructing concrete walks, steps and retaining wall at Court House, advertised in Engineering Record.

Steel Towers—Keyport, Wash.—Until April 29, by Bureau Yards and Docks, Navy Dept., Washington, D. C., for constructing two steel towers at Pacific coast torpedo station, Keyport, as per Spec. No. 2220.

Vacuum Cleaning System—Los Angeles, Cal.—Until May 8, by James A. Wetmore, Acting Supervising Archt., Treas. Dept., Washington, D. C., for a vacuum cleaning machine in U. S. post office and court house at Los Angeles.

Boilers and Pumps—Pasadena, Cal.—Until April 25, by Herman Dyer, City Clk., for furnishing two water-tube boilers, one of 6000 sq. ft. of heating surface and one 7000 sq. ft., and a seven-stage centrifugal boiler feed pump.

Cement—Ottawa, Ont.—Until April 18, by J. W. Pugsley, Secy. Dept. of Rys. and Canals, Ottawa, for supply of 42,000 bbls. Portland cement more or less required in construction of the various canals of the Dominion, to be delivered in such quantities, at such places and at such times as may be directed.

Magnesia Pipe, Etc.—Panama.—Until April 26, by Maj. Earl I. Brown, Corps Engrs., U. S. A., General Purchasing Officer, Panama Canal, Washington, D. C., for Cir. 1031, vitrified sewer pipe, magnesia pipe covering. Also, same place, until April 27, for Cir. 1032, malleable iron castings, asphaltum, coal tar pitch, etc.

Jacks and Parts and Track Drills For Sale—Panama.—Until April 21 by R. E. Rutherford, Asst. Purchasing Agent the Panama Canal, 24 State Street, New York, N. Y., for purchase of miscellaneous jacks and parts and track drills for sale by the Panama Canal, advertised in Engineering Record.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Grandstand — Reading, Pa.**—Reading Fair Co. awarded contract for constructing concrete grandstand to L. H. Focht & Son of Reading, at about $34,000.

★**Speedway—Birmingham, Ala.**—Contract for grading speedway for the Birmingham Motor & Country Club awarded Newell Contracting Company, Birminghim, at about $100,000.

★**Levee Work—Alexandria, La.**—Contract awarded Douglas & Burt, Dixie, La., by Red River, Achafalya & Bayou Boeuf Levee Board for revetment or mattress protection work on Red River from mouth of Bayou Rapids to foot of Beauregard Street, in Alexandria, a distance of 1100 ft., at 69 cts. per sq. yd.

★**Pipe Line—Ft. Smith, Ark.**—Contract for laying pipe line 18 miles long, of 10 in steel pipe, from Kibler field to South Ft. Smith, awarded by Clear Creek Gas & Oil Co., to Hope Engineering Co., of Tulsa, Okla., at about $40,000.

Fort Rosencrans, Cal. — Following are bids opened March 31 by U. S. Engineer Office, Los Angeles, for furnishing (s) 8000 bbl. cement, (b) sand and (c) rock at Fort Rosencrans: Jonas Hansson, San Diego, (a) $2.23 per bbl. Colton or Riverside brand, (b) $1.84 per ton, Mission Valley brand, (c) $2.14 per ton Ballast Point; J. R. Atchison, San Francisco, Cal., (a) $2.2475 Mount Diablo; John Engebretsen, San Diego, (a) $2.28 Colton or Riverside, (b) $2.26 Mission Valley, (c) $2.27 Independent Stone Co. Quarry; Spreckels Bros. Commercial Co., San Diego, (a) $2.30 Bear; C. L. Hyde Construction Co., San Diego.

(c) $1.85 Ballast Point or $2.15 from elsewhere; Fenton Sumption Barnes Co., San Diego, (b) $1.875 and (c) $2.08 if Otay sand and rock are furnished, $2.02 for Otay sand alone; Independent Stone Co., San Diego, (b) $1.94, (c) $2.24; Mission Sand & Rock Co., San Diego, (c) $1.88.

★Cement—Vancouver, B. C.—Contracts for cement, gravel, etc., for one year (bids opened March 6) awarded as follows: Cement, to Evans, Coleman & Evans of Vancouver, Balfour Gauthrie, and R. V. Winch, at $2.25 per bbl.; castings, Vancouver Engineering Works, 3 cts. per lb., and aand and gravel, Champion & White, $1.75 per yd. James Smart, City Purchasing Agent.

Proposals

For Proposals Advertised, See Pages 40a, 40b, 40c and 40d.

WATERWORKS.

Bids Close.		See Eng. Record.
Apr. 17.	Extensions, Norfolk, Neb. Adv. Mar. 25, April 1.	Mar. 25
Apr. 17.	Air Compressors, Galesburg, Ill. Adv. Apr. 15.	Apr. 15
Apr. 18.	Water Works, Lockhart, Tex. Adv. Apr. 1, 8.	Apr. 1
Apr. 18.	Water Works, Lake Norden, S. D.	Apr. 8
Apr. 18.	Mains, McCombs, Miss.	Apr. 8
Apr. 18.	Pipe, Panama	Apr. 8
Apr. 18.	Meters and Steel, Etc., Chicago, Ill.	Apr. 15
Apr. 18.	Pipe, Boston, Mass.	Apr. 15
Apr. 18.	Pump, Kewaunee, Wis.	Apr. 15
Apr. 19.	C.-I. Pipe and Dam, Butler, N. J. Adv. Apr. 8.	Apr. 8
Apr. 19.	Pipe, Hydrants, Etc., New York, N. Y.	Apr. 15
Apr. 19.	Pipe, Rochester, N. Y.	Apr. 15
Apr. 19.	Pump and Engine, Wittenburg, Wis.	Apr. 15
Apr. 20.	Water Works, Harlowton, Mont. Adv. Apr. 1 to 15.	Apr. 1
Apr. 20.	Pump, Etc., Lynn, Mass.	Apr. 8
Apr. 20.	Water Softening Apparatus, Jacksonville, Fla.	Apr. 8
Apr. 20.	Pump, Etc., Chicago, Ill.	Apr. 15
Apr. 20.	Remodeling Filtration Plant, Youngstown, Ohio.	Apr. 15
Apr. 24.	Pump House, Madison, Wis.	Apr. 1
Apr. 26.	Pipe, Etc., Lebanon, Pa. Adv. Apr. 15.	Apr. 15
May 1.	Pump, Middletown. Ohio.	Apr. 8
May 9.	Filtration Plant, New Brunswick, N. J. Adv. Apr. 15.	Apr. 15
May 15.	Water Works, Yoncalla, Ore.	Apr. 8

SEWERAGE AND SEWAGE DISPOSAL.

Apr. 17.	Watertown, S. D. Adv. Mar. 25, April 1.	Mar. 25
Apr. 17.	Washington, D. C. Adv. Apr. 8.	Apr. 8
Apr. 17.	Marlborough, Mass. Adv. Apr. 8, 15.	Apr. 8
Apr. 17.	Yonkers, N. Y.	Apr. 15
Apr. 18.	Starke, Fla.	Apr. 1
Apr. 18.	Wabasha, Minn.	Apr. 1
Apr. 18.	Woonsocket, R. I. Adv. Apr. 1.	Apr. 1
Apr. 18.	Midvale, Utah	Apr. 15
Apr. 19.	Binghamton, N. Y.	Mar. 25
Apr. 19.	Des Moines, Iowa	Apr. 8
Apr. 19.	Oriskanny, N. Y. Adv. Apr. 8.	Apr. 8
Apr. 19.	Ridgefield, N. J.	Apr. 15
Apr. 19.	New York, N. Y.	Apr. 15
Apr. 20.	Albany, N. Y.	Mar. 25
Apr. 20.	Urbana, Ohio	Apr. 1
Apr. 20.	Marengo, Iowa.	Apr. 8
Apr. 20.	Chippewa Falls, Wis.	Apr. 15
Apr. 21.	Chippewa Falls, Wis.	Apr. 15
Apr. 24.	Niles, Ohio Adv. Apr. 15.	Apr. 15
Apr. 25.	Lakewood, Ohio. Adv. Apr. 15.	Apr. 15
Apr. 26.	Binghamton, N. Y. Adv. Apr. 1 to 15.	Apr. 1
Apr. 27.	Xenia, Ohio	Mar. 25
Apr. 27.	Urbanna, Ohio.	Apr. 15
May 1.	Anoka, Minn.	Apr. 8
May 1.	Hutchinson, Kan.	Apr. 15
May 1.	Harrisburg, Pa.	Apr. 15
May 1.	Wessington, S. D. Adv. Apr. 15.	Apr. 15
May 2.	Alton, Ill.	Apr. 15
May 3.	Chicago, Ill. Adv. Apr. 15.	Apr. 15

BRIDGES.

Bids Close.		See Eng. Record.
Apr. 18.	Lowell, Mass. Adv. Apr. 1 to 15.	Apr. 1
Apr. 18.	Nashville, Tenn.	Apr. 1
Apr. 20.	Bradentown, Fla.	Apr. 1
Apr. 21.	Cincinnati, Ohio	Apr. 15
Apr. 21.	Emporia, Kan.	Apr. 15
Apr. 23.	Richmond, Ind.	Apr. 15
Apr. 24.	Monroeville, Ala.	Apr. 8
Apr. 24.	New Orleans, La.	Apr. 8
Apr. 25.	Reading, Pa.	Apr. 15
Apr. 25.	Crookston, Minn.	Apr. 15
Apr. 25.	Maine Adv. Apr. 15.	Apr. 15
Apr. 27.	St. Helens, Ore.	Apr. 8
Apr. 27.	Corning, N. Y. Adv. Apr. 8.	Apr. 8
Apr. 29.	Johnson Creek, Wis.	Feb. 26
Apr. 29.	Johnson Creek, Wis.	Apr. 1
May 1.	Amarillo, Tex.	Mar. 18
May 1.	Odessa, Wash.	Apr. 1
May 1.	Eagle Bend, Minn.	Apr. 15
May 1.	Buffalo, Okla.	Apr. 15
May 1.	Los Angeles, Cal.	Apr. 15
May 2.	Concrete, Wash.	Apr. 15
May 6.	Bridgeport, Conn. Adv. Apr. 15.	Apr. 15
May 9.	Manhattan, Kan.	Apr. 15
May 9.	Summerville, W. Va.	Apr. 15
May 20.	Lyndhurst, N. J.	Mar. 18
Jun. 8.	El Dorado, Kan.	Apr. 8

PAVING AND ROADS.

Apr. 17.	Norfolk, Neb. Adv. Mar. 25, April 1.	Mar. 25
Apr. 17.	New Castle, Ind. Adv. Apr. 8.	Apr. 8
Apr. 17.	Princeton, N. J.	Apr. 15
Apr. 17.	Marinette, Wis.	Apr. 15
Apr. 17.	Albany, N. Y.	Apr. 15
Apr. 17.	Boston, Mass.	Apr. 15
Apr. 18.	Bartow, Fla.	Mar. 25
Apr. 18.	Lawton, Okla.	Mar. 25
Apr. 18.	Berwyn, Ill.	Apr. 1
Apr. 18.	Marinette, Wis.	Apr. 1
Apr. 18.	Luverne, Minn.	Apr. 8
Apr. 18.	Sheperdsville, Ky.	Apr. 8
Apr. 18.	Gloversville, N. Y.	Apr. 15
Apr. 18.	Clarksdale, Miss.	Apr. 15
Apr. 18.	Lincoln, Neb.	Apr. 15
Apr. 18.	New Haven, Conn.	Apr. 15
Apr. 18.	Massachusetts	Apr. 15
Apr. 18.	Columbia, Mo.	Apr. 15
Apr. 18.	Troy, N. Y.	Apr. 15
Apr. 18.	Paterson, N. J.	Apr. 15
Apr. 18.	Michigan City, Ind.	Apr. 15
Apr. 19.	Ivanhoe, Minn.	Apr. 8
Apr. 19.	Rochester, Mich.	Apr. 8
Apr. 19.	Girard, Ohio	Apr. 15
Apr. 19.	New Philadelphia. Ohio.	Apr. 15
Apr. 19.	New York, N. Y.	Apr. 15
Apr. 19.	Trenton, N. J.	Apr. 15
Apr. 19.	Cleveland, Ohio	Apr. 15
Apr. 19.	Menominee, Mich	Apr. 15
Apr. 19.	Illinois	Apr. 15
Apr. 19.	Tropico, Cal.	Apr. 15
Apr. 20.	Sarasota, Fla.	Mar. 25
Apr. 20.	Seymour, Mo.	Apr. 1
Apr. 20.	Bradentown, Fla.	Apr. 1
Apr. 20.	Albany, N. Y. Adv. Apr. 1 to 15.	Apr. 1
Apr. 20.	Eldora, Iowa	Apr. 15
Apr. 20.	Chicago, Ill.	Apr. 15
Apr. 20.	Bartlett, Tex	Apr. 15
Apr. 20.	Buffalo, N. Y.	Apr. 15
Apr. 21.	Spokane, Wash.	Apr. 8
Apr. 21.	Blackwell, Okla.	Apr. 8
Apr. 21.	Ohio	Apr. 8
Apr. 21.	St. Louis, Mo.	Apr. 15
Apr. 21.	Long Island City, L. I., N. Y.	Apr. 15
Apr. 24.	Lafayette, Ala.	Apr. 1
Apr. 24.	Everett, Wash.	Apr. 8
Apr. 24.	Seattle, Wash.	Apr. 8
Apr. 24.	Weston, W. Va.	Apr. 8
Apr. 24.	New Orleans, La.	Apr. 8
Apr. 24.	Jasper, Ind.	Apr. 15
Apr. 25.	Bucyrus, Ohio Adv. Apr. 1 to 15.	Apr. 1
Apr. 25.	Britt, Iowa	Apr. 8
Apr. 25.	Lewiston, Idaho	Apr. 8
Apr. 25.	Woonsocket, R. I. Adv. Apr. 8, 15.	Apr. 8
Apr. 25.	Dayton, Ohio.	Apr. 8
Apr. 25.	Belleville, N. J.	Apr. 15
Apr. 25.	McKinney, Tex.	Apr. 15
Apr. 25.	Piqua, Ohio Adv. Apr. 15.	Apr. 15
Apr. 25.	Maine. Adv. Apr. 15.	Apr. 15
Apr. 27.	Corning, N. Y. Adv. Apr. 8.	Apr. 8
Apr. 27.	Newark, N. J.	Apr. 15
Apr. 27.	Winchester, Ind.	Apr. 15
Apr. 28.	West Union, W. Va.	Apr. 8
Apr. 28.	Spokane, Wash.	Apr. 8
Apr. 28.	Plymouth, Ind.	Apr. 15
Apr. 28.	Albany, N. Y. Adv. Apr. 15.	Apr. 15
Apr. 29.	Indiana	Apr. 15
Apr. 30.	Jackson, Tenn.	Apr. 1
May 1.	Galion, Ohio	Mar. 18
May 1.	Eveleth, Minn.	Mar. 18
May 1.	Pontiac, Ill.	Apr. 1
May 1.	Winlock, Neb.	Apr. 1
May 1.	Urbana, Ohio	Apr. 8
May 1.	Hazard, Ky.	Apr. 8
May 1.	Hartford, Conn. Adv. Apr. 8, 15.	Apr. 8
May 1.	Newton, N. J. Adv. Apr. 8, 15.	Apr. 8
May 1.	Colfax, Wash.	Apr. 15
May 1.	Winchester, Ind.	Apr. 15
May 1.	Washington, D. C.	Apr. 15
May 1.	Seattle, Wash.	Apr. 15
May 1.	Indiana	Apr. 15
May 2.	Seattle, Wash.	Apr. 15
May 2.	Indiana	Apr. 15
May 2.	Albany, N. Y. Adv. Apr. 15.	Apr. 15
May 2.	Booneville, Ind.	Apr. 15
May 2.	Woonsocket, R. I. Adv. Apr. 15.	Apr. 15
May 2.	Mt. Vernon, Wash.	Apr. 15
May 5.	Albany, N. Y. Adv. Apr. 15.	Apr. 15
——	Binghamton, N. Y. Adv. Feb. 12, 19.	Feb. 12

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS.

Apr. 20.	Dredging, Manistee, Mich. Adv. Apr. 1 to 15.	Apr. 1
Apr. 20.	Ditches, Lawrenceville, Ill.	Apr. 15
Apr. 20.	Ditch, St. Peter, Minn.	Apr. 15
Apr. 20.	Dam, Gonzales, Tex.	Apr. 15
Apr. 20.	Pump House, Arcadia, Cal.	Apr. 15
Apr. 21.	Ditch, Roseau, Minn.	Apr. 15
Apr. 24.	Hyd. Machinery, Wheeling, W. Va. Adv. Apr. 8, 15.	Apr. 8
Apr. 24.	Drainage Ditch, Des Moines, Iowa	Apr. 15
Apr. 25.	Drain, Hastings, Mich.	Apr. 8
Apr. 25.	Channel, Maple Park, Ill.	Apr. 15
Apr. 26.	Lock Gates, Etc., Pittsburgh, Pa. Adv. Apr. 1 to 15.	Apr. 1
Apr. 26.	Dredging, Buffalo, N. Y. Adv. Apr. 1 to 15.	Apr. 1
Apr. 26.	Riprap, Tompkinsville, N. Y.	Apr. 8
Apr. 26.	Dredging, Wilmington, Del.	Apr. 8
Apr. 27.	Dock, San Francisco, Cal. Adv. Apr. 1 to 15.	Apr. 1
Apr. 28.	Wharf, Houston, Tex. Adv. Apr. 1.	Apr. 1
Apr. 28.	Stone, Philadelphia, Pa.	Apr. 15
Apr. 29.	Riprap and Capstones, Wilmington, N. C. Adv. Apr. 1, 8.	Apr. 1
Apr. 29.	Dredging, San Francisco, Cal.	Apr. 8
Apr. 29.	Irrigation, Anderson, Cal.	Apr. 15
May 1.	Wharf, Etc., Honolulu, Hawaii.	Mar. 25
May 3.	Reclamation Work, Powell, Wyo.	Apr. 15
May 4.	Dredging, New York, N. Y. Adv. Apr. 8, 15.	Apr. 8
May 5.	Irrigation, Ft. Shaw, Mont. Adv. Apr. 8.	Apr. 8
May 6.	Leasing Land and Water for Power Purposes, Louisville, Ky. Adv. Mar. 11.	Mar. 11
May 8.	Dredging, Wilmington, Del. Adv. Apr. 15.	Apr. 15
May 10.	Dredging, Buffalo, N. Y. Adv. Apr. 15.	Apr. 15
May 15.	Dredging, Bridgeport, Conn. Adv. Apr. 15.	Apr. 15
——	Sublet Levee Work, Chicago, Ill. Adv. Apr. 1.	Apr. 1
——	Levee Grading, Vincennes, Ind. Adv. Apr. 8, 15.	Apr. 8

PUBLIC BUILDINGS AND SCHOOLS.

Apr. 17.	Napa, Cal.	Apr. 15
Apr. 18.	Columbus, Ohio	Mar. 25
Apr. 18.	Fort Dodge, Iowa	Mar. 25
Apr. 18.	Margie, Minn.	Apr. 1
Apr. 18.	Fort Jennings, Ohio	Apr. 1
Apr. 18.	Warren, Ohio	Apr. 1
Apr. 18.	Anthon, Iowa	Apr. 8
Apr. 18.	Sharpsville, Ind.	Apr. 8
Apr. 18.	Jackson, Ky.	Apr. 8
Apr. 18.	Oakland, Neb.	Apr. 15
Apr. 19.	Arkadelphia, Ark. Adv. Mar. 11, 18.	Mar. 11
Apr. 19.	Hastings, Minn.	Apr. 8
Apr. 19.	Lansing, Mich.	Apr. 8
Apr. 19.	Spencer, Ohio	Apr. 15
Apr. 19.	Pittsburgh, Pa.	Apr. 15
Apr. 20.	Niles, Ohio	Apr. 1
Apr. 20.	Carpenter, Iowa	Apr. 1
Apr. 20.	Forest City, Iowa	Apr. 1
Apr. 20.	New York, N. Y.	Apr. 15
Apr. 21.	Athens, Ohio	Apr. 8
Apr. 21.	Los Angeles, Cal.	Apr. 15
Apr. 22.	Falls City, Wis.	Apr. 15
Apr. 22.	Clontarf, Minn.	Apr. 15
Apr. 22.	Uniontown, Pa.	Apr. 15
Apr. 22.	Elm Mott, Tex.	Apr. 15
Apr. 24.	Delphi, Ind.	Feb. 26
Apr. 24.	Roseburg, Ore.	Mar. 25
Apr. 24.	Lebanon, Ohio	Apr. 1
Apr. 24.	Huntington, Ind.	Apr. 8
Apr. 24.	Boxholm, Minn.	Apr. 8
Apr. 24.	Wallingford, Conn.	Apr. 8
Apr. 24.	Sheldon, Iowa	Apr. 15
Apr. 24.	Portland, Me.	Apr. 15
Apr. 24.	Joliet, Ill.	Apr. 15
Apr. 24.	Massachusetts	Apr. 15
Apr. 25.	Dover, Ohio	Apr. 8
Apr. 25.	Cochrane, Ont.	Apr. 15
Apr. 25.	Uniontown, Pa.	Apr. 15
Apr. 25.	Boardman, Ohio.	Apr. 15
Apr. 25.	Wascousta, Mich	Apr. 15
Apr. 26.	Evansville, Ind.	Mar. 25
Apr. 26.	Newark, N. J.	Apr. 8
Apr. 26.	Mason City, Iowa	Apr. 15
Apr. 27.	Portland, Ind. Adv. Mar, 25.	Mar. 25
Apr. 27.	Wheelersburg, Ohio	Apr. 15
Apr. 28.	New Orleans, La.	Mar. 11
Apr. 28.	Carbondale, Pa.	Apr. 15
Apr. 29.	Strongville. Ohio	Apr. 1
Apr. 29.	Indian Head, Md.	Apr. 15
Apr. 29.	Lebanon, Ind.	Apr. 15
Apr. 30.	New Bedford, Mass.	Apr. 15
May 1.	Gaylord, Minn.	Apr. 15
May 1.	Norton, Kan.	Apr. 15
May 1.	Rensselaer, Ind.	Apr. 15
May 2.	Little Sioux, Iowa	Apr. 15
May 2.	Brainerd, Minn.	Apr. 15
May 2.	Oaklandon, Ind.	Apr. 15
May 3.	Conesville, Ohio	Apr. 15
May 4.	Douds Leando, Iowa	Apr. 15
May 5.	Selma, Iowa	Apr. 15
May 8.	Elkins, W. Va.	Mar. 25
May 10.	Evansville, Ind.	Apr. 8
May 13.	Norfolk, Va.	Apr. 15
May 15.	Newport, R. I.	Apr. 8
May 15.	Ft. Huachuca, Ariz. Adv. Apr. 15.	Apr. 15
May 17.	Little Falls, Minn.	Apr. 15
May 18.	Durango, Col.	Apr. 15
May 19.	Wenatchee, Wash.	Apr. 15
May 20.	Cordova, Alaska	Apr. 15
May 25.	Butler, Pa.	Mar. 18

PRIVATE BUILDINGS.

Apr. 20.	Taylorville, Ill.	Apr. 8
Apr. 20.	Protection, Kan.	Apr. 1
Apr. 20.	Los Angeles, Cal.	Apr. 15
Apr. 22.	Mankato, Minn.	Apr. 15
Apr. 25.	Hartford, Conn.	Apr. 8
Apr. 25.	Topeka, Kan.	Apr. 15
Apr. 27.	Flandreau, S. D.	Apr. 15
May 1.	Akron, Ohio	Mar. 18
May 1.	San Bernardino, Cal.	Apr. 8

NEW INDUSTRIAL PLANTS.

Apr. 20.	Baltimore, Md.	Apr. 1

MISCELLANEOUS.

Apr. 17.	Sale of Dredge, Grand Rapids, Mich. Adv. Mar. 25 to Apr. 15.	Mar. 25
Apr. 17.	Fire Equipment, Ashland, Ky. Adv. Apr. 1.	Apr. 1
Apr. 17.	Road Roller, Brookline, Mass.	Apr. 15
Apr. 17.	Road Oil, Albany, N. Y.	Apr. 15
Apr. 17.	Road Oil, New Haven, Conn.	Apr. 15
Apr. 18.	Cement, Leavenworth, Kan.	Apr. 15
Apr. 18.	Crushed Stone, Fort Wayne, Ind.	Apr. 15
Apr. 18.	Cement, Ottawa, Ont.	Apr. 15
Apr. 18.	Fire Escapes, Boston, Mass.	Apr. 15
Apr. 19.	Sprinkling System, Pittsburgh, Pa.	Apr. 15
Apr. 20.	Freight Handling Winches For Sale, Boston, Mass. Adv. Apr. 1.	Apr. 1
Apr. 20.	Elevator, Parkersburg, W. Va.	Apr. 8
Apr. 20.	Dredging, St. Francisville, Ill.	Apr. 8
Apr. 20.	Disposal of Ashes, Washington, D. C. Adv. Apr. 8.	Apr. 8
Apr. 20.	Road Roller, Evansville, Ind.	Apr. 8
Apr. 20.	Cement, New York, N. Y.	Apr. 15
Apr. 21.	Sale of Tracks, Drills and Jacks, Panama Adv. Apr. 15.	Apr. 15
Apr. 21.	Walls, etc., Boston, Mass.	Apr. 15
Apr. 22.	Steel Towers, Cordova, Alaska	Mar. 11
Apr. 24.	Road Oiling Machine, St. Peter, Minn.	Apr. 15
Apr. 24.	Removing Wreck, Philadelphia, Pa.	Apr. 15
Apr. 24.	Concrete mixer, Montclair, N. J. Adv. Apr. 15.	Apr. 15
Apr. 25.	Fences, Contract 173, New York, N. Y. Adv. Apr. 8.	Apr. 8
Apr. 25.	Tunnels, Dixon, Ill.	Apr. 15
Apr. 26.	Supplies, Panama	Apr. 15
Apr. 25.	Centrifugal Pump, Boilers, Etc., Pasadena, Cal.	Apr. 15
Apr. 27.	El. Ry., New York, N. Y.	Apr. 15
Apr. 27.	Asphaltum, Etc., Panama	Apr. 15
Apr. 28.	Rutherford, N. J.	Apr. 15
Apr. 29.	Steel Towers, Keyport, Wash.	Apr. 15
Apr. 30.	Cement, Etc., Westmount, Que.	Apr. 1
May 1.	Cement, Washington, D. C.	Apr. 15
May 2.	Automatic Sprinkling System in Almshouse, Hartford, Conn.	Apr. 15
May 3.	Ventilating Apparatus, Richmond, Va.	Apr. 15
May 4.	Steps, Etc., Jefferson City, Mo.	Apr. 8
May 8.	Vacuum Cleaning, Los Angeles, Cal.	Apr. 15
Jun. 15.	Cross Ties, Anchorage, Alaska	Apr. 15
May 15.	Concrete Walls, Etc., Mandan, N. D. Adv. Apr. 15.	Apr. 15
May 15.	Terracing Hill, Mandan, N. D. Adv. Apr. 15.	Apr. 15
——	Heating Plant, Tucson, Ariz. Adv. Apr. 15.	Apr. 15

SEARCHLIGHT SECTION

Official Proposal Announcements

Price, $2.40 an inch.—Copy can be received until Thursday 10 a. m. for issue mailed the next morning

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Bids open April 20, 1916.

HIGHWAY IMPROVEMENTS

OFFICE OF THE STATE COMMISSIONER OF HIGHWAYS
ALBANY, N. Y.

Sealed proposals will be received by the undersigned at their office, No. 55 Lancaster Street, Albany, N. Y., at 1 o'clock p. m., on Thursday, the 20th day of April, 1916, for the improvement of the highways in the following counties:

Onondaga (two highways, 2.40, 5.12);

Saratoga (approximately 5.74);

Ulster (approximately 0.49); together with a concrete bridge.

Maps, plans, specifications and estimates may be seen and proposal forms obtained at the office of the Commission in Albany, N. Y., and also at the offices of the division engineers in whose divisions the roads are to be improved. The addresses of the division engineers and the counties in which they are in charge will be furnished on request.

The especial attention of bidders is called to "General Information for Bidders" in the itemized proposal, specifications and contract agreement.

EDWIN DUFFEY,
Commissioner.
I. J. MORRIS,
Secretary.

Bids open April 25, 1916.

STREET IMPROVEMENT

BUCYRUS, OHIO.

Sealed proposals for the improvement of twelve streets, totaling 100,000 sq. yd. in the City of Bucyrus, Ohio, will be received until 12 o'clock noon, Tuesday, April 25, 1916.

Specifications cover brick, concrete, asphalt and asphalt block. Part concrete foundation, part old macadam.

Plans and specifications can be seen and bidding blanks can be procured at the office of the City Civil Engineer, Bucyrus, Ohio.

Local certified check for $300 for each street, payable to M. J. Lutz, Director of Public Service.

F. L. NIEDERHEISER,
City Civil Engineer.
AUGUST BROEMEL,
City Clerk.

Bids open May 1, 1916.

GRADING IN SUSSEX COUNTY

NEWTON, N. J.

Notice is hereby given that sealed bids will be received by the Board of Freeholders of the County of Sussex for the grading of the Ross's Corner Sussex Road in the Townships of Frankford and Wantage in the County of Sussex; estimated amount of excavation 55,190 cubic yards of earth and 5500 cubic yards of rock; and will be opened and read in public in the Freeholders Room in Newton, N. J., on Monday, May 1, 1916, at eleven A. M.

Drawings, specifications and forms of bid contract and bond for the proposed work, prepared by Harvey Snook, County Engineer, and approved by the State Commissioner of Public Roads, have been filed in the office of said engineer at Newton, N. J., and of said Commissioner at the State House, Trenton, N. J., and may be inspected by prospective bidders during business hours. Bids must be made on the standard proposal forms in the manner designated therein and required by the specifications, must be inclosed in sealed envelopes, bearing the name and address of the bidder on the outside, addressed to the Board of Freeholders, and must be accompanied by a certified check or cash for not less than one thousand dollars and be delivered at the place and at the time above named. The standard proposal form is attached to the specifications, copies of which will be furnished on application to engineer.

By order of the Board of Freeholders of Sussex County.

R. L. SLATER,
Clerk.

Bids open April 18, 1916.

PROPOSAL FOR THE CONSTRUCTION OF A REINFORCED CONCRETE BRIDGE OVER THE MERRIMACK RIVER AT PAWTUCKET FALLS AND FOR THE REMOVAL OF THE PRESENT STRUCTURE; AND THE ALTERATION OF THE PRESENT BRIDGE OVER THE NORTHERN CANAL

CITY OF LOWELL, MASS.

Sealed proposals directed to the City Clerk will be received by the Municipal Council of Lowell, Mass., at City Hall, until 10 a. m., Tuesday, April 18, 1916, for the construction of a reinforced concrete bridge over the Merrimack River, at Pawtucket Falls, and for the removal of the present structure; and the alteration of the present bridge over the Northern Canal.

Plan and profile of the bridge site, together with general information regarding the proposed structure may be obtained from Mr. Stephen Kearney, City Engineer, Lowell, Mass., upon deposit of fifteen dollars ($15.00), which deposit will be refunded upon the return of all papers in fair condition.

All contractors will be required to submit with their proposals detail drawings and specifications giving full information regarding unit stresses and loading used in the design, all of which will be subject to the approval of the City Engineer.

Each bid must be accompanied by a certified check for the sum of five thousand dollars ($5,000), drawn to the order of the Treasurer of the City of Lowell.

The Municipal Council of the City of Lowell, Mass., reserves the right to reject any or all proposals or any part thereof.

Per order Municipal Council.

CHAS. J. MORSE,
Comm. of Streets and Highways.

Bids open April 20, 1916.

WATER WORKS SYSTEM

HARLOWTON, MONT.

Sealed proposals will be received by the Town of Harlowton, Meagher County, Mont., until 5 p. m., April 20, 1916, at the Council Chambers in Harlowton, Mont., for furnishing materials, machinery and constructing a complete water-works system for the said town, in accordance with plans and specifications on file in the office of the Town Clerk at Harlowton, Mont., and in the office of George E. Baker, the Consulting Engineer, at Whitehall, Mont.

This work includes furnishing motor or gasoline engine, pump, fire hydrants, gates, water-pipe, pump station, and equipment as shown on plans.

Each proposal must be accompanied by a certified check for five per cent (5%) of the amount of the bid, but to be not less than three hundred dollars ($300.00), made payable to the Town of Harlowton, Mont., as evidence of good faith. Specifications, form of proposal, contract and plans may be seen at the office of the Town Clerk in Harlowton, Mont., or will be mailed upon application to the Engineer, in Whitehall, Mont., accompanied by the payment of five dollars ($5.00) for the specifications and form of proposal and contract, and five dollars ($5.00) for the plans.

The right is reserved to reject any or all bids.

GEO. E. BAKER,
Consulting Engineer
FRED W. BARRON, Mayor.
S. K. CAMPBELL, Town Clerk.

Bids open April 27, 1916.

NOTICE TO CONTRACTORS.

CONCRETE GRAVING DOCK FOR SAN FRANCISCO, CAL.

Sealed bids for the construction of a concrete graving dock at HUNTER'S POINT, SAN FRANCISCO, one thousand (1000) feet long by one hundred and twenty (120) feet wide, with a depth of forty (40) feet over sill at mean high water, for the UNION IRON WORKS DRY DOCK COMPANY, will be received at the offices of said company, No. 260 California Street, San Francisco, up to Thursday, April 27, 1916.

Plans and specifications prepared by Howard C. Holmes, Consulting Engineer, are on file and may be seen at the offices of—

Union Iron Works Dry Dock Company,
260 California St., San Francisco.

Howard C. Holmes, Consulting Engineer,
112 Market St., San Francisco.

Bethlehem Steel Corporation,
111 Broadway, New York.

Each prospective bidder may obtain one copy of said plans, specifications and other information by depositing certified check for One Hundred Dollars as a guarantee for their return.

Any further information will be furnished on application to

UNION IRON WORKS DRY DOCK COMPANY,
260 California St., San Francisco,
or to
HOWARD C. HOLMES,
Consulting Engineer,
Santa Marina Building,
112 Market St., San Francisco.

Bids open April 26, 1916.

INTERCEPTING SEWER

BINGHAMTON, N. Y.

Sealed proposals for the construction of Section One of the Main Intercepting Sewer will be received by the Board of Contract and Supply at its offices in the Municipal Building, Collier Street, Binghamton, N. Y., until 2:30 p. m., on Wednesday, April 26, 1916.

The work involves the furnishing and placing of approximately 400 lin. ft. of 6-in. V. T. pipe sewer, 400 lin. ft. of 12-in. V. T. pipe sewer, 1200 lin. ft. of 15-in. V. T. pipe sewer, 1300 lin. ft. of 18-in. V. T. pipe sewer, 4000 lin. ft. of 24-in. V. T. pipe sewer, 1500 lin. ft. of 36-in. monolithic concrete or reinforced concrete pipe sewer, 1100 lin. ft. of 42-in. monolithic concrete or reinforced concrete pipe sewer, 5000 lin. ft. of 48-in. monolithic concrete or reinforced concrete pipe sewer, four River Crossings and various other appurtenances.

Plans and specifications may be consulted and proposal blanks may be secured from the City Engineer, Municipal Building, Binghamton, N. Y. A charge of ten ($10) dollars will be made for each set of plans and specifications taken from the office. This money will not be refunded. Checks should be made payable to the Comptroller of the City of Binghamton.

A certified check for $7,500 shall accompany all bids.

Bidders are required to visit the site of the work before submitting bids. Proposal forms contain, under oath, a statement that this provision has been complied with and any proposal not containing such a statement will be rejected as informal.

W. EARL WELLER,
City Engineer.

Bids open April 25, 1916.

WATER DRAINS AND PAVING

WOONSOCKET, R. I.

Sealed proposals will be received by the Board of Aldermen of the City of Woonsocket, R. I., at the Aldermen's Chambers, City Hall, Woonsocket, R. I., until 8.15 p. m., Tuesday, April 25, 1916, at which time and place proposals will be publicly opened and read. Said Board of Aldermen will be in session at 8 p. m., for the purpose of receiving proposals for the following work.

PAVING.

CONTRACT No. 1. For paving with granite blocks on concrete foundation, East School Street from North Main Street to east line Pond Street; Allen Street from Bernon Street northerly; Corey Street from North Main Street to Blackstone Street; Prospect Street from North Main Street to Prospect Street; Court Street from Main Street to bridge.

CONTRACT No. 2. For paving with granite blocks on concrete foundation, Social Street from Monument Square to George Street.

CONTRACT No. 3. For paving with granite blocks on concrete foundation, Winter Street from Harris Avenue to North Main Street.

CONTRACT No. 4. For paving with granite blocks on concrete foundation, Cumberland Street from end of brick paving to south line Cass Avenue.

SURFACE WATER DRAINS.

CONTRACT No. 1. For building surface water drains in East School Street from North Main Street to Social Trench; Winter Street from Summer Street to present drain near Temple Street; Winter Street, from Privilege Street to beyond the N. Y., N. H. & H. R. R.; Social Street from Mill Street to Pond Street; Social Street from Elm Street to George Street; in Elm Street from Social Street to Peters River.

CONTRACT No. 2. For building surface water drains in Carrington Avenue from Greene Street to Park Avenue and from Roberts Street to Manville Road; in Manville Road from Carrington Avenue to Davison Avenue; in Lowland Street from Park Place to end of present drain; in Mason Street from Cherry Brook to Fifth Avenue.

Each item must be considered a separate proposal and each proposal must be accompanied by a certified check for ($500) Five Hundred Dollars, drawn and made payable to the order of the City Treasurer of the City of Woonsocket as surety that if a proposal is accepted, a contract will be entered into.

Proposals must be on forms provided. Specifications and form of proposals for paving may be obtained at the office of the City Engineer upon deposit of $2. Plans, specifications and form of contract and proposal may be obtained at the office of the City Engineer upon deposit of $5. Deposits will be returned if plans and specifications are returned in good condition.

The right to reject any or all bids is expressly reserved as the interest of the city may appear.

GEORGE H. EMMOTT,
President;
TELESPHORE DESROSIERS,
CHARLES D. SOUTHWICK,
JAMES F. CARROLL,
ADRIEN H. SYLVESTRE.
Board of Aldermen.
FRANK H. MILLS,
City Engineer.

GRADING WORK TO LET

1,700,000 cu. yds. earth for drag lines and teams, on Wabash River Levee, at Vincennes, Ind.

Apply at our Chicago office, Continental and Commercial Bank Building, or A. W. Riney, Superintendent, Grand Hotel, Vincennes, Ind.

MACARTHUR BROTHERS COMPANY.

CONTRACTING NEWS

Of Special Interest to Engineers, Contractors, Builders and Manufacturers of Engineering and Building Supplies

THAT the cost of production of steel, one of the most important materials of construction work, has permanently gone up and is not likely to come down for a long time is the interpretation put upon the decision of the steel makers to raise the price of steel rails. For fifteen years Bessemer rails have sold at $28 a ton and open-hearth rails at $30 a ton. If the present increased prices of other steel products were due simply to greatly increased temporary demand and not to changes in the cost of manufacture, the prices of rails would now be kept steady, as throughout other periods of change in the steel market. As a matter of fact the scarcity of labor in this country is resulting in a more or less general and permanent rise in the level of wages. Close observers have pointed out that this situation holds elements of danger to the entire business structure of this country at the close of the present war. It is possible that the cost of production in the United States will be raised permanently above the level at which our products can compete with those of other nations in the markets of the world. It is to be hoped that the rise will not be so general nor so great as to produce this result, as construction work would be the first to feel and the last to recover from the readjustment that would inevitably follow such conditions at the close of the European War.

Buildings

The lowest bid received for constructing the post office at Wilmington, N. C., was $368,000. The following large building contracts have been awarded: New York City, $250,000 residence; Philadelphia, $250,000 factory; Cleveland, $2,500,000 hotel; Euclid, Ohio, $800,000 manufacturing plant. Bids are desired April 30 at Chester, Pa., for constructing a $350,000 office building.

The following new proposed building work is noted: Flushing, L. I., $250,000 factory; Chicago, plans being prepared, $250,000 apartment house, and $200,000 apartment house. Peoria, Ill., $450,000 steel mill to be built; St. Louis, $2,000,000 hotel to be built; Grand Rapids, Mich., $375,000 school building construction approved; St. Paul, $250,000 addition to hospital to be built.

Bridges and Roads

Road work was much more active last week, especially in point of bids desired. Among the contracts awarded were the following: Massachusetts Highway Commission, several contracts, $85,000; Hartford, Conn., paving work, $75,000; Belvidere, N. J., road contract, $112,000; Maryville, Tenn., road contracts, $300,000; Cleveland, Ohio, paving contracts, $100,000; South Bend, Ind., paving contracts, $130,000; Audubon, Iowa, paving work, $88,000; Valesco, Tex., highway bridge over Brazos River, $100,000; Pueblo, Col., paving work, $123,000.

Bids are desired on the following work: Philadelphia, April 25, paving work, $273,000; Lafayette, Ala., April 24, 28 miles road work; Gulfport, Miss., May 1, 60 miles road work; Ohio highway commissioner, April 28, country road work, $1,130,000; South Bend, Ind., May 16, paving work, $154,000; Marshalltown, Iowa, May 8, 63,000 sq. yd. concrete pavement; Seattle, April 24, paving work, $310,000.

The prospective work noted includes: Bridgeport, Conn., $2,275,000 voted for paving; Richmond, Va., plans completed for road work to cost $222,000; Conshohocken, Pa., highway bridge planned, cost $250,000; Jacksonville, Fla., $208,000 road bonds sold; Dayton, Ohio, $200,000 road bonds sold; Minneapolis, estimate submitted for boulevard to cost $197,000; Salt Lake City, $212,000 authorized for paving work.

Waterworks and Sewers

Bids have been opened in New York City for water main construction to cost $55,000. Ocala, Fla., has awarded contracts amounting to $107,000 for waterworks construction. Bids are desired at Wilmington, Del., for constructing a large mechanical filter plant. Ironton, Ohio, plans to build a $250,000 filtration plant. Lawrence, Kan., expects to spend $200,000 improving recently acquired water plant. The sum of $400,000 for waterworks has been voted at Albuquerque, N. M. Waterworks construction estimated to cost $175,000 is contemplated at Bakersfield, Cal.

Bids have been opened in Brooklyn, N. Y., for sewer work to cost $345,000. Contract has been awarded at Philadelphia for constructing an intercepting sewer at $185,000. The sewage disposal plant to be built at Milwaukee, for which $1,560,000 is available, is to be let May 25. A $60,000 sewer system in addition to a disposal plant is contemplated at Marlboro, Mass. The sum of $200,000 has been authorized for sewer construction at Westerley, R. I. A committee is to investigate the question of building a $1,000,000 sewage-disposal plant at New Haven, Conn. Plans have been approved for a $70,000 sewage system in Hoboken, N. J. Tulsa, Okla., has sold $100,000 sewer bonds.

Miscellaneous

A contract for an additional section of the Dorchester Tunnel in Boston has been awarded at $347,000. The contract for disposing of New York City's garbage, involving the construction of a large reduction plant on Staten Island, was awarded on April 10. The lowest bid opened in New York City for removing Coenties Reef in the East River was $197,000. The construction of a $1,000,000 ore dock has been contracted for at Ashland, Wis.

A viaduct for eliminating grade crossings at Cheektowaga, N. Y., has been ordered built by the State public service commission at a cost of $400,000. The Mississippi Legislature has authorized expenditures amounting to $2,500,000 for the repair and maintenance of levees in two Mississippi districts. Instructions have been issued to increase the height of the Fairmont dam near Los Angeles at a cost of $150,000. Two California irrigation projects are reported, one to cost $1,000,000 at Terra Bella, and one to cost $1,500,000 at Lindsay.

WATERWORKS

PROPOSED WORK.

Perry, N. Y.—Plans for filtration plant submitted to State Conservation Committee for approval. C. C. Hopkins, Engineer, Cutler Bldg., Rochester; O. N. Boltere, Village Clerk.

Millville, N. J.—The Supreme Court at Trenton has affirmed ordinance passed by Millville to acquire municipal water plant by purchasing Millville Water Co. and Peope's Water Co.'s plants.

Frostburg, Md.—William Harvey, Town Engineer, estimates cost of rebuilding Old Reservoir, to have a capacity of 4,000,000, at $10,801.

Maryland.—Following are bills signed by Governor: Authorizing money for roads in Howard County (Ellicott City, County Seat), authorizing Kensington to borrow money for water works; authorizing hospital in Charles County (La Platte, County Seat); school bond issue for Washington County (Hagerstown, County Seat); Bridge across Potomac; improving Main Street in Queenstown; authorizing Cambridge to borrow money to pave streets; bridge loan for Talbot County (Easton, County Seat); road from Aberdeen to Cowenton; drawbridge across Sinepuxet Bay; bond issue for roads in Montgomery County (Rockville, County Seat).

Takoma Park, Md.—Mayor S. W. Williams authorized to engage an engineer for the proposed $25,000 reservoir recently authorized by citizens.

St. George, S. C.—Water works bonds for $15,000 will he sold May 1 by M. C. Hall, Comr. Public Works.

Tifton, Ga.—See "Public Buildings and Schools."

Florence, Ala.—All bids opened April 10 for constructing a filtration plant, concrete basins, buildings and piping, pump, etc., have been rejected as being in excess of amount available; city will do work, under supervision of Knight & Quayle of Chattanooga, Tenn. C. H. Jordan, Commissioner Public Property.

Defiance, Ohio.—Purchasing plant of local water company or construction of new plant is contemplated by city.

Ironton, Ohio.—Water bonds for $250,000 for constructing filtration plant will be sold May 16 by Percy W. Dean, City Auditor. Walter L. Watson, Engineer, Ironton.

Salem, Ohio.—City Council authorized Service Director to sell $50,000 water works improvement bonds.

Youngstown, Ohio.—Deep Rock Water Co. considering purchasing water works operated by Realty Security Co. east of Pleasant Grove.

Highland Park (P. O. Detroit), Mich.—City Council considering constructing a pipe line from pumping station on Dequindre Avenue to 24-in. main on Woodward Avenue; cost about $50,000.

Sheboygan Falls, Wis.—Citizens April 4 voted to issue bonds for constructing water works. Sanitary sewer and electric light plant also contemplated. J. Donohue, Sheboygan, Engineer; Frank R. Kroeger, City Clerk.

Cedar Rapids, Iowa. — Park Avenue Realty Co. had plans prepared for water system in Bever Woods addition calling for 10,800 ft. of 6-in. c.-l. pipe; also for a sewer system calling for 10,700 ft. 6 and 8-in. pipe. F. A. Greene, Engineer, care of Anderson Land Co., 401 Masonic Temple, Resident Engineer.

West St. Paul, Minn.—Village Council considering securing water system. Address Ambrose Bill, West St. Paul, for further information.

Lawrence, Kan.—City is desirous of securing propositions from consulting engineers for the furnishing of plans, etc., for the improvements to be made to the lately purchased water plant; improvements to cost $200,000, propositions to be in by April 24. E. H. Dunmire, City Engineer.

Oskaloosa, Kan.—Citizens voted $32,500 bonds for installation of water works. Address City Clerk.

Alliance, Neb.—Contract soon to be let for constructing a reinforced concrete reservoir to cost $8,000. Grant & Fulton, Engrs., Lincoln; Carter Calder, City Clerk.

Overton, Neb.—Citizens voted in favor of constructing water works.

Sheridan, Mont.—Reported George E. Baker, Whitehall, Mont., engaged to prepare plans for water works to cost $20,000.

Martin, Tex.—See "Sewerage and Sewage Disposal."

Kennedy, Tex.—Election to be held May 16 to vote $32,000 bonds for constructing water works and sewerage. Address City Commissioners.

Clinton, Okla.—Construction of water works system contemplated. Address City Clerk.

Dustin, Okla.—City Council authorized improvements to water works costing $5,000. J. H. Swafford, Pres. Board of Aldermen.

Castle Rock, Col.—Citizens voted $40,000 bonds for rebuilding municipal water works.

Alamogordo, N. M.—Citizens voted $300,000 bonds for water, light and ditch system. Address City Clerk.

Albuquerque, N. M.—Citizens voted $400,000 bonds for water works. Address City Clerk.

Las Cruces, N. M.—Citizens voted $19,000 bonds for water works and sewer improvements. Address City Clerk.

Coulee City, Wash.—Reported Box & Noe of Coulee City, real estate dealers, have applied to Council for a 50-year franchise to install water works and distribution system.

Olympia, Wash.—Plans completed by J. B. Weddell, City Engineer, for extensions and improvements to water system; cost $33,000. About 37,010 ft. 10-in., 8-in. and 6-in. pipe, and 70 fire hydrants will be required, wood and steel pipe being considered.

Portland, Ore.—Contract will soon be let by City Commissioners for purchasing about 850 water meters.

Bakersfield, Cal.—City Council concontemplates constructing water system for East Bakersfield Wards. Robert B. Ray, City Engineer, estimates cost as follows: $120,235 for distributing system; $50,000 for six pumping plants of 1,400,000 gal. per day capacity, discharging directly into distribution system or $30,575 for 4,000,000 gal. reservoir and $33,052 for four pumping plants to discharge into reservoir. Wallace M. Morgan, City Manager.

Woodbridge, Ont.—Village Council engaged E. A. James of Toronto to prepare plans for water works, to include pumping station, filtration beds, standpipe and mains; cost about $27,500.

BIDS DESIRED.

New York, N. Y.—Until May 9 by Board of Water Supply, Municipal Building, New York, for Contract 147, furnishing and installing Pitot conections, valves, stuffing boxes, and appurtenances for controlling riser valves in the shafts of city tunnel of Catskill Aqueduct in New York City, advertised in Engineering Record.

Jersey City, N. J.—Until May 2, by City Commissioners for 300 fire hydrants f.o.b. P. R. R. siding at West Newark Avenue. Michael I. Fagen, City Clerk.

Harrisburg, Pa.—Reported desired until May 1 by Harry F. Bowman, Supt. of Safety, for water pipe in Market, Twenty-first and Twenty-second Streets and Bellevue Road. M. B. Cowden, City Engr.

Until April 26, by Harry F. Bowman, Superintendent Public Safety, for furnishing yearly supply of ⅝, ¾, 1, 1¼, 1½ and 2 in. water meters.

Philadelphia, Pa.—Reported desired until April 26, by Department Public Works (Geo. E. Datesman, Dir.), for concrete valveboxes for South Philadelphia, and for flanged pipe for high-pressure fire service. Contract 291.

Wilmington, Del.—Until May 12 by Board Water Commissioners (Edgar H. Hoopes, Jr., Ch. Engr.) for constructing a 12,000,000-gal mechanical filter plant and appurtenances, advertised in Engineering Record. George W. Fuller, Consulting Engineer, 170 Broadway, New York, N. Y.

Washington, D. C.—Until May 8, by Commissioners D .C. (Oliver P. Newman, Chmn.) for furnishing and delivering cast-iron water pipe and cast-iron water pipe specials.

Madison, W. Va.—Until June 1 by Mayor and Town Council for furnishing material and constructing water works.

Columbia, S. C.—Until May 2 by R. C. Keenan, Supt. Dept. of Engineering, for constructing a high velocity rapid sand water filtration plant, together with building, piping, filter appurtenances, etc. John McNeal, City Engr.

Cleveland, Ohio.—Reported desired until April 25 by A. R. Callow, Comr. Purchases and Supplies, 513 City Hall, for engine and turbine automatic control oiling and filter systems for Division Avenue Pumping Station.

East Chicago, Ind.—Reported desired until April 24, by Board Public Works, for new pump engine and boilers and appurtenances for the Alder Street Pumping Station.

Chicago, Ill.—Until April 26, by Board Local Improvements (Edw. J. Glackin, Secy.), for constructing water service pipes in Archer Avenue, South Artesian, Aubert Avenues and numerous other streets.

Until April 28, by Department Public Works (W. R. Moorhouse, Comr.), for furnishing material for constructing and delivering on sidings of the Central Park Avenue Pumping Station valves and accessories. Also separate bids for furnishing and delivering f.o.b. cars or by team to city warehouse, Thirty-first Street and Sacramento Avenue, 100 self-closing service hydrants.

Mt. Horeb, Wis.—See "Sewerage and Sewage Disposal."

Blue Earth, Minn.—Until about May 1, by Don Fitch, Superintendent Water Works and Electric Light, for one 200-hp. engine and one 200-kw. and one 100-kw. direct-connected.

Hutchinson, Minn.—Reported desired until May 1, F. N. Moore, City Clk., for water mains with appurtenances.

Wadena, Minn.—Until May 5, by James Meisner, Superintendent Water Works, for about 10,000 ft. 4 and 6 in. mains (150 lb. pressure), twenty 7 ft. hydrants, two 2½ in. openings, forty-eight 6 in. gate valves and fittings, etc. John Wilson, Engineer, Duluth.

Hutchinson, Kan.—Reported desired until May 1, for constructing water mains. F. N. Noon, City Clerk.

Lawrence, Kan.—See "Proposed Work."

Henryetta, Okla.—Until April 24 by City Clerk for pump motor set, generator set with auxiliaries, etc., for water works extension.

Wilson, Okla.—Until May 3, by Board Trustees, for water works and electric light plant, including 12,500 ft. 24 and 6 in. c.-i. pipe, 21 hydrants, 25 gate valves, and boxes, 30,000 gal. elevated tank, pump, generators, etc. Benham Engineering Company, Oklahoma, Okla., Engrs.

Portland, Ore.—Reported desired until May 8 by J. R. Wood, Purchasing Agent, for 850 ⅝-in. water meters.

PRICES AND LETTINGS.

★*Indicates award of contract.*

New York, N. Y.—Unofficial total of lowest bid opened April 11 by Water Board, Municipal Building, for Contract 171, surfacing with bituminous macadam and vitrified brick blocks about 3 miles highway in Kensico Reservoir, Mount Pleasant, submitted by H. S. Kerbaugh, Inc., 6 Church Street, New York, at $45,145.

★**Ocala, Fla.** — Contracts awarded by City Council for constructing combined water works and electric light plant to Benjamin Thompson Co. of Tampa at $97,254, and for tank to R. D. Cole Mfg. Co. of Newman, Ga.; cost of tank without foundation $9,748 (bids opened March 30). Twombley & Henney, Engineers, 55 Liberty Street, New York, N. Y.

Florence, Ala.—See "Proposed Work."

★**Lenoir City, Tenn.**—Contract for repairs to water works (bids opened April 8) awarded April 11, Wardelp Mfg. Co., Knoxville, Tenn., at $8,666. W. U. Shipley, Recorder.

★**Cleveland, Ohio.**—Contract awarded by Board of Control to the Gibson & Price Co., 1786 Columbus Road, for $7,050 for lead pipe, and to the United Brass Manufacturing Co., 3844 Hamilton Avenue, for $5,765 for brass fittings for city water works. (Bids opened April 11.)

★**Cleveland, Ohio.**—Contracts for water works supplies awarded by City Board of Control as follows: Stop cock boxes, W. P. Taylor Company, Buffalo, N. Y., at $6,277; reciprocating boiler feed pump, Epping-Carpenter Pump Company, 328 Champlain Avenue, $1,796; valves, Rensselaer Valve Company, Troy, N. Y., $14,352.

★**Kewanee, Ill.**—Contract for deep well awarded Whitney Well Company, Chicago, at $17,060.

★**Davenport, Iowa.**—Contracts for water and sewer pipes for the year 1916 awarded by Board of Public Works to Adolph Kahles, Davenport. Probable cost $48,000.

★**Greensburg, Kan.**—Contract for constructing water works awarded Everett & Burt, Hutchinson, Kan., at $28,998, and for pump to H. R. Worthington, Kansas City, Mo., at $1,885 (bids opened April 4). Black & Veatch, Inter State Building, Kansas City, Mo., engineers.

★**Meade, Kan.**—Contract for constructing concrete reservoir (bids opened April 7) awarded P. J. Lee, Meade, at $3,538. Black & Veatch, engineers, Inter State Building, Kansas City, Mo.

★**Fort Bliss, Tex.**—Contract for erecting pumping plant at this post awarded William S. King, Lonoke, Ark., for construction at $5,600, and for pipe line at $2,490.

★**Seattle, Wash.**—Contract for furnishing 42-in. steel pipe to be laid in Lake Union tunnel awarded by Bd. Public Works to Booker, Kiehl & Whipple, Central Building, at $18,178.

Following are bids opened recently by Board of Public Works for water mains in Forty-third Avenue N. E.: V. Ramaglia, Box 172, Yesler Station, $25,453 and $25,435; G. H. Young, 2410 East Valley Street, $27,752 and $27,751; D. & V. Bressi, 1101 Twenty-fifth Street, Avenue S, $26,479, and N. Finrite & Bros., 1630 Twenty-fifth Avenue, $26,792 and $26,417.

New York, N. Y.—Following are unit figures of the four lowest bids opened April 7 by Board of Water Supply, Gas and Electricity for water mains in Broadway, Amsterdam, Columbus and other avenues in Borough of Manhattan: (a) Santore Construction Co., Times Building, $54,935; (b) Soraci Contracting Co., 170 Broadway, $56,296; (c) Beaver Engineering & Contracting Co., 51 Chambers Street, $58,049; (d) Frank L. Paino, Brooklyn, $62,515.

	(a)	(b)	(c)	(d)
625 ton c.-i. pipe	$30.25	$36.00	$30.90	$42.00
55 ton c.-i. castings	65.85	75.00	0.001	80.00
38 ton c.-i. castings	63.00	50.00	0.001	55.00
16 20-in. valves	118.50	150.00	1,208.45	230.00
40 12-in. valves	32.50	40.00	0.001	86.00
27 6-in. valves	13.00	15.00	0.001	34.50
23 fire hydrants	28.00	30.00	0.001	61.00
7,800 cu. yd. earth excavation	0.0001	0.001	0.001	1.00
1,800 cu. yd. rock excavation	4.50	0.001	0.001	0.01
350 cu. yd. masonry excavation	0.0001	0.001	0.001	0.01
10 lin. ft. 48-in. pipe	5.00	0.001	0.001	3.00
10 lin. ft. 36-in. pipe	5.00	0.001	0.001	3.00
900 lin. ft. 30-in. pipe	0.70	3.00	0.001	1.80
5,200 lin. ft. 20-in. pipe	0.60	2.00	0.001	0.70
4,600 lin. ft. 12-in. pipe	0.43	1.00	0.001	0.40
700 lin. ft. 6-in. pipe	0.001	0.001	0.001	0.40
16 20-in. valves	125.00	300.00	1,208.45	100.00
40 12-in. valves	110.00	3.00	0.001	50.00
28 6-in. valves	105.00	3.00	0.001	20.00
25 fire hydrants	103.00	2.00	0.001	30.00
1,200 lin. ft. ¾-in. pipe	0.001	0.001	0.001	0.01
25 cu. yd. brick masonry	0.001	0.001	0.001	0.01
15 cu. yd. concrete masonry	0.01	0.001	0.001	0.01
2 M ft. lumber	0.001	0.01	0.001	0.01
4,000 lb. iron and steel	0.0001	0.001	0.001	0.03
3,000 lb. lead pipe	0.12	0.001	0.001	0.01
70 cu. yd. mold	0.001	0.001	0.001	0.01
2,000 sq. ft. sods	0.001	0.001	0.001	0.01
100 sq. ft. flagging	0.0001	0.001	0.001	0.01
3,000 sq. ft. cement walk	0.0001	0.001	0.001	0.01
200 lin. ft. curbing	0.0001	0.001	0.001	0.01
500 sq. yd. granite block	0.0001	0.001	0.001	0.01
10 sq. yd. granite block	0.0001	0.001	0.001	0.01
1,160 sq. yd. sheet asphalt	0.0001	0.001	0.001	0.01
50 sq. yd. asphalt	0.0001	0.001	0.001	0.01
350 sq. yd. asphalt block	0.0001	0.001	0.001	0.01
100 lin. ft. vitrified pipe	0.0001	0.001	0.001	0.01
225 ton-load pipe	0.0001	0.001	0.001	0.01
600 ton-miles pipe	0.0001	0.001	0.001	0.01
90 ⅝-in. or ¾-in. connections	3.00	0.001	0.001	0.01
20 1-in. house connections	3.00	0.001	0.001	0.01
10 2-in. house connections	3.00	0.001	0.001	0.01

★**Portland, Ore.**—Contract for furnishing 100 6-in. gate valves for City Water Bureau for 1916 awarded by City Council to M. L. Kline, 84 Front Street, for $1,125.

★**Calexico, Cal.**—Contract awarded H. R. Boynton & Co., Los Angeles, for furnishing 385 ton of c.-i. pipe at $18,005. E. B. Browne, City Clerk.

★**Calexico, Cal.**—Contract for furnishing pipe, cocks, hydrants, etc., for municipal water system awarded H. R. Boynton Co., Los Angeles, at $21,764. Bids opened April 4 by city.

SEWERAGE AND SEWAGE DISPOSAL

PROPOSED WORK.

Marlboro, Mass. — Sewer system for Ward 6 includes 30,000 ft. 6 to 12-in. pipe and costing $60,000 is contemplated; also a disposal plant. George A. Stacy, Supt. Water and Sewerage Commissioners.

Westerly, R. I.—At recent Town Meeting citizens authorized $200,000 bond issue for building and maintaining sewers.

Bridgeport, Conn.—See "Paving and Roads."

New Haven, Conn.—The Mayor was authorized to appoint a committee of 5 experts on sanitation to act with Aldermanic Committee on Sewers and Sanitation on question of disposal of sewage; probable cost of improvement $1,000,000.

Hoboken, N. J.—City Commissioners have approved revised plans for the sewer system to be constructed in the upper section of the city at a cost of $70,000. James H. Fuertes, Engineer, 140 Nassau Street, New York.

New Brunswick, N. J.—City Commission will construct sewers in Codwise Avenue and Lawrence Street; 20-in. pipe will be used.

Altoona, Pa.—Plans filed with State Health Dept. at Harrisburg by J. W. Shields, City Engineer, for extension of sewer system in section of city annexed to Sixth Ward.

Scranton, Pa.—Plans for sewer system for Twenty-first Ward and for extension of sewer for Twelfth Ward submitted to City Council. W. A. Schunk, City Engineer.

Windber, Pa.—Election to be held May 16 on issue of $100,000 bonds for street and sewer improvements. Thomas Delehunt, Burgess.

Jackson, Tenn.—City contemplates constructing extensions to sewer system. Lawrence Taylor, Mayor.

Cincinnati, Ohio.—City Council approved approximate estimate of $66,020 submitted by City Engineer Frank S. Krug as cost of constructing sewers under Avondale Relief Sewers Contract No. 5.

Coshocton, Ohio.—In a report to City Council the City Engineer favors the construction of 3 trunk line storm sewers, one at Seventh and Orange Streets, to be 36 in. in diameter, cost $12,870; one at Walnut Street to extend to Red Sea, distance of 2250 ft., and one at Orange and Cambridge Streets, distance of 4500 ft.

Princeton, Ind.—Plans and specifications authorized for sanitary sewers to cover north half of city. H. J. Toell, City Engineer.

Cambridge, Ill.—Contract soon to be let for constructing sewer system about 6½ miles long with two outlets, and Imhoff septic tanks for sewage disposal plant. H. C. Stokes, City Engineer, Kewanee, in charge of work.

Sheboygan Falls, Wis.—See "Water Works."

Paullina, Iowa.—Construction of a sewage disposal plant is under consideration. Address City Clerk.

Pender, Neb.—Citizens voted to issue bonds for constructing sewers.

Austin, Tex.—See "Bridges."

Belleville, Tex.—Contract soon to be let for constructing additions to sewer system; disposal plant and purifier will be added. C. G. Crueger, County Judge.

Greenville, Tex.—A. D. Duck, City Engineer, preparing plans for a sewage disposal plant for 15,000 population. Probably Imhoff and tanks; incinerator plant also proposed.

Marlin, Tex.—Bonds for following improvements will be sold April 24: $45,000 for sanitary sewer system, $60,000 for schools and $15,000 for water works extensions. E. W. Bounds, Mayor; J. H. Pouree, City Secretary.

Paris, Tex.—Plans prepared for a disposal system. System may be installed by force account. Bonds will not be sold in about a month or six weeks. Edward H. McCusteon, Mayor.

Texas.—Through the passage in the Legislature of the Anti-Stream Polution Act, the following towns will have to construct additions and make improvements in their sewer systems: Amarillo, Ballinger, Beeville, Bryan, Colina, Cisco, Coleman, Dallas, El Campo, Fort Worth, Gainesville, Gonzales, Greenville, Hillsboro, Honey Grove, Huntsville, Jacksonville, Laredo, Palestine, Plainview, Shiner and Waxahachie.

Van Alstyne, Tex.—Construction of a sewer system under consideration. L. Carver, Mayor.

Victoria, Tex.—Contract soon to be let for constructing sewage disposal plant, to cost $25,000. Address City Secretary.

Tulsa, Okla.—Sewer bonds amounting to $100,000 sold.

Lamar, Col.—Contract will be let about June for constructing 2½ miles of 24-in. vitr. tile sewers to cost $18,800. H. C. Byrnes, Engineer, Lamar; S. E. Cook, City Clerk.

Las Cruces, N. M.—See "Water Works."

Calexico, Cal.—Board Trustees ordered H. W. Blaisdel of Los Angeles to prepare surveys, plans and specifications for proposed drainage storm sewer from end of Sixth Street.

Vancouver, B. C.—Reported contract soon to be let by City and Sewerage Board for constructing sea wall and sewer across Coal Harbor.

BIDS DESIRED.

Providence, R. I.—Until April 24, by City Clerk, for constructing sewers in several streets. James H. Gainer, Mayor, Chmn. Board Contract and Supply.

Hartford, Conn.—Until May 2, by Board of Contract and Supply, for Section "A" of sewer system from Uphill Street to city line, including 723 ft. 60-in., 500 ft. 48-in., 342 ft. 39-in., 1138 ft. 36-in., 650 ft. 33-in. and 346 ft. 30-in. Bids on Section "B," about 12,000 ft. tile sewer, will be opened probably May 9. R. N. Clark, City Engineer.

Riverside, N. J.—Until May 8, by Borough Council, for constructing sewers and disposal works, advertised in Engineering Record. Joseph H. Weston, Borough Clerk; Jesse F. Zabriskie, Borough Engineer, Borough Hall.

Newark, Del.—Until May 8, by Sewer Commission, for constructing Sewer Extension No. 2, advertised in Engineering Record. Kastenhuber & Anderson, Chief Engineers, Easton, Md.

Louisville, Ky.—Reported desired until May 1, for constructing main outfall sewer about 5100 ft. long and 39 in. in diam. Probable cost $25,000. J. White Guyn, City Engineer.

Struthers, Ohio.—See "Paving and Roads."

East Chicago, Ind.—Reported desired until April 24, by Board Public Works (M. R. Shocks, Chmn.), for constructing sewers in various streets.

Lebanon, Ind.—Reported desired until April 24, by Wm. F. Smith, City Clk., for constructing sewers.

Columbus, Wis.—Reported desired until April 29, by Benj. Paepke, City Clk., for constructing sewer system.

Milwaukee, Wis.—Until about May 25 by Board of Public Works for constructing sewers and sewage disposal plant for which citizens recently voted a $1,560,000 bond issue. J. H. Fowler, Secretary; T. Chalkley Hatton, Engineer, City Hall.

Mt. Horeb, Wis.—Until May 6, by M. A. Knappe, Village Clerk, for 8277 ft. 6 to 12-in. pipe sewers, 7346 lin. ft. 6-in. c.-i. pipe and 1818 ft. 4-in. c.-i. pipe, six 6-in. valves and boxes and 14 hydrants, etc.

Lake View, Iowa.—Reported desired until April 24, by City Clerk, for sewer and sewage disposal plant. Brice & Standevin, Engrs., 430 Bee Building, Omaha.

Northwood, Iowa.—Until April 24, by J. E. Amundsen, Town Clk., for 5417 lin. ft. 10 and 12 in. sewer together with manholes, septic tank, and one bulkhead.

Lake Crystal, Minn.—Until May 1 by W. P. Cobb, City Clerk, for constructing a general sewer to disposal tank, approximately 5690 ft., together with manholes, Y branches, etc.; disposal tank at outfall to Lilly Lake sludge bed, sump pit, sewage pump and accessories, and for extensions to sewers, about 56 blocks, varying from 8 to 12-in. pipe. J. F. Druar, Consulting Engineer, 312 Commercial Building, St. Paul, Minn.

Ipswich, S. D.—Until May 5 by the City Auditor for constructing 2810 ft. of 8-in. and 10-in. sewer with flush tanks and manholes. Dakota Engineering Co., Mitchell, S. D., Engineers.

Yankton, S. D.—See "Paving and Roads."

Victoria, Tex.—Reported desired until May 1, for constructing sewage treatment plant. L. A. Gueringer, City Engr.

Oatman, Ariz.—Reported desired until May 15, for constructing sewer system with five miles of 14 in. pipe. Address Oatman Water Co.

Ogden, Utah.—Reported desired until April 24, by Walter Richey, City Recorder, for pipe sewers in Sewer Dist. No. 130 and 132.

Montreal, Que.—Until May 2 by Board of Commissioners (L. N. Senecal, Secy.) for constructing outlet for the Emard Ward main sewer.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**New Haven, Conn.**—Contract awarded Thomas F. Maher, 883 Orange Street, for constructing sewers in portions of Reas, Elizabeth, Lincoln, Butter, Henry, Second and other streets (bids opened April 10). H. J. Kellogg, Asst. City Engr.

Brooklyn, N. Y.—Following are four lowest bids opened April 12 by L. H. Pounds, Pres. Brooklyn Borough, for constructing sewers in Myrtle Avenue, from Claremont to Classon Avenue, and in Classon Avenue from Myrtle to Park Avenue, about 1596 lin. ft. 54-in., 609 lin. ft. 48-in., 540 lin. ft. 42-in. and 260 lin. ft. 36-in. brick sewer, and 1052 lin. ft. 12 to 24-in. pipe sewer, together with manholes, etc. Engineer's estimate, $45,183 (bids are on percentage basis of engineer's estimate): P. J. Donlon Contracting Co., 82 South Third Street, 96.9 per cent; Louis A. Deiser, Jr., 388 Broadway, 107.9 per cent; Concrete Material Co., Inc., 892 Hancock Street, 109 per cent; Harrison & Craig, 120 per cent.

In Park Avenue, from Sumner to Tompkins Avenues, and in Tompkins Avenue from Park to Vernon Avenues, about 2585 lin. ft. 36 to 60-in. sewer, and 566 lin. ft. 12-in. pipe sewer, manholes, etc. Engineer's estimate, $32,310 (bids on percentage basis): Angelo Paino, Morris Park, L. I., 100 per cent; D. Donegan Company, 5904 Fourteenth Avenue, 104 per cent; Louis A. Deiser, Jr., 388 Broadway, 119 per cent, and Rosenthal Engineering Contracting Co., 166 Hooper Street, 126 per cent.

★**Rochester, N. Y.**—Contracts for equipment for sewage disposal plant at Irondequoit awarded by Bd. Contract and Supply as follows: Seneca Engineering Co. of Rochester for installing revolving screens and other equipment for removal of solids from sewage at $53,925, and to F. L. Heughes Co. of Rochester for erecting steel work for excavating apparatus at grit chambers at R., W. & O. R.R. trestle and at Hastings Avenue.

★**Philadelphia, Pa.**—Following are four lowest bids opened April 14 by Director of Public Works for constructing the Frankford Creek intercepting sewer: Cantrell Construction Company, Twenty-first Street and Sedgley Avenue, $185,682 (awarded contract); Lombardi & Perna, $206,587; Keystone State Construction Company, Penna Building, $213,755; Emilo Pascuzzi, 244 E. Durham Street, $219,719.

★**Eustis, Fla.**—Contract for constructing 70 blocks of street paving, sanitary and storm sewers, including Imhoff system of disposal, awarded as follows: Sanitary sewers, J. F. Morgan Co., Attala, Ala; street and storm sewers, to Continental Public Works Co., 2 Rector Street, New York, N. Y. Pavement to be asphaltic concrete on concrete base in fire limits and sand asphalt on macadam base in residence sections. Isham & Randolph, Engineers, Jacksonville.

★**Cleveland, O.**—Contract awarded by Board Control for sewers in Broadview Avenue to Amato Construction Co., 1108 Engineers Building, at $11,377.

★Contract awarded by Board Control for additions to Walworth Run Sewer to Donnelly & Graham, Big Four R. R. and Thirtieth Street, at $25,000 (bids opened April 5).

★**Carroll, Iowa.**—Contract for constructing storm sewer system awarded by City Council to Paul Paulsen of Carroll at $17,495 for cement sewers.

St. Paul, Minn.—Following are bids opened recently by city for constructing sewer in Capitol Avenue: Engineer's estimate $95.496; O'Neil & Preston, Ashland and Syndicate Streets, 33 and 36 in. Chicago Reinforced Pipe Company pipe and 42 and 54-in. segimental block, $96.000; E. T. Webster, 437 Beacon Avenue, $108,226; Thornman Bros., 1312 Snelling Avenue N., $118,650.

Houston, Tex.—Following are four lowest bids opened for constructing storm and sanitary sewers on Main Street: E. M. Scheflow, Houston, $17,322; H. M. Miller, $18,685; Houston Construction Co., Houston, $18,787; Hunter & Hunter Houston, $18,932.

Brooklyn, N. Y.—Following are unit figures of the four lowest bids opened April 12 by Lewis H. Pounds, President Brooklyn Borough, for constructing sewers in Chauncey Street from Ralph Avenue to Broadway: (a) D. Donegan Co., 5904 Fourteenth Avenue, $72,793; (b) Murphy Bros., Brooklyn, $81.220; (c) Concrete Material Co., Inc., 892 Hancock Street, $83,496; (d) Philip Canadella, $91,848.

	(a)	(b)	(c)	(d)
706 lin. ft. of 96-in. brick	$27.90	$31.75	$35.00	$35.00
770 lin. ft. of 68-in. brick	17.70	18.40	26.00	23.00
745 lin. ft. of 54-in. brick	10.70	13.87	18.00	14.00
761 lin. ft. of 48-in. brick	9.00	11.35	12.50	14.00
457 lin. ft. of 42-in. brick	6.80	8.67	9.25	10.00
2,161 lin. ft. of 12-in. pipe	2.35	2.31	2.60	2.65
At Intersection No. 1.				
14 lin. ft. of special sewer "A"	11.00	13.60	10.00	22.00
18 lin. ft. of 15-in. pipe	3.00	1.70	3.00	3.00
1 overflow manhole	73.90	85.00	150.00	150.00
At Intersection No. 2.				
26 lin. ft. of 42-in. brick	7.00	10.25	10.00	25.00
14 lin. ft. of 12-in. pipe	3.00	2.25	2.50	3.00
At Intersection No. 3.				
15 lin. ft. of special sewer "B"	8.00	10.25	10.00	22.00
12 lin. ft. of 12-in. pipe	4.00	2.25	2.50	3.00
1 overflow manhole	90.00	85.00	150.00	260.00
At Intersection No. 4.				
28 lin. ft. of 30-in. brick	6.00	10.25	10.00	22.00
At Intersection No. 6.				
1 storm overflow	213.50	145.00	250.00	250.00
119 house connection drains, reconnected	3.50	3.00	5.00	7.00
13 sewer basins, reconnected	50.00	15.00	60.00	60.00
1 manhole, Class "C"	60.00	60.00	75.00	125.00
21 manholes, Class "D"	40.00	40.00	60.00	65.00
12 manholes, Class "E"	40.00	40.00	50.00	65.00
460,000 ft., board measure, of sheeting and bracing	25.00	26.00	0.01	22.00
21,000 ft., board measure, of foundation planking	28.00	28.00	30.00	30.00
100 cu. yd. Class "B" concrete	5.00	6.00	7.00	7.25
1,000 lin. ft. piles	0.20	0.25	0.10	0.26
2,000 lb. steel rods	0.04	0.04	0.05	0.05

Brooklyn, N. Y.—Following are unit figures of the four lowest bids opened April 12 by Lewis H. Pounds, President Brooklyn Borough, for constructing sewers in Pacific Street, Troy Avenue and other streets: (a) D. Donegan Co., 5904 Fourteenth Avenue, $94,844; (b) Concrete Msterial Co., 892 Hancock Street, $113,456; (c) J. F. Cogan Co., 2 Franklin Street, $119,371, and (d) Daniel Rogge, 3071 Perry Avenue, Bronx Borough, $124,564.

	(a)	(b)	(c)	(d)
940 lin. ft. of 78-in. brick	$23.40	$39.00	$35.00	$28.00
724 lin. ft. of 72-in. brick	21.40	36.00	33.00	27.00
778 lin. ft. of 60-in. brick	15.80	23.00	25.00	22.00
763 lin. ft. of 54-in. brick	11.90	14.00	18.00	14.00
774 lin. ft. of 42-in. brick	7.40	9.00	15.00	10.00
421 lin. ft. of 30-in. brick	5.25	7.00	11.00	9.00
38 lin. ft. of 30-in. brick and concrete	6.00	8.00	8.50	9.00
15 lin. ft. of special "A"	7.85	15.00	20.00	16.00
39 lin. ft. of special "B"	9.90	30.00	40.00	20.00
8 lin. ft. of 24-in. pipe	3.85	6.00	6.00	2.00
14 lin. ft. of 18-in. pipe	3.20	5.00	5.00	3.00
770 lin. ft. of 15-in. pipe	2.45	3.00	3.60	3.25
1,043 lin. ft. of 12-in. pipe	2.30	2.50	3.00	3.25
144 lin. ft. of 8-in. house connection drains	1.20	1.50	2.00	3.00
2 overflow manholes, "A" and "E"	130.00	300.00	150.00	170.00
1 overflow manhole, "B"	97.35	150.00	175.00	125.00
2 overflow manholes, "C" and "D," with drop chambers	163.00	300.00	300.00	300.00
1 special manhole, "X"	49.50	100.00	60.00	100.00
2 manholes, Class "C"	88 00	125.00	90.00	125.00
9 manholes, Class "E"	60.00	60.00	70.00	50.00
13 manholes, on pipe sewers, Class "D"	45.00	60.00	35.00	100.00
13 sewer basins reconnected	45.00	50.00	40.00	50.00
63 house connections reconnected	5.00	5.00	3.00	5.00
750,000 ft., board measure, of sheeting and bracing	25.00	0.01	0.01	35.00
8,500 ft., board measure, of foundation planking	28.00	30.00	36.00	30.00
100 cu. yd. of Class "B" concrete	5.00	7.00	10.00	7.00
10 cu. yd. of brick masonry	10.00	13.00	12.00	15.00
10 bbl. of cement	1.75	1.50	2.00	2.00
2,000 lb. of steel rods	0.04	0.05	0.05	0.05
1,000 lin. ft. of piles	0.20	0.10	0.01	0.01

Brooklyn, N. Y.—Following are unit figures of the four lowest bids opened April 12 by Lewis H. Pounds, President Brooklyn Borough, for constructing sewers in Chauncey Street from Lewis to Ralph Avenues, Proposition "A": (a) Concrete Material Co., Inc., 892 Hancock Street, $178,107; (b) P. J. Donlon & Craig Co., 82 S. Third Street, $187,501; (c) Harrison & Craig Co., $227,322; (d) Old Colony Construction Co., 103 Park Avenue, New York, $261,811; Proposition "B": (a) J. F. Cogan Co., 233 Broadway, New York, $186,068; (b) P. J. Donlon Contracting Co., 82 S. Third Street, $195,374; (c) Harrison & Craig Co., $220,641; (d) Daniel Rogge, 3071 Perry Avenue, Bronx Borough, $230,194

	(a)	(b)	(c)	(d)
Proposition "A"				
2,442 lin. ft. 114-in. brick	$50.00	$55.00	$53.60	$62.00
901 lin. ft. 102-in. brick	36.00	30.00	45.60	55.00
37 lin. ft. 96-in. brick	36.00	25.00	41.50	40.00
834 lin. ft. 15-in. pipe	3.00	3.00	2.00	4.00
4,227 lin. ft. 12-in. pipe	2.50	3.00	1.50	2.50
At Intersection No. 1.				
24 lin. ft. special 54-in.	15.00	20.00	18.60	35.00
1 special connecting chamber	750.00	1,200.00	950.00	1,500.00
77 lin ft. special sewer "A"	10.00	11.00	12.00	14.00
1 special manhole "F"	75.00	75.00	50.00	75.00
1 special manhole "G"	75.00	100.00	50.00	90.00
At Intersection No. 2.				
1 special connecting chamber	350.00	800.00	550.00	600.00
6 lin. ft. special sewer "B"	10.00	11.00	9.50	26.00
18 lin. ft. 15-in. pipe	3.00	3.00	3.00	5.00
1 overflow manhole	150.00	100.00	60.00	300.00
170 house connection drains, reconnected	5.00	5.00	6.00	8.50
10 sewer basins, reconnected	50.00	60.00	45.00	12.00
3 manholes, Class "A"	500.00	500.00	375.00	500.00
1 manhole, Class "C"	100.00	200.00	85.00	100.00
41 manholes, Class "D"	60.00	50.00	60.00	75.00
1,100,100 ft., board measure, sheeting and bracing	0.01	0.01	33.00	30.00
20 cu. yd. Class "B" concrete	7.00	12.00	8.00	8.00
10 cu. yd. brick masonry	15.00	15.00	12.00	15.00
10 bbl. cement	1.50	2.00	2.00	2.00
1,000 lin. ft. piles	0.10	0.01	0.01	0.25
2,000 lb. steel rods	0.05	0.10	0.06	0.06
20,000 ft., board measure, foundation planking	30.00	30.00	35.00	40.00
Proposition "B"				
1,621 lin. ft. 114-in. brick in tunnel	53.00	65.00	60.00	72.00
821 lin. ft. 102-in. brick in open cut	52.00	55.00	50.60	56.00
901 lin. ft. 102-in. brick	52.00	30.00	45.60	52.00
37 lin. ft. 96-in. brick	45.00	30.00	41.50	28.00
48 lin. ft. 15-in. pipe	5.00	3.00	8.00	3.25
2,511 lin. ft. 12-in. pipe	0.01	3.00	2.00	3.50
At Intersection No. 1.				
24 lin. ft. special 54-in.	30.00	20.00	18.60	23.00
1 special connecting chamber	1,500.00	1,200.00	950.00	1,600.00
77 lin. ft. special sewer "A"	20.00	11.00	12.00	13.00
1 special manhole "F"	55.00	76.00	50.00	50.00
1 special manhole "G"	60.00	100.00	50.00	65.00
At Intersection No. 2.				
1 special connecting chamber	1,500.00	800.00	525.00	800.00
6 lin. ft. special sewer "B"	25.00	11.00	9.50	10.00
18 lin. ft. 15-in. pipe	5.00	3.00	3.00	2.00
1 overflow manhole	150.00	100.00	60.00	130.00
90 house connection drains, reconnected	0.01	6.00	6 00	5.00
10 sewer basins, reconnected	40.00	50.00	45.00	50.00
3 manholes, Class "A"	250.00	500.00	375.00	500.00
1 manhole, Class "C"	175.00	200.00	85.00	130.00
22 manholes, Class "D"	0.01	50.00	60.00	100.00
35,000 ft., board measure, foundation planking	35.00	30.00	35.00	35.00
480,000 ft., board measure, sheeting and bracing	0.01	0.01	33.00	0.01
1,000 cu. yd. concrete or brick masonry around sewer in tunnel	0.01	0.01	10.00	0.01
10 cu. yd. Class "B" concrete	10.00	12.00	8.00	8.00
10 cu. yd. brick masonry	12.00	15.00	12.00	15.00
10 bbl. cement	2.00	2.00	2.00	2.00
1,000 lin. ft. piles	0.01	0.01	0.01	0.01
2,000 lb. steel rods	0.05	0.10	0.06	0.05

★**Calexico, Cal.**—Contract awarded California-Arizona Construction Company, 1700 East Washington Street, Los Angeles, for constructing sanitary sewer system involving 15,075 ft. 8-in. and 4292 ft. 6-in. vitr. pipe, 695 Y's and T's, manholes, etc., at $14,622.

BRIDGES

PROPOSED WORK.

Boston, Mass.—See "Electric Railways."

Bridgeport, Conn.—See "Paving and Roads."

Bridgeport, Conn.—City Council sold $220,000 Grand Street bridge bonds. Address City Clerk.

Trenton, N. J.—Construction of a bridge over Sanhican Creek to replace one recently destroyed being considered. Theodore Tobish, County Engineer.

Conshohocken, Pa.—County Commissioners at Norristown plan constructing over Schuylkill River and across tracks of Philadelphia & Reading at Conshohocken. Estimated cost $250,000. Address County Clerk.

Media, Pa.—County Commissioners plan constructing a concrete bridge over Ridley River on Morton Avenue at a point where Chester, Ridley Township, and Eddystone Borough connect. Address County Clerk.

Pennsylvania—Following permits authorized by State Water Supply, Harrisburg: Commissioners of Chester County, to construct a bridge across a tributary of East Branch of Octoraro Creek, one mile above mouth of stream, on Atglen-Swan Road; Commissioners of Berks County, to construct bridge across Allegheny Creek, on road from Morgantown Road to Beckersville, in Bucknock Township; to construct a bridge over Pine Creek, one mile north of Greenawalt Station, in Albany Township; Pennsylvania R.R. Co., to make change in present four-span double track, through truss bridge, No. 88, across the Schuylkill River, at Reading, Berks County; Joseph E. Thropp, to construct fill along the Raystown Branch of the Juniata River, at the upper end of his Saxton Furnace Plant, in Liberty Township, Bedford County; Scranton Gas & Water Co., to reinforce Williams Bridge Dam, on Stafford Meadow Brook, near Scranton, in Roaring Brook Township, Lackawanna County; Pittsburgh Plate Glass Co., to dredge sand and gravel from channel of Allegheny River, and backfill a portion of same, beginning at Ross Island on the north and extending downstream to a point at or near Nicholson's Island, all in Armstrong County.

Cumberland, Md.—Four bridges on Connellsville division of Baltimore & Ohio R.R. (F. L. Stuart, Ch. Engr., Baltimore) are to be replaced with heavier type of bridge.

Montgomery, Ala.—Plans being prepared by N. H. Courtenay, Chief Engineer of Louisville & Nashville R.R. at Louisville for a steel highway bridge to replace present wooden bridge over railroad tracks at Bell Street.

Clarksville, Tenn.—Election to be held to vote bonds for constructing a bridge across Cumberland River at Clarksville, costing approximately $200,000. W. T. Young Engineer, Nashville. C. W. Tyler. County Judge.

Memphis, Tenn.—Reported Arkansas & Memphis Ry. Bridge & Terminal Company will take steps at once to construct the Harrahan Bridge across Mississippi River at Memphis.

Owensboro, Ky.—See "Paving and Roads."

Madison, Wis.—Plans approved by City Council for Rutledge Street bridge. Estimated cost $8,000. Address City Clerk.

Minneapolis, Minn.—Plans prepared by F. W. Chappelen, City Engineer, for an ornamental concrete bridge to be constructed across West Lake Street over tracks of Milwaukee & Minneapolis & St. Louis R. R. Cost $100,000.

Austin, Texas.—City Commissioners appropriated $60,000 for constructing bridges and sewers. Address City Clerk.

Beaumont, Tex.—County Commissioners soon to let contract for constructing 2 concrete culverts on Spindletop and Taylor's bayou roads and for drawbridge over Mayhaw Bayou. Address County Clerk.

Santa Ana, Cal.—Election to be held to vote $11,000 bonds for concrete bridge on Hannah Street. Address City Clerk.

Santa Barbara, Cal. — Mayberry & Parker and Fred L. Johnson, Pacific Electric Building, Los Angeles, engaged by Board of Supervisors to prepare plans for concrete bridges across San Antonio Creek on Lompoc Harris Station Road and across Romeo Creek on East Valley Road, Montecito.

BIDS DESIRED.

Croton Falls, N. Y.—Until May 1, by Harvey B. Green, Clerk Board County Supervisors, White Plains, for erection of the dismantled Fulton Avenue bridge over west branch of Croton River, at Croton Falls, which bridge is now stored on the property of the Westchester Lighting Co. at Mount Vernon.

Philadelphia, Pa.—Until April 27, by Dept. Public Works, Bureau of Surveys, for Schedule "A," bridges on line of Island Avenue, under P., B. & W. R. R. and on line of Godfrey Avenue, under North Pennsylvania R. R., advertised in Engineering Record.

Cumberland, Md.—Until June 5 by Mayor for constructing two reinforced concrete bridges over Wills Creek, one at Baltimore Street and one at Valley Street, according to plans to be prepared by B. H. Davis, Whitehall Building, New York; Ralph L. Rizer, City Engineer.

Rocky Mount, Va.—Reported desired until April 24, by County Commissioners, for constructing steel bridge, 81 ft. long, over Blackwater Creek at Deyerles Ford. G. P. Coleman, State Highway Engr. at Richmond.

Paducah, Ky.—Reported desired until May 2, by Gus G. Singleton, County Clerk, for constructing 30 ft. concrete bridge on Clark Line Road and 18 ft. concrete bridge on Hinkleville Road.

Delaware, Ohio.—Contract will be let about May 1 by Cleveland, Cincinnati, Chicago & St. Louis Ry. (C. A. Paquette, Chief Engineer, Cincinnati), for constructing the substructure of bridge across Olentangy River at Delaware; cost of substructure $12,000.

Brownstown, Ind.—See "Paving and Roads."

Rensselaer, Ind.—Until May 2, by County Commissioners, for constructing five steel bridges, one each in Newton, Carpenter, Union and Berkeley Townships. J. P. Hammond, Co. Aud.

Terre Haute, Ind.—Until April 29, by County Auditor for constructing a reinforced concrete bridge in Fayette Township, one 80 ft. and two 75 ft. spans, 312 ft. over all, 75,000 lbs. steel, 1433 cu. yds. concrete, 175 piling 20 ft. long, 11,000 cu. yds. earth work, advertised in Engineering Record. Herbert C. Anderson, County Surveyor.

Marietta, Okla.—Reported desired until May 1 by Board County Commissionera (E. G. McKinney, Chmn.) for constructing a 50-ft. steel bridge across Parsley Homa Creek.

Stillwater, Okla.—Reported desired until May 1 by W. T. Keys, Co. Clk., for constructing 8 steel and one concrete bridge.

Los Angeles, Cal.—Until May 8, by Board Supervisors (A. M. McPherrin, Clerk), for constructing reinforced concrete viaduct 242 ft. long and 20 ft. wide over ravine, Pacific Electric Railway Tracks and Iona Avenue, at Western Avenue.

Modesto, Cal.—Until May 9, by Board of Supervisors for constructing a reinforced concrete bridge, 14 spans, 35 ft. wide across Toylum Tuolumne River at south boundary of Modesto. Probable cost $70,000. Edgar H. Annear, County Surveyor.

Santa Barbara, Cal.—Until May 1, by Board Supervisors (C. A. Hunt, Clerk), for constructing reinforced concrete girder bridge over Zaca Creek on line of State Highway in Third Road District. Probable cost $12,000.

Etobicoke, Ont.—Until April 27, for constructing reinforced concrete bridge of 25 ft. span, known as the Culham Bridge. Frank Barber, Township Engr., 57 Adelaide Street E., Toronto.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★Battenville, N. Y.—Contract for constructing steel bridge at Battenville awarded by R. L. Skinner, Town Superintendent, Greenwich, to United Construction Co., Albany, at $5,599. Bids opened April 14.

★Harrisburg, Pa.—Contract for constructing concrete and steel bridge over Spring Creek, 3 miles south of Harrisburg, reported awarded by Pennsylvania R. R. Co. to John L. Kuhn Co. of Harrisburg.

West Chester, Pa.—Contracts awarded by County Commissioners to Dunleavy Bros., Coatesville, for constructing three-arch stone masonry bridge over Beaver Creek, at Edge's mill, Cain Township, at $4,650, and for two-arch stone bridge over Octoraro Creek, West Sadsbury Township, at $4,707.

Miami, Fla.—Following are four lowest bids opened April 6 by W. B. Moore, City Clerk, for constructing (a) bridge at Twelfth Street, and (b) bridge at Avenue D, both over Miami River; M. F. Comer, Miama, (a), $55,191; (b), $48,075; Blodgett Construction Company, Kansas City, Mo., (a), $57,508; (b), $50,325; Hackedorn Contracting Company, Indianapolis, Ind., (a), $60,001; Horton Concrete Construction Company, Kansas City, Mo., (a), $61,548; Everett P. Maule, Miami, (b), $50,325; Hillyer & Sperring Company, Jacksonville, (b), $50,345; Harrington, Howard & Ash, engineers, Kansas City, Mo.

★Indianola, Miss.—Contract awarded by County Commissioners for constructing steel drawbridge over Sunflower River near Woodburn to Larimer-Burgett Bridge Co., Memphis, Tenn., at $19,850.

★Indianapolis, Ind.—Contract awarded by County Commissioners for constructing steel bridge over Lick Creek west of Bridgeport on National Road to Central States Bridge Co., Indianapolis, at $5,999.

Chicago, Ill.—Lowest bid, opened April 10 by County Superintendent Public Service, for constructing reinforced concrete two-span bridge, each span 30 ft., for Proviso Township, submitted by Walsh Construction Company, Chicago, at $5,350.

★Marshalltown, Iowa.—Contract for constructing 48 concrete bridges and culverts (bids opened April 8) awarded by County Commissioners to Thor Construction Company, Cedar Falls, H. W. Dobson, County Auditor.

★Leavenworth, Kan.—Contract for rebuilding viaduct awarded by City Commission to Leavenworth Bridge Co., Leavenworth, at $12,750. A 2-ft. concrete arch will be placed beneath present arch as a reinforcement.

Olathe, Kan.—All bids opened April 4 by County Commissioners for constructing five concrete bridges have been rejected as exceeding engineer's estimate; county will probably do the work. W. J. Moon, County Clerk.

Clayton, Mo.—Following are four lowest bids opened by County Court for constructing steel bridge across Meramec River at Valley Park: Miller Borchedin Bridge Building Company, St. Louis, $46,900; Vincennes Bridge Company, Vincennes, Ind., $47,950; Illinois Steel Bridge Company, 208 S. La Salle Street, Chicago, Ill., $47,950, and Missouri Valley Bridge & Iron Company, Denver, Col., $49,950.

★Galveston, Tex.—Contract awarded by County Commissioners for constructing temporary vehicle bridge over Galveston Bay between the island and mainland to William Moore, Texas City, at $41,561 (bids opened April 10).

★Marshall, Tex.—Following are four bids opened April 10 by T. E. Hilliard, City Engineer, for constructing reinforced concrete viaduct over railroad yard: A. W. Frazier, St. Louis, Mo., $61,894 (awarded contract); Dobbs & Wetmore, Meridian, Miss., $64,034; Fox Construction Company, El Reno, Okla., $71,456, and McKinzie Construction Company, Webb City, Mo., $71,538.

★Velasco, Tex.—Contract awarded Virginia Bridge Company of Texas for constructing bridge over Brazos River between Velasco and Freeport, which is to cost $100,000. T. G. Banks, Engineer, Freeport; George C. Morris, Receiver.

★Cathlamet, Wash.—Contract awarded by County Commissioners for constructing steel bridge over Grey's River to Coast Bridge Co., Portland, Ore., at $7,200. Thomas H. Allman, County Engineer.

Portland, Ore.—Following bids submitted to County Commissioners for constructing four concrete bridges on St. Helens Road: Standifer-Clarkson Co., Portland, at $19,231; Moore Bros., Portland, $19,309; Mueller Construction Co., $19,992; Portland Bridge & Building Co., Worcester Bldg., $20,376.

★Hanford, Cal.—Contract for constructing bridges and culverts on County Highway No. 1, Division No. 3, and Highway No. 1, Division 8, Section L, Lemore to Stratford, awarded H. E. Walker, Lemore, at $5,330.

Ventura, Cal.—Following bids opened April 6, 7 and 8 are held under consideration (all others rejected) by Board of Supervisors for constructing bridges (a) 240-ft. steel span and two approach spans (county to furnish all steel for 240-ft. span) across Sespe Creek west of Fillmore; (b) 200-ft. combination steel and timber span across Ventura River one mile north of Canet Station; (c) 160-ft. combination steel and timber span and 90-ft. pile trestle over San Antonio Creek near La Crosse Station; G. E. Preble, Santa Ana (a) $10,046; (b) $7,278; S. M. Kerns, Long Beach (a) $11,900; W. M. Ledbetter, 1533 South Weston Avenue, Los Angeles, (a) $12,472; C. E. Cotton, San Francisco (b) $7,626; E. A. Garland, Santa Barbara, (3) $6,845.
★Contract for constructing six 129-ft. steel spans (county to furnish all steel in six spans), five concrete piers, etc., across Santa Clara River, near Santicoy, awarded William M. Ledbetter, 1533 South Western Avenue, Los Angeles, at $22,110.

PAVING AND ROADS

PROPOSED WORK.

Westerly, R. I.—All bids opened April 4 by Town Council for constructing Watch Hill Road have been rejected as they exceeded the appropriation, which is $65,000. New bids will be asked.

Bridgeport, Conn.—Citizens voted to issue $2,275,000 bonds for paving streets, construct sewers in new districts, enlarge old sewers, construct three bridges across estuary of harbor, erect five new schools and enlarge old ones, and construct new parks.

Albany, N. Y.—Senate passed bill appropriating $3,700,000 for maintaining highways. Edwin Duffey, State Highway Comr.

Albion, N. Y.—Election will be held May 3 to vote on paving 1.38 miles of Main Street. Estimated cost $100,000.

Geneva, N. Y.—Board of Public Works voted paving with brick Madison and North Genesee Streets and Avenue E, and with concrete Gates Avenue. Address City Clerk.

Patchogue, L. I., N. Y.—Citizens voted $40,000 bonds for street improvements.

Freehold, N. J.—The State Road Dept. at Trenton will apportion $106,000 as Monmouth County's share for constructing state aid roads.

Hoboken, N. J.—City Commissioners April 12 decided to pave 15 streets in the Fourth Ward. James Landigan, Street Commissioner.

Salem, N. J.—All bids opened by Bd. Freeholders, Salem, for constructing Pennsgrove-Pennsville Road, 11,226 ft. long, rejected, being in excess of $50,000 available for improvement.

Allentown, Pa. — Highway Department plans spending $250,000 for street improvements and storm water sewers. Address City Clerk.

Harrisburg, Pa.—County Commissioners plan rebuilding Horeshoe Turnpike between Hummelstown and the Lebanon County line. Address County Clerk.

Jenkintown, Pa.—Borough Council approved ordinances for $11,600 for highways and bridges. Address Borough Clerk.

Steelton, Pa.—Council passed ordinance providing for $50,000 bond issue for paving. Election to be held May 16.

Mount Wolf, Pa.—Borough Council plans macadamizing principal streets. Address Borough Clerk.

Nazareth, Pa.—About $30,000 street improvements contemplated. Address Borough Clerk.

Oakhurst, Pa.—Borough Council approved holding an election to vote bond issue of $20,000 for about 4 miles of brick paving on concrete base.

Richmond, Va.—Bolton, Clark & Pratt, Engineers, estimated cost of constructing Riverside Drive at $222,225. Work to include following: Rock excavation, 144,438 cu. yd.; earth excavation, 37,893 cu. yd.; reinforced concrete viaduct (station 30 to 33); reinforced concrete retaining walls, 2,594.79 cu. yd.; galvanized corrugated iron pipe culvert; 1800 lin. ft. 30-in pipe; 8-in. gravel road, with asphaltic binder, 160,000 sq. yd., 40 ft. wide. Address Clerk Administrative Board.

Belington, W. Va.—Citizens of Parker District, Barbour County, Belington, voted $130,000 bonds for constructing 18 miles of permanent roadway. Address Clerk, Parker District, Belington.

Clarksburg, W. Va.—Citizens of Ten-Mile district plan constructing 25 miles of permanent roads in district. Address Clerk, Ten-Mile District, Clarksville.

Grafton, W. Va.—Citizens of Barker District voted $130,000 bonds for road improvements. Address Clerk of Barker District, Grafton.

Louisburg, N. C.—Citizens of Cedar Rock Township voted $30,000 road bonds. Address Township Clerk.

Tifton, Ga.—See "Public Buildings."

Bushnell, Fla.—Road and bridge bonds for $60,000 will be sold May 8, by Board County Commissioners. (W. N. Potter, Clerk).

Jacksonville, Fla.—County Commissioners sold $208,000 Road District No. 2 bonds. Address County Clerk.

Birmingham, Ala.—City Commission directed Julian Kendrick, City Engineer, to draw up an ordinance for paving Seventh Avenue, Ninth Avenue, and portions of other streets, at an estimated cost of $50,000.

Brookhaven, Miss.—County Board of Supervisors authorized issue of $200,000 bonds for good roads. George C. Hoskins, Engineer in Charge, care of Board.

Caledonia, Miss.—Citizens voted $40,000 bonds for roads. Address City Clerk.

Columbus, Miss.—County voted $40,000 bonds for constructing Jackson Military Highway. J. A. Watson, Road Supervisor, Columbus.

Greenwood, Miss.—County Board of Supervisors intends issuing $600,000 bonds for good road purposes.

Grenada, Miss.—Reported paving of the streets with wood block is under consideration. B. F. Thomas, Mayor.

Cleveland, Tenn.—County Court authorized selling of $25,000 pike road bonds. Address County Clerk.

Madisonville, Tenn.—Road bonds for $190,000 will be sold May 10. Address A. M. Swanay, Chairman County Court.

Covington, Ky.—County Commissioners reported planning improving about 487 miles county roads. Address County Clerk.

Morganfield, Ky.—Citizens voted $450,000 road bonds. Address County Clerk.

Owensboro, Ky.—Road and bridge bonds for $600,000 will be sold April 21 by Daviess County Fiscal Court (R. L. Lancaster, County Judge).

Powell, Ky.—Citizens voted $40,000 bonds for constructing roads and bridges. Address County Clerk.

Canton, Ohio.—County Commissioners plan paving with macadam Justus-Beach City Road. Address County Clerk.

Cincinnati, Ohio. — County Surveyor Wm. Boeh submitted to County Board of Commissioners an estimate of $71,971 as cost of improving Reading Road through the village of Reading with bitulithic, and $101,029 with brick.
City Council approved approximate estimates submitted by City Engineer Frank S. Krug for improvement of Jones Street from Armory Avenue to Liberty Street; with asphalt, $12,792; bitulithic, $13,647.

Cleveland, Ohio.—County Commissioners voted to extend Cedar Road from Green Road to Chagrin River; distance of 6 miles.
Bonds for $98,343 will be sold April 22, by E. G. Krause, County Clerk, for improving Euclid Avenue.

Dayton, Ohio.—County Commissioners sold $200,000 road improvement bonds. Address County Clerk.

Jefferson, Ohio.—Road bonds for $96,500 will be sold May 22 by Board County Commissioners (B. E. Brainerd, Clerk.)

Lisbon, Ohio.—County Commissioners approve plans prepared by H. Armstrong, County Engineer, for improving about 34 miles county roads, including part Lincoln Highway and inter-county roads. Address County Clerk.

Randolph, Ohio.—Paving bonds for $13,000 will be sold May 15, by Trustees of Randolph Township. J. A. Hartman, Township Clk.

Warren, Ohio.—County Commissioners plan constructing brick highway from Niles to Mineral Ridge. Address County Clerk.

Bluffton, Ind.—County Treasurer has sold $108,000 road bonds.

Elkhart, Ind.—County Commissioners sold $68,500 bonds for constructing West Lincoln Avenue brick road in Elkhart Township. Address County Clerk.

Indianapolis, Ind.—Board Public Works adopted resolutions to pave portions of Forty-first Street, Holmes Avenue and Walnut Street.

Seymour, Ind.—City intends improving with gravel portions of Ninth, Bruce, Tipton and Jackson Streets. Address City Engineer.

Highland Park (P. O. Detroit), Mich.—Village Council considering widening Woodward Avenue and authorized Elmer C. Foster, Superintendent of Public Works, to prepare plans and specifications for same. Address Village Clerk.

Pontiac, Mich.—Citizens voted $1,000,000 good road bonds. Nothing further will be done about construction until 1917. Floyd B. Babcock, County Clk.

St. Ignace, Mich.—Citizens voted $75,000 road bonds. Address County Clerk.

Albion, Ill.—Citizens voted $16,000 bonds for road improvements. C. C. Rice, Engineer, Albion; Arch. C. Smith, City Clerk.

Ellendale, Minn.—Paving of Main Street is contemplated by city.

Minneapolis, Minn.—Park Board adopted plans and estimates submitted by Theodore Wirtn, Superintendent of Parks, for constructing a hard paved roadway encircling Lake Calhoun; estimated to cost about $197,780.

Minnesota.—State Highway Department, St. Paul (George W. Cooley, State Highway Engineer), intends grading about 1945 miles, graveling 705 miles and constructing 1823 concrete culverts, at a total cost of $2,228,500. About $600,000 will be spent in addition for maintenance of about 12,000 miles.

St. Paul, Minn.—City Council considering paving about 8 miles of streets in Merriam Park.

Elkton, Kan.—No bids opened April 15 for constructing 8 miles of macadam road. Plans not yet completed. Contract will be let about June. A. B. Wilkins, County Judge.

Grand Forks, N. D.—Contract soon to be let for 13,000 yd. of pavement. J. J. Smith, City Engineer.

Mena, Ark.—Polk County Commissioners are to issue bonds for constructing 58 miles of rock roads north and south. Hugh R. Carter, State Highway Engineer at Little Rock, is completing plans; estimated cost $180,000.

Beaumont, Tex.—Plans submitted for road work under recent $190,000 bond issue. Address County Clerk.

Gainesville, Tex.—City authorities considering paving with rock asphaltum on Commerce, Dixon and West California Streets. Address Mayor.

Paris, Tex.—Election to be held in August to vote $250,000 bonds for constructing good roads. J. J. Cendenning, County Judge, Paris.

Rio Grande, Tex.—County will construct road improvements costing $40,000. F. Osterveen, County Commissioner, Rio Grande City, Tex.

Poteau, Okla.—Election to be held May 6 to vote bonds for road improvements. A. B. Green, County Commissioner, Poteau.

Bellingham, Wash.—County Commissioners plan paving 4½ miles Marietta Road. Cost, $60,000.

Centralia, Wash.—City Council will construct 20 blocks of concrete walks by day labor. L. M. Lee, City Clerk.

Seattle, Wash.—It is proposed to pave with asphalt and brick block on West McGraw Street at a cost of $103,202. A. H. Dimock, City Engineer.

Waterville, Wash.—Robert F. Foster, County Engineer, preparing plans for Permanent Highway No. 4 to be constructed from Mansfield east; cost, $20,000. D. F. Kinder, County Auditor.

Portland, Ore.—Plans and specifications prepared for lowering grade and paving Broadway and portions of Williams and Vancouver Avenue, Ross and Wheeler Streets. Philip Dater, Engineer, 397 E. Forty-sixth Street N., estimates cost of paving with asphaltic concrete $43,003; sheet asphalt, $44,211; bitulithic, $42,060.

San Diego, Cal.—Fairchild Gilmore Wilton Company, 392 Pacific Electric Building, Los Angeles, will erect a $15,000 asphalt paving plant on tidelands if granted lease by Council.

Santa Ana, Cal.—Election to be held to vote $9,000 bonds for purchase of combination auto truck and street roller. Address City Clerk.

Ventura, Cal.—Reported State Highway Commission, Sacramento, contemplates constructing a concrete highway between Springville and Montaloo bridge, about 7 miles, at a cost of $60,000.

Manti, Utah.—County Commissioners plan spending $10,000 for the Sanpete County side of new state road from Ephraim to Orangeville in Emery County. Address County Clerk.

Salt Lake City, Utah.—About $212,405 has been authorized spent by City Commission for city paving and other public improvements during 1916.

Boise, Idaho.—Election soon to be held to vote on issuing $200,000 bonds for constructing roads in Ada County. Address County Clerk.

Stratford, Ont.—Perth County Council voted $20,000 for county roads. Address County Clerk.

Toronto, Ont.—City Council plans spending $31,000 for improving Humber Boulevard. Address City Clerk.

BIDS DESIRED.

Massachusetts.—Until April 25, by State Highway Commission, Boston, for 8500 lin. ft. in town of Barr and 3900 lin. ft. in town of Philipston.

Brooklyn, N. Y.—Until April 26, by L. H. Pounds, Pres. Brooklyn Borough, for improving on portions of Albermarle Road, Ralph, Sutter and Twenty-fifth Avenue and other streets, in all about 7755 sq. yd. asphalt, together with curbing, etc. Security $8,700. Also for furnishing and delivering one steam asphalt roller.

Freehold, N. J.—Until May 3, by Board Chosen Freeholders, for constructing new road from Keysport to South Amboy with amesite. Also separate bids for reconstructing Keysport-Amboy Road with amlesite.

Keyport, N. J.—Until May 8, by Borough Council, for reinforced concrete pavement, approximately 12,000 sq. yd. advertised in Engineering Record. R. O. Walling, Mayor.

Paterson, N. J.—Until April 26, by Board Chosen Freeholders (Geo. W. Botbyl, Clerk), for improving Paterson and Hamburg Turnpike, Section IV., in Borough of Pompton Lakes, with bituminous concrete on stone foundation, in all about 17,119 sq. yd. Also separate bids for improving Paterson-Hamburg Turnpike, Sect. III, in Township of Wayne, with a bituminous concrete and granite block and macadam surface, in all 48,058 sq. yd., on a stone and concrete foundation.

Ambler, Pa.—Until May 1, by Wm. M. Johnson, Boro. Clk., for stone, slag and oils to be used in construction of streets for Borough.

Harrisburg, Pa.—Reported desired until April 24, by W. H. Lynch, Supt. Streets and Pub. Improv., for paving six streets in Bellevue Park. M. B. Cowden, City Engr.

Lebanon, Pa.—Until May 12, by City Clerk, for paving, advertised in Engineering Record. Paul A. Volcker, City Engr.

Lebanon, Pa.—Reported desired until May 15, by D. M. Sharp, City Clerk, for paving. Estimated cost $90,000.

Philadelphia, Pa.—Until April 25, by William H. Connell, Chief Bureau Highways, Department of Public Works, for following work: Schedule "A" grading, cost $83,165; Schedule "B" asphalt paving, cost $54,175; Schedule "C" vitr. block paving, $12,500; Schedule "D" asphalt repaving, $38,050; Schedule "E" granite block repaving, $9,300; Schedule "F" surfacing water-bound macadam, $26,850; Schedule "G" resurfacing with water-bound macadam, $2,600; Schedule "H" improving Oxford Avenue, $36,000; Schedule "I" repaving bituminous pavement; Schedule "J" furnishing and applying bituminous materials; Schedule "K" curbing and footway work, city to pay cost, $11,700; Schedule "L" painting and repairing bridges, $5,000.

Until April 28, by William H. Connell, Chief Bureau of Highways, Department of Public Works, for following improvements: Schedule "A," vitr. block repaving, cost $16,000; Schedule "B," water-bound macadam surfacing, cost $42,670; Schedule "C," sprinkling waterbound macadam and dirt roads.

Pittsburgh, Pa.—Until April 25, by Department Public Works, for grading, paving and curbing Ward, Chauncey Torrens and numerous other streets.

Wilkes-Barre, Pa.—Until May 2, by City Clerk, for paving 17 streets, advertised in Engineering Record. M. C. Murray, Supt. Department Streets and Public Impovements.

Atlanta, Ga.—See "Miscellaneous."

Miami, Fla.—Reported desired until May 6, by Board County Commissioners, for constructing Tamiami Trail road from Miami to Lee County Line. Hobart Crabtree, Co. Engr.

Bay Minette, Ala.—Reported desired until May 15 (not April 15, as previously stated), by County Commissioners, for improving Trunk Line Road from Little River to Gulf of Mexico, about 90 miles, and Forrest Highway from Bay Minette to Perdido, 13 miles, and seven sections of the road, 9 to 20 miles each; also a number of smaller roads.

Lafayette, Ala.—Until April 24, by County Commissioners, for constructing Lafayette-Waverly Road and Cuseta Lanett Road, 28 miles, including bridges, etc. S. E. Fitch, Co. Engr.

Shreveport, La.—Until April 24, by J. F. Bullen, Parish Engineer, Shreveport, for 5.2 miles of the Arkansas Line Road gravel. W. E. Atkinson, State Highway Engineer, New Orleans.

Grenada, Miss.—Until May 1, by L. B. James, City Recorder for constructing approximately 11,000 sq. yd. creosoted wood block pavement, together with curbing, sewering, etc.

Gulfport, Miss.—Until May 1, by County Commissioners, Gulfport, for about 60 miles of highway in Harrison County, advertised in Engineering Record. Said road to be graded and surfaced with wood block, vitr. brick, concrete, Warrenite or Rocmac. J. F. Galloway, County Engineer.

Laurel, Miss.—Until May 4, by Highway Commission, District No. 2, addressed to S. W. Lindsey, Chmn., for constructing highways, including grading, draining and furnishing materials, as follows: From Laurel North to Jones County line at Mossville, 9.16 miles; south to District line, 4.67 miles; Mile 10 on Hebron Road to County line, 7.67 miles; north on Saundersville Road to north line of Beat No. 2 2.12 miles, to cover a distance of approximately 23.62 miles.

Amsterdam, Ohio.—Until April 24, by Village Council, for furnishing material and improving Liberty Street. O. D. Hersh, Village Clerk.

Cincinnati, Ohio. — Until May 5 by County Commissioners (Albert Reinhardt, Clk.) for repairing Camargo Pike Road in Symmes Township, known as Road No. 292.

Norwood, Ohio.—Reported deisred until May 1 for improving streets. Probable cost $100,000. J. G. Schmidt, City Engr.

Ohio.—Until April 28, by Clinton Cowen, State Highway Commissioner, Columbus, for constructing following roads, including bridges, culverts, grading and paving:

Champaign County, Sect. O, Urbana West Jefferson Road, Goshen Township, with water-bound macadam. Length 1.56 miles. Cost $13,059.

Clark County, Sect. 1, Springfield-Urbana Road, Moorefield Township, with surface-treated macadam. Length 4.35 miles. Cost $48,620. Alternate bids for water-bound macadam, same length. Cost $43,718.

Columbiana County, on Sect. R, Cleveland East Liverpool Road, Elk Run and Center Townships, with bituminous macadam. Length 3.01 miles. Cost $33,968.

Crawford County, Sect. K, Bucyrus-Gallon Road, Whetstone Township, paving with brick (Monolithic type). Length 1.69 miles. Cost $33,491. Sect. L, Bucyrus-Marion Road, Bucyrus Township, with brick (Monolithic type). Length 1.03 miles. Cost $20,729. Alternate bids, with brick (semi-Monolithic type). Cost $21,143. Sect. I-2 Columbus Sandusky Road, Holmes Township, constructing bridge and culverts, grading roadway and paving with brick. Length .5 miles. Cost $10,563.

Delaware County, Sect. F, Columbus-Sandusky Road, Delaware and Troy Township, with bituminous macadam. Length 0.97 miles. Cost $12,117. Alternate bids, with concrete. Estimated cost $14,931. Sect. J, Delaware-Mt. Gilead Road, Oxford Township, with bituminous macadam and reinforced concrete. Length 3.72 miles. Cost $38,362. Alternate bids for reinforced concrete and plain concrete. Cost $37,360. Sect. I, Columbus-Sandusky Road, Delaware Township, bituminous macadam. Length 1.9 miles. Cost $22,555. Alternate bids, with reinforced concrete. Cost $31,379.

Franklin County, Sect. O, Columbus-Sandusky Road, Clinton Township, with brick (semi-Monolithic). Length 0.76 miles. Cost $50,455.

Geauga County, Section H, Burton-Bloomfield Road, Burton and Middlefield Townships, with concrete 2.97 miles. Cost $35,911. Sect. J, Chagrin Falls-Greenville Road, Russell and Bainbridge Township, with concrete and brick. Length 2.5 miles. Cost $29,056. Alternate, with brick Length 2.18 miles. Estimated cost $29,339.

Green County, Sect. S, Dayton-Chillicothe Road, in Exenia, Cedarville and New Jasper Townships, water-bound macadam. Length 5.67 miles. Cost $34,236.

Jefferson County, Sect. A, Skelly-Empire Road, Wayne Township, water-bound macadam. Length 0.91 miles. Cost $14,556. Sect. J, Ohio River Road, with brick. Length 0.72 miles. Cost of construction $22,868.

Knox County, Sect. J, Mt. Vernon-Coshocton Road, Howard Township, with water-bound macadam, 2.06 miles. Cost $22,979. Alternate bids, with bituminous macadam. Cost $26,709. Sect. 1, Columbus-Millersburg Road, Clay and Morgan Townships, with water-bound macadam. Length 4.18 miles. Cost $49,011. Alternate bids, with bituminous macadam. Estimated cost $57,254.

Logan County, Sect. D, Urbana-Bellefontaine Road, Liberty Township, with water-bound macadam. Length 4.15 miles. Cost $28,350.

Mahoning County, Sect. W, Youngstown-New Bedford Road, Coitsville Township, with water-bound macadam. Length 1.31 miles. Cost $12,235.

Mercer County, Sect. E, Celina-Greenville Road, Marion and Granville Townships, with reinforced concrete. Length 3.08 miles. Cost $45,423.

Miami County, Section E, Dayton-Troy Road, Monroe Township, with bituminous macadam. Length 5.03 miles. Cost $52,576. Alternate bids, paving with reinforced concrete. Cost $70,780.

Monroe County, Sect. J, Woodsfield-Marietta Road, in Center and Wayne Township, with bituminous macadam. Length 1.92 miles. Cost $34,334.

Muskingum County, Sect. L, Zanesville-Caldwell Road, Wayne Township, with brick. Length 1.35 miles. Cost $27,480.

Portage County, Section U, Cleveland-East Liverpool Road, Ravenna Township, with brick. Length 2.40 miles. Estimated cost $40,539. Alternate bids, with concrete. Cost $32,236.

Ross County, Sect. M, Chillicothe-Lancaster Road, Green Township, brick. Length 1.02 miles. Cost $14,499.

Starke County, Sect. I, Akron-Canton Road, Plain and Lake Townships, with brick. Length 5.78 miles. Cost $135,662.

Tuscarawa County, Section O, New Philadelphia-Urichsville Road, with brick. Length 2.37 miles. Cost $49,168.

Union County, Section F, Urbana-Marysville Road, in village of Marysville, with reinforced concrete. Length 0.21 miles. Estimated cost $3,353.

Washington County, Section K, Marietta-McConnellsville Road, Waterford Township, paving with either tarbound or asphalt-bound macadam. Length 1.80 miles. Estimated cost tar, $13,261.25; asphalt, $13,635. Sect. L, Athens-Marietta Road, Wesley Township, either tar-bound macadam, or asphalt-bound macadam. Length 1.23 miles. Estimated cost, tar, $18,250; asphalt, $18,830.

Wood County, Sect. E, Bowling Green-Perrysburg Road, Plain, Center, Middleton Township. Length 4.77 miles, bituminous macadam, or bituminous concrete. Cost bituminous macadam, $44,497; bituminous concrete asphalt, $49,133; tar, $48,125. Sect. F, Bowling Green-Perrysburg Road, Middleton and Perrysburg Townships. Length 5.98 miles. With either bituminous macadam, or bituminous concrete. Cost bituminous macadam, $52,105; bituminous concrete asphalt, $57,795; tar, $56,530.

Ashland County, Sect. A, Ashland-Loudenville Road, Montgomery Township, constructing, repairing bridges, culverts, removing old structures, widening roadway and resurfacing with water-bound macadam. Length 1.55 miles. Cost $18,786.

Struthers, Ohio.—Until April 26, by Johan Richards, Village Clk., for paving portions of Short, Terrace and Elm Streets, together with sewers, etc.

Steubenville, Ohio.—Until April 25, by County Commissioners, for constructing brick road, beginning at terminus of West Market Street at corporation line and running westward along Steubenville and Cambridge Roads a distance of about 7600 ft. Cost $41,600. John S. Means, Co. Aud.

Urbana, Ohio.—Reported desired until May 2, by H. E. Rock, Dir. Pub. Service, at office of City Auditor, for paving Miami Street with brick. Estimated cost $40,000; E. F. Sweetman, City Engr.

Angola, Ind.—Until May 9, by Roy Hirst, City Clerk, for about 20,000 sq. yds. paving on North Wayne Street, advertised in Engineering Record. C. P. Powers, City Engineer.

Brownstown, Ind.—Until May 1, by Albert Luedtke, County Auditor, for ½ mile of brick and 1½ miles of bituminous macadam pavement, to cost $25,000, also for 22 bridges, mostly steel, from 12 to 90 ft. spans, and for a pile timber dike, 36 piles. Ross O. Baldwin, Engineer, Seymour.

Goshen, Ind.—Until May 2, by W. M. Gilletts, County Surveyor, for paving on portions of Elkhart-Jackson Township Line Road, about 3400 sq. yds., and on Clinton-Benton Township Line Road, 42,980 sq. yds. brick pavement.

Indiana.—By County Commissioners for constructing roads as follows:

May 1:

Rushville.—15,320 ft. gravel road in Posey Township. Allen R. Holden, Co. Aud.

Brookville.—2¾ miles road. Chas. G. Reifel, Co. Aud.

Brownstown.—Constructing brick and bituminous-filled macadam road in Carr Township. Albert Laedtke, Co. Aud.

May 2:

Delphi.—Constructing two roads in Democrat Township, and one in Jackson Township. H. D. Good, Co. Aud.

Crawfordsville. — Constructing gravel roads in Clark and Coal Creek Townships. W. F. Batman, Co. Aud.

Goshen.—Constructing brick road on line between Clinton, Benton, Elkhart and Jackson Townships. A. R. Bemendeffer, Co. Aud.

Bedford.—Constructing gravel or macadam road in Pleasant Run Township. Ezra W. Edwards, Co. Aud.

May 3:

Muncie.—Constructing brick roads in Center and Munroe Townships. Francis M. Williams, Co. Aud.

Indianapolis, Ind.—Until April 26, by Board Public Works (Jos. D. Turk, Secy.), for paving Warman Avenue, Michigan and Ohio and other streets. Separate bids, until April 28, same place for paving portions of Winthrop Avenue, Fairfield and Euclid Avenues and other streets. Also separate bids until May 1, for paving portions of Arlington, Miley, Spann Avenues, State and other streets.

Ligonier, Ind.—Until May 3, by R. E. Jeanneret, City Clerk, for about 40,000 sq. yd. of brick pavement on natural foundation on portions of several streets including 30,000 lin. ft. curb. Rosebeck & McKee, Engrs., Mansfield.

South, Bend, Ind.—Until May 16, by Board Public Works (E. M. Morris, Chairman), for 71,500 sq. yd. pavement on Eddy Street and Mishawaka Avenue, advertised in Engineering Record. Asphalt, asphaltic concrete, bitulithic and brick.

South Bend, Ind. — Until May 16, by Board of Public Works, for paving 2½ miles of Mishhawaka Avenue, at a cost of $154,000.

Saginaw, Mich.—Until May 2, by City Clerk, for approximately 30,000 sq. yd. sheet asphalt paving, advertised in Engineering Record. George Holcomb, Commissioner Public Works.

Alton, Ill.—Until May 2, by Board of Local Improvement, for improving 9 streets with vitr. brick, on 4-in. concrete base, and lined with concrete curb, advertised in Engineering Record. In all, about 48,500 sq. yds. paving and 29,140 lin. ft. curbing. T. H. Landon, City Engineer.

Chicago, Ill.—Until April 24 by Department Public Works (W. R. Moorhouse, Comr.) for furnishing f.o.b. cars at team tracks approximately 12,000 sq. yd. creosoted wood blocks.

Until April 27, by Board Local Improvements (Edw. Glackin, Secy.), for paving on numerous alleys.

Marshalltown, Iowa.—Until about May 8, by W. H. Steiner, City Engineer, for 63,000 sq. yds. of concrete pavement on West, State and Doty Streets and Twelfth Avenue, including 2500 lin. ft. curb.

Hallock, Minn.—Reported desired until April 25, by James Davnie, Co. Aud., for four jobs of state road work.

Salina, Kan.—Reported desired until May 1, by Charles E. Banker, City Clk., for approximately 15,492 sq. yd. paving, 17,289 lin. ft. curb and gutter, etc.

Wichita, Kan.—Reported desired until May 1, by H. D. Lester, City Clerk, for paving Main and Market Streets, Nims Avenue and Merriam Park with brick. B. Wells, City Engr.

North Platte, Neb.—Until May 12 (re-advertisement), by C. J. McNamara, City Engineer, for 45,000 sq. yd. brick, concrete and sheet asphalt pavement on Dewey, Locust and other streets. All bids opened April 14 rejected.

Yankton, S. D.—Until April 24, by John W. Summers, City Aud., for 78,000 sq. yd. concrete asphalt, concrete and bitulithic pavement, 121,000 lin. ft. curb, 23,000 cu. yd. grading and 14,200 lin. ft. 10 to 30 in. storm sewers.

Great Falls, Mont.—Until June 2, by W. H. Harrison, City Clerk, for paving with gravel bitulithic on portions of Fifth Avenue North, Fourth, Fifth and Ninth Streets, at a cost of $45,000.

Kansas City, Mo.—Until April 25, by Board Public Works (Edw. F. Webster, Act. Secy.), for constructing vertical fiber vitrified brick block pavement on a number of alleys and paving with concrete on Fiftieth Street, Highland and Kansas Avenues.

Marysville, Mo.—Until April 24, by A. D. Hewitt, City Clk., for constructing approximately 13,000 sq. yd. vertical fiber brick pavement, 6000 ft. curb, etc. Chas. E. McCree, Engr., 217 Glendale Bldg., Kansas City, Mo.

St. Louis, Mo.—Until May 2, by Board Public Service (William T. Findly, Secretary), for paving with vitrified brick on portions several alleys, including Lettings 304 to 327 inclusive; also for paving with refined asphalt and curbing with granite on Thekla Avenue, Letting 328.

Caldwell, Tex.—Reported desired until July 10, by County Commissioners (W. M. Hillard, Co. Judge), for constructing clay sand road. Probable cost $20,000.

Chehalis, Wash.—Reported desired until May 3 by D. W. Monfort, Co. Aud., for constructing one mile of grading, and surfacing and constructing a 705-ft. pile trestle approach to Riverside bridge. J. D. Nevill, Co. Engr.

Mount Vernon, Wash.—Until April 26, by E. Crookston, City Clerk, for paving Second, Broadway, Cleveland and other streets, with concrete pavement in all about one mile. John Meehan, City Engr.

Seattle, Wash.—Until April 24, by Clerk Board County Commissioners for paving as follows: Bothwell Snohomish Road 49,910 sq. yd. monolithic, brick or concrete; Enumelaw Auburn Road 30,399 sq. yd. concrete 20 ft. wide. A. P. Denton, County Engineer.

Salt Lake City, Utah.—Reported desired until May 2, by Gordon Snow, City Recorder, for paving with sheet asphalt portions of Eleventh Street, with bitulithic, Sixth Avenue. Probable cost $75,768. S. Q. Cannon, City Engr.

Moscow, Idaho.—Until April 26, by R. J. Strong, City Clerk, for paving, curbing, etc., on city streets, in all about 7000 sq. yd. of paving and 5200 cu. yd. excav.

Orofino, Idaho.—Until April 28, by Board Village Trustees, for following: 6547 sq. yd. 5-in. concrete paving, 19,577 sq. ft. concrete sidewalks, 2340 lin. ft. concrete curb, etc., for paving Johnson Avenue. W. B. Kinne, Village Clerk.

Ottawa, Ont.—Until April 25, by Secretary Board of Control, for Rideau Street and Dalhousie Street paving, 8000 sq. yd. asphalt and 4000 yd. wood block. F. C. Askwith, Acting City Engineer.

PRICES AND LETTINGS.

★Indicates award of contract.

Boston, Mass.—Following are three lowest bids opened April 14 by Park Department for building brick and concrete walks at Columbia Road Boulevard: James Doherty, 33 Calumet Street, Roxbury, $9,688; D. M. Biggs & Co., 60 March Street, Dorchester, $11,105, and John McCourt Co., 36 Waite Street, Roxbury, $11,380.

Three lowest bids opened same time and place as above for resurfacing Commonwealth Avenue from Arlington Street to Massachusetts Avenue: Bituminous macadam basis, J. C. Coleman & Sons Co., Roxbury, $27,125; concrete basis, Michael Meehan, Jamaica Plain, $28,320; bitulithic basis, James Doherty, 33 Calumet Street, Roxbury, $31,572. Resurfacing Commonwealth Avenue from Massachusetts Avenue to Brookline Avenue: Bituminous macadam basis, Rowe Construction Co., Brighton, $14,652; concrete basis, Michael Meehan, Jamaica Plains, $16,807; bitulithic, Warren Bros., Boston, $14,486.

★Massachusetts.—Following are three lowest bids opened April 11 by Massachusetts Highway Commission for highway improvements:

★Town of Northfield, Lane Construction Corporation, Meriden, Conn., $10,078 (awarded contract); D. O'Connell Sons, Holyoke, $11,353; R. H. Newell Company, Uxbridge, $114,444.

★Montague.—R. F. Hudson, Melrose, $16,735 (awarded contract); D. O'Connell Sons, Holyoke, $16,441, and B. E. Savage, Worcester, $16,924.

★Dighton.—Hamilton Flood, Wollaston, $8,861 (awarded contract); Charles R. Alger, Taunton, $19,809; H. E. Cushing, Seekonk, Mass., $10,828.

★Gloucester.—Andrew M. Cushack, 319 Washington Street, Boston, $28,822 (awarded contract); R. F. Hudson, Melrose, $28,857, and Middlesex Contracting Company, 7 Water Street, Boston, $33,467.

★Ashby.—David H. Damon, Ashby, $16,609 (awarded contract); Lane Construction Corporation, Meridian, $16,082; Alco Contracting Company, Boston, $16,620.

★Abington.—E. J. Rourke, Abington, $6,961 (awarded contract); only bidder.

★Connecticut.—Contracts awarded by Charles J. Bennett, State Highway Commissioner, Hartford, for paving in town of Groton: (a), 3670 lin. ft. and (b), 11,250 lin. ft. plain concrete on Thames Street (bids opened April 12): Leonardo Suzio, Meriden, (a), $12,646; (b), $33,205 (awarded contract on both (a) and (b). Other bidders: Connecticut Hassam Paving Company, New Haven, (a), $12,596; (b), $33,275; A. Vito Construction Corporation, Thompson, (a), $14,016; (b), $36,638; Frank Arrigoni & Bro., Middletown. (a), $14,386; (b), $37,827.

★Town of Southbury, 10,035 lin. ft. 5-in. native stone: Ahern Brothers Contracting Co., Willimantic, $13,982 (awarded contract); Mascetti & Holley, Torrington, $14,022; John DeMichael & Bro., Torrington, $20,534.

Town of New Milford. 5-in. native stone macadam on Chicken Hill Road: H. Sanford Osborn, Redding Ridge, $15,556; Mascetti & Holley, Torrington, $16,406; Ahern Brothers Contracting Co., Willimantic, $14,636 (low); John DeMichael & Bro., Torrington. $21,869.

★Town of Berlin, 3155 lin. ft. concrete on Main Street: Leonardo-Suzio Construction Co., Meriden, $14,043 (awarded contract); Thomas Kearney, Meriden, $15,967; Pierson Engineering Contracting Co., Hartford, $18,988; Connecticut Hassam Paving Co., New Haven, $17,144.

★Town of Manchester, 2360 lin. ft. concrete on North Main Street: Thomas Kearney, Meriden, $7,308 (awarded contract).

Town of Stratford, 3828 lin. ft. concrete: Richard Lamb, 136 Liberty Street, New York, $9,676 for State, $2,184 for town and $11,225 for Connecticut Co. section (low); Leonardo-Suzio Construction Co., Meriden, $9,710, $2,206 and $11,267 respectively.

Hartford, Conn.—Following are bids opened April 11 by Board of Contract & Supply, for approximately $75,000 worth of paving on Church, Main and Park Streets, Connecticut Boulevard, Albany, Maple and Capital Avenues, about 32,200 sq. yds. sheet asphalt wearing surface and 5,300 sq. yds. resurfacing and repairing: (a), Sewage Disposal & Water Plant Co., Schenectady, N. Y.; (b), Union Paving Co., Schenectady, N. Y.; (c), Edward Balf Co., Hartford. Asphalt, per sq. yd.: (a), 90 cts.; (b), 89 cts.; (c), 91 cts. Asphalt concrete per cu. yd.: (a), $9.50; (b), $10.50; (c), $7. Cement concrete per cu. yd.: (a), $5.32; (b), $4.14; (c), $4.83. Resurfacing per sq. yd.: (a), $1.05; (b), 89 cts.; (c), $1.07. Excavation per cu. yd.: (a), 88 cts.; (b), 60 cts.; (c), 73 cts. Repairs and patching per sq. yd.: (a), $1.40; (b), $1.17; (c), $1.57.

★Buffalo, N. Y.—Contract awarded by Superintendent Public Works to German Rock Asphalt Company, Inc., Morgan Building, for repair of all asphalt pavements for year 1916, at $34,494.

★Contracts awarded by Superintendent of Public Works as follows, for paving: Henry P. Burgard Company, 1968 Fillmore Avenue, asphalt Jefferson Street, $75,450; Sterling Avenue, $11,740. Erie Contracting Company, D. S. Morgan Building, stone on Scott Street, $5,360.

★Herkimer, N. Y.—Contract awarded by County Commissioners for constructing roads as follows: No. 15, Ilion-Spinnerville Road, 2.53 miles, German Flatts to John Jova, Newburg, at $16,880; No. 27, Joslyn Hill Road, 2.29 miles, Frankfort, to Ft. Schuyler Construction Co., Utica, at $16,180; No. 13, Welsh Bush to Meyer Gulf Road, 6.42 miles, Frankfort, to Edward J. Cunningham, Utica, at $36,088; No. 23, 8.52 miles, in Manheim East Creek toward Dolgeville, to S. A. Seymour, Little Falls, at $39,609; No. 14, Barringer Road, 3.79 miles in German Flatts and Frankfort, to Newport Construction Co., $26,662.

Long Island City, L. I., N. Y.—Following are two bids opened April 13 by Maurice E. Connolly, Pres. Queens Boro., for paving with sheet asphalt on concrete foundation on Rockaway Beach Boule. (a) 1650 cu. yd. concrete, (b) 9950 sq. yd. sheet asphalt, 5 years maintenance, (c) total: Borough Asphalt Co., 1301 Metropolitan Avenue, (a) $6, (b) $1.25, (c) $21,212; Barber Asphalt Paving Co., 29 Sixth Street, (a) $[illegible].60, (b) $1.73½, (c) $24,776.

★Oswego, N. Y.—Contracts for about 14,275 sq. yds. vitr. brick pavement (bids opened April 10), awarded by Commissioner of Public Works as follows: West Sixth Street, to Tyne-Willey Company, Binghamton, at $13,226, and West Eighth Street to Barber Serpain, Binghamton, at $13,384.

★Belvidere, N. J.—Contracts for constructing roads awarded as follows: Washington-Buttzville Road to R. A. Copen, Hoboken, and Hope-Bridgeville Road to Edward P. Arbogast, Stroudsburg, Pa.; total cost of both roads, $112,200. (Bids opened April 11.)

★Elgin, Ill.—Following are unit figures of the four bids opened April 6 by city for paving Villa Street: (a) Engineer's estimate, $67,600; (b) Logan & Goertz Construction Co., Elgin, $56,491 (awarded contract), Purington brick; (c) Illinois Hyd.-Stone & Construction Co., Elgin, $57,060; H. G. Goelite, Oak Park, Ill., $57,600, Purington.

	(a)	*(b)	(c)	(d)
27,050 sq. yd. brick pavement	$1.90	$1.87	$1.88	$1.90
9,700 lin. ft. curb and gutter	0.55	0.52	0.55	0.55
516 lin. ft. concrete gutter	0.30	0.30	0.30	0.30
760 lin. ft. concrete headers	0.35	0.35	0.35	0.35
80 sidewalk headers	2.00	2.00	2.00	2.00
80 gutter plates	3.00	3.00	3.00	3.00
Adjusting manholes and catchbasins	50.00	43.20	50.00	50.00

★McPherson, Kan.—Following are unit figures of the four lowest bids opened April 16 by H. A. Rowland, City Engineer, for 40,679 sq. yd. asphaltic concrete pavement and 29,348 ft. concrete combined curb and gutter: (a) Engineer's estimate, $76,015; (b) Watts & Amernan, Salina, Kan., $68,971 (awarded contract); (c) Security Paving Co., Kansas City, Mo., $70,944; (d) Kaw Paving Co., Topeka, Kan., $71,127; (e) Johnson Construction Co., Chicago, Ill., $73,307.

	(a)	*(b)	(c)	(d)	(e)
40,895 sq. yd. asphaltic concrete	$1.30	$1.22	$1.22	$1.23	$1.25
29,518 lin. ft. curb and gutter	0.50	0.40	0.43	0.46	0.50
302 lin. ft. curb	0.30	0.25	0.30	0.28	0.30
20 catchbasins	10.00	10.00	10.00	10.00	10.00
7,610 cu. yd. excavation	0.40	0.28	0.30	0.32	0.35
1,000 lin. ft. 24-in. vitrified pipe	1.40	1.40	1.42	1.20	1.15
380 lin. ft. 21-in. vitrified pipe	1.00	1.20	1.26	1.00	0.90
680 lin. ft. 18-in. vitrified pipe	0.80	1.00	1.00	0.70	0.70
2,120 lin. ft. 15-in. vitrified pipe	0.60	0.50	0.75	0.52	0.50
1,180 lin. ft. 12-in. vitrified pipe	0.40	0.35	0.55	0.40	0.40
1,000 lin. ft. 8-in. vitrified pipe	0.25	0.30	0.40	0.33	0.30
568 sq. yd. concrete pavement	1.00	1.00	1.00	1.00	1.25

★Pueblo, Col.—Following are unit figures of four lowest bids opened April 10 by D. P. Gaymon, City Engineer, for Court Street and Grand Avenue Paving District: (a) Engineer's estimate, $128,736 with $1,287 extras; (h) Axton & Spratlem, Pueblo, $122,949 (awarded contract); (c) Strange & McGuire, Salt Lake City, Utah, $124,083; (d) P. C. Croll, Pueblo, $124,732; (e) J. C. McGuire, Butte, Mont., $126,504.

	(a)	*(b)	(c)	(d)	(e)
1,660 lin. ft. 15-in. vitrified sewer	$1.10	$1.00	$1.18	$1.50	$1.02
890 lin. ft. 12-in. vitrified sewer	0.95	0.82	1.00	1.40	0.84
780 lin. ft. 19-in. vitrified sewer	0.80	0.60	0.85	0.80	0.63
8 catchbasins	45.00	40.00	45.00	45.00	42.00
7 manholes	45.00	40.00	45.00	45.00	42.00
17 intakes	22.00	21.50	20.00	25.00	22.00
17,340 lin. ft. combined curb and gutter	0.70	0.67	0.65	0.43	0.68
13,610 cu. yd. excavation	0.45	0.35	0.42	0.40	0.38
40,525 sq. yd. bitulithic paving	2.45	2.37	2.36	2.46	2.44
840 sq. yd. stone block paving	8.20	8.00	8.30	8.00	8.05
30-in. gutter only	...	0.335	0.35	0.20	0.40

★Freehold, N. J.—Contracts awarded by Bd. Freeholders to Heferman Co., Freehold, as follows: Freehold-Adelphia Road, $19,970; Bergen Mill cut-off and Pickney Road to Red Bank, at $5,970.

★Port Elizabeth, N. J.—Cumberland County Bd. Freeholders at Bridgeton awarded contract for constructing road from Fort Elizabeth to Tuckahoe, to Craig & Mulford of Cedarville, at $14,474.

★Ellicott City, Md.—Contract awarded by County Commissioners for constructing road from Lisbon to Woodbine, to Thomas, Bennett & Hunter, Westminster, at $20,031.

Eustis, Fla.—See "Sewerage and Sewage Disposal."

★Crowley, La.—Contract awarded by City Council for paving with gravel base, tarvia binding, Parkenson Avenue to De Jersey & Naff, Opelousas, at 95c. per sq. yd. for paving and 45 cts. per lin. ft. for curbing and gutter.

★Maryville, Tenn.—Contract awarded by County Commissioners for constructing pike roads to Oliver-Hill Construction Co., at $300,000.

★Akron, Ohio.—Contracts awarded by County Commissioners (W. G. High, Clk.) as follows for road improvements (bids opened April 11 and 13), awards made April 14 (monolithic type brick):

Richfield Road, Sec. 2, to Windsor Construction Co., Akron, $63,504.

Copley Road, Sec. 2, E. McShafrey & Son, Akron, $37,434.

S. Arlington Road, Sec. 3, W. W. Hatch, Goshen, Ind., $57,598.

Mogadore Road, Sec. 1, McAlonan Bros., Akron, $31,710.

Payne Road, water bound slag, J. C. Devine Co., Alliance, $8,014.

★Cincinnati, Ohio.—City Board of Control has awarded contract for improving Sixth Street, 9800 sq. yds. wood block, to Kirchner Construction Co., Cincinnati, Ohio, at $36,789.

★Cleveland, Ohio.—Contracts for paving awarded as follows by City Board of Control East 140th Street, to Baldwin Bros. Company, 660 Rose Building, at $23,439; East Eighty-third and 122d Streets, Rieley Bros., 348 Arcade Building, $17,913; West Ninety-fifth and 105th Streets, East 116th Street, Nye and Scranton Roads and Dearborn and Grace Avenues, Cleveland Trinidad Paving Company, 420 Lakeside Avenue, $58,235.

★Contract awarded by Board of Control to R. P. Burnett, 527 Society Bldg., for paving Columbus Road, for $16,620.

★New Philadelphia, Ohio.—Contract for improving Tuscarawas New Philadelphia County Road, including constructing a trestle bridge over Ohio Canal awarded Springer & Rogers, for road grading, and Frank McClean for bridge, contractors of New Philadelphia.

Ohio.—Following are lowest bids opened on April 7 by State Highway Dept. at Columbus (Clinton Cowan, Comr.) for constructing roads:

Ashland County, Savannah-Vermilion Road, T. A. Gruber, Mansfield, $6,667.

Ashtabula County, Cleveland-Buffalo, Heystek-Baker Construction Company, Kalamazoo, Mich., $140,760; Jefferson-Andover, Glen W. Hadley, Canton, $86,490.

Belmont County Barnesville-Hendrys, A. Emery & Sons, Zanesville, $57,396.

Butler County, Hamilton-Middletownburg, Capital Construction Company, Columbus, $3,085.

Champaign County, Urban - Sidney, Brookville Bridge Co., Brookville, $1,074.

Columbiana County, Cleveland-East Liverpool, Rinehart Bros., East Liverpool, $20,020.

Darke County, Celina - Greenville, Mueller Construction Company, Columbus, $43,908.

Erie County, Sandusky-Norwalk, Earl Walters, Sandusky, $.0,474, $21,240, $28,19

Franklin County, Columbus-Sandusky, Culbertson & Culbertson, Richmond, Ind., $45,848.

Greene County, Dayton-Chillicothe, H. E. Barney, Dayton, $12,635.

Guernsey County, Cambridge-Caldwell, Seiple & Wolf, Youngstown, $12,728; National, W. H. Young Company, Columbus, $96,160.

Harrison County, Dennison-Cadiz, R. L. Timmons & Sons, Cadiz, $35,764.

Holmes County, Columbus-Millersburg, Holmes Construction Company, Millersburg, $24,255.

Jefferson County, Steubenville-Cambridge, S. T. Frazier, Bloomingdale, $14,833.

Licking County, Columbus-Millersburg, Vogelmeier Bros., Newark, $5,609.

Madison County, Urbana-London, Culbertson & Culbertson, Richmond, Ind., $59,455.

Mahoning County, Akron-Canfield, L. H. Young Contracting Company, West Austintown, $20,221; Youngstown-Salem, Smith Construction Company, Youngstown, $12,147.

Montgomery County, Dayton - Troy, Brentlinger & Anderson, Dayton, $21,212; Cincinnati-Dayton, Culbertson & Culbertson, Richmond, Ind., $34,040; Dayton-Troy, Brentlinger & Anderson, Dayton, $28,282.

Morrow County, Marion-Galion, Mustard Bros., Ada, $23,950; Mt. Gilead-Mt. Vernon, J. A. Westrick, Holgate, macadam, $78,000, and Grohne Contracting Company, Joliet, Ill., reinforced concrete, $97,293.

Ottawa County, Port Clinton-Marblehead, Gray Bros., Bowling Green, $23,345. Pierson & Walsh, Fremont, $24,429.

Portage County, Cleveland - Kent, Mueller Construction Company, Columbus, $37,791.

Sandusky County, Fremont-Port Clinton, Ziegler & Reardon, Fremont, $16,874. Sandusky-Clyde, Lee Bros. & Petticord, Clyde, $22,706; Fremont-Castalia, Pearson & Welsh, Fremont, $7,994.

Scioto County, Ohio River, Seiple & Wolfe, Youngstown, tar-bound macadam, $36,393; Sheridan & Kirk Contracting Company, Portsmouth, asphalt-bound macadam, $36,759; brick on rolled foundation, $52,079; brick on concrete foundation, $62,952.

Seneca County, Tiffin-Bellevue, B. D. Knepper, Tiffin, $13,999; Upper Sandusky-Bellevue, Rolla M. Myers, Attica, $18,238.

Summit County, Akron-Medina, Morgan Bros., Ravenna, $32,000.

Tuscarawas County, Newcomerstown-

Uhrichsville, T. J. Norman & Son, Coshocton, $14,867; Canal Dover-Millersburg, Pace Bros., Cleveland, $23,480; Canal Dover-Wooster, Holmes Construction Company, Millersburg, $15,505.

Wayne County, Massillon-Wooster, Richard H. Shafer Company, Findlay, $76,500.

Williams County, West Unity-Montpelier, Zeller & Drum, Swanton, $19,985.

Lake County, Painesville-Warren, J. C. Divine Company, Alliance, $10,990.

Wooster, Ohio.—Following are two lowest bids opened by City Council for paving with brick E. Bowman Street: Herring & Son, Cleveland, $15,869, and Midland Construction Co., Lima, $14,624.

★**Anderson, Ind.**—Contract awarded Masters Construction Company, Seymour, for paving 38,000 sq. yd. on Anderson Street at about $50,000.

★**Indianapolis, Ind.**—Contracts awarded by County Commissioners for paving with concrete following roads: To M. J. Hayes, Indianapolis, for Sanders Road, 2 miles, at $41,000; to Edward G. Gant, Greenfield, for Keystone Avenue, 1½ miles, at $25,844; Harmening Road, 1¼ miles, at $34,474.

★**South Bend, Ind.**—County Commissioners awarded W. W. Parker Company, of Hammond, contract for constructing gravel road in Penn Township at $16,900.

Lowest bid opened April 4 by Department Public Works for paving Michigan Avenue with Trinidad Lake asphalt, 27,000 sq. yd., submitted by Western Construction Company, Lafayette, at $65,383, and W. B. Brady Construction Company, Chicago, Ill., lowest for paving with asphaltic concrete on Indiana Avenue at $65,777.

★**East Moline, Ill.**—Contract reported awarded General Engineering & Construction Company, Rockford, for paving on Seventeenth Avenue, at $25,226. Other bidders: Central Engineering Company, Davenport, Iowa, $26,467; Lord Construction Company, Monmouth, $27,065; and Abrahams & Porter Construction Company, East Moline, $27,446.

★**Moline, Ill.**—Contract for 17,000 sq. yds. stone-filled sheet asphalt, etc., awarded McCarthy Improvement Company, Davenport, Iowa, at $43,559 (bids opened April 10). Lyle Payton, City Engineer.

Morrison, Ill.—Lowest bid opened by Board of Local Improvements for paving on Wall Street submitted by Curdie & Wolf, of Alton, at $1.895 per sq. yd. for brick pavement; total $90,426.

Racine, Wis.—Lowest bidder for constructing roads (bids opened April 5) by County Highway Commissioner was Municipal Equipment Company, 111 W. Jackson Street, Chicago, Ill., as follows: Twelfth Street Road, $11,226; Franksville Road, $8,036, and Yorkville Road, $6,408.

★Contract awarded by Board of Public Works for paving portion Franklin Street with asphalt, to Western Improvement Co., Racine, at $1.99 per sq. yd.

★**Audubon, Iowa.**—Contract awarded by City Council for paving 48,000 yd. with asphaltic concrete to National Roofing Co., Omaha, Neb., at about $88,000. (Bids opened April 6.)

★**Nevada, Iowa.**—Contract for 21,000 sq. yd. asphaltic concrete pavement awarded Ford Paving Company, Cedar Rapids. R. A. Davis, City Clerk. (Bids opened April 11.)

★**Perry, Iowa.**—Contract for 30,000 sq. yds. pavement, including brick, concrete asphaltic and creosoted block, awarded James Horrabin & Company, Des Moines (bids opened April 10). Charles E. Wilson, City Engineer.

Duluth, Minn.—D. H. Clough & Company, Sixty-third Avenue and Grand Avenue West, submitted lowest bid for paving Nineteenth Avenue, East, from Fourth to Eighth Streets, with one course reinforced concrete, at $13,222.

★Contract for grading, curbing and macadamizing West Eighth Street awarded E. A. Dahl & Company, 510 Columbia Bldg., at $12,602. L. Ayres, City Engr.

★**St. Paul, Minn.**—Contracts awarded by City Council for paving Como Avenue and N. Snelling Avenue to Thornton Bros., 401 Scandinavian-American Bank Building, at $54,495.

★Contract for paving Shelby Avenue from Victoria to Fairview Avenues awarded McClure Contracting Company, St. Paul, at $84,450.

Following are bids opened recently by city for paving:

Victoria Street, Engineer's estimate $20,454—Fielding & Shepley, $19,402; McClure Contracting Company, McClure Building, $20,086; W. J. Hoy Company, Metropolitan Building, $20,169, and General Contracting Company, Plymouth Building, Minneapolis, $22,025.

Portland Avenue, Engineer's estimate $53,812—Fielding & Shepley, 216 W. University Avenue, $50,603; W. J. Hoy Company, Metropolitan Building, $52,608, and McClure Construction Company, McClure Building, $53,430.

Fourteenth Street, W. J. Hoy Company, Metropolitan Building, $13,730.

State Street, Engineer's estimate $9,075; W. J. Hoy Company, Metropolitan Building, $10480.

Camo Avenue, Engineer's estimate, $41,241—Fielding & Shepley, 216 University Avenue, $39,369; W. J. Hoy Company, Metropolitan Building, $41,221; McClure Construction Company, McClure Building, $41,482; Sen Contracting Company, $42,658.

Prescott Street, Engineer's estimate $8,732; W. J. Hoy Company, Metropolitan Building, $10,423.

Eleventh Street, Engineer's estimate, $13,791; W. J. Hoy Company, Metropolitan Building, $16,219.

★**Huron, S. D.**—Contract for 16,000 sq. yds. of paving awarded C. H. Atkinson, Watertown, S. D., at $1.89 per sq. yd. for asphaltic concrete. S. S. Oviatt, City Auditor. (Bids opened April 3.)

★**Little Rock, Ark.**—Contract for 40,000 cu. yd. grading, 41,000 lin. ft. curb and gutters and 55,000 sq. yd. pavement in Street Improvement Dists. No. 9 and 244, awarded to J. P. Shelby & Co., of Little Rock, at $65,900.

★**Marysville, Wash.**—Contract awarded by City Council for constructing cement sidewalks, grading, etc., on Birch St., to W. J. Hoover, Everett, at $8,222.

Seattle, Wash.—Low bid opened by Board of Public Works for paving Ninth Avenue, W., submitted by F. McLellan, Globe Block, at $8,001.

★Contracts awarded by Board of Public Works to P. J. McHugh, Third Avenue, N., and Mercer Street, for paving Thackery Street, at $18,242, Latona Avenue at $8,457; Cresman Contracting Co., 614 Madison Street, for concrete walks on East Valley Street at $8,474.

Spokane, Wash.—Following are bids opened April 7 for Inland Empire Permanent Highway No. 13-B: (a) asphalt macadam, (b) asphaltic concrete on macadam base—Mitchell Bros., (a), $34,757; (b), $43,798; Standard Asphalt Paving Company, (b), $43,926 (bidders of Spokane). Charles Gabriel, Clerk County Commissioners; Alfred T. Anderson, County Auditor.

★**Walla Walla, Wash.**—Contract for paving 3 miles of city streets with 5-in. asphaltic concrete awarded Independent Asphalt Company, Northern Bank Building, Seattle, at $89,839. W. R. Rehorn, City Engineer.

★**Astoria, Ore.**—Contract awarded by City Council for retaining walls and paving Commercial Street, to J. A. McEachern & Co., Bell Street Dock, Seattle, Wash., at $24,490.

Whittier, Cal.—Lowest bid opened by City Council for constructing oil macadam pavement, cement curb and gutters, on about one mile of Lemon Street, submitted by S. C. Contracting Company, 421 Washington Boulevard, Los Angeles.

★**Lewiston, Idaho.**—Reported contract awarded by Tammany-Waha District for constructing 5.3 miles of road which will form a link in Idaho state highway, to George H. Kester, Lewiston, at $20,000.

★**London, Ont.**—Contracts for paving (bids opened March 30) awarded as follows: To Standard Paving Company, Ottawa, 34,478 sq. yd. asphalt concrete, 2 in. wearing surface, 1 in. binder, 5 in. plain concrete and grading, at $2 per sq. yard, total $68,956, and for 17,685 sq. yd. asphaltic concrete, 2 in. wearing surface, 1 in. binder, 6 in. plain concrete and grading, at $2.05 per sq. yd., total $36,254; and to Fielder Construction Company, London, 2303 sq. yd. vitr. brick, 1½ in. sand cushion and 6 in. plain concrete base and grading, $2.65; total, $6,103. H. A. Brazier, City Engineer.

STREET CLEANING AND GARBAGE DISPOSAL

PROPOSED WORK.

Springfield, Mass.—Bd. Supervisors approved plans for constructing an incinerator on Logan Street; probable cost $15,000.

Barberton, Ohio.—Construction of a garbage disposal plant contemplated by City Council.

Houston, Tex.—City plans constructing two garbage incinerator plants, to cost $5,000 each. Address Mayor.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Brookline, Mass.**—Following are three bids opened April 3 for collecting and removing garbage for a period of five years: North Shore Contracting Company, Lynn, $23,000; T. N. Lane, East Boston, $24,000, and Jerry Bond, Needham, $34,250. (Awarded contract April 17.)

★**New York, N. Y.**—The Board of Estimate on April 10 passed a resolution awarding contract to Gaffney, Gahagen & Van Etten Co. to erect a disposal plant on Staten Island. This firm will pay city $900,000 a year for five years, after which the city will take over plant, which will be operated by city.

Rochester, N. Y.—Lowest bid opened by Board Contract & Supply, on April 5, for sprinkling streets submitted by Bantel & Hartung, at 45.7 per cent of estimated cost, which is $93,218.

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS

PROPOSED WORK.

Dam—Ogdensburg, N. Y.—A concrete and steel dam and bulkhead is to be constructed at outlet of Cranberry Lake; cost about $25,000. C. C. Burns of Watertown said to be interested.

Hydroelectric Plant—Trenton, N. J.—Plans being prepared by Trenton Water Power Co. for construction of a hydroelectric power plant on Assunpink Creek.

Levee—Clarksdale, Miss.—Legislature has authorized Yazoo-Mississippi Levee Board (F. N. Birdsall, Secy.), to issue $1,500,000 bonds for repair of and maintenance of levees in this district.

Levee—Greenville, Miss.—Legislature has authorized Mississippi Levee Board (W. H. Mayhew, Secy.), to issue $1,000,000 bonds for repairing and maintenance of levees in this district.

Dam—McMinnville, Tenn.—Great Falls Power Co. granted permission by County Court to construct a dam at Caney Forks Falls; also construct bridge at top of dam and one at Harsh's Ferry and raise bridge crossing Collins River.

Creek Improvement—Belleville, Ill.—Contract will be awarded about June 15 by W. C. Wolf, City Engineer, for straightening and deepening creek in Belleville to cost $79,600. H. W. Flood, Engineer, 17 S. Illinois Street, Belleville.

Ditch—Bemidji, Minn.—Judge Stanton ordered construction of ditch No. 25, to be 250 miles long and cost $483,000.

Dredging—Minneapolis, Minn.—In a report submitted to Park Board, Theodore Wirth, Supt., estimated cost of constructing a lagoon at south end of Lake Calhoun at $198,529, and for dredging Rice Lake at $227,776.

River Improvements—St. Paul, Minn.—City Council engaged M. L. Barnes of Albany, N. Y., to work in conjunction with City Engineer on a detailed report on navigation facilities, including feasibility of proposed development, a physical survey of shores, levees, river banks and establishment of terminals, location of railroad connections, wharves and warehouses and estimated cost of proposed improvement.

Drainage—Wentworth, S. D.—Drainage improvements in Moody and Lake Counties costing $65,000 will include main ditch 9 miles long, 4 to 13 ft. deep, 4 to 10 ft. bottom, slopes 1 to 1, about 249,060 cu. yd. excav. black loam and clay; estimated cost of excavation 12 cts. per cu. yd. Charles A. Trimmer, Consulting Engineer, Madison, S. D.

Levees—England, Ark.—Dickinson & Watson, 610 State Bank Building, Little Rock, appointed engineers to repair damage done by recent floods on Plum Bayou levee between Little Rock and Pine Bluff.

Irrigation—Memphis, Ark.—Drainage District No. 3 of Crittenden County, organized with Willis E. Ayres of Memphis, Engineer, and L. P. Berry of Marion, Attorney. As soon as surveys are made a bond issue of $225,000 will be sold. The district will have 55 miles of canals, and includes 38,000 acres north of Erie and Crawfordsville and touches Clarksdale.

Drainage—Mound City, Ark.—Morgan Engineering Co., Memphis, Tenn., engaged by Trustees of Drainage District No. 8, Crittenden County (Charles L. Lewis, Chmn.), to prepare plans for 37 miles of canals to be constructed during the coming summer.

Ditches—Alamogordo, N. M.—See "Water Works."

Irrigation—Bakersfield, Cal.—Miller & Lux, Merchants' Exchange Building, San Francisco, applied to State Water Commission, Sacramento, for permission to appropriate water from Buena Vista Slough in Kern County to irrigate 10,000 acres of desert land, Junction of Kern, Tulare and Kings Counties.

Irrigation—Lindsay, Cal.—The Lindsay-Strathmore Irrigation District works will include dams in Tule and Kaweah Rivers, 2 reservoirs, one 22,000 acre ft. and one 12,000 acre ft. capacity, and ditches and tunnels, 11 miles long. About 45 wells will be sunk and pumping units installed. Total cost approximately $1,500,000. John H. Quinton, Hollingsworth Bldg., Los Angeles, Engr.

Dam—Los Angeles, Cal.—Board of Public Service instructed William Mulholland, Chief Engineer, to raise Fairmont dam an additional 70 ft.; cost about $150,000.

Pier—Manhattan Beach, Cal.—Plans completed about May 17 for the pleasure pier and pavilion contemplated here; cost, $110,000. Llewellyn Price, City Clerk; Train & Williams, Engrs., 226 Exchange Building, Los Angeles.

Pier, Etc.—San Diego, Cal.—City applied to U. S. Engineer, Los Angeles, for permission to construct 800 ft. reinforced concrete pleasure pier, eight 200-ft. timber groins, two 800 ft. loose rock jetties, one 6 ft. wide and one one 10 ft. wide at top at water front near Ocean Beach; cost, about $125,000. George Cromwell, City Engineer; F. M. Lockwood, City Mgr.

Irrigation—Terra Bella, Cal.—Plans approved by State Engineer for irrigation system for Terra Bella Irrigation District to include about 16 wells, four 8-in. and two 12-in. centrifugal pumps, two 120-hp. Diesel engines, two 25-hp. motors and one 75-hp. engine, turbines, and 30- to 40-in. distributing mains; cost reported at $1,000,000. S. E. Kieffer, Engineer, 57 Post Street, San Francisco.

Irrigation—Whittier, Cal.—Whittier Water Co. has asked State Railroad Commission for permission to construct system of pipes for delivering water to Orchard Dale Water Co., to be used for irrigating about 600 acres of fruit land.

Irrigation—Boise, Idaho.—State Land Board approved plans to increase from 30,000 to 40,000 acres district to be irrigated by Wickahoney Land & Water Co.; cost for additional improvement about $500,000.

BIDS DESIRED.

Sea Wall—Fort Pierce, Fla.—Until May 2, by County Commissioners (J. E. Fultz, Clerk), for constructing sea wall and fill along Indian River front, sea wall to be 800 ft. long and extend out about 400 ft. from shore. Miller Hallowes, Engr., Fort Pierce.

Dike—Brownstown, Ind.—See "Paving and Roads."

Drainage—Princeton, Ill.—Until May 5, by G. M. Westphal, Drainage Commissioner, for constructing improvements in Green River Drainage District, estimated to cost $15,000.

Levee—Pittsfield, Ill.—Until April 27, by Board Commissioners of the McGee Creek Levee and Drainage Dist., at office of Williams & Williams, Attorneys, Pittsfield, for levee work amounting to about 83,000 cu. yd. Web P. Bushnell, Engr., Quincy.

Drainage—Spirit Lake, Iowa.—Reported until April 28, by John B. Blow, Co. Aud., for constructing Drainage Dist. No. 6, to consist of 43,635 ft. of from 36-in. to 6-in. tile, 11 inlets and one concrete bulkhead. Also separate bids same time and place for constructing Drainage Dist. No. 25, in all about 82,976 ft. of from 36 to 6-in tile, 30 inlets, two concrete bulkheads and one catch basin.

Ditch—Le Sueur Center, Minn.—Reported desired until April 28, by Thos. F. Dunn, Co. Aud., for constructing Ditch No. 42, requiring 14,079 cu. yd. earth, cost $2,422; Ditch No. 19, requiring 20,237 cu. yd., cost $3,987, and Ditch No. 44, requiring 59,225 cu. yd. earth, cost $7,090.

Ditch—St. James, Minn.—Reported desired until May 9, by J. C. Jensen, Co. Aud., for constructing Judicial Ditch No. 10, all tile. Probable cost Sect. A, $33,966; Sect. B, $13,458; Sect. C, $1,294.

Gates, Etc.—Lincoln, Neb.—Reported desired until May 1, by Director Chimney Rock Irrigation Dist., for constructing steel waste and check gates near head of Chimney Rock Canal, consisting of two batteries of steel gates of four slides each, etc.

Irrigation—St. Ignatius, Mont.—Until May 25 by U. S. Reclamation Service, St. Ignatius, for constructing canals and structures on Flathead Project, Mont., advertised in Engineering Record.

Irrigation—Ft. Laramie, Wyo.—Until May 22 by U. S. Reclamation Service, Ft. Laramie, for constructing tunnels and concrete lining of canal approaches to same on Ft. Laramie Canal, North Platte Project, Nebraska, Wyoming, advertised in Engineering Record.

Irrigation—Alpaugh, Cal.—Until April 28, by Board of Directors of Alpaugh Irrigation District (W. T. Holton, Secy.), for following: Furnishing and installing machinery, motors, transformers, wiring, etc., and housing, to lift 9000 gallons per minute at Smyrna, Kern County; drilling five wells at Alpaugh and equipping with pumps; 65,000-gallon hemispherical bottom steel tank and tower at Alpaugh; pump, motor, gasoline engine and housing for this tank; constructing concrete reservoir; approximately 193,500 ft. of soil-proof riveted steel pipe, with necessary valves, fittings, etc.; repairing and regrading approximately 6.5 miles of earth canal.

Dredging—Los Angeles, Cal.—Until May 10, at U. S. Engineer's Office, for dredging in Los Angeles Harbor.

Cribwork and Concrete Wall—Toronto, Ont.—Until May 1, by Chmn. Toronto Harbor Commissioners, 50 Bay Street, Toronto, for cribwork and concrete wall. E. L. Cousins, Chief Engineer and Manager.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Dredging—Boston, Mass.**—Following are three lowest bids opened April 5 by Board of Harbor & Land Commissioners (William F. Williams, Ch. Engr.), for dredging:

★In Wellfleet Harbor channel and

basin, about 55,000 cu. yd. material to be removed (price given is per cu. yd.); Maryland Dredging & Contracting Company, Baltimore, Md., 19.53 cts. and $9.50 (awarded contract); Bay State Dredging & Contracting Company, 247 Atlantic Avenue, Boston, 25.5 cts. and $10; J. S. Packard Dredging Company, Providence, R. I., 30.49 cts. and $10; Jeremiah P. O'Riordan, Charlestown, 32.25 cts. and $5.

★dredging channel and basin in Nobscusset Harbor, Dennis, removal of about 40,000 cu. yd. material; Maryland Dredging & Contracting Company, Baltimore, Md., 27.53 cts. and $9.50 (awarded contract); J. S. Packard Dredging Company, Providence, R. I., 32.7 cts. and $10; John R. Burke, 78 Devonshire Street, Boston, 34⅝ cts. and $10; Bay State Dredging & Contracting Company, 247 Atlantic Avenue, Boston, 35.4 cts. and $10.

Bulkhead—Boston, Mass.—Following are four lowest bids opened April 14 by Directors of Port of Boston for constructing bulkhead along Northern Avenue extension, South Boston, Contract 49: (a) Construction of bulkhead 1000 lin. ft.; (b) furnishing and placing extra sheeting wales, etc., 25M ft.; (c) total for a and b: William H. Ellis & Son Company, 479 Meriden Street, (a) $23.61, (b) $59, (c) $25,085; W. O. Wilson & Company, (a) $23,755 (total), (b) $60; George T. Tendle Company (a) $23.94, (b) $59, (c) $25,415; H. P. Converse & Company, 88 Broad Street, (a) $24.07, (b) $68, (c) $25,770.

★Dredging—Buffalo, N. Y.—Contract for dredging Inner Harbor to the completed contract depth for maintenance of channel from June 30, 1916 to June 30, 1917, awarded H. S. Kerbaugh, Inc., Buffalo, at 35 cts. per cu. yd. scow measure.

Dredging—New York, N. Y.—Following are totals of four lowest bids opened April 14 by U. S. Engineer's Office, Army Building, 39 Whitehall Street, New York, for dredging and rock removal in Coenties Reef, East River, N. Y.: Great Lakes Dredge & Dock Co., Boston, Mass., $196,900; Bowers Southern Dredging Co., Galveston, Tex., $238,434; James Stewart & Co., Inc., 30 Church Street, New York, $344,717, and Eugene Breymann, Boston, Mass., $377,777.

★Sea Wall—Savannah, Ga.—Contract for constructing a sea wall at Jekyl Island awarded to J. W. Fitzgerald, Jr., of Savannah, at about $65,000.

Levee Improvements—Memphis, Tenn.—Following are bids opened April 11 by City for constructing three reservoirs in connection with their levee protection work: Reservoir No. 2, Koehler Bros.-Fowler Construction Co., Memphis, $28,371 (only bidder). Reservoir No. 3 (four bidders): Koehler Bros.-Fowler Construction Co., $25,633; Turner & Thomas $26,892; M. E. Larkin, $27,184, and F. D. Harvey & Co., $36,220 (bidders of Memphis). Reservoir No. 4 (four lowest): A. DeFranceschi, $11,547; M. E. Larkin, $13,541; Turner & Thomas, $16,318, and Koehler Bros.-Fowler Construction Co., $16,527. J. H. Weatherford, City Engineer.

★Dock—Ashland, Wis.—Contract for constructing Soo Ore dock awarded Foley Bros. Construction Company, St. Paul, Minn., at about $1,000,000. Dock will be of reinforced concrete and steel, storage capacity 50,000 tons, and will have 75 pockets on each side. C. N. Kalk, Ch. Engr. Soo R. R. Co., Minneapolis, Minn.

★Ditches—Windom, Minn. — Contracts for constructing ditches (bids opened April 14) awarded by S. A. Brown, County Auditor, as follows: No. 19 to D. A. Lahart of Mount Lake, at $20,490, and No. 24 at $22,140 and No. 26 to O. M. Anderson, Somers, Iowa, at $13,994.

★Irrigation — Malta, Mont. — Contract awarded by U. S. Reclamation Service, Washington, D. C., for earthwork on Bowdoin Canal and laterals on Milk River Project, Mont. (bids opened March 15), at $9,106. Work involves excavation of about 62,110 cu. yd. of material and necessary overhaul.

★Ditch—Cuero, Tex.—Contract for repairing drainage ditch near Cuero awarded by County Commissioners to L. G. Crawford of Bay City at $9,776 (bids opened April 3).

★Boston, Mass.—Following are unit figures of the four lowest bids opened April 11 by Boston Transit Commission for constructing Section J of Dorchester Street Tunnel: (a) T. A. Gillespie Co., 363 Dorchester Avenue, $346,887 (awarded contract); (b) Coleman Bros., Boston, $352,712; (c) Hugh Nawn Contracting Co., 82 Savine Street, Roxbury, $367,812; (d) Bruno & Petitti, 18 Tremont Street.

	*(a)	(b)	(c)	(d)
60,000 cu. yd. earth excavation open cut method	$2.80	$2.90	$3.00	$3.00
500 cu. yd. old masonry removed	3.40	4.00	3.00	6.00
13,000 cu. yd. concrete	8.60	8.50	9.00	8.25
50 cu. yd. cinder concrete	5.00	5.00	7.00	10.00
400 cu. yd. mortar	8.75	9.00	12.00	16.00
200 cu. yd. concrete with small stone	9.00	10.00	12.00	15.00
3,000 sq. yd. granolithic	0.60	1.00	1.40	2.00
400 lin. ft. casing steel platform columns	1.15	1.20	2.00	1.00
1,050 lin. ft. casing steel tunnel columns	1.05	1.00	1.25	1.00
200 cu. yd. brick masonry	18.00	16.00	18.00	18.00
140 lin. ft. laying 8-in. vitr. pipe for invert drain	0.25	0.30	0.50	0.76
1,500 lin. ft. laying 6-in. to 15-in. vitr. pipe for sewers	0.45	0.50	0.50	1.00
1,600 lin. ft. 18-in. to 30-in. vitr. pipe for sewers	0.90	0.90	0.80	2.00
1,000 lin. ft. laying 3-in. and 4-in. vitr. and c.-i. pipe	0.20	0.20	0.25	0.50
600 ton setting steel 6 lb. or less per ft	7.00	8.00	7.00	16.00
900 ton setting steel more than 6 lb. per ft	11.00	13.00	11.50	10.00
4,000 sq. yd. Portland cement plaster	0.20	0.30	0.30	0.50
50 cu. yd. neat cement grout	14.00	14.00	17.00	20.00
100 cu. yd. grout, mixed 1:1½	9.25	9.00	12.00	16.00
200 cu. yd. grout, mixed 1:4	7.00	7.00	6.00	12.00
45,000 sq. yd. prepared textile and asphalt	0.40	0.40	0.40	0.40
150 M ft. 4-in. hard pine sheet piling	75.00	50.00	60.00	60.00
Supporting and protecting buildings, risks, etc	3,350.00	4,000.00	3,500.00	5,000.00

★Dredging—Redwood City, Cal.—Contract awarded by Redwood City Harbor Company to San Francisco Bridge Co., Nevada Bank Building, San Francisco, for dredging water frontage each of city, about 500,000 yd. of material to be removed.

ELECTRIC RAILWAYS

PROPOSED WORK.

Lewiston, Me.—Reported the Lewiston, Augusta & Waterville St. Ry. Co. will repair track between Brunswick and Bath, new ties and rails being used. Company plans to construct bridge over the New Meadows and repair Brunswick and Topsham Bridge.

Boston, Mass.—The City and Boston Elevated R. R. Co. has asked Public Service Commission for permission to reconstruct Brookline Avenue Bridge over Boston & Albany R. R. so that cars may operate over it.

Waterbury, Conn. — The Connecticut Company, New Haven, will spend about $40,000 in double tracking from Robbins Street to Morningside Avenue in Waterbury and Watertown.

Jamestown, N. Y.—Panama Traction Company will begin at once location survey for an interurban electric railway from Youngsville, Pa., to Jamestown, N. Y. Chapman & Graham, Engrs., Gokey Building, Jametown.

Phoenixville, Pa.—Plans being considered for constructing an electric railway from Phoenixville to Norristown via Mont Clare, Oaks, Audubon and Jeffersonville. Thomas E. O'Connell, Pres. Phoenixville-Valley Forge & Strafford Electric Ry. Co., is interested.

Sharon, Pa.—Youngstown & Sharon Street Railway Co. received franchise from City Council to construct extension to Buhl Farm.

Shelbyville, Ky.—Surveys completed and right-of-way secured by Shelbyville & Frankfort Realty Co. for railway to be constructed between Shelbyville and Frankfort via Bridgeport, Grafenburg, Peytona and Clayvillage, 19½ miles. Overhead trolley will be used. Power stations will be located at Shelbyville and Frankfort. J. W. Gudgel, Shelbyville, Secretary.

Salem, Ohio.—Reported a corporation is being organized to construct an interurban railway between Youngstown and Salem, via Canfield. John Goeppinger of Alliance is interested.

Logansport, Ind.—The Ft. Wayne & Northern Indiana Traction Co. of Ft. Wayne will restore Broadway line in Logansport and track will be relaid at once. Concrete poles are to be used.

St. Joseph, Mich.—Plans being considered by M. W. Stock to construct a railway from St. Joseph to Michigan City.

Peoria, Ill.—The Chicago, Peoria & Quincy Traction Co. (John L. Soebbing of Quincy, Pres.), has entered into a contract with A. C. Black and E. S. Woolner of Peoria to finance and construct railway.

Springfield, Ill.—Work will soon begin on constructing Springfield & Jacksonville Electric Ry. from Springfield to Jacksonville via Berlin. J. H. McFarlane of Springfield is general manager of J. H. McFarlane Co., organized to construct the line.

Fergus Falls, Minn.—Construction of a railway from Sisseton to Perham, via Fergus Falls, contemplated. Address Commercial Club.

Temple, Tex.—Marlin-Temple Interurban Promotion Co. chartered to construct a railway from Marlin to Temple. S. D. Hanna of Temple, Engineer.

Baker, Ore.—Construction of an electric railway from Baker to Pine, 45 miles, and from Baker to Eagle Valley, 75 miles. Alexander Allerdyce is interested.

Elsinore, Cal.—Charles De Lacour has asked Bd. Supervisors for a franchise to construct an electric railway from Elsinore to San Diego via Wildomar, Murrietta and Temecula.

PRICES AND LETTINGS.

★Indicates award of contract.

★New Castle, Ohio.—Contract for constructing 2-story brick and concrete, 100 x 70-ft. substation for Mahoning & Shenango Ry. & Light Co. awarded to Stone & Webster Engineering Corp., 147 Milk Street, Boston, Mass.; estimated cost, $150,000.

RAILROADS

PROPOSED WORK.

Cheektowaga, N. Y.—Public Service Commission of Second Dist. ordered elimination of the Harlem Avenue grade crossing in town of Cheektowaga and Village of Sloan in Erie County, including construction of a viaduct, steel frame construction, with concrete floor, 24-ft. roadway, paved with brick, and one 6-ft. sidewalk, to cross 57 tracks belonging to main line and yards of Delaware, Lackawanna & Western, Lehigh and Erie R.Rs. To be one-quarter mile between abutments and cost about $400,000. The Commission appropriated $100,000 as State's share of cost.

Niagara Falls, N. Y.—Work will start in May on the elimination of grade crossings at College Avenue, Portage Road and Lockport Street at a cost of $500,000, city to pay approximately $200,000 and the railroads—N. Y. Central, Erie, Lehigh Valley and International Ry. Company (electric)—the remainder. John L. Harper, Engineer, Grade Crossing Advisory Commission.

Orange, N. J.—City has received from Lackawanna R.R. signed agreement between city and railroad company for elimination of grade crossings.

Charleston W. Va.—Reported Virginia Ry. Co. (H. Fernstrom, Ch. Engr., Norfolk, Va.), is considering constructing a 60-mile railroad into Guyan and Coal Valleys.

Montgomery, Ala.—Seaboard Air Line Company (W. D. Fancette, Ch. Engr., Norfolk, Va.) has applied to city for right of way to build a new road at their own expense to eliminate two grade crossings on Lower Wetumpke Road. Cost, $50,000.

Hartsville, Tenn.—Surveys being made for railroad which it is proposed erecting between Hartsville and Red Boiling Springs, via Lafayette. J. C. Collins, Secy. Directors, 601 Statesman Building, Nashville, Tenn.

Paducah, Ky.—Paducah & Illinois R.R. Co. applied to City Commissioners to construct and maintain tracks on numerous streets. It is intention of company if granted this privilege to erect passenger and freight depot at Second and Washington Streets.

Indianapolis, Ind. — Cleveland, Cincinnati, Chicago & St. Louis Ry. (C. A. Paquette, Chief Engineer, Cincinnati, Ohio), intends doing some concrete, steel and grading work in Indianapolis at a cost of $200,000. Contract will be let about May 15.

South Bend, Ind.—Mayor Keller, in his annual report, urges steps taken at once to elevate tracks of Lake Shore & Grand Trunk R.R. over streets. City has $150,000 toward project.

Garry, Mont.—Reported Great Northern Ry. Co. plans double tracking road on west side of Rockies and reduction of curves. Section to be improved is 10 miles long between Paola and Garry. P. S. Hervin, Great Falls, Resident Engineer, Great Falls.

Great Falls, Mont.—Reported Chicago, Milwaukee & St. Paul Ry. will soon start construction of 72-mile branch road between Great Falls and Agawam.

Midland, Tex.—Reported construction of a railroad from Midland to Seminole, a distance of 65 miles, is under consideration. Address T. J. O'Donnell, Midland.

North Yakima, Wash.—Reported Northern Pacific Ry. Company (W. L. Darling, Ch. Engr., St. Paul, Minn.) will spend about $1,000,000 in Yakima Valley this year, mainly for new track construction.

Eugene, Ore.—Reported Southern Pacific Ry. Company (W. Wood, Ch. Engr., San Francisco, Cal) intends making yard improvements and has applied for permit to lay an additional track from a point 1500 ft. north of River Road to Pearl Street, the two to cost $100,000.

Redondo Beach, Cal.—Reported Atchison, Topeka & Santa Fe R. R. (G. W. Harris, Ch. Engr., Los Angeles) is planning constructing a line between Redondo Beach and San Pedro via Torrance, approximately 12 miles, and also to construct yards on 30-acre tract near San Pedro harbor front.

PRICES AND LETTINGS.

★Indicates award of contract.

★Williamsburg, Va.—Chesapeake & Ohio R.R. Co. awarded contract to Simon Curtis, Leehall, to build a branch line from Williamsburg to proposed site on York River of power plant of E. I. du Pont de Nemours & Co.

★Frankfort, Ind.—Contract for constructing Pennsylvania R.R. between Ben Davis and Frankfort awarded to Dunn-McCarthy Co. of Chicago, Ill.; cost of improvement about $4,500,000.

★Great Falls, Mont.—Contract awarded by Great Northern Ry. Co. (P. S. Hervin, Great Falls, Res. Engr.) for constructing 600-ft. tunnel near Great Falls to A. Gutherie & Co., St. Paul, Minn.

★Lewistown, Mont.—Reported contract awarded by Chicago, Milwaukee & St. Paul Ry. Company (C. F. Loweth, Ch. Engr., Chicago, Ill.), for grading and building side tracks on line between Mobridge and Harlowtown, 500 miles, to D. J. Burke of Lewiston.

★Seattle, Wash.—Reported Great Northern Ry. Co. has awarded contract for placing 10,000 M ft. timber in position and for the combination back walls and roof timbering for the proposed snow sheds in Cascade Mountains near Scenic to Grant Smith Co., Henry Building, and Henry McPhee, Henry Building, respectively, at a total approximate cost of $1,000,000.

PUBLIC BUILDINGS AND SCHOOLS

PROPOSED WORK.

Chisholm, Me.—A $25,000 brick grammar school is to be erected. Address Chairman Building Committee, Board of Education.

Bristol, R. I.—Clark Horne, Providence, is architect for two-story brick school to cost, with equipment, $52,000. B. W. Wall, Secretary Town Board.

Bridgeport, Conn.—See "Paving and Roads."

Mount Kisco, N. Y.—Plans being prepared by Ernest Sibley, Palisade Park, N. J., for two-story school addition; cost, $40,000. Address Board of Education.

New York, N. Y.—Plans filed for erecting 6 and 10-story fireproof hospital building for Bellevue and Allied Hospital, Twenty-sixth Street and First Avenue; cost $800,000; McKim, Mead & White, Archts., 101 Park Avenue; 2-story fireproof stores on New Market and Division Streets for Department of Bridges, city of New York, cost $50,000; Floyd Y. Parsons, Archt., 1133 Broadway.

Board of Education has decided to ask Board of Estimate for $3,766,807 for new school buildings, additions, alterations and sites.

East Orange, N. J.—Contract will be let about June 1 by Board of Education for erecting addition to Elmwood School, fireproof, three stories, and cost $100,000. Guilbert & Betelle, Archts., 665 Broad Street, Newark.

Haddon Heights, N. J.—Election to be held April 25 to vote $30,000 bonds to erect school. Address School Board.

Hoboken, N. J.—Fagen & Briscoe, 95 River Street, engaged by Board of Education to prepare plans for new school to replace School No. 3 on Adams and 11th Streets; cost, about $175,000.

Ridgefield, N. J.—Board of Education will issue $40,000 bonds for erecting school in Morsemere Section of town.

Brackenridge, Pa.—Board of Education will erect $30,000 school.

Philadelphia, Pa.—Trustees of University of Pennsylvania propose erecting building for advancement of women's education on Thirty-fourth and Walnut Streets, as a memorial to Colonel Joseph M. Bennett.

Trevorton, Pa.—Clyde S. Adams, 1509 Arch Street, Philadelphia, is architect for two-story, 95 x 120-ft. school. Address Board of Education.

Williamsport, Pa.—Erection of school is contemplated. A. J. Updegraff, Secretary Bd. Education.

Richwood, W. Va.—S. W. Ford & Company, Clarksburg, engaged to prepare plans and specifications for proposed $40,000 school, for which bonds were recently voted. Address Board of Education.

Macon, Ga.—All bids opened for erecting city hospital rejected by Board of Hospital Commissioners, being in excess of $100,000 available.

Tifton, Ga.—Citizens voted $76,000 improvement bonds, proceeds to be used for erecting high school, waterworks extension and street paving. Address the Mayor.

Birmingham, Ala.—Election to be held June 5 to vote $2,000,000 bonds for school improvements. Address Secretary Board of Education.

Selma, Ala.—City Council has appropriated $30,000 for erecting a new modern school.

Alexandria, La.—Election to be held May 2 to vote $50,000 bonds for erecting two schools. Address City Clerk.

Jackson, Miss.—State Legislature has authorized bond issue of $125,000 for repairing old capitol and $25,000 for establishment of a tuberculosis hospital; also $200,000 to improve rural schools.

Jackson, Tenn.—County contemplates voting $60,000 bonds for school buildings. William Allen, County Judge, Jacksboro.

Lewisburg, Tenn.—County considering erecting a high school, costing $50,000. L. Clevenger, County Judge.

Nashville, Tenn.—William B. Ittner, Board of Education Building, St.. Louis, Mo., is architect for the east wing of Hume Fogg high school. J. J. Keyes, Superintendent of Schools.

La Grange, Ky.—All bids opened recently for erecting City Hall rejected by Town Board as being too high.

Cheshire, Ohio.—Citizens voted $30,000 to erect new school. Address Clerk School Board.

Cleveland, Ohio.—Trustees of Grace Hospital, 2307 West Fourteenth Street, planning replacing present structure with a new fireproof building, costing $200,000. Dr. John T. Henderson, 2128 West 100th Street, Secy. of Board.

Erection of five-story addition to St. Luke's Hospital, 6606 Carnegie Avenue, contemplated; probable cost $200,000. Address Chairman Building Committee.

Girard, Ohio.—School bonds for $70,000 will be sold May 1, by Wade R. Deemer, Clerk Board Education.

Lorain, Ohio.—Council authorized issue of $55,000 bonds to erect new municipal bathhouse on West Erie Avenue Park site. Address City Clerk.

Laporte, Ind.—City Board of Education has accepted gift of $27,500 from Andrew Carnegie for erecting public library.

Michigan City, Ind.—Plans prepared by Wilson D. Parker, Board of Trade Building, Indianapolis, for an addition to and remodeling of Central School, costing $60,000. Address Clerk of School Board.

Detroit, Mich.—Erection of $75,000 grade school in Fifth Ward on Stockdale Road, to be known as George W. Cook School, contemplated. Address Board of Education.

Grand Rapids, Mich.—Council recently approved $375,000 school bond issue to include following improvements for which plans are being prepared: Addition to Union High School, $200,000; new school in Fountain District, $83,000, and $45,000 for new Walker School. H. N. Morrill, Secy. Board of Education.

Sturgis, Mich.—Robinson & Campau, Houseman Building, Grand Rapids, engaged to prepare plans for high school to cost about $125,000. Address Board of Education.

Madison, Wis.—Citizens voted $150,000 bonds to erect new city hall. Address City Clerk.

Des Moines, Ia.—Board of Education, April 6, sold $368,000 school bonds.

Clark Lake, Minn.—Election to be held May 23 to vote $75,000 bonds for erecting court house.

Hibbings, Minn.—Erection of an addition to public library being considered by Village Council, cost $56,000.

Minneapolis, Minn.—Erection of a municipal pasteurization plant for city is contemplated, cost about $70,000.

Board of Education intends erecting a 2-story brick and reinforced concrete school at Forty-third Street South, and Thirty-first Avenue, South, to cost $85,000.

Moorhead, Minn.—Citizens will vote April 25 on issue of $75,000 bonds for erecting high school.

St. Paul, Minn.—St. Joseph Hospital will erect building on property adjacent to present building. Cost, $250,000.

Marlin, Tex.—Brick high school costing $50,000 to be erected possibly this year. A. T. Goode, Secretary School Board.

Marlin, Tex.—See "Sewerage and Sewage Disposal."

Paris, Tex.—Plans being prepared by Supervising Architect, Washington, D. C., for a post office building to replace building destroyed by fire. Appropriation available, $200,000.

Plans soon to be prepared for a court house to replace building destroyed by fire. The erection of a court house and jail costing $150,000 or over is under consideration. S. Bedford, County Auditor.

City is planning erecting an up-to-date market house in the proposed market square. Edward H. McCuistion, Mayor.

Eufaula, Okla.—County Commissioners contemplate erecting a court house. Address County Clerk.

Seattle, Wash.—J. R. West, Ch. Engr. Port Commission, directed to modify plans and specifications for fruit cold storage warehouse to be erected at Spokane Street and to install refrigerating equipment on three of the seven floors of structure at cost of $30,000; also prepare plans for extensions of Spokane transit shed on Whatcom Avenue, distance 380 ft., making structure 880 ft. long, 90 ft. wide; cost $70,000.

Thornton, Wash.—Citizens voted in favor of erecting $33,000 brick school. Address Clerk School Board.

Los Angeles, Cal.—Contract will be let in May by Board of Supervisors (A. M. McPherrin, Clk.), for erecting six-story reinforced concrete and brick service building, 80 x 100 ft., at Workman Street and Mission Road. George Low, County Archt.

R. D. Farquhar, Van Nuys Building, engaged by Board of Education to prepare plans for a $30,000 school to be erected in Torrance.

Merced, Cal.—Competitive plans until May 16 by High School Board, for school, to cost $150,000.

BIDS DESIRED.

Worcester, Mass.—Until April 25 by Mayor George M. Wright, for erecting police station; cost, $150,000.

Howard, R. I.—Reported desired until April 27, by Board of Control and Supply (Gilbert R. Parker, Secy.), 18 State House, Providence, for furnishing material and erecting 3-story ward building and for alterations to two existing ward buildings and other work for State hospital for insane. Martin & Hall, Archts., 806 Union Trust Bldg., Providence. Rich. D. Kimball Co., Engrs., 430 Industrial Trust Bldg., Providence.

Woonsocket, R. I.—Until May 12, by School Committee, for erecting a brick high school on High Street. Cost $40,000. Fred M. Buxton, Chmn. Committee. W. A. Fountain, Archt., Federal Building.

Bridgeport, Conn.—Until April 24, by Board Education (Wm. B. Boardman, Chmn. Bldg. Com.), for furnishing material and erecting a six-room addition to assembly hall, and alterations to Hall School on Claremont Avenue. Fred. A. Cooper, Archt., Connecticut National Bank Building, Bridgeport.

Dannemora, N. Y.—Until May 8, by Dr. Charles H. North, Medical Superintendent Dannemora State Hospital, for structural steel and iron work and steel guards and doors for northwest wing of said hospital, advertised in Engineering Record. Lewis F. Pilcher. State Archt., Capitol, Albany.

Jersey City, N. J.—Until May 3, by Board of Education, for erecting School No. 16 on Washington and Sussex Streets. John T. Rowland, Archt., 100 Sip Avenue.

Washington, N. J.—Until May 15, by Borough Board of Education, for alterations and additions to school. Separate bids for heating, ventilating, etc. Rasmussen & Wayland, Archts., 1133 Broadway, New York, N. Y.

Ebensburg, Pa.—Until May 17 (extension of date from April 17), by School Board (A. J. Apel, Secy.), for erecting a 2-story brick hollow tile school. Walter R. Myton, Archt., 1204 First National Bank Building, Johnstown.

Woodlawn, Pa.—Until May 4, by W. C. Eckles, Secy. Borough, for erecting a 12-room school.

Frederick, Md.—Until May 1, by Mayor and Board of Aldermen, for Contract A, extension of and repairs to existing building: Contract B, installation of power plant equipment, boilers, generator and switchboard; Contract C, revision and extension of line work, furnishing lamps, transformers and electrical equipment and power station wiring. advertised in Engineering Record.

Harrisburg, Va.—Reported desired until May 1, by State Normal School, for erecting dormitory. C. M. Robinson, Inc., Richmond, Archt.

Cincinnati, Ohio.—Reported desired until April 24, by Board of Directors, University of Cincinnati (Dan'l. Laurence, Clk.), for alterations and additions to Engineering Annex. Tietig & Lee, Archts., Fourth National Bank Bldg.

Covington, Ohio.—Reported desired until April 24, Geo. M. O'Donnell, Clk. Board Education, for erecting grade school addition 2 story and basement, 73 x 64 ft. E. H. Eickett, 274 East Twelfth Avenue, Columbus.

Lancaster, Ohio.—Reported desired until April 26, by County Commissioners (O. E. Myers, Clk.), for laundry and storage building for the County Infirmary.

Lorain, Ohio.—Until May 4, by Board Education (D. A. Cook, Clerk), for furnishing material and erecting addition to high school in Dist. No. 4. Separate bids for heating, plumbing, wiring, etc.

Medina, Ohio.—Until May 6, by Board Education (E. E. Lowe, Clerk R. F. D. No. 5), for furnishing material and erecting a school. Separate bids for heating, ventilating, etc. F. S. Rusk and Cree Sheets, Archts., 145 High Street, Columbus.

Seville, Ohio.—Until May 13, by E. R. Alexander, Clerk Board of Education, for erecting a brick and concrete 2-story fireproof school costing $32,000 with equipment. Bonds will be sold May 1. Althouse & Jones, Mansfield, Archts.

Atwood, Ill.—Reported desired until April 29, by Township School Dist., care U. S. Garrett, Atwood, for erecting 2-story and basement school. Probable cost $40,000. Hewett & Emerson, Archts., 321 West Main Street, Peoria.

Eldorado, Ill.—Until April 24, by Board Education (R. G. Putnam, Secy.), for furnishing material and erecting a high school. N. S. Spencer & Son, Archts., Champaign, Ill.

Illinois.—Until May 2, by Board of Administration (Frank D. Whipp, Fiscal Superv.), for erecting State Institutes buildings as follows: Cottages for patients, two new cottages for tubercular patients to be erected at Peoria State Hospital, South Bartonville. Separate bids for heating, plumbing, electric wiring, etc. An employees' building to be erected at St. Charles School for Boys near St. Charles. Separate bids for heating, plumbing, etc. Hon Jas. Dibelka. Archt., 130 N. Fifth Avenue, Springfield.

Bangor, Wis.—Until April 27, by F. A. Harrison, Clk., Board Education, for erecting school. Separate bids for heating, plumbing, etc. Chandler & Park, Archts., Racine.

Racine, Wis.—Reported desired until April 29, by Board Public Works, for constructing municipal garage in rear of No. 5 Fire Engine House. P. H. Connolly, City. Engr.

Wausau, Wis.—Reported desired until April 28, by G. A. Runkel, Chmn., Public Property Commission, for erecting tuberculosis sanitarium at County Farm of Settin; two-story and basement, 120 x 210 ft., T-shaped. Probable cost, $50,000.

Williams Bay, Wis.—Until May 1, by S. B. Barrett, Clk., Board Education, for erecting a school. Separate bids for heating, plumbing, electric wiring, etc.

Dow City, Iowa.—Reported desired until May 5, by Board Education, for erecting three-story brick school. Probable cost $75,000. Edgar L. Barber, Archt., Denison.

Fertile, Iowa.—Until May 10, by Board Education (E. M. Lang, Secy.), for erecting consolidated school. Separate bids for heating, plumbing, etc. Thornwald Thorson, Archt., Forest City.

Little. Sioux, Iowa.—Until May 13 (change of date from May 2), by Independent School District (T. J. Lanyon, Secy.), for furnishing material and erecting school. H. W. Underhill & Co., Archts., Bryant Bldg., Kansas City, Mo.

New Albin, Iowa.—Reported desired until May 5, by School Board (R. G. May, Secy.), for erecting brick and stone high school, including heating, plumbing, etc. Parkinson & Dockendorff, Archts., La Crosse, Wis.

Selma, Iowa.—Until May 15, by Consolidated Independent School Dist. (R. L. Schlotter, Secy), for furnishing material and erecting a school. H. W. Underhill & Co., Archts., Bryant Bldg., Kansas City, Mo.

Seymour, Iowa.—Reported desired until May 4, by Chas. West, Secy. Board of Education, for erecting 6-story and basement, 60 x 135 ft. school. Probable cost $40,000. Sanneman & Goold, Archts., 619 Reserve Bank Bldg.

Ware, Iowa.—Reported desired until May 1 by Independent Consolidated School Dist. (M. Leith, Pres.), for erecting school. Separate bids for heating, plumbing and electric work. J. W. Bradford, Archt., Ft. Dodge.

Mayer, Minn.—Until May 15, by Board Education No. 73, Ferdinand Schmidt, Clk., for erecting brick school. Separate bids for heating, ventilating, plumbing, etc. Kerby T. Snyder, Archt., 643-645 Plymouth Building, Minneapolis.

Waldorf, Minn.—Until May 10, by Board Education (Raymond Doyle, Secy.), for erecting school. Separate bids for heating, ventilating, etc. F. W. Kinney, Archt., 1003-4 Plymouth Bldg., Minneapolis.

Lyons, Kan.—Reported desired until April 26, by Board Education (H. E. Ernest, Secy.), for erecting brick and concrete high school. Lorenz Schmidt, Archt., 126 Market Street, Wichita.

Scott City, Kan.—Reported desired until May 8, by County Board of Education, for erecting county high school. Holland & Son, Archts., Topeka.

Norfolk, Neb.—Reported desired until May 1, by Secy. Board Control, for erecting three-story building at Hospital for insane.

Osnabrock, N. D.—Reported desired until April 25, by Alma School Dist. Trustees (J. Ludwigsen, Clk.), for erecting school. Separate bids heating, ventilating, etc.

Bowman, S. D.—Reported desired until April 24, by School Board of Twin Butte School Dist. No. 1 (J. M. Folsom, Clk.), for erecting two-story brick school.

Madison, S. D.—Until April 25, by Board of Regents (J. W. Dwight, Pres.), for erecting a training school on campus of the State Normal School. Joseph Schwartz, Archt., Sioux Falls.

Burbank, Cal.—Until May 2, by Board Trustees (E. M. Peyton, Clk.) for erecting 2-story and basement brick city hall and jail. Elmore R. Jeffery and Frank R. Schaefer, Archts., 1202 Van Nuys Building, Los Angeles.

Kimberly, Idaho.—Reported desired until May 1, by H. W. Mund, Secy. School Dist. No. 2, for erecting high school. Probable cost $40,000. B. Morgan Nisbet, Archt., Trust Bldg., Twin Falls.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Haverhill, Mass.**—Contract reported awarded A. N. Currier Sons Company of Boston, for erecting addition to Greenleaf School at $31,639.

★**Lockport, N. Y.**—Contracts for erecting high school (bids opened April 11) awarded as follows: Masonry and carpentry, John Moon, Lockport, $27,118; plumbing, heating and ventilating, Mapes & Payne, Lockport, $3,112; electric wiring, Knopp Electric Company, Lockport, $615. Emmet Belknap, Superintendent of Schools.

Hoboken, N. J.—Lowest bid opened April 12 by Board of Education for erecting addition to high school submitted by M. T. Connelly Construction Co., Jersey City, at $92,997.

★**Hazelton, Pa.**—Contract for erecting concrete school (bids opened April 10) awarded Shamokin Mfg. Company, Shamokin, at $78,849. Next three bidders: Audo Brislin, Summit Hill, $81,982; E. J. Bailey, Brickton, N. Y., $85,590, and United Fire Proof Company, 8 West Fortieth Street, New York, $85,800. D. T. Evans, Secy. School District.

★**Ogontz, Pa.**—Contract reported awarded George F. Payne & Company, 401 South Juniper Street, Philadelphia, for erecting 4-story school; cost $160,000. Horace Trumbauer, Archt., Land Title Building, Philadelphia.

★**Wilcox, Pa.**—Contract for erecting high school (bids opened April 12), awarded P. W. Finn, Altoona, at $32,023.

★**Jacksonville, Fla.**—Following are four lowest bids opened April 15 by Board Public Instruction and Board of Trustees for erecting the Panama Park School: R. V. Labarre Construction Company, Birmingham, Ala., $47,770 (awarded contract; J. E. Hollingsworth & Company, $53,887; D. E. Bosrick, Birmingham, Ala., $53,948; and W. P. Richardson, $55,250.

★**East Youngstown, Ohio.**—Iron City Lumber Company, 522 Williamson Ave., Youngstown, secured contract for bricks at about $23,000, for proposed $60,000 school to be erected on Robinson plot.

★**Youngstown, Ohio.**—Contracts awarded by Board of Education for erecting Stambaugh School, at Steelton and Jackson School, at Pine Grove, as follows:

★Jackson school: masonry, Parrish Brothers, Youngstown, $50,731; carpentry, R. S. Constable, $14,876; plumbing, W. J. Scholl Plumbing Company, 16 East Boardman Street, $9,289; electric wiring and fixtures, G. A, Webster Electric Company, 117 North Phelps Street, $1,632.

★Stambaugh School: masonry, Parrish Brothers, Youngstown, $56,347; carpentry, Henry J. Gerst, $9,536; plumbing, H. C. Teal Plumbing Company, 119 East Commerce Street, $7,764; electric wiring and fixtures, G. A. Webster Electric Company, 117 North Phelps Street, $2,052.

★**Huntington, Ind.**—Contract for erecting U. S. Post Office awarded William Everly, Indianapolis, at $71,853.

Detroit, Mich.—Following are lowest combined bids opened recently by Board of Education for erecting Holmur Avenue School: General masons, Otto Misch, 725 Chamber of Commerce Building; carpenter work, Ernst Thiede, 287 Berlin Street; heating, ventilating and plumbing, A. W. Schultz & Co., 815 Gratiot Street; electric wiring system, Gray Bros. Electric Co., 70 State Street. Contracts will not be let until about May, as sufficient funds are not available. Charles N. Gadd, Secretary of Board.

★**Auburn, Ill.**—Contract for erecting high school in Township awarded Charles Ogg of Auburn. Cost, including plumbing and heating, $36,000.

★**Mattoon, Ill.**—General contract for erecting Washington School awarded to L. M. Moore & Son of Danville at $41,275, heating and plumbing contract to White & Hanson of Mattoon at $10,843.

Faribault, Minn. — Following are low bidders for improvements and alterations to State School for Blind: General contract, John P. O'Neil, Faribault, $33,729; heating and ventilating, P. J. Gallagher, $6,282, and electric work, C. W. Turner, $700. Bids opened April 11 by State Board of Control, St. Paul.

St. Paul, Minn.—Lowest bid opened April 10 by County Board of Control, for erecting addition to city and county hospital, submitted by C. Ash & Sons Company, new High School Building, South St. Paul, at $29,146.

★**Columbus, Kan.**—Contract for erecting county high school reported awarded F. H. Crites, New York Life Building, Kansas City, Mo. Cost, about $40,000.

Falls City, Neb.—Following are four lowest bids opened April 7 by Supervising Architect, Washington, D. C., for constructing U. S. Post Office: (a) limestone; (b) sandstone: R. S. Moore, Lafayette, Ind., (a) $45,655, (b) $47,125; Thomas W. Cissell, Wooster, Ohio, (b) $50,000; George A. Shaul, Seneca, Kan., (a) $45,146; Charles Weitz Sons, Des Moines, Iowa, (a) $43,000, (b) $43,600; W. G. Carter Co., Chamber of Commerce Building, Chicago, Ill., (a) $45,320, (b) $46,820.

Valley City, N. D.—Following are four lowest bids opened April 6 by Supervising Architect, Washington, D. C., for constructing U. S. Post Office: (a) limeston; (b) sandstone: John Lauritzen, Fergus Falls, Minn., (a) $76,572; W. D. Lovell, Minneapolis, Minn., (a) $72,540; William O'Neil & Son, Co., Faribault, Minn., (a) $69,072; G. W. Stiles Construction Co., Rookery Building, Chicago, Ill., (a) $73,390, (b) $77,390; Northern Construction Co., Milwaukee, Wis., (b) $78,317; and Thomas W. Cissell, Wooster, Ohio, (b) $81,500.

★**Clark, S. D.**—Contracts for erecting school (bids opened April 10) awarded as follows: General contract to Gray Construction Co., Watertown, $25,999, and heating, plumbing and ventilating to Watertown Heating, Plumbing & Ventilating Co., at $9,500. W. M. Ayer, Secy. Board Education.

★**Kalispell, Mont.**—Contract for constructing U. S. Post Office awarded Welch Bros. & Hannaman, Oakland, Cal., at $80,120.

★**Neosho, Mo.**—Contract for erecting high school awarded to J. B. Wager, Neosho, at $38,689.

★**Big Springs, Tex.**—Contract for erecting high school awarded by School Board to A. J. Olson, Cisco. School bonds amounting to $40,000 have been sold for erection of this school.

★**Lipscomb, Texas.**—Contract for erecting court house (bids opened April 10), awarded W. M. Rice, Amarillo, Texas, at $36,700. W. H. Sewell, County Judge.

★**Seattle, Wash.**—Contract for erecting Political Science and Commerce Building at University of Washington awarded as follows: Excavation, H. D. Stewart, Seattle, excavation and concrete work at $2,974 and $38,513 respectively; steel, Northwest Steel Company, Portland, Ore., $18,400; heating, D. H. King, Seattle, $16,839; plumbing, Eckhart Heating & Plumbing Company, Seattle, $5,649, and electric wiring, J. J. Aquitter & Company, Seattle, $3,222. William Markham, Secy. Board of Regents, Univ. of Washington.

★Following are bids opened April 7 by School Board (Reuben W. Jones, Clerk) for erecting addition to the B. F. Day School: Dow & Ryden, Mehlhorn Building, $61,986 (awarded contract); Scherer & Carlson, Seattle, $66,508; John Larson, Seattle, $67,110; Henrickson & Company, Seattle, $67,848. Edgar Blair, Archt., 1426 Jackson Street.

Portland, Ore.—Following are four lowest bids opened April 6 for erecting Franklin High School (bidders all of Portland): Muir & McClelland, $82,991; Friberg-McLennan Company, $84,870; Boyajohn Arnold Company, $89,000, and Parker & Banfield, $89,453. F. A. Naramore, Supt. Properties School Dist. No. 1.

PRIVATE BUILDINGS

PROPOSED WORK.

Boston, Mass.—Steps being taken to erect six-story industrial building in connection with Morgan Memorial, 89 Shawnut Avenue; cost about $70,000. Address Superintendent.

Pittsfield, Mass.—G. E. Haynes, Miller Building, is architect for edifice to be erected on Plunkett Street for St. Mary's Parish; cost about $50,000.

Brooklyn, N. Y.—Plans being prepared by W. T. McCarthy, 16 Court Street, for five 5-story apartment houses to be erected on Seventy-fifth Street and Third Avenue, for Wolfinger & Lasberg Building Company, 346 Broadway, New York; total cost approximately $300,000.

Kew (P. O. Jamaica), L. I., N. Y.—Kew Gardens Country Club contemplating erecting clubhouse to cost approximately $100,000. Frederick T. Youngs, Chairman, Metropolitan Avenue, Kew Gardens.

New York, N. Y.—Plans filed for erecing following buildings: Three 5-story brick apartment buildings on Amsterdam Avenue and 150th Street for Parkside Realty Company, total cost $150,000, Gronenberg & Leuchtag, Archts., 303 Fifth Avenue.; 5-story brick apartment house on 215th Street and Seaman Avenue for H. D. Construction Company, cost $55,000, Neville & Bagge, Archts., 105 West Fortieth Street; 12-story fireproof tenement house at 630 Park Avenue for 630 Park Avenue Company, Inc., cost $400,000, J. Edwin R. Carpenter, Archt., 681 Fifth Avenue; 12-story fireproof store and loft building at 599 Broadway for Frederick Ayer, Milk Street, Boston, Mass., cost $350,000, J. Odell Whitenack, Archt., 231 West Eighteenth Street; 4-story fireproof store and loft buildings at 457 West Fourteenth Street for William Waldorf Astor, cost $85,000, James S. Maher, Archt., 431 West Fourteenth Street; 2 and 4-story fireproof theater at 217 West Forty-fifth Street for Astor Estate, cost $90,000, Herbert J. Krapp, Archt., 116 East Sixteenth Street; 5-story brick tenement on Courtland Avenue and 151st Street for Benenson Realty Company, cost $50,000, William E. Erb, Archt., 401 East 152nd Street; three 6-story brick tenements on 201st Street and Briggs Avenue for John Fox, total cost $140,000, Charles Schaefer, Jr., Archt., 401 Tremont Avenue.

New York, N. Y.—Carrere & Hastings, 52 Vanderbilt Avenue, and W. E. Mason, Jr., are associate architects for remodeling dwelling at 111 East Sixty-ninth Street, for J. A. Sturaberg; cost $30,000.

Schenectady, N. Y.—Contract soon to be let for erecting four-story and basement, 90 x 200-ft., brick and stone Masonic Temple on State Street; estimated cost, $100,000. Denvers, Moseley & Campaigne, Archts., Illuminating Building, Troy. R. R. Douglas, Chairman Building Committee, 211 Center Street.

Syracuse, N. Y.—Plans being prepared by Merrick & Randall, S. A. & K. Building, for 3 or 4 story, 98 x 198 ft., printing and office building to be erected for Syracuse Journal Company, cost $200,000.

Plans completed by Russell & King, Snow Building, for three-story and basement, 50 x 100-ft., brick and steel business block to be erected on South Clinton Street for Pease & Howard Heater Company; estimated cost, $40,000.

Hoboken, N. J.—German Hospital and Dispensary Association contemplates erecting two-story brick hospital to cost about $30,000. Dr. Joseph Rector, 307 York Street, in charge.

Irvington, N. J.—Plans filed for three-story store and apartment building to be erected at 1006 Springfield Avenue for Mahlon S. Drake, Sr., 98 Heller Parkway; estimated cost $23,000. Arthur H. Thomson, Archt., 222 Market Street, Newark.

Morristown, N. J.—Reported Grinnell Willis of South Street and Headley Road has made offer to Directors of Morristown Library and Lyceum Association to finance erection of $60,000 library contemplated, at South and Boykin Streets, for which Edward L. Tilton, 32 Broadway, New York, has prepared plans.

McKees Rocks, Pa.—St. Mary's Greek Catholic Church Society will erect new edifice on Olivia and Ellen Streets, to cost about $50,000.

Norristown, Pa.—Pennsylvania R. R. (Alex Shand, Ch. Engr., Philadelphia), intends erecting a freight station and transfer at Swede and Barbadoes, Lafayette and Washington Streets.

Philadelphia, Pa.—Gomery Schwartz Motor Car Company will erect a 10-story fireproof building, 137 x 180 ft., at Broad and Cherry Streets. Charles E. Oelschlager, Archt., Harrison Building.

Westside Presbyterian Church, Germantown, planning to erect new parish house, to cost about $40,000. Rev. William Porter Lee, Pastor.

Plans being prepared by George I. Lovatt, 416 Walnut Street, for a parochial school to be erected at Twenty-third and Mifflin Streets for Congregation of St. Edward's Roman Catholic Parish.

Hagerstown, Md.—St. Mary's R. C. Church intends erecting on S. Prospect Street a $100,000 edifice.

Moundsville, W. Va.—Plans of Meanor & Sweeney, of Huntington, accepted for proposed brick, limestone and terra cotta Roman Catholic Church, to be erected on Jefferson Avenue and Seventh Street; cost approximately $27,000.

Montezuma, Ga.—Plans being prepared by T. F. Lockwood, Columbus, for a $25,000 Methodist Church to be erected here.

New Orleans, La.—Boston Club, 824 Canal Street, taking steps to erect new clubhouse, probable cost $200,000. Address Chairman Building Committee.

Cleveland, Ohio.—Reported Charles H. Gill, 1867 Crawford Road, will erect between twenty and thirty-six apartments at Euclid Avenue and E. Seventy-first Street.

Congregation of Immanuel Baptist Church, Superior Avenue and E. 110th Street, plans erecting an edifice at Saywell Avenue and E. 133d Street. Rev. James McAllister, 1237 E. 111th Street, Pastor.

Masonic organizations of West Side Masonic Temple, West Twenty-fifth Street and Church Avenue, N. W., plan erecting new temple; probable cost $100,000.

Plans being prepared by F. A. Pease Engineering Co., Marshall Building, for a union station for interurban lines B. & O., Nickel Plate, Erie and W. & L. E. R. R., and an office building to be erected on the Public Square by the recently incorporated Terminal Company.

A. C. Edwards, 615 Union Building, is architect for five-story, brick and steel fireproof hospital to be erected at 3126 Prospect Avenue by the Co-operative Hospital Association (H. A. Becker, President); estimated cost, $300,000. Northampton Apartment, 3124 Prospect Avenue, is to be remodeled at cost of $25,000 and later made a wing of new hospital.

George F. Hammond, Archt., 4220 Prospect Avenue, will erect at 4310 Prospect Avenue a $30,000 apartment building.

Reported N. S. Calhoun, 1629 Magnolia Drive, will erect $25,000 residence on East 115th Street, near Wade Park Avenue.

Carl W. Blossom, 1883 East Eighty-fourth Street, reported intends erecting $30,000 residence on Magnolia Drive and East 108th Street.

East Cleveland, Ohio.—John E. Morris, 62 Idlewood Avenue, will erect $30,000 store and apartment building on Euclid and Allandale Avenues.

Mansfield, Ohio.—Plans prepared by F. B. Hursh, of Mansfield, approved for new edifice to be erected on Sherman Place for St. Matthew's Lutheran Church, cost about $25,000. Rev. A. C. Miller, Pastor.

Ravenna, Ohio.—Church of Christ (Scientist) will erect new edifice to cost $50,000.

Youngstown, Ohio.—C. W. Deibel, 115 W. Rayen Avenue, Youngstown, intends erecting moving picture theater to cost about $50,000, in Youngstown or Cleveland.

Garrett, Ind.—Garrett State Bank will erect a $25,000 building.

Indianapolis, Ind.—Cadillac Realty Company will erect a salesroom, offices, repair and auto-body rebuilding department at Meridian and Eleventh Streets to cost approximately $180,000. A. W. Steinhart, Pres. Cadillac Automobile Company of Indiana, 500 N. Capitol Avenue, is a director of the corporation.

Milford, Ind.—Grace Church plans erecting $25,000 edifice. Address Pastor.

Chicago, Ill.—Plans being prepared by L. G. Hallberg & Company, 19 South La Salle Street, for nine-story, fireproof, reinforced-concrete apartment building to be erected by Charles B. Smith on Sheridan Road; cost about $250,000.

Plans being prepared by Carl W. Westerlind, 111 W. Washington Street, for 148 x 145 ft. apartment building to be erected at Pine Grove Avenue and Surf Street; cost about $200,000.

McKinley Park Masonic Temple Association has purchased site on Thirty-fourth Street and Western Avenue and proposes erecting a $100,000 Masonic Temple.

An eight-story store and office building will be erected at Clark and South Water Streets by Frank Cuneo of Garibaldi & Cuneo, 1 West South Water Street; cost, $100,000.

Joseph E. Swanson, 3122 Sheridan Road, will erect a six-story apartment building on Fullerton Parkway and Commonwealth Avenue, to cost about $250,000.

Moline, Ill.—Plans completed by Hammond W. Whitsitt, Moline, for the First Congregational Church, to cost $55,000.

Peoria, Ill.—John Linn, Commission Merchant, 203 S. Washington Street, plans erecting a warehouse; cost about $30,000.

Milwaukee, Wis.—A three-story and basement, 60 x 120 ft., brick and concrete apartment building will be erected on Downer Avenue and Webster Place for Reitman-Straus Company, 415 Railway Exchange Building; cost about $40,000.

Reported Miller Brewing Company, Thirty-ninth and State Streets, is having plans prepared for nine-story, reinforced-concrete, terra cotta and brick hotel and theater building to be erected on Third Street and Grand Avenue.

Duluth, Minn.—Duluth Lodge B. P. O. Elks will erect a 3-story building to present clubhouse at a cost of $30,000. Kelly & Williams, Architects, First National Bank Bldg., Duluth.

Hibbing, Minn.—Edifice is to be erected by Methodist Episcopal Congregation at cost of $25,000. R. W. Adair, Pastor.

St. Paul, Minn.—Knights of Pythias planning to erect four-story lodge building.

The Schurmeier Wagon Company, Ninth Street and Broadway, will erect a wholesale house at 405 Rosabel Street, costing $200,000. Plans have been prepared.

Joplin, Mo.—Odd Fellows Building Assoc. (Henry Phelps, Pres.) contemplating erecting a $30,000 lodge building.

Little Rock, Ark.—Bankers' Trust Co. planning erecting two or three additional stories to present building. R. L. Temmel, Pres.

Marlin, Tex.—Dr. W. H. Allen, Marlin, is reported interested in sanitarium contemplated here to cost $35,000.

Sherman, Tex. — Woodlawn Country Club will erect a concrete, brick and tile club house costing $30,000. Address Secretary.

Pullman, Wash.—A reinforced-concrete mausoleum to be erected here for Northwest Mausoleum Co., White Building, Seattle; cost about $60,000.

Covina, Cal.—See "Prices and Lettings."

Los Angeles, Cal.—Contract about to be let by Fred. R. Dorn, Archt., 1230 Marsh Story Building, for a three-story brick loft building, 60 x 140 ft., to be erected at Los Angeles and Tenth Streets, for Brown, Pallette & Brown.

Preliminary plans being prepared by W. J. Dodd & William Richards, Brockman Building, for a 3-story fireproof theater to be erected on Grand Avenue and Seventh Street for Shirley Ward and others.

Ocean Park, Cal.—A. B. Rosenthal, 507 Lankershim Building, Los Angeles, engaged to prepare plans for an 8-story reinforced concrete hotel, to be erected by Great Western Amusement Company, Henry W. Schleutter, President. Cost, about $1,000,000.

Tucson, Ariz.—Henry O. Jaastad, Tucson, engaged to prepare plans for additions and alterations to Southern Bank & Trust Company's building; cost, $40,000.

Ogden, Utah.—Plans being prepared for $40,000 club house to be erected for Eagles Lodge.

BIDS DESIRED.

Hartford, Conn.—Reported competitive plans desired until May 1, by Y. W. C. A. (Francis Cooley, Chmn., 241 Church Street), for 6-story, 103 x 188 ft. building. Probable cost $215,000.

Albany, N. Y.—Reported desired until April 24, by Esenwein & Johnson, Archts., 781 Ellicott Square, Buffalo, for erecting 18 story and basement, 88 x 122 ft. addition to Hoel stores and office buildings of Hotel Ten Eyck (F. W. Rockwell, Mgr.). Probable cost $1,000,000.

Elmira, N. Y.—Reported desired until April 25, by Mowbray & Uffinger, Archts., 56 Liberty Street, New York, for alterations to building Merchants National Bank (C. C. Swan, Pres.). Probable cost $25,000.

Schenectady, N. Y.—Reported desired until April 24, by Obenaus Nichols Co., Inc., Archts., 208 South Center Street, for erecting two-story and basement clubhouse, 86 x 42 ft., for Lodge No. 480 B P. O. E.

Chester, Pa.—Reported desired until April 30, by Mowbray & Uffinger, 56 Liberty Street, New York, N. Y., for erecting 7-story, 50 x 100 ft., bank and office building, of Delaware County Trust, Safe Deposit & Title Insurance. (Jas. A. G. Campbell, Pres.). Probable cost $350,000.

Philadelphia, Pa.—Reported desired until May 1, for erecting two and three story brick, stone and terra cotta 40 x 100 ft. brick store building at Front and Dauphin Streets for Armin A. Frankel. Magaziner & Potter, Archts., 603 Chestnut Street.

Suffolk, Va.—Reported desired until April 25, for constructing 6-story and basement brick, stone and concrete and marble 35 x 88 ft. bank building, for American Bank. J. K. Peebles, Archt., Kevan Law Building, Norfolk.

Chicago, Ill.—Reported desired until May 1, for erecting 2-story garage, 100 x 200 ft., for Wm. C. Rudd & Co. A. P. Dippold, Archt., 1330 East Forty-seventh Street.

Freeport, Ill.—Reported desired until April 24, for erecting 7-story and basement, 50 x 120 ft., bank building for State Bank. Probable cost $150,000. Frank A. Carpenter, Archt., 420 Brown Bldg., Rockford, Ill.

Marion, Ill.—Until April 26, by First National Bank, for erecting bank building. N. S. Spencer & Son, Archts., 320 North Neil Street, Champaign, and 1035 Old Colony Bldg., Chicago

Clear Lake, Iowa.—Reported desired until April 25, for erecting Masonic Temple. J. W. Bradford, Archt., Fort Dodge.

Mason City, Iowa.—Until May 3, for erecting two-story bank and office building, 45 x 96 ft., fireproof construction. Broaten & Mincy, Archts., Mason City.

Until May 10, by Modern Brotherhood of America (T. B. Hanley, Pres.), for furnishing material and erecting a nine-story office building at Michigan and State Streets. Separate bids for heating, plumbing, etc. Bell & Bentlet, Archts., 518 Security Bldg., Minneapolis.

Sheffield, Iowa. — Until May 11, by Building Committee of Order of Odd Fellows, for erecting lodge building for said Association. J. H. Jeffers, Archt., Mason City.

Canby, Minn.—Reported desired until April 24, A. Moorman & Co., 501 Minn Street, Archt., St. Paul, for erecting two-story, 76 x 81 ft. building for Bank of Canby.

Hastings, Neb.—Reported desired until April 21, by C. W. Way Co., Archts., Hastings, for erecting addition to Clarke Hotel. Probable cost, $60,000.

Belt, Mont.—Reported desired until April 28, by Knights of Pythias Building Committee, for erecting a two-story and partial basement 50 x 80 ft. building for said Association. Geo. H. Shanley, Archt., Great Falls.

Lake Benton, Minn.—Until April 25, by Alfred Soderlind, Cashier Farmers Bank, for erecting one-story and basement brick bank building. Albert Schippel, Archt., Mankato.

Jamestown, N. D.—Until May 1, by Alfred Steel, Chmn. Bldg. Com. Jamestown Lodge, No. 6, A. F. and A. M., for erecting Masonic Temple. J. A. Shannon, Archt., Devils Lake.

Portland, N. D.—Until April 26, by C. N. Brunsdale, Secy. Lutheran Church, for furnishing material and erecting new edifice. J. E. Nason, Archt. Corn Exchange, Minneapolis.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★South Boston (P. O. Boston), Mass.—Contract for erecting storage warehouse for Boston Wharf Company awarded to J. M. & C. J. Buckley, 128 Vernon Street, Worcester, at about $76,400.

★Springfield, Mass.—Contract awarded Flynt Building & Construction Company of Palmer, for erecting machinery building of Eastern States Exposition Group, at $55,352

★Hartford, Conn.—Theodore Newton & Sons, Hartford, have contract to erect a 50 apartment house on Farmington Avenue, of steel and reinforced concrete, for Hartford Realty Company.

★Manchester, Conn.—Contract awarded Aberthaw Construction Company, 27 School Street, Boston, Mass., for erecting fireproof, brick, stone and concrete recreation building on Education Square for Cheney Brothers; cost about $130,000.

★New York, N. Y.—Contract awarded Wells Construction Company, 237 Fifth Avenue, for erecting 10-story brick and marble school at 52 East Seventy-eighth Street to 61 East Seventy-seventh Street for Finch School, cost $100,000. Hasselman & Harde, Archts., 56 West Forty-fifth Street.

★Andrew Brose, 1 Madison Avenue, has secured contract to erect 4-story brick stable and garage at 14 Lawrence Street for Cushman's Sons, Inc., 517 West Fifty-ninth Street, cost $50,000. Charles Stegmayer, Archt., 168 East Ninety-first Street.

★Contract awarded Hasco Building Company, 245 West Fifty-fifth Street, for erecting twelve-story, 148 x 100 ft., fireproof, brick, terra cotta and limestone, auto service building, with reinforced concrete floors, on Sixty-fourth Street and Broadway, for estate of Mary E. Pincnot, cost about $500.000. Cross & Brown Company, 18 East Forty-first Street, Agents.

★Contract awarded Thompson-Starrett Company, 49 Wall Street, for erecting brick and marble residence on Ninety-first Street and Madison Avenue, for C. M. McNeil, President of Utah Copper Company, 25 Broad Street, cost about $250,000. Frederick Junius Sterner, Archt., 154 East Sixty-third Street.

★Jersey City, N. J.—Contract awarded Turner Construction Company, 11 Broadway, New York, for erecting a 7-story tank building for Colgate & Company; concrete, 60 x 118 ft.

★Perth Amboy, N. J.—Contract for erecting addition to New Packer House (bids opened April 15) awarded Grant Thompson Co., 1328 Broadway, New York. Probable cost, $60,000.

★Johnstown, Pa.—Contract awarded Berkebile Brothers, of Johnstown, for erecting four-story brick office and apartment building for Dr. J. B. Lowman, at 116 Market Street. H. M. Rogers, Archt., Johnstown.

★Philadelphia, Pa.—Contract for erecting 5-story fireproof building for Denny, Hillborn & Rosenbach awarded to Henry E. Baton, Twelfth and Sansom Streets. A. J. Sauer & Co., Archts., 908 Chestnut Street.

★Permit issued to Rittenhouse Square Realty Co. to erect a 15-story steel, stone and brick apartment house, 45 x 122 ft., at Nineteenth and Walnut Streets; cost, $1,300,000.

★Pittsburgh, Pa.—Contract awarded W. B. Bennett, 742 North Negley Avenue, for erecting three-story and basement brick and stone loft building at Center and Ellsworth Avenues for J. D. Boyce; cost $30,000.

★Kennicott Company of Chicago Heights, Ill., secured contract for about $200,000 worth of steel required in buildings to be erected in Pittsburgh by Koppers Company, engineers and contractors.

★Rochester, Pa.—Contract for erecting new church for First Baptist Congregation awarded McDonald & Hartman of Rochester, at $23,845.

★Baltimore, Md.—Contract for erecting 3-story building at Mount Royal Avenue and Cathedral Street for Automobile Club of Maryland awarded Charles L. Stockhausen Co., 410 North High Street, at about $60,000. Wyatt & Nolting, Archts., 1012 Keyser Bldg.

★Avondale, Ohio.—Contract awarded M. Marcus Building Company, 2035 Reading Road, Cincinnati, for erecting $40,000 addition to K. K. Bene Israel Synagogue, Rockdale and Harvey Avenues. A. Lincoln Fechheimer, Archt., Lyric Theater Building, Cincinnati.

★Cleveland, Ohio.—Contract awarded by Richardson & Yost, Archts., Rockefeller Building, to Alexander Brothers, Williamson Building, for erecting three-story, 116 x 80 ft., concrete and steel building on Superior Avenue and East Forty-ninth Street for National Telephone Supply Company; probable cost $75,000.

★General contract for erecting Hotel Winton at 1004 Prospect Avenue, awarded to Wells Bros. Co., 53 Jackson Boulevard, Chicago, Ill. N. Max Dunning, 35 S. Dearborn Street, Chicago, Ill., architect. Total cost of hotel $2,500,000.

★Contracts for steel work awarded National Iron & Wire Co., 3901 Hamilton Avenue, as follows: On $25,000 factory for Climax Cleaner Mfg. Co. on West 110th Street; $75,000 store and office building at Euclid Avenue and East 101st Street, and $50,000 building at 735 Woodland Avenue for Federal Coffee Mills Co., 828 Broadway.

★Contract for excavation for the Cleveland & Youngstown R. R. freight terminal on Orange Avenue from East Ninth to Thirty-fourth Streets awarded Walsh Construction Co., Davenport, Iowa.

★Ironton, Ohio.—Contract for erecting four-story, brick, concrete and fireproof Masonic Temple awarded Covell Construction Company of Ionia, Mich.; cost about $70,000.

★Marion, Ind.—Contract for erecting bank and office building for Marion National Bank awarded H. W. Klausman, 1137 K. of P. Building, Indianapolis, for general work, plumbing, heating and electrical work. D. A. Bohlen & Son, Indianapolis.

★Cooperstown, N. D.—Contracts for erecting Masonic Temple awarded as follows: General contract, Read, McDonald, Brewster Company, Minneapolis, Minn., $21,867; heating, ventilating, plumbing, wiring and vacuum piping, Champlin & Nanson, Fargo, $3,915.

★Seattle, Wash.—Contract awarded by George W. Lawton, Archt., Alaska Building, to Victor J. Murdock, 626 Fourteenth Avenue, for erecting 5-story and basement, brick apartment house at Melrose, Howard and Olive Streets for Goodwin Realty Company; cost $70,000.

★Covina, Cal.—Contract for excavation, foundation and basement walls and first story floor slabs for reinforced-concrete administration building, 127 x 76 ft., and two dormitories, each 48 x 81 ft., for California Masonic Orphans Home Association awarded G. H. Whyte, Paloma Street and Allen Avenue, Pasadena, at $21,474. Contract for concrete superstructure is to be awarded later. John H. Blee, Archt., 516 Union League Building, Los Angeles.

★Long Beach, Cal.—Contract for erecting three-story and basement brick apartment house and store at Ocean Avenue and Marine Way awarded H. E. Martin, 625 South Spring Street, Los Angeles, at about $46,000. J. W. Robinson, Los Angeles, Owner.

★Los Angeles, Cal.—Contract awarded Frank L. Meline, 6778 Hollywood Boulevard, to erect four-story apartment house at Hollywood Boulevard and Highland Avenue, for J. E. Ransford, 735 South Hope Street. Cost, about $150,000.

★Contract awarded L. T. Mayo, 630 Black Building, to erect a four-story brick apartment house, 70 x 108 ft., on Coronado Street and Wilshire Boulevard, for Charlotte Goodrich. L. L. Jones, Archt., 1919 Citizens' National Bank Building.

NEW INDUSTRIAL PLANTS

PROPOSED WORK.

Boston, Mass.—Plans prepared for five-story brick and steel addition to George E. Kunhardt Mills, 77 Summer Street; estimated cost $140,000.

Springfield, Mass.—Morris Manufacturing Company, recently incorporated, will erect main factory for making die-casting machines on Page Boulevard. Leon J. Harley, Jr., of Harley Company, Springfield, reported interested.

Flushing, L. I., N. Y.—Plans filed for concrete office and factory building to be erected on Lawrence Street for Nathan Manufacturing Company, 101 Park Avenue, New York, cost $250,000.

Le Roy, N. Y.—Contract soon to be let by Arnold & Stern, Archts., Rochester, for erecting two-story, 60 x 100-ft., brick and steel factory for O. F. Woodward Company.

Long Island City, L. I., N. Y.—Plans being prepared by William Higginson, 21 Park Row, New York, for two 4-story reinforced concrete factory buildings to be erected for Degnon Realty & Terminal Improvement Company, one to be erected at Anabel Avenue and Creek Street, costing $125,000, and the other on Pearson and Meadow Streets, costing $100,000.

Plans being prepared for 9-story brick and steel addition for National Sugar Refining Co. plant at Pidgeon and Front Streets, cost $100,000.

New York, N. Y.—Plans filed for erecting 16-story fireproof store and factory building at 21 West Thirty-eighth Street for A. B. S. Company, Inc., 238 William Street, cost $200,000. Lucian C. Smith, Archt., 2 West Forty-seventh Street.

Rochester, N. Y.—Contract soon to be let for erecting 50 x 120-ft. brick and steel foundry at Curlew and Villa Streets for Northwestern Brass & Aluminum Company (George H. Hetzler, Manager), 14 Riley Street. J. H. Oberlies, Archt., Granite Building.

Jersey City, N. J.—National Air Cell and Covering Company, 212 Van Brunt Street, Brooklyn, N. Y., will erect a concrete 4-story 80 x 306-ft. factory at South Cove, Jersey City, to cost $100,000.

Beaver, Pa.—Beaver Refrigerator Manufacturing Company planning to rebuild plant on Block House run, destroyed by fire.

New Kensington, Pa.—Plans being prepared by Richard Irvin, Union Bank Building, Pittsburgh, for a $100,000 chemical plant, which the Pittsburgh Salt & Chemical Co. intends erecting here.

Philadelphia, Pa.—Plans being prepared by William Steel & Sons, 1600 Arch Street, for six-story addition to plant of Philadelphia Electric Company at Nineteenth Street and Allegheny Avenue.

Topton, Pa.—Boyertown Burial Casket Company, Topton, will erect a 4-story building, 40 x 126 ft. M. R. Strunk, Superintendent.

Uniontown, Pa.—John Harmon, Uniontown, is architect for one-story concrete and brick foundry and machine shop to be erected on Miller Avenue for Evans Mold & Machine Company.

Wilkes-Barre, Pa.—George F. Welsh, of Wilkes-Barre, is architect for two-story, 162 x 200 ft., reinforced concrete and brick silk mill to be erected for Duplan Silk Company.

Wilmington, Del.—Artillery Fuse Company will erect a plant in South Wilmington to cost $28,000.

Charlotte, N. C.—Charlotte Electric Repair Company, 508 West Fourth Street, has purchased site on the Piedmont & Northern line and will erect plant for repairing and rebuilding electric machinery.

Columbus, Ohio.—Reported Hocking Valley Railway Company (William Michel, Ch. Engr., Columbus) will erect a $250,000 round house and machine shop on Parsons Avenue.

Cleveland, Ohio.—Ohio Bronze Powder, American Sewer Pipe and Cuyahoga Shale Brick Companies reported planning erecting new factories at East 152d Street and Nickel Plate R. R.

East Liverpool, Ohio.—Golding & Sons Flint Mill Company (John M. Manor, General Manager), Fourth Street, contemplates erecting new plant; estimated cost $75,000.

Fremont, Ohio.—Stockholders of Peoples Elevator Company, Fremont, have decided to erect new elevator; probable cost, $30,000.

Portsmouth, Ohio.—Whitaker-Glessner Company, of Wheeling, W. Va., plans erecting 500-ton blast furnace at Portsmouth Works. A by-product coke oven plant is also contemplated.

Fort Wayne, Ind.—Plans and specifications being prepared for an additional five-story and basement, reinforced-concrete and brick building, to be erected at plant of General Electric Company.

Peoria, Ill.—A steel mill is to be erected by Keystone Steel & Wire Company (B. L. Sommer, Mgr.), Peoria. Cost of mill, $450,000. Open-hearth furnaces and roll mill are also to be erected. Total cost, with equipment, $1,760,000.

Cedar Rapids, Iowa.—Quaker Oats Company of Cedar Rapids intends spending $250,000 including enlargement of buildings, etc.

Minneapolis, Minn.—Northrup, King & Company (C. C. Massie, Pres.), 26 Hennepin Avenue, will erect a plant costing $300,000.

St. Paul, Minn.—Single Service Carrier Co., Incorporated, to erect a factory to manufacture containers for perishable products. Capital $50,000. Among incorporators are George W. Hancock and F. G. Bradbury, 202 Dispatch Building.

Oregon City, Ore.—Reported Rasmussen Grace Co., Gates Bldg., Portland, engaged by Hawley Pulp & Paper Company of Oregon City to prepare plans and specifications for a 1000-hp. power plant for the Oregon City mill. Cost, $75,000 to $100,000. Building to house plant to be of reinforced concrete construction.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★Flushing, L. I., N. Y.—Contract for foundation work on the factory buildings of Nathan Manufacturing Company, 101 Park Avenue, New York, awarded Underpinning & Foundation Company, 290 Broadway, New York, Eugene Schoen, 106 East Nineteenth Street, Archt., and Alexander Briciner, 104 West Forty-second Street, both of New York. About 3000 wood piles required. See "Proposed Work."

★Long Island City, L. I., N. Y.—Contract awarded Johnson Sherrane, 38 Park Row, New York, for erecting one-story brick dyeing and printing factory on Paynter Avenue, for Beyer Dyeing & Printing Company, 507 West Fiftieth Street, New York, cost $25,000. Hopkins & McEntee, Archts., 37 East Twenty-eighth Street, New York.

★Utica, N. Y.—Contract awarded by Briggs-Seabury Ordnance Company to Westinghouse Church Kerr Company, 37 Wall Street, New York, for erecting 50 x 300-ft., 4-story and basement factory on Turner Street; cost $90,000.

★Secaucus, N. J.—Contract awarded by Dennis Martin Company of Newark to Guarantee Construction Company, 140 Cedar Street, New York, for erecting group of brick, concrete and frame buildings for a chemical plant on the shore of Hackensack River near Snake Hill, Secaucus.

★Philadelphia, Pa.—Contract for erecting 8-story concrete factory building at Nineteenth Street and Allegheny Avenue for Electric Storage Battery Co. awarded to William Steele & Sons Co., 1600 Arch Street. Estimated cost $250,000.

★Steelton, Pa.—Contracts in connection with 500-ton blast furnace of the Pennsylvania Steel Company awarded as follows: Excavation and concrete work to Raymond Concrete Pile Company, 90 West Street, New York, N. Y., and steel work and erection of steel to Pennsylvania Engineering Works, New Castle, Pa.

★Baltimore, Md.—Contract awarded Consolidated Engineering Co., 243 Calvert Bldg., to erect a 3-story fireproof factory on Parkdale Avenue, near Druid Hill Park, for William E. Hooper & Sons Co., 56 Maryland Life Bldg., cost $60,000.

★Cincinnati, Ohio.—Stegner & Hughes, Architects, 1012 Commercial Tribune Building, have contract for five-story reinforced concrete addition to American Tool Works Co.'s plant at Pearl and Third Streets and Eggleston Avenue; cost, about $300,000.

★Cleveland, Ohio.—Contract awarded W. I. Thompson & Son, 5110 Euclid Avenue, for constructing $80,000 plant for Cleveland Wire Spring Company on Harvard Avenue and East Forty-ninth Street. Engineers, George S. Rider & Co., 512 Century Building.

★Euclid, Ohio.—General contract for constructing plant at Euclid Avenue and Nickel Platte R. R. for Cleveland Milling Machine Co. (Frank S. Shields, Pres.), 218 Engineers' Building, Cleveland, awarded to Samuel Austin & Son Co., 14,230 Euclid Avenue. Cost $800,000.

★Los Angeles, Cal.—Contract for erecting three-story brick factory, 192 x 76 ft., at Pico and Los Angeles Streets, awarded Broadway Construction Company, 235 E. Washington Street, at $26,000. M. H. Olmsted, Earl Automobile Works, will occupy the building. Fred R. Dorn, Archt., 1230 Marsh Story Building.

MISCELLANEOUS

PROPOSED WORK.

Bridgeport, Conn.—See "Paving and Roads."

Transmission Line—Franklin, N. Y.—Franklin & Otsego Light & Power Co. contemplates erecting a transmission line to Sidney Center, a distance of 4 miles. E. A. Mackey, Pres.

Elevator—New York, N. Y.—New electric elevator is to be installed in Margaret Louisa Home of the Y. W. C. A., 14 East Sixteenth Street; also refrigeration and heating in connection with alterations to be made in building. Charles Houghin Higgins, Consulting Engineer and Architect, 30 Church Street.

Park Improvements—Jersey City, N. J.—City Commissioners April 11 appropriated $25,000 for improvements in Reservoir Park.

Park Improvements—Chicago, Ill.—Citizens April 4 voted $1,000,000 bonds for Lincoln Park system and Irving Park Boulevard. Deorge T. Donoghue, Engineer, Clark and Center Streets.

Elevator—Omaha, Neb.—Cost of installing elevators in city hall estimated by architect at $28,200. Address City Clerk.

Transmission Line — Emma, Mo.—Reported Emma Creamery Co. contemplates constructing a transmission line from Sweet Springs to Emma for power purposes.

Transmission Line—Wallace, Idaho.—City Council granted to Washington Water Power Co. of Spokane permission to erect transmission lines through streets and alleys of Wallace to enable company to supply energy to several mining properties under development on Placer Creek.

BIDS DESIRED.

Road Oil—Boston, Mass.—Until April 25, by Supply Department (D. Frank Doherty, Supt.), for 200,000 gal., more or less, non-asphaltic road oil, in such quantities as may be directed from April 25, 1916, to Dec. 31, 1916.

Stone Crusher—Newton, N. J.—Until April 28, by Town Committee, for a new stone crusher equipped with a set of Manganese steel crushing plates.

Road Roller—Atlanta, Ga.—Until April 29 by County Commissioners of Roads and Revenues for two 10-ton double cylinder three-wheel steam road rollers with or without scarifier attachment ,advertised in Engineering Record. C. M. Holland, Purchasing Agent, 507 Court House, Atlanta.

Elevator—Pensacola, Fla.—Until May 6, by Bureau Yards & Docks, Navy Dept., Washington, D. C., for furnishing and installing a freight elevator at the naval aeronautic station, Pensacola.

Street Signs—Rock Island, Ill.—Reported desired until April 30, by City Clerk, for furnishing about 1900 street signs.

Swimming Pool—Houston, Tex.—Until April 24, by E. E. Bonney, City Secretary, for constructing a shelter house, pergola and swimming pool, in Elizabeth, Baldwin Park. M. J. Sullivan, City Archt.

Concrete Mixer — Ottawa, Ont. — Until April 25, by Secretary Board of Control, for a concrete mixer ½ yr. either steam or gasoline. F. C. Askwith, Acting City Engineer.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★Manhole Frames—Boston, Mass.—Contract for furnishing 25 tons of cast-iron manholes and frames and covers by Boston Transit Commission (bids opened April 13) awarded to Gibby Foundry Company, Boston, at $1,618.

★Heating Plant—South Bend, Ind.—St. Joseph Heating Co., recently incorporated, with F. A. Bryan as President and C. B. Calvert Secretary, has awarded contracts as follows for constructing a heating plant to furnish heat to the city, franchise for which was recently granted to them: To American District Steam Co. of North Tonawanda, N. Y., installation of underground equipment; trenching, to Hobart & Roach, South Bend.

★Cement—Lansing, Mich.—Contract for furnishing asphalt cement for 1916 awarded Cleveland Trinidad Paving Co., Cleveland, Ohio, at $20.98 per ton new in iron drums.

Road Oil — Clayton, Mo.—Lowest bid opened by County Court for furnishing road oil for laying dust of road of county was submitted by Pierce Oil Corporation at 3.9 cts. per gal. About $27,215 was spent last year for this purpose.

★Cement — Chehalis, Wash. — Contract awarded Washington Portland Cement Company, Seattle, for furnishing 10,000 bbl. cement for country roads at $1.56 per bbl. at factory. D. W. Montfort, County Auditor.

Citrus Experiment Station—Berkeley, Cal.—Following are four lowest bids opened by Board of Regents of University of California for erecting a citrus experiment station; including 55,000 gal. reinforced concrete reservoir, 160,000 gal. oil lined earth reservoir; 4480 ft. irrigation pipe lines, 2420 ft. domestic water supply pipes, and 2 pump houses: Hudson & Shaw, 733 Central Building, Los Angeles, $8,177; Cresmer Mfg. Company, Riverside, $8,814; James H. Jacobs Construction Company, H. W. Hellman Building, Los Angeles, $9,975, and Johnson & Shea, Riverside, $19,500.

Proposals

For Proposals Advertised, See Pages 43, 44, 45 and 46.

WATERWORKS.

Bids Close.		See Eng. Record.
Apr. 25.	Filter System, Cleveland, Ohio	Apr. 22
Apr. 26.	Pipe, Etc., Lebanon, Pa. Adv. Apr. 15.	Apr. 15
Apr. 26.	Meters, Harrisburg, Pa.	Apr. 22
Apr. 26.	Pipe, Chicago, Ill.	Apr. 22
Apr. 28.	Pipe, Chicago, Ill.	Apr. 22
May 1.	Pump, Middletown, Ohio.	Apr. 8
May 1.	Pipe, Harrisburg, Pa.	Apr. 22
May 1.	Mains, Hutchinson, Kan.	Apr. 22
May 1.	Engine, Blue Earth, Minn.	Apr. 22
May 2.	Filtration Plant, Columbia, S. C.	Apr. 22
May 2.	Hydrants, Jersey City, N. J.	Apr. 22
May 3.	Water Works, Wilson, Okla.	Apr. 22
May 5.	Mains, Etc., Wadena, Minn.	Apr. 22
May 8.	Meters, Portland, Ore.	Apr. 22
May 8.	Pipe, Washington, D. C.	Apr. 22
May 9.	Filtration Plant, New Brunswick, N. J. Adv. Apr. 15, 22.	Apr. 15
May 9.	Contract 147, New York, N. Y. Adv. Apr. 22.	Apr. 22
May 12.	Filtration Plant, Wilmington, Del. Adv. Apr. 22.	Apr. 22
May 15.	Water Works, Yoncalla, Ore.	Apr. 8
Jun. 1.	Water Works, Madison, W. Va.	Apr. 22

SEWERAGE AND SEWAGE DISPOSAL.

Bids Close.		See Eng. Record.
Apr. 24.	Niles, Ohio Adv. Apr. 15, 22.	Apr. 15
Apr. 24.	Providence, R. I.	Apr. 22
Apr. 25.	Lakewood, Ohio. Adv. Apr. 15, 22.	Apr. 15
Apr. 26.	Binghamton, N. Y. Adv. Apr. 1 to 22.	Apr. 1
Apr. 27.	Xenia, Ohio	Mar. 25
Apr. 27.	Urbana, Ohio	Apr. 15
Apr. 29.	Columbus, Wis.	Apr. 22
May 1.	Anoka, Minn.	Apr. 8
May 1.	Hutchinson, Kan.	Apr. 15
May 1.	Harrisburg, Pa.	Apr. 15
May 1.	Wessington, S. D. Adv. Apr. 15, 22.	Apr. 16
May 1.	Louisville, Ky.	Apr. 22
May 1.	Lake Crystal, Minn.	Apr. 22
May 1.	Victoria, Tex.	Apr. 22
May 2.	Alton, Ill.	Apr. 15
May 2.	Montreal, Que.	Apr. 22
May 2.	Hartford, Conn.	Apr. 22
May 3.	Chicago, Ill. Adv. Apr. 15, 22.	Apr. 15
May 5.	Ipswich, S. C.	Apr. 22
May 5.	Mt. Horeb, Wis.	Apr. 22
May 8.	Riverside, N. J. Adv. Apr. 22.	Apr. 22
May 8.	Newark, Del. Adv. Apr. 22.	Apr. 22
May 15.	Oatman, Ariz.	Apr. 22

BRIDGES.

Apr. 25.	Reading, Pa.	Apr. 15
Apr. 25.	Crookston, Minn.	Apr. 15
Apr. 25.	Maine Adv. Apr. 15.	Apr. 15
Apr. 27.	St. Helens, Ore.	Apr. 8
Apr. 27.	Corning, N. Y. Adv. Apr. 8.	Apr. 8
Apr. 27.	Estobicoke, Ont.	Apr. 22
Apr. 29.	Johnson Creek, Wis.	Feb. 26
Apr. 29.	Johnson Creek, Wis.	Apr. 1
Apr. 29.	Terre Haute, Ind. Adv. Apr. 22.	Apr. 22
May 1.	Amarillo, Tex.	Mar. 18
May 1.	Odessa, Wash.	Apr. 1
May 1.	Eagle Bend, Minn.	Apr. 15
May 1.	Buffalo, Okla.	Apr. 15
May 1.	Los Angeles, Cal.	Apr. 15
May 1.	Croton Falls, N. J.	Apr. 22
May 1.	Marietta, Okla.	Apr. 22
May 1.	Santa Barbara, Cal.	Apr. 22
May 2.	Concrete, Wash.	Apr. 15
May 2.	Paducah, Ky.	Apr. 22
May 2.	Rensselaer, Ind.	Apr. 22
May 6.	Bridgeport, Conn. Adv. Apr. 15.	Apr. 15
May 8.	Los Angeles, Cal.	Apr. 22
May 9.	Manhattan, Kan.	Apr. 15
May 9.	Summerville, W. Va.	Apr. 15
May 20.	Lyndhurst, N. J.	Mar. 18
Jun. 5.	Cumberland, Md.	Apr. 22
Jun. 8.	El Dorado, Kan.	Apr. 8

PAVING AND ROADS.

Bids Close.		See Eng. Record.
Apr. 25.	Bucyrus, Ohio Adv. Apr. 1 to 22.	Apr. 1
Apr. 25.	Britt, Iowa	Apr. 8
Apr. 25.	Lewiston, Idaho	Apr. 8
Apr. 25.	Woonsocket, R. I. Adv. Apr. 8, 15.	Apr. 8
Apr. 25.	Dayton, Ohio.	Apr. 8
Apr. 25.	Belleville, N. J.	Apr. 15
Apr. 25.	McKinney, Tex.	Apr. 15
Apr. 25.	Piqua, Ohio Adv. Apr. 15.	Apr. 15
Apr. 25.	Maine. Adv. Apr. 15.	Apr. 15
Apr. 25.	Hallock, Minn.	Apr. 22
Apr. 25.	Philadelphia, Pa.	Apr. 22
Apr. 25.	Ottawa, Ont.	Apr. 22
Apr. 25.	Massachusetts	Apr. 22
Apr. 25.	Kansas City, Mo.	Apr. 22
Apr. 25.	Steubenville, Ohio	Apr. 22
Apr. 26.	Indianapolis, Ind.	Apr. 22
Apr. 26.	Brooklyn, N. Y.	Apr. 22
Apr. 26.	Paterson, N. J.	Apr. 22
Apr. 26.	Struthers, Ohio	Apr. 22
Apr. 27.	Corning, N. Y. Adv. Apr. 8.	Apr. 8
Apr. 27.	Newark, N. J.	Apr. 15
Apr. 27.	Winchester, Ind.	Apr. 15
Apr. 27.	Chicago, Ill.	Apr. 22
Apr. 27.	Philadelphia, Pa. Adv. Apr. 22.	Apr. 22
Apr. 28.	West Union, W. Va.	Apr. 8
Apr. 28.	Spokane, Wash.	Apr. 8
Apr. 28.	Plymouth, Ind.	Apr. 15
Apr. 28.	Albany, N. Y. Adv. Apr. 15, 22.	Apr. 15
Apr. 28.	Ohio	Apr. 22
Apr. 28.	Philadelphia, Pa.	Apr. 22
Apr. 28.	Orifino, Idaho	Apr. 22
Apr. 28.	Indianapolis, Ind.	Apr. 22
Apr. 29.	Indiana	Apr. 15
Apr. 29.	Golden, Col. Adv. Apr. 15, 22.	Apr. 15
Apr. 20.	Jackson, Tenn.	Apr. 1
May 1.	Galion, Ohio	Mar. 18
May 1.	Eveleth, Minn.	Mar. 18
May 1.	Pontiac, Ill.	Apr. 1
May 1.	Winlock, Neb.	Apr. 1
May 1.	Urbana, Ohio	Apr. 8
May 1.	Hazard, Ky.	Apr. 8
May 1.	Hartford, Conn. Adv. Apr. 8 to 22.	Apr. 8
May 1.	Newton, N. J. Adv. Apr. 8 to 22.	Apr. 8
May 1.	Colfax, Wash.	Apr. 15
May 1.	Winchester, Ind.	Apr. 15
May 1.	Washington, D. C.	Apr. 15
May 1.	Seattle, Wash.	Apr. 15
May 1.	Indiana	Apr. 15
May 1.	Wichita, Kan.	Apr. 22
May 1.	Brownstown, Ind.	Apr. 22
May 1.	Gulfport, Miss. Adv. Apr. 22.	Apr. 22
May 1.	Grenada, Miss.	Apr. 22
May 1.	Salina, Kan.	Apr. 22
May 1.	Indiana	Apr. 22
May 1.	Delaware, Ohio.	Apr. 22
May 2.	Seattle, Wash.	Apr. 15
May 2.	Indiana	Apr. 15
May 2.	Albany, N. Y. Adv. Apr. 15, 22.	Apr. 15
May 2.	Booneville, Ind.	Apr. 15
May 2.	Woonsocket, R. I. Adv. Apr. 15, 22.	Apr. 15
May 2.	Mt. Vernon, Wash.	Apr. 15
May 2.	Salt Lake City, Utah	Apr. 22
May 2.	Wilkes-Barre, Pa. Adv. Apr. 22.	Apr. 22
May 2.	Urbana, Ohio	Apr. 22
May 2.	Saginaw, Mich. Adv. Apr. 22.	Apr. 22
May 2.	St. Louis, Mo.	Apr. 22
May 2.	Indiana	Apr. 22
May 2.	Alton, Ill. Adv. Apr. 22.	Apr. 22
May 3.	Ligonier, Ind.	Apr. 22
May 3.	Freehold, N. J.	Apr. 22
May 3.	Chehalis, Wash.	Apr. 22
May 3.	Indianapolis, Ind.	Apr. 22
May 3.	Indiana	Apr. 22
May 4.	Laurel, Miss.	Apr. 22
May 5.	Albany, N. Y. Adv. Apr. 15, 22.	Apr. 15
May 5.	Cincinnati, Ohio	Apr. 22
May 8.	Bushnell, Fla.	Apr. 22
May 8.	Marshalltown, Iowa	Apr. 22
May 8.	Keyport, N. J. Adv. Apr. 22.	Apr. 22
May 9.	Angola, Ind. Adv. Apr. 22.	Apr. 22
May 9.	Modesto, Cal.	Apr. 22
May 12.	North Platte, Neb.	Apr. 22
May 15.	Bay Minette, Ala.	Apr. 22
May 15.	Lebanon, Pa.	Apr. 22
May 16.	South Bend, Ind. Adv. Apr. 22.	Apr. 22
May 22.	Jefferson, Ohio	Apr. 22
Jun. 2.	Great Falls, Mont.	Apr. 22
July 10.	Caldwell, Tex.	Apr. 22

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS.

Apr. 24.	Hyd. Machinery, Wheeling, W. Va. Adv. Apr. 8 to 22.	Apr. 8
Apr. 25.	Drain, Hastings, Mich.	Apr. 8
Apr. 25.	Channel, Maple Park, Ill.	Apr. 15
Apr. 25.	Pittsburgh, Pa.	Apr. 22
Apr. 26.	Lock Gates, Etc., Pittsburgh, Pa. Adv. Apr. 1 to 22.	Apr. 1
Apr. 26.	Dredging, Buffalo, N. Y. Adv. Apr. 1 to 22.	Apr. 1
Apr. 26.	Riprap, Tompkinsville, N. Y.	Apr. 8
Apr. 26.	Dredging, Wilmington, Del.	Apr. 8
Apr. 26.	Mt. Vernon, Wash.	Apr. 22
Apr. 26.	Moscow, Idaho.	Apr. 22
Apr. 27.	Dock, San Francisco, Cal. Adv. Apr. 1 to 15.	Apr. 1
Apr. 27.	Levee, Pittsfield, Ill.	Apr. 22
Apr. 28.	Wharf, Houston, Tex. Adv. Apr. 1.	Apr. 1
Apr. 28.	Stone, Philadelphia, Pa.	Apr. 15
Apr. 28.	Irrigation, Alpaugh, Cal.	Apr. 22
Apr. 28.	Ditch, Spirit Lake, Iowa.	Apr. 22
Apr. 28.	Ditch, La Sueur Center, Minn.	Apr. 22
Apr. 29.	Riprap and Capstones, Wilmington, N. C. Adv. Apr. 1 to 22.	Apr. 1
Apr. 29.	Dredging, San Francisco, Cal.	Apr. 8
Apr. 29.	Irrigation, Anderson, Cal.	Apr. 15
May 1.	Wharf, Etc., Honolulu, Hawaii.	Mar. 25
May 1.	Cribwork, Etc., Toronto, Ont.	Apr. 22
May 1.	Gates, Etc., Lincoln, Neb.	Apr. 22
May 1.	Norwood, Ohio.	Apr. 22
May 2.	Sea Wall, Fort Pierce, Fla.	Apr. 22
May 3.	Reclamation Work, Powell, Wyo.	Apr. 15
May 4.	Dredging, New York, N. Y. Adv. Apr. 8 to 22.	Apr. 8
May 5.	Irrigation, Ft. Shaw, Mont. Adv. Apr. 8.	Apr. 8
May 5.	Drainage, Princeton, Ill.	Apr. 22
May 6.	Leasing Land and Water for Power Purposes, Louisville, Ky. Adv. Mar. 11.	Mar. 11
May 6.	Miami, Fla.	Apr. 22
May 8.	Dredging, Wilmington, Del. Adv. Apr. 15, 22.	Apr. 15
May 9.	Ditch, St. James, Minn.	Apr. 22
May 10.	Dredging, Buffalo, N. Y. Adv. Apr. 15, 22.	Apr. 15
May 10.	Dredging, Los Angeles, Cal.	Apr. 22
May 12.	Lebanon, Pa. Adv. Apr. 22.	Apr. 22
May 15.	Dredging, Bridgeport, Conn. Adv. Apr. 15, 22.	Apr. 15
May 22.	Irrigation, Fort Laramie, Wyo. Adv. Apr. 22.	Apr. 22
May 25.	Irrigation, St. Ignatius, Mont. Adv. Apr. 22.	Apr. 22
———	Sublet Levee Work, Chicago, Ill. Adv. Apr. 1.	Apr. 1
———	Levee Grading, Vincennes, Ind. Adv. Apr. 8, 15.	Apr. 8

PUBLIC BUILDINGS AND SCHOOLS.

Bids Close.		See Eng. Record.
Apr. 24.	Pittsburgh, Pa.	Apr. 22
Apr. 25.	Dover, Ohio	Apr. 8
Apr. 25.	Cochrane, Ont.	Apr. 15
Apr. 25.	Uniontown, Pa.	Apr. 15
Apr. 25.	Boardman, Ohio.	Apr. 15
Apr. 25.	Wascousta, Mich.	Apr. 15
Apr. 25.	Osnabrock, N. D.	Apr. 22
Apr. 25.	Madison, S. D.	Apr. 22
Apr. 26.	Evansville, Ind.	Mar. 25
Apr. 26.	Newark, N. J.	Apr. 8
Apr. 26.	Mason City, Iowa	Apr. 15
Apr. 26.	Lyons, Kan.	Apr. 22
Apr. 27.	Portland, Ind. Adv. Mar. 25.	Mar. 25
Apr. 27.	Wheelersburg, Ohio	Apr. 15
Apr. 27.	Bangor, Wis.	Apr. 22
Apr. 28.	New Orleans, La.	Mar. 11
Apr. 28.	Carbondale, Pa.	Apr. 15
Apr. 28.	Warsaw, Wis.	Apr. 22
Apr. 29.	Strongville, Ohio	Apr. 1
Apr. 29.	Indian Head, Md.	Apr. 15
Apr. 29.	Lebanon, Ind.	Apr. 15
Apr. 29.	Atwood, Ill.	Apr. 22
Apr. 29.	Racine, Wis.	Apr. 22
Apr. 30.	New Bedford, Mass.	Apr. 15
May 1.	Gaylord, Minn.	Apr. 15
May 1.	Norton, Kan.	Apr. 15
May 1.	Rensselaer, Ind.	Apr. 15
May 1.	Harrisburg, Pa.	Apr. 22
May 1.	Stillwater, Okla.	Apr. 22
May 1.	Frederick, Md. Adv. Apr. 22.	Apr. 22
May 1.	Williams Bay, Wis.	Apr. 22
May 1.	Norfolk, Neb.	Apr. 22
May 1.	Kimberly, Idaho.	Apr. 22
May 2.	Little Sioux, Iowa	Apr. 15
May 2.	Brainerd, Minn.	Apr. 15
May 2.	Oaklandon, Ind.	Apr. 15
May 2.	Burbank, Cal.	Apr. 22
May 3.	Conesville, Ohio	Apr. 15
May 3.	Illinois	Apr. 22
May 3.	Jersey City, N. J.	Apr. 22
May 4.	Douds Leando, Iowa	Apr. 15
May 4.	Woodlawn, Pa.	Apr. 22
May 4.	Lorain, Ohio	Apr. 22
May 5.	Selma, Iowa	Apr. 15
May 5.	Dow City, Iowa	Apr. 22
May 5.	New Albion, Iowa	Apr. 22
May 6.	Medina, Ohio	Apr. 22
May 8.	Elkins, W. Va.	Mar. 25
May 8.	Dannemora, N. Y. Adv. Apr. 22.	Apr. 22
May 10.	Evansville, Ind.	Apr. 8
May 10.	Fertile, Iowa	Apr. 22
May 10.	Waldorf, Minn.	Apr. 22
May 12.	Woonsocket, R. I.	Apr. 22
May 13.	Norfolk, Va.	Apr. 15
May 13.	Seeville, Ohio	Apr. 22
May 13.	Little Sioux, Iowa	Apr. 22
May 15.	Newport, R. I.	Apr. 8
May 15.	Ft. Huachuca, Ariz. Adv. Apr. 15, 22.	Apr. 15
May 15.	Mayer, Minn.	Apr. 22
May 15.	Selma, Iowa	Apr. 22
May 16.	Merced, Cal.	Apr. 22
May 17.	Little Falls, Minn.	Apr. 15
May 18.	Durango, Col.	Apr. 15
May 19.	Wenatchee, Wash.	Apr. 15
May 20.	Cordova, Alaska	Apr. 15
May 25.	Butler, Pa.	Mar. 1

PRIVATE BUILDINGS.

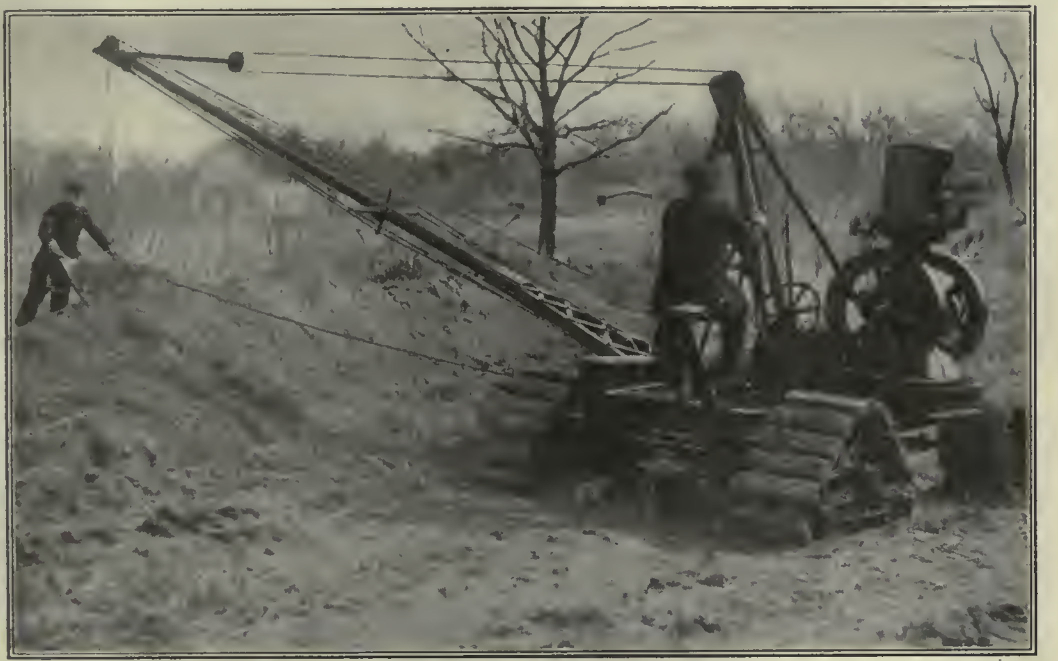
Apr. 25.	Hartford, Conn.	Apr. 8
Apr. 25.	Topeka, Kan.	Apr. 15
Apr. 25.	Marion, Ill.	Apr. 22
Apr. 25.	Elmira, N. Y.	Apr. 22
Apr. 25.	Clear Lake, Iowa	Apr. 22
Apr. 25.	Worcester, Mass.	Apr. 22
Apr. 25.	Suffolk, Va.	Apr. 22
Apr. 26.	Philadelphia, Pa.	Apr. 22
Apr. 26.	Lake Benton, Minn.	Apr. 22
Apr. 26.	Portland, N. D.	Apr. 22
Apr. 27.	Flandreau, S. D.	Apr. 15
Apr. 28.	Belt, Mont.	Apr. 22
Apr. 30.	Chester, Pa.	Apr. 22
May 1.	Akron, Ohio.	Mar. 18
May 1.	San Bernardino, Cal.	Apr. 8
May 1.	Chicago, Ill.	Apr. 22
May 1.	Hartford, Conn.	Apr. 22
May 1.	Hutchinson, Minn.	Apr. 22
May 1.	Jamestown, N. D.	Apr. 22
May 1.	Philadelphia, Pa.	Apr. 22
May 3.	Mason City, Iowa	Apr. 22
May 8.	Scott City, Kan.	Apr. 22
May 10.	Mason City, Iowa	Apr. 22
May 11.	Sheffield, Iowa	Apr. 22
May 15.	Washington, N. J.	Apr. 22
May 17.	Ebensburg, Pa.	Apr. 22

MISCELLANEOUS.

Apr. 24.	Concrete mixer, Montclair, N. J. Adv. Apr. 15.	Apr. 15
Apr. 25.	Fences, Contract 173, New York, N. Y. Adv. Apr. 8.	Apr. 8
Apr. 25.	Tunnels, Dixon, Ill.	Apr. 15
Apr. 25.	Concrete Mixer, Ottawa, Ont.	Apr. 22
Apr. 25.	Road Oil, Boston, Mass.	Apr. 22
Apr. 26.	Supplies, Panama	Apr. 15
Apr. 25.	Centrifugal Pump, Boilers, Etc., Pasadena, Cal.	Apr. 15
Apr. 27.	El. Ry., New York, N. Y.	Apr. 15
Apr. 27.	Asphaltum, Etc., Panama	Apr. 1
Apr. 28.	Rutherford, N. J.	Apr. 15
Apr. 28.	Stone Crusher, Newton, N. J.	Apr. 22
Apr. 29.	Steel Towers, Keyport, Wash.	Apr. 15
Apr. 29.	Road Roller, Atlanta, Ga. Adv. Apr. 22.	Apr. 22
Apr. 30.	Cement, Etc., Westmount, Que.	Apr. 1
Apr. 30.	Street Signs, Rock Island, Ill.	Apr. 22
May 1.	Cement, Washington, D. C.	Apr. 15
May 1.	Oil, Etc., Ambler, Pa.	Apr. 22
May 2.	Automatic Sprinkling System in Almshouse, Hartford, Conn.	Apr. 15
May 3.	Ventilating Apparatus, Richmond, Va.	Apr. 15
May 4.	Steps, Etc., Jefferson City, Mo.	Apr. 8
May 6.	Elevator, Pensacola, Fla.	Apr. 22
May 8.	Vacuum Cleaning, Los Angeles, Cal.	Apr. 15
Jun. 15.	Cross Ties, Anchorage, Alaska	Apr. 15
May 15.	Concrete Walls, Etc., Mandan, N. D. Adv. Apr. 15.	Apr. 15
May 15.	Terracing Hill, Mandan, N. D. Adv. Apr. 15.	Apr. 15
May 22.	Derrick Boat, Norfolk, Va. Adv. Apr. 22.	Apr. 22
———	Heating Plant, Tucson, Ariz. Adv. Apr. 15.	Apr. 15

Back Filler Is Equipped With Caterpillar Traction

What is thought to be the first back-filling machine with caterpillar traction is that recently perfected by the Parsons Company, of Newton, Iowa. The outfit, as shown in the illustration, is offered with either Parco traction or wheel drivers and is said to have many valuable features, among which are a boom that can be swung alongside the machine without removing it, a band brake on the traction drive that permits safe unloading from cars or on a heavy grade, and the method of power transmission—by a multiple-disc clutch, direct connected to the drive shaft.



THIS BACK-FILLING MACHINE IS SAID TO BE THE ONLY ONE HAVING CATERPILLAR TRACTION

The manufacturer claims that the Parsons back-filler will not slip sidewise. A tipping test, putting five men weighing 825 lb. on the end of the boom, was tried without causing the machine to overturn.

The traction speed of the machine is from 1¼ to 1½ miles per hour, while the average operating speed is four loads a minute.

Youngstown Sheet and Tube Company Buys $7,000,000 Properties

By a cash payment of $2,500,000, made on April 11, the Youngstown Sheet & Tube Company bought capital stock in the Andrews & Hitchcock Iron Company involving the use of property estimated at $7,000,000. This includes the two blast furnaces at Hubbard, Ohio, each with a daily capacity of 400 tons, ore rights in a one-twelfth interest in the Mahoning ore mine in the Mesabi range, Minnesota, and over 2000 acres of land in Greene County, Pa., and Hubbard County, Ohio. The total annual capacity of the Youngstown Sheet & Tube Company will then be 1,050,000 tons, or, with the putting into operation of the three new open-hearth furnaces at East Youngstown, Ohio, about July 1, the yearly capacity will be about 1,200,000 tons of steel ingots.

Asphaltic Pavement with Slag Aggregate

There was laid in the city of McKeesport, Pa., in the fall of 1910 an experimental pavement composed of a specially prepared asphalt and a mineral aggregate of finely crushed slag and a good proportion of the usual dust or "filler." This type of pavement received the name of "Bitoslag" and is stated after five years of service under heavy traffic to have required no maintenance cost. The same type of construction was next applied in October, 1915, when it was laid in the section of Philadelphia known as Germantown.

The specifications for the new pavement call for an aggregate of carefully selected, hard, air-cooled blast-furnace slag, so crushed that all particles will pass a ¼-in. screen. The grading is carefully specified. A similar careful specification is provided for the filler. The requirements for preparation call for the heating of the mineral aggregate to a temperature of 350 to 450 deg. Fahr., followed by the addition of the required amount of filler. A residium, obtained from asphaltic petroleum, is then added to the extent of 2 per cent of the combined weight of slag and filler, and the whole mixed until the residium is thoroughly incorporated. A predetermined amount of molten "Improved Bitoslag Paving Cement" is then added and the mixing operation further continued until the entire mass is uniform. The amount of paving cement is determined by the variations in the mesh constituent of the slag and filler. The material is laid hot and then rolled so that the wearing surface shall not be less than 2 in. in thickness.

The pavement is controlled by the Bitoslag Paving Company, with offices at 90 West Street, New York City.

Pump Companies Consolidate

The properties of the International Steam Pump Company and those of all its subsidiaries, with the exception of Henry P. Worthington, have been acquired by the recently incorporated Worthington Pump & Machinery Company, of New York City.

Business Notes

The Pennsylvania Wire Glass Company of Philadelphia has removed its New York office to 20 West Thirty-fourth Street.

Rensselaer Valve Manufacturing Company has moved its general sales office to new quarters at 50 Church Street, New York City.

Harry Channon has been elected president of the McMaster-Carr Supply Company of Chicago, and James A. Delaney has been made vice-president.

The Dunn Wire Cut Lug Brick Company of Conneaut, Ohio, has purchased the plant and business of the Indiana Paving Brick & Block Company of Brazil, Ind.

Harry L. Musser, who was formerly connected with the McMyler Interstate Company, has been appointed sales manager of the G. H. Williams Company of Erie, Pa.

G. H. Williams Company of Erie, Pa., has been reorganized and the following officers elected: President and treasurer, C. C. Williams; secretary, J. C. Mathews; assistant secretary, E. F. Jones.

E. S. Cullen, who has been connected with the Niles-Bement-Pond Company for a number of years, has opened offices in the Leader-News Building, Cleveland, under the name of the E. S. Cullen Machinery Company.

R. W. Hawkins, until recently connected with the H. Channon Company of Chicago, has organized the firm of Hawkins & Company, with offices at 79 West Monroe Street, Chicago, to engage in the machinery and mill-supply business.

O. G. Smith, formerly connected with the Platt Iron Works Company of Dayton, Ohio, has been appointed district manager for the National Transit Pump & Machine Company, in charge of the new branch in the Marquette Building, Chicago.

The Pittsburgh-Des Moines Company has purchased all accounts and assumed all liabilities of the Des Moines Bridge & Iron Works. The business of the Des Moines company will be conducted under the same management and methods as heretofore.

The Pacific Tank & Pipe Company of San Francisco, Cal., has moved its office to the Trust & Savings Building. This concern has also just completed the erection of a new plant at East Wilmington, with greatly improved facilities for handling business.

Alexander C. Brown has been promoted from the position of vice-president of the Brown Hoisting Machinery Company to that of general manager.

The Southern Pine Association, Interstate Building, New Orleans, is having a number of duplicates of the chart showing the application of the density rule for grading Southern yellow pine made for their display at the Building Material Exhibit in Chicago, the rooms of the Illinois Society of Architects and other places where they may be constantly inspected by those interested in the subject. The first chart was exhibited by the association at the National Railway Appliances Show in Chicago, March 21-23.

Trade Publications

Link Belt Company, Chicago, book 238, 6¼ x 3½ in.; 8 pages, shows two types of grab buckets, handling all kinds of material.

League of Minnesota Municipalities, Minneapolis, Minn. "Minnesota Municipalities," a new 7 x 10 in. bi-monthly magazine for circulation among municipal officers of Minnesota.

The Strauss Bascule Bridge Company, Chicago, Ill., booklet, 8½ x 5¼ in., 16 pages, illustrated, accompanied by packet 10½ x 5 in. of 22 illustrations of Strauss Bascule bridges built and under construction.

Reinforced Concrete Pipe Company, Chicago, catalog, 10 x 7 in., 32 pages, illustrated. Advocates reinforced concrete pipe for general use in sewers and tells how company arranges to handle work with local labor.

Redwood Manufacturers Company, San Francisco, Cal., Catalog 7, 6 x 9¼ in., 110 pages, illustrated. Contains many valuable tables and worked out examples to be used in connection with pipe installations.

The Colorado Culvert & Flume Company, Pueblo, Col., catalog 16-A, 11 x 8½ in., 32 pages, illustrated. Tells advantages of the No-Lap joint and contains tables and diagrams valuable for use in irrigation work.

The Kilbourne & Jacobs Manufacturing Company, Columbus, Ohio, catalog 41, 6 x 9 in., 30 pages, illustrated. Describes standardized line of wheelbarrows and scrapers made by this company and contains tables and an index.

Universal Form Clamp Company, Chicago, booklet, 5 x 8 in., 36 pages, illustrated. Describing the Universal form clamp, tightening wrench, rod puller, wire clamp and easy chair, accompanied by many photographs of actual work.

The Labor and Material Situation

How It Will Affect Construction Work—Summary of Important Jobs Announced and Let

As THE construction season develops it becomes more evident that prices of materials will not limit the volume of construction work. Aside from steel, which, after all, is not the largest financial factor in construction investment, few materials are finding a large export outlet. Attention has been called to the general increases of several hundred per cent in ocean freight rates, due to the scarcity of vessels, which has limited the development of trade with South America and other countries in cement and similar materials. Most of these products, therefore, will have to be consumed at home, and this factor should prevent an undue rise in prices. While it is true that deliveries on new orders of reinforcing bars and structural material are slow, still enough of such steel has already been sold to account for a great deal of construction work. The freight congestion is being relieved as new equipment is put in service, and other conditions become effective, so that it may be expected to improve from now on. A month ago the car shortage was seriously affecting the lumber industry, while now lumber is moving in better volume. The Western mills and the Southern mills on a few lines are able to get empty cars at a better rate. Money for construction work is still forthcoming, apparently in any volume. New York City recently sold a large issue of bonds at a price bringing the lowest interest return of any issue in years.

The whole situation seems to narrow down to the question of how much work can be carried out with the available labor. A large number of industries have been able to export their products in greatly increased volume to Europe, and plants have been enlarged and more men put on in sufficient numbers to account for a great part of the floating supply of labor, especially in the East. Large strikes have occurred, but it is not likely that the supply of idle labor will be much increased in this way. Settlements are effected quickly, as was the case with the strike on the New York subway work. In general, the country has too much at stake to permit any large part of its laboring population to remain idle. A year ago the labor agencies in many sections were doing little business, because there was little demand for men. To-day they are doing little business because there are few men to be had. The street fronts of their offices are plastered with advertisements for men, whereas last year an agent was lucky if he had a single poster to show on his bulletin board. It is feared that this labor shortage will be felt not only by contractors but by the manufacturers of construction materials and contractors' supplies. This has already occurred in the cement industry. It is said, however, that the brick yards in the New York territory were able to open the season with a good force of laborers, many of whom returned from winter work at higher wages in steel plants.

It is obvious that the South, where most of the common labor is native, is in less danger of a shortage than the rest of the country, and that the East, where practically all of the labor is foreign born, and where the heaviest demands from manufacturing establishments have been met, will be the most affected. It will be remembered that fewer immigrants reached this country in the last six months of 1915 than during many single months between 1912 and the beginning of the war. It is likely that the large proportion of this class of labor that is employed in the steel industry will be kept busy at their present jobs for at least a year, and the steel industry is itself now in need of more labor. If this country should get into difficulties with Mexico or should become involved in the European war the supply of labor might at once be heavily drawn on to recruit an army. It is especially significant that construction men would be needed in large numbers, and could be better spared than employees in manufacturing lines, most of which must be kept going to supply an army.

On the whole, it appears to be safe to count on at least some increase in wages on construction work, and to plan in laying out new work to use construction plant wherever possible to save labor.

Buildings

A factory contracted for at Newark, N. J., will cost $235,000. A contract has been let for building a university library to cost $175,000 at South Bend, Ind. Contracts for the court house at Prescot, Ariz., totaling $225,000 have been awarded. The prospective building work noted includes: Brooklyn and New York City, plans filed for $450,000 loft building, $250,000 loft building and $275,000 apartment house; Paterson, N. J., architects engaged, two school buildings, cost $350,000; Philadelphia, $2,500,000 school bonds sold; Cleveland, bonds for $500,000 addition to stock yards reported issued; St. Paul, plans prepared, $2,300,000 hotel; plans being prepared, $660,000 athletic club; Muskogee, Okla., railroad shops planned, cost $250,000; Lewistown, Mont., $200,000 bank building planned; Soap Lake, Wash., plans being prepared, $250,000 sanitorium; Long Beach, Cal., plans being prepared, $750,000 theater.

Bridges and Roads

It is reported that contracts for the bridges at Miami, Fla., have been awarded at a total of $103,000. A viaduct to be built at Simpson, Pa., will cost $150,000. Plans have been completed for the bridge over the Willamette River at Salem, Ore., which will cost $200,000. It is reported that concrete bridges to be built by the Santa Fé between San Diego and Los Angeles will cost $1,000,000.

The following lettings of road and paving work are noted: Hartford, Conn., paving contract awarded, $79,000; Albany, N. Y., bids opened, four highway contracts, $514,000; Portsmouth, Va., road contract awarded, $140,000; Morrison, Ill., paving contract awarded, $92,000; Kansas City, Kan., five paving contracts awarded; Seattle, bids opened, paving work to cost $95,000.

Bids are desired for road work costing $137,000 at Lockport, N. Y., and for 40,000 sq. yd. of pavement at Wilson, N. C. Prospective work noted includes: New Jersey, large amount of county road work; Cincinnati, road work costing $82,000 authorized; Shreveport, La., tax voted to build 100 miles of roads; Muncie, Ind., $1,000,000 to be spent in road construction; Eufaula, Okla., $450,000 road bonds sold; Sulphur Springs, Tex., $400,000 road-bond issue approved.

Waterworks and Sewers

The trunk sewer at Washington has been contracted for at $50,000. Sewer work costing $75,000 has been contracted for at Des Moines, Iowa. Bids are desired at Ironton, Ohio, for constructing a $250,000 reservoir and filtration plant.

The following prospective water and sewer work is noted: Pawtucket, R. I., ordinance passed authorizing $100,000 waterworks and $80,000 sewer construction; Wilmington, Del., plans being prepared for large covered reservoir; Cleveland, plans being prepared for $350,000 reservoir; Kewanee, Ill., $90,000 sewer construction under consideration; Logansport, Ind., $240,000 sewer system to be built; Oklahoma City, Okla., $1,500,000 water bonds to be voted on; San Francisco, new $4,000,000 submarine pipe line being considered; Los Angeles, construction of $1,300,000 disposal plant ordered by state board of health.

Miscellaneous

The construction of a power tunnel to cost $750,000 has been contracted for at Rochester, N. Y. Bids are desired for another section of the New York state barge canal at Albany, for three additional subway sections in New York City and for drainage work to cost $406,000 at Bemidji, Minn.

A report has been submitted to the Board of Estimate of New York City on rebuilding the west side branch of the New York Central Railroad at a cost of $14,700,000. Port improvements costing $10,000,000 and rapid transit construction costing $57,100,000 have been provided for in loan bills passed by the Philadelphia City Council. A franchise for an electric railroad which will cost $800,000 to build has been granted at Cincinnati. The construction of a railroad costing $450,000 is under consideration at Columbia, Ky. Grade-crossing elimination work ordered at Kenosha, Wis., will cost $1,600,000. Plans have been submitted for a $200,000 dam and hydroelectric plant at Fort Dodge, Iowa.

CONTRACTING NEWS

Of Special Interest to Engineers, Contractors, Builders and Manufacturers of Engineering and Building Supplies

WATERWORKS

PROPOSED WORK.

Pawtucket, R. I.—Board of Aldermen passed ordinances authorizing issue of following bonds: $50,000 for abolition of grade crossings, $80,000 sewer purposes, $40,000 improving and equipping public parks, $100,000 water works construction. Address Clerk Board Contract & Supply.

Warwick, R. I.—The Assembly passed bill incorporating the West Shore Water Co. to supply town.

Wheatland, Pa.—Citizens voted in favor of consructing water works, to cost $17,000. J. Fred Thomas, City Building, Farrel, Engineer; F. L. Hutchinson, Borough Secretary.

Mount Rainier, Md.—Citizens April 17 voted $100,000 bonds for water works and sewerage system. Surveys have been completed and contracts to be let at once. Address Mayor.

Wilmington, Del.—Plans being prepared by George W. Fuller, Consulting Engineer, 170 Broadway, New York, N. Y., for a 7,500,000-gal. covered filtered water reservoir of concrete to be constructed on Rodney Street. Plans will be completed about May 12 and contract let about 2 weeks later. E. M. Hoopes, Jr., Chief Engineer Board Water Commissioners.

Mineral, Va.—Election to be held April 29 to vote $10,000 bonds for constructing water works and electric light plant. Address City Clerk.

Radford, Va.—Radford Water Power Company, of Radford (R. F. Jenkins, Secretary-Treasurer) will construct a supply system and install pumping station with filter plant, cost $25,000; 2 pumps, motor driven, 300 gal., 500 gal.; 9000 ft. 12-in. main with valves; 1,000,000-gal. filter. Company will do own work. Contracts for pumps, valves and filter not awarded.

Wheeling, W. Va.—Reported holding of an election to vote $300,000 bonds for constructing a filtration plant is reported under consideration. Address City Clerk.

West Monroe, La.—Election to be held May 16 to vote $45,000 bonds for water tank, electric pump and filtering plant, extension of water and light service and additional apparatus for fire protection.

Lexington, Ky.—Council reported to be considering plans for restoring reservoir and extending flood walls and also purchasing of a centrifugal pump to cost $3,000, direct connected to motor.

Alliance, Ohio.—Chester & Fleming, Pittsburgh, Pa., engaged by Joseph H. McConnell, Service Director, to prepare plans for proposed extension to city water filter plant; also specifications and plans for a new pump to be installed in city water works' pumping station.

Beshler, Ohio.—Election will be held May 10 to vote on constructing electric light plant and water works system. Address City Clerk.

Cleveland, Ohio.—F. H. Stephenson, Chief Engineer of City Water Works, is preparing plans for stone and concrete work on new Baldwin reservoir to hold 180,000,000 gal., estimated to cost, complete, $350,000. Contract to be let late in June or early in July. Thomas Farrell, Director Public Utilities.

Reported as soon as filtration plant is completed, State Board of Health will order concrete coverings for reservoirs, to cost $200,000.

Middleton, Ohio.—City Commission sold $40,000 water works bonds.

Portsmouth, Ohio.—Plans about completed for the reservoir and flood wall extension improvements. Address Board of Control.

Toledo, Ohio.—R. W. Pratt of Cleveland, J. W. Ellms of Cincinnati, and Wm. G. Clark of Toledo, selected by city as consulting engineers to report on repairs to filtration plant; probable cost of improvements, $60,000.

Rock Island, Ill.—Reported contract soon to be let by Board Local Improvements for 8 and 10-in. mains, to cost $12,000, and an elevated tank of 100,000 gal. capacity. Wallace Treichler, City Engineer.

McKinney, Minn.—It is proposed to construct a water works system, costing $30,000. P. Holand, Village Clerk

Slater, Minn.—Citizens voted $35,000 bonds for extension of water mains and improvements in electric light plant. Work will include a quantity of c.-i. mains, street valves and fire hydrants. L. E. Shepherd, Superintendent Slater Light & Water Works. C. H. Tucker, Mayor.

Thief River Falls, Minn.—City Council considering installation of filtration plant costing $30,000.

Dighton, Kan.—Election will be held May 16 to vote $28,000 bonds for constructing electric light plant and water works. W. B. Rollins & Co., Midland Building, Kansas City, Mo., Engineers.

Fort Scott, Kan.—Plans being prepared by G. W. Stiles, Bryant Building, and E. M. Stevens, Commerce Building, Kansas City, Mo., for a combined electric light plant and water works system, including filtration plant. J. O. Brown, City Clerk.

Merna, Neb.—Citizens voted $59,000 bonds for improving electric light plant and water works.

Palo, Kan.—Construction of municipal electric light plant and water works system is contemplated by city.

Miller, Neb.—Citizens voted $10,000 bonds for water works. Address City Clerk.

Hysham, Mont.—Reported town has voted in favor of water works and electric light plant. J. C. Lyndes, Mayor.

Springfield, Mo.—Reported Springfield Water Company intends making extensive improvements, including extension of mains and additional wells for emergency purposes.

Texarkana, Ark.—Texarkana Water Corporation will build extension No. 67 at once, which will include an increase in feeders in main part of the city, including 3900 ft. 8 to 12-in. pipe, 67 valves, 80 hydrants, and a 2,600,000-gal. per day centrifugal pump. J. G. Wood, Superintendent.

Troup, Tex.—Citizens voted $17,000 bonds for water works. Address Mayor.

Venus, Tex.—City will install water works and sewerage system costing approximately $30,000. Address City Clerk.

Winnsboro, Tex.—City contemplates installing water works and sewerage to cost $25,000.

Blackwell, Okla. — Citizens April 19 voted $32,000 bonds for water works, $10,000 for electric light extensions, and $18,000 for storm sewers, plans being prepared by Benham Engineering Co., Oklahoma, Okla., and contract will be let in May.

Dewar, Okla.—Citizens voted $40,000 bonds to construct water works. Address City Clerk.

Eufaula, Okla.—County Committee reported considering water works and road improvements. Address County Clerk.

Idabel, Okla.—Extension to water works contemplated at cost of $7,000. Address City Clerk.

New Wilson, Okla.—Citizens voted $25,000 bonds for constructing electric light plant and water works. Address City Clerk.

Oklahoma, Okla.—Election to be held May 20 to vote $1,500,000 bonds for constructing water works. Address City Clerk.

Sand Springs, Okla. — Sand Springs Power, Light & Water Co. granted franchise to construct water works.

Welch, Okla.—Construction of water works contemplated. Bonds sold. Address City Clerk.

Aberdeen, Wash.—Surveys for Wishkah water project have been completed by L. D. Kelsey, City Engineer, and contract for constructing will soon be let. P. F. Clark, City Clerk.

Everett, Wash.—An agreement has been reached between the city and the Everett Ry., Light & Water Company, of Everett, to take over the plant of the said company. The city plans to construct in connection with this plant a gravity water system from Sultan Basin. About $600,000 is available for the gravity system.

Seattle, Wash.—It is proposed to install water mains in Hudson Street at a cost of $21,900, including 10,253 lin. ft. 8 and 12 in. c. i. pipe. Water mains in Forty-fourth Avenue S. W., costing $20,000, also contemplated. A. H. Dimock, City Engineer.

City Council has adopted resolutions for water mains in North Tenth, North Forty-eighth and North Forty-ninth Avenues, Northeast, and North Fifty-ninth Street. L. B. Youngs, Supt. Water; A. H. Dimock, City Engineer.

Plans and specifications for installation of water mains in East Marginal Way have been filed with Board of Public Works (C. B. Bagley, Secy). A. H. Dimock, City Engineer; cost $62,000.

Tenino, Wash.—City Council directed Tenino Water Co. to secure new water supply system by June 1.

Merrill, Ore.—City Council considering securing water system. Address City Clerk.

Corcoran, Cal.—Corcoran Gas & Water Company will add a 60,000-gal. steel tank and an 80-ft. tower to the system this summer.

San Francisco, Cal.—Reported Spring Valley Water Company (W. B. Bourne, Pres.), considering building a new pipe line across the bay at an estimated cost of $4,000,000.

Casa Grande, Ariz.—Bonds sold for municipal lighting, water and ice plant. Address City Clerk.

Sault Ste. Marie, Ont.—Contract will soon be let by city for constructing power and pumping station on Gore Street; cost, about $7,500. A. E. Pickering, City Engineer.

A water works is to be constructed. Three sources of supply are under consideration, but nothing definite has been done about the matter. R. G. Campbell, City Clerk.

BIDS DESIRED.

New Brunswick N. J.—Until May 9, by Board Fifty City Commissioners, for steel standpipe, 40 ft. diam. x 85 ft. high, concrete foundation; advertised in Engineering Record. Eugene J. McLaughlin, City Clerk.

Conway, Pa.—Until May 1 by Town Council (E. M. Mensch, Secy.) for water meters.

Washington, D. C.—Until May 4, by Bureau Supplies and Accounts, Navy Department, Washington, D. C., for steel pipe, flush pipes, valves, fittings, etc.

Jacksonville, Fla. — Until May 4 by Board Bond Trustees (Gustav Muller, Chmn.) for furnishing material and drilling a 10-in. artesian well a depth of 1000 ft. and casing same with first quality standard wrought-iron pipe to water bearing rock approximately 500 ft.

Marion, Ala.—Reported desired until May 1, for water works, to consist of 20,000-gal. capacity, brick and cement building, 30 x 60 ft., and 12,000-gal. tank and tower. Address M. L. Murfee, Marion Institute, Marion.

Ironton, Ohio.—Until May 18 by Director Public Service for furnishing material and improving and enlarging present water works, including constructing new brick pumping station, pump well and intake force main, pumping machinery, concrete distribution reservoir and filtration plant. Bonds amounting to $250,000 are to be sold May 16 for this improvement. J. F. Witmer Co., Engineers, Dun Building, Buffalo, N. Y. F. A. Ross, Clerk to Director. Specifications on file in New York Office of Record, 239 West Thirty-ninth Street.

Chicago, Ill.—Until May 2, by Department Public Works (W. R. Moorhouse, Comr.), for furnishing and delivering to city of Chicago, f.o.b. Municipal Warehouse, Thirty-first and Sacramento Avenue, pipe and pipe fittings.

Illinois—Until May 9, by State Board Administration (Frank D. Whipp, Fiscal Supervisor, Springfield), for constructing water supply systems at the following institutions: At State Colony for Epileptics, near Dixon; Alton State Hospital at Upper Alton, elevated steel water tank, also for Alton State Hospital. Jas. B. Dibelka, Architect, 130 North Fifth Avenue, Chicago.

Denmark, Wis.—Until May 16, by George H. Rathke, City Clerk, for 6 and 8-in. pipe, hydrants, and specials, valves, etc., elevated tank, 17 ft. 4 in. x 17 ft. 3 in., elevated 90 or 100 ft. W. G. Kirchoffer, Engineer, Madison.

Pleasantville, Iowa.—Until May 10, by J. K. Keefer, Clerk, for constructing municipal water works costing $20,000. Des Moines Iron Works, Des Moines, Engineers.

Shelby, Iowa.—Reported desired until May 4, by J. H. Hager, Town Clk., for constructing water distributing system. J. H. Mayne, Engr., Council Bluffs.

Winterset, Iowa.—Until May 8, by H. S. Ely, City Clerk, for improvements to water works, including concrete pump house, pipe, valves and fittings, for connecting pump to well; 226 tons 8-in. c.-i. pipe, 1180 lb. hub end specials, etc. O. W. Stiles, Engineer, 16 Bryant Building, Kansas City, Mo.

Sleepy Eye, Minn.—Reported desired until May 2 by A. D. Bertrand, City Recorder, for constructing water mains in various streets.

Wadena, Minn.—Until May 1 by Village Council for extending water works system, to consist of 8800 ft. of 6 and 4-in. water mains, 20 fire hydrants, gate valves, etc. A. C. Murray, City Recorder; John Wilson, Engr., First Natl. Bank Building, Duluth.

Newton, Kan.—Reported desired until May 1, by A. Martin, City Clk., for improving water system. W. B. Rollins & Co., 439 Midland Building, Kansas City, Mo., Consulting Engr.

Wynot, Neb.—Reported desired until May 2 by F. A. Leise, Village Clk., for extending water mains.

Aberdeen, Wash.—Reported desired until May 31, by P. T. Clark, City Clerk, for constructing Wishkah water system, to consist of 22 miles 28 in. wood stave pipe, diverting wiers, gate houses and settling basins, etc. Louis D. Kelsey, City Engineer.

Hamilton, Ont.—Until May 8, by S. H. Kent, City Clk., care of Chester S. Walter, Mayor, Chmn. Board Control, for mechanical rakes and appurtenances at Gage Avenue pumping station.

Humboldt, Ont.—Until May 8, by Town (J. G. Yoeger, Mayor), for constructing concrete pump well 25 ft. inside diameter, 25 ft. deep, with walls 18 in. thick. Chipman & Power, Consulting Engineers.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Lynn, Mass.**—Contract for one 3,000,000 centrifugal pump, 250 ft. head, 1170 r.p.m. (bids opened April 20) awarded by Department of Water to Power Equipment Company, 343 Dearborn Street, Chicago, at $988, and for one 200 hp. electric motor f.o.b. Lynn to Lynn Gas & Electric Company, Lynn, at $1,080. R. H. Sutherland, Asst. Supt. Water Works Dept.

★**New York, N. Y.**—Following are two bids opened April 18 by Board Water Supply for Contract 95, furnishing traveling cranes equipment in chambers at Ashokan, Kensico and Hill View reservoirs, in town of Olive, Ulster County, Mt. Pleasant and city of Yonkers, Westchester County: Lord Electric Company, 105 West Fortieth Street, New York, N. Y., $34,500 (awarded contract); Lupfer & Remick, 594 Ellicott Street, Buffalo, N. Y., $40,100.

★Contract for furnishing and installing steam heating systems in Ashokan Lower Gate and Kensico Lower Effluent Chambers in town of Olive, Ulster County, and Mt. Pleasant, Westchester County, N. Y. Contract 164 awarded L. F. Bannon Plumbing, Heating & Contracting Company, 16 Hasbrouck Avenue, Kingston, N. Y., at $5,665.

★Contracts awarded by Board of Water Supply, Gas and Electricity for 815 tons of cast-iron pipe as follows 315 tons in Borough of Manhattan to R. D. Wood & Co., Philadelphia, Pa., at $28.94, delivered, for 8 and 12-in., and 53 tons of fittings at $60, delivered; Warren Foundry & Machine Co., 111 Broadway, 500 tons, delivered in Queens Borough, at $31.40, and $31.80, according to place of delivery.

★**New York, N. Y.**—See "Water Works."

★**Butler, N. J.**—Contract for intake dam on Apshawa Brook and pipe laying for Butler Water Company (bids opened April 19) awarded Partridge & Burke, Hohokus, N. J., at $7,565. A. W. Cuddeback, Engineer, 156 Ellison Street, Paterson.

★**Perth Amboy, N. J.**—Contract awarded Warren Foundry & Machine Co., 111 Broadway, New York, for 104 tons c.-i. pipe, at $26.90, and 40,000 lb. mixed fittings at 4 cts. per pound.

★**Norfolk, Va.**—Contract for constructing extensions to water system (bids opened April 17) awarded Norfolk Bridge & Construction Co., Norfolk, at $13,365. P. F. Stofford, City Clerk.

★**Cincinnati, Ohio.**—City Board of Control awarded contract for underfeed stoker equipment for California Pumping Station to the Underfeed Stokers Co., Chicago, Ill., at $7,470.

★Contract for laying section of 36-in. loop main in Eastern Avenue awarded Thomas P. Strack, Cincinnati, at $5,489.

★**Youngstown, Ohio.**—Following are bids opened April 20 by Daniel J. Jones, Secretary Service Director, for (a) three pumps for water works and (b) alterations to filtration plant; (a) Dravo Doyle Company, Pittsburgh, Pa., $21,750 (awarded contract); W. J. Scholl Company, Youngstown, $25,300; (b) William M. Henderson Company of Youngstown, $16,679 (awarded contract); Lane & Ewer, $17,298.

★**Normal, Ill.**—Contract awarded Lee Stuart, Normal, for water mains in Dale, Kingsley, Hale and Adelaide Streets, at $2,956.

★**Billings, Mont.**—Contract awarded Security Bridge Co., Lewiston, Idaho, for drilling wells, laying mains and building tank and pump station (bids opened April 12). G. E. Williams, County Clerk.

★**Broadview, Mont.**—Contract for constructing water works, including sinking six wells, constructing pump house, equipped with two distinct pumping units, 20 hp. each, a 50,000-gal. tank and a 75-ft. tower, water mains from 4 to 6 in., awarded Security Bridge Co., Billings, at about $30,000 (bids opened April 12).

★**Three Forks, Mont.**—Contract for constructing c.-i. pipe water mains and concrete reservoir awarded Security Bridge Co., Minneapolis, Minn. Paul Peine, City Clerk.

★**Olympia, Wash.**—Contract for constructing concrete reservoir (bids opened April 10) awarded B. S. Davis, Tacoma, at $2,650. D. A. Torgerson, Secy. State Board Control, Olympia.

★**Seattle, Wash.**—Contract awarded by Board of Public Works for installing water main in Forty-third Street, N. E., to V. Ramaggiia, Yesler Station, at $25,453.

Lowest bid opened by Board of Public Works for installing water main in Orcas Street submitted by H. Young, 2416 East Valley Street, at $13,478.

★**Bandon, Ore.**—Contract awarded U. S. Cast Iron Pipe & Foundry Company of Portland and to Pacific Tank & Pipe Company of San Francisco, Cal., for pipe, and for valves and hydrants to Rensselaer Valve Company, Seattle, Wash., at $5,436. Contract for c. i. collars and c. i. fittings for wood pipe awarded W. F. Rogers Foundry, Bandon, Ore., at 4 cents per pound delivered at the work. J. S. Sawyer, City Engineer.

SEWERAGE AND SEWAGE DISPOSAL

PROPOSED WORK.

Biddeford, Me.—It is proposed to construct a 3 x 5-ft. egg-shaped sewer in Summer Street, to cost $15,000. W. C. Bigelow, City Engineer.

Lowell, Mass.—Reported city is considering constructing the Oaklands sewer, main link to cost about $30,000. Address City Clerk.

Manchester, Conn.—Board of Selectmen considering constructing surface water system for west side.

Chatham, N. J.—The Madison-Chatham Joint Sewer Commission, following a report from George W. Fuller, 170 Broadway, New York, N. Y., Engineer, and Otto Ross, Mayor of Madison, Chairman of Disposal Plant Committee, recommending spending $16,000 on the plant, is to investigate proposed improvements and report back to joint body.

Scranton, Pa.—Plans submitted to State Board of Health for sewers in Twenty-first and Twelfth Wards. Address City Clerk.

Mount Ranier, Md. — See "Water Works."

Key West, Fla.—Election will probably be held in two months to vote $250,000 bonds for constructing sewer system. H. C. Wetmore, Supt. Water Works.

McComb, Miss.—City Council voted $90,000 bonds for constructing sewerage system.

Lexington, Ky.—Plans being prepared by J. White Guyn, City Engineer, for constructing main outfall sewer.

Bowling Green, Ohio.—Contract soon to be let for constructing sanitary sewer in Summit and Liberty Streets. R. S. Sweet, City Auditor.

Leetonia, Ohio.—City Council considering constructing sewage disposal plant and constructing two main sewer branches.

Miamisburg, Ohio.—Reported city is considering bond issue of $113,000 for sanitary sewer system. Address City Clerk.

Portsmouth, Ohio.—Council has approved plans for proposed Hilltop sanitary sewer system.

Logansport, Ind.—The new sanitary sewer system, to be known as Hamilton

Height sewer system, will cover part of city bounded by Broadway, Spencer Park, Wabash River and Fifth Street. A trunk and lateral lines, approximately 12 miles, contemplated; estimated cost, according to G. L. Closen, Consulting Engineer, Chicago, as follows: 63,070 ft. sewer, 1 to 6-ft. sewer, cost $220,619; 288 catch basins and connections, $14,400; one special catch basin, $200; 265 manholes, cost $250, 1 bulkhead, $250; also $15,000 worth of rock excavation.

Oakwood, Mich.—Construction of extension to sewer system contemplated. Address F. J. Clippert, Member Bd. Commerce.

Alton, Ill.—City Council voted to issue $200,000 bonds for sewer and paving improvements.

Beardstown, Ill.—Citizens voted against issuing $30,000 bonds to construct a sewer system. R. B. Maslin, City Clerk.

Cairo, Ill.—City Commissioners decided to rebuild broken part of Commercial Avenue sewer at an estimated cost of $18,000.

Kewanee, Ill.—Construction of a sewer in southwest part of city and costing $90,000 is under consideration. H. C. Stokes, City Engineer.

Madison, Ill.—Contract will be let about June 20 for constructing 35,000 ft. tile sewers.

Sioux City, Iowa.—Contract soon to be let for constructing 18-in. storm sewers in Pierce and Myrtle Streets. Address City Clerk.

Bemidji, Minn.—It is proposed to construct 5300 ft. of 8-in. sewer to cost $9,500. Thomas W. Swinson, City Engineer.

Kansas City, Kan.—Contract will be let in May for sewer improvements costing $20,000. William Barclay, City Engineer.

Ainsworth, Neb.—Citizens voted $19,000 bonds for constructing sewers. Address City Clerk.

Redfield, S. D.—Citizens will vote $28,000 bonds for constructing sewer system. Address City Clerk.

Austin, Tex.—Reported constructing of a sewage disposal plant is under consideration. Address Mayor.

Dallas, Tex. — City Commission petitioned to construct a storm-water sewer on Lemmon Avenue, between Cole and Katy R. R. tracks.

Lancaster, Tex.—Plans being prepared by N. Wernskiold, 409 Flato Building, Dallas, for a sewer system and tanks.

Venus, Tex.—See "Water Works."

Winnesboro, Tex.—See "Water Works."

Deming, N. M.—Citizens April 5 voted $20,000 bonds for constructing sewers and a disposal plant. A. A. Temke, City Clerk.

La Grande, Ore.—Reported City Council instructed City Engineer to prepare plans for sewer system for part of South La Grande. Address City Engineer.

California—Following cities are considering sewer improvements:
Pasadena—A site secured for a disposal plant for Pasadena, Alhambra and South Pasadena.
Hermosa Beach—Plans being prepared by C. R. Summer, City Engineer, for additional septic tanks, outfall pump and tunnel.
Los Angeles—Ordered by State Board of Health to construct a disposal plant and an outfall into the ocean, estimated by City Engineer to cost $1,300,000. Election to be held in June to vote on this improvement.

Hermosa Beach, Cal.—C. R. Sumner, City Engineer, is preparing plans for additional septic tanks outfall, pump and tunnel.

Lompoc, Cal.—Election to be held in May to vote on constructing a sewer system, 70,440 ft. 6 to 14-in. clay pipe, and costing $49,900, and an Imhoff disposal plant costing $2,700. Haviland & Tibbetts, Engineers, San Francisco.

Long Beach, Cal.—County Bd. Supervisors Los Angeles commissioned R. V. Pearsall, Engineer, Long Beach, to prepare plans for storm drainage system for Signal Hill; probable cost, $150,000.

Los Angeles, Cal. — State Board of Health at Sacramento has directed the city to construct a disposal plant and outfall into the ocean. Cost is estimated by Homer Hamlin, City Engineer, at about $1,300,000. Election to be held in June to vote on bonds.

BIDS DESIRED.

Brookline, Mass.—Until May 1, by Selectmen, at Town Hall, for constructing about 1800 lin. ft. 4 ft. 5 in. x 5 ft. concrete drain, and 12-in. pipe sewer in Amory and Freeman Streets.

Albany, N. Y.—Until May 1 by Board Contract and Supply (Isidore Wachsman, Secy.) for completing the sewage disposal works.

Binghamton, N. Y.—Until May 24 (extension of date), by W. Earl Weller, City Engineer, for constructing Section 1 of the main intercepting sewer.

Brooklyn, N. Y.—Until May 3, by L. N. Pounds, Pres., Borough Brooklyn, for constructing sewer in Tehama Street, from Thirty-sixth Street to West Street. Security, $3,092.

New York, N. Y.—Until May 3 by Marcus M. Marks, Pres. Manhattan Borough, for storm relief sewer in 114th Street between First Avenue and East River. Security $20,000.

Rochester, N. Y.—Until May 3, by Board Contract & Supply (F. X. Pifer, Secy.), for screen house and pump house at main sewage disposal plant.

Jacksonville, Fla.—Until May 12, by Board Bond Trustees (Gustav Muller, Acting Chairman), for constructing 5000 ft. 12 to 51 in. sanitary and storm water sewers for city.

Toledo, Ohio.—Reported desired until May 2, by Director Public Service, for constructing sewers. Probable cost, $19,475.

Chicago, Ill.—Until May 1 by Board Local Improvements (Edw. J. Glackin, Secy.) for constructing sewers with manholes, etc., in Albany, Clyde and Lowe Avenues and numerous other streets.

Grays Lake, Ill.—Until May 8, by R. W. Churchill, Grays Lake, for sewer system and settling tank, advertised in Engineering Record. Cost, $25,000.

Maywood, Ill.—Until May 4 by Board Local Improvements (Howard A. Ullrich, Secy.) for constructing uncompleted portion of sewers system, to consist of 3720 lin. ft. 61, 42 and 36-in. concrete sewer and 15,083 lin. ft. 12 to 24-in. tile pipe sewer, 192 concrete catchbasins, etc.

Waverly, Iowa.—Until May 2 by Village Council for constructing sanitary sewers. H. R. Vanderveer, City Clk.

Bemidji, Minn.—Until May 1 by George Stein, City Clk., for constructing approximately 5330 ft. 8-in. sanitary sewer extension, manholes, etc.

Mahnomen, Minn.—Until May 1 by Village Council at office of George O. Lee, Village Clk., for constructing sewerage system extension in village.

Spooner, Minn.—Until May 22, by A. M. Robertson, Village Clerk, for furnishing material and constructing sewer system and disposal works. Bids will be considered together or separately on system and disposal plant.

McPherson, Kan.—Until May 4, by Ellen Lundstrom, City Clerk, for constructing septic tank and six filter beds 40 x 100 ft., besides other apparatus. H. A. Rowland, City Engineer.

Neodesha, Kan.—Until May 15 by J. J. Carroll, City Clk., for furnishing material and constructing intercepting sewer and sewage disposal plant. Black & Veatch, Engrs., Inter State Building, Kansas City, Mo.

Pender, Neb.—Until May 12, by Village Clerk, for constructing sewer system, including 20,557 lin. ft. 8 to 24 in. vitr. pipe and 9000 ft. 4-in. c. i. pipe. Cost, $25,010. Grant & Fulton, Engrs., Bankers Life Bldg., Lincoln.

Ipswich, S. D.—Until May 1 (change of date), by City Auditor for 2810 ft. 8 and 10 in. sewers with necessary appurtenances. Dakota Engineering Company, Engineers, Mitchell, S. D.

Fargo, N. D.—Reported desired until May 3 by A. R. Watkins, City Aud., for constructing sewers in Fourth Avenue, Third Avenue and Fifth Street.

Park Rapids, N. D.—Reported desired until May 9 by Frank Prochaska, City Aud., for constructing sewer system, including treatment plant; probable cost $16,000. H. G. Lyken, Engr., Grand Forks.

Rawling, Wyo.—Reported desired until May 3 by J. E. Bang, City Clk., for extending sewer system.

Fresno, Cal.—Reported desired until May 3, by Olmsted Gillelen, Hollingsworth Bldg., Los Angeles, Consulting Engrs. for constructing storm and sanitary sewer system. B. E. Cronhite, City Engr.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Ocean Beach, L. I., N. Y.**—Contract for constructing sewers and sewage treatment works at Ocean Beach awarded H. L. Connell, New York. Lederle & Provost, Consulting Engineers, 39 West Thirty-eighth Street, New York.

★**New Brunswick, N. J.**—Contract awarded Brunswick Construction Company for constructing Mile Run sewer at $10,530.

★**Washington, D. C.**—Following are four lowest bids opened April 17 by Commissioners D. C. for constructing outlet trunk sewers between Pennsylvania R.R. Bridge and Banning Bridge: W. D. Murray Co., Inc., Norfolk, Va., $50,326 (awarded contract); George Hyman, Washington, D. C., $51,943; Warren F. Brenizer Co., Washington, D. C., $53,910; Whiting Turner Construction Co., Baltimore, Md., $58,706. Asa E. Phillips, Supt. of Sewers.

★**Savannah, Ga.**—Reported arrangements have been made for the construction of the eastern and western divisions of the drainage extension by Gadsden Contracting Company of Savannah, associated with Guild & Company of Chattanooga, Tenn. Contract reported awarded to an Eastern firm has been taken over by this company.

★**Starke, Fla.**—Contract for constructing sanitary sewerage system and paving certain streets, about 26,900 lin. ft. terra cotta pipe, etc., and 14,328 sq. yd. pavement, etc., awarded J. B. McCreary Company, Atlanta, Ga., on the percentage basis (bids opened April 18). C. A. Futch, Town Clerk.

★**Cincinnati, Ohio.**—City Board of Control awarded contract for sewer improvement in ravine from Oskamp Avenue to Massasoit Avenue to Weiling & Franz, Cincinnati, at $16,958.

★**Des Moines, Iowa.**—Contracts for constructing Close Creek Sewer System No. 3369 (bids opened April 19) awarded as follows: Contract No. 1, to Inland Construction Co., St. Louis, Mo., at 84 cts. per foot; total $75,829, and Contract No. II, to J. B. Sheets Co., Pittsburgh, Pa., at $2.79 per foot; total $91,833.

★**Winner, S. D.**—Following are four lowest bids opened April 10 by Claude Manly, City Auditor, for constructing sewerage system: C. H. Green, Spokane, Wash., $20,781 (awarded contract); Dobson Company, Lincoln, Neb., $21,805; Gordon & Taylor, Denver, Colo., $21,892, and Haggart Construction Co., Fargo, N. D., $21,916.

BRIDGES

PROPOSED WORK.

Athens, Pa.—Reported contract will soon be let by Lehigh Valley R. R. (E. B. Ashby, Ch. Engr., New York, N. Y.) for constructing bridge over Chemung River.

Johnstown, Pa.—Council will construct a new bridge over Stony Creek at Horner Street.

Simpson, Pa.—Delaware & Hudson Co. (James MacMartin, Ch. Engr., Albany) will construct 800-ft. concrete viaduct over its tracks. Estimated cost, $150,000.

Paulding, Miss. — See "Paving and Roads."

Jonesboro, Tenn.—County Commissioners appropriated about $9,000 for constructing bridge across Chuckey River. Address County Clerk.

Bellefontaine, Ohio.—Bridge bonds for $25,000 will be sold May 8 by O. W. Loffer, Co. Aud.

Bemidji, Minn.—It is proposed to construct a bridge across Mississippi River on Nymons Road and pave 10,000 sq. yd. with concrete. Thomas W. Swinson, City Engineer.

Kansas City, Mo.—Ordinance to grade Holmes Street from Nineteenth to Twenty-first Street and requiring Kansas City Terminal Ry. Co. to erect a viaduct has passed lower house of Council.

Cameron, Tex.—Commissioners Court voted to construct a steel bridge over San Gabriel River at San Andres crossing.

Richmond, Tex.—Citizens voted $25,000 bonds for constructing bridge over Big Creek. Address County Clerk.

San Angelo, Tex.—Six bridges in Tom Green County are to be repaired by County Commissioners.

Seattle, Wash.—City Council appropriated $5,800 for raising Ballard bridge and $10,000 for constructing fourth pier for Montlake Avenue bridge across Lake Washington Canal. F. A. Rapp, Bridge Engineer, will prepare plans.
A. H. Dimock, City Engineer, has completed plans for an 86-ft. steel and wood Howe truss span bridge to be constructed over Northern Pacific Ry. right-of-way at Fifteenth Avenue, Northwest, by day labor. Estimated cost $10,000.

Salem, Ore.—County Courts of Marion and Polk Counties propose constructing jointly a bridge across Willamette River at Salem, plans for which have been prepared by State Highway Commission. The bridge is to consist of four 161-ft. camel-back steel spans with a 138-ft. vertical lift span and a reinforced concrete viaduct approach on Polk County end, 850 ft. in length, roadway 26 ft., with 6-ft. walks on either side. Steel structure is estimated to cost $143,100, including foundations, and the reinforced concrete viaduct approach $55,400. Floor of main spans is of wood on steel joints with bituminous surface. If concrete under floor is substituted, $4,500 is to be added to cost of steel structure. John H. Lewis, State Engr., Salem.

Needles, Cal.—Oatman-Needles Bridge Co. (J. P. Finan, Secy.-Treas.), of Oatman, Ariz., contemplates constructing a highway bridge over Colorado River near Needles.

San Diego, Cal.—Reported Atchison, Topeka & Santa Fe R. R. (C. F. W. Felt, Ch. Engr., Chicago, Ill.) is planning to construct reinforced concrete bridges on line between San Diego and Los Angeles, about 120 miles, to replace temporary structures. Cost reported at $1,000,000.

BIDS DESIRED.

Albany, N. Y.—See "Hydraulic Construction and River Improvement."

Denton, Md.—Reported desired until May 9 by Harry Waldorf, County Roads Engineer, for constructing 150-ft. span steel concrete bridge.

Summersville, W. Va.—Until May 9, by County Commissioners, Summersville, for constructing two reinforced concrete arch bridges in Nicholas County, advertised in Engineering Record.

Louisa, Ky.—Reported desired until May 1 by County Judge for constructing concrete bridge over Dry Fork Creek at Webbville and another one mile above Webbville, former to be 100 ft. and latter 85 ft., both with 12-ft. roadway and two concrete abutments. B. J. Calloway, County Engr.

Chillicothe, Ohio.—Until May 1 by W. S. Barrett, Co. Aud., for constructing a 90-ft. pony truss steel bridge with 16-ft. roadway.

Dayton, Ohio.—Until May 22 by Board County Commissioners (Walter H. Aszling, Clk.) for constructing steel bridge superstructure for Bridge No. 174, Jefferson Township, known as West Carrollton Bridge, to consist of one 200-ft. span and four 100-ft. spans, with an 18-ft. roadway of 3-in. creosoted wood plank and 3-in. creosoted block floor, and a uniform live load capacity of 100 lb. per sq. ft. or a 12-ton road roller.

Richmond, Ind.—Until about July 1, for constructing a $120,000 concrete bridge at South G Street over White River. Address —John U. Mueller, Consulting Engineer, New Castle.

Illinois.—By State Highway Department for constructing bridges as follows:
Until May 8:
Polo, Coffman Bridge, concrete 25-ft. span, 20-ft. roadway, in Pine Creek Township, Ogle County. Engineer's estimate $1,250.
Until May 10:
Jerseyville, Elliott and Dodge bridges, 10 ft. and 12 ft., roadways 16 ft., in Rule Township, Jersey County. Engineer's estimates: Elliott $650 and Dodge $620.
Galesburg, Appleton, Harshbarger and Meeks bridges, in Knox County, spans 10, 16 and 30 ft., roadways, 30, 24 and 20 ft. Engineer's estimate $3,970.

Charles City, Ia.—Reported desired until May 2 by James A. Cutler, Co. Aud., for constructing two 70-ft. concrete arch span at Nora Springs. Engineer's estimate, $11,264.

Jefferson, Iowa. — Until May 9, by County Auditor, for constructing one deck girder, four concrete slabs, one box culvert and two I-beam bridges. H. W. Thompson, County Engineer.

Brewster, Minn.—Reported desired until May 1 for constructing two 60-ft. steel truss, reinforced girder, on concrete abutments in town Alba, Jackson County. H. W. Haberman, Clk., Brewster.

Cohassett, Minn.—Reported desired until May 2 for constructing bridge across Bass Brook, on Duluth Street. Bids desired on, three types of bridges as follows: Steel and concrete with two 76-ft. truss spans and two 30-ft. spans; steel and concrete bridge, eight 23-ft. spans, and one 26-ft. span; reinforced concrete bridge with four 45-ft. spans and two 15-ft. spans. Frank Sherman, Co. Aud.

Morris, Minn.—Until May 13, by C. R. Wollthan, Co. Aud., for constructing bridge, No. 2145, on State Road No. 11, reinforced concrete pier, two 50-ft. skewed truss span, 18-ft. roadway.

Rochester, Minn.—Reported desired until May 6 for constructing State Bridge No. 1613, between Cascade and Oronco Townships, two 80-ft., low riveted truss spans, 18-ft. roadway, on reinforced concrete abutments, etc. Lester J. Fiegel, County Auditor.

Eureka, Kan.—Until May 1 by Ira Whipple, City Clk., for constructing concrete bridge across east branch of Fall River.

Great Bend, Kan.—Until May 3, by C. F. Youkin, County Clerk, for constructing bridges as follows: Carroll Bridge No. 1, at Boyd, two plain concrete abutments and two plain concrete piers, superstructure of three 24-ft. reinforced concrete spans, 18-ft. roadway. Carroll Bridge No. 2, two plain concrete abutments, superstructure of reinforced concrete slab of 15 ft. and 18-ft. roadway. Coe Russell Bridge, two plain concrete abutments, superstructure of reinforced concrete, girder span, 25 ft.; 18-ft. roadway. Witte Bridge, two plain concrete abutments, superstructure of 25 ft. reinforced concrete, girder span, 18-ft. roadway.

Manhattan, Kan.—Until May 16, by George H. Hungerford, County Clerk, for constructing bridges as follows: Stockdale bridge, two plain concrete piers, through pin-connected steel superstructure, 260 ft. span, 16-ft. roadway, wood floor, alternate bids combination concrete and stone piers, creosoted wood block floor, and repairing and approaches. Garrison Crossing Bridge on Blue River, one steel tubular pier, replacing with solid concrete pier, also to support two 120-ft. steel spans, having wood floors. Randolph Bridge, Randolph, a bridge similar to Stockdale.

Medicine Lodge, Kan.—Reported desired until May 1 by W. S. Grant, Co. Clk., for one 600-ft. pile bridge with concrete floor, and one 100-ft. steel bridge with concrete floor.

Kearney, Neb.—Reported desired until May 23 by J. H. Dean, Co. Clk., for constructing steel truss bridge, to consist of ten 100-ft. low truss spans, 16-ft. roadway resting on concrete piers, and abutments; also one concrete arch bridge of 14 spans, two 55 ft., two 60 ft., two 65 ft., two 70 ft., two 75 ft., two 80 ft. and two 85 ft., resting on concrete piling.

Sheridan, Wyo.—Until May 15, by T. A. Morris, City Clerk, bids, including plans and specifications, for a 65-ft. clear span steel or reinforced concrete arch bridge on Alger Avenue across Big Goose Creek, also for taking down and the removal of the present steel 65-ft. bridge to Dow Street for storage.

Buffalo, Okla.—Reported desired until May 1 by E. S. Hubbard, Co. Clk., for constructing five concrete bridges and one steel bridge with concrete abutments.

Chehalis, Wash.—Reported desired until May 3, by County Auditor, for constructing a 705-ft. trestle approach to Riverside Bridge. J. D. Nevill, County Engineer.

Seattle, Wash.—Reported desired until May 5, by C. B. Bagley, Secy. Board Public Works, for furnishing steel and iron work for a 86-ft. Howe truss and 100-ft. Howe truss span in approaches to 15 Avenue northwest, Salmon Bay Bridge.

San Luis Obispo, Cal.—Reported desired until May 4 by F. J. Rodrigues, Co. Clk., for constructing Pratt riveted steel truss bridge, with concrete floor. A. F. Parson, Co. Surv.

Arden, Man.—Until May 16 by M. E. Broughton, Secy. and Treas., for erecting reinforced concrete bridge over White Mud River at Section 31, Township 14, Range 13 W., three miles from Arden Station.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Miami, Fla.**—Reported contract awarded by City Council to M. J. Comer, Miami, for constructing across Miami River, Twelfth Street bridge, at $55,191, and Avenue D bridge, at $48,075.

★**Bardwell, Ky.**—Contract awarded by Fiscal Court for constructing 10 steel and concrete bridges on Bardwell-Maywell intercounty seat highway to J. Adams, Mayfield.

★**Sheperdsville, Ky.**—Contract awarded by Bullitt and Nelson County Fiscal Courts for constructing bridge over Wilson Creek between said counties to Vincennes Bridge Co., Vincennes, at $4,244.

★**Springfield, Ky.**—Contracts awarded by Nelson and Washington Fiscal Courts for constructing bridge across Chaplin River between Nelson and Washington Counties to East St. Louis Bridge Co., East St. Louis, Ill., at $6,390 for superstructure, and Murphy Bros., at $5.14 per cu. yd. for substructure.

★**London, Ohio.**—Contract for constructing girder bridge over Big Sugar Creek, three 66-ft. spans, awarded A. J. Yawger Co., Indianapolis. C. A. Paquette, Ch. Engr., Cleveland, Cincinnati, Chicago & St. Louis R.R., Cincinnati.

★**Youngstown, Ohio.**—Contract awarded by County Commissioners for constructing reinforced concrete bridge, about 70 ft. long, at McCartney Road, across Lincoln Park, to R. C. Shook, Youngstown, at $5,416 (bids opened April 17).

★**Shelbyville, Ind.**—Contract for constructing 138-ft. truss bridge over Black River awarded by C. A. Payette, Ch. Engr. Cleveland, Cincinnati & Chicago R.R., Cincinnati, to King Bridge Co., Cleveland, Ohio.

★**Dixon, Ill.**—Contract awarded Rink & Snell, Dixon, for paving Franklin Greve Section of Lincoln Highway, at $28,335.

Rock Island, Ill.—Following are four lowest bids opened April 15 by Joint Boards of Road and Bridge Committee of Rock Island and Henry Counties for constructing Colona bridge across Rock River, concrete construction: Gould Construction Co., Davenport, Iowa, at $59,300; Porter McCully Cn., Mackinaw, $60,940; N. M. Stark Co., Des Moines, $62,543; T. J. McCarthy Co., Davenport, $64,400. W. Treichler, Co. Engr.

★**Denison, Iowa.**—Contract for constructing bridge and box culverts (bids opened April 13), totaling a cost of $47,681, awarded Herman Grill, Denison; A. W. Merrick Boone; E. McNeal, Detroit, Mich., and T. A. Hickey, Manilla. H. B. Fistiel, County Engineer.

★**Toledo, Iowa.**—Contracts for constructing 5650 lin. ft. corrugated culvert pipe and 1240 ft. c.-i. pipe awarded as follows (bids opened April 17 by County Commissioners): Cast-iron pipe to American Casting Co., Birmingham, Ala., at $2,260, and corrugated pipe to Klauer Manufacturing Co., Dubuque, Iowa, at $5,785. A. R. Hebenstreit, County Engineer.

★**Clayton, Mo.**—Contract awarded by County Commissioners for constructing Valley Park steel bridge over Meramec River to Miller-Borcherding Steel Bridge Co., St. Louis, at $46,900 (bids opened April 11).

★**Fort Worth, Tex.**—Contract awarded by County Commissioners for constructing Park Street bridge to Austin Bros. of Dallas.

★**Montesano, Wash.**—Contracts awarded by County Commissioners to Monson Construction Co., Montesano, at $16,148, for constructing bridge over Satsop River, and R. E. Mieth, Montesano, at $15,293, for constructing bridge over Wynoochee River. (Bids opened April 17.)

★**Riverside, Wash.**—Following are four bids opened April 4 by County Commissioners at Conconally for constructing Riverside Bridge at Riverside: Illinois Steel Bridge Co., 208 S. La Salle Street, Chicago, Ill., $10,995 (awarded contract); C. L. Graves, Seattle, $11,576; J. R. Wood, Seattle, $11,900, and Weymouth Construction Co., Seattle, $12,662. H. E. Smith, County Engineer.

★**Seattle, Wash.**—Contract awarded American Bridge Co. for 1060 tons of steel for highway bridge over Lake Washington Canal.

★**Stevenson, Wash.**—Contract awarded by County Commissioners for constructing Clarke County Line Cascade Section of State Road No. 8 to Porter Bros., Railway Exchange Building, Portland, Ore., at $54,630. (Bids opened April 15.)

★**St. Helens, Ore.**—Contract for constructing steel span bridge near Veronia awarded Tuxney Bremer Co., Tillamook, at $4,640.

California.—Following are four lowest bids opened April 17 by California Highway Commission, Forum Building, Sacramento, for constructing a steel truss bridge with reinforced concrete approaches in Humboldt County, Division I, Route I, Section E: Engineer's estimate $100,440; Mercer Fraser Co., Eureka, $102,825; McLaren & Peterson, San Francisco, $103,700; Frank L. Smith, Eureka, $108,000, and Ross Construction Co., Sacramento, $108,810.

PAVING AND ROADS

PROPOSED WORK.

Bristol, Conn.—Carlton W. Buell, City Engineer, has prepared estimate for improving about 24,690 ft. of streets. Estimated cost $107,540. Address City Clerk.

Buffalo, N. Y.—Contract soon to be let by City Council for paving portions of Choate Avenue, Gittere and Oberlin Streets. Address City Clerk.

Malone, N. Y.—Citizens April 11 voted $78,000 bonds for road improvements and park system. George A. Willison, Deputy Clerk.

Collingswood, N. J.—Council authorized election to vote $135,000 bonds for street improvements.

Elizabeth, N. J.—Board of Works adopted resolutions for paving eleven streets. Address Clerk of Board.

Jersey City, N. J.—Supreme Court has declared void the contract awarded in December by Board of Chosen Freeholders, at $486,688, for improving Newark Turnpike between Harrison and Kearney. Address County Clerk.

New Jersey.—Following road improvements are to be made in New Jersey. Address State Engineer, Trenton.

Bergen County—Bergen Turnpike from Hudson County line to Fairview, about 5½ miles, material not decided; appropriation, $36,000.

Hunterdon County—Road from New Germantown to Lamington, 1 mile; from Lambertville to Mercer County line; general surfacing of main county roads with macadam top dressing and oil. Estimated cost, $250 per mile.

Mercer County—Board of Free Holders arranging to spend $500,000 for road work; about $100,000 appropriated for repairs to present macadam roads; many macadam roads to be replaced with more permanent type of paving. Road from Lawrenceville to Princeton, 4½ miles, macadam, cost, $55,000; road from Trenton to Allentown, 5½ miles, bituminous macadam, cost $60,000; from Trenton to connect with Pennington and Hopewell roads, about 13 miles, macadam, cost $20,000; from Trenton to Lawrenceville, 5 miles, bituminous concrete, cost $20,000.

Middlesex County—Board of County Freeholders arranging to spend about $150,000 for road work; new road from Franklin Park to Somerset (in conjunction with Somerset County Board of Freeholders); material not selected; Cranbury Pike; material not selected.

Monmouth County—Road from Keyport to Red Bank, first section; material not selected. Coast Boulevard Wreck Pond near Spring Lake, new bridge and fills, cost $22,000.

Morris County—Lake Hopatcong Road, north of Dover, about 7 miles; material not selected.

Passaic County—Board of Chosen Freeholders authorized to bond for $99,000 for road work in present year. Road from Midvale to Greenwood Lake, macadam, cost $25,000; road from Hamburg to Paterson, macadam, cost $25,000; Little Falls Turnpike, amiesite; Cannon Ball Road, macadam and widening of road; Madison Avenue, Paterson, macadam and amiesite with middle parkway.

Somerset County—County Freeholders arranging to spend $75,000 for road work. Inter-county road from New Brunswick to Kingston, macadam, cost $30,000; Pine Brook Road, from Far Hills to Bernardsville, 6½ miles, material not decided, asphalt being considered, cost $16,000; road from Somerville to Bound Brook, 4½ miles, macadam.

Sussex County—County Freeholders appropriated $24,000 for road work. Road from Stockholm to Unionville by way of Sussex, top dressing stone with oil.

Union County—Mountainside Chapel to Springfield, material not decided; new road from Cranford to Westfield line, material not decided.

Warren County—New road from Bridgeville to Hope, 10 miles, material not decided; new road from Washington to Oxford, about 8 miles, material not decided.

Perth Amboy, N. J.—City will issue $65,000 bonds for street improvements. Address City Clerk.

Trenton, N. J.—City Commissioners will spend $55,000 for paving with bituminous concrete Parkside, Eastfield, Bryn Mawr and other streets; also $25,000 for repaving W. State, Chestnut, Greenwood and other streets. Abram Swan, City Engineer.

City Commission considering paving with asphaltic concrete on concrete base Cummings Avenue. L. D. Hirsch, City Clerk.

Clearfield, Pa.—Borough Council approved $80,000 bond issue and will present same to voters at May primaries. Address Borough Clerk.

Narberth, Pa.—Borough Council plans $30,000 bond issue for highway improvements. Address Borough Clerk.

Newtown, Pa.—Council decided to spend $20,000 for street improvements. Address City Clerk.

Baltimore, Md.—Paving Commission, 601 Garrett Building, plans paving with sheet asphalt portions of Harlem, Myrtle and Westwood Avenues and Calhoun and Presbury Streets.

Norfolk, Va.—County Road Board at Portsmouth appropriated $9,000 for resurfacing a portion of Jamestown Boulevard, at city limits of Norfolk, through Larchmont and suburbs. Address County Clerk, Portsmouth.

Elkins, W. Va.—Road bonds for $220,000 will be sold May 1 by W. O. Triplett, President County Court.

Hundred, W. Va.—Citizens of Church District of Wetzel County voted $240,000 road improvement bonds. Address Clerk at Church District, Hundred.

Lewisburg, W. Va.—Citizens voted $155,000 bonds for constructing J. R. and K. pike on National Midland trail.

Citizens April 15 voted $153,500 bonds for road improvements. John S. Crawford, County Clerk.

Lumberport, W. Va.—Citizens voted $25,000 bonds for paving principal streets. Address City Clerk.

Americus, Ga.—Street improving bonds for $30,000 will be sold May 1, by Mayor and City Council.

Bronson, Fla.—All bids opened April 19 by A. P. Hardee, Clerk Board County Commissioners, for constructing roadway in Special Road and Bridge District No. 1 have been rejected.

Miami, Fla.—Reported contract soon to be let by City Council for paving three miles with asphalt, nine miles native rock, constructing nine miles of curbs and gutters and about 14 miles of sidewalks. Address City Clerk.

Birmingham, Ala.—The repaving of Tuscaloosa Avenue at a cost of about $60,000 is under consideration.

Houma, La.—Contract soon to be let for constructing about 12 miles of road, surfaced with gravel. T. B. Smith of Houma, Engineer.

Natchitoches, La.—Citizens of Natchitoches Parish voted $20,000 bonds for constructing roads. Address Pres. Police Jury, Natchitoches.

Shreveport, La.—Citizens voted in favor of an additional tax for 100 miles of good roads. J. F. Bullen, Parish Engineer, Shreveport.

Paulding, Miss.—Road and bridge bonds for $15,000 will be sold May 1, by County Supervisors, Dist No. 3. (T. Q. Brame, Clk.)

Wartburg, Tenn.—Election to be held May 20 to vote $1,000,000 bonds for road improvements. W. L. Stricklin, County Judge, Wartburg.

Grayson, Ky.—Paving bonds for $50,000 will be sold May 8, by County Fiscal Court. J. E. Thornbury, Judge.

Newport, Ky.—Clerk of County Fiscal Court has been ordered to readvertise for bids for reconstruction of Water Works Road one mile east of Newport Corporation line.

Winchester, Ky.—Citizens voted $40,000 road bonds. Address County Clerk.

Bowling Green, Ohio.—Portions of Pike, Liberty, South Maple, East Lehman and Lime Streets and Georgia and West Merry Avenues are to be paved with either macadam concrete or other asphaltic mixture. R. S. Sweet, City Auditor.

Cincinnati, Ohio.—County Commissioners April 18 authorized road work for the season, amounting to $100,000.

William Hoen, County Surveyor, estimates cost of oiling 51 roads at $31,866; same has been approved by County Commissioners.

Following road improvements authorized by County Commissioners: Muddy Creek Pike, Harrison Pike, West Miami River Pike, Valley Junction Road, Blue Rock Pike, North Bend Road, Burns Schoolhouse Road, Pleasant Run Road and Hamilton Pike and Plainfield Pike, at a total cost of $82,199.

County Board of Commissioners directed County Surveyor Wm. Boeh to prepare plans and estimates of cost for improving Reading Road with brick, concrete or warrenite through the village of Reading.

Cleveland, Ohio.—About $75,000 will be appropriated by state for country road work along West Shore at Rocky River and Bay villages. Address County Clerk.

Delaware, Ohio.—Contract will be let about June for about 17,000 sq. yd. brick or concrete pavement on S. Sandusky Street and W. Central Avenue. G. S. Irwin, City Engineer.

Findlay, Ohio.—It is proposed to pave East Sandusky, Putnam, Prospect and several other streets at a cost of $100,000. U. K. Stringfellow, Engineer, Findlay.

Jefferson, Ohio.—Paving bonds for $49,000 will be sold May 22 by Board County Commissioners. B. E. Brainerd, Clk.

McConnellsville, Ohio.—Paving bonds for $11,500 will be sold May 5 by C. C. Morgan, Village Clk.

Muncie, Ind.—County Commissioners plan spending approximately $1,000,000 for constructing and improving roads. Address County Clerk.

Battle Creek, Mich.—About 5 miles of pavement will be constructed during summer, costing $100,000. Most of pavement laid will be macadam with cement base and asphalt top. Address City Clerk.

Menominee, Mich.—All bids opened April 19 by County Commissioners for 3 miles of waterbound macadam road on Trunk Line Road No. 1, and about 2 miles on County Road No. 4 rejected, and work is to be done by the County Road Engineer.

Alton, Ill.—City Court has approved paving of Main street at a cost of $106,000. Address Clerk Board Local Improvements.

Fairfield, Ill.—City Council has passed ordinance authorizing paving about 7000 ft. with wire-cut lug brick. If approved by Court, contract will be let about June 1. E. A. Cox, Engineer, Carbondale. W. L. McFarlan, City Engineer; A. J. Poorman, Mayor.

Joliet, Ill.—City Council plans paving with bituminous material portion of Wilcox Street, at an estimated cost of $39,913. Address City Clerk.

Moline, Ill.—Reported city will take steps at once to widen Fifth Avenue at a cost of $94,000.

Rock Island, Ill.—Board Local Improvements authorized paving with asphalt on Seventeenth Avenue, sidewalks on Twenty-fifth and Thirtieth Streets, and with brick on Twenty-third and Forty-fifth Streets.

Bemidji, Minn.—See "Bridges."

Neodesha, Kan.—Reported city is considering paving 25 blocks of brick pavement. Address City Clerk.

Fremont, Neb.—It is proposed to pave with concrete on W. Tenth, W. Fifth and N. Clarkson Streets. L. M. Roessler, City Hall.

Omaha, Neb.—Citizens voted $1,700,000 bonds for grading and paving roads. Address County Clerk.

Bismarck, N. D.—City Commission considering paving about 161 blocks. Address City Clerk.

Hillsboro, Mo.—Citizens voted $500,000 bonds for constructing permanent roads and bridges. Harry D. Griffith, Engr., Hillsboro. G. W. Gasche, County Clerk.

Kansas City, Mo.—It is proposed to pave Eighteenth Street, from Grand Avenue to Woodland Avenue, a distance of 16 blocks. Clark R. Mandigo, Assistant City Engineer. Street is 65 ft. wide with a 42½ ft. roadway.

Monett, Mo.—Citizens April 18 voted $50,000 bonds for good roads. John Walsh, Clerk Special Road District; Bert Robbins, Engineer, Monett.

Ballinger, Tex.—Citizens voted good roads proposition. A fund of $27,000 will be provided annually for road improvements.

Bastrop, Tex.—Citizens voted $30,000 bonds for road improvements in Cedar Creek.

Corsicana, Tex.—Election to be held May 20 to vote on $40,000 bond issue for improving roads in Eureka Road Dist.

Edinburg, Tex.—Citizens voted $250,000 bonds for constructing Hidalgo's portion of proposed Diamond Loop Highway. Address County Clerk.

Hillsboro, Tex.—Election to be held May 24 to vote $140,000 bonds for road improvements. Address City Clerk.

Houston, Tex.—Council is considering paving portions of Jackson Street and Capitol Avenue with either creosoted wood blocks, ventrere fiber brick, bitulithic, Uvalde rock asphalt, asphaltic concrete or sheet asphalt. E. E. Sands, City Engineer.

Hutto, Tex.—Road bonds amounting to $50,000 sold.

Mount Pleasant, Tex.—Citizens of Winfield Precinct voted $100,000 road bonda. Address Clerk Winfield Precinct at Mount Pleasant.

Sulphur Springs, Tex.—The Attorney General at Austin approved issue of $400,000 Hopkins County Road Dist. No 1 road bonds.

Taylor, Tex.—The Attorney General at Austin approved bond issue of $50,000 for street improvements.

Taylor, Tex.—It is proposed to construct a highway between Taylor and Hutton costing $50,000. This is part of Meridian Highway scheme. J. N. May, County Commissioner, Georgetown.

Winfield, Tex.—Citizens voted $75,000 bonds for road improvements.

Eufaula, Okla.—It is proposed to construct about 100 miles of permanent roads, 23 miles being Jefferson Highway. Road bonds for $450,000 were sold April 14 Address J. P. Eanson, Eufaula.

Eufaula, Okla.—See "Water Works."

McAlester, Okla.—County contemplates spending $600,000 on road improvements. J. O. Toole. County Commissioner, McAlester.

Bellingham, Wash.—City Cooncil voted to construct concrete walks on Harris Avenue, Eleventh, High, Virginia and Alabama Streets. Address City Clerk.
City Council considering paving Ellis Street with concrete. Address City Clerk.

Blaine, Wash. — City Council passed resolutions to pave 1¼ miles main road leading into city from Pacific Highway to southeast. Estimated cost $16,000. Address City Clerk.

Chehalis, Wash.—Contract to be let early in May for paving National Avenue. Estimated cost $25,000. Address D. W. Boone, City Clerk.

Colfax, Wash.—About 26.3 miles of gravel and 4.6 miles of macadam road are to be constructed in this county during 1916. J. M. McCaw, County Engineer.

Ephrata, Wash.—All bids opened by County Commissioners for constructing Permanent Highway No. 6A rejected. Lowest bid, $17,244. C. T. Sanders, County Clerk.

Port Angeles, Wash.—Survey being made for constructing gravel road between Joyce and Pysh, to cost $100,000. Richard W. Rump, County Engineer.

Seattle, Wash.—City Council passed bills providing for improvement by constructing cement walks on portions of 7 streets, including Twenty-second Street North, Twenty-fourth Street North and Montlake Place, at $8,423, and paving with brick an alley at $1,999. Address City Clerk.
A. H. Dimock, City Engineer, filed plans and specifications with Board of Public Works, estimating cost for grading and paving as follows: Western Avenue, $122,000; Rainier Avenue, $33,000, and Thirty-ninth Avenue S., $22,651. Address City Clerk.
Contract soon to be let by Board of Public Works for paving Warren Avenue from First Avenue to Roy Street. Estimated cost $44,591. Address City Clerk.

Spokane, Wash.—County Commissioners passed resolutions for constructing this summer with asphaltic concrete 3 miles Apple Way from east city limits to Dishman, and 2 miles Mead Highway north from Mead. Estimated cost per mile $10,000. J. W. Strack, County Engineer.
Commissioners of Spokane County, Washington, and Kootenai County, Idaho, plan paving 30 miles of Apple Way from Spokane to Coeur d'Alene, Idaho. J. W. Strack, County Engineer, Spokane, and Neil S. Coventry, County Engineer, Coeur d'Alene, Idaho.

Tacoma, Wash.—Contract will be let some time in May for paving about one mile of Pacific Avenue probably with asphalt at an estimated cost of $32,000. Work includes storm sewers costing $8,000. A. C. Raleigh, City Engineer.

Walla Walla, Wash. — Commissioners passed resolutions for paving two miles of highway between Waitsburg and Columbia County line. Grova Cookerly, County Engineer.

Portland, Ore.—City Council plans macadamizing two miles of drives in Mt. Tabor Park. Address City Clerk.

Ross, Cal.—Citizens voted $18,000 bonds for resurfacing principal streets with asphalt. Address City Clerk.

Douglas, Ariz.—Paving of 9th and F Avenues distance of 1 mile contemplated. Fred Lindner, City Clerk.

Safford, Ariz.—Construction of Clifton-Solomonville Highway contemplated, about $90,000 available for improvement. Address George A. Foote, Chmn. Supervisors of Graham County, Safford, Ariz.

Salt Lake City, Utah.—County Commissioners propose during next year spending $157,984 on road improvements.

Lewiston, Idaho.—It is proposed to lay about 9000 sq. yd. 6-in. concrete pavement and 3650 lin. ft. curb in District No. 10, cost $9,000; also 14,000 sq. ft. of concrete sidewalk is contemplated. D. C. Wrighter, City Engineer, Lewiston.

St. Maries, Idaho.—City Engineer is preparing plans and specifications for improving Main and other streets by grading and paving. Estimated cost $15,594.

Hamilton, Ont.—The paving of Catharine Street will be done by day labor. Address City Engineer.

BIDS DESIRED.

Massachusetts.—Until May 2, by State Highway Commission (Wm. D. Sohier, Chmn.) for constructing roads as follows:
Hancock, surfacing road, about 6100 ft. in length.
Wilbraham, surfacing section of State Highway, about 8900 ft.

Rhode Island.—Until May 5, by State Board Public Roads, State House, Providence, for constructing following roads:
North Kingstown, road between East Greenwich and Wickford, length 2.16 miles.
Narragansett, road from Narragansett Pier through Wakefield, length 2.99 miles.
Westerly, post road, 1 mile long.
East Providence, near Riverside, a road distance of 0.93 mile.
Portmouth, from Stone Bridge westerly, a distance of 1.1 miles.
Middletown, East Main Road, length 1.75 miles.
Cranston, New London turnpike, length 2 miles.
Cumberland, Mendon Road, length 2 miles.
Johnson, Hartford Pike, length 2 miles.

New Canaan, Conn.—Until May 6, by John E. Hersam, Borough Clerk, for reinforced concrete pavement on portions of Main Street, Forest Street, East and Railroad Avenues, advertised in Engineering Record.

Albany, N. Y.—Until May 1 by Board Contract snd Supply (Isidore Wachsman, Secy.) for improving Pennsylvania and McArdle Avenues and Thornton Street with asphalt concrete foundation, curbing, etc.

Lockport, N. Y.—Reported desired until May 1 by County Supervisors (Roland B. Singer, Chmn.) for constructing highway system as follows: Fillmore-Chapel-Ransomville Road, 5.964 miles, in Porter and Lewiston, cost $45,856; Beebe-Chestnut Road, 5.73 miles, in Wilson, $39,763; Warren's Corner Road, 2.96 miles, in Lockport, $33,971; Pendleton-Town Line Road, 3 miles, in Pendleton and Wheatfield, $17,383.

New York, N. Y.—Until May 4 by Douglas Mathewson, Pres. Bronx Borough, for improving portions of E. 199th, W. 233d, W. 234th to other streets, to consist of 1080 sq. yd. bituminous macadam, 53,960 sq. ft. two course concrete sidewalks, 5050 lin. ft. guard rail, together with necessary curbing, manholes, basins, etc. Total security $13,000. Also for constructing sewers in Radcliffe, Pierce, Colden Avenues and numerous other streets. Proposition "A," Engineer's estimste, 17,280 lin. ft. 12 to 30-in. vitr. pipe, 2120 lin. ft. concrete sewer, together with manholes, basins, etc. Proposition "B," Engineer's estimate, 16,175 lin. ft. 12 to 30-in. vitr. pipe sewers, 2120 lin. ft. vitr. segment block sewers, together with manholes, basins, etc. Security $70,000.

Patchogue, L. I., N. Y.—Until May 9, by Edward B. Woodruff, Village Clerk, for concrete pavement on Ocean Avenue, advertised in Engineering Record.

Poughkeepsie, N. Y.—Until May 18 by Board Public Works for paving Parker Avenue and N. Clinton Street, in all about 24,000 sq. yd. vitr. brick pavement, 4700 lin. ft. new four cut bluestone curb, etc., advertised in Engineering Record. E. W. Sylvester, Supt. Public Works.

Madison, N. J.—Until May 5, by Street and Sidewalk Committee (Jos. E. Pierson, Chmn.), for improving King Road from Green Avenue to Madison Avenue; in all, about 5800 sq. yd. asphaltic block pavement on concrete base.

Johnstown, Pa.—Reported desired until May 4, by Jackson R. Crissy, City Engr., for paving with brick and concrete fourteen stretches of city thoroughfares.

Pennsylvania.—Until May 15, by State Highway Department, Robert J. Cunningham, State Highway Commissioner, Harrisburg, for constructing following roads:
Delaware County, reinforced cement concrete road in Aston and Concord Townships, length 19,223 ft. Reinforced cement concrete or bituminous and reinforced cement concrete road in Birmingham Township, length 14,535 ft. Vitr. block road in Nether Providence Township, length 4250 ft.
Chester County, reinforced cement concrete or bituminous and reinforced cement concrete road in Pennsbury and Kennett Township, length 17,795 ft. Reinforced cement concrete or bituminous and reinforced cement concrete road in London Grove and Penn, length 10,344 ft.
Montgomery County, bituminous concrete, Whitemarsh Township, 4390 ft.

Denton, Md.—Reported desired until May 9, by Harry Waldorf, County Roads Engineer, for constructing 10,000 sq. yd. concrete surfacing on Main Street, also for 2 miles of shell road on Low Schoolhouse Road and 2.4 miles of shell road on Federalsburg Hynson Road.

Washington, D. C.—Until 2 p. m. May 1 by Commissionera D. C., Room 509, District Building, for furnishing and delivering during fiscal year beginnning July 1, 1916, ending June 30, 1917, granite curbing. Oliver P. Newman, Chmn.

Greenville, N. C.—Until May 1, grading and laying approximately 15,000 sq. yd. granolithic sidewalk in town of Greenville. J. C. Tyson, City Clk.

Wilson, N. C.—Until May 11, by Mayor and Board of Commissioners, for street improvements, advertised in Engineering Record. Anderson & Christie, Inc., Consulting Engrs., Charlotte, N. C.; E. F. Killette, Mayor.

Columbia, S. C.—Until May 9 by R. C. Keenan, Council Supt. of Streets, for about 17,000 sq. yd. or more street paving, together with concrete curb, etc.; bids desired on sheet asphalt, bitulithic and vitr. paving on 5-in. concrete base. John McNeal, City Engr.

Miami, Fla.—Reported desired until May 3, by Z. T. Merritt, Clerk County Commissioners, for constructing road in Special Road and Bridge Dist. No. 2.

Camden, Ala.—Reported desired until May 12 by J. N. Stamford, Chmn. County Commissioners, for constructing 4 miles of road from Lower Beach Tree Road to railway tracks.

Columbus, Miss.—Reported desired until June 5 by W. N. Hutchinson, County Road Commissioner, for constructing about 20 miles of gravel and concrete roads. C. L. Woods, Engr., Columbus.

Ellisville, Miss.—Reported desired until May 4 by S. W. Lindsey, Chmn. County Commissioners, for constructing 23.62 miles highway in District No. 2.

Jackson, Miss.—Reported desired until May 3, by C. M. Farr. Secy. Second Supervisors District, Bolton, for improving 9 miles of highway.

Meridian, Miss.—Reported desired until May 2 by County Road Commission (H. F. Braochm, Chmn.) for applying bituminous wearing surface to all hard-surfaced roads in district. J. T. Pinkston, Co. Engr.

Decatur, Tenn.—Until May 1 by Board County Road Commissioners (R. L. McKenzie, Secy.) for improvements of roads through Meigs County.

Greenville, Ky.—Reported desired until May 2 by Orein L. Roark, City Clk., for paving streets with macadam, together with curb, gutters, etc.; probable cost $35,000.

Louisville, Ky.—Until May 4, by Board Public Works (Roger G. McGrath, Secy.), for constructing sidewalks on Bellaire. Greenwood Avenues and other streets.

Cincinnati, Ohio.—Until May 12, by Board of County Commissioners (Albert Reinhardt, Clerk), for improvement of Caldwell Drive, from Burns Avenue to the North Bend Road. County Surveyor Wm. Boeh's estimate, $38,485.

Fayette, Ohio.—Reported desired until May 8 by C. E. Hawes, City Clk., for 8000 sq. yd. paving. Alternate bids on asphalt, vitr. block, brick or concrete. George Champe, Engr., 610 Nasby Building, Toledo.

New Philadelphia, Ohio.—Until May 16, by County Commissioners New Philadelphia, for road improvements, including Dennison-Cadiz Road, 2.43 miles macadam; Bolivar Road, 1½ miles concrete; brick on Salem Township Road 2.06 miles, Strasburg Village Road 1.02 miles, and Reiser Road 0.83 miles, advertised in Engineering Record. Edward Stingel, County Highway Supt., New Philadelphia; R. H. Bussdorfer, County Auditor.

Toledo, Ohio.—Reported desired until May 2, by Director Public Service, for street paving, estimated to cost $109,000. Bids will be considered on brick, asphalt and other materials.

Urbana, Ohio.—Until May 2, by Harry E. Rock, Director Public Service, for 11,850 sq. yd. tar, asphalt or mastic filler, 4550 lin. ft. straight curb on Miami Street from Pennsylvania R. R. to Edgewood Avenue, and about 7950 sq. yd. vitr. brick paving, repressed lug, repressed plain, wire cut lug or wire cut plain from High Street Street to Pennsylvania R. R. Emmett F. Sweetman, City Engineer.

Vincennes, Ind.—Until May 1, by city, for about 3 miles of asphalt pavement on Church, Vigo and other streets and combined curb and gutter. H. T. Watts, City Engineer.

Boyne, Mich.—Until May 1 by J. L. Ekstrom, City Clk., for paving three blocks of Lake Street and two blocks of Water Street with concrete.

Hillsdale, Mich.—Until May 5, by E. L. Ranney, City Clerk, for paving about 14,000 sq. yd.; advertised in Engineering Record.

Newberry, Mich.—Until May 1 by County Commissioners for constructing work specified on the Luce County Road System. Contract No. 1, first mile consists of resurfacing and widening present 9 ft. waterbound macadam to 16 ft. and incidental grading; next ½ mile consists of grading and building 16 ft. waterbound macadam, east and west mile, on town line consists of grading and building 14 ft. waterbound macadam. Contract 2, 14 ft. waterbound macadam, beginning at center of Section 9T and proceeding in northerly direction to Section 33. Perry Leighton, Co. Clk.

Paw Paw, Mich.—Until May 1 by Harold Spicer, Village Clerk, for constructing two course concrete pavement for Paving Dist. No. 3; also paving portions of Main, Gempe and Niles Street with similar pavement.

Alton, Ill.—Reported desired until May 2, by E. H. Landon, City Engineer, for 29,140 ft. concrete curbing and 48,500 sq. yd. brick paving on 4-in. concrete base.

Byron, Ill.—Reported desired until May 12 by T. C. Gill, Town Clk., for 9 miles of macadam road.

Chicago, Ill.—Until May 8, by Board Local Improvements (Edw. Glackin, Secy.) for grading, curbing and paving with vitr. brick West Division St., Euclid Ave. and numerous other streets and alleys.

Evanston, Ill.—Until May 2, by Commissioner Public Works, for 5000 sq. yd. brick pavement.

Illinois.—Until May 3 by State Highway Department, Springfield, for constructing road as follows:

Quincy, Adams County, 6910 ft. waterbound macadam road. Engineer's estimate $18,037.

Mattoon, Coles County, 7100 ft. monolithic brick road. Engineer's estimate $15,145.

Park Ridge, Cook County, concrete road, 8142 ft. Engineer's estimate $22,489.

Wheeling, Cook County, 14,077 ft. concrete road. Engineer's estimate $31,548.

Maywood and Hillside, Cook County, 15,331 ft. concrete road. Engineer's estimate $34,628.

Elva, De Kalb County, 17,888 ft. concrete road. Engineer's estimate $24,950.

Paxton, Ford County, 13,522 ft. gravel road. Engineer's estimate $16,118.

Mount Carmel, Wabash County, 3820 ft. gravel road. Engineer's estimate $5,416.

Linnville, Ill.—Reported desired until May 4 by Town Clerk for 10½ miles waterbound macadam road.

Mount Morris, Ill.—Reported desired until May 5 by W. H. Miller, Town Clk., for 11 miles of gravel road.

Sterling, Ill.—Until May 9, by Roy Baer, Town Clerk, for 26,803 sq. yd. brick paving on Lincoln Highway. V. N. Taggett, County Superintendent of Highways, Morrison.

Woosung, Ill.—Reported desired until May 3 by J. C. Hagerman, Town Clerk, for waterbound macadam and gravel roads, in all about 6730 cu. yd. material.

Menomonie, Wis.—Until May 9, by Board of Public Works (J. R. Mathews, Chmn.) for furnishing material and paving with reinforced concrete Depot Hill Street from the C., St. P., M. & O. tracks to the junction of Main Street and Second Street W. and North Broadway from bridge south to connect with the brick paving at Fourth Avenue.

Sheboygan, Wis.—Until May 1, by Board Public Works (C. U. Boley, Chmn.) for grading and paving roadway and concrete paving, curbing and sidewalks on portions of North Eleventh Street, in all about 23,225 sq. yd. paving and 10,370 lin. ft. curbing. John Kummer, Co. Controller.

Grinnell, Iowa.—Until May 10 by A. C. Harriman, City Clk., for 24,000 sq. yd. bitulithic, brick or asphalt paving and 17,000 ft. curb and gutter. Iowa Engineering Co., Clinton, Iowa, Engrs.

Aitkin, Minn.—Until May 3 by H. C. Beecher, Co. Aud., for constructing Sections B, C, D and E of Judicial Road in Le May Township; probable cost $10,143.

Bemidji, Minn.—Until May 1 by George Stein, City Clk., for constructing 9000 sq. yd. paving and 1500 ft. storm sewers.

Buffalo, Minn.—Reported desired until May 2 by John A. Berg, Co. Aud., for constructing a number of county roads.

Kent, Minn.—Reported desired until May 2 by County Board Supervisors (H. B. Rieland, Clk.) for constructing 4 miles of road.

Minneapolis, Minn. — Reported desired until May 1 by A. P. Erickson, Co. Aud., for road work under contracts Nos. 3, 4 and 7.

Morris, Minn.—Until May 13 by C. R. Wollthan, Co. Aud., for constructing State Roads Nos. 2, 3, 4, 9 and 11, to consist of 27,274 lin. ft. turnpiking, 59,451 cu. yd. grading, together with culverts, etc.

Willmar, Minn.—Until May 16 by Samuel Nelson, Co. Aud., for constructing State Roads Nos. 1, 3, 4, 5, 6 and 8.

Worthington, Minn.—Reported desired until May 4 by Gus Swanberg, Co. Aud., for constructing State Road No. 2, Indian Lake Township, and constructing about ½ mile of road within corporate limits of village. Total length 16,432 ft.

Pittsburg, Kan.—Until May 1, by A. D. Stivers, City Engineer, for 9715 sq. yd. paving, 3460 lin. ft. curbing, etc.

New Rockford, N. D.—Reported desired until May 1 by W. C. Dresser, City Clk., for constructing cement walks and crosswalks for year 1916.

Spearfish, S. D.—Reported desired until May 1 by Walter Harkness, City Aud., for constructing sidewalks, etc., for ensuing year.

Independence, Mo. — Reported desired until May 5, by Allen C. Southern, County Surveyor, for improving several roads, including 9200 sq. yd. macadam on Park Hickman Mills Road; 45,472 sq. yd. Schoolhouse and Lake City Roads, 10,814 sq. yd. Frank Frick Road, 40,234 sq. yd. Valley Road, 33,964 sq. yd. C. A. Duck Road.

Kansas City, Mo.—Until May 2, by Board Public Works (Edw. F. Webster, Act. Secy.), for constructing artificial stone sidewalks on Twenty-sixth, Fifty-ninth and numerous other streets.

Until May 5, by Allen C. Southern, Co. A. Surv. and Ex-Officio Highway Engr., for paving portions of Swope Park-Hickman Mill Road, Owens School House and Lake City Road, Frank Frick Road and the Valley Road; in all, about 107,720 sq. yd. macadam pavement, 86,119 cu. yd. earth excav., etc.

Sikeston, Mo.—Until May 15 by Earl J. Malone, City Clerk, for furnishing material and paving with asphalt macadam on portion of New Madrid Street and Kings Highway, advertised in Engineering Record. Benjamin L. Parker, City Engineer.

Cathlamet, Wash.—Reported desired until May 2, by County Auditor, for reconstructing Deep River Road, including 2900 cu. yd. earth excav., 79,000 ft. timber clearing 11 acres, etc. T. H. Allman, County Engr.

Coupeville, Wash.—Until May 8, by Roy H. Gillespie, County Auditor, for 4.63 miles of permanent highway known as Lin's Corner-Bay View Road.

Enumclaw, Wash.—Until May 2, by O. C. Magnuson, City Clerk, for 16,420 sq. yd. one course concrete mixed 1-2-3, on Griffin and Maple Avenues, etc., and 8270 ft. curbing. Cost, $26,375. W. T. Lippard, City Engineer.

Seattle, Wash.—Reported desired until May 8, by County Commissioners, for constructing Mercer Island Road, estimated to cost $9,000.

Astoria, Ore.—Reported desired until May 3, by Committee of Streets and Public Ways, at office of City Auditor, for constructing road and bridges as follows: Commercial Street, concrete viaduct and 6440 sq. yd. pavement, cost $101,510; Eleventh Street, concrete viaduct, 3144 sq. yd. pavement, cost $40,385; Duane Street, concrete viaduct, 1988 sq. yd. pavement, cost $25,901; Bonds Street, paving, 8344 sq. ft. concrete walks, plain; 14,000 sq. ft. concrete walks, reinforced; 1754 lin. ft. concrete curb, plain; 2100 lin. ft. concrete wall, etc. Probable cost $33,013. G. T. McClean, City Engr.

Los Angeles, Cal.—Until May 15, by Board Supervisors, for constructing a 5-in. concrete pavement on Section H, Mint Canyon Road, 1.11 miles, county to furnish 2089 bbl. cement, 2089 tons gravel and 1405 tons sand.

Stockton, Cal.—Reported desired until May 3 by County Supervisors for surfacing Ripons main street and Perrott Road with oil macadam, and 1½ miles other road work.

Lewiston, Utah.—Reported desired until May 2 by P. E. Van Orden, Town Clk., for about 25,600 sq. ft. concrete sidewalk, etc.

Salt Lake City, Utah.—Reported desired until May 2 by Gordon Snow, City Recorder, for paving Sixth Avenue with bitulithic; probable cost $19,143. S. Q. Cannon, City Engr.

PRICES AND LETTINGS.

★Indicates award of contract.

★Massachusetts—Contracts for paving in various towns (bids opened April 18) awarded by Massachusetts Highway Commission, Boston, for resurfacing roads as follows: Andover, to R. F. Hudson, Melrose, $17,754, and also in Reading, same contractor, at $15,615: to C. F. Alger of Taunton, road in Dennis and one in Barnstable at $18,849 and $7,327 respectively, and in Lunenburg to R. H. Newell Co., Uxbridge, at $7,320.

★Connecticut — Contract awarded by State Highway Commissioner, Hartford, for 3828 lin. ft. reinforced concrete paving on Main Street and East Broadway, Stratford, to Richard Lamb, 90 West Street, New York, at about $10,000.

★Hartford, Conn.—Following are unit figures of the Sewage Disposal & Water Plant Co., Schenectady, N. Y., the successful bidder on bids opened April 11 by Board of Contract and Supply for paving: New work: 32,195 sq. yd. sheet asphalt, 90 cts.; 50 cu. yd. extra binder, $9.50; 5365 cu. yd. concrete foundation, 5.32; 9025 cu. yd. excav., 88 cts.; resurfacing: 3290 sq. yd. sheet asphalt, $1.05; 40 cu. yd. extra binder, $9.50; 60 cu. yd. concrete foundation, $6.50. Repairs: 2000 sq. yd. sheet asphalt, $1.40; 10 cu. yd. concrete foundation, $6.50; total, $73,024.

Albany, N. Y.—Following are four lowest bids opened April 20 by State Highway Commission for constructing public highways by State Aid:

Road No. 1353, Solvay State Fair, Syracuse, Onondaga County, 2.4 miles: Morrison & Quinn, Inc., Rochester, $40,236; Heisler & Aldershof, Albany, $40,320; Rock & Griffin Co., Watertown, $41,319; Warner Quinlan Asphalt Co., Syracuse, $41,635.

Road No. 5587, Syracuse-Fayetteville, Onondaga County, 5.12 miles: M. J. Gleason Co., Syracuse, $86,405; Mondo Construction Co., Inc., Syracuse, $87,486; Monroe Roads Co., Pittsford, $95,607; Guy B. Dickison, Syracuse, $87,765.

Road No. 1345, Mechanicsville-Clifton Park, Sartoga County, 5.74 miles: Irvine & Barry, Huntington, Province of Quebec, Canada, $59,875; Thomas H. Carr, Troy, $66,024; Richard Hopkins, Troy, $66,464; John B. Dower, Ballston Spa, $67,932.

Road No. 5599, Kingston-Port Ewen (Rondout Bridge), Ulster County, 0.49 mile: Larkin & Sangster, Buffalo, $320,881; Ward & Tully, Inc., Brooklyn, $323,197; Snare & Triest Co., New York, $343,930, and Frank L. Cohen, Buffalo, $347,283.

★Troy, N. Y.—Contract for furnishing and repaving with asphalt about 7000 sq. yd. (bids opened April 18) awarded John W. Davett. John J. Laughlin, Secy. Board Contract and Supply.

★Utica, N. Y.—Contracts awarded by Board of Contract and Supply to Harry W. Roberta & Co., Utica, for paving with bitulithic with artificial stone curbing portions of Margaret Street, Greenwood Court, Hampden Place, Thistle Road and Cromwell Place, at a total of $30,828.

★Dover, N. J.—Contract awarded M. Irving Demarest, Seawaren, N. J., for improving Blackwell Street and Sussex Turnpike Road (bids opened April 11). J. F. Runyon, County Auditor, Morristown.

Scranton, Pa.—Following are lowest bids, April 15, by Director Public Works for first letting of contracts in city's 1916 program of street improvement: (a) asphalt, (b) combination asphalt and stone (price given per sq. yd.): Sweeney Bros., Oxford Court, (a) $1.89; Olive Street, (b) $2.44; South Washington Avenue, (a) $1.78; Boulevard Avenue, (a) $1.80. Gaynor Contracting Co., Board Trade Bldg., Moosic Street, (a) $1.82. R. C. Ruthven, 314 Cater Bldg., Monsey Avenue, (a) $1.74; Wyoming Avenue, (a) $1.89. Matthias Stipp, 435 Moir Court, Poplar Street; (b) $2.43, New York Street, (b) $2.25, Ash Street, (a) $1.93.

★Norfolk, Va.—Contract awarded W. J. Creedon, Norfolk, for paving in Districts Nos. 3 and 6, at a total of about $19,727. P. F. Stofford, City Clerk.

★Portamouth, Va.—Contract awarded by County Commissioners for paving with concrete Indian Pool Bridge Road, Broad Creek Road, Princess Anne Turnpike, Indian River Road and Hodges Avenue to Lawson Construction Co. at about $140,000.

★Lake City, Fla.—Contract for 21,000 sq. yd. of brick paving awarded Alabama Paving Company, Birmingham, Ala. J. W. Lane, Secy. Board Bond Trustees. (Bids opened April 17.)

★Clarksdale, Miss.—Contract for 52,000 sq. ft. sidewalks, curb and gutter (bids opened April 18), awarded A. DeFrancischi & Co., Memphis, Tenn. O. C. Tuttle, Clerk.

★Caddoo, La.—Contract for constructing 6½ miles road in Caddoo Parish awarded to Healy Constr. Co., Meridian, Miss., at about $23,500.

★Shreveport, La.—Contracts for constructing 9 miles of road (bids opened April 13) awarded as follows: 6.57 miles gravel road (Parish of Caddo, to furnish gravel f.o.b. cars on road) to Healy Construction Company, Meridian, Miss., $23,532; and for 2.52 miles of gravel road (parish to furnish gravel f.o.b. cars on road), to Hall Matteir Shreveport at $6,004. J. F. Bullen, Parish Engineer, Shreveport.

★Bardstown, Ky.—Contracts awarded Blue Grass Construction Company, Bardstown at about $25,000 for constructing roads as follows: 6 miles Bardstown-Taylorville Pike Road, 3 miles Bardatown & Springfield Pike Road; reconstruction) and 4770 ft. new construction on Bardstown & Lebanon Road. The bid, $1.25 per 2000 lbs. on reconstruction and $1.21 per ton on new road for stone waterbound macadam. Wallace Brown, County Judge.

★Knoxville, Tenn.—Contract awarded by City Commission for paving with Trinidad asphalt 9000 sq. yd. to Murray Construction Co., Knoxville, at $1.23 per sq. yd. for paving, and 55 cts. for excavating and sub-grading.

★Lancaster, Ohio.—Contract awarded by County Commissioners to Highway Improvement Co. of Columbus for improving 2 miles Infirmary Pike, at $23,022.

North Vernon, Ind.—Following are bids opened April 14 by city for 4732 sq. yd. pavement on Walnut Street—(a) brick, (b) concrete, (c) asphaltic concrete: James DeGolger, Anderson, (a) $10,072, (b) one course, $7,487; H. W. Miller, North Vernon, (b) two course, $1.40 per yd. (a) $1.90 (Nashville), (c) $1.70; C. V. Bergen, Franklin, (a) $1.85 (Medora), (b) two course and one course, same, $1.44; Jefferson Construction Co., Louiaville, Ky., (a) (Medora), $1.97; Ewing Shields Seymour, (a) $1.85, (b) 2 course, $1.44. Charles W. Miles, City Engineer.

★South Bend, Ind.—Following are unit figures of three bids opened April 4 by F. J. Anderson, City Engineer, for paving Michigan Street (a) Western Construction Company, Mishawaka, $65,974 (awarded contract); (b) S. S. Saxton Company, Chicago, Ill., $69,183; and (c) W. B. Brady Construction Company, Chicago, Ill., $71,101:

	*(a)	(b)	(c)
18,922 sq. yd. sheet asphalt	$1.81	$1.90	$1.97
5904 sq. yd. brick	2.40	2.60	2.35
7664 cu. yd. grading	.55	.70	.68
5994 sq. yd. extra concrete under street car track	.65	.70	.99
57 manholes and inlets reset	1.60	2.50	1.00
24 lin. ft. marg. curb	.25	.30	.20
7090 lin. ft. combined curb and gutter	.60	.65	.55
15,437 lin. ft. Graite Stretcher block street car rails	.38	.48	.38

★South Bend, Ind.—Contract for paving Indiana Avenue, about 34,050 sq. yd., with asphaltic concrete, awarded W. B. Brady, Chicago, Ill., at $65,383.

★Rochester, Mich.—Contract for paving with brick on village portion of Main Street awarded Williston Construction Company, Chicago, Ill., at $25,484. This company bid lowest on Street Railway's portion (contract not yet awarded) at $12,425. L. A. Boulay Company, Engineers.

★Minonk, Ill.—Contract awarded I. D. Lain of Bloomington for constructing 3 miles of brick pavement in Woodford County, at about $30,000.

★Morrison, Ill.—Contract for paving Wall Street district awarded by Board Local Improvements to Central Engineering Company, Davenport, Iowa, at $92,162.

★Pekin, Ill.—Contract for paving McLean Prince Street District awarded by Board Local Improvements to Jansen & Zoeller of Pekin at an estimated cost of $72,000.

★Rockford, Ill.—Contract awarded A. E. Rutledge, Rockford, for brick paving on Auburn and Morgan Streets, at $48,000. and macadam on Chicago Avenue to Carrico Stone Company at $17,192.

★Springfield, Ill.—Contract for resurfacing Fourth Street with creosoted blocks awarded by Board Local Improvements to J. O. Patterson & Company at $13,000.

West Salem, Ill.—Contract for 16,187 sq. yd. macadam paving and 7535 lin. ft. curb and gutter (bids opened April 15) awarded J. W. Owens & Sons, Poseyville, at $15,393. C. Couch, Secy. Board Local Improvements.

★Marinette, Wis.—Following are four lowest bids opened April 17 by A. L. Hilles, City Engineer, for 11,000 sq. yd. reinforced concrete pavement: Chris. Johnson, Oshkosh, $16,718; Coslin & Mogunson, Marinette, $16,968; Murphy Construction Co., Manitowoc, $17,896, and Franz Rodloff, Plymouth, $18,598.

★Akron, Iowa.—Contract awarded by City Council for paving with concrete principal streets to C. F. Lytle, Akron, at $30,000.

★Eldora, Iowa.—Contract for 35 miles of roads (bids opened April 20) awarded by County Commissioners to J. E. McAndrew, Keokuk, at 19.45 cts. per cu. yd. E. W. Dunn, County Engineer.

★Marion, Iowa.—Contract for paving 16 blocks (bids opened April 17) awarded Ford Paving Company, Cedar Rapids. T. H. Oxley, City Clerk.

★Toledo, Iowa.—Contract for grading 10 miles of road (bids opened April 17) awarded by County Commissioners as follows: 122,900 cu. yd. to Cameron, Joyce & Co., Keokuk, Iowa, at 20.5 cts., and 4100 cu. yd. to Blythe Bros., Tama, at 18 cts. A. R. Hehmstreit, County Engineer.

★New York, N. Y.—Following are unit figures of the bids opened April 11 by Water Board, Municipal Building, New York, for Contract 171, surfacing with bituminous macadam and vitr. brick block portions of highway at Kensico Reservoir in town of Mount Pleasant, Westchester County: (a) H. S. Kerbaugh, Inc., 6 Church Street, New York, $45,145 (awarded contract); (b) Edward D. Monahan, 1301 Metropolitan Avenue, Brooklyn, $50,123; (c) Emerson Building Co., 103 Park Avenue, New York, $56,978.

	*(a)	(b)	(c)
17,000 lin. ft. of road excavating and grading (rolling, preparation and shallow excavation)	$0.25	$0.27	$0.49
100 cu. yd. excavating and grading (excavation not included in Item 1)	1.20	0.50	1.50
4,500 cu. yd. bituminous macadam bottom course	3.55	3.80	4.19
27,000 sq. yd. bituminous macadam surfacing	0.35	0.41	0.4275
600 cu. yd. concrete masonry for pavement foundations	3.65	4.71	4.72
100 cu. yd. concrete masonry for edgings, etc	6.25	5.00	5.80
1,200 bbl. Portland cement	1.75	1.86	1.88
3,300 sq. yd. vitrified brick pavement	1.95	2.35	2.16
200 ton bitumen in asphalt cement	20.00	20.00	26.50

★**Duluth, Minn.**—Contract for paving Central Avenue with reinforced concrete awarded U. A. Nelson, at $28,654. L. Ayres, City Engineer.

★**Kansas City, Kan.**—Contract for paving State Street awarded by City Commission to Bitumenized Road Paving Co. of Kansas City, Mo., at $50,000.

★Contracts for paving awarded by City Commissioners as follows (price given per sq. yd.): 45,830 sq. yd., to R. W. Van Roosen Constr. Co. of St. Joseph, Mo., at 97.4 cts. to $2.165; 26,179 sq. yd., to G. G. Roudebush of Kansas City, Kan., at from $1.02 to $1.75; 5840 sq. yd., to Kramer Contr. Co. of Kansas City, Mo., at $1.03 and $1.04; 32,970 sq. yd., to H. B. Fenton & Co. of Kansas City, Kan., at $32,970. Prices given on various kinds of materials.

★**Columbia, Mo.**—Following are four bids opened April 18 by City for paving Sexton Road with macadam, Tarvia X, about 11,688 sq. yd., and 9801 lin. ft. curb and gutter: Columbia Paving Co., $16,020; J. A. Stewart, $16,080; Lyon & Turnbaugh, $16,664, and Garth Clinkscales, $16,898. Bidders of Columbia. J. Paul Price, City Engineer.

★**Kansas City, Mo.**—Contract for constructing concrete on Collings Road (bids opened April 15) awarded M. Ross, Armour Boulevard and Locust Street, at $39,334.

★**Bryan, Tex.**—Contract awarded by City Council for paving about 5 miles of streets to Kaw Paving Co., Topeka, Kan., at $94,292.

★**El Paso, Tex.**—Contract awarded by City Commissioners for paving Alameda Avenue to El Paso Bitulithic Company, El Paso, at $1.775 per sq. yd.; total $17,796.

Everett, Wash.—Following are bids opened April 17 by County Commissioners for constructing one course concrete pavement roads in Snohomish County:

★Proposition No. 1: Everett to Silver Lake, 37,556 sq. yd. paving, 6577 cu. yd. grading, Bancroft & Morgan, Everett, $51,411 (awarded contract); Mark O'Dell, care of Master Builders Association, Boston Block, Seattle, $53,927; H. J. Kaiser, Everett, $52,965; McAdam & Co., Everett, $59,425.

★Proposition No. 33: Silver Lake to Snohomish County line, 83,000 sq. yd. paving, including 22,064 cu. yd. grading, P. G. Dunn & Co., L. C. Smith Building, Seattle, at $1.07 per sq. yd., total, $114,802 (awarded contract); Bancroft & Morgan, Everett, $120,637; H. J. Kaiser, Everett, $122,302; Independent Asphalt Paving Co., Seattle, $118,030.

★Proposition No. 2 (only one bid submitted: Forty-first Street from Rucker Avenue to city limits, 9222 sq. yd. paving, 8029 cu. yd. grading, Mark O'Dell, care of Master Builders Association, Boston Block, Seattle, $12,623 (awarded contract).

★Vernon Road, etc.: (a) paving Highway No. 23, (b) grading Highway No. 22, (c) grading Highway No. 24, Grant & Erwig, Everett (a), $14,974 (awarded contract); Ward & Templeton, Everett (b), $9,882 (awarded contract); Etridge & Burney, Everett, submitted low bid for (c), $8,998.

★Contract awarded for Proposition No. 19, Cavileros Corners to Snohomish, 40,524 sq. yd. paving, 14,153 cu. yd. grading, to Mark O'Dell, care of Master Builders Association, Boston Block, Seattle, at $59,205.

★**Seattle, Wash.**—Contract awarded by Board of Public Works for paving Ninth Avenue West to F. McLellan, Globe Block, at $8,001.

Following bids opened by Board of Public Works for paving Bailey Street: F. McLellan, Globe Block, $31,985; P. J. McHugh, Third Avenue North and Mercer Street, $32,834; Washington Paving Co., L. C. Smith Bldg., $32,714, and Independent Asphalt Paving Co., Northern Bank Bldg., $35,900.

Following bids opened by Board of Public Works for paving Rainier Avenue from Jackson to Massachusetts Street: Washington Paving Co., L. C. Smith Building, at $69,634; F. McLellan, Globe Block, $69,878; T. Ryan & Co., Northern Bank Building, $70,291; Sprager Concrete Co., Colman Building, $71,466.

Lowest bid for paving Twelfth Avenue submitted by R. G. Stevenson, 1327 Ewing Street, at $25,161.

★**Spokane, Wash.**—Contract for constructing Inland Empire Permanent Highway (bids opened April 7) awarded Mitchell Bros., Spokane. Charles Gabriel, Clerk County Commissioners.

Portland, Ore.—Following bids opened by City Council for change of grade and paving Broadway from east approach of Broadway bridge to Union Avenue: Oregon Independent Paving Co., Portland, $45,490 bitulithic with stone block center, $46,708 asphaltic-concrete on concrete base with stone block center, $46,070 asphalt pavement stone block center. Oskar Huber, Portland, $46,024 bitulithic on crushed rock base, basalt stone center. Warren Construction Co., Portland, $48,855 bitulithic on crushed rock base, basalt stone block center.

Anaheim, Cal.—Lowest bid for grading and constructing 163,860 sq. ft. 4½-in. concrete base and 1½-in. asphalt surface pavement on East Broadway, submitted by George R. Curtis, 552 South St. Louis Street, Los Angeles, at 10.75 cts. per square foot; total, $17,616. Next lowest, George H. Oswald, O. T. Johnson Building, Los Angeles, 11 cts. per square foot; total, $18,024.

★Contract for 327,450 sq. ft. similar work on West Broadway awarded George R. Curtis, 552 South St. Louis Street, Los Angeles, at 10.75 cts. per square foot; total, $35,201. Next bidder, George H. Oswald, at 11 cts.; total, $36,029.

★**Benicia, Cal.**—Contract awarded by Board of Supervisors at Fairfield for constructing macadamized road between Benicia and Vallejo to P. H. Hoare, Oakland, at $23,035.

★**California** — Contract awarded by California Highway Commission, Sacramento, for constructing an underground crossing near Roseville in Placer County, Division III, Route 3, Section A, about 630 ft. long, to Ross Construction Company, Forum Building, Sacramento.

★**Los Angeles, Cal.**—Following are four lowest bids opened recently by Board of Supervisors for constructing 2.57 miles of macadam road, involving 28,000 cu. yd. excav., 13,565 lin. ft. shaping roadbed, 9940 tons macadam etc., between El Seguindo and Venice: White & Gaskill, Long Beach, $14,191; Crown Construction Co., Los Angeles, $14,283; Modern Construction Co., Los Angeles, $14,997; W. A. Dontanville, Pasadena, $15,824.

Following are four lowest bids opened by Board of Supervisors for constructing about 4 miles of concrete highway, involving approximately 43,167 cu. yd. excav., 21,398 lin. ft. shaping roadbed, 56,795 sq. yd. concrete pavt., 19,103 lb. reinforced steel metal pipe, etc., on Pico Boulevard between Los Angeles and Venice: Fred Hoffman, 111 East Twelfth Street, Long Beach, $26,982; Matthews Construction Co., $27,773; James L. Frazer, Long Beach, $28,388; Metropolitan Construction Co., Los Angeles, $28,807.

★**Ventura, Cal.**—Contract for paving road between Oxnard and Huenema Streets (bids opened April 10) awarded by County Highway Commissioner to Magill Finley Co., Santa Ana, at $17,193. Next three bidders: C. L. Haydee Construction Co., San Diego, $18,133; John D. Marsh, Los Angeles, $19,871; L. Fleming & Sons, $20,640.

★Contract for constructing 8 miles of county highway Santa Paula to Fillmore, involving 31,880 cu. yd. excav., 43,615 lin. ft. shaping roadbed, 8995 cu. yd. concrete in pavement, bridges and culvert, 20,000 lb. reinforcing steel and about 800 ft. 2 to 42-in. corrugated iron pipe, awarded Bradshaw-Burns Co., Van Nuys Building, Los Angeles, at $34,017. Next three lowest: John D. Marsh, $36,513; Bent Bros., $37,518, and W. A. Dontanville, $37,882.

STREET CLEANING AND GARBAGE DISPOSAL

PROPOSED WORK.

Waukegan, Ill.—Council is considering constructing an incinerator plant. Address City Clerk.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Elgin, Ill.**—Contract for constructing an incinerator awarded by City Council to Otto A. Elliott & Co. of Springfield at $8,000 for McGuire-Hunter type of incinerator.

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS

PROPOSED WORK.

Canal—Boston, Mass.—In a report filed with the Legislature on April 13, the Harbor and Land Commission estimates the cost of proposed inland canal from Brockton to Taunton via Taunton and Matfield Rivers at $9,000,000.

Port Improvements—Philadelphia, Pa.—City Council April 11 passed two loan bills aggregating $114,525,000, providing for transit and port improvements and financing of general purposes and unfunded debt. The port improvements include $10,000,000 and the subway and elevated lines $57,100,000.

Drainage—Crowley, La. — Preliminary surveys being made for drainage system to drain 30,000 acres of farm lands in southwest Louisiana. Work will require about 25 miles of open ditches suitable for floating dipper construction; estimated cost $100,000. Merril Bernard, Crowley, Engineer.

Drainage—Gueydan, La.—Plans being considered for protection from overflow by freshets and improving of gravity drainage; cost $250,000. Warren B. Reed, Engr., Morgan City, La.; F. E. Everett, Engineer in Charge, Gueydan.

Earth Work—New Orleans, La.—Contract soon to be let by Board of State Engineers, New Orleans, for 610,000 cu. yd. earth work estimated to cost $150,000.

Ditch—Dayton, Ohio.—Commissioners of Darke, Miami and Montgomery Counties have agreed to construct a tri-county ditch on Reitz Joint. L. P. Knoop, County Engineer, Miami County.

Dam—Sheboygan, Mich.—Harrison G. Robey of Alpena has petitioned the Board of Supervisors for authority to construct an electric light and power dam on Pigeon River, to be 16 ft. high, concrete, and have 40 ft. spillway and a chute for lumber.

Dam—Fort Dodge, Iowa.—Burns & McDonald, Kansas City, Mo., have submitted plans for the hydroelectric power dam to be constructed north of the city on Des Moines River in vicinity of Northern Iowa Power Company project. Citizens last fall voted $200,000 bonds for this improvement. Address City Clerk.

Dam—Austin, Tex.—Reported purchase and completion of a new dam by city is being considered. Address City Engineer.

Jetty Work—Galveston, Tex.—Plans completed for repair work on south jetty, costing $25,000. Address U. S. Engineer, Galveston.

Pier—Port Arthur, Tex.—City is to spend about $25,000 for repairs to pleasure pier and causeway extending into lake a distance of 3000 ft. Address City Engineer.

Dam—Texas.—State Bd. of Water Commissioners at Austin issue permit to E. E. Townsend of Alpine to construct a dam across Cayanosa draw in Pecos County for creating and impounding reservoir to divert flood waters of the draw, and to appropriate 2765 ft. of water per annum for stock raising and irrigation of 1082 acres of land.

Hydro Electric Plant—Las Vegas, N. M.—Rio Grande Light, Heat & Power Company has filed with State Engineer estimates of the cost of constructing the hydro electric plant at White Rock Canyon Dam to cost $772,690; intakes and penstocks, $127,800; transmission line, $271,500; substations, $180,000.

Retaining Wall — Portland, Ore.—Reported Commissioner Public Works has been directed by Council to prepare preliminary plans for concrete retaining wall along Vista Avenue, a distance of 1400 ft.

Jetty Improvement — Umpqua, Ore.—Reported Port of Umpqua has authorized sale of $200,000 improvement bonds, to be used to improve the bar and jetty at Umpqua. Contract for construction will be let latter part of May.

Pier—Manhattan Beach, Cal.—A. L. Harris, Portland, Ore., engaged to prepare plans for the pleasure pier, to cost $70,000.

Flood Drainage—Long Beach, Cal.—R. V. Pearsall, Long Beach, engaged to prepare plans for the drainage system in Signal Hill District. Address Clerk Board of Supervisors.

Harbor Improvements — Los Angeles, Cal.—Reported an election will probably be held in June to vote $2,500,900 bonds for harbor improvements. F. T. Woodman, Pres. Board Harbor Commissioners.

Dam—San Diego, Cal.—M. M. O'Shaughnessy, City Engineer of San Francisco, engaged as consulting engineer for the construction of the lower Otay and Barrett dams. Preliminary surveys will be made by George Cromwell, City Engineer, and F. M. Lockwood, Manager of Operations. A bond issue will be called to vote bonds for improvements which will cost probably $1,500,000.

Dredging—Santa Ana, Cal.—Newbert Protection Dist. (H. Clay Kellogg, Ch. Engr.) contemplates voting $25,000 bonds for dredging channel 200 ft. wide and 800 ft. long for Santa River, $12,000 for bridge over channel and $13,000 for levees and perhaps for purchase of dredger.

Flood Control—Pima, Ariz.—W. L. Marshall, Consulting Engineer of the Department of the Interior, Washington, D. C., has submitted a report to the Secretary of the Department, on the spending of $50,000 for experimental work in flood control of Gila River in Graham County, and recommends constructing of light spurs, groins or deflecting dykes of piles, brush and concrete, causing deposits of sand and silt to gather at proper places for diverting river to a power channel.

Causeway—Vancouver, B. C.—Reported city this summer will construct the Coal Harbor Causeway, costing $100,000.

BIDS DESIRED.

State Canal Work—Albany, N. Y.—Until May 16, by W. W. Wotherspoon, Supt. Public Works, for improving New York State canals, as follows: Contract No. 23-A, Erie Canal, Section 9, completing construction of canal from King Bend to Lehigh Valley Railroad crossing, about ½ mile east of Genesee River; length, 5.13 miles. Contract No. 27-A, Champlain Canal, Section 2, constructing diversion channel for Bond Creek near Lock No. 8.

State Canal Work—Albany, N. Y.—Until May 4 separate bids for tugs for towing boats on the Barge Canal portions of the Erie Canal between Waterford and Jacksonburg, a distance of 85 miles, and between Newark and Wayneport. Legislature appropriated $45,000 for this work.

State Canal Work—Albany, N. Y.—Until May 23, by W. W. Wotherspoon, State Superintendent Public Works, Albany, for Contract 128, constructing substructure, superstructure and approaches of a highway bridge over Hudson River at Northumberland, also Contract 129, bridge over Mohawk River near Schenectady, advertised in Engineering Record.

Dam—Gloversville, N. Y.—Until May 6, by Morrell Vrooman, Engineer, 10 North Main Street, Gloversville, for constructing a concrete and masonry dam across Garoga Creek at Rockwood, N. Y., for Rockwood Mfg. Company, Rockwood, N. Y., advertised in Engineering Record.

Seawall—Washington, D. C.—Until May 15, by U. S. Engineer, Room 305 Southern Building, Washington, D. C., for furnishing and placing riprap on seawall foundation, and for furnishing and delivering building stone Anacostia River, D. C.; advertised in Engineering Record.

Drainage—Tallahassee, Fla.—Until May 29, by Board Commissioners of the Everglades, Drainage District, Tallahassee, for following construction: Drainage canal known as Dania Canal; improvement of Miami Canal, between Lock and the junction with South New River Canal; improvement of South New River Canal: advertised in Engineering Record. F. C. Elliot, Chief Drainage Engr.

Seawall—Bay St. Louis, Miss.—Reported desired until May 5, by Jos. F. Cazeneuve, Chmn. Bond Commission, for anchorage concrete pile seawall.

Drainage—Cleveland, Miss.—Until May 3 by Board Drainage Commissioners (J. C. Brooks, Chmn.) for constructing drainage canals in Deeson Drainage Dist., main ditch 9.2 miles, 241,630 cu. yd. excav.: lateral A 1.2 miles, 16,000 cu. yd. excav.; lateral B 0.9 mile, 40,000 cu. yd.; lateral C 1 mile, 23,000 cu. yd. W. W. Boone, Engr., Deeson Drainage Dist.

Drainage—Jackson, Tenn.—Reported desired until May 13, for constructing drainage canal 15,552 ft. long, 288,000 cu. yd. excav.

Drainage—Durand, Mich.—Reported desired until May 9 at Village Hall for constructing Holly Drain, including three highway bridges, ditch to have a bottom width of 25 and 30 ft. A. H. Reid, Co. Drain Comr., Flint.

Ditches—Danville, Ill.—Reported desired until May 8, by Commissioners of Bridgman Drainage District, Courthouse, for constructing ditches to include 56,048 ft. from 32 to 40 in. tile. Clark & Hutton, Baum Bldg., Attorneys for Dist.

Drainage—Bloomfield, Iowa.—Until May 29 by I. A. Patterson, Co. Aud., for constructing channel in Fox River Drainage Dist. No. 1, located in Davies County, to consist of approximately 592,717 cu. yd. excav., length of ditch 13.6 miles; cost $41,490. Advertised in Engineering Record. H. O. Wray, Engr., Bloomfield.

Drainage—Garner, Iowa.—Until May 2 by Board County Supervisors for improving Drain No. 7, consisting of five sections of tile work, approximately 200,000 ft. 6 to 42 in.; also 29,000 ft. of 3-ft. base; cost $212,215. E. P. Hancock, Co. Aud.

Ditches—Bemidji, Minn.—Until May 19, as a whole or separately, by J. L. George, Co. Aud., for constructing Judicial Ditch No. 25; the work involves construction of 223 miles ditches, revision of 17 miles of river, 3,371,259 cu. yd. excav., 223 miles road leveling, culverts, etc. Cost $406,770. Bids for road leveling desired separately. John Burke, Engr., Bemidji.

Ditch—St. Cloud, Minn.—Until May 13 by N. Thomey, Co. Aud., for constructing Ditch No. 36, to consist of main ditch, 116 stations in length, containing 67,488.52 yd.; 12 branches, containing 93,596.27 yd.; one 28-ft. I-beam bridge, two reinforced concrete culverts, etc.; cost $14,487.

Sluice Gates—Malta, Mont.—Until May 15 by Dept. of Interior, U. S. Reclamation Service, Washington, D. C., for furnishing steel and c.-i. sluice gates, gate frames, lifting devices and accessories for Milk River Project. A. P. Davis, Ch. Engr.

Drainage—Angleton, Tex.—Until May 19, by M. N. Perry, Chmn. Drainage Commissioners, Angleton District No. 1, for constructing drainage improvements, consisting of excav. approximately 550,000 cu. yd. dirt, for ditches, clearing and snagging of streams, and constructing bridges and street drains. Williams & Munson, Attorneys, Angleton.

Cement—Denver, Col.—See "Miscellaneous."

Irrigation—Grand Junction, Col.—Until May 23 by U. S. Reclamation Service, Grand Junction, for constructing approximately 3930 lin. ft., 60 in. diam., continuous wood stave pipe for the Grand Valley Irrigation Project, Col.

Reclamation Work—Wenatchee, Wash.—Until May 23, by Wenatchee Reclamation District, Wenatchee, for manufacturing and laying complete, except excavating and back filling 5470 ft. 63 in. reinforced concrete pipe under hydraulic head, ranging from 10 to 100 ft, reinforcing to provide full strength required with factor of safety of 3; also for approximately 100 tons ⅝-in. two-piece steel bands complete with shoes and nuts for 60-in wood stave pipe. W. T. Knapp, Secy. District.

Drainage—Otterville, Ont.—Until May 10 by Alex. McFarlane, Clk., Township So. Norwich, for constructing Collyer Drain, 9817 lin. ft. of tile drains and 1475 lin. ft. open drain. F. J. Ure, Township Engr.

Dredging—Port Hope, Ont.—Until May 2, by R. C. Desrochers, Secretary Department Public Works, Ottawa, for dredging at Port Hope.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Drainage—Brooklyn, N. Y.—Two lowest bids opened April 17 by Bd. Health, New York, for draining and ditching land around Jamaica Bay in both Kings and Queens Counties, for eliminating of mosquitoes, submitted by R. M. Brown & C. R. Simpson, New York, at $60,778, and United States Drainage & Irrigation Co., 17 Battery Place, New York, at $79,850.

Dredging—Buffalo, N. Y.—Following are two lowest bids opened by Board of Public Works (Arthur Kreinheder, Supt.) for dredging Buffalo River from Ohio Street bridge: Great Lakes Dredge & Dock Co., Morgan Building, $32,400, and H. S. Kerbaugh, Telephone Building, $33,000.

★**Dredging—New York, N. Y.**—Tuttle & Raynor, Eastport, L. I., N. Y., secured contract for sand pit and jetty construction in Great South Bay (Patchogue River), N. Y., and dredging in Browns Creek, N. Y., at $20,353 (bids opened by U. S. Engineer, New York, April 10).

Pier—New York, N. Y.—Following are bids opened April 20 by Department of Docks and Ferries, New York, for constructing pier at West Fifty-sixth Street, Contract 1509—(a) freight shed, (b) 13,424 sq. yd. asphalt pavement, (c) total: Penna Steel Co., Steelton, Pa., (a) $498,100, (b) $1.15, (c) $513,538; Post & McCord, 101 Park Avenue, (a) $517,000, (b) $1.16, (c) $532,572; Snare & Triest, Woolworth Building, (a) $519,500, (b) $1.15, (c) $535,038; W.F. Plass & Bro., 145 W. Eighteenth Street, (a) $520,000, (b) $1.15, (c) $535,438; Teran, Mahaney & Munro, Grand Central Terminal, submitted lowest bid for heating, at $11,000, and J. S. Murphy, 353 E. Seventy-eighth Street, lowest for plumbing, at $12,844.

★**Tunnel—Rochester, N. Y.**—Dock Construction Co. of Hoboken, N. J., contractors, have started construction of the horse shoe tunnel for Rochester Ry. & Light Co., from the dam above Middle Falls under the Genesee River to the eastern base of the Lower Falls, a distance of 1550 ft.; cost estimated at $750,000.

★**Levee — St. Joseph, La.** — Contract awarded by Fifth District Levee Board to Nicholson & Jones for 150,000 cu. yd. of earthwork at 15.43 cts. per cu. yd.

★**Dredging—Huntington, Ind.**—Contract awarded Wolcott Dredging Co., Lafayette, for constructing dredge ditch, together with laterals, about 12 miles, at $37,765.

Dredging—Manistee, Mich.—Lowest bid opened April 20 by U. S. Engineer, Grand Rapids, for dredging in Manistee Harbor, Mich., about 57,000 cu. yd., submitted by Greiling Bros. Co., Green Bay, Wis., at 17.5 cts.

★**Steel for Pier—Ashland, Wis.**—Contract for 1625 steel shapes for dock of Minneapolis, St. Paul & Sault Ste. Marie R. R. awarded Minneapolis Steel & Machinery Co., Minneapolis, Minn.

Dredging—Milwaukee, Wis.—Lowest bid opened by Bd. Public Works for dredging in rivers during year 1916 submitted by A. H. Vogel of Milwaukee at 9.7 cts. per sq. yd.; total cost of work about $35,000.

★**Drainage — Storm Lake, Iowa.**—Contract for constructing open ditch in Drainage District No. 83, Buena Vista County, Iowa, about 160,000 cu. yd. earth excav., awarded J. F. Reynolds, 304 Superior Street.

★**River Improvement—Kansas City, Kan.**—Contract for clearing Kaw River awarded by Wyandotte County Commissioners to Kansas City Bridge Co. of Kansas City, Mo., at $21,498.

★**Irrigation — Maita, Mont.** — Contract awarded L. W. Dotson, Glasgow, Mont., for earthwork on Bowdoin Canal and laterals on Milk River Project, Mont., for $9,106.

★**Irrigation — Poison, Mont.** — Contract awarded C. H. Long of Poison, for earthwork and structures on laterals of Jecke division, Flathcad irrigation project, Mont., at $9,385.

★**Wharf — Galveston, Tex.** — Contract awarded by U. S. Engineers to Charles Clark of Galveston for improving wharf at Port Aransas at $7,000.

★**Drainage—Port Arthur, Tex.**—Conditional contract awarded by city (bids opened April 12) for constructing drainage and revetment system for Port Arthur to Henry J. Cox & Co. of Alexandria, La. Work to consist of 200,000 cu. yd. of levees, 150,000 cu. yd. of canals and ditch excavation, 150,900 ft. creosoted pine culverts and bridges. J. F. Coleman, Consulting Engineer, 920 Hibernia Building, New Orleans, La.

ELECTRIC RAILWAYS

PROPOSED WORK.

Portland, Me.—Chotaw Power & Light Co. incorporated to construct and operate railways. Capital, $1,250,000. Among incorporators: S. I. Gould of Portland, and E. L. Jones of Gorham.

Morristown, N. J.—Morris County Traction Co. will install new rotary transformer equipment in sub-station near Dover.

Newbern, N. C.—Newbern-Ghent St. Ry. Co. contemplates constructing extension into Jones County.

Chillicothe, Ohio.—Hillsboro, Cynthiana and Bainbridge Traction Co. given permission by State Utilities Commission to issue $1,700,000 bonds for building traction line from Hillsboro to Chillicothe.

Cincinnati, Ohio.—City Council April 18 granted franchise to Westend Rapid Transit Co. for a 7-mile electric line from Anderson's Ferry to the city. This line will serve as an entrance for the Cincinnati, Lawrenceburg & Aurora Traction Co.'s line and is being promoted by the same interests. New line will cost $800,000. Construction will begin about Sept. 1.

Dayton, Ohio.—Dayton, Middletown & Cincinnati Traction Co. incorporated to construct an electric railway between Cincinnati and Dayton via Sharonville, Westchester, Germantown, Reading and Bond Hill. Among those interested: J. G. Miller of Westchester and R. H. Billingslea of Bethany.

Elkhart, Ind.—Reported Valley Traction Co. will construct a 9-mile interurban line. H. E. Bucklin, Elkhart, Pres.

Detroit, Mich.—Highland Park & Royal Oak Railroad Co. granted a franchise to construct a line from Highland Park to Royal Oak. Robert E. Barber of Highland Park is interested.

Joliet, Ill.—Reported the Illinois Light & Power Co. contemplates constructing an electric railway from Joliet to Kankakee. Powers & Co. of Chicago, Ill., said to be interested.

Superior, Wis.—Extensions are to be made to the street car systems at a cost of $125,000. Address J. Carson, Ch. Engr., Duluth Street Ry. Co., 2631 W. Superior Street, Duluth, Minn.

St. Paul, Minn.—The Dale Street car line is to be extended from Maryland to Nebraska Street.

Columbus, Kan.—The Oklahoma & Interstate Railway has received a franchise from Council to construct a line in Columbus. John R. Rose of Oklahoma, Pres.

St. Louis, Mo.—St. Louis & Jennings Railway Co. has been reorganized to extend line to business district of St. Louis. The company is considering constructing an extension to Ferguson, 2¾ miles north of Jennings.

Tulsa. Okla.—Surveys have been made for construction of an interurban railway from Tulsa to Coweta, distance of 25 miles. H. D. Patee of Tulsa is interested.

San Francisco, Cal.—Plans and specifications will be presented to Bd. of Supervisors by M. M. O'Shaughnessey, City Engineer, for constructing elevated line adjacent and parallel to Market St.

BIDS DESIRED.

New York, N. Y.—By Public Service Commission, 154 Nassau Street, New York, for three sections of the Fourteenth Street-Eastern Rapid Transit Line, which is operated by the New York Municipal Railway Corporation under Dual System contracts. Until May 18 for Contract No. 1, in Borough of Manhattan, covering portion of the line extending under Fourteenth Street from Sixth Avenue to Irving Place. May 16 for Section No. 4, and until May 22 for Section No. 5; both sections are in Brooklyn, extending from No. Seventh Street and Bedford Avenue to Bushwick Avenue and Meserole Street.

New York, N. Y.—By Conners Brothers, 64 West Eighty-eighth Street, New York, N. Y., to let contract for 4 miles of overhead trolley work, advertised in Engineering Record.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Tulsa, Okla.**—Contract awarded by Sand Springs Ry. Co. for constructing 4 miles of second track from Crib Springs to Tulsa, including a steel span bridge 50 ft. long, to J. S. Greer of Sand Springs.

RAILROADS

PROPOSED WORK.

Bangor, Me.—Eastern Railroad Co. proposes constructing a railroad from Bangor to Houlton, distance of 120 miles.

New York, N. Y.—Controller Prendergast, Chairman of the Board of Estimate's Committee on Port and Terminal Facilities has submitted a report to Board of Estimates and Apportionment estimating cost of eliminating New York Central R. R. grade crossings on West Side at $14,708,000. Tracks in residential district to be tunneled and in the commercial district placed on elevated structures.

Newark, N. J.—Grade crossing on Peckman Town Road of the Erie R. R. (R. C. Falconer, Supt. Construction, 30 Church Street, New York), through Cedar Grove Township is to be raised. Frank W. Crane, Township Engineer.

Hagerstown, Md.—Norfolk & Western R. R. (J. E. Crawford, Ch. Engineer, Roanoke, Va.) is considering spending about $60,000 in improving track facilities in Hagerstown.

Wellsburg, W. Va.—Wellsburg & Eastern R. R. Company incorporated for the purpose of constructing a railroad from Wellsburg, Brooks County, W. Va., to Washington, Pa., following Buffalo Creek; surveys and profiles of the road have been completed. H. O. Wells, Pres., and Neil Moran, Secy. and Treas. Schmidt & Arbenz, Attorneys, Schmulbach Building, Wheeling, may be able to give further information.

Montgomery, Ala.—Central of Georgia R. R. (C. K. Lawrence, Ch. Engr., Savannah, Ga.) and Board of Commissioners are considering constructing a new bridge to replace wooden structure over railroad tracks on Upper Wetumpka Road, inside city limits. New bridge is to be 250 ft. long. Nothing very definite has been done about the matter.

Columbia, Ky.—Col. J. T. Gathright, Louisville, and others are reported interested in the construction of a railroad from a point on Greensburg branch of Louisville & Nashville R. R. to Columbia, Adair County, a distance of about 20 miles, and to cost $450,000.

Cleveland, Ohio.—F. A. Pease Engineering Company, Marshall Building, is revising plans for the tunnel to be constructed under Ontario Street from East Twenty-second Street to Public Square, a distance of about 1 mile, for the Cleveland & Youngstown R. R. This tunnel is in connection with the depot and 700-room hotel to be erected on the Public Square, for which the Crowell-Lundoff-Little Company, 1951 East Fifty-seventh Street, have contracts.

Kenosha, Wis.—The Wisconsin Railroad Commission, Madison, decided April 20 that all main tracks of the Wisconsin Division of the Chicago & North Western R. R. (W. H. Finley, Ch. Engr., Chicago, Ill.) be elevated from a point south of Selma Avenue in town of Mt. Pleasant south of the city to a point north of the city limits in the town of Somers. All grade crossings to be eliminated and subways built at Selma, Ashland, Prairie, Grand Avenues, Collins, Strong, Elizabeth, Pomeroy Park, Market, Middle, Broad, Bronson, Division and North Streets. Pedestrian subways will be provided for on this division at Garden Street and limit streets at north city limits. Tracks of the Kenosha line are to be elevated, a subway provided for on Fremont Avenue; switch tracks at Main Street to be depressed and viaduct built to carry Main Street over tracks. Change in the tracks and building of viaduct will necessitate construction of either a new bridge across the river, or the changing of grade of the old bridge. The entire cost, including land damages, will be $1,600,000. Cost to be born by railroad company within their right of way and the cost to the city all work outside of the right of way of lines.

Davenport, Iowa.—The Milwaukee, Burlington and Davenport, Rock Island & North Western Ry. Co. (O. B. Grant, Genl. Mgr., Davenport) at meeting of Levee Improvement Committee agreed to construct a union passenger station, freight depot, modern yards, team tracks and depress main line tracks and eliminate grade crossings and remove from in front of city switch tracks.

St. Paul, Minn.—Directors of the Chicago Great Western R. R. (C. G. Delo, Ch. Engr., Chicago, Ill.), reported considering shortening the Minneapolis-Rochester line by building from Rochester direct to Mantorville; the new construction would shorten the line 25 miles.

Monett, Mo.—Citizens voted $60,000 bonds to be used in building a link in the Springfield, Joplin & Kansas City R. R. Address City Clerk.

BIDS DESIRED.

Cincinnati, Ohio.—By W. C. Cushing, Ch. Engr. M. of W., S. W. System Pennsylvania R. R., Pennsylvania Station, Pittsburgh, Pa., for grading, masonry and street work needed in the grade crossing work at Delta Avenue. Contract for superstructure has been awarded.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Marion, Ohio.**—Contract awarded P. T. Clifford & Son, Valparaiso, Ind., for work on Toledo division of Pennsylvania R. R., involving 3½ miles of grade reduction and second-track work 2 miles north of Marion.

★**Fort Wayne, Ind.**—Contract awarded by Board Public Works to Brooks Construction Company, of Ft. Wayne, for city's portion of the track elevation work on Coombs Street at $17,500.

PUBLIC BUILDINGS AND SCHOOLS

PROPOSED WORK.

Bristol, Mass.—Plans being prepared for a $65,000 school to be erected at Court and Church Streets. Address School Board.

New Bedford, Mass.—Plans prepared by Louis E. Destremps, N-B Theater Building, for proposed new police headquarters, approved by City Property Committee, and Mayor Hathaway was instructed to negotiate for purchase of site; $150,000 available.

Salem, Mass.—City Council appropriated $110,000 to erect addition to Bowditch Street School.

Salisbury, Mass.—At recent town meeting it was voted to erect a central school to cost $40,000. Address Clerk School Board.

Shelburne Falls, Mass. — Trustees of Arms Academy voted to spend $25,000 for erecting two-story and basement school north of present site.

Newport, R. I.—Preliminary plans prepared by Hammett B. Seabury, Springfield, Mass., for an 18-room addition to high school; also a central heating plant to heat this and three other schools.

Warwick, R. I.—The Assembly passed a bill authorizing a bond issue for Warwick for $100,000 for constructing three new schools and additions to others.

Albany, N. Y.—Governor Whitman April 20 signed bill authorizing the State Hospital Commission to improve and enlarge Long Island State Hospital; cost, not to exceed $30,000.

Jamestown, N. Y.—Citizens authorized Board of Education to spend $39,000 for constructing a detached heating plant on high school grounds to heat the High School and East Second Street Grammar School.

Pittsford, N. Y.—Plans being prepared by Gordon & Madden, 300 Sibley Block, Rochester, and William G. Kaelber, associate architects, for two-story and basement, 70 x 160-ft., brick and steel high school; estimated cost $70,000.

Rensselaer, N. Y.—Common Council approved plans of J. D. Shoemaker of Rensselaer for proposed two-story brick and limestone school for District No. 1, to be erected on Washington Street.

Spring Valley, N. Y.—Plans being prepared by Ernest Sibley, Palisades Park, N. J., for two-story and basement, 118 x 56-ft., brick and stone school to be erected on North Main Street; estimated cost, $35,000. George M. Brewer, President Board of Education.

Cedargrove, N. J.—John Pierson & Son of Perth Amboy engaged by Board of Education of Cedargrove Township to prepare plans and specifications for school addition; cost not to exceed $25,000.

Montclair, N. J.—Plans being prepared by Starrett & Van Vleck, 8 West Fortieth Street, New York, for two 2-story brick additions to Cedar Avenue School; cost, $175,000. Frank J. Taylor, Secretary, Board of Education.

Morristown, N. J.—Citizens voted $73,000 bonds for school buildings and improvements. Address Clerk School Board.

Paterson, N. J.—Board of Education engaged architects to prepare plans as follows: H. B. Crosby, First National Bank Building, for three-story, 42-room brick school, to be erected at Carroll

Street and Hamilton Avenue, costing $225,000, and Charles E. Sleight, Romaine Building, for three-story, 16-room brick school at Dixon and Caldwell Avenues, costing $125,000. J. F. Dunphey, Secretary Board of Education.

Whitehouse Station, N. J.—Erection of four-room school and auditorium, costing approximately $120,000, contemplated by Board of Education of Readington Township (S. J. Dilts, District Clerk).

Altoona, Pa.—Mercy Hospital intends erecting an annex to present group of buildings; cost $50,000. Address Superintendent.

Enola, Pa.—Election to be held latter part of May in East Pennsboro Township to issue $40,000 bonds for erecting high school. Address Clerk Board of Township School Directors, Enola.

Luzerne, Pa.—Citizens of the borough voted $35,000 bonds for high school. Address Borough Clerk.

Connellsville, Pa.—Citizens voted $250,000 school buildings bonds. Walter G. Eccles, New Castle, and Harry Altman, Uniontown, engaged as architects for the two schools. High school cost $170,000 and West Side Grade $60,000.

Northampton, Pa.—Clyde S. Adams, 1509 Arch Street, Philadelphia, is architect for two-story school to be erected in Northampton Heights.

Philadelphia, Pa.—School bonds amounting to $2,500,000 sold April 17 by Finance Committee of Board of Education.

Plans completed by J. Horace Cook, City Hall, for 3-story 120 x 214-ft. school to be erected at Fifty-fifth and Chestnut Streets.

New Windsor, Md.—Plans being prepared for addition to Blue Ridge College; cost, $25,000.

Wilmington, Del.—Citizens of Du Pont School Dist. of Delaware approved plans for a $120,000 addition to Alexiz 1 du Pont High School.

Lauray, Va.—Citizens voted $200,000 bonds for erecting high school. Address Board of Education.

Norfolk, Va.—School Site Committee recommends site on Eleventh Street and Llewellyn Avenue for proposed Boys' High School. Address Board of Education.

Portsmouth, Va.—Washington Magisterial District School Board approved plans of Ferguson, Carlow & Taylor, Royster Building, Norfolk, for proposed 16-room school to be erected at South Norfolk; cost about $35,000.

Biltmore, N. C.—Citizens voted $45,000 bonds to erect new high school. Address School Board.

Florence, S. C.—Board of Commissioners of Florence School District engaged W. J. Wilkins & Co. of Florence to prepare plans for high school for white children, to be erected on Pine Street, and for rebuilding school for colored children, destroyed by fire.

Sanford, Fla.—School Board sold $75,000 school bonds.

Montgomery, Ala.—An additional dormitory is to be erected at Woman's College of Alabama at a cost of $50,000.

Shreveport, La.—Election will be held in May to vote $150,000 bonds for erecting a school. Address Pres. School Bd.

Jackson, Miss.—The Capitol Commission engaged Theodore C. Link, Carlton Building, St. Louis, Mo., to prepare plans for rebuilding old state house on Capitol Avenue at a cost of $125,000.

McComb, Miss.—Erection of a school to cost about $35,000 contemplated. Address Board of Education.

Tylertown, Miss.—Contract soon to be let for erecting court house and jail to cost $75,000. Address County Clerk.

Bartlett, Tenn.—Steps being taken to erect $25,000 school. Address Clerk School Board.

Kingston, Tenn.—Plans being prepared for a $25,000 high school. Address Clerk Board Education.

Knoxville, Tenn.—Reported Carnegie Hall at Maryville College, recently destroyed by fire, will be rebuilt.

Madisonville, Tenn.—County Court of Monroe County voted $50,000 bonds for erecting schools at Sweetwater, Madisonville and Tellico Plains. Address County Clerk.

Canton, Ohio.—School bonds for $168,000 will be sold May 11 by W. C. Lane, Clk. Board Education.

Cleveland, Ohio.—City Council Committees on Parks and Finance April 14 approved issue of $55,000 bonds to erect municipal bathhouse in the vicinity of St. Clair Avenue and East Fifty-fifth Street.

Board of Education is having plans prepared for additions to Tremont, East Technical High, Memorial and South Clark Avenue Schools, and also plans for three new schools.

Board of Education April 17 sold $1,000,000 school bonds.

Plans prepared by A. C. Edwards, Union Building, for erecting a 5-story hospital on Prospect Avenue for Co-Operative Hospital Association at cost of about $300,000. Henry A. Becker, Pres., and F. O. Blazier, Secy.

Fremont, Ohio.—W. W. Sabin, 1900 Euclid Avenue, Cleveland, is architect for two buildings for County Memorial Hospital, which is to be brick and concrete and cost $125,000 with equipment.

Girard, Ohio.—Miller & Son, Youngstown, engaged to prepare plans for two eight-room schools, one to be erected on Morris plat, the other on Smithsonian Avenue; probable total cost $70,000. Address Board of Education.

London, Ohio.—The State Prison Commission and Governor Willis, at Columbus, engaged Richards, McCarty & Bulford, Hartman Building, Columbus, to prepare plans for prison on state farm near London.

Reily, Ohio.—George Barkman of Hamilton engaged by Trustees of Reily Township to prepare plans for proposed $30,000 school.

Sciotoville, Ohio.—School bonds for $25,000 will be sold May 8 by W. B. Halstead, Clk. and Treas. Porter Township Rural School Dist.

Somerset, Ohio.—Rusk & Sheets, 145 N. High Street, Columbus, engaged to prepare plans for $40,000 school. Address School Board.

Van Buren, Ohio.—School bonds for $45,000 will be sold May 1 by Geo. W. Connell, Clk. Allen Township Rural School Dist.

Huntington, Ind.—School bonds for $24,500 will be sold May 1 by Trustees Rock Creek School Dist. (Burdge H. Hurd, Attorney).

Detroit, Mich.—Health Committee of the Board of Estimate appropriated $125,000 for a new unit at the tuberculosis hospital.

Grand Rapids, Mich.—H. H. Turner, Grand Rapids, is architect for four-story fireproof addition to the Union High School. Address Clerk Board of Education.

Jackson, Mich.—Citizens voted $150,000 bonds for erecting new hospital. Address City Clerk.

Sault Ste. Marie, Mich.—Erection of hospital on Metzger Heights contemplated; probable cost $60,000. Address Secretary, Civic and Commercial Association.

Moline, Ill.—Citizens April 15 voted $50,000 bonds to erect new school on Seventh Street. Address Board of Education.

Newell, Iowa.—Beuttler & Arnold, Security Building, Sioux City, engaged to prepare plans for a high school to cost about $25,000. Contract will be let the latter part of May. Address School Board.

Sioux City, Iowa.—Plans being prepared by Beuttler & Arnold, Security Building, for five-room addition to Whittier School, in Morningside, and four-room addition to Hawthorne School in Leeds; total cost approximately $40,000.

Albert Lea, Minn.—It is proposed to erect a $25,000 centralized school in East Chain Township.

Bird Island, Minn.—Citizens voted $58,000 bonds for erecting new school. Address School Board.

Fairmont, Minn.—Citizens voted to consolidate six school districts and erect a school in East Chain Township. Address Clerk Consolidated School Board, East Chain Township, R. F. D. Fairmont.

Fergus Falls, Minn.—State Board of Control at St. Paul is considering improvements at the Fergus Falls Hospital for Insane to cost $75,000.

Goodland, Kan.—W. E. Hulse & Co. of Hutchinson engaged to prepare plans for proposed $25,000 school. Address Clerk, School Board.

Kingman, Kan.—Citizens voted $30,000 bonds to erect school. Bonds will be sold May 10. W. Murray, President Board of Education.

Ottawa, Kan.—Steps being taken to erect a $100,000 high school. Address Secretary Board of Education.

Fremont, Neb.—Steps being taken to erect new court house; cost about $100,000. Address County Clerk.

Sioux Falls, S. D.—City will vote on issuing $125,000 bonds for erecting city auditorium.

Big Spring, Tex.—The Attorney General at Austin approved a bond issue of $40,000 for Big Springs Independent School Dist.

Fort Stockton, Tex.—Plans completed by M. L. Waller & Company, Ft. Worth, for a high school, cost $40,000.

Houston, Tex.—Contract soon to be let for erecting negro school costing $45,000. Address City Secretary.

McKinney, Tex.—Election to be held May 16 to vote $25,000 bonds for erecting a ward school.

Wichita Falls, Tex.—The Attorney General at Austin approved a $225,000 issue of Wichita County courthouse bonds.

McAllen, Tex.—Plans completed by M. L. Waller & Company, Ft. Worth, for a brick and reinforced concrete school to cost $60,000.

Alva, Okla.—Erection of a high school contemplated; cost $65,000. Address Bd. Education.

Nowata, Okla.—Election will probably be held to vote $50,000 bonds for erecting high school. Address Clerk Board of Education.

Woodward, Okla.—Citizens have petitioned Mayor to call election to vote $30,000 bonds to erect city hall.

Colfax, Wash.—Beezer Brothers, Northern Bank Building, engaged to prepare plans and specifications for 5-story, brick and stone hospital to be erected for Sisters of Charity; cost $90,000. Contract will be let about May 15.

Corvallis, Ore.—J. V. Bennes, Chamber of Commerce Building, Portland, engaged to prepare plans for brick library to be erected for Oregon Agricultural College at Corvallis; cost about $200,000.

Milwaukie, Ore.—Citizens voted $25,000 bonds for erecting a school.

Los Angeles, Cal.—Bd. Supervisors directed George Low, County Architect, and John Schulz, Consulting Engineer, to prepare plans for 3-story concrete and brick juvenile detention home.

City Council considering erecting a detention home for women prisoners; cost, about $40,000.

Modesto, Cal.—School bonds for $200,000 will be sold May 9 by Modesto School Dist. Hugh Benson, Co. Clk.

Placentia, Cal.—Election will be held April 22 to vote $30,000 bonds for erecting a school. Address Clerk School Dist.

South Pasadena, Cal.—Board Education contemplates calling an election to vote on issuing $350,000 bonds for new school buildings and sites. Address Clerk Board Education.

Visalia, Cal.—Election will probably be held to vote $100,000 bonds for erecting a grammar school and two primary schools. Address Clerk of School Dist.

Mt. Pleasant, Utah.—Contract will be let in June for erecting school for which citizens April 3 voted $30,000 bonds. John S. Blair, Clerk Board of Education.

Ottawa, Ont.—Special Committee of Parliament appointed by the Government accepted plans of Pearson & Marchand of Toronto for the new Parliament buildings. Contract for erecting same about to be let; probable cost $1,500,000.

Port Credit, Ont.—Citizens reported in favor of purchasing site and erecting four-room school, to cost $30,000. Address Clerk School Board.

Calgary, Alta.—Erection of an armory building, costing $100,000, contemplated. Address R. C. Desroches, Secretary, Department of Public Works, Ottawa, Ont.

The Pas, Man.—Provincial Government has decided to erect $60,000 community house here.

BIDS DESIRED.

Oldtown, Me.—Reported desired until May 15 by W. E. Mansur, Archt., Bangor, for erecting school; probable cost $40,000.

Quincy, Mass.—Reported desired until May 3 by Thomas Swithin, Comr. Public Works, for erecting two schools, each two stories and basement, 165 x 115 ft.; probable cost $220,000. Cleveland & Godfrey, 15 Beacon Street, Boston, Archts.

Woonsocket, R. I.—Reported desired by city until May 12 for erecting an 8-room brick school on the Mercy Ball Estate site; probable cost $40,000. Walter F. Fontaine, Archt., Woonsocket.

Madison Barracks, N. Y.—Until May 24, by Quartermaster, Madison Barracks, for furnishing material and constructing one double set N. C. O. Quarters, advertised in Engineering Record.

Rochester, N. Y.—Reported desired until May 1 by Board Education (J. S. Mullan, Secy.) for erecting 6-room addition to school No. 28; probable cost $22,000. Gordon & Madden, Archts., Sibley Building.

Spring Lake, N. J.—Reported desired until May 6 for erecting Ann May Memorial Hospital to be three stories and basement, brick and stone. Magaziner & Potter, Archts., 603 Chestnut Street, Philadelphia, Pa.

Arden, Pa.—Until May 29, by T. J. Underwood, Co. Controller, Washington, for furnishing material and erecting a two-story brick hospital and ward building at County Home, Arden.

Northampton Heights, Pa.—Until May 1 by Building Committee, Board Educ. (George E. Borman, Secy.), for erecting new school. Separate bids for heating, plumbing, etc. Clyde S. Adams, Archt., 1509 Arch Street, Philadelphia.

Washington, D. C.—Until May 18, by U. S. Coast Guard, Washington, D. C., for alterations to White River Coast Guard Station, and launchway, White River, Mich., advertised in Engineering Record.

Petersburg, Va.—Until May 1, by J. M. Townsend, Clk. School Board, for competitive plans for Petersburg high school.

Pineville, W. Va.—Reported desired until June 8, for erecting 3-story 75 x 100-ft. courthouse. Probable cost, $80,000. H. M. Cline, Chmn. Board Co. Comra.

Newman, Ga.—Reported desired until May 15, by Board Education, for erecting 166 x 66-ft. school. Probable cost, $40,000. H. Bleckley, Archt., Third National Bank Bldg.

Atwater, Ohio.—Until May 13, by Board Education (H. H. Wolf, Clk.), for furnishing material and completing first and second stories and parts of basement of public grade and high school. L. W Thomas, Archt., 305 Pythian Building, Cleveland.

Bristolville, Ohio.—New bids desired for erecting the school. Bids opened April 15 rejected as being too high. R. B. Brockett, Clk. Bd. of Educ.

Derby, Ohio.—Reported desired until May 13 by Board Education for erecting two-story and basement, 55 x 85 ft. school. Matheny, Allen & Mounts, Archts., Huntington National Bank Building, Columbus; probable cost $25,000.

Kent, Ohio.—Until May 17, by Board Trus. Kent State Normal School (John A. McDowell, Secy.), for erecting women's dormitory for said school.

Lafayette, Ohio.—Reported desired until May 6, by A. L. Buchanan, Clk. Board Educ., for erecting high school. F. S. Rusk & Cree Sheets, Archts., 145 North High Street, Columbus.

Lebanon, Ohio.—Until May 8 by Board County Commissioners (M. E. Ross, Clk.) for erecting Soldiers' and Sailors' Memorial structure. Bids desired for labor and material as a whole or separately. Bausmith & Drainie, Archts., office of County Auditor, Lebanon.

Lordstown, Ohio.—Until May 10, by C. S. Fullerton, Clk. Board Education, for furnishing material and erecting fireproof school. Separate bids for plumbing, heating, etc. Robt. J. Keich, Archt., Room 409 Western Reserve Bank Building, Warren.

Van Buren, Ohio.—School bonds for $45,000 will be sold May 6 by Board Education.

Greentown, Ind.—Reported desired until May 9 by B. T. Ellis, Township Trus. for erecting 2-story and basement, 58 x 72 ft. township high school; probable cost $24,000. Elmer E. Dunlap, Archt., 909 State Life Building, Indianapolis.

Birmingham, Mich.—Until May 6, by Clarence Vliet, Supt. Schools, for erecting high school. Edw. C. Van Leyen and Edw. Schilling, 1115-21 Union Trust Building, Detroit.

Ecorse, Mich.—Until May 13, by F. N. Vellnure, Secy. Board Educa., for erecting school. Edw. C. Van Leyen and Edw. A. Schilling, Archts., Union Trust. Building, Detroit.

Ithaca, Mich.—Until May 6, by County Clerk, for erecting the Gratiot County Poor House. Edgar M. Wood, Archt., Alma.

Wahjamega, Mich.—Until May 24, by Board Control of the Michigan Farm Colony for Epileptics, care of Dr. R. R. Dixon, Supt., Wahjamega, for furnishing material and erecting patients' cottage No. 5. E. R. Dunlap, Archt., Hammond Building, Detroit.

Arthur, Ill.—Reported desired until May 10 by Board Education for erecting 2-story and basement school; probable cost $50,000. I. W. Royer, Archt., Urbana.

Alta, Iowa.—Until May 6, by Board Education New Fairview Consolidated School Dist. for erecting school. Separate bids for heating, plumbing, etc.

Bancroft, Iowa.—Until May 3 by Board of Education for erecting brick and stone school costing $35,000. Charles Derman & Co., Cedar Rapids, Archts.

Boone, Iowa.—Until May 22 (readvertisement) by Board County Supervisors, for erecting court house. Separate bids for heating plant, electrical work, etc. Norman T. Vorse, Archt., S. & L. Building, Des Moines. J. R. Curry, Co. Aud.

Cherokee, Iowa.—Reported desired until May 2 by Sioux Valley Hospital Assoc. (James Weart, Chmn.) for erecting two-story and basement, 38 x 70 ft. hospital; probable cost $25,000. Beuttler & Arnold, Archts., 609 Security Building, Sioux City.

Otranto, Iowa.—Until May 12 by F. A. Gleason, Secy. Bd. Educ., for erecting consolidated school. Separate bids for heating, plumbing, etc. J. W. Trafer, Archt., Mason City.

Selma, Iowa.—Until May 22 (change of date from May 15) by Consolidated Independent School Dist. (R. L. Schlotter, Secy.) for furnishing material and erecting a school. H. W. Underhill & Co., Archts., Bryant Building, Kansas City, Mo.

Silver City, Iowa.—Until about May 6 by Clerk Board Education for erecting brick school to cost $42,000. Edwins & Edwins, Archts., Minneapolis, Minn.

Sulphur Springs, Iowa.—Reported desired until May 11 by Board Directors Sulphur Springs Consolidated School Dist. of Buena Vista County (E. P. Wright, Pres.) for erecting school. Separate bids for heating, plumbing, etc. Marten & Hoskins, Archts., Storm Lake.

Bird Island, Minn.—Until May 22 by H. M. Miekle, Clk. Independent School Dist. No. 64, for erecting fireproof school. Separate bids for heating, plumbing, etc. W. L. Alban, Archt., 347 Endicott Building, St. Paul.

Canby, Minn.—Until May 11 by Board Educ., Consolidated School Dist. No. 30, for erecting high school and remodeling present school. Separate bids for heating, plumbing, etc. Kirby T. Snyder, Archt., 643 Plymouth Building, Minneapolis.

Perham, Minn.—Until May 15 by Mike Goblirich, Secy. School Board, School Dist. No. 44, for erecting high school and remodeling old high and grade school. Separate bids for heating, plumbing, science and laboratory equipment, etc. G. L. Lockhart, Archt., 285-288 Endicott Building, St. Paul.

St. Paul, Minn.—Until May 1, by August Hohenstein, Purchasing Agent, for erecting the McClellan School, including heating, plumbing, electric work, etc.

Buffalo, N. D.—Until May 3 by School Board for erecting high school in Dist. No. 38. Separate bids for heating, plumbing, etc. A. H. Foss, Archt., Elbow Lake, Minn.

Claire City, S. D.—Until May 12 by School Board (R. O. Gauper, Clk.) for erecting high and grade school. D. A. Burnett, Archt., Lidgerwood, N. D.

Twin Bridge, Mont.—Reported desired until May 8 by A. M. Alderson, Secy. State Board Examiners, Helena, for erecting dormitory building at State Orphan's Home, Fred. E. Wilson, Archt., Bozeman.

Tahoka, Tex.—Until May 2 by P. H. Northcross, County Clerk, for erecting a 4-story fireproof court house.

Keyport, Wash.—Until May 27, by Bureau Yards and Docks, Navy Dept., Washington, D. C., for constructing brick operating building on concrete foundation with tar and gravel roof at Pacific Coast Torpedo Station.

Seattle, Wash.—Reported desired until May 8 by School Board for erecting two-story addition to the Queen Anne Grade School at Sixth Avenue, W and Lee Street. Separate bids for heating, plumbing, etc. Edgar Blair, 1426 Jackson Street, Archt. Probable cost $50,000.

Youngsville, Cal.—Reported desired until May 3, by W. F. McClure, State Engineer, Sacramento, for erecting ten hospital cottages for Veterans Home of California.

Stockton, Cal.—Reported desired until May 2, by W. F. McClure, State Engr., Sacramento, for erecting armory.

Montpelier, Idaho.—Until May 8 by Thomas Barrett, City Clk., for erecting city hall, 2 stories, 76 x 78 ft., concrete, brick and tile construction; probable cost $60,000. Boyer & Rogers, Archts., Pocatello.

Markham, Ont.—Until May 12, by Markham Agricultural Society (Jas. Torrance, Chmn. of Committee), for erecting building 80 x 200 ft., suitable for Agricultural Hall.

PRICES AND LETTINGS.

★Indicates award of contract.

★Hoboken, N. J.—Contracts for erecting addition to high school awarded as follows: General construction, to M. T. Connolly Contracting Co., 238 Seventeenth Street, Jersey City; plumbing, James A. Marnell, 207 Washington Street, Hoboken; heating and ventilating, John H. Cooney, 210 Fourth Street, Harrison; electrical work, LaPointe Electrical Co., 65 Eighth Street, Hoboken; probable cost, $75,000. R. A. Marnell, Business Mgr., Board of Education.

★Philadelphia, Pa.—Contract for alterations and addition to courthouse building on Wood and Twelfth Streets awarded James P. Farrell & Co., 1621 Sansom Street; cost, $29,000.

★Shenandoah, Pa.—Contract for erecting three-story brick and steel high school on White Street awarded John J. O'Hearn of Shenandoah, at $108,400.

★West Chester, Pa.—Contract awarded by State Armory Board for erecting one and two-story brick and stone armory building to Henry L. Brown, 1714 Sansom Street, Philadelphia. Philip H. Johnson, Archt., Land Title Building, Philadelphia.

★Danville, Va.—Contract for erecting high school (bids opened April 10) awarded W. A. Gravely, Danville, at $33,800. Pritchett & Henderson, Archts.

★Valley City, N. D.—Contract for constructing U. S. Post Office awarded William O'Neill & Son Company, Faribault, Minn., $69,072.

★Wilmington, N. C.—Contract for constructing U. S. Custom House and appraiser's stores and court house at Wilmington awarded Northeastern Construction Company, 225 Fifth Avenue, New York, N. Y., at $368,400, and for mechanical equipment, except elevators, to G. A. Kees Domestic Engineering Company, St. Paul, Minn., at $37,746.

★Wilmington, N. C.—Eastern Steel Co., 60 Broadway, New York, N. Y., secured contract for 400 tons of steel work for the Custom House. Northeastern Construction Co., 225 Fifth Avenue, New York, N. Y., general contractors.

Savannah, Ga.—Following are four lowest bids opened April 11 by city for constructing the auditorium: E. Morgan, Savannah, $173,102; R. V. Labatte, Birmingham, Ala., $182,236; Carroll Blake Construction Company, Atlanta, $188,386; Travers Wood Company, Richmond, Va., $200,800. Seckinger & Garwes, Savannah, submitted lowest bid for plumbing at $8,425, and Barfield Chapman Company, of Savannah, lowest for heating and ventilating at $20,742. L. K. Comstock & Company, New York, electric wiring, $12,065. Otis Elevator Company only bid on elevator at $3,425. Reported plans are to be revised.

★Bristol, Tenn.—Contract for erecting central high school awarded by School Commission to William H. Bostwick of Jefferson City at $48,000.

★Knoxville, Tenn.—Contract for erecting fifteen-room addition to Moses School awarded L. A. Galyon & Son, 932 S. Ninth Street, at $39,630, and heating and plumbing to Ahler Plumbing Co.

★Jackson, Ky.—Contract for erecting brick and stone jail (bids opened April 18) awarded Little Cleckler Construction Co., Anniston, Ala., at $25,225. Alfred Russell, County Clerk.

★Chillicothe, Ohio.—Contract for erecting school awarded as follows: General contract, Sunnyside Lumber Co. of Athens, at $25,486; heating, Columbus Heating & Ventilating Co., Columbus, at $2,169.

★London, Ohio.—Contracts for erecting centralized school (bids opened April 15) awarded by Board of Education (W. F. Glass, Clerk) as follows: General contract to Martin Construction Co., $39,500; heating, Columbus Heating & Ventilating Co., $5,250; plumbing, Hoffman Conklin Co., $4,000. Bidders of Columbus.

★Salem, Ohio.—Contract for completing new high school building on Garfield Avenue awarded Walker & Curley Company, Bessemer Building, Pittsburgh, Pa., at $36,000.

★Urbana, Ohio.—Contracts for erecting high school in Urbana Township Rural School District (bids opened April 8) awarded as follows: General contract to H. C. McCall, Worthington, $25,827; heating and ventilating, the McGinnes Company, Pittsburgh, Pa., $4,759; plumbing and sewerage, Stephenson & Mong, Piqua, $1,895. B. F. Dixon, Clerk Urbana Township Board of Education.

★Seymour, Ind.—Contract for constructing U. S. Post Office awarded Callahan-Mandl Company, Chicago, Ill., at $49,700.

★South Bend, Ind.—Contract for erecting library for Notre Dame University awarded Bedford Stone & Construction Co., Indianapolis; steel to Hugh J. Baker, Indianapolis; sheet metal work, Joseph Lauber, South Bend; cement work, Marquette Cement Co., La Salle, Ill.; terra cotta, Northwestern Terra Cotta Co., Chicago, Ill. Estimated cost, $175,000. Edward Tilton, Archt., South Bend.

★Canton, Ill.—Contract awarded G. W. Perkins, Canton, for erecting grammar school, at $38,840, and for heating and plumbing to Buckley & Bowen, of Canton, at $10,984.

★Carbondale, Ill.—Contract for erecting auditorium at Southern Illinois Normal School awarded English Bros., Champaign, Ill.; cost about $100,000.

★Eau Claire, Wis.—Contracts for erecting Second Ward School awarded by Board of Education as follows: General contract, Farnum Brothers, Minneapolis, Minn.; plumbing, Garrigan & O'Brien, Faribault, Minn.; wiring, Kelly Construction Co., Eau Claire. Volkman & Hancock, Archts., 106½ Grand Ave.

★Galva, Iowa.—Following are four lowest bids opened April 11 by School Board (F. E. Baumgardner, Pres.), for erecting school: J. F. Leefers Co., Cedar Rapids, $46,522 (awarded contract); Tom Parks, Storm Lake, $51,878; Western Construction Co., Iowa City, and G. A. Shannon & Son, Chippewa Falls, Wis., each bid $52,000.

★Inwood, Iowa.—Contract for erecting two-story brick and stone, fireproof school awarded Zack Eyers, Le Mars; heating and plumbing, Mathey & Co., Le Mars; total cost, about $35,000. Beuttler & Arnold, Archts., Security Building, Sioux City.

★Waukon, Iowa.—Contract for erecting a high school at Waukon awarded to La Crosse Steel Constr. Co. of La Crosse, Wis., at about $50,000.

★Faribault, Minn.—Contract for alterations to State School for Blind (bids opened by State Board of Control, St. Paul) awarded as follows: General contract, John P. O'Neil, $34,898; heating and plumbing, P. J. Gallagher, $6,252; electric work, C. W. Turner, $760. Bidders of Faribault.

★St. Paul, Minn.—Contracts awarded as follows by City Board of Control for erecting addition to east wing of men's building at City Hospital, costing $34,336; General contract, C. Ash & Sons, New High School Building, South St. Paul; plumbing, Richter Plumbing Co., St. Paul; electric wiring and fixtures, Electric Construction Co., 174 East Sixth Street.

★Devils Lake, N. D.— Contract for erecting high school (bids opened April 11) awarded Dinnie Bros., Grand Forks, at $34,285. Address Secretary Board of Education.

★Clark, S. D.—Contract for erecting High School awarded Gray Construction Co. of Watertown at $25,999.

Arkadelphia, Ark.—Following are four lowest bids opened April 19 by Supervising Architect, Washington, D. C., for constructing post office—(a) limestone, (b) sandstone: George W. Stiles Construction Company, Chicago, Ill., (a) $45,847, (b) $47,847; H. F. Doyle, Cottonplant, Ark., (a) and (b) $44,850; George A. Shaul, Seneca, Kan., (a) $44,847; Algernon Blair, Montgomery, Ala., (a) $44,872; R. S. Moore, Lafayette, Ind., (b) $48,000; W. G. Carter Company, Chicago, Ill., (b) $49,672.

★Abilene, Tex.—Contract for erecting girl's dormitory at Simmons College awarded to R. C. Lewis of Abilene at about $40,000.

★Georgetown, Tex.—Contract for erecting science building at Southwestern Univ., 3-story fireproof, 112 x 70 ft., awarded A. O. Harvey, 1123 Granger Street, Fort Worth, and for heating, plumbing and lighting to John L. Martin, Austin. M. L. Waller, 412 Dan Waggoner Bldg., Fort Worth, Archt.; A. Dee Simpson, Secy. Board Trustees.

Delta, Okla.—See "Proposed Work."

★Aberdeen, Wash.—Contract for constructing U. S. Post Office awarded Henrickson & Company, Seattle, Wash., at $74,058.

★Seattle, Wash. — Contract awarded Northwest Steel Co., Portland, Ore., for 190 tons of steel for building at University of Washington.

Los Angeles, Cal.—Lowest bid opened April 13 by Bd. of Education for general contract for brick and concrete school on Marengo Heights site submitted by Alta Planing Mill Co., 1812 Industrial Street, at $26,346. R. H. Farrell, Archt., 1437 San Pedro Street.

Napa, Cal.—Lowest bid for erecting the cottage for men and women at Napa State Hospital, near Napa, submitted by L. G. Bergren & Son, Hearst Building, San Francisco, at $26,262.

★San Francisco, Cal.—Contracts awarded O. Monson, 1734 Tenth Avenue, for erecting northeast wing of San Francisco Hospital at $184,374, and for the nurses' home at $25,437, and Charles H. Hock of San Francisco for the brick and terra cotta work at $59,730 and $9,985 respectively.

★Prescott, Ariz.—Contracts for erecting court house (bids opened April 15) awarded as follows: General contract, Rogers & Ashton, Denver, at $180,000; heating and plumbing, J. D. Potter Plumbing & Heating Company, Denver, Col., at $17,195; electric work, Vyne Bros., Prescott, $3,190; metal doors and trim, Interior Metal Mfg. Company, Jamestown, N. Y., at $17,400; metal windows, U. S. Metal Products Company, Los Angeles, Cal., $7,237. R. Bleecker, Clerk, Board Supervisors.

PRIVATE BUILDINGS

PROPOSED WORK.

Boston, Mass.—Bankers Realty Investment Co. will erect an 11-story business building on State Street and Atlantic Avenue. Dinsmore & Le Clare, Archts.

Holyoke, Mass.—Plans being prepared by C. E. Nuitt, 8 Wall Street, Worcester, for the Immaculate Conception Church.

Worcester, Mass. — United Wholesale Grocery Co. will erect 4-story concrete warehouse on Grafton Street to cost $40,000.

Providence, R. I.—The Rhode Island Co. (H. W. Sanborn, Ch. Engr., Providence) is to construct a freight terminal at Eddy, Richmond and Point Streets, at cost of about $75,000.

Albany, N. Y.—Young Men's Hebrew Association contemplates erecting club building to cost approximately $100,000. Morris Sherman, Franklin Street, in charge.

Brooklyn, N. Y.—Plans filed for erecting following buildings: 6-story loft building on Third Avenue and Thirty-sixth Street for Bush Terminal Company, Forty-third Street; cost $450,000; 2-story brick theater and roof garden on Fifty-first Street and Third Avenue for Mystic Theater Company, 5108 Third Avenue. cost $100,000.

Plans prepared by Shampan & Shampan, 772 Broadway, Brooklyn, for six-story apartment house to be erected on Ross Street and Marcy Avenue for I. Motchcam; cost, $50,000.

Buffalo, N. Y.—Plans completed by Lansing, Bley & Lyman, Prudential Building, for two-story and basement, brick and terra cotta, 384 x 80-ft. store and office building to be erected at Delaware Avenue and Chippewa Street for Robert W. Pomeroy, Fidelity Building, and Ralph G. Wright; estimated cost, $100,000.

Canton, N. Y.—Masons considering plans for three-story store and lodge building; cost about $35,000.

Lockport, N. Y.—Common Council has approved petition of New York Central Railroad (George W. Kittredge, Ch. Engr., New York) to close two unused streets on the west side and in return said railroad will erect new freight house at cost of $100,000; also pave one of the city's leading highways from the business section to the site of new terminals.

New York, N. Y.—Society for Relief of the Destitute Blind, Amsterdam Avenue and 104th Street, contemplate erecting new building at Grand Boulevard and 193rd St., to cost, including site, $190,000 Lewis Spencer Morris, Treasurer, 32 Liberty Street.

Plans filed for erecting following buildings: 13-story fireproof apartment building at 31 East Seventy-second Street for 31 East Seventy-second Street, Inc., cost $275,900, Rouse & Goldstone, Archts., 38 West Thirty-second Street; 5-story brick store and apartment building at 54 Vermilyea Avenue for Marva Realty Corp., cost $55,000, Irving Margon, Archt., 370 East 149th Street; two 5-story brick apartments at 184th Street and Broadway for Number One Realty Company, total cost $80,000, Maximilian Zipkes, Archt., 405 Lexington Avenue; 8-story fireproof apartment building at 40 West Eighty-fourth Street for 40 West Eighty-fourth Street, Inc., cost $100,000, George F. Pelham, Inc., Archt., 30 East Forty-second Street; 3-story fireproof garage at Washington Avenue and 160th Street for Concourse Improvement Company, cost $50,000, Samuel J. Kessler, Archt., 232 East 165th Street; 4-story fireproof garage at West End Avenue and Sixty-fourth Street for New York Central Railroad Company, cost $75,000, J. C. Cocker, Archt., 2017 Fifth Avenue; 12-story fireproof store and loft building at 44 East Thirty-second Street for Hasco Building Company, cost $250,000, Walter Hasfeld, Archt., 245 West Fifty-fifth Street; two 5-story brick tenements at 165th and Faile Streets for Adavine Construction Company, total cost $120,000, Charles B. Meyers, Archt., 1 Union Square; 11-story and basement addition at 415 Fifth Avenue for Charles Scribner, cost $150,000, Ernest Flagg, Archt., 109 Broad Street.

New York, N. Y.—Plans being prepared by Warren & Wetmore, 16 E. Forty-seventh Street, for a hotel to be erected at Forty-third Street and Lexington Avenue for Bowman Hotel Corporation; capital $4,000,000. J. McE. Bowman, Proprietor of the Biltmore Hotel, is interested.

Rochester, N. Y.—Plans being prepared by Leon Stern, Chamber of Commerce Building, for two-story and basement, brick and steel seed warehouse to be erected by Mandeville & King, 186 East Main Street.

Rochester, N. Y.—Central Presbyterian Church will remodel Sunday School building at estimated cost of $80,000.

East Orange, N. J.—Neil J. Convery, 9 Clinton Street, Newark, is architect for three-story apartment building to be erected on Park Avenue; cost $40,000.

Jersey City, N. J.—Casino Realty Co., Jersey City, will erect on Baldwin and Hoboken Avenues an apartment house 77 x 104 ft.

Jersey City Grocery Co., 3 Prince Street, will erect four-story, concrete warehouse, 250 x 100 ft., at Eighth and Division Streets.

Morristown, N. J.—Reported contract will be let about middle of May by New York Telephone Co., for erecting an exchange building here, requiring 150 tons of steel.

Perth Amboy, N. J.—Mowbray & Uffinger, 56 Liberty Street, New York, engaged to prepare plans for three-story, brick and stone bank, store and office building to be erected at Smith & Maple Streets for Perth Amboy Savings Institure; cost, $109,000.

Union Hill (P. O. Weehawken), N. J.—Plans being prepared by John P. Messmer, 610 Summit Avenue, Weehawken, for two-story brick clubhouse to be erected in Union Hill for Palisade Council, No. 387, Knights of Columbus; cost, approximately $30,000. Dr. H. H. Tyndall, Chairman, Building Committee.

West New York (P. O. Weehawken) N. J.—Charles Goldberger, 415 Lewis Street, Union Hill, will erect four-story, brick tenement house, 25 x 90 ft., at Park Avenue and Seventh Street; cost, $25,000.

Harrisburg, Pa.—Five-story, 52 x 210-ft. addition is to be erected in rear of Dives, Pomeroy & Stewart Dept. store. (W. M. Bennethum, Mgr.)

Chiauk Emuna Congregation will erect a $40,000 synagogue at Sixth and Forster Streets. Joseph Claster, Pres. Building Committee.

Hecktown, Pa.—Dryland Church is to erect a $30,000 building.

Meadville, Pa.—Erie R. R. Co. (R. C. Falconer, Supt. Constr., 50 Church Street, New York, N. Y.) plans erection of $40,000 freight house here.

Nicetown, Pa.—Midvale Steel Co. plans erecting a 3-story office building.

Philadelphia, Pa.—Contract soon to be let for erecting five-story and basement, 25 x 153-ft., reinforced concrete and brick warehouse at 124 North Second Street, for C. B. Porter Company. Engineers, Frank C. Roberts & Co., Real Estate Trust Building.

Plans being prepared by E. F. Durang & Son, 1200 Chestnut Street, for three-story, 42 x 135-ft., brick and stone convent building to be erected at Thirty-eighth and Spring Garden Streets for St. Agatha's Parish.

De Armond, Ashmead & Bickley, 618 Chestnut Street, are architects for ten-story, brick, steel and concrete bank building to be erected at 20 South Fifteenth Street for Franklin Trust Co.

Plans being prepared by George Nattress, 1129 Walnut Street, for three-story, stone parish house to be erected at Germantown for St. Michael's Episcopal Church.

Bunting &Shrigley, 603 Chestnut Street, prepared plans for 4-story building to be erected at 1431 Chestnut Street for Logan Trust Company.

Plans being prepared by Ballinger & Perrot, Methodist Building, for a 4-story parochial school to be erected at Belgrade and Westmoreland Streets for R. C. Church of the Nativity.

Plans being prepared by Baldwin & Pennington, 601 Professional Building, for a 5-story, 30 x 72-ft. building to be erected at 220 N. Howard Street for Cohen & Hughes, 315 N. Howard Street. Cost, $40,000.

Plans being prepared for 5-story building to be erected at Fifteenth and Walnut Streets by Frank E. Hahn.

Pittsburgh, Pa.—O. M. Topp, Jenkins Building, engaged to prepare plans for $40,000 church to be erected at Hamilton and Brushton Avenues, East End, for St. Stephens' Evangelical Lutheran Church.

Washington, Pa.—Second Presbyterian Church will erect an edifice to cost about $75,000. A. H. McIlivane, member of Building Committee.

Baltimore, Md.—Plans being prepared by Baldwin & Pennington, Professional Building, for 5-story, 30 x 72-ft. building for Cohen & Hughes; cost, about $40,000.

Spartanburg, S. C.—Reported plans being prepared for six-story, fireproof hotel which W. T. Finch intends erecting on site of former City Club house on East Main Street, to be used as an annex to Finch Hotel on South Liberty Street; probable cost $75,000.

Sumter, S. C.—Reported Harby & Co. (A. C. Phelps, Sumter, Gen. Mgr.) contemplates erecting a warehouse on Washington, Oakland and Council Streets.

Miami, Fla.—Baptists propose erecting a church costing $75,000. Address Dr. J. L. White, Pastor.

Tampa, Fla.—C. W. Green and C. D. Perchi of Tampa and George W. Gandy of Petersburg, planning to erect theater building on Franklin Street to cost $50,000.

Birmingham, Ala. — Joy & Gallup, Archts., Birmingham, it is reported, desire bids on erecting building for Birmingham News; contract for excavation has been let.

New Orleans, La.—Mas Blanche Company will erect a 6-story fireproof addition to their department store on Canal Street.

Clarksville, Miss.—Methodists propose erecting a $40,000 church.

Shreveport, La.—Plans being prepared for an auditorium building with a seating capacity of 4800, to cost about $150,000. Address M. E. Dodd, Chrmn. Building Committee, Shreveport.

Rubenstein Bros., Shreveport, purchased site and will erect a six or eight-story building.

Chattanooga, Tenn. — C. P. Holden, Mackinac Island, Mich., intends erecting a 250-room hotel here.

Louisville, Ky.—Plans of Loomis & Hartmann, Todd Building, approved by Louisville Turngemeinde Association for erection of 2-story clubhouse; cost about $50,000.

Cleveland, Ohio.—Plans filed for $25,000 addition to new Holy Cross Home for Crippled Children, at 9014 Cedar Avenue. Bishop W. A. Leonard, of the Episcopal Diocese of Ohio, in charge.

Cleveland, Ohio.—Newburg Heights Masonic Temple will erect a 3-story brick temple costing about $65,000 at 8910 Miles Avenue.

Plans being prepared by Walker & Weeks, 1900 Euclid Avenue, for a $25,900 dwelling to be erected at Cleveland Heights for Max Bellman, 10628 Ashbury Avenue.

Plans being prepared by Walker & Weeks, 1900 Euclid Avenue, for a $30,000 dwelling to be erected for H. D. Horwitz, Hotel Statler.

Richardson & Yost, 354 Rockefeller Building, are architects for Mall moving picture theater to be erected at Superior Avenue and East Third Street at a cost of $50,000. Louis Becht, 260 Superior Avenue, Owner.

C. N. Hickok, 3922 Prospect Avenue, reported planning erecting a $50,000 dwelling on Coit Road near Lake Shore Boulevard.

Reported Mrs. Pauline Roth, Cleveland Heights, will erect three apartment houses each costing $25,000, on Lancashire Road, Cleveland Heights.

Bloomington, Ind.—Monroe Lodge, No. 22, F. & A. M., has purchased site and will erect two-story, stone Masonic Temple, including assembly hall, reception rooms, library, gymnasium and rest rooms; cost, $40,000.

Evansville, Ind.—Hadi Temple, Mystic Order of Shriners, has appointed committee to select site for new mosque temple, to cost about $100,000.

Fort Wayne, Ind.—Charles Weatherhogg, Hamilton National Bank Building, is architect for $30,000 school hall building to be erected for St. Paul's Roman Catholic Church. Rev. H. F. Joseph Kroll, Pastor.

Rochester, Ind.—L. H. Sturges, Board of Trade Building, Indianapolis, engaged to prepare plans for Methodist Church, to cost $30,000.

Mishawaka, Ind.—Dr. E. H. Sutherland of Mishawaka, proposes erecting $30,000 sanitarium for mental science on the east bank of Lake Manitou.

Chicago, Ill.—Plans prepared by Roy France, 155 N. Clark Street, for erection of a 5-story, 150 x 100 ft., store and apartment house at Greenview and Birchwood Avenues for Charles F. Henry; cost $230,000.

Peoria, Ill. — Lehmann Building Co. (Charles V. O'Hern, 224 West Virginia Street, Secretary) proposes erecting 10 or 12-story fireproof office building at Main Street and Jefferson Avenue.

Madison, Wis.—Piper Brothers of Madison have purchased Madison Hotel site at Mifflin and Pinckney Streets, and propose erecting six or seven-story fireproof business building.

Milwaukee, Wis.—Leenhouts & Guthrie, 424 Jefferson Street, are architects for four-story and basement, 60 x 120-ft., tile, brick and reinforced concrete apartment building to be erected on Van Buren and Knapp Streets for Van Buren Realty Co.; cost, about $60,000.

Davenport, Iowa.—See "Railroads."

Fort Dodge, Iowa.—Contract soon to be let for erecting seven-story, fireproof, brick, reinforced concrete floors, bank and hotel building, at Central Avenue and Eighth Street, for Iowa Savings Bank (E. J. Breen, President); probable cost, $160,000.

Minneapolis, Min.—Fifth Church of Christ (Scientist), 300 Twelfth Avenue, Southeast, will spend $50,000 for completion of interior of edifice.

H. J. Olsen, 1300 Linden Avenue, North, will erect a 3-story brick apartment house.

St. Paul, Minn.—C. W. Briggs, 3421 Humboldt Avenue South, will erect a two-story flat on Fairview and Ashland Avenues, costing $25,000.

Plans prepared by A. H. Stem, Endicott Building, for a 15-story concrete fireproof hotel to be erected at Jackson and Third Streets, and cost $2,300,000.

Plans being prepared by A. H. Stem, Endicott Building, for a building for St. Paul Athletic Club, to cost $650,000.

Kansas City, Kan.—Erection of a community building for Hebrew Assoc. is contemplated, at cost of $100,000. Jacob Billikoopf of Jewish Educational Inst. said to be interested.

Topeka, Kan.—Reported Knights and Ladies of Security, Topeka, will erect ten-story office building on Kansas Avenue.

Reported Commercial Club contemplates erecting at Seventh Street and Kansas Avenue a club house costing $100,000.

Lewistown, Mont.—Bank of Fergus County, Montana Hardware Company and associated interests planning erecting six-story, 90 x 190 ft. fireproof building to replace the Commercial Building recently destroyed by fire; probable cost $200,000.

Kansas City, Mo.—A $1,000,000 ten-story hotel contemplated here, probably in vicinity of Twelfth Street and Grand Avenue. J. T. Donegan, 5049 Delmar Avenue, St. Louis, reported interested.

St. Louis, Mo.—Mortgage Trust Co. (T. W. Bennett, Pres.), Broadway and Pine Streets, will erect at Ninth Street and Washington Avenue and lease to Hotel Statler Co., a 17-story hotel; cost, including site, $2,000,000.

Paris, Tex.—W. B. Wise, Paris, intends replacing brick buildings on Lamar Avenue destroyed by recent fire with reinforced concrete and steel buildings, chief among which is to be the Grand Theater, costing $75,000.

J. H. Gooch, Clarksville Street, intends erecting on Clarksville and Rusk Streets a grocery store costing $100,000.

First Baptist Church has decided to erect at $50,000 edifice. Address Pastor.

Soap Lake, Wash.—Reported plans being prepared for a sanitarium and surgical laboratory which Dr. E. G. Enberg of Soap Lake and associates propose erecting; cost $250,000.

Spokane, Wash.—Elks Lodge contemplating erecting new building to cost $125,000. William F. Connor, Secretary.

Portland, Ore.—Contract soon to be let for erecting three-story and basement, 100 x 100-ft. reinforced concrete and terra cotta bank building at Sixth and Stark Streets for U. S. National Bank of Portland. A. E. Doyle, Archt., Worcester Building.

Plans being prepared for 6-story, 50 x 100-ft. brick apartment building to be erected on Tenth and Yamhill Streets for Morris Taylor of Portland; estimated cost $60,000.

Anaheim, Cal.—Contract will be let about May 10, by Eugene Durfee, Nagle Bldg., for erecting a 3-story steel and brick office and bank building at Center and Los Angeles Sts. for First Natl. Bank.

Los Angeles, Cal.—A. Wackerbarth, 202 N. Main Street, engaged to prepare plans for a three-story brick apartment and store building, 50 & 150 ft. at Adams and La Salle Streets, for E. F. Gerecht, 411 Fay Building.

Plans prepared for two-story brick bakery building, 150 x 150 ft., to be erected at Beaudry Avenue and Mignonette Street, for Davis Standard Bread Co., 532 South Beaudry Avenue.

Long Beach, Cal.—Plans being prepared by H. H. Anderson, 18 Moody Building, for two-story brick theater, 150 x 50 ft., to be erected at 30 Pine Street, for E. W. Bollinger, Cashier First Natl. Bank, Orange; cost, about $50,000.

Los Angeles, Cal.—Plans being prepared by Morgan, Walls & Morgan, 1136 Van Nuys Building, for 11-story and basement reinforced concrete hotel, 120 x 80 ft., to be erected at Sixth Street and Grand Avenue, for Frank Simpson, 1032 Ingraham Street. First unit to be constructed will be 60 x 80 ft.

Pasadena, Cal.—Plans being prepared by Cyril Bennett, 234 Boston Building, for a two-story concrete and hollow tile storage building, 140 x 82 ft., to be built by day labor, on Broadway near Colorado Street, for B. O. Kendall Co., 67 North Raymond Avenue.

Bertram G. Goodhue, 2 West Forty-seventh Street, New York, N. Y., engaged to prepare plans for concrete music hall to be erected on grounds of Throop Inst. Technology, for Pasadena Music and Art Association; cost, about $150,000.

San Francisco, Cal.—Market Street Realty Co. incorporated with $3,000,000 capital, and will erect moving-picture theater at Fourth and Market Streets. Charles Schlessinger, Mills Building, reported interested.

Visalia, Cal.—Plans being prepared for a five-story fireproof hotel, 90 x 117 ft., of about 125 rooms, to be erected at Main and Church Streets, for J. Sub Johnson, Visalia; cost, $135,000.

Miami, Ariz.—Plans being prepared by Henry A. Jaasted, Tucson, for three-story reinforced concrete Y. M. C. A. building, 97 x 170 ft.; probable cost, $75,000.

Wallace, Idaho.—A three or five-story brick business building is to be erected at Cedar and Sixth Streets by J. W. Tabor of Wallace and others; cost about $50,000.

BIDS DESIRED.

Hoosick Falls, N. Y.—Until May 2, by Building Committee of United Lodge No. 509, I. O. O. F., Hoosick Falls (Arthur O. Curtis, Secy.), for erecting building for said lodge.

Reading, Pa.—Until May 5, by Board Trustees of Hope Rescue Mission, for erecting fireproof mission building at Second and Court Streets. Wm. White, Secy. Bldg. Committee. J. Earl Hickman, Archt., 119 South Fifth Street.

Cincinnati, Ohio.—Until May 27, by Elzner & Anderson, Archts., Ingalls Building, for erecting a Y. M. C. A. building. Bids desired for each branch of work separately or for all branches collectively in lump.

Rochester, Ind.—Until May 10 for erecting Trinity Evangelical Church. Address Rev. George C. Pullman, Pastor.

Fairmont, Minn.—Until May 8 for erecting fireproof addition to the Bullard Hotel. Separate bids for heating, plumbing, etc. G. A. E. Luedtke, Owner. George Pass & Sons, Archts., Mankato.

Rochester, Minn.—Until May 12 by Masonic Temple Assoc. for erecting three-story fireproof building for said association. Separate bids for heating, plumbing, etc. F. H. Ellerbe, Archt., Endicott Building, St. Paul.

Port Colbourne, Ont.—Until May 1 (extension of date from April 15), by Building Committee (E. P. Johnson, Secy.), for erecting St. James Church.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**New York, N. Y.**—C. T. Wills, Inc., 286 Fifth Avenue, has secured contract for erecting store and office building at 509 Fifth Avenue, for Thomas L. Sturges Estate; estimated cost $200,000. Herman Lee Meader, Archt., 2 West Thirty-third Street.

★**Hackensack, N. J.**—Contract awarded Ferber Construction Co. of Hackensack, for erecting three-story and basement, brick, limestone and terra cotta commercial building for Public Service Corporation; cost, approximately $50,000.

★**Collingdale, Pa.**—Contract for erecting school and auditorium for St. Joseph Parish on Bartram Avenue awarded James P. Farrell & Co., Inc., Lippincott Building, Philadelphia, at $32,150.

★**Harrisburg, Pa.** — Stapf & Benfer, Harrisburg, secured contract for erecting St. Lawrence German Catholic Church; cost, $40,000.

★Contract awarded Harold A. Hipple, Room 15, Harrisburg National Bank Building, for erecting a service building for Keystone Motor Car Company, South Cameron Street, at about $25,000.

★**Marcus Hook, Pa.**—Contract awarded Harry Brocklehurst, 512 W. Norris Street, Philadelphia, for erecting 45 brick workingmen's houses in industrial village of American Viscose Co. here. Ballinger & Perrot, Archts., Philadelphia.

★**Philadelphia, Pa.**—Contract awarded Stacy Reeves & Sons, 2011 Market Street, for erecting 68 x 300-ft., six story, brick addition to department store of Strawbridge & Clothier, 827 Market Street; cost, $125,000.

★Contract awarded Henry P. Schneider, 3712 York Road, for erecting two-story and basement, 131 x 91 ft., hall and store building on Germantown Avenue and Venango Street for George F. Stumpfig; cost, $40,000.

★Contract awarded H. E. Grau Co., 1707 Sansom Street, for erecting warehouse for American Radiator Co.; cost, $25,000.

★Contract awarded William Steel & Sons Co., 1600 Arch Street, for erecting seven-story and basement, brick, terra cotta and reinforced concrete, 139 x 240 ft., warehouse and one-story, brick and concrete, 226 x 110 ft., garage at Twenty-third and Walnut Streets, for John Wanamaker; cost $656,000.

★Contract awarded Benjamin F. Bennett Building Company, 123 S. Howard Street, for erecting a fireproof steel and concrete building for Baltimore Oil Engine Company, Eastern Avenue and Thirty-first Street. Cost, $40,000. Walter M. Gieske, Archt., 65 Guther Building.

★**Pittsburgh, Pa.**—Contract awarded W. E. Bell for erecting for Richard Jennings, Jr., a $50,000 residence in Irwin Drive, Edgeworth.

★**Wayne, Pa.**—Contract for erecting school for St. Katharine of Sionna Parish awarded John McShain, Philadelphia, at $25,985.

★**Baltimore, Md.**—Contract for erecting apartment house on Charles Street and University Parkway for Charlton Apartment Co. awarded Charles L. Stockhausen Co., Marine Bank Building. Parker, Thomas & Rice, Archts., Union Trust Building.

★**Tifton, Ga.**—Contract for erecting building for Bank of Tifton awarded to Southern Ferro Concrete Co. of Atlanta. Exterior to be marble. Edwards & Sayward, Archts., Atlanta.

★Cleveland, Ohio.—Contract reported awarded Turner Construction Co., Buffalo, N. Y., for erecting a high level freight terminal on W. Ninth Street and Lakeside Avenue to cost $1,000,000. George T. Bishop, 1206 Williamson Building, interested.

Cleveland, Ohio.—See Detroit, Mich.

Portsmouth, Ohio.—Following are four lowest bids opened by Trustees of Fourth Street Methodist Church for erecting new edifice on Logan Street and Franklin Avenue: Harrison Smith, Huntington, $29,750; Portsmouth Construction Co., Portsmouth, $31,304; W. F. Carson, Portsmouth, $33,363; H. F. Cook, Portsmouth, $33,994.

★Toledo, Ohio.—Contract awarded Toledo Engineering & Construction Co., Second National Bank Building, for erecting three-story and basement, semi-fireproof lodge building on Broadway and Colburn Street for Viking Lodge, 892, I. O. O. F.; cost, about $60,000.

Vincennes, Ind.—Albert Schnuck, Vincennes, submitted lowest bid for erecting Masonic Temple on Fifth Street and Broadway, at $29,900. John W. Gaddis, Archt., Vincennes.

★Detroit, Mich.—Contract awarded American Bridge Co., Beecher & M. C. R. R., for 300 tons of steel for the J. B. Book buildings at Detroit, and 575 tons for the addition to Gilsey House at Cleveland, Ohio.

★Marlin, Tex.—Contract awarded F. A. Caperton for erecting two-story and basement hospital for Dr. W. H. Allen; cost $25,000.

★Long Beach, Cal.—Contract awarded J. C. Beer, Ocean and Falcon Avenues, for a three-story, brick store and apartment building, 81 x 60 ft., and one-story, brick store, 60 x 60 ft., to be erected on Pike and Chestnut Place, for E. B. Campbell; cost, about $40,000.

★Los Angeles, Cal.—Contract awarded F. L. Somers, 1415 Baker Detwiler Building, for erecting four-story and basement reinforced concrete warehouse, 80 x 200 ft., at Second Street and Central Avenue, for E. P. Bosbyshell; owner to furnish materials. W. J. Saunders, Archt., 319 Laughlin Bldg.

★Moose Jaw, Sask.—Contract for constructing Standard No. 2 stations for C. P. R. R. awarded A. G. Creelman & Co., City Market Wharf, Vancouver, B. C. F. C. Macnabb, Division Engineer, C. P. R., Moose Jaw, Sask.

★Vancouver, B. C.—Contract awarded Grant, Smith & McDonald, Seattle, Wash., for erecting proposed brick and terra cotta joint passenger station for Great Northern and Northern Pacific Ry. on False Creek, Vancouver.

NEW INDUSTRIAL PLANTS

PROPOSED WORK.

Hudson, Mass.—The Wottoquottoc Worsted Co., Hudson, is to build a one-story brick addition, 75 x 180 ft.

Binghamton, N. Y.—Plans being prepared by T. I. Lacey & Son, Kilmer Building, for moving picture theater, four stores and cigar factory building, of concrete and steel, to be erected at Court and Jay Streets, by William H. Ogden, of W. E. Ogden & Co., 80 State Street; cost, about $25,000.

Buffalo, N. Y.—Plans filed for erecting four-atory reinforced concrete addition to plant of Pierce-Arrow Motor Car Company at Elmwood Avenue and New York Central R. R. Belt Line; estimated cost, $100,000.

Hornell, N. Y.—Reported Charles M. Crook of Catskill is planning to erect brick plant here; probable cost $150,000.

Schenectady, N. Y.—The 51 x 312-ft. brick factory to be erected for General Electric Company will be done by day labor; estimated cost, $25,000. Plans also being prepared for two additional factory buildings.

Syracuse, N. Y.—Taber & Baxter, Gurney Building, are architects for two-story 44 x 144-ft., mill construction, brick addition to plant of Lefever Arms Company on Maltby Street; estimated cost, $25,000.

Harrison, N. J.—Henry Ford, Detroit, Mich., has secured a site near here on which he intends erecting first unit of a plant costing $1,000,000, and plans for which have been prepared.

Newark, N. J.—John Campbell & Co., 75 Hudson Street, New York, will erect a plant, including six one-story buildings, 50 x 100 ft.; cost $30,000.
Berkowitz, Goldsmith & Spiegel, 34 New York Avenue, will erect a 4-story factory, costing $25,000.

Linden, N. J.—Ammos Phos Chemical Corporation will erect a plant costing $71,000.

Darby, Pa.—Contract soon to be let by Griswold Worsted Co., Darby, for erecting 4-story factory 55 x 100 ft.

Sharon, Pa.—Sharon Steel Hoop Co. (Severen P. Ker, President), is having plans prepared for new machine and blacksmith shops.

Hopewell, Va.—Plans and specifications being prepared for $2,000,000 steel plant which Walter Sachs of Petersburg, and associates, propose erecting here, with yearly capacity of 400,000 tons.

Richmond, Va.—Richmond Cold Storage Co. to construct a 5-story concrete building; cost about $80,000.

Louisiana.—Consolidated Oil Refining Co., St. Louis, Mo., intends establishing a $60,000 refinery in Red River oil field, either at Grand Bayou, Abington or some other place convenient to the source of production. It will have offices in Shreveport with F. B. and C. E. Grevemberg as general managers.

Paducah, Ky.—H. M. Dalton of Paducah reported interested in erection of factory here for manufacturing from cement a substitute for marble, brick, stone, granite, etc.; probable cost $50,000.

Cleveland, Ohio.—Plans filed for erecting following buildings: Two-story, 248 x 180-ft. brick, concrete and steel manufacturing building at 874 East Seventy-second Street for Properties Company; three-story concrete factory at 1700 Walworth Avenue for Barrett Manufacturing Company, Illuminating Building.
Reported Cleveland Union Stockyards Company, West Sixty-fifth Street, and Big Four R. R. is issuing $500,000 bonds for building additions.
Northern Ohio Blower Company, 4515 Storer Avenue, is planning a $40,000 factory to be erected at West Sixty-fifth Street and W. & L. E. R. R.

Massillon, Ohio.—Peerless Drawn Steel Co. (Fred Snyder, President) intends enlarging plant at cost of about $40,000.

Detroit, Mich.—Directors of Detroit Iron & Steel Co. of Detroit considering plans for a third blast furnace as an addition to plant on Zug Island; cost $1,000,000.

Grand Rapids, Mich.—Robinson & Campau, Houseman Building, are architects for three-story and basement, brick, mill construction factory to be erected for Nelson-Matter Furniture Company.

Waukesha, Wis.—Plans being prepared by Schuchardt & Judell, 428 Jefferson Street, Milwaukee, for four-story, 40 x 150 ft., reinforced concrete and brick factory to be erected for Waukesha Pure Food Co.; cost about $50,000.

Breckenridge, Minn.—The Great Northern R. R. Co. (A. H. Hogeland, Ch. Engr., St. Paul) will spend about $125,000 for improvements, to include roundhouse, enlarge machine shops, and additional yardage, etc.

Muskogee, Okla.—Missouri, Kansas & Texas R. R. (L. F. Lonnbladh, Ch. Engr., Dallas, Tex.), plans constructing improvements, including shops and roundhouses; cost, $250,000.

Seattle, Wash.—A. J. Capron, Ainsworth Building, Portland, Ore., reported interested in a syndicate contemplating erecting paint and varnish manufacturing plant on Duwamish waterway, Seattle; probable cost $500,000.

Tonasket, Wash.—Reported plant of Tonasket Flour Mill Company, recently destroyed by fire, will be rebuilt.

Portland, Ore.—Reported Portland Paper Package Company (C. D. Brunn, President), Portland, will erect plant for manufacture of shipping and corrugated cases at Twenty-fifth Street and Holladay Avenue, in Sullivan's Gulch, Portland.

Brawley, Cal.—Plans being prepared by C. M. Gay & Son, 335 Towne Avenue, Los Angeles, for reinforced concrete cold storage building, capacity 5000 tons daily, 100 x 100 ft., 40 ft. high; icing dock, 860 x 14 x 15 ft., and frame and iron ice factory, daily capacity 90 tons, 80 x 100 x 28 ft., for Holton Power Co.; C. E. Paris, General Mgr. Probable cost, $100,000.

Calton, Cal.—Reported Pacific Fruit Express Co. (L. E. Cartmill, Supt.) contemplates erecting an ice plant on Pacific Electric Ry. right of way at a cost of about $35,000.

Long Beach, Cal.—George E. Reynolds, Consulting Engineer for S. D. Fergus, mining operator, reported arrangements have been made to erect a $1,500,000 zinc refining plant on inner harbor near San Pedro, Los Angeles, and Salt Lake Ry. tracks.

Vernon (P. O. Watts), Cal.—Reported California Tissue Mills Co., Fifty-fourth and Alameda Streets, intends enlarging plant at a cost of $40,000.

PRICES AND LETTINGS.

★Indicates award of contract.

★North Andover, Mass.—Contract awarded E. A. Peabody & Son, Bay State Building, Lawrence, for erecting brick and steel addition to foundry plant of Davis & Furber Machine Co.

★Bay Way, N. J.—Contract awarded Milliken Bros., 111 Broadway, New York, N. Y., for 440 tons of steel shapes for an addition to plant of Waclark Wire Co., at Bayway.

★Newark, N. J.—Contract awarded American Contract Steel Co., Essex Building, for erecting nine-story, 100 x 200 ft., reinforced concrete and brick factory at Middlesex and Fourth Streets for Hyatt Roller Bearing Co.; cost about $235,000.

★Allentown, Pa.—Contract awarded McClintoc-Marshall Co., Oliver Building, Pittsburgh, for 600 tons of steel for plant of Traylor Engineering Co.

★Philadelphia, Pa.—Contract awarded Wilbert Beaumont, 322 Stephen Girard Building, for erecting three-story, 110 x 44 ft., concrete and brick manufacturing building on Seventh and Wood Streets for Central Machine Co.; cost $25,000.
★Contract awarded Turner Concrete Steel Co., 1713 Sansom Street, for erecting five-story, reinforced concrete and brick factory addition at 414 North Third Street for Alexander Brothers; cost $75,000. George F. Pawling & Co., Archts., 1432 South Penn Square.

★Reading, Pa.—Contract awarded Reading Contracting Co., Reading, for erecting mill building, 73 x 337 ft., for Carpenter Steel Co.; cost $50,000.

★Baltimore, Md.—General contract for erecting factory building for Baltimore Oil Engine Co., on Thirty-first Street and Eastern Avenue, awarded Benjamin F. Bennett Building Co., 123 S. Howard Street, at $40,000. Walter M. Gieske, Archt., Gunther Building.
★Contract for erecting one-story fireproof grain storage building at Marshall and McComas Streets awarded by Western Maryland Ry. Co. to James Stewart & Co., Chicago, Ill. Cost, about $135,000.

★Point Pleasant, W. Va.—Contract awarded by Marietta Manufacturing Co. to C. B. Kimberly Co. of Wheeling, for erecting 100 x 260-ft. mill-construction building; cost, $25,000.

★Atlanta, Ga.—Contract awarded by Seaboard Air Line R.R. to Morrow Transfer Co. of Atlanta for erecting shops at Howell Station at approximately $65,000.

★Columbus, Ga.—Contract awarded Frank A. Pearce, Columbus, for erecting a 10,000 spindle cotton mill and a 3-story warehouse for the Swift Manufacturing Co. Cost, including site, etc., about $200,000. J. E. Sirrine, Greenville, S. C., Engineer.

★Montgomery, Ala.—Contract awarded Griffin Construction Co., Atlanta, Ga., for erecting a seed house, 80 x 250 ft., for an oil mill for Alabama Cotton Oil Co. Cost, $40,000.

★Ironwood, Mich.—Contract for 210 tons of steel for improvements to plant of Oliver Mining Co. awarded American Bridge Co., Detroit.

★Champaign, Ill.—Contract awarded Freeman & Brooks, Champaign, for erecting ice and cold storage plant, fireproof and reinforced concrete construction, for Smith & Co., on State and Prairie Streets; cost, approximately $90,000.

★Beloit, Wis.—Contract awarded Lakeside Bridge & Steel Co., North Milwaukee, for 510 tons of steel for an addition to plant of Yates Machine Co.

★St. Paul, Minn.—Contract for excavation and foundation of terminal elevator to be erected by Equity Co-operative Exchange on the upper levee awarded W. J. Hoy, Metropolitan Building, at $25,796.

★Garfield, Utah.—Contract for a converter flue requiring 440 tons of steel awarded Minneapolis Steel & Machinery Co., Minneapolis, Minn.

MISCELLANEOUS

PROPOSED WORK.

Mosquito Breeding Elimination—Cape May C. H., N. J.—Reported about $15,000 will be spent by the State and Board of Freeholders in eliminating mosquito breeding places in Cape May County. Address Clerk Board of Freeholders.

Transmission Line—Birmingham, Ala.—The Alabama Power Co. intends constructing the steam plant on Black Warrior River at Baker Creek. The transmission line is also to be extended. Ingalls Iron Works of Birmingham has contract for structural steel to be used in the power plant.

Park improvement—Chicago, Ill.—All bids opened March 21 by West Chicago Park Commissoners (Timothy Cruise, Secy.), for excavating and grading in Austin Park site about 204,000 cu. yd. clay and 67,000 cu. yd. black soil, etc., rejected at meeting April 7. No new bids asked yet.

Park improvements—Madill, Okla.—Ordinance passed by Council authorizing $10,000 bond issue for park purposes.

Fill—Portland, Ore.—Port of Portland Commission granted permission to Walter F. Beebe of Northwest Steel Co. for a fill on property of Oregon Washington Railroad & Navigation Co., adjoining steel plant on Sheridan Street, on which to construct two steel steamers. About 60,000 cu. yd. of fill will be required.

BIDS DESIRED.

Boilers and Engines—Bridgeport, Conn.—Until May 10, by Board of Contract & Supply for Ice Plant Commission, for the following: Three high-speed double-acting horizontal ammonia compressors and appurtenances; three 125 hp. water tube boilers and appurtenances; three 150 hp. uniflow steam engines, and one 125 hp. uniflow steam engine, direct connected to 220-volt 3-phase 60-cycle alternating-current generator, all four proposals advertised in Engineering Record. Fletcher Thompson, Inc., Engineers, 1089 Broad Street, Bridgeport.

Balconies—New York, N. Y.—Until May 1 by Board Trustees Bellevue and Allied Hospitals for furnishing material and erecting new balconies, including electrical work on south side of Pavilions I and K, of the new Bellevue Hospital on First Avenue and Twenty-sixth Street. Security $17,000.

Sprinkling System—New York, N. Y.—Until May 2, by J. T. Featherston, Commissioners of Streets, for furnishing and installing sprinkler system and other fire protection on various dumping boards in Borough of Manhattan, Bronx and Brooklyn. Security, $10,100.

Wall—Washington, D. C.—Until May 8 by District Commissioners (Oliver P. Newman, Chmn.) for reconstructing portion of wall on Canal Road between Aqueduct bridge and Foundry branch.

Steel Pontoon—Memphis, Tenn.—Until May 11, by U. S. Engineer Office, Memphis, Tenn., for one steel pontoon, advertised in Engineering Record.

Road Oil—Columbus, Ohio.—Reported desired until May 2 by L. J. Guthke, Secy. Board Purchase, for furnishing city with 1500 tons lake sand and 20,000 gal. road oil and 10,000 gal. asphalt road oil.

Cement—Indianapolis, Ind.—Reported desired until May 4, by Park Commissioners, for 1200 to 1500 bbls. Portland cement.

Lift and Hoistway—Davenport, Iowa.—Until May 15 by James A. Wetmore, Acting Superv. Archt., Treas. Dept., Washington, D. C., for installing complete hoistway, hydraulic freight lift, etc., in U. S. Post Office at Davenport.

Oil Tractor—Long Prairie, Minn.—Reported desired until May 1 by E. M. Berg, Co. Aud., for a 3-way drag or road planer for engine power; also one oil tractor for road building purposes f.o.b. Long Prairie; must be at least 30-60 hp. and face of drive wheel must be at least 30 in. in width.

Crushed Stone—St. Paul, Minn.—Until May 1, by August Hochenstein, Purchasing Agent, for 40 cars crushed granite or trap rock, C. St. P. M. & O. Ry. tracks Dayton's Bluff Districts (First and Second Wards); 4 cars crushed granite or trap rock, Anderson's crossing highwood on C. B. & Q. Ry; 3 cars crushed granite or trap rock, Minnesota Transfer, Tenth and Eleventh Wards, all to go through 2-in. ring.

Cranes—Houston, Tex.—Until May 10 by E. E. Sands, City Engineer, for one electric traveling crane for wharf and four traveling cranes for aewage disposal plants; cost $8,000 and $7,500 respectively.

Houston, Tex.—Reported desired until May 10, by E. D. Fands, City Engr., for constructing electric traveling crane for wharf. Probable cost $8,000. Also four traveling cranes for sewage disposal plant. Probable cost $7,500.

Cement—Denver, Col.—Until May 25, by U. S. Reclamation Service, Denver, Col., for furnishing 115,000 bbl. Portland cement f.o.b. cars at works of the bidder, advertised in Engineering Record.

PRICES AND LETTINGS.

★Indicates award of contract.

Park Improvement—Boston, Mass.—Following are two bids opened April 20 by Park Commissioners (C. E. Putman, Engineer), for grading, draining, constructing walks, etc., at Ward 19 playground: Thomas Russo, 240 North Street, $50,457, and J. C. Coleman & Sons Co., 1620 Tremont Street, $38,592.

Cement—Louisville, Ky.—Following are bids opened April 15 by U. S. Engineer, Louisville, for furnishing and delivering Amercan Portland cement for Dam 43, Ohio River, 10 cts. for empty sacks not returned, (a) delivery U. S. barges on Ohio River between Louisville, Ky., and Dam 43, plan a; (b) delivery f.o.b. cars on U. S. siding at Pulchers, Ky., plan b; (1) price per bbl.; (2) total; Lehigh Portland Cement Company, 1500 Consumers Building, Chicago, Ill. (b) (1) $1.52, (2) $38,000; Louisville Cement Company, Louisville (a) (1) $1.50, (2) $37,500, (b) (1) $1.57, (2) $39,250; Kosmos Portland Cement Company, Inc., 614 Paul Jones Building, Louisville, Ky. (a) (1) $1.30, (2) $32,500; (b) (1) $1.52, (2) $38,000.

Powder and Dynamite—Seattle, Wash.—Following are three bids opened by C. E. Dole, Purchasing Agent, Alaska Ry. Commission, Bell Street Dock, Seattle, for (a) 220,000 lb. powder, and (b) 500,000 lb. dynamite, for use for government railway in Alaska: E. I. DuPont de Nemours Co., Wilmington, Del.; Giant Powder Co., San Francisco, Cal., Hercules Powder Co., Wilmington, Del., each bidding the same, (a) $22,000, and (b) $106,-925.

Proposals

For Proposals Advertised, See Pages 40a, 40b and 41.

WATERWORKS.

Bids Close.		See Eng. Record.
May 2.	Filtration Plant, Columbia, S. C.	Apr. 22
May 2.	Hydrants, Jersey City, N. J.	Apr. 22
May 2.	Mains, Sleepy Eye, Minn.	Apr. 23
May 2.	Mains, Wynot, Neb.	Apr. 29
May 2.	Pipe, Chicago, Ill.	Apr. 29
May 3.	Water Works, Wilson, Okla.	Apr. 22
May 4.	Distributing System, Shelby, Iowa	Apr. 29
May 4.	Well, Jacksonville, Fla.	Apr. 29
May 4.	Pipe, Etc., Washington, D. C.	Apr. 29
May 5.	Mains, Etc., Wadena, Minn.	Apr. 22
May 8.	Meters, Portland, Ore.	Apr. 22
May 8.	Pipe, Washington, D. C.	Apr. 22
May 8.	Improvements, Winterset, Iowa	Apr. 29
May 8.	Improvements, Hamilton, Ont.	Apr. 29
May 8.	Well, Humboldt, Ont.	Apr. 29
May 9.	Filtration Plant, New Brunswick, N. J. Adv. Apr. 15, 22.	Apr. 15
May 9.	Contract 147, New York, N. Y. Adv. Apr. 22.	Apr. 22
May 9.	Stand Pipe, New Brunswick, N. J. Adv. Apr. 29.	Apr. 29
May 9.	Systems, Illinois	Apr. 29
May 10.	Water Works, Pleasantville, Iowa	Apr. 29
May 12.	Filtration Plant, Wilmington, Del. Adv. Apr. 22.	Apr. 22
May 16.	Water Works, Yoncalla, Ore.	Apr. 8
May 16.	Pipes, Hydrants, Etc., Denmark, Wis.	Apr. 29
May 18.	Water Works, Ironton, Ohio	Apr. 29
May 31.	System, Aberdeen, Wash.	Apr. 29
Jun. 1.	Water Works, Madison, W. Va.	Apr. 22

SEWERAGE AND SEWAGE DISPOSAL.

Bids Close.		See Eng. Record.
May 1.	Wessington, S. D. Adv. Apr. 15, 22.	Apr. 15
May 1.	Brookline, Mass.	Apr. 29
May 2.	Alton, Ill.	Apr. 15
May 2.	Montreal, Que.	Apr. 22
May 2.	Hartford, Conn.	Apr. 22
May 2.	Waverly, Iowa	Apr. 29
May 3.	Chicago, Ill. Adv. Apr. 15, 22.	Apr. 15
May 3.	Rawlings, Wyo.	Apr. 29
May 3.	Brooklyn, N. Y.	Apr. 29
May 3.	Fargo, N. D.	Apr. 29
May 2.	New York, N. Y.	Apr. 29
May 3.	Rochester, N. Y.	Apr. 29
May 4.	Maywood, Ill.	Apr. 29
May 4.	McPherson, Kan.	Apr. 29
May 5.	Ipswich, S. C.	Apr. 22
May 5.	Mt. Horeb, Wis.	Apr. 22
May 8.	Riverside, N. J. Adv. Apr. 22, 29.	Apr. 22
May 8.	Newark, Del. Adv. Apr. 22, 29.	Apr. 22
May 8.	Grays Lake, Ill. Adv. Apr. 29.	Apr. 29
May 9.	Park Rapids, N. D.	Apr. 29
May 12.	Jacksonville, Fla.	Apr. 29
May 12.	Pender, Neb.	Apr. 29
May 15.	Oatman, Ariz.	Apr. 22
May 15.	Neodesha, Kan.	Apr. 29
May 21.	Toledo, Ohio.	Apr. 29
May 22.	Spooner, Minn.	Apr. 29
May 24.	Binghamton, N. Y. Adv. Apr. 29.	Apr. 29
May 31.	Fresno, Cal.	Apr. 29

BRIDGES.

Bids Close.		See Eng. Record.
May 2.	Concrete, Wash.	Apr. 15
May 2.	Paducah, Ky.	Apr. 22
May 2.	Rensselaer, Ind.	Apr. 22
May 2.	Cohassett, Minn.	Apr. 29
May 3.	Great Bend, Kan.	Apr. 29
May 3.	Chehalis, Wash.	Apr. 29
May 4.	San Luis Obispo, Cal.	Apr. 29
May 5.	Seattle, Wash.	Apr. 29
May 6.	Bridgeport, Conn. Adv. Apr. 15.	Apr. 15
May 6.	Rochester, Minn.	Apr. 29
May 8.	Bellefontaine, Ohio	Apr. 29
May 8.	Los Angeles, Cal.	Apr. 22
May 9.	Manhattan, Kan.	Apr. 15
May 9.	Summerville, W. Va. Adv. Apr. 29.	Apr. 29
May 9.	Jefferson, Iowa	Apr. 29
May 9.	Denton, Md.	Apr. 29
May 13.	Morris, Minn.	Apr. 29
May 15.	Sheridan, Wyo.	Apr. 29
May 16.	Arden, Man.	Apr. 29
May 18.	Manhattan, Kan.	Apr. 29
May 20.	Lyndhurst, N. J.	Mar. 18
May 22.	Dayton, Ohio	Apr. 29
May 23.	Kearney, Neb.	Apr. 29
May 23.	Albany, N. Y. Adv. Apr. 29.	Apr. 29
Jun. 5.	Cumberland, Md.	Apr. 22
Jun. 8.	El Dorado, Kan.	Apr. 8

PAVING AND ROADS.

Bids Close.		See Eng. Record.
May 1.	Hartford, Conn. Adv. Apr. 8 to 22.	Apr. 8
May 1.	Newton, N. J. Adv. Apr. 8 to 22.	Apr. 8
May 1.	Gulfport, Miss. Adv. Apr. 22.	Apr. 22
May 2.	Seattle, Wash.	Apr. 15
May 2.	Indiana	Apr. 15
May 2.	Albany, N. Y. Adv. Apr. 15 to 29.	Apr. 15
May 2.	Booneville, Ind.	Apr. 15
May 2.	Woonsocket, R. I. Adv. Apr. 15, 22.	Apr. 15
May 2.	Mt. Vernon, Wash.	Apr. 15
May 2.	Salt Lake City, Utah	Apr. 22
May 2.	Wilkes-Barre, Pa. Adv. Apr. 22, 29.	Apr. 22
May 2.	Urbana, Ohio	Apr. 22
May 2.	Saginaw, Mich. Adv. Apr. 22.	Apr. 22
May 2.	St. Louis, Mo.	Apr. 22
May 2.	Indiana	Apr. 22
May 2.	Alton, Ill. Adv. Apr. 22.	Apr. 22
May 2.	Kent, Minn.	Apr. 29
May 2.	Lewiston, Utah	Apr. 29
May 2.	Meridian, Miss.	Apr. 29
May 2.	Greenville, Ky.	Apr. 29
May 2.	Buffalo, Minn.	Apr. 29
May 2.	Salt Lake City, Utah	Apr. 29
May 2.	Enumclaw, Wash.	Apr. 29
May 2.	Kansas City, Mo.	Apr. 29
May 2.	Massachusetts	Apr. 29
May 2.	Toledo, Ohio.	Apr. 29
May 2.	Alton, Ill.	Apr. 29
May 2.	Cathlamet, Wash.	Apr. 29
May 2.	Evanston, Ill.	Apr. 29
May 3.	Ligonier, Ind.	Apr. 22
May 3.	Freehold, N. J.	Apr. 22
May 3.	Chehalis, Wash.	Apr. 22
May 3.	Indianapolis, Ind.	Apr. 22
May 3.	Indiana	Apr. 22
May 3.	Stockton, Cal.	Apr. 29
May 3.	Aitkin, Minn.	Apr. 29
May 3.	Woosung, Ill.	Apr. 29
May 3.	Astoria, Ore.	Apr. 29
May 3.	Illinois	Apr. 29
May 3.	Miami, Fla.	Apr. 29
May 3.	Jackson, Miss.	Apr. 29
May 4.	Laurel, Miss.	Apr. 22
May 4.	Ellisville, Miss.	Apr. 29
May 4.	Linnville, Ill.	Apr. 29
May 4.	Worthington, Minn.	Apr. 29
May 4.	New York, N. Y.	Apr. 29
May 4.	Johnstown, Pa.	Apr. 29
May 4.	Louisville, Ky.	Apr. 29
May 5.	Albany, N. Y. Adv. Apr. 15 to 29.	Apr. 15
May 5.	Cincinnati, Ohio	Apr. 22
May 5.	Mount Morris, Ill.	Apr. 29
May 5.	Providence, R. I.	Apr. 29
May 5.	Hillsdale, Mich. Adv. Apr. 29.	Apr. 29
May 5.	McConnelisville, Ohio	Apr. 29
May 5.	Kansas City, Mo.	Apr. 29
May 5.	Madison, N. J.	Apr. 29
May 5.	Independence, Mo.	Apr. 29
May 6.	Miami, Fla.	Apr. 22
May 6.	New Canaan, Conn. Adv. Apr. 29.	Apr. 29
May 8.	Bushnell, Fla.	Apr. 22
May 8.	Marshalltown, Iowa	Apr. 22
May 8.	Keyport, N. J.	Apr. 22
May 8.	Fayette, Ohio	Apr. 29
May 8.	Grayson, Ky.	Apr. 29
May 8.	Coupeville, Wash. Adv. Apr. 22, 29.	Apr. 29
May 8.	Seattle, Wash.	Apr. 29
May 8.	Chicago, Ill.	Apr. 29
May 9.	Angola, Ind. Adv. Apr. 22, 29.	Apr. 22
May 9.	Modesto, Cal.	Apr. 22
May 9.	Columbia, S. C.	Apr. 29
May 9.	Menomonie, Wis.	Apr. 29
May 9.	Sterling, Ill.	Apr. 29
May 9.	Patchogue, L. I., N. Y. Adv. Apr. 29.	Apr. 29
May 9.	Denton, Md.	tApr. 29
May 10.	Grinnell, Iowa	Apr. 29
May 11.	Wilson, N. C. Adv. Apr. 29.	Apr. 29
May 12.	Lebanon, Pa. Adv. Apr. 22.	Apr. 22
May 12.	North Platte, Neb.	Apr. 22
May 12.	Bryon, Ill.	Apr. 29
May 12.	Camden, Ala.	Apr. 29
May 13.	Morris, Minn.	Apr. 29
May 15.	Bay Minette, Ala.	Apr. 22
May 15.	Lebanon, Pa.	Apr. 22
May 15.	Rhode Island	Apr. 29
May 15.	Sikestown, Mo. Adv. Apr. 29.	Apr. 29
May 15.	Pennsylvania	Apr. 29
May 15.	Los Angeles, Cal.	Apr. 29
May 16.	South Bend, Ind. Adv. Apr. 22, 29.	Apr. 22
May 16.	Willmar, Minn.	Apr. 29
May 16.	New Philadelphia, Ohio Adv. Apr. 29.	Apr. 29
May 18.	Poughkeepsie, N. Y. Adv. Apr. 29.	Apr. 29
May 22.	Jefferson, Ohio	Apr. 22
Jun. 2.	Great Falls, Mont	Apr. 22
Jun. 5.	Columbus, Miss.	Apr. 29
July 10.	Caldwell, Tex.	Apr. 22

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS.

Bids Close.		See Eng. Record.
May 2.	Sea Wall, Fort Pierce, Fla.	Apr. 22
May 2.	Drainage, Garner, Iowa	Apr. 29
May 2.	Dredging, Port Hope, Ont.	Apr. 29
May 3.	Reclamation Work, Powell, Wyo.	Apr. 15
May 3.	Drainage, Cleveland, Miss.	Apr. 29
May 4.	Dredging, New York, N. Y. Adv. Apr. 8 to 29.	Apr. 8
May 4.	Boats for State Canal Work, Albany, N. Y.	Apr. 29
May 5.	Irrigation, Ft. Shaw, Mont. Adv. Apr. 8.	Apr. 8
May 5.	Drainage, Princeton, Ill.	Apr. 22
May 5.	Seawall, Bay St. Louis, Miss.	Apr. 29
May 6.	Leasing Land and Water for Power Purposes, Louisville, Ky. Adv. Mar. 11.	Mar. 11
May 6.	Dam, Gloversville, N. Y. Adv. Apr. 29.	Apr. 29
May 8.	Dredging, Wilmington, Del. Adv. Apr. 15 to 29.	Apr. 15
May 8.	Ditches, Danville, Ill.	Apr. 29
May 9.	Ditch, St. James, Minn.	Apr. 22
May 9.	Drainage, Durand, Mich.	Apr. 29
May 10.	Dredging, Buffalo, N. Y. Adv. Apr. 15 to 29.	Apr. 15
May 10.	Dredging, Los Angeles, Cal.	Apr. 22
May 10.	Drainage, Otterville, Ont.	Apr. 29
May 13.	Ditch, St. Cloud, Minn.	Apr. 29
May 13.	Drainage, Jackson, Tenn.	Apr. 29
May 15.	Dredging, Bridgeport, Conn. Adv. Apr. 15 to 29.	Apr. 15
May 15.	Seawall, Washington D. C. Adv. Apr. 29.	Apr. 29
May 15.	Sluice Gates, Malta, Mont.	Apr. 29
May 15.	Dam, Fort Dodge, Iowa	Apr. 29
May 16.	Canal Work, Albany, N. Y.	Apr. 29
May 19.	Ditches, Bemidji, Minn.	Apr. 29
May 19.	Drainage, Angleton, Tex.	Apr. 29
May 20.	Sale of Shot Drill, Denver, Col. Adv. Apr. 29.	Apr. 29
May 22.	Irrigation, Fort Laramie, Wyo. Adv. Apr. 22.	Apr. 22
May 23.	State Canal Work, Contracts 128 and 129, Albany, N. Y.	Apr. 29
May 23.	Irrigation, Grand Junction, Col.	Apr. 29
May 23.	Irrigation, Wenatchee, Wash.	Apr. 29
May 25.	Irrigation, St. Ignatius, Mont. Adv. Apr. 22.	Apr. 22
May 25.	Cement, Denver, Col. Adv. Apr. 29.	Apr. 29
May 29.	Drainage, Bloomfield, Ia. Adv. Apr. 29.	Apr. 29
May 29.	Drainage, Tallahassee, Fla. Adv. Apr. 29.	Apr. 29
——	Sublet Levee Work, Chicago, Ill. Adv. Apr. 1.	Apr. 1
——	Levee Grading, Vincennes, Ind. Adv. Apr. 8, 15.	Apr. 8

PUBLIC BUILDINGS AND SCHOOLS.

Bids Close.		See Eng. Record.
May 1.	Frederick, Md. Adv. Apr. 22.	Apr. 22
May 2.	Little Sioux, Iowa	Apr. 15
May 2.	Brainerd, Minn.	Apr. 15
May 2.	Oaklandon, Ind.	Apr. 15
May 2.	Burbank, Cal.	Apr. 22
May 2.	Stockton, Cal.	Apr. 29
May 2.	Cherokee, Iowa	Apr. 29
May 2.	Tahoka, Tex.	Apr. 29
May 3.	Conesville, Ohio	Apr. 15
May 3.	Illinois	Apr. 22
May 3.	Jersey City, N. J.	Apr. 22
May 3.	Buffalo, N. D.	Apr. 29
May 3.	Quincy, Mass.	Apr. 29
May 3.	Bancroft, Iowa	Apr. 29
May 3.	Youngsville, Cal.	Apr. 29
May 4.	Douds Leando, Iowa	Apr. 15
May 4.	Woodlawn, Pa.	Apr. 22
May 4.	Lorain, Ohio	Apr. 22
May 5.	Selma, Iowa	Apr. 15
May 5.	Dow City, Iowa	Apr. 22
May 5.	New Albion, Iowa	Apr. 21
May 6.	Medina, Ohio	Apr. 22
May 6.	Alta, Iowa	Apr. 29
May 6.	Silver City, Iowa	Apr. 29
May 6.	Lafayette, Ohio	Apr. 29
May 6.	Birmingham, Mich.	Apr. 29
May 6.	Ithaca, Mich.	Apr. 29
May 6.	Spring Lake, N. J.	Apr. 29
May 8.	Elkins, W. Va.	Mar [illegible]
May 8.	Dannemora, N. Y. Adv. Apr. 22, 29.	Apr 22
May 8.	Twin Bridges, Mont.	Apr. 29
May 8.	Lebanon, Ohio	Apr. 29
May 8.	Montpelier, Idaho	Apr. 29
May 8.	Seattle, Wash.	Apr. 29
May 9.	Greentown, Ind.	Apr. 29
May 10.	Evansville, Ind.	Apr. 8
May 10.	Fertile, Iowa	Apr. 22
May 10.	Waldorf, Minn.	Apr. 22
May 10.	Arthur, Ill.	Apr. 29
May 10.	Lordstown, Ohio	Apr. 29
May 11.	Canby, Minn.	Apr. 29
May 11.	Sulphur Springs, Iowa	Apr. 29
May 12.	Woonsocket, R. I.	Apr. 22
May 12.	Claire City, S. D.	Apr. 29
May 12.	Otranto, Iowa	Apr. 29
May 12.	Markham, Ont.	Apr. 29
May 12.	Providence, R. I.	Apr. 29
May 13.	Norfolk, Va.	Apr. 15
May 13.	Seeville, Ohio	Apr. 22
May 13.	Little Sioux, Iowa	Apr. 22
May 13.	Derby, Ohio	Apr. 29
May 13.	Ecorse, Mich.	Apr. 29
May 15.	Newport, R. I.	Apr. 8
May 15.	Ft. Huachuca, Ariz. Adv. Apr. 15 to 29.	Apr. 15
May 15.	Mayer, Minn.	Apr. 22
May 15.	Selma, Iowa	Apr. 22
May 15.	Oldtown, Me.	Apr. 29
May 15.	Perham, Minn.	Apr. 29
May 15.	Newman, Ga.	Apr. 29
May 16.	Merced, Cal.	Apr. 22
May 17.	Little Falls, Minn.	Apr. 15
May 17.	Kent, Ohio	Apr. 29
May 18.	Durango, Col.	Apr. 15
May 18.	Washington, D. C. Adv. Apr. 29.	Apr. 29
May 19.	Wenatchee, Wash.	Apr. 15
May 20.	Cordova, Alaska	Apr. 15
May 22.	Bird Island, Minn.	Apr. 29
May 22.	Boone, Iowa	Apr. 29
May 22.	Selma, Iowa	Apr. 29
May 24.	Madison Barracks, N. Y. Adv. Apr. 29.	Apr. 29
May 24.	Wahjamega, Mich.	Apr. 29
May 25.	Butler, Pa.	Mar. [illegible]
May 27.	Keyport, Wash.	Apr. 29
May 29.	Arden, Pa.	Apr. 29
Jun. 8.	Pineville, W. Va.	Apr. 29

PRIVATE BUILDINGS.

Bids Close.		See Eng. Record.
May 2.	Hoosick Falls, N. Y.	Apr. 29
May 3.	Mason City, Iowa	Apr. 22
May 5.	Reading, Pa.	Apr. 29
May 8.	Scott City, Kan.	Apr. 22
May 8.	Fairmont, Minn.	Apr. 29
May 10.	Mason City, Iowa	Apr. 22
May 10.	Rochester, Ind.	Apr. 29
May 11.	Sheffield, Iowa	Apr. 22
May 12.	Rochester, Minn.	Apr. 29
May 15.	Washington, N. J.	Apr. 22
May 17.	Ebensburg, Pa.	Apr. 29
May 27.	Cincinnati, Ohio	Apr. 29

MISCELLANEOUS.

Bids Close.		See Eng. Record.
May 2.	Automatic Sprinkling System in Almshouse, Hartford, Conn.	Apr. 15
May 2.	Sprinkling System, New York, N. Y.	Apr. 29
May 2.	Road Oil, Columbus, Ohio	Apr. 29
May 3.	Ventilating Apparatus, Richmond, Va.	Apr. 15
May 4.	Steps, Etc., Jefferson City, Mo.	Apr. 8
May 4.	Cement, Indianapolis, Ind.	Apr. 29
May 6.	Elevator, Pensacola, Fla.	Apr. 22
May 8.	Vacuum Cleaning, Los Angeles, Cal.	Apr. 15
May 8.	Wall, Washington, D. C.	Apr. 29
May 10.	Traveling Crane, Houston, Tex.	Apr. 29
May 10.	Boilers, Etc., Bridgeport, Conn. (4 Props.) Adv. Apr. 29.	Apr. 29
May 11.	Steel Pontoons, Memphis, Tenn. Adv. Apr. 29.	Apr. 29
Jun. 15.	Cross Ties, Anchorage, Alaska	Apr. 15
May 15.	Concrete Walls, Etc., Mandan, N. D. Adv. Apr. 15.	Apr. 15
May 15.	Terracing Hill, Mandan, N. D. Adv. Apr. 15.	Apr. 15
May 15.	Lift and Hoistways, Davenport, Iowa	Apr. 29
May 16.	El. Ry., Section No. 4, New York, N. Y.	Apr. 29
May 18.	Sect. No. 1, El. Rys., New York, N. Y.	Apr. 29
May 22.	Sect. No. 5, El. Rys., New York, N. Y.	Apr. 29
May 22.	Derrick Boat, Norfolk, Va. Adv. Apr. 22.	Apr. 22
May 25.	Cement, Denver, Col.	Apr. 29
——	Heating Plant, Tucson, Ariz. Adv. Apr. 15.	Apr. 15
——	El. Rys., New York, N. Y. Adv. Apr. 29.	Apr. 29

Market Conditions Indicate Material Prices Will Fluctuate from Variety of Causes

Wages of Construction Workers Go Up in Chicago Territory as Strikes Grow in East

IT is thought that the possibility of this country's becoming involved in the European War or being obliged to intervene in Mexico has been discounted, and that such an event would have little effect in diminishing business activity. On the other hand, it is likely, to a large extent in the first contingency and to a much less degree in the second, that such an event would hold up a great deal of construction work because its immediate effect would be to convert a much larger proportion of the steel mills to the purpose of making war supplies. Moreover, such a contingency, necessitating as it would loans to the United States Government, would at once stiffen the money markets. Some stiffening is already taking place gradually as a result of the constant demand on the resources of this country to finance its exports. Indeed, it is likely that conditions will not be quite so favorable again for some time for either bond sales or short-time financing. The increasing demand for short-time loans has already raised the interest rate to a point where banks are no longer as eager to invest in bonds as was the case last fall and winter.

The increasing price of coal and of chemicals that are used in manufacturing many building materials, as well as the uncertainty of the labor market, are all factors which have made manufacturers unwilling to cover dealers or to accept long-term contracts. Under such conditions it is not possible for dealers to carry large stocks, and consequently local building material markets at any point in the country are liable to extreme fluctuations due to local conditions, such as, for instance, the present tie-up in New York harbor.

A large share of the steel shipments now being made, according to the *Iron Age*, is on orders placed at good figures, and the coming quarterly earnings of the U. S. Steel Corporation are expected to exceed even the record of more than $60,000,000 set for the first quarter of this year. Structural steel cannot be bought for less than $2.60 per 100 lbs., f.o.b. Pittsburgh, carload lots, and a great deal is being sold at $3. Warehouse prices have risen to $3.50. Industrial and railroad buying is conspicuous, while orders for railroad cars have been checked and many roads are redesigning their cars to use more wood.

The absolute minimum for plates on the above basis, three to six months' delivery, is $3.75, while nearly all of the business being done is at $4. Orders for long-deferred delivery have been placed at $2.90, while $6 has been paid for some lots. Warehouse prices are $4.50.

Steel bars at $3 are hard to find. Warehouse prices have advanced to $3.50, and iron bars have advanced to $2.50.

No. 28 black sheets are now $2.85 to $2.90 for Bessemer, and $2.95 to $3 for open hearth, while galvanized sheets of the same grades are $4.90 to $5 and $5 to $5.10.

Cast iron pipe, Class B and heavier, tidewater, has advanced to $30.50 per ton, while Class A and gas pipe is $31.50. Buying for private waterworks and gas companies is active, while municipal buying is still slow.

Iron pipe has remained steady, $86 per ton, carload lots, Pittsburgh, being still quoted for black, 2½ to 6-in., and $126 for galvanized. Steel pipe, however, has advanced again to $64 for black and $103 for galvanized. The demand is very heavy and mills are sold to August or later. Orders in April tripled those of a year ago and prices will again advance shortly if the demand keeps up.

It may be said of the entire steel situation that the mills are so heavily loaded with orders that only a moderate demand would be necessary to sustain prices for some time, and yet the demands continue good in spite of advanced rates.

Cement prices have remained stationary in the East, while advancing in the Central states and in the Rocky Mountain territory. Prices to consumers in carload lots at important centers, without containers, are reported as follows: New York, $1.37; Pittsburgh, $1.41; Cleveland, $1.54; Chicago, $1.46; Detroit, $1.55; Milwaukee, $1.58; St. Paul, $1.53; Duluth, $1.66; and Denver, $2.07.

Wholesale prices, New York, on building materials were last Saturday: Hudson common brick, $7.50@$7.55 per thousand, a decline from last month; ¾-in. crushed trap rock, $1 per cu. yd., 5 cents advance from last month; gravel, 1½-in., 80 cents per cu. yd., ¾-in., .85 cents per cu. yd., gravel passing subway specifications, 95 cents per cu. yd., prices unchanged; Cow Bay sand, 40 to 45 cents per cu. yd. Denver prices on broken stone, carload lots, are now $1.65 per cu. yd., while gravel is $1.15 and sand 90 cents per cu. yd.

There has been an increase in the volume of business in the lumber market, and neither the Southern nor the Pacific Coast mills have yet felt a labor shortage. With the coming of good weather and the use of lumber for construction purposes, buying by retail yards will probably increase considerably in volume. All Western mills are advancing 50 cents per thousand on all items except timber, while hemlock and spruce have each advanced $1 per thousand in the New York market and yellow pine timbers have dropped 50 cents per thousand in the same market. The lateness of the seasonal demand has enabled the Southern mills to put their stocks in better shape than those of the mills in the West. The car situation in the South continues to improve.

The labor situation threatens a general advance in wages and a general increase in the cost of manufacturing. While it is felt that, from the economic standpoint, this country cannot yet support itself on an 8-hour day, it is recognized that some wage increase will have to be granted. Where this has not already resulted from strikes, or from voluntary concessions, such as those of the steel mills, it is taking place as a result of employers' bidding in the open market for labor. Labor agents in Chicago are finding difficulty in supplying men for work out of town. Prices are much above normal, and have already reached the level paid in 1907. This represents about 50 per cent increase over the wages paid last year for unskilled labor. Further increases of 25 to 50 per cent are looked for by July. Carpenters and machinists who could be hired in Chicago last year at 40 and 45 cents an hour are already paid 60 cents an hour, and this rate is expected to go up. The demand for construction labor in the Chicago market is about on a par with that for other lines, and the prices, $2.50 to $3 per day for common labor, are the same as those paid by the industries.

Buildings

Bids have been opened at Howard, R. I., for constructing institution buildings to cost $192,000. Contracts amounting to $450,000 have been awarded on the post office at New Haven, Conn. A contract for building a $200,000 school has been awarded at Cote de Nieges, Que. The following prospective work is noted: North Tarrytown, N. Y., site purchased for $200,000 hospital; Charlotte, N. C., $500,000 company incorporated to build and operate tire plant; Cleveland, bonds voted for $1,500,000 convention hall, plans being prepared; Dayton, Ohio, $250,000 public building being considered; Detroit, $300,000 business building to be erected; Nashville, Tenn., $250,000 bank building to be erected; St. Louis, $250,000 grain elevator and $300,000 addition to hotel contemplated; Kansas City, contract to be let, $200,000 library; London, Ont., contract to be let, $200,000 school; Guelph, Ont., site purchased for $250,000 factory.

Bridges and Roads

Bridge work noted includes: Rock Island, Ill., contract awarded, $59,000 concrete bridge; Rockford, Ill., contract awarded, $91,000 bridge; Miami, Okla., contract for steel bridges awarded, $63,000; Ocean City, Md., bill appropriating $200,000 for bridge signed by Governor; Kankakee, Ill.. bridge work costing $55,000 under consideration; Minneapolis, $140,000 railroad viaduct to be built.

Bids have been opened or contracts awarded on the following paving work: Maine State Highway Commission, road work, $170,000 largely awarded; Massachusetts Highway Commission, road work, $72,000, one contract awarded; New Haven, Conn., $140,000 paving contract awarded; New York State Highway Commission, road work, $217,000, bids opened; Philadelphia, paving work, total low bids, $198,000; Polk County, Fla., road work, $1,500,000, contracts awarded contingent on election; Seattle, paving work, $125,000 awarded, $54,000 additional bids opened.

Bids are desired for 28 miles of road construction at Bradentown, Fla., for paving work to cost $191,000 at East St. Louis, Ill., and for heavy road grading at Holton, Kan. The following prospective work is also noted: Jackson, Miss., $850,000 road bonds sold; Lawrenceburg, Tenn., $350,000 road bonds voted; Cincinnati, $1,638,000 voted for street improvements; Hamilton, Ohio, contracts to be let June 1 for road work to cost $180,000; Gary, Ind., plans prepared for 65,000 sq. yd. asphalt pavement.

Waterworks and Sewers

The following waterworks construction is noted: Rochester, N. Y., lowest bid received for water conduits, $411,000; Cincinnati, $400,000 voted to complete high-pressure fire system; Lima, Ohio, $550,000 voted for storage reservoir; Tyler, Tex., $250,000 waterworks bonds sold; Yucaipa, Cal., private water company sold $150,000 improvement bonds; Hull, Que., $150,000 filtration plant, plans being prepared; St. Hyacinthe, Que., plans being prepared, $75,000 filter plant.

The sewer work noted includes: Brooklyn, N. Y., bids desired May 11, considerable sewer construction; Chicago, bids desired May 18 for building 8600 ft. of 16½-ft. trunk sewer; Lexington, Ky., sewer system and disposal plant, $225,000, contract to be let this month; Madison, Ill., steps taken to construct $145,000 sewer system; Dallas, Tex., $300,000 voted for sewer improvements; Portland, Ore., sewer work costing $250,000 under consideration; Vancouver, B. C., plans being prepared, $300,000 trunk sewer.

Miscellaneous

A contract for building a $1,000,000 trolley line from Willamantic, Conn., to Manchester has been awarded. The contract for the removal of Coenties reef in New York Harbor has been awarded at $196,000. Work has begun on a $2,000,000 railroad contract awarded at Indianapolis. Bids are asked on 793,000 cu. yd. of excavation for an irrigation canal at Fort Laramie, Wyo.

The following prospective work is noted: Cincinnati, proposition for $6,000,000 rapid transit construction carried at election; Cleveland, proposition to construct subway approaches to high level bridge, cost $850,000, carried; Chicago, park improvements costing $750,000 to be begun; Sioux City, Iowa, report on river improvements costing $120,000 approved; San Antonio, Tex., company incorporated to build 125-mile railroad; Pasco, Wash., contract to be let for $1,000,000 railroad cutoff; Mohave, Cal., permit applied for to build irrigation system costing $400,000; Ottawa, Ont., extensive harbor and river improvements reported authorized by the Department of Public Works.

CONTRACTING NEWS

Of Special Interest to Engineers, Contractors, Builders and Manufacturers of Engineering and Building Supplies

WATERWORKS

PROPOSED WORK.

Pennsylvania.—Permits issued by State Department of Health relative to water works as follows:

Millvale, approving changes at water works pumping station and requiring adequate purification.

Union City, approving new additional well supply and requiring purification of surface supplies.

Wyoming Valley Water Supply Co. (Hazleton Dept.), approving emergency disinfecting apparatus.

Ambridge, approving plans for improvements in distributing system and pumping station.

Renovo, approving temporary disinfection plans and requiring plans for permanent purification.

South Fork (South Fork W. Co), approving temporary disinfection plans and requiring construction of previously approved filtration works.

Stoneboro, approving new reservoir and extension of distributing system.

Greensburg (Westmoreland Water Co.), approving temporary disinfecting apparatus and requiring filtration plans for auxiliary supply.

Curwensville (Curwensville Water Co.), requiring plans for temporary disinfecting apparatus and permanent purification of emergency supply.

Exeter Township, Berks Co. (St. Lawrence Water Co.), approving additional drilled well supply.

Creekside (Creekside Water Co., approving water works system plans.

Greenville (Greenville Water Co.), approving plans for high service pumping station and accesories.

Marion Heights (Marion Heights Water Co.), approving plans for water-works system.

Portage Township, Cambria Co. (Cambria Water Company of Portage Township, Pa.), approving plans for water-works system.

Pittsburgh, Pa.—New bids to be asked for water meters. About $100,000 will be spent. Address Director Public Works.

Wheatland, Pa.—The water works proposed here will require 3200 ft. 8-in. and 5900 ft. 6-in. c. i. pipe, ten hydrants, 70 meters standpipe pump and working barrell, valves, etc., and cost $18,000. J. Fred Thomas; Engineer, Farrell; F. L. Hutchinson, Borough Secretary.

Windsor, Pa.—Citizens recently voted $20,000 bonds for constructing water works. Address Borough Clerk.

Shelby, N. C.—Water, sewer and street improvement bonds for $40,000 will be sold by city. Address J. T. Gardner, Mayor.

Gadsden, Ala.—Knight & Quale, Municipal Engineers, Chattanooga, Tenn., are engineers for water works plant.

Jackson, Ky.—A company has been incorporated in which Dr. J. S. Redwine of Jackson is interested, for the purpose of constructing and operating a water works in Jackson and for which a franchise has been granted.

Cincinnati, Ohio.—Citizens April 25 voted $400,000 bonds for completion of high-pressure fire protection system. Specifications to be prepared at once by J. A. Hiller, General Superintendent Water Works.

Coshocton, Ohio.—Council passed resolution declaring it necessary to improve water works by installing new pump, constructing pump pit and lowering suction main. Chester & Fleming, Engineers, Pittsburgh, Pa.

Lima, Ohio.—Citizens April 25 voted $550,000 bonds for new storage reservoir, $100,000 for paving of streets and $100,000 for river improvement. James I. Heffner, Clerk of Council.

Detroit, Mich.—Reported Board Water Commissioners considering installation of a set of reserve pumps at a cost of $150,000 or the enlargement of the intake pipe.

Marquette, Mich.—Contract soon to be let for the foundation for the new aqueduct. Address D. G. Moon, Engineer, Appleton, Wis.

Blairstown, Iowa.—Citizens voted, March 31, to construct water works C. W. Roland Co., Des Moines, Engineers; Leonard Kuinn, Mayor.

Duluth, Minn.—Citizens voted $30,000 bonds to extend water mains. Address City Clerk.

Overton, Neb.—Contract will be let about last of May or early in June for a 300-gal. per minute, 50,000-gal. elevated tank to cost $12,000. Charles F. Sturtevant, Engineer, Holdredge, Neb. J. W. Dunaway, City Clerk.

Highwood, Mont.—County Commissioners at Ft. Benton report water works to be constructed in Highwood (an unincorporated town), cost $10,000. John S. Culbertson, County Surveyor. Address Lester M. Bond, County Clerk, Ft. Benton.

Brenham, Tex.—City Council is considering installation of water meters. Address Mayor.

Kendall, Texas.—Citizens voted $60,000 bonds for water works and sewer system.

Seguin, Tex.—Installation of a modern filtering plant at the water works is under consideration. Address Mayor.

Troup, Texas.—Contract will be let about June 1 by R. G. Storey, City Attorney, for constructing municipal water works, costing $17,000, on which citizens voted April 18 in favor of constructing.

Tyler, Texas.—City has entered into contract with Tyler Water Company, and Ben B. Cain and Frank Dallas for purchase of water plant in this city; it is proposed to rehabilitate and improve the plant and lay several miles of new mains to outlying districts. Address Mayor.

Everett, Wash.—County Commissioners have granted a franchise to city of Everett to place water mains and power lines along county roads in route from Sultan Basin to Everett. City will develop power and water supply to Sultan Basin, a distance of 35 miles. Address City Clerk.

Hoquiam, Wash.—The Hoquiam Water Company (Harry L. Heermans, Pres.) is having plans prepared for a dam to be constructed on Davis Creek, to be of earth fill with concrete core; cost, $50,000.

Reardan, Wash.—Town Council engaged Sawyer Bros., Seattle, to make a survey for establishment of water works and sewer system.

Los Angeles, Cal.—City Council has been petitioned to call an election to authorize the formation of the water district embracing Batrdstown, Farmdale, Sierra Vista and Newton Park, which has been recently annexed to the city and to bond in the sum of $200,000 for the purchase of the remainder of the system of the Consolidated Water Co.'s system, rehabilitating the system and laying new steel pipe main from Garvanza reservoir, approximately 7 miles. About $80,000 will be needed for immediate improvements, the remainder to be used later to extend system. Address William Mulholland, Chief Engineer, Board Public Service Commission, Knickerbocker Bldg.

Yucaipa, Cal.—Reported Yucaipa Water Company No. 1 has sold $150,000 bonds for improvements.

Hull, Que.—Plans being prepared by J. A. La Forest, City Engineer, for a filtration plant to cost about $150,000.

St. Hyacinthe, Que.—Plans being prepared by F. E. Field, Atwater Avenue, Montreal, for a mechanical gravity filter system of 4.000,000 gal. daily capacity, cost approximately $75,000.

Clinton, Ont.—Town Engineer will prepare plans for additional water mains to cost $8,000. By-law will be submitted.

London, Ont.—E. V. Buchanan, General Manager, City Hall, will lay water mains 8 and 10 in., to cost $45,000. Work will be done by city, by day labor.

Sarnia, Ont.—The Board of Engineers reporting on water works improvements, we are officially informed, include F. A. Dallyn, Engineer Provincial Board of Health of Ontario; F. W. Thorold Company, Consulting Engineers, Toronto, Ont., and R. S. & W. S. Lea, Consulting Engineers, of Montreal, Que.

BIDS DESIRED.

Newton, Mass.—Until May 15, by J. Clifton Whitney, Water Commissioner, City Hall, West Newton, Mass., for constructing Sections 3 and 4 of a reinforced concrete reservoir on Waban Hill, Newton, Mass., Edwin H. Rogers, City Engineer.

Washington, D. C.—Until May 15, by Commissioner D. C. (Oliver P. Newman, Chmn.), for repairing and rebuilding water tower for the Fire Department.

Cleveland, Ohio.—Reported desired until May 9 by A. R. Callow, Comr. Purchases and Supplies, for superstructure of gate and screen well house, crane hoists, etc., at Division Avenue Pumping Station.

Dover, Ohio.—Reported desired until May 10 by Director Public Service for extending water system.

Wooster, Ohio.—Until May 22, by Max Bloomberg, Director Public Service, for laying approximately 4372 ft. 16 and 12-in. c.-.pipe, and taking up 2120 ft. 4 and 6-in. pipe.

Chicago, Ill.—Until May 8 by Department Public Works (W. R. Moorehouse, Comr.) for furnishing and delivering to city of Chicago at its water meter shops, Indiana Avenue, or the Municipal shops, Thirty-first Street, velocity water meters. Also separate bids for one motor-driven centrifugal 500-gal. pump, with all auxiliaries, appurtenances, accessories, etc.

Elkhorn, Wis.—Until May 12, by Elkhorn Water & Light Commission, for machinery and equipment, including one 40-hp. induction motor, slip ring type, with panel and starter; also one 40-hp. induction motor, of the squirrel-cage type, complete with compensator or starter; one 75-hp. induction motor, slip ring type, complete with panel, starter, pulley and belt idler. Advertised in Engineering Record. One 40-hp. motor will be purchased, but bids desired on both types. Bid on 75-hp. motor should be with and without idler. Charles Pipeplow, Secy.

Westbrook, Minn.—Until May 16 by Joseph Budish, Village Recorder, for a 40,000-gal. steel tank to be erected on 80-ft. tower.

Wakeeney, Kan.—Until May 22 by J. H. Heckman, City Clerk, for constructing water works extension, including oil engine, motor driven triplex pump complete with motor 60 cycle 3-phase 2200 volt two 60-cycle 3-phase 2300 volt generator with exciters and a switchboard, complete.

Alliance, Neb.—Reported desired until May 16, by Carter Calder, for waterworks improvements to consist of reinforced concrete reservoir, 60 x 80 x 14 ft., laying pipe, trenching, etc. Probable cost, $10,100.

St. Louis, Mo.—Until May 19, Water Commissioners, by Department Public Utilities, Room 312 City Hall, for 26,960 lin. ft. more or less, 36 in. lockbar steel-coated water pipe or 36 in riveted steel-coated water pipe, also for laying same.

El Paso, Texas.—Until June 3, by Depot Quarter Master El Paso, for installing an electrically operated equipment in pumping plant at Ft. Bliss, advertised in Engineering Record.

Toronto, Ont.—Until May 9 by T. L. Church (Mayor), Chmn. Board Control, for supply of two gasoline diaphragm pumps.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Ilion, N. Y.**—Contract for constructing concrete covered filter beds, control house, etc. (bids opened April 11) awarded Morrison & Quinn, Cutler Building, Rochester. George Rasbach, Clerk, Bd. Water Comrs.

Rochester, N. Y.—Lowest bid on 37-in. lock bar steel pipe for the completion of a section of third conduit from Hemlock Lake to Rochester submitted by T. A. Gillespie Co., 50 Church Street, New York, at $411,680 for furnishing, hauling and laying with appurtenances; lowest bid for furnishing pipe only submitted by U. S. Cast Iron Pipe & Foundry Co., 71 Broadway, New York City, at $326,110, and for hauling pipe, by Desiderio & Sattler of Rochester, at $130,155.

★**Altoona, Pa.**—Contracts awarded by Municipal Board of Control as follows: For remodeling filter plant at water works station, to William Henderson, at $15,678, and for furnishing and installing three centrifugal pumps and accessories in pumping plant, to Dravo-Doyle Company, of Pittsburgh, at $21,750.

★**Harrisburg, Pa.**—Contract for furnishing meters for the year awarded Gainon Meter Co. (bids opened April 26). H. T. Bowman, Supt. Public Safety.

Lebanon, Pa. — Following two bids opened by City Council April 26 for laying 10,600 ft. 6 and 12-in. water mains. F. J. Reilly of Lancaster, $15,768, and J. U. Fritchey & Son of Lancaster, $21,265.

Memphis, Tenn.—Following are three bids opened April 11, by D. C. Miller, Chief Clerk, Engineer's Department, for constructing three reservoirs: A. De Franceschi, Memphis, $11,547; Koehler Bros.-Fowler Construction Company, Memphis (two bids), $25,633 and $28,371.

★**Cleveland, Ohio.**—Contract awarded by City Board of Control to National Valve Company for furnishing ejector piping and drains for steam lines at water works, Division Avenue pumping station, at $2,119 (bids opened April 14).

★**Marquette, Mich.**—Contract for 2550 ft. 90-in. and 100 ft. 66-in. Oregon fire wooden stave pipe for new aqueduct awarded Pacific Coast Pipe Company, Seattle, at $3.85 and $2.85 per lin. ft., respectively; for steel bands every 3 in. at $1.94 each for large size and $1.50 for smaller size; total, $24,684.

★**Denison, Iowa.**—Contracts for water works improvements (bids opened April 19) awarded as follows (J. G. Thorne, Consulting Engineer, Clinton): Division "A," pump house to Renfro & Lewis, Denison, $1,950; Division "B," reservoir, 235 ft. 8 and 10 c.-i. supply pipe laid, 8 and 10 gate valves and specials, and Division "C," 7920 ft. c.-i. pipe laid, 7 hydrants, 16 gate valves and 5000 lb. specials to Ward & Weighton, Sioux City, Iowa, at a total of $11,735; Division "D," air lift pump; Division "E," compressor receiver, and 30-hp. motor, 2 stage 10 x 6½ x 10, both to Ingersoll Rand Co., Chicago, Ill., at $98 and $1,400 respectively; Division "F," centrifugal pump and 40-hp. motor, Merkle Hines Machinery Co., Kansas City, Mo., $1,143.

★**Hampton, Iowa.**—Contract for steel tank awarded Des Moines Iron & Bridge Co., Des Moines, at $6,580.

★**Aberdeen, Wash.**—Contract for furnishing 1000 M ft. of pipe staves to be used in construction of Wishkah water project awarded Vance Lumber Company of Malone at $23 per M. f.o.b. Malone. Bids will soon be asked on 1000 M. ft. additional required. L. D. Kelsey, City Engineer.

★**Seattle, Wash.**—Contract awarded by Board Public Works to Herbert Young, 2416 East Valley Street, at $13,479, for water mains in Orcas and other streets.

★**Hemet, Cal.**—Contract awarded Bent Bros. Construction Company, Central Building, Los Angeles, for reconstructing pipe line outlet system from Lake Hemet through the mountains 7 miles east of Hemet for Lake Hemet Land & Water Company, Hemet. Work will require boring 265-ft. tunnel through solid rock, constructing about 1400 ft. 12 to 39-in. cement and concrete pipe lines, part under pressure, siphons, steel bridges and hoisting materials up steep slopes. Contract for steel for two 112-ft. bridges awarded Llewellyn Iron Works, Los Angeles. H. Hawgood, H. W. Hellman Building, Los Angeles, Consulting Engineer.

Pasadena, Cal.—Following are bids opened recently for furnishing (a) 12,000 ft. 4-in. c. i. Class "B" water pipe, (b) 60 ft. 10-in., and (c) 12 4-in. tees, three bells, and 12 4-in. plugs, Class "D": U. S. Cast Iron Pipe & Foundry Company, $39.60 per ton, (b) $36.60, (c) $70 per ton; H. R. Boynton Company, Los Angeles (a) $40.60, (b) $37.60, (c) $72.50; American C. I. Pipe Company (a) $40.60 for 12-ft. lengths, and $41.60 for 16-ft. lengths, (b) $37.60, (c) $70.

Lowest bid opened recently by City Commissioners for furnishing and installing deep-well pump submitted by Pomona Mfg. Company, Pomona, Cal., at $6,205.

SEWERAGE AND SEWAGE DISPOSAL

PROPOSED WORK.

Marblehead, Mass. — Town Commissioners considering constructing a sewer system costing $300,000. Address Town Clerk.

Binghamton, N. Y.—Intercepting sewer bonds for $150,000 will be sold May 10 by city. Address Clerk Board Contract & Supply.

Nyack, N. Y.—Sewer bonds amounting to $50,000 have been sold. Address Village Clerk.

Oneonta, N. Y.—Clyde & Potts, 30 Church Street, New York, N. Y., engaged to prepare plans for sewage disposal plant. Frank M. Gurney, City Engineer.

Dunnellen, N. J.—City will sell May 24 $10,000 sewer bonds. Address City Clerk.

New Brunswick, N. J.—All bids opened recently for constructing trunk sewer have been rejected. Lowest $10,530. New bids to be asked. Address Asher Atkinson, City Engineer.

Hazleton, Pa.—Contracts soon to be let for sewer construction costing $22,000. B. E. Youngman, City Engineer; S. J. Hughes, City Clerk.

Pennsylvania.—Permits isued by State Department of Health as follows for sewer improvements:

Port Carbon, requiring comprehensive sanitary sewerage and sewage disposal plans.

Whitehall Township, Lehigh Co. (Lehigh Car, Wheel and Axle Works), sewage treatment.

Canaan Township, Wayne Co. (State Hospital for the Criminal Insane), approving outfall sewer and sewage treatment plans.

Duquesne, approving plans for district sanitary sewers and sewage pumping station.

Marysville, approving plans for sanitary sewer system and sewage treatment works.

Towanda, granting extension of time for revision of sewage treatment plans.

West Chester, approving plans for district sanitary sewer system.

Woodlawn, approving plans for comprehensive sanitary sewer system and preliminary plans for sewage treatment works and requiring detailed plans.

Philadelphia, approving lateral sewer extensions (2 permits).

Punxsutawney, Pa.—Plans submitted to State Health Department for the sewage disposal plant and extensions to sewer system proposed here.

Lexington, Ky.—Contract will be let latter part of May by W. H. McCockle, Commissioner Public Works, for main outfall sewer, consisting of 5000 ft. 30-in. brick sewer and 2400 ft. 48-in. concrete sewer, costing $45,000, and an Imhoff disposal plant, 3,000,000-gal. capacity, costing $180,000. Solomon Norcross Company, Atlanta, Ga., Engineers for disposal plant, and J. White Gaynor, Lexington, Engineer for sewers.

Akron, Ohio.—Reported city is taking steps to construct the West Hill sewage disposal plant. Carl F. Beck, Service Director.

Bucyrus, Ohio.—Highway improvements bonds for $25,000 will be sold May 22 by H. A. Biebighauser, County Auditor.

Columbus, Ohio.—Following bond issues carried at election April 25: $25,000 for sewer repairs, $20,000 for bridge and viaduct repairs, $50,000 for street repairs, and $80,000 for garbage and refuse collections. Address Director Service.

Coshocton, Ohio.—John A. Hanlon engaged to make a preliminary survey and report on a new sewer system. Address Service Director.

Cleveland, Ohio.—Board of Control will ask new bids on sewering part of Shaker Boulevard and North Moreland Boulevard. Bids opened recently rejected.

Newcomerstown, Ohio. — The Village Board has decided upon a site for a sewage disposal plant. Address Village Clerk.

West Park, Ohio.—Sewer bonds for $100,000 will be sold May 15 by Fred Feuchter, Co. Clk.

Indianapolis, Ind. — Board of Public Works approved plans for the Pogue's Run Main drain costing $40,000, and for the Emerson Avenue and Butler Avenue main drain, costing $20,000.

East St. Louis, Ill.—Construction of a sewer in Bowman Avenue, including vitr. clay pipe, vitr. segment block sewer and reinforced concrete sewer, estimated to cost $44,900, is under consideration. E. F. Harper, City Engineer.

City Council April 24 passed resolution authorizing construction of vitr. clay pipe sewer in Winstanley Avenue. Sewer District Improvement, including 6 to 30-in. pipe, estimated cost $18,254. E. F. Harper, City Engineer.

Madison, Ill.—Preliminary steps taken to construct sewer system about 38,000 ft. 12 to 42-in. sewer, costing $145,000, and pumping plant, $15,000. Contract will be let in about 90 days or later. Shenpard & Morgan, Engineers, Edwardsville.

Pinckneyville, Ill.—Board Local Improvements passed resolution to construct a sewer system costing $45,000, including septic tank. L. L. Harper and C. R. Rodenberg, Engineers, East St. Louis; George Hencke, Mayor.

Iroquois, S. D.—Citizens considering sewer system. Address City Clerk.

Austin, Tex.—Election soon to be held to vote bonds for constructing sewerage system. Address City Clerk.

Canadian, Texas.—Plans being prepared for sewerage system costing $26,000. Bonds have been sold. Address City Clerk.

Childress, Texas.—A sewer system costing $30,000 is to be installed. Address City Clerk.

Dallas, Tex.—Citizens April 4 voted $300,000 bonds for sewer improvements in addition to sewer work under way. Address City Clerk.

Hamlin, Texas.—City contemplates installation of sewer system throughout the city. Address Mayor.

Hillsboro, Texas.—City is considering sewage disposal plant and desired to confer with consulting engineers on said project. Address Mayor.

Kendall, Texas.—See "Water Works."

Paris, Tex.—R. G. Tyler of Paris has prepared plans for the sewage disposal plant, which is to be sludge process. Work to be done by force account. W. H. McCuerston, Mayor.

Plainview, Tex.—A septic tank costing $5,000 is to be constructed. B. L. Spencer, Supt. Sewers and Water.

Portland, Ore.—Reported Municipal Bureau of Sewers plans reconstructing Tanner Creek sewer system; cost $250,000. A. L. Barbur, City Auditor; P. Dater, City Engineer.

Outremont, Que.—City Council considering making following improvements: Cement sidewalks, cost $15,000; new sewers, $17,000; garbage destructor, $18,000; road grading and macadam work, cost $36,000. Address E. J. Samson, Outremont.

Vancouver, B. C.—A. D. Creer, 718 Granville Street, Vaucouver, is preparing plans for a trunk sewer to cost $300,000.

BIDS DESIRED.

Binghamton, N. Y.—Until May 10, by Board Contract & Supply, for constructing sewers in Fayette and South Mozart Streets.

Brooklyn, N. Y.—Until May 10 by L. H. Pounds, Borough Pres., for installing mechanical equipment of the sewage pumping station at Avenue V, Sect. No. 3, sanitary outlet sewers, storm outlet sewers and force mains, together with all adjuncts and appurtenances within W. Tenth Street and W. Eleventh Street of Sewage Pumping Station; security $25,000.

Brooklyn, N. Y.—Until May 11, by L. H. Pounds, Boro. Pres., for furnishing material and constructing sewers in portions of Howard Avenue and Herkimer Street, engineer's estimate, 2147 lin. ft. 30 to 42-in. sewer, together with storm overflows, basins, etc. Security $10,000. In portions of Saratoga Avenue, Engineer's estimate 2035 lin. ft. 30 to 42-in. sewer, together with manholes, basins, etc. Security $8,852. In Avenue J, Engineer's estimate 2722 ft. 6 to 60-in., with manholes, basins, etc. Security $20,851. In Rockaway Avenue, Engineer's estimate 1598 ft. 12 to 30-in. sewer, together with manholes, basins, etc. Security $12,389. In West Eleventh Street, Engineer's estimate 10,901 lin ft. 8 to 114-in., together with manholes, basins, etc. Security $60,000. Also separate bids, same time and place, for constructing temporary relief sewer in right-of-way between East Thirty-seventh and East Fifty-first Streets, together with temporary storm overflow connection at Flatbush Avenue and Foster Avenue. Security $20,000.

Long Island City, L. I., N. Y.—Until May 10, by Maurice E. Connolly, Pres. Boro. of Queens, for constructing sewers and appurtenances in Jamaica Avenue. Engineer's estimate 1051 lin. ft. plain concrete sewer, 788 lin. ft. 12 to 24-in. vitr. pipe sewer, together with manholes, basins, etc. Security $2,300. In portions of Maple Street, Engineer's estimate 1534 ft. 6 to 18-in. vitr. pipe, with manholes, basins, etc. Security $2,300. In portions of Bedford Avenue, Engineer's estimate 1810 lin. ft. plain concrete sewer, 3132 lin. ft. vitr. pipe, 12 to 24-in., etc. Security $25,000. In Lott, Windom; Shipley and Ashland Streets, Engineer's estimate 3056 ft. vitr. pipe, 15 to 24-in., 1266 lin. ft. 12-in. pipe, manholes, etc. Security $8,000. In Maure and Jamaica Avenues, Engineer's estimate 1622 lin. ft. reinforced concrete sewer, 2384 lin. ft. plain concrete sewer, 2173 lin. ft. 12 to 22-in. vitr. pipe, manholes, basins, etc. Security, $22,000.

New York, N. Y.—Until May 12, by Marcus M. Marks, Pres. Manhattan Borough, for constructing receiving basins, also alter and improve on East Fourth, Twenty-fifth, 120th and Stanton Streets. Security $3,500.

Montclair, N. J.—Until May 22, by Harry Trippett, Town Clerk, for constructing storm sewers for Upper Mountain Avenue, with outlet sewers, advertised in Engineering Record. Edgar S. Closson, Town Engineer.

Newark, N. J.—Reported desired until May 18 by Board of Streets and Water Comrs. (M. R. Sherrerd, Ch. Engr.) for constructing N. Ninth and Halstead Street sewers.

Until May 23 by Passaic Valley Sewerage Commissioners (Joseph H. Quigg, Clerk) for construction of a part of Section 4 of the outfall sewerage works, consisting of bulkhead, flushing intake, sludge main and all appurtenant work, advertised in Engineering Record. Wm. M. Brown, Ch. Engr.

Ridgefield Park, N. J.—Until May 23, by Board Commissioners, for constructing sewers, treatment works, etc., for sewer diversion and treatment; advertised in Engineering Record. Lederle & Provost, Engr., 39 West Thirty-eighth Street, New York, N. Y.

Mount Union, Pa.—Reported desired until May 8 by City Council for constructing sanitary sewers in Shaver Market and other streets. D. W. Dillman, Engr., Altoona Trust Building, Altoona.

Durham, N. C.—Until May 25 by Mayor and Board of Aldermen for building an outfall sewer line of 24-in. terra cotta pipe about 6½ miles long, and a 10-in. outfall sewer line about 4 miles long, advertised in Engineering Record. H. Keuffner, City Engineer; Gilbert C. White, Consulting Engineer.

Greer, S. C.—Until May 8 by Board Public Works for approximately 8000 ft. 8-in. sewer pipe.

Bowling Green, O.—Until May 13, by J. E. Braid, Dir. Pub. Service, for constructing sanitary sewers in Clough and Summit Streets.

Girard, Ohio.—Reported desired until May 8 for constructing sewers in several streets. William Wilson, Engr., Youngstown.

Linden Heights, Ohio.—See "Paving and Roads.'

Highland Park, Mich.—Until May 22, by R. M. Ford, Village Clerk, for constructing sewers advertised in Engineering Record.

Chicago, Ill.—Until May 18 by John McGillen, Clerk Sanitary District of Chicago, for Calumet Intercepter sewer, Contract No. 4, advertised in Engineering Record.

Appleton, Wis.—Reported desired until May 17, by E. L. Williams, City Clerk, for constructing sewers in Meade and other streets.

Milwaukee, Wis.—Reported desired until May 16, by Sewerage Commission (John H. Fowles, Secy.), for completing the sewage intercepting system.

Milwaukee, Wis.—Until May 25, by Milwaukee Sewerage Commission, for 600-ft. inverted siphon under Milwaukee River, shafts, valve chambers, 350 ft. cast iron, 8507 ft. concrete and 2266 ft. terra cotta pipe. Advertised in Engineering Record. T. Chalkley Hatton, chief engineer, City Hall. This is the first of eight contracts for 30 to 72-in. reinforced concrete sewers which will be let at intervals of two weeks by the commission within the next two months for the Low Level intercepting system, bonds to the extent of $1,160,000 being available.

Park Falls, Wis.—Reported desired until May 9 by Committee Streets and Public Works for constructing storm sewers in various streets.

Sparta, Wis.—Reported desired until May 8 by A. W. Smith, Chmn. Committee on Streets, at office of Z. S. Rice, City Attorney, W. Oak Street, for constructing sewers in First Sewer Dist.

Mitchell, S. D.—Until May 15, by Thos. Eastcott, City Auditor, for furnishing material and constructing trunk sewers in Sewer Dist. No. 5; also Branches "AP" and "AR," to consist of approximately 3514 ft. 8 and 10-in. vitr. pipe, together with manholes, etc.

Missoula, Mont.—Until May 10, by Ruth E. Kellogg, City Clerk, for furnishing material and constructing a storm sewer system complete, grading, parking, curbing and paving, together with all accessories, in Special Improvement Dist. No. 37, East Front Street, in all about 6840 sq. yds. Pavement to be creosoted wood block on 4-in. concrete base, standard bitulithic on 4-in. concrete base, bitulithic pavement on bituminous base of crushed stone or gravel spread to a depth of at least 6 in. and thoroughly compressed; asphaltic concrete 4-in. concrete base or 6-in. crushed stone base. E. S. Hathaway, City Engr.

Austin, Tex.—Reported desired until May 14, by City Clerk, for sewering Little Shoals Creek. Probable cost, $50,000.

Blackwell, Okla.—See "Paving and Roads."

Salt Lake City, Utah.—Reported desired until May 16, by Gordon Snow, City Recorder, for Sewer extension No. 341 and No. 363.

London, Ont.—Until May 12 by H. A. Brazier, City Engineer, for sanitary sewers 10, 12, 16 and 18 in.; estimated to cost $60,000.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Marlborough, Mass.**—Contract for furnishing 22,909 ft. 5 to 12-in. vitr. pipe with bends, etc. (bids opened April 17) awarded by Water and Sewerage Commissioners to J. E. Warren & Company, Florence, Street, Marlborough (representative of Kaul Mfg. Company, Toronto, Ont.) at $5,072.

★**Illinois.**—Contract awarded Joseph E. Nelson & Sons, 118 North La Salle Street, Chicago, for toilet facility building; also septic tanks and sewers at Mounds and Pinckneyville, Ill., for Illinois Central R. R. Co.

★**New Lisbon, Wis.**—Contract for 15,537 ft. sewers (bids opened April 14) awarded F. O. Drawatizsky, Tomah. H. P. Gibson, City Clerk.

BRIDGES

PROPOSED WORK.

Newfane, N. Y.—Citizens voted $23,000 bonds for constructing bridge over Eighteen Mile Creek on the Ide Road. Address Town Clerk.

Signac, N. J.—Board of Chosen Freeholders, Paterson, plan constructing steel and concrete bridge over Passaic River at Signac, on Newark-Pompton Turnpike. Estimated cost $40,000. Address County Clerk, Paterson.

Altoona, Pa.—County Commissioner, State Highway Department and Pennsylvania R. R. reported considering the construction of a bridge at McKee, near Altoona.

Pennsylvania. — State Water Supply Commission Harrisburg has approved the following applications:

Pennsylvania Railroad Company, to construct concrete extension to arch bridge No. 76.45 (old No. 77) across Black Fox Run, in Toby and Perry Townships, Clarion County; construct bridge over Union Run, Canton Township, Bradford County; bridge over Two Mile Run, No. 122.04 (old No. 94), Cranberry Township, Venango County.

Commissioners of Butler County, to construct bridge over Bull Creek (Sefton Branch), Clinton Township, Butler County.

Pittsburgh Plate Glass Company, to construct railway siding along the eastern bank of the Allegheny River, near Logansport, Armstrong County.

City of Johnstown, construct a bridge (Moxham Bridge) over Stony Creek, at Central Avenue, Johnstown.

Commissioners of Huntingdon County, to construct bridge across Trough Creek (Great Trough Creek), about 1 mile east of Newburg, in Tod Township.

Bessemer & Lake Erie Railroad Company, to construct temporary trestle and permanent concrete arch over and make a change in the channel of Otter Creek, at a point 1.6 miles north of the Coolspring-Findley Township line, in Coolspring Township, Mercer County.

Supervisors of Wysox Township, Bradford County, construct bridge across Outlet of Lake Wesauking (branch of Wysox Creek), about 4 miles northeast of Towanda Borough.

Erie Railroad Company, construct bridge over Hogback Run, 0.7 mile north of West Middlesex, Shenango Township, Mercer County; a bridge over Welsh's Run, 1.2 miles north of West Middlesex, in Hickory Township, Mercer County.

Supervisors of Chartiers Township, Washington County, to construct bridge over unnamed stream, in village of Arden Mines.

Bird Coal Company, construct a bridge over Kaufman's Run, 3432 feet from mouth of stream in Stone Creek, Somerset County.

Cambria & Indiana Railroad Company, to construct bridge over Little Elk Creek, in Blacklick Township, Cambria County; bridge over Coal Pit Run, Blacklick Township, Cambria County; bridge over Lincoln Run, Black Lick Township, Cambria County.

Meadville City, construct a concrete encased I-beam and concrete slab bridge acros Mill Run, at North Main Street; concrete encased I-beam bridge over Mill Run, at Water Street; concrete encased I-beam bridge over Mill Run, at Poplar Street, Meadville, Crawford County.

Commissioners of Blair County, construct a bridge across Mill Run at Thirty-first Street and Broad Avenue, Altoona; construct a bridge over Plum Creek, near Erb Station, in Taylor Township, Blair County; construct extension bridge across Mill Run, near the Altoona Driving Park, Logan Township; construct reinforced concrete culvert across Yingling Run, near the General Refractories Company's plant at Sarah Furnace, in Greenfield Township.

Supervisors of Gamble Township, Lycoming County, to construct bridge over T. B. Albert Branch of Murries Run, on a new road from the Calvert Post Office, Bodines Post Office road, Gamble Township, Lycoming County; to construct bridge over Swartz Branch of Murries Run, on Calvert Post Office, Bodines Post Office road, Gamble Township, Lycoming County.

Carnegie Steel Company, a change in location of pile ice breaker in the Monongahela River, borough of Braddock, near the Braddock-North Braddock borough line, in Allegheny County; construct a wall along right east bank of Monongahela River, in Braddock and North Braddock Boroughs, Allegheny County.

Ocean City, Md.—Governor signed bill appropriating $200,000 for constructing bridge across Sinepuxent Bay at Ocean City. Address County Clerk, Snow Hill.

Richmond, Va.—Reported constructing of a bridge at Laurel Street is under consideration. Address City Clerk.

Cleveland, Ohio.—See "Miscellaneous."

Columbus, Ohio.—See "Sewerage and Sewage Disposal."

Elyria, Ohio.—County Commissioners voted to construct bridge over Beaver Creek near Oak Point. It will be of concrete abutment structure with steel spans and creosoted wood block floor. Address County Clerk.

Kenton, Ohio.—County Commissioners sold $20,000 bridge bonds. Address County Clerk.

Youngstown, Ohio.—F. M. Lillie, City Engineer, preparing plans for Cedar Street approach, which will be part of Himrod Avenue bridge. Estimated cost, $125,000. Address City Clerk.

Kankakee, Ill.—County Board is considering constructing a bridge 700 ft. long over Kankakee River at Warner's Landing, cost $45,000; 9000-ft road improvement on Archer Road, cost $33,845; Jackson bridge, $4,000; Baker Bridge, Manhattan Township, $3,000, and Wilmington Felix Bridge, $2,500.

Minneapolis, Minn.—The Maryland & St. Louis Ry. and the Chicago, Milwaukee & St. Paul R. R. will construct a viaduct at West Lake Street over their tracks. Roadway 50 ft., two 8-ft. sidewalks, 146 ft. long, over Maryland & St. Louis Ry., 400 ft. fill approach, and 200 ft. long over C., M. & St. P. Ry., 600 ft. fill approach; total cost, $140,000. Plans prepared by F. N. Cappelin, City Engineer. Work is to be done by the railroad companies.

Kearney, Neb.—Commissioners of Kearney and Buffalo Counties approved plans for steel and concrete bridge across Platte River, south of Kearney; estimated cost, $65,000. Address Clerk Buffalo County, Kearney.

Springfield, Mo.—Springfield Traction Co. (A. T. Van Dieuse, Gen. Mgr., Springfield), plans to construct a concrete viaduct at entrance to Walnut Grove Park. Cost about $10,000.

Dallas, Tex.—Contract soon to be let for constructing the east approach to the Commercial Street Viaduct, including 190 ft. retaining wall and earth fill, three 24-ft. spans and one 14-ft. span, reinforced concrete girders. H. Moseley, City Engineer.

Rockwall, Texas.—State Reclamation Department has approved plans for bridge over East Fork of Trinity River, in Rockwall County. J. F. Eitt, Engineer, Dallas County, prepared plans.

Waco, Texas.—Reported contract soon to be let for constructing bridge at South Fifth Street, near Baylor, to replace present temporary bridge. Address City Engineer.

San Bernardino, Cal.—City Council contemplates calling an election in the summer to vote following bonds: $100,000 for city hall site; $75,000 for auditorium in Lugo Park; $18,000 for Arrowhead Bridge; $35,000 for Third Street bridge; $35,000 for Mt. Vernon Avenue bridge, etc.

Fort Stanley, Ont.—Dock improvements and a swing bridge costing $100,000 are to be made here. William Gray, 520 King Street, London, will have charge of the work.

Malahide, Ont.—City Engineer of St. Thomas is preparing plans for an iron and concrete bridge with cement floors to be constructed at a cost of $25,000, in Malahide Township. Contract soon to be let.

BIDS DESIRED.

Maine.—Until May 11, by State Highway Commission Augusta for following:
Bridge between Van Buren and St. Leonards, N. B., 77,580 ft. plank and floor timbers on steel bridge on St. John River; also painting said bridge and for painting steel bridge over East Branch of Penobscot River in Medway.

Darien, Conn.—Until May 10 by Robert N. Green, Supt. of Highways, for constructing reinforced concrete bridge on Middlesex Road over Stony Brook, having two 9-ft. spans, with necessary abutments and center piers and 24-ft. roadway.

Heuvelton, N. Y.—Until May 16, by N. Wells, Town Clerk, for constructing concrete steel arch bridge over Oswegatchie River, advertised in Engineering Record. Engineers Concrete Steel Engineering Company, Park Row Bldg., New York, N. Y. Arthur Burna, Town Supt.

Morristown, N. J.—Until May 15, by Joint Committee Board Chosen Freeholders of Morris and Union Counties, for constructing a 75-ft. span reinforced concrete bridge, width 38 ft., over Passaic River at Chatham Road, between Union and Morris Counties. Fred S. Smith, Engr., Morris County, Morristown, and Jacob L. Bauer, Engr., Union County, 120 Broad St., Elizabeth.

Bradentown, Fla.—Until May 24 by Robert H. Roesch, Co. Clk., for constructing 10 bridges of concrete and steel, or concrete steel and wood, in Sarasota Venice Road and Bridge Dist. The sum of $40,000 is available for constructing these bridges. Charles A. Brown, Dist. Engr., Sarasota.

Bradentown, Fla.—See "Paving and Roads."

Palatka, Fla.—See "Paving and Roads."

Gadsden, Ala.—Reported desired until May 16 by County Commissioners for constructing 80-ft. steel span bridge over Big Wills Creek, near Gadsden, and concrete foundation for steel bridge over Big Wills Creek.

Blue Lick Springs, Ky.—Until May 17 by County Clerk, Carlisle, for constructing bridge over Licking River at Blue Lick Springs, 243 ft. long, composed of two spans each 121 ft. long.

Nashville, Tenn.—Until May 23, by W. M. Pollard, County Judge, for constructing bridge over Cumberland River at Hydes Ferry, Nashville, advertised in Engineering Record.

Ashland, Ohio.—Until May 15, by County Commissioners, for constructing several bridges, including Solomon Fetzer Bridge in Milton Township, Jerry Eby culvert in Milton Township, and others. H. G. McGuire, County Aud.

Bryan, Ohio.—Reported desired until May 8 by G. C. Bencler, Co. Aud., for constructing 21 bridges in various townships. Probable cost $14,300.

Hamilton, Ohio.—Until about June 1, by L. M. Hammerle, County Engineer, for constructing deck girder concrete bridge; cost $18,000; also May 15 separate bids for a deck girder concrete bridge; cost, $6,000.

Mount Gilead, Ohio.—Reported desired until May 19 by G. O. Higgin. Co. Aud., for constructing bridges in various townships.

Niles, Ohio.—Until May 15 by County Commissioners (W. L. Hoffman Clk.) for constructing substructure and superstructure of bridge across Meader Creek in Weathersfield Township on Main Street extension.

Warren, Ohio.—Reported desired until May 15 by W. L. Hoffman, Co. Clk., for substructure and superstructure of bridge across Meander Creek in Weathersfield Township, on Main Street extension in city of Niles.

Bedford, Ind.—Reported desired until May 18 by County Commissioners for constructing 6 steel and reinforced concrete bridges. E. W. Edwards, Co. Aud.

Illinois.—Until May 10, by State Highway Commission, at office of County Clerk, Carlinville, for constructing following bridges:
Hettick, for constructing 7 reinforced concrete bridges in Macoupin County, in Section D known as Castile, Dugger No. 1, Dawson, Hanshaw, Ambrose, Duckels, and Alderson bridges. Engineers' estimate $9,885.
Macoupin, for constructing three reinforced concrete and one steel bridges in Macoupin County, Section E, known as Meyers, Ellis, Piasa and Eddington No. 1. Engineers' estimates $10,455.

La Moure, N. D.—Reported desired until May 16, for constructing steel bridge 50 ft. long, single span, five steel piers at each end; 32-ft. bridge on five steel piles, concrete floor, 18-ft. roadway, three 6-ft. wings and one 12-ft. wing, both in Township 133; steel bridge 40 ft. long, five steel piles, 18-ft. roadway, 12-ft. wings, and a 40-ft. steel bridge, five steel piles, concrete floor, 18-ft. roadway, both in Township 135.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Maine.—Following bids opened April 25 by State Highway Commission, Augusta, for bridge construction:
South Thomaston—One wooden truss and granite fill: Noyes & Campbell, Augusta, $7,000; C. E. Bicknell and E. W. Freeman, Rockland, $6,315 (not awarded).
Southport, Boothbay Harbor (no bids received).

Lowell, Mass.—Following are two bids opened April 18 by City Clerk specifying kind of bridge to be constructed over Merrimack River and northern canal at Pawtucketville: National Engineering Corporation, Inc., Lowell, three span, $115,000; four river spans, $99,575; suspended deck and two river spans, through bridge, $85,692, and for two river spans with a third arch ring through bridge, $83,370. Daniel O'Connell Sons Company, Holyoke, two main channel spans each 140 ft., $109,300, or 150 ft., $120,600, three span bridge, $112,300.

★**Boswell, Pa.**—Contract for steel span bridge 650 ft. in length to be constructed on outskirts of Boswell, awarded by Johnson Somerset Trolley Company, to Phenix Bridge Company, of Phenixville. Cost reported at $50,000. Cambria Steel Company has contract for furnishing 4000 tons of rails for trolley line extensions.

★**New Orleans, La.**—Contract awarded by Highway Department of State Board of Engineers, New Orleans, for constructing bridge on Section 3 of the Arkansas Highway in Parish of Caddo (bids opened April 24) to Bloodgett Construction Company, Shreveport, $11,149.

★**Rockford, Ill.**—Contract awarded by City Council for constructing Chestnut Street bridge to N. M. Stark Co., Des Moines, Iowa, at $91,564.

★**Rock Island, Ill.**—Contract awarded by Board of Bridge Committee of Rock Island and Henry Counties for constructing Colona Bridge across Rock River, concrete construction, to Gould Construction Co., Davenport, Iowa., at $59,300.

★**Oskaloosa, Iowa.**—Contract awarded by County Commissioners for constructing bridge over Skunk River at Curriera Mills on Iowa City Road to Des Moines Bridge & Iron Works, Des Moines, at $17,849.

★**Miami, Okla.**—Contract for constructing five steel bridges awarded Missouri Valley Bridge & Iron Company, Leavenworth, Kan., at $63,436. George J. Stem, County Engineer, Oklahoma.

★**Poteau, Okla.**—Contract for constructing three steel bridges in Wister Township, Leflore County, awarded Kansas City Bridge Company, Kansas City, Mo., at $17,000. D. W. Patton, County Highway Engineer, Poteau.

PAVING AND ROADS

PROPOSED WORK.

Biddeford, Me.—Paving bonds for $25,000 will be sold May 9 by city.

Great Barrington, Mass.—Citizens, April 25, voted $10,000 bonds for road construction on Moment Mountain Road. A. C. Collins, Moderator, may be able to give information.

New Haven, Conn.—Permanent Paving Commission has voted to ask Board of Aldermen for $50,000 for paving two streets.

Newark, N. J.—State appropriated $75,000 for road repairs in Essex County. This amount will be used as follows: $30,000 for improving Springfield Avenue, South Orange Township and Millburn; $10,000 for same avenue between Spring Street and Morris Turnpike, Milburn, and $35,000 for improving Broad Street, Bloomfield north of Bay Avenue to Passaic County line.

New Jersey.—Election to be held in November to vote on the $7,000,000 road bill recently passed in the Legislature. Edwin A. Stevens, State Road Commissioner, Trenton.

Paterson, N. J.—Road improvements bonds for $160,000 will be sold May 10 by Finance and Auditing Committee of Board Chosen Freeholders (Geo. W. Botbyl, Clk.).

Trenton, N. J.—Finance Committee of Board of Chosen Freeholders approved specifications for resurfacing with Warrenite the Lawrenceville-Princeton Road. Address Clerk of Board of Chosen Freeholders.
All bids opened recently by Board of Freeholders for constructing first section of the Pennsgrove-Pennsville Road have been rejected as being irregular. Lowest bid was $65,509. New bids to be asked immediately.

Hazleton, Pa.—It is proposed to pave Diamond Avenue, East Broad, Chestnut and Juniper Streets and repave Broad Street; material not yet decided upon. Cost $79,000. B. E. Youngerman, City Engineer; S. J. Hughes, City Clerk.

New Wilmington, Pa.—T. A. Gilkey, Engineer, New Castle, preparing plans for paving Market St. and Neshannock Ave. Address City Clerk.

Philadelphia, Pa.—Contract awarded by Bureau of Highways about six months ago for paving have been annulled. They were subject to cancellation if orders to proceed with the work were not received within six months. Address City Clerk.

Spangler, Pa.—Election will probably soon be held to vote $42,000 bonds for paving. Address City Clerk.

Williamsport, Pa.—Surfacing of West Fourth Street at a cost of about $30,000 is reported under consideration. George K. Harris, Supt. Public Improvements.

Tazewell, Va.—Road improvement bonds for $255,000 will be offered by county for sale about June 1. G. A. Martin, Road Engineer; C. W. Greever, County Clerk.

Shelby, N. C.—See "Water Works."

Americus, Ga.—Later official reports state street improvement bonds for $30,000 will be sold by city May 9 (not May 1 as previously stated). N. M. Dudley, Chmn. Finance Committee.

Bartow, Fla.—Election to be held June 1 in the county to vote $1,500,000 bonds for constructing paved macadamized or hard-surfaced roads. (Contracts awarded.) See "Prices and Lettings." J. A. Johnson, Clerk County Commissioners.

Bradentown, Fla. — Road and bridge bonds for $250,000 will be sold May 22 by County Commissioners. Robt. H. Roesch, Clk.

Fort Myers, Fla.—Citizens of Labelle District voted $164,000 road bonds. Address Clerk of Labelle District at Fort Myers.

Kissimmee, Fla.—Citizens voted $250,000 bonds for brick and sand asphalt roads. Address County Clerk.

Mobile, Ala.—Contract will soon be let by Commissioners of Mobile and Baldwin Counties for constructing Delta Highway to connect Mobile and Baldwin Counties either by the Nicol and Hume route or any route, and for constructing bridge across Spanish River. Address Clerk of Mobile County at Mobile.

Baton Rouge, La.—West Baton Rouge, Point Coupee and Iberville Parishes, assisted by business interests in the city of Baton Rouge, are taking steps to build a highway from Port Allen, in West Baton Rouge, to Rosedale, in Iberville Parish, a distance of 16 miles. Address County Clerk, Baton Rouge.

Mansfield, La.—Citizens of Mansfield and vicinity voted $250,000 road bonds, $150,000 to be used for constructing a link in the Jefferson Highway and $100,000 for gravel roads out of town of Mansfield. Address City Clerk.

Canton, Miss.—Contract will be let some time in May for paving about 1200 ft. with concrete or asphalt on West Center Street, and graveling West Peace, Academy and other streets at a cost of about $40,000. Information desired on some lasting but inexpensive pavements. Bonds will be sold May 15. W. L. Dinkins, Mayor.

Jackson, Miss.—County Commissioners sold $850,000 road bonds. Address County Clerk.

Benton, Tenn.—Polk County voted $95,000 road improvement bonds.

Lawrenceburg, Tenn. — Citizens voted $350,000 road bonds. Address County Clerk.

Aurora, Ohio.—City Council authorized improvement of Indiana Avenue from West Conwell Street to south corporation line. Address City Clerk.

Bellaire, Ohio.—Citizens voted $40,000 bonds for improving West Twenty-third and West Washington Streets. Address City Clerk.

Chillicothe, Ohio.—Glen L. Perry, County Highway Supt., submitted a report to County Commissioners estimating cost of improving Ross County highways as follows: Improving county roads in ten townships at $88,425; township roads in same townships, $49,051; bridge construction for the year, $33,300; improved roads, $9,232; road construction, $91,680; road resurfacing, $74,700; total, $346,089. All of this work may not be done this year.

Cincinnati, Ohio.—Citizens April 25 voted $1,638,050 bonds for street improvements, including Hamilton Avenue, $251,250; Quebec Road, $175,000; Fairbanks Avenue, $151,500; Ludlow Avenue, $142,500; Eastern Avenue, $459,750; Madison Road, $142,500; Freeman Avenue, $105,000; Central Avenue, $120,800; Harrison Avenue, $39,750; Grandin Road, $50,000.
County Commissioners approved plans and specifications for improvement of Caldwell Drive. Estimated cost, $38,485. Address County Clerk.

Columbus, Ohio.—See "Sewerage and Sewage Disposal."

Columbus, Ohio.—County Commissioners plan resurfacing and repairing 35 roads, about 150 miles. Address County Clerk.

Dayton, Ohio.—Paving bonds for $33,000 will be sold May 23, by Walter H. Aszling, Clk. Co. Comrs.

Hamilton, Ohio.—Contract will be let soon after June 1 by County Commissioners for macadam and concrete roads to cost $180,000. L. M. Hammerle, County Engineer, Hamilton.

Lima, Ohio.—See "Water Works."

New Philadelphia, Ohio.—County Commissioners authorized $115,000 bonds for improving portions of five roads. Address County Clerk.

Salem, Ohio.—It is proposed to pave with brick block on Jennings Avenue, about 8,214 sq. yd., at a cost of $21,000, including 4693 ft. 4 x 18-in. stone curb. B. M. French, City Engineer. J. N. Russell, Director Public Service.

Springfield, Ohio.—Citizens voted $349,000 bonds for street improvements. Address City Clerk.

Xenia, Ohio.—Citizens April 25 voted to improve 15,000 sq. yds. on East Main and Columbus Streets and 2000 sq. yds. on Riger Street. J. P. Shumaker, City Engr. Contract will be let about June 15.

Columbus, Ind.—County Commissioners sold $24,000 bonds for constructing gravel roads. Address County Clerk.

Gary, Ind.—Board Public Works has ordered City Engineer to prepare plans for resurfacing Broadway from Third Avenue to Twentieth Avenue, about 65,000 sq. yd., with sheet asphalt.

Pontiac, Mich.—Board of Supervisors will sell $250,000 road bonds for constructing a complete system of highways throughout the county. It is proposed to construct, this summer, 57½ miles and later 30 miles.

East St. Louis, Ill.—E. F. Harper, City Engineer, estimates cost of paving with brick, asphalt filler, ⅝-in. sand cement cushion, 6-in. concrete base, on Thirty-sixth Street, at $25,127.
County Court has approved the assessment for the improvement of State Street from Thirty-fourth and Eighty-ninth Street, 3.6 miles.

Joliet, Ill.—City Council authorized paving with asphaltic concrete Center Street at $11,610. Address City Clerk.

Kankakee, Ill.—City Council passed ordinance for paving with asphalt portion of Chicago Avenue. Estimated cost, $35,400. Address City Clerk.

Madison, Wis.—County Commissioners plan constructing 40 miles of road. Address County Clerk.

Marshalltown, Iowa.—City Council intends paving six of leading streets out of city.

Minneapolis, Minn.—The sum of $143,000 has been apportioned by Council Committee for curbing and guttering in various wards this summer.

Fargo, N. D.—Contract soon to be let by city for paving approximately 19 blocks, bids to be on asphalt, creosote block, vitri brick, Portland cement, concrete, bituminous concrete and bitulithic. Address City Clerk.

Billings, Mont.—Citizens of County voted $175,000 bonds for constructing gravel road from eastern to western part of county. Address County Clerk.
City Council plans constructing several thousand feet of concrete curbs and walks. Address City Clerk.

Monett, Mo.—Road improvements bonds amounting to $50,000 for Special Road District will be sold May 10 by John Walsh, Clerk Board Commissioners, advertised in Engineering Record.

Tuscumbia, Mo.—Citizens voted $30,000 bonds for constructing cross state highway. Address County Clerk.

Aransas Pass, Texas.—Citizens voted $10,000 bonds to build the city's portion of the diamond loop highway to Padre Island, a distance of 14 miles. Address City Clerk.

Athens, Texas.—Citizens of Precinct No. 3 voted $60,000 road bonds. Address Clerk Precinct No. 3, at Athens.

Bay City, Tex.—Road improvement bonds amounting to $100,000 will be sold, proceeds to be used to shell roads recently built.

Ft. Worth, Tex.—Contract will be let early in May for repaving 4400 ft. on Main Street. Bids will be considered on Wood block, asphaltic concrete, brick, bitulithic, etc. A 12 to 24-in. vitr. pipe storm sewer will also be installed. F. J. Vonzuben, City Engineer.

Karnes City, Texas.—Attorney General has approved $75,000 bonds issue for Karnes County Road District No. 3.

Lockhart, Tex.—Caldwell County $50,000 road improvement bonds have been approved by the Attorney-General. Address County Clerk.

Port Aransas, Tex.—Citizens voted $10,000 toward building the Diamond Loop Highway to Padre Island, a distance of 14 miles. Address City Clerk.

Wichita Falls, Texas.—See "Public Buildings and Schools."

Aberdeen, Wash.—City Council passed resolutions for paving 13½ blocks of streets and laying 26 blocks of concrete sidewalks. P. F. Clark, City Clerk.

Bellingham, Wash.—County Commissioners have approved proposition to construct hard surface road 4½ miles long to Marietta, to cost $60,000. C. M. Adams, County Engineer; William D. Wallace, County Auditor.

Chehalis, Wash.—Election will probably be held this summer to vote $1,000,000 bonds to construct hard-surfaced roadways. D. W. Montford, County Auditor, J. D. Neville, County Engineer.

Granite Falls, Wash.—W. C. Bickford, County Engineer, Everett, is completing survey for paving 1 mile in Granite Falls. Estimated cost, $12,000.

Seattle, Wash.—A. H. Dimock, City Engineer, has filed with Board of Public Works estimates of cost of paving with brick East Marginal Way. Estimated cost, $127,944.

Monmouth, Ore.—City Council intends paving entire length of Main Street in the business section. Address City Clerk.

Portland, Ore.—Contract soon to be let by County Commissioners for constructing 24-ft. bitulithic pavement on crushed stone base on Figure 8 on Columbia River Highway. This contract, awarded on brick pavement, was recently relinquished. Address County Clerk.

El Centro, Cal.—Citizens are petitioning Board of Supervisors to call an election to vote $1,000,000 bonds for constructing paved highways throughout the country.

Los Angeles, Cal.—City Council and Board of Supervisors agreed to construct jointly 2 miles of pavement along Manchester Avenue. Contract will be let about June 1.

Riverside, Cal.—County Highway Commission (Lester S. Moore, Secy.) recommended to Board of Supervisors a $713,425 bond issue for completing highway system.

San Francisco, Cal.—Board of Works authorized the improvement of portion of Leavenworth Street and crossing of Leavenworth and Francisco Streets. Estimated cost, $15,000. Address City Clerk.

Salt Lake City, Utah.—City Engineer Sylvester Q. Cannon recommends paving with asphalt on Thirteenth Street East, from Fifth to Ninth Streets, and from Ninth to Eleventh Streets, with cement concrete.

Coeur d'Alene, Idaho.—County Commissioners will soon construct highway in Fourth of July Canyon. Estimated cost, $60,000. D. E. Danby, County Auditor.

Outremont, Que.—See "Sewerage and Sewage Disposal."

BIDS DESIRED.

Boston, Mass.—Until May 8, by Edw. F. Murphy, Comr. Public Works, for repairing asphalt or bithlithic pavements on any streets in Boston not under guaranty when ordered to do so by Commissioner between May 15, 1916, and Jan. 31, 1917.

New Haven, Conn.—Until May 11, by F. L. Ford, City Engineer, for paving four streets.

Binghamton, N. Y.—Until May 10, by Board Contract and Supply for paving Fayette, Robinson and Montgomery Streets and Conklin, Whitney and East Starr Avenues.

Brooklyn, N. Y.—Until May 11 by L. H. Pounds, Borough Pres., for laying sidewalks, grading and paving portions of Bay Thirty-seventh and Hicks Streets, Bushwick Avenue and numerous other streets, in all about 27,785 sq. yd. asphalt, 17,240 sq. ft. cement sidewalk, together with curbing, etc. Total security $26,900.

Waterloo, N. Y.—Until May 18 by F. G. Stewart, Village President, for approximately 23,000 sq. yd. reinforced concrete paving and approximately 10,000 lin. ft. concrete curbing, advertised in Engineering Record. M. L. Van Kirk, Village Engineer.

Atlantic City, N. J.—Reported desired until May 10 for 6260 sq. yd. macadam and gravel pavements. A. H. Nelson, Co. Engr.

Grantwood, N. J.—Reported desired until May 8, by Borough Council of Clifside Park, at Fire Hall, Palisade Avenue and Park Place, Clifside Park (Louis Rentler, Clk.), for surfacing with bituminous and tar on macadam foundation of Palisade Avenue and Gorge Road approximately 17,127 sq. yd. bituminous, 14,334 sq. yd. tar, 31,461 sq. yd. foundation. McClave & McClave, Borough Engrs., Columbia Avenue, Grantwood.

Elizabeth, N. J.—Until May 11 by Board Public Works for constructing 35,000 sq. yd. sheet asphalt pavement on 6-in. concrete foundation. Thomas E. Collins, City Engr.

Paterson, N. J.—Until May 9, by Board Public Works, for grading, curbing and guttering, of 21 streets, including Glover Avenue, Carbons and other streets; similar work, including sidewalks on 5 streets including Crooks and Knickerbocker Avenues, also for sidewalks on Trenton Avenue and East Twenty-ninth Street. H. J. Harder, City Eng.

Washington, D. C.—Until June 1, by Commissioners D. C. for making repairs to asphalt pavements, including resurfacing and concrete base on certain streets for a period of 2 or 5 years from July 1, advertised in Engineering Record.

Bradentown, Fla.—Until May 24 by Robert H. Roesch, Co. Clk., for improving by grading and surfacing with sand asphalt, about 28 miles of road in Sarasota-Venice Road and Bridge Dist., in all about 148,000 sq. yd. sand asphalt surface, 159,000 sq. yd. concrete base, 260,000 lin. ft. concrete curb, 98,000 sq. yd. sand asphalt shoulders, 148,000 sq. yd. oil base, etc. Charles A. Browne, District Engr., Sarasota.

Bridgeville, Pa.—Until May 9 by M. R. Mallery, Chmn. Street Committee, for grading, curbing and paving Hickman, Murray and Station Streets, in all about 7500 sq. yd.; also for constructing sewers, in all about 5780 lin. ft. 8 and 15-in. in St. Clare and Mill Streets.

Carbondale, Pa.—Until May 22, for 7000 sq. yd. penetration waterbound macadam and approximately one-half of a total of nearly 50,000 sq. yd. brick pavement on 4 and 6-in. concrete base. J. A. Saxe, City Engr., City Hall.

Pittsburgh, Pa.—Until May 18, by John P. Moore, County Controller, for furnishing material and reconstructing approximately 22 miles of worn macadam roads with Class "A" and Class "B" asphalt surfacing material, with alternate bids for reconstructing 4¾ miles with Class "A" asphalt, also for 4¾ miles reinforced concrete wearing surface, furnishing 29,000 tons more or less ballast screening, etc.

Washington, Pa.—Reported desired until May 17 by J. T. Underwood, Contractor, for paving Washington-Bethany Road, about 1 mile.

Baltimore, Md.—Reported desired until May 10, by Paving Commission (R. K. Compton, Chmn.), for 33,550 sq. yd. sheet asphalt, 2525 sq. yd. vitr. block, etc.

Cumberland, Md.—Until May 22, by Mayor and City Council, for paving and otherwise improving streets; advertised in Engineering Record. Ralph L. Rizer, City Engineer.

Towson, Md.—Reported desired until May 11, by County Commissioners (Chas. J. Fox, Clk.), for Registertown Road resurfacing, with asphalt 3 miles; Allegheny Avenue 1 mile with concrete, White House Road 2 miles with concrete, and Paper Mill Road one mile with concrete.

Huntington, W. Va.—Reported desired until May 8 by Board County Comrs. for paving a number of streets. A. B. Maupin, City Engr.

West Union, W. Va.—Until May 26 by Hiram Hutson, Clk. County Court, for constructing a number of roads in West Union Dist. Horner Bros., 314 West Main Street, Engrs., Clarksburg.

Miami, Fla.—Reported desired until May 18, by City Clerk, for 12,400 sq. yd. concrete sidewalk and 14,000 lin. ft. curb. B. H. Klyce, City Engr.

Palatka, Fla.—Until June 7, by County Commissioners for paving with vitr. brick and concrete or granite curb, approximately 21 miles of highway and approximately 500 cu. yd. reinforced concrete in bridges, advertised in Engineering Record.

Columbus, Miss.—Reported desired until May 10, by County Commissioners for constructing 10 miles macadam roads. Probable cost $20,000. Also separate bids for 4½ miles in Bent Oak Road Dist. E. Hauser, Engr., Columbus.

Carlisle, Ky.—Until May 17 by Fiscal Court Nicholas County (John F. Sugg, Clk.) for improving county road known as Headquarters and Hooktown Turnpike, to the Bourbon County line, a distance of 6 miles.

Rutledge, Tenn.—Reported desired until May 10, by County Road Commission, for 60 miles of grading and 45 miles of macadam paving.

Jasper, Tenn.—Reported desired until May 12 by County Commissioners for constructing road to Dixie Highway. Probable cost $60,000.

South Pittsburg, Tenn.—Until May 12, by County Commissioners, for about $100,000 worth of macadam roads. J. E. Moreland, County Engineer.

Louisville, Ky.—Until May 11 by Board Public Works (Roger G. McGrath, Secy.) for paving Brook, F. Lytle and numerous other streets. Samples of vitr. brick must be submitted.

Canton, Ohio.—Until May 10, by George McCloskey, Director Public Service, for 66,000 sq. yd. brick, 40,000 sq. yd. sheet asphalt and 90,000 yd. material not specified, all on 5-in. concrete foundation. W. E. Sarver, City Engineer.

Cincinnati, Ohio.—Until May 11, by Chas. F. Hornberger, Public Service Director, for improving Lincoln Avenue from Stanton Avenue to Alms Place. City Engineer Frank S. Krug's estimate: Asphalt, $16,604; bitulithic, $18,609.

Until May 15, by the Public Service Director, for improving Pearl Street from Broadway to Martin Street, 9500 sq. yd. of granite. City Engineer's estimate, $43,184.

Until May 12, by County Commissioners (Albert Reinhart, Clk., for improving Caldwell Drive in Section 7 and 13, Springfield Township.

Reported desired until May 19, by County Commissioners (A. Reinhart, Clk.), for cleaning and oiling various roads.

Dayton, Ohio.—Until May 18, by County Commissioners, for Range Road Improvement, including 5220 cu. yd. gravel or crushed stone, 14,349 cu. yd. excav., 7000 gal. road oil applied, 800 lin. ft. guard rails. Walter H. Aszling, Clk. of Board.

Linden Heights, Ohio.—Until May 20, by Al. H. Probst, Village Clerk, for paving seven streets with bituminous macadam, approximately 3 miles, including sewers; streets to cost $70,000 and sewers $18,000; advertised in Engineering Record. R. K. Schlafiy, Engineer, Columbus.

Mansfield, Ohio.—Until about May 24, by W. J. Hazettine, City Engineer, for paving with brick on Bowman Street and with tarvia on Vincennes Street on concrete foundation.

Marion, Ohio.—Until May 19, by Director Public Service for furnishing material and paving, curbing, grading, draining, etc., follow roads: Davis Street, 23,873 sq. yd., including C., D. and M. street car tracks, and Forest Street; Bain and Avondale Avenues and Carhart Street, in all 11,975 sq. yd. Bids on labor and material must be stated separately. H. A. Stevens, Clerk.

New Albany, Ohio.—Until May 12 by Village Council for constructing sidewalks on Main, High and other streets. Jennings, Lawrence & Lindsey, Engrs., Hartman Building, Columbus. N. D. Kern, Village Clerk.

New Bremen, Ohio.—Until May 13 by Board County Commissioners for furnishing material and constructing concrete floor (roadway and sidewalk for a bridge across the Miami and Erie Canal at Plum Street. F. W. Langhorst, Co. Aud.

Payne, Ohio.—Until May 13 by B. C. Craig, Village Clerk, for 13,202 sq. yd. street paving.

Tiffin, Ohio.—Reported desired until May 24 for about 15,000 sq. yd. paving. Address William Heller, Dir. Pub. Service.

Troy, Ohio.—Until May 11, by Frank Burkholder, Director Public Service, improving Main Street, including grading, cement curb and gutter, 5550 lin. ft., curb and gutter 3000 sq. ft., sidewalk 7055 lin. ft., 10 to 20-in. sewer pipe, 18,630 sq. yds. paving, brick, bituminous concrete or bituminous macadam. M. A. Gantz, City Engineer.

Zanesville, Ohio.—Until May 9, by W. W. Roach, Director Public Service, for paving with brick on Market Street on a concrete foundation. C. R. Spencer, City Engineer.

Zanesville, Ohio.—Reported desired until May 9, by City, for 11,733 sq. yd. asphalt pavement on concrete base, 2000 lin. ft. curb and gutter, etc. Probable cost, $23,000. C. R. Spencer, City Engr.

Cannelton, Ind.—Until May 8, by Fred Berger, City Clerk, for 61,000 ft. 5-ft. concrete walks. Herman & Memme Engineering Company, Jasper, Ind., Engineers.

Hudson, Mich.—Until May 19, by Fred. P. George, City Clerk, for 23,000 sq. yd. of resurfacing on Maple Grove Avenue and E. Main and Grove Streets, to cost $20,000. George Champe, Engineer, Toledo.

Potosi, Mich.—Until May 13, for constructing roadbed for highway in Washington County, approximately 13,000 to 15,000 yd. W. R. Heagler & Sons, Engrs., Potosi.

Paris, Ill.—Until May 10, by County Supervisors (P. L. Stoneburner, Chmn.) for constructing 10,500 lin. ft. brick pavement on portions of Lower Terre Haute Road and Springfield Road. Geo. D. Murphy, Co. Clerk.

Illinois.—Until May 10, by State Highway Dept., Springfield, for constructing roads as follows:

Martinsville, Clark County, Sect. B, concrete road, 4500 ft. Engineers' estimate $8,350.

Breese, Clinton County, Sect. B, oiled earth, 13,500 ft. Engineers' estimate $5,529.

Trenton, Clinton County, 9204 ft. oiled earth. Engineers' estimate $3,535.

Lombard, Du Page County, 7200 ft. bituminous macadam. Engineers' estimate $17,584.

Lake Villa, Lake County, 5040 ft. concrete. Engineers estimate $12,659.

Waukegan, Waukegan County, 2275 ft. concrete. Engineers' estimate $4,740.

Vincennes, Ind., Lawrence County, 4800 ft. brick. Engineers' estimate $11,588.

Ava, Jackson County, 21,600 ft. earth. Engineers' estimate $14,402.

Morrison, Ill.—Until May 16, by Vernon N. Taggett, County Supt. of Highways, for 26,803 sq. yd. brick paving on Lincoln Highway in Sterling Township.

River Forest, Ill.—Until May 8 by Board Local Improvements (John T. Muir, Chmn.) for improving portions of Park and Forest Avenues and Thomas Street with asphaltic concrete. Total estimated cost $13,115.

Nevada, Iowa.—Until May 16 by R. A. Davis, City Clk., for 14,000 sq. yd. pavement and 8000 lin. ft. curb. Bids desired on either brick, asphalt concrete or reinforced concrete.

Vinton, Iowa.—Until May 10, by W. E. Klingman, City Clerk, for 24 blocks of paving brick and concrete, including Whipple and College Avenues and Ellis Street, on concrete foundation, including 10,660 lin. ft. curb. Cost, $35,000.

Vinton, Iowa.—Reported desired until May 10, by W. E. Klingman, City Clerk, for 17,500 sq. yd. brick and concrete pavement on concrete base and 10,660 ft. concrete curb. Estimated cost, $35,000.

Luverne, Minn.—Until May 23 by Olaf Skyberg, Co. Aud., for State Road No. 5, length 4½ miles, in all about 7570 lin. ft. turnpiking, 7200 yd. graveling, 27,000 cu. yd. grading Road No. 5, about 8000 cu. yd. graveling, Road No. 2, 23,600 lin. ft., turnpiking, 10,130 cu. yd. graveling, etc.

Kearney, Neb.—Reported desired until May 11, by T. N. Hartzell, City Clerk, for paving with vertical fiber brick, asphaltic concrete and concrete monolithic brick in paving Dists. No. 6 and 7.

Lincoln, Neb.—Reported desired until May 8, by Theo. H. Berg, City Clerk, for paving in Dist. No. 327, No. 328, No. 345, in all about 13,190 sq. yd., asphaltic concrete, 7950 curb and gutter, etc.

Lisbon, N. D.—Reported desired until May 9, by Chas. E. Best, County Auditor, for constructing creosoted wood block pavement over Fifth Street bridge.

Missoula, Mont.—See "Sewerage and Sewage Disposal."

Kansas City, Mo.—Until May 9, Board Public Works (Edw. F. Webster, Act. Secy), for paving with sheet asphalt on Summit and Thirty-fifth Streets, with creosoted wood block portion of Nineteenth and Main Streets, and Portland cement concrete on Forty-sixth Street and West Prospect Place, and a number of alleys. Also separate bids for artificial stone curbing on East State, McGee and other streets.

Until May 16, by Allen C. Southern, County Surveyor, for macadamizing a portion of Woodland Avenue, in all about 8564 sq. yds. Also separate bids for macadamizing W. R. Nelson Road, in all about 2043 sq. yds.

Amarillo, Tex.—Until May 9, by M. H. Hardin, City Manager, for approximately 75,000 sq. yd. paving and all other work incidental thereto.

Blackwell, Okla.—Until May 10, by Clyde V. Butcher, City Clerk, for paving Street Improving Dist. No. 1, to consist of vitr. brick block on 1½-in. sand cushion and 4-in. concrete base with cement grout filler, in all approximately 38,590 cu. yd., and 15,000 lin. ft. curb. Also for constructing storm sewers.

Washington.—Reported desired until May 22, by James Allen, Secy, State Highway Board, Olympia, for surfacing with gravel or Colville shale about 4½ miles of Inland Empire Highway from Colville south in Stevens County. R. B. Thomas, Co. Engr.

Lodi, Cal.—Until May 15, by H. S. Clark, City Clerk, for municipal paving plant, costing about $7,500, for which citizens, April 10, voted in favor of constructing. L. F. Barzellotti, Engineer, City Hall.

Ventura, Cal.—Until May 13, by Board of Supervisors (J. B. McCloskey, Clk.), for grading and constructing 6.34 miles of 4-in. concrete pavement 16 ft. wide, Ventura to La Crosse, Division 6, Section 1, approximately 17,720 cu. yds. excav., 34,490 lin. ft., shaping roadbed, 12,000 lbs. reinforcing steel, etc.

Venice, Cal.—Until May 15, by C. Y. Burns, City Clerk, for grading and constructing asphaltic concrete pavement on Venice Boulevard and Walgrove Avenue.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Maine.—Following are bids opened April 25 by State Highway Commission Augusta, for highway improvements (gravel surface unless otherwise stated):

★Damriscotta, 3.22 miles (four lowest): James McGregor & Co., Rumford, $14,109 (awarded contract); H. L. Baker, Woolwich, $14,110; Ahern Construction Company, Willimantic, Conn., $15,082; A. Williams & Co., Boston, Mass., $15,428.

Brunswick, 4.69 miles: James H. Kerr, Rumford, $41,676 (only bidder, not awarded).

Noblesboro, 2.67 miles: Ahern Construction Company, Willimantic, Conn., $16,096; James McGregor & Co., Rumford, $16,205; and Noyes & Campbell, Augusta, $18,619 (not awarded).

★Lincolnville, 3.5 miles: H. L. Baker, Woolwich, $15,406 (awarded contract); Noyes & Campbell, Augusta, $19,742.

★Greene, 1.8 miles, macadam surface: James McGregor & Co., Rumford, $11,875 (awarded contract); Small & Ingalls, Bar Harbor, $13,357; James H. Kerr, Rumford, $13,485; Noyes & Campbell, Augusta, $13,649.

★Fairfield, 1.88 miles: Greenwood & Ford, Skowhegan, $8,881 (awarded contract); W. H. Doran, Mercer, $10,822, and D. D. Pietro, 424 Hanover Street, Boston, Mass., $14,479.

★Hermon, 3.08 miles: W. H. Doran, Mercer, $17,614 (awarded contract; John G. Fleming Lincoln, $18,762; and Murtaugh Hughes, Bangor, $24,842.

Cherryfield, 3 miles: A. Williams & Co., Boston, Mass., $20,570; Bradbury Smith, West Sullivan, $20,928 (not awarded).

Edmunds, 2 miles: A. Williams & Co., Boston, Mass., $12.509 (not awarded).

★Mechanic Falls, 2.6 miles (four lowest): Marco Lavorgna, Canton, $10,843 (awarded contract); James H. Kerr, Rumford, $13,482; James McGregor & Co., Rumford, $13,983; W. H. Doran, Mercer, $15,832.

★**Massachusetts.**—Following are bids opened April 25 by Massachusetts Highway Commission, Boston, for constructing road improvements:

★Taunton—Hamilton Flood, Quincy, Mass., $14,886 (awarded contract); H. E. Cushing, Sekonk, Mass., $15,176; and J. McCormick, Providence, R. I., $18,915.

★Clarksburg—Samuel B. Horton, Everett, $7,302 (awarded contract).

Barre—Charles E. Horne, Millbury, $10,636; R. H. Newell Company, Uxbridge, $11,477; and B. E. Savage, Worcester, $10,711 (not awarded yet).

Phillipston—Charles E. Horne, Millbury, Mass., $8,211 (lowest not awarded yet).

★Wayland and Sudbury (bids opened April 18)—Framingham Construction & Supply Company, Framingham, Mass., $39,250 (awarded contract); A. Williams & Company, 27 Lowell Street, Boston, $29,725; and R. F. Hudson, Melrose, $39,870.

★**Bridgeport, Conn.**—Contract awarded by City Council for resurfacing number of streets to Warren Bros., Boston, Mass., at $500,000.

★**New Haven, Conn.**—Contract awarded C. B. Blakeslee & Sons, New Haven, for wood block pavement on sections of eight streets, at a cost of $140,000.

★**Hartford, Conn.**—The Board of Contract & Supply, according to later information, has awarded the contract for street paving (bids opened April 11) to Union Paving Company, Schenectady, N. Y., for $63,059.

Albany, N. Y.—Following are lowest bids opened April 28 by State Highway Commission, 55 Lancaster Street, for repair of public highways by State aid:

Contract 901—Albany County, 2.83 miles; John Doyle, Albany, $12,382.

Contract 902—Albany County, 7.38 miles; S. B. Van Wagenen, Inc., Rondout, $24,922.

Contract 872—Chemung County, 31.89 miles; Atlantic Refining Company, Philadelphia, Pa., $12,986.

Contract 863—Clinton County, 31.55 miles; The Defiance Corporation, Ticonderoga, N. Y., $12,242.

Contract 880—Columbia County, 16.43 miles; Conway Brothers & Kennedy, Eddyville, N. Y., $6,279.

Contract 931—Dutchess County, 1.8 miles; Thomas J. Martin, Beacon, N. Y., $8,530.

Contract 921—Hamilton County, 8.43 miles; Defiance Corporation, Ticonderoga, $3,324.

Contract 929—Nassau County, 1.17 miles; Ulrich & Persicano, Brooklyn, $11,890.

Contract 876—Niagara County, 28.57 miles; Sweeney & Boland, Rochester, $7,827.

Contract 911—Rensselaer County, 2.75 miles; M. Fitzgerald, Hoosick Falls, $15,078.

Contract 909—Rensselaer County, 3.76 miles; Gifford Construction Company, Jamaica, $27,141.

Contract 864 — Rensselaer County, 7.4 miles; Olan T. Benedict, Pittsfield, Mass., $19,160.

Contract 865—Rensselaer County, 11.84 miles; Clarence E. Walker, Troy, $6,010.

Contract 861—Saratoga County, 2.27 miles; J. A. Laparte, Mechanicsville, $6,098.

Contract 867—Schenectady County, 11.79 miles; Paul Schultz, Albany, $4,113.

Contract 920—Tompkins County, 47.78 miles; Atlantic Refining Company, Philadelphia, Pa., $17,984.

Contract 899—Warren County, 6.57 miles; John Anderson, Newcomb, $8,429.

Contract 903—Westchester County, 4.31 miles (no bids received).

Contract 888—Westchester County, 19.78 miles; Paul Schultz, Albany, $7,760.

Broken Stone Contract No. 72—Hamilton County, 7.75 miles; Edgar Call, Lake Pleasant, N. Y., $5,461.

Following are lowest bids opened May 2 by State Highway Commission, Albany, for repairing public highways:

Repair Contract 862, Albany County, 19.93 miles, John T. O'Neil, Troy, $7,081.

Repair Contract 910, Albany County, 4.16 miles, Jos. Walker Constr. Co., Albany, $17,781.

Repair Contract 914, Cayuga and Oswego Counties, 46,04 miles, W. F. Hill & Co., Fulton, $17,992.

Repair Contract 895, Columbia County, 10.13 miles, Jos. Walker Constr. Co., Albany, $3,569.

Repair Contract 923, Columbia County, 2.89 miles, Jos. Walker Constr. Co., Albany, $10,501.

Repair Contract 928, Cortland County, 41.86 miles, McGreevey, McGuigan & Baum Constr. Co., Elmira, $12,631.

Repair Contract 877, Erie County, 12.59 miles, Cold Springs Constr. Co., Buffalo, $5,043.

Repair Contract 907, Franklin County, 17.06 miles, Kellogg Boynton, Keeseville, $5,388.

Repair Contract 904, Jefferson County, 2.47 miles, Rock & Griffin Co., Watertown, $12,747.

Repair Contract 860, Jefferson County, 31.88 miles, Richard Hopkins, Troy, $10,596.

Repair Contract 854, Livingston County, 1.09 miles, John C. Bradley, Corning, $11,395.

Repair Contract 874, Livingston and Wyoming Counties, 46.76 miles, Crouch Bros., Rochester, $13,956.

Repair Contract 875, Monroe County, 43.63 miles, Crouch Bros., Rochester, $7,815.

Repair Contract 885, Oneida, Otsego and Herkimer Counties, 51.39 miles, James E. Martin, Utica, $17,218.

Repair Contract 869, Rensselaer County, 0.29 mile, Gifford Constr. Co., Jamaica, $4,798.

Repair Contract 900, Rensselaer County, 1.73 miles, Gleason & Davitt, Albany, $10,092.

Repair Contract 871, Rensselaer County, 1.47 miles, Thos. H. Karr, Troy, $6,782.

Repair Contract 913, Rensselaer County (withdrawn).

Repair Contract 866, Saratoga County, 22.50 miles, Richard Hopkins, Troy, $6.777.

Repair Contract 917, Schenectady County, 5.31 miles (four lowest), Brown & Lowe Co., Schenectady, $27,749; Thos. Murray, Le Roy, $29,976; Jos. Walker Constr. Co., Albany, $30,206; John B. Dower, Ballston Spa, $31,090.

Repair Contract 855, Schuyler County, 22.94 miles, McGreevey, McGuigan & Baum Constr. Co., Elmira, $8,084.

Repair Contract 881, Ulster County, 19.05 miles, Jos. Walker Constr. Co., Albany, $12,677.

Repair Contract 898, Warren County, 29.08 miles, Defiance Corporation, Ticonderoga, $5,973.

Contract 887, 7.60 miles, Contract 879, 6.01 miles, and Contract 919, 9.68 miles, in Westchester County (no bids received).

Repair Contract 857, Yates County, 24 miles, McGreevey, McGuigan & Baum Constr. Co., Elmira, $8,716.

Buffalo, N. Y.—Following bids submitted to Board of Contract and Supply: Repaving Main Street with asphalt, German Rock Asphalt Co., Inc., D. S. Morgan Building, $16,990; sandstone, Erie Construction Co., D. S. Morgan Building, $18 850.

★**Gloversville, N. Y.**—Contract for 12.000 sq. yd. of concrete pavement (bids opened April 18) awarded John P. Dugan & Company, Amsterdam, $16,690, and 3308 lin. ft. 18 to 24-in. storm water sewers to Sherman Contract Company, Oneonta, at $8,107. H. J. Hanmer, City Engineer.

Long Island City, L. I., N. Y.—Lowest bid submitted to Maurice E. Connolly, Borough President, for repairing asphalt pavements throughout borough, by Barber Asphalt Co., Woolworth Bldg., at $19,175.

★**Rochester, N. Y.**—Contract awarded Whitmore, Rauber & Vicinus, Rochester, for asphalt pavement on Thurston Road at $36,255.

★**Schenectady, N. Y.**—Contract awarded by Board of Contract and Supply for repairing asphalt streets with stone-filled asphalt, including concrete foundation, to Union Paving Co., Schenectady, at $13,772.

Avella, Pa.—A. P. O. Halderman, Wheeling, W. Va., secured contract for improving three sections of Township Road (bids opened April 15).

★**Northumberland, Pa.**—Contract awarded P. N. Ring & Company, Mahonoy City, for paving city blocks with Paxtonville paving bricks at $1.95 per sq. yd.; total about $16,393.

Philadelphia, Pa.—Following are average unit low bids opened April 25 by Department Public Works, Bureau of Highways (William H. Connell, Chief of Bureau) for grading and paving:

Grading—86,786 cu. yd.; total amount of low bids $48,345, average price 55.7 cts. per cu. yd., bidders: McNichol Paving & Construction Company, 1923 Cherry Street; O'Neill Company, 7811 Hermantown Avenue; J. Joseph McHugh, 1430 S. Penn Square; A. McIlhenny, 1230 S. Twenty-eighth Street, and P. J. Snyder & Co., Bailey Bldg.

Asphalt Paving—With vitr. brick gutters, including 6 in. concrete base, total amount of low bids, $45,031; average bid $2.251 per sq. yd. Bidders: Barber Asphalt Paving Company, Land Title Bldg.; Philadelphia Paving Company, 1345 Arch Street; Mack Paving & Construction Company, Twentieth Street and Sedgely Avenue, and Eastern Paving Company, Penn Square Building.

Paving—With vitr. block, including 6-in. concrete base; total $8,319; average bid $2.481 per sq. yd. Bidder: J. Jos. McHugh, 1430 South Penn Square.

Asphalt Repaving—Including 6-in. concrete base, 14,981 sq. yd.; total $35,340; average bid $2.35 per sq. yd. Bidders: Barber Asphalt Paving Company, Land Title Bldg.; Eastern Paving Company, Penn Square Building.

Granite Block Repaving—2,080 sq. yd.; average price $3.92 per sq. yd.; total $8,155. Bidder: J. Kane, 4840 Mascher Street.

Surfacing Waterbound Macadam—3 in. on a 5-in. broken stone base, 15,690 sq. yd.; average price $1.07 per sq. yd.; total $16,793. Low bidders: T. F. Reilly, Commercial Trust Bldg.; Anders & Snyder, Heed Building; P. J. Snyder, Bailey Bldg.

Improving Oxford Avenue—Total of low bids $30,308. Bidder: J. J. McHugh, 1430 Penn Square.

Repairing Bituminous Pavements—Total low bids $6,440. Bidder: Mack Paving & Construction Company, Twentieth and Sedgely Avenue.

Furnishing and Applying Bituminous Materials—Water gas, tar base (cold applications), 50,000 gal. at 6.4 cts. per gal.; total $3,200; water gas, tar base (hot applications), 20,000 gal., 8 cts.; total $1,600. Bidders: The Barrett Company, Thirty-sixth Street and Grays Ferry Avenue.

Repairing Footways—City to pay; total $6,997. Bidder: Reed & O'Rourke, 1213 Cherry Street.

Painting and Repairs to Bridge—Total low $4,712. Bidder: Interstate Engineering & Construction Company, Coleman Bldg.

Average low bids opened April 28 by Department of Public Works, Bureau of Highways, for paving:

Schedule "A," vitr. block repaving, total amount of low bids, $10,364; vitr. block paving, including renewal of 40 per cent of concrete base, average price $2.205 per sq. yd., Philadelphia Paving Company, 1345 Arch Street.

Schedule "B," surfacing waterbound macadam, 3 in. on a 5-in. broken stone base, total average of low bids, $26,783, average price $1.446 per sq yd., Anders & Snyder, Heed Building.

Schedule "C," sprinkling macadam and dirt roads, average for sprinkler, $6.31 per day. Low bidders: F. L. Bader, 5013 Woodland Avenue; J. Irvin, Twenty-fifth and Moore Streets; R. P. Bennie, Chew and Price Streets; Estate of D. McMahon, Germantown and Chelton Avenues.

★**Weston, W. Va.**—Contract awarded Ridge Bros. Construction Company, Pittsburgh, Pa., for improving roads leading out of Weston (bids opened April 24), at $70,344. Leander Traville, Clerk.

★**Bartow, Fla.**—Contracts awarded by County Commissioners, Bartow (J. A. Johnson, Clerk), for constructing 240 miles of hard-surfaced roads (asphalt) as follows (bids opened April 22):

Division 1, William P. McDonald Construction Company, Mt. Vernon, N. Y., $284,964.

Division 2, Continental Public Works Company, 2 Rector Street, New York, N. Y., $218,479.

Division 3, Eureka Paving Company, Houston, Texas, $299.695.

Division 4, Edwin C. Humphrey, Hackensack, N. J., $232,630.

Division 5, Edwards Construction Company, Tampa, Fla., $272,195.

Bridges awarded Champion Bridge Company, Wilmington, Ohio, $59,809.

Culverts, Edwards Construction Com pany, Tampa, Fla., $66,125.

★**Deland, Fla.** — Contract awarded Southern Clay Manufacturing Company, Chattanooga, Tenn., for about 200,000 yd. of 3½-in. wire cut lug brick pavement in the Deland-Lake Helen District, a distance of about 26 miles, the brick to be laid on edge on a natural soil foundation and grouted.

★**Lafayette, Ala.** — Contract for constructing Lafayette-Waverly Road (bids opened April 24) awarded by County Commissioners to Stanley & Singer, LaFayette, at $49,205. Other bidders: Nixon & Smith, Deatsville, Ala., $52,474, and W. A. Hicks & Son, Fayette, Ala., at $54,724. S. E. Fitch, County Engineer.

★**Selma, Ala.**—Contract for graveling road from Safford to Wilcox County line (bids opened April 17) awarded by County Commissioners, 5 miles, to D. R. Cook & Company, Selma, at $12,000, and to C. E. Shurtrine, Safford, for 4½ miles, at $10,000. W. S. Crisman, County Engineer.

New Orleans, La.—Following are totals of four lowest bids opened April 24 by Board State Engineers, New Orleans, for road improvement:

Section No. 3, Lafayette-New Iberia Highway, comprising 5 miles of gravel road, concrete culverts, c. i. pipe, etc., Paxton Miller, Paterson, $11,377; J. N. George & Sons, Shreveport, $11,435; Perry & Bonner, Lake Charles, $11,975; Worthington Construction Company, Brookhaven, Miss., $12,012.

Ten and a half miles of Winnfield-Jonesboro and Winnfield-Colfax Highways: Lambert & Co., Baton Rouge, $12,492; J. N. George & Sons, Shreveport, $13,832; Texas Grading Company, Houston, Tex., $13,897; M. Tansey, Derry, La., $13,634.

★Section 3, Arkansas Highway in Parish Caddo: S. A. Gano, Jackson, Miss., $12,865 (awarded contract); Healy Construction Company, Meridian, Miss., $13,125; J. N. George & Sons, Shreveport, $13,510; Blodgett Construction Company, Shreveport, $13,844.

★**Dayton, Ohio.**—Two bids opened April 25 by County Commissioners for improving Shakertown Pike, John Wroe, 435 Grafton Avenue, $33,729 (awarded contract), Bigler Bros., Dayton, $34,012.

★**Ohio.**—Contracts awarded by State Highway Commission, Columbus, for constructing state roads as follows (bids opened April 7):

★Butler County, Hamilton Middletown, Section H. Calital Construction Company, Columbus, $3,085.

★Champaign County, Urban-Sidney, Section L, Brookville Bridge Company, Brookville, $1,074.

★Guernsey County, Cambridge, Caldwell, Section L, Seiple & Wolf, Youngstown, $12,729.

★Licking County, Columbus-Millersburg, Sect. Q, Vogelmeier Brothers, Newark, $5,509.

★Mahoning County, Akron, Canfield Section A S, L. H. Young Contracting Company, West Austintown, $20,282.

★**Warren, Ohio.**—Contract awarded by County Commissioners for constructing 7½ miles of Church Hill-Hubbard Road to Seipel & Wolf, Youngstown, at $21,909.

★**Wabash, Ind.**—Contract awarded by City Council for paving with sheet asphalt two streets, to Federal Asphalt Paving Co., Hamilton, Ohio, at $46,600.

★**Winchester, Ind.**—Contract awarded by County Commisioners for constructing with brick and concrete Bundy road, to James Burke, Anderson, at $24,771.

★**Shenandoah, Iowa.**—Contract awarded by City Council for paving with asphalt 40 blocks, to Dunnegan & Briggs, Shenandoah, at $1.41 per sq. yd.

Ivanhoe, Minn.—All bids opened April 19 for grading State roads Nos. 2, 3, 12 and 13 have been rejected and work is to be done by day labor. Karl A. Hausen, County Auditor.

★**Mandan, N. D.**—Contract awarded by Board of City Commissioners to S. Birch & Sons Construction Company, Fargo, for bitulithic paving and drainage work, at $152,500. This contract is for a specially designed drainage system for a street that has been a natural water course. Black & Griffin, Engineers, Mandan.

★**Marysville, Mo.**—Contract for about 13,000 sq. yd. of fiber brick pavement awarded Metropolitan Paving Company, St. Joseph, at $1.84 per sq. yd., and for curbing and guttering, at 57.5 cts. per lin. ft. A. D. Hewett, Clerk.

★**Bartlett, Texas.**—Contract awarded Levy & Levy, Temple, for about 27,000 sq. yds. of vitr. brick paving.

★**McKinney, Texas.**—Contract awarded Kaw Paving Company, Kansas City, Mo., for about 4 miles of paving.

★**San Antonio, Texas.** — Contracts awarded by Board of City Commissioners for paving as follows (price given per sq. yd.): To Western Paving Co., Oklahoma, Okla., at $1.32, for asphaltic concrete on macadam base on French Place, for bituminous asphaltic concrete on present foundation on Main Street; to Uvalde Asphalt Co., Beaumont, at $1.40, for 3-in. Uvalde rock asphalt on present macadam foundation on Avenue E, and at $1.50 for 1-in. cold-rolled rock asphalt on 5-in. reinforced concrete base on South Laredo Street.

★**Everett, Wash.**—Contract awarded by County Commissioners for constructing 3 miles of hard-surface road on Pacific Highway, north of Marysville to Bancroft & Morgan, Everett, at $34,294.

★**Palouse, Wash.** — Reported contract awarded by City Council for paving several streets with 2-in. bituminous top on 4-in. bituminous base to Washington Paving Co., L. C. Smith Building, Seattle, at about $40,000.

Seattle, Wash.—Low bids submitted to Board of Public Works for grading Hind Street by D. & V. Bressi, 1101 Twentieth Avenue South, at $13,941, and for Juneau Street, by William Kopta, New York Block, at $40,714.

★Contracts awarded by Board of Public Works for paving as follows: Rainier Avenue, to Washington Paving Co., L. C. Smith Building, at $69,634; Twelfth Avenue, to R. G. Stevenson, 1327 Ewing Street, at $25,510; Bailey Street, to F. McClellan, Globe Block, at $31,985.

★Contract awarded by County Commissioners for surfacing with brick 10 miles of Des Moines Road, to F. McClellan Globe Block, at $222,691.

★Stevenson, Wash.—Contract for constructing Clarke County line, Cascade Section (bids opened April 15) awarded by County Commissioners to Porter Bros. & Company, Portland, Ore., at $54,630. Other bidders: T. H. Cockran & Sons, Portland, $64,567; General Construction Company, Spokane, $68,963; and Federal Construction Company, Vancouver, Wash., $81,877. Charles H. Wilcox, County Auditor.

★Portland, Ore.—Contract awarded by City Council for paving Broadway to Oregon Independent Paving Co., Portland, at $45,490.

★Portland, Ore.—Contract awarded Oregon Independent Paving Company of Portland for paving Broadway at $45,490.

★Anaheim, Cal. — Contract awarded George R. Curtis, 552 South St. Louis Street, Los Angeles, for approximately 491,320 sq. ft. 1½-in. asphalt wearing surface on 4½-in. asphaltic concrete base on Broad Street, at $52,806.

★Beaumont, Cal.—Contract for constructing cement curbs, cement gutters and cement sidewalks, about 5 miles of streets, awarded Highway Construction Company, Highlands, at about $40,000.

★Los Angeles, Cal.—Contract awarded by Board of Supervisors as follows: To S. C. Contracting Company, Washington Bldg., for 1.51 miles of 4-in. concrete paving near Palo Herde Station, in Road District No. 61, involving 4500 cu. yd. excav., 7596 ft. shaping, 4700 lb. reinforcing steel, 14,880 sq. yd. concrete pavt., 1170 bbl. cement at $19,700. Next three bidders: J. Hein, $19,950; Metropolitan Construction Company, $20,758, and Fred Hoffman, Long Beach, $22,200.

★To Brashear Burns Company, Van Nuys Bldg., for 6.36 miles of concrete highway on Workman Mill Road, between Whittier Boulevard and El Monte Pomona Road, in Road District No. 1, approximately 26,000 cu. yd. excav., 33,700 lin. ft. shaping, 16,270 lb. reinforcing steel, 74,690 sq. yd. 5-in. concrete pavement at $34,638.

★Contract for grading, concrete curbing and walks on track near 101st Street and Harvard Boulevard awarded Brashear Burns Co., Van Nuys Building, at $15,005.

★Contract awarded George R. Curtis, 552 South St. Louis Street, for 121,800 sq. ft. cement walk, 122,190 sq. ft. grading, etc., on Los Feliz Avenue, at $46,917. Next lowest, R. F. Wyckoff, at $54,762.

Redondo Beach, Cal.—Following are four lowest bids opened recently by Board of Trustees for constructing about 126,000 sq. ft. concrete base and oil-wearing surface pavement, 34,000 sq. ft. cement walk, 6700 lin. ft. cement curbs, concrete bridges and culverts, on Lucia Avenue: California Arizona Construction Company, 1700 East Washington Street, Los Angeles, $28,810; Grown Construction Company, Los Angeles, $30,078; Municipal Improvement Company, Los Angeles, $29,048, and J. Hein, Los Angeles, $30,439.

★San Francisco, Cal.—Contracts awarded by Board of Works for improving streets as follows: To Federal Construction Co., San Francisco, at $8,124, for Bay View Street, and at $14,813, for Rhode Island Street; Ransome-Crummey Co., Oakland, at $10,611 for Forty-third Avenue.

★Tropico, Cal.—Contract for 75,000 sq. ft. 3-inch macadam pavement, 5100 lin. ft. cement curb, 25,000 sq. ft. cement walks, concrete gutter and timber bridge on Adams Street, and Moore Avenue (bids opened April 19 by Nelson C. Burch, City Clk.), awarded E. Schelling, 560 West Jefferson Street, Los Angeles, at $10,933.

★Toronto, Ont.—Contract for asphalt pavement on Evelyn Avenue awarded Construction & Paving Company of Ontario, Ltd., Ontario, at $12,012.

STREET CLEANING AND GARBAGE DISPOSAL

PROPOSED WORK.

Shelby, N. C.—See "Water Works."

Columbus, Ohio.—See "Sewerage and Sewage Disposal."

Reardan, Wash.—See "Water Works."

Outremont, Que.—See "Sewerage and Sewage Disposal."

Saskatoon, Sask.—Among improvements contemplated during 1916 by the city include $100,000 for incinerator, $28,000 for completion of water main across river to Nutana, $28,000 for power house addition, etc.

PRICES AND LETTINGS.

★*Indicates award of contract.*

New Orleans, La.—Following are four lowest bids opened April 11 by Commission Council of city for constructing a refuse incinerator for Algiers: John O. Chisholm & Company, New Orleans, $31,940; James A. Petty, New Orleans, $31,982; C. W. Neville, New Orleans, $34,572, and Incinerator Company, $35,750.

★Houston, Texas.—Contract for constructing 2 garbage incinerators of 25 tons and 12½ tons daily capacity, each awarded by City Commission to J. W. Stokes, Oklahoma, Okla., at $8,200 and $5,000 respectively.

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS

PROPOSED WORK.

River Improvements—Lima, Ohio.—See "Water Works."

River Straightening—Onawa, Iowa.—Taylor & Moriarity, Sioux City, have submitted a report, which has been approved by Board of Supervisors, on the straightening of Soldier River, in Monona County, about 12 miles, estimating cost at $120,000. Address J. P. Olander, County Auditor.

Ditches—Fergus Falls, Minn.—County Commissioners voted $50,000 bond issue for constructing ditches. Address County Clerk.

Irrigation—Bozeman, Mont.—Reported Madison Valley Irrigation District, comprising about 3500 acres between Ennis and McAllister, has been formed; ditch 12 miles long is included in the work; cost, $30,000. W. J. Kremer, of Ennis, Engineer.

Drainage—Blytheville, Ark.—The Circuit Court has granted the petition for the creation of the Keystone Drainage District, embracing 200,000 acres. A. C. Lang is one of the Drainage Commissioners.

Wharf Bonds—Orange, Texas.—Attorney General has approved issue of $150,000 dock and wharf bonds, $150,000 school bonds and $25,000 street bonds. Address City Clerk.

Levee Work—Wilmer, Tex.—Citizens voted $110,000 bonds for levee construction in Drainage and Levee District No. 1. J. D. Jones, of Wilmer, may be able to give information.

Dam—Hoquaim, Wash.—See "Water Works."

Fill—Seattle, Wash.—Contract soon to be let for constructing a hydraulic fill of 2½ miles East Marginal Way; estimated cost $35,000. Arthur P. Denton, County Engineer.

Irrigation—White Salmon, Wash.—Reported George R. Wilbur and James H. Izzard, of Hood River, Ore., are arranging details on project to irrigate about 800 acres in the Underwood Flat District, near here; cost, $40,000.

Irrigation Bonds—Brawley, Cal.—Irrigation bonds for $500,000 will be sold May 11 by Directors of Imperial Irrigation Dist. at El. Centro. (O. M. Berry, Secy.)

Irrigation—Dinuba, Cal.—Directors of Alta Irrigation District (Walter Billingslea, Chmn.) will arrange preliminary steps for organizing all irrigation interests now taking water from Kings River, for purpose of carrying out a plan of conserving flood waters of the river by construction of reservoirs and dams in the vicinity of Pine Flats, Fresno County; probable cost $6,000,000.

Irrigation—Kernville, Cal.—F. G. Dilthey, Kernville, has applied to State Water Commission, Sacramento, for permission to pump 100 miners' inches of water from North Fork of Kern River for irrigation purposes.

Irrigation—Mohave, Cal.—Mohave Mutual Land & Water Company, San Francisco, has applied to State Water Commission, Sacramento, for permission to impound all waters of Oak Creek watershed, consisting of water in Mill and Oak Creeks and from springs and flood waters of not less than 70 sec.-ft., to be used to irrigate 61,440 acres of desert land lying south of Tehachapi Mountain Range, in Kern County. The construction of earth and concrete dam 100 ft. high, 600 ft. wide at the bottom and 300 ft. wide at top, forming a reservoir of a storage capacity of 50,000 acre feet, concrete spillway around dam, ditch 7½ miles long, and to cost a total of $400,000, contemplated.

Irrigation—Riverside, Cal.—W. J. Hole, owner of La Sierra Heights, west of Riverside, has been granted permission by State Water Commission to appropriate 1000 acre feet of water per annum to be used on approximately 4200 acres of land. He intends constructing a reservoir estimated to cost $10,000.

Harbor and River Improvements—Ottawa, Ont.—Reported Department Public Works has authorized appropriations for extensive harbor and river improvements.

Dock — Fort Stanley, Ont. — See "Bridges."

Hydro Plant—Sarnia, Ont.—Contract soon to be let for constructing a hydro power and lighting system to cost $70,000. J. D. Stewart, Sarnia, has charge of matter.

Hydro Electric—Walkerton, Ont.—Town Council has asked Ontario Hydro Commission for plans and estimates for an electric lighting and power development plant to be supplied from Eugenia Falls. A. Collins, Town Clerk. Cost, $25,000.

Dam—Moosejaw, Sask.—The reinforced concrete dam of the Canadian Pacific R. R. has been swept away by the flood of April 24. George Bury, Gen. Mgr., C. P. R., Montreal, Que.

BIDS DESIRED.

Dredging—New York, N. Y.—Until June 1, by U. S. Engineer Office, First District, New York, N. Y. Army Bldg., 39 Whitehall Street, for dredging in Tarrytown Harbor, N. Y., advertised in Engineering Record.

Levee—New Orleans, La.—Until May 20, by Board State Engineers (Frank M. Kerr, Ch. Engr.) for constructing Cypress Creek Levee, approximately 610,000 cu. yd.

Breakwater—Indiana Harbor, Ind.—Until June 2, by U. S. Engineer, 508 Federal Building, Chicago, Ill., for constructing rubble mound breakwater at Indiana Harbor, Ind. Advertised in Engineering Records.

Dredging—Chicago, Ill.—Until May 26, U. S. Engineer, Chicago, Ill., for dredging in Calumet River, Ill. Advertised in Engineering Record.

Riprap Slope Construction—Chicago, Ill.—Until May 11 by John McGillen, Clk. Sanitary Dist. of Chicago, for construction of riprap slopes on Contract Sect. 7 and 8, of the Calumet Sag Channel, in Townships of Palos and Worth, Cook County, in all, about 200,000 sq. yd.

Channel Improvement — Maple Park, Ill.—Until May 20 (readvertisement) for deepening, widening, etc., channel district, 200,000 cu. yd. earth excav., etc. Hay & Lowman, Sycamore, Engineer; M. O. Brien, Clerk, Comrs. Union Drainage Dist. No. 3.

Ditches—Racine, Wis.—Reported desired until May 22 by Thompson, Meyers & Kearney, Attorneys, Root River Drainage Dist., for constructing open ditches as follows: Main ditch, north, 1.45 miles, 289,872 cu. yd. excav.; south ditch, 3.16 miles, 68,460 cu. yd. excav.; Miller Branch, 0.3 mile, 3900 cu. yd. excav.

Irrigation—Fort Laramie, Wyo.—Until May 25 by Dept. Interior, U. S. Reclamatio Service, Washington, D. C., for earthwork on about 8½ miles of main canal, involving the excavation of approximately 793,000 cu. yd.

Irrigation—Denver, Colo.—See "Miscellaneous."

Fill—Seattle, Wash.—Reported desired until May 16, by Byron Phelps, Co. Aud., for making hydraulic fill on the Seattle Duwamish Road, involving the handling of 130,000 cu. yd. material, road to be 2½ miles long. Probable cost $35,000. A. P. Denton, Co. Engr.

Dam—Spokane, Wash.—Until May 12, by U. S. Engrs. Office, Burke Bldg., Seattle, for removal of present cofferdam, at locks of Lake Washington Canal, and constructing timber guide well, 826 ft. long, 16 ft. wide and 30 ft. high.

Irrigation—Payson, Utah.—Until June 16, by U. S. Reclamation Service, Provo, for construction involving about 70,000 cu. yds. canal excav., 11,000 cu. yds. rolled embankment, 3500 cu. yds. excav. for structures, 1500 cu. yds. reinforced concrete, and 700,000 sq. ft. canal lining, near Payson, on Tintic Branch, Denver & Rio Grande R. R. Advertised in Engineering Record.

Wharf Improvements—Houston, Tex.—Following are unit figures of the three bids opened April 28 by city for constructing steel craneway and craneway shed at Wharf Unit No. 4: (a) Midland Bridge Co., Kansas City, Mo.; (b) Virginia Bridge & Iron Co. of Tennessee, Virginia, Tenn.; (c) Horton & Horton, Houston. Lump sum includes excavation, hauling, timber in foundations, concrete, Class I, II and III; extra brick masonry, manholes, catchbasins, inlets, etc.:

	(a)	(b)	(c)
Lump sum as per plans and specifications	$24,881.00	$23,860.00	$24,450.00
Structural steel, lb.	0.06	0.055	0.055
Corrugated asbestos metal siding, 20 ga., square	30.00	18.60	....
Corrugated asbestos metal roofing, 20 ga., square	30.00	18.50	....
6-in. galvanized iron gutter, 20 ga., lin. ft.	0.15	0.50	0.35
5-in. galvanized iron downspout, 20 ga., lin. ft.	0.15	0.50	0.35
Fixed metal sash glazed, sq. ft.	0.80	0.50	0.60

Manufacturer of conduit and grade: (a) Approved; (b) Am. Cir. Loom Co., "X-Duct" or equal Ruby Core; (c) Marks Mfg. Co. or Central Tube Safety Ins. Wire & Cable Co.

Manufacturer of wire and grade: (a) Approved; (b) Am. Cir. Loom Co., "X-Duct" or equal Ruby Core; (c) Marks Mfg. Co. or Central Tube Safety Ins. Wire & Cable Co.

Wharf No. 4—Houston, Tex.—Following are unit figures of the four bids opened April 28 by city for constructing Wharf and Shed Unit No. 4: (a) Horton & Horton, Houston, (1) to total with Item No. 1, $296,697; (2) total with Item No. 2, $299,197; (3) revised specifications Item No. 1, $296,947; (4) Item No. 2, $298,447; (b) James Stewart & Co., Inc., Houston, (1) $305,672; (2) $302,637; (3) $305,062; (4) $302,127; (c) The Midland Bridge Co., Kansas City, Mo., (1, 2, 3 and 4 the same), $413,607; (d) H. C. Gass, Houston, (1 and 4 the same), $451,185.

	(a)	(b)	(c)	(d)
Item 1—Lump sum bid, city of Houston wharf	$256,900.00	$262,770.00	$367,000.00	$399,000.00
Item 2—Lump sum bid, wharf as modified	259,400.00	259,835.00	367,000.00	....
50,000 cu. yd. excavation, hauled	0.29	0.30	0.29	0.32
20,000 cu. yd. excavation, refill	0.29	0.48	0.31	0.32
1,000 lin. ft. timber piling, plumb	0.25	0.225	0.34	0.45
1,000 lin. ft. timber piling, batter	0.50	0.26	0.38	0.60
600 lin. ft. concrete piling, 30 ft. lg.	1.20	1.40	2.50	1.50
400 lin. ft. concrete piling, 20 ft. lg.	1.20	1.50	2.50	1.40
30 M ft. timber sheet piling, 30-36 ft.	50.00	50.00	56.00	45.00
20 M ft. timber sheet piling, 28-24 ft.	45.00	47.00	60.00	40.00
10 M ft. timber sheet piling, 22-16 ft.	40.00	44.00	43.00	35.00
10 M ft. decking, 4 in. and under	37.00	42.00	38.00	35.00
1 M ft. dim. timbers in platforms	60.00	52.50	40.00	30.00
1 M ft. dim. timbers in fender syst.	60.00	52.50	40.00	35.00
100 cu. yd. concrete, Class 1	7.50	7.50	12.50	9.50
200 cu. yd. concrete, Class 2	7.00	6.50	11.00	9.00
100 cu. yd. concrete, Class 3	6.60	6.25	10.00	8.50
100 cu. yd. concrete, Class 4	6.00	6.00	7.60	8.00
40,000 lb. reinforcement	0.05	0.0425	0.057	0.04
5,000 sq. ft. form surface	0.10	0.11	0.15	0.06
1,000 sq. ft. form surface	0.07	0.125	0.14	0.06
1,000 sq. ft. form surface	0.12	0.15	0.15	0.06
2 moor. cavels	20.00	0.18	10.00	15.00
10,000 lb. tie rods	0.06	0.07	0.06	0.04
50 inserts	1.50	0.50	0.60	1.00
100 cu. yd. trenching	1.00	0.76	0.60	1.00
100 lin. ft. 24-in. vitr. sewer pipe	1.65	1.75	2.00	1.50
20 lin. ft. 15-in. vitr. sewer pipe	0.90	0.75	0.80	1.20
30 lin. ft. 8-in. vitr. sewer pipe	0.40	0.60	0.30	0.60
20 lin. ft. 6-in. vitr. sewer pipe	0.26	0.50	0.20	0.60
40 lin. ft. 6-in. c.-i. soil pipe	0.46	1.00	0.70	1.00
40 lin. ft. 5-in. g.-i. d. s., No. 20 g.	0.25	0.32	0.15	0.20
50 lin. ft. 6-in. g.-i. gutter, No. 20 g.	0.30	0.35	0.25	0.20
10 lb. 16-oz. copper flash	0.60	0.65	0.60	0.40
100 sq. ft. fixed m. sash, glazed	0.60	0.60	0.80	0.25
100 sq. ft. vent. m. sash, glazed	0.75	0.76	1.00	0.25
100 lin. ft. 10-in. c.-i. water pipe	1.50	1.75	1.60	1.40
100 lin. ft. 4-in. c.-i. water pipe	0.75	0.75	0.60	0.70
2 col. fire hydrants	37.00	95.00	50.00	36.00
100 sq. yd. 2-in. asphalt pavement	1.00	1.00	1.00	2.00
10 sq. yd. 3-in. vertical fiber pavement	1.45	1.75	3.20	2.00
2 standard sgl. inlets	26.00	25.00	8.00	7.00
500 lb. nails, spikes, bolts, etc.	0.10	0.06	0.04	0.0f
200 lin. ft. railroad track	2.50	1.85	3.30	1.20
2 switches	250.00	375.00	180.00	90.00
50 cu. yd. road. shell ballast	1.50	1.55	1.50	2.00
1 M ft. cypress lumber	50.00	60.00	40.00	40.00
10 square roofing	5.00	5.00	5.00	10.00
100 sq. yd. 8-in. shell roadway	0.60	0.35	0.60	2.50
100 lin. ft. branch circuit	0.15	0.16	0.50	0.20
5 ceiling out. boxes	5.50	1.00	6.50	4.00
5 bracket out. boxes	5.50	1.00	6.50	4.00
6 switch boxes	1.75	1.00	2.00	3.00
6 local switches	2.20	1.50	2.50	2.00
5 plugging boxes	16.00	7.50	20.00	2.00
5 circuit connections	11.60	4.00	12.00	20.00
2,000 man-hour labor, skilled	0.80	0.85	0.75	0.50
4,000 man-hour labor, unskilled	0.30	0.32	0.30	0.25
1,000 team-hour teams	0.70	0.75	0.70	0.70

Time of completion, days, $100 per day: (a) 200, (b) 185, (c) 225, (d) 1 year.

PRICES AND LETTINGS.

★Indicates award of contract.

★Dredging—Buffalo, N. Y.—Contract for dredging North (Buffalo River) entrance channel and Watson Elevator site, Buffalo (bids opened April 26 by U. S. Engineer, Buffalo) awarded H. S. Kerbaugh, Inc., Buffalo, at 21.5 cents per cu. yd. for 65,000 cu. yds. dredging, scow measure; total $13,975. Other bidder, Great Lakes Dredge & Dock Company, 22 9/10 cents and $14,885 respectively.

★Dredging—New York, N. Y.—Contract for dredging and rock removal in Coenties Reef, East River, N. Y., awarded Great Lakes Dredge & Dock Company, Boston, Mass., at $196,900 (bids opened April 14 by U. S. Engineer, New York).

Dredging—Wilmington, Del.—Following are bids opened April 26 by U. S. Engineer, Wilmington, for dredging in Smyrna River: About 115,000 cu. yds.: River & Harbor Improvement Company, Philadelphia, Pa., 8.9 cts.; Rickards Dredging Company, Philadelphia, Pa., 14.3 cts., and the Maryland Dredging Company, Baltimore, Md., 17 cts.

Drainage—New Orleans, La.—Following are four bids opened March 22 by F. S. Shields, Secretary Sewerage and Water Board, for Contract No. 76-D, additions to drainage pumping station No. 3: John Riess, $60,365; Hampton Reynolds, $68,400; Black & Laird Construction Company, $68,850, and R. McCarthy, Jr., $74,112.

★Drainage—Carlton Center, Mich.—Contract for constructing Little Thornapple River Drain (bids opened April 25) awarded Wage & Tyler, Coldwater, Mich., at $24,955. George Burgess, Special County Drain Commissioner, Hastings.

★Dredging—Manistee, Mich.—Contract for dredging in Manistee Harbor (bids opened April 20 by U. S. Engineer, Grand Rapids) awarded Greiling Bros. Company of Green Bay, Wis., at $9,975.

★Ditch—Roseau, Minn.—Contract for constructing Ditch No. 24 (bids opened April 21) awarded Northwestern Drainage Company, Thief River Falls. Probable cost $15,000. S. G. Bertilrud, County Auditor.

Ditch—St. Peter, Minn.—Contract for constructing Ditch No. 59, to consist of 25,388 ft., 8 to 26 in tile, etc. Bids opened April 20, awarded by County Commissioners to North Star Concrete Company, Mankato, at $12,895. W. H. Holz, County Auditor.

★Drainage—Mandan, N. D.—See "Paving and Roads."

★Dam—Gonzales, Texas. — Contract (bids opened April 20 by Gonzales Water Power Co.), for constructing dam on Guadalupe River at Gonzales awarded L. D. Kaughan, Ft. Worth. Frank Taylor Construction Engineer, Austin.

Dock—Montrose, Ont.—See "New Industrial Plants."

ELECTRIC RAILWAYS

PROPOSED WORK.

Cross Anchor, S. C.—Plans being prepared for construction of an electric railway from Spartanburg to Clinton via Walnut Grove, Hobbysville, Cross Anchor and Tylersville, about 35 miles. Among those interested, W. B. Patton of Cross Anchor and A. B. Calvert of Spartanburg.

Mandeville, La.—Plans being made to erect a railway from Mandeville to Madisonville and Hammond, about 25 miles. Town Council of Mandeville may be able to give further information.

Cincinnati, Ohio.—Citizens April 25 voted $6,000,000 bonds for constructing a rapid transit loop and interurban entrance system. Rapid Transit Commission is now authorized to proceed with specifications for the loop.

Columbus, Ohio.—Columbus Railway Power & Light Co. plans to erect a power plant on Kimball Street, near Broad Street, on Scioto River; cost about $375,000.

Utica, Mich.—Reported Detroit United Ry. Co. of Detroit considering construction of an extension from West Utica to Utica, distance of 5 miles.

Jerseyville, Ill.—Alton & Jacksonville Ry. Co. of Alton considering extending line from Jerseyville to Jacksonville.

Green Bay, Wis.—Green Bay & Eastern Ry. Co. has asked Wisconsin Railroad Commission for a certificte of necessity and convenience for constructing a railway from Green Bay to Manitowoc, with extensions eventually to Sturgeon Bay and Sheboygan. William M. Willinger, Manitowoc, Pres.

BIDS DESIRED.

New York, N. Y.—Until May 25, by Public Service Commission for First Dist. (Oscar S. Straus, Chmn.), for construction of station finish for 7 stations on the Seventh Avenue-Lexington Avenue Rapid Transit Railroad, from Forty-third to 106th Street.

PRICES AND LETTINGS.

★Indicates award of contract.

★Willimantic, Conn.—Contract awarded by Willimantic & Manchester Street Ry. Company, of Hartford, to C. E. Coon Construction Company, Cleveland, Ohio, for constructing a railway about 20 miles in length, from Manchester Green to Willimantic, costing, according to reports, about $1,000,000. William S. Hyde, Mnnchester, President.

★Perry, Iowa.—Contract awarded W. J. Zitterel Company, Webster City, for constructing an electric generating plant for Iowa Ry. & Light Company.

★Ogden, Utah.—Contract for constructing grade for Brigham-Hot Springs cutoff for Ogden, Logan & Idaho Ry. Co., awarded to Utah Constr. Co. of Ogden.

RAILROADS

PROPOSED WORK.

Mahanoy City, Pa.—Public Service Commission at Harrisburg directed Lehigh Valley R. R. Co. (E. B. Ashby, Ch. Engr., 143 Liberty Street, New York, N. Y.) to construct a subway and eliminate grade crossings at Mahanoy City.

Chicago, Ill.—Reported Chicago & Eastern Illinois R. R. (L. C. Hartley, Ch. Engr., McCormick Bldg.), intends making extensive improvements during coming summer, mainly new track ties, ballast and a second track on the Chicago & St. Louis line.

San Antonio, Tex.—The San Antonio & Northwestern R. R. Company has been chartered to construct and operate a railroad from San Antonio through counties of Bexar, Medina, Bandera, Real and Edwards to town of Rock Springs, in Edwards County, a distance of 125 miles. H. H. Gielder, George P. Childers and others of San Antonio, incorporators.

Pasco, Wash.—Contract soon to be let by Northern Pacific Ry. Company, St. Paul, Minn. for constructing proposed Grandview-Gibbon cut-off; also contemplates making improvements between Ellenburg and Pasco to cost approximately $1,000,000.

PRICES AND LETTINGS.

★Indicates award of contract.

★Indianapolis, Ind.—P. F. McCarthy of Davenport, Iowa, and James C. Dunn of Chicago, Ill., successful contractors for the 42 miles of steam railroad out of Indianapolis, have begun work on the contract, which is to cost $2,000,090.

PUBLIC BUILDINGS AND SCHOOLS

PROPOSED WORK.

Biddeford, Me.—Contract will be let about middle of June for erecting the police headquarters main building, to be three-story, garage and jail, one-story, brick and fireproof; cost, $120,000. Louis E. Destrempe, Archt., New Bedford. J. L. Gibbs, Inspector of Public Buildings, is in charge of the work.

Bennington, Vt.—Reported Henry W. Putman, Jr., of New York, N. Y., donated $90,000 toward erecting the Henry W. Putman Memorial Hospital.

New Bedford, Mass.—City Council authorized issue of $56,243 bonds for erecting bath houses on shore of Hazelwood Lake.

Springfield, Mass.—Plans prepared by Samuel M. Green Co., 293 Bridge Street, Boston, for Hooker School; cost about $220,000; also for addition to Howard Street School.

Worcester, Mass.—New bids are to be asked for erecting the police station. All bids opened recently rejected. Cost $150,000. George C. Halcott, Supt, Bldg.

Bridgeport, Conn.—Plans for addition to Jefferson School are to be prepared by F. A. Cooper.

Brooklyn, N. Y.—Governor Whitman at Albany signed bill appropriating $30,000 for additional accommodations at Long Island State Hospital.

Ilion, N. Y.—Erection of an eight-room school to North Street school is contemplated; cost, about $48,000. Tentative plans prepared by Fuller & Robinson Co. of Albany.

North Tarrytown, N. Y.—Site has been purchased on North Broadway for erection of the Isaac L. Rice Memorial Hospital; cost, about $200,000. Address Mrs. Isaac L. Rice.

Syracuse, N. Y.—Park and school bonds amounting to $168,000 reported sold.

White Plains, N. Y.—Bd. of Supervisors passed resolution appropriating $300,000 for erection of a county hospital on Cochran Farm Property near East View.

Dover, N. J.—Bd. of Education engaged John T. Simpson, of Newark, to prepare plans for a high school, to be erected on Myrtle Avenue, at a cost of $100,000.

Irvington, N. J.—Erection of an addition to high school at cost of $35,000 is contemplated by Irvington Bd. of Educatiton.

Trenton Junction, N. J.—School costing $34,000 to be erected. Citizens voted an additional $9,000 to $25,000 available. F. C. Leaming, Pennington Road, Chmn. School Board.

Avoca, Pa.—Plans being prepared by Austin L. Reilly, Bennett Building, Wilkesbarre, for high school to be erected in Avoca, at cost of $80,000.

Ebensburg, Pa.—A grade and high school is to be erected in Ebensburg at a cost of $90,000. Address Bd. of Education.

Enola, Pa.—Reported school recently destroyed by fire is to be rebuilt, at cost of $30,000. Address Bd. of Education.

Erie, Pa.—Plans being prepared by William B. Ittner, of St. Louis, Mo., for erection of Academy High School, at cost of $450,000. Wm. J. Flynn, Business Mgr. of School Bd.

Kittanning, Pa.—Plans being prepared by Janssen & Abbott, Century Building, Pittsburgh, for a building for Armstrong County General Hospital; cost, $100,000.

Lilly, Pa.—A school is to be erected in Lilly at cost of about $30,000. Address Bd. of Education.

Monarch, Pa.—School Board considering erecting an 8-room school, at cost of about $35,000. Isaac Ball, Pres.

Reading, Pa.—City plans erecting a municipal hospital costing $25,000. Address City Clerk.

Beckley, W. Va.—Bd. of Education is having plans prepared for a 2-story school; cost $50,000.

Warwood, W. Va.—Contract about to be let for erecting Center Warwood High School, at a cost of about $65,000. Address Secy. Richland School Dist.

Biltmore, N. C.—Contract soon to be let for erecting one three-story brick high school costing $38,000 with equipment. Address L. D. Maney, Biltmore.

Birmingham, Ala.—The remodeling of the Roden Building for auditorium and municipal building purposes is under consideration. Address Secretary City Commission.

Birmingham, Ala.—Erection of a municipal hall and city building being considered. Address H. Key Milner, Chrmn. Chamber of Commerce, Auditorium Committee.

Mansfield, La.—Contract soon to be let for erecting high school. Address Secretary Board Education.

Many, La.—Plans being prepared for a court house to cost about $85,000. Address County Clerk.

Shreveport, La.—Citizens voted $150,000 bonds for school improvements. Address Secretary School Board.

Philadelphia, Miss.—County Supervisors contemplate erecting an agricultural high school; cost $30,000.

Greeneville, Tenn.—The County Court appropriated $50,000 for erection of a court house.

Maryville, Tenn.—Carnegie Hall at Maryville College recently destroyed by fire is to be rebuilt, at a cost of about $50,000. Samuel T. Wilson, Pres.

Nashville, Tenn.—The Galloway Memorial Hospital to be erected at Vanderbilt University at a cost of $200,000.

Newport, Tenn. — Cooke County has voted $30,000 bonds to erect a county high school. Address Clerk County Board Education.

Millington, Tenn.—A high school is to be erected in Millington at a cost of about $30,000. Address Shelby County School Bd.

Alliance, Ohio.—Citizens voted $100,000 bonds for erecting additions to schools.

Brook Park (P. O. Berea), Ohio.—School bonds for $35,000 will be sold May 15, by A. H. Pincombe, Clk. Board Education.

Cleveland, Ohio.—Citizens April 25 voted $2,500,000 bonds for erecting municipal convention hall, building to cost $1,500,000, plans for which are being prepared by F. H. Betz, City Architect. City Hall to be of reinforced concrete and granite. Contract will be let in the fall. Alex. Bernstein, Director Public Service.

Dayton, Ohio.—County Commissioners of Preble and Montgomery Counties and Bd. of Trustees of Hospital selected a site 6½ miles north of Dayton for the District Tuberculosis Hospital to be erected at a cost of about $60,000.

Jefferson, Ohio.—Citizens voted $36,000 school bonds.

Kenmore, Ohio.—Citizens April 25 voted $75,000 bonds to erect a high school. National Engineering Company, Cleveland, Engineers.

Kent, Ohio.—Contract about to be let for erecting a dormitory at Kent State Normal College; cost, about $135,000. Building Commission comprises the Governor, Secretary of State and Auditor of State, all at Columbus.

Kingston, Ohio.—Citizens voted $30,000 bonds for erection of school. Address Bd. of Education.

Perrysburg, Ohio.—Plans prepared by M. M. Stophlet, of Toledo, for erection of a 2-story brick and concrete addition to high school to cost $41,000.

Toledo, Ohio.—Plans being prepared for a hospital to be erected on site 147 x 230 ft. at Madison Avenue and Twenty-third Street for Catholic Diocese of Toledo, to be conducted by Sisters ot Mercy. Address Mother Superior Bernardine.

West Park, Ohio.—Election to be held May 9 to vote $65,000 bonds for erecting school on Longhead Avenue and one on Settlement Road. Address Village Clerk.

Gary, Ind.—Plans being prepared by W. B. Ittner, of St. Louis, Mo., for erecting two schools to cost about $350,000.

Indianapolis, Ind.—School bonds for $75,000 will be sold May 20, by Board School Commissioners.

Hastings, Mich.—A high school is to be erected in Hastings at a cost of about $80,000. Address Secy. Bd. of Education.

Jackson, Mich.—Plans being prepared by L. H. Field, Jr., of Jackson, for erection of school at Blackstone and West Main Streets.

Northville, Mich.—Plans being prepared by Joseph E. Mills & Son, Detroit, for a brick fireproof school costing $50,000. Charles A. Dolph, Secy. Board Education.

Tecumseh, Mich.—Citizens voted to issue $75,000 bonds for erection of a school.

Eau Claire, Wis.—The city sold $85,000 Public Auditorium bonds. George Awsemb, 14 East Jackson Boulevard, Chicago, Ill., Archt.

Prairie du Chien, Wis.—Plans being prepared for a school to be erected at a cost of about $60,000. Address Bd. Education.

Sioux City, Iowa.—A brick dormitory costing $40,000 is to be erected at Springdale Trinity College. A. L. Steele, Secy. Third Order Regular of St. Francis, may be able to give information.

A 3-story, 80 x 80-ft. fireproof hospital is to be erected in Sioux Falls. Dr. Moe of Lake Heron, Minn., said to be interested.

Bird Island, Minn.—W. L. Alban, Endicott Building, St. Paul, is architect for school for which citizens recently voted $58,000 bonds. Address Clerk Board Education.

Mound, Minn.—A school is to be erected in Consolidated School Dist. at a cost of $55,000. J. F. Wilkins, Secy. Bd. of Education Consolidated School Dist.

Kiowa, Kan.—Citizens voted $43,000 bonds for erection of a high school.

Osawatomie, Kan.—Plans being prepared by T. W. Williamson, 735 Kansas Avenue, Topeka, for brick and stone high school to be erected in Osawatomie, at a cost of about $40,000.

Ottawa, Kan.—Citizens voted to erect a fireproof high school and a ward school. Bonds to be sold May 10. H. W. Chaffee, Clerk Board Education.

Mandan, N. D.—Plans completed by G. R. Horton of Jamestown for first unit of Mandan High School, to consist of fireproof, brick gymnasium auditorium and vocational building, 54 x 100 ft.; cost, about $30,000.

Sioux Falls, S. D.—Citizens voted $125,000 bonds for erecting municipal auditorium. Address City Clerk.

Kansas City, Mo.—Contract about to be let for erecting addition to Library at Locust, Cherry and Ninth Streets; cost, $200,000. Address Bd. of Education.

Kansas City, Mo.—Contract soon to be let for erecting 5-story, 108 x 75-ft. concrete and brick, fireproof hospital. Cost $90,000 with equipment. St. Elmo Sanders, 321 Lathrop Building, Kansas City, may be able to give additional information.

Rich Hill, Mo.—Citizens voted $29,000 bonds to erect high school. C. C. Stonebraker, Secy. Board Education.

Ft. Stockton, Tex.—Attorney General has approved $50,000 bonds of Pecos County School District No. 1.

Plainview, Tex.—School bonds amounting to $50,000 have been sold. Address Clerk Board Education.

Wichita Falls, Texas.—Election to be held May 23 to vote $65,000 school bonds and $40,000 for street paving. Address City Clerk.

Culver City, Cal.—Citizens voted $55,000 bond issue for erecting school in Culver City School District. Address Clerk of Board.

La Canada, Cal.—Allison & Allison, 1405 Hibernian Bldg., Los Angeles, engaged to prepare plans for a 1-story, four-room school; cost $25,000.

Oxnard, Cal.—School bonds for $51,000 have been sold. Allison & Allison, Archts., 1405 Hibernian Building, Los Angeles, preparing plans.

Placentia, Cal.—Frederick H. Eley, Register Bldg., Santa Ana, engaged to prepare plans for a $30,000 school.

Visalia, Cal.—Election to be held May 16 to vote $105,000 bonds for erecting grammar school and two primary schools.

Wasco, Cal.—Ernest J. Kump, Fresno, engaged to prepare plans for a brick and concrete school to cost about $30,000.

London, Ont.—Contract soon to be let for erecting technical school to cost $200,000. A. E. Nutter, Archt., Dominion Bank Building. A. E. Silverwood, Chmn. Board of Education.

BIDS DESIRED.

Portland, Me.—Until June 7 by James A. Wetmore, Acting Supervising Archt., Treas. Dept., Washington, D. C., for constructing steerage barracks and storehouse for U. S. Quarantine Station at Portland.

Longmeadow, Mass.—Until May 8 by Robert C. Munroe, Chmn. Bldg. Com., for erecting the Converse Street School. Separate bids for heating and plumbing, etc. B. C. and G. C. Gardener, Archts., Springfield.

Elmira, N. Y.—Until May 15, by Henry Melville, Pres. Bd. Mgrs., New York Reformatory, Napanoch, for furnishing, f.o.b. Elmira, for shop building No. 4, all structural steel and iron work, including stairs, also separate bids for all exterior and interior steel window frames and sash, all metal covered doors, frames and sash, both proposals advertised in Engineering Record. Lewis F. Pilcher, State Archt., Albany.

Freehold, N. J.—Until May 19, by Board of Freeholders, for enlarging the court house at a cost of $50,000.

Allentown, Pa.—Until May 13, by Clinton E. T. Henninger, President School Board, for erecting school building on annex to Kratzer School. Charles W. Gossart, Architect, Sixth and Hamilton Streets, Allentown.

Polk, Pa.—Reported desired until May 10 by J. M. Murdock, Supt. State Schools for Feeble-Minded, for erecting one-story, 42 x 32 ft., 2 wings, 22 x 44 ft. hospital for said institution. Probable cost $40,000.

Washington, D. C.—Until May 29 by Department of Interior, Office of Indian Affairs (Cato Sells, Comr.) for erecting stone employees' mess building, two stone cottages and gas house, additions to stone school and boiler house building and remodeling old mess building at Western Navajo School, Ariz.

Washington, D. C.—Until May 25, by E. P. Bertholf, Capt. Comdt. U. S. Coast Guard, Washington, D. C., for constructing a coast guard station and accessories at Point Betsie, Mich., advertised in Engineering Record.

Glenville, W. Va.—Until May 23 by County Court (N. E. Rymer, Clk.) for furnishing material and erecting a courthouse, jail and sheriff's residence. Separate bids for heating, plumbing, etc. Holmboe & Lafferty, Archts., Clarksburg.

Waynesville, N. C.—Until June 8 by James A. Wetmore, Acting Supervising Archt., Treas. Dept., Washington, D. C., for erecting U. S. Post Office at Waynesville.

Jacksonville, Fla.—Reported desired until May 13, by Board Public Instructions, at office of J. Hathaway, County Supt., 415 Masonic Temple Bldg., for erecting eight-room brick school at Twenty-first and Walnut Streets. Separate bids for heating, plumbing, etc. Rutledge Holmes, Architect, Duval Building.

Marysville, Tenn.—Until June 8 by James A. Wetmore, Acting Supervising Archt., Treas. Dept., Washington, D. C., for erecting post office at Marysville.

Cincinnati, Ohio.—Bids will be received until May 22 by Board of Education for remodeling the Whittier School.

Columbus, Ohio.—Reported desired until May 9, by George A. Borden, Director Public Service, for erecting one-story and basement, 168 x 158-ft. shelter house, at Shiller Park. Probable cost $40,000. Bassett & Tresselt, 10 East Town Street, Architects.

Galloway, Ohio.—Reported desired until May 19 by Karl F. Huf, Clk. Board Education, R. F. D. No. 1, Prairie Township, Galloway, for erecting 2-story and basement, 58 x 39 ft., centralized school. W. H. Tremaine, Archt., Chamber of Commerce Building, Columbus.

Kent, Ohio.—Until May 20 (change of date), by Board Trus. Kent State Normal School (John A. McDowell, Secy.), for erecting women's dormitory for said school, fireproof and cost $120,000. Wilbur T. Mills Company, Archts., Columbus, Ohio.

Newport, Ohio.—Reported desired until May 12 by Board Education (R. Kirkbride, Clk.), for erecting high school. Harry C. Meyer, Archt., Zanesville.

Reynoldsville, Ohio. — Reported desired until May 20 by C. G. Smith for erecting school on East Broadway. J. A. Jones, Archt., Dispatch Building, Columbus.

Reading, Ohio.—Until May 22 by George W. Fricke, Clk. Board Education, for erecting school. Garber & Woodward, Archts., Union Central Building, Cincinnati, and 420 Benson Street, Reading.

Kokomo, Ind.—Reported desired until May 9, by B. T. Ellis, Trus. Union Township, for erecting two-story and basement brick school. Elmer E. Dunlap Co., Architects, State Life Building, Indianapolis.

Tiosa, Ind.—Reported desired until May 12, by William Foster, Trustee Richland Township, for erecting two-story and basement high and grade school. Griffith & Goodrich, Architects, Fort Wayne.

East Lansing, Mich.—Until May 16, by Edwyn A. Bowd, Architect, Lansing, for furnishing material and erecting high school. Separate bids for heating, plumbing, etc.

Wexford, Mich.—Until May 20, by Board Education (Albert Guerbsey, Secy.), for furnishing material and erecting an eight-room school. Separate bids for heating, plumbing, etc.

Joliet, Ill.—Reported desired until May 15 by J. F. Skeels, Clk. Board School Inspectors, Public Library Bldg., for erecting 2-story and basement 12-room school. Probable cost $75,000. John D. Chubb, Archt., 109 N. Dearborn Street, Chicago.

Urbana, Ill.—Until May 29, by James B. Dibelka, State Architect, 130 North Fifth Avenue, Chicago, for furnishing material and erecting Women's Residence Hall at University of Illinois. Separate bids for heating, plumbing, electric wiring, etc.

Sauk City, Wis.—Until May 11 by Board Education for erecting school. Separate bids for heating, plumbing, etc. Alfred C. Clas, Archt., 201-206 Colby Abbott Building, Milwaukee.

Swea City, Iowa.—Until May 15, by H. N. Kruse, Secy. Board Education, for erecting two-story and basement new consolidated school; also for repairing old school. Probable cost $55,000. Edwins & Edwins, Architects, 911 Northwester Building, Minneapolis, Minn.

Minneapolis, Minn.—Until May 15, by Board of Education (George F. Womrath, Bus. Supt.), for erecting Hiawatha School. R. V. L. Haxby, Architect, Board Education; Rose & Harris, Engineers, 470 Auditorium Building.

Wabasha, Minn.—Reported desired until May 10 by John Boss, Co. Aud., for erecting two-story and basement, 40 x 120 ft., jail and sheriff residence. Probable cost $30,000. Hoffman & Moose, Archts., 17 W. College Avenue, Rochester.

Garrison, N. D.—Reported desired until May 16, for erecting school. Ashlemen & Gage, Architects, Fargo.

Jamestown, N. D.—Until May 8 by John Bensch, Secy. of Board Education, for erecting two-story and basement school for First Ward; also complete the two-story and basement addition to North Side school. Gilbert R. Horton, Archt., Citizens' National Bank Bldg.

Millarton, N. D.—Until May 26 by William Long, Pres. Seventh School Dist. No. 56, for erecting two-story and basement brick school. Gilbert R. Horton, Archt., Citizens' National Bank Bldg.

Bowman, S. D.—Until May 27 (readvertisement) by School Board (J. M. Folson, Clk.) for erecting a school.

Roslyn, S. D.—Until May 20 by Board Education (O. O. Floren, Clk.) for erecting two-story brick school. Carlson & Hasslen, Archts., Ortonville.

Nevada, Mo.—Reported desired until May 18 by Library Board (O. T. Vedder, Secy.) for erecting library. Separate bids for heating, plumbing, etc. A. T. Simmans, Archt., Bloomington.

Belton, Tex.—Until June 5 by James A. Wetmore, Acting Supervising Archt., Treas. Dept., Washington, D. C., for erecting post office at Belton.

Tahoka, Tex.—Until May 22, by P. H. Northcross, Co. Clerk, for erecting four-story fireproof court house, advertised in Engineering Record.

Wichita Falls, Tex.—Until May 17, by County Commissioners, for erecting court house. Separate bids for heating, plumbing, etc. Sanguinet & Staats, Archts., Ft. Worth.

Downey, Cal.—Until May 23, by Board Trustees of Downey School District (Joseph Smith, Clk.), for erecting one-story and basement, 10-room tile and concrete school, 186 x 145 ft. John C. Austin, Archt., 1125 Baker Detweiler Bldg., Los Angeles.

Los Angeles, Cal.—Until May 15 by Board of Supervisors for erecting a brick and concrete 2-story wing and one-story wing to psychopathic ward, and also an extension to dining-room at County Farm, George Low, County Architect.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Boston, Mass.**—Contract for erecting annex to Public Library on Blagden Street awarded to George B. Long Co., of Worcester, at $125,000.

★**Springfield, Mass.**—Contract for erecting cattle building and horse show building for Eastern States Exposition at West Springfield awarded to L. S. Wood of Springfield at $98,145.

★**Stoughton, Mass.**—Contract for erecting school awarded by School Bd. to J. H. Kelley, of Madison, at $26,400.

Worcester, Mass.—All bids opened April 25 by city for erecting police station were in excess of the $150,000 available; bidders asked to refigure. John W. Odlin, Secy. to Mayor.

★**New Haven, Conn.**—Contract for interior finish in U. S. Post Office (except mechanical equipment and elevators and the completion of approaches) awarded John H. Parker Company, 315 Fourth Avenue, New York, N. Y., at $365,985, and for mechanical equipment (except elevators) to S. Faith & Company, Philadelphia, Pa., at $84,903.

Howard, R. I.—Following are bids opened April 27 by Board of Control, Providence, for constructing (a) three-story brick ward building for Hospital for Insane at Howard and for reconstructing two existing buildings, and (b) a 3-story ward building alone: Charles B. Maguire Company, Turks Head Building, Providence (a) $172,769, (b) $110,798; Wilmarth Mackillop Company, of Pawtucket (a) $179,914, (b) $117,851; Hope Building Company, 87 Weybosset Street, Providence (a) $181,393, (b) $110,027; Horton & Hemenway, 683 Atlantic Avenue, Boston, Mass. (a) $183,171, (b) $113,631; lowest for plumbing from E. J. Sullivan, of Providence, $19,680.

★**Syracuse, N. Y.**—Contracts for masonry and carpentry work for Joseph Slocum Agricultural College awarded to Dawson Bros., at $115,000, and to Maurice F. Lane, 274 Cortland Avenue, at $47,995, respectively.

Newark, N. J.—Following are lowest bids opened April 26 by Committee on Buildings, Grounds and Supplies of Board of Education for erecting addition to John Catlin School in Ann Street: Carpenter and mason work, Wm. G. Sharwell & Co., 377 North Fifth Street, $89,771; steel work, Hedden Iron Constr. Co. of Newark, $18,167; heating, Jas. F. Kelly, $21,987, and plumbing, R. B. Schmidt, 390 Walnut Street, $7,432.

★**Pittsburgh, Pa.**—Contract for furnishing structural steel for George Westinghouse School in Homewood awarded to American Bridge Co., Frick Bldg., at about $120,550.

★**Uniontown, Pa.**—Georges Township School Bd. awarded contract for erecting Township High School to John C. Gibson and J. C. Knapp, at $79,836. Harry W. Altman, Archt., 306 First National Bank Bldg.

★**Middlebourne, W. Va.**—Contract for erecting county infirmary building awarded Johnson & Jemison, Middlebourne, at $27,225. J. E. Smith, Clerk County Court.

★**Mansfield, La.**—Contract for erecting school awarded by School Board to Corbin Bros. of Mansfield at $46,295.

New Orleans, La.—Following are four lowest bids opened April 25 by Commission Council of the city for erecting Algiers School: John O. Chisholm, New Orleans, La., $41,680; J. W. Lennox, Algiers, $41,750; J. A. Petty, New Orleans, $42,785; G. E. & E. E. Reimann, New Orleans, $43,511.

Humboldt, Tenn.—Following are four lowest bids opened April 21 by Supervising Architect, Washington, D. C., for constructing U. S. Post Office: Algernon Blair, Montgomery, Ala., $41,923; Frank L. Johnson & Company, Duluth, Minn., $42,670; R. P. Farnsworth & Company, New Albany, Ind., $43,400; G. W. Stiles Construction Company, Rookery Building, Chicago, Ill., $44,500.

★**Knoxville, Tenn.**—Contracts for erecting South Knoxville, Lincoln Park and Powell's Station Schools awarded by Knox County Bd. of Education to A. Cox of Knoxville, at $38,063. Each building to be two-story brick.

Athens, Ohio.—Following are two bids opened April 21 by Bd. County Commissioners for erecting Children's Home: Lowell Planing & Mill Co. of Lowell, $33,704, and Cullen Vaughn Co. of Hamilton, $34,837. Ritter & Bates, Architects, Portsmouth.

★**Leavittsburg, Ohio.**—Contract for erecting Warren Township School awarded to Kratt & Agnew, of Lorain, at about $26,000.

★**Parral, Ohio.**—Contracts awarded for erecting Dover Township School; general contract to J. Gutensohn, of Urichsville, $21,000; plumbing to Cramer & Weber, of Dover; heating and ventilating to Columbus Heating & Ventilating Co., of Columbus, building to cost $28,000.

★**Delphi, Ind.**—Contract for erecting main building of Carroll County Court House awarded to A. E. Kimmer, of Lafayette, at $147,500; heating and plumbing contract to Hipskind Heating & Plumbing Co., of Wabash, at $14,565.

★**New Salem, Ind.**—Contract for erecting school (bids opened April 22) awarded H. G. Mitchell, Scottsburg, Ind., at $20,478, and for heating, ventilating and plumbing to Beale Bros., at $6,141. E. R. Titsworth, Trustee Noble Township.

★**East Lansing, Mich.**—Contracts for erecting buildings for Michigan Agricultural College awarded as follows: Engineering building to Fred Trier of Saginaw, at $121,422, and for three shops to Byers Bros. Constr. Co. of Kalamazoo, at $45,252.

★**Warren, Ill.**—Contract for erecting school awarded to Winchester & Stuart of Rockford, at $39,526.

★**Fort Dodge, Iowa.**—Contract for erecting Webster County Home awarded by Bd. Supervisors to Jensen Constr. Co. of Fort Dodge, at $44,598.

★**Sheldon, Iowa.**—Contract for erecting high and grade school (bids opened April 14) awarded Ingemann & Company, St. Paul, Minn.

★**West Liberty, Iowa.** — Contract for erecting high school awarded by School Bd. (bids opened April 17) to Western Constr. Co. of Iowa City at $61,400. Proudfoot, Bird & Rawson, Archts., Des Moines.

★**Oakland, Neb.**—Contract for erecting 3-story high school (bids opened April 18 by Bd. of Education), awarded to Trenton Building Co. of Lincoln, at $49,987. E. F. Nelson and Terch Electric Co., both of Oakland, received plumbing and electric wiring contracts. Berlinghof & Davis, Archts., 610 Security Mutual Life Bldg., Lincoln.

★**Madison, S. D.**—Contract for erecting training school on campus of State Normal School (bids opened April 25) awarded Sioux Falls Construction Company, Sioux Falls, at $48,820. Irwin Daldrich, Secy, Regents of Education.

★**Osnabrock, N. D.**—Contract for erecting school (bids opened April 12) awarded Northern Construction Company, Grand Forks, for general construction at $19,575, and for heating and plumbing to Dakota Heating & Plumbing Company, Grand Forks, at $4,189. H. G. Lykken, Archt., Grand Forks.

★**Bryan, Texas.**—Contract for erecting animal husbandry building for Agricultural & Mechanical College awarded McKenzie Construction Company, San Antonio, at $40,000.

★**Denton, Tex.**—Contract for erecting Brackenridge Hall, a dormitory at College of Industrial Arts, awarded by Building Committee, Bd. of Regents, at Dallas, as follows: General construction, Watson Co. of Dallas, $98,089; installing heating apparatus, Kinnison Bros. of Dallas, about $5,000; plumbing, Montreif & Manchester Co. of Fort Worth, $6,194, and for electrical work to John L. Martin of Austin, at $2,290. E. E. McAnally of Dallas, Archt.

★**Seattle, Wash.**—Additional contracts in connection with addition to B. F. Day School (bids opened April 7) awarded as follows: Heating, Musgrave & Blake, 936 Henry Building, $18,766, and plumbing, Rautmann Plumbing & Heating Company, 118 Knight Street, $8,639; Dow & Ryden, Mehlbourne Building, has general contract. C. P. Middleton, Asst. Secy. Seattle School Dist. No. 1.

★**Portland, Ore.**—Contract for erecting Franklin High School (bids opened April 6) awarded Muir & McClelland, Portland, at $84,776.

Roseburg, Ore.—Following are four lowest bids opened April 24 by Supervising Architect, Washington, D. C., for constructing U. S. Post Office (a) limestone, (b) sandstone: Stebinger Bros., Portland (a) $84,045, (b) $83,745; Harding F. Allan, Seattle, Wash., $84,500; Sound Construction & Engineering Company, Seattle, Wash. (a) $84,228, (b) (three bids) $83,800, $87,300 and $84,800; Olson & Johnson, Missoula, Mont. (b) $84,445; Welch Bros. & Hanneman, Oakland, Cal. (a) and (b) $84,679.

Los Angeles, Cal.—Following are four lowest bids opened April 21 by Library Board for erecting a one-story and basement brick branch library at Santa Monica Boulevard and Madison Avenue: F. O. Engstrum Company, Fifth and Seaton Streets, $27,380; C. Karseboom, 1445 Dana Street, $27,625; B. D. Kronnick, 3901 South Hill Street, $28,343; Kling Company, 421 Union League Building, $28,820. C. H. Russell, Archt., 1106 Story Building.

Cordova, Alaska.—Following are four bids opened April 22 by Bureau of Yards & Docks, Navy Dept., Washington, D. C., for work complete for constructing two 300-ft. steel towers at U. S. Naval Radio Station, Cordova: Grant Fee, 2440 Sixteenth Street, San Francisco, Cal., $35,500; W. B. Concanon, 525 Market Street, San Francisco, Cal., $40,572; Henry Monk, Pensacola, Fla., $54,224; and McCrae & Layaz, 1275 Sacramento Street, San Francisco, Cal., $40,888.

★**Cote des Neiges, Que.**—Contract for erecting a $200,000 school awarded by School Commissioners as follows: Steel work, Phoenix Bridge & Iron Co. of Montreal; heating and ventilating, T. Lessard & Son, Montreal; tile and marble work, Smith Marble & Constr. Co. of Montreal. G. A. Monette, Power Building, Montreal, Archts.

★**Toronto, Ont.**—Contract for erecting barn at Men's Industrial Farm awarded by Board of Control to James A. Wickett, Ltd., care of Board Control, $25,723.

PRIVATE BUILDINGS

PROPOSED WORK.

Augusta, Me.—Victory & Hill Publishing Company, Augusta, reported considering erecting new building this summer.

Gloucester, Mass.—Plans prepared by Martin & Freethy, 141 Milk Street, Boston, for erection of a 2-story concrete building on Commercial Street for Cunningham & Thompson Co.

West Lynn, Mass.—Plans of Earp & Son approved for erection of brick and concrete theater building to be erected at Holland and Western Avenues at a cost of $35,000. Joseph Scholnick said to be interested.

Worcester, Mass.—Denholm & McKay Company Department Store plans erecting a 5-story annex costing $100,000. Frost & Chamberlain, State Building.

Cram & Ferguson, 33 West Forty-second Street, New York, N. Y., are architects for the parish house which is to be erected for All Saints Parish at a cost of $50,000.

Brooklyn, N. Y.—Plans filed for erecting a 6-story apartment house at Hope and Havemeyer Streets for Ross Land Co., cost $45,000. Shampan & Shampan, Archts., 772 Broadway.

Lockport, N. Y.—Robert North of Buffalo has been engaged to prepare plans for East Avenue Congregational Church, to cost about $30,000. Rev. George A Brock, Pastor.

New York, N. Y.—Plans filed for erecting following buildings: Three 6-story brick apartments at 244 West Fifteenth Street, for Charles Rubinger, cost $150,000, Rouse & Goldstone, Archts., 38 West Thirty-second Street; four 5-story brick tenement at Vermilyea Avenue and Academy Street, for Marva Realty Cor., cost $175,000, Irving Margon, 370 East 149th Street, Archt.; 5-story fireproof residence at 13 E. Ninety-first Street, for Charles M. MacNeill, cost $340,000, Frederick Sterner, Archt., 154 East Sixty-third Street; 11-story store and office building at 19 East Forty-fifth Street, for Henry Phipps Estate, cost $500,000, Starrett & Van Vleck, Archts., 8 West Fortieth Street; 6-story brick store and loft building at Fifth Avenue and Thirty-seventh Street, for United States Realty & Improvement Co., cost $60,000, George A. & Henry Boehm & Starrett & Van Vleck, Archts, 8 West Fortieth Street; 12-story fireproof stores, offices and lofts at 109 West Sixty-fourth Street, for Mary E. Pinchot Estate, cost $500,000, Walter Haefeli, 245 West Fifty-fifth Street, Archt.; 2-story fireproof theater, stores and office building at 223 West 125th Street, for 233 West 125th Street Co., cost $250,000, Thomas W. Lamb, 644 Eighth Avenue, Archt.; 16-story fireproof office building at Broadway and Twenty-first Street, for Ritz Realty Cor., cost $300,000, Schwartz & Gross, Archts., 347 Fifth Avenue; 8-story fireproof apartment house at 127 East Sixty-sixth Street, for Chapin Home for Aged, cost $275,000, Walter B. Chambers, Archt., 109 Broad Street, Co-operative Bldg. Constr. Co., 7 East Forty-second Street, Builders; two 5-story brick tenements at 180th Street and Monterey Avenue, for Benenson Realty Co., cost $105,000, Wm. E. Erb, Archt., 401 East 152d Street; two 5-story brick tenements at 183d Street and Tiebout Avenue, for Grand Terrace Constr. Co., cost $100,000, Moore & Landsiedel, Third Avenue and 148th Street, Archts; two 5-story brick tenements at Home St. and Vyse Avenue, for Galveston Bldg. Co., cost $100,000, Kreymborg Architectural Co., 1029 East 163d Street, Archts.; two 5-story brick tenements at Grand Concourse and 192d Street, for 173d Street Realty Co., cost $120,000, Kreymborg Architectural Co., 1029 East 163d Street, Archts.

New York, N. Y.—Plans prepared by Frederick Sterner, 154 East Sixty-third Street, for a residence to be erected at Ninety-first Street and Madison Avenue for Charles H. MacNeill.

A site has been purchased at 181st Street and Broadway for erection of a theater for B. S. Moss.

Rochester, N. Y.—Plans being prepared by Gordon & Madden, 300 Sibley Block, with John Vickery as associate architect, for remodeling Sunday-school building of Central Presbyterian Church; cost, about $80,000.

Camden, N. J.—Broadway Realty Co. will erect a theater at Broadway and Carman Streets; cost, $100,000. Address Thos. G. Coulter, Wm. P. Hollinger and Newton B. T. Roney.

Newark, N. J.—Plans filed for erection of 10-story brick loft building to be erected at 309 Plane Street for Roth & Co.; cost, $50,000.

Altoona, Pa.—Charles W. Albright, of Albright Bros., Altoona, is reported interested in a company which intends erecting a 2-story fireproof bank building at 1108 Twelfth Avenue.

Carbondale, Pa.—Congregation of First Presbyterian Church (Rev. Charles Lee, Pastor) is to erect an edifice to cost about $75,000.

Hanover, Pa.—Plans being prepared by I. M. Meyers of Hanover for erection of an edifice for Congregation of U. B. Church.

Harrisburg, Pa.—Contract about to be let for erecting a five-story apartment house at 713 North Second Street for J. Hervey Patton, at cost of about $45,000. M. I. Kast, 222 Market St., Archt.

Reading, Pa. — Schuylkill Seminary plans erecting a $50,000 building.

Scranton, Pa.—A 2-story addition costing $30,000 is to be erected at the Michael Bosak Building. E. H. Davis, Archt., Union Bank Building.

Sellersville, Pa.—The Artman Home for Poor Lutherans will be erected on a 113-acre site recently purchased on Branch Creek; cost of improvement, $100,000.

Williamsport, Pa.—St. John's Lutheran Church planning a $35,000 church to be erected at Grier Street and Erie Avenue. F. A. Rianhard, Archt., Williamsport; Rev. William F. Rentz, Chmn. Building Committee.

Hagerstown, Md.—Erection of a Railroad Y. M. C. A. at Washington and Walnut Streets is contemplated, at cost of $35,000. Address E. W. Babcock, Secy.

Salisbury, Md.—Bethesda Methodists contemplate erecting a $60,000 church.

Mullens, W. Va.—Plans prepared by G. R. Ragan of Roanoke, Va., for erecting a stone and brick bank and hotel building for Bank of Wyoming County (J. C. Sullivan, Pres.); cost $30,000.

Charlotte, N. C.—Plans prepared for erection of a passenger station at Charlotte for Norfolk Southern R. R. Co. (T. L. Nicholson, Ch. Engr., Norfolk, Va.); cost, about $40,000.

Columbia, Tenn.—First Presbyterian Church will erect a $30,000 edifice.

Nashville, Tenn.—Fourth National Bank will erect a $250,000 building.

Canton, Ohio.—Plans being prepared by Wheeling & Lake Erie R. R. Co. (W. L. Rohbock, Ch. Engr., Leader-News Building, Cleveland) for a 3-story, 360 x 40-ft. concrete freight house and a 2-story, 25 x 125-ft. office building; cost, about $200,000.

Cleveland, Ohio.—George S. King, Permanent Building, is architect for the 3-story apartment house to be erected on Murray Hill and Edgehill Roads by Piscope Bros.

John R. Criley, Wooster, will erect a $35,000 house on Edgehill Road, Cleveland Heights.

Reported Eureka Lodge of Masons will erect a $50,000 temple at 2326 East Fifty-fifth Street.

F. F. Bookstop, 136 Shore Line, is architect for a store and apartment house to be erected at Cedar Avenue and East Ninetieth Street for Samuel Gurse.

Joseph Tanno purchased a site at Fairchild Avenue and Stearns Road for erection of an apartment house, to cost about $50,000.

Dayton, Ohio.—Erection of a music hall or fine arts building being considered; probable cost, $250,000. Address Mrs. H. E. Talbot, Dayton Civic Music League.

Ravenna, Ohio.—Erection of a Masonic Temple in Ravenna is contemplated; cost, about $40,000. Address E. O. Trescott, Tyrian Chapter No. 89, R. A. M.

Ft. Wayne, Ind.—The Blue Lodge of Masons reported considering erecting a building to cost about $200,000.

New Albany, Ind.—Erection of a Masonic Home at East Eleventh and Market Streets is contemplated, at a cost of about $50,000. William E. Coolman of New Albany Lodge is said to be interested.

Cadillac, Mich.—Congregation of First Methodist Church considering erecting an edifice to cost about $50,000. M. M. Callen, Pastor.

Detroit, Mich.—A seven-story business building is to be erected at Lafayette Boulevard and Shelby Streets by Sweeney-Huston Co.; cost, about $300,000.

Detroit, Mich.—Plans are being prepared by Smith, Hinchman & Grylls, Washington Arcade, for a 9-story steel and terra cotta building to be erected at Woodward Avenue and State Street for S. S. Kresge Co.

Plans prepared by Van Leyen & Schilling for erection of 25-story apartment hotel of steel and concrete construction, to be erected on Woodward Avenue, in Highland Park, at a cost of about $2,000,000. Fred A. Sollman of Detroit said to be interested.

Menominee, Mich.—A motion picture theater is to be erected in Menominee at a cost of about $25,000. Mr. Campbell, manager of Grand Theater, said to be interested.

Chicago, Ill.—The Englewood Lodge, A. F. & A. M., 6730 Wentworth Avenue, contemplates erecting a three-story temple in Englewood, at cost of $100,000.

Plans being prepared by E. M. Newman, 30 North La Salle Street, for erecting a three-story temple for Northern Masonic Temple Asso., 4547 Evanston Avenue, at Magnolia and Lafayette Avenues; cost, about $75,000.

A store and apartment building is to be erected on a site 150 x 178 ft. on Sheridan Road and Boulevard for Chas. H. Kusel of Kusel & Harris, at a cost of about $280,000.

Fond du Lac, Wis.—A $70,000 passenger station is to be erected in Fond du Lac by the Chicago & Northwestern R. R. Co. (W. H. Finley, Ch. Engr., Chicago, Ill.).

Kenosha, Wis.—A 6-story lodge building is to be erected in Kenosha for Elks at cost of about $125,000.

Milwaukee, Wis.—A two-story brick, 30 x 180-ft. brick bank building is to be erected at Mitchell Street and Sixth Avenue for Mitchell Street State Bank; cost, $80,000. John T. Johnson, Pres.

A four-story brick and concrete apartment building is to be erected at Martin and Astor Streets for Builders' Investment Co., at a cost of about $150,000. Martin Tullgren & Sons, Archts., 133 Second Street.

Des Moines, Iowa.—Congregation of Grace Methodist Church is considering spending about $40,000 for building or remodeling church auditorium. J. W. Long, member of Building Committee.

Sioux City, Iowa.—Plans being prepared by W. L. Steele, United Bank Building, for a brick and terra cotta edifice to be erected at Thirteenth and Nebraska Streets for First Congregational Church.

Plans being prepared by F. E. Colby & Son, Davidson Building, for a 2-story brick commercial building to be erected on Pierce Street for the Tyson Interests of Chicago, Ill.; cost about $50,000.

Sioux City, Iowa.—Construction of double-deck stockyards covering 147,000 sq. ft. contemplated by Sioux City Stock Yards Co., at a cost of $250,000.

Minneapolis, Minn.—J. A. Toms, 1720 Clinton Avenue, will erect a 3-story brick apartment house at 300 East Fifteenth Street to cost $40,000.

St. Paul, Minn.—Joseph and Charles Friedman contemplate erecting a 30-apartment brick hotel in St. Anthony Hill Dist.; cost, about $125,000.

Erection of a two-story building at Randolph Street and Snelling Avenue is contemplated for St. Paul Academy; cost, about $55,000.

St. Louis, Mo.—An addition of 200 rooms to Washington Hotel at King's Highway and Washington Boulevard is contemplated; cost, about $300,000. Address Ben. G. Veith of Jefferson City.

El Paso, Tex.—Trost & Trost, Mills Building, completed plans for a warehouse, 4-story, to be erected for Krakauer, Zork & Moye on El Paso Street.

Taylor, Tex.—Contract will soon be let for remodeling Sturgis-Goldstein Co.'s store building; cost, about $30,000. C. H. Page & Bro. of Austin, Archts.

Colorado Springs, Colo.—The Atchison, Topeka & Santa Fe R. R. Co. (C. F. W. Felt, Ch. Engr., Chicago, Ill.), will erect a 3-story depot in Colorado Springs, cost about $155,000.

Denver, Col.—Plans completed by H. W. J. Edbrooke, Opera House Block, for a 3-story apartment house to be erected at Grove Street and West Fairview Avenue for J. H. Tilden, at a cost of $40,000.

Seattle, Wash.—The Goodwin Realty Co. will erect a 5-story, 97 x 78-ft. apartment house at Melrose and Howard Avenues and Olive Street; cost, $70,000.

The Great Northern Ry. Co. (A. H. Hogeland, Ch. Engr., St. Paul, Minn.) is preparing plans for erection of a 100 x 100-ft. warehouse to be erected at Railroad Avenue North and Garfield Street; cost, about $50,000.

Plans to be prepared by Charles Haynes, Mehlhorn Building, for a 2-story concrete public market to be erected at Westlake and Sixth Avenues and Virginia Street, cost $60,000, for General Market Co. (Thos. Boyd, Mgr.).

Los Angeles, Cal.—Work is about to begin on erection of two buildings at Central Avenue and Seventh Street for Wholesale Terminal Co., to be 2 and 6-story concrete, 1100 ft. long. A third building will be erected later; cost of proposed improvement about $6,500,000. Address Isidore Dockweiler, Secy.

San Francisco, Cal.—A 12-story office building is to be erected at Second and Market Streets. Contract for steel work awarded to Dyer Bros., Seventeenth and Kansas Streets, San Francisco. For further information address John S. Drum, Pres. Savings Union Bank and Trust Co.

Seal Beach, Cal.—White City Amusement Company, Seal Beach, will erect amusement resort units, including dancing pavilion, chute the chute; cost, about $150,000.

London, Ont.—J. C. Duffield City Gas Co. of London has purchased a site for a moving picture theater; cost $150,000.

London, Ont.—John Hayman & Sons, 432 Wellington Street, preparing plans for a 4-story brick apartment house to cost $50,000.

Public Utilities Commission has authorized E. V. Buchanan, Gen. Mgr., and Philip Pocock, Chairman, as a committee to secure an architect to prepare plans for a hydroelectric sales building with offices above, to cost $75,000.

Toronto, Ont.—Plans prepared for a steel and concrete warehouse to be erected at a cost of $500,000 for T. Eaton Co. of Toronto. Address George W. Thompson, Louisa Street, Toronto, Engr.

Toronto, Ont.—H. P. Knowles, 52 Vanderbilt Avenue, New York, N. Y., has plans for a Masonic Temple to cost $175,000.

BIDS DESIRED.

Reading, Pa.—Until May 9 (extension of date from May 5) by J. E. Hickman, Architect, 119 South Fifth Street, Reading, for erecting Mission Building at Second and Court Streets.

Sayre, Pa.—Reported desired until May 10 by Rev. F. D. Cornell, Pastor First Methodist Church, for erecting one-story and basement church and Sunday school building. Probable cost $30,000. Fulton & Butler, Archts., 51 West Main Street, Uniontown.

Jasper, Ala.—Until May 22 by Building Committee Methodist Episcopal Congregation (L. B. Musgrove, Chmn.) for erecting edifice for said congregation. Joy & Gallup, Archts. and Engrs., Inc., Jefferson County Bank Building, Birmingham.

Sheffield, Iowa.—Until May 18 for erecting fireproof garage for J. P. McCammant. J. H. Jeffers, Archt., Mason City.

Topeka, Kan.—Reported desired until May 15 by Rev. M. J. O'Leary, Pastor Holy Name Congregation, for erecting 2-story brick church, 65 x 84 ft. Probable cost $30,000.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Hartford, Conn.**—Contract for erecting apartment house, brick construction, at Windsor Avenue and Kennedy Street awarded G. Gudemo, Hartford; cost, $75,000. Danl. A. Guerriro, Archt., Hartford. Joseph Bonee, 74 Windsor Avenue, Owner.

★**Albany, N. Y.** — Contract awarded Charles P. Boland Co., Douw Building, Albany, for erecting addition to Delaware & Hudson Co. office building and new building of Albany Journal Co. on the Plaza at foot of State Street. Marcus T. Reynolds, 100 State Street, Archt.

★**Brooklyn, N. Y.**—Contract for erecting a parochial school at H and Fourth Streets for St. Thomas Aquinas Church awarded to P. J. Brennan & Son, 624 Madison Avenue, New York City, at about $175,000. J. Haimle and Corbett, Archts.

★**Scranton, Pa.**—Contracts awarded by Department of Public Works for paving streets as follows (price given per sq. yd.): To Sweeney Bros., Scranton, at $1.76 for Monsey Avenue, $1.78 for South Washington Avenue, $1.89 for Oakford Court; to Gaynor Contracting Co., Board Trade Building, at $2.53 for Poplar Street and Clay Avenue, $2.48 for Olive Street, $1.82 for Moosic Street; to Mathias Stipp, 435 Moir Court, at $1.93 for Ash Street.

★**Scranton, Pa.**—Contract awarded Ludwig T. Stipp, Scranton, for erecting Ford Service Building. Cost, $50,000. Most of sub-contracts awarded.

★**Camden, N. J.**—Contract for erecting addition to Public Service Commercial building in Federal Street awarded to J. F. Rogers of Moorestown at about $28,000.

★**Hackensack, N. J.**—Contract for erecting a 3-story 40 x 104-ft. brick and terra cotta Public Service Commercial building at Main and Salem Streets awarded to Ferber Constr. Co. of Hackensack at about $50,000.

★**Williamsport, Pa.**—Contract for erecting edifice for St. John's Lutheran Congregation awarded James V. Bennett Co. at about $35,000. Rev. William F. Rentz, Pastor.

★**Augusta, Ga.**—Contract for erecting 3-story brick apartment, 128 x 87 ft., at Greene and Tenth Streets, for United Apartment Co., awarded to Gude & Co. of Atlanta at $60,000.

★**Cincinnati, Ohio.**—The L. B. Harrison Hotel Company has awarded contract to erect gymnasium annex to Ohio Building & Construction Co., Cincinnati, Ohio.

★**Cleveland, Ohio.** — Contract awarded Mettler Gloyd Company, 753 Hippodrome Building, for erecting a 4-story Masonic Temple at 8910 Miles Park Avenue for Newburg Heights Masonic Temple Assoc. Cost, $65,000. William J. Carter, Illuminating Building, Archt.

★**Ravenna, Ohio.**—Contract for erecting edifice for Congregation of Ravenna Church of Christ awarded to P. L. Frank Constr. Co. and Loomis & Seymour Const. Co., both of Ravenna, at $35,587.

★**Mason City, Iowa.**—Contract awarded George Hoffman, Rochester, for erecting 8-story fireproof hotel, to cost $130,000.

★**Canby, Minn.**—Contract for erecting Bank of Canby building awarded A. Moorman & Company, 501 Minnesota Street,, St. Paul (bids opened April 24).

★**Wichita, Kan.**—Contract (bids opened April 17) for erecting a 4-story brick store and apartment building at Lafayette and Harding Streets for Caesar Wackell awarded to Eli Belisle at $29,000.

★**Terry, Mont.**—Contract for erecting State Bank for Terry awarded to Christianson & Frederickson of Terry, at $50,000.

★**Albuquerque, N. M.**—Contract for erecting building for Gross, Kelly & Co. on present site awarded to Ubank & Ditrell of El Paso, Tex., at about $50,000.

★**Los Angeles, Cal.**—Contract for erecting 5-story reinforced concrete garage and service building, 100 x 156 ft., at Eleventh and Hope Streets for M. H. Newmark awarded Leonardt & Peck, H. W. Hellman Building at about $105,000. Morgan, Walls & Morgan, Archts., 1136 Van Nuys Building.

Los Angeles, Cal.—Contract for excavation, concrete work, partitions and plastering for part four and part seven-story reinforced concrete apartment house, 50 x 141 ft., to be eected on Clay and Third Streets for C. F. Borton, Hibernian Building, awarded J. M. Connors, 513 Stimson Building, at $35,000. W. J. Sanders, Archt., 319 Laughlin Building.

San Francisco, Cal.—See "Private Proposed."

★**Ogden, Utah.**—Contract for erecting a a club house for Ogden Aerie No. 118, Fraternal Order of Eagles, awarded to Charles J. Humphries of Ogden, at about $40,000.

★**Ottawa, Ont.**—Contract for erecting brick and concrete power house for Imperial Realty Co. of Salter Street awarded John Sutherlsnd, 216 Cooper Street, Ottawa; cost $35,000.

NEW INDUSTRIAL PLANTS

PROPOSED WORK.

South Brewer, Me.—Eastern Manufacturing Company, Bangor, reported intends erecting an extension to plant at South Brewer costing $100,000. A new chemical plant is also contemplated.

Berlin, N. H.—International Paper Company is considering erecting a paper mill to cost $1,500,000.

Fall River, Mass.—Plans being prepared for erection of a 3-story concrete dye house for American Thread Co.; cost, $300,000.

Waterbury, Conn.—Birmingham Iron Foundry Company, Waterbury, will erect a factory, 50 ft., high-class and steel construction. The equipment will consist of five traveling cranes, electrically operated, from 7½ to 25 tons capacity, and sand blast and air compressor. Contract for steel work awarded Berlin Construction Company, of Berlin, and for steel sashes and glass to Fenestra Steel Sash Company of Detroit, Mich.

New York, N. Y.—Kloos Mfg. Co. incorporated with a capital of $80,000 to erect a building to manufacture boot and shoe trees. Among incirporators, J. R. Ferry, 20 West Twenty-second Street, and A. M. Sullivan, 100 Broadway.

Niagara Falls, N. Y.—The Union Automatic Air Brake Co. incorporated to manufacture air brakes, railway safety devices, etc. Capital $200,000. Among incorporators, F. A. Jones of Niagara Falls, and R. C. Palmer of Buffalo.

Ransomville, N. Y.—Plans completed by John G. Elendt of Rochester for erecting a chemical cold storage plant, to be two stories, 60 x 100 ft., brick and concrete construction; cost, $75,000. Address G. E. Hubble.

Elizabeth, N. J.—Samuel L. Moore & Sons, Front Street, planning to build a one story 60 x 140 ft. power house; cost $25,000. Ring, Cleaves & Graham Co., 280 N. Broad Street, Elizabeth, Archts.

Newark, N. J.—The Keystone Reduction Co., 61 Broadway, New York, N. Y., will erect a 40 x 750-ft. steel constructed building at Avenue P and Central R. R.

Chester, Pa.—Reported Chester Shipbuilding Co. will erect a plant on Delaware River, north of Chester. Wm. C. Sproul and J. Howard Pew, Pres. of Sun Co., said to be interested.

Philadelphia, Pa.—Plans being prepared by Ballinger & Perrot, Methodist Building, for a one-story steel, reinforced concrete and brick factory, 462 x 66 ft., for Newcraft Manufacturing Company, New Brunswick, N. J.

Punxsutawney, Pa. — Punxsutawney Iron & Steel Co. incorporated with a capital of $50,000 to erect a plant for manufacture of fabricated iron and steel. Among incorporators, D. M. McCormick and Thomas McMillan.

Reading, Pa.—Pennsylvania Optical Co. is to build a 4-story 229 x 93 ft. factory.

Sunbury, Pa.—The Susquehanna Silk Mill Co. considering erecting a 5-story steel and concrete building at Sunbury.

Richmond, Va.—The Worthington Pump & Machine Co. incorporated to manufacture pumps and machinery. Among incorporators, Gardiner F. Lloyd of New York, N. Y., and Thomas B. Gay of Richmond.

Charlotte, N. C.—J & D Tire & Rubber Co. of Charlotte (Herbert O. Smith, Pres.) incorporated to erect factory building for manufacture of automobile tires. Capital $500,000. One building to be two-story 80 x 200 ft. and another building one-story 100 x 100 ft.

Statesville, N. C.—The Buffalo-Shoals Clay Mfg. Co. of Statesville incorporated to erect a clay products plant on Catawba River. Among incorporators, E. R. Rankin and E. G. Gaither. Capital, $25,000.

Tampa, Fla.—Contract about to be let by Florida Packing & Provision Co. for erecting packing plant between Tampa and Port Tampa City. Main building is to be three-story 75 x 140 ft., of reinforced concrete and steel.

Birmingham, Ala.—Sloss-Sheffield Steel & Iron Company, Woodward Building, will erect a by-product plant in North Birmingham, consisting of over 100 ovens; also a benzol plant in connection with the by-product plant.

New Decatur, Ala.—The F. L. Matthews Compress Co. will erect a cotton compress at Washington and Market Streets, at cost of about $75,000. F. L. Matthews of Attalla interested.

Knoxville, Tenn.—The Tennessee Mills incorporated with a capital of $100,000 to erect a plant on Vine Avenue for manufacturing underwear. Among incorporators, C. L. Leonhardt and S. W. Duggan.

Cleveland, Ohio.—Gravity Carburetor Company, 1767 East Eighteenth Street, plans erecting a 2-story factory to cost $30,000 at Perkins Avenue and East Thirty-seventh Street.

Reported Grabler Manufacturing Company will erect a $25,000 addition to plant at 6565 Broadway.

Detroit, Mich.—General Motors Co. purchased a site of 34 acres on Holbrook Avenue in Detroit and Hamtramck for erection of a manufacturing plant for Cadillac Motor Co.

South St. Paul, Minn.—Armour & Co. of St. Paul will erect a packing plant in South St. Paul to cost from $1,500,000 to $2,000,000.

St. Paul, Minn.—Contract about to be let for erecting a 4-story, 130 x 45-ft. addition to plant of American Can Co. at Prior Avenue and Minnehaha Street; cost, $50,000.

St. Louis, Mo.—Reported the St. Louis, Iron Mountain & Southern Ry. Co. (E. A. Hadley, Ch. Engr., St. Louis) will erect a concrete grain elevator of 1,000,000-bu. capacity in Carondelet, at cost of about $250,000.

Pueblo, Colo.—Pueblo Milling & Elevator Co. incorporated to erect a mill and elevator in Pueblo. Capital $100,000. Among incorporators are J. K. Mullen of Denver, and R. G. Breckenridge of Monte Vista.

Spokane, Wash.—Carsten Packing Company plans erecting an addition to their plant.

Hanford, Cal.—Plans being prepared for a 3-story brick flour mill to be erected for Lacey Company (H. G. Lacey, Pres.).

Long Beach, Cal.—Reported American products Company (I. N. Naylor, President) intends erecting a kelp reduction plant here.

Los Angeles, Cal.—Contract will be let about May 15 by J. Schulz, Engineer, 305 Wright & Callender Building, for erecting a one-story brick and hollow tile factory, 200 x 200 ft., office building, 36 x 36 ft., loading platforms, etc., on Santa Fe Avenue, for Southern California Box Company, 1335 East Sixth Street.

St. John's, N. B.—Plans being prepared by A. D. Swan of Montreal, Que., for installation of machinery to facilitate rapid handling of steamers at all harbors in island for the Anglo Newfoundland Development Co. of St. John; estimated cost $40,000.

Kenogami, Que.—Price Bros., 56 St. Peter Street, Quebec, considering constructing extensions to lumber mills and installing new machinery to cost about $150,000.

Guelph, Ont.—White Sewing Machine Co. has purchased a site of 20 acres at Guelph, Ont., and intends erecting a factory to cost $250,000.

Hamilton, Ont.—Grasselli Chemical Co. is preparing plans for a brick addition to factory; cost $30,000.

Kingsville, Ont.—The Erie Tobacco Company is reported considering the rebuilding of the factory destroyed by fire recently.

London, Ont.—Ford Motor Co. of Canada (W. Smith of London, Mgr.) will erect an addition to plant, to cost $50,000.

New Toronto, Ont.—The Goodyear Tire & Rubber Co. will erect a plant of brick and steel construction at Ninth Street and Lake Shore Road for manufacture of tires.

Niagara Falls, Ont.—The Blystone Mfg. Co. (main office Cambridge Springs, Mass.), makers of concrete machinery, will erect a plant in Canada.

Petrolea, Ont.—Lambton Flax Mills Company (Howard Fraleigh, Mgr., Forest, Ont.) intends erecting two factories, one at Petrolea and one at Sarnia, to cost $60,000. All latest machinery and equipment to be installed.

St. Thomas, Ont.—St. Thomas Pure Milk Company (A. Anderson, Mgr.) is preparing to erect a brick factory, 40 x 90 ft., to be equipped with modern pasteurizing apparatus and cold storage equipment; estimated cost, $50,000.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Manchester, N. H.**—Contract for erecting a 4-story 45 x 154-ft. factory on Grove Street for Willard H. Griffin Shoe Co. awarded to Bunton & Bernard of Manchester, at about $35,000. J. Edward Baker of Manchester, Archt.

★**Bridgeport, Conn.**—Contract for erecting a 3-story, 400 x 25-ft. brick and steel addition to building of American Graphophone Co. at Railroad and Hancock Avenues awarded to Samuel Austin & Son Co., 245 Water Street, at about $50,000.

★**Waterbury, Conn.**—See "Proposed Work."

Waterbury, Conn.—Lowest bids opened by Charles H. Preston, Jr., Archt., 136 Grand Street, for the factory to be erected for A. H. Wells & Co., Inc., Waterbury, submitted by H. Wales Lines Co. of New Haven at $23,209, for general construction, and by Berlin Construction Co. of Berlin at $6,900, for structural steel.

★**Camden, N. J.**—Contract for erecting cabinet factory for Victor Talking Machine Company awarded Irwin & Pennington, Philadelphia, Pa.; cost, $500,000.

★**Mount Airy, Pa.**—Contract awarded William H. Eddleman & Sons, Roxborough, for erecting a 1-story ice storage house, 26 ft. 6 in. x 42 ft. 6 in., for the Up-to-Date Ice & Coal Manufacturing Company, to be erected at Mount Airy Avenue and Sprague Street. Peuckert & Wunder, Archts. and Engrs., 310 Chestnut Street, Philadelphia.

★**Philadelphia, Pa.**—Contract awarded H. E. Grau, 1707 Sansom Street, for erecting a one-story brick addition to plant of American Radiator Company, at Taylor and Wharton Streets, to cost $25,000.

★**Roxborough, Pa.**—Contract awarded William H. Eddleman & Sons, Roxborough, for erecting a 1-story ice storage plant, 54 x 33 ft., on East Green Lane and Ridge Avenue for the Glen Willow Ice Manufacturing Company. Peuckert & Wunder, Engrs. and Archts., 310 Chestnut Street, Philadelphia.

★**Canton, Ohio.**—Contract for erecting an electric steel mill in Canton for Timken Roller Bearing Co. awarded to Canton Bridge Co. of Canton; cost of improvement about $500,000.

★**Grand Rapids, Mich.**—Contract for building factory at Seventh Street and Muskegon Avenue, n. w. for Nelson-Matter Furniture Co. awarded to Hauser-Owens-Ames Co., at about $80,000.

★**Cudahy, Wis.**—General contract for erecting storehouse and shipping building and two manufacturing buildings of steel and concrete construction for Federal Rubber Mfg. Co. awarded to Fred T. Ley Co. of Springfield, Mass.

★**Madison, Wis.**—Contract for erecting 4-story, 90 x 225-ft. packing and cold storage plant for Farmers' Co-operative Packing Co. awarded to Mueller Constr. Co. of Chicago, Ill., at about $225,000. Gardner & Lindberg, Archts., 140 South Dearborn Street, Chicago, Ill.

★**South Ft. Smith, Ark.**—Contract for erecting a 3-story, 70 x 60-ft. addition to factory of Best-Clymer Mfg. Co. awarded to Fred Schleuter of Ft. Smith, at about $40,000.

★**Albuquerque, N. M.**—Contract awarded Joseph E. Nelson & Son, 118 N. La Salle Street, Chicago, Ill., for erecting blacksmith shop, 86 x 305 ft., brick and steel construction, for Atchison, Topeka & Santa Fe R. R.; cost, $75,000.

★**Quebec City, Que.**—Contract for erecting a brick factory for Dominion Coraet Co. awarded to M. Cauchon, 307 Richardson Street, at about $60,000. New machinery is to be installed.

★**Montrose, Ont.**—Contract for erecting brick and concrete repair shop, round house and coal dock for Michigan Central Ry. Co. (George H. Webb, Ch. Engr., Detroit, Mich.) awarded Walbridge & Aldinger of Detroit.

★**Calgary, Alta.**—Contracts awarded as follows by Alberta Farmers' Corporation Elevator Company, Ltd., for constructing elevators (complete): 7 to Thomas Jameson McKenzie, Calgary; 3 (labor only), to W. S. McDonald, Calgary, and 4 to E. M. Nesbitt, Edmonton (labor only).

★**Vancouver, B. C.**—Contract for erecting addition to factory of Begg Motor Co. awarded to Dominion Constr. Co., 509 Richards St., at $25,000.

MISCELLANEOUS

PROPOSED WORK.

Park Bonds — Syracuse, N. Y. — See "Public Buildings and Schools."

Subway — Cleveland, Ohio.—Citizens of the county, April 25, voted to construct subway approaches to high level bridge over Cuyahoga River; estimated cost $850,000. Plans being prepared by W. A. Stinchcomb, County Engineer.

Park and Playground.—Chicago, Ill.—West Park Board has voted to begin at once building a park and playground on the site bounded by Austin and Central Avenues, Adams Street and the Chicago, Elgin & Aurora R. R. Improvements contemplated will cost about $750,000.

Transmission Line—Minneapolis, Minn.—The Northern States Power Co. has contracted with Wisconsin-Minnesota Light & Power Co. of Chippewa Falls, Wis., to construct a transmission line to Division Street sub-station now under construction; cost, $700,000.

Street Signs—Austin, Tex.—City Council is considering placing street signs on approximately 300 corners in the city. Address Mayor.

Coal Chutes—London, Ont.—Grand Trunk Ry. (W. A. Davidson, Division Supt., London) contemplates erecting steel and concrete coal chutes costing $25,000.

Locomotive—St. Davids, Ont.—Reported Queenston Quarry Company, St. Davids, desires to purchase a second-hand, medium-size industrial locomotive.

BIDS DESIRED.

Road Oil—Brooklyn, N. Y.—Until May 11, by Park Board (Cabot Ward, Pres.), New York, for furnishing, delivering and spreading 41,550 gal. of non-asphaltic road oil in Parkways in the Borough of Brooklyn.

Steel Towers—Buffalo, N. Y.—Until May 22, by Lighthouse Inspector Buffalo, for furnishing two steel towers, advertised in Engineering Record.

Lighting Bridge — Baltimore, Md.—Until May 23 by State Roads Commission, 601 Garrett Building, Baltimore, for Contract BC-17, Section 10, lighting for Hanover Street bridge and approaches, comprising all necessary transformers, switchboards and attachments, wiring, poles, fixtures, globes, lamps, etc., for 1½ miles of street and bridge lighting, advertised in Engineering Record.

Underpass — Atlanta, Ga.—Repored desired until May 19 for constructing roadway beneath Southern Ry. tracks on S. Pryor Street, work divided into two sections, 15,000 cu. yd. earth excav. on S. Pryor Street and Ridge Avenue, and 25,000 cu. yd. earth excav on S. Pryor Street. Address Commissioners County Roads and Revenues (W. T. Winn, Chmn.)

Signs—Springfield, Ill.—Until June 1 by State Highway Commission, Springfield (William W. Marr, Chief State Highway Engineer) designs for a guide sign of metal or concrete providing spacing for placing characters, letters and figures for giving direction and distance to objective points, and to be used exclusively on State Aid Roads of Illinois. Awards made by July 1 and $25 paid to person whose design is accepted. Cost of sign is not to exceed $25 complete, ready for erecting, and to be not more than 7 ft. in height after erecting in place. Design selected to become property of Commission.

Road Oil—Fond du Lac, Wis.—Reported desired until May 8, by J. F. Hohensee, City Clerk, for furnishing 30,000 gal. road oil.

Road Machinery—Olivia, Minn. — Until May 12 by J. L. Johnson, Co. Aud., for a tractor capable of burning kerosene or distillate; tractor must be caterpillar or similar type and must be delivered at the bar not less than 40 hp. or over 50. Bids must include a price list of repairs, also cost of converting the traction wheels of convertible type of tractor to caterpillar type, etc.

Cranes and Dredge—Vallejo, Cal.—Until May 20 by Bureau Yards and Docks, Navy Dept., Washington, D. C., as follows: For furnishing two shipbuilding cranes at the Navy Yard, Mare Island; until June 3, for a gravity-swing one-ton bucket dredge for the Navy Yard, Mare Island.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Elevators—Parkersburg, W. Va.—Lowest bid opened April 20 by Supervising Architect, Washington, D. C., for remodeling electric passenger elevator in U. S. Post Office submitted by Kaestner & Hecht, Chicago, Ill., at $3,156.

★Cement—Louisville, Ky.—Contract for furnishing American Portland cement for Dam No. 43 Ohio River awarded Kosmos Portland Cement Company, Louisville, at $38,000.

★Cement—San Diego, Cal.—Contract for furnishing cement, sand and crushed rock, delivery to be made at San Diego (bids opened March 31 at Los Angeles) awarded as follows: Cement to Joncas Hansom, San Diego, at $17,840, and for sand and rock to Mission Sand & Rock Company, San Diego, at $19,928.

★Turbines — Toronto, Ont.—Contract awarded I. P. Morris Company, Philadelphia, Pa., by Mattagami Pulp & Paper Company of Toronto for two 4500-hp. vertical shaft, single runner turbines to operate under a head of 45 ft. An additional unit will be installed in this plant in the near future.

Proposals

For Proposals Advertised, See Pages 45, 46, 47 and 48.

WATERWORKS.

Bids Close.		See Eng. Record.
May 9.	Filtration Plant, New Brunswick, N. J. Adv. Apr. 15. 22.	Apr. 15
May 9.	Contract 147, New York, N. Y. Adv. Apr. 22.	Apr. 22
May 9.	Stand Pipe, New Brunswick, N. J. Adv. Apr. 29.	Apr. 29
May 9.	Systems, Illinois	Apr. 29
May 9.	Well Gatehouse, etc., Cleveland, Ohio	May 6
May 9.	Pumps, Toronto, Ont.	May 6
May 10.	Water Works, Pleasantville, Iowa.	Apr. 29
May 10.	Extensions, Dover, Ohio.	May 6
May 12.	Filtration Plant, Wilmington, Del. Adv. Apr. 22.	Apr. 22
May 12.	Motors, Elkhorn, Wis. Adv. May 6.	May 6
May 15.	Water Works, Yoncalla, Ore.	Apr. 8
May 15.	Tower, Washington, D. C.	May 6
May 15.	Reservoir, Newton, Mass.	May 6
May 16.	Pipes, Hydrants, Etc., Denmark, Wis.	Apr. 29
May 16.	Steel Tank, Westbrook, Minn.	May 8
May 16.	Improvements, Alliance, Neb.	May 6
May 18.	Water Works, Ironton, Ohio	Apr. 29
May 19.	Pipe, St. Louis, Mo.	May 6
May 22.	Pipe, Wooster, Ohio.	May 6
May 22.	Extension, Wakeeney, Kan.	May 6
May 31.	System, Aberdeen, Wash.	Apr. 29
Jun. 1.	Water Works, Madison, W Va.	Apr. 22
Jun. 3.	Electrical equipment for water plant, Ft. Bliss, Tex. Adv. May 6.	May 6

SEWERAGE AND SEWAGE DISPOSAL.

Bids Close.		See Eng. Record.
May 8.	Riverside, N. J. Adv. Apr. 22 to May 6.	Apr. 22
May 8.	Newark, Del. Adv. Apr. 22, 29.	Apr. 22
May 8.	Grays Lake, Ill. Adv. Apr. 29.	Apr. 29
May 9.	Park Rapids, N. D.	Apr. 29
May 9.	Park Falls, Wis.	May 6
May 10.	Brooklyn, N. Y.	May 6
May 10.	Long Island City, L. I., N. Y.	May 6
May 10.	Missoula, Mont.	May 6
May 10.	Binghamton, N. Y.	May 6
May 11.	Brooklyn, N. Y.	May 6
May 12.	Jacksonville, Fla.	Apr. 29
May 12.	Pender, Neb.	Apr. 29
May 12.	London, Ont.	May 6
May 12.	New York, N. Y.	May 6
May 13.	Bowling Green, Ohio.	May 6
May 14.	Austin, Tex.	May 6
May 15.	Milwaukee, Wis.	May 6
May 15.	Oatman, Ariz.	Apr. 22
May 15.	Neodesha, Kan.	Apr. 29
May 15.	Mitchell, S. D.	May 6
May 16.	Salt Lake City, Utah.	May 6
May 17.	Appleton, Wis.	May 6
May 18.	Chicago, Ill. Adv. May 6.	May 6
May 18.	Newark, N. J.	May 6
May 20.	Linden Heights, Ohio. Adv. May 6.	May 6
May 21.	Toledo, Ohio.	Apr. 29
May 22.	Spooner, Minn.	Apr. 29
May 22.	Montclair, N. J.	May 6
May 22.	Highland Park, Mich. Adv. May 6.	May 6
May 23.	Newark, N. J.	May 6
May 23.	Ridgefield Park, N. J. Adv. May 6.	May 6
May 24.	Binghamton, N. Y.	Apr. 29
May 25.	Durham, N. C. Adv. May 6.	May 6
May 25.	Milwaukee, Wis. Adv. May 6.	May 6
May 31.	Fresno, Cal.	Apr. 29

BRIDGES.

Bids Close.		See Eng. Record.
May 9.	Manhattan, Kan.	Apr. 15
May 9.	Summerville, W. Va. Adv. Apr. 29.	Apr. 29
May 9.	Jefferson, Iowa	Apr. 29
May 9.	Denton, Md.	Apr. 29
May 10.	Darien, Conn.	May 6
May 10.	Illinois	May 6
May 11.	Maine	May 6
May 13.	Morris, Minn.	Apr. 29
May 15.	Sheridan, Wyo.	Apr. 29
May 15.	Hamilton, Ohio	May 6
May 15.	Warren, Ohio	May 6
May 15.	Morristown, N. J.	May 6
May 15.	Niles, Ohio	May 6
May 15.	Ashland, Ohio.	May 6
May 16.	Arden, Man.	Apr. 29
May 16.	La Moure, N. D.	May 6
May 16.	Gadsden, Ala.	May 6
May 16.	Heuvelton, N. Y. Adv. May 6.	May 6
May 17.	Blue Lick Springs, Ky.	May 6
May 18.	Manhattan, Kan.	Apr. 29
May 18.	Bedford, Ind.	May 6
May 19.	Mt. Gilead, Ohio.	May 6
May 20.	Lyndhurst, N. J.	Mar. 18
May 22.	Dayton, Ohio	Apr. 29
May 23.	Kearney, Neb.	Apr. 29
May 23.	Albany, N. Y. Adv. Apr. 29.	Apr. 29
May 23.	Nashville, Tenn. Adv. May 6.	May 6
May 24.	Bradentown, Fla.	May 6
Jun. 1.	Hamilton, Ohio	May 6
Jun. 5.	Cumberland, Md.	Apr. 22
Jun. 8.	El Dorado, Kan.	Apr. 8

PAVING AND ROADS.

Bids Close.		See Eng. Record.
May 8.	Coupeville, Wash Adv. Apr. 22, 29.	Apr. 29
May 8.	Seattle, Wash.	Apr. 29
May 8.	Chicago, Ill.	Apr. 29
May 8.	Grantwood, N. J.	May 6
May 8.	Boston, Mass.	May 6
May 9.	Angola, Ind. Adv. Apr. 22, 29.	Apr. 22
May 9.	Modesto, Cal.	Apr. 22
May 9.	Columbia, S. C.	Apr. 29
May 9.	Menomonie, Wis.	Apr. 29
May 9.	Sterling, Ill.	Apr. 29
May 9.	Patchogue, L. I., N. Y. Adv. Apr. 28.	Apr. 29
May 9.	Denton, Md.	Apr. 29
May 9.	Bridgeville, Pa.	May 6
May 9.	Lisbon, N. D.	May 6
May 9.	Zanesville, Ohio	May 6
May 9.	Amarillo, Tex.	May 6
May 9.	Kansas City, Mo.	May 6
May 9.	Paterson, N. J.	May 6
May 9.	Zanesville, Ohio.	May 6
May 10.	Baltimore, Md.	May 6
May 10.	Vinton, Iowa.	May 6
May 10.	Grinnell, Iowa	Apr. 29
May 10.	Columbus, Miss.	May 6
May 10.	Atlantic City, N. J.	May 6
May 10.	Paterson, N. J.	May 6
May 10.	Illinois	May 6
May 10.	Blackwell, Okla.	May 6
May 10.	Binghamton, N. Y.	May 6
May 10.	Paris, Ill.	May 6
May 10.	Canton, Ohio	May 6
May 11.	Wilson, N. C. Adv. Apr. 29, May 6.	Apr. 29
May 11.	Elizabeth, N. J.	May 6
May 11.	Kearney, Neb.	May 6
May 11.	Louisville, Ky.	May 6
May 11.	Brooklyn, N. Y.	May 6
May 11.	Cincinnati, Ohio	May 6
May 11.	New Haven, Conn.	May 6
May 11.	Troy, Ohio	May 6
May 11.	Spokane, Wash.	May 6
May 11.	Towson, Md.	May 6
May 12.	Lebanon, Pa. Adv. Apr. 22, May 8.	Apr. 22
May 12.	North Platte, Neb.	Apr. 22
May 12.	Bryon, Ill.	Apr. 29
May 12.	Camden, Ala.	Apr. 29
May 12.	New Albany, Ohio	May 6
May 12.	Jasper, Tenn.	May 6
May 12.	Cincinnati, Ohio	May 6
May 13.	Morris, Minn.	Apr. 29
May 13.	New Bremen, Ohio.	May 6
May 13.	Payne, Ohio	May 6
May 13.	Ventura, Cal.	May 6
May 13.	Petosi, Mich.	May 6
May 15.	Lodi, Cal.	May 6
May 15.	Cincinnati, Ohio	May 6
May 15.	Bay Minette, Ala.	Apr. 22
May 15.	Lebanon, Pa.	Apr. 22
May 15.	Rhode Island	Apr. 29
May 15.	Sikestown, Mo. Adv. Apr. 29.	Apr. 29
May 15.	Pennsylvania	Apr. 29
May 15.	Los Angeles, Cal.	Apr. 29
May 16.	South Bend, Ind. Adv. Apr. 22, 29.	Apr. 22
May 16.	Willmar, Minn.	Apr. 29
May 16.	New Philadelphia, Ohio. Adv. Apr. 29.	Apr. 29
May 16.	Nevada, Iowa	May 6
May 17.	Carlisle, Ky.	May 6
May 16.	Kansas City, Mo.	May 6
May 18.	Morrison, Ill.	May 6
May 17.	Washington, Pa.	May 6
May 18.	Poughkeepsie, N. Y. Adv. Apr. 29, May 6.	Apr. 29
May 18.	Pittsburgh, Pa.	May 6
May 18.	Waterloo, N. Y. Adv. May 6.	May 6
May 18.	Miami, Fla.	May 6
May 18.	Dayton, Ohio.	May 6
May 19.	Marion, Ohio	May 6
May 19.	Hudson, Mich.	May 6
May 19.	Cincinnati, Ohio.	May 6
May 20.	Linden Heights, Ohio. Adv. May 6.	May 6
May 22.	Jefferson, Ohio	Apr. 22
May 22.	Carbondale, Pa.	May 6
May 22.	Washington	May 6
May 22.	Cumberland, Md. Adv. May 6.	May 6
May 23.	Luverne, Minn.	May 6
May 24.	Tiffin, Ohio	May 6
May 24.	Bradentown, Fla.	May 6
May 24.	Mansfield, Ohio	May 6
May 26.	West Union, W. Va.	May 6
Jun. 1.	Hamilton, Ohio	May 6
Jun. 1.	Washington, D. C. Adv. May 6.	May 6
Jun. 2.	Great Falls, Mont.	Apr. 22
Jun. 5.	Columbus, Miss.	Apr. 29
Jun. 7.	Palatka, Fla. Adv. May 6.	May 6
July 10.	Caldwell, Tex.	Apr. 22

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS.

Bids Close.		See Eng. Record.
May 8.	Dredging, Wilmington, Del. Adv. Apr. 15 to May 6.	Apr. 15
May 9.	Ditch, St. James, Minn.	Apr. 22
May 9.	Drainage, Durand, Mich.	Apr. 29
May 10.	Dredging, Buffalo, N. Y. Adv. Apr. 15 to May 6.	Apr. 15
May 10.	Dredging, Los Angeles, Cal.	Apr. 22
May 10.	Drainage, Otterville, Ont.	Apr. 29
May 11.	Rip Rap, Chicago, Ill.	May 6
May 12.	Dam, Etc., Spokane, Wash.	May 6
May 13.	Ditch, St. Cloud, Minn.	Apr. 29
May 13.	Drainage, Jackson, Tenn.	Apr. 29
May 15.	Dredging, Bridgeport, Conn. Adv. Apr. 15 to May 6.	Apr. 15
May 15.	Seawall, Washington D. C. Adv. Apr. 29, May 6.	Apr. 29
May 15.	Sluice Gates, Malta, Mont.	Apr. 29
May 15.	Dam, Fort Dodge, Iowa.	Apr. 29
May 16.	Canal Work, Albany, N. Y.	Apr. 29
May 16.	Fill, Seattle, Wash.	May 6
May 19.	Ditches, Bemidji, Minn.	Apr. 29
May 19.	Drainage, Angleton, Tex.	Apr. 29
May 20.	Sale of Shot Drill, Denver, Col. Adv. Apr. 29.	Apr. 29
May 20.	Channel Improvement, Maple Park, Ill.	May 6
May 20.	Levee, New Orleans, La.	May 6
May 22.	Irrigation, Fort Laramie, Wyo. Adv. Apr. 22.	Apr. 22
May 22.	Ditches, Racine, Wis.	May 6
May 23.	State Canal Work, Contracts 128 and 129, Albany, N. Y. Adv. Apr. 29, May 6.	Apr. 29
May 23.	Irrigation, Grand Junction, Col.	Apr. 29
May 23.	Irrigation, Wenatchee, Wash.	Apr. 29
May 25.	Irrigation, St. Ignatius, Mont. Adv. Apr. 22.	Apr. 22
May 25.	Cement, Denver, Col. Adv. Apr. 29.	Apr. 29
May 25.	Irrigation, Ft. Laramie, Wyo.	May 6
May 26.	Dredging, Chicago, Ill. Adv. May 6.	May 6
May 29.	Drainage, Bloomfield, Ia. Adv. Apr. 29. May 6.	Apr. 29
May 29.	Drainage, Tallahassee, Fla. Adv. Apr. 29, May 6.	Apr. 29
Jun. 1.	Dredging, Tarrytown, N. Y. Adv. May 6.	May 6
Jun. 2.	Breakwater, Indian Harbor, Ind. Adv. May 6.	May 6
Jun. 15.	Irrigation, Payson City, Utah Adv. May 6.	May 6
———	Sublet Levee Work, Chicago, Ill. Adv. Apr. 1.	Apr 1
———	Levee Grading, Vincennes, Ind. Adv. Apr. 8, 15.	Apr. 8

PUBLIC BUILDINGS AND SCHOOLS.

Bids Close.		See Eng. Record.
May 8.	Dannemora, N. Y Adv. Apr. 22, 29.	Apr. 22
May 9.	Greentown, Ind.	Apr. 29
May 9.	Columbus, Ohio	May 6
May 9.	Kokomo, Ind.	May 6
May 10.	Evansville, Ind.	Apr. 8
May 10.	Fertile, Iowa	Apr. 22
May 10.	Waldorf, Minn.	Apr. 22
May 10.	Arthur, Ill.	Apr. 29
May 10.	Lordstown, Ohio	Apr. 29
May 10.	Polk, Pa.	May 6
May 10.	Wabasha, Minn.	May 6
May 11.	Canby, Minn.	Apr. 29
May 11.	Sulphur Springs, Iowa.	Apr. 29
May 11.	Sauk City, Wis.	May 6
May 12.	Woonsocket, R. I.	Apr. 22
May 12.	Claire City, S. D.	Apr. 29
May 12.	Otranto, Iowa.	Apr. 29
May 12.	Markham, Ont.	Apr. 29
May 12.	Providence, R. I.	Apr. 29
May 12.	Tiosa, Ind.	May 6
May 12.	Newport, Ohio	May 6
May 13.	Norfolk, Va.	Apr. 15
May 13.	Seeville, Ohio	Apr. 22
May 13.	Little Sioux, Iowa.	Apr. 22
May 13.	Derby, Ohio	Apr. 29
May 13.	Ecorse, Mich.	Apr. 29
May 13.	Allentown, Pa.	May 6
May 13.	Jacksonville, Fla.	May 6
May 15.	Newport, R. I.	Apr. 8
May 15.	Ft. Huachuca, Ariz. Adv. Apr. 15 to May 6.	Apr. 15
May 15.	Mayer, Minn.	Apr. 22
May 15.	Selma, Iowa	Apr. 22
May 15.	Oldtown, Me.	Apr. 29
May 15.	Perham, Minn.	Apr. 29
May 15.	Newman, Ga.	Apr. 29
May 15.	Joliet, Ill.	May 6
May 15.	Minneapolis, Minn.	May 6
May 15.	Swea City, Iowa	May 6
May 15.	Los Angeles, Cal.	May 6
May 15.	Elmira, N. Y. (2 Props.) Adv. May 6.	May 6
May 16.	Merced, Cal.	Apr. 22
May 16.	Garrison, N. D.	May 6
May 16.	East Lansing, Mich.	May 6
May 17.	Wichita Falls, Tex.	May 6
May 17.	Little Falls, Minn.	Apr. 15
May 17.	Kent, Ohio.	Apr. 29
May 18.	Durango, Col.	Apr. 15
May 18.	Washington, D. C. Adv. Apr. 29, May 6.	Apr. 29
May 18.	Nevada, Mo.	May 6
May 19.	Wenatchee, Wash.	Apr. 15
May 19.	Galloway, Ohio	May 6
May 19.	Freehold, N. J.	May 6
May 20.	Cordova, Alaska	Apr. 15
May 20.	Reynoldsville, Ohio	May 6
May 20.	Roslyn, S. D.	May 6
May 20.	Wexford, Mich.	May 6
May 20.	Kent, Ohio.	May 6
May 22.	Tahoka, Tex. Adv. May 6.	May 6
May 22.	Reading, Ohio	May 6
May 22.	Bird Island, Minn.	Apr. 29
May 22.	Boone, Iowa.	Apr. 29
May 22.	Selma, Iowa.	Apr. 29
May 23	Glenville,. W. Va.	May 6
May 23.	Downey, Cal.	May 6
May 23.	Cincinnati, Ohio	May 6
May 24.	Madison Barracks, N. Y. Adv. Apr. 29, May 6.	Apr. 29
May 24.	Wahjamega, Mich.	Apr. 29
May 25.	Butler, Pa.	Mar. 18
May 26.	Millarton, N. D.	May 6
May 27.	Bowman, S. D.	May 6
May 27.	Reading, Ohio	May 6
May 27.	Keyport, Wash.	Apr. 29
May 29.	Arden, Pa.	Apr. 29
May 29.	Urbana, Ill.	May 6
May 29.	Tuba, Ariz.	May 6
Jun. 5.	Belton, Tex.	May 6
Jun. 7.	Portland, Me.	May 6
Jun. 8.	Pineville. W. Va.	Apr. 29
Jun. 8.	Marysville, Tenn.	May 8
Jun. 8.	Waynesville. N. C.	May 6

PRIVATE BUILDINGS.

Bids Close.		See Eng. Record.
May 9.	Reading, Pa.	May 6
May 10.	Mason City, Iowa.	Apr. 22
May 10.	Rochester, Ind.	Apr. 29
May 10.	Sayre, Pa.	May 6
May 11.	Sheffield, Iowa	Apr. 22
May 12.	Rochester, Minn.	Apr. 29
May 15.	Washington, N. J.	Apr. 22
May 15.	Topeka, Kan.	May 6
May 17.	Ebensburg, Pa	Apr. 22
May 18.	Sheffield, Iowa	May 6
May 22.	Jasper, Ala.	May 8
May 27.	Cincinnati, Ohio	Apr. 29

MISCELLANEOUS.

Bids Close.		See Eng. Record.
May 10.	Traveling Crane, Houston, Tex.	Apr. 29
May 10.	Boilers, Etc., Bridgeport, Conn. (4 Props.) Adv. Apr. 29.	Apr. 29
May 11.	Steel Pontoons, Memphis, Tenn. Adv. Apr. 29, May 6.	Apr. 29
May 11.	Road Oil, Brooklyn, N. Y.	May 6
May 12.	Road Machinery, Olivia, Minn.	May 8
Jun. 16.	Cross Ties, Anchorage, Alaska	Apr. 15
May 15.	Concrete Walls, Etc., Mandan, N. D Adv. Apr. 15.	Apr. 15
May 15.	Terracing Hill, Mandan, N. D. Adv. Apr. 15.	Apr. 15
May 15.	Lift and Hoistways, Davenport, Iowa.	Apr. 29
May 16.	El. Ry., Section No. 4, New York, N. Y.	Apr. 29
May 18.	Sect. No. 1, El. Rys., New York, N. Y.	Apr. 29
May 19.	Underpass, Atlanta, Ga.	May 6
May 20.	Cranes, Vallejo, Cal.	May 8
May 22.	Sect. No. 5, El. Rys., New York, N. Y.	Apr. 29
May 22.	Derrick Boat, Norfolk, Va. Adv. Apr. 22.	Apr. 22
May 22.	Towers, Buffalo, N. Y. Adv. May 6.	May 6
May 23.	Lighting Bridge, Baltimore, Md.	May 6
May 25.	Cement, Denver, Col. Adv. April 29. Adv. May 6.	Apr. 29
May 25.	El. Rys., New York, N. Y.	May 6
Jun. 1.	Design for Sign, Springfield, Ill.	May 6
Jun. 3.	Dredge, Vallejo, Cal.	May 6
———	Heating Plant, Tucson, Ariz. Adv. Apr. 15.	Apr. 15
———	El. Rys., New York, N. Y. Adv. Apr. 29.	Apr. 29

Shortage of Common Labor Felt First in Eastern and Central States Where Manufacturing is Centered

Skilled Labor Less Affected in Cities of This Section Because Largely Organized—First Returns of Census Show Serious Shortage Expected in Many Sections—Exports Break World's Record

[The labor situation has threatened this country, in a period of expansion, with difficulties unknown and not susceptible of any accurate estimate based only on past conditions. The most important factors, the stoppage of immigration and the phenomenal industrial development along special lines peculiarly affecting common labor, are without precedent. What is actually going on? In what sections of the country is the contractor faced with a scarcity of labor and higher wages? What has the summer in store?

To present actual conditions and data for an accurate estimate of the future to its readers, the Engineering Record has asked more than 100 men of national prominence in contracting the present status of the labor market as it effects their work and their opinion of what is coming. Labor agents throughout the country have been interviewed and special correspondence has been used to supplement this information. The returns from the Eastern and Central states, where it was to be expected that the shortage would first be felt, are now complete, and are presented below. Those from other sections, combined with them, will be used to prepare a map showing conditions and wages throughout the country, which will appear next week.]

COMMON labor is becoming very scarce and wages have gone up from 25 to 33 cents an hour in the New England territory. Skilled labor is absorbed somewhere as fast as the contractor releases it, according to L. C. Wason of the Aberthaw Construction Company. Carpenters are going into millwright work and laborers into machine shops, and the surplus of labor on which the contractor can draw in starting additional work has vanished.

Around New York (and the same is true of Chicago and other large cities) union skilled labor is already paid so highly that none of it has been tempted into industrial lines. A carpenter strike is on in the metropolitan district and higher wages than have ever been paid in this territory are asked. Common labor in the Buffalo district is now being paid 27½ cents per hour by contractors. Projected work of the New York State Highway Commission is seriously threatened by a scarcity of labor.

As regards Pennsylvania, wages of common labor have increased 10 to 25 per cent, according to John Price Jackson, Commissioner of labor. The general level, including industrial Labor, is $2 per day. Labor is moving restlessly. Labor agents in the coal sections anticipate great difficulty in getting common labor for construction work, as the recent mine advances amount to $2.25 to $2.35 for an 8-hr. day, and the mines can take care of a large share of all the labor in that territory. In Cleveland the Hunkin-Conkey Construction Company finds common labor more difficult to get, and union labor plentiful. Common labor has advanced to 25 or 30 cents per hour. Advertisements for labor at these rates are plentiful. W. P. Anderson and H. N. Kirchner state that similar conditions prevail in Cincinnati with common labor scarce at 25 cents, difficult to manage and looking for an advance, and skilled labor normal. Dayton labor agencies report wages high and rising and everyone employed. New men are being found for construction work.

Reports from Chicago vary widely, several large operators having experienced little difficulty so far in securing common labor. Organized common labor has advanced by agreement to 42½ cents per hour, and non-union labor to 31¼ cents. W. A. Rogers of the Bates & Rogers Construction Company, and other large contractors of Chicago, on the other hand, expect a greater scarcity of unskilled labor with material advances in wages. Mr. Rogers points out that even the end of the war may not increase the supply of labor, as Europe is likely to prohibit emigration for some time, and that not only will wages of skilled and common labor continue to increase, but efficiency is apt to decrease, materially advancing the cost of construction work. The experience of the Chicago Surface Lines is that both the skilled and common labor on which they depend is growing scarcer, and that construction is likely to be held up thereby.

At Racine, Wis., common labor is very scarce and wages have advanced, 25 to 30 cents per hour being paid. This is a manufacturing section and it is hoped that warm weather will bring into outdoor work some of the labor now employed in factories.

Common labor may be scarce in St. Louis and serious labor troubles threaten construction work. The Thomas-Harmon Company states that some work is already being held up on this account. The railroads are taking many men at $1.75 to $2.10 with board, and wages of non-union labor have consequently advanced to $2.50 per day on some construction work. Organized common labor is now demanding $3.50 per day in St. Louis.

In Kansas City wages have gone up, the base for common labor being 17½ cents per hour, but no marked shortage is yet apparent. Kansas City is west of the manufacturing section of the country and is largely a distributing center. In the Minnesota iron mining districts $2.50 to $2.75 is being paid common labor and foreigners are scarce. When the mines reach capacity operation in June a further shortage is looked for.

To sum up, organized skilled labor in most of the large cities is still sufficient for building work. Common labor and non-union skilled labor, however, are scarce and appear likely to become much scarcer. The projects likely to be held up by these conditions are those where the investment is of a speculative nature, and railroad work by the roads that do not feel able to pay advanced prices. That these effects are already being felt to some extent is not to be doubted. The attention of readers is called to the fact that immigration has increased slightly of late, and that the U. S. Government can probably fill for a short while limited demands for foreign unskilled labor.

Our March exports, estimated at more than $410,000,000, are the greatest ever recorded in any country for one month. March imports broke the record for this country, but still leave a balance of $196,000,000 in our favor. As has been pointed out before, this trade balance must be financed to a great extent at home, and is causing a stiffening in money rates. Spring business in record breaking volume is well under way and this factor also is making a considerable demand on the enormous reserve funds accumulated in this country.

As an indication of the volume of work being contracted for and projected it is worthy of note that the contracting news section of the Engineering Record published during April last almost 50 per cent more items than during April, 1915. This compares with a gain of only 11.8 per cent. in the value of building permits for April in eighty-three leading cities as compared with April, 1915. While this comparison is not based on sufficient data to make it accurate, it is fair to assume that the activity in general construction work is even more marked than in building, and that there is no relief in sight to the labor situation from a diminished volume of general construction.

Buildings

Large building contracts recently awarded include: Brooklyn, N. Y., large 7-story reinforced-concrete factory; Jersey City, N. J., $275,000 cold storage warehouse; Chicago, $900,000 group of stock yards buildings; $400,000 mercantile building and $350,000 mercantile building; Portland, Ind., $238,000 court house. Bids are reported desired at Chicago for constructing a $200,000 office building.

Prospective building work noted includes: West Springfield, Mass., plans completed, $300,000 addition to manufacturing plant; Huntington, W. Va., $300,000 school bonds voted; Eaton, Ohio, $250,000 court house bonds sold; Marion, Ohio, $200,000 hotel planned; Peoria, Ill., erection of steel plant requiring 75,000 yd. of concrete contemplated; New Orleans, La., plans prepared, $200,000 club building; Gulfport, Miss., $500,000 company incorporated to build manufacturing plant; Amarillo, Tex., plans for $225,000 hotel approved; Modesto, Cal., $200,000 school to be built; Thorne, Ont., $200,000 paper mill to be built; Hamilton, Ont., plans being prepared for $1,000,000 coke plant; Winnipeg, Man., plans being prepared, $500,000 bank building.

Bridges and Roads

Bids have been opened on a bridge to cost $110,000 at Philadelphia. The California Highway Commission has awarded a contract for a highway bridge at $102,000. Bids are desired at Providence, R. I., for constructing a 220-ft. concrete arch bridge. Plans have been completed for the proposed viaduct at Birmingham, Ala.

A large volume of road work has been let recently, mostly in the Central and Western states. It includes: Petersburg, Va., $110,000 road contract awarded; Goshen, Ind., $177,600 road work awarded; Ohio State Highway Department, low bids opened total $1,000,000; Cleveland, $617,500 paving contract awarded; Yankton, S. D., $111,000 road contract awarded; Golden, Col., low bids for road work total $325,000; Salt Lake City, low bids received amounting to $96,000 for paving work; Butte, Mont., $70,000 paving contract awarded; Idaho, $63,000 road contract awarded; Everett, Wash., $172,000 road work contracted for; Seattle, $222,000 paving contract awarded, $84,000 road contract awarded.

The following new work is noted: Ohio, bids desired May 19, large volume additional road work; Marshalltown, Iowa, bids desired 63,000 sq. yd. paving; Bemidji, Minn., bids desired, road work to cost $105,000; Adrian, Mich., $75,000 road work to be done; Murfreesboro, Ark., engineer engaged, road work to cost $150,000; Greenville, Mo., $200,000 road bonds voted; Mercedes, Tex., $250,000 highway bonds voted; Billings, Mont., $175,000 road bonds sold.

Waterworks and Sewers

A sewer system and disposal plant contracted for at Ridgefield, N. J., will cost $98,000. Xenia, Ohio, has contracted for the building of a $55,000 disposal plant. A contract for building an $80,000 sewer system has been let at Richmond, Cal. The bids desired include: 2000 ft. of compressed air tunnel for the Passaic sewer at Newark, N. J.; the covered concrete reservoir at Wilmington, Del.; waterworks improvements costing $500,000 at St. Paul; and waterworks improvements costing $600,000 at Everett, Wash.

Proposed work includes: New Haven, Conn., cost of disposal plant estimated at $500,000; Richmond, Va., $408,000 appropriated for waterworks and sewer construction; Pittsburgh, ordinance providing for $350,000 storm sewer approved; Dover, Ohio, waterworks improvements costing $83,000 to be built; Dayton, Ohio, contract for $160,000 sewer to be let soon; Portsmouth, Ohio, $400,000 reservoir bonds to be sold; Whitefish Bay, Wis., plans prepared, $200,000 water and sewer system; Kansas City, $200,000 sewer bonds to be sold; Seattle, plans being prepared for $125,000 sewer system.

Miscellaneous

A contract for building the West Sixty-sixth Street pier in New York City has been awarded at $535,000. A $370,000 speedway has been contracted for at Cincinnati. The first unit of the Hunters Point drydock at San Francisco has been contracted for at $700,000. Bids are desired for constructing a $460,000 weir at Sacramento, Cal.

The following new work is noted: Richmond, Va., $1,500,000 passenger terminal proposed; Sandusky, Ohio, reported railroad docks costing $1,000,000 will be built; Salt Lake City, railroad improvements costing $1,500,000 proposed; Lewiston, Idaho, $750,000 dam proposed; North Yakima, Wash., $204,000 approved for construction under U. S. Reclamation Service; Echo, Ore., $1,100,000 irrigation bonds sold; Los Angeles, Cal., plans to be prepared for $600,000 tunnel; Toronto, Ont., expenditure of $1,250,000 on hydroelectric system authorized; Edmonton, Alta., plans being prepared for $500,000 power development.

CONTRACTING NEWS

Of Special Interest to Engineers, Contractors, Builders and Manufacturers of Engineering and Building Supplies

WATERWORKS

PROPOSED WORK.

Geneva, N. Y.—The citizens, at recent election, defeated issue of $12,000 bonds for addition to filtration system.

Troy, N. Y.—Contract will be let about July by city for a reinforced concrete gate house with 24-in. and 16-in. reducer valves. A. C. Roche, City Engineer.

Newark, N. J.—Governor Fielder May 5 appointed the North Jersey Water Commission, consisting of George G. Wright of Paterson, E. E. Hincke of Montclair, Mr. Ramsey of Perth Amboy and Mr. Laurent Tonnelle of Bayonne, as a commission to construct a reservoir in the vicinity of Wanaque to supply cities and towns of Northern New Jersey with potable water. The commission will organize at once, and it is reported that Morris Sherrerd, Chief Engineer, Board Street and Water Commissioners, Newark, will be appointed as Chief Engineer of this commission. Estimated cost of reservoir, dam and pipe line is about $6,000,000.

Lebanon, Pa.—All bids opened April 26 by Dan M. Sharp, City Clerk, for furnishing about 5000 ft. of 12-in. c. i. pipe rejected.

New Castle, Pa.—Reported local water works company will construct a 20-in. main from reservoir to Highland Avenue Dist. J. H. Simpson, Supt. of company.

Blackstone, Va.—Water improvement bonds for $25,000 will be sold May 29 by town. R. B. Stone, Clk.

Richmond, Va. — The Board of Aldermen approved of a $2,000,000 bond issue for following improvements: Public schools, buildings and sites, $582,175; Binford School addition, $50,000; water works flume, $100,000; water works mains, $108,000; construction of sewers, $200,000; North Dock Street improvements, $25,000; city storehouse, $35,000; Second Police Station, $33,000; sidewalk construction, $50,000, etc.

Wheeling, W. Va.—Election to be held in June to vote on bonds for a filtration plant. Address City Engineer.

Lumberton, N. C.—Water and light bonds for $30,000 will be sold May 25, by Board Commissioners, Ira B. Townsend, Clk. and Treas.

Athens, Ga.—The citizens voted $40,000 bonds for extensions and improvements to water works system.

Tallapoosa, Ga.—About $35,000 is to be spent by city for purchasing and improving water works.

Mooreland, Fla.—Citizens voted $25,000 bonds for water works and electric light plant.

Lake Charles, La.—Plans completed by Burns & McDonnell, Interstate Bldg., Kansas City, Mo., for water works improvements, including new pumping plant, machinery, and 15 miles of mains; estimated cost, $150,000.

Cleveland, Ohio.—City Board of Control rejected all bids opened April 25 for seamless steel tubing for water works.

Dayton, Ohio.—See "Sewerage and Sewage Disposal."

Dover, Ohio.—A 2,000,000-gal. pump, a 12,000,000-gal. standpipe and 1640 lin. ft. 14-in. and 9,200 lin. ft. 12-in. c. i. pipe, valves and boxes will be installed for the water works, costing $83,000. George E. Arnold, Engineer, New Philadelphia, Ohio. P. W. Hill, Director Public Service.

Hamilton, Ohio.—City Council voted to issue $19,000 bonds for improvements to gas, electric light and water works plants.

Lima, Ohio.—Contract soon to be let for constructing water works improvements. Address City Engineer.

Portsmouth, Ohio.—City reservoir and flood extension bonds for $40,000 will be sold.

Tiltonsville, Ohio.—Election to be held to vote $30,000 bonds for constructing water works system. Address City Clerk.

Zanesville, Ohio.—Citizens April 25 voted $350,000 bonds for a water works C. W. Roach, Service Director.

West Lebanon, Ind.—Construction of water works and paving streets contemplated. Address City Clerk.

Highland Park (P. O. Detroit, Mich.).—Highland Park Council engaged W. C. Head, engineer to prepare plans and estimates for a 14,000,000-gal. storage reservoir and filtration plant for Highland Park water works system; cost about $200,000.

Aurora, Ill. — Citizens voted $75,000 bonds for improving pumping station. A H. Larue, Supt. Water Department.

Normal, Ill.—Reported election to be held to vote $22,000 bonds for constructing water works and sewer improvements. Address City Clerk.

Whitefish Bay, Wis.—See "Sewerage and Sewage Disposal."

Hampton, Iowa.—Citizens voted in favor of extending and repairing water system. Address City Clerk.

Vinton, Iowa.—Citizens voted $15,000 bonds for water works improvement; bonds to be sold September or October. W. E. Klingerman, City Clerk.

Detroit, Minn. — Citizens voted $30,000 bonds to extend water mains.

Mora, Minn.—Plans being prepared by J. F. Druar, Commercial Bldg., St. Paul, for water and sewer system.

Osborne, Kan.—Bonds for improving water and light system, amounting to $15,000, have been sold. S. P. Crampton, City Clerk.

Belwood, Neb. — Alma Engineering Works, Omaha, are engineers for water works to cost $8,000. J. P. Delaney, Clerk.

Bozeman, Mont.—Water bonds for $235,000 will be sold May 18 by C. A. Speith, City. Clk.

Glendive, Mont.—Citizens will vote May 15 for $65,000 bonds for filtration plant. Burns & McDonnell, Interstate Bldg., Kansas City, Mo., Engrs.

Great Falls, Mont.—Bonds for $150,000 will be sold May 16 by W. H. Harrison, City Clk., for water-filtration plant.

Bentonville, Ark. — City contemplates improving water works and lighting plant to cost about $25,000.

Crowell, Tex.—Citizens voted bond issue for constructing water works.

Seattle, Wash.—City Council has indefinitely postponed the installation of water mains in Bangor and other streets at a cost of $43,654. L. B. Youngs, Supt. Water Works.

Oregon City, Ore.—Commission is considering building of a reservoir of 5,000,000 gal. capacity, 10,000 yd. excav., 1700 cu. yd. concrete and 70 tons c. i. pipe. Nothing definite has been done about matter. Rands & White, 921 Electric Building, Portland, Engineers.

Bell, Cal.—Franchise granted by Board of Supervisors to Bell Water Co. of Bell to construct a system of iron screw and steel riveted water pipes in a section southeast of the city to supply water for irrigation and domestic purposes.

Hollywood, Cal.—The City Council authorized issue of $1,020,000 water bonds.

San Diego, Cal.—City Council has rescinded former action in awarding contract for furnishing wood stave pipe line and will ask new bids about May 18.

St. Hyacinthe, Que.—Contract will be let about June 1 by City Clerk for mechanical gravity filtration system of 4,000,000 gal. daily capacity, including coagulation basins, clear water reservoir, four filters buildings, and the following pumps: One 5-mdg wash water, 4-mdg domestic service, one 4-mdg fire, all centrifugal, motor driven. Cost, $75,000. Frederick E. Field, Engineer, 383 Oxford Avenue, Montreal, Que.

Ridgetown, Ont.—Town Council preparing plans for extensions to water works system, including connecting up wells and laying additional mains; cost $10,000. Address Mayor.

BIDS DESIRED.

Boston, Mass.—Until May 15, by Edw. F. Murphy, Comr. Public Works, for laying water pipes in various streets in Brighton, West Roxbury and Hyde Park.

Hartford, Conn.—Until May 16, by the Board of Water Commissioners (C. M. Saville, Chief Engr.), for the furnishing and erection of one 40-in. to 42-in. and two 60-in. diameter vertical pressure filters, a 96-in. diameter pressure coagulation tank, pressure reagent and coagulent feeders and appurtenances in connection with the Nepaug reservoir system.

Brooklyn, N. Y.—Until May 16, by William Williams, Commissioner Water Supply, Gas and Electricity, New York, for hauling and laying water mains and appurtenances in Hicks, West, East Tenth, East Twenty-sixth and other streets, Boro. Brooklyn. Security $4,000.

Brockton, N. Y.—Until May 18 by Board Village Trustees for constructing earth dam with appurtenances on East Branch of Slippery Rock Creek, advertised in Engineering Record. Walter McCulloh, Consulting Engr., Gluck Bldg., Niagara Falls. H. M. Fleming, Village Clk.

Perry, N. Y.—Until May 27 by Board Village Trustees for constructing a slow sand filter, pure water reservoir and appurtenances, advertised in Engineering Record. O. N. Bolton, Village Clerk.

Newark, N. J.—Until May 23, by Board Street and Water Commissioners (Morris R. Sherrerd, Ch. Engr.), for furnishing and delivering and putting in position at South Eighth Street Meter Testing Station (now under construction) a meter testing apparatus, a device for testing the accuracy of water meters from 3 to 12 in. in diam. inclusive, size of inlet and outlet pipes being 6 in. in diam.

McKeesport, Pa.—Until May 15, by City Council, for constructing retaining wall, bulkhead, intake and pump well, with superstructure in connection with Monongahela intake. Leo Hudson, Consult. Engr., 802 House Bldg., Pittsburg.

Wilmington, Del.—Until June 2 by Board Water Commissioners for constructing a 7,500,000-gal. reservoir at Rodney and Eighth Streets, advertised in Engineering Record. Edgar M. Hoopes, Jr., Chief Engineer.

Harbor Beach, Mich.—Until May 15, by W. A. Trescott, City Clerk, for one 100,000 steel tank and tower 90 ft. to bottom of tank; one pump, pumping 1000 gal. per minute; two boilers 100 h.p.: H. T. boilers 125 lb. pressure. James J. Bennett, Water Commissioner.

Maywood, Ill.—Until May 15 by Edward J. Thielen, Village Clk., for improving water works, to consist of 900,000 gal. capacity concrete reservoir: also a 6000 gal. auxiliary reservoir, laying water mains, etc.

Ft. Madison, Iowa.—Until May 17, by city, for constructing a 1,000,000-gal. concrete reservoir. Burns & McDonnell, Engrs., Interstate Bldg., Kansas City, Mo.

Chisholm, Minn.—Reported desired until May 20 for constructing water works, to consist of one centrifugal pump, 700 gal. per min.; one centrifugal pump, electric motor, 800 gal. per minute. C. J. Sullivan, Supt. Water Works.

Morris, Minn.—Until May 31, by City Commission for C. I. water pipe and specials, advertised in Engineering Record. S. A. Siverts, Jr., City Manager.

Red Lake Falls, Minn.—Reported desired until May 15 for extending city water mains, hydrants, etc. Joseph Perrault, City Clk.

St. Paul, Minn.—Until June 5 by Board Water Commissioners for furnishing following: Castings and small pipe connections for two 48 x 24 in. Venturi meters; c. i. pipe and special castings for two coagulating basins and their appurtenances and a 30,000,000-gal. high service reservoir; gate valves and sluice gates for two coagulating basins and a 30,000,000-gal. reservoir; all other materials excepting gate valves, sluice gates, meters, etc. All four proposals advertised in Engineering Record.

Commerce, Okla.—Until May 17, by Board of Trustees, for furnishing machinery, etc., for constructing water works including C. I. Class B. pipe, 13,140 lin. ft. 4, 6 and 8 in., 11,660 lin. ft. 2 and 1½ in. w. i. pipe, gate valves, hydrants, well, reservoir, power pumps, etc. Benham Engineering Company, Engineers, Oklahoma City, Okla.

Everett, Wash.—Until June 5, by city, for water works improvements, including 28 miles of flow line, two river crossings, rock fill dam and other improvements; approximate estimated cost $600,000. Advertised in Engineering Record. Burns & McDonnell, Interstate Bldg., Kansas City, Mo., Engrs. Louis Lesh, City Clerk.

San Diego, Cal.—Until May 17 (readvertisement) by Allen H. Wright, City Clerk, for furnishing material and constructing approximately 23,700 lin. ft. 36-in. continuous woodstave pipe line between Harvey Diverting Dam and connecting with pipe line from Upper Otay reservoir, about 2000 ft. south of Upper Otay Dam, including 10 6-in. blowoffs and 11 4-in. valves, saddles, bolts, gaskets, and gate valves. Probable cost $55,000.

Charlottetown, P. E. I.—Until May 20, by R. S. & W. S. Lea, New Birks Bldg., Montreal, Que., for a 1,000,000-gal. oil-driven waterworks pump.

North Bay, Ont.—Until May 15 by H. J. McAuslan, Town Engr., for approximately 3730 ft. of 4 and 6-in. cast-iron water mains and specials.

Wallace, Man.—Until May 26, by Wm. Whiteford, Secy.-Treas., for concrete pipes on a number of roads.

Panama.—Until May 26, by Major Earl I. Brown, Corps Engrs. U. S. A., General Purchasing Officer Panama Canal, Washington, D. C., for Cir. 1039 wrought iron and steel pipe, meters, etc.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Boston, Mass.**—Contract awarded U. S. Cast Iron Pipe & Foundry Company, 71 Broadway, New York, N. Y., for furnishing 115 tons 6-in. flexible joint water pipes for water service of Public Works Department at $44 per ton; total $5,060.

★**Holyoke, Mass.**—Contract awarded by Water Commissioners for supplies for water works as follows: To Standard Cast Iron Pipe & Foundry Co., of Bristol, Pa., for furnishing 1500 ft. 6-in., 1200 ft. 8-in. and 1400 ft. 10-in. c. i. pipe, at $30.68 per ton; special castings to McHugh Foundry Co., of Holyoke; hydrants to Norwood Engineering Co., Florence, Mass.; for wrought iron galvanized pipe to Holyoke Valve & Hydrant Co. and Holyoke Supply Co., Holyoke.

★**New York, N. Y.**—Following are four lowest bids opened April 25 by Board Water Supply, Municipal Building, for Contract 173, furnishing and erecting fences in the vicinity of Kensico Reservoir, towns of Mt. Pleasant and North Castle, Westchester County: William Heyman, 15 Exchange Place, Jersey City, N. J., $13,525 (awarded contract); C. L. Dooley, Inc., 257 Adelphi Street, Brooklyn, $13,694; Mulford Stow, Highland, N. Y., $14,072, and Kaufman & Garcey, 51 Chambers Street, New York, $14,292.

★**New Brunswick, N. J.**—Four lowest bids opened May 9 by city for a 6,000,000-gal. filter plant submitted by Roberts Filter Mfg. Company, Darby, Pa., at $77,520. Utility Construction Company, New Brunswick, $82,825; American Water Softener Company, Philadelphia, Pa., $84,241, and Suburban Engineering Company, New York, $87,737. Four lowest for 40 x 85 ft. stand pipe (bids opened same time): Chicago Bridge & Iron Works, Chicago, Ill., $18,730; Memphis Steel Company, Greensburg, Pa., $18,760; Tippet & Wood, Phillipsburg, Pa., $20,408, and Hughes Foulkrod Company, Philadelphia, Pa., $21 ,870. Asher Atkinson, City Engineer.

★**Columbia, S. C.**—Contract for constructing high velocity rapid sand water filtration plant six 1,000,000-gal. units awarded N. Y. Continental Jewell Filtration Co., 15 Broad Street, New York, N. Y., at $35,095. John McNeal, City Engineer.

★**Louisville, Ky.**—Contract for furnishing 35 hydrants awarded K. A. Barker, Louisville, and 5 hydrants to A. P. Smith Mfg. Company, East Orange, N. J. D. R. Lyman, City Engineer.

★**Cleveland, Ohio.**—Contract awarded by City Board of Control to William Patison Supply Company, 215 St. Clair Avenue, for 6000 ft. galvanized steel pipe for city water works at $1,215. (Bids opened April 25.)

Middletown, Ohio.—Following are lowest bids opened May 1 by City Commissioners for pumps, valves, etc.: Two low-service, electrically driven, centrifugal pumps, Dravo Doyle Co., Indianapolis, $4,585: steam, turbine-driven, centrifugal pump, United Engineering Co., Chicago, $7,654: horizontal, cross-compound, condensing pumping engine, Worthington Pump & Machinery Corp., Cincinnsti, $11,975; steam, turbine-driven, centrifugal pump, United Engineering Co., Chicago, Ill., $7,654: horizontsl, cross-compound, condensing pumping engine, Hooven & Owens Rentschler Co., Hamilton, $16,470. Water pipe, (a) per ton, (b) total: B. & S., pipe, (a) $29.30, (b) $8 007; B. & S., specials, (a) $80, (b) $1,972; flanged pipe, (a)

$50,000, (b) $1,633; flanged specials, (a) $150, (b) $3,168; miscellaneous, (a) $125, (b) $625; total $15,406; Venturi meter, Dravo Doyle Co., Indianapolis, Ind., $895; valves, Flower Stephens Manufacturing Co., Detroit, Mich., $1,215; bell and valves, James B. Glow & Sons, Chicago, Ill., $1,140; sluice gates. Flower Stephens Manufacturing Co., Detroit, Mich., $200. Seabury Gould Pollard, Consulting Engineer, 3422 Burch Avenue, Cincinnati.

★**Warsaw, Ill.**—Contract for furnishing mains awarded Monie & Dunbar, St. Louis, Mo., at $6,683.

★**Silver Lake, Minn.**—Contract for constructing water works (bids opened April 13), awarded Badger Construction Company, Fargo, N. D., at $21,998.

St. Paul, Minn.—Lowest bid opened recently by city for furnishing valves for Water Department, submitted by Flower Stephens Company of Detroit, Mich.

★**Wadena, Minn.**—Contract for extending water works (bids opened May 1), awarded Pastoret Construction Company, Duluth, $9,761. A. C. Murray, Recorder.

★**Aberdeen, Wash.**—City has rescinded former action in awarding stave contract in connection with water works, and has again awarded said contract to Pacific Lumber Agency of Aberdeen at $25 per thousand, in all about 2,000,000 ft.

★**Colfax, Wash.**—Contract awarded by Council for furnishing 5½ miles of 12-in. c. i. pipe to complete the water line from Glenwood Springs to Colfax, U. S. Pipe & Foundry Company, 71 Broadway, New York, at $41 per ton, f.o.b. Colfax; for laying pipe, to Ristedt & Bragg, Colfax, at $9,076, and for furnishing leadite to Crane & Co., Spokane, at $13.112 per hundred.

Seattle, Wash.—P. J. McHugh, Third Avenue North and Mercer Street, submitted lowest bid for water mains and paving in Seventh Avenue North, at $16,118.

★**Berkeley, Cal.**—Contracts for an irrigation and water supply system for Riverside Citrus Experiment Station awarded by Trustees University of California as follows: Concrete reservoir to Hudson & Shaw, 733 Central Building, Los Angeles, at $993; also pump house, sump, etc., at $1,873; pipe lines and irrigation reservoir to Cresmer Mfg. Company, Riverside, at $4,340 and $392 respectively. R. G. Sproul, Assistant to Comptroller.

★**Pasadena, Cal.**—Contract for furnishing and installing a deep well pump with capacity of 1070 gal. per minute under a 240-ft. head, for municipal water department, awarded International Pump Co., at $6,750 for Worthington pump.

★**San Marino, Cal.**—Contract for constructing reinforced concrete reservoir about 190 x 165 x 18 ft., not including timber and composition roofing, awarded to Munoz & Munoz, 800 Central Building, Los Angeles, at $16,119. Mayberry & Parker, Engineers, Pacific Electric Building; Huntington Land & Improvement Company, Pacific Electric Building, Los Angeles, owner.

★**Collingwood, Ont.**—Contract awarded by Council to Turbine Equipment Company, Toronto, for new water works pumping machinery to cost $35,000.

SEWERAGE AND SEWAGE DISPOSAL

PROPOSED WORK.

Peabody, Mass.—Street and sewer bonds for $30,000 sold. Address Town Clerk.

Quincy,, Mass.—City sold $35,000 sewer bonds.

New Haven, Conn.—Reported estimate of cost of a sewage-disposal system for city is $500,000. Mayor Rice is Chmn. of Joint Committee on Sewers and Sanitation of Bd. of Aldermen.

Nyack, N. Y.—Sewer bonds recently sold are refunding bonds, no new work contemplated.

Bernardsville, N. J.—Construction of sewage-disposal plant in Bernards Township contemplated. Address Bd. of Health.

Paterson, N. J.—The Towns of Haledon and Prospect Park applied to Bd. of Finance to join in Passaic Valley trunk sewer project.

Carbondale, Pa.—Hendricks Mfg. Company considering installation of disposal plant.

Pittsburgh, Pa.—Finance Committee of City Council approved Council's ordinances providing $350,000 bond issue for storm sewer in Nile Mile Run and for widening, straightening and improving Saw Mill Run.

Pottsville, Pa.—City Council will engage an engineer to prepare plans for a sewerage system.

Quakertown, Pa.—The Borough Council voted to construct a sewage disposal plant.

Richmond, Va.—See "Water Works."

Fulton, Ky.—Surveys, plans and specifications being made by Frank L. Wilcox, Consulting Engineer, St. Louis, Mo., for sewers.

Dayton, Ohio.—Contract soon to be let for constructing Dry Hollow Creek Run sewer, to cost $160,000. F. O. Eichelberger, City Engineer.

Dayton, Ohio. — $465,000 water, sewer and street improvements bonds have been sold. Address Director Public Service.

Cambridge, Ill.—Contract to be let soon after May 25 by city for constructing sewer system, including 6½ miles of 8, 10 and 12-in. vitr. pipe, cost $43,000. H. G. Stokes, City Engineer, Kewanee, may be able to give information.

Whitefish Bay, Wis.—Edward F. Leidel, Milwaukee, has prepared plans for a sewer and water system costing $200,000.

Dubuque, Iowa.—Ralph P. Melendy, Asst. County Engineer, engaged to prepare plans and estimates of cost of constructing a sewer system for East Dubuque.

Mora, Minn.—See "Water Works."

Ellis, Kan.—The city sold $31,000 bonds and will construct sewer system. Address City Clerk.

Wymore, Neb.—City Council considering constructing sewer system; cost $25,000.

Bozeman, Mont.—Sewer bonds for $70,000 will be sold May 18, by C. A. Speith, City Clk.

Harlowton, Mont.—Sewer bonds for $25,000 will be sold May 22, by S. K. Campbell, City Clk. Geo. Baker, City Engr.

Kansas City, Mo.—Following bonds are to be sold: $75,000 for purchase of land and erection of buildings at Municipal Farm; $100,000 for improving city sewer system; $200,000 for bridges and viaducts; $200,000 for approaches to Twelfth Street viaduct; $200,000 for improvements to parks and parkways; $250,000 for constructing Twenty-third Street viaduct; $25,000 for Chestnut Avenue traffic way; $100,000 for Blue Valley sanitary sewer. Address Mayor.

Amarillo, Tex.—It is proposed to construct 3 miles of 6 and 8 in. sewers at a cost of $5,000 and a septic tank to cost $5,000 additional. Contract will be let about June 10. M. H. Hardin, City Manager.

Corsicana, Tex.—Contract will be let this summer for about $10,000 worth of sewer improvements and disposal plant, an additional $10,000 including sludge beds, etc.

Austin, Tex.—City Commission approved resolution providing for construction of a storm sewer on Little Shoal Creek and appropriating $50,000 for the improvement.

Cameron, Tex.—Plans to be submitted to State Sanitary Engineering Department for a sewage disposal plant. M. H. Bailey, City Secretary.

Gainesville, Tex.—State Sanitary Engineering Department considering plans for a sewage disposal plant proposed in this city by the Gainesville Sewer Company (A. J. Scott, Manager).

Jefferson, Tex.—Contract soon to be let for a sewage disposal plant. George Niedemyer, Secy. Jefferson Sewer Company.

Kerens, Tex. — O'Neill Engineering Company, Dallas, preparing plans for a sewage disposal plant and sewer system.

Palestine, Tex.—Plans under consideration for a sewage disposal plant. G. A. Wright, Mayor.

San Angelo, Tex.—Plans being prepared for a sewage disposal plant for San Angelo Sewer Company (C. C. Kirkpatrick, President).

Seguin, Tex.—Revised map of proposed improvements to sewerage system completed; cost $35,000. Bartlett & Rainey, Engineers.

Tyler, Tex.—City has purchased present sewer system and is having plans prepared by Bartlett & Ranney, San Antonio, for improvements.

Wharton, Tex.—Plans being prepared for a sewage disposal plant. G. S. Gordon, Mayor.

Folsom, Cal.—C. G. Gillespie, Chief Engineer State Board of Health, Sacramento, estimates cost of constructing a sewer system in Folsom at $20,000.

BIDS DESIRED.

Biddeford, Me.—Until May 29, by Board Municipal Officers for constructing reinforced concrete egg-shaped sewer, advertised in Engineering Record. Leopold A. Girard, Mayor; W. C. Bigelow, Engr., 5 Smith Bldg.

Boston, Mass.—Until May 16, by Boston Transit Commission, 15 Beacon Street (B. Leighton Beal, Secy.), for about 3650 lin. ft. sewer pipe, 8 to 20 in., delivered near Andrews Square, South Boston, or at Stock Yards of Transit Commission, at C and Cypher Streets, Boston.

Hartford, Conn.—Until 11 A. M., May 16, by the Board of Contract and Supply, for a section of 24-inch tile and cast iron sewer in Grove Street. Bond for $2,000.

Waterbury, Conn.—Reported desired until May 16, for constructing sewers in several streets. R. A. Cairns, City. Engr.

Binghamton, N. Y.—Until May 24 (re-advertisement), by Board of Contract and Supply, for constructing Section No. 1 of the main intercepting sewer, advertised in Engineering Record. W. Earl Weller, City Engineer.

New York, N. Y.—Until May 17, by Marcus M. Marks, President Manhattan Borough, for alterations and improvements to sewers in 151st Street, Park Avenue, West Side, receiving basins in Bradhurst and Eleventh Avenues. Security, $12,100.

Yonkers, N. Y.—Until May 15, by Board Contract & Supply (Edw. P. Walsh, Secy.), for constructing sewers in Forest and Sedgwick Avenues.

Newark, N. J.—Until May 31 by Passaic Valley Sewerage Commissioners, Essex Bldg., Newark, for constructing Southerly portion of Section 27 of Kearney, Harrison, Newark Branch Intercepting Sewer, advertised in Engineering Record. Wm. M. Brown, Ch. Eng.

Westfield, N. J.—Until May 27 by Town Council for constructing a relief sewer advertised in Engineering Record. Charles Clarke, Town Clk.

Hazleton, Pa.—Until May 20, by B. E. Youngman, City Engineer, for constructing uncompleted portion of sewer system requiring 400 ft. 3 ft. 6 in., 900 ft. 4 ft., 200 lin. ft. 4 ft. 6 in. and 1100 lin. ft. 24 in. sewer pipe; appropriation $22,000.

Princeton, Ind.—Reported desired until May 15, for constructing 8500 ft. 6 and 8-in. tile sewers. H. J. Toole, City Engr.

Graysville, Ill.—Until May 15 by city for constructing a sewer system estimated to cost $20,769.95, advertised in Engineering Record. Paul R. Blood, Public Engineer.

Marshall, Ill.—Reported desired until June 1, for constructing nine blocks of sanitary and storm sewers. J. W. Lewis, Chmn. Board Local Improvements.

Appleton, Wis.—Reported desired until May 17, E. L. Williams, City Clk., for constructing sewers in Meade, Lawe, Washington and other streets.

Monticello, Wis.—Reported desired until June 1, by Village Council, care of Dr. Bloomer, for constructing sewers and disposal plant, to include Imhoff tank. W. G. Kirchoffer, Engineer, 24 North Carroll Street, Madison.

Lake View, Iowa.—Until May 15 (re-advertisement), by City Clerk, for constructing sewers and sewage disposal plant. Brice & Standevin, 430 Bee Building, Omaha, Neb.

Ottumwa, Iowa.—Until May 15, by W. J. Berry, Commissioner Street & Public Improvements for sewers, salt glazed vitr. clay pipe, or Standard Portland cement concrete, in portions of Sheridan Avenue, South Willard and other streets.

Anoka, Minn.—Until May 18, by City Commission, for constructing sewage treatment plant, consisting of settling tank, sludge bed and appurtenances, etc., 38,628 lin. ft. 8 to 20 in. sanitary sewers, 2678 ft. 8 to 36 in. double sewers, 85 manholes, flushtanks, lampholes, etc. L. P. Wolff, Consulting Engr., St. Paul; Henry Lee, City Clerk.

Ainsworth, Neb.—Reported desired until May 15, by T. Ritter, City Clerk, for constructing sewers. Bruce & Standeven, Engineers, 430 Bee Building, Omaha.

Greybull, Wyo.—Reported desired until May 19, for constructing main and lateral sanitary sewers, Imhoff tank, etc. H. Higgins, Town Clk.

Myrtle Point, Ore.—Until May 22, by City Clerk, for constructing sewerage system, involving 24,366 lin. ft. 6, 10 and 12 in. sewer pipe, manholes, basins, and 34 lampholes, etc..

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Ridgefield, N. J.**—Contract for constructing sewer system and sewage disposal plant (bids opened April 19) awarded Cavanagh Contracting Company, 150 Nassau Street, New York, $87,617; Charles Ippolito, Orange, N. J., $10,300. C. B. Wilson, Clerk.

★**Jacksonville, Fla.**—Contracts for furnishing materials (bids opened April 14 by Board Bond Trustees) awarded as follows: Vitr. sewer pipe, 21,044 ft., 8 to 24 in., and 1500 8 x 5 Y's, to Macon Sewer Pipe Works, $15,984; C. I. pipe, 9314 lin. ft., 8 to 24 in., five tons specials, to U. S. Cast Iron Pipe & Foundry Company of Birmingham, Ala., at $18,893; C. I. culvert pipe, 2283 ft., 16, 8, 24 and 36 in., to American Casting Company of Birmingham, Ala.; reinforced concrete pipe, 14,791 ft., 27 to 54 in., to Lock Joint Concrete Pipe Company, at $48,510.

★Contracts for constructing sewers awarded as follows (bids opened April 14 by Board): Section III—Riverside laterals and Oceola Street sanitary sewer, Meshler & Flynn, at $45,919; Section IV—Storm sewers in Eleventh, Barrs, Main and Newman Streets, to Bryan & Company of Jacksonville, at $28,657; also Section V—Howard Avenue sanitary sewer and Section VII—Henry Swift, Georgia, Duval and Fairfield Streets, storm sewers at $30,101 and $58,850 respectively and Section VI Liberty Street storm sewer, Meshler & Flynn, $31,935.

Sections I and II, sanitary and storm sewers, rejected and new bids opened May 12.

★**Cincinnati, Ohio.**—City Board of Control awarded contract for laying vitrified pipe sewer in Draper Street to John B. McLane & Co., 520 East Fourth Street, at $16,709.

★**Xenia, Ohio.**—Contract awarded Bailey & Rhodes, Kent, for constructing a sewage disposal plant at $55,050. J. P. Shumaker, City Engineer.

★**Northwood, Iowa.**—Contract for 27,581 lin. ft. pipe sewers, etc., awarded Security Bridge Company, Minneapolis, Minn., at $20,999. J. E. Armundson, City Clerk.

★**Lake Crystal, Minn.**—Contract for constructing sewers (bids opened May 1) awarded A. A. Dobson, 310 First Natl. Bank Bldg., Lincoln. W. P. Cobb, City Clerk.

★**Houston, Tex.** — Contracts recommended for award as follows: Sewers on Leeland Avenue and on Milby Street to Horton & Horton, Houston, at $12,500; for three centrifugal pumps in connection with sewage disposal plants, first two to cost $5,600 each, and other $3,000, to Goulds Mfg. Co., Seneca Falls, N. Y.

★**Victoria, Tex.**—Following are 3 lowest bids opened by City Council May 1 for constructing sewage disposal plant: Dallas Lime & Gravel Co., Dallas, $24,668; Depew & Ranney, San Antonio, $27,212, and Trueheart & Jackson, San Antonio, $25,097.

★**Richmond, Cal.**—Contract for grading and constructing sewer system in Canal Sub-Division for Richmond Canal & Land Co. (H. W. Wernse, Secy.), awarded to Richmond Dredging Co., Richmond, at about $80,000.

★**Ooden, Utah.**—Contract for constructing pipe sewers in Sewer District Nos. 130 and 132 awarded Green Engineering & Construction Co., Tooele, Utah. Walter Rieley, City Recorder.

BRIDGES

PROPOSED WORK.

New London, Conn.—Yates & Yates, 120 Broadway, New York, engaged as consulting engineers for the county of New London, to design and supervise construction of a highway bridge across Niantic River to replace bridge condemned by War Department. Proposed bridge will have one bascule span, and several reinforced concrete spans, total length, including fill approaches at either end is approximately 600 ft. Contract will probably be let this summer.

Mayfield, Pa.—Construction of a bridge over Lackawanna River in Mayfield costing $10,000 has been recommended by the Jury. Address Gomer Davis, Clerk Courts.

Uniontown, Pa.—County Commissioners approved plans for a railroad bridge to be constructed by Pittsburgh & Lake Erie R. R. over Dickerson's Run. Cost $30,000.

Ocean City, Md.—A bridge is to be constructed at a cost of $50,000 at Ocean City, by County Commissioners, Snow Hill, and the State Road Commission, Baltimore.

Ft. Lauderdale, Fla.—See "Paving and Roads."

Birmingham, Ala.—Plans completed by Julian Kendrick, City Engineer, for proposed viaduct contemplated at Twenty-first Street.

Lake Charles, La.—See "Hydraulic Construction and River Improvements."

Cincinnati, Ohio.—Board of County Commissioners ordered plans and specifications for two bridge improvements on the Springfield Pike. County Surveyor Wm. Boeh estimates cost of the new bridge over the west fork of Millcreek, at Woodlawn, is $40,000. Springfield Pike is to be part of Dixie Highway, and because the bridge will eliminate a dangerous curve the State Highway Commission will pay half the cost. The widening of bridge at C. H. & D. crossing, Hartwell, to permit a 60-ft. roadway; cost $85,000. The Board will issue bonds to pay the County's share of these improvements.

Burnet, Tex.—Attorney General has approved Burnet County bridge bonds amounting to $10,000.

Fort Worth, Tex.—State Reclamation Department, Austin, has approved plans for a highway bridge to be constructed across Trinity River at Park Street. H. B. Hayes, County Engineer, Fort Worth.

Washington.—The state and Northern Pacific Ry. Co. will build concrete bridge 800 ft. long, with 22 ft. clearance above tracks, where Pacific Highway crosses railway tracks at Nisqually. Estimated cost $20,000. James Allen, State Highway Engineer, Olympia.

Portland, Ore.—A concrete arch viaduct is to be erected over tracks of the Oregon Electric Ry. at Miltonomah Station at a cost of $17,000. C. H. Purcell, Engineer, 504 Court House; J. Knowles, Chief Clerk.

Santa Ana, Cal.—Election June 6 to vote $6,000 bonds for constructing bridge over Santiago Creek, at North Flower Street. Address City Clerk.

Holbrook, Ariz.—Bridge bonds for $63,000 have been sold. Proceeds to be used to construct steel highway bridges. D. M. Moss, Clerk Board of Supervisors.

Enniskillen, Ont.—Michigan Central Ry. (W. Williams, St. Thomas, Supt. of Bridges) is preparing plans for a 201-ft. steel and concrete bridge to cost $50,000.

Malahide, Ont.—Contract soon to be let for constructing a 300-ft. steel bridge, to cost $50,000. Engineer Bell, Court House, St. Thomas.

BIDS DESIRED.

Clarksburg, Mass.—Until May 16, by State Highway Commission (Wm. D. Sohier, Chmn.), Boston, for constructing concrete bridge 69 ft. span, on state highway in town of Clarksburg.

Providence, R. I.—Until May 17, by State Board Public Roads, Providence, for replacement of State Bridge No. 117, "Whipple Bridge," near village of Lonsdale, advertised in Engineering Record.

Woonsocket, R. I.—Until May 23, by Board of Alderman (Contract 1) for constructing reinforced concrete bridge over Mill River at Social Street, and Contract 2, bridge on Cumberland Street over Peters River, advertised in Engineering Record. Frank H. Mills, Mills City, City Engineer.

New York, N. Y.—Until May 16, by Department of Bridges (F. J. H. Kracke, Comr.), for furnishing and delivering creosoted wood block.

Freehold, N. J.—Until May 19, by Board Chosen Freeholders, Monmouth County (C. E. Close, Clk.) for furnishing material and constructing a reinforced concrete bridge in Township of Holmdel, Monmouth County. Geo. D. Cooper, Co. Engr., Red Bank.

Brockport, Pa.—Until May 26, by Board County Supervisors (I. D. Kerns, Secy.) for constructing a 50-ft. span with a 16-ft. roadway bridge, with concrete floors and concrete foundations.

Warren, Pa.—Until May 31 by County Commissioners at Warren for constructing a concrete bridge over Allegheny River at Warren, advertised in Engineering Record. Luten Engineering Company, Calder Building, Harrisburg, Engineers.

Clifton Forge, Va.—Until May 18, by Supt. Public Works, for constructing reinforced concrete bridge for a deck girder bridge with two piers, total length of bridge 104 ft. over all, with 18-ft. roadway, 4-ft. walk. T. P. Halloran, Chmn. Finance Committee.

Hartford, W. Va.—Until June 2, by Clk. County Court, Point Pleasant, for construcing a reinforced concrete viaduct at Hartford. R. P. Davis, Bridge Engineer, State Road Bureau, Morgantown.

Atlanta, Ga.—Until May 19, by W. E. Chambers, Purchasing Agent, for constructing reinforced concrete bridge and earth approach of Piedmont Park Boulevard Bridges.
Until May 19, by W. E. Chambers, Purchasing Agent, for painting iron and steel bridges.

Washington, Ga.—Until May 23 by County Commissioners at Washington, for constructing a bridge over Little River, 11 miles from Washington, between counties of Wilkes and McDuffie, to have two rubble abutments, 20 ft. high, resting on piles, and one 110-ft. steel span 16-ft. roadway. Searcy B. Slack, Engineer, Good Roads Department, University of Georgia, Athens.

Elyria, Ohio.—Until May 25, by Board County Commissioners (F. L. Ellenberger, Clk.), for constructing superstructure of the Beaver Creek Culvert, No. 3-22, in Black River Township, to consist of steel trusses, creosoted wood block floor, 84-ft. pony truss and 18-ft. roadway. Estimate cost $3,661. Also separate bids for substructure stone or 1:3:5 concrete subfoundation woodpiling. Estimated cost $3,699. E. P. Crosse, Co. Surv.

Mt. Gilead, Ohio.—Reported desired until May 26, by C. O. Higgins, Co. Aud., for substructure and superstructure of Rule bridge, between North Bloomfield and Congress Townships.

St. Clairsville, Ohio.—Until May 29, by Bert W. Hopkins, Co. Aud., for furnishing material and constructing one concrete top and one concrete abutment and repair of one abutment for bridge over Moore's Run in West Wheeling, to be 20 ft. span with 34½-ft. roadway.

Benton Harbor, Mich.—Until May 18, by M. Z. Jones, Benton Harbor, for constructing superstructure and substructure of two-span concrete bridge over Paw Paw River, between Benton Harbor and Township of Benton, length 150 ft.; cost $12,000.

East Peoria, Ill.—Until May 17, by National Bank, East Peoria, for constructing steel superstructure on reinforced concrete abutments in Fondulac Township, Tazewell County, Ill. Cost, $7,240. Frank S. Cook, County Supt. of Highways, Mackinaw.

Joliet, Ill.—Until May 18 by County Superintendent of Highways, Joliet, for constructing a reinforced concrete bridge between Felix Township, Grundy County, and Wilmington Township, Will County. Cost, $3,080.

Duluth, Minn. — Reported desired until May 20 for constructing bridges as follows: 126-ft. steel bridge over St. Louis River, Township 53; 180-ft. steel bridge over Little Forks River, on Eden Road, Township 63. J. O. Walker, Co. Aud.

Stanton, Minn.—Reported desired until May 17 for constructing a 50-ft. concrete through girder span, 18-ft. roadway bridge over Canon River, in town of Stanton. C. H. Meyer. Co. Aud., Red Wing.

Hayti, S. D.—Until June 6 by Board County Commissioners (David Sour, Chmn.) for all bridges, abutments and repairs to bridges, as required by county, for ensuing six months. Guy Obson, Co. Aud.

Richmond, Tex. — Until May 19 by County Commissioners for constructing bridge over Big Creek. W. I. McFarlane, Co. Judge.

Waco, Tex.—Reported desired until May 15 by John Dollins, Mayor, for painting and reflooring the iron bridge over Brazos River at foot of Washington Street.

Lawton, Okla.—Until May 25, by Charles Critches, County Clerk, for constructing steel bridges with concrete abutments.

Seattle, Wash.—Reported desired until May 22, by Bryon C. Phelps, Co. Aud., for constructing Fall City bridge, center span to be 100 ft. with two 95 ft. spans, and fill approach. Probable cost $95,000. A. P. Denton, Co. Engr.

Ottawa, Ont.—Until May 16 by Secretary Board Control for superstructure of Pretoria Avenue bridges. F. C. Askwith, Act. City Engr.

Wallace, Man.—Until May 26, by Wm. Whiteford, Secy. Treas., for constructing 20 ft. and 25 ft. concrete bridges and one concrete culvert.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Boston, Mass.**—Contract awarded McClintic Marshall Company, Pittsburgh, Pa., for 3000 tons of steel for bridges at Boston.

★**Massachusetts.**—Contract awarded by State Highway Commissioner, Boston, for constructing single-span highway bridge over northern branch of Hoosac River, at Red Mills, in Clarksburg Township, to J. L. Horton, Springfield, at $12,000.

Philadelphia, Pa. — Following bids, opened April 28, by Department of Public Works, for constructing steel bridge on line of Godfrey Avenue, for tracks of P. R. Ry. Co., at Fern Rock: Brown-King Construction Co., Harrison Block, at $109,154; Robert Lombardi, Betz Block, $122,500; A. L. Carhart, Hale Block, $124,000, and Thomas F. Reilly, 1616 Thompson Street, $125,800.

★**Miami, Fla.**—We are officially informed that contracts for constructing the two reinforced concrete bridges over Miami River, one at Twelfth Street and one at Avenue D were awarded M. F. Comer, 700 Water Street, Toledo, Ohio.

★**Dayton, Ohio.** — Pacific Bridge Co., Portland, Ore., authorized by City Trustees to sublet contract for constructing Fifth Street bridge to Hackedora Contracting Co., Indianapolis, Ind.

★**Illinois.**—Contract for constructing the Slough Bridge in Peru Township, La Salle County, awarded by State Highway Commission, Springfield, to Wausau Iron Works, Wausau, Wis., at about $13,345.

★**Marengo, Iowa.**—Contract awarded by County Commissioners for bridge work for 1916 to M. O. Burnett Bridge & Construction Co., Marengo, at $23,000.

★**Primghar, Iowa.**—Contracts for bridge work during year 1916 awarded George Gardner, Sheldon, $13,500; L. Mead, Calumet, $5,500; Edward Lemke, Paullina, $4,000. J. C. Kenigam, County Engineer.

★**Rochester, Minn.**—Contract for constructing State Bridge No. 1613 (bids opened May 6), awarded William O'Shea & Sons, Minneapolis, at $1,950.

★**Hanover, Kan.**—Contract awarded Topeka Bridge & Iron Company, Topeka, for constructing a 350-ft. bridge at $22,278.

★**Concrete, Wash.**—Reported contract awarded by County Commissioners, Mt. Vernon, for constructing 186-ft. concrete bridge over Baker River, at Concrete, to J. R. Wood, 621 Valley Street, Seattle, at about $21,000. (Bids opened May 2).

★**California.**—Contract awarded by California Highway Commission, Sacramento, for constructing a steel truss bridge with reinforced concrete approaches in Humboldt County, Division No. I, Route I, Section E, across Eel River, south of Scotia, Mercer Fraser Co., Eureka, Cal., at $102,825.

★**Santa Barbara, Cal.**—Following contracts awarded by Bd. of Supervisors for constructing concrete girder bridges: Over Zaca Creek, at Station 472 Plus 00, Section D on Line State Highway, in Third Road Dist., to Humphreys Constr. Co., Santa Barbara, at $9,600, and for bridge at Station 310 Plus 5, to Dominguez & Walter, Santa Barbara, at $21,000, and $26 for piles.

PAVING AND ROADS

PROPOSED WORK.

Amesbury, Mass.—Town intends building a tar road on Elm Street to cost $22,000. Address Secretary Board of Selectmen.

Boston, Mass.—Reported new bids to be asked for paving Commonwealth Avenue; estimated to cost $47,500. Address Commissioner Public Works.

Peabody, Mass.—See "Sewerage and Sewage Disposal."

Albion, N. Y.—Citizens voted $120,000 bonds for paving Main Street and business portion of East Bank Street. Business portions will be paved with Albion sandstone block and residential portion of Main Street with brick, both on concrete foundation and sandstone curbing. Address City Clerk.

Moline, N. Y.—Paving bonds for $33,000 will be sold May 22 by Franklin County. Plans being prepared by S. A. Howard, County Superintendent of Highway, Malone, for brick pavement.

Saratoga Springs, N. Y. — Common Council plans spending $27,500 for improving streets. Address City Clerk.

Lakewood, N. J.—Paving bonds for $30,000 will be sold May 19 by George H. Hurlbert, Township Clerk.

Archbald, Pa.—Contract soon to be let by Borough Council for paving Laurel, Wayne and other streets at estimated cost $42,000. Address Borough Clerk.

Lebanon, Pa.—City Council passed ordinance authorizing $24,000 bond issue for paving street and alley intersections. Address City Clerk.

Narberth, Pa.—Borough Council sold $30,000 bonds for improving highways. Address Borough Clerk.

New Wilmington, Pa.—Contract to be let in about a month for brick paving on concrete base on Market Street and Neshannock Avenue, about two miles in all. P. A. Gilkey, Engineer, New Castle.

Scranton, Pa.—In the city's budget about $85,000 improvements are provided for, including $13,000 for repaving North Main Street and $10,000 for Welland Culvert; also $10,800 for Nay Aug Park.

Baltimore, Md.—The Aejis Company, 700 Equitable Building, contemplates paving streets, sidewalks and constructing sewers, etc., at a cost of $32,000.

Norfolk, Va.—City Council plans paving Plume Street, cost $13,000, and Church Street, cost $134,317. Address City Clerk.

Richmond, Va.—See "Water Works."

Hundred, W. Va.—It is proposed to construct in Church District, Wetzel County, 15 miles of road, principally brick, on concrete foundation, with concrete curb. Citizens recently voted $240,000 bonds for road improvements in this district. Surveys not yet made. F. M. Cross, Secy. Church District Advisory Committee.

New Martinsville, W. Va.—Church District Road bonds amounting to $240,000 will be sold by the County Court at New Martinsville June 10. Sylvester Myers, County Clerk; J. R. Wilson, Engineer, Mannington.

Parkersburg, W. Va.—Citizens, May 2, voted $70,000 bonds for Tygards District permanent roads. Burdett Woodyard, Engineer, Parkersburg. C. E. Pahl, Clerk Commissioners.

West Virginia.—Road improvement bonds throughout State have been voted in following precincts:
Wetzel County (New Martinsville C. H.), Church Prect., $240,000.
Barbour County (Philippi C. H.), Barker Prect., $130,000.
Wood County (Parkersburg C. H.), Clay Prect., $40,000; Tygart Prect., $100,000.
Roane County (Spencer C. H.), Spencer Prect., $240,000.
Logan County (Logan C. H.), Logan Prect., $200,000.
Raleigh County (Beckley C. H.), Town Prect., $300,000; Trap Hill Prect., $175,000; Shady Springs Prect., $135,000; Slab Fork Prect., $210,000.
Greenbrier (Lewisburg C. H.), White Sulphur Prect., $90,000.
Marion (Fairmount C. H.), Lincoln Prect., $600,000.

Fort Lauderdale, Fla.—Road and bridge bonds for $175,000 will be sold May 25 by Board County Commissioners (A. B. Lowe, Chmn.).

Palatka, Fla.—County Commissioners plan spending $1,000,000 for constructing about 200 miles of road. Address County Clerk.

Selma, Ala.—Contract soon to be let by city for paving. Louis Benish, Mayor.

Greenwood, Miss.—Citizens voted $600,000 bonds for public road improvements. Address County Clerk.

Kentucky.—About $4,000,000 will be spent on reconstructing roads under supervision of State Commissioner of Roads at Frankfort.

Owensboro, Ky.—Road bonds for $600,000 will be sold June 1 (extension of date) by County Fiscal Court.

Bowling Green, Ohio.—County Commissioners sold $80,000 bonds for stone roads. Address County Clerk.

Bryan, Ohio.—Paving bonds for $141,500 will be sold May 22 by G. C. Beucler, Co. Aud.

Canton, Ohio. — Road improvements bonds for $146,000 will be sold May 17, by Board County Commissioners. W. C. Schick, Clk.

Cincinnati, Ohio.—City Council, May 2, approved approximate estimate of $11,132 45, submitted by City Engineer Frank S. Krug, for improvement of Kling Avenue from Harrison Avenue, 829 ft. eastwardly, with brick and 6-in. water main; also approximate estimate of $8,447.25 for similar improvements on Concordia Street from Melish to Lincoln Avenue.

Cincinnati, Ohio.—Board of Commissioners approved estimates for improvement Reading Pike through the village of Reading, and have ordered plans and specifications complete. County Surveyor Wm. Boeh estimates cost as follows: Monolithic brick, $68,561; brick, $75,021; concrete, $52,925; warrenite, $63,708.

Cleveland Heights (P. O. Warrensville), Ohio.—See "Bids Desired.

Dayton, Ohio.—See "Sewerage and Sewage Disposal."

Defiance, Ohio.—It is proposed to pave several streets at a cost of $50,000, including Jackson, First and Third Streets, including sandstone curbing. Material for paving not yet decided. C. A. Smith, Engineer, Defiance; B. S. Mier, Service Director.

Ironton, Ohio.—Paving bonds for $40,000 will be sold May 22 by W. H. Crawford, Co. Aud.

Maumee, Ohio.—It is proposed to pave about 20,000 sq. yd. on Broadway with asphalt concrete, asphalt macadam or reinforced concrete, including stone or concrete curbing; cost $44,000. Contract will be let about July 1. George Champe, Engineer, 610 Nasby Building, Toledo.

McConnellsville, Ohio.—City Council sold $11,500 paving bonds. Address City Clerk.

Norwood, Ohio.—Citizens April 25 voted $130,000 bonds for street improvements. G. P. Evans, City Auditor.
Contract will be let about July for improving streets. No bids opened May 1. J. G. Schmidt, City Engineer.

Port Clinton, Ohio.—County Commissioners sold $25,000 road bonds. Address County Clerk.

Sidney, Ohio.—Contract will soon be let by County Commissioners for improving 5.78 miles of Dixie Highway from Piqua north to Shelby County line. Address County Clerk.

Adrian, Mich. — Citizens of Madison Township voted $75,000 bonds for improving highways in the township. Address Clerk of Madison Township, Adrian.

Pontiac, Mich.—Paving bonds for $250,000 will be sold May 22 by County Clerk. Board of Supervisors propose constructing this summer about 57½ miles of roads.

Chicago, Ill.—Cook County voted May 4 to spend $500,000 for road building in the country districts. Concrete will be used on Fort Madson and Ballard Roads and Routes 29, 32, 38, and asphalt concrete on macadam base on Route No. 29, Rand Road, Higgins Road, Archer Road and 147th Street. All roads will be 18 ft. wide. Address County Superintendent Highways, Chicago.

Fairfield, Ill.—Main and First Streets are to be paved with vitr. brick on cement base at a cost of $51,000. W. L. McFarland, City Engineer.

Rock Island, Ill.—County Court has petitioned to pave Thirty-ninth Street from Fifth to Eighth Avenues with asphalt at a cost of $9,056, and Twenty-third Street from Second to Fourth Streets and Second Avenue from Twenty-third to Twenty-fourth Streets brick at $9,600.
City Commission adopts ordinance to provide for paving Seventeenth Avenue, Twenty-fifth to Thirtieth Streets, with asphalt; cost $16,345. Wallace Treichler, City Engineer.

West Allis, Wis.—Contract soon to be let for 6,343 sq. yd. concrete paving and 6,370 cu. yd. excav. on National Avenue. W. G. Orvert, City Engineer.

Waukesha, Wis.—County Commissioners plan repaving 5 miles with macadam Blue Mound Road from Milwaukee County line to Gehrke's corners at estimated cost $36,000. Address County Clerk.

★**Charles City, Iowa.**—Contract for constructing two concrete arch span bridges at Nora Springs (bids opened May 2), awarded Koss Construction Company, Des Moines, at $12,700. James A. Cutler, County Auditor.

Minneapolis, Minn.—Paving Commission intends this summer paving about eighteen blocks on Minnehaha Avenue, also paving portions of Portland and Twenty-eighth Streets, and issuing $283,462 bonds for these and other street improvements.

Park Board voted in favor of the Lake Calhoun Boulevard and Lagoon to cost $400,000; asphaltic concrete will probably be used for paving.

Moorehead, Minn.—All bids opened April 10 for 10,832 sq. yd. of paving on Eighth Street South.

Lemmon, S. D.—Two main highways are to be constructed across Perkins County, one from Lemmon and the other from Hettinger. Address County Clerk.

Billings, Mont.—County Commissioners sold $175,000 road bonds, proceeds to be used to construct a gravel road from eastern to western extremity of the county connecting with Yellowstone trail.

Independence, Mo.—Contract will soon be awarded by County Court for macadamizing 2½ miles of W. R. Nelson Road, between Raytown and Blue Ridge Roads. Estimated cost $21,000. Address County Clerk.

Marshall, Mo.—It is proposed to construct 40 miles of road; cost $10,000.

DeWitt, Ark.—Plans prepared by Hugh R. Carter, State Highway Engineer, Little Rock, for 5 miles of macadam road, to be constructed by County Commissioners from Humphrey to Goldner; cost $27,500.

El Dorado, Ark.—Bonds for paving twenty-five blocks in business district, amounting to $25,000, are to be sold. Address Mayor.

Murfreesboro, Ark.—Lund & Hill, Little Rock, engaged to prepare plans for Pike County line of Jefferson Highway, 41 miles; cost $150,000.

Anahuac, Tex.—County Commissioners plan spending $50,000 for shelling roads in various parts of county. Address County Clerk.

Bartlett, Tex.—The Attorney-General at Austin approved issue of $24,000 city paving bonds. Address City Clerk.

Ladonia, Tex.—Citizens of Road District No. 6, Fanning County, have voted $140,000 bonds for building good roads.

Marlin, Tex.—Election soon to be held in Marlin Precinct to vote $500,000 paving bonds and another in Rosebud Precinct. Address County Clerk, Marlin.

Mercedes, Tex. — Citizens of county voted $250,000 bonds for highway improvements. Address County Clerk.

Sulphur Springs, Tex.—Surveys being made for Hoppin County Road District No. 1, which will probably cost $400,000. Daniel R. Junell, County Judge.

Blaine, Wash.—Contract soon to be let by city for paving D and H Streets. Estimated cost, $25,000. E. E. Pruner, City Clerk.

Olympia, Wash.—Contract soon to be let by city for improving Eighteenth Street, including paving, curbing, etc.; cost $11,500. J. B. Weddell, City Engineer; W. A. Hoage, City Clerk.

Seattle, Wash.—Council has indefinitely postponed paving of West McGraw Street and other streets at $106,097.

A. H. Dimock, City Engr., submitted plans and specifications to Board of Public Works for paving West Howe Street and grading and curbing W. Hanford Street.

Plans for water mains, grading, paving, etc., of Willow Avenue, referred to City Council by Board of Public Works, with recommendation that alternative bids be authorized. A. H. Dimock, City Engr.

Board of Public Works approved reports and estimates for cement walks on Division Avenue, Northwest. Cost $26,859. Address City Clerk.

East Marginal Way, about 40,860 sq. yd., is to be paved with brick block, including 35,800 ft. concrete alley side strip; cost $123,117. A. H. Dimock, City Engineer. Address Secretary Board Public Works.

A. P. Denton, County Engineer, completed plans for grading and gravel-surfacing 10 miles Black Diamond-Maple Valley Highway, $65,000; 1½ miles between Woodinville and Duval, $15,000. Byron Phelps, Clerk of County Commissioners.

Spokane, Wash.—County Commissioners propose improving 20 miles of highways this summer, including 4 miles of Spring Valley to North Pine, asphalt macadam or asphaltic concrete; cost $35,000; contract to be let about May 28; 3 miles Apple Way, city limits to Dishman, concrete, warrenite or asphaltic concrete; cost $30,000; contract to be let about May 19; 2.28 miles resurfacing Mead to Newport, asphaltic concrete or warrenite; cost $25,000; contract to be let about May 19; 1 mile Madison Street extension on Valleyford Road, gravel or asphalt macadam; cost $8,000; contract to be let about May 19; three roads, 3.75 miles, Moran Township, gravel or asphalt macadam; cost $20,000; contract to be let about May 28; 3.5 miles Truax Road east of Fairfield, gravel; cost $11,000; contract to be let about June 1; 2 miles Day Road, north of Mead, gravel or asphalt macadam; cost $9,000; contract to be let about June 1. J. W. Strack, County Engineer; Alfred T. Anderson, County Auditor.

Waterville, Wash.—Contract will be let about June 1 by County Commissioners for constructing Permanent Highway No. 4; cost $20,000. Robert F. Foster, Co. Engr.

Marshfield, Ore.—City Council plans hardsurfacing Central Avenue from Fourth to Fourteenth Streets, and constructing cement sidewalks from Market to Adler Streets. Address City Clerk.

Marshfield, Ore.—Election will be held May 19 to vote $352,000 bonds for constructing county roads. Address County Clerk.

McMinnville, Ore.—City Council passed ordinances authorizing paving of Maple, Mills and other streets with hard-surface pavement. Address City Clerk.

North Bend, Ore.—City Engineer will prepare plans for paving the water-front road from Washington Street to city limits. Address City Clerk.

Paris, Idaho.—Paving bonds for $10,000 will be sold May 31 by W. Smith Hoge, City Clerk, for paving Main Street.

Tilbury, Ont.—Town Council contemplates laying new pavements costing $30,000; material not yet chosen. W. H. Hutton, Town Clerk.

BIDS DESIRED.

Boston, Mass.—Until May 15, by E. F. Murphy, Comr. Public Works, for sea walls and paving with granite block or Hassam block in Condor Street, East Boston.

Massachusetts.—Until May 16, by State Highway Commission (Wm. D. Sohier, Chmn.), Boston, for constructing following roads:

Somerset, 4100 ft. road.
Hancock, 6100 ft. road.
Hingham, 4500 ft. road.
Plymouth, 5100 ft. road.

South Hadley, Mass.—Until May 16, by Board Selectmen (E. R. Noel, Chmn.), for Warrenite pavement, to be laid over old concrete pavement in South Hadley Falls.

Stanford, Conn.—Until May 22, by Common Council, for paving advertised in Engineering Record.

New York, N. Y.—Until May 16, by Marcus M. Marks, Pres. Manhattan Borough, for paving on portions of West Thirtieth, East Fifty-eighth, Bradhurst Avenue, John and a number of other streets, in all about 21,290 sq. yds. asphalt on concrete foundation, 14,020 sq. yds. granite block pavement on concrete foundation, 2600 sq. yds. wood block pavement on concrete foundation, together with all curbing, guttering, manholes, etc. Security, $33,750.

Until May 19, by Marcus M. Marks, Pres. Manhattan Borough, for repaving with asphalt on concrete foundation portions of Cedar Street. Engineer's estimate 620 sq. yd. asphalt, manholes, etc. Security $600. Portions of Claremont Avenue. Engineer's estimate 14,700 sq. yd. asphalt, 100 sq. yd. granite blocks, manholes, etc. Security $10,000. Repaving with granite block portions of Park Row and Chatham Square. Engineer's estimate 13,700 sq. yd. granite block pavement, outside railroad area 1670 sq. yd., in railroad area, manholes, etc. Security $18,000. Portions of Houston Street. Engineer's estimate 1570 sq. yd. granite block pavement, outside railroad area, 240 sq. yd. in railroad area, manholes, etc. Security $2,000. Portions of Eleventh Avenue. Engineer's estimate 6680 sq. yd. granite block pavement outside railroad area, 760 sq. yd. in railroad area, with manholes, etc. Security $8,000.

Port Jervis, N. Y.—Until June 5 by John F. Cleary, City Clerk, for about 6500 sq. yd. brick paving on East Main Street, with curbing, etc., advertised in Engineering Record.

Yonkers, N. Y.—Until May 15, Board Contract & Supply (Edw. P. Walsh, Secy.) for paving portions of Morris and Willow Streets and McLean Avenue.

Fair Haven, N. J.—Until May 23 by Charles P. Cross, Borough Clerk, for 60,290 sq. ft. 4-in. concrete sidewalks, 16,260 lin. ft. concrete curbing, advertised in Engineering Record. Arthur C. Swift, Boro. Engr., Red Bank.

Jersey City, N. J.—Until May 23 by City Commissioners for improving Linden Court and its southern terminus with asphalt. Mich. I. Fagen, City Clk.

Newark, N. J.—Until May 25 by Board Street & Water Commissioners for grading, curbing, flagging and paving on Clinton Place, 5700 sq. yd. bitulithic pavement on 6-in. concrete foundation, 14,000 sq. ft. cement sidewalks, 5 in. thick, etc., and North Ninth Street, 8800 sq. yd. similar pavement and 21,000 sq. yd. cement sidewalks, 5 in. thick.

Paterson, N. J.—Until May 16 by Board Public Works for resurfacing of River Street with granite block and about 34,000 sq. yd. of macadam pavement and constructing overflow sewer in Pine and Oliver Streets. H. J. Harder, City Engr.

Pennsgrove, N. J.—Until May 15 (readvertisement), by Board of Freeholders at Salem, for building first section of the Pennsgrove-Pennsville road with bituminous concrete surface upon macadam foundation. I. C. Smashey, Clerk of Bd.

Trenton, N. J.—Until May 17, by City Commission, for paving portions of North Eastfield Avenue, Bryn Mawr Avenue, West and other streets with bituminous concrete pavement. Leon D. Hirsch, City Clerk.

Hazleton, Pa.—Until May 20, by B. E. Youngman, City Engineer, for paving Diamond Avenue 12,436 sq. yd. and repaving Broad Street 22,000 sq. yd. brick, wood, sheet asphalt, Hassam, or amiesite, on concrete base will be used. Paving extension on Broad Street and Beaver Meadow Road 5000 sq. yd., contractor to suggest some inexpensive binding except waterbound macadam. Cost $79,000.

Upper Marlboro, Md.—Reported desired until May 16, by Henry S. J. L. Briscoe, Clk. Co. Comrs., to construct section State Aid highway, on Sargent Road, a distance of 1.12 miles.

Gate City, Va.—Reported desired until June 5, by J. R. Richmond, Co. Clk., for road improvements; $43,800 available.

Lumberport, W. Va.—Reported desired until May 29, for paving a number of streets, for which $20,000 were recently voted.

Houma, La.—Reported desired until May 27, by Police Jury, for constructing 12 miles road along right bank of Bayou Terrebone, to include 20,000 cu. yds, excav., culverts, etc. Probable cost $45,000. T. B. Smith, Houma, Engr.

Terrebonne, La.—Until July 5, by Police Jury (J. C. Dupont, Pres.), for furnishing material and constructing 11.7 miles of sand, clay, gravel roads in the parish advertised in Engineering Record.

Tennessee.—By Tennessee State Highway Department, Nashville, for bituminous material in anticipation of treating about 100 miles of waterbound macadam and chirt gravel roads in Shelby, Madison, Knox, Hamilton and Davidson Counties. A. M. Nelson, State Highway Engr.

Bellevue, Ky.—Until May 18, by Town Council, for paving Taylor Avenue with vitr. brick. Joseph Hermann, Engr., Newport.

Louisville, Ky.—Until May 15, by Board Public Works (Roger G. McGrath, Secy.), for paving on portions of Twentieth Street, and alleys on Baxter Avenue and Dumesnil Streets. Samples of vitr. block must be submitted.

Cheviot, Ohio.—Until May 19, by Albert J. Reusing, Village Clerk, for furnishing material and treating with oil the streets, alleys, squares and public roadways, etc., in village for one year from May 1, 1916.

Cleveland Heights (P. O. Warrensville), Ohio.—Until June 5, by H. H. Canfield, Village Clerk, Cleveland Heights, for furnishing material and improving portions of Lamberton Road, Beechwood Avenue, Euclid Heights Boulevard, De Sota Avenue and a number of other streets, with brick, asphalt or macadam. Paving bonds amounting to $136,000 will be sold same date. F. A. Pease Engr. Co., Marshall Building, Cleveland.

Crestline, Ohio.—Reported desired until June 1, for paving with brick. Probable cost, $9,000. J. W. Atkinson, Engr. Galion.

Fayette, Ohio.—Until May 23 by C. D. Hause, Village Clerk, for paving East Main Street, advertised in Engineering Record. Bids will be considered on concrete, vitr. block or asphalt block.

Galion, Ohio.—Until June 1, by A. F. Unckrich, Director Public Service, for furnishing material and paving Grove Avenue with brick, asphalt, asphaltic block, wood block, sheet asphalt or asphaltic concrete together with necessary gutter, curbing and drainage, advertised in Engineering Record.

Loudonville, Ohio.—Reported desired until May 23, by Mayor and Council, for paving East Main Street, Spring, South Water and other streets.

Ohio.—Until May 19 by Clinton Cowen, State Highway Commissioner, Columbus, for constructing following roads:

Athens County — Logan-Athens Road, length 1.5 miles.
Auglaize County—Kenton-Wapakoneta Road, length 1 mile. Celina-Kossuth Road, length 1.01 miles.
Columbiana County — Salem-Alliance Road, length 4.12 miles.
Defiance County — Hicksville-Defiance Road, length 3.94 miles.
Fulton County—Toledo-Auglaize Road, length 2.32 miles. Wauseon-Napoleon Road, length 1.53 miles.
Geauga County — Cleveland-Meadville Road, length 5.64 miles.
Guernsey County—McConnelsville-Cambridge Road, length 1.08 miles. National Road, length 7.48 miles.
Hancock County—Lima-Sandusky Road, length 6.48 miles. Lima-Sandusky Road, length 3.48 miles. Lima-Sandusky Road, length 2.34 miles.
Huron County — Barberton-Greenwich Road, length 1.26 miles. Bellevue-Norwalk Road, length 0.9 mile.
Knox County—Columbus-Wooster Road, length 0.94 mile. Columbus-Wooster Road, length 0.98 mile.
Lake County—Painesville-Warren Road, length 0.71 mile.
Licking County — Newark-Lancaster Road, length 2.12 miles.
Logan County—Bellefontaine-Richwood Road, length 1.32 miles.
Madison County — Washington-London Road, length 0.81 mile.
Miami County — Piqua-Sidney Road, length 5.78 miles.
Muskingum County—Zanesville-Dresden Road, length 1.47 miles.
Richland County—Mansfield-Mount Vernon Road, length 1.5 miles. Belleville-Lexington Road, length 1.5 miles.
Ross County — Cincinnati-Chillicothe Road, length 1.85 miles.
Sandusky County — Fremont-Bowling Green Road, length 6.01 miles.
Summit County—Akron-Canton Road, length 2.06 miles.
Trumbull County—Chagrin Falls-Greenville Road, length 3.09 miles.
Union County—Marysville-Marion Road, length 0.34 mile.
Washington County — Marietta-McConnelsville Road, length 1.09 miles.
Wayne County—Wooster-Canal Dover Road, length 1.98 miles.
Williams County—Bryan-West Unity and Bryan-Wauseon Road, length 4.69 miles. Bryan-Edgerton Road, length 6.75 miles.
Wyandot County—Forest-Upper Sandusky Road, length 1.02 miles.

Bloomington, Ind.—Until May 19, by Horace Blakley, City Clerk, for improving Horace and Walnut Streets.

Bluffton, Ind.—Until May 26, by City Council, for resurfacing Main, Market, Johnson and Washington Streets. Address City Clerk.

Indiana.—By County Commissioners for constructing following roads:

May 16:

Brazil, for brick road in Brazil Township. W. O. Graeser, Co. Aud.

May 25:

Rushville, concrete road in Rushville Township, macadam road in Anderson Township, and brick and bound macadam road in Rushville Township. Allen R. Holden, Co. Aud.

Evansville, two rock roads in Perry Township. C. P. Beard, Co. Aud.

Winchester, stone and gravel roads in Monroe, Greensfork, and Jackson Townships, 10,602, 15,240 and 2285 ft. in length. Chas. E. Tilison, Co. Aud.

May 26:

Warsaw, concrete and gravel roads in Scott and Jefferson Townships. V. D. Mock, Co. Aud.

May 27:

Muncie, macadam roads in Liberty and Center Townships, two brick and a concrete road in Center Township, and gravel roads in Monroe, Perry, Mt. Pleasant and Center Townships, nine in all. F. M. Williams, Co. Aud.

June 5:

Versailles, crushed stone roads in Adams and Laughry Townships. J. Francis Lochard, Co. Aud.

Greencastle, 14,373 ft. macadam road in Greencastle Township and 5020 ft. gravel road in Russell Township. Joe M. Allen, Co. Aud.

June 6:

Kokomo, 5309 ft. stone road in Taylor Township, 7730 ft. waterbound macadam road and 8624 ft. asphaltic concrete road in Center Township. William L. Benton, Co. Aud.

Bloomfield, macadam road in Richland Township. Geo. E. Kidd, Co. Aud.

Boonville, rock road in Boon Township, rock road in Greer Township. Gaines H. Bass, Co. Aud.

Indianapolis, Ind.—Until May 17, by Board Public Works (Jos. P. Turk, Secy.), for sidewalks in Morris Street, Wilkins Avenue, North Drive and other streets. Also separate bids for paving Rural, Thirty-fifth and other streets and alleys.

Until May 18, by Park Commissioners (Jas. H. Lowry, Secy.), for graveling and improving East Garfield Drive, Raymond and other streets.

Belden, Mich.—Until May 24 by City Clerk for paving North and South Bridge Streets; check $1,000. The L. A. Boulay Co., Engineers, 1250 Nicholas Building, Toledo, Ohio.

Ypsilanti, Mich.—Until May 15, by Summer Damon, City Clerk, for paving portions of S. Washington, Huron, River and other streets.

Brocton, Ill.—Until May 20, by Committee on Highways, Embarrass Township, Edgar County, at office of Bruce Gillis, Town Clerk, Brocton, for constructing 3700 lin. ft. combination rock and gravel road on Isabel Road and 5545 lin. ft. combination rock and gravel road on Springfield Road.

Evanston, Ill.—Until May 15, by Commissioner Public Works, for approximately 45,000 sq. yd. brick pavement, 24,000 sq. yd. bituminous macadam, 2750 lin. ft. 6 in. c. i. water main.

Illinois.—Until May 17, by State Highway Department, Springfield, for constructing the following roads:

Sandusky, Alexander County, Sect. B—13,120 ft. gravel. Engineer's estimate, $19,560.

Whittington, Franklin County, Sect. C.—6416 ft. concrete. Engineer's estimate, $8,461.

Mt. Carroll, Carroll County, Sect. B.—8,400 ft. gravel. Engineer's estimate, $14,236.

Woodstock, McHenry County, Sect. G.—10,500 ft. Engineer's estimate, $11,792. Sect. H.—10,500 ft. Engineer's estimate, $11,811. Both gravel.

Oregon, Ogle County, Sect. C.—4,200 ft. concrete. Engineer's estimate, $17,394.

Watseka, Iroquois County, Sect. D.—12,085 ft. bituminous macadam. Engineer's estimate, $17,692.

Lemont, Will County Sect. C.—9000 ft. concrete. Engineer's estimate, $25,993.

Rockford, Winnebago County, Sect. C.—9150 ft. concrete. Engineer's estimate, $19,037.

Paxton, Ford County, Sect. B.—13,522 ft. gravel. Engineer'a estimate, $16,119.

Radnor, Peoria County, Sect. C.—11,274 ft. concrete and brick. Engineer's estimate, $32,660.

Morris, Grundy County, Sect. B.—3100 ft. concrete and bituminous macadam. Engineer's estimate, $5,676. Sect. C.—5261 ft. bituminous macadam. Engineer's estimate, $10,536.

Sterling, Ill.—Reported desired until May 16 by Town Highway Comrs. for 6803 sq. yd. brick pavement, redressing present gravel and macadam roadway, or constructing new gravel and macadam base, etc.

Knoxville, Iowa.—Reported desired until May 15 by Paul M. Black, City Clk., for cement sidewalks for year ending April 1.

Marshalltown, Iowa.—Until May 24, by S. S. Wilson, City Clerk, for about 63,000 sq. yd. of paving and 25,000 lin. ft. curb, advertised in Engineering Record. A. W. Steiner, City Engineer.

Monona, Iowa.—Reported desired until May 15 by H. S. Rittenhouse, Town Clk., for cement crossings and sidewalks for year 1916.

Ottumwa, Iowa.—Until May 15, by W. J. Berry, Commissioner Streets & Public Improvements, for paving and curbing portions of several streets, including East Maple, West Maple, South Washington, and other streets, also for curbing on various streets.

Bemidji, Minn.—Reported desired until May 18, by J. L. George, Co. Aud., for constructing and improving state roads Nos. 2 and 13, 77, 60 and a number of other roads. Probable cost, $105,400.

Jelle, Minn.—Reported desired until May 15 by F. E. Magnusson, Town Clk., for grading, surfacing, etc., highway, 6¼ miles. Separate bids for clearing and grubbing.

St. Paul, Minn.—Until May 15 by Aug. Hohenstein, Purchasing Agent, for grading Grantham Street. Also separate bids for brick paving blocks for crosswalks, paving Johnson Parkway, and granite curbing on E. Seventh Street.

Reported desired until May 26 by County Commissioners for concrete road about 1 mile long through Robbinsdale, estimated cost $12,000; concrete road, ¾ mile long, connecting North Shore Road with Superior Boulevard, cost $18,000; grading and graveling, approximately a mile each, of Stubbs Bay Boulevard in Orono Lake, Independence to Hassam Road, Medina Township, and Bloomington to Edina Road, Bloomington and Edna Townships. Cost of three roads $15,000.

Lindsborg, Kan.—Reported desired until May 20, for 21,000 lin. ft. combined curb and gutter. H. A. Rowland, Engr., McPherson.

Tonganoxie, Kan.—Until May 22 by City Clerk for about 2731 sq. yd. concrete paving and 1892 lin. ft. concrete curb on Fourth Street.

Wichita, Kan.—Reported desired until June 10, for paving several streets. Probable cost, $25,000. B. C. Wells, City Engr.

Reported desired until May 24, by H. D. Lester, City Clk., for paving Central and Yale Avenues. B. Wells, City Engr.

Independence, Mo.—Until May 19 by Allen C. Southern, Co. Surveyor, for paving roads in Township 48, to consist of 53,760 sq. yd. macadam pavement, 90,300 cu. yd. earth excav., 7000 sq. yd. riprap, etc. Also separate bids for paving Hill Rock Road, a distance of 3 miles, to consist of 31,767 sq. yd. macadam, 43,302 cu. yd. earth excav., 8000 cu. yd. rock excav., etc.

St. Louis, Mo.—Until May 16 by Board Public Service (William T. Findly, Clk.) for constructing sidewalks on Pemrose and Twenty-second Streets, Terry Avenue and numerous other streets.

Corsicana, Tex.—Until May 16, by George A. Duren, City Engineer, for 66,555 sq. yd. paving and 23,770 lin. ft. curbing, estimated to cost $78,928 and $10,855 respectively. Contract for an additional 30,000 yd. of paving will be let in June.

Cold Spring, Tex.—Until May 30, by William McMurray, County Judge, for approximately 24 miles of sand, clay and gravel roads in Road District No. 2. L. S. Bryant, Engineer, Shephard.

Shepherd, Tex.—Until May 30 by William McMurray, County Judge, Sheperd State Bank, for approximately 24 miles of sand clay and gravel roads in Road Dist. No. 2, San Jacinto County. L. S. Bryant, Engr., Sheperd.

Asotin, Wash.—Until June 5, by Delta Kraudelt, Co. Aud., for constructing permanent highway work. Probable cost $10,000. V. G. Shellman, Co. Engr.

Everett, Wash.—Until May 29 by Mac Weatherbee, County Auditor, for paving 6 miles of Monroe-Kings County line road and 1.5 miles road through Marysville; also until June 5, for hard surfacing 1.1 miles of road through Sultan.

Seattle, Wash.—Reported desired until May 29, by Bryon Phelps, Co. Aud., for grading and surfacing about 7.7 miles of road between Black Diamond and Franklin. Probable cost $50,000.

Sultan, Wash.—Until June 7, by W. F. Leaville, City Clerk, for paving Main Street, involving about 7500 sq. yd. Bids desired on all classes of pavement.

Tacoma, Wash.—Until May 26, by Thos. N. Norris, Co. Aud., for improving Permanent Highway No. 3 B, known as National Park Highway, a distance of 6.066 miles, to consist of clearing, grading, ditches, paving, with either bitucrete, bitulithic, Warrenite, brick or monolithic method or with one-course concrete. Also until May 27, for Permanent Highway No. 8, known as Pacific Highway South, a distance of 2.12 miles, to consist of grading, ditches, etc., and paving with any one of the above-named pavements. D. H. White, Co. Engr.

Walla Walla, Wash.—Until May 26 by County Commissioners, Walla Walla, for 27,800 ft. Inland Empire highway west of Touchet, 10,983 cu. yd. gravel; cost $14,479. G. C. Cookerly, County Engineer.

Salt Lake City, Utah.—Until June 27 by Gordon Snow, City Recorder, for 183,251 sq. yd. paving—asphalt, Fifth to Ninth Street; concrete, Ninth to Eleventh Street. Cost, $94,000. S. C. Cannon, Engineer, 301 C. & C. Building.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Massachusetts. — Following are bids opened May 2 by Massachusetts Highway Commission, Boston, for highway improvements:

★Wilbraham—Lane Construction Corporation, Meriden, Conn., $15,070 (awarded contract); Davis & Brock, Fitchburg, $20,260, and Perini & Company, Ashland $24,805.

Hancock—Perini & Company, Ashland, Mass., $19,164, and Fred E. Ellis, Melrose, $16,665 (all bids rejected).

★Contract for constructing 3900 lin. ft. road in Town of Phillipston (bids opened April 25) awarded by Massachusetts Highway Commission, Boston, to Charles E. Horne, Millbury, at $8,211.

★Contract awarded by Massachusetts Highway Commission, Boston, as follows (bids opened May 9) for constructing State road:

★Westwood, Fred E. Ellis, Melrose, $9,666 (awarded contract); Snow & Farrington, Wrentham, $9,673.

★**Hartford, Conn.**—Contract for Contract 16—gravel road east of East Branch Reservoir—awarded by Board of Water Commissioners to Louis Longhi & Bro., Torrington, at following bid (bids opened May 1): 177 acres clearing and grubbing road location, $60.00; 38,000 cu. yd. earth excav., 48 cts.; 6000 cu. yd. rock excav., $1.60; 21,000 sq. yd. 8-in. gravel surface, 38 cts.; 150 sq. yd. 8 in. Telford base, 50 cts.; 50 cu. yd. broken stone and gravel, $1.; 750 sq. yd. cobble gutters, 50 cts.; 250 cu. yd. dry rubble masonry and paving, $3.50; 50 cu. yd. rubble masonry laid in mortar, $5; 30 cu. yd. concrete masonry, $8; 2,000 lb. c. i. strainers, 6 cts.; 200 lin. ft. 6 in. tile pipe, 25 cts.; 8500 lin. ft. wooden guard rail, 28 cts.; 6000 lin. ft. wire fence; total, $44,015. Next three bidders: Mascetti & Holley, Torrington, $44,950; John De Michiel & Bro., Torrington, $51,345; A. D'Ambrosio Silverlane, Conn., $51,100.

Albany, N. Y.—Following are lowest bids opened May 5 by State Highway Commission, 55 Lancaster Street, for repairs to public highways:

Contract 856, Allegany County, 15.42 miles, Kennedy Construction Company, Albany, $5,371.

Contract 890, Cattaraugus County, 8.37 miles, Shipman & Lincoln, Gowanda, $2,620.

Contract 891, Chenango County, 19.9 miles, H. A. Murphy, Albany, $4,731.

Contract 893, Delaware and Otsego Counties, 12.86 miles, H. A. Murphy, Albany, $5,671.

Contract 905, Essex County, 25.85 miles, Langan Construction Company, Albany, $8,060.

Contract 883, Fulton County, 33.66 miles, John P. Dugan & Company, Inc., Amsterdam, $12,310.

Contract 922, Greene County, 15.5 miles, H. A. Murphy, Albany, $6,456.

Contract 932, Jefferson and Lewis Counties, 9.32 miles, Pathfinder Construction Company, Inc., Fulton, N. Y., $4,896.

Repair Contract 859, Lewis County, 17.23 miles, Pathfinder Construction Company, Inc., Fulton, $5,483.

Contract 884, Lewis County, 33.89 miles, Alfred H. Flinn, Albany, $10,860.

Contract 853, Monroe County, 1.76 miles, Henry G. White, Rochester, $10,987.

Contract 873, Monroe County, 30.65 miles, Ribstein-Holter Company, Inc., Rochester, $7,855.

Contract 916, Onondaga County, 67.71 miles, Edwin Styring, Syracuse, $30,583.

Contract 878, Ontario County, 26.44 miles, Kennedy Construction Company, Albany, $6,906.

Contract 927, Orange County, 3 miles, Schunnemunk Construction Company, Highland Mills, $3,637.

Contract 896, Orange County, Griffin & Griffin, Norwich, $2,099.

Contract 892, Otsego County, 23.64 miles, H. A. Murphy, Albany, $11,796.

Contract 894, Otsego County, 7.76 miles, H. A. Murphy, Albany, $4,193.

Contract 930, Rockland County, 7.3 miles, J. F. Gallagher & Company, Inc., Kingston, $25,716.

Contract 897, St. Lawrence County, 30.95 miles, Herbert W. Fearl, Potsdam, $8,573.

Contract 906, St. Lawrence County, 20.49 miles, Spellman-Oliver Company, Chateaugay, $6,645.

Contract 910, St. Lawrence County, 2.52 miles, Arthur F. McConville, Ogdensburg, $12,041.

Contract 908, St. Lawrence County, 53.61 miles, Kellog Boynton, Keesville, $15,750.

Contract 915, Seneca and Wayne Counties, 42.53 miles, F. H. Wells, Savannah, N. Y., $15,965.

Contract 886, Steuben County, 63.12 miles, Kennedy Construction Company, Albany, $26,518.

Contract 924, Suffolk County, 1.75 miles, Gifford Construction Company, Jamaica, $18,048.

Contract 926, Suffolk County, 4.5 miles, Edward F. Monahan, Manhattan Beach, $13,439.

Contract 925, Suffolk County, 2.14 miles, Murray & Gardner, Inc., Center Moriches, N. Y., $15,033.

Contract 882, Sullivan County, 23.20 miles, Armstrong & Trowbridge, Middletown, $6,907.

Contract 858, Tioga County, 25.29 miles, Dana W. Robbins, Inc., New York, N. Y., $8,718.

Contract 912, Washington County, 4.77 miles, Rumpf & Stevens, Lake Placid, $25,973.

Contract 858, Washington County, 28.76 miles, William G. Fox, Saratoga Springs, $9,675.

★**Corning, N. Y.**—Contract awarded by Board of Public Works for paving with creosoted blocks North Side bridge to Standard Engineering Co., Toledo, Ohio, at $7,108.

New York, N. Y.—Following are four lowest bids opened May 4 by President Bronx Borough, for constructing sidewalks and crosswalks and fences, etc., in East 228th Street: O. Daniels Company, Woolworth Bldg., $31,740; Spadaro Contracting Company, 827 East 217th Street, $35,479; Bonavia Contracting & Constructing Co., $33,729, and Amanna & Lyons, $36,541.

Lowest bid opened same time and place as above for similar work on Digney Avenue submitted by M. Di Menna Construction Company, $13,166, and on West 233rd and West 234th Streets, by V. Zambetti, Liebig Avenue and 260th Street, at $11,288.

Newark, N. J.—Following are four lowest bids opened April 27 by Board Street and Water Commissioners for repairing with wood block Roseville Avenue from Orange Street to Springdale Avenue: McMahon Construction Co., 1127 Broad Street, $48,337; Glenfield Construction Co., 141 S. Eighth Street, $51,802; Ralph Sangiovanin, 80 Hoyt Street, $53,978; Newark Paving Co., 133 First Street, $55,143.

All bids opened April 27 by Board of Public Works for paving with wood block Roseville Avenue rejected.

★**Newton, N. J.**—Following bids opened May 1 by Board of Chosen Freeholders for grading and widening Ross's Corner-Sussex Road: Franklin Contracting Co., 52 Vanderbilt Avenue, New York, at $30,113 (awardsd contract); Reilly & Knapp Construction Co., Pottsville, Pa., $31,773; Joseph F. Burke, Plainfield, $32,838.

★**Pennsylvania.**—Contracts awarded by State Highway Department, Harrisburg, for furnishing and applying bituminous materials on surface of State Highway routes and State aid roads (bids opened May 1) as follows (the contracts are for heavier surface treatments than those awarded recently): District No. 1, about 663,596 gal. required, awarded Headley Good Roads Company, Philadelphia, at 7.63 cts. per gal.; District No. 2, 262,591 gal., also to Headley Good Roads Company at 7.72 cts. per gal.; District No. 3, 4390 gal., to Good Roads Company, Baltimore, Md., at 8.1 cts. per gal.; District No. 4, 83,007 gal., Atlantic Refining Company, Philadelphia, 8.1 cts. per gal.

★Contract awarded by State Highway Department for Class "C" bituminous material for use by the Maintenance Division during the present season. Contract for first, third, and fourth districts to Barrett Manufacturing Company, of Philadelphia, at 7.49 cts., .075 cts., and .075 cts. per gal., respectively, for the said districts: contracts for Second District to United Gas Improvement Company, Philadelphia, at 7.6 cts. per gal.

★**Petersburg, Va.**—Contract awarded by Board of County Supervisors at Prince George for constructing concrete highway between Petersburg and Hopewell to Austin & Demmitt, Baltimore, Md., at $110,000.

★**Miami, Fla.**—Contract for constructing Tamiami Trail Road (bids opened May 3) awarded J. B. McCrary Company, Atlanta, Ga., at $241,500. Hobart Crabtree, County Engineer.

★**Barbourville, Ky.**—Contracts awarded by County Commissioners for roads as follows To T. J. Vermillion & Son, Barbourville, for six miles of Cumberland River extension road; Sam Jackson, Flat Lick, for three miles of road toward Bell County line. Because of irregularity in bid contract was not awarded for constructing six miles of road toward Clay County.

★**Greenville, Ky.**—Contract for macadam pavement (bids opened May 2) awarded Cresap Bros., Humboldt, Tenn., at $24,632. Next three lowest: N. E. Stone Madisonville, Ky., $26,426; Boyd Williams Construction Company, McMinnville, Tenn., $27,063, and Southern Asphaltoline Company, Louisville, Ky., $27,708. R. M. Barken, City Engineer.

★**Cincinnati, Ohio.**—City Board of Control awarded contract for improvement of Pavilion Street with 850 sq. yd. of brick paving and 250 cu. yd. of reinforced concrete retaining walls, to W. G. Langenheim, Cincinnati, Ohio, at $11,879.

★**Cleveland, Ohio.**—Contract awarded by City Board of Control for paving as follows: Enterprise Paving & Construction Co., 8436 Broadway, for paving portions of Corby, Ludlow, Keswick, Beckett, Chadbourne, Southington and Buckeye Roads and Warsaw Avenue at $126,165; Cleveland Trinidad Paving Co., 420 Lakeside Avenue, Shaker Boulevard, E. 132d and 137th Streets, Ripley, Livingstone, Ashwood, Cormere, Haddam and Kemper Roads at $297,355; Bentley Bros. Co., 410 Electric Building, Drexmore and Hampton Roads and North and South Moreland Boulevard at $137,634 (bids opened April 26) Gould & Maybach, 823 E. 150th Street, Waterloo Road at $33,167, and R. P. Bennett, 527 Society for Savings Building, Scoville Avenue at $22,735 (bids opened April 19).

★**Findlay, Ohio.**—Contracts awarded by Board of Control to Harry J. Hall & Son, Findlay, at $14,249 for paving Liberty Street with Lincoln brick, at $3,292 for Maple Avenue with Bessemer brick, at $14,744 for East Street with Hocking wirecut brick and at $5,225 for Garfield Avenue with concrete.

★**Niles, Ohio.**—Contract for paving Third Street (bids opened April 24) awarded Gallagher & Aaron, Youngstown, at $22,162. Other bidders: McDermott & Hannon, Niles, $23,188; L. H. Young Construction Co., Niles, $24,327, and M. P. Connelly & Son, Youngstown, $24,691. H. W. Turner, City Engineer.

Ohio.—Following are lowest bids opened April 28 by State Highway Department, at Columbus (Clinton Cowan, Comr.), for constructing roads:

Champaign County, Section O, Urbana-West Jefferson Road, waterbound macadam, length 1.56 miles; S. W. Wrightdel, Logan, Ohio, $12,567.

Clarke County, Section 1, Springfield-Urbana Road, length 4.35 miles; Sylvester Baughman, Marysville, Ohio, surface-treated macadam $44,528 and waterbound macadam $39,626.

Columbiana County, Section R, Cleveland-East Liverpool Road, bituminous macadam, length 3.01 miles; Public Contracting Co., Elyria, Ohio, $32,750.

Crawford County, Section K, Bucyrus-Galion Road, brick (monolithic type), length 1.69 miles; L. R. McMichael, Bucyrus, Ohio, $31,800. Section L, Bucyrus-Marion Road, length 1.03 miles; L. R. McMichael, Bucyrus, Ohio, brick monolithic $19,400, semimonolithic brick $20,500. Section I-2, Columbus-Sandusky Road, brick, length 0.5 mile; A. J. Brady and J. C. Drake, Marion, Ohio, $10,560.

Delaware County, Section F, Columbus-Sandusky Road, length 0.97 mile; S. C. & Stewart Kisner, Delaware, Ohio, macadam $11,620, reinforced concrete $14,179. Section J, Delaware-Mount Gilead Road, length 3.72 miles; Brewer, Tomlinson & Brewer, Chillicothe, Ohio, macadam $36,662, reinforced concrete and plain concrete $35,860. Section 1, Columbus-Sandusky Road, length 1.9 miles; S. C. & Stewart Kisner, Delaware, Ohio, macadam $21,563, concrete $30,370.

Franklin County, Section O, Columbus-Sandusky Road, brick (semimonolithic), length 0.76 mile; Culbertson & Culbertson, Richmond, Ind., $47,848.

Geauga County, Section H, Burton-Bloomfield Road, concrete, length 2.97 miles; the L. H. Young Contracting Co., West Austintown, Ohio, $35,033. Section J, Chagrin Falls-Greenville Road, 2.50 miles; Farrell Engineering & Construction Co., Cleveland, concrete and brick $28,154; the Enterprise Paving & Construction Co., Cleveland, brick $28,348.

Greene County, Section S, Dayton-Chillicothe Road, waterbound macadam, length 5.67 miles; McGarry & Sparks, Columbus, $30,500.

Jefferson County, Section A, Skelly-Empire Road, waterbound macadam, length 0.9 mile; W. R. Heburn, Mount Pleasant, Ohio, $14,359. Section J, Ohio River Road, brick, length 0.72 mile; Springer & Springer, Wheeling, W. Va., $21,471.

Knox County, Section J, Mount Vernon-Coshocton Road, length 2 miles; the Mansfield Construction Co., Mansfield, Ohio, waterbound macadam $21,678, bituminous macadam $25,109. Section I, Columbus-Millersburg Road, length 4.18 miles; the Mansfield Construction Co., Mansfield, Ohio, waterbound macadam $47,510, bituminous macadam $55,553.

Logan County, Section D, Urbana-Bellefontaine Road, waterbound macadam, length 4.15 miles; D. R. McArthur and D. C. Fox, Belle Center, Ohio, $25,744.

Mahoning County, Section U, Youngstown-New Bedford Road, waterbound macadam, length 1.31 miles; Evans Bros., Hubbard, Ohio, $10,864.

Mercer County, Section E, Celina-Greenville Road, reinforced concrete, length 3.08 miles; Joseph and Lisle Karsh, Celina, Ohio, $45,314.

Miami County, Section E, Dayton-Troy Road, length 5.03 miles; C. E. Williams, Grand Rapids, Mich., bituminous macadam, $52,236; J. A. Westrick, Holgate, Ohio, reinforced concrete $70,545.

Monroe County, Section J, Woodsfield-Marietta Road, bituminous macadam, length 1.92 miles; Abner Juniper & Son, Nelsonville, Ohio, $33,000.

Muskingum County, Section L, Zanesville-Caldwell Road, brick, length 1.35 miles; C. W. Hughes and C. K. Smith, Malta, Ohio, $23,680.

Portage County, Section U, Cleveland-East Liverpool Road, brick, length 2.40 miles; Morgan Bros., Ravenna, Ohio, $40,300.

Ross County, Section M, Chillicothe-Lancaster Road, brick, length 1.02 miles; Brewer, Tomlinson & Brewer, Chillicothe, Ohio, $12,974.

Stark County, Section I, Akron-Canton Road, brick, length 5.78 miles; J. B. Smith, J. C. Krabill and J. E. Siffert, Canton, Ohio, $124,452.

Tuscarawas County, Section O, New Philadelphia - Uhrichsville Road, brick, length 2.37 miles; Pace Bros., Cleveland, $44,155.

Union County, Section F, Urbana-Marysville Road, reinforced concrete, length 0.21 miles; John L. Porter, Marysville, Ohio, $3,133.

Washington County, Section K, Marietta-McConnellsville Road, length 0.80 mile; McElfresh, Danford & Glover, Caldwell, Ohio, tarbound macadam $12,996, asphalt-bound macadam $13,362. Section L, Athens-Marietta Road, length 1.23 miles; The Engineering Service Co., Columbus, Ohio, tarbound macadam $18,250, asphalt-bound macadam $18,829.

Wood County, Section E, Bowling Green-Perrysburg Road, length 4.77 miles; Gray Bros., Bowling Green, Ohio, bituminous macadam $33,500, asphalt concrete $38,000. Section F, Bowling Green-Perrysburg Road, length 5.98 miles; Gray Bros., Bowling Green, Ohio, bituminous macadam $39,400, asphaltic concrete $46,400, bituminous concrete $44,000.

Ashland County, Section A, Ashland-Loudenville Road, resurfacing and waterbound macadam, length 1.55 miles; Gallagher & Aaron, Youngstown, Ohio, $17,859.

★Piqua, Ohio. — Contract for paving (bids opened April 25) awarded Hennessy Brothers, Piqua, at $1.89 per sq. yd. for South Street and $25,803 for Nicklin Avenue paving with Bermudez asphalt. J. M. Lloyd, Clerk.

★Struthers, Ohio.—Contract for paving Elm Street (bids opened April 26) awarded J. P. Morrison & Co., Youngstown, at $10,684. J. Richards, Clerk.

★Urbana, Ohio.—Contract awarded by Director of Public Service for paving Miami Street to Edward D. Murray, Dayton, at $44,000. (Bids opened May 2).

★Youngstown, Ohio.—Contracts awarded by Director Public Service for paving Crescent Street and Lauderdale Avenue to M. F. Clark, Youngstown, at a total of $11,480.

★Goshen, Ind.—Following contracts awarded by County Commissioners May 2 and 4 for constructing roads: Oakland Avenue Road in South End, Concord Township, 18,480 sq. yd. concrete and Clark Truex Road in Locke Township, 10,335 sq. yd. concrete to Amandus M. Smith of Elkhart, at $26,056 and $13,952 respectively; Olive Township Road, 31,397 sq. yd. concrete to Heysteck-Baker Construction Co. of Kalamazoo, Mich., at $40,520; Clinton-Benton Township Line Road, 42,980 sq. yd. brick, L. W. Seaman of Goshen, at $69,692, and La Grange Road in Clinton Township, 16,787 sq. yd. brick, to William Coin of Frankfort, at $27,300.

★Plymouth, Ind.—Contracts for constructing gravel roads throughout the county (bids opened April 28 awarded as follows: Road No. 1, A. W. Keefe, Plymouth, $11,462; No. 2 and 3, Hyman Chase & Co., Logansport, $14,811; No. 4, Putnam Bros., Marion, $32,290; Boggs Road, Mahoney Bros., Lafayette, $17,490, and Stephens Road, Thomas, Benssett & Thomas, Mount Vernon, at $15,053. Arthur W. Thomson, County Engineer.

★Princeton, Ind.—Contract awarded by County Commissioners for constructing stone road in Washington Township to Dozier, Dunkel & Lane Co., Mount Carmel, Ill., at $30,450.

★Lawrenceburg, Ind.—Contract awarded Kelly-Springfield Machinery Company, Springfield, Ohio, for furnishing an oil-burning road roller at $2,900. Harry E. Lutherbeck, Auditor.

★New Castle, Ind.—Contract for 18,000 sq. yd. brick paving (bids opened April 17) awarded Burk Construction Company, New Castle. L. M. Johnson, City Clerk.

★Houghton, Mich.—Contract awarded by County Commissioners for grading and macadamizing the highway from Lake Linden to Laurium awarded J. E. Blomgren, Norway, Mich., at $22,000; and for macadamizing 16 ft. wide with crushed rock on Dollar Bay to Lake Linden to Hicks Engineering Company, Vulcan, at $36,000.

★Newberry, Mich. — Contract awarded Sattrel Company, Marquette, for constructing Luce County Road system (bids opened May 1) at $11,180. Perry Seighton, Clerk.

Chicago, Ill.—Following are four bids opened April 24 by A. W. Miller, Superintendent of Streets, for 12,000 sq. yd. creosoted wood blocks: Chicago Creosote Co., 30 N. La Salle Street, $1.62 per sq. yd.; Jemison Wright Co., Toledo, Ohio, $1.80; Ayer & Lord Tie Co., 80 East Jackson Boulevard, $1.93, and Republic Creosote Co., Indianapolis, Ind., $1.95.

★Evanston, Ill.—Following are four bids opened May 2 by I. C. Brown, Commissioner Public Works, for 5000 sq. yd. brick paving: M. Foley Company, 716 Main Street, $14,428 (awarded contract); H. G. Golitz, Oak Park, Ill., $14,501; J. A. McGarry Company, 189 W. Washington Street, Chicago, $16,457; Smith & Brown Company, 128 North La Salle Street, Chicago, $16,298.

★Kankakee, Ill.—Contract awarded F. P. Caughlin, Chicago, for 6500 yd. asphaltic concrete pavement, at $15,585. H. A. Sylvester, City Clerk.

★Rock Island, Ill.—Contracts awarded McCarthy Improvement Co., 214 W. Fourth Street, Davenport, as follows, for paving: Eleventh Street District, $13,637; Twenty-third Avenue, Eleventh to Sixteenth Streets, $17,971; Seventeenth Avenue, Tenth to Fifteenth Streets, $12,226.

★Washburn, Wis.—Contract for paving Bayfield Street and First Avenue E., awarded Thomas G. Wooley, La Crosse, at about $40,000. W. F. Reichardt, Watertown, Archt.; A. W. MackLeod, Mayor.

★Des Moines, Iowa.—Contract awarded by City Council for paving with lake asphalt Maple Street, to Des Moines Asphalt Paving Co., Des Moines, at $1.98 per yd.

Bemidji, Minn.—Lowest bid opened May 1 by George Stein, City Clerk, for 9000 sq. yd. concrete pavement, 1 to 3½, submitted by Goodman & Lorlved, Bemidji, at $1.12 sq. yd.

★Duluth, Minn.—Contract awarded by City Commissioners for paving Nineteenth Avenue East, to D. H. Clough & Co., Duluth, at $13,222.

★St. Paul, Minn.—Contracts awarded by County Commissioners for grading and macadamizing 3 miles of road from Wayzata to Long Lake to F. Balch & Co., 1431 Capitol Avenue, at $14,000.

★York, Neb.—Contract awarded Roberts Construction Co., Lincoln, for paving Blackburn and Kiplinger Avenues at $2.025 per sq. yd. A. B. Chatterton, City Clerk

★Yankton, S. D.—Contract awarded by City Commissioners for paving with concrete 45 blocks to C. H. Atkinson, Watertown, at $111,560.

★Butte, Mont.—Contract awarded by City Council for paving West Broadway to J. C. Maguire, Butte, at $70,140.

★Dallas, Tex.—Contract awarded Vibrolithic Construction Company, Dallas, for 15,285 sq. yd. vibrolithic on Wood and Young Streets, at about $38,000. H. Moseley, City Engineer.

★McKinney, Tex.—Contract awarded Kaw Paving Company, Topeka, Kan., on Texico asphalt for Improvement District No. 4 (bids opened April 25), at $63,000. Charles Schultz, Engr., McKinney.

Golden, Col.—Following are four lowest bids opened April 29 by Board County Commissioners for constructing the South Golden Road, 4.8 miles, between Denver and Golden (bids include grading, bridge and concrete construction and paving): Concrete—Gaffey & Keefe Construction Co., 245 Kalamath Street, Denver, $65,280; G. H. Stack, $66,365; Thomas Phillips, $67,142; Tully Construction Company, $71,512.

Topeka—Thomas Phillips, 302 R. R. Bldg., Denver, $82,018; Tully Construction Company, $84,733; G. S. Lambie, $88,327; Strange Maguire Paving Company, $88,811.

Warrenite—Strange Maguire Paving Co., Salt Lake City, Utah, $89,369; Warren Bros., $96,643; Thomas Phillips, $101,178, and Tully Construction Company, $103,893.

Amiesite (three bids)—Gaffey & Keefe, $81,558; J. F. Roberts Construction Company, $113,127, and A. F. Hewitt, $199,115

Bellingham, Wash. — Following bids opened by Board of Public Works far paving portion of Indian Street with (a) asphalt, (b) two-course cement, (c) one-course concrete: K. Sauset, Bellingham, (a) $10,571, (b) $10,491, (c) $10,111; Independent Asphalt Co., Seattle, (a) $10,770; J. Lich, Bellingham, (a) $10,781; H. B. Peterson, Bellingham, (a) $11,027, (b) $10,993, (c) $10,803; Riddle & Hawkins, Bellingham, (b) $11,068, (c) $10,803.

Cathlamet, Wash.—Binkey & Crothers, Cathlamet, submitted lowest bid to County Commissioners at $11,942, for constructing Deep River Highway. Thomas H. Allman, County Engineer. (Bids opened May 2).

★Colfax, Wash.—Contract awarded by County Commissioners for constructing Permanent Highway No. 10 to G. L. Stickler, Davenport, at $41,457. Other bids were: Carlson-Chindahl, Spokane, $44,170; H. H. Boomer Co., Spokane, $48,644; Mitchell Bros., Spokane, $43,200. (Bids opened May 1.) J. M. McCaw, County Engr.

★Enumclaw, Wash.—Contract awarded by Board of Public Works for paving with one-course concrete a number of streets to Washington Paving Co., L. C. Smith Bldg., Seattle, at $26,866. (Bids opened May 2.)

★Everett, Wash.—Reported contract awarded by County Commissioners for paving with one-course concrete to H. J. Kaiser & Co., Everett, at $83,451 for (a) Everett-Marysville Road and at $88,453 for (b) road between Monroe and Snohomish. Other bidders: Mark O'Dell, Seattle, (a) $84,738, (b) $89,695; Leddingham & Cooper, Everett, (a) $86,318, (b) $93,008.

★Mount Vernon, Wash. — Contract awarded by Board of Public Works for paving with concrete, Second Street, to Skagit Construction Co., Mount Vernon, at $9,782.

★Reported contract awarded by County Commissioners for paving with one-course concrete 1½ miles county road to Skagit Construction Co., Mount Vernon, at $12,400.

Seattle, Wash.—Following are four lowest bids opened recently by County Commissioners for paving 8 miles of the extension of Fourteenth Avenue S. from city limits—(a) monolithic brick, (b) concrete, (c) brick block: F. McLellan, Globe Block, (a) $222,691, (b) $130,427, (c) $268,253; Washington Paving Co., L. C. Smith Building, (a) $229,490, (b) $141,973, (c) $263,662; Nettleton, Brush & Eachbach, American Bank Building, (a) $267,600; P. J. McHugh, Third Avenue N. and Mercer Street, (b $162,200, (c) $289,200; T. Ryan & Co., Lowman Building, (a) $269,462, (b) $156,705, (c) $299,765. A. P. Denton, Co. Engr.

★Contract for above work awarded F. McClellan, Globe Block, at $222,691, for monolithic brick.

★Following bids received by County Commissioners for paving county highway from Bothell Road to Woodinville with (a) monolithic brick, (b) concrete, (c) brick block: Cascade Construction Co., Pacific Block, Seattle, (a) $91,600, (b) $70,900, (c) $84,400 (awarded contract); Washington Paving Co., L. C. Smith Bldg., (a) $90,856, (b) $74,594, (c) $84,943; M. P. Zindorf, Alaska Bldg., (a) $96,000, (b) $77,825, (c) $93,000; Booker, Kiehl & Whipple, Central Bldg., (a) $99,437, (b) $60,324, (c) $96,566.

★Contracts awarded by Board of Public Works for paving and curbing Juneau Street to William Kopta, New York Block, at $40,773, and Hinds Street, to D. & V. Bressi, 1101 20th Avenue S., at $13,941.

★Contract awarded by County Commissioners for paving with one-course concrete Auburn-Enumclaw Road to J. M. Clapp, Burke Building, at $41,351. Next three bidders: Washington Paving Co., Seattle, $42,943; Erickson Anderson, Seattle, $43,139; M. J. Kaiser, Everett, $43,885.

★Portland, Ore.—Contract awarded by City Council for repairing asphalt pavements for ensuing year to Oskar Huber, Portland, at $2.65 per sq. yd. for replacing entire pavement, $1.78 for resurfacing and $1.20 for skin patching; total $10,845.

Lancaster, Cal.—Lowest bid opened recently by County Board Supervisors for constructing macadam pavement and cement curbs on 1.33 miles of Tenth Street and Antelope Avenue, Road Dist. No. 93, submitted by J. Hein, 511 Stimson Building, Los Angeles, at $11,745.

★San Francisco, Cal.—Contract awarded by Board of Works for improving portion of Twenty-fifth Avenue to A. E. Buckman, Lick Bldg., at $9,962.

★Salt Lake City, Utah.—Following bids opened by city May 2 for paving (a) Eleventh Street with sheet asphalt and (b) Sixth Avenue with bitulithic; J. W. Mellen, (a) $76,654, (b) $19,577; P. J. Moran Contracting Co., Inc., (a) $76,107, (b) $19,612, and Strange-Maguire Paving Co., (a) $76,543 and (b) $19,025. Awarded contract on (b). Bidders all of Salt Lake City. Gordon Snow, City Auditor.

★Idaho.—Contract awarded by State Highway Commissioner, Boise, for constructing state highway to Washington state line to General Construction Co., Spokane, at $63,721. Next three bidders: Carlson-Chindahl, Spokane, $66,683; Rojotte, Fobert & Winters, Spokane, $69,352; E. Wrenn, Fenn, $77,186.

★Moscow, Idaho.—Contract awarded by City Council for paving with 1½-in. asphalt, 4-in. concrete base in three districts to Standard Asphalt Co., Spokane, Wash., at $34,553.

★Ford, Ont.—Contracts amounting to $45,000 for paving with reinforced concrete Belle Avenue awarded to Chick Construction Co., Windsor, and Gouin & Desjardins of Tecumseh, Ont.

★Toronto, Ont.—Contract for paving with bitulithic on Western Avenue awarded Commissioner of Works, at $10,450.

STREET CLEANING AND GARBAGE DISPOSAL

PROPOSED WORK.

Detroit, Mich.—Reported the Detroit Reduction Co. will rebuild plant recently destroyed by fire.

Lincoln, Neb. — All bids opened March 22 by City Council for constructing garbage incinerator rejected. New bids will probably be received.

BIDS DESIRED.

Long Island City, L. I.—Until May 18, by Maurice E. Connolly, Pres. Queens Borough, for the reception, transportation and final disposition of garbage, rubbish, ashes and street sweepings, in portion of the Fifth Ward, Borough of Queens, during the months of May, July, August, September and October, 1916, and furnishing and operating necessary dumps, scows, tugs, etc. Security, $4,500.

Whiting, Ind.—Until May 25, by Board Public Works, for constructing two units 20-ton capacity garbage disposal plants, advertised in Engineering Record.

PRICES AND LETTINGS.

★Indicates award of contract.

★Clarksdale, Miss.—Contract for constructing garbage incinerator awarded Sparks Crematory Construction Company, Minneapolis, Minn. A. C. Tuttle, City Clerk.

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS

PROPOSED WORK.

Drain — Boston, Mass.—Commissioner Murphy of the Department Public Works intends improving Freeport Street Brook, a surface drain of concrete in Bowdoin Street; cost $22,000.

Wharf—New London, Conn.—Construction of a municipal wharf and ferry slip improvements contemplated. Probable cost $32,000. Address Mayor.

Power Development—Oswego, N. Y.—Reported Water Service Commission is considering developing water power at new dam, probable cost $500,000. Address Secy. Water Service Commission.

Drainage—Pittsburg, Pa.—City Council voted in favor of issue of $200,000 bonds for drainage basin for Nine Mile Run and $150,000 bonds for widening and improving Saw Mill Run.

Dredging—Baltimore, Md.—The Bd. of Estimates reported considering deepening channel from Ft. McHenry to Port Covington. Bonds amounting to $1,500,000 may be sold in the fall.

Pier—Tampa, Fla.—The Board of Port Commissioners decided to construct a slip and pier in the Estuary.

Wharf—Lake Charles, La.—Plans completed for a municipal wharf to cost about $15,000. Address City Clerk. Election will probably be held to vote $30,000 bonds, proceeds to be used to construct wharf, build concrete bridge over Pithon coulee, at Ryan Street, and dredging.

Flood Protection—Portsmouth, Ohio.—See "Water Works."

Docks—Sandusky, Ohio.—Reported Baltimore & Ohio R. R. Co. (F. L. Stuart, Ch. Engr., Baltimore, Md.), plans constructing docks and providing machines for handling ore and grain from Great Lakes. Cost about $1,000,000.

Drainage—Belleville, Ill. — Richland Creek Drainage District has been created and plans for straightening and deepening channel through Belleville approved. Cost about $78,000. E. P. Lauschner is a Commissioner of the District.

Drainage—Topeka, Kan.—V. B. Parkhurst has submitted plans, specifications and estimates for drainage work in Belvue Drainage District amounting to $78,664.

Drainage—Earle, Ark.—Drainage District No. 3, Crittenden County, organized for the purpose of constructing a 35-mile canal. Bonds amounting to $225,000 will be sold. W. E. Ayers, Randolph Building, Memphis, Ark., Engr.

Drainage—McGhee, Ark.—The Cypress Creek Drainage District, Tensas Basin Levee Board, Desha County Levee Board and Chicot County Levee Board propose closing 1½ miles of the gap between Arkansas and Mississippi River levee costing $150,000. Contract to be let by State Board of Engineering, New Orleans.

Levee Work—Athens, Tex.—Plans submitted to State Reclamation Department for the levee district to be constructed in Henderson County. Q. W. Finley, Engineer, Ennis.

Irrigation—Austin, Tex. — Blueprints completed for the Parson's slough district and Five Mile Creek District in Dallas County. Also for Red Oak Creek District in Ellis County. Address State Reclamation Department, Austin.

Levees — Ennis, Tex.—Citizens voted $110,000 bonds to construct a levee in Ellis County Levee Dist. No. 3. Address County Clerk.

Power Development—Everett, Wash.—City Commissioners will engage an engineer to investigate possibilities of developing power of Sultan River.

Irrigation—Ashland, Ore.—Election will be held May 19 in Talent Irrigation Dist. to vote $900,000 bonds for improvements.

Irrigation—Echo, Ore.—Teel Irrigation Dist. bonds amounting to $1,100,000 sold. Address Directors Teel Irrigation Dist.

Hydro-Electric Plant—Portland, Ore.—Plans being prepared by W. H. Daly, Commissioner of Department of Public Utilities, and engineers of the municipal water bureau, providing for the installation of a municipal electric-lighting plant. Tentative plans call for the construction of a hydro-electric power plant on Bull Run River, in connection with an impounding dam which will soon be necessary for the conservation of the city water supply. It is estimated that about 4000 hp. can be developed, at a cost of about $200,000.

Irrigation — California. — Barclay McCowan of Bakersfield, District Attorney for Kern County, has applied to State Water Commission, Sacramento, for permission to appropriate 10,000 second feet of flood waters of Kern River. Plans include construction of reservoirs at head waters of the river to store 250,000 acre feet and canals and pipe lines to carry water from the reservoir to irrigate approximately 100,000 acres of high mesa lands around Lerdo, San Emidio, Kern and Edison Mesas.

Hydroelectric Plant — Fontana, Cal.—Fontana Power Co., organized to construct a hydroelectric plant and has applied to State Railroad Commission, Sacramento, for permission to issue and sell $250,000 bonds to finance project. A pipe line will be constructed to carry 326 miners inches of water under pressure from a point in Lytle Creek, 9 miles northwest of Rialto, to site of new plant; a transmission line will be constructed.

Flood Protection Work—Los Angeles, Cal.—County Commissioners making surveys for flood protection work. Address County Clerk.

Pier—Manhattan Beach, Cal.—Contract will be let, probably last of June, for constructing a pleasure pier and pavilion. Llewellyn Price, City Clerk.

Levee Work—National City, Cal.—Western Salt Works, National City, has applied to U. S. Engineer, Los Angeles, for permission to construct a levee across southern end of San Diego Bay to inclose an area for industrial purposes.

River Protection Work—Olive, Cal.—An election to be held to vote $20,000 bonds for constructing protection work along east bank of Santa Ana River and $5,000 for clearing channel and reinforcing weakest points. J. D. Thomas, Olive, Chairman District.

Dam—Pasadena, Cal.—J. W. Reagan, County Flood Control Engineer, Los Angeles, will prepare plans for concrete dam 125 ft. high to be constructed at Devils Gate, in Arroyo Seco, northwest of Pasadena.

Irrigation — Princeton, Cal. — Construction of an irrigation district in a 12,000 acre tract is being considered. Bd. of Supervisors of Colusa and Glenn Counties received a petition for said improvement. Address Secretary, Princeton Chamber of Commerce.

Irrigation—San Dimas, Cal.—M. L. Hazzard, 217 North Bright Street, Whittier, has applied to State Water Commission, Sacramento, for permission to appropriate 2000 second-ft. of water in San Dimas Canyon for irrigation purposes. He plans to construct a concrete arched dam in Puddington Canyon, District, 130 ft. high, 550 ft. wide at top and 25 ft. wide at bottom, to form a reservoir with a storage capacity of about 17,000 acre-ft.; also a tunnel through the mountains separating San Dimas and San Gabriel Canyons, and a pipe line or flume about 4 miles long from end of tunnel to reservoir. Distributing system will be necessary to carry water about 10 miles.

Hydroelectric System — Rodney, Ont. — Citizens voted $15,000 bonds for new hydroelectric lighting and power distribution system.

Hydro Substation—Welland, Ont.—Contract soon to be let for hydro substation, cost including equipment, $40,000. Address Clarence M. Webber, Welland.

BIDS DESIRED.

Boston, Mass.—See "Paving and Roads."

Dam—Brockton, N. Y.—See "Water Works."

Pier—Brooklyn, N. Y. — Until May 20, according to reports, by Bush Terminal Company, foot Forty-third Street, Brooklyn, for constructing pier shed at foot of Thirty-ninth Street, requiring about 1000 tons steel work.

Jetty—Wilmington, Del.—Until May 26, by U. S. Engrs. Office, Old Federal Bldg., for repair to jetty at mouth of Broadkill River.

Concrete Flood Gates—Savannah, Ga.—Until May 25, by County Commissioners, for constructing reinforced concrete lock or flood gates at outlet of Placentia Canal. G. Reuben Butler, Clk. Co. Comrs.

Levee Work—New Orleans, La.—Contracts soon to be let by Orleans Levee Board for constructing protection levee below the city: Section No. 1, 28,000 lin. ft., approximately 350,000 cu. yd. excav. and 75 acres clearing; Section No. 2, 20,000 lin. ft. levee, approximately 250,000 cu. yd. excav. and 50 acres clearing; Section Nos. 3 and 6, 400 lin. ft. levee, approximately 60,000 cu. yd. excav. and 12,300 lin. ft. levee enlargement, approximately 80,000 cu. yd. excav.

Ditch—Knox, Ind.—Until May 15, by Clk. Starke Circuit Court, for constructing Cole ditch to consist of nine arms parts of which are tile, the other work to be constructed by means of floating steam dredge.

Foundations for Hydroelectric Plant—Marquette, Mich.—Until May 18 by R. Graham Moon, City Purchasing Agent, for foundations for the hydroelectric plant for Light and Power Commission. Thomas W. Orbison, Consulting Engr., Appleton.

Drainage—Maple Park, Ill.—Until May 20, by Drainage Commissioners of Union Drainage Dist. No. 3 of the town of Virgil, Kane County, and town of Cortland, De Kalb County, repairing open ditches in said Drainage District, including about 15.13 miles open ditch, repair and excavating and clearing approximately 200,000 cu. yd. dirt. Fissler, Fulton & Roberts, Attorneys, Daniel Pierce Bldg., Sycamore.

Drainage—Bloomfield, Iowa.—Specifications for the work contemplated in Drainage District No. 1, involving construction of channel in Fox River, bids for which are to be opened May 29, are on file in New York office of Engineering Record. H. O. Wray, Engineer. I. A. Patterson, County Auditor.

Dam, etc.—Ft. Dodge, Iowa.—Until May 24, by city, for constructing a hydroelectric plant and concrete dam across Des Moines River, 350 ft. long and 20 ft. high. Burns & McDonnell, Engrs., Interstate Bldg., Kansas City, Mo.

Ditch—Northwood, Iowa.—Reported desired until May 19 by County Board of Supervisors of Worth and Mitchell Counties for constructing drains and ditches in Drainage Dist. No. 1, Mitchell County, and No. 22 of Worth County. A. M. Swanson, Co. Aud., Mitchell County, at Osage, and C. N. Urdahl, Co. Aud., Worth County.

Drainage—Oskaloosa, Iowa.—Until June 1 by Board of Supervisors for construction of Sections 1, 2 and 3 of South Skunk Drainage Ditch, advertised in Engineering Record. Roy E. Rowland, County Auditor.

Levee Work—Waterloo, Neb.—Reported desired until May 15, by Board Directors, Elkhorn Valley Drainage Dist., for one or more sections of levee along Platte River, in Douglas and Sarpy Counties. Towl Engineering Company, 1122 City National Bank Bldg., Omaha, Drainage Engr.

Drainage—Armour, S. D.—Until May 26 by County Auditor for constructing an open ditch for Simpson Lake Drainage District; work suitable for dry lands outfit. Main ditch is 2¾ miles long; laterals ⅓ of a mile; bottom width 6 ft.; depth varying from 1 to 6 ft.; total estimated yardage 22,000; cost 20 cts. per yd. Another similar ditch will be let about July. Dakota Engineering Co., Mitchell, S. D., Engineers.

Irrigation—Malta, Mont.—Until June 22, by U. S. Reclamation Service, Malta, for earth work and structures, Bowdoin Canal-Milk River project, about 16 miles from Malta, advertised in Engineering Record.

Jetty Work—Galveston, Tex.—Until May 15, by Lieut. Col. C. S. Riche, Corps Engrs., U. S. A., Galveston, for repair of jetty work to cost $16,400.

Dredging, etc.—Seattle, Wash.—Until May 31, by U. S. Engrs. Office, Seattle, for dredging, removal of cofferdam, etc., at Puget Sound, Lake Washington Locks.

Irrigation—Hermiston, Ore.—Until June 15, by U. S. Reclamation Service, Hermiston, for canal enlargement, Umatilla project, advertised in Engineering Record.

Weir—Sacramento, Cal.—Reported desired until May 23, for constructing a weir. Probable cost, $460,000. Address City Engineer.

Dam, Etc.—Medicine Hat, Alta.—Reported desired until May 15 for constructing dam and ditch on Sections 9 and 10. Address F. Kennedy & Sons, 735 Second Street, Medicine Hat.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Drain—Brookline, Mass. —** Contract awarded J. Driscoll & Son Company, Washington Street, Brookline, for constructing about 1800 lin. ft. concrete drain at $18,225. Next three bidders: Thomas Russ & Company, 240 North Street, Boston, $18,586; John McCourt Company, 46 Wait Street, Roxbury, $18,669; Anthony Baruffoldi, 9 Parker Place, Somerville, $19,626. E. A. McEttrick, Secretary Selectmen.

★**Pier—New York, N. Y.—**Contract for constructing Pier 28, at West Fifty-sixth Street, North River, awarded Snare & Triest, Woolworth Building, at $535,038. Contract for 100 tons of steel required awarded American Bridge Company, 30 Bridge Street.

★**Lock Operating Machinery—Pittsburgh, Pa.—**Contract awarded by U. S. Engineer Office, Pittsburgh, to Penn Bridge Co., at $9,256 for Section A, and Independent Bridge Co., Pittsburgh, Pa., for Section B at about $20,550, for furnishing valves and lock operating machinery at Lock No. 4, Monongahela River (bids opened April 26).

★**Dredging—Wilmington, Del.—**Contract awarded River and Harbor Improvement Co., Philadelphia, Pa., for dredging Smyrna River, Del., at 8.9 cts.; total $10,235. Bids opened April 26 by U. S. Engineers.

Riprap and Capstone—Wilmington, N. C.—Following are four lowest bids opened April 29 by Capt. C. S. Ridley, Corps Engineers, U. S. A., Wilmington, for (a) riprap, (b) capstones, (c) total: Paul & Cornell Co., Inc., Newsom, N. C., (a) $1.80 per ton, (c) $25,740; Harris Granite Quarries Co., Salisbury, N. C., (b) $1.895, (c) $27,098; Raleigh Granite Co., Citizens Bank Building, Raleigh, N. C. (a) and (b) $1.78, (c) $28,124; Weston & Brooker Co., Columbia, S. C., (a) $1.97, (b) $2.80, (c) $32,371.

★**Ditch — Louisville, Ky. —** Contract awarded by Fiscal Court to R. H. & G. A. McWilliams, McCormick Building, Chicago, Ill., for constructing Pond Creek Ditch, 160,000 cu. yd. of excav., at $23,000.

★**Irrigation — Marquette, Mich.—**Contract for 2500 ft. wood stave pipe awarded by Light & Power Commission to Pacific Coast Pipe Company, Seattle, Wash. It is proposed to furnish additional water and increase power capacity of present hydroelectric plant in Kead River. (See "Bids Desired.") Thomas W. Orbison, Consulting Engr., Appleton, Wis. J. F. Anderson, Purchasing Agent, Marquette.

★**Levee Work—Pittsfield, Ill.—**Contract for 83,000 cu. yd. levee work (bids opened April 27), awarded R. H. & G. A. McWilliams, Chicago, Ill., at 19.5 cts.

★**Levee Work — Lewisville, Ark.—**Contract for constructing 4 miles of 10 to 13 ft. levee awarded by Commissioners of Long Prairie Levee District, La Fayette County, to R. H. & G. A. McWilliams, McCormick Building, Chicago, Ill., at 17½ cts. per cu. yd. Work to be done with 80-ft. boom dragline excavator.

★**Levee Work—Morrilton, Ark.—**Contract awarded M. J. Cole, Jr., Little Rock; for constructing 4½ miles of levee for Conway County Levee District No. 6. Robert Stallings, 110 State Bank Building, Little Rock.

★**Wharf — Houston, Tex. —** Contract awarded by City Council for constructing Municipal Wharf No. 4 to Horton & Horton, Houston, at $259,400.

★**Dredging—Orange, Tex.—**Contract for dredging a 6000-ft. slip 200 ft. wide half the way and 100 ft. the remainder of way, awarded to John Jacobson, of Texas City, by City Commission.

★**Irrigation—Echo, Ore.—**Contract for constructing Paradise Irrigation Project near Echo awarded H. J. Kaiser & Company, Northwest Bank Bldg., Portland, at $2,759,000, and for the Teal Irrigation Project, near Echo, at $1,100,000.

Irrigation—Anderson, Cal.—Following are lowest bids opened April 28 by Commissioners Anderson Cottonwood Irrigation District for constructing the said district system: Bland & Wilson, Colusa, 15c. per cu. yd. for excavation work, about 800,000 cu. yd. in all; tunnel under Redding Cemetery, James Wilson, to build weir and dig tunnel, $58,884; siphon across Sacramento River consisting of 606 ft. 42-in. pipe on river bed with concrete pipe at each end aggregating 4200 ft. in length, Chadwick & Sykes, Crocker Bldg., San Francisco, at $30,000; 13,000 bbls. cement, Smith & McCarley, Cottonwood, and the McCormick & Saeltzer Company, of Redding, a tie bid at $2.56 per bbls., sacks to be returned; metal flumes from $51 per ton for iron to $61 per ton for steel. Bidders, Smith & Mc Carley, of Cottonwood, Western Pipe & Steel Company, and the California Corrugated Culvert Company; the California Corrugated Culvert Company, San Francisco, also bid $27,500. There will be about 26,000 ft. metal flume. In all about 11,820 cu. yd. reinforced concrete and 1,153,711 cu yd. earth work required in the job.

★**Dredging—San Francisco, Cal.—**Contract awarded American Dredging Co., San Francisco, for dredging in Oakland Harbor about 520,000 cu. yd. at 7.23 cts. per cu. yd. Other bidders: Standard American Dredging Co., San Francisco, 8 cts. per cu. yd., and S. F. Bridge Co., San Francisco, 7.87 cts. Bids opened April 29 by U. S. Engineer, San Francisco.

★**Drydock—San Francisco, Cal.—**Contract for constructing first unit of Hunters Point drydock (bids opened April 27), awarded by Union Iron Works to San Francisco Bridge Co., Nevada Bank Bldg., San Francisco, at $700,000. Howard C. Holmes, Consulting Engineer, Santa Marina Bldg., 112 Market Street.

★**Drainage—Stockton, Cal. —** Contract awarded Frank C. McIntire, of Stockton, for excavating 6½ miles of drainage canal along west and north corner of South San Joaquin Irrigation District, at 10.9 cts. per cu. yd.; total $21,800.

ELECTRIC RAILWAYS

PROPOSED WORK.

New York, N. Y.—Public Service Commission for First District has approved the issue of $8,000,000 bonds for the New York Connecting R. R. Company, proceeds to be used for general construction purposes.

Troy, N. Y.—Plans being considered by United Traction Co. (Jas. MacMarten, Ch. Engr., Albany), for construction of extension over Temperance Hill, Troy.

Torresdale, Pa.—Trenton, Bristol & Philadelphia Street Ry. Company (M. J. Hill, Gen. Mgr. and Purchasing Agent, Bristol) will spend $40,000 in improving roadbed of the road between Torresdale terminus and Bristol, Pa.

Guilford, Md.—The Public Service Commission of Maryland authorized United Railways & Electric Co. of Baltimore to construct proposed extension to Guilford.

Tazewell, Va.—Company is being organized to construct an electric railway from Tazewell to New Tazewell, about 2 miles. The Board of Trade may be able to give further information.

Tampa, Fla.—Tampa & Eastern Traction Co. plans constructing a railway from Tampa to Lakeland. E. J. Binford, Tampa, Mgr.

Nashville, Tenn.—Surveys have been completed by Tennessee & Kentucky R. R. for railway from Nashville, Tenn., to Russellville, Ky., via Springfield, Orlinda and Adairville, 54 miles.

Orlinda, Tenn.—Tennessee & Kentucky R. R., Nashville, Tenn., plans constructing a branch line from Orlinda, Tenn., to Frankfort, Ky., 14 miles.

Ecorse, Mich.—Samuel A. Merchant Co. petitioned Council for a franchise to construct a line in Ecorse.

Royal Oak, Mich.—The citizens approved of granting a franchise to Pontiac & Owosso Ry. Co., Oliver M. Lau, of Detroit, is interested.

Duluth, Minn.—Plans being made by Duluth-Superior Traction Co. to extend its lines to fair grounds in Superior. The company is considering double tracking East End line from court house to Nemadji River.

Minneapolis, Minn.—Minneapolis Street Ry Co. (J. J. Caufield, Minneapolis, Gen. Supt.), will extend Western Avenue line to Glenwood Park.

Van Buren, Ark.—Surveys being made for extensions of the Fort Smith Light & Traction Company, Fort Smith, to extend lines from Van Buren to Alma.

Port Arthur, Ont.—Port Arthur Civic Railway Co. will reconstruct about ½ mile of track from Argyle Street to Arthur Street.

Winnipeg, Man.—Winnipeg Electric Ry. Co. considering constructing extension to Academy Street Line to Midland Ry. of Manitoba, and of Talbot Avenue line, from Roland to Cameron Street.

BIDS DESIRED.

Brooklyn, N. Y.—Until May 16, by New York Municipal Ry. Corporation, care of Chief Engineer, 83 Clinton Street, Brooklyn, for construction of elevated railroad stations on Jamaica Line.

Until May 23 by Public Service Commission for First Dist., 120 Broadway, New York, for constructing a two-tracked elevated railroad in Borough of Brooklyn, extending over East Ninety-eighth Street and Livonia Avenue, from President Street to New Lots Avenue.

New York, N. Y.—Until May 25 by Public Service Commission for First District, 120 Broadway, for Section No. 2 of Route No. 8, a two-track sub-surface railroad extending under East Fourteenth Street in Borough of Manhattan, from Irving Place to Avenue B.

RAILROADS

PROPOSED WORK.

Kinston, N. C.—The Duplin Railroad Co. received a charter to construct a railroad about 50 miles long, from Kinston, in Lenoir County, through Pender and Duplin Counties. Among those interested are G. B. D. Parker, of Chinquapin, and W. J. Kennedy, of Beulaville.

Mitchell, S. D.—State Railway Commission at Pierre granted to South Dakota & Western Ry. of Yankton, permission to construct a line from Mitchell to Platte.

Texarkana, Ark.—Iron Mountain R. R. (E. A. Hadley, Ch. Engr., St. Louis, Mo.), contemplates erecting an 8-stall engine house and double tracking main line through local yards.

Baker, Ore.—Reported Sumpter Valley R. R. Company (E. B. Pengra, Gen. Mgr., Baker) has plans for improvements, including new rails, erection of roundhouse at Austin, ballasting roadbed and straightening curves, etc. Cost, $75,000.

Salt Lake City, Utah.—The Denver & Rio Grande R. R. Co. (J. G. Gwyn, Ch. Engr., Denver, Colo.) intends changing grades on main line west of Tennessee Pass, improving roadbed, building spurs in Utah coal fields, purchasing motive power and equipment for Utah Grand Division. Probable total cost $1,500,000.

BIDS DESIRED.

Alaska.—Until May 22, by Alaska Engineering Commission, Bell Street Warehouse, Seattle, C. E. Dole, Purchasing Agent, for a drag line excavator, 50,000 rail braces, 100 guard rails, 300,000 tie plates, 20 pair switch points, ties, angle bars, etc., for use in construction of Alaskan Government Railway.

PUBLIC BUILDINGS AND SCHOOLS

PROPOSED WORK.

Sanford, Me.—Steps being taken to erect $60,000 high school. Address Clerk School Board.

Lowell, Mass.—Plans to be prepared for erection of a high school to cost about $900,000. Address Secy. of School Committee.

Pittsfield, Mass.—The School Board reported considering making repairs to Tucker School, to cost $52,000. Steam and ventilating to cost $16,000, removing roof and replacing with flat roof and adding 4-room addition, $35,000.

Shelburne Falls, Mass.—It is proposed to erect a 3-story high school and gymnasium for Arms Academy; cost $25,000. W. B. Reid, Archt., 280 High Street, Holyoke. Address Board Trustees, Arms Academy.

Shrewsbury, Mass. — Town meeting voted to erect one-story school to contain six rooms and an assembly hall; cost not to exceed $25,000.

Allegany, N. Y.—One 2½-story semi-fireproof brick and cement gymnasium is to be erected at St. Boneventure College at St. Boneventure, N. Y. Cost $35,000. Mowbray & Uffinger, 51 Liberty Street, New York, Architects.

Rome, N. Y.—Erection of two-story, 12-room brick school on South James Street contemplated; cost $50,000. Carl H. Simon, President Board of Education.

Hackensack, N. J.—High school bonds for $275,000 have been sold. Frank Eurich, Archt., Hackensack.

Nutley, N. J.—Board of Education considering erecting two-story brick school on Bloomfield Avenue; probable cost $40,000.

Wilkinsburg, Pa.—City Council considering a site for a borough hall building.

Newark, Del.—It is proposed to alter the old College Hall at Delaware College into student club house at a cost of $75,000. Day & Klauder, Archts., Philadelphia, Pa. Contract will be let in about 6 weeks.

Richmond, Va.—See "Water Works."

Huntington, W. Va.—Citizens voted $300,000 school bonds. Address Bd. of Education.

Charlotte, N. C.—School bonds for $30,000 will be sold May 15, by County Board Education. (J. M. Matthews, Secy.)

Selma, Ala.—A six or eight-story brick school, costing, including site, $30,000, is contemplated. E. C. Melvin, Chairman Committee, care Selma National Bank.

McCombs, Miss.—School bonds for $30,000 will be sold May 16, by Mayor and Board of Selectmen, addressed to L. H. Marsalis, City Clk.

New Orleans, La.—Plans for office building for Sewerage and Water Board are being revised. No bids opened April 26; advertisement withdrawn.

Stonewall, La.—Plans being prepared by Neild & Olscher, Shreveport, for a high school. Address Secretary Board of Education.

Millington, Tenn.—Plans prepared by Hsnker & Cairns, Scimetar Building, for a 2-story brick school to be erected at cost of $50,000. C. O. Williams, Supt. County Schools.

Basil, Ohio.—Villages of Baltimore and Basil in Fairfield County have voted $60,000 bonds for site and erection of a school.

Bowling Green, Ohio.—Citizens voted $41,000 bonds for erecting school. Contract to be let about June 15. M. M. Stophlet, Architect, Toledo. H. E. Hall, County Superintendent.

Columbus, Ohio.—Howard & Merriam, 8 East Broad Street, engaged by city to prepare plans for isolation hospital; cost, $25,000.

Eaton, Ohio.—County Commissioners May 1 sold $250,000 courthouse bonds.

Girard, Ohio.—School bonds for $70,000 sold May 1 by Wade R. Deemer, Clerk, Board of Education.

Grand Rapids, Ohio.—School bonds for erecting 2-story brick school have been sold. Howard & Merriam, Architects, Columbus; R. J. Shuel, Clerk Board Education.

Jefferson, Ohio.—School bonds for $36,000 will be sold May 26, by Clara C. Hamilton, Clk. Board Education.

Massillon, Ohio.—Plans prepared for a 2-story, 81 x 102 ft. building to be erected at Massillon State Hospital; cost $70,000. H. C. Eyman, Supt.

New Lexington, Ohio.—Perry County voted $42,000 bonds to erect new children's home. Address County Clerk.

Struthers, Ohio.—Citizens voted $60,000 bonds for erecting a municipal building.

Bainbridge, Ind.—Monroe Township will erect $25,000 addition to high school in Bainbridge. Address Township Clerk.

Huntington, Ind.—School bonds amounting $24,500 sold May 1 by Trustees Rock Creek School District.

New Haven, Ind.—A high school is to be erected in New Haven at a cost of about $35,000. Address Bd. of Education.

South Bend, Ind.—Plans being prepared by Freymuth & Maurer, South Bend, for the Sample Street School. to be brick and concrete and cost $100,000.

Decatur, Ill.—Erection of a $50,000 addition to Decatur and Macon County Hospital being considered. Address County Clerk, Decatur.

Moline, Ill.—Plans being prepared for a high school costing $29,000. Address Board Education.

Mounds, Ill.—Contract will be let about July 1 by Board of Education for erecting a brick, 2-story and basement, high and grade school costing $40,000. Warren W. Day, Archt., 527 Main Street, Peoria.

Lewis, Iowa.—Citizens voted $70,000 bonds for erecting and equipping consolidated school. Address Clerk School Board.

Aurora, Minn.—Citizens of Independent School Dist. No. 13 voted $125,000 bonds for erecting school.

Fairmont, Minn.—Contract soon to be let for erecting school in East Chain Township, costing $25,000. Address Clerk East Chain Township, Fairmont.

Mound, Minn.—Citizens voted $55,000 bonds for erecting school in District No. 85. J. P. Wilkins, Clerk School Board.

Rochester, Minn.—State Board of Control, St. Paul, is considering erecting at the State Hospital for the Insane a building for married couples employed at the hospital; cost $100,000.

Leoti, Kan.—Citizens of Wichita County voted $35,000 bonds for a court house.

Lyons, Kan.—Charles D. Cuthhert, Topeka, is preparing plans for a city hall; cost, $30,000.

Wichita, Kan.—County has voted $35,000 bonds for erecting a court house. Address County Clerk.

Lincoln, Neb.—Plans prepared for erection of a teacher's college high school, cost about $100,000. Address Mr. Avery, Chancellor.

Stuart, Neb.—Contract will be let early in June for erecting the high school. Address Secretary Board of Education.

Wayne, Neb.—The State Normal Bd. at Lincoln appropriated $65,000 for erecting a gymnasium at State Normal School.

Sheridan, Wyo.—C. A. Randall, Sheridan, is architect for the semi-fireproof brick school, to cost $60,000. Address Clerk School District No. 7.

Marshall, Mo.—The sum of $100,000 has been bequeathed to city for a hospital. Address City Clerk.

Marshfield, Mo. — George F. Reed, Springfield, engaged to prepare plans for a $25,000 school.

Bigelow, Ark.—School Board considering erecting a $25,000 school.

Warren, Ark.—City has issued $50,000 bonds for erecting school. Address Secretary Board of Education.

Dallas, Tex.—Improvements costing $150,000 to be made to the buildings at the Texas State Fair Grounds.

Galveston, Tex.—Plans completed for a brick and stone high school. Address Clerk Board of Education.

Laredo, Tex.—Three schools, brick and reinforced concrete construction, will be erected at a cost of $80,000, including equipment. W. S. Ryan, President Board Laredo Independent School District.

Paris, Tex.—Plans being prepared for a court house. Address County Clerk.

San Antonio, Tex.—Plans being prepared for a $300,000 high school. Address Secretary Board of Education.

Astoria, Ore.—Reported School Board sold $75,000 bonds of $100,000 bond issue for erecting grade school. Contract will soon be let.

Hood River, Ore.—Citizens voted $45,000 bonds to erect new grade school and an annex to the high school. Address Clerk School Board.

Culver City, Cal.—O. P. Dennis, 618 Fay Building, Los Angeles, engaged to prepare plans for a 10-room school, probably hollow tile, to cost $45,000.

Modesto, Cal.—A high school and grade school will be erected at a cost of $200,000. DeReamer & Hewitt, Los Angeles, architects for high school, and Stone & Wright, Stockton, architects for grammar school. Scott Snowden, Secretary, Modesto School Dist.

London, Ont.—Militia Department will erect a new steel stores building costing $50,000; plans in progress. Maj. Bishop, Wolseley Barracks, London, may be able to give information.

The Pas, Man.—The Provincial Government has had plans prepared for commercial building to be erected here, brick, 2 stories and cost $30,000. G. N. Taylor, The Pas, Archt.

BIDS DESIRED.

Lee, Mass.—Until May 19, by Building Committee of New High School, for erecting new high school; also heating, ventilating and plumbing. William T. Towner, Inc., and Constantine Schubert, Archts., 366 Fifth Avenue, New York, N Y.

Hartford, Conn.—Until May 23 (readvertisement), by the Board of Contract and Supply for equipping almshouse with automatic sprinklers, fire walls, fire doors, etc. The bid received on this work, opened recently, was $16,000, which is in excess of the amount available.

Middletown, Conn.—Until June 16, by James A. Wetmore, Acting Supervising Architect, for erecting post office at Middletown.

Ogdensburg, N. Y.—Until May 27, by Building Committee Ogdensburg Hospital at office of Williams & Johnsons, Achitects, 40 Ford Street, Ogdensburg, for erecting addition to city hospital.

Elizabeth, N. J.—Reported desired until May 15, by Board Recreation Commissioners (Frank Kleinhans, Treas.), for erecting rest house and wading pool on playgrounds at Christine and South Seventh Streets and Second and Third Avenues. Separate bids on masonry, plumbing, etc.

Hyndman, Pa.—Until May 17, by M. H. Kramer, Secy. School Board, for erecting a high school.

Washington, D. C.—Until May 31, by Treas. Dept. U. S. Coast Guard, Washington, D. C., for erecting coast-guard station and accessories at Smith Island.

Until June 1, by U. S. Coast Guard, Treasury Department, Washington, D. C., for constructing a coast-guard station and accessories at Hatteras Inlet, Coracoke Island, N. C., advertised in Engineering Record.

Until June 2, same place as above, for constructing a coast-guard station and accessories at Cape Lookout, N. C., advertised in Engineering Record.

Waynesville, N. C.—Until June 6, by Jas. A. Wetmore, Acting Superv. Archt. Treas. Dept., Washington, D. C., for erecting U. S. post office at Waynesville.

Lake Charles, La.—Until June 5, by Board of Education, for erecting 3-story pressed brick high school. Nolan & Torre, Archts., New Orleans.

McCombs, Miss.—Until May 16, by L. H. Maralis, City Clerk, for erecting brick high school. Separate bids for heating, plumbing, etc. Xavier A. Kramer, Engr. and Archt., Magnolia.

Bristolville, Ohio.—Until May 27 (readvertisement), by R. B. Brockett, Clerk Board of Education, for erecting school.

Carthage, Ohio.—Until May 24, by D. L. Sampson, Secy. Hamilton County Agricultural Society, Room 30, Wiggins Block, Cincinnati, for furnishing material and erecting agricultural building located on Fair Grounds, Carthage. Harry Hake, Archt., Provident Bank Building, Cincinnati.

Cincinnati, Ohio.—Until May 22, by Walter J. Friedlander, Dir. Public Safety, for erecting engine house at southeast corner of Eastern and Starder Avenues. Separate bids for plumbing, gasfitting, heating, etc. Harry Hake, Archt., and Charles H. Kuck, Associate Archt., New Telephone Bldg., 225 E. Fourth Street, Cincinnati.

Lebanon, Ohio.—Until June 2 (readvertisement), by County Commissioners, for erecting county infirmary.

Lowellville, Ohio.—Until June 1, by Board Education Poland Township (W. J. Maurice, Clk.), for furnishing material and erecting a school. C. C. & A. L. Thayer, Archts., New Castle, Pa.

Tiltonsville, Ohio.—Reported desired until May 27, by Seth Williams, Clerk Board Education, for erecting two-story and basement, 110 x 60 ft. school. Probable cost $50,000. E. R. Thompson, Architect, 524 Belmont Avenue, Youngstown.

Irvington, Ind.—Until June 10, by County Commissioners, for erecting Childrens' Guardian Home at Irvington. Herbert Foltz, Architect, Indiana Pythian Building, Indianapolis. Leo K. Fesler, County Auditor.

New Bethel, Ind.—Until May 20, by J. E. Wheatley, Trus. Franklin Township, for erecting a two-story brick and stone school.

Union City, Ind.—Until May 20, for erecting two story and basement brick school on Winchester Pike. Address Elmer Losch, Archt., Union City.

Buckley, Mich.—Reported desired until May 20, by Board of Education, Unit School Dist. (Albert Guernsey, Secy.), for erecting an 8-room school. Separate bids for heating, plumbing, etc. Jens C. Peterson, Architect, State Bank Building, Traverse City.

Northville, Mich.—Until May 20, by Charles A. Dolph, Secretary School District No. 2 for erecting a school costing $50,000.

Geneva, Ill.—Until June 6, by State Board Administration, Capitol Building, Springfield, for erecting gymnasium building at State Training School for Girls, Geneva. James B. Dibelka, State Architect, 130 North Fifth Street, Chicago.

Neenah, Wis.—Until June 19 by Supervising Architect, Washington, D. C., for constructing U. S. Post Office, advertised in Engineering Record.

Douds Leando, Iowa.—Until May 19 (readvertisement), by Consolidated Independent School Dist. (F. M. Gilbert, Secy.) for furnishing material and erecting a school. H. W. Underhill & Co., Architects, Bryant Building, Kansas City, Mo.

Fayette, Iowa.—Reported desired until May 18, by School Board Independent School Dist. (F. E. Finch, Pres.), for erecting high school. Separate bids for heating, ventilating, etc. J. G. Ralston, Architect, Waterloo.

West Bend, Iowa.—Reported desired until May 16, by E. G. Minger, Secy. Board Education, for erecting two-story and basement 62 x 148 ft. school. Probable cost $60,000. Marten & Hopkins, Architects, Storm Lake.

Grand Meadow, Minn.—Until May 18, by P. T. Elliott, Clerk Board Education, for erecting a high and grade school. Separate bids for heating, plumbing, etc. Stebbins & Haxby, Architects; Rose & Harris, Engineers, Auditorium Building, Minneapolis.

David City, Neb.—Until May 25, by Secretary Board of Education, for erecting high school. Separate bids for heating, plumbing, etc. R. A. Bradley & Co., Architects, Hastings.

Grand Forks, N. D.—Reported desired until May 27, for erecting school in Dist. No. 131, Adams Township. Separate bids for heating, ventilating, etc. W. J. Edwards, Grand Forks, Architect.

Hazen, N. D.—Until May 15, by J. C. Schleppergrell, Clerk School Board, for erecting school. W. D. Gillespie, Architect, Fargo.

Wilton, N. D.—Until May 29, by Simon Jahr, Clerk Special School Dist., for erecting two-story and basement addition to present brick school. Gilbert R. Horton, Architect. Citizens National Bank Building, Jamestown.

St. Louis, Mo.—Until May 27, by Dr. A. T. Laird, Secretary Sanitary Commission, at office of Holstead & Sullivan, Architects, 410 Palladio Building, for two-story annex and three-story addition to present boiler house.

Ft. Mason, Cal.—Until May 18, by Constructing Quartermaster, for constructing four field officers' quarters and eight double sets officers' quarters, at Presidio, San Francisco.

Oxnard, Cal.—Until May 16, by Board Trustees Oxnard School Dist. (H. M. Staire, Clk.), for furnishing material and erecting a school. Separate bids for heating, plumbing, etc. Allison & Allison, Archts., 1405 Hiberian Bldg., Los Angeles.

Riverside, Cal.—Until May 20, by Board Regents, University of California, 417 Union League Bldg., Los Angeles, for erecting two-story and basement brick and hollow tile laboratory, auditorium and library building, a two-story residence, barns, etc., at Citrus Experiment Station, to cost $125,000. Lester H. Hibbard, Archt., 1200 Marsh Strong Bldg., Los Angeles.

Fillmore, Utah.—Until about June 1, by Clerk Board of Education, for erecting two-story brick high school, to cost $60,000. Joseph Wilson, Archt., Provo.

Haileysburg, Ont.—Until May 15, by J. H. Shibley, Secy. Haileysburg High School Board, for furnishing and erecting School of Mines building at Haileysburg.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Portland, Me.—Following are four lowest bids, opened April 27, for erecting high school: Forgione & Romano Company, Portland, $388,868; F. W. Cunningham & Sons, Portland, $389,993; Norman Kerr, New York, N. Y., $394,000; P. F. Kenney Company, Boston, Mass., $409,000.

★**Revere, Mass.**—Contract for erecting 12-room brick Revere Street school awarded by Building Committee of Revere School Bd. to C. S. Cunningham & Son Constr. Co., 7 Water Street, Boston, at $85,000. Coffin Co. of Boston secured contract for heating and ventilating.

★**Albany, N. Y.**—Contracts for work at Long Island State Hospital awarded as follows by L. F. Pilcher, State Architect, Albany: Construction of chronic hospital to W. F. Plass & Bro., Inc., 145 West Eighteenth Street, New York, and reception hospital to P. F. Kenny Company, 33 Old Broadway, New York.

★**Port Washington, L. I., N. Y.**—Contract for erecting addition to high school awarded by Bd. of Education to Kelly Constr. Co. of Yonkers at $95,300.

Northampton Heights, Pa.—Lowest bid opened May 1 by Board of Education for erecting two-story, brick and stone school submitted by Andrew Breslin of Summit Hill, at $41,700. Clyde S. Adams, Archt., 1509 Arch Street, Philadelphia.

★**Newark, Del.**—Contracts for erecting agricultural building at Delaware College (bids opened April 29) awarded as follows: General contract, to Franklin M. Harris, Philadelphia, Pa., at about $113,000; heating, plumbing, etc., Boon & Sample, Philadelphia, Pa., about $33,000; electrical work, Cater & Shepard, Philadelphia, Pa., about $6,969. Day & Klauder, Archts., Philadelphia, Pa.

★**Harrisonburg, Va.**—Contract for erecting dormitory at State Normal School (bids opened May 1), awarded W. M. Bucher & Son, Harrisonburg, at $31,440. Julian A. Burruss, Pres. State Normal School.

★**Ashland, Ky.**—General contract for erecting fireproof hospital for Kings Daughters awarded Sanders & Fearing, Ashland, at $36,420 (not including heating, plumbing, etc.). J. M. King, Archt., Ashland.

Oaklandon, Ind.—Following are four lowest bids opened May 2 by County Commissioners, Indianapolis, for erecting tuberculosis hospital: William P. Jungclaus, 827 Massachusetts Avenue, Indianapolis, $55,183; Charles J. Wacker, Indianapolis, $56,373; Chiron C. Peirson, Marchants Bank Bldg., Indianapolis, $57,000; Shiel-Chapin Construction Company, 220 North Illinois Street, Indianapolis, $57,264. Lowest for plumbing and heating, E. A Strong & Sons, Indianapolis, $10,000. William E. Russ, Archt., 1405 Merchants Bank Building, Indianapolis.

★**Portland, Ind.**—Contracts for erecting court house (bids opened April 27) awarded by County Commissioners as follows: General construction (Dawson Construction Co., Pittsburgh, Pa., $209,745; heating and plumbing, Woolen & Collon, Indianapolis, Ind., $26,000; wiring, Carter Electric Shop, Kokomo, $2,900. John Bonifas, County Auditor.

★**Terre Haute, Ind.**—Contract awarded as follows by Board of School Trustees for erecting McLean Departmental School: Main building, brick and stone, to A. W. Stoolman of Champaign, Ill., $88,189; heating and ventilating and plumbing, to Prox & Burget of Terre Haute, at $28,800. Separate building will house heating plant, to consist of three 100-hp. steel tubular boilers.

★**Normal, Ill.** — Contract for erecting women's dormitory at State Normal University (bids opened April 13) awarded Fitzsimmons Construction Co., Springfield. David Felmley, President.

★**Wausau, Wis.**—Contract for erecting 2-story, 120 x 210 ft. tuberculosis sanitarium at County Farm awarded to F. W. Krause of Wausau at $53,200. Bids opened by Public Property Committee April 28.

★**Bancroft, Iowa.**—Contract for erecting school (bids opened May 3) awarded B. Y. Construction Company, Dayton, Iowa, at $27,490. P. H. L., Secy. Board of Education.

★**Margie, Minn.**—Contract for erecting school (bids opened April 8) awarded Harold Stubes, International Falls. D. B. Jewell, County Superintendent Schools.

★**Arkadelphia, Ark.**—Contract for erecting U. S. Post Office awarded H. F. Doyle, Cottonplant, Ark., at $44,850.

★**Falls City, Neb.**—Contract for erecting U. S. Post Office awarded Charles Weitz Sons, Des Moines, Iowa, at $43,600.

★**Oakland, Neb.**—Contract for erecting a high school awarded to Trenton Building Co. of Lincoln at $49,987. Bids opened April 18 by Bd. of Education. Berlinghof & Davis, Archts., 610 Security Mutual Life Building, Lincoln.

Jamestown, N. D.—Lowest bid opened recently for erecting buildings at the Jamestown State Asylum submitted by W. H. Curran, Valley City, at $60,000 for dormitory and $26,000 for dining hall.

★**Roseburg, Ore.**—Contract for erecting U. S. Post Office awarded Stebinger Bros., 626 Broadway Street Terrace, Portland, at $83,745.

PRIVATE BUILDINGS

PROPOSED WORK.

Norton, Mass. — The Country Day School, a private institution, intends erecting a $60,000 gymnasium.

Springfield, Mass.—The Kresge Company 5 and 10 Cent Store, and Dr. G. W. Kinnell, are to erect a two-section twin building 3 story, 71 x 209 ft., of white terra cotta, to cost $80,000.

Worcester, Mass.—Plans being prepared by N. Clifford, 49 Vernon Street, for a 5-story, 51 x 78 ft., brick apartment house, to be erected on Kingsbury Avenue.

Babylon, L. I., N. Y.—Preliminary plans being prepared by York & Sawyer, 50 East Forty-first Street, New York, for brick hospital to be erected here for South Side Hospital Association; cost about $50,000.

Flushing, L. I., N. Y.—Plans being prepared by V. W. Tandy, 1931 Broadway, New York, for a 2½-story, 72 x 45 ft., tile and stucco residence and garage, to be erected at State and North Prince Streets for Mrs. C. J. Walker, 108 West 136th Street, New York; cost about $50,000.

Ilion, N. Y.—Plans completed by Henry M. Congdon & Son, 18 Broadway, New York, for 1½-story stone church and parish house, to be erected on Center Street for St. Augustine's Protestant Episcopal Church; cost $60,000. Rev. L. R. Benson, Pastor.

Kew Gardens (P. O. Jamaica), L. I., N. Y.—Contract about to be let for erecting a clubhouse at Station Square, Kew Gardens. Nathaniel Vickers, Archt., 413 Curtis Avenue, Richmond Hill. Frank E. Haff, 17 Lefferts Avenue, Kew Gardens, Pres.

Long Island City, L. I., N. Y.—Plans being prepared by Frank J. Schefcik, 4168 Park Avenue, New York, for two five-story brick apartment buildings to be erected on Fourth Avenue and Broadway for Orel Construction Company; total cost $100,000.

New York, N. Y.—E. M. Statler, Hotel Belmont, reported considering a site on which to erect a hotel.

Plans filed for erecting following buildings: Six-story brick apartment building at 516 West 188th Street for Charlemont Building Corp., cost $90,000; Neville & Bagge, Architects, 105 West Fortieth Street. Three five-story brick apartment buildings at Audubon Avenue and 190th Street for J. R. Building Company, Inc., total cost $220,000; Kreymborg Architectural Company, Architects, 1029 East 163rd Street. Five-story brick apartment building on 228th Street and Marble Hill Avenue for Mary A. Finnegan, cost $50,000; Moore & Landsiedel, Architects, 148th Street and Third Avenue. Five-story brick store and apartment building at 174th Street and St. Nicholas Avenue for Seco Realty Corp., cost $85,000; Sass & Springsteen, Archts., 32 Union Square. Two five-story brick tenements at 165th Street and Bryant Avenue for Marmer Construction Company, total cost $120,000; Kreymborg Architectural Company, Architects, 1029 East 163rd Street. Alterations to five-story brick store and office building at 451 Broadway for Globe Wernicke Company, cost $50,000; Starrett & Van Vleck, Architects, 8 West Fortieth Street.

Peekskill, N. Y.—Plans being prepared by Beverly S. King, 103 Park Avenue, New York, for three- or four-story brick hotel which William G. Lawson, Peekskill, intends erecting at South and Dehue Streets; approximate cost $50,000.

Jersey City, N. J.—Plans completed by Nathan Welitoff, 222 Washington Street, Newark, for five-story brick apartment house to be erected at 51 Mercer Street for Peter Bentley, 75 Montgomery Street; cost $70,000.

West Hoboken, N. J.—Hensel & Weir, West Hoboken, are preparing plans for a new academy and remodelling 2 schools for St. Michaels Parish, estimated cost $250,000.

Brooklyn, Pa.—The Catholic Club of Brooklyn is considering erecting a clubhouse on Pearl Rd. at a cost of about $50,000.

Erie, Pa.—A clubhouse is to be erected at East Eighteenth and State Streets for Erie Aerie of Eagles; cost about $65,000.

Philadelphia, Pa.—Sauer & Company, 908 Chestnut Street, preparing plans for a 4-story store and warehouse, 40 x 110 ft., with 3-story wing, 70 x 72 ft., for Derbyshire Brothers.

Pittsburgh, Pa.—Trustees of Methodist Church South, on Second Street and Fairmont Avenue, considering preliminary plans for new edifice to cost about $40,000.

Scranton, Pa.—Plans completed for new edifice to be erected for Holy Cross Parish of Bellevue, at Broadway and Fifth Avenue; cost about $60,000. Rev. W. P. O'Donnell, Pastor.

York, Pa.—Noble Commandery, Ancient and Illustrious Order Knights of Malta intends erecting building to cost about $50,000.

Baltimore, Md.—Reported M. Filmore Carter, Franklin and Hilton Streets, will erect eight cottages at a cost of about $60,000, at Frederick Road and Melvin Avenue.

Guilford, Md.—The Union Protestant Infirmary, 1514 Division Street, Baltimore, purchased a 2-acre tract at Guilford as a site for hospital costing $250,000.

Richmond, Va.—Richmond, Fredericksburg & Potomac Railroad Company (S. B. Rice, Engineer, Maintenance of Way, Richmond) and Atlantic Coast Line Railroad Company (J. E. Willoughby, Chief Engineer, Wilmington, N. C.) have decided to erect a new passenger station on the Hermitage site on West Broad Street at cost of $1,500,000.

Fairmont, W. Va.—Methodists propose erecting a $50,000 church.

New Orleans, La.—Plans being prepared for Elks Home to cost $200,000.

Morristown, Tenn. — Masons propose erecting a 4-story brick temple costing $25,000.

Akron, Ohio.—Plans being prepared for $80,000 lodge building which Knights of Columbus propose erecting.

Cleveland, Ohio.—Plans filed for erecting three-story, brick, stone and concrete laboratory in Broadway and East Twenty-sixth Street for Grasselli Chemical Co., The Arcade Building; cost $40,000.

Marion, Ohio.—Reported Ralph T. Lewis plans to erect a 150-room hotel in Marion, at a cost of $200,000.

Urichsville, Ohio.—Masons contemplate erecting three-story and basement brick Temple at Third and Uhrich Streets; cost approximately $35,000.

Battle Creek, Mich.—C. D. McLane of Rock Island engaged to prepare plans for brick and stone Y. M. C. A. building for which I. L. Stone has donated $50,000.

Detroit, Mich.—Reported contract soon to be let for proposed $60,000 building to be erected in connection with the Rescue Home for Girls and Women. Albert Kahn, Architect, 58 Lafayette Avenue. Edward B. Underwood, Assistant Secretary of Properties of Salvation Army, may be able to give information.

Chicago, Ill.—Reported Chicago Canal & Dock Company, will erect for McNeil & Higgins Company, 225 North State Street, a 7-story and basement building of mill construction on East Grand Avenue and Seneca Street; cost $300,000.

Minneapolis, Minn.—Minneapolis General Electric Company, 15 South Fifth Street, has plans for a five-story addition to building at Fifth Street, South, to cost $100,000.

Lake Harriet Methodist Church plans erecting a new edifice costing $25,000.

Twin City Building & Investment Co., 319 New York Life Building, will erect at 2300 Nicollet Avenue an apartment house to cost $47,500.

T. Peebles & Co., 312 Andrus Building, will erect at 511 University Avenue S. W. a 3-story brick apartment house costing $45,000.

J. J. Jenson, 3833 Seventeenth Avenue, will erect a 2-story brick apartment house to cost $45,000.

St. Paul, Minn.—Joseph J. Pfister, 1712 Selby Street, will erect a 3-story brick and Bedford stone apartment house to cost about $85,000 on Western and Laurel Avenues.

Butte, Mont.—Reported Arthur H. Mueller, of Butte, will erect a 4 or 5-story apartment building on Granite and Jackson Streets; cost $100,000.

Kansas City, Mo.—Smith, Rea & Lovitt, Finance Building, are architects for a 5-story reinforced concrete hotel to be erected at a cost of $70,000.

Hot Springs, Ark.—Mann & Stearns, Little Rock, preparing plans for a bath house to be erected by Sorrell & Latta, two story, fireproof, concrete, costing $65,000; heating and plumbing $16,000 additional.

Amarillo, Tex.—Plans for Amarillo Hotel approved by H. P. Canode, proprietor; cost about $225,000.

Bay City, Tex.—Reported plans and specifications being prepared for new depot to be erected here for Santa Fe System (C. F. W. Felt, Ch. Engr., Chicago, Ill.); cost about $50,000.

Houston, Texas.—Congregation of Trinity Baptist Church purchased site at Common and Hogan Streets for edifice to cost $100,000.

Paris, Tex.—Masons having plans prepared for a 4-story reinforced concrete building to cost $50,000.

City officials and railroad officials considering new terminal facilities. Address City Clerk.

Wharton, Tex.—Plans being prepared for a brick and stucco freight and passenger station for the Gulf, Colorado & Santa Fe R.R.

Los Angeles, Cal.—Mayberry & Parker, 472 Pacific Electric Bldg., engaged to prepare plans for an 8-story and basement reinforced concrete mercantile building to be erected at Los Angeles and Ninth Streets, for Valentine Katz. Five stories will be erected this year.

John Parkinson, 1035 Security Bldg., is architect for two reinforced concrete wholesale buildings each 125 x 100 ft. and two 2-story brick and concrete market buildings, one 40 x 1500 ft. and one 80 x 1250 ft., to be erected at Seventh Street and Central Avenue, for Los Angeles Union Terminal Company.

Winnipeg, Man.—Plans being prepared for 10-story building to be erected at McDermot and Main Streets for Bank of Hamilton. Cost $500,000.

BIDS DESIRED.

Fitchburg, Mass.—Reported desired until May 15 by E. W. Maynard, 226 Tremont Street, Boston, for erecting a one-story, 86 x 207 ft. theater for estate of Andrew Whitney, Geo. Whitney Administrator. Probable cost $65,000.

Monroe, La.—Reported desired until May 15, by J. W. Smith, Assoc. Archt. Monroe, for erecting 3-story, 60 x 150-ft. temple for Western Star Lodge No. 24, F. & A. M. Probable cost $65,000.

Chicago, Ill.—Reported plans desired until June 13 by Wm. Tabor, Fin. Secy., 138 N. La Salle Street, Amalgamated Assoc. of Street & Electric Ry. Employees, Div. No. 241, for three or four-story and basement, 80 x 180 ft. office building to be erected at Asland Blvd. and Van Buren Streets. Probable cost $200,000.

Sheffield, Iowa.—Until May 18, by J. P. McCammant, Citizens' Bank, for erecting fireproof garage. J. H. Jeffers, Archt., Mason City.

Hutchinson, Minn. — Reported desired until May 16, by Jorgenson Bros., for erecting three-story and basement, 85 x 135 ft. bank, hotel and store building for Jorgenson Bros. Probable cost $40,000. Silas Jacobson, 601 Capital Bank Building, St. Paul.

Salina, Kan.—Reported desired until May 16, by Rev. B. R. Lantz, Pastor St. Johns Lutheran Church, for erecting one-story and basement, 112 x 69 ft. church. Probable cost $40,000. E. O. Brostrom, 300 Brent Building, Kansas City, Mo., Archt.

Aberdeen, S. D.—Until May 15, by C. W. Gates Amusement Co., Aberdeen, S. D., for erecting a fireproof theater. John K. Van Ess, Archt., Aberdeen.

Turton, S. D.—Until May 17, by the Farmers' State Bank, for erecting bank. Separate bids for heating, plumbing, etc. Geo. F. Fossum, Archt., Aberdeen.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**St. Johnsbury, Vt.**—Contract awarded Cummings Construction Company, of Woodsville, N. H., for erecting $85,000 addition to St. Johnsbury House.

★**Providence, R. I.**—Contract for erecting St. Ann's Parish School awarded Rocco M. Famiglietti, 367 Branch Avenue, at $35,900.

★**Hartford, Conn.**—William Boardman & Sons Co. awarded contract for erecting an office and business building at 304 Asylum Street to Adam Puroes of Hartford at about $28,000. S. A. Allen, Archt., Hartford.

★**Brooklyn, N. Y.**—P. M. O'Brien Company, 22 East Forty-second Street, New York, secured general contract for three-story brick and limestone, 65 x 138 ft. parochial school and three-story, 33 x 65 ft. convent, to be erected for St. Jerome's Roman Catholic Church at Newkirk and Nostrand Avenues. Rev. Thomas F. Lynch, Pastor. John Bagley Day, Archt., 1265 Broadway, New York.

★**New York, N. Y.**—Contracts for improvements in Margaret Louisa Building of the Y. W. C. Assoc., 14 East Sixteenth Street, have been awarded as follows: Heating plant and appurtenances, Hugh Getty, Inc., 359 West Twenty-sixth Street, and for electric elevator and appurtenances, to Otis Elevator Co., Eleventh Avenue and Twenty-eighth Street, and for refrigerating plant and appurtenances, to Shipley Construction & Supply Co., Columbia Street, Brooklyn. Charles Houghin Higgins, Archts., 30 Church Street, New York.

★**Schenectady, N. Y.**—Contract for erecting club house for Lodge No. 480 B. P. O. Elks (bids opened April 24), awarded general contract to Thomas Hanahan, 16 South Wendell Avenue, at $25,000, and for heating and plumbing to Frank V. De Forest, 780 State Street, at $3,100.

★**Steelton, Pa.**—Contract for erecting church for St. Mary's Croation Church awarded Stampf & Benfer, Harrisburg, at about $33,000.

★**Baltimore, Md.**—Contract for erecting Y. M. C. Assoc. Building on South Clinton Street awarded J. Henry Miller, Inc., Eutaw and Franklin Streets, at about $50,000.

★Contract awarded Charles L. Stockhausen Company, Marine Bank Bldg., for erecting an apartment house at University Parkway and Charles Street, for Carlton Apartment House Company; cost $80,000. Parker, Thomas & Rice, 1109 Union Trust Bldg., Archts.

★**Cincinnati, Ohio.**—Contract for fireproof, concrete, brick and stone parochial school building for St. Lawrence Church, Warsaw Avenue, awarded H. Melrose & Son, 556 Boal Street, at $50,000. Architect, Anthony Kung, Jr., 955 W. Court Street.

★**New Albany, Ind.**—Contract awarded A. N. Struck Co. of Louisville, Ky., for erecting six-story, reinforced concrete office building on Spring and Pearl Streets for German-American Realty Co.

★**Chicago, Ill.**—Blome Sinek Co., 139 N. Clark Street, Chicago, are erecting under general contract the mercantile building for Henneberry Co., Twenty-second and Grove Streets, Chicago, cost being about $400,000. S. N. Crowen, Archt.

★Blome Sinek Co., 139 N. Clark Street, are erecting under general contract the mercantile building for the International Tailoring Co., Jackson Boulevard and Peoria Street; cost about $350,000. Mundie & Jensen, Archts.

★**Green Bay, Wis.**—Contract for erecting edifice for Congregation of Grace Lutheran Church, on Moravian Street, awarded to H. J. Selmer, of Green Bay, at about $25,000.

★**Ft. Dodge, Iowa.**—Contract for erecting a 7-story building for Prusia Hardware Co. (J. F. Nelson, Mgr.), awarded to C. E. Atkinson, of Webster City.

★**Mankato, Minn.**—Contract for erecting 2 additional stories and basement of brick and remodeling bank building for Mankato State Bank awarded Otto Neitge, Mankato.

★**Ellis, Kan.**—Contract for erecting Y. W. C. A. building and a high school to cost $25,000 awarded to Sanneman Bros., of Green.

★**Hastings, Neb.**—Contract for erecting addition to Clarke Hotel (bids opened April 21) awarded W. N. Gedney, Kansas City, Mo.

★**Butte, Mont.**—Contract awarded by Montana Amusement Company (F. T. Bailey, Pres.), to Nelson & Pederson, of Butte, for erecting an 84 x 126 ft. theater; cost $85,000. Arnold & Van House, Archts., Butte

★**St. Louis, Mo.**—Contract awarded American Bridge Co., Third National Bank Building, St. Louis, for 4000 tons of steel for the Statler Hotel.

Olympia, Wash.—Lowest bid opened recently for erecting 2-story addition to Martin Building submitted by O. F. Larson, Provident Building, Tacoma, at $39,347. J. H. Wohleb, Archt., Olympia.

★**Seattle, Wash.**—Contract awarded Ranier Construction & Engineering Co., Stuart Building, for erecting 5-story and basement, 75 x 90 ft., brick and mill apartment house, at Seventh Avenue and Seneca Street, for the Logan Commercial Co., American Bank Building; cost $55,000.

★**Astoria, Ore.**—Contract awarded C. L. Houston, Astoria, for erecting a concrete mausoleum for Portland Mausoleum Co.; cost $30,000. Lawrence & Holford, Archts., Chamber of Commerce Building, Portland.

★**Oxnard, Cal.**—Contract awarded Leanardt & Peck, 721 H. W. Hellman Bldg., Los Angeles, for erecting 2 reinforced concrete steel frame and corrugated iron pulp drying warehouses, each 250 x 60 ft., 21 ft. high, steel train shed, 85 x 30 ft., 30 ft. high, and 3-story and basement reinforced concrete and brick addition, 30 x 50 ft., to office building for American Beet Sugar Company, Kremple & Erkes, Archts., 415 Henne Bldg., Los Angeles; cost about $100,000.

NEW INDUSTRIAL PLANTS

PROPOSED WORK.

South Brewer, Me.—Eastern Manufacturing Company will enlarge plant at cost of about $100,000. Erection of a new chemical plant also contemplated.

West Springfield, Mass.—Plans completed by McClintock & Craig, 33 Lyman Street, Springfield, for erection of addition of 4 buildings to plant of Gilbert & Barker Mfg. Co. for manufacture of gasoline and oil storage tanks, to cost about $300,000.

Pawtucket, R. I.—Narragansett Machine Company, Eeten Avenue, is to erect 3 1-story additions, 123 x 31, 55 x 25 and 50 x 60 ft. respectively.

Perry, N. Y.—The Tempest Knitting Co. plans erecting a 3-story, 24 x 124 ft. addition to knitting mills.

Warsaw, N. Y.—The Brown Knitting Co. will erect a 2-story brick, 117 x 56 ft. addition to plant on Center Street.

Audubon, N. J.—Audubon Wire Cloth Company, Audobon, will soon let contract for erecting reinforced concrete building 60 x 90 ft., to be used for wire-weaving plant.

Newark, N. J.—Reported the storage house of Consolidated Color & Chemical Co., in Brown Street, recently destroyed, will be rebuilt.

Kutztown, Pa.—Kutztown Foundry & Machine Company decided to spend $60,000 in improving plant.

Pittsburgh, Pa.—McAllister Motor Car Company, Baum and Beatty Streets, plans erecting a $100,000 service station and repair shop at Baum Boulevard. Hunting-Davis Company, Archts., Century Building.

Attalla, Ala.—National Pipe & Foundry Co. has decided to erect a soil pipe plant here. Some of the equipment has been purchased. A. M. Shook, Jr., of Birmingham is secretary of company.

Gulfport, Miss.—The Skinner Water Proofing Co. incorporated with a capital of $500,000 to erect a plant for water proofing cloth. Among incorporators: W. A. Skinner of Gulfport and R. B. Phillips of Paducah, Ky.

Dayton, Ohio.—Fyr Fyter Company incorporated at Columbus plans erecting factory for manufacture of fire extinguishers. A. S. Iddings, 701 Reibold Building, reported interested.

Chicago, Ill.—Paul Gerhardt, Schiller Building, is architect for 6-story, 163 x 125 ft., reinforced concrete packing plant, to be erected at Larrabee and Menominee Streets, for John Hetzel; cost $200,000.

Peoria, Ill.—The Keystone Steel & Wire Co., Peoria, contemplates erecting immediately a steel plant, to consist of two 75-ton open hearth furnaces, a 35-in. blooming mill and a Morgan continuous rod mill. Julian Kennedy, Pittsburgh, is engineer for open hearth furnaces and blooming mill, and the rod mill has been purchased from Morgan Construction Co. of Worcester, Mass. Buildings will be of structural steel with sheet metal coverings; approximately 75,000 yd. of concrete will be used in foundation and footings.

Milwaukee, Wis.—Reported J. H. Murphy, 902½ Kenesaw Street, will erect a $90,000 grain drying plant at 206 Florida Street.

Minneapolis, Minn.—Twin City Trading Company, Twenty-fourth and S. E. Elm Streets, has plans for a grain elevator which it is proposed erecting at Elm and Twenty-fifth Streets; capacity 300,000 bu.

Owatonna, Minn.—Owatonna Farmers Co-operative Company planning to erect a plant to cost $125,000.

St. Paul, Minn.—Foot, Schultze & Co., East Third and Waconta Streets, will erect a shops factory on Rinert Street, to cost $1,000,000.

Stuttgart, Ark.—Standard Milling Co., Houston, Tex., will erect a rice mill and elevator to cost $100,000.

Portland, Ore.—F. C. Knapp, Pres. Peninsular Lumber Company, McKenna Avenue, intends erecting a wooden shipbuilding plant at foot of McKenna Avenue.

Elmira, Ont.—C. Steeb, Guelph, is preparing plans for a knitting factory to be erected and equipped at a cost of $35,000.

Hamilton, Ont.—Cary Safe Company, 250 Chicago Street, Buffalo, N. Y., intends erecting a branch factory here costing $50,000. Site secured.

Hamilton By-Product Coke Ovens Company have plans prepared for a new plant to be erected and equipped at a cost of $1,000,000. V. Byrnes, Manager.

Ruscomb, Ont.—Plans being prepared by William Lockhart, Rumcomb, for a brick and tile plant, to be erected and equipped with latest machinery, at a cost of $35,000.

Thorne, Ont.—H. V. Keating, Fort Frances, engaged to have charge of the $200,000 paper mill to be erected and equipped at Shelter Bay, below the Island of Anticosti. Warren Curtin of Thorold, owner.

Winnipeg, Man.—Rice Mills Co., St. Boniface, whose mills were recently destroyed by fire, contemplates rebuilding.

Stovel Printing Company will rebuild plant recently destroyed by fire, and purchase new machinery.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Brooklyn, N. Y.**—Contract awarded Turner Construction Company, 11 Broadway, New York, for erecting seven-story reinforced concrete factory, 85 x 100 ft., at Grand and Flushing Avenues, for Pathe Freres Phonograph Company. Helmle & Corbett, Archts., 190 Montague Street.

★**Watertown, N. Y.**—Contract awarded by New York Air Brake Company to Hydraulic Construction Company, Watertown, for a steam power plant including brick superstructure, reinforced concrete roofing coal pocket, of concrete construction, with trestle and railroad construction, etc. Plans prepared by Samuel M. Green Company, Springfield, Mass.

★**Camden, N. J.**—Contract awarded A. Raymond Raff, 1635 Thompson Street, Philadelphia, Pa., for erecting a two-story factory for New Jersey Leather Company.

★**Jersey City, N. J.**—Contract for erecting 10-story reinforced concrete cold storage warehouse for Swift & Co. has been awarded Blome Sinek Co., 1540 Equitable Building, New York, at approximately $275,000. C. H. Kane, Chief of Construction.

★**Nicetown, Pa.**—Contract awarded McClintoc Marshall Co., Pittsburgh, for 3000 tons steel for Midvale Steel Company's plant.

★**Uniontown, Pa.**—Contract awarded James A. Johnson, Uniontown, for erecting brick and fireproof foundry for Evans Mould & Machine Company. John H. Harman, Archt., Uniontown.

★**Wilkes-Barre, Pa.**—Contract awarded Shepherd Construction Co., Miners Bank Building, Wilkes-Barre, for erecting empire shops for Lehigh & Wilkes-Barre Coal Co. Shops will include a 2-story wheelwright and paint shop, 41 x 75 ft., fireproof; electrical, plumbing and harness shop same size; 3-story, fireproof, dry kiln, 24 x 30 ft., and a 2-story fireproof carpenter and car shop, 205 x 41 ft.

★**Cincinnati, Ohio.**—Contract awarded by American Diamalt Co. to H. C. Hazen Contracting Co., 2070 Reading Road, for erecting five-story, concrete, brick and steel factory on Southside Avenue, at $25,000. Architect, Gustave W. Drach, 1701 Union Trust Building.

★**Youngstown, Ohio.**—Contract awarded Riter-Conley Mfg. Company, Pittsburgh, Pa., for 3000 tons steel for Struthers Furnace Company's plant.

★**Chicago, Ill.**—Contract awarded Blome Sinek Co., 139 N. Clark Street, Chicago, for oleo and butterine building and beef cooler at Union Stock Yards, and cold storage warehouse at soap works for Armour & Co.; cost of buildings aggregate $900,000. R. C. Clark, Archt.

★**St. Paul, Minn.**—Contract reported awarded Paul Steenberg, 2123 Shelby Avenue, for erecting three-story reinforced concrete and steel plant at Wheeler and University Avenues, for Brown, Blodgett & Sperry; cost $120,000.

★**Great Falls, Mont.**—Reported contract awarded by Montana Flour Mills Company to C. O. Jarl, of Great Falls, for erecting 250 x 125 ft., reinforced-concrete, flour mill, at $100,100.

★**Houston, Tex.**—Contract awarded by Anderson, Clayton & Co., to Horton & Horton, Houston, for constructing a reinforced concrete building, 150 x 1050 ft., for cotton concentration plant, to cost about $83,000.

★**Colton, Cal.**—Contract for constructing a 20-ton ice plant, including reinforced concrete building 100 x 80 ft., awarded Horstman & Plimert, 1117 Baker Detwiler Bldg., Los Angeles, H. Delno, Colton, Owner.

★**Los Angeles, Cal.**—Contract for erecting a 2-story and basement, brick, 108 x 138 ft. factory at Santa Fe Avenue and Cheney Street for Van Vorst & Berman awarded Alta Planing Mill Co., 830 McGarry Street, at about $35,000.

★**Preston, Ont.**—Contract awarded R. Gatehouse, Preston, for erecting a three-story addition to plant of Solid Leather Shoe Company. Cost $50,000.

MISCELLANEOUS

PROPOSED WORK.

Park Improvement—New York, N. Y.—Harry F. McGarvie is reported interested in a company which intends constructing an amusement park on Bronx River in West Farms on "Baron Waldorf Astor tract."

Conduits—North Bergen, N. J.—New York Telephone Company plans building conduits in twenty-two streets in order to place all wires underground.

Dry-dock—Philadelphia, Pa.—The Sub-Committee of House Naval Affairs Committee approved spending $500,000 to begin construction of a $4,000,000 dry-dock for League Island Navy Yard, Philadelphia.

Rock Crushing Plant—Ripplemead, Va.—Virginia Ity. (H. Fernstrom, Chief Engineer, Norfolk) will erect a rock-crushing plant to cost $100,000.

Subway—Meridian, Miss.—Plans and specifications approved for a subway for New Orleans & Northeastern Alabama & Vicksburg and Mobile & Ohio Railroads. Cost $125,000.

Subway — Cleveland, Ohio.—City and County Commissioners are considering extending subway approach to new high level bridge over Cuyahoga River, voted April 25, from the bridge to Public Square on East Side, cost $850,000 to $1,850,000, all to be paid by county. Address County Clerk.

Electric Light Plant Machinery—Globe, Ariz.—Globe Light & Power Company, planning installing additional machinery and equipment costing $12,000.

Concrete Carpets—Phoenix, Ariz.—Construction of concrete carpets at crossings of a number of streams in Maricopa County being considered by Harold Bargeman, County Engineer.

Tunnel—Los Angeles, Cal.—City Council has abandoned plan to make open cuts through Bunker Hill and has instructed Homer Hamlin, City Engineer, to prepare plans for a double bore tunnel at Second Street. Cost about $600,000.

Power System — Edmonton, Alta. — E. W. Bowness, of the Edmonton Power Company, preparing plans for the development of the municipal power system; cost, including railway, $500,000.

BIDS DESIRED.

Lockers, Albany, N. Y.—Until May 18, by State Armory Commission (Frank W. Ward, Secy.), Albany, for furnishing and installing metal lockers in various armories and other military structures of the State, advertised in Engineering Record.

Elevator—Newark, N. J.—Until May 23, by Committee on Public Buildings (Thos. J. Lee, Jr., Chmn.), for elevator, for northeast wing of City Hospital, on Camden Street. Fred. A. Phelps, Archt. and Engr.

Fence—Philadelphia, Pa.—Until May 15, by Department Public Works (George E. Datesman, Director), for improving Stenton Park at Eighteenth and Court Streets, for erecting wrought iron fences, pipe and cable fences, etc.

★**Oiling Streets—Louisville, Ky.**—Contract awarded Southern Asphaltoilene Road Company, 510 Lincoln Building, for oiling city streets at $37,100.

★**Speedway—Cincinnati, Ohio.**—Promoters of Cincinnati Speedway, to be built near Sharon, Ohio, have awarded contract for construction to Edward Ryan & Co., Paul and Madison Road. The speedway will be 70 ft. wide, 2 miles long. It will be built entirely of wood, requiring 8,000,000 ft. of lumber, and will cost $370,000. Architect, Harry Hake, Telephone Building.

Boilers—New Philadelphia, Ohio.—Until May 15, by James E. Scott, Dir. Public Service, for furnishing and delivering and erecting one 200-hp. water-tube boiler of not less than 150 lbs. steam pressure.

Cement, Sand, Etc.—Indianapolis, Ind.—Until May 22, by County Commissioners, for gravel, cement, sand, reinforcing metal, etc., for highway. Leo K. Fesler, Co. Aud.

Underpass—Oakland, Cal.—Reported desired until May 15 by George E. Gross, Clk. Board County Supervisors, for constructing steel girder span for underpass under tracks of the Central Pacific R.R.

★**Lumber—Panama.**—Contract for 8000 M ft. lumber for use on Panama Canal awarded J. G. Rainwater Lumber Company of New Orleans, La., at about $275,000.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Fire System—Indian Head, Md.**—Contract awarded Noland-Clifford Company, Newport News, Va., at $17,127 for furnishing and installing high-pressure fire system at Indian Head (bids opened April 8 by Bureau of Yards & Docks, Washington, D. C.).

★**Tunnel—Dixon, Ill.**—Contract awarded by State Board of Administration, Springfield, for constructing 6900 ft. of tunnel between buildings at State Colony for Epileptics at Dixon to William Allen & Son, Peoria, at $68,000.

Steel Towers—Keyport, Wash.—Lowest bid opened April 29 by Bureau of Yards & Docks, Washington, D. C., for furnishing two 400-ft. steel towers at Pacific Coast Torpedo Station, Keyport, submitted by Pittsburgh-Des Moines Steel Company, Curry Building, Pittsburgh, Pa., at $44,400.

★**Ferry Terminals—San Francisco, Cal.**—Contract for constructing Vashon Ferry Terminals awarded by County Commissioners to J. A. M. McEachern Company, Bell Street Block, at $32,995.

Proposals

For Proposals Advertised, See Pages 40a, 40b, 40c and 40d.

WATERWORKS.

Bids Close.		See Eng. Record.
May 16.	Pipes, Hydrants, Etc., Denmark, Wis.	Apr. 29
May 16.	Steel Tank, Westbrook, Minn.	May 6
May 16.	Improvements, Alliance, Neb.	May 6
May 16.	Pipe, Brooklyn, N. Y.	May 13
May 16.	Filters, Hartford, Conn.	May 13
May 17.	Water Works, Commerce, Okla.	May 13
May 17.	Reservoir, Fort Madison, Iowa	May 13
May 17.	Pipe line, San Diego, Cal.	May 13
May 18.	Water Works, Ironton, Ohio	Apr. 29
May 18.	Dam, Brockton, N. Y. Adv. May 13.	May 13
May 19.	Pipe, St. Louis, Mo.	May 6
May 20.	Extension, Chisholm, Minn.	May 13
May 20.	Pumps, Charlottetown, P. E. I.	May 13
May 22.	Pipe, Wooster, Ohio	May 6
May 22.	Extension, Wakeeney, Kan.	May 6
May 23.	Testing Apparatus, Newark, N. J.	May 13
May 26.	Pipes, Wallace, Man.	May 13
May 26.	Pipe, Etc., Panama	May 13
May 27.	Filtration Plant, Perry, N. Y. Adv. May 13.	May 13
May 31.	System, Aberdeen, Wash.	Apr. 29
May 31.	C. I. Pipe and Specials, Morris, Minn. Adv. May 13.	May 13
Jun. 1.	Water Works, Madison, W Va.	Apr. 22
Jun. 1.	Filtration Plant, St. Hyacinthe, Que.	May 13
Jun. 2.	Reservoir, Wilmington, Del. Adv. May 13.	May 13
Jun. 3.	Electrical equipment for water plant, El Paso, Tex. Adv. May 6, 13.	May 6
Jun. 5.	Gate Valves, Etc., St. Paul, Minn. Adv. May 13.	May 13
Jun. 5.	Material, St. Paul, Minn. Adv. May 13.	May 13
Jun. 5.	Castings, Etc., St. Paul, Minn. Adv. May 13.	May 13
Jun. 5.	C. I. Pipe, Etc., St. Paul, Minn. Adv. May 13.	May 13
Jun. 5.	Water Works, Everett, Wash.	May 13

SEWERAGE AND SEWAGE DISPOSAL.

Bids Close.		See Eng. Record.
May 16.	Salt Lake City, Utah	May 6
May 16.	Waterbury, Conn.	May 13
May 16.	Boston, Mass.	May 13
May 16.	Boston, Mass.	May 13
May 16.	Hartford, Conn.	May 13
May 17.	New York, N. Y.	May 13
May 17.	Appleton, Wis.	May 6
May 18.	Chicago, Ill. Adv. May 6.	May 6
May 18.	Newark, N. J.	May 6
May 18.	Anoka, Minn.	May 13
May 19.	Greybull, Wyo.	May 13
May 19.	Freehold, N. J.	May 13
May 20.	Linden Heights, Ohio Adv. May 6.	May 6
May 20.	Hazleton, Pa.	May 13
May 21.	Toledo, Ohio.	Apr. 29
May 22.	Spooner, Minn.	Apr. 29
May 22.	Montclair, N. J.	May 6
May 22.	Highland Park, Mich. Adv. May 6, 13.	May 6
May 22.	Myrtle Point, Ore.	May 13
May 23.	Newark, N. J. Adv. May 6, 13.	May 6
May 23.	Ridgefield Park, N. J. Adv. May 6, 13.	May 6
May 24.	Binghamton, N. Y.	Apr. 29
May 21.	Binghamton, N. Y. Adv. May 13.	May. 13
May 25.	Durham, N. C. Adv. May 6, 13.	May 6
May 25.	Milwaukee, Wis. Adv. May 6, 13.	May 6
May 25.	Lawton, Okla.	May 13
May 25.	Elyria, Ohio	May 13
May 26.	Brockport, Pa.	May 13
May 26.	Wallace, Man.	May 13
May 27.	Westfield, N. J. Adv. May 13.	May 13
May 29.	St. Clairsville, Ohio	May 13
May 29.	Biddeford, Me. Adv. May 13.	May 13
May 31.	Newark, N. J. Adv. May 13.	May 13
May 31.	Fresno, Cal.	Apr. 29
May 31.	Warren, Pa. Adv. May 13.	May 13
Jun. 1.	Marshall, Ill.	May 13
Jun. 1.	Monticello, Wis.	May 13

BRIDGES.

Bids Close.		See Eng. Record.
May 16.	Arden, Man.	Apr. 29
May 16.	La Moure, N. D.	May 6
May 16.	Gadsden, Ala.	May 6
May 16.	Heuvelton, N. Y. Adv. May 6.	May 6
May 16.	New York, N. Y.	May 13
May 16.	Ottawa, Ont.	May 13
May 17.	Blue Lick Springs, Ky.	May 6
May 17.	Providence, R. I. Adv. May 13.	May 13
May 17.	Stanton, Minn.	May 13
May 17.	East Peoria, Ill.	May 13
May 18.	Clifton Forge, Va.	May 13
May 18.	Manhattan, Kan.	Apr. 29
May 18.	Bedford, Ind.	May 6
May 18.	Benton Harbor, Mich.	May 13
May 18.	Joliet, Ill.	May 13
May 19.	Mt. Gilead, Ohio	May 6
May 19.	Atlanta, Ga.	May 13
May 19.	Richmond, Tex.	May 13
May 20.	Duluth, Minn.	May 13
May 20.	Lyndhurst, N. J.	Mar. 18
May 22.	Dayton, Ohio	Apr. 29
May 22.	Seattle, Wash.	May 13
May 23.	Kearney, Neb.	Apr. 29
May 23.	Albany, N. Y. Adv. Apr. 29.	Apr. 29
May 23.	Nashville, Tenn. Adv. May 6, 13.	May 6
May 23.	Washington, Ga.	May 13
May 23.	Woonsocket, R. I. Adv. May 13.	May 13
May 24.	Bradentown, Fla.	May 6
May 26.	Tacoma, Wash.	May 13
May 26.	Bluffton, Ind.	May 13
May 26.	Mount Gilead, Ohio	May 13
Jun. 1.	Hamilton, Ohio	May 6
Jun. 2.	Hartford, W. Va.	May 13
Jun. 5.	Cumberland, Md.	Apr. 22
Jun. 6.	Hayti, S. D.	May 13
Jun. 8.	El Dorado, Kan.	Apr. 8

PAVING AND ROADS.

Bids Close.		See Eng. Record.
May 15.	Sikestown, Mo. Adv. Apr. 29.	Apr. 29
May 15.	Evanston, Ill. Adv. May 6.	May 6
May 16.	South Bend, Ind. Adv. Apr. 22, 29.	Apr. 22
May 16.	Willmar, Minn.	Apr. 29
May 16.	New Philadelphia, Ohio Adv. Apr. 29.	Apr. 29
May 16.	Nevada, Iowa	May 6
May 16.	New York, N. Y.	May 13
May 16.	Corsicana, Tex.	May 13
May 16.	Paterson, N. J.	May 13
May 16.	Upper Marlboro, Md.	May 13
May 16.	St. Louis, Mo.	May 13
May 16.	Sterling, Ill.	May 13
May 16.	Kansas City, Mo.	May 6
May 16.	Morrison, Ill.	May 6
May 16.	South Hadley, Mass.	May 13
May 16.	Indiana	May 13
May 16.	Massachusetts	May 13
May 17.	Indianapolis, Ind.	May 13
May 17.	Washington, Pa.	May 6
May 17.	Carlisle, Ky.	May 6
May 17.	Illinois.	May 13
May 17.	Trenton, N. J.	May 13
May 18.	Poughkeepsie, N. Y. Adv. Apr. 29, May 6.	Apr. 29
May 18.	Pittsburgh, Pa.	May 6
May 18.	Waterloo, N. Y. Adv. May 6, 13.	May 6
May 18.	Miami, Fla.	May 6
May 18.	Dayton, Ohio.	May 6
May 18.	Bemidji, Minn.	May 13
May 18.	Bellevue, Ky.	May 13
May 18.	Indianapolis, Ind.	May 13
May 19.	Marion, Ohio	May 6
May 19.	Hudson, Mich.	May 6
May 19.	Cincinnati, Ohio.	May 6
May 19.	Independence, Mo.	May 13
May 19.	Ohio.	May 13
May 19.	Bloomington, Ind.	May 13
May 19.	New York, N. Y.	May 13
May 19.	Cheviot, Ohio	May 13
May 20.	Linden Heights, Ohio Adv. May 6.	May 6
May 20.	Lindsborg, Kan.	May 13
May 20.	Brocton, Ill.	May 13
May 20.	Hazleton, Pa.	May 13
May 22.	Jefferson, Ohio	Apr. 22
May 22.	Carbondale, Pa.	May 6
May 22.	Washington	May 6
May 22.	Cumberland, Md. Adv. May 6, 13.	May 6
May 22.	Ironton, Ohio.	May 13
May 22.	Tonganoxie, Kan.	May 13
May 22.	Stamford, Conn. Adv. May 13.	May 13
May 23.	Luverne, Minn.	May 6
May 23.	Loudonville, Ohio	May 13
May 23.	Jersey City, N. J.	May 13
May 23.	Fayette, Ohio Adv. May 13.	May 13
May 23.	Fair Haven, N. J. Adv. May 13.	May 13
May 24.	Tiffin, Ohio	May 6
May 24.	Bradentown, Fla.	May 6
May 24.	Mansfield, Ohio	May 6
May 24.	Wichita, Kan.	May 13
May 24.	Belding, Mich.	May 13
May 24.	Marshalltown, Iowa Adv. May 13.	May 13
May 25.	Newark, N. J.	May 13
May 25.	Indiana	May 13
May 26.	West Union, W. Va.	May 6
May 26.	Walla Walla, Wash.	May 13
May 26.	St. Paul, Minn.	May 13
May 26.	Indiana	May 13
May 27.	Houma, La.	May 13
May 27.	Indiana	May 13
May 29.	Lumberport, W. Va.	May 13
May 29.	Seattle, Wash.	May 13
May 29.	Everett, Wash.	May 13
May 30.	Cold Springs, Tex.	May 13
May 30.	Sheperd, Tex.	May 13
Jun. 1.	Hamilton, Ohio	May 6
Jun. 1.	Washington, D. C. Adv. May 6.	May 6
Jun. 1.	Crestline, Ohio	May 13
Jun. 1.	Galion, Ohio. Adv. May 13.	May 13
Jun. 2.	Great Falls, Mont.	Apr. 22
Jun. 6.	Columbus, Miss.	Apr. 29
Jun. 5.	Gate City, Va.	May 13
Jun. 5.	Indiana	May 13
Jun. 5.	Port Jervis, N. Y. Adv. May 13.	May 13
Jun. 5.	Cleveland Heights (P. O. Warrenville), Ohio	May 13
Jun. 5.	Everett, Wash.	May 13
July 5.	Terrabonne, La. Adv. May 13.	May 13
Jun. 6.	Indiana	May 13
Jun. 7.	Sultan, Wash.	May 13
Jun. 7.	Palatka, Fla. Adv. May 6, 13.	May 6
July 10.	Caldwell, Tex.	Apr. 22
Jun. 10.	Wichita, Kan.	May 13
Jun. 27.	Salt Lake City, Utah	May 13

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS.

Bids Close.		See Eng. Record.
May 16.	Dredging, Bridgeport, Conn. Adv. Apr. 15 to May 6.	Apr. 15
May 15.	Seawall, Washington D. C. Adv. Apr. 29 to May 13.	Apr. 29
May 16.	Canal Work, Albany, N. Y.	Apr. 29
May 16.	Fill, Seattle, Wash.	May 6
May 18.	Dam, Brockton, N. Y. Adv. May 13.	May 13
May 18.	Found. for Hydro Electric Plant, Marquette, Mich.	May 13
May 19.	Ditches, Bemidji, Minn.	Apr. 29
May 19.	Drainage, Angleton, Tex.	Apr. 29
May 19.	Ditch, Northwood, Iowa	May 13
May 20.	Sale of Shot Drill, Denver, Col. Adv. Apr. 29.	Apr. 29
May 20.	Channel Improvement, Maple Park, Ill.	May 6
May 20.	Levee, New Orleans, La.	May 6
May 21.	Pier, Brooklyn, N. Y.	May 13
May 22.	Irrigation, Fort Laramie, Wyo. Adv. Apr. 22.	Apr. 22
May 22.	Ditches, Racine, Wis.	May 6
May 23.	State Canal Work, Contracts 128 and 129, Albany, N. Y. Adv. Apr. 29 to May 13.	Apr. 29
May 23.	Irrigation, Grand Junction, Col.	Apr. 29
May 23.	Irrigation, Wenatchee, Wash.	Apr. 29
May 23.	Weir, Sacramento, Cal.	May 13
May 24.	Concrete Dam, Etc., Fort Dodge, Iowa	May 13
May 25.	Flood Gates, Savannah, Ga.	May 13
May 25.	Irrigation, St. Ignatius, Mont. Adv. Apr. 22.	Apr. 22
May 25.	Cement, Denver, Col. Adv. Apr. 29.	Apr. 29
May 25.	Irrigation, Ft. Laramie, Wyo.	May 6
May 26.	Dredging, Chicago, Ill. Adv. May 6, 13.	May 6
May 26.	Drainage, Aberdeen, S. D.	May 13
May 29.	Drainage, Bloomfield, Ia. Adv. Apr. 29, May 6.	Apr. 29
May 29.	Drainage, Tallahassee, Fla. Adv. Apr. 29 to May 13.	Apr. 29
May 31.	Dredging, Etc., Seattle, Wash.	May 13
Jun. 1.	Dredging, Tarrytown, N. Y. Adv. May 6, 13.	May 6
Jun. 1.	Drainage, Oskaloosa, Iowa Adv. May 13.	May 13
Jun. 2.	Breakwater, Indiana Harbor, Ind. Adv. May 6, 13.	May 6
Jun. 15.	Irrigation, Payson City, Utah Adv. May 6.	May 6
Jun. 15.	Irrigation, Hermiston, Ore. Adv. May 13.	May 13
Jun. 22.	Irrigation, Malta, Mont. Adv. May 13.	May 13
———	Sublet Levee Work, Chicago, Ill. Adv. Apr. 1.	Apr. 1
———	Levee Grading, Vincennes, Ind. Adv. Apr. 8, 15.	Apr. 8

PUBLIC BUILDINGS AND SCHOOLS.

Bids Close.		See Eng. Record.
May 15.	Ft. Huachuca, Ariz. Adv. Apr. 15 to May 6.	Apr. 15
May 15.	Elmira, N. Y. (2 Props.) Adv. May 6.	May 6
May 15.	Elizabeth, N. J.	May 13
May 16.	Merced, Cal.	Apr. 22
May 16.	Garrison, N. D.	May 6
May 16.	East Lansing, Mich.	May 6
May 16.	Oxnard, Cal.	May 13
May 16.	McCombs, Miss.	May 13
May 16.	West Bend, Iowa	May 13
May 17.	Wichita Falls, Tex.	May
May 17.	Little Falls, Minn.	Apr. 15
May 17.	Kent, Ohio	Apr. 29
May 17.	Hyndman, Pa.	May 13
May 18.	Durango, Col.	Apr. 15
May 18.	Washington, D. C. Adv. Apr. 29, May 6.	Apr. 29
May 18.	Nevada, Mo.	May 6
May 18.	Fort Mason, Cal.	May 13
May 18.	Fayette, Iowa	May 13
May 18.	Grand Meadow, Minn.	May 13
May 19.	Wenatchee, Wash.	Apr. 15
May 19.	Galloway, Ohio	May 6
May 19.	Freehold, N. J.	May 6
May 19.	Douds Leando, Iowa	May 13
May 20.	Cordova, Alaska	Apr. 15
May 20.	Reynoldsville, Ohio	May 6
May 20.	Roslyn, S. D.	May
May 20.	Wexford, Mich.	May
May 20.	Kent, Ohio.	May
May 20.	Riverside, Cal.	May 13
May 20.	Buckley, Mich.	May 13
May 20.	New Bethel, Ind.	May 13
May 20.	Union City, Ind.	May 13
May 20.	Northville, Mich.	May 13
May 22.	Tahoka, Tex. Adv. May 6, 13.	May 6
May 22.	Reading, Ohio	May 6
May 22.	Bird Island, Minn.	Apr. 29
May 22.	Boone, Iowa	Apr. 29
May 22.	Selma, Iowa	Apr. 29
May 22.	Cincinnati, Ohio	May 13
May 23.	Glenville, W. Va.	May 6
May 23.	Downey, Cal.	May 6
May 23.	Cincinnati, Ohio	May 6
May 23.	Hartford, Conn	May 13
May 24.	Madison Barracks, N. Y. Adv. Apr. 29 to May 13.	Apr. 29
May 24.	Wahjamega, Mich.	Apr. 29
May 24.	Carthage, Ohio	May 13
May 25.	Butler, Pa.	Mar. 18
May 25.	Washington, D. C. Adv. May 6, 13.	May 6
May 25.	David City, Neb.	May 13
May 26.	Millarton, N. D.	May 6
May 27.	Bowman, S. D.	May 6
May 27.	Reading, Ohio	May 6
May 27.	Keyport, Wash.	Apr. 29
May 27.	Ogdensburg, N. Y.	May 13
May 27.	Grand Forks, N. D.	May 13
May 27.	St. Louis, Mo.	May 13
May 27.	Tiltonville, Ohio	May 13
May 27.	Bristolville, Ohio	May 13
May 29.	Arden, Pa.	Apr. 29
May 29.	Urbana, Ill.	May 6
May 29.	Tuba, Ariz.	May 6
May 29.	Wilton, N. D.	May 13
May 31.	Washington, D. C. Adv. May 13.	May 13
Jun. 1.	Lowellville, Ohio	May 13
Jun. 1.	Washington, D. C. Adv. May 13.	May 13
Jun. 1.	Fillmore, Utah.	May 13
Jun. 2.	Washington, D. C. Adv. May 13.	May 13
Jun. 2.	Lebanon, Ohio	May 13
Jun. 5.	Belton, Tex.	May 6
Jun. 5.	Lake Charles, La.	May 13
Jun. 6.	Waynesville, N. C.	May 13
Jun. 6.	Geneva, Ill.	May 13
Jun. 7.	Portland, Me.	May 6
Jun. 8.	Pineville, W. Va.	Apr. 29
Jun. 8.	Marysville, Tenn.	May 6
Jun. 8.	Waynesville, N. C.	May 6
Jun. 10.	Irvington, Ind.	May 13
Jun. 16.	Middletown, Ohio	May 13
Jun. 19.	Neenah, Wis. Adv. May 13.	May 13

PRIVATE BUILDINGS.

Bids Close.		See Eng. Record.
May 16.	Salina, Kan.	May 13
May 16.	Fitchburg, Mass.	May 13
May 16.	Hutchinson, Minn.	May 13
May 17.	Turton, S. D.	May 13
May 17.	Ebensburg, Pa.	Apr. 22
May 18.	Sheffield, Iowa	May 6
May 18.	Sheffield, Iowa	May 13
May 22.	Jasper, Ala.	May 6
May 27.	Cincinnati, Ohio	Apr. 29
Jun. 13.	Chicago, Ill.	May 13

MISCELLANEOUS.

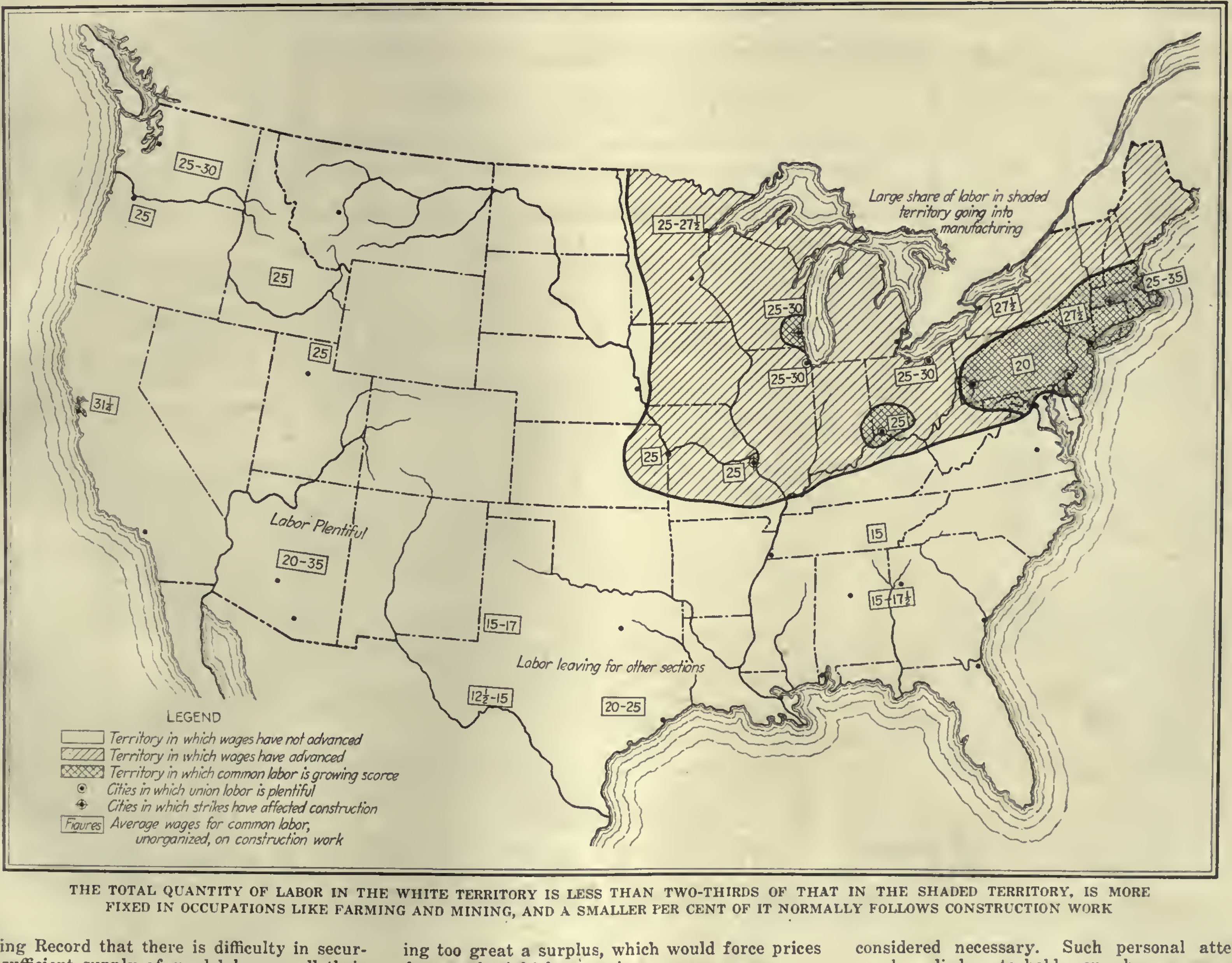
Bids Close.		See Eng. Record.
May 15.	Concrete Walls, Etc., Mandan, N. D. Adv. Apr. 15.	Apr. 15
May 15.	Terracing Hill, Mandan, N. D. Adv. Apr. 15.	Apr. 15
May 16.	El. Ry., Section No. 4, New York, N. Y.	Apr. 29
May 16.	El. Rys., Brooklyn, N. Y.	May 13
May 16.	Garbage, Long Island City, L. I.	May 13
May 18.	Lockers, Albany, N. Y. Adv. May 13.	May 13
May 18.	Sect. No. 1, El. Rys., New York, N. Y.	Apr. 29
May 19.	Underpass, Atlanta, Ga.	May 6
May 20.	Cranes, Vallejo, Cal.	May 6
May 22.	Sect. No. 5, El. Rys., New York, N. Y.	Apr. 29
May 22.	Derrick Boat, Norfolk, Va. Adv. Apr. 22.	Apr. 22
May 22.	Towers, Buffalo, N. Y. Adv. May 6.	May 6
May 22.	Railroad Supplies, Alaska	May 13
May 22.	Cement, etc., Indianapolis, Ind.	May 13
May 23.	Lighting Bridge, Baltimore, Md. Adv. May 6, 13.	May 6
May 23.	El. Rys., Brooklyn, N. Y.	May 13
May 23.	Elevator, Newark, N. J.	May 13
May 25.	Cement, Denver, Col. Adv. April 29.	Apr. 29
May 25.	El. Rys., New York, N. Y.	May 6
May 25.	El. Rys., New York, N. Y.	May 13
May 25.	Garbage Disposal Plant, Whiting, Ind. Adv. May 13.	May 13
May 26.	Jetty, Wilmington, Del.	May 13
Jun. 1.	Design for Sign, Springfield, Ill.	May 6
Jun. 3.	Dredge, Vallejo, Cal.	May 6
Jun. 9.	Steamer, Washington, D. C. Adv. May 13.	May 13
Jun. 12.	Coal, Norfolk, Va. Adv. May 13.	May 13
———	Heating Plant, Tucson, Ariz. Adv. Apr. 15.	Apr. 15
———	El. Rys., New York, N. Y. Adv. Apr. 29 to May 13.	Apr. 29

Wages Have Advanced Over an Area Representing Sixty-one per Cent of the Country's Population

Situation Already Acute in Areas Containing 27 Per Cent of Population—Business Conditions Indicate That General Demand for Labor Will Increase Rather Than Slacken—Effect on the Labor Market of Farming and the Lumber Industry

WAGES of common labor have gone up, indicating growing scarcity, over an area which represents 61 per cent of the total population of the United States on the basis of the 1910 census. Still more acute conditions are already being felt over an area in which 27 per cent of the total population of the country is concentrated. This has occurred at the very beginning of the construction season and before the annual demand for farm labor has made itself felt.

The accompanying map illustrating these conditions is conservative. Several contracting firms with work at present going on in most sections of this country and in Canada have written the Engineering Record that there is difficulty in securing a sufficient supply of good labor on all their work except for that on the Pacific Coast and in the Southwest. It may be pointed out in passing that less than 10 per cent of the total population of the country resides in these sections. The contractors referred to, who have a view of the entire country, are without exception anxious about the outcome of the labor situation.


25-30
25
25
25
31½
Labor Plentiful
20-35
15-17
12½-15
20-25
Labor leaving for other sections
25-27½
25-30
25-30
25-30
25
25
25
Large share of labor in shaded territory going into manufacturing
27½
27½
25-35
20
15
15-17½
LEGEND
Territory in which wages have not advanced
Territory in which wages have advanced
Territory in which common labor is growing scarce
Cities in which union labor is plentiful
Cities in which strikes have affected construction
Figures Average wages for common labor, unorganized, on construction work

THE TOTAL QUANTITY OF LABOR IN THE WHITE TERRITORY IS LESS THAN TWO-THIRDS OF THAT IN THE SHADED TERRITORY, IS MORE FIXED IN OCCUPATIONS LIKE FARMING AND MINING, AND A SMALLER PER CENT OF IT NORMALLY FOLLOWS CONSTRUCTION WORK

Exclusive of Texas, which has been included with the Southwest, the Southern states contain about 22 per cent of the country's population. Negro labor, usually considered much less efficient than foreign labor, will probably come north from these states. That the remaining Western states, which contain but 7 per cent of our population, can supply much labor for work outside their boundaries is considered doubtful. Wages in these states and on the Pacific Coast are also normally higher than in other sections.

It is further significant that, in the sections in which plenty of labor has been reported, construction work has not yet really become active. On the whole, the prediction seems justified that labor is going to be difficult to secure this summer and difficult to hold without advancing wages.

A favorable feature of the situation is to be found in the crop reports. A materially smaller acreage of wheat and other crops has been planted. Fewer men will be required to harvest them, and it is expected that the country will avoid producing too great a surplus, which would force prices down and might have serious consequences.

Although the demands for financing our foreign commerce are apt to be heavy, there is an unprecedented supply of money in this country. Bank deposits in all sections have increased from 10 to 23 per cent, and practically the whole country is in a position to buy. This means that there will be no slowing down of industrial production, and that the industries will be strong bidders for labor. It may be significant that the heaviest gains in bank deposits correspond with the shaded areas on the labor map.

The lumber industry, which employs large numbers of men, has not yet begun to make sales that will expand production; yet even to produce enough to meet the present demand has forced a wage advance in the North Central states. That much heavier demand will develop, bringing this industry in sharp competition for labor, seems exceedingly likely. Lumber is being considered more extensively in planning new construction than at any time within recent years, and is again coming into use for everything from railroad equipment to mill buildings, making its appearance in fields where it was supposed the advantage of steel was permanently established.

Contractors who have camp jobs will do well to pay unusual attention to their camps, and all contractors will do well to look more carefully after the welfare of their men than has generally been considered necessary. Such personal attention can be relied on to hold men when no wages the contractor can afford to pay will accomplish this result.

Buildings

Contracts amounting to $208,000 have been awarded for building a school at Philadelphia. The construction of a high school at Camden, N. J., to cost $391,000 has been contracted for. A contract for building a $750,000 extension to a pulp mill has been awarded at Oregon City, Ore. The new work noted in this issue includes: $300,000 office building, plans filed, and $200,000 hospital, architects engaged, New York City; schools to be built, $250,000, Jamestown, N. Y.;

plans prepared, $320,000 ship yard, Elizabeth, N. J.; buildings for institution, $300,000, to be built, Cincinnati; erection of $250,000 institution under consideration, plans being prepared for $300,000 and $500,000 industrial plants, and work start on $200,000 automobile plant, Cleveland; plans prepared, $400,000 industrial plant, Beloit, Wis.; plans prepared, $500,000 mercantile building, Kansas City; $200,000 glass plant to be built, Ada, Okla.; $1,500,000 bank building to be constructed, Dallas, Tex.; plans completed, $1,000,000 theatre, Montreal; plans being prepared, $300,000 office building, Toronto.

Bridges and Roads

A contract for building the bridge at Lowell, Mass., has been awarded at $115,000. Bids will be opened June 15 at Philadelphia for the construction of a bridge to be built under a $200,000 appropriation. Plans are being prepared for an $80,000 steel bridge for Oceanside, Cal.

Bids have been opened or contracts awarded on the following road and paving work: Lockport, N. Y., $160,000 road work, bids opened May 1; Boonville, Ind., contract awarded, roads to cost $84,000; Harrisburg, Ill., $130,000 paving contract awarded; Blackwell, Okla., $104,000 paving contract has been awarded.

Bids for paving and road work are desired as follows: Albany, N. Y., June 5 and 7, large volume of road work; Greenwich, Conn., May 29, 43,500 sq. yd. concrete pavement; Eaton, Ohio, June 14, 40,000 sq. yd. paving; Canton, Ohio, bids opened, 44,000 sq. yd. of pavement; Vincennes, Ind., June 6, paving work to cost $130,000; Jackson, Mich., May 28, paving work costing $83,000.

Road work in this issue includes: Syracuse, N. Y., $200,000 to be spent for city pavements; Fairmont, W. Va., $650,000 road bonds to be sold; Greenwood, Miss., 100 miles of hard surface road construction to be let in July; Sterling, Ill., paving work to cost $123,000 proposed; Richmond, Ind., concrete road petitions approved involving expenditure of $190,000; Fresno, Cal., county highway commission recommends expenditure of $3,600,000 for road construction.

Waterworks and Sewers

Low bids have been received on three sewer sections in New York City amounting respectively to $62,000, $132,000 and $142,000. A contract has been awarded for laying 10 miles of large diameter steel water pipe at Rochester, N. Y. A larger number of small sewer construction projects than usual are noted under "bids desired" in addition to the following: Milwaukee, June 8, two contracts, extensions to intercepting sewer systems; Akron, Ohio, June 1, sewer work costing $100,000; Oatman, Ariz., waterworks and sewer system to cost $250,000.

Plans are being prepared for a $1,000,000 trunk sewer system at Buffalo. Plans have been approved for a sewer system costing $175,000 at Fargo, N. D. A $500,000 bond issue for constructing sewers have been voted at Fresno, Cal.

Miscellaneous

A contract for crib work amounting to $250,000 has been recommended for award in connection with the Toronto harbor improvements. A $165,000 contract for irrigation pumping machinery has been awarded at Alpaugh, Cal. Bids are desired June 1 for a station-finish contract on the Lexington Avenue subway in New York City. Bids will be opened May 29, for constructing a flood-protection wall costing $105,000 at Portsmouth, Ohio. A $130,000 ditch contract will be let June 3 at Caledonia, Mich. A bill appropriating $130,000 for a parkway has been passed at Atlantic City, N. J. Canal enlargement costing $340,000 is contemplated near Lake Charles, La.

CONTRACTING NEWS

Of Special Interest to Engineers, Contractors, Builders and Manufacturers of Engineering and Building Supplies

WATERWORKS

PROPOSED WORK.

Boston, Mass.—Plans submitted to War Department for the proposed high-pressure pumping station, which is to cost $150,000. Address Mayor.

Fall River, Mass.—Plans being prepared for extending the water supply, including construction of one or more reservoirs. Address Town Clerk.

Attica, N. Y.—Citizens considering purchasing and reconstructing plant of Attica Water, Gas & Electric Co., or constructing new plant. Address City Clerk.

Red Creek, N. Y.—Citizens voted to construct water works; cost $30,000.

Yonkers, N. Y.—Water Bureau Superintendent Peene submitted to Public Works Commissioner Brady a recommendation to install a 3,000,000-gal. capacity pump at the Tube Well Station; cost $12,000.

Elizabeth, N. J.—Linden Water Company formed with John P. Winans, Linden; Louis Focht, Trenton, and others, for the purpose of erecting water plant in Linden Township.

Monaca, Pa.—Borough Council planning constructing a municipal reservoir on Monaca Heights.

New Castle, Pa.—City of New Castle Water Company, through their purchasing agent, 60 Broad Street, New York, N. Y., will purchase material for about one mile of 20-in. pipe line. All questions as to engineering and construction should be addressed to the said company at the New York address.

Windsor, Pa.—Engineer engaged to prepare plans and supervise construction of water works recently authorized by the voters. Address City Clerk.

Mount Rainer, Md.—Water and sewer bonds for $100,000 will be sold June 5 by Peter J. Hagen, Town Clk.

Takoma Park, D. C.—Harry Stevens, Union Trust Building, Washington, D. C., engaged to prepare plans for a reservoir and other water works improvements to be made in Takoma Park, Md. (P. O. Tacoma Park, D. C.); B. G. Davis, Clerk and Treasurer.

Fairmont, W. Va.—Contract will be let soon after June 1 by city for 1000 ⅝-in. meters. Ira L. Smith, Water Commissioner.

Hickory, N. C.—Water and sewer extension bonds amounting to $10,000 sold by city.

Bamberg, S. C.—Citizens May 2 voted $15,000 bonds for electric light plant, water supply and extensions to water lines. G. D. Ryan, Supt. Electric Light & Water Plant.

St. George, S. C.—Water works and electric light bonds for $20,000 have been sold. Address City Clerk.

Hogansville, Ga.—Citizens voted $55,000 bonds for constructing water works and sewerage system. Address Town Clerk.

Georgetown, Miss.—Plans being prepared for a water system to cost $25,000, by Z. A. Kramer, Engineer, Magnolia, Miss. H. A. Mentz, Asst. Engr., Magnolia.

Cincinnati, Ohio.—Walter J. Friedlander, Safety Director, has directed Harry Hake, Telephone Building, to prepare plans and specifications for the pumping station for the new high-pressure fire-service system. Waterworks Supt. J. A. Hiller and Pumping Supt. C. H. Anderson will visit other cities to inspect high-pressure pumping equipment before any bids are received.

Columbus, Ohio.—The Superintendent of Water Works, in a report to City Council, recommended purchase of a new pump to lift water from the river to filtration plant, cost about $20,000.

Euclid, Ohio.—Water works bonds for $21,850 will be sold June 12 for laying 6 and 8 in. water mains in Genesee, Chippewa, Delaware and other streets. H. S. Dunlop, City Clk.

Georgetown, Ohio.—It is proposed to construct water works, but no definite steps have been taken yet. J. R. Brown, Mayor.

Lima, Ohio.—Bonds for $560,000 for new storage reservoir and rapid sand filtration plant will be sold June 6 by A. L. Metheamy, Director Public Service, C. H. Bryson, City Engineer; R. Winthrop Pratt, Designing Engineer, Cleveland.

Piqua, Ohio.—Ordinance passed in City Council authorizing employ of Hazen, Whipple & Fuller, to prepare a supplementary report to that made three years ago by this firm, and submit same by June 15, 1916, on improvements to water works.

Salem, Ohio.—Water works bonds for $50,000 will be sold June 15 by George Holmes, City Aud.

Wellington, Ohio.—Construction of water works reported contemplated. Address Village Clerk.

Rock Island, Ill.—It is proposed to lay water mains in Twenty-ninth Avenue at a cost of $17,267 and paving with brick on Thirty-ninth Street at a cost of $9,056. Wallace Treichler, City Engineer.

Hampton, Iowa.—Improvements to water works are planned, including replacing present standpipe with a 100,000-gal. elevated steel tank, install one or more wells and extend mains. Address City Clerk.

Rock Rapids, Iowa.—Improvements to water works costing $5,000 contemplated. J. K. Medberry, City Clerk.

McKinley, Minn.—Water works costing $40,000 to be installed requiring drilling of two or more wells south of village, erecting of a pump house, electric-driven pumps installed, a steel tank of 100,000-gal. capacity erected. One mile of sidewalks also will be constructed. Address City Clerk.

Dighton, Kan.—Citizens, May 1, voted $28,000 bonds for constructing water works and electric light plant. W. B. Rollins & Company, 439 Midland Bldg., Kansas City, Mo., Engrs.

Ellendale, N. D.—Council taking steps to install the new water works. Address City Engineer.

Oldham, S. D.—Citizens are petitioning Town Board to install a municipal water works. Address Town Clerk.

Princeton, Mo.—Citizens, May 5, voted $12.500 bonds for water main extensions. Address City Clerk.

The value of a Contracting News Service is measured by the number of

BIDS DESIRED

items published. The number of such items in this week's Contracting News Section of Engineering Record is

301

During the last four issues in April, 927 "Bids Desired" items were published in the Contracting News pages. In addition, 2608 items covering proposed work and prices and lettings appeared in those four issues.

Harlowton, Mont.—All bids opened recently for constructing water works have been rejected and new bids will be asked about June 5. George E. Baker, Consulting Engineer, Whitehall.

Carthage, Tex.—Plans and specifications being prepared for water works. Address Mayor.

Dallas, Tex.—State Board of Health has recommended to city of Dallas that immediate improvements be made to the water supply, including additional filtration plants and provisions made for disinfecting the water.

Houston, Tex.—City Council intends installing meters in the suburb of Brunner. E. E. Sands, City Engineer.

Mansfield, Tex.—Water Works bonds in the sum of $12,000 have bcen approved by Attorney General.

Santa Ana, Tex.—City Council considering a filtration plant for the water works. Address Mayor.

Temple, Tex.—Board Waterworks Commission (C. W. Caldwell, Secy.), will soon let contract for 600 water meters.

Terrell, Tex.—Bartlett & Ranney, Chandler Building, San Antonio, engaged to investigate and report on improvements and developments for an adequate water supply. T. C. Russell, Chmn. Board City Commissioners.

Seattle, Wash.—Reports and estimates of constructing water mains in Shilshole Avenue filed by A. H. Dimock, City Engineer, have been approved by Board of Public Works. C. B. Bagley, Secy.

Board Public Works has approved reports and estimates for water mains, etc., in Hudson Street, to cost $22,878.

Oregon City, Ore.—Plans completed by Water Board and Council for a 5,000,000 gal. reservoir, to cost $35,000. Address City Clerk.

Coeur d'Alene, Idaho.—City is reported considering holding an election to vote on purchasing local water works system at a cost of $225,000. City is also considering duplicating present plant at a cost of $150,000. Address City Clerk.

Hailey, Idaho.—Reported Hailey Hot Springs Company will spend $40,000 in constructing a pipe line and 2 natatoriums at Hailey Hot Springs Hotel.

Pocatello, Idaho.—City is considering the purchase of the present water works or the construction of an entire new plant at a cost of $250,000. Address City Clerk.

Aylmer, Que.—F. Meddles, Care Montreal Power Company, Montreal, Que., is preparing plans for a filtration plant to cost $25,000.

BIDS DESIRED.

Ft. Wadsworth, N. Y.—Until June 1, by Quartermaster, Ft. Hamilton, for extending water and sewerage systems at Ft. Wadsworth, advertised in Engineering Record.

New York, N. Y.—See "Public Buildings and Schools."

Tchula, Miss.—Reported desired until June 6, by W. W. Gwin, Mayor, for constructing waterworks, sewers and electric light plant.

Cleveland Heights (P. O. Warrensville), Ohio.—Until June 5, for laying a 6-in. water main in Lamberton Road, costing $2,685. F. A. Pease Eng. Co., 802 Marshall Bldg., Engrs., Cleveland.

Columbus, Ohio.—Reported desired until May 23, by Luis J. Guthke, Secy. Board Purchase, for furnishing and installing a steel lining for soda tank at the water purification plant. Jerry O'Shaughnessy, Supt. Water Works.

Farmersville, Ohio.—Until May 27, by A. F. Gilbert, Clerk Board Public Affairs, for 100 g.p.m. pump, 15 hp. oil engine, 1400 ft. 8-in., 2500 ft. 6-in. and 5450 ft. 4-in. pipe, 50,000-gal. tank on 100-ft. tower, 16 4-ft. hydrants, and 4 6 and 8-in. gate valves. National Company, South Bend, Engineers.

Elmhurst, Ill.—Until May 24 by Common Council for constructing a brick and tile and concrete pumping station, 24 x 36 ft. H. L. Emerson, Engr., 1118 Chamber of Commerce Building, Chicago.

East Troy, Wis.—Reported desired until June 5 for laying about 2000 ft. 4-in. water pipe, setting hydrants, etc. O. R. Kurzrok, Village Clk.

Vinton, Iowa.—Until May 26, by W. E. Klingman, City Clerk, for machinery for water and light plant, including one 300-kw. steam turbine and turbo generator, complete, with exciter; (b) for furnishing, erected on foundation and connected to turbine, one jet condenser for above unit; (c) installing one switchboard and voltage regulator. J. B. Hill, Engineer, Iowa City; cost, $29,000.

Fairmont, Minn.—Until May 25 by H. B. Tuttle, City Clk., for approximately one mile 4-in. water mains, Class C, including hydrants, valves, etc. Frank O. Jones, City Engr.

Oskaloosa, Kan.—Reported desired until May 29, by W. O. Werswick, City Clk., for constructing waterworks, for which $32,500 bonds were recently voted. O. W. Stiles, 416 Bryant Bldg., Kansas City, Mo., Engr.

Mullen, Neb.—Until June 2 by C. M. Barneby, Village Clerk, for constructing water works, including 60-gal. pump, 6-in. well, 40,000-gal. elevated tank and 4 and 6-in. mains; cost $10,000. Des Moines Bridge & Iron Works, Des Moines, Iowa, Engrs.

Overton, Neb.—Reported desired until May 25 for furnishing material and constructing water works. J. W. Dunnaway, Village Clk.

Fargo, N. D.—Reported desired until May 24 for 5846 lin. ft. water main, 4 to 10 in., with hydrants etc. A. R. Watkins, City Aud.

Port Arthur, Tex.—Until June 15, by R. H. Dunn, Mayor, for furnishing and installing equipment for pumping plant. J. F. Coleman, Consulting Engr., 921 Hibernia Bldg., New Orleans.

Castle Rock, Col.—Reported desired until June 1, by H. J. Johnson, Town Clk., for furnishing material and constructing water works. George H. Sethman, Engr., 215 Equitable Bldg., Denver.

Wenatchee, Wash. — Reported desired until May 23, for constructing and laying 5470 ft. 63 in. reinforced concrete pipe. W. P. Knapp, Secy. Drain. Dist.

Burbank, Cal.—Reported desired until May 23 by Emily Peyton, City Clk., for constructing concrete reservoir, 47 x 48 ft. and 6 ft. deep.

Oatman, Ariz.—Reported desired until June 15, for constructing waterworks and sewer system. Probable cost $250,000. Address C. L. Mayhew, Secy. Mohave Oatman Water Co.

Winnemucca, Nev.—Until June 17, by County Commissioners, for furnishing material and constructing main and branch conduits to deliver water from Humboldt Mountain Range to the town of Lovelock, work includes approximately 21,000 lin. ft. 4, 5, 6 and 8-in. vitr. clay pipe, 72,981 lin. ft. 8 in. and 28,460 lin. ft. 12-in. machine banded redwood pipe (alternate bids will be considered on riveted steel pipe), 26 2-in. air valves, six 3-in. air valves, 28 2-in. blow-off valves and 5 3-in. blow-off valves, two 4-in. automatic blow-off valves and two 6-in. automatic blow-off valves, excavating and back filling of pipe trenches and hauling and distributing pipe. J. W. Davey, Clerk of Board. L. H. Taylor, Engineer, Lovelock.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**New York, N. Y.**—Contract awarded L. K. Comstock & Company, Inc., 30 Church Street, for furnishing and installing riser valves, controlling apparatus in shafts of city tunnel of Catskill Aqueduct in city of New York, Contract 147, at $27,600 (bids opened May 9 by Board Water Supply).

★**Rochester, N. Y.**—Contract awarded T. A. Gillespie Co., 50 Church Street, New York, for laying about 10 miles of 37-in. lock bar steel pipe, Conduit III.

★**Conway, Pa.**—Contract for furnishing water meters (bids opened May 1) awarded National Meter Company, Pittsburgh, for ⅝, ¾, 1 and 10-in. meters. E. Munensch, Secy. of Council.

★**Mercer, Pa.**—Contract awarded by Mercer Water Company to Pitt Construction Company of Pittsburgh for constructing a filtration plant.

★**Rocky Mount, Va.**—Contract is reported awarded J. B. McCrary, Atlanta, Ga., for constructing water works to cost about $40,000.

★**Warsaw, Ill.**—Contract for installing extensions to water system awarded Moine & Dunbar, St. Louis, Mo., at $6,683. Paul G. Kranshaar, City Clerk.

Winterset, Iowa.—Des Moines Bridge & Iron Company, Des Moines, submitted lowest bid for improvements to water works (bids opened May 8 by City). H. S. Ely, City Clerk.

★**Eveleth, Minn.**—Contracts awarded Pastarrt Construction Company, Duluth, and Lawrence McCann, Everett, for water mains, to cost $15,000, including 9000 ft. 6-in. and 5000 ft. 4-in. c. i. pipe. C. H. Williams, City Clerk. C. M. Darway, City Engineer.

New Wilson, Okla.—All bids opened May 3 for constructing water works and electric light plant rejected. Town will do the work. Lowest bid was $28,500, Benham Engineering Company, Oklahoma City. C. W. Henson, Town Clerk.

★**Colville, Wash.**—Contract awarded John Acorn and J. A. C. Acorn, Colville, for constructing a 1,000,000-gal. reservoir at $7,398.

★**Ottawa, Ont.**—Council awarded contract to National Iron Works, Cherry Street, Toronto, for water mains required for this season's work.

SEWERAGE AND SEWAGE DISPOSAL

PROPOSED WORK.

Lynn, Mass.—W. L. Vennard, City Engineer, has prepared plans for a reinforced concrete relief basin and connecting outlet main to conduct the flowage into the harbor at tidewater; cost between $8,000 and $15,000.

New Bedford, Mass.—Committee on Roads, Bridges and Sewers has recommended an appropriation of $17,000 for lowering sewer in South Water Street.

Pittsfield, Mass.—Construction of sewers in Parkside, Ventura, Melrose and Rutledge Avenues and in Williard Place and Longview Terrace contemplated; cost about $19,500. Address City Clerk.

Revere, Mass.—Municipal Council appropriated $20,500 for constructing sewers. Address Town Clerk.

Stoughton, Mass.—Town Special Committee on Sewerage is considering constructing a sewer system. Address Town Clerk.

Woonsocket, R. I.—Construction of sewers in Winter, Temple Farm and Prosnect streets contemplated by city; cost $21,000. Address City Clerk.

Hartford, Conn. — Because the bids opened recently for constructing a sewer in Blue Hill Avenue exceed the amount appropriated, the construction of the sewer will be delayed for some time. See "Prices and Lettings."

Binghamton, N. Y.—City Council voted to construct sewers on Balcom Avenue, Louisa, Davis and Schubert Streets. W. Earl Weller, City Engineer.

Plans completed for sewage disposal plant to be constructed here but nothing will be done with the construction this year. Total cost, including intercepting sewer, bids for which are to be opened May 24, will be about $500,000. W. Earl Weller, City Engineer.

Buffalo, N. Y.—Plans are being prepared for Scajaquada trunk sewer to cost between $1,000,000 and $1,250,000. It will probably be two months before plans are completed. Address Secretary Board of Public Works.

Buffalo, N. Y.—Dr. Earle B. Phelps, consulting engineer of the International Joint Commission, has submitted a report recommending treatment of sewage in this city by constructing and operating Imhoff tanks and disinfecting works at Niagara Street, near Cornelius Creek, on Squaw Island, at Tiff Street, near Hopkins. Total yearly cost $400,000.

Kenmore, N. Y.—The Village Trustees of Kenmore and Town Board of Tonawanda considering constructing stormwater sewer.

Long Island City, L. I., N. Y.—Board of Estimate intends constructing a sewer in portions of Atlantic, Herald and Napier Avenues and Fulton Street at a cost of $30,300.

East Orange, N. J.—Reported preliminary estimates of Nicholas S. Hill, Jr., 100 William Street, New York, N. Y., on cost of constructing a high-level sewer for East Orange is $1,216,700. It is proposed to carry sewage through Newark to meadows on Newark Bay and there be given treatment before entering into Newark Bay.

Point Pleasant, N. J.—At recent election citizens voted $21,000 bonds for extending sewer system. Address Town Clerk.

Pitman, N. J.—Contract will be let about July for constructing the sewer system, 18 miles, of 8 to 15-in. T. C. pipe sewer, costing $70,000, and 2 disposal plants, costing $32,000 additional. Remington & Vosburg, Engrs., Camden.

Altoona, Pa.—State Board of Health approved plans for sanitary sewer system through Columbia Park addition in Sixth Ward. J. W. Shields, City Engr.

Beaver Falls, Pa.—County Commissioners having plans and specifications prepared for sewage disposal plant at county home.

Carlisle, Pa.—Plans submitted to State Board of Health for the sewage disposal plant which the Directors of the Poor of the County propose establishing at the county almshouse.

Harrisburg, Pa.—Commission authorized constructing eight branch sewers at a cost of $41,600. M. B. Cowden, City Engineer.

Johnstown, Pa.—Plans have been submitted to State Board of Health for the sewers to be constructed in this city. Address Mayor.

Quakertown, Pa.—Installation of a sewer plant is under consideration, but nothing definite has yet been done about the matter. Frank Thatcher, Borough Secretary.

Williamsport, Pa.—City contemplates constructing a sewage disposal plant. John B. Otto, City Engineer.

Mount Rainer, Md. — See "Water Works."

Richmond, Va.—City Engineer estimates cost of constructing sewer in North Avenue at $80,000. Proposed sewer is to care for drainage of the northern section recently annexed.

Hogansville, Ga.—Citizens voted to issue $55,000 bonds for constructing water works and sewerage system. Address City Clerk.

Copperhill, Tenn.—Citizens voted to construct a sewer system. Contract for construction will be let about middle of June. Ben Crawford, Mayor; A. S. Clarke, City Clerk.

Cincinnati, Ohio.—City Council has approved estimate of Frank S. Krug, City Engineer, at $48,390, for constructing trunk sewer from present terminus to corporation line.

Council has ordered plans and estimates for sewer from northeast corner of Hyde Park East, subdivision to the Duck Creek interceptor.

Wm. E. Harmon & Co., 515 Gwynne Building, Cincinnati, Ohio, promoters of the Hyde Park East subdivision, will lay three miles of sewers in newly opened streets. Contract for work, estimated at $35,000, will be let shortly.

Delaware, Ohio.—State Board of Health advises city to construct a sewage disposal plant at once. George Irwin, City Engineer.

Euclid, Ohio.—Sewer bonds for $24,330 will be sold June 12 for constructing sewers in Genesee, Seneca, Delaware and other streets. H. S. Dunlop, City Clk.

Hamilton, Ohio.—Estimated cost at $53,187 for constructing sewers in Fairview, Elmo, Woodlawn, Jersey, Fitton, Pleasant and other streets in 6th Ward submitted to City Council by city engineer.

Indianapolis, Ind.—Plans being prepared for a local sewer to be laid in Tremont Avenue at a cost of $20,000. Part will be constructed of 12-in. pipe and part of 3-ft. circular sewer.

Muskegon Heights, Mich.—Hoad & Decker of Ann Arbor engaged to prepare plans for sewer system.

Pickneyville, Ill.—It is proposed to construct a sanitary sewer requiring 8 to 12-in. pipe, a septic tank, etc., and estimated to cost $44,000. Specifications completed. No deep excavation and no rock. George Hincke, Mayor.

Eau Claire, Wis.—Sewer improvements costing $15,000 are to be made this summer. Address Commissioner Public Works.

Kansas City, Kan.—Ordinances passed for construction of 26,123 lin. ft. pipe sewer from 8 to 24 in. diameter and 1110 lin. ft. circular brick sewer of 27, 36 and 39 in. diameter. Address City Clerk.

Omaha, Neb.—Construction of sewer and pavement in Minne Lusa addition north of Miller Park contemplated. Sewer to be extension of Miller Park sewer and provides disposal of refuse from northwest Omaha; cost about $57,000.

Wymore, Neb.—Plans being prepared by John L. Hershey, Beatrice, for sewers. An election will probably be held in August to vote bonds for these improvements. C. R. Freehann, City Clerk.

Fargo, N. D.—City Commissioners have tentatively approved plans for the sewer system for the southern residence district; cost $175,000.

Jamestown, N. D.—Louis P. Wolff, 1000 Germania Bldg., St. Paul, Minn., preparing plans for a trunk and sanitary sewer; cost, including disposal plant, $70,000.

Columbus, Mont.—Contract soon to be let by Council for constructing sewer system, including disposal plant. George N. Cardozo, City Engineer.

Kansas City, Mo.—Mayor signed bond issue ordinance including $100,000 for sewers, $100,000 for Blue Valley sewer, $200,000 bridges and viaducts, $200,000 Twelfth Street Traffic Way approaches; $200,000 parks and parkways including Slope Park; $250,000 Twenty-third Street viaduct; $75,000 Municipal Farm (women's dormitory); $25,000 Chestnut Avenue viaduct.

Liberty, Mo.—Sewer bonds for $20,000 will be sold June 2 by B. F. Corbin, Ex Officio Clk. City Council.

McGenee, Ark.—City Council passed an ordinance creating an improvement district for installation of sewer system. Address City Clerk.

Galveston, Tex.—Until May 25, by City, for constructing concrete drains on Avenue H, from Thirty-fith to Forty-sixth Streets; estimated cost, $16,015. A. T. Dickey, City Engineer.

Greenville, Tex.—Citizens May 6 voted to construct sewers and sewage disposal plant. A. D. Duck, Engineer, Box 341, Greenville.

Houston, Tex.—City Council has appropriated $15,000 from Sanitary Sewer Fund for purchase of material for a pipe line extending from Willow Street pumping plant to north side distributing plant; $14,650 for blowers, equipped with electric motors for the disposal plant; $4,000 for rebuilding pumping plant. E. E. Sands, City Engineer.

San Angelo, Tex.—Reported citizens considering purchasing present sewerage system or constructing a new one. Address Mayor.

Tyler, Tex.—Bartlett & Ranney, Chandler Building, San Antonio, engaged to prepare plans and investigate and report on disposal of sewage, for the Tyler Sewer Company (B. B. Cain, Pres., Dallas).

Seattle, Wash.—A. H. Dimock, City Engineer, directed to prepare plans and specifications for an arterial sewer in Ranier Valley, costing according to preliminary estimate $125,000, and requiring 3000 ft. 78 in., 1200 ft. 72 in., 1500 ft. 36 in. and 2500 ft. 30 in pipe and some small pipe 18 in. and less.

Plans approved for sewers in North and West Fortieth Street. A. H. Dimock, City Engineer.

Fresno, Cal.—Citizens voted May 3 $500,000 bonds for constructing storm and sanitary sewer system. Plans prepared by B. E. Cronkite, City Engineer. Olmsted & Gilleien, 1112 Hollingsworth Building, Los Angeles, Consulting Engineers.

San Francisco, Cal. — Board Public Works approved plans prepared by the City Engineer for constructing a sewer in Oakdale Street, estimated to cost $22,000.

Toronto, Ont.—Commissioner Harris recommends that a sewer be constructed in Queen Street, from Pape Avenue to Leslie Street, with necessary outlets, under Section No. 9; probable cost $50,108.

BIDS DESIRED.

Boston, Mass.—Until May 23, by Edward F. Murphy, Comr. Pub. Wks., for constructing sewers in South End Sewer Improvement, Shawmut Avenue, Upton and Newland Streets, city proper. Also same time and place for constructing sewers in Haydn and Brahms Streets, West Roxbury. Also until May 22, for constructing sewerage works in Perham Street, an outlet in Winslow and Vermont Streets and private lands in Roxbury.

Cooperstown, N. Y.—Until June 2, by Board Village Trustees, for constructing sewers, advertised in Engineering Record. Morrell Vrooman, Engineer, Gloversville; Kenneth Root, Village Cerk.

Ft. Wadsworth, N. Y.—See "Water Works."

Montclair, N. J.—Until June 12, by Harry Trippett, Town Clerk, for constructing storm sewers in Pine Street, advertised in Engineering Record.

Akron, Ohio.—Until June 1, by Coventry Land & Improvement Company, 403 Ohio Building, Akron, for constructing about 4900 ft. 15 to 42-in. sanitary sewer and about 2000 ft. 60 to 72-in. storm drain; approximate cost $100,000, advertised in Engineering Record. W. H. Kroeger, Manager of Company.

Dayton, Ohio.—Until May 24 by Department Public Service (Victor E. Parker, Secy.) for constructing storm water sewers in Lorain Avenue, K, L, Louie and numerous other streets.

Xenia, Ohio—Reported desired until June 15, for constructing storm sewers. Probable cost. $35,000. J. P. Shumaker, City Engr.

Marshall, Ill.—Reported desired until May 22 by Board Local Improvements for 6834 lin. ft. 6 to 15-in. vitr. pipe sewers. W. R. Paige, Consulting Engr., 108-109 Rose Dispensary Building, Terre Haute.

Salem, Ill.—Reported desired until July 15, for constructing sewer system and sewage disposal plant. Address City Clerk.

Long Island City, L. I., N. Y.—Following are unit figures of three bids opened May 10 by Maurice E. Connolly, President Queens Boro., for constructing sewers in Woodhaven Avenue, Bradon and other streets: (a) E. A. Weiss, Times Building, New York, $62,655; (b) Frank L. Paino, 67 Bay Forty-seventh Street, Brooklyn, $69,270; (c) Peace Bros., 20 Main Street, Flushing, $69,615.

	(a)	(b)	(c)
1,488 lin. ft. 5-ft. 3-in. reinforced concrete	$20.00	$18.00	$22.50
451 lin. ft. 3-ft. 9-in. plain concrete	10.50	14.00	11.00
406 lin. ft. 3-ft. 6-in. plain concrete	7.60	10.00	10.00
703 lin. ft. 3-ft. 0-in. plain concrete	5.60	7.00	7.00
250 lin. ft. 2-ft. 6-in. plain concrete	5.40	6.00	6.00
688 lin. ft. 24-in. vitrified pipe	4.20	6.00	4.60
250 lin. ft. 22-in. vitrified pipe	3.40	4.00	3.75
486 lin. ft. 20-in. vitrified pipe	2.60	4.00	3.75
498 lin. ft. 18-in. vitrified pipe	2.20	4.00	4.00
511 lin. ft. 15-in. vitrified pipe	1.80	3.00	2.90
699 lin. ft. 12-in. vitrified pipe	1.50	3.00	2.50
46 manholes, complete	60.00	70.00	60.00
1 junction chamber at Woodhaven Avenue and Jamaica Avenue, complete	370.00	500.00	350.00
1 junction chamber at Manor Avenue and Jamnica Avenue, complete	370.00	500.00	350.00
1 junction chamber at Woodhaven Avenue and Bradon Avenue, complete	370.00	500.00	600.00
69 lin. ft. 12-in. vitrified pipe for basin connection spurs	1.00	1.00	1.00
198 6-in. spurs, 24 in. long, on concrete	1.00	0.10	0.50
55 6-in. spurs, on 24-in. vitrified pipe	3.50	1.00	3.00
20 6-in. spurs, on 22-in. vitrified pipe	3.00	1.00	2.75
40 6-in. spurs, on 20-in. vitrified pipe	2.25	1.00	2.50
38 6-in. spurs, on 18-in. vitrified pipe	2.00	1.00	2.00
37 6-in. spurs, on 15-in. vitrified pipe	1.50	1.00	1.50
56 6-in. spurs, on 12-in. vitrified pipe	1.00	1.00	0.75
4,533 lin. ft. 6-in. pipe for house connection drains	0.85	1.00	1.10
50 cu. yd. concrete, Class A, not shown on plan	6.00	5.00	...
4,000 lb. reinforcing steel	0.05	0.04	...
100 M ft. timber for sheeting and bracing	27.00	30.00	0.01

New York, N. Y.—Following are unit figures of four lowest bids opened May 4 by Douglas Mathewson, Pres. Bronx Boro., for constructing sewers in Radcliffe Avenue and other streets:

Proposition A: (a) Peter B. Stanton, 2327 Walton Avenue, $142,000; (b) Anita Constr. Co., 2975 Marion Avenue, $144,242; (c) Marrone & Palladino, 658 E. 221st Street, $147,000; (d) Gasparrini & De Blasio, 1964 Honeywell Avenue, $150,000.

Proposition B: (a) Marrone & Palladino, 658 E. 221st Street, $137,861 (awarded contract); (b) Peter B. Stanton, 2327 Walton Avenue, $142,000; (c) John C. Rodgers, Jr., 271 W. 125th Street, $143,000; (d) Gaspsrrini & De Blasio, 1964 Honeywell Avenue, $150,000.

Proposition A	(a)	(b)	(c)	(d)
1,955 lin. ft. concrete, 4 ft. 0 in	$12.00	$8.00	$13.00	$11.00
520 lin. ft. concrete, 3 ft. 9 in	8.00	7.00	12.00	11.00
285 lin. ft. concrete, 3 ft. 6 in	8.00	7.00	12.00	10.00
812 lin. ft. concrete, 3 ft. 3 in	8.00	7.00	12.00	8.00
242 lin. ft. concrete, 3 ft. 0 in	8.00	6.50	10.00	8.00
261 lin. ft. concrete, 2 ft. 9 in	8.00	6.50	10.00	8.00
525 lin. ft. vitrified pipe, 30 in	8.00	6.00	7.00	8.00
1,345 lin. ft. vitrified pipe, 24 in	5.00	5.00	6.00	6.00
525 lin. ft. vitrified pipe, 20 in	4.00	4.75	4.00	6.00
1,440 lin. ft. vitrified pipe, 18 in	4.00	4.50	4.00	4.50
3,890 lin. ft. vitrified pipe, 15 in	3.50	4.00	3.50	3.50
8,450 lin. ft. vitrified pipe, 12 in	3.50	3.79	3.00	3.00
935 lin. ft. of basin connection	1.00	2.00	1.00	2.00
200 lin. ft. vitrified pipe drain, 12 to 24 in	0.01	0.25	1.00	...
2,655 spurs for house connections	0.01	1.00	...	0.01
210 manholes	50.00	50.00	55.00	60.00
24 receiving basins, Type B	150.00	100.00	175.00	150.00
14 receiving basins, Type C	125.00	95.00	155.00	150.00
9,500 cu. yd. rock excav	2.00	2.50	2.00	2.50
1,000 cu. yd. Class C concrete	5.00	5.00	4.00	5.00
1,000 lb. steel reinforcing bars	0.01	0.02	0.04	0.04
5 M ft. timber sheeting	0.01	1.00	...	...

Proposition B	*(a)	(b)	(c)	(d)
1,955 lin. ft. vitrified segment block, 4 ft. 0 in	$8.00	$12.00	$12.00	$10.00
520 lin. ft. vitrified segment block, 3 ft. 9 in	7.00	8.00	10.00	10.00
285 lin. ft. vitrified segment block, 3 ft. 6 in	6.00	8.00	9.00	10.00
812 lin. ft. vitrified segment block, 3 ft. 3 in	6.00	8.00	8.50	8.00
242 lin. ft. vitrified segment block, 3 ft. 0 in	5.00	8.00	8 00	7.50
261 lin. ft. vitrified segment block, 2 ft. 9 in	5.00	8.00	7.50	7.00
525 lin. ft. vitrified pipe, 30 in	7.00	8.00	5.00	8.00
1,345 lin. ft. vitrified pipe, 24 in	5.00	5.00	5.00	6.00
525 lin. ft. vitrified pipe, 20 in	4.00	4.00	3.75	6.00
1,440 lin. ft. vitrified pipe, 18 in	4.00	4.00	3.50	4.50
3,890 lin. ft. vitrified pipe, 15 in	3.50	3.50	3.00	3.50
8,450 lin. ft. vitrified pipe, 12 in	3.00	3.60	2.50	3.00
935 lin. ft. basin connections	1.00	1.00	1.00	2.00
200 lin. ft. vitrified pipe drains, 12 to 24 in	1.00	0.01	1.00	...
2,655 spurs for house connections	25.00	0.01	0.50	0.01
210 manholes	55.00	50.00	50.00	60 00
24 receiving basins, Type B	175.00	150.00	150.00	150.00
14 receiving basins, Type C	155.00	125.00	150.00	150.00
9,500 cu. yd. rock excav	3.00	2.00	3.00	2.50
1,000 cu. yd. Class C concrete	4.00	5.00	5.00	5.00
1,000 lb. steel reinforcing bars	0.04	0.01	0.05	0.04
5 M ft. timber sheeting	20.00	0.01	40.00	...

Milwaukee, Wis.—Until June 8, by Sewerage Commission, for constructing extensions to intercepting sewer system. Official Notice No. 18 and Official Notice No. 17, both proposals advertised in Engineering Record.

Mapleton, Minn.—Until May 23 by Andrew Kaufman, Village Clk., for constructing several portions of sanitary sewer system to consist of installation of disposal plant, 35,000 gal. capacity, sludge beds, including building of 346 ft. 8-in. sanitary sewer manholes and disposal plant, etc.

Wabasha, Minn.—Until May 29, by J. M. Schouweiler, City Recorder, for constructing extension to sewer system.

Oatman, Ariz.—See "Water Works."

PRICES AND LETTINGS.

★*Indicates award of contract.*

Hartford, Conn.—Lowest bid opened May 2 for constructing Section A of sewer system from Uphill Street to city line (the pipe to be furnished by the city) submitted by F. Barone, $32,711. Other bidders, A. D. Ambrosio, $34,011; W. T. Ryan Constr. Co., $34,107 (bidders of Hartford). Awarding of contract deferred.

Lowest bid, opened by Bd. of Contract & Supply, for constructing Section B, Blue Hills sewer system submitted by D'Onfrom Bros of Fitchburg, Mass., at about $36,000.

★**Albany, N. Y.**—Contract for constructing sewage disposal works on Westerlo Island awarded by Bd. of Contract & Supply to Peter Keeler Bldg. Co. of Albany, at $131,782.

Brooklyn, N. Y.—Following are five lowest bids opened May 11 by L. H. Pounds, Borough President, for constructing sewer in West Eleventh Street from Q to Eighty-sixth Streets, price being on percentage basis of engineer's estimate, which is $139,510: E. A. Weiss, Times Building, New York, 95.5 per cent; Ward & Tully, Tenth Avenue, Brooklyn, 99.75 per cent; J. F. Cogan Company, Woolworth Building, New York, 113 per cent; B. G. D. Company, 114 per cent, and Merrill-Ruckgaber Company, 50 Church Street, New York, 114 per cent.

Following are four lowest bids opened May 11 by L. H. Pounds, Borough President, for constructing sewers in Howard Avenue and Herkimer Street, bids being on percentage basis of engineer's estimate, which is $23,805: E. A. Weiss, Times Building, New York, 92½ per cent; Russell Engineering & Contracting Corporation, Inc., 165 Hooper Street, 118 per cent; Concrete Material Company, 123 per cent.; John C. Schrade, 133 per cent.

New York, N. Y.—Following is unit figure of lowest bid opened May 3 by Marcus M. Marks, President Manhattan Borough, for constructing a storm relief sewer in 114th Street, between First Avenue and the East River: John C. Rodgers, 271 West 125th Street, 1097 lin. ft. 5 ft. 3 in. x 8 ft., $27; 90 lin. ft. 12 in. vitr. pipe, basin connections, $2; 100 lin. ft. 6 in. vitr. drain pipe for house connections, $1; 150 lin. ft. 6 in. risers, $1; 50 spurs 6 in. for house connections, $1; 12 manholes, $50; one special overflow section at First Avenue, $3,000; one receiving basin altered to Type "B," $100; one inlet, Type "A," $100; 2 inlets, Type "B," $100; 50 cu. yd. concrete, Class "B," $5; 5 cu. yd. rock excav. and removed, Class "A," $5; 6000 lbs. additional steel reinforcement imbedded in concrete, 6 cts.; 70 M ft. timber and planking in foundation, $40,000; 45 M ft. timber in flooring, $50; 5500 lin. ft. piles in place, 40 cts.; 50 lin. ft. 6 in. granite curb set in concrete, $1; 100 cu. yd. riprap, $2; 1134 sq. yd. pavement, $4; total $46,710. Total of next three lowest: P. J. Duffy, $48,417; U. S. Drainage & Irrigation Company, $49,000, and Gasparrini & De Blasio, $50,016.

★**Oriskany, N. Y.**—Contract awarded Morrison & Quinn, Rochester, for constructing sewerage system (bids opened April 19 by Bd. Village Trustees), at about $30,346. A. M. Scripture, Engineer, Utica.

★**Rochester, N. Y.**—Following are three lowest bids opened by Bd. Contract & Supply May 4 for constructing (a) screen house and (b) pump houses for sewage disposal plant in Irondequoit: A. Freiderich & Sons Co., Rochester, (a) $40,000, and (b) $1,642; R. T. Ford Co., Rochester, (a) $42,000, (b) $4,274, and George C. Rossell, Triangle Bldg., Rochester, (a) $43,331 and (b) $1,791.

★**Grays Lake, Ill.**—Contracts for constructing sewer system and settling tank (bids opened May 8) awarded The Embankment Company, Joliet, at $16,401. R W. Churchill, City Attorney.

★**Murphysboro, Ill.**—Contract awarded J. E. & B. S. Craine Company, Carbondale, for laying West Side sewer system at $29,000.

★**Missoula, Mont.**—Contract for constructing storm sewers (bids opened May 10) awarded J. C. Maguire, Butte, at $22,732. R. E. Kellogg, City Clerk.

★**Austin, Tex.**—Contracts for constructing Little Shoal Creek storm sewer awarded in three sections as follows: Southern section to Dallas Lime & Gravel Company, Dallas, at $32,473; section from Sixteenth Street to arched culvert at Nineteenth Street, to Ray McDonald of Austin, at $5,941, and 60-in. circular sewer in Nueces Street from Sixteenth to Nineteenth Streets, to William Fuhrman, at $4,725.

★**Victoria, Tex.**—Contract for constructing sewage disposal plant awarded Dallas Lime & Gravel Company, Dallas, at $26,669. R. Trevino, Engineer, P. O. Box 160, Victoria.

★**Blackwell, Okla.**—Following are four bids opened recently by Council for constructing system of storm sewers: M. A. Swatek & Company, Oklahoma, $16,900 (awarded contract); W. F. Power, Guthrie, $18,425; Tolbert Construction Company, Muskogee, $18,515, and Park Moran Company, Okmulgee, $18,588. Benham Engineering Company, Oklahoma, Engineers.

BRIDGES

PROPOSED WORK.

Perry, N. Y.—Citizens voted $11,000 bonds for constructing 250-ft. concrete bridge in Borden Avenue, over Silver Lake Outlet. Address Township Clerk.

New Castle, Pa.—Plans being prepared by Erie R. R. (R. S. Parsons, Ch. Engr., 50 Church Street, New York, N. Y.), for bridge, to be constructed over Neshannock Creek, near its junction with Shenango River.

Pennsylvania. — State Water Supply Commission has approved following applications:

Citizens Water Company of College Hill, supply water to public in Borough College Hill, Beaver County.

Meadow Lake Fishing Club, to construct a dam on Clarks Run, in Middle Smithfield Township, Monroe County.

Pennsylvania Railroad Company, to construct bridge over Hyner Creek (No. 201.69), above mouth, Chapman Township, Clinton County; construct extension to bridge No. 132.99 (old No. 582) over Oil Creek, 5.5 miles from mouth, and 1.6 miles south of Petroleum Center Station, Cornplanter Township, Venango County.

Supervisors of Menlo Township, Mifflin County, to construct bridge over Kishacoquillas Creek (West Branch) about one mile southwest of village of Nonno.

Supervisors of Lawrence Township, Clearfield County, construct bridge over Moose Creek, 0.25 mile north of Clearfield, on Guinea Hill Road.

Philadelphia & Reading Railway Company, addition to bridge over Willow Creek, 600 feet west of Fleetwood Station, in the Borough of Fleetwood, Berks County; construct bridge across West Branch of Brandywine Creek, in the City of Coatesville, Chester County.

Supervisors of Franklin Township, Snyder County, to construct bridge across Walters Run, about 2 miles northwest of Middleburg Borough, on Troxelville Road; to construct bridge over Spruce Run, about 1¾ miles northeast of northeast corner of Middleburg, on New Berlin Road.

Commissioners of Butler County, to construct bridge (Pflugh) over Sullivan Run, 1 mile direct west of Mt. Chestnut; to construct bridge over Little Connoquenessing Creek (McGinnis Bridge), 5.5 miles direct west of Butler, in Connoquenessing Township; to construct a bridge over Thorn Creek, one mile east of Renfrew, on Renfrew-Butler Road, Penn Township.

Supervisors of Neshoppen Township, Wyoming County, to construct bridge over Ben Cole Creek, about 1.5 miles northwest of Neshoppen.

Central Railroad Company of Pennsylvania, to make change in one pier under bridge of three 43-foot spans and in trestle approach thereto across Fishing Creek, about one mile south of Mill Hall Borough, Clinton County.

Commissioners of Monroe County, to construct a bridge over Pocono Creek, at Bartonsville, Pocono Township.

White Deer Mountain Water Company, to construct a dam on Spruce Run, in White Deer and Buffalo townships, Union County.

Jefferson Electric Company, to construct dam across Mahoning Creek, in the Borough of Punxsutawney, Jefferson County.

Supervisors of Sparta Township, Crawford County, to construct bridge over Murdock Run, on road to Union City, 1½ miles west of Spartansburg.

Supervisors of West Mahoning Township, Indiana County, to construct bridge over Sugar Run, 1¼ miles northeast of Smicksburg Station, on road to Porter; to construct bridge over Owl Hollow Run, one-half mile east of Smicksburg, on main road to Punxsautawney.

Supervisors of Jenks Township, Forest County, to construct bridge over Millstone Creek, 2 miles east of Marionville.

Commissioners of Montgomery County, to construct temporary supports under the highway bridge, crossing the Schuylkill River, between Conshohocken and West Conshohocken.

New York & Pennsylvania Company, to construct a retaining wall and intake along the east bank of the East Branch of the Clarion River, in Borough of Johnsonburg, Elk County.

Baltimore and Ohio Railroad Company, to construct a bridge over Wills Creek (Bridge No. 10), 0.3 mile west of Hyndman, and 8 miles north of the Pennsylvania-Maryland line, in Bedford County.

Lehigh Valley Railroad Company, to construct temporary trestle over Wyalusing Creek, 0.7 mile west of Wyalusing Borough, Bradford County; over Moshoppen Creek, 0.1 mile west of Moshoppen, Bradford County; over Wysox Creek, 0.8 mile east of Wysox Borough, Bradford County, and over the Chemung River, 0.5 mile east of Athens, Bradford County.

Commissioners of Northumberland County, construct new 70-foot span, through, plate girder steel bridge, across Shamokin Creek, on South Shamokin Street, in the Borough of Shamokin.

Supervisors of Ward Township, Tioga County, to construct bridge over Fall Brook, 2 miles north of Fall Brook, on Mainsburg Road.

Supervisors of Bradford Township, Clearfield County, construct bridge over Roaring Run, at Mineral Springs Park.

Supervisors of Brush Creek Township, Fulton County, construct bridge over Mountain Stream, about 1 mile below the source.

Philadelphia, Pa.—All bids opened April 28 by Bureau of Surveys for constructing Steel bridge on line of Godfrey Avenue for tracks of P. R. R., at Fern Rock, rejected. New bids will probably be asked.

Bushnell, Fla.—Special Road and Bridge Dist. No. 3 bonds for $20,000 will be sold June 5, by County Commissioners (W. N. Potter, Clerk).

Chattanooga, Tenn.—Reported Queen & Crescent R. R. Company will construct a bridge over Tennessee River.

Reported County Commissioners are considering constructing an $850,000 bridge over Trinity River.

Henderson, Ky.—The Illinois Central R. R. (A. S. Taedwin, Ch. Engr., Chicago, Ill.) does not at present time intend constructing a bridge over Ohio River at Henderson.

Shelbyville, Ky.—See "Electric Railways."

Bellefontaine, Ohio.—County Commissioners sold $25,000 bridge bonds. Address County Clerk.

Cleveland, Ohio.—See "Paving and Road Making."

Dayton, Ohio.—Victor C. Smith, County Surveyor, will prepare plans for Upper Miamisburg Bridge. Estimated cost, $100,000.

Indianapolis, Ind.—Bridge bonds for $100,000 reported to be sold June 14, by L. K. Fesler, Co. Aud.

Eureka Springs, Ark.—Road Commissioners, Eureka Springs (E. M. Bare, Secy.), about to engage an engineer to prepare estimates and supervise construction of 19 1/5 miles of macadam road, including a 300-ft. steel bridge.

Houston, Tex.—County Commissioners plan constructing steel and concrete bridge, draw or lift bridge, to replace present structure over Bray's bayou at Harrisburg. Cost, about $17,000.

Seattle, Wash.—Bids rejected by Board of Public Works for constructing two Howe truss spans in approaches to Fifteenth Avenue Northwest bridge at Ballard. New bids will soon be asked. C. B. Bagley, Secy. Board Public Works.

Cayuse, Ore.—Oregon, Washington, R. R. & Navigation Co. will let contract this month for an extension of bridge over Umatilla River involving erection of an 80-ft. through plate girder span to cost $12,000.

Joseph, Ore.—The Oregon, Washington, R. R. & Navigation Company will construct three bridges on the Joseph branch. Two 80-ft. girder spans, three 20-ft. deck plate spans, and two 40-ft. deck plate girder spans. Three bridges to cost $36,000.

Los Angeles, Cal.—F. H. Joyner, County Road Commissioner, reports to Board of Supervisors that loss to bridges and roads in the county by flood damages of last winter cost $148,955.

The Atchison, Topeka & Santa Fe R. R. (C. F. W. Felt, Ch. Engr., Chicago, Ill.) will replace four permanent bridges and several temporary bridges destroyed by the washout between Los Angeles and San Diego.

Oceanside, Cal.—Plans being prepared for a $80,000 steel bridge, to be constructed over San Luis River for Atchison, Topeka & Santa Fe R. R. (C. F. W. Felt, Ch. Engr., Chicago, Ill.).

BIDS DESIRED.

Morristown, N. J.—Until May 22 by Board Chosen Freeholders Morris County and Board Chosen Freeholders Union County for constructing new reinforced concrete arch bridge, 75-ft. span and 38 ft. wide, over Passaic River between Morris and Union Counties. Fred. S. Smith, Engr., Morris County, Morristown. Jacob L. Baeur, Engr., Union County, Elizabeth.

Butler, Pa.—Until May 23, by County Commissioners (J. N. Maharg, Chmn.), for constructing county bridges as follows: Reinforced concrete bridge over Bull Creek Road in Clinton Township, stone substructure and steel superstructure over Thorn Creek on the Butler and Renfrew Road in Penn Township, reinforced concrete bridge and stone abutment over Little Connoquenessing Creek in Connoquessing Township, reinforced concrete bridge stone abutment over Sullivan Run in Franklin Township, and other bridge throughout the county. W. Marks Starr, Co. Clk.

Pennsylvania—Until May 31, by State Highway Dept. Harrisburg, for constructing following bridges:

Route 302, Station 1463 about one mile east of New Florence, Westmoreland County, reinforced concrete bridge, 20 ft. span.

Route 295, Station 414, one mile east Albion, Erie County, steel plate girder bridge, 40 ft. span, concrete abutments.

Philadelphia, Pa.—Until June 13, by Bureau of Surveys, Department Public Works, for Schedule A, bridge on line of Bensalem Avenue, over Pennypack Creek (3 concrete arches, 60 ft., 100 ft. and 60 ft. spans, 80 ft. wide, concrete retaining walls, concrete balustrades, grading); appropriation $200,000, advertised in Engineering Record.

Clintwood, Va.—Until June 26, by County Clerk for constructing two steel bridges and for concrete work for abutments and piers of same. W. E. French, Co. Engr.

Fort Lauderdale, Fla.—Until June 8 by County Commissioners for constructing 2 highway bridges, bascule type, of movable spans, with 50-ft. channel opening. H. C. Davis, Fort Lauderdale, Engineer for Commissioners.

New Orleans, La.—Until June 5 by Highway Department of the Board of State Engineers New Orleans for erecting a 306-ft. bridge in La Salle Parish.

Macon, Miss.—Until June 6, by John A. Tyson, Clk. Bd. Co. Comrs., for constructing two bridges, one single arch 38-ft. span, other for three spans, one 20 ft. and one 12 ft., total length of each bridge 66 ft. long and 16 ft. wide.

Columbus, Ohio.—Until June 2, by County Commissioners (John Scott, Clerk), for constructing concrete culverts on Harbor Road, Sharon Township, on Indianaola Avenue in Indian Springs Addition, Clinton Township, and paving roadway of Schrock bridge over Alum Creek in Blendon Township.

Steubenville, Ohio.—Reported desired, until May 23, by John L. Mean, Co. Aud., for constructing concrete bridge over Goose Run.

Tiffin, Ohio.—Reported desired until May 27, by J. E. Hershberger, County Auditor, for 40 ft. reinforced concrete bridge in Attica, and a 40 ft. concrete arch bridge in Republic.

Xenia, Ohio.—Reported desired until May 26, by Geo. W. Kendall, Clerk County Commissioners, for constructing steel truss bridge, 16 x 57 ft., with creosoted block floor, in New Jasper Township.

Newcastle, Ind.—Reported desired until June 5 by County Commissioners for constructing abutments and steel bridge near Baker Farm in Fall Creek Township; also concrete culvert, earth fill, etc.

Rennselaer, Ind.—Until June 6, by County Commissioners for constructing nine steel bridges. Joseph P. Hammond, Co. Aud.

Wabash, Ind.—See "Paving and Roads."

Wabash, Ind.—Reported desired until June 6 by Co. Comrs. for creosoted block floors for bridge spanning Treaty Creek and bridge spanning Eel River.

Illinois.—Until May 24, by State Highway Commission, Springfield, for constructing eight small steel and concrete bridges in McDonough County. Engineers estimate, $4,090.

Rice Lake, Wis.—Until May 29, by Oscar G. Jensen, City Clerk, for plans and specifications for a concrete bridge extending over Red Cedar River at Main Street, advertised in Engineering Record.

Des Moines, Iowa.—Until May 25 by A. H. Davison, Des Moines, for constructing superstructure of reinforced concrete viaduct over Court Avenue, to cost $40,000. E. L. Masqueray, Engineer, St. Paul, Minn.

Mahnomen, Minn.—Until May 27 by County Board for constructing bridge across Wild Rice River south of Mahnomen. John W. Carl, Co. Aud.

Newton, Kan.—Until May 29, by C. A. Young, Co. Clk., for constructing reinforced concrete bridges in Harvey County as follows: East Turkey Creek Bridge, Alta Township, superstructure 35 ft. reinforced concrete through girder span, with 16 ft. roadway. Lawton Bridge, Highland Township, substructure two plain concrete abutments and one pier, superstructure 2 reinforced concrete skew slab spans each 20 ft. long with 20 ft. roadway. Dalton Bridge, Lakin Township, superstructure 25 ft. reinforced concrete through girder span with 18 ft. roadway. Masters Bridges, Lakin Township, superstructure 25 ft. reinforced concrete through girder span with 18 ft. roadway. Burt Amidon Bridge, Pleasant Township, superstructure 30 ft. reinforced concrete through girder span with 16 ft. roadway. All substructures to consist of two plain concrete abutments.

Brooking, S. D.—Reported desired until June 6 for all bridges, abutments, approaches and repairs, etc., to bridges during year 1916. F. H. Ripley, Co. Aud.

Huron, S. D.—Reported desired until June 6 for constructing 11 steel and concrete bridges. M. D. Whisman, Co. Aud.

Montrose, S. D.—Reported desired until June 6 for constructing reinforced concrete bridges; 16-ft. span bridge, 18-ft. roadway, Greenland Township; a 30-ft. span, 11-ft. roadway, in Ramsey Township, and numerous small bridges throughout the county. C. F. Erickson, Co. Aud.

Houston, Tex.—Until May 22 by H. L. Washburn, County Auditor, for placing bridges and culverts on Treschwig Road.

Aberdeen, Wash.—Reported desired unsired until June 5, by W. D. Campbell, Co. Aud., Montesano, for constructing a bridge over the Humptulips River on Hansen Road. Cost $14,500. Geo. D. Robertson, Co. Engr.

Independence, Ore.—Reported desired until May 24, Asa B. Robinson, Jr., Co. Clk., Dallas, for constructing concrete bridge at Independence, to be three span, concrete footing and piers on pile foundations. C. R. Canfield, Co. Engr.

Fullerton, Cal.—Reported desired until May 31 by City Trustees for bridge 34 ft. long and 20 ft. wide with concrete abutments and timber superstructure on Union Avenue.

Mansonville, Que. — Reported desired until June 1 by J. N. Labell, Secy.-Treas., for constructing steel bridge, 75-ft. span, to cross Missisquoi River near Potton Springs.

London, Ont.—Reported desired until May 27 by Charles Talbot, Engr., London, for constructing steel bridge. Probable cost $10,000.

Ottawa, Ont.—Until May 25 (extension of date from May 16), by H. L. Howe, Secy. Board Control for constructing superstructure of Pietoria Avenue bridge.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Lowell, Mass.**—Contract for constructing bridge over Merrimack River and Northern Canal at Pawtucketville awarded by city to National Engineering Co., 689 Lawrence Street, Lowell, at $115,410. S. Flynn, City Clerk.

★**New York, N. Y.**—Contract for furnishing structural steel for Williamsburg Bridge (bids opened May 4) awarded by F. J. H. Kracke, Commissioner Bridges, to Vulcan Rail & Construction Co., 35 Meserole Avenue, Brooklyn, at $9,949.

★**Watertown, N. Y.**—Contract for constructing bridge across Black River (bids opened March 31 by E. W. Sayles, City Engineer) awarded Di Menna & De Paola, Third Avenue and 149th Street, New York, at $19,947.

★**Denton, Md.**—Contract for constructing a 150-ft. span steel concrete bridge awarded G. W. Drury, York, at $9,662 (bids opened May 9) by H. Waldorf, County Roads Engineer.

★**Summerville, W. Va.**—Contract for constructing 2 bridges over Birch River (bids opened May 9 by County Commissioners) awarded Concrete Steel Bridge Co., Clarksburg, W. Va., at $6,464. P. N. Wiseman, Clerk County Court.

★**Chillicothe, Ohio.**—Contract for constructing a 90-ft. pony truss steel bridge, 16-ft. roadway (bids opened May 1 by W. S. Barrett, County Auditor) awarded Capital Construction Co., Columbus.

★**New Trenton, Ind.**—Contract awarded by County Commissioners at Brookville for constructing 500-ft. steel bridge at New Trenton, to Oregona Bridge Co., Lebanon, at $31,577.

★**Rushville, Ind.**—Contract for constructing steel and concrete bridge across Elm River, between Rush and Hancock Counties, near Carthage, awarded Burk Construction Company, New Castle, at $11,000. A. R. Holden, County Auditor, Rushville. A. Cameron, Engineer, Rushville.

Illinois.—Lowest bids opened May 10 by State Highway Commission, Springfield, for constructing bridges in Macoupin County, submitted by Martin & Stanfield, Palmyra, $8,977.

★**Chippewa Falls, Wis.** — Contract awarded A. Guthrie & Company, St. Paul, Minn., for constructing an 800-ft. bridge across Chippewa River for the Chicago, St. Paul, Minneapolis & Omaha R. R.

★**Charles City, Iowa.**—Contract awarded by Board of County Supervisors for constructing two 70-ft. concrete arch spans at Nora Springs over Shellrock River to Koss Construction Company, Des Moines, at $12,700. James A. Cutler, County Auditor (bids opened May 2).

★**Jefferson, Iowa.**—Contract for constructing deck girder, four concrete slabs, one box culvert and two I-beam bridges (bids opened May 9 by B. S. McCully, County Auditor), awarded Marsh Engineering Co., Des Moines, at $17,954.

★**Freeport, Tex.**—The Houston & Brazos Valley R. R. (T. G. Banks, Supt. Freeport, Tex.) awarded contract for a railway and wagon bridge across Brazos River to A. Giltheror, Houston, Tex.

★**Buffalo, Okla.**—Contract for constructing 5 concrete bridges and one steel bridge (bids opened May 1 by E. S. Hubbard, County Clerk) awarded Canton Bridge Company, Canton Ohio. C. W. Simonds, Acting Engineer, Buffalo.

★**Odessa, Wash.**—Lowest bids opened May 1 by W. N. Nevins, City Clerk, for constructing steel bridge at Third Street submitted by Coast Bridge Co., Ry. Exchange Building, Portland, Ore., at $6,875, and for concrete bridge by Charles G. Huber, Tacoma, at $7,134 (awarded contract).

Astoria, Ore.—J. H. Tillman, Portland, submitted lowest bid to County Commissioners at $6,796 for wooden bridge, and at $9,496 for steel bridge on Necanicum Highway.

Los Angeles, Cal.—Following are four lowest bids, opened May 8 by Board of Supervisors, for constructing reinforced concrete viaduct 242 ft. long, 20 ft. wide, over ravine Pacific Electric tracks and Ionia Avenue at Western Avenue: Andrew Holoway, 471 South Broadway, Pasadena, $17,561; Boardman Construction Company, 1107 Story Bldg., Los Angeles, $17,850; S. M. Kerns Company, Long Beach, $18,800, and Mesmer & Rice, Los Angeles, $19,530.

PAVING AND ROADS

PROPOSED WORK.

Peabody, Mass.—It is proposed to pave with grouted granite blocks on Peabody Square, at a cost of $12,000. Frank Emerson, Town Engineer.

Bath, N. Y.—County Board of Supervisors authorized construction of 6.21 miles of Campbell-Risingville Road, 5.58 miles of Canisteo-Hartsville Road; 3 miles of Rathbone-Cameron Mills Road, and 2.5 miles of Cameron-Freemont Road. Address County Clerk.

Dolgeville, N. Y.—Citizens, May 3, voted $22,000 paving bonds. S. J. Neff, Engineer, Dolgeville; W. H. Bacon, Town Clerk.

It is proposed to pave Faville Avenue and State Street at a cost of $22,000. S. J. Neff, Engineer, Dolgeville; W. H. Bacon, City Clerk.

Long Island City, L. I., N. Y.—Board of Estimate, New York, has authorized paving with asphalt on Lefferts Place, from Liberty Avenue to Rockaway Boulevard, at a cost of $20,000.

Malone, N. Y.—Paving bonds for $33,000 will be sold May 22 by Board Village Trustees (not county as previously stated). George A. Willson, Deputy Clerk.

Syracuse, N. Y.—City will spend $200,000 for resurfacing pavements. Address City Clerk.

Audubon, N. J. — Ordinance passed Council providing for street improvements costing $100,000. Eight streets to be paved at once. Address City Clerk.

Elizabeth, N. J.—Curbing and repaving of Elizabeth Avenue, First, South, Broad, Madison, Chilton, South, Mary and Elm Streets at a cost of $100,000 is under consideration. Address John F. Kenan, Clerk Board Public Works.

Glen Ridge, N. J.—Borough Council Plans paving with concrete about 11,700 ft. of roadway from East Orange to Bay Avenue. Address Borough Clerk.

Morristown, N. J.—Board of Freeholders have issued $66,000 bonds for road improvements.

Harrisburg, Pa.—Agreement reached between State Highway Department and the Pennsylvania R.R. to build a road from Speeceville, Pa., to Clark's Ferry, a distance of 4 miles, to replace present narrow road between railroad and the Susquehanna River.

Commission authorized paving with asphalt on various streets, including Cumberland, May, Snow and other streets, in all 11,733 sq. yd., and 6,321 lin. ft. curbing. M. B. Cowden, City Engr.

Hydetown, Pa.—Borough Council decided to construct about a mile of brick road, 16 ft. wide from end of macadam highway this side of cemetery on Hydetown Road, through village of Hydetown to Fleming crossing. Address Borough Clerk.

Manheim, Pa.—Borough Council plans paving with concrete portions of Clark, Grant, Prussian and Sixth Streets. Estimated cost $20,000. Address Borough Clk.

Pittsburgh, Pa.—Commissioners of Alleghany and Washington Counties appropriated $23,000 and $18,000 respectively toward hard-surfacing highway from Wheeling, W. Va., to Pittsburgh. Estimated cost $175,000. State Highway Commission, Harrisburg, to bear remainder of cost.

Washington, D. C. — Senate passed Bankhead good roads bill to spend $85,000,000 in constructing post roads, contingent on an equal expenditure by the States. Appropriation for $10,000,000 for roads in national forests is included.

South Boston, Va.—Until May 25, by W. L. Penick, Mayor, for 14,000 to 20,000 yds. of asphalt concrete pavement. Anderson & Christie, Engrs., Charlotte, N. C.

Beckley, W. Va.—Road bonds for $285,000 will be sold June 1 by J. Smith, Clerk County Court.

Fairmont, W. Va.—About $650,000 bonds will be sold in Lincoln District, Marion County, for brick concrete and asphaltum pavements, on concrete foundation. A. D. Wilkinson, Clerk County Court, Fairmont.

Kingwood, W. Va.—Road improvements bonds for $164,000 will be sold June 12, by County Court (E. C. Everly, Clerk).

West Virginia.—Clerk of County Courts will sell bonds as follows:

June 7, $164,000 bonds in Preston County for Kingwood District. Address Clerk at Kingwood.

June 20, $240,000 bonds in Rone County for Spenas District. Address Clerk at Spencer.

Cocoa, Fla.—Citizens of Cocoa-Rockledge Indian River Road District voted $300,000 bonds for hard-surfacing and widening Dixie highway through this district. Address Clerk of Cocoa-Rockledge Indian River District, Cocoa.

De Land, Fla.—Special Road and Bridge Dist. bonds for $250,000 will be sold June 12 by Board County Commissioners (Samuel D. Jordan, Clerk).

Jennings, La.—Election to be held May 29 to vote $500,000 bonds for public highways in Jefferson Davis Parish.

New Orleans, La.—Contracts soon to be let by Highway Department of the Board of State Engineers for hard surfacing of 63 miles of roads in De Sota Parish.

Road bonds for $150,000 for building roads in Tangipahpa Parish will be sold July 1 by Highway Department Board State Engineer, New Orleans.

Tribordeaux, La.—Contract soon to be let by Secretary Police Jury for 12 miles of gravel roads.

Clarksdale, Miss.—County has voted $600,000 bonds for good roads. Address County Clerk.

Tennessee.—Following counties will vote on bond issue for road construction: Obion County, in May, on issue of $500,000 to construct 160 miles of roads; Humphreys County to issue $200,000 bonds; Henry County election in August, $250,000; Hardin County, June 3, $100,000; Morgan County election May 20, $100,000 bonds and Chester County $100,000 bonds.

Burlington, Ky.—Citizens voted $200,000 road bonds. Address County Clerk.

Covington, Ky.—County Commissioners sold $150,000 road bonds. Address County Clerk.

Bucyrus, Ohio.—Paving bonds for $48,920 will be sold June 3 by Otto Feir'ng, County Auditor.

Cleveland, Ohio.—Council Committee on Streets has approved a bond issue of $3,500,000, election to be held in August: $2,300,000 to be used for paving and street extensions and $1,200,000 for revamping present Superior Avenue Viaduct.

Euclid, Ohio.—Paving bonds for $85,060 will be sold June 12 for paving and laying sidewalks on Genesee, Seneca, Chippewa and a number of other streets. H. S Dunlop, Clk.

Fairport, Ohio.—Road ' improvements bonds for $45,000 will be sold June 6 by W. A. Craemer.

Jamestown, Ohio.—Paving bonds for $25,000 will be sold May 31 by D. E. Bailey, Village Clk.

Jefferson, Ohio.—Paving bonds for $60,000 will be sold June 12 by County Commissioners (B. E. Brainard, Clk.).

Lima, Ohio.—Street improvements bonds for $100,000 will be sold June 6, by David L. Rupert, City Aud.

Norwood, Ohio.—Paving bonds for $32,000 will be sold May 22, by G. P. Evans, City Aud.

Brazil, Ind.—Contract will probably be let late in May by County Commissioners for constructing a 3-mile 16-ft. wide brick road on stone and concrete base; estimated cost, $69,000.

Richmond, Ind.—County Commissioners approved petitions for improving with concrete three miles of National Road, from eastern boundary line of Center Township to Henry County line. Estimated cost $180,000. Address County Clerk.

Tipton, Ind.—It is proposed to pave with either concrete, brick or asphalt about 8770 Sq. yd. on Mill Street on concrete foundation; cost $15,000. J. O. Bowlin, City Engineer; John Small, City Clerk.

Lake Odessa, Mich.—Citizens voted $12,000 bonds for improving three blocks of streets. Elvin F. Bradley, Clerk.

East St. Louis, Ill.—Plans completed for paving with brick 12,225 sq. yd. on Twenty-third Street and refurfacing with brick 62,660 sq. yd. on Missouri Avenue.

Milan, Ill.—Village Board has passed ordinance providing for 9 miles of cement walks, estimated to cost $24,000. Charles S. Thompson, Pres.

Sterling, Ill.—It is proposed to pave on Second Street, Second and Sixth Avenues, in all about 51,000 sq. yd., with brick blocks on 4 in. concrete foundation with 20,000 lin. ft. concrete combined curb. Cost $123,000. Contract will be let about June 1. Edward O. Hills, Designer Engineer, Fulton.

Hurley, Wis.—County Commissioners will bond county for $20,000 for State highway roads. Address County Clerk.

Milwaukee, Wis.—Bonds for $300,000 will be sold May 18 by Public Debt Commission for Lake Shore Drive.

Britt, Iowa.—Laying about 50,000 yd. of paving and 30,000 lin. ft. combined curb and gutter or curb contemplated here. Theodore S. De Lay, of Creston, Consulting Engineer.

Luverne, Minn.—The City has ordered 46 blocks of granite curbing. Address City Clerk:

Minneapolis, Minn.—The proposed roadway around Lake Calhoun, including Lake Calhoun Boulevard, requiring 90,000 sq. yd., and South Bay Drive, requiring 24,000 sq. yd., and 48,000 lin. ft. concrete curbing, will be constructed by force account except dredging, which will be let in fall work for 1917. Paving asphaltic concrete. A. C. Godward, Park Engineer, 400 City Hall.

St. Paul, Minn.—Ramsey County will spend $155,000 bonds for improving present roads and constructing new roads.

Kansas City, Kan.—L. H. Ellis, Engineer Park Board, estimates cost of paving Argentine Drive 1¼ miles with asphaltic concrete at $30,000.

Omaha, Neb.—See "Sewerage and Sewage Disposal."

Anaconda, Mont.—It is proposed to pave Main, Hickory and East Park streets, in all about 47,000 sq. yd., with asphaltic concrete on hot mix base. W. B. Vestal, Jr., Engineer, Anaconda. Address City Clerk.

Great Falls, Mont.—City Council adopted resolutions for paving with bitulithic Fifth Avenue and cross streets between First and Second alleys north, from present terminus of pavement at Ninth Street to west side of Fifteenth Street; estimated cost $46,360.

Helena, Mont. — City Commissioners passed resolutions authorizing construction of cement walks, curbs, etc., in Broadway District. Estimated cost $10,000. Address City Clerk.

Greenville, Mo.—Citizens voted $200,000 bonds for constructing, improving and maintaining public roads, bridges and culverts in the county. Address Chairman Bond Committee.

Independence, Mo.—Allen C. Southern, County Engineer, is preparing specifications and estimates for macadamizing Kentucky Avenue a distance of 1⅞ miles.

Joplin, Mo.—Property owners petitioned for paving Main Street from Tenth to Twentieth Streets with National pavement. Address City Clerk.

Kansas City, Mo.—Contracts soon to be let by city for paving Eighteenth Street, from Grand to Woodland Streets, 16 blocks and McGee Street, from Fifteenth to Twentieth Streets. Address Commissioner Public Works.

Morrilton, Ark.—Contract will be let about July for paving Railway Avenue and Church Street, material not decided upon. Clifton Moose, City Clerk.

Angleton, Tex.—The Attorney-General at Austin approved issue of $22,500 bonds for Brazoria County Road Dist. No. 19. Address County Clerk.

Contract will soon be awarded by County Commissioners for paving with gravel 9 miles of Chocolate Bayou Road from end of present terminus to county line. Estimated cost $25,000. Address County Clerk.

Brenham, Tex.—Election will probably be held to vote $300,000 bonds for constructing roads around Brenham Precinct. Address the Mayor.

El Paso, Tex.—Commissioners' Court has voted $200,000 bonds for completing upper valley road to Anthony and lower valley road to Fabens. Adrian Pool, County Judge.

Franklin, Tex.—Road bonds for $46,000, for Justice Precinct No. 8, Robertson County, have been sold by Commissioners Court. Address County Clerk.

Honey Grove, Tex.—Election to be held June 3 to vote $35,000 bonds for constructing roads in Mulberry and Ravenna Dist. Address Mayor.

Waxahachie, Tex.—City Council voted to pave one mile of streets in residential district, including Monroe, Water and Ferris Avenues.

Everett, Wash.—City Council plans paving with one-course concrete, 30 ft. wide, Cedar Street, from Hewitt to Pacific Streets. Hans Mumm, Jr., City Engineer.

Ilwaco, Wash.—Contract will soon be awarded by City Council for paving First Street. Estimated cost $14,000. G. G. Hall, Engineer.

Vancouver, Wash.—County Commissioners plan improving this summer roads at Camas and LaCenter. Cost, $30,000. Address County Clerk, Vancouver.

Portland, Ore.—Philip Dater, City Engineer, filed plans with City Council for macadamizing Schuyler Avenue and paving East Glisan Street; cost $37,000. A. L. Barbur, City Auditor.

Arcadia, Cal.—City Trustees considering purchase of a road roller, grader and scarifier. Charles Grimes, City Engineer.

Bakersfield, Cal.—Highway bonds for $500,000 will be sold June 9 by Board of Supervisors.

Fresno, Cal.—County Highway Commission (W. S. Farley, Chief Engineer) has recommended to the Board a $3,600,000 bond issue for 441 miles of highways as follows: $2,692,730 for 235 miles of 5-in. base and asphaltic surface roads 16 ft. wide, $540,000 for 108 miles of gravel base roads, and $40,000 for grading and repairing mountain roads, and $200,000 for bridges and culverts.

Redwood City, Cal.—About $45,000 will be spent for street improvements. Address City Clerk.

San Diego, Cal.—It is proposed to pave portions of Laurel and Fir Streets with asphalt on concrete base. George Cromwell, City Hall, Engineer: Allen H. Wright, City Clerk.

St. Foye, Que.—Contract soon to be let by P. N. Robitaille, St. Foye, for $15,000 concrete walks and $100,000 for macadam roadways.

BIDS DESIRED.

Portland, Me.—Reported desired until June 2, by B. Bradbury, Jr., Comr. Pub. Wks., for paving Stevens and Allen avenues, and North Street, with Hassam bico-mac pavement.

Buffalo, N. H.—Until May 23, by Alonzo G. Hinckley, Clk. Board County Supervisors, for constructing county roads No. 5, Lake Street Road, No. 8, Alden Murray's Corners Road, No. 7, Waverly Street Road.

Massachusetts.—Until May 23, by State Highway Commission (William D. Sohier, Chmn.), Boston, for constructing 13,800 ft. road in towns of Mashpee and Barnstable; also 4200 ft. in town of Methuen.

Salisbury, Mass.—Until May 23, by State Highway Commission (Wm. D. Sohier, Chmn.), Boston, for constructing 10,600 ft. in length, in town of Salisbury.

Greenwich, Conn.—Until May 29 by Town Highway Commission for 43,500 sq. yd. reinforced concrete pavement, advertised in Engineering Record.

Albany, N. Y.—Until June 5, by State Commission of Highways, 55 Lancaster Street, Albany (Edwin Duffey, Commissioner), for constructing various highways and repairs of highways, and until June 7 for similar work, advertised in Engineering Record.

Brooklyn, N. Y.—Until May 24, by L. H. Pounds, Pres. Boro. Brooklyn, for paving, sidewalks, curbing, guttering, etc., portions of Argyle Road, Bay Ridge Avenue, Bristol, Butler and numerous other streets, in all about 90,418 sq. yd. asphalt, 23,600 sq. yd. granite, 23,590 lin. ft. cement sidewalk, together with manholes, etc. Total security $103,400.

Buffalo, N. Y.—Until May 27, by Department Public Works (Arthur W. Kreimheder, Comr.), for paving portions of Ulman, West Ferry, Ferry and other streets.

Bloomfield, N. J.—Until June 5, by Raymond F. Davis, Town Clk., for constructing a number of sidewalks, together with curbing, guttering, etc.

Hackensack, N. J.—Until June 5, by Bd. Chosen Freeholders, for road machinery, advertised in Engineering Record.

Newark, N. J.—Until May 22, by Committee of Roads and Assessments and Speedways of the Board Chosen Freeholders, for furnishing and laying 100,000 sq. yd. more or less liquid asphalt. Fred. A. Reimer, Co. Engr.

Tenafly, N. J.—Until May 24 by Mayor and Council for resurfacing portions of various roads and streets in Borough with hot asphalt binder. E. Stanley Clarke, Chmn. Road Committee.

Union Hill, N. J.—Until June 5, by City Council, for repaving eight entire streets with asphalt.

Pittsburgh, Pa.—Until May 26 by John P. Moore, Co. Controller, for creosoted wood block floors and other repairs on following bridges, Bull Creek, Little Bull Creek, Chartiers Creek, Deer Creek, Kelleys Run and numerous other bridges through the county.

Reading, Pa.—Until May 24, by City Clerk, for paving and appurtenances on various streets, in all about 3020 sq. yd. wood block paving on concrete base, 7370 sq. yd. vitr. block paving on concrete base 33,700 sq. yd. asphalt paving on concrete base, 11,300 sq. yd. resurfacing with sheet asphalt on concrete base, 8000 sq. yd. repairs to sheet asphalt, etc.

Baltimore, Md.—Until May 24 by Board of Awards for grading and paving with cement a number of alleys.

Eastville, W. Va.—Until May 24, by Eastville Dist. Road Board, at office of County Clk., for grading and surfacing with sand clay about 13.4 miles of road. Mack Galbreath, Engr., Eastville.

Kingwood, W. Va.—By County Court of Preston County, for about 32 miles of concrete and macadam road in Portland District, 18 miles in Kingwood District. Richard R. Feller, Terra Alta, W. Va., District Engineer.

Bakersville, N. C.—Repored desired until May 22, by County Commissioners, to construct macadam roads from Toccane via Bakersville to about ½ mile east of Bakersville, a distance of 4 miles, including grading, ditches, etc.

Dunn, N. C.—Until June 13, by Mayor and Board of Aldermen, for street improvements, advertised in Engineering Record. Gilbert C. White, Engineer, Durham, N. C.

Tallahassee, Fla.—Until June 8, by Board County Commissioners (J. C. Moore, Chmn.), for constructing the Chaires and Capitola Bainbridge or Spanish Trail and Jackson Bluffs Roads, to consist of approximately 91,387 cu. yd. excav., 33 miles sand clay roads and 1670 lin. ft. 12 to 36-in. drains.

Birmingham, Ala.—Until May 30, by City Commission, for paving Clairmont Avenue and Forty-second Street, estimated cost $28,000. Bids will be received on bitulithic and asphalt and includes 7300 cu. yd. excav., 4720 lin. ft. cement combined curb and gutter, 12,700 sq. yd. paving, 18 new inlets, etc. Julian Kendrick, City Engineer.

New Orleans, La.—Until June 5 by Highway Department of the Board of State Engineers for constructing 13.4 miles of gravel road in Bossier Parish.

Charleston, Miss.—Reported desired unsired until June 5, by Board County Supervisors (D. S. Henderson, Clk.), for constructing 1¾ miles of road.

Greenwood, Miss.—Until July 10, by Board County Supervisors (A. R. Bew, Clk.), for constructing 100 to 140 miles of hard-surface road.

Nashville, Tenn.—Until May 22, by State Highway Dept., 405 Seventh Avenut, for purchase and delivery of bituminous material f.o.b. tank cars, with special heater attachment, separately for Sec. No. 1, Memphis, Shelby County; Sec. No. 2, Jackson, Madison County; Sec. No. 3, Nashville, Davidson County; Sec. No. 4, Chattanooga, Hamilton County, and Sec. No. 6, Knoxville, Knox County, approximately 500,000 gal. A. M. Nelson, Engineer, 405 Seventh Avenue, Nashville.

Akron, Ohio.—Until May 23 by County Commissioners for improving Richfield Road, Section 2, a distance of 2.59 miles. U. G. High, County Auditor.

Armstrong Mills, Ohio.—Reported desired, until May 28, by N. K, Pugh, Clk. Washington Township, for grading and macadamizing or graveling or paving with brick one mile of highway,

Cedarville, Ohio.—Until June 7, by J. W. Johnson, Village Clerk, for 4000 sq. yd. paving on Main Street. Bids will be considered on brick, wood block, sheet asphalt, asphaltic concrete, water-bound macadam, and tar-bound macadam. J. P. Shumaker, Engineer, Xenia. $15,810.

Cincinnati, Ohio.—Until May 26, by Board County Commissioners (Albert Reinhart, Clerk), for resurfacing Varner Road and Walnut Creek Roads in Columbia Township, and North Bend Road in Springfield Township, West Miami River Road in Whitewater Township.

Cleveland, Ohio.—Until May 24, by Board County Commissioners (E. G. Krause, Clerk), for improving Euclid Avenue from center line of Doan Street to easterly line in East Cleveland. Also separate bids for improving Euclid Avenue from westerly line of East Cleveland to center line of Doan Street. W. A. Stinchcomb, County Surveyor.

Dayton, Ohio.—Until May 25, by Director Public Service, James E. Barlow, Secy., for paving on portions of Arbor Avenue, Germantown, and a number of other streets. F. O. Eichelberger, City Engr.

Eaton, Ohio.—Until June 14, by Earl Dalrymple, Village Clerk, for approximately 40,000 sq. yd. paving, advertised in Engineering Record. A. L. Reid, Village Engineer.

Greenfield, Ohio.—Reported desired until June 15, for brick and macadam pavement. Probable cost $25,000. E. M. Connor, City Clk.

Lima, Ohio.—Reported desired until May 22, by Ray John, Clerk County Commissioners, for repairing St. Johns Road, Lima-Findlay Road and High Street road with crushed stone.

Steubenville, Ohio.—Reported desired, until June 3, for paving Spring Avenue, Slack Street and alleys between Ridge and Maryland Avenues, in all about 4540 sq. yds. brick paving on concrete foundation, together with cement walks, etc. Probable cost, $12,148.

Wooster, Ohio.—Until May 31, by Max Bloomberg, Dir. Public Service, for furnishing material, curbing, draining and paving with brick South Beaver Street and Madison Avenue.

Youngstown, Ohio.—Reported desired until May 22, for 14,220 ft. slag macadam. F. H. Vogan, Clerk County Commissioners.

Until May 25, by Director Public Service (Daniel J. Jones, Clk.), for paving on portions of Fairview, Hillsdale and Florist Avenues and Market Street; also for constructing sewer on Taft Avenue.

Indiana.—By County Commissioners for constructing roads as follows:

Until May 27:

Sullivan, 11,027 ft. concrete road, Hamilton Township. F. M. Daniels, Co. Aud.

Until June 5:

Vernon, constructing stone road in Geneva Township. G. J. Bernhart, Co. Aud.

Salem, concrete and gravel road in Blue River Township, macadam and brick gravel road in Brown Township. Ira H. Rutherford, Co. Aud.

Portland, stone road in Beaver Creek Township. John Bonifas, Co. Aud.

Newport, three paved roads in Clinton Township. Roy Slater, Co. Aud.

Cannelton, macadam road in Tobin Township. M. C. Conway, Co. Aud.

Scottsburg, 2.85 miles gravel road in Vienna Township. Robert Blunt, Co. Aud.

Until June 6:

Goshen, brick roads in Jackson Township. A. R. Bemenderfer, Co. Aud.

Monticello, rock road, Union Township. A. G. Fisher, Co. Aud.

Boonville, rock road in Boon Township. Gaines H. Bass, Co. Aud.

Rensselaer, stone road in Keener Township. Joseph P. Hammond, Co. Aud.

Bloomington, stone roads in Bloomington and Prairies Townships. W. F. Kinser, Co. Aud.

Until June 7:

Shelbyville, crushed stone road, in Liberty Township. Frank W. Fagel, Co. Aud.

Columbia City, gravel and stone road in Washington Township. Thomas A. McLaughlin, Co. Aud.

Lafayette, 2.56 miles gravel road, Perry Township, and 2.97 miles in Wayne Township. C. W. Baxter, Co. Aud.

Rushville, Ind.—Reported desired until May 26, for oiling city streets. Address City Clk.

Vincennes, Ind.—Until June 6, by W. H. Reel, County Engineer, for Ewing, Simpson and Cantwell concrete roads, 76,136 sq. yd. paving and grading, estimated cost $130,000, advertised in Engineering Record.

Escanaba, Mich.—Until June 1, by County Road Commissioners, at 703 Ludington Street, for grading and ditching the Lathrop Trunk from Beaver Crossing to County Line, a distance of 14 miles, grading, ditching and macadamizing Brampton to Beaver Crossing, a distance of 5 miles; work to be complete in 1916; macadamizing from Brampton to County Line, a distance of 19 miles; work to be complete in 1918. Bids for grading and ditching must be separate from macadam. P. Mason, County Engineer.

Jackson, Mich.—Until May 26, by City Commission, for paving on portions of Greenwood Avenue in all about 19,158 sq. yds. with either brick sand cushion, sheet asphalt or asphalt concrete. McBridge Street, 2471 sq. yds. with asphalt concrete; Harwood Street, 3106 sq. yds. with asphalt concrete, and Washington Trail and Pearl Street, 8151 sq. yds. with brick on sand cushion. A. W. D. Hall, City Engr.

Adeline, Ill.—Reported desired until May 26, by James F. Harrison, Town Clerk, for 10 miles waterbound macadam roads in Lee River Township, in all about 16,000 cu. yd.

Decatur, Ill.—Reported desired until June 1, for paving several streets with brick. P. T. Hicks, City Engr.

Illinois.—Until May 24 by State Highway Commission, Springfield, for constructing road as follows:

Breese, Clinton County, Section B, 13,500 ft. oiled earth. Engineer's estimate $5,529.

Trenton, Clinton County, Section C, oiled earth, 9203 ft. Engineer's estimate $3,535.

Crawford County, Section C, 2200 ft. concrete flat rock. Engineer's estimate $7,155.

Henderson, Knox County, Section B, oiled earth, 36,615 ft. Engineer's estimate $18,007.

Lake Villa, Lake County, Section B, concrete, 5040 ft. Engineer's estimate $12,659.

Waukegan, Lake County, Section C, 2275 ft. concrete. Engineer's estimate $4,740.

Sparlan, Marshall County, Section D, oiled earth, 24,043 ft. Engineer's estimate $11,430.

McNabb, Putman County, Section C, 1750 ft. gravel. Engineer's estimate $2,531.

Monmouth, Warren County, Section C, 2008 ft. brick. Engineer's estimate $4,920.

Marshall, Ill.—Until May 22, by Board Local Improvement, for 23,460 sq. yd. vitr. brick pavement, monolithic construction, and 10,130 ft. concrete curb and gutter.

Polo, Ill.—Reported desired until May 25, by Albert Sweet, Town Clerk, for 8 miles of macadam road in Pine Creek Township, in all about 12,800 cu. yd.

Neenah, Wis.—Reported desired until June 2 by Board Public Works (H. S. Zemlock, Clk.) for paving with brick asphalt, or reinforced concrete, Nicolet Avenue and Ninth Street.

Superior, Wis.—Reported desired, until May 29, by Board Public Works, for paving on North Twenty-first and North Twenty-fourth Streets. Bids on sheet asphalt, reinforced concrete or brick.

Centerville, Iowa. — Reported desired until May 23 for paving 15,500 sq. yd. paving, 10,800 lin. ft. curb, etc. Bids asked on bitulithic, asphalt, concrete and cement. P. M. Black, City Clk.

Kearney, Iowa.—Reported desired until May 24 for paving Dists. Nos. 9 and 14. T. N. Hartzell, City Clk.

Knoxville, Iowa.—Until May 23, for 15,500 sq. yd. paving and 10,800 ft. curb. P. N. Black, City Clerk; W. G. Hall, Centerville, Iowa, Engineer.

Minneapolis, Minn. — Reported desired until May 26 by Co. Comrs. concrete paving in village of Wayzata, Robbinsdale, and Edina. Al. P. Erickson, Co. Aud.

Atchison, Kan.—Until May 23 by County Clerk for building 2½ miles of hard surfaced highway on which alternate proposals will be received on macadam and concrete; also for grading 2 miles of roadway by moving approximately 10,000 cu. yd. excav.; also for building a reinforced concrete bridge, 20-ft. span, 16-ft. roadway, and a steel bridge, 100-ft. span, approaches 25 ft. in length. S. K. McCrary, Bridge Engineer and Road Commissioner.

Lincoln, Neb.—Reported desired until May 27, for grading and paving with vertical brick or asphalt concrete in Dist. No. 12.

Omaha, Neb.—Reported desired until May 23 by T. J. O'Connor, City Clerk, for paving with either asphalt, stone, vitr. brick, vitr. block, artificial stone, wood block, etc., in various street improvement districts.

Papillion, Neb.—Reported desired until June 6 for constructing concrete sidewalks, culverts, etc., for year. George F. Oliver, Village Clk.

Larimore, N. D.—Reported desired until June 5 for constructing sidewalks and curbs for year 1916. E. McKenna, City Aud.

Billings, Mont.—Until June 6 by E. M. Snickinburger, City Engineer, for 10,000 sq. yd. paving on N. Thirtieth Street.

Kansas City, Mo.—Until May 23, by Board Public Works (J. Pearce Kane, Secy.), for furnishing material and paving with concrete and creosoted block, portions of Twenty-fourth Street, Jackson Avenue, Walnut and other streets.

Beaumont, Tex.—Reported desired, until May 24, by R. J. Barry, Co. Aud., for repairing 10 to 18 miles of highway connecting Beaumont and Port Arthur. Surfacing may be of reinforced concrete, bitulithic or rock asphalt. George W. White, Co. Engr.

Galveston, Tex.—Until May 25, by city, for laying vitr. brick or wood block paving on Thirty-seventh Street from Avenue B to Avenue F; estimated cost, $17,484; and on Avenue H from Thirty-fifth and Forty-sixth Streets, and on Thirty-fifth Street from Avenue F to Avenue H; estimated cost, $54,465.

Timpson, Tex.—Until May 29, by City for 60,000 sq. ft. standard cement sidewalk. Henry E. Elrod, Engr., Southwestern Building, Dallas. B. J. Hawthorn, Mayor.

Kiefer, Okla.—Until June 8, by P. J. Tuttle, Township Clerk, for furnishing material and constructing approximately 20 miles macadam roads and concrete culverts for same; approximately 60,000 cu. yd. excav. and embankment, and 33,000 cu. yd. crushed limestone. Chas. E. Hagerty, Consulting Engineer, 301 Mid Continent Building, Muskogee.

Ft. Collins, Colo.—Until May 29, by Ray Baxter, City Clerk, for paving in College Avenue Improvement District No. 2, and La Porte Improvement District No. 3, advertised in Engineering Record. Specifications on file in New York office of Engineering Record. Frank P. Coeder, City Engineer.

Glenwood Springs, Col.—Reported desired, until June 8, by C. L. Hubbard, Co. Clk., for constructing about 4½ miles of highway. P. G. Thurmond, Engr., Rifle, Col.

Blaine, Wash.—Reported desired until June 5, by E. P. Pruner, City Clk., for paving a number of streets with either concrete (one ond two course) or asphalt. Probable cost $18,000. J. C. Hills, City Engr.

Dayton, Wash.—Reported desired until May 27, J. F. Clancy, Co. Aud., for con3structing 5 miles Permanent Road No. 2A, from Columbia School to Walla Walla County line. F. W. Guernsey, Co. Engr.

South Bend, Wash.—Reported desired until June 6, by W. E. Lovering, Co. Aud., for constructing Permanent Highway No. 5A, between South Bend and Raymond, consisting of clearing, grubbing, draining, constructing a 675 ft. retaining wall, reinforced concrete 4800 ft. one-course concrete pavement, etc., also grading, draining, etc., State Road No. 20, North Raymond. Charles B. Mins, Co. Engr.

Tacoma, Wash.—Reported desired until May 23, by County Commissioners, for 3 miles of road.

Reported desired until May 27, by Thos. N. Morris, County Auditor, for improving Permanent Highway No. 8, a distance of about 2 miles. Work includes grading, paving with bitucret, warrenite, bitulithic, asphalt or concrete or wood block.

Waterville, Wash.—Reported desired until about June 5, by D. F. Kinder, County Auditor, for constructing Permanent Highway No. 4 east from Mansfield; 4½ miles road will be surfaced with hard rock. Cost $20,000. Robert Foster, County Engineer.

Bakersfield, Cal.—Until June 8, by Board Supervisors (F. E. Smith, Clk.), for grading, concrete paving and constructing bridges and culverts on 7.45 miles of Division 6, Section 2, McKittrick Maricopa Road, west of Taft.

Riverside, Cal.—Until May 31, by County Highway Commission, for concrete paving on Route No. 12. G. M. Pearson, Chief Engr., Com'n; Lester S. Moore, Chief Clerk.

Stockton, Cal.—Reported desired, until June 6, by E. D. Graham, Clk. County Supervisors, for 2½ miles road improvements.

St. Lamberts, Que.—Reported desired until May 22 at Town Hall (James R. Beatty, Secy. and Treas.) for paving Waterman and Bridge Streets. E. Drinkwater, Town Engr.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Boston, Mass.**—Contract awarded Central Construction Co., 228 Southampton Street, Roxbury, at $43,300, for repairing asphalt and bitulithic pavements (bids opened May 8 by Edward F. Murphy, Comr. Public Works). W. J. McGlouchy, Supervisor of Contracts.

★**Rhode Island.**—State Board of Public Roads, Providence, awarded contracts as follows for bituminous reconstruction (bids opened May 5):

★North Kingston, 2.1 miles, Ames D. Bridges Sons, Hazardville, Conn., $20,001 (awarded contract); Joseph McCormick, Providence, $20,377; Lane Construction Co., Meriden, Mass., $22,087; B. E. Savage, Worcester, Mass., $23,992.

★Westerly, 1 mile, A. Vito Construction Corporation, Thompson, Conn., $7,804 (awarded contract); Ahern Construction Co., Willimantic, Conn., $12,278.

★Portsmouth. 1.1 miles, Callan Construction Co., $15,970 (awarded contract); Lane Construction Co., Meriden, Mass., $16,589.

★East Providence, 0.93 mile, Joseph McCormick, Providence, $11,225 (awarded contract); Oscar W. Rackle, Providence, $12,278.

★Middletown, 1.75 miles, Lane Construcstruction Co., Meriden, Mass., $28,245 (awarded contract).

★Cumberland, 2 miles, P. J. Quinn, $26,182 (awarded contract).

★Narragansett, 2.99 miles, Charles W. Towle, $35,544 (awarded contract); Oscar W. Rackle, Providence, $38,926.

Cranston, 2 miles, Oscar W. Rackle, Providence, $21,578; Lane Construction Co., Meriden, Mass., $21,864; Joseph McCormick, Providence, $22,374; E. J. Tracy, Derby, Conn., $22,775 (award pending).

Johnston, 2 miles, Oscar W. Rackle, Providence, $25,914; Joseph McCormick, Providence, $29,357; Lane Construction Co., Meriden, Conn., $30,212 (award pending).

★**Westerly, R. I.**—Contract awarded by Town Council to A. Vito Construction Corporation, Thompson, Conn., for bituminous highway between this town and Watch Hill at $39,624.

★**Woonsocket, R. I.**—Contracts awarded by Board of Aldermen to Warren Bros., Boston, Mass., for bitulithic on Hamlet Street at $19,250, and for compressed concrete with granite blocks between rails on Blackstone Street to Simpson Bros. Corp., 166 Devonshire Street, Boston, Mass., at $10,143.

★**New Haven, Conn.**—Following are bids opened recently by city for paving—(a) four streets with sheet asphalt and (b) resurfacing three streets with wood block: C. W. Blakeslee & Sons Co., New Haven, (a) $70,924 (awarded contract), (b) $39,312; Union Paving Co., Schenectady, N. Y., (a) $71,860, (b) $37,789 (awarded contract); Edward Tracy, Derby, (a) $73,172.

★Connecticut Hassan Company awarded contract for paving certain city streets, at $15,820; Edward Tracy of Derby, to pave two streets with sheet asphalt for $11,932. Union Paving Company, Schenectady, N. Y., laying wooden blocks on two streets for $8,593, and C. W. Blakeslee & Sons Company, New Haven, paving two streets with bituminous macadam for

★**Albany, N. Y.**—Contract for improving Pennsylvania Avenue and Cuyler Avenue and Thornton Street awarded by Bd. Contract and Supply to Michael F. Dollard, Albany, at $23,266.

Lockport, N. Y.—Following bids opened May 1 by County Supervisor for constructing (a) Fillmore-Chapel-Ransomville Road, 5.94 miles, (b) Beebe-Chestnut Road in Wilson, 5.273 miles, (c) Warren's Corners, Town of Lockport, 2.96 miles, (d) Pendleton Town line road in Pendleton and Wheatfield, 3 miles; Mumm Construction Co., Buffalo, (a), $49,714; (b), $49,900; (c), $32,418; (d), $18,469. F. E. Dean, Youngstown (a), $50,171. Bison Engineering & Construction Co., Buffalo (b), $54,264; (c), $31,448. C. B. Wetmore Co., Lockport (c), $31,629. Busch & Percival, Buffalo (c), $30,495. Harridine Bros., Spencerport (c), $26,556 (awarded contract). Gipp Co., Buffalo (d), $17,266. Contracts on (a), (b) and (d) not yet awarded.

★**Patchogue, L. I., N. Y.**—Contract for paving with concrete on Ocean Avenue (bids opened May 9 by Edward B. Woodruff, Village Clerk) awarded Gifford Construction Co., Jamaica, at $19,770. Edw. A. May, Engineer, Patchogue.

★**Rochester, N. Y.**—Contracts for paving with asphalt awarded by Bd. Contract and Supply as follows: Burlington Avenue and Raeburn Avenue, Rochester Vulcanite Paving Co., Exchange Place Building, at $12,707 and $14,622 respectively, and Westchester Avenue, to Julius Frederichs, Rochester, at $15,717.

★Contracts awarded by Board of Contract and Supply for paving as follows: To Frank Brotsch, E. & B. Building, at $14,677, for brick pavement on Walnut Street; Whitmore, Rauber & Vicinus, 279 South Avenue, at $19,492, for asphalt pavement on Marlborough Street.

★**Camden, N. J.**—Contract awarded by Board of Chosen Freeholders for resurfacing King's Highway near Haddonfield to J. F. Shanley & Co., 31 Clinton Street, Newark, at $12,227.

Freehold, N. J.—Following bids opened by Board of Freeholders for paving with amiesite first section of Keyport-South Amboy Road: R. G. Shreffler, Long Branch, $17,329; Joseph Burke, Plainfield, $18,248; Liddle & Pfeiffer, Perth Amboy, $19,020; F. H. Riddle, New Brunswick, $19,445. (Bids opened May 3.)

★**Newark, N. J.**—Contract awarded by Board of Chosen Freeholders for paving, with granite block, about 12,000 yd., between trolley tracks in South Orange Avenue, Vailsburg Section, to Glenfield Construction Co., 141 South Eighth Street, at $1.88 per sq. yd.

★**Princeton, N. J.**—Contract awarded by Borough Council for asphalt block pavement on Nassau Street from Washington Road to Harrison Street to Hastings Paving Co., Hastings, N. Y., at about $34,000.

Pennsylvania. — Following are bids opened May 15 by State Highway Department, Harrisburg, for six sections of highway construction.

Section 2, Route 131, in Aston and Concord Townships, Delaware County, including reinforced cement concrete pavement, 3.64 miles: Dwyer & Company, Philadelphia, $68,535; Neff Horn & Company, Slatington, $79,273; and Juanita Paving Company, Philadelphia, $81,440.

Section 4, Route 131, in Birmingham Township, Delaware County, reinforced cement concrete or bituminous and reinforced concrete pavement, 2.75 miles: Juanita Paving Company, Philadelphia, $50,193; Newton Paving Company, Philadelphia, $51,908; B. F. Wickersham, Kennett Square, $56,668; Charles T. Eastburn Company, Inc., Yardley, $60,727.

Section 5, Route 131, Pennsbury and Kennett Townships, Chester County, reinforced cement concrete or bituminous and reinforced cement concrete, 3.37 miles: Corcoran Construction Company, West Chester, $62,492; Newton Paving Company, Philadelphia, $64,301; Juanita Paving Company, Philadelphia, $64,743; William C. Evans, Ambler, $68,057.

Section, 7, London Grove and Penn Townships, Chester County, reinforced cement concrete or bituminous and reinforced cement concrete, 1.96 miles: D. E. O'Connell & Sons, Avondale, $44,256; R. B. Taylor, Bellefonte, $45,745; Juanita Paving Company, Philadelphia, $47,699; William C. Evans, Ambler, $51,442.

State Aid Application 563, in Whitemarsh Township, Montgomery County, about 0.83 miles, bituminous construction: Class "A" sheet asphalt; "B" Filbertine; "c" Warrenite or "d" amiesite: (lowest) (a) Newton Paving Company, Philadelphia, $16,112; (b) William C. Evans, Ambler, $17,239; (c) Dwyer & Company, Philadelphia, $17,954; (d) Paul J. Snyder & Company, Philadelphia, $15,912.

State Aid Application 407, in Nether Providence Township, Delaware County, vitr. brick block, 0.8 miles, 18 ft. wide: Dwyer & Company, Philadelphia, $21,686; Gillespie & Son, Oakview, $24,217; Charles T. Eastburn Company, Inc., Yardley, $26,153; Gibbons & Buckley, Lansdowne, $26,301.

★**Denton, Md.**—Contract for 10,000 sq. yd. concrete surfacing on Main Street (bids opened on May 9 by H. Waldorf, County Roads Engineer) awarded Holt Construction Co., Denton, at $18,181.

★**Columbia, S. C.**—Contract for about 17,000 sq. yd. paving (bids opened May 9 by R. C. Keenan, Supt Streets) awarded Atlantic Bitulithic Paving Co., Richmond, Va., at $1.96 per sq. yd. John McNeal, City Engineer.

★**Cincinnati, Ohio.**—Contract awarded by County Commissioners for reconstructing with brick lower mile of Water Works Road to Edward J. Knepfle, 148 Fairfield Avenue, Belleville, at $16,986.

★County Board of Commissioners awarded following contracts for road improvements: Kugler Mill Road, to Peter Praechter, 2935 Gerard Street, at $16,690; Three-Mile Road, to Van Camp Brothers, Newtonsville, at $9,069.80; Camargo Pike, to G. W. Rich, Loveland, at $9,016; Wesselmann Road, to Wm. Harrell, at $9,737.

★**McConnellsville, Ohio.**—Contract awarded by City Council for paving with Bolin block Ninth and Tenth Streets to W. H. Quigley, McConnellsville, at $10,710.

★**Piqua, Ohio.**—Board of Control awarded contract for paving with bitulithic 21,000 sq. yd. on Broadway to Hinkle & Sullivan, Cincinnati, at $2.15 per sq. yd.; total $45,150.

★**Boonville, Ind.**—Contract awarded by County Commissioners for constructing Dorsey Reed system of roads in Boonville and Boon Townships to Traylor & Kemp, Jasper, at $84,318.

★**Elkhart, Ind.** — Contracts awarded by County Commissioners for constructing roads as follows: To A. M. Smith, Elkhart, at $6,074, for half mile of central part of Oakland Avenue Road; at $26,056, for 1½ miles southern part of same road, and at $13,952, for 2 miles of Locke Township Road; and to Heysteck-Baker Construction Co., Kalamazoo, Mich., at $40,520, for 4 miles of Olive Township Road.

★**Goshen, Ind.**—Contract awarded by Common Council for paving portion of Third Street with cut lug brick block on 6-in. gravel foundation to W. W. Hatch & Sons Co., Goshen, at $1.62 per sq. yd.; total $27,526.

★**Marion, Ind.**—Contract awarded by County Commissioners for constructing Center and Franklin Township tar binder road to Glen Bemfield, Marion, at $14,480. (Bids opened May 2.)

★**Monticello, Ind.**—Contract awarded by County Commissioners for constructing county road to T. Callahan, Rensselaer, at $11,912. (Bids opened May 2.)

★**Scottsburg, Ind.**—Contract awarded by County Commissioners for constructing Plymouth free gravel road in Leighton Township to Edgar L. Maggard, Scottsburg, at $15,328.

★**South Bend, Ind.**—Contract awarded by County Commissioners for constructing Haven Hubbard Road in Olive Township to George M. Gross & Co., Laporte, at $32,749.

East St. Louis, Ill.—See "Bridges."

Illinois.—Lowest bid opened May 3, by State Highway Commission, at Springfield, for concrete roads 18 ft. wide, in Cook County, were: Milwaukee Avenue, near city limits, Hannon & McDonald, Chicago, $20,710, for 8142 ft.; Milwaukee Avenue, far end, Commonwealth Improvement Co. of Chicago, $29,871 for 14,077 ft.; Twelfth Street, Grant Summerville, Chicago Heights, $31,331 for 15,331 ft., Hannon & McDonald put in a combined bid of $82,155.

Following are lowest bids opened May 10 by State Highway Commission, Springfield, for paving: Lawrence County, Section B, 4800 ft. brick, and Clark County, Section B, concrete, 4500 ft., F. W. McElroy, Robinson, $10,560 and $7,222 respectively; Du Page County, bituminous macadam, 7200 ft., J. A. McGarry & Co., 189 W. Washington Street, Chicago, Ill., $16,730.

★**Menominee, Wis.**—Contract for furnishing material and paving with concrete on Depot Hill Street (bids opened May 9 by Board of Public Works) awarded Cast Stone Construction Co., Eau Claire, at $11,857. F. W. Rowe, City Clerk.

★**Racine, Wis.**—Contract for paving 6007 sq. yd. (bids opened April 22 by city) awarded Western Improvement Co., Ninth Street, at $1.99 per sq. yd. P. H. Connolly, City Engineer.

★**Grinnell, Iowa.**—Contract for 24,000 sq. yd. of paving (bids opened May 10 by A. C. Harriman, City Clerk) awarded William Horrabin, Iowa City, at $1.925 per sq. yd. for bitulithic. Des Moines Asphalt Paving Co., Des Moines, bid $2.01, and Ford Paving Co., Cedar Rapids, $2.03.

★**Vinton, Iowa**—Contract for paving 24 blocks on Whipple and College Avenues (bids opened May 10 by W. E. Klingman, City Clerk) awarded F. K. Hahn, Cedar Rapids.

★**Duluth, Minn.**—Contract awarded by City Commissioners for paving West Third Street to Olson & Johnson, Duluth, at $162,662.

★**Eveleth, Minn.**—Contract for paving (bids opened May 1) awarded Lawrence McCann Company, Eveleth, at $19,000, for bitulithic. C. H. Williams, City Clerk.

★**Worthington, Minn.**—Contract for constructing State Road No. 3 (bids opened May 4) awarded W. E. Bloom, Worthington, as follows: Grading, 23 cts. per yd.; turnpiking, 7 cts. per ft.; side ditching, 15 cts. per yd.; concrete culverts, plain, $10 per yd., and concrete culverts, reinforced, $12 per yd. G. Swanberg, County Auditor.

★**Lincoln, Neb.**—Contract for 13,190 sq. yd. asphaltic concrete (bids opened May 8 by Theodore H. Berg, City Clerk) awarded Ford Paving Co., 711 Brandeis Building, Omaha.

★**Lisbon, N. D.**—Contract for creosoted wood block pavement on Fifth Street bridge awarded Great Northern Bridge Company, Minneapolis, Minn. (Bids opened May 9 by Charles E. Best, County Auditor.)

★**Mandan, N. D.**—Contract awarded by City Council for paving with bitulithic about 50,000 yd. in residential district to Warren Bros., Billings, Mont., at $165,000.

Houston, Tex. — Following are bids opened May 8 by city for paving Commonwealth Avenue: Eureka Paving Co., Houston, 2-in. asphaltic concrete, $11,222; 2-in. sheet asphalt, $11,967; 1½-in. sheet asphalt, 1-in. binder, $12,215; Finley Method Co., Houston, 6½-in. Portland cement concrete with Finley Method top coat, $9,855, and 8-in. gravel with bituminous top, $7,514.

★Contract awarded Finley Method Co., Houston, for improving Houston Huble Road, at $30,412.

★**Blackwell, Okla.**—Contract awarded May 10 by City Council for 21 blocks of vitr. brick block paving to M. A. Swatel & Company, Oklahoma, at $104,608. Next three lowest: E. W. Giger Construction Company, Leavenworth, Kan., $104,150; Park Moran Company, Okmulgee, Okla., $160,023, and Charles L. Besler Contracting Company, Winfield, Kan., $107,771 Benham Engineering Company, Oklahoma, Engineers.

★**Golden, Col.**—Contract awarded by Board County Commissioners for constructing 4.8 miles of concrete road between Denver and Golden to Gaffy & Keefe Construction Co., 245 Kalamath Street, Denver, at $65,279.

Everett, Wash.—Cuillton Bros., Everett, submitted lowest bid to County Commissioners at $27,272 for constructing 2 miles of Cascade Highway. W. C. Bickford, County Engineer.

★**Olympia, Wash.**—Contracts awarded by Board of Public Works for paving to Washington Paving Co., L. C. Smith Building, Seattle, at $11,517 for Eighteenth Street and at $11,500 for Main Street.

★**Seattle, Wash.**—Contract awarded by Board of Public Works for paving, water mains, etc., in Seventh Avenue N. to P. J. McHugh, Third Avenue N. and Mercer Street, at $18,117.

★**Spokane, Wash.**—Reported contract awarded by County Commissioners for constructing with asphalt macadam 4 miles of Spring Valley Permanent Highway to Spokane Asphalt Macadam Paving Co., Seattle, at $29,750.

Astoria, Ore.—Following bids opened by Committee of Streets and Public Ways for constructing roads and bridges on (a) Eleventh Street, (b) Commercial Street, (c) Duane Street: Washington Paving Co., L. C. Smith Building, Seattle, (a) $36,348, (b) $89,317, (c) $22,062; J. A. McEachern Co., Bell Street Wharf, Seattle, (a) $50,325, (b) $115,219, (c) $30,066; Tacoma Dredging Co., Tacoma, (a) $44,516, (b) $104,107, (c) $29,090; Standifer-Clarkson, Portland, (a) $39,750, (c) $22,480; Palmberg-Mattson, Astoria, (a) $37,685, (c) $22,480. Olof Anderson, City Aud. (Bids opened May 3.)

Portland, Ore.—Following bids opened by County Commissioners for constructing (a) Canyon Road and (b) Pacific Highway: Coast Contracting Co., Portland, (a) $17,526; E. T. Johnson, Portland, (a) $20,029, (b) $12,166; T. H. Cochran & Sons, Portland, (a) $28,762, (b) $16,616; Tobin & Stevens, Portland, (a) 20,251.

★Contract awarded by County Commissioners for constructing 24-ft. bitulithic pavement on crushed stone on Figure 8 on Columbia River Highway to Warren Construction Co., Portland, at $13,692.

★**Tillamook, Ore.**—Contract awarded by County Commissioners for constructing Tillamook County Road to Feldschau & Jackson, Tillamook, at $11,518. J. C. Holden, County Clerk. (Bids opened May 5.)

★**Los Angeles, Cal.**—Following are four lowest bids opened recently for 137,590 sq. ft. asphalt pavement, 7,740 sq. ft. cement walk, on Bronson Avenue: Fairchild-Gilmore-Wilton Co., Pacific Electric Bldg., at $23,872 (awarded contract); George H. Oswald, O. T. Johnson Bldg., $26,567; George R. Curtis, 552 South St. Louis Street $28,283; Ford & Stout, $29,265.

Willowbrook, Cal.—Following are four lowest bids opened May 8 by Board Supervisors for disintegrated granite pavement, cement curb, etc., in Road District No. 96, involving 25,020 cu. yd. excav., 19,083 lin. ft. concrete gutter, 138,883 sq. yd. cement walk, 11,222 lb. reinforced steel (county to furnish 11,850 tons disintegrated granite, 3700 bbl. cement, etc): Fred Hoffman, 111 East Twelfth Street, Long Beach, $28,100; Conner Construction Company, Los Angeles, $28,400; Heinauer & Thiel, $28,000, and James L. Fraser, Long Beach, $28,900.

★**Orafino, Idaho.**—Contract awarded by City Council for constructing 20,000 sq. ft. cement walks and paving Johnson Avenue to C. M. Payne, Spokane, Wash.

★**Ingersoll, Ont.**—Contract awarded Municipal Concrete Construction Co., Ingersoll, for reinforced concrete pavements to cost $35,000.

★**Ottawa, Ont.**—Contract awarded by Council for asphalt paving to Ottawa Constructinn Co., Ottawn, nt $52,000.

STREET CLEANING AND GARBAGE DISPOSAL

PROPOSED WORK.

Anaconda, Mont.—City desires information on garbage disposal plants. Installation of a plant is under consideration. W. B. Vestal, Jr., City Engineer.

BIDS DESIRED.

Elizabeth, N. J.—Reported desired until May 25, for disposal of garbage and refuse. Address Board Public Works.

Whiting, Ind.—Reported desired, until May 25, by M. C. Douglas, City Clk., for constructing garbage disposal plant.

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS

PROPOSED WORK.

Relief Basin—Lynn, Mass.—See "Sewerage and Sewage Disposal."

Dredging—Hoboken, N. J.—The Hoboken Drydock & Repair Company, Hoboken, incorporated to do dredging, drydock and general repair work.

Dredging—Lake Charles, La.—The deepening to 9 ft., with a channel 100 ft. wide, of the intercoastal canal to Sabine River is contemplated; cost about $340,000. Address Chamber of Commerce.

Shed.—New Orleans, La.—Dock Board contemplates spending $200,000 for additional sheds on property acquired from Louisville & Nashville R. R.

Drainage — Clarksdale, Miss. — Olaham Drainage District bonds for $74,000 have been sold. Address County Clerk.

Dock—Conneaut, Ohio.—The Pittsburgh & Conneaut Dock Company and the Bessemer & Lake Erie R. R. Company, subsidiaries of the United States Steel Corporation, it is reported, will construct a concrete dock 2050 ft. long and 1015 ft. wide on site of No. 1 dock; cost $3,000,000. Dock will be constructed of concrete and steel, with two 700-ft. conveyor bridges, 8 electric Hulett machines, and 6 or 8 tracks running round the dock. The channel to the dock will be widened to 300 feet.

Retaining Walls—Fremont, Ohio.—H. E. Dodge, Marion Steam Shovel Co., Marion, is surveying the Sandusky River at Fremont and will report to City Council on cost of building retaining walls along the banks to prevent flooding the business district and of dredging sand and gravel from river.

Dam—Cadillac, Mich.—Reported Commonwealth Power Co. (B. C. Cobb, 14 Wall Street, New York, N. Y., Pres.), considering constructing power dam at junction of Manistee and Pine Rivers.

Levee Work — Hillview, Ill.—Contract will be let in about a month for constructing the Hillview Drainage and Levee District, about 12½ miles, including 220,000 cu. yd. excav.; estimated to cost $49,000. Caldwell Engineering Co., Engineers, Jacksonville, Ill.

Drainage—Moline, Ill.—Moline & Rock Island City Commissioners considering constructing a storm drain along Forty-sixth Street, to cost $25,000.

Drainage — Quincy, Ill. — Edmund T. Perkins Engineering Company, Chicago, Ill., engaged as engineers in charge of Shelby County Drainage District.

Drainage — Rock Island, Ill.—Drury Drainage District Directors are preparing a $54,000 bond issue of which $50,000 will be used to repair the levee inundated by breaking of levee wall recently.

Levee Bonds—Davenport, Iowa.—Levee bonds for $100,000 have been sold. Address Secretary Levee Commission.

Drainage—Emmetsburg, Iowa.—Bd. of Supervisors voted to construct a 22-mile drainage ditch to carry overflow water of Des Moines River through greater part of Palo Alto County; cost about $135,000.

Channel Improvement—Caledonia, Minn.—District Court of Houston County has ordered straightening Root River channel to be 20 miles long; cost estimated at $160,000.

Drainage—Sioux Falls, S. D.—County Commissioners adopted resolution and a survey will be made of the proposed extension of the Sioux Valley drainage ditch No. 1 through Covell's Lake. Address County Clerk.

Levee Improvements—Fort Worth, Tex.—Tarrant County Levee District No. 1, including territory on both banks of Trinity River, in vicinity of Ft. Worth, has voted $95,000 bonds for completion of levee to protect Trinity bottoms from floor damages. Address Mayor.

Marlin, Tex.—John Maxey, of Houston, engaged by city to plan a sewer system. Address Mayor.

Port Improvements—Kennewick, Wash.—Paul P. Whitman, York Blk., Seattle, has prepared plans for port improvements, to include harbor improvements, rail and water transfer and terminal facilities. An election will probably be held on the project. Address Commissioners Port of Kennewick.

Irrigation — North Yakima, Wash. — Specifications have been prepared by U. S. Reclamation Service, at Denver, Colo., for power and pumping machinery and transmission line for the Grandview Irrigation District, where a pumping plant and irrigation system are to be installed for the district. The pumping plant will consist of two units, one a direct connected hydraulic turbine with centrifugal pump and the other an electrical unit for which power will be developed at a drop in the Rocky Ford canal and transmitted three miles to the pumping station. Bids for wood stave pipe required are to be opened May 20. See "Bids Desired." The specifications for the distribution system will be issued in a few days and items include excavation, Class I, 63,500 cu. yd.; Class II, 500 cu. yd.; Class III, 1700 cu. yd.; back fill, 7900 cu. yd.; concrete lining, 1500 cu. yd.; concrete in structure, 540 cu. yd.; installation of wood pipe, 11,600 lin. ft., 6 to 22 in. vitri. clay pipe, 21,090 lin. ft., 6 to 24 in., 1050 lin. ft. steel flume and 155 M ft. lumber in structures. U. S. Reclamation will purchase all wood stave and vitr. clay pipe, steel headgates, reinforcing steel, cement and lumber. R. K. Tiffany, Project Manager.

Irrigation — Prosser, Wash.—Reported Horse Heaver Irrigation District will, June 6, vote $15,000,000 bonds for constructing irrigation canals and reservoirs.

Canal Improvement—Spokane, Wash.—Reported Otis Orchard District, near Spokane will bond for $125,000 for improvements to Newman Lake Canal system. About $75,000 will be used to lay underground pipes, etc.

Drainage — Atwater, Cal. — Board of Supervisors, Merced, direct [illegible] County Surveyor to make surveys and estimates of cost for proposed Atwater Drainage Dist near Atwater, about 6000 acres.

Irrigation — Hanford, Cal. — Plans of Stratford Irrigation Dist. (L. L. Dennett, Attorney, Modesto, have been approved by W. F. McClure, State Engineer, Sacramento. It is proposed to take water from Kings River and tributaries. The District will include about 9000 acres.

Drainage—Huntington Beach, Cal.—Talbert Drainage District (S. W. Price of Bolsa, Business Manager) contemplates constructing two 48-in. pipe lines to carry off surplus water; also throwing up a dyke to protect the lower section of district from high tides. Address S. H. Finley, Chief Engineer, Santa Ana.

Irrigation—Madera, Cal.—The plans of Madera Irrigation Dist. (W. S. Orvis, Secy.), to take over water from San Joaquin and Chowchilla Rivers for irrigation purposes have been approved by W. F. McClure, State Engineer, Sacramento. The present Madera Canal & Irrigation system will probably be taken over and new laterals constructed. A dam at Friant will be constructed later.

Irrigation—Caldwell, Idaho.—Plans approved for an irrigation system to water about 964 acres in Caldwell Irrigation District. Bonds for $20,000 will be sold May 27 by Secretary Caldwell Irrigation District.

Dam — Lewiston, Idaho.—Plans under consideration for building a dam in Snake River, between Lewiston, Idaho, and Clarkston, Wash. Cost $750,000. Two cities to be bonded for the improvement. W. F. Kattenbach, Lewiston.

Hydro Electric Plant—Arthur, Ont.—By-law passed authorizing construction of a hydro electric lighting and power distribution system. D. T. Small, Arthur, in charge.

Hydroelectric Substation—Welland, Ont.—The construction of a hydroelectric substation costing $40,090 is subject to the approval of the Ontario Ry. & Municipal Board. C. M. Webber, Clerk.

Dam—Edmonton, Alta.—G. W. Farrell & Company, 43 St. Francis Xavier Street, Montreal, Que., is in charge of improvements contemplated by Edmonton Power Company, Edmonton, which will include new dam, power house and electric line.

BIDS DESIRED.

Dredging, seawall, etc.—Boston, Mass.—Until May 26, by Park and Recreation Dept. (John H. Dillon, Chmn.), for grading, seawall, grand stand, and dredging on North End Beach.

Dock Repairs—Albany, N. Y.—Until June 1 by Conservation Commission, 156 State Street (A. S. Houghton, Secy.), for furnishing material and rebuilding repair of docks on St. Lawrence Reservation at De Wolf's Point and Picnic Point in the St. Lawrence River between Clayton and Alexandria Bay.

Rip Rap.—Tompkinsvile, N. Y.—Until June 8, by J. T. Yates, Lighthouse Inspector, for furnishing and placing about 500 tons of rip rap in two gaps in old rip rap wall and about 500 tons in pile on shore at Little Gull Island Light Station, Long Island Sound, N. Y.

Repairs to Wharves, Tompkinsville, N. Y.—Until June 1, by Lighthouse Inspector, Tompkinsville, for repairing fender and bearing piles of wharves at General Lighthouse Depot, Tompkinsville; advertised in Engineering Record.

Dredging—Philadelphia, Pa.—Until June 12, by Lighthouse Inspector, Philadelphia, Pa., for dredging basin at Edgemoor Lighthouse Depot, Delaware; advertised in Engineering Record.

Dredging—Baltimore, Md.—Until June 15, by U. S. Engineer, Office Baltimore, for dredging in Patapsco River, Md., advertised in Engineering Record.

Levee Work—New Orleans, La.—Until May 31 by Board Levee Commissioners, Suite 201, New Court Building, New Orleans, for constructing Lower Protection Levee, Third District, as follows: Section I, 350,000 cu. yd.; Section II, 250,000 to 350,000 cu. yd.; Section III, 140,000 cu. yd. Alternate bids will be taken on Sections I and II combined. C. J. Donner, Secy.

Levee Work—Port Allen, La.—Until June 1, by the Atchafalaya Basin Levee Dist. at office of the Board State Engrs., Rooms 213-215, New Orleans Court Building, New Orleans, for following levee work (raising and enlarging) on the left or East Bank of the Atchafalaya River in Parish of Pointe Coupee, Haygood to Milan Levee approximately 340,000 cu. yds.; Milan to Major Barbre Levee, approximately 335,000 cu. yds.; Major Barbre to Hudson Levee, approximately 425,000 cu. yds.

Dredging—Greenville, Ohio.—Until June 3, by County Commissioners, for dredging a part of Stillwater Creek, about 7.97 miles, cost $43,664; advertised in Engineering Record. Harry C. Miller, County Surveyor.

Cleaning Channel, etc., Newark, Ohio.—Until June 7, by County Commissioners, for cleaning a channel about 1800 ft. long, in all about 18,824 cu. yd. excav., constructing breakwaters, etc. Engineers' estimate $8,337. J. W. Hursey, Co. Aud.

Flood Protection Wall — Portsmouth, Ohio.—Until May 29, by Ralph Calvert, Director Service, for constructing second section of flood protection wall: estimated cost $105,229, advertised in Engineering Record.

Flood Protection Work—Portsmouth, Ohio.—Until May 29, by Ralph Calvert, Director Service, for material for repairing distribution reservoir, advertised in Engineering Record. Cost $27,000. S. C. Harper, City Engineer.

Dredging—Michigan City, Ind.—Until June 10, by U. S. Engineer, 508 Federal Bldg., Chicago, Ill., for dredging in Michigan City Harbor, Ind., advertised in Engineering Record.

Ditch—Caledonia, Mich.—Until June 3 by E. N. Newhouse, Co. Aud., for constructing Judicial Ditch No. 1, to consist of approximately 1,825,450 cu. yd. excav., 3 steel bridges, 6000 ft. corrugated metal culverts. Estimated cost $130,527.

Drainage — Davison, Mich. — Reported desired until May 23, for constructing tile drainage ditches. A. H. Reid, Co. Drainage Comr.

Improving Creek — Bellville, Ill. — Reported desired until June 15, for improving creek. Probable cost $79,600. W. C. Wolf, City Engr.

Water Power Lease at Dam No. 1—Joliet, Ill.—Until June 15, by Canal Commission, at office of Governor, Springfield, for water power lease at Dam No. 1, Joliet, advertised in Engineering Record.

Drains—Webster City, Iowa.—Until May 26 by Joint Board Supervisors of Wright and Hamilton Counties for constructing Drain 133 in Wright and Drain 188 in Hamilton of salt gazed vitr. pipe. Probable cost $35,452. F. E. Osler, Co. Aud. Wright Co. and W. J. Peterson Co. Aud. Hamilton County.

Drains—Waseca, Minn.—Until May 23 by Common Council for constructing tile drains in the western portion of city. John Madigan, City Clk.

Bulkhead—Seattle, Wash.—Reported desired until June 5, by County Commissioners (Bryon Phelps, Clk.), for constructing the Portage-Ellisport Road Hydraulic Fill and Bulkhead. Probable cost $30,000. A. P. Denton, Co. Engr.

Irrigation—Anderson, Cal.—Until May 29 (readvertisement), by Directors of Anderson-Cottonwood Irrigation District for all laterals, the dam, Churn Creek siphon, side gates, end gates, drops and the main canal south from Panorama Point.

Flood Protection — Ray, Ariz. — Until June 10, by L. S. Cates, General Manager, Ray Consolidated Copper Co., for constructing steel sheet pile bulkhead and reinforced concrete retaining wall at Ray, advertised in Engineering Record.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Dredging—Buffalo, N. Y.—Following are bids opened May 10 by U. S. Engineer, Buffalo, for dredging in Lake Erie to Black Rock Harbor and Erie Basin and in Black Rock Canal, Buffalo: (a) per cu. yd., 94,000 cu. yd. scow meas.; (b) total: H. S. Kerbaugh, Inc., Telephone Building, (a) 24.5 cts., (b) $23,030; Great Lakes Dredg. & Dock Company, Morgan Building, (a) 26.6 cts., (b) $25,004; James Stewart & Company, Inc., 30 Church Street, New York, (a) 65 cts., (b) $51,700.

Dredging—New York, N. Y.—Lowest bid opened May 4 by U. S. Engineer, New York, for dredging Staten Island Sound, N. Y., submitted by P. Sanford Ross, Inc., 277 Washington Street, Jersey City, N. J., at 12.45 cts. per cu. yd., scow measure.

★**Pier—Baltimore, Md.**—Contract awarded Sanford & Brooks, Commerce and Waters Streets, for erecting a pier for the Canton Company, to cost $500,000.

★**Drainage—Jackson, Tenn.** — Contract for constructing drainage canal 14,880 ft. long (bids opened May 13) awarded Swamp Drainage Company, Tupelo, Miss., at $14,342. A. W. Stovall, Judge County Court.

★**Drainage — Danville, Ill.**—Contract awarded Chrisman Construction Company, Chrisman, Ill., for constructing cement tile ditches for Bridgman Drainage District (bids opened May 8), at $35,240. Clark & Hutton, Attorneys, Danville.

★**Levee Work—St. Francisville, Ill.**—Contract awarded Bayless Benham, Lyons, Ind., for dredging ditches in England Pond Drainage District (bids opened April 20), at 11 cts. per cu. yd., about 92,000 cu. yd. George W. Harvey, Engineer.

★**Dredging—Milwaukee, Wis.**—Contract for dredging in rivers during year 1916 awarded by Board Public Works to Arthur H. Vogel, 49 Canal Street, at 9.7 cts. per cu. yd. Total cost about $35,000.

★**Drainage — Algona, Iowa.**—Contract for 7 drains, in District No. 126, including 8 to 36-in. tile, concrete bulkhead and 20 intakes, awarded J. S. Jensen, Rutland, at $22,485. C. E. Paine, Engineer, Algona; E. H. Beardsley, County Auditor.

★**Ditch—St. James, Minn.**—Contracts for constructing Judicial Ditch No. 10 (bids opened May 9) awarded as follows: Section A, to Minnesota Pipe & Tile Company, Mankato, at $32,287; Section B to Ceylon Cement Tile Company, Ceylon, Minn., at $12,432. J. Jensen, County Auditor.

Irrigation—Ft. Shaw, Mont.—Following are totals of bids opened May 5 by U. S. Reclamation Service, Ft. Shaw, for furnishing about 575 ft. 96-in. wood stave pipe for Sun River Project: Fir staves, National Tank & Pipe Company, 275 Oak Street, Portland, Ore., $7,463; Portland Wood Pipe Company, P. O. Box 1183, Portland, Ore., $8,096, and Pacific Tank & Pipe Company, Fifth and Bryan Streets, San Francisco, Cal., $7,262, and for redwood staves, $7,762.

Irrigation—Powell, Wyo.—Following are bids opened May 3 by U. S. Reclamation Service, Powell, for constructing structures on the Shoshone Project, Wyo.: Threet Bros. & Jolley, Lovell, Wyo., Schedule I $16,260; Security Bridge Company, Minneapolis, Minn., Schedule, $15,736; Schedule II, $40,541; total, $56,277. Gates & Stebbins, San Diego, Cal., Schedule I, $15,292; Schedule II, $38,616; total, $53,908.

★**Conduit—Ft. Worth, Tex.**—Contract for completing the Lake Worth conduit awarded Lock Joint Pipe Company, East Orange, N. J.

★**Irrigation—Anderson, Cal.**—Contracts in connection with the Anderson-Cottonwood Irrigation District awarded by Directors as follows: To James Willison of Modesto, for digging tunnel at the intake at $29,795, and for main canal from the outlet of the tunnel to Panorama point midway between Anderson and Cottonwood at $76,000; to F. W. Neilson for all bridges at $15,000. See "Bids Desired."

★**Irrigation—Alpaugh, Cal.** — Contract for furnishing and installing machinery, motors, transformers, wiring, etc., and housing to lift 9000 gal. of water per minute, at Smyrna, Kern County; drilling five wells at Alpaugh and equipping pump, constructing concrete reservoir and erecting 65,000 gal. steel tank and tower; repairing and regrading about 6.5 miles earth canal for Alpaugh Irrigation Dist., awarded to McClanahan, Araner & Carter, Rialto Building, San Francisco, at about $165,000. Bids opened April 28 by Board Directors Alpaugh Irrigation Dist. (W. T. Holton, Secy.).

★**Dredging—Oakland, Cal.**—Contract for dredging in Oakland Harbor, Cal., awarded American Dredging Company, San Francisco, at $37,596.

★**Irrigation—Yucaipa, Cal.** — Contracts for extending South Mesa Water Company's irrigation system awarded as follows: 300,000-gal. concrete-lined reservoir to Montizel & Sons, Redlands, and 6500 ft. 4, 6 and 8-in. riveted asphalt-coated pipe to Western Pipe & Steel Company, Los Angeles. Philip B. Hasbrouck, Resident Engineer.

Harbor Improvements—Toronto, Ont.—Bids of R. Weddell Co. of Toronto and Russell Co. of Toronto recommended for award for constructing crib work and head walls in connection with harbor improvements, to cost about $250,000. Bids opened May 1. Chm. Toronto Harbor Commissioners. 50 Bay Street, Toronto (E. L. Cousins, Ch. Engr.).

ELECTRIC RAILWAYS

PROPOSED WORK.

Johnstown, Pa.—Citizens of Upper Yoden Township planning to construct 1¼ miles of trolley line extension from terminal of Johnstown Traction Company's Southmont Line; cost $18,000. The Traction Company has agreed to furnish cars, provided track is laid by Township.

Montoursville, Pa.—The Montoursville Passenger Ry. Co. plans to extend lines 1½ miles, 0.6 mile to be span wire construction and 0.9 mile bracket construction. Company will purchase 56-lb. relaying T rails.

Womelsdorf, Pa.—Womelsdorf, Richland & Myerstown Street Ry. Co. incorporated to construct an electric railway from Womelsdorf to Newmanstown. Among incorporators: Leroy Valentine and Frank Rader, both of Lebanon.

Washington, D. C.—Reported the Washington & Old Dominion Ry. Co. is considering constructing an extension in Virginia.

Fallbrook, Va.—Reported surveys completed by Atchison, Topeka & Santa Fe R. R. (C. F. W. Felt, Ch. Engr. System, Chicago, Ill.) for Fallsbrook-Oceanside branch, about 20 miles long, washed out last January.

Bartow, Fla.—Franchise granted for construction of an electric railway from Bartow to Lakeland and Winter Haven, about 25 miles. Address County Commissioners for further information.

Sarasota, Fla.—Plans being made for constructing an electric railway from Tampa to Venice, about 68 miles. A. Evans Townsend, Engr., Sarasota, is interested.

Owensboro, Ky.—Owensboro Interurban Lines incorporated to construct an electric railway. Among incorporators, A. Bresler and S. H. Heaver.

Shelbyville, Ky.—The Shelbyville & Frankfort Realty Co. contemplates constructing two power houses and three bridges in connection with electric railway from Shelbyville to Frankfort. J. W. Gudgel, Secy.

East Cleveland, Ohio.—City Council granted to J. L. Free Land Co., 1004 Prospect Avenue, Cleveland, a franchise to construct an electric line on Noble Road, from Euclid Avenue to Cleveland Heights.

Minneapolis, Minn.—Plans being prepared by City Engineer for a municipal street railway from Thirty-second and Central Avenues to city filtration plant; cost, about $40,000.

Omaha, Neb.—Extensive improvements contemplated by Omaha & Council Bluffs Street Ry. Co., at cost of about $250,000.

Dallas, Tex.—Reported the Dallas Traction Co. is considering constructing an extension from Waco to Taylor, about 70 miles.

Dallas Standard Traction Co. will construct about ½ mile track in Mt. Auburn Addition.

Quebec, Que.—The Quebec Railway, Light & Power Company contemplates constructing a railway at a cost of $150,000.

Edmonton, Alta.—Plans being prepared by E. W. Boweness of Edmonton Power Co., for development of a municipal power system, including railway, to cost about $500,000.

BIDS DESIRED.

New York, N. Y.—Until June 1 by Public Service Commission for First District, 120 Broadway, for constructing station finish on Sections No. 12 to 15 on Route No. 5 of the Lexington Avenue subway, including 110th, 116th, 125th, 149th Streets, Mott Haven, and Third Avenue and 138th Street.

Toronto, Ont.—Until May 23 by T. L. Church (Mayor), Chmn. Bd. Control, for one single truck, double end street car completely equipped, one car body double end, single truck, equipment for one single truck car, etc., all for Bloor Street Division Toronto Civil Ry.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**New York, N. Y.**—Contract awarded last December to Lawrence C. Manuell, 11 Pine Street, at $2,063,877, for constructing Section No. 2 of Routes Nos. 19 and 22, the Pelham Bay Park elevated extension of the Lexington Avenue subway, has been signed during past week by Public Service Commission for First District.

RAILROADS

PROPOSED WORK.

Bangor, Me.—The Eastern Maine R. R. (F. O. Beal, Vice-Pres., Bangor) will construct a line from Bangor northeast to Great Pond, thence north to head of Nicatous Lake and via Carroll, Prentiss, Bancroft and Haynesville to Houlton, 112 miles.

Scranton, Pa.—City officials have submitted to Delaware & Hudson R. R. Co. (Jas. MacMartin, Ch. Engr., Albany, N. Y.) plans for eliminating of eleven grade crossings and for raising tracks from 5 to 15 ft. above present levels. All present grade crossings to be eliminated with either overhead crossings or subways.

Augusta, Ga.—J. A. J. Henderson, President of the Ocilla Southern R. R., is reported to have made an offer to the Western & Atlantic R. R. Commission to extend the said railroad from Atlanta to St. Marys and Jacksonville.

Perry, Ga.—Ocilla Southern (D. C. Smith, Gen. Mgh., Ocilla) has preliminary survey for a line from Perry north to Macon and expects to commence construction on this 28-mile extension during 1916.

Mulberry, Fla.—Franchise granted to Export Phosphate Ry. & Terminal Company (H. L. Pierce, Pres., Tampa) to build a railroad from Mulberry to Tampa, about 30 miles. The part of the line within the city of Tampa is to be operated by electricity, and eventually the entire system will be electrified.

South Bend, Ind.—At joint session of Advisory Board of Council and Board of Public Works favorable action was taken on the adoption of a resolution providing for grade separations in connection with the elevation of the N. Y. Central R. R. tracks in the city. The resolution provides for a 12½-ft. elevation of tracks along entire length of improvements except at Michigan and Chapin Streets, where elevation is to be 16 ft., the street to be depressed 6 ft. below ground grade. Estimated cost to city will be between $250,000 and $300,000.

Larned, Kan.—Anthony & Northern R. R. Company (J. E. Waite, Ch. Engr., Hutchinson) will soon construct a branch line from Larned north an indefinite distance.

Earl, Ark.—Crittenden Ry. (E. T. Sellew, Gen. Mgr., Crittenden) is planning to extend line through St. Francis Valley, Ark.

San Antonio, Tex.—San Antonio Belt & Terminal Company will erect a terminal system and station here.

Las Vegas, N. M.—The Atchison, Topeka & Santa Fe R. R. (C. F. W. Felt, Ch. Engr., Chicago, Ill.), will spend $330,000 in improvements at Las Vegas, to include a 34-stall roundhouse, reinforced concrete, a brick power house, 35 x 70 ft., a 600-ton coal storage and service plant.

Leavenworth, Wash. — Leavenworth-Vaneo R. R. incorporated, with Joseph T. West, Secy. and Treas., to build a 25-mile railroad from Leavenworth to Vaneo. Main office 512 Colman Bldg., Seattle.

Grants Pass, Ore.—Reported Smith Powers Lumber Company, Grants Pass, plans constructing between 5 and 10 miles of railroad this summer, some consisting of logging roads up Sand Creek and Salmon River.

Los Angeles, Cal.—City Council appointed a committee, of whom F. D. Howell, Chief Engineer Board Public Utilities, Homer Hamlin, City Engineer, and Samuel Storrow are members, to consider plan for elimination of grade crossings. It is proposed to remove Southern Pacific Ry. tracks from Alameda Street about 2 miles; also construct viaducts over tracks of Atchison, Topeka & Santa Fe R. R., the San Pedro, Los Angeles & Salt Lake Ry. and Southern Pacific Ry. Co. and river.

Sarnia, Ont.—City Council is negotiating with Michigan Central R. R. with a view of having line extended into the city this summer.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**White House, N. J.**—Contract awarded Scully Ceruso Company, Newark, for grading from White House to Gladstone for New Jersey Central and the Pennsylvania R. R. companies. Cost $40,000.

★**Akron, Ohio.**—Contract awarded by Erie R. R. to Kidder & McCourt, for grading new yard, requiring about 72,000 yd. of material to be handled.

★**Yates City, Ill.**—Contract awarded by Chicago, Burlington & Quincy R. R. to Railroad Water & Coal Handling Company, Chicago, Ill., for erecting a water station involving laying of about 13,000 ft. 8-in. c. i. pipe and a 30-hp. oil engine directly connected to a triplex pump.

★**Wenatchee, Wash.**—Reported Great Northern Ry. Company awarded contract to A. Guthrie & Company of Portland, Ore., for doubling tracking line between Wenatchee and Leavenworth.

PUBLIC BUILDINGS AND SCHOOLS

PROPOSED WORK.

Berlin, N. H.—Contract soon to be let for erecting six-room, fireproof, brick and concrete grade school in Ward 1, to cost about $40,000. Address Clerk School Board.

Amesbury, Mass.—Town voted $125,000 bond issue for erecting high school. Address Town Clerk.

Boston, Mass.—Schoolhouse Committee is planning erecting at North End a 22-room school. Dr. F. B. Dyer, Supt. of Schools.

Fall River, Mass.—Board of Aldermen passed ordinance authorizing issue of $150,000 bonds for erecting tuberculosis hospital. Address City Clerk.

Saugus (P. O. Lynn) Mass.—Willard M. Bacon, 27 Kilby Street, Boston, engaged to prepare plans for 12-room Junior High School; cost $75,000. Edgar Banks Oliver, Chairman Building Committee.

Springfield, Mass.—Contract soon to be let by Schoolhouse Commissioners for erecting addition to Howard School (Kirkham & Partlett, Springfield, Archts.) and for the new Hooker School (S. M. Green Company, Springfield, Archts.).

Westboro, Mass.—Town meeting voted May 2 to erect a high school of brick costing $60,000.

New Britain, Conn.—Board of Education is considering plans submitted for a school, 24 rooms, an assembly hall and gymnasium, and will make a selection some time this month.

New London, Conn.—Trustees of Connecticut College for Women authorized erection of new dormitory and gymnasium to cost $30,000. F. Vallentine Chappell, Chairman Trustees.

Carthage, N. Y.—Plans prepared for a 60 x 40-ft. brown brick building for Cochran Memorial Library. Address Carthage Free Library Asso.

Geneva, N. Y.—State Legislature passed bill providing for erection of new administration and demonstration building at Experiment Station, to cost $100,000, of which sum $20,000 shall be appropriated this year.

Gloversville, N. Y.—Citizens authorized Board of Education to erect school on site of present high school to relieve congestion; cost not to exceed $80,000.

Jamestown, N. Y.—Citizens voted to erect a grammar and high school; probable cost, $250,000. Address Board of Education.

Pittsford, N. Y.—Citizens of District No. 6 voted to rebuild school on Lincoln Avenue, recently destroyed by fire, at an estimated cost of $67,000. Address Board of Education.

Freehold, N. J.—Town Commissioners passed ordinance authorizing issue of $35,000 bonds for erecting municipal building. Plans prepared.

Hightstown, N. J.—Peddie Institute will spend $75,000 for erecting junior school on Etra Road.

Laurel Springs, N. J.—Board of Education having plans prepared by John L. Coneys, 1513 Walnut Street, Philadelphia, Pa., for two-story brick and stone, 46 x 60 ft. school.

Trenton, N. J.—City will erect an art school costing $28,500.

Woodbridge, N. J.—Township Committee voted $35,000 bonds to erect a municipal building.

Beaver, Pa.—Board of Education voted to erect a 10-room grade school on Market Street; cost about $35,000. Plans being prepared.

Birdsboro, Pa.—Citizens voted $50,000 school bonds.

Ebensburg, Pa.—County Commissioners considering erecting an insane asylum, costing $300,000.

Ellwood City, Pa.—C. C. and A. L. Thayer, of New Castle, engaged to prepare plans and specifications for school to be erected in Fourth Ward; probable cost $30,000.

Erie, Pa.—Reported contract will be let about June 15 for erecting $500,000 academy high school at Twenty-sixth and State Streets. William B. Ittner, Archt., Board of Education Building, St. Louis, Mo.

Johnstown, Pa.—Preliminary plans prepared by J. Emmet Lucas, George Wild and J. E. Adams of Johnstown, approved for proposed Junior High School group of buildings. Address Secretary School Board.

Lancaster, Pa.—Franklin & Marshall College will erect a $100,000 dormitory for theological seminary.

Lilly, Pa.—Citizens voted $30,000 bonds for erecting school. Archt. J. E. Adams, Johnstown.

Monarch, Pa.—Contract will be let soon after June 12 by Dunbar Township School District for erecting a 2-story brick and tile school costing $25,000. Andrew P. Cooper, Archt., Uniontown, Pa.

West Chester, Pa.—A two-story and basement, fireproof, brick, stone and terra cotta school is to be erected, cost about $100,000. Address Board of Education.

Wilmington, Del.—Brown & Whiteside, Wilmington, are architects for the fireproof 2-story addition to be erected to Alexis I. du Pont School; cost, $110,000. W. K. Geige, 23 South Penna Avenue, Wilmington, may be able to give information.

Petersburg, Va.—School bonds amounting $200,000 sold, proceeds to be used for erecting new high school and repairing present schools. Address Board of Education.

Richmond, Va.—Reported plans being prepared for several units to be erected in connection with Memorial Hospital; probable cost, $200,000.

Clarksburg, W. Va.—Contract soon to be let for erecting five-story, brick, tile and fireproof hospital on Mechanic Street for Mason Hospital Company; cost about $50,000. Dr. S. M. Mason of the Kessler Hospital will have charge.

Hickory, N. C.—School bonds amounting $25,000 sold. Address Clerk School Board.

Macon, Ga.—Election to be held June 27 to vote $200,000 bonds for erecting a city auditorium and also for hospital. Address Mayor.

De Land, Fla.—Citizens, May 9, voted $60,000 bonds to erect new school. Address Clerk School Board.

Birmingham, Ala.—Reported design of Eugene H. Knight, Archt., of Birmingham, for city hall, jail, library and auditorium building utilizing steel frame of Roden Building at Eighteenth Street and Fifth Avenue approved by Chamber of Commerce. Address H. Key Milner, Chairman Chamber of Commerce Auditorium Committee.

Laurel, Miss.—City will issue $25,000 bonds for erecting a hospital. Address City Clerk.

Columbus, Miss.—Bonds amounting to $50,000 sold by city for erecting a high school.

Pineville, La.—School bonds for $20,000 have been voted. Address Clerk of School Board.

Harriman, Tenn.—Citizens May 6 voted $50,000 bonds for erecting school. A. R. Davis, Secy. School Board.

Newport, Tenn.—Contract will be let in September or October by County School Superintendent for erecting the 2-story brick high school, to cost $30,000.

Louisville, Ky.—Superintendent O. L. Reid recommended to Board of Education erection of addition to Broadway School to accommodate the Louisville Normal School; estimated cost, $40,000.

Winchester, Ky.—Board of Directors May 2 rejected all bids opened for erecting $50,000 hospital, as being too high. New bids will be asked. J. W. Crone, Archt., Winchester.

Ansonia, Ohio.—School bonds for $35,000 will be sold June 10, by J. C. Poling, Clk. Board Education.

Bedford, Ohio.—Election to be held June 9 to vote $30,000 school bonds. Address Clerk Board Education.

Cincinnati, Ohio.—The Longview Building Commission has been organized to supervise erection of a $250,000 dormitory for women and a $50,000 refrigerator plant and laundry at the Longview Insane Asylum. (Albert Reinhardt, clerk of the new commission). Elzner & Anderson, 136 Ingalls Building, Cincinnati, preparing plans for the structures.

Columbus, Ohio.—Citizens of Norwich Township voted $60,000 bonds for erecting two elementary school buildings.

Findlay, Ohio.—Allen Township School bonds, in all $45,000, sold for erecting a central school. Address Allen Township School Board.

Jefferson, Ohio.—F. L. Packard, New Hayden Building, Columbus, is architect for the 2-story fireproof school. C. C. Hamilton, Clerk School District.

Perrysburg, Ohio.—School bonds for $11,000 will be sold May 20, by Board Education (Charles E. Van Norman, Clk.).

Rieiy, Ohio.—School bonds for $30,000 will be sold June 1, by Board Education (J. P. Van Audsall, Clk.).

Weston, Ohio.—School bonds for $55,000 will be sold by J. M. C. Cook, Clk. Bd. Educ., June 3.

Huntington, Ind.—Plans about completed for a county hospital to cost $30,000. M. B. Stults, Pres. Board.

Terre Haute, Ind.—State Board of Finance, Indianapolis, authorized Trustees of Indiana State Normal School (Joshua Jump, Secy.), to construct a Science building, costing $100,000. Preliminary plans will be considered at June meeting.

Winchester, Ind.—Reported erection of a $32,000 high school is under consideration. Address School Board.

Plymouth, Mich.—Citizens of Plymouth School Dist. voted to erect school to replace building recently destroyed; cost about $100,000.

Quincy, Ill.—School bonds for $75,000 will be sold June 29 by Board of Education (Clyde L. Sears, Business Manager).

Janesville, Wis.—Tentative plans submitted by School Board to City Council for proposed four-story annex to high school; cost, about $85,000.

Milwaukee, Wis.—Erection of a $50,000 lion house, hospital, bear dens and separate quarters for reptiles, water animals, deer; etc., contemplated for Washington Park Zoo. E. H. Bean, Supt.

New Richmond, Wis.—Volkman & Hancock, Eau Claire, engaged to prepare plans for school, to cost, including heating plant, approximately $40,000.

Park Falls, Wis.—A high school costing $48,000 is to be erected here. Address Secretary Board of Education.

Superior, Wis.—It is proposed to erect a 2-story fireproof brick and concrete addition to the school to cost $60,000. Radcliffe & Crumpton, Archts., Superior; L. A. Nichols, Secy. Bd. Education.

Ft. Dodge, Iowa.—Architects selected by School Board to prepare plans for two $30,000 schools, one to be erected on Round Prairie and the other in the Mineral City addition.

Knoxville, Iowa.—Contract will be let about June 15 by Board of Education (T. G. Gilson, Secy.) for erecting a brick school to cost $75,000. Sawyer and Watrous, Archts., Des Moines.

Meriden. Iowa.—Plans being prepared by W. L. Steele, United Bank Building, Sioux City, for a brick and stone school to be erected at Meriden; cost about $20,000.

Sioux City, Iowa.—William L. Steel, Sioux City, is architect for the 4-story fireproof hospital to be erected for Benedictine Sisters at a cost of $150,000. Plans will be ready about May 15.

Contract soon to be let for erecting a 2-story and basement dormitory and chapel at Springdale for Trinity College; cost $40,000. Address Wm. L. Steele, Archt., Sioux City.

Adams, Minn.—Consolidated School District No. 8 has voted $30,000 bonds for erecting high school. Address Clerk of District.

Glenville, Minn.—School Board intends erecting a $30,000 school.

Mound, Minn.—Plans being prepared for a school to be erected in Consolidated School District and cost $50,000. J. P. Wilkins, Secy. School Board.

St. Paul, Minn.—Contract Committee, May 5, rejected all bids recently opened for erecting McClellan School.

Hays, Kan.—Citizens voted to issue $50,000 bonds for erecting central high school. Address State Architect at Topeka.

Smith Center, Kan.—Election soon to be held to vote on erecting a $50,000 high school. Plans have been prepared by T. W. Williamson, Archt., Topeka.

Topeka, Kan.—Election will be held about May 29 to vote $100,000 bonds for erecting city jail.

Missoula, Mont.—A one or two-story six to eight-room school is planned, costing $27,000. L. E. Harris, Clerk School District No. 1.

Columbia, Mo.—Citizens voted $35,000 bonds to erect school for negroes and $55,000 bonds for a new ward school and additions to old buildings. W. B. Ittner, Board of Education Building, St. Louis, engaged to prepare plans.

Joplin, Mo.—Rose & Peterson, Kansas City, Kan., Architects, have been authorized to contract for erecting the tuberculosis hospital, to cost $90,000.

Moberly, Mo.—It is proposed to erect a 2-story addition to the high school; cost $43,000. W. H. Sayler, Gumbel Bldg., Kansas City, Archt. Robert Kingsbury, Secy. Board Education.

Springfield, Mo.—George F. Reed, Holland Bldg., and O. L. Brettner, Holland Bldg., engaged to prepare plans for two schools to cost $50,000.

Sweetwater, Tex.—C. H. Page & Brother, Austin National Bank Building, Austin, engaged to prepare plans for $100,000 courthouse to be erected here. Address County Clerk.

Waco, Tex.—Building Committee of proposed new ward school building at Bosque and Twenty-fifth Streets rejected all bids for erecting building. Plans are to be revised and new bids asked soon. B. B. Cobb, Supt. Schools.

Chickasha, Okla. — Reported School Board intends making school improvements costing $70,000.

Sand Springs, Okla.—Citizens voted $25,000 bonds for erecting a school.

Spokane, Wash.—Arthur Cowley of Spokane selected by City Commissioners to prepare plans for moving and rebuilding city crematory; cost $30,000.

Hood River, Ore.—C. J. Crandall of The Dalles reported engaged to prepare plans for school for which citizens recently voted $45,000 bonds.

Los Angeles, Cal.—Contract will be let in June by Board Educ. (W. A. Sheldon, Secy.) for erecting brick and concrete power house at Los Angeles High School. John C. Austin, Archt., 1125 Baker Detwiler Bldg., Los Angeles.

Van Nuys, Cal.—Steps being taken to erect city hall on Virginia Avenue and Sherman Way; cost approximately $25,000.

Idaho Falls, Idaho.—Election soon to be held to vote $70,000 bonds for erecting a courthouse and jail. Address County Clerk.

Nampa, Idaho.—Reported School Board will soon let contract for erecting school to cost $60,000.

Ford City, Ont.—J. C. Pennington, La Belle Building, Windsor, will prepare plans for a brick and concrete school to cost $40,000.

Hamilton, Ont.—City is considering erecting a $300,000 technical school. Address Mayor.

BIDS DESIRED.

Brandon, Vt.—Until May 22, by Trustees of Vermont State School for Feeble Minded Children (John E. Piddock, Secy.) for erecting two dormitory buildings at Brandon. A. I. Lawrence, Archt., 135 College Street, Purlington.

Boston, Mass.—Until May 29, by Richard A. Lynch, Supt. Pub. Bldgs., for erecting a municipal building at Ashland, corner Washington Street, Roslindale.

Putnam, Conn.—Until June 20, by James A. Wetmore, Acting Supervising Archt., Treas. Dept., Washington, D. C., for erecting post office at Putnam.

Elmira, N. Y.—Until June 12, by Henry Melville, President Board Managers, N. Y. State Reformatory, Elmira, for structural steel and iron work, steel window frames and sash and metal covered roofs for shop building No. 4 at said Reformatory, advertised in Engineering Record. Lewis F. Pilcher, State Architect, Albany.

New York Mills, N. Y.—Until July 1 by Board Education for erecting a 2-story and basement school for Union Free School Dist. No. 4, Towns of Whitestown and New Hartford, to cost $76,000. Walter G. Frank, Archt., Utica.

New York, N. Y.—Until June 13, by Board Water Supply, Municipal Building, for Contract 144, constructing 2 concrete stone and brick buildings, approximately 40 x 15 x 20 ft., 820 sq. yd. brick pavement, 600 ft. balustrade and miscellaneous work at Silver Lake reservoir, Staten Island, advertised in Engineering Record.

Pawling, N. Y.—Reported desired until May 22 by Alfred Hopkins, Archt., 101 Park Avenue, New York City, for erecting two-story and basement, 58 x 91 ft. school. Probable cost $35,000. Robert Hurd, Pres. Bd. Educ.

North Arlington, N. J.—Until June 6 by Mayor and Borough Council for erecting fire house and hall. Separate bids for heating, plumbing, etc. Joseph W. Baker, Archt., 111 N. Fourth Street, Harrison, N. J.

Trenton, N. J.—Until May 29, by Board of School Trustees (Thomas D. Sensor, Pres.), for erecting a school.

Chambersburg, Pa.—Until June 6, by County Commissioners (Dan'l Gilbert, Clk.), for erecting 3-story brick addition to county home. M. R. Rhoads, Archt., Chambersburg.

Connellsville, Pa.—Reported desired until June 2, by Board of Education for erecting two-story brick, fireproof grade school in west side to consist of twelve classrooms with combination basement gymnasium and auditorium. Harry Altman, Archt., Uniontown.

Ellwood City, Pa.—Until May 26 by Board Education (W. J. Moore, Secy.) for erecting a 12-room fireproof school. Separate bids for heating, wiring, plumbing, etc. C. C. & A. L. Thayer, Archts., New Castle.

South Boston, Va.—Until June 15, by James A. Wetmore, Acting Supervising Archt. Treas. Dept., Washington, D. C., for erecting U. S. post office at South Boston.

Glenville, W. Va.—Reported desired until May 25, by N. E. Ryner, Clk. County Commissioners, for erecting two-story and basement,, 70 x 94 ft., courthouse and jail of brick. Holmbal & Lafferty, Archts., Clarksburg.

Ronceverte, W. Va.—Reported desired, until May 31, by L. E. Kramer, Secy. Board Educ., for erecting a high school. H. Ruswarme, Archt., Charleston, W. Va.

Minden, La.—Until June 22, by Jas. A. Wetmore, Acting Supervising Archt., Treas. Dept., for erecting U. S. post office at Minden.

Beattyville, Ky.—Until June 5 by Werner & Adkins, architects, 1206 Mercantile Library Building, Cincinnati, Ohio, for remodeling Lee County Court House. Estimated cost $35,000.

Lakeland, Ky.—Until May 25, by Kentucky State Board Control for Charitable Institutions, at office of D. X. Murphy & Bros., Archts., 714-720 Louisville Trust Bldg., Louisville, for erecting kitchen and bakery building for Central State Hospital, Lakeland. Also same time and place for alterations to colored ward building at Eastern State Hospital for Lexington.

Beloit, Ohio.—Until June 8, by Beloit Village School Dist. (Mrs. J. A. James, Clk.), for furnishing material and erecting a school. Frank L. Packard, Archt., Columbus.

Boardman, Ohio.—Until June 5, by Geo. A. Davidson, Clk. Bd. Educ., for furnishing material and erecting school. Stanley & Scheible, Archts., 1301-06 Wick Bldg., Youngstown.

Circleville, Ohio.—School bonds for $130,000 will be sold June 1 by E. S. Neuding, Clk. Board Education.

Hanover, Ohio.—Until June 10, by A D. Jones, Clk. Board Education, for erecting high school. Wm. B. Patton, Archt., 15½ South Park Place, Newark.

Kirkersville, Ohio.—Until June 3, by Board Educ. (E. E. Stewart, Clk.), for furnishing material and erecting a grade and high school. Separate bids for heating, ventilating, etc. F. S. Rusk & Cree Sheets, Archts., 145 N. High Street, Columbus.

Lowellville, Ohio.—Until June 5, by W. J. Maurice, Clerk Board Education, for erecting a fireproof addition to school at North Side. W. D. Eckles, Archt., New Castle, Pa.

Youngstown, Ohio.—Until June 1, by Board Educ. Poland Township Rural School Dist., for furnishing material and erecting a school in northwest portion of said district. C. C. & A. L. Thayer, Archts. for Bd. Educ.

Broad Ripple, Ind.—Until May 24, by Washington Township Trustees, for erecting school in Dist. No. 7. H. L. Bass & Co., Archts., Hume-Mansur Bldg., Indianapolis.

Manistique, Mich.—Until June 8 by Alice G. Reilly, Secy. Board Education, for furnishing material and erecting a high school; also a building containing a gymnasium shop and heating plant. Separate bids for heating, plumbing, etc. Robinson & Campau, Archts., 450 Houseman Building, Grand Rapids, or at office of Bd. Educ., Manistique.

Chicago, Ill.—Reported desired, until May 23, by Commissioner Public Works, for erecting a two-story and basement brick fire house at 430 W. 104th Street.

Illinois.—Until June 13 by Board of Administration Capitol, Springfield, for erecting following buildings:
Jacksonville, kitchen building at State Hospital.
Normal, new gymnasium building at Illinois Soldiers' Orphans Home. Separate bids for heating, plumbing and electrical work of both buildings. James B. Bibelka, State Archt., 130 N. Fifth Avenue, Chicago.

Anthon, Iowa.—Reported desired until May 26 for erecting, including heating, plumbing etc., school. J. H. Craddock, Archt., Omaha.

Douds Leando, Iowa.—Until May 23 (change of date from May 19) by Consolidated Independent School Dist. (F. M. Gilbert, Secy.) for furnishing material and erecting a school. H. W. Underhill & Co., Architects, Bryant Building, Kansas City, Mo.

[illegible], Iowa.—Until June 7 by W. W. Little, Secy. Board Educ. Independent Consolidated School Dist., for erecting a grade and high school. Separate bids for heating, electrical work, etc. Reimer & Herlin, Archts., Marshalltown.

Mount Pleasant, Iowa.—Reported desired until May 26 by C. Van Brussells, Secy. Bd. Educ. Independent School Dist. for erecting school. Separate bids for heating, lighting, etc. Fugard & Knapp, Archts., McKinnie Building, Moline.

Newell, Iowa.—Reported desired until June 12 by Secy. Board Education for erecting two-story high school. Beuttler & Arnold, Archts., 609 Security Building, Sioux City.

Sioux City, Iowa.—Reported desired until May 29 by I. Lee Storm, Secy. Bd. Educ., for erecting two-story and basement school. Probable cost $25,000. Beuttler & Arnold, Archts., 609 Security Building.

Sioux City, Iowa.—Until June 1, for erecting a hospital, fireproof, 5 story, for Benedictine Sisters, to cost $150,000. William L. Steele, Archt., Sioux City.

Springdale, Iowa.—Contract will be let about June 20 for erecting a dormitory for Trinity College to cost $45,000. W. L. Steele, Archt., Sioux City.

Stewart, Iowa.—Until May 22 by G. F. Taylor, City Clerk for erecting a brick city hall.

Bageley, Minn.—Until May 22 by Board Educ. Independent School Dist. No. 2, for erecting a high school. E. F. Broomhall, Archt., 710 Alworth Building, Duluth.

Duluth, Minn.—Until May 27, by Dr. A. A. T. Laird, Secy. Sanitarium Commission, County of St. Louis, at office of Holstead & Sullivan, Archts., 410 Palladio Building, Duluth, for erecting a two-story annex and three-story addition to present boiler house.

Nopeming, Minn.—Reported desired until May 27 by Halstead & Sullivan, Arcbts., 410 Palladio Building, Duluth, for erecting two-story and basement, 262 x 22 ft., and three-story, 40 x 60 ft., sanitarium and boiler house addition, for St. Louis County Sanitarium. Probable cost $50,000.

Bricelyn, Minn.—Reported desired until May 24 by A. B. Elverstrom, Secy. Bd. Educ., for erecting a two-story and basement, 38 x 70 and 36 x 73 ft. addition to high school. Probable cost $35,000. E. F. Broomhall, Archt., 710 Alworth Building, Duluth.

Leoti, Kan.—Reported desired until June 6 by Wililam Reese, Co. Comr., Leoti, for erecting three-story and basement, 62 x 66 ft., court house. Probable cost $50,000.

Red Cloud, Neb.—Until June 6, by School Board Dist. No. 2, Webster County (C. J. Pope, Secy), for erecting high school. Separate bids for heating, plumbing, etc. R. A. Bradley & Co., Archts., Exchange National Bank Bldg., Hastings.

Redfield, S. D.—Until June 26, by Supervising Architect, Treasury Department, Washington, D. C., for constructing U. S. post office, advertised in Engineering Record.

Hettinger, N. D.—Until June 5, by Alex. Stensby, Clerk Hettinger, Special School District No. 3, for erecting a 3-story brick addition to school. Jesse M. Warren, Archt., Butte.

Austin, Tex.—Until May 19 by W. H. Cullen, Pres. School Board of Pease School, in this city, for remodeling and additions to said school. Dennis R. Walsh, Archt.

Plainview, Tex.—Until May 30, by J. F. Sanders, Plainview, for erecting a 3-story brick and reinforced concrete school.

Inglewood, Cal.—Until June 2, by Board Trustees, Union High School Dist. (F. D. Parent, Clk.), for erecting brick and steel auditorium building, seating capacity 1060. Norman F. Marsh and H. C. Howard. Archts., 214 Broadway Central Bldg., Los Angeles.

Douglas, Ariz.—Until June 21, by Jas. A. Wetmore, Acting Superv. Archt., Treas. Dept., Washington, for erecting complete U. S. post office and custom house at Douglas.

Salt Lake City, Utah.—Until May 29, by Board Education (L. P. Judd, Clk.), for erecting Liberty School on Third East between Ninth and Tenth Streets. Separate bids for heating, plumbing, etc.

Emmett, Idaho.—Reported desired, until May 29, by R. B. Wilson, County Clerk, for erecting addition to court house.

Murtaugh, Idaho.—Reported desired until May 26 by E. S. True, Secy. Bd. Trus. Independent School Dist., for erecting combination grade and high school. Separate bids for heating, plumbing, etc. Morgan Nisbet, Archt., 8 Trust Building, Twin Falls.

Montreal, Que.—Reported desired until May 23 by Roman Catholic School Board, Montreal, for erecting a school. J. L. Bigonesse, Archt., 60 Notre Dame East.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Woonsocket, R. I.**—Contract for erecting school on Mercy Ball Estate (bids opened May 12) awarded John F. Flemant, Rathbun Street. W. F. Fontaine, Archts., Woonsocket.

★**Brooklyn, Conn.**—Contracts for erecting Bengal School awarded by Board of Education as follows: General contract, George S. Chatfield Company, 73 Canal Street, Waterbury, $52,629; heating, Charles Thatcher Company, 39 Center Street, Waterbury, $15,787; plumbing, M. J. Daly & Sons, 553 Bank Street, Waterbury, $5,950; electrical work, Standard Electric Time Company, 26 Center Street, Waterbury, $1,515.

★**New York, N. Y.**—Contract awarded H. C. Stowe Construction Co., 221 Greenpoint Avenue, Brooklyn, for alterations to hospital at foot of East Twenty-sixth Street for Bellevue and Allied Hospitals; cost $50,000. McKim, Mead & White, Archts., 101 Park Avenue.

★**Spring Valley, N. Y.**—Contracts for erecting school on Upper Main Street awarded, by Board of Education, as follows: General contract, W. B. Eyric, Grantwood, N. J., $28,365; heating, Atlantic Heating & Engineering Company, Hempstead, L. I., $3,273; plumbing, Elmer Van Orden, Spring Valley, $2,595; electric work, J. M. Requa, Monsey, $628.

★**Camden, N. J.**—Contracts awarded May 5 by Board of Education for erecting high school on Baird Avenue and Park Boulevard, Forest Hill Park, as follows: General contract, Cramp & Company, Seventeenth and Walnut streets, Philadelphia, Pa, $360,451; plumbing, William Anderson, Atlantic City, $23,600; electrical work, Strang Electrical Company, Camden, $7,300. Paul A. Davis, 3d, Archt., 1713 Sansom Street, Philadelphia, Pa.

★Contract for erecting public library awarded to Doyle & Co., 1519 Sansome Street, Philadelphia, Pa., at $130,000.

★**Camden, N. J.**—Contract for erecting one-story, 108 x 56 ft. library awarded Doyle & Company, 1519 Sansom Street, Philadelphia, Pa.; cost $130,000.

★**Carbondale, Pa.**—Contract for erecting high school in Carbondale awarded to Herman Mailander of Wilkes Barre, at $119,239.

★**Northampton Heights, Pa.**—Contract for erecting two-story, 80 x 120 ft., brick and stone school awarded Shamokin Lumber Company of Shamokin. Clyde S. Adams, Archt., 1509 Arch Street, Philadelphia.

★**Philadelphia, Pa.**—Following are lowest bids opened by Board of Education for erecting three-story and basement, limestone, brick and reinforced concrete school on Fifty-fifth and Chestnut Streets: General contract, Warren, Moore & Company, Commercial Trust Building, $176,878; heating, J. J. Nesbitt, 1538 Cherry Street, $20,000; plumbing, Walters, Purks & Mellon, 4417 Ludlow Street, $9,466; ventilating, W. English & Company, 259 North Lawrence, Street, $2,190.

Henry L. Brown, 1714 Sansom Street, submitted lowest bid for erecting three-story and basement, 61 x 69 ft. addition to school on Twenty-seventh and Clearfield Streets, at $49,607, and S. Faith & Company, 2427 Pennsylvania Avenue, for plumbing, at $2,525.

★**Uniontown, Pa.**—Contract awarded by School Board for erecting the 11-room Park School (bids opened April 25), to Vinton & Lyons of Uniontown, at $56,947; next two lowest bids were W. E. Priest of Uniontown, $57,706, and George M. Hall of Homestead, $56,986. John H. Harman, 632 First National Bank Bldg., Archt.

★**Woodlawn, Pa.**—Contract for erecting twelve-room school awarded Wallis & Carely Company, Sharon, at about $63,168.

★**Portsmouth, Va.**—Contract for erecting sixteen-room school in South Norfolk awarded by Washington District School Board to Nash-Jones Company, Norfolk, at $30,400.

Elkins, W. Va.—Following are four lowest bids, opened May 8 by Supervising Architect, Washington, D. C., for constructing the U. S. Post Office at Elkins: (a) limestone, (b) sandstone: Westchester Engineering Company, White Plains, N. Y., (a) $112,470, (b) $118,500; W. H. Fissell & Company, New York, (a) $111,900, (b) $116,600; J. S. Rodgers Company, Moorestown, N. J., (a) $115,500, (b) $119,500; Wise Granite & Construction Company, Richmond, Va., (a) $118,490; (b) $122,000.

Evansville, Ind.—Following are four lowest bids, opened May 10 by Supervising Architect, Washington, D. C., for constructing U. S. Post Office: R. P. Farnsworth & Company, New Albany, Ind., $135,700; Chris Kanzler & Son, Evansville, $134,000; Balkin Construction Company, Chicago, Ill., $142,862, and W. H. Fissell & Company, St. James Building, New York, N. Y., $148,600.

★**Lafayette, Ind.**—Contract for erecting brick and concrete biology building on campus of the Purdue University awarded Leslie Colvin, Anderson.

★**Oaklandon, Ind.**—Contracts for erectisg county tuberculosis hospital here awarded by County Commissioners at Indianapolis as follows: General contract, William P. Jungclaus, 827 Massachusetts Aveiue, Indianapolis, $55,183; heating and plumbing, E. A. Strong & Son, Indianapolis, $10,000; William E. Russ, Archt., 1405 Merchants Bank Building, Indianapolis.

★**Boxholm, Iowa.**—General contract for erecting high and grade school awarded Royles Co., Onawa. Estimated cost, complete, $50,000.

Carpenter, Iowa.—M. F. Jones, 417 Granby Bldg., Cedar Rapids, submitted lowest bid for erecting high and grade school, at $33,000.

★**Brainerd, Minn.**—Contract for erecting jail and sheriff's residence, to cost $35,000, awarded as follows: General contract to H. J. Frandsen, St. Paul; heating, lighting and plumbing, Slipp-Gruenhagen Company, Brainerd; cell work, Diebold Safe & Lock Company. Alden & Harris, Commerce Building, St. Paul, Archts.

★**San Antonio, Tex.**—Following are four lowest bids opened May 7 by School Board (Paul H. Scholz, Business Agent) for erecting west side school: Arend & Vogel, $35,557 (awarded contract); Aiken & Femplin, $38,913; C. M. Schoenfeld, $39,417, and Wright & Sanders, $39,967. Bidders all of San Antonio.

Waco, Tex.—See "Proposed Work."

★**Loveland, Col.**—Contract for erecting high school awarded Anton Davidson, Denver, Col., at $88,000. Roeschlaub & Fuller, Archts, Denver, Col.

Seattle, Wash.—Following are four lowest bids opened May 8 by School Board (Reuben W. Jones, Secy.) for erecting addition to Queen Anne School: John Larson, 4103 Ainsworth Avenue, $56,184; Jenkins & Jones, Transportation Building, $58,350; Swenson & Company, Seattle, $58,781; Scherer & Carlson, Seattle, $59,826.

Roseburg, Ore.—Following are four lowest bids opened by School Board for erecting proposed high school: John Hunter, Roseburg, $57,784; Southworth & Hendrick, Salem, $62,531; Snook & Travers, Salem, $63,990; Stebbinger Brothers, Portland, $68,778.

★**Los Angeles, Cal.**—Contract for erecting library at Santa Monica Boulevard and Madison Ave., East Hollywood, awarded C. Karsebloom, 1445 Dana Street, at about $27,625. C. H. Russell, Archt., 1106 Story Building.

★**Cochrane, Ont.**—Contract for erecting school to cost $40,000 awarded Oliver Edwards & Company, Cochrane, Angus & Angus, Archts., North Bay, Ont.

PRIVATE BUILDINGS

PROPOSED WORK.

Chicopee Falls, Mass.—Wernick Bros., Chicopee Falls, will erect a 3-story moving picture theater and office building at Broadway and Main Street; cost about $50,000.

Pittsfield, Mass.—St. Stephen's Episcopal Church will erect a $30,000 parish house on Allen Street in the rear of the church.

Hartford, Conn.—Permit granted to Stone & Webster Engineering Company, 147 Milk Street, Boston, Mass., to erect a 3-story brick and steel, 44 x 71 ft., substation, costing $66,000.

Binghamton, N. Y.—Mollen Transfer Company will erect a 4-story brick fireproof storage warehouse, to cost $40,000. Moores & Dunford, Archts., 10 S. La Salle Street, Chicago, Ill.

Symphony Theater Company (N. Kornblite, Pres.), will erect a 4-story theater building, to cost $150,000. Leon H. Lempart & Sons, Archts., Cutler Bldg., Rochester.

Brooklyn, N. Y.—Plans being prepared hy P. Tillion & Son, 381 Fulton Street, for two 4-story brick apartments, to be erected on East Ninth Street and Ditmas Avenue, for Smith & Son, Inc.; total cost $50,000.

Plans being prepared by W. T. McCarthy, 16 Court Street, for 6-story elevator apartment house, 96 x 138 ft., to be erected on Livingston and Clinton streets, for Wolfinger & Lasberg Building Company; cost approximately $300,000.

Plans being prepared by Cantor & Dorfman, 373 Fulton Street, for four-story apartment house, to be erected on Forty-third Street and Eighth Avenue for Finnish Co-operative Home Association (Hjalmar Gronman, President); cost $55,000.

New York, N. Y.—Plans filed for erecting following buildings: Two 6-story fireproof apartments at Fort Washington Avenue and 162d Street; total cost $300,000; and five 5-story brick stores and tenements at 170th Street and Townsend Avenue, total cost $315,000, for J. M. B. Company, Inc.; Sass & Springsteen, Archts., 32 Union Square; 5-story brick apartment at 467 West 152nd Street for Presto Realty Corp., cost $85,000, Moore & Landsiedel, Archts., 148th Street and Third Avenue; two 5-story brick tenements at Audubon Avenue and 186th Street, for Manhattan Heights Improvement Company, total cost $145,000, Sass & Springsteen, Archts., 32 Union Square; 15-story fireproof office building at 60 Liberty Street for Sixty Liberty Street Corporation, cost $300,000, Cross & Cross, Archts., 10 East Forty-seventh Street; 29-story, fireproof store and office building at 130 West Forty-second Street, for Bush Terminal Company, cost $600,000, Helmle & Corbett, Archts., 190 Montague Street, Brooklyn; 17-story fireproof store and office building at 18 West Forty-fifth Street for Berkeley Arcade Corp., cost $750,000, Starrett & Van Vleck, Archts., 8 West Fortieth Street; two 5-story brick tenements at Marmion Avenue and 175th Street, for Marquette Construction Company, total cost $105,000, Kreymborg Architectural Company, Archts., 1029 East 163rd Street; 5-story brick tenement at 169th Street and Franklin Avenue, for County Building Corp., cost $75,000, Kreymborg Architectural Company, Architects, 1029 East 163rd Street.

Louis Allen Abramson, 220 Fifth Avenue, engaged to prepare plans and specifications for new hospital, to be erected at 1897 Madison Avenue, for Jewish Maternity Hospital, 270 East Broadway, probably eight stories, of brick terra cotta and limestone, cost about $200,000.

Elizabeth, N. J.—J. Ben Beatty, 57 Broad Street, is preparing plans for theater, to be erected on East Jersey Street, at a cost of $30,000.

Jersey City, N. J.—National Building Company, West Hoboken, will erect a four-story tenement building on Boulevard, to cost $25,000. James Billington, 2614 Boulevard, will erect a similar building on the Boulevard; cost $25,000.

Newark, N. J.—Fairchild Baldwin Company, 786 Broad Street, will alter Broad Street building at a cost of $25,000.

James E. Bathgate, 254 Roseville Avenue, it is reported, will erect four-story brick dwelling on Roseville Avenue, to cost $25,000.

Johnstown, Pa.—Willow Street United Evangelical Church will erect $50,000 edifice on Somerset Street. Rev. Norman C. Milliron, Pastor.

Mt. Joy, Pa.—Congregation of Kinderhook Evangelical Church purchased site adjoining present church for erection of a new edifice.

Philadelphia, Pa.—Clinton & Russell, 32 Nassau Street, New York, are architects for fifteen-story brick, stone, steel and terra cotta apartment house, to be erected at Thirteenth and Spruce Streets, for John Stafford, 1112 Chestnut Street. Owner ready for bids on brick, cut stone work, ornamental terra cotta, partitions and fireproof floors.

Philadelphia, Pa.—Pennsylvania Society for Prevention of Cruelty to Animals will erect a $75,000 building at 922 N. Broad Street.

Philadelphia, Pa.—The Atlantic Refining Co. will erect a 2-story brick boiler house, 90 x 100 ft., at Passyunk Avenue, west of Twenty-eighth Street; cost $31,000.

Plans completed by Frederick Webber, Morris Bldg., for a 15-story office building to be erected at 1429 Walnut Street, for Samuel L. Brumbaugh, at a cost of about $800,000.

Pittsburgh, Pa.—Baltimore & Ohio R. R. Co. (F. L. Stuart, Ch. Engr., Baltimore, Md.) considering erecting a 7-story freight depot at Anderson and Isabella streets.

Baltimore, Md.—Plans to be prepared by Clyde N. Friz, 1523 Munsey Bldg., for a building for the Knights of Pythias, to cost about $150,000. James M. Hendrix, 126 North Gay Street, Secy. Building Committee.

Plans being prepared by E. L. Palmer, Jr., 1620 Munsey Bldg., for an apartment house to be erected in Roland Park at a cost of $85,000.

Frank Baldwin, 601 Professional Building, is preparing plans for the St. Elizabeth Home for colored children, to be erected at a cost of $150,000 on site of the Pen Lucy School.

Maryland Steel Company, Sparrows Point, is having plans prepared by Bissell & Sinkler, Bailey Bldg., Philadelphia, Pa., for 24 two-story houses for the employees.

A social hall is to be erected on site adjoining synagogue at Eutaw Place and Lanvale Streets; cost about $50,000. Rev. William Rosenau, Rabbi.

Gastonia, N. C.—Osceola Mills Co. will erect a cloth mill; cost about $125,000.

Greensboro, N. C.—Plans being prepared for an 8-story, 34 x 98 ft. building, to be erected at West Market and South Elm Streets, for A. J. Klutz, Prop. Greensboro Drug Store; cost about $100,000.

Atlanta, Ga.—Southern Bell Telephone & Telegraph Co. plans to erect a concrete office and building exchange to cost $100,000.

Tampa, Fla.—The Baker & Holmes Co. of Jacksonville will erect a concrete warehouse on a site 175 x 200 ft. at Morgan and Bell streets.

Clarksdale, Miss.—Methodists propose erecting a $40,000 edifice.

Meridian, Miss. — R. H. Hunt, James Building, Chattanooga, Tenn., engaged to prepare plans for new edifice for Fifteenth Avenue Baptist Church, to be erected at Sixth Street and Sixteenth Avenue; cost $30,000.

New Orleans, La.—Contract about to be let by Cumberland Telephone & Telegraph Co. for erecting an 8-story steel, stone and terra cotta office and exchange building; cost $325,000.

McMinnville, Tenn. — The Nashville, Chattanooga & St. Louis R. R. (H. McDonald, Ch. Engr., Nashville) making plans for a new passenger station, probably erected by force account.

Memphis, Tenn.—Reported Memphis Knights of Columbus Bldg. Asso. and Catholic Club of Memphis considering erecting a club house; cost about $100,000.

Memphis, Tenn.—Turley & Naill, 26 North Second Street, will erect a 3-story fireproof office building, to cost $40,000.

Covington, Ky.—Samuel Hannaford & Sons, Hulbert Block, Cincinnati, Ohio, engaged to prepare plans for three-story office building, to be erected at Pike Street and Madison Avenue, for German Mutual Fire Insurance Company; cost $125,000.

Akron, Ohio.—St. Vincent de Paul's Roman Catholic Church plans erecting new convent and auditorium to cost $125,000.

Bellaire, Ohio.—Baltimore & Ohio R. R. (F. L. Stuart, Ch. Engr., Baltimore, Md.) intends erecting a 40 x 160 ft. freight house, covered platform 16 ft. x 80 ft. and an open platform 16 x 190 ft.; also plans erecting a 2-story brick office building 40 x 40 ft.

Cleveland, Ohio.—Plans being prepared by Abram Garfield, 915 Garfield Bldg., for an 8-story, 152 x 48 ft. fireproof building for Babies' Hospital, at 2500 East Thirty-fifth Street; cost $100,000.

Reported the Schauffler Missionary Training School, 5115 Fowler Avenue, will erect a 3-story building at cost of $65,000. M. W. Mills, Principal.

The Reserve Photo Plays Co. (R. H. McLaughlin, Pres.), 635 Leader-News Bldg., will erect a $100,000 studio.

Greek Catholic Union considering erecting an orphanage to cost about $250,000. A. J. Korney, 2335 West Eleventh Street, may be able to give further information.

Reported the Wanda Furniture Co., Broadway and East Seventy-first Street, will erect a $25,000 warehouse in rear of plant.

Reported Roy Black, 605 Sincere Bldg., will erect a store and apartment house at Cedar Avenue and East Seventy-ninth Street; cost about $75,000.

Plans being prepared by Matzinger & Lauffer, 109 Lennox Bldg., for an edifice to be erected at Dudley and Hayden Avenues for Congregation of St. Paul's Lutheran Church. Rev. W. H. Bunge, Pastor, 6809 Colgate Avenue.

Trustees of Second Christian Science Church, Euclid Avenue and East Seventy-seventh Street, planning to erect new edifice to cost about $200,000.

Dayton, Ohio.—Germania Building Association (William H. Kuhlman, President), 430 East Fifth Street, contemplates erecting office building on site of old post office at Main and Fifth Streets.

Lancaster, Ohio.—D. Riebel & Sons, First National Bank Building, Columbus, engaged to prepare plans for new edifice to be erected for German Lutheran Church, cost $40,000.

Lima, Ohio.—A Y. M. C. A. Bldg. is to be erected in Lima at a cost of $125,000. Address Secretary Y. M. C. Asso.

Mentor, Ohio.—J. H. Graham, 1836 Euclid Avenue, Cleveland, is architect for a residence to be erected in Mentor for O. C. Brooks, 7708 Platt Avenue. Cost $45,000.

Toledo, Ohio.—Plans being considered by Building Committee for new Lutheran Orphans' Home, to be erected on Sesman Street; cost about $50,000.

Ft. Wayne, Ind.—Plans being prepared by C. Weatherhogg, Hamilton National Bank Building, for three-story and basement apartment building, to be erected for William Ralston; cost $35,000.

Greensburg, Ind.—Board of Trustees of I. O. O. F. Lodge propose erecting two-story addition to hospital building; cost $25,000.

Muncie, Ind.—Tentative plans prepared for proposed Y. W. C. A. Building to be erected here; probable cost $200,000.

Danville, Ill.—Chicago & Eastern Illinois Railway Co. (L. C. Hartley, Ch. Engr., McCormick Bldg., Chicago) will erect new passenger depot at Fairchild and Jewel streets; cost, including rearrangement of tracks and sheds, $165,000.

Joliet, Ill.—The Woodruff Inn Garage is to be erected at Jefferson and Scott Streets, at a cost of $100,000. George Woodruff is interested.

Erection of a 2-story brick club house at Scott and Clinton Streets is contemplated by Joliet Lodge of Elks; cost about $50,000. E. R. Smith, Secy. Building Committee.

Taylorville, Ill.—Erection of $25,000 union station contemplated here for Wabash Railroad and Chicago & Illinois Midland Railroad Company (W. F. Mackie, Ch. Engr., Taylorville).

Eau Claire, Wis.—Plans prepared by Frank E. Gray, Milwaukee, for one-story and balcony, with basement, 42 x 124 ft. brick and fireproof theater, to be erected for Profit Sharing Theater Company; cost $40,000.

Milwaukee, Wis.—Layton Park English Lutheran Church plans erecting new edifice on present site at Twenty-third Avenue and Layton Boulevard; probable cost $35,000. Rev. Harry E. Olsen, Pastor.

Minneapolis, Minn.—The Polish Catholic Church will erect, at Sixth Street and Twenty-second Avenue, a church, school and parish house to cost $25,000.

Hennepin Holding Company, Plymouth Bldg., will erect a brick, tile, steel and reinforced concrete theater at Seventh Street and Hennepin Avenue, costing $90,000.

Wichita, Kan. — Christian Science Church intends erecting new edifice on present site at Eleventh and Robinson Streets; probable cost $75,000.

Norfolk, Neb.—Norfolk Masonic Temple Company intends erecting three-story brick Masonic Temple; cost about $30,000.

Grand Forks, N. D.—Sisters of St. Joseph will establish a convent here costing $100,000.

Deer Lodge, Mont.—Northern Pacific R. R. Co. (W. L. Darling, Ch. Engr., St. Paul, Minn.) will erect a passenger station in Deer Lodge, at a cost of about $25,000.

Kansas City, Mo.—Plans prepared for a 9-story, 140 x 140 ft. brick mercantile building, to be erected at Twentieth and Wyandotte Streets, for H. D. Lee Mercantile Co. (H. D. Lee, Pres.); cost about $500,000.

Webb City, Mo.—Chapman Bros. & Longacre will erect a 600-ton concentration plant at cost of $80,000.

Forest Park, Ark.—Methodists propose erecting a $25,000 church.

Stuttgard, Ark.—Plans being prepared for erection of a building for Stuttgard Lodge B. P. O. Elks, at cost of about $33,000.

Dallas, Tex.—American Exchange National Bank will erect a 16-story fireproof building on site of old Imperial Hotel. Cost $1,500,000. E. J. Cannon, Chmn. Bldg. Com.

Dallas, Tex.—City Federation of Women's Clubs is considering erecting a $65,000 building.

El Paso, Tex.—Reported El Paso Country Club, recently destroyed by fire, is to be reerected at cost of $150,000.

Freeport, Tex. — Freeport Chemical Wks., Freeport, will erect a 223 x 175 x 163 ft. concrete and brick building, cost $100,000, and install subliming and milling machinery to cost $20,000.

Houston, Tex.—Missouri, Kansas & Texas Railway Company (L. F. Lonnbladt, Ch. Engr., Dallas), contemplates erecting steel and concrete cotton warehouse on site of building recently destroyed by fire.

Southern Drug Company, Caroline Street and Franklin Avenue, will erect a 3-story building, to cost $50,000.

Ada, Okla.—American Glass Casket Co. of Oklahoma City is to erect a concrete and steel building for plant to manufacture glass caskets and floor tiling; cost $200,000.

Ardmore, Okla. — Presbyterians will erect a $35,000 brick and terra cotta church.

Quinton, Okla.—Quinton Smelter Co. recently incorporated with capital of $125,000, plans building a zinc smelter.

Portland, Ore.—Cutter & Malmgren, 1023 Riverside Avenue, Spokane, Wash., engaged to prepare plans and specifications for a $100,000 residence, to be erected for Theodore B. Wilcox.

Glendale, Cal.—Plans being prepared by Arthur G. Lindley, 310 Hollingsworth Building, Los Angeles, for a brick church to be erected at Third Street and Kenwood Avenue for Glendale Methodist Congregation. Cost $30,000. B. D. Sudden, Pastor, 133 Jackson Street.

San Francisco, Cal.—Ellis-Street Investment Company will erect a $1,200,000 theater at Ellis and Mason streets for Charles H. Brown, Humboldt Bank Bldg.

★**Santa Rosa, Cal.**—Contract awarded by J. W. Cline to J. O. Kuykendall for erecting theater at B and Fifth Streets; cost approximately $40,000.

Vallejo, Cal.—St. Vincent's Roman Catholic Church will erect new parochial school, to cost about $40,000.

Plans prepared for three-story Masonic Temple, to cost $100,000.

Rupert, Idaho.—Reported William Laidlaw, James Turnbull and John Drockie, all of Rupert, intend erecting a hotel here, costing $50,000.

Levis, Que.—The Intercolonial R. R. (E. G. Connette, Pres., Ellicott Square, Buffalo, N. Y.) is reported revising plans for the passenger station to be erected at Quebec.

Montreal, Que.—Plans completed for erection of a theater to be erected at St. Catharine and St. Timothee streets; cost about $1,000,000. George Rabinovitch said to be interested.

London, Ont.—Trades & Labor Council (James Husey, 241 Colborne Street, Pres.) will soon engage an architect to prepare plans for a $50,000 temple.

Stratford, Ont.—J. A. Davidson is Chairman of the Committee having in charge the alterations and additions planned to Central Methodist Church at a cost of $25,000.

Toronto, Ont.—Robert Simpson Company, Yonge Street, Toronto, is preparing plans for a reinforced concrete warehouse, to be erected at a cost of $600,000.

J. Whitney of Detroit is having plans prepared for a theater, which he intends erecting on the site of the Princess Theater, destroyed by fire; cost $150,000.

Toronto, Ont.—William Steele & Sons & Co., 423 Ryrie Building, are preparing plans for a concrete and terra cotta warehouse and office building for T. Eaton & Co., 190 Yonge Street; estimated cost $300,000.

Toronto, Ont.—T. Eaton Company, Toronto, is seeking a site on which it is proposed erecting a mail-order office building, to cost $1,000,000.

BIDS DESIRED.

Philadelphia, Pa.—Reported desired until May 22, for erecting a one-story 85 x 75 ft. church, for Palatinate Reformed Church, Rev. F. E. Wieder, 1220 North Fifty-seventh Street, Pastor. Probable cost $30,000. Geo. E. Savadge, Archt., Witherspoon Bldg.

Warren, Pa.—Reported desired until June 1, by Brockway, McNeill Co., Warren, for erecting 3-story, 50 x 120 ft., garage building for Rossell Bros.

Annapolis, Md.—Reported desired until May 29, by W. N. French, Chmn. B. P. O. E. Elks Club, for erecting clubhouse on Main Street.

New Orleans, La.—Reported desired until July 1, by C. E. Chapman, Archt., 622 Commercial Place, for erecting hotel 68 x 100 ft. Probable cost $50,000.

Kasson, Minn.—Until May 24, by Kasson Hotel Co., for erecting three-story and basement hotel. Separate bids for heating, plumbing, etc.

Grand Island, Neb.—Reported desired until July 1, by B. P. O. E. No. 604, H. M. Conners, Secy., and Oscar R. Kirschke, Archt., Grand Island, for erecting a three-story 53 x 100 ft. club house.

Kansas City, Mo. — Reported desired until June 1, by S. B. Tarbet, Archt., 507 Republic Bldg., for erecting five-story, 50 x 142 ft. auto training school for Rahe Automobile Training School. Probable cost, $85,000.

Toronto, Ont.—Until May 23, by T. L. Church, Mayor, Chmn. Bd. Control, for erecting steel frame brick-faced tile addition, including heating plant, to St. Claires Avenue car barns, at Christie Street.

Windsor, Ont.—Until May 30 by G. Jacques & Co., Boug Block, for erecting a brick and concrete building costing $30,000.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Pittsfield, Mass.**—Contract for erecting Kinnell-Kresge Building, on North Street, awarded Tracey Brothers of Waterbury, Conn.; cost about $80,000.

★**Providence, R. I.**—Contract awarded H. L. Hemenway & Company of Boston, Mass., for erecting Calvary Episcopal Church, stone and limestone, with tower. Clark & Howe, Archts., 1208 Turk's Head Bldg.

★**New Haven, Conn.**—Contract awarded by Southern New England Telephone Co. to Sperry & Treat Co., 39 Church Street, for erecting ten-story building in rear of main building on Court Street; estimated cost about $250,000.

★**New York, N. Y.**—Contract awarded McDermott & Hanigan, for erecting edifices on Tinton Avenue and 155th Street, for St. Anselm's Roman Catholic Church; estimated cost $100,000. Rev. Bernard Kevenhoerster, Pastor. Gustav E. Steinbach, Archt., 15 E. Fortieth Street.

★**Richmond Hill, L. I., N. Y.**—Contract awarded Frank Droesch, Woodhaven, L. I., for erecting two-story brick and limestone parochial school at Greenwood and Brandon Avenue for Roman Catholic Church of the Holy Child; cost $55,000. Gustave E. Steinbach, Archt., 15 East Fortieth Street, New York.

★**Kearny, N. J.**—Contract for erecting Masonic Temple at Kearny and Bergen avenues awarded to William Nairn of Kearny, at about $35,000.

★**Altoona, Pa.**—Stoke & Cassidy, Altoona, awarded contract for erecting modern fireproof business and apartment building for Welsh Bros. at intersection of Eleventh and Union Avenues.

★**Greensburg, Pa.**—Contract for erecting edifices for First Presbyterian Congregation awarded to Edward A. Weir of Pittsburgh at $160,400. Cram & Ferguson of Boston, Mass., Archts.

★**Harrisburg, Pa.**—Contract for erecting St. Mary's Croatian Catholic Church, Second and Hoffer Streets, awarded Stapf & Benfer, of Harrisburg, at $33,062. Rev. Anthony Zuvich, Pastor. A. A. Reichter, Archt., Reading.

★**Johnstown, Pa.**—Contract for erecting new Mooses Home on Bedford Street for Johnstown Lodge, No. 48 Loyal Order of Moose, awarded Charles A. Clawson, 163 D Street, at $41,000.

★**Philadelphia, Pa.**—Contract awarded Cramp & Company, Denckla Building, for erecting an eight-story brick and reinforced concrete loft building at Thirteenth and Wood streets, for L. A. Belmont. And. J. Sauer & Company, Archts., 908 Chestnut Street.

★Contract awarded William R. Dougherty, 1008 Samson Street, for erecting three-story brick and stone convent at Thirty-eighth and Spring Garden streets, for St. Agatha's R. C. Church. E. F. Durang & Sons, Archts., 1200 Chestnut Street.

★**Wheeling, W. Va.**—Contract awarded R. R. Kitchen Company, Board of Trade Building, for erecting four-story building at Fifteenth and Chapline Streets for Bell Telephone Co.; cost about $125,000.

★**Tampa, Fla.**—Contract for erecting 210 x 80 ft., reinforced concrete warehouse on Twiggs Street and Maxwell Avenue for Dekle Investment Company, awarded McGucken & Hyer, Tampa; cost about $40,000.

★**Cordova, Ala.**—Contract for erecting reinforced concrete warehouse for Indian Head Mills awarded E. F. Hettrick Engineering Company, Birmingham, Ala. L. Green, Atlanta, Ga., Archt.

★**Cincinnati, Ohio.**—The Ohio Building & Construction Co., general contractors for new gymnasium for the L. B. Harrison Hotel, has sublet steel work to Potthoff Construction Co., Cincinnati, and brick work to David Hummel Building Co., Cincinnati.

★**Cleveland, Ohio.**—Contract for erecting a 2-story warehouse at Detroit Avenue and West Fifty-seventh Street, for Templin-Crockett-Bradley Co., awarded to George A. Rutherford Co., 2160 East Eighteenth Street. Cost $30,000.

★**St. Bernard, Ohio.**—J. F. Sheblessy, 519 Main Street, Cincinnati, architects in charge of the construction of the Sisters' Home for St. Clemens' Church, has awarded contracts as follows: Brick work, August Wahoff; plumbing and heating, Frank Niesen & Co.; roofing, S. Volz; carpentry, A. C. Broxterman. Bidders all of Cincinnati.

★**South Bend, Ind.**—Contract for erecting Christian Science Church awarded H. G. Christman Co., South Bend, at about $90,000.

★**Flint, Mich.**—Contract awarded by B. J. McDonald to H. V. Snyder & Son of Battle Creek for erecting two-story fireproof garage; cost $30,000.

★**Cherokee, Iowa.**—Contract awarded Coomer & Small, Sioux City, for erecting brick and stone hospital for Sioux Valley Hospital Society; cost $50,000. Beuttler & Arnold, Archts., Security Building, Sioux City.

★**West Burlington, Iowa.** — Contract awarded by Chicago, Burlington & Quincy R.R. to Westinghouse, Church, Kerr & Co., 37 Wall Street, New York, N. Y., for erecting additional shop buildings.

★**St. Paul, Minn.**—Butler Bros., New York Life Building, awarded contract for erecting apartment house adjoining Angus Hotel, on Western Avenue, to cost $200,000.

★**Topeka, Kan.**—Contract for erecting a Masonic Temple awarded to Frank M. Spencer & Son, of Topeka. Cost $100,000.

★Contract for erecting 2-story concrete and brick warehouse at First and Kansas Avenue for A. Alford, awarded to Henry Bennett & Son of Topeka, at $32,000.

★**Flandreau, S. D.**—Contract for erecting Roman Catholic Church awarded to Carl Cropp of St. Cloud, Minn., at $24,844 exclusive of furnishing the brick. W. E. Greene, Archt., Luverne, Minn

★Los Angeles, Cal.—Contract for erecting 4-story, 50 x 100 ft. apartment house at 722 South Hartford Avenue, for Mrs. M. O. Head, awarded Barkelew & Gould, 1017 East Twenty-first Street, at $34,000. Frederick Noonan, 1031 Los Angeles Investment Co. Bldg., Archts.

★Montreal, Que.—Contract awarded O. Archambault, 610 Parc Lafontaine Street, for erecting the Presbytery for St. Catharines Trustees, 408 Amherst Street, at $28,000.

★Quebec, Que.—Contract awarded by Fathers of St. Sacramento, 368 Mt. Royal Avenue, to L. G. Fauteux, St. Banoit, Que., to erect a new monastery, to cost $75,000.

★Contact awarded Junchereau & Lamonde, 325 Richardson Street, for erecting Commercial Academy for Commercial Academy Co. at $260,000.

★Toronto, Ont. — Contract awarded George Oakley & Son, 278 Booth Avenue, Toronto, for stonework in connection with new union station; cost $350,000.

★Regina, Sask.—Poole Construction Company of Regina, secured contract to erect warehouse for Canadian Consolidated Rubber Company; cost about $30,000.

NEW INDUSTRIAL PLANTS

PROPOSED WORK.

Buffalo, N. Y.—Lehigh Valley Railroad (E. B. Ashby, Ch. Engr., New York) planning to build two new repair shops, one in East Buffalo and the other at Tifft farm; also intends erecting six other shops to be located at Hazleton, Delano and Coxton, Pa., and Auburn, Cortland, Manchester.

Chrome, N. J.—United States Metal Refining Company, Chrome, will double plant by erecting eight tanks, new nickel plant, office building, tank house, laboratory building, and additions to storage building.

Elizabeth, N. J.—Campbell Art Company, 1144 Elizabeth Avenue, having plans prepared for a two-story plant, to be erected on Newark Avenue; cost $75,000.

Samuel L. Moore & Sons Corporation has had plans prepared by Ring, Cleaves & Graham Co., 280 North Broad Street, for ship yard plate and angle shop, to cost $320,000.

Perth Amboy, N. J.—Roessler & Hasslacher Chemical Company, Front Street, is having plans prepared for a four-story addition.

Trenton, N. J.—Plant of Chandler Oilcloth Company destroyed by an explosion will be rebuilt.

Philadelphia, Pa.—Morris & Erskine, Crozer Building, preparing plans for a 4-story factory, 50 x 100 ft., to be erected at Stenton Avenue and Wayne Junction, for Leeds & Northrup Company.

Paden City, W. Va.—Carter Iron Manufacturing Company incorporated with Frank C. Taylor, 37 Wall Street, New York, N. Y., and others, and plans erecting factory here.

Rockingham, N. C.—Steele's Cotton Mills Company, Rockingham, will enlarge plant and install 17,000 spindles, 400 looms and accompanying machinery; cost complete about $500,000.

Ashland, Ky.—Ashland Iron & Mining Company, Ashland, will erect a finishing plant to cost $750,000. Contract recently awarded for open-hearth plant.

Cloverport, Ky.—According to press reports plans are being prepared by Louisville, Henderson & St. Louis R. R. (R. N. Hudson, Gen. Mgr., Louisville) to rebuild the railroad shops at Cloverport which were recently destroyed by fire.

Cleveland, Ohio.—West Steel Castings Co., 811 East Seventieth Street, will erect an addition to plant to cost $30,000.

Willard Storage Battery Co., East 131st Street and St. Clair Avenue, plans to erect additions to plant to cost $159,000.

Grant Motor Co. of Findlay (D. A. Shaw, Pres.) will start work this summer on first unit of plant to be erected at Coit Road and Kirby Street, to cost $200,000. Other units are to be erected later; total cost $1,000,000.

Plans being prepared by Goodman & Lindberg, of Chicago, Ill., for additions, also for a new plant for Cleveland Provision Co., 2527 Canal Road.; cost about $500,000.

Plans being prepared by Forest City Engineering Co., 512 Hippodrome Bldg., for 8 concrete buildings, to be erected at Big Four R. R. tracks and Denison Avenue by National Artificial Silk Co., 735 Central Avenue; cost, including equipment, $300,000. Reported addition will be made to plant in near future; total cost to be about $1,000,000.

Springfield, Ohio.—Contract soon to be let for erecting two-story and basement, 50 x 150 ft., brick and concrete addition to plant of Home Dairy & Standard Ice Cream Company on West Mulberry Street. W. K. Shilling, Archt., Bushnell Building.

Struthers, Ohio.—Western Conduit Company (L. J. Campbell, President), will spend $50,000 in enlarging plant here.

Chicago, Ill.—John Hetzel, Vice-President of Western Packing & Provision Company, 3854 South Morgan Street, has purchased site at Thirty-seventh Place and Morgan Street and intends erecting packing plant to cost about $400,000.

Sexton & Co., 236 West Lake Street, will erect a building on Illinois Street adapted to wholesale grocery business, including manufacturing and preserving plant, coffee roasters, etc., and a refrigerating plant, to cost about $350,000.

Oaklawn, Ill.—Reported Chicago & Eastern Illinois Railway Co. (L. C. Hartley, Ch. Engr., McCormick Bldg., Chicago) intends erecting here this summer coach and paint shops, to cost about $100,000.

Beloit, Wis.—Fairbanks-Morse Company have had plans prepared for improvements and addition to plant at Beloit, to cost approximately $400,000.

Milwaukee, Wis.—E. C. Kropp Company, 258 Jefferson Street, will erect a factory at 618 Sixteenth Street, to cost $36,000.

Vaughn, Meyer & Sweet, Majestic Building, are engineers for foundry to be erected at Sixty-fourth and Sixty-eighth Avenues, West Allis, for Electric Steel Casting Company.

Minneapolis, Minn.—Albert Dickinson Company of Chicago will erect an elevator with a capacity of 300,000 bushels, at Twenty-fifth Avenue and Elm Street. Clement S. Sheffield, Superintendent.

St. Paul, Minn.—Fountain Faucet Company incorporated with John Everall Vice Pres. and A. W. Melander Manager, and intends erecting a plant here for manufacture of a patent fountain faucet.

Marysville, Mont.—Marysville Gold Mining Corporation (M. L. Hewett, Vice-Pres.) reported considering erection of a mill for treatment of ores.

Kansas City, Mo.—Plans completed for two 3-story buildings to be erected for the Ford Motor Car Company, Eleventh Street and Winchester Avenue.

New Braunfels, Tex.—Bartlett & Ranney, Chandler Building, San Antonio, engaged to prepare plans and specifications and supervise construction of a 500-kw. steam turbogenerator with fireproot power house, etc., for the Landa Industries (Harry Manda, Pres.)

Berlin, Ont.—Plans being prepared for a factory which J. Walters & Sons, manufacturers of fiber products will erect at a cost of $35,000.

Fort William, Ont.—N. M. Patterson Co. will erect by day labor an addition to their grain elevator, concrete construction; cost $50,000.

Harrow, Ont.—R. Findlay, 10 Phillips Place, Montreal, Que., is preparing plans for a reinforced-concrete factory to cost $35,000 for the W. Clark Canning Co., 83 Amherst Street, Montreal, Que.

Renfrew, Ont.—The water power dry house of the O'Brien Munitions Company recently destroyed by fire, is to be rebuilt, new conveyors and general equipment installed.

Simcoe, Ont.—The Unique Shoe Co. is preparing plans for a $25,000 shoe factory to be erected at Simcoe, if by-law, to be submitted shortly, is favorable. J. W. Phillips, 10 W. Market Street, Montreal, Que., Mgr.

Timmins, Ont.—Hollinger Gold Mining Company, will erect by force account a $75,000 steel and concrete addition to their mills and install new machinery.

Toronto, Ont.—The Flint Varnish & Color Co. is preparing plans and will erect by day labor an addition to their factory; cost $150,000.

Winnipeg, Man.—Provincial Government reported considering constructing a terminal elevator costing $500,000.

FRICES AND LETTINGS.

★*Indicates award of contract.*

★Perth Amboy, N. J.—Contract awardea John W. Ferguson, Paterson, for erecting additions and a new tank house for Raritan Copper Works; cost $80,000.

★Contract awarded Metzger & Fisher, Denckla Building, Philadelpbia, Pa., for erecting three-story, 80 x 100 ft., brick and reinforced concrete factory, for Bayuk Brothers & Company; cost $50,000. E. Allen Wilson, Archt., 1208 Chestnut Street, Philadelphia, Pa.

★Philadelphia, Pa.—Contract awarded William H. Eddleman & Sons, 453 Green Lane, Roxborough, for erecting ice storage plants for Up-to-date Ice Company, and Glen Willow Ice Manufacturing Company. Peuckert & Wunder, Archts., 310 Chestnut Street.

★Contract awarded Stewart Brothers, 2526 North Orkney Street, for erecting five-story, 25 x 150 ft., brick and reinforced concrete factory and warehouse, at 124 North Second Street, for C. P. Porter Company.

★Contract awarded Warren, Moore & Company, Commercial Trust Building, for alterations and additions to factory of Miller Lock Company, Tacony and Orthodox Street; cost $40,000.

★Louisville, Ky.—Contract awarded Janse Brothers, Boomer, Crain & Howe, 906 Dime Bank Bldg., Detroit, Mich., for erecting steel and concrete grain elevator, with capacity of 364,000 bushels, on South Brook Street, for W. A. Thompson & Company; cost $80,000.

★Cincinnati, Ohio.—Architects Zettel & Rapp, 607 Johnston Building, in charge of the construction of the new power plant for the R. K. LeBlond Machine Tool Co., have awarded contract for structural steel to the Potthoff Construction Co., Cincinnati, and for steel sash to the David Lupton Sons Co., Philadelphia, Pa.

★Cleveland, Ohio.—Walther Engineering Co., care of Engineers, secured general contract for first unit of proposed $4,000,000 plant for Grant Motor Car Company, to be erected at Coit and Kirby Roads, of steel and concrete, 181 x 561 ft. and one and two stories high. W. S. Ferguson Company, Engineers, 1900 Euclid Avenue.

★Oregon City, Ore.—Contract awarded by Hawley Pulp & Paper Company to Grace & Rasmussen Company, Portland, for erecting generating plant and pulp mill, one of the five buildings included in the $750,000 extension.

★Los Angeles, Cal.—Contract awarded J. A. Creek, 1308 Baker Detweiler Building, at about $35,000, for erecting a one-story hollow tile and brick factory, 200 x 200 ft., at 2315 Santa Fe Avenue for Southern California Box Company. J. Schultz, Engineer, 305 Wright Callander Building.

★Ottawa, Ont.—Contract awarded by Burrows Refining Co., 629 Wellington Street, to Campbell Iron & Steel Works, Carling Avenue, for tanks and machinery for their plant; cost $35,000.

★Peterboro, Ont.—Contract awarded by Quaker Oats Company, 34 Hunter Street, to Canadian Leonard Construction Company, Peterboro, for erecting an addition to their plant to cost $50,000.

★Stamford, Ont. — Contract awarded Snyder & Gulet, 594 Ferry Street, Niagara Falls, for erecting a plant for American Cyanamid Co. of Niagara Falls; cost $35,000.

MISCELLANEOUS

PROPOSED WORK.

Ferry Improvement — New London, Conn.—At a special city meeting $32,000 appropriated for improvement and enlargement of the public landing and ferry slip at the foot of State Street. Address City Clerk.

Parkways—Atlantic City, N. J.—City Commission has passed on second reading the bill to extend and pave Bekley Square; also a bill for a $130,000 parkway to include the extension of the new Absecon Atlantic City motor speedway.

Improvement Bonds—Kansas City, Mo.—Improvement bonds for $1,500,000 will be sold June 1 by city. Curtis Hill, City Engineer.

Turning Basin Improvements—Houston, Tex.—City Council has appropriated from Harbor Bond Fund $40,000 for constructing a storage yard on south side of turning basin terminals and switching facilities will be installed. E. E. Sands, City Engineer.

BIDS DESIRED.

Elevator—Providence, R. I.—Until May 22, by Frank E. Fitzsimmons, Custodian, for supplying and installing in U. S. post office, courthouse and custom house automatic freight elevator gates.

Iron Stairs—Alden, N. Y.—Until May 23, by Board Conty Supervisors at Buffalo (Alonzo G. Hinckley, Clk), for erecting iron stairs at new shelter house at Erie County Farm, Alden.

Borings—Brooklyn, N. Y.—Until May 27, by Bureau Yards and Docks, Navy Dept., Washington, D. C., for Spec. No. 2233 borings at the Navy Yard, New York.

Elevator—New York, N. Y.—Until May 23, by Marcus M. Marks, Pres. Manhattan Borough, for furnishing material and installing electric elevator and equipment in courthouse located at 170 East 121st Street, Borough Manhattan.

Ferryboat, New York, N. Y.—Until May 26, by R. A. C. Smith, Commissioner of Docks, for Contract No. 1521 furnishing all labor and material required for repairs to municipal ferryboat "Bay Ridge." Security, $7,000.

Mail Handling Apparatus—New York, N. Y.—Until June 30, by James A. Wetmore, Acting Superv. Archt., Treas. Dept., Washington, D. C., for a mechanical system of mail handling apparatus in U. S. post office (new) at New York City.

Borings—Philadelphia, Pa.—Until May 27, by Bureau Yards and Docks, Navy Dept., Washington, D. C., for Spec. 2234 borings at the Navy Yard, Philadelphia.

Iron Stairs—Washington, D. C.—Until May 29, by James A. Wetmore, Acting Superv. Archt., for cast-iron stairs, etc.

Cement—Heidelberg, Ky.—Until May 22, by U. S. Engrs. Office, Second Dist., room 415, Custom House, Cincinnati, Ohio, for furnishing and delivering to the U. S. post office at Heidelberg about 4200 bbl. of American Portland cement. Robt. R. Ralston, Maj. Corps Engrs., U. S. A.

Band Stand—Cincinnati, Ohio.—Until May 22, by Chas. F. Hornberger, Dir. Pub. Service, for constructing reinforced concrete band stand on Erie Avenue.

Cement—Lorain, Ohio.—Until May 22, by Light House Inspector, Buffalo, N. Y., for furnishing 525 bbl. of American Portland cement at Lorain.

Stairs, Railings, Etc.—Lockport, Ill.—Until June 10 by John Lambert, Pres. Penitentiary Commission, 209 S. La Salle Street, Chicago, for iron work, including stairs, railings, certain plate work, steel doors, frames, etc., as required in cell house of 248 cells, at site of New Illinois Penitentiary, near Lockport. W. Carby Zimmerman, Archt., 64 Van Buren Street, Chicago.

Platform — Minneapolis, Minn. — Until June 12 at Custodians Office for constructing city mailing platform at U. S. post office.

Traveling Cranes—Houston, Tex.—Until May 26 for four small traveling cranes for sewage disposal plant. E. E. Sands, City Engr.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★Concrete Thoroughfare—Plainfield, N. J.—Contract awarded H. B. Sproul Company, Peekskill, for a concrete bed thoroughfare from Mountain Avenue, Scotch Plains, to Mountainside, a distance of 3½ miles; cost $79,855.

Elevator—Parkersburg, W. Va.—Contract for installing elevator in U. S. Post Office awarded Otis Elevator Company, Washington, D. C., at $3,319.

★Power Plants—Butte, Mont.—Contract awarded S. Morgan Smith Company, York, Pa., by Montana Power Company, Butte, for four 15,000-hp. vertical hydraulic turbine units to be operated under a head of 100 ft., to be installed in connection with the "Holter" development on Missouri River, near Great Falls. Also is installing for this company two 16,000-hp. vertical units.

★Conduits—Fort Worth, Tex. — Special "conduit line fund" created by City Commission for completion of Lake Worth conduit and Mayor Tyra and City Secretary Harwood authorized contract with Lock Joint Pipe Co. for completion of conduit.

★Ferry Terminals — Seattle, Wash.—Contract awarded J. H. McEachern, Seattle, by County Commissioners, for constructing 2 docka and ferry slips with apron and pontoon for new Vashon Ferry, now building, at $32,995.

Proposals

For Proposals Advertised, See Pages 45, 46, 47, 48, 49 and 50.

WATERWORKS.

Bids Close.		See Eng. Record.
May 23.	Testing Apparatus, Newark, N. J.	May 13
May 23.	Reservoir, Burbank, Cal.	May 20
May 23.	Pipe, Wenatchee, Wash.	May 20
May 23.	Pipe, Columbus, Ohio.	May 20
May 24.	Mains, Fargo, N. D.	May 20
May 24.	Pumping Station, Elmhurst, Ill.	May 20
May 25.	System, Overton, Neb.	May 20
May 25.	Improv., Fairmont, Minn.	May 20
May 25.	Machinery for Works, Vinton, Iowa.	May 20
May 26.	Pipes, Wallace, Man.	May 13
May 26.	Pipe, Etc., Panama.	May 13
May 27.	Filtration Plant, Perry, N. Y. Adv. May 13.	May 13
May 27.	System, Farmersville. O.	May 20
May 29.	System, Oskaloosa, Kan.	May 20
May 31.	System, Aberdeen, Wash.	Apr. 29
May 31.	C. I. Pipe and Specials, Morris, Minn. Adv. May 13, 20.	May 13
Jun. 1.	Water Works, Madison, W. Va.	Apr. 22
Jun. 1.	Filtration Plant, St. Hyacinthe, Que.	May 13
Jun. 1.	Extending System, Ft. Wadsworth, N. Y. Adv. May 20.	May 20
Jun. 1.	System, Castle Rock, Col.	May 20
Jun. 2.	Reservoir, Wilmington, Del. Adv. May 13.	May 13
Jun. 2.	Waterworks, Mullen, Neb.	May 20
Jun. 3.	Electrical equipment for water plant, El Paso, Tex. Adv. May 6 to 20.	May 6
Jun. 5.	Gate Valves, Etc., St. Paul, Minn. Adv. May 13, 20.	May 13

Bids Close.		See Eng. Record.
Jun. 5.	Material, St. Paul, Minn. Adv. May 13, 20.	May 13
Jun. 5.	Castings, Etc., St. Paul, Minn. Adv. May 13, 20.	May 13
Jun. 5.	C. I. Pipe, Etc., St. Paul, Minn. Adv May 13, 20.	May 13
Jun. 5.	Water Works, Evarett, Wash. Adv. May 13, 20.	May 13
Jun. 5.	East Troy, Wis.	May 20
Jun. 5.	System, Mount Rainier, Md.	May 20
Jun. 5.	Mains, Cleveland Heights (P. O. Warrensville), Ohio	May 20
Jun. 6.	System, Tchula, Miss.	May 20
Jun. 13.	Contract 144, New York, N. Y. Adv. May 20.	May 20
Jun. 15.	Works, Port Arthur, Tex.	May 20
Jun. 15.	System, Oatman, Ariz.	May 20
Jun. 17.	Water Works, Winnemucca, Neb.	May 20

SEWERAGE AND SEWAGE DISPOSAL.

Bids Close.		See Eng. Record.
May 22.	Highland Park, Mich. Adv. May 6, 13.	May 6
May 22.	Marshall, Ill.	May 20
May 22.	Boston, Mass.	May 20
May 23.	Newark, N. J. Adv. May 6, 13.	May 6
May 23.	Ridgefield Park, N. J. Adv. May 6, 13.	May 6
May 23.	Mapleton, Minn.	May 20
May 23.	Boston, Mass.	May 20
May 24.	Binghamton, N. Y. Adv. May 13, 20.	May 13
May 24.	Dayton, Ohio	May 20
May 25.	Durham, N. C. Adv. May 6 to 20.	May 6
May 25.	Milwaukee, Wis. Adv. May 6 to 20.	May 6
May 25.	Lawton, Okla.	May 13
May 25.	Elyria, Ohio	May 13
May 25.	Galveston, Tex.	May 20
May 26.	Brockport, Pa.	May 13
May 26.	Wallace, Man.	May 13
May 27.	Westfield, N. J. Adv. May 13, 20.	May 13
May 29.	St. Clairsville, Ohio	May 13
May 29.	Biddeford, Me. Adv. May 13, 20.	May 13
May 29.	Wakesha, Minn.	May 20
May 31.	Newark, N. J. Adv. May 13, 20.	May 13
May 31.	Fresno, Cal.	Apr. 29
May 31.	Washington, D. C. Adv. May 20.	May 20
Jun. 1.	Marshall, Ill.	May 13
Jun. 1.	Monticello, Wis.	May 13
Jun. 1.	Ft. Wadsworth, N. Y. Adv. May 20.	May 20
Jun. 1.	Akron, Ohio Adv. May 20.	May 20
Jun. 2.	Cooperstown, N. Y. Adv. May 20.	May 20
Jun. 6.	Alliance, Ohio Adv. May 20.	May 20
Jun. 8.	Milwaukee, Wis. (2 Props.) Adv. May 20.	May 20
Jun. 15.	Xenia, Ohio	May 20
July 15	Salem, Ill.	May 20

BRIDGES.

Bids Close.		See Eng. Record.
May 2.	Morristown, N. J.	May 20
May 23.	Kearney, Neb.	Apr. 29
May 23.	Albany, N. Y. Adv. Apr. 29.	Apr. 29
May 23.	Nashville, Tenn. Adv. May 6, 13.	May 6
May 23.	Washington, Ga.	May 13
May 23.	Woonsocket, R. I. Adv. May 13.	May 13
May 23.	Butler, Pa.	May 20
May 23.	Steubenville, Ohio.	May 20
May 24.	Bradentown, Fla.	May 6
May 24.	Illinois	May 20
May 24.	Independence, Ore.	May 20
May 25.	Des Moines, Iowa	May 20
May 25.	Ottawa, Ont.	May 20
May 26.	Tacoma, Wash.	May 13
May 26.	Bluffton, Ind.	May 13
May 26.	Mount Gilead, Ohio	May 13
May 26.	Xenia, Ohio	May 20
May 27.	London, Ont.	May 20
May 27.	Tiffin, Ohio	May 20
May 27.	Mahnomen, Minn.	May 20
May 29.	Newton, Kan.	May 20
May 29.	Rice Lake, Wis. Adv. May 20.	May 20
May 31.	Warren, Pa. Adv. May 13, 20.	May 13
May 31.	Pennsylvania	May 20
May 31.	Fullerton, Cal.	May 20
Jun. 1.	Hamilton, Ohio	May 6
Jun. 1.	Mansonville, Que.	May 20
Jun. 2.	Colombus, Ohio	May 20
Jun. 2.	Hartford, W. Va.	May 13
Jun. 5.	Cumberland, Md.	Apr. 22
Jun. 5.	Bushnell, Fla.	May 20
Jun. 5.	Newcastle, Ind.	May 20
Jun. 5.	Aberdeen, Wash.	May 20
Jun. 5.	New Orleans, La.	May 20
Jun. 6.	Hayti, S. D.	May 13
Jun. 6.	Brookings, S. D.	May 20
Jun. 6.	Montrose, S. D.	May 20
Jun. 6.	Huron, S. D.	May 20
Jun. 6.	Wabash, Ind.	May 20
Jun. 6.	Macon, Miss.	May 20
Jun. 8.	El Dorado, Kan.	Apr. 8
Jun. 8.	Ft. Lauderdale, Fla.	May 20
Jun. 13.	Philadelphia, Pa. Adv. May 20.	May 20
Jun. 26.	Clintwood, Va.	May 20

PAVING AND ROADS.

Bids Close.		See Eng. Record.
May 22.	Cumberland, Md. Adv. May 6, 13.	May 6
May 22.	Stamford, Conn. Adv. May 13.	May 13
May 22.	Newark, N. J.	May 20
May 23.	Luverne, Minn.	May 6
May 23.	Loudonville, Ohio	May 13
May 23.	Jersey City, N. J.	May 13
May 23.	Fayette, Ohio Adv. May 13.	May 13
May 23.	Fair Haven, N. J. Adv. May 13.	May 13
May 23.	Tacoma, Wash.	May 20
May 23.	Knoxville, Iowa	May 20
May 23.	Omaha, Neb.	May 20
May 23.	Centerville, Iowa	May 20
May 23.	Atchison, Kan.	May 20
May 23.	Akron, Ohio	May 20
May 23.	Salisbury, Mass.	May 20
May 23.	Buffalo, N. Y.	May 20
May 23.	Massachusetts	May 20
May 23.	Kansas City, Mo.	May 20
May 24.	Tiffin, Ohio	May 6
May 24.	Bradentown, Fla.	May 6
May 24.	Mansfield, Ohio	May 6
May 24.	Wichita, Kan.	May 13
May 24.	Belding, Mich.	May 13
May 24.	Marshalltown, Iowa Adv. May 13.	May 13
May 24.	Reading, Pa.	May 20
May 24.	Kearney, Iowa	May 20
May 24.	Tenafly, N. J.	May 20
May 24.	Cleveland, Ohio	May 20
May 24.	Eastville, W. Va.	May 20
May 24.	Brooklyn, N. Y.	May 20
May 24.	Illinois	May 20
May 24.	Baltimore, Md.	May 20
May 24.	Beaumont, Tex.	May 20
May 25.	Newark, N. J.	May 13
May 25.	Indiana	May 13
May 25.	Polo, Ill.	May 20
May 25.	Akron, Ohio	May 20
May 25.	Youngstown, Ohio	May 20
May 25.	Dayton, Ohio.	May 20
May 25.	South Boston, Va.	May 20
May 25.	Galveston, Tex.	May 20
May 26.	West Union, W. Va.	May 6
May 26.	Walla Walla, Wash.	May 13
May 26.	St. Paul, Minn.	May 13
May 26.	Indiana	May 13
May 26.	Cincinnati, Ohio	May 20
May 26.	Rushville, Ind.	May 20
May 26.	Adeline, Ill.	May 20
May 26.	Minneapolis, Minn.	May 20
May 26.	Pittsburgh, Pa.	May 20
May 26.	Jackson, Mich.	May 20
May 27.	Houma, La.	May 13
May 27.	Indiana	May 13
May 27.	Lincoln, Neb.	May 20
May 27.	Tacoma, Wash.	May 20
May 27.	Dayton, Wash.	May 20
May 28.	Jackson, Mich.	May 20
May 27.	Indiana	May 20
May 27.	Buffalo, N. Y.	May 20
May 28.	Armstrong Mills, Ohio	May 20
May 29.	Lumberport, W. Va.	May 13
May 29.	Seattle, Wash.	May 13
May 29.	Everett, Wash.	May 13
May 29.	Ft. Collins, Colo. Adv. May 20.	May 20
May 29.	Timpson, Tex.	May 20
May 29.	Greenwich, Conn. Adv. May 20.	May 20
May 29.	Superior, Wis.	May 20
May 30.	Cold Springs, Tex.	May 13
May 30.	Sheperd, Tex.	May 13
May 30.	Birmingham, Ala.	May 20
May 31.	Wooster, Ohio	May 20
May 31.	Riverside, Cal.	May 20
Jun. 1.	Hamilton, Ohio	May 6
Jun. 1.	Washington, D. C. Adv. May 6.	May 6
Jun. 1.	Crestline, Ohio	May 13
Jun. 1.	Galion, Ohio. Adv. May 13.	May 13
Jun. 1.	Escanaba, Mich.	May 20
Jun. 1.	Decatur, Ill.	May 20
Jun. 2.	Great Falls, Mont.	Apr. 22
Jun. 2.	Portland, Me.	May 20
Jun. 2.	Neenah, Wis.	May 20
Jun. 2.	Inglewood, Cal.	May 20
Jun. 3.	Bucyrus, Ohio	May 20
Jun. 3.	Steubenville, Ohio.	May 20
Jun. 5.	Columbus, Miss.	Apr. 29
Jun. 5.	Gate City, Va.	May 13
Jun. 6.	Indiana	May 13
Jun. 5.	Port Jervis, N. Y. Adv. May 13, 20.	May 13
Jun. 5.	Cleveland Heights (P. O. Warrenville), Ohio	May 13
Jun. 5.	Everett, Wash.	May 13
July 5.	Terrabonne, La. Adv. May 13.	May 13
Jun. 5.	Charleston, Miss.	May 20
Jun. 5.	Albany, N. Y. Adv. May 20.	May 20
Jun. 5.	Bloomfield, N. J.	May 20
Jun. 5.	Waterville, Wash.	May 20
Jun. 5.	Blaine, Wash.	May 20
Jun. 5.	Larimore, N. D.	May 20
Jun. 5.	Hackensack, N. J. Adv. May 20.	May 20
Jun. 5.	New Orleans, La.	May 20
Jun. 5.	Indiana	May 20
Jun. 5.	Union Hill, N. J.	May 20
Jun. 6.	Indiana	May 13
Jun. 6.	Vincennes, Ind. Adv. May 20.	May 20
Jun. 6.	Billings, Mont.	May 20
Jun. 6.	Papillion, Neb.	May 20
Jun. 6.	South Bend, Wash.	May 20
Jun. 6.	New Orleans, La.	May 20
Jun. 6.	Indiana	May 20
Jun. 6.	Stockton, Cal.	May 20
Jun. 7.	Sultan, Wash.	May 13
Jun. 7.	Palatka, Fla. Adv. May 6 to 20.	May 6
Jun. 7.	Albany, N. Y. Adv. May 20.	May 20
Jun. 7.	Cedarville, Ohio	May 20
Jun. 7.	Indiana	May 20
Jun. 8.	Tallahassee, Fla.	May 20
Jun. 8.	Kiefer, Okla.	May 20
Jun. 8.	Bakersfield, Cal.	May 20
Jun. 8.	Glenwood Springs, Col.	May 20
July 10.	Caldwell, Tex.	Apr. 22
Jun. 10.	Wichita, Kan.	May 13
Jun. 12.	Jefferson, Ohio	May 20
Jun. 12.	Euclid, Ohio	May 20
Jun. 13.	Dunn, N. C. Adv. May 20.	May 20
Jun. 14.	Eaton, Ohio Adv. May 20.	May 20
Jun. 15.	Greenfield, Ohio	May 20
Jun. 27.	Salt Lake City, Utah	May 13
July 10.	Greenwood, Miss.	May 20

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS.

Bids Close.		See Eng. Record.
May 22.	Irrigation, Fort Laramie, Wyo. Adv. Apr. 28.	Apr. 22
May 23.	State Canal Work, Contracts 128 and 129, Albany, N. Y. Adv. Apr. 29 to May 20.	Apr. 29
May 23.	Irrigation, Grand Junction, Col.	Apr. 29
May 23.	Irrigation, Wenatchee, Wash.	Apr. 29
May 23.	Weir, Sacramento, Cal.	May 13
May 23.	Drains, Waseca, Minn.	May 20
May 23.	Drainage, Davison, Mich.	May 20
May 24.	Concrete Dam, Etc., Fort Dodge, Iowa	May 13
May 25.	Flood Gates, Savannah, Ga.	May 13
May 25.	Irrigation, St. Ignatius, Mont. Adv. Apr. 22.	Apr. 22
May 25.	Cement, Denver, Col. Adv. Apr. 29.	Apr. 29
May 25.	Irrigation, Ft. Laramie, Wyo.	May 6
May 26.	Dredging, Chicago, Ill. Adv. May 6 to 20.	May 6
May 26.	Drainage, Aberdeen, S. D.	May 13
May 26.	Drains, Webster City, Iowa	May 20
May 26.	Dredging, Boston, Mass.	May 20
May 29.	Drainage, Bloomfield, Ia. Adv. Apr. 29, May 6.	Apr. 29
May 29.	Drainage, Tallahassee, Fla. Adv. Apr. 29 to May 13.	Apr. 29
May 29.	Flood Protection Wall, Portsmouth, Ohio (2 props.) Adv. May 20.	May 20
May 29.	Irrigation, Anderson, Cal.	May 20
May 31.	Dredging, Etc., Seattle, Wash.	May 13
May 31.	Levee Work, New Orleans, La.	May 20
Jun. 1.	Dredging, Tarrytown, N. Y. Adv. May 6 to 20.	May 6
Jun. 1.	Drainage, Oskaloosa, Iowa Adv. May 13, 20.	May 13
Jun. 1.	Levee, Port Allen, La.	May 20
Jun. 1.	Dock Repairs, Albany, N. Y.	May 20
Jun. 1.	Repairs to Wharf, Tompkinsville, N. Y. Adv. May 20.	May 20
Jun. 2.	Breakwater, Indiana Harbor, Ind. Adv. May 6 to 20.	May 6
Jun. 3.	Ditch, Caledonia, Mich.	May 20
Jun. 3.	Dredging, Greenville, Ohio Adv. May 20.	May 20
Jun. 5.	Fill, Seattle, Wash.	May 20
Jun. 7.	Cleaning Channel, Newark, Ohio	May 20
Jun. 8.	Rip rap, Tompkinsville, N. Y.	May 20
Jun. 10.	Flood Protection, Ray, Ariz. Adv. May 13, 20.	May 13
Jun. 10.	Dredging, Michigan City, Ind. Adv. May 20.	May 20
Jun. 12.	Dredging, Philadelphia, Pa. Adv. May 20.	May 20
Jun. 15.	Irrigation, Payson City, Utah Adv. May 6.	May 6
Jun. 15.	Irrigation, Hermision, Ore. Adv. May 13.	May 13
Jun. 15.	Dredging, Baltimore, Md. Adv. May 20.	May 20
Jun. 16.	Improv. Creek, Belleville, Ill.	May 20
Jun. 15.	Water Power Lease, Joliet, Ill. Adv. May 20.	May 20
Jun. 22.	Irrigation, Malta, Mont. Adv. May 13.	May 13

PUBLIC BUILDINGS AND SCHOOLS.

Bids Close.		See Eng. Record.
May 22.	Tahoka, Tex. Adv. May 6, 13.	May 6
May 23.	Glenville, W. Va.	May 6
May 23.	Downey, Cal.	May 6
May 23.	Cincinnati, Ohio	May 6
May 23.	Hartford, Conn	May 13
May 23.	Douds Leando, Iowa	May 20
May 23.	Montreal, Que.	May 20
May 24.	Madison Barracks, N. Y. Adv. Apr. 29 to May 20.	Apr. 29
May 24.	Wahjamega, Mich.	Apr. 29
May 24.	Carthage, Ohio	May 13
May 24.	Bricelyn, Minn.	May 20
May 24.	Broad Ripple, Ind.	May 20
May 25.	Butler, Pa.	Mar. 18
May 25.	Washington, D. C. Adv. May 6, 13.	May 6
May 25.	David City, Neb.	May 13
May 25.	Lakeland, Ky.	May 20
May 25.	Glenville, W. Va.	May 20
May 26.	Millarton, N. D.	May 6
May 26.	Anthon, Iowa	May 20
May 26.	Murtaugh, Idaho	May 20
May 26.	Mt. Pleasant, Iowa	May 20
May 26.	Ellwood City, Pa.	May 20
May 26.	Ellwood City, Pa. Adv. May 20.	May 20
May 27.	Bowman, S. D.	May 6
May 27.	Reading, Ohio	May 6
May 27.	Keyport, Wash.	Apr. 29
May 27.	Ogdensburg, N. Y.	May 13
May 27.	Grand Forks, N. D.	May 13
May 27.	St. Louis, Mo.	May 13
May 27.	Tiltonville, Ohio	May 13
May 27.	Bristolville, Ohio	May 13
May 27.	Nopeming, Minn.	May 20
May 27.	Duluth, Minn.	May 20
May 29.	Arden, Pa.	Apr. 29
May 29.	Urbana, Ill.	May 6
May 29.	Tuba, Ariz.	May 6
May 29.	Wilton, N. D.	May 13
May 29.	Sioux City, Iowa	May 20
May 29.	Trenton, N. J.	May 20
May 29.	Salt Lake City, Utah	May 20
May 29.	Boston, Mass.	May 20
May 29.	Emmet, Idaho.	May 20
May 30.	Plainview, Tex.	May 20
May 31.	Ronceverte, W. Va.	May 20
May 31.	Washington, D. C. Adv. May 13.	May 13
Jun. 1.	Lowellville, Ohio	May 13
Jun. 1.	Washington, D. C. Adv. May 13.	May 13
Jun. 1.	Fillmore, Utah.	May 13
Jun. 1.	Youngstown, Ohio	May 20
Jun. 1.	Sioux City, Iowa	May 20
Jun. 2.	Washington, D. C. Adv. May 13.	May 13
Jun. 2.	Lebanon, Ohio	May 13
Jun. 2.	Connellsville, Pa.	May 20
Jun. 3.	Kirkerville, Ohio	May 20
Jun. 5.	Belton, Tex.	May 6
Jun. 5.	Lake Charles, La.	May 13
Jun. 5.	Beattyville, Ky.	May 20
Jun. 5.	Hettinger, N. D.	May 20
Jun. 6.	Waynesville, N. C.	May 13
Jun. 6.	Geneva, Ill.	May 13
Jun. 6.	Chambersburg, Pa.	May 20
Jun. 6.	North Arlington, N. J.	May 20
Jun. 6.	Leoti, Kan.	May 20
Jun. 6.	Red Cloud, Neb.	May 20
Jun. 7.	Portland, Me.	May 6
Jun. 7.	Early, Iowa	May 20
Jun. 8.	Pineville, W. Va.	Apr. 29
Jun. 8.	Marysville, Tenn.	May 6
Jun. 8.	Waynesville, N. C.	May 6
Jun. 8.	Manistique, Mich.	May 20
Jun. 8.	Beloit, Ohio	May 20
Jun. 10.	Irvington, Ind.	May 13
Jun. 10.	Hanover, Ohio	May 20
Jun. 12.	Newell, Iowa	May 20
Jun. 12.	Elmira, N. Y. Adv. May 20.	May 20
Jun. 13.	Trenton, N. J. Adv. May 20.	May 20
Jun. 13.	Illinois	May 20
Jun. 13.	New York, N. Y. Adv. May 20.	May 20
Jun. 15.	South Boston, Va.	May 20
Jun. 16.	Middletown, Ohio	May 13
Jun. 19.	Neenah, Wis. Adv. May 13, 20.	May 13
Jun. 20.	Putnam, Conn.	May 20
Jun. 20.	Springdale, Iowa	May 20
Jun. 21.	Douglas, Ariz.	May 20
Jun. 22.	Minden, La.	May 20
Jun. 26.	Redfield, S. D. Adv. May 20.	May 20

PRIVATE BUILDINGS.

Bids Close.		See Eng. Record.
May 23.	Toronto, Ont.	May 20
May 24.	Kasson, Minn.	May 20
May 27.	Cincinnati, Ohio	Apr. 29
May 29.	Annapolis, Md.	May 20
May 30.	Windsor, Ont.	May 20
Jun. 1.	Warren, Pa.	May 20
Jun. 1.	Kansas City, Mo.	May 20
July 1.	New Orleans, La.	May 20
July 1.	Grand Island, Neb.	May 20
Jun. 13.	Chicago, Ill.	May 13

MISCELLANEOUS.

Bids Close.		See Eng. Record.
May 22.	Derrick Boat, Norfolk, Va. Adv. Apr. 22, May 20.	Apr. 22
May 22.	Towers, Buffalo, N. Y. Adv. May 6.	May 6
May 22.	Cement, Heidelberg, Ky.	May 20
May 22.	Cement, Lorain, Ohio	May 20
May 22.	Band Stand, Cincinnati, Ohio	May 20
May 23.	Lighting Bridge, Baltimore, Md. Adv. May 6, 13.	May 6
May 23.	El. Rys., Brooklyn, N. Y.	May 13
May 23.	Elevator, Newark, N. J.	May 13
May 23.	St. Ry., Toronto, Ont.	May 20
May 23.	Elevator, New York, N. Y.	May 20
May 23.	Iron Stairs, Alden, N. Y.	May 20
May 25.	Cement, Denver, Col. Adv. April 29.	Apr. 29
May 25.	El. Rys., New York, N. Y.	May 13
May 25.	Garbage Disposal Plant, Whiting, Ind. Adv. May 13.	May 13
May 25.	Garbage, Elizabeth, N. J.	May 20
May 25.	Garbage Disposal, Whiting, Ind.	May 20
May 26.	Jetty, Wilmington, Del.	May 13
May 26.	Ferryboat, New York, N. Y.	May 20
May 26.	Traveling Cranes, Houston, Tex.	May 20
May 27.	Borings, New York, N. Y.	May 20
May 27.	Boring, Philadelphia, Pa.	May 20
May 29.	Iron Stairs, etc., Washington, D. C.	May 20
May 29.	Elevator Gates, Providence, R. I.	May 20
Jun. 1.	Design for Sign, Springfield, Ill.	May 6
Jun. 1.	El. Rys., New York, N. Y.	May 20
Jun. 3.	Dredge, Vallejo, Cal.	May 6
Jun. 9.	Steamer, Washington, D. C. Adv. May 13, 20.	May 13
Jun. 10.	Stairs, etc., Lockport, Ill.	May 20
Jun. 12.	Coal, Norfolk, Va. Adv. May 13.	May 13
Jun. 12.	Platform, Minneapolis, Minn.	May 12
Jun. 30.	Mechanical Mail Handling Appar., New York, N. Y.	May 12
———	El. Rys., New York, N. Y. Adv. Apr. 29 to May 13.	Apr. 29

Factors That Argue Continuation of Present Activity for Some Time Without Sudden Decline

Presidential Year and Probable Effect on This Country of End of European War Introduce Uncertainty That May Check Overextension Which Has Marked Previous Periods of Prosperity

AMONG the fundamental statistics recognized by leaders in the business world as indicating the present condition of the country and the probable future trend of business, new building, bank clearings, total reserves, exports and foreign trade, the production of pig iron, railroad earnings, bank deposits and commodity prices show increases which are favorable to continued business activity. Fire losses and failures decreased during April both as compared with the previous month and with April, 1915. On the other hand, gold movements have not been so favorable to this country as last year, sales of both stocks and bonds on the New York Stock Exchange have been much smaller in volume than last year, while prices have remained the same or only advanced slightly, and much smaller crops are expected than those of last year. It is estimated that the winter wheat crop will produce 23.8 per cent less than that of last year. Prices, the volume of business and general conditions improved during the latter part of 1915 with a rapidity that has not been equaled in many years, and reached such a high point in the beginning of the year that it is felt in many quarters that further advances are not to be looked for. Construction work, however, lags behind general improvement.

The course of things in the past under normal world conditions has been at such times toward overextension, a slight decline and a sharp break, followed by one or more years of depression or uncertain conditions. The suddenness and severity of the break has usually been in proportion to the overextension and to the blindness of the general public to the preceding indications of decline. There are several conditions, however, which seem likely to work as a check on overextension in the present instance. There is considerable political uncertainty at present which is causing some hesitation, though if the Republican party is reunited at the coming convention it is possible that many will take it as a highly favorable sign and the signal for continued expansion. There is also much uncertainty as to conditions in the money market at the close of the European War. Will Europe need all of its capital at home, and will it come to this country for more with offers of large interest returns? Or, when the drain on European capital created by the present war is at an end, will it rush to this market to purchase the securities of a country which is in a more stable position than any other? Will Europe practically cease to buy from us when the return of the armies to peaceful pursuits puts it in a better position to supply its own wants, or will Europe find it necessary to continue abnormal purchases of American farm and manufactured products after the war until a complete readjustment has taken place?

In view of these uncertainties, it is likely that the bankers of this country will hold the investment of funds in securities to a lower point than would otherwise be the case, and endeavor to keep much of their surplus in a liquid or readily convertible form so that they will be in a position to meet any contingency. This tendency, if it develops to marked extent, should check to some degree any abnormal investment in new enterprises, such as has always been a factor in bringing periods of prosperity to an end.

It might be pointed out that the lines most in danger of overextension at this time are those to which our export trade gave the initial impetus which started the rapid recovery of 1915. In these lines, however, the large steel, munitions and manufacturing concerns are generally thought to have kept their eyes open, and made sure that whatever decline took place in orders, their extensions would be paid for by the immediate business, and the worst that could happen would be the temporary closing of the new plants in the face of a great decline in orders.

The danger to contractors in a period of possible overextension is that they will expand their business as if the extended scale of operation apparent at the moment were to continue indefinitely. The well-managed concerns, however, never make this mistake. As to whether such a situation is likely to be reached in the present year, the question of the volume of money that will be invested in American bonds and other securities covering construction work has a most important bearing. An investigation of this situation by the Engineering Record is under way and it is hoped that some definite indications will be found to serve as a guide for engineers and contractors on this subject.

Buildings

Building work is now very active and appears likely to continue so. Large contracts reported in this issue include the following: Buffalo, $1,000,000 chemical plant; Philadelphia, $550,000 apartment house; Nicetown, Pa., $320,000 machine shop; Coatesville, Pa., $300,000 machine shop; Erie, Pa., $300,000 grain elevator; Cleveland, steel contract awarded on $1,000,000 warehouse, contract awarded for $300,000 addition to hotel; Cincinnati, $250,000 college building, $250,000 machine shop; Chatham, Ont., contracts awarded on $1,000,000 refinery. In addition, bids have been opened on the post office at Newport, R. I., which will cost $254,000, and bids are desired for erecting a $500,000 school at Erie, Pa.

A large amount of proposed work noted includes the following: Bridgewater, Mass., $236,000 school to be built; New York, plans approved, $500,000 church; Dunkirk, N. Y., $200,000 college building contemplated; Philadelphia, plans prepared, $250,000 school building; South Bethlehem, Pa., reported $500,000 addition to steel plant to be made; Turtle Creek, Pa., plans being prepared, $200,000 high school; Bristol, Tenn., $200,000 college building to be built; Norwood Heights, Ohio, architect selected, $450,000 seminary; Cleveland, $500,000 freight depot proposed, plans being prepared for $250,000 labor temple, $200,000 church proposed and electric light company to erect buildings to cost $290,000; Lafayette, Ind., plans being prepared, $250,000 armory; Detroit, plans being prepared, $200,000 office building; Duluth, $500,000 automobile plant proposed; St. Paul, $2,500,000 packing plant proposed; Houston, Tex., plans prepared, $500,000 warehouse; Fort Worth, Tex., $250,000 Masonic temple to be built; Smithfield, Utah, $1,000,000 sugar refinery contemplated; San Bernardino, Cal., $250,000 hotel proposed, Los Angeles, plans being prepared, $700,000 theater; Winnipeg, Man., plans prepared, $250,000 building; Vancouver, B. C., $500,000 hotel proposed.

Bridges and Roads

A contract for an $84,000 bridge has been awarded at Philadelphia. The lowest bid received for constructing a viaduct at Peoria, Ill., was $108,000. Three viaduct contracts amounting to $147,000 have been awarded at Astoria, Ore. The lowest bid received for constructing the reinforced-concrete bridge at Modesto, Cal., was $112,000. The bill appropriating $1,000,000 for replacing the aqueduct bridge across the Potomac River at Washington has been signed by the President. Two reinforced-concrete bridges, one 1000 ft. long, are coming up at Des Moines, Iowa. A $75,000 bridge is to be built at Chandler, Ariz.

Paving work is also active, especially in small contracts. Contracts awarded include: Penns Grove, N. J., road work, $52,000; New Philadelphia, Ohio, road contracts, $143,000; Monroe, Mich., three contracts, $98,000, $73,000 and $64,000; Bakersfield, Cal., concrete paving, $64,000. Bids are asked on the following work: Pennsylvania, further state road work; New Martinsville, W. Va., 15 miles of road work; Dayton, Ohio, paving work to cost $100,000; Columbus, Ind., paving work to cost $80,000; Aitkin, Minn., road work to cost $164,000. Proposed work noted includes: Owensboro, Ky., $600,000 road bonds sold; Benton, Tenn., $100,000 for road work; Lawrenceburg, Tenn., $300,000, road work.

Waterworks and Sewers

Waterworks and sewer construction noted includes the following: New Brunswick, N. J., filtration plant and standpipe costing $96,000 contracted for; Rector, Ark., $54,000 waterworks and sewer construction contracted for; Commerce, Okla., waterworks contracts totaling $85,000 awarded; Dayton, Ohio, bids desired, 1 mile of 9-ft. storm sewer; La Porte, Ind., bids desired, reinforced-concrete reservoir; Hagerstown, Md., sewer system costing $750,000 proposed; Johnstown, Pa., ordinance authorizing $200,000 sewer construction passed; Dover, Ohio, waterworks construction costing $80,000 proposed; Zanesville, Ohio, $350,000 pumping station and water supply to be built; McCombs City, Miss., $75,000 to be spent for sewer construction, Portland, Ore., $225,000 sewer planned.

Miscellaneous

Bids have been opened in New York City on two subway contracts, one of which was awarded at $1,847,000 and the low bid on the other of which was $2,528,000. A $280,000 dredging contract has been awarded at the same city, and bids were received on a $630,000 barge canal contract at Albany, N. Y. Philadelphia has passed the $67,000,000 bond issue for rapid transit construction and port improvements and a $47,000,000 issue for general improvements. Erie, Pa., has voted money for the flood protection work recommended, which will cost $950,000. Other proposed work includes: Indian Head, Md., $1,000,000 railroad company promoted; York, Pa., $500,000 to be spent for railroad improvements; Middletown, Tenn., receiver authorized to build railroad line costing $700,000; Mobile, Ala., $740,000, port improvements recommended; San Antonio, Tex., surveys being made for 240-mile railroad; Seattle, plans prepared, $200,000 drydock.

CONTRACTING NEWS

Of Special Interest to Engineers, Contractors, Builders and Manufacturers of Engineering and Building Supplies

WATERWORKS

PROPOSED WORK.

Red Creek, N. Y.—H. C. Kittridge, Rochester, is engineer for proposed water works for which citizens voted $30,000 bonds. Address Village Clerk.

Passaic, N. J.—City considering purchasing distributing system of East Jersey Water Co. at cost of $400,000.

Perth Amboy, N. J.—City will issue $100,000 bonds for extensions to water mains from Ernston standpipe to Raritan River.

Baldwyn, Miss.—It is proposed to install a water works system to cost $10,000, including 50,000-gal concrete reservoir, 1350 gal. pump, two 25-hp. crude oil engines, etc. X. A. Kramer, Engineer, Magnolia, Miss.; H. A. Mentz, Asst. Engr., Magnolia.

Dover, Ohio.—It is proposed to install at water works 2,000,000-gal. electric pump, 1,500,000-gal. standpipe, 70 ft. diameter, 53 ft. high; extend water lines to cost $22,000, and for the labor $12,000 additional; total cost $50,000. Contract will be let in July or August. George Arnold, New Philadelphia, Ohio, Engineer. P. W. Hill, Director Public Service.

Fosteria, Ohio.—City officials considering constructing municipal electric lighting system, water works and sewage disposal plant.

Zanesville, Ohio.—The $350,000 bonds authorized at recent election will be used to construct a pumping station and furnish a water supply from wells. W. W. Roach, Director Public Service.

Madison, Wis.—Mead & Seastone, Engineers, 530 State Street, submitted to Special Council Committee a report estimating cost of developing artesian water supply at $222,000. Engineers recommend that six wells not located on station grounds be provided with air lifts and that the compressors be installed at the station. Four wells on station grounds provided with air lifts, an 8,000,000-gal. pump to be installed at the station, and a 1,500,000-gal. addition to reservoir at East Dayton Street, two new air compressors to be driven by steam, two new 200-hp. and a 30-in. equalizer pipe installed, also a new smokestack 6 ft. in diameter and 150 ft. high installed. The building of a new pumping station on a new site is also under consideration by the Commission.

Wisconsin.—See "Sewerage and Sewage Disposal."

Wisconsin.—New water works proposed in Denmark, East Wauwatosa, and improvements planned to water works at Clintonville, Colby, Columbus, Cornell, Cudahy, East Milwaukee, Eau Claire, Grand Rapids, Kohler, La Crosse, Nekoosa, New Lisbon, Oconomowoc, South Milwaukee, Sturgeon Bay, Two Rivers, Wauwatosa, and West Allis.

Rochester, Minn.—Election will be held to vote $175,000 bonds for purchase and rehabilitation of plant of Rochester Water Co.

Lawrence, Kan.—Recent election in favor of issuing $175,000 bonds for purchase of present water works has been declared invalid, and another election is to be held June 15. Address City Clerk.

Osborne, Kan.—The extension of lines and construction of a standpipe contemplated. E. J. Archer & Company, Kansas City, Mo., Engineers; S. P. Crampton, City Clerk.

Denton, Mont. — See "Paving and Roads."

Glendive, Mont.—Citizens May 15 voted $65,000 bonds for filtration plant. F. H. Handforth, Engineer, Glendive, and Burns & McDonnell, Kansas City, Mo., Engrs. August Colin, Clerk.

Great Falls, Mont.—See "Paving and Roads."

Highwood, Mont.—Water works costing $12,000 are to be installed including pump, 90 gal. per minute, total head 175 ft., reservoir 30,000 gal., 10 hydrants, probably steel pipe. Gerhorz & Jaqueth Engineering Company, Great Falls, Engineers.

Bartlett, Tex.—Improvements are to be made to the water works. Address City Engineer.

Beaumont, Tex.—Residents of South Park, a suburb of Beaumont, said to be considering issuing $100,000 bonds for building a pipe line and lease it to city for furnishing water to South Park. Address Mayor.

Cooledge, Tex.—Citizens voted $16,000 bonds for water works. Address City Clerk.

Crowell, Tex.—O'Neil & Sons, Dallas, are engineers for the proposed water works, to cost $18,000. W. B. McCormick, City Secretary.

Clinton, Okla.—Citizens will vote, May 29, on issuing $50,000 bonds for water works. Plan is to pipe supply from near Foss, Okla. Address City Clerk.

Howe, Okla.—Town voted $50,000 water works bonds. Address Town Clerk.

Welch, Okla.—Water works bonds for $24,000 sold. Contract will soon be let. Address City Clerk.

Seattle, Wash.—City Council adopted the report of the City Utilities Department granting petition of the Second Water District of King County for Cedar River supplies at the north city limits. District is about 6 miles long. L. B. Young, Superintendent Water.

Los Angeles, Cal.—City Commission has issued an order authorizing the Whittier Water Co. to lay pipe along Colima Road in Los Angeles County from its main on the Los Angeles and Santa Ana Road to the tracts known as the Orchard Dale Tract and the Luitwieler, a distance of about 10,000 ft.

Oatman, Ariz.—Water works and sewerage system to be installed by Mohave Oatman Water Company by day-labor. D. L. Mayhew, Secretary Company.

Victoria, B. C.—It is proposed to connect a 12-in. pipe with high-pressure fire system, also to give a greater supply to high-level district. Cost $15,000. Address Water Commissioner.

BIDS DESIRED.

Medford, Mass.—Until May 31, by Water and Sewer Commissioners for about 500 water meters.

Hartford, Conn.—Until June 6 by Board Contract & Supply for building a concrete steel conduit to inclose Gully Brook, advertised in Engineering Record.

New Brunswick, N. J.—Until June 6, by City Commissioners, for furnishing and delivering one motor-driven centrifugal pumping unit of 3,000,000 gal. per 24-hr. capacity, and two motor-driven centrifugal pumping units of 6,000,000 gal. per 24-hr. capacity, against a total combined heat of 100 ft., advertised in Engineering Record. Asher Atkinson, City Engineer.

Williamsburg, Va.—By city for franchises for electric car line, light and power, sewerage and water, advertised in Engineering Record. For information address W. L. Jones, President City Council.

Shreveport, La.—Until May 29, for 11,890 ft. 6 to 12 in. c. i. pipe, Class B, 20 tons ordinary c. i. specials, valves, boxes, hydrants, etc. Address City Secretary.

Farmersville, Ohio.—Until June 3 (extension of date), by A. F. Gilbert, Clerk Board Trustees of Public Affairs, for constructing water works, to consist of deep well pump, distribution system, valves, hydrants, pipes, etc. The National Company, Engineers, South Bend, Ind.

Garrett, Ind.—Reported desired until June 1, by W. W. Mountz, City Clk., for constructing reinforced concrete reservoir of 275,000 gals. capacity.

LaPorte, Ind.—Until June 12, by Board Public Works, for a reinforced concrete reservoir, advertised in Engineering Record. L. Drew Goddard, City Engineer.

Crystal Falls, Mich.—Until June 5, by W. J. Gribble, City Clerk, for water works extension to consist of excavating, hauling and laying pipe appurtenances, and refilling trenches for water distribution system.

Maywood, Ill.—Until May 29 (readvertisement) by Edward J. Thelin, Village Clk., for constructing a 900,000-gal. storage reservoir and laying necessary pipe and connections.

Sheboygan Falls, Wis.—Until June 10, by Frank R. Roeyer, City Clerk, for constructing water works to cost $35,000.

Whitewater, Wis.—Until June 9, by A. N. Savee, Secretary Water Commission, City Hall, for drilling and reaming of 312 ft. of 15-in. holes and 52 ft. or more of 8-in. holes in rock for the repair of two deep wells at the water works plant. W. G. Kirchoffer, Engineer, Madison.

Blairstown, Iowa.—Until May 29, by City Clerk for constructing water works.

St. Paul, Min.—Until June 12 by August Hohenstein, Purchasing Agent, for furnishing material, manufacturing complete, and delivering at McCarron Pumping Station two rotary screens. Estimated cost, $6,000.

Westbrook, Minn.—Until May 31, by Joseph Budish, City Clerk, for a 40,000-gal. steel tank, to be erected on an 80-ft. tower.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Boston, Mass.**—Contract for water mains in Brighton, North Roxbury and Hyde Park (bids opened May 15) awarded John Guarlalo, 45 Brook Avenue, Roxbury, at $2,548.

Newton, Mass.—Lowest bid, opened May 15, for constructing sections 3 and 4 of reinforced concrete reservoir, on Waban Hill, submitted by Old Colony Construction Company, 6 Beacon Street, Boston, at $54,107. Next three bidders: B. F. Smith Company, 136 Federal Street, Boston, $64,736; T. Stuart & Son Company, Newton, $71,058, and G. Feralio & Company, 31 North Square, Boston, $72,117. J. C. Whitney, Water Commissioner.

Hartford, Conn.—Lowest bid, opened May 16 by Board of Water Commissioners (C. M. Saville, Ch. Engr.), for furnishing and erecting one vertical pressure filter in town of Canton submitted by Norwood Engineering Company, Florence, $2,815.

★**New Brunswick, N. J.**—Contract for construction of filtration plant awarded to Roberts Filter Co. of Darby, Pa., at $77,520.

★Contract for constructing steel standpipe awarded to Chicago Bridge & Iron Wks. Co., Chicago, Ill., at $18,730.

★**Lebanon, Pa.**—Following are four lowest bids opened May 19 by Mayor and Council for constructing water distribution system: M. A. Mangan & W. S. Pugh of Pottsville, $14,312 (awarded contract); F. J. Reilly, $14,521; Martin Applegate & Earl, $14,831; and D. G. Sturgeon, $16,423.

★**Memphis, Tenn.**—Contract awarded by city for reservoirs in connection with North Memphis Levee Project as follows: No. 2 and 3 to Koehler Bros., Fowler Constr. Co., $28,371 and $25,633 respectively, and reservoir No. 4 to A. De Franceschi, at $11,547, contractors of Memphis, Tenn.

★**Wilmington, Del.**—Following are unit figures of successful bidder and next three lowest bids opened May 12 by Board Water Commissioners for constructing a 12,000,000-gal. mechanical filter plant and appurtenances—(I) total minus item 11a, (II) total minus item 11b: (a) Roberts Filter Mfg. Co., Darby, Pa., (I) $154,080 (awarded contract), (II) $154,318; (b) Pittsburgh Filter Mfg. Co., Pittsburgh, Pa., (I) $156,640, (II) $157,150; (c) Edward L. Bader, Atlantic City, N. J., (I) $165,250, (II) $166,450; (d) M. L. Bayard & Co., Philadelphia, Pa., (I) $193,000, (II) $218,800. (Engineer, George W. Fuller, 170 Broadway, New York, N. Y.)

Item		(a)	(b)	(c)	(d)
1	8,700 cu. yd. earthwork, general	$1.15	$1.00	$1.00	$1.40
2	100 cu. yd. earthwork for filtered-water main	6.00	2.00	1.00	3.00
3	600 cu. yd. rock excavation, general	2.10	2.25	2.50	3.00
4	100 cu. yd. rock excavation for filtered-water main	7.50	5.00	4.00	5.00
5	1,400 cu. yd. concrete masonry for substructures	8.35	12.00	12.50	12.00
6	1,200 cu. yd. concrete masonry for superstructures	17.50	14.50	12.50	18.00
7	14,000 sq. ft. machine surfacing of concrete	0.06	0.05	0.07	0.10
8	11,000 sq. ft. granolithic surfacing of concrete	0.05	0.10	0.07	0.12
9	170,000 lb. steel reinforcement	0.045	0.046	0.06	0.05
10	Piping and filter equipment, complete	44,000.00	46,990.00	44,000.00	67,000.00
11a	Operating tables, complete	1,964.00	2,310.00	2,400.00	30,000.00
11b	Stands for operating filter valves and for mounting gages, complete	1,726.00	1,800.00	1,200.00	4,200.00
12	Filter gravel and filter sand, complete	2,900.00	3,400.00	3,100.00	5,300.00
13	Superstructures, complete	30,688.00	32,000.00	48,000.00	32,200.00
14	Alterations to existing pre-filters, complete	5,000.00	3,500.00	2,500.00	5,400.00
15	Waterproofing, complete	1,321.00	980.00	1,300.00	2,000.00
16	Filtered-water main, complete	14,100.00	13,400.00	10,000.00	12,500.00

★**Cleveland, Ohio.**—Contract awarded by Bd. of Control for constructing superstructure of gate and screen well house, crane hoists and screens for water works, Division Avenue Pumping Station to Brandt & Weitz Constr. Co., care Board of Control, at $14,378.

★**Rock Island, Ill.**—Contract for laying water mains in Twenty-ninth Avenue and Thirty-ninth Street awarded P. V. TrenkenaChuk, Rock Island, at $16,787, for 6570 ft. 10-in. pipe, 22 hydrants, etc. W. Treichler, Engineer, Rock Island.

★**Kewaunee, Wis.**—Contract for furnishing one 750,000-gal. pump awarded by Board Public Works to Eppington Carpenter Pump Company, Pittsburgh, Pa., at $1,052.

★**Alliance, Neb.**—Contract for improving water works (bids opened May 16) awarded Nebraska Construction Company, Lincoln, at $8,715. Carter Calder, City Clerk.

★**Rector, Ark.**—The Commissioners Water Works Improvement Dist. No. 1, awarded contract for constructing water works and sewers to Long & Hagerty of Bessemer, Ala., at $54,000.

★**Milford, Tex.**—Contract for constructing water works awarded E. D. Lumsden, Sherman, Tex., at $5,924. Henry E. Elrod, Consulting Engineer, Dallas.

★**Commerce, Okla.**—Contract for constructing a distributing system, to include c.-i. water mains, pumping station and reinforced concrete reservoir, awarded W. S. Sherman Machine & Iron Works, Oklahoma, Okla., at $17,849; for furnishing and erecting complete air lift equipment, duplex power pumps, motors, piping and all electric equipment, to Worthington Pump & Machinery Corporation, Kansas City, Mo., at $6,235; fire hydrants and valves to Ludlow Valve Mfg. Company at $1,164, and furnishing and erecting a 75,000-gal. elevated tank and tower to Chicago Bridge & Iron Works, Chicago, Ill., at $5,700. Benham Engineering Company, Engineers, Oklahoma City.

★**Portland, Ore.**—Contract for furnishing 850 ⅝-in. water meters (bids opened May 8) awarded Gamon Meter Co., Newark, N. J.

★**North Bay, Ont.**—Contract awarded Canadian Allis-Chalmers, Ltd., Toronto, for 4 and 6-in. mains, about 3170 ft., and specials. H. J. McAuslan, Town Engineer.

SEWERAGE AND SEWAGE DISPOSAL

PROPOSED WORK.

Peabody, Mass.—The sewer system proposed at a cost of $22,000 will be done by day labor. Frank Emerson, Town Engineer.

Ansonia, Conn.—Sewer bonds for $20,000 have been sold by the city. Address City Clerk.

Bridgeport, Conn.—City Engineer Alfred H. Terry in his annual report estimates the cost of necessary sanitary intercepting sewers, pumping stations and treatment plants which city contemplates constructing at $1,521,000 and recommends work begun at once.

Jamestown, N. Y.—Plans being prepared by Chapman & Graham, Engineers, Gokey Building, Jamestown, for an inverted siphon or pressure sewer under Chadakoin River near Fairmount Avenue Bridge.

Kenmore, N. Y.—White & Gitman, Buffalo, are engineers for the storm water sewers to be constructed at a cost of $20,000. E. W. Johnson, Village Clerk.

Monroe, N. Y.—Clyde Potts, 30 Church Street, New York, engaged to design a sewerage system.

Dover, N. J.—Board Sewerage Commission approved plans for a survey of city for installation of sewer system. Address City Clerk.

Plainfield, N. J.—Construction of a sewage disposal plant in Middlesex County contemplated by Plainfield, North Plainfield and Dunellen.

Erie, Pa.—See "Railroads."

Johnstown, Pa. — Ordinance passed Council for $200,000 loan, to be used for laying two miles 62-in. sewer mains. J. R. Crissey, City Eng.

Hagerstown, Md.—It is proposed to lay 50 miles of 8 to 30-in. pipe sewer and one mile of 54-in. concrete sewer, to cost $750,000. J. B. Ferguson, City Engineer.

McCombs City, Miss.—City will spend $75,000 or more in construction of sewer system. Address O. B. Quinn, Mayor.

Wisconsin.—Citizens voted bonds for constructing sewerage systems in Elkhart Lake, Randolph and Clinton, and for water works and sewers in Chilton. Plans have been prepared for water works and sewerage in Pulaski, but construction will not begin until 1917.

Ottumwa, Iowa.—New bids will be asked about end of June for 3¼ miles of 10- and 24-in. sewer in Millner, Sheridan and Iowa Avenues. J. F. Brady, City Engineer.

Stuart, Iowa. — Preliminary survey being made for the proposed sewer system. Election to be held on constructing said system. Theo DeLay, Engineer, Creston; G. F. Taylor, City Clerk.

Butte, Mont.—City Council considering installation of storm sewers. J. J. Armstrong, Commissioner Public Works.

Great Falls, Mont.—See "Paving and Roads."

Kansas City, Mo.—Sewer bonds for $200,000, bridge and viaduct bonds for $200,000, work house and house of correction bonds for $75,000 will be sold June 1 by George H. Edwars, Mayor, and Eugene H. Blake, City Controller.

Arlington, Tex.—City has for sale $10,000 sewer bonds. F. R. Wallace, City Clerk.

Sweetwater, Tex.—Citizens May 10 voted $50,000 bonds for constructing sewer system and Imhoff sewage disposal plant. Contract will be let in June. H. C. Hord, Jr., City Engineer.

Portland, Ore.—Reported plans about to be prepared for reconstructing Tanner Creek Sewer; estimated to cost $225,000. P. Dater, City Engineer.

Seal Beach, Cal.—S. H. Finley, Santa Ana, appointed City Engineer and directed to prepare preliminary plans for a sewer system.

Fernie, B. C.—Town Engineer William J. Ramsay preparing plans for sewers to cost about $30,000.

BIDS DESIRED.

Huntington, Mass.—Until June 1, by Prudential Committee and Board of Commissioners of Huntington Fire District (Dwight W. Stowell, Chmn.), for 5700 ft. 8 and 24-in. sewer. For further particulars address James L. Tighe, Engineer, 189 High Street, Holyoke.

Wilson, Conn.—Until June 6 by the Wilson Fire District for constructing 10,000 ft. 8 to 18-in. vitr. tile sewer. Homer R. Turner, Engr., Windsor.

Binghamton, N. Y.—Until May 31, by Board Contract and Supply, for constructing sewers in Balcolm Avenue, Lewis, Louisa and Schubert Streets. W. Earl Weller, City Engineer.

Brooklyn, N. Y.—Until June 7 by L. H. Pounds, Borough President, for furnishing material and constructing complete superstructures of the sewage pumping station at Morgan Avenue and Maspeth Avenue, Section 2, of storm sewers and sanitary sewers in portions of Maspeth Avenue, Conselyea Street and Garden Avenue, and a forcs main and all appurtenances in Maspeth and Morgan Avenues. Security $25,000.

Long Island City, N. Y.—Until May 29 by Maurice E. Connolly, Pres. Queens Boro., for constructing sewers and appurtenances in Jamaica Avenue, Maure Avenue, Woodhaven Avenue and other streets. Security $59,000.

Point Pleasant, N. J.—Until June 6, by W. J. Newbury, Borough Clerk, for constructing an extension to sewer system to cost $21,000. Bonds will be sold June 1. R. W. Morris, Engineer, Point Pleasant.

South Orange, N. J.—Until May 29 by Street and Highway Committee of the Board Trustees of Village of South Orange for constructing storm water sewers in Ridgewood Road and Third Street, sanitary sewer in Halsey Place and in Page Terrace.

Brentwood, Pa.—Until June 1, by Borough Sewer Committe (H. G. Benson, Chmn.) for constructing sanitary sewer system. Douglas & McKnight, 1315 Union Bank Building, Pittsburgh, Borough Engineers.

Washington, D. C.—Until May 31, by Commissioners D. C., for constructing sewers.

Shelby, N. C.—Reported desired until June 6 by J. T. Gardner, Mayor, for constructing about 2 miles of sewers.

McComb City, Miss.—Until June 20, by Board of Mayor and Selectmen, for constructing a sewer system, also for $90,000 bonds for said system.

Johnson City, Tenn.—Reported desired until June 6, for 6450 ft. 6 to 12-in. sewers, with manholes, etc. P. F. McDonald, City Engr.

Alliance, Ohio.—Until June 6, by J. H. McConnell, Director Public Service, for constructing improvements to sewers. R. Winthrop Pratt, Hippodrome Bldg., Cleveland, Engineer.

Cleveland, Ohio.—Reported desired until June 1, by Commissioner Purchases and Supplies for constructing sewers in East 117th Street and seven other streets.

Dayton, Ohio.—Until June 7, by J. E. Barlow, Director Public Service, for furnishing material and constructing about 4700 ft. 9-ft. storm sewer and appurtenances, advertised in Engineering Record. F. O. Eichelberger, City Engineer.

Grayville, Ill.—Until May 29, by Paul R. Blood, Public Engineer, Grayville, for constructing sanitary sewer system, estimated cost $20,769.

Bedford, Iowa.—Reported desired until June 5, by J. Kessler Jones, City Clk., for constructing vitr. salt-glazed sewers on North and Dodge Streets.

Waverly, Iowa.—Until June 7, by H. R. Vanderveer, City Clerk, for constructing sanitary sewers.

Neodesha, Kan.—Until June 5 (readvertisement), by J. J. Carroll, City Clk., for furnishing material and constructing intercepting sewer and sewage disposal works. Black & Veatch, Engrs., Inter-State Bldg., Kansas City. J. J. Carroll, City Clk

Ainsworth, Neb.—Until June 9 (readvertisement), by Fred Jay, City Clerk, for constructing sewerage system.

Ralston, Neb.—Reported desired until May 29 by City Clerk for constructing sewers and manholes. Towl Engineering Co., Engra., Omaha.

Bozeman, Mont.—Until June 1, by C. A. Spieth, City Clerk, for constructing outlet and sanitary sewers involving approximately 20,000 lin. ft. 8 to 20 in. standard pipe, together with trenching, etc.

Afton, Okla.—Until June 14, by Board Trustees for constructing system of main and lateral sewers, approximately 9075 lin. ft. 10, 12 and 15 in. pipe, 21 manholes, 1 flush tank sewage purification plant and laterals, 16,845 lin. ft. 8 and 10 in. pipe, 8 manholes, 17 lampholes, 7 flush tanks. Cost of main sewers, $17,000; laterals, $13,500. Engineers, Benham Engineering Company, Oklahoma, Okla.

Oakesdale, Wash.—Reported desired until June 15 by City Clerk for constructing 2½ miles of vitr. pipe sewer and tank and filter beds. Estimated cost $18,000. Swayer Bros., Engrs., Lindelle Block, Spokane.

St. Catherines, Ont.—Until June 1, by Chairman Board Works, for constructing sewers, in all about 5140 ft. 54, 60 and 72-in. sewers, with manholes, etc. W. P. Near, City Engr.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Newark, N. J.—Lowest bid opened May 23 by Passaic Valley Sewerage Commission for constructing a portion of Section No. 4 of the outfall sewerage works, including bulkhead, sludge main and flushing intake on Newark Meadows at Bay Shore reported submitted by Arthur McMullen Company, 149 Broadway, New York, at $74,800.

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★**Newark, Del.**—Following are two bids opened May 8 by Sewer Commission for constructing sewer extension No. 2: Smith & Ruggles, Baltimore, Md., $9,859 (awarded contract), and L. B. Jacobs, Newark, Del., $11,153. Kastenhuber &

Chicago, Ill.—Following are four lowest bids opened May 18 by Trustees Sanitary District, for constructing Calumet Intercepting Sewer (a) concrete alternate, (b) brick and concrete alternate: Newman & Co. (a) $562,020, (b) $694,770; Nash Bros. (a) $636,184, (b) $670,936; U. S. Dredge & Dock Co. (a) and (b) $640,323; T. J. Froschner Contr. Co. (a) $660,364, (b) $693,228.

★**Austin, Tex.**—Following are official unit figures of successful bidder, Texas Construction Co., care of City Clerk, for Contract I of Little Shoal sewerage (bids opened May 14 by City Clerk): 238 ft., Section A, 1 ft. 6 in. wall, $7.60; 287 ft., Sec-. tion A, 2 ft. 6 in. wall, $8.36; 20 ft., Section Ar, 2 ft. 6 in. wall, $8.85; 282 ft., Section A, 2 ft. 8½ in. wall, $7.63; 20 ft., Section Ar, 2 ft. 8½ in. wall, $8.12; 346 ft., Section A, 3 ft. 1½ in. wall, $9.05; 20 ft., Section Ar, 3 ft. 1½ in. wall, $9.55; 330 ft., Section A, 3 ft. 3¾ in. wall, $9.30; 20 ft., Section Ar, 3 ft. 3¾ in. wall, $9.80; 290 ft., Section A, 3 ft. 6 in. wall, $9.50; 80 ft., Section Ar, 3 ft. 6 in. wall, $10.00; 289 ft., Section Ar, 3 ft. 8½ in. wall, $10.26; 351 ft., Section Br, 3 ft. 9½ in. wall, $8.40; 142 ft., Section Br, 4 ft. 0 in. wall, $9.00; Eighth Street bulkheads, $88; Twelfth Street bulkheads, $30; 2000 cu. yd. earth excavation, 65 cts.; 4000 cu. yd. rock excavation, $1.48; remove 400 cu. yd. stone masonry wall, 75 cts.; remove 50 cu. yd. dry masonry wall, 75 cts.; 100 cu. yd. 1:6 rubble concrete, $6; 8 manholes complete, $30; 10 18-in. vitrified slants, $2; 24 24-in. vitrified slants, $3. Total, $31,840. Total of next three lowest: Dallas Lime & Gravel Co., Dallas, $32,474; Ray McDonald, Austin, $33,945; J. O. Polhemus, Austin, $36,259.

★Contract for Contract III, including 1040 ft., 60-in. concrete sewer, 2000 cu. yd. earth excavation, 500 cu. yd. solid rock, etc., awarded William Fuhrman, at $4,725.

Contract II, including 401 ft., Section C, 6-in. wall; 70 ft., Section Cr, 6-in. wall; 443 ft., Section C, 12-in. wall; 68 ft., Section C, 12-in. wall; 68 ft., Section Cr, 12-in. wall; 200 cu. yd. earth and 600 cu. yd. rock excavation, etc., rejected; city will do the work. Lowest bid $5,941.

London, Ont.—Lowest bids, opened May 12 by Public Works Committee for constructing storm sewers were as follows: Contracts No. I and V, Webster Construction Company, London, $3,974 and $5,987 respectively; contract II, J. H. McKnight Construction Company, 88 St. Davids Road, Toronto; Contracts III and IV, J. H. McLaughlin, 574 Somerset Street, Ottawa, $8,201 and $5,751. Lowest for sewage disposal plant submitted by Arnot Construction Company, Esplanade, Toronto, at $41,898. Chipman & Power, Engineers, Toronto.

BRIDGES

PROPOSED WORK.

Waterbury, Conn.—Plans being prepared for a 12-track bridge over South Leonard Street, for New York, New Haven & Hartford R. R. Co. (Edw. Gagel, Ch. Engr., New Haven, Conn.).

Poughkeepsie, N. Y.—State Public Service Commission, Albany, approved plans for steel bridges over tracks of Central New England R.R. (Edward Gagel, Ch. Engr., New Haven, Conn.) at North Street and North Clinton Street, Poughkeepsie. Estimated cost $29,000. State and city to pay each $7,250. Address Clerk of Public Service Commission.

Washington, D. C.—President signed bill appropriating $1,000,000 for replacing aqueduct bridge across Potomac River at Georgetown. Address Bridge Engineer Commissioners, D. C.

Harriman, Tenn.—Rome County will spend $50,000 on bridges. Geo. P. Lindsay, Co. Judge.

Grand Forks, N. D.—The Northern Pacific R. R. Co. will next winter rebuild bridge over Red River at Grand Forks. W. L. Darling, Ch. Engr., St. Paul, Minn.

Miles City, Mont.—County Commissioners plan constructing steel bridge across Powder River, near Miles City, costing $15,000, and four bridges across Tongue River. H. E. Pearnall, County Engineer.

Kansas City, Mo.—See "Sewerage and Sewage Disposal."

Gainesville, Tex.—Reported a bridge is to be constructed between Gainesville and Marietta. Address Mayor.

Wichita Falls, Tex.—Election to be held June 20 in the county to vote $80,000 bonds for bridge improvements. Address County Clerk.

Kalama, Wash.—County Commissioners plan constructing two steel bridges, one across South Toutle River and the other at Coal Bank Rapids, costing about $6,000 each. R. C. Westwick, County Engineer.

Newport, Wash.—U. S. Government approved construction of steel bridge across Coeur d'Alene River near here. H. A. Sewell, County Engineer.

Los Angeles, Cal.—Homer Hamlin, City Engineer, directed to prepare plans for a concrete bridge to be constructed over Los Angeles River near Ivanhoe Station to connect Los Angeles with Tropico; cost about $15,000.

Chandler, Ariz.—Reported a bridge costing $75,000 will be constructed across Gila River by U. S. Indian Service. A diversion dam is to be constructed later at a cost of $125,000.

Victoria, B. C.—Provincial Government approved plans for steel bridge to be constructed over Pend O'Reille River at Waneta. Estimated cost, $15,000.

BIDS DESIRED.

Salem, N. J.—Until June 9 by Board Chosen Freeholders (H. P. Gray, Dir.) for the Penns Neck bridge over Salem River, to consist of new draw span, together with supporting piers, and fenders to protect the same, and a new fixed span on southeast end of said bridge.

Trenton, N. J.—Until June 2, by Board Freeholders, for constructing two culvert bridges over streams on Cosswicks Road, also culverts over Tiher Run, also separate bids for a stone bridge and three reinforced concrete culverts over streams on River Road. Hopewell Township. Theodore Tobish, County Engineer.

Washington, Pa.—Until May 31, by T. J. Underwood, County Controller, for constructing Fry Bridge, in Finleyville Borough, a plate girder 60 ft. span with concrete abutments; Van Voorhis Bridge, a through truss 86.5 ft., concrete abutments, in Fallowfield Township; Smallwood Bridge, a 66-ft. reinforced concrete arch, in East Pike Run, Township; to remove Oller Bridge, an old truss bridge, and re-erect on new concrete abutments, and construct concrete sidewalk and new hand rail on McDonald Station Bridge.

Brewton, Ala.—By Court Commissioners Escambia County, for constructing a 100-ft. low truss steel bridge 20 ft. wide, 10-ton capacity, riveted and on concrete foundations, to span Burnt Cork Creek. Also separate bids for steel span alone. W. E. Rushing, Judge of Probate, Brewton.

Canton, Miss.—Until June 6, by D. C. McCool, Clerk Canton, and S. L. Griffin, Clerk Yazoo City, for constructing a steel bridge, also for a concrete bridge over Big Black River at Scott's Ferry.

Flora, Miss.—Until June 6, jointly by S. I. Griffin, Clk. Yazoo County, Yazoo City, and D. C. McCool, Clk. Madison County, Canton, for constructing a steel or concrete bridge across the Big Black River at Scotts Ferry, near Flora, on the Y. & M. V. R.R. Alternate bids will be taken on concrete and steel construction. Xavier A. Kramer, Consult. Engr., Magnolia.

Barbourville, Ky.—Until June 5, by Fiscal Court, for constructing a bridge over Culberland River at Flat Lick to consist of two 150-ft. spans and one 50-ft. span, roadway wooden floor, substructure of concrete. Plans may be had by writing to George G. Fetter & Company, Louisville, Ky.

London, Ky.—Until June 8, by County Fiscal Court (J. L. Harrison, Clk.), for constructing 8 steel bridges and 2 small concrete bridges.

Cleveland, Ohio. — Until May 31 by County Commissioners for constructing bridges and culverts on Cleveland and Sandusky roads in Dover and Rocky River Townships; length 2.09 miles. Estimated cost $3,816. Separate bids same place for improving same work on same road, 3.47 miles. Estimated cost, $4,521. Until June 3, same place for same work, same road, length 1.87 miles. Estimated cost $7,179.

Youngstown, Ohio. — Reported desired until May 31 by Board County Commissioners (Frank H. Vogan, Clk.) for constructing concrete bridge at Elm Street, Poland Township.

Indiana.—By County Commissioners for constructing following bridges:

Until June 6:

Winamac, constructing four bridges. W. E. Munchenberg, Co. Aud.

Peru, constructing five bridges. F. K. McElheny, Co. Aud.

Bloomington, constructing nine bridges, seven of them on Dixie Highway. W. F. Kinser, Co. Aud.

Rensselaer, constructing nine steel bridges. Jos. P. Hammond, Co. Aud.

Cambridge, Ill.—Until June 2, by Highway Commissioner of Western Township, for constructing three reinforced concrete highway bridges and culverts, total concrete 100 cu. yd. James H. Reed, County Superintendent of Highways, Cambridge, Ill.

Illinois.—By State Highway Commission for constructing bridges as follows:

Until June 1:

Joliet, Albers Bridge, 24-ft. span, 18-ft. roadway, reinforced concrete bridge, between Rich Township, Cook County, and Monee Township, Will County. Engineer's estimate, $940.

Until June 2:

Clinton, Cowell Bridge, reinforced concrete bridge, Harp Township. Engineer's estimate, $1,310.

Clayton Bridge, reinforced concrete, 12-ft. span, 18-ft. roadway, Rutledge Township. Engineer's estimate, $965.

Until June 3.

Manito, Wheeler and Goldsmith bridges, reinforced concrete and steel with creosote wood block floors, each 32-ft. span, 16-ft. roadways. Engineer's estimate, not including back fill and approach grades, Wheeler, $1,460, and Goldsmith, $1,235.

Until June 20:

Westfield, Flenner Bridge, reinforced concrete, 24-ft. span, 18-ft. roadway, in Hutton Township. Engineer's estimate, $1,480.

Madison, Wis.—Reported desired until June 9, by City Clerk, for constructing reinforced concrete arch bridge at Rutledge Street. Estimated cost $9,000. E. E. Parker, City Engr.

Adel, Iowa.—Until June 1, by County Auditor, for constructing four highway bridges. Engineer's estimate, $24,800.

Duluth, Minn.—Until June 5, by O. Halden, Co. Aud., for constructing steel or reinforced concrete bridge over Oster River, on Tischer Road, also concrete culvert, steel bridge over Judicial Ditch No. 3, steel or reinforced concrete bridge over Mudhen River, on Morrison Road, etc., also constructing a number of roads throughout the county.

Little Falls, Minn.—Reported desired until June 6, for constructing bridge in Pierz Township, a 50-ft. steel truss span, 18 ft. roadway, reinforced concrete floors and abutments. B. Y. McNairy, Co. Aud.

El Dorado, Kan.—Until June 8, by County Clerk, for constructing a through girder reinforced concrete bridge on Gordon Road, to cost $11,000. C. W. Buskirk, Engineer, El Dorado.

Brainerd, Neb.—Reported desired until June 6, for constructing 23 ft. slab or beam span bridge on reinforced concrete abutment over Sand Creek. C. W. Mahlum, Co. Aud.

Hettinger, N. D.—Reported desired until June 5 by Walter F. Kelly, Co. Aud., for constructing 7 bridges.

Madison, S. D.—Reported desired until June 6 by M. E. McGillivary, Co. Aud., for 10 concrete bridges and abutments for one steel bridge.

Woonsocket, S. D.—Reported desired until June 6, for furnishing material and constructing bridges as follows: 20 ft. span steel bridge, 16 ft. roadway, cement floor and abutments; steel bridge 30 ft. span, 16 ft. roadway, cement floor and abutments; steel bridge 80 ft. span, 16 ft. roadway, tubular piers, etc. C. B. Jacobson, Co. Aud.

Lexington, Mo.—Reported desired until May 29, by Geo. W. Bates, Co. Clk., for constructing one concrete slab bridge, 5 steel bridges, 2 concrete girder bridges, 13 culverts, etc. Hugh C. Rogers, Co. Engr.

Houston, Tex.—Until May 29, by H. L. Washburn, Co. Aud., for constructing draw or lift bridge on Harrisburg Road across Broys Bayou. W. N. Thacher, Co. Engr.

Jones, Okla.—Until June 5, by W. T. Keys, County Clerk, Oklahoma City, for constructing 12 steel bridges.

Muskogee, Okla.—Until June 5, by County Clerk, for constructing culverts and bridges located on State Road in Muskogee County. Probable cost $4,000.

Stillwater, Okla.—Until June 5 (readvertisement), by W. F. Keys, County Clerk, for constructing 8 steel and one concrete bridge.

Fullerton, Cal.—Reported desired until May 31, by City Trustees, for constructing a bridge on Union Avenue 34 ft. long and 24 ft. wide, concrete abutments and timber superstructure. . Alternate bids desired for work, and for furnishing material. Cost $3,000. W. J. Renshaw, City Engineer.

Modesto, Cal.—Until June 13 (readvertisement), by Board of Supervisors Modesto, for constructing a reinforced concrete bridge, 14 spans, 35 ft. wide, across Toylum Tuolumne River at south boundary of Modesto.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Massachusetts.** — Contract for constructing concrete bridge on State Highway in Clarksburg (bids opened May 16), awarded by Massachusetts Highway Commission, Boston, to G. Ferullo, Boston, at $5,478.

★**Providence, R. I.**—Contract for constructing Whipple Bridge, 220 ft. long, 38 ft. wide, 20 ft. above stream, three span reinforced concrete, awarded by State Board of Public Works to McKinnon Construction Co., 70 Water Street, East Providence, at $30,698. Next three lowest: Bowman Bros., Providence, $31,335; Rennell Construction Co., Produce Exchange, New York, N. Y., $32,900; and Hynes Construction Co., Wales, Mass., $33,612. (Bids opened May 17.)

★**Bridgeport, Conn.**—Contract awarded by Board of Contract and Supply for constructing Grand Street and East Washington Avenue bridges over Pequonnock River to Edward De Voe Tompkins, 17 E. Thirty-eighth Street, New York, N. Y., at $281,119.

★**Thompsonville, Conn.**—S. A. Sibley of New Haven secured contract for constructing a concrete bridge in Thompsonville at $4,930.

★**Heuvelton, N. Y.**—Contract for constructing bridge over Oswegatchie River (bids opened May 16 by N. Wells, Town Clerk) awarded Mecca Construction Company, Inc., Ogdensburg, at $32,562. Engineers, Concrete Steel Engineering Company, Park Row Bldg., New York, N. Y.

★**Philadelphia, Pa.**—Contract awarded May 17 by George E. Datesman, Director Dept. Public Works, for constructing steel and concrete bridges at Island Avenue under tracks of P. B. & W. R. R. to William P. Mahoney, Harrison Block, at $84,000. (Bids opened April 27.)

★**Blue Lake Springs, Ky.**—Contract for constructing bridge over Licking River (bids opened May 17 by John F. Sugg, Clerk County) awarded Vincennes Bridge Company, Vincennes, Ind., for superstructure, at $9,810, and to Butler-Tyler Company, Louisville, for substructure, at $2,900.

★**Terre Haute, Ind.**—Contract awarded by County Commissioners for constructing bridge to C. Elmer Garrard, Bloomingdale, at $20,945.

Peoria, Ill.—Following bids opened by city for construction of reinforced concrete viaduct over tracks of C. B. & Q., C. & N. W. and M. & St. L. railroads. Widell Co., Mankato, Minn., $108,000; J. J. Jobst, Peoria, $115,661; Bates & Rogers Co., Chicago, $130,000, and John T. Walbridge Engineering Co., Chicago, $125,700.

★Contract for the above bridge reported awarded to Widell Co., Mankato, Minn.

★**Superior, Wis.**—Contract awarded by Great Northern Ry. Co. for reconstructing Twenty-first Street viaduct to Peppard & Fulton, Minneapolis, Minn., at $50,000.

★**Morris, Minn.**—Contract for constructing bridge No. 2145 (bids opened May 13 by C. R. Wollthan, County Auditor) awarded Morris Construction Company, Morris, at $5,190.

★**Billings, Mont.** — Reported contract awarded by County Commissioners for constructing two bridges, one over Clearwater River and other over Ford Creek, to Security Bridge Co., Billings, at $23,000. Arthur Boyer, County Engineer.

★**Olympia, Wash.**—Reported contract awarded by County Commissioners, for constructing steel bridge over Des Chutes River at Collins Pl., south of Olympia, on Pacific Highway, to Coast Bridge Company, Portland, Ore., at $11,500.

★**Astoria, Ore.**—Contract for constructing reinforced concrete viaducts on Eleventh, Commercial and Duane Streets awarded Washington Paving Company, L. C. Smith Bldg., at $147,728; contract for paving three streets awarded William Ollar of the Western Paving Company of Astoria, at $14,000 for bitulithic. Olaf Anderson, City Auditor.

Modesto, Cal.—Following are four lowest bids opened May 9 by Board of Supervisors for constructing a reinforced concrete bridge, 14 spans 35 ft. wide, across Toylum Toulumne River at south boundary of Modesto: C. E. Cotton, $112,397; Howard S. Williams, $115,760; Manning Bros., $116,900, and Ernest Green, Modesto, $119,423. See "Bids Desired."

Orofino, Idaho.—Security Bridge Co., Lewiston, submitted lowest bids to County Commissioners at $19,485 for wagon bridge across Clearwater River at Absahka.

★**Toronto, Ont.**—Contract for constructing concrete bridge at Strachan Avenue awarded to C. J. Townsend, 79 Spadina Avenue, Toronto.

PAVING AND ROADS

PROPOSED WORK.

Boston, Mass.—Governor signed bill appropriating $10,000 for repairing road between Pelham Hill and Amherst line.

Fitchburg, Mass.—City Council plans spending $52,000 for macadamizing a number of streets. Address City Clerk.

Southington, Conn.—The State Highway Commission, Hartford, will lay a permanent pavement 18 ft. wide through center of town; cost about $30,000.

Dunkirk, N. Y.—Councilmen plan improving a number of streets, costing about $250,000. Address City Clerk.

Norwich, N. Y.—Common Council voted to pave Rexford Street at cost of $11,000.

Audubon, N. J.—Borough Council will spend about $100,000 on street paving, including Merchant, Oakland, Virginia, Maple and other streets.

Collingswood, N. J.—Election to be held June 20 to vote $140,000 bonds for street paving. Address City Clerk.

Elizabeth, N. J.—Reported City will repair St. George Avenue at a cost of $10,000; Westfield Avenue at a cost of $31,000.

Hoboken, N. J.—City Commissioners will issue $205,000 bonds for street improvements. Daniel A. Haggerty, City Clerk.

Keyport, N. J.—The State Highway Commission at Trenton will make a survey of boulevard between Atlantic Highlands and Keyport and construct the Ocean Boulevard.

Newark, N. J.—Board of Chosen Freeholders sold $60,000 road bonds.

Orange, N. J.—City Commissioners decided on wood block pavement for Main Street. Probable cost $80,000.

Paterson, N. J.—Surveys for constructing 19 roads have been made by County Engineer; cost about $180,000.

Pennsylvania.—All bids opened May 15 by State Highway Department, Harrisburg, for construction of Section 4 in Birmingham Township, Delaware County, and Section 5, Pennsbury and Kennett Townships, Chester County, rejected as being too high; also bids on state aid applications opened same time for one in Nether Providence Township, Delaware County, and one in Whitemarsh Township, Montgomery County. New bids to be asked very soon, with some additional work on State Highway Route No. 131, and some other construction.

Steelton, Pa.—Citizens May 16 voted $55,000 bonds for paving. William E. Calloghan, Engineer, Steelton; E. C. Henderson, Chmn. Highway Committee.

West Alexander, Pa.—It is proposed to pave about 12,000 sq. yd., probably with brick. Appropriation available $15,000. J. W. Crimes, Clerk of Council.

West Union, W. Va.—Special Road improvements bonds Grant Dist., Doddridge County, will be sold June 20 by County Court (Hiram Hutson, Clk.).

Bryson City, N. C.—Swain Road Dist. bonds for $100,000 will be sold June 1 by Frank E. Fry, City Secy.

Americus, Ga.—City Council sold $30,000 street improvement bonds. Address City Clerk.

Georgia.—About $90,387 will be appropriated by the State for improving roads in various counties. Address State Highway Department, Nashville.

Bonifay, Fla.—Citizens of Noma District voted $50,000 bonds for constructing about 100 miles of hard roads. Address Clerk of Noma District, Bonifay.

Sebring, Fla.—Paving bonds for $50,000 will be sold June 20 by H. C. Brown, the Mayor and Town Council.

Jennings, La.—Jefferson Davis Parish sold $500,000 highway bonds, pending result of election to be held May 29. Address Clerk Parish.

Alexandria, La.—Good Roads bond issue for Districts 6 and 10 voted May 17. Approximate cost $110,000. Address President Police Jury.

Colfax, La.—About 12 miles of good roads to be built in Grant Parish. Address Dr. W. R. Buffington, Colfax.

Mansfield, La.—DeSoto Parish voted $250,000 bonds for good roads. Address President Police Jury.

Holly Springs, Miss.—Holly Springs will spend $10,000 in concrete pavement on the Square. Horace H. Hull, Memphis, Supervising Engr. Albert Herr, Mayor.

District No. 1, Marshall County, will sell bonds of $200,000 for building concrete roads. Horace H. Hull, Memphis, Tenn., Supervising Engr. C. T. Ames, Chmn. Board Commissioners, Holly Springs.

Benton, Tenn.—County Commissioners will spend approximately $100,000 in improving county roads. J. H. Williamson, Co. Judge, Benton.

Bristol, Tenn.—City Commissioners contemplates improving several streets with concrete.

Lawrenceburg, Tenn.—Lawrence County will spend over $300,000 in improving county roads. E. E. McNeely, Co. Judge.

Burlington, Ky.—Citizens voted $200,000 road bonds. Address County Clerk.

Owensboro, Ky.—County Commissioners sold $600,000 road and bridge bonds. Address County Clerk.

Pineville, Ky.—Citizens voted $150,000 road bonds. Address County Clerk.

Chardon, Ohio.—Highway Improvement bonds for $35,000 will be sold June 5 by County Commissioners (Peter Small, Chmn.).

Cincinnati, Ohio.—City of Norwood requested County Commissioners to cooperate in improving portion of Montgomery Pike through Norwood with granite paving. Norwood offers to pay two-thirds of the estimated cost of $90,000 if the county will pay the remainder Matter taken under advisement pending a report from Wm. Boen, County Surveyor.

City Council will soon take steps for the improvement of Central Avenue (estimated by city engineer to cost $178,000, with wood block and granite), and for raising and paving Eastern Avenue (estimated by city engineer, paving with granite, at $548,000). These are first improvements to be made with the recently authorized $1,638,050 street improvement bonds authorized at recent election.

Contract soon to be let by County Commissioners for improving Wolfangle Road, estimated by County Engineer to cost $17,000.

County Commissioners authorized plans and specifications prepared for constructing a road connecting the Hopewell and Symmestown Roads near Brecon.

City Engineer Frank S. Krug submitted to City Council approximate estimate of $52,934 as cost of improving Elheron Avenue from Bassett Road to Price Avenue with granite; also approximate estimate of $9,053 as the cost of improving Larch Avenue from Hamilton to Belmont Avenues with bituminous macadam.

Cleveland, Ohio.—City Council plans improving Buckley Boulevard; probable cost $20,000. Address City Clk.

Defiance, Ohio.—County Commissioners sold $10,300 road bonds. Address County Clerk.

Jefferson, Ohio.—County Commissioners sold $54,000 road bonds. Address County Clerk.

Port Clinton, Ohio.—Road bonds for $55,000 will be sold May 29 by Ottawa County Commissioners.

Youngstown, Ohio.—County Commissioners sold $34,000 road bonds. Address County Clerk.

Zanesville, Ohio.—It is proposed to pave streets and construct sewers at a cost of $44,000, bonds for which were voted April 25. W. W. Roach, Director Public Service.

South Bend, Ind.—Road improvements bonds amounting to $36,400 have been sold. Address County Clerk.

Terre Haute, Ind.—County Commissioners approved bond issue of $46,210 for constructing highways in Fayette, Nevins and Sugar Creek Townships. Address County Clerk.

Lake Odessa, Mich.—Contract soon to be let for paving with brick three blocks on Fourth Avenue at a cost of $18,000. E. H. Christ, Engineer, Grand Rapids; E. F. Bradley, Village Clerk.

Des Moines, Iowa.—Plans being prepared for about 10 miles of sheet asphalt, asphaltic concrete, bitulithic brick and concrete pavement. Horace Susong, City Clerk.

Grand Forks, N. D.—Contract will soon be let for paving Belmont and Vernon Avenues from Eighth Avenue to city limits. Estimated cost $43,719. Address City Auditor.

Butte, Mont.—J. J. Armstrong, City Engineer, completed plans for paving portion of Main Street Boulevard. Estimated cost, $375,000.

Helena, Mont.—City Council plans paving Sixth Avenue, Lawrence and Park Streets; probable cost, $21,000.

Great Falls, Mont.—Plans being prepared by City Council for paving twenty blocks, installing two miles of water mains and sewer in a number of streets.

Stuttgart, Ark.—Paving bonds for $35,000 will be sold May 25, by Commissioners Street Improvement Dist. No. 3 (J. L. Hagler, Secy.).

Texarkana, Ark.—Paving bonds for $150,000 have been sold. Address Mayor.

Chandler, Tex.—Citizens May 16 voted $60,000 bonds for road construction work in the county. Address County Judge.

Cisco, Tex.—Election to be held June 6 to vote $60,000 bonds for road improvements. Address Mayor.

Ennis, Tex.—Election to be held June 17 to vote $75,000 bonds for road improvements. Address Mayor.

Higgins, Tex.—Citizens May 14 voted $75,000 bonds for road improvements. W. H. Sewell, County Judge; P. O. Boyd, County Clerk.

Houston, Tex.—Property owners have petitioned for the extending of Montrose Boulevard from San Antonio and Aransas Pass Ry. to entrance of Hermann Park, a distance of 3500 ft., and 90 ft. wide.

County Commissioners voted $75,000 bonds for improvements to roads, bridges and ferries in Precinct No. 2.

Kountze, Tex.—Citizens voted $224,000 bonds for road improvements in Road Dist. No. 3, Hardin County. Address County Clerk.

Mount Vernon, Tex.—Citizens will vote June 16 on $75,000 bond issue for good roads in Road District No. 1. Address County Clerk.

Schulenburg, Tex.—About 6 miles of streets to be paved. Address Mayor.

Aberdeen, Wash. — Board of Public Works plans paving 14 blocks of Hume Street and several other streets. L. D. Kelsey, City Engineer.

North Yakima, Wash. — City Council passed resolution to pave North Sixth Street and South First Avenue, including 12,000 yd. paving, walks, curbs, etc. R. V. Hooper, City Clerk.

Paving of Lincoln and East Yakima Avenues, Race and Adams Streets, is under consideration by City Council. N. A. Gilman, City Engineer.

Seattle, Wash.—A. H. Dimock, City Engineer, filed plans with Board of Public Works for paving Fourteenth Street, at $11,000; Alki Avenue, $30,000, and paving and sidewalks on Fifth Street, $100,000. C. B. Bagley, Secy. Bd. Pub. Works.

Reported County Commissioners (Byron Phelps, Clerk) passed resolutions for improving 4.3 miles Renton-Kenneydale Road. A. P. Denton, County Engineer, will prepare plans.

Independence, Ore.—County Commissioners plan straightening Main Street and constructing 2 or 3 miles of hard surface road, costing $10,000. C. R. Canfield, County Engineer.

Marshfield, Ore. — Reported about 10 blocks on Central Avenue are to be paved and new sewers laid in Front and Fifth Streets. Address City Clerk.

Anaheim, Cal.—City Council is reported to have rescinded contract recently awarded for approximately 491,310 sq. ft. concrete base and asphaltic surface pavement on Broadway and will ask new bids, to be opened probably June 20.

Hanford, Cal.—City Trustees approved plans for paving 5 miles with asphaltic concrete, including storm sewer system. Probable cost $200,000.

Phoenix, Ariz.—City Commission voted to pave 8 blocks on North Fourth Street.

Blackfoot, Idaho.—Citizens May 9 voted $22,000 bonds for improving streets in District No. 18. James Young, Engineer, Blackfoot.

Idaho Falls, Idaho.—Contract will soon be let for paving with bitulithic Ridge Avenue, and with concrete Elm Street. Address City Clerk.

Moscow, Idaho.—Contract will soon be let by City Council for paving roadway on Eighth Street bridge and for construction of bridge on Eighth Street. Address City Clerk.

BIDS DESIRED.

Massachusetts.—Until May 31, by Massachusetts Highway Commission, Boston, for surfacing about 5100 ft. of State highway in town of Great Barrington.

Northampton, Mass.—Until May 29, by Committee on Highways (W. P. Latham, Supt.), for a 10-ton steam roller.

Wellington, Mass.—Until May 29, by Committee on Highways for a 15-ton steam roller. W. P. Lathan, Superintendent of Streets.

Dolgeville, N. Y.—Until June 17, by Board Village Trustees, for furnishing material and improving Faville Avenue and State Street with bituminous macadam, rolled stone base and concrete base, and Bermudez asphalt with rolled stone base and concrete base, advertised in Engineering Record. S. J. Neff, Engineer, Dolgeville; E. H. Bacon, Village Clerk.

Elmira, N. Y.—Until June 5, by Louis C. Andrews, City Clerk, for paving, advertised in the Engineering Record.

Milburn, N. J.—Until June 12, by Township Committee (William Byrd, Chmn.), at Town Hall, for grading, guttering and paving portions of Highland Avenue, Hobart Avenue and Brantwood Drive.

Newark, N. J.—Until June 1, by Board Streets and Water Comrs. (Morris R. Sherrerd, Ch. Engr.), for paving portions of Halsted, Cliff, Foster and other streets, in all about 21,750 sq. yd. asphalt, with curbing, etc. Separate bids same time and place for paving portions of Willoughby and Tyler Streets, in all about 6180 sq. yd. bitulithic pavement.

Paterson, N. J.—Until June 6, by Board Public Works, for constructing brick wall around city yard at Yorke Avenue and Harrison Street, also paving portions of Main, Spruce and Market Streets and constructing sewers in Paxton Street, Delaware and Dundee Avenues and other streets.

Until June 6, by Board Public Works, at office of Colin McLean, Street Comr., for furnishing and applying road oil on macadam streets of city.

Union, N. J.—Until June 6, by Board of Council, for repaving Hudson Avenue, Lewis Street and Hudson Boulevard and other streets with asphalt block or bituminous concrete on a 6-in. concrete foundation. Emil Bautz, Town Clerk.

West Hoboken, N. J.—Until May 31, by Town Council, for repairing all brick pavements in the town. August L. Wachlin, Town Clerk.

Carbondale, Pa.—Until May 29 by City for about $150,000 worth of brick paving. H. G. Likeley, City Clerk.

Corry, Pa.—Until May 31, by City, for grading, curbing and paving with brick portions of Pleasant Street, Spring Street, First Avenue and other streets, in all about 6720 sq. yds. paving; also for constructing sanitary sewers in West Wayne Street. Nevin R. Dickson, City Engineer.

New Wilmington, Pa.—Until June 6, by Borough (Wm. McElwee, Secy.), for paving 11 sections of street. In all about 21,900 sq. yd. brick pavement, 14,900 lin. ft. curbing, etc. Thos. A. Gilkey, Engr., Mercantile Bldg., Newcastle.

Pennsylvania.—Until June 16, by State Highway Department, Harrisburg, for paving, advertised in Engineering Record.

Wilkes-Barre, Pa.—Until May 31, by F. R. Hendershot, Controller, for constructing and resurfacing county highway leading from Hillside to Huntley, a distance of 3.2 miles.

Georgetown, Del.—Until June 6 by Morgan T. Gun, County Road Engineer, for resurfacing Georgetown-Laurel Road, advertised in Engineering Record.

Wilmington, Del.—Until May 31, by Board Directors Street and Sewer Departments (Henry C. Taylor, Secy.), for grading and excavating streets, in all about 50,000 sq. yd., constructing concrete foundations, paving with sheet asphalt, asphaltic concrete, bitulithic, vitr, block brick gutters, etc.

Cumberland, Md.—Until June 3, by Mayor and City Council, for street improvements, advertised in Engineering Record.

New Martinsville, W. Va.—Until June 29 by County Court at New Martinsville for constructing approximately 15 miles of improved roads in Church District, Wetzel County, advertised in Engineering Record. J. Russell Wilson, Engineer, First National Bank Building, Mannington, W. Va. S. Myers, County Clerk.

Shelby, N. C.—Until June 6, by J. T. Gardner, Mayor and Board Aldermen, at office of Geo. P. Webb, Town Clk., for paving certain streets, in all about 26,232 sq. yd. brick pavement, 4949 lin. ft. curb, catch basin, manholes, etc. The J. B. McCrary, Co. Engineers, National Bank Bldg., Atlanta, Ga.

Sanford, Fla.—Until June 10, by the County Commissioners (E. A. Douglas, Clk.) for grading and paving with brick the following highways: Robinson Springs 37,120 sq. yd. Oviedo, junction with present brick roadway in Township 20, 47,892 sq. yd. Sanford, Geneva, 25,465 sq. yd. Sanford, Wekiva River 17,725 sq. yd. streets within corporation limit 9075 sq. yd., bridges, curbs, etc. G. R. Ramsey, Highway Engr. People National Bank Bldg., Orlando.

Sebring, Fla.—Until June 21, by H. C. Brown, Mayor and Town Council, for furnishing material and constructing approximately 48,000 sq. yd. street paving (asphalt, concrete and sheet asphalt), with all necessary gutters, drains, etc. H. S. Judson, Engineering Co., Engrs., Savannah, Ga., and Bartow, Fla.

Mobile, Ala.—Until July 1, by Board of Revenue and Road Commissioners of Mobile County, at Mobile, for constructing the Delta Highway lying within Mobile County.

Vernon, Ala.—Until June 21, by County Commissioners, for grading, draining and graveling Sulligent and Detroit Road and 11 miles Vernon and Columbus, Miss., Road. W. S. Keller, State Highway Engineer, Montgomery.

New Orleans, La.—Until June 12, by Highway Dept. of the Board State Engineers, New Orleans Court Bldg., for constructing 65 miles gravel road in De Soto Parish and about 12 miles of earth in Grant Parish. W. E. Atkinson, State Highway Engr.

Charleston, Miss.—Reported desired until June 21 by Board Supervisors Tallahatchie County, for constructing 1¾ miles of road. D. S. Henderson, Co. Clk.

Johnson City, Tenn.—Until June 6, for 13,652 sq. yd. asphalt, asphaltic concrete, concrete or Tarvia, and 11,000 ft. curb and gutter. P. F. McDonald, City Engr.

Louisville, Ky.—Until June 1, by Board Public Works (Roger G. McGrath, Secy.), for vitr. block pavement on Floyd Street, Letting 617. Also on sidewalks of Alta, Bonnycastle Avenues and other streets, Letting No. 618. Samples of vitr. block must be submitted.

Alliance, Ohio.—Until June 2 by Wade W. Shidler, City Engineer, for 20,000 yd. of brick block pavement and 25,000 lin. ft. 5 x 20-ft. stone curb on Prospect, Linden and Patterson Sts.

Cincinnati, Ohio.—Until June 9, by County Commissioners (Albert Reinhart, Clerk), for resurfacing Wooster Pike from Easter Avenue to Plainville Pike, Columbia Township.

Columbus, Ohio.—Until May 31, by County Commissioners (John Scott, Clk.), for draining and macadamizing the Wilson Road, in Franklin, Norwich and Prairie Townships.

Columbus, Ohio.—Until June 6, by Board County Commissioners (John Scott, Clk.), for grading, draining and macadamizing Darby Road in Norwich and Brown Townships.

Dayton, Ohio.—Until June 6, by J. E. Barlow, Director Public Service, for constructing 3½ in. wood block on 6-in. concrete foundation, curbing and other work incidental thereto, advertised in Engineering Record. Cost $100,000. F. O. Eichelberger, City Engineer.

Defiance, Ohio.—Reported desired until June 5, by Roger Daoust, Clk. Co. Comrs., for grading and macadamizing 9939 ft. of road. Probable cost $16,269.

Elyria, Ohio.—Until June 1, by M. M. Wilcox, Dir. Public Service, for constructing sidewalks for the year 1916.

Maumee, Ohio.—Reported desired until July 1, for 20,000 yd. of paving. T. N. Dowling, City Clk.

Painesville, Ohio.—Until May 29, by Board County Commissioners (W. Albert Davis, Secy.), for paving with concrete and gravel road in Kirkland Township a distance of 4.87 miles. H. P. Cummings, County Surveyor.

West Park, Ohio.—Until June 5, by Fred. Feuchter, Village Clk., for constructing sidewalks on Willams, West Park, Rockport, Sixth Street.

Zanesville, Ohio.—Reported desired until June 15, for 13,000 sq. yd. brick pavement and 1300 yd. concrete paving, etc. C. R. Spencer, City Engr.

Fort Wayne, Ind.—Until June 1, by Wildwood Park Company, 705 Schoaff Bldg., for furnishing material and paving, constructing sidewalks, etc., to consist of 13,000 yd. grading, 5200 lin. ft. asphalt pavement, 10,000 lin. ft. sidewalk, etc.

Columbus, Ind.—Until June 7, by County Commissioners, for paving on Kraus and Sheit Roads with concrete at a cost of $80,000. Lloyd Rogers, Engineer, Columbus; W. H. Scott, County Auditor.

Indiana.—By County Commissioners for constructing roads as follows:

June 5:

Greenfield, concrete and gravel road in Blue River Township, macadam and brick road in Brown Township. Harvey J. Rhue, Co. Aud.

Hartford City, roads in Harrison and Washington Townships. J. L. McGeath, Co. Aud.

Rising Sun, broken stone road in Randolph Township. J. R. Elder, Co. Aud.

Paoli, 6086 ft. gravel or macadam roads in French Lick Township. E. A. Palmer, Co. Aud.

Until June 6:

Huntington, road in Salamonie Township. Ovid E. Eviston, Co. Aud.

Plymouth, constructing three roads in Bourbon Township. Otto H. Webber, Co. Aud.

Noblesville, roads in Adams, Jackson, Washington and White River Townships. W. O. Horton, Co. Aud.

Knox, road in Railroad and Oregon Townships. Chas. Weninger, Co. Aud.

Martinsville, roads in Jackson and Adams Townships. Sam Watson, Co. Aud.

Huntington, roads in Polk Township. O. E. Eviston, Co. Aud.

Until June 7:

Peru, road in Peru Township. Frank K. McElheny, Co. Aud.

Until June 8:

Indianapolis, constructing two roads in Center Township. L. K. Fesler, Co. Aud.

Until June 12:

South Bend, road in Union Township. Arthur W. Wolf, Co. Aud.

Until June 16:

Franklin, Johnson Morgan County Line, road. John C. Gregg, Co. Aud.

June 25:

Indianapolis, reconstructing two roads, Franklin Township. Leo. F. Fesler, Co. Aud.

Indianapolis, Ind.—Until June 1, by Board Park Commissioners, for improving portions of Burdsal Avenue, Ghent Avenue, Fall Creek Parkway, and other streets.

Ann Arbor, Mich.—Until June 7, by Board Public Works for constructing between 11,00 and 14,000 sq. yd. vitr. brick pavement. Manley Osgood, City Engineer.

Gilford, Mich.—Until June 1, by Ed. Miller, Highway Commissioner of Township of Gilford, for constructing 2½ miles of 16-ft. trunk line road in said township.

Kalamazoo, Mich.—Until June 5, by City Clerk, for 600,000 vitr. paving brick and 25,000 sq. yd. asphaltic concrete, advertised in Engineering Record.

Decatur, Ill.—Until June 2, by Board Local Improvements, for grading, curbing and paving North Monroe Street; cost $32,761, and West Green Street, cost $59,935, and North State Street, cost $5,092.

Illinois.—Until May 31, by State Highway Department, Springfield, for constructing road as follows:

Taylorville, Christian County, Sect. A, 9882 ft. oil earth. Engineer's estimate $8,164.

Sandusky, Alexander County, Sect. B, 13,130 ft. gravel road. Engineer's estimate $19,660.

Woodstock, McHenry County, Sect. G, 10,500 ft. gravel. Engineer's estimate $11,792.

Hartland, McHenry County, Sect. H, 10,500 ft. gravel road. Engineer's estimate $11,811.

Griggsville, Pike County, Sect. B, 7300 ft. water-bound macadam $15,673.

Decatur, Macon County, Sect. A, oiled earth, 60,365 ft., $30,118.

Morrison, Ill.—Until June 7 (readvertisement), by Vernon N. Taggett, County Supt. of Highways, for 26,803 sq. yd. brick paving on Lincoln Highway in Sterling Township.

Janesville, Wis.—Reported desired until June 13 for 14,458 sq. yd. asphalt macadam and 3000 cu. yd. excav. Address City Clerk.

Rockville Center, Wis.—Until June 20, by Village Clerk, for constructing concrete roads, advertised in Engineering Record.

West Allis, Wis.—Reported desired until June 5, by City Clerk, for 6343 sq. yd. one course concrete paving. E. G. Orbert, City Engr.

Des Moines, Iowa.—Reported desired until May 31, by Horace Susong, City Clk., for paving West Twenty-ninth and Grand Streets and East Grand Avenue with sheet asphalt, bitulithic vertical-fiber brick.

Dubuque, Iowa.—Until June 1, by J. J. Shea, City Recorder, for improving portions of Burns and Custer Streets and Atlantic Avenue, in all about 8410 sq. yd. macadam, together with curbing, grading, etc.

Mt. Ayr, Iowa.—Until May 31, by Town, for 15,600 sq. yd. paving, 9000 lin. ft. curb, catchbasins, etc., E. T. Archer & Co., Engrs., 514 New England Bldg., Kansas City, Mo. J. N. Lineburg, Town Clk.

Aitkin, Minn.—Reported desired until May 29, by H. C. Beecher, Co. Aud., for constructing State Rural Highway No. 70, 64 miles long, to consist of 26,120 cu. yd. clay and sand paving, 3540 cu. yd. graveling, widening and leveling 17,824 lin. ft. ditch banks, 3275 lin. ft. railing, 81,904 cu. yd. offtake ditch, 33,809 cu. yd. overhaul, etc. Probable cost $164,244.

Duluth, Minn.—See "Bridges."

Lincoln, Neb.—Reported desired until June 1, H. E. Wells, Co. Clk., for grading and paving in Dist. No. 13, estimated cost, brick paving, $8,800 and asphaltic concrete, $7,500. Also separate bids for paving in Dist. No. 14. Cost of brick paving, $18,700 and asphaltic concrete $17,000.

Billings, Mont.—Until May 31, by Board County Commissioners, for grading, constructing drainage work and surfacing approximately 47 miles public highway, in three sections, as followse Division west of Billings, 25.6 miles between Billings and Huntley 10.9 miles, between Huntley and Ballatine 10.6 miles. F. E. Williams, Co. Clk.

Kansas City, Mo.—Until May 26, by Until May 31, by Board Park Commissioners (T. C. Harrington, Sec'y.), for constructing bituminous macadam pavement on portions of Eighteenth and Nineteenth Streets, and alleyways on The Paseo.

Sedalia, Mo.—Reported desired until June 5, by W. E. Gold, City Clk., for 5500 sq. yd. concrete paving, together with curb, etc.

Fort Worth, Tex.—Reported desired until June 6, for paving one mile of streets. Address City Secretary.

Norman, Okla.—Reported desired until June 2, by J. Martha Wise, City Clk., for paving on several streets. Bids desired on brick, reinforced concrete and bitulithic.

Oklahoma, Okla.—Reported desired until May 29, by C. F. Semmenlbeck, City Clk., for paving portions of Thirty-third Street, Classen Boulevard, with National road asphalt, and portions of Nineteenth Street with sheet asphalt.

Asotin, Wash.—Reported desired until June 6, for constructing highway. Probable cost $10,000. V. G. Shellman, Co. Engr.

Clarkston, Wash.—Reported desired until June 6 by V. G. Shellman, Co. Engr. Asotin, for highway improvements. Probable cost $10,000.

Ephrata, Wash.—Reported desired until June 6, by C. T. Sanders, Clk. County Commissioners, for constructing county road 3⅜ miles south of Warden. Also constructing concrete bridge near Krupp and one 2 miles west of Ephrata. E. H. Stradling, Co. Eng.

Goldendale, Wash.—Until June 5, by R. M. Spoon, County Auditor, for constructing 3 miles of Permanent Highway No. 5, to cost $17,000. Lyman W. Ward, County Engineer.

Seattle, Wash.—Until June 5, by County Commissioners, for grading and graveling road between Woodinville and Duval, a distance of 3 miles. Cost $15,000. A P. Denton, City Engineer; Byron Phelps, Clerk of Commissioners.

Vancouver, Wash.—Reported desired until June 6, by May R. Haack, Co. Aud., for constructing Permanent Highway No. 3A, 6 and 7, involving two miles or more of highway in following places, Pacific Highway, through city of La Center, River Road, and Tenney Road, joining the Pacific Highway with Sara Ridgefield Road, waterbound macadam to be used. W. A. Schwarz, Co. Engr.

Washington.—Until June 12, by State Highway Commission (James Allen, Secy., Olympia), for surfacing with gravel or shale following roads, about 6.8 miles of Inland Empire Highway in Spokane County, about 1.3 miles in Clarke County.

Fowler, Cal.—Reported desired until June 15, for about 13,000 sq. yd. pavement. Cost $10,000. Address C. P. Jensen, City Engineer.

Hanford, Cal.—Until June 5, by Board County Supervisors (E. F. Pickerell, Clk.) for traction engine, or caterpillar, and a road grader.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Massachusetts.**—Contracts for paving awarded by Massachusetts Highway Commission, Boston, as follows (bids opened May 16):

★Somerset.—Joseph McCormack, Providence, $8,648 (awarded contract), (only bidder).

★Hancock.—Perini & Bianchi, Ashland, $15,125 (awarded contract); D. J. Sheehan Company, Lynn, $16,590; Middlesex Constructing Company, 7 Water Street, Boston, $16,742.

★Hingham.—Hamilton Flood, Wollaston, $8,026 (awarded contract).

★Plymouth.— E. J. Rourke, Abington, $12,542 (awarded contract); F. E. Ellis, Melrose, $17,101 other bidder.

★**Connecticut**—Contracts awarded by State Highway Commissioner, Hartford, for about 2 miles reinforced concrete road on Derby Turnpike, Town of Orange, to Robert D. Daley Co., New Haven, at about $36,000, and for bi-comoc pavement about 3000 sq. yd. on Cherry Street, town of Milford, to Connecticut Hassan Paving Co., New Haven, at about $5,000.

★**New Britain, Conn.**—Contract awarded by Board of Aldermen to Union Paving Co., Schenectady, N. Y., for laying sheet asphalt pavement consisting of a 3-in. top and 6-in. concrete base on two streets at $1.88 per sq. yd. with maintenance for five years. Approximate cost of work $17,000.

★**Manhasset, L. I., N. Y.**—Contract awarded by Town Board for rebuilding, with asphaltic concrete, Plandome Road from North Hempstead Turnpike to Reid Avenue, Port Washington, to Andrew Bros., Mineola, at $1.25 per sq. yd.

★**Cliffside Park, N. J.**—Contract for paving Palisade Avenue awarded E. C. Humphrey, Hackensack, at $45,932.

★**Elizabeth, N. J.**—Following are four lowest bids opened May 11 by Board of Public Works for paving (a) Bayway from Chilton to West Grand Streets, 10,992 sq. yd., and (b) Meadow Street and Jackson Avenue: Continental Public Works Company, Kearny, (a), $23,,096 (awarded contract); (b), $31,987 (awarded contract); H. C. Humphrey, Hackensack, (a), $23,923; (b), $33,356; Newton Paving Company, (a), $23,860; (b), $32,903; Union Paving Company, (a), $24,466; (b), $34,194. Continental Public Works Company, Kearny, also secured the contract to pave portions of Clover and Grove Streets and Dewey Place, in all about 8904 sq. yds., at a total of $18,333.

★**Keyport, N. J.**—Following are four lowest bids, opened May 8 by Borough Council, for paving Broad Street with concrete, about 12,000 sy. yd., (a) with guarantee, (b) without guarantee: Ganford Company, Inc., Long Island City, N. Y., (a) $21,454 (awarded contract), (b) $21,212; Richard Lamb, 136 Liberty Street, New York, (a) $22,904; (b) $23,145; Louis J. Sieling, Red Bank, N. J., (a) $23,727; (b) $23,364; C. H. Wisans Company, Elizabeth, (a) $24,513, (b) $23,908. Arthur S. Van Buskirk, Boro. Clerk.

★**Pennsgrove, N. J.**—Following are four lowest bids, opened May 15 by I. C. Smashey, Clerk Board Chosen Freeholders, Salem, for building 1st section of Pennsgrove-Pennsville Road with bituminous concrete surface on macadam foundation: Joseph F. Burk & Company, Plainfield, $62,266; E. C. Humphrey, Hackensack, $63,981; Sutton & Corson Company, Ocean City, $65,296, and Robert J. McCarthy, Jersey City, $65,245.

★Pennsylvania.—Contracts awarded by State Highway Department, Harrisburg, as follows on bids opened May 15: State Highway Route 131, Section 2, Concord and Aston Townships, Delaware County, with reinforced cement concrete pavement, 19,223 ft. in length, to Dwyer & Company, Philadelphia, at $68,633, and for State Highway, Route 131, Section 7, London, Grove and Penn Townships, Chester County, 1.96 miles, to D. E. O'Connell & Sons, Avondale, at $44,456.

★Baltimore, Md.—Lowest bid opened by Paving Commission for Contract No. 135 submitted by Baltimore Asphalt Block & Tile Co., at $53,645.

★Bryson City, N. C.—Contract for paving 12,000 sq. yd. with concrete awarded C. U. Requarth, Inc., Charlotte, N. C., at $1.10⅜ per sq. yd.

★Chattanooga, Tenn.—Contracts awarded by City Council for paving with oil-distilled asphalt portions of Mitchell and Read Avenues and Long Street, to West Construction Co., Chamberlain Bldg., at total of $47,741.

★Greenville, Tenn.—Contract awarded by city to Ely Construction Co., of Chattanooga for paving several streets with asphalt on concrete base.

★Winchester, Tenn.—Chas. Butler of Nashville, awarded contract by County Commissioners for grading and macadamizing county roads at about $30,000.

★Williamsburg, Ky.—Contract awarded by County Commissioners for grading and draining about 25 miles of county road to L. R. Figg Company, Louisville.

★Canton, O.—Contracts awarded by Charles F. Hornberger, Dir. Pub. Service, for improving streets as follows (bids opened May 10): To E. A. Downs Construction Co., Canton, for Eighth Street and Carnahan Avenue, N. E., Gibbs Avenue, N. E., and Ninth Street, N. E., at $35,623, $29,597 and $26,825, respectively; Cleveland Trinidad Paving Co., 3409 Trumbull Street, Cleveland, for Fourteenth Street, N. E., at $19,275, and Wise Bros., Canton, for Brown Avenue, N. W., $28,625.

Cincinnati, Ohio.—Following are four lowest bids opened by County Commissioners for constructing Caldwell Drive: John Ruebel Construction Co., $33,673; Joseph A. Burns, $36,054; John Funke, $37,298; R. E. Cash, $38,420. Lowest bid received for the repair of Pleasant Ridge Road was $11,300, by Nugent & Hines, Cincinnati, Ohio.

Following are the four lowest bids opened by Public Service Director Chas. F. Hornberger for improving Lincoln Avenue from Stanton Avenue to Alma Place, 8200 sq. yd., either (a) asphalt or (b) bitulithic: Paul N. Kingsley, Chicago, Ill., $14,351 (a), $17,676 (b); Kirchner Construction Co., 221 W. Ninth Street, (a) $16,041, (b) $18,383; Henkel & Sullivan, 710 Mercantile Library Building, (a) $16,197, (b) $18,209; Scully Brothers, 242 Loraine Avenue, (a) $16,288, (b) $18,793. City Engineer Frank S. Krug's estimates (a) $16,604, (b) $19,109.

★Cleveland, Ohio.—Contract for paving Colt Road awarded Gould & Maybach, 823 East 150th Street, at $8,666, and paving East 145th Street, Isidore and Elmhurst Avenues, to Geo. B. Herring & Son, 10539 Drexel Avenue, at $14,330.

★Dayton, Ohio.—Contract for gravel, crushed stone and road oil (bids opened May 18 by County Commissioners) awarded Longnecker Himes Company, Pleasant Hill, at $19,275. C. H. Aszling, Clerk County Committee.

★New Philadelphia, O.—Contracts awarded by County Commissioners as follows for constructing roads (bids opened May 16): Brick pavement—1.02 miles on Main Street, Strassburg, to Millersburg Brick & Tile Co., Millersburg, at $41,759; 2.06 miles Salem Township Road, to W. M. Brode Company, Strassburg, at $37,984; .83 mile on Reiser Road, Warwick Township, Coshocton Construction Co., Coshocton, $13,950. Macadam—2.42 miles, Dennison Cadiz Road, to R. L. Timmons & Son, Cadiz, at $22,794, and concrete on 1¼ miles of Bolivar Strassburg Road, to Daley Brothers Construction Co., Bolivar, at $17,570.

★Payne, Ohio.—Contract for 13,202 sq. yd. street paving (bids opened May 13 by C. B. Craig, Village Clerk) awarded Minnick Construction Company, New Castle, Ind., at $31,199.

★Troy, Ohio.—Contract awarded by Director Public Service for paving with Metropolitan block East Main Street, to Hennessey Bros., Troy, at $39,912.

Brazil, Ind.—Following bids opened May 16 by County Commissioners for constructing monolithic brick pavement 16 ft. wide on macadam base on Kester Road in Brazil Township: Carpenter Construction Co., Brazil, $58,400; S. R. Adams & Co., Princeton, $60,591; Campbell & Hawkins, Brazil, $60,748; G. F. Miller, Lebanon, $60,849.

★Ligonier, Ind.—Contract awarded by City Council for paving about 2½ miles of streets with brick to Minick Construction Co., Newcastle, at $94,357.

★Monroe, Mich.—Contracts awarded by County Commissioners for constructing roads as follows: To Garrigan Bros., Toledo, Ohio, at $98,000, for 9.77 miles on Stewart Road and for 6.84 miles of Palmer Road, at $73,000; Edington & Robbins, Arlington, Ohio, at $64,700, for 6.72 miles of Ida-Maybee Road.

★Paris, Ill.—Following are bids opened May 10 by Board Supervisors, for constructing 10,500 lin. ft. brick pavement: Alan Jay Parrish, Paris, $23,206 (awarded contract); Goggin Construction Company, Arcola, $23,280; Sells & Kollar, Pana, $23,322.

★Pontiac, Ill.—Contract awarded H. Lobb & Son, Pontiac, for 8000 sq. yd. brick paving at $16,600. J. C. Wade, City Engineer.

★Sheboygan, Wis.—Contract for 8660 sq. yd. two course concrete pavement on Lincoln Avenue, and 5510 lin. ft. combination curb, awarded John Braun, Sheboygan, at $1.42 per sq. yd. and 54 cents per lin. ft. respectively; total, $15,273. Next two bidders: Murphy Construction Company, Manitowoc, $15,729, and Garvey & Wyenberg Construction Company, Appleton, $16,075. C. U. Boley, City Engineer.

★Nevada, Iowa.—Contract for 14,000 sq. yd. of paving (bids opened May 16 by R. A. Davis, City Clerk) awarded Ford Paving Company, Cedar Rapids.

★Bemidji, Minn.—Contract for paving 9000 sq. yd. with concrete (bids opened May 1 by George Stein, City Clerk) awarded Goodman & Lortved, Bemidji, at $1,12 per sq. yd.

Minneapolis, Minn.—Following are bids opened May 12 by K. E. Alexander, City Purchasing Agent, for 30,000 sq. yd. vitr. paving blocks: Purington Paving Brick Company, Galesburg, Ill., $1.06 per sq. yd., f.o.b. Minneapolis; Colburn Murray Brick Company, 630 McKnight Bldg., $1.10 per sq. yd., f.o.b. Minneapolis, and $1.18 per sq. yd. on Hillsdale Blocks.

★Iola, Kan.—Contract awarded Kaw Paving Company, Topeka, for asphaltic concrete pavement at about $31,000.

★North Platte, Neb.—Contract for paving about 45,000 sq. yd. on portions of Dewey, Locust, and other streets awarded G. V. Strack, Denver, Col., at following unit figures (bids opened May 12): 2900 lin. ft. concrete curb, 6 x 20 in., 38 cts.; 2800 lin. ft. concrete curb, 6 x 24 in., 42 cts.; 300 ft. combined curb and gutter, 18 in., 85 cts.; 200 ft. 30-in., 90 cts.; 5700 ft. concrete drain in box, 12 x 20 in. inside, 6 in. thick, 91 cts.; 45,000 sq. yd. paving, 3-in. vertical brick block, $2.175, and in concrete, $1.575 per sq. yd. Other bids on paving were: Thomas Philips, Denver, vitr. brick block, $2.43; 3-in. fiber brick, $2.18; Natural Lake sheet asphalt, $1.88; oil sheet asphalt, $1.78; concrete, $1.90; Wood, Bancroft & Doty, Omaha, Neb., 3-in. vertical brick block, $2.18, and concrete, $1.70; Ford Paving Company, Omaha, Neb., 3-in. vertical fiber brick, $2.19; Natural Lake sheet asphalt, $1.92; oil sheet asphalt, $1.87. C. J. McNamara, City Engr.

Cincinnati, Ohio.—Following are unit figures of the four lowest bids opened May 15 by Charles F. Hornberger, Public Service Director, for improvement of Pearl Street from Broadway to Martin Street, granite: (a) City Engineer's estimate, $41,584; (b) Evan Evans, 1226 Ida Street, Cincinnati, $39,134; (c) Scully Brothers, 242 Loraine Avenue, Cincinnati, Ohio, $39,900; (d) Paul H. Kingsley, Chicago, Ill., $40,357; (e) Thomas P. Strack, 31 Goodall Building, Cincinnati, $40,414.

	(a)	(b)	(c)	(d)	(e)
600 lin. ft. underdrainage, 6-in. vitr. pipe	$0.25	$0.10	$0.25	$0.25	$0.20
600 lin. ft. drains, 12-in. pipe (I. C.)	1.00	0.75	0.75	0.60	1.00
270 lin. ft. drains, 12-in. pipe (M. S.)	1.60	1.60	1.60	2.00	1.60
80 lin. ft. drains, 15-in. pipe	2.45	2.50	2.40	2.50	2.40
8 T-branches on 12-in. pipe	0.75	1.00	0.75	1.00	0.60
3 manholes, complete	60.00	60.00	60.00	70.00	60.00
30 manholes readjusted	3.00	5.00	3.00	5.00	3.00
4 gutter inlets	30.00	20.00	30.00	30.00	30.00
20 inlets, Plan 3	45.00	45.00	40.00	40.00	40.00
4 inlets readjusted	5.00	5.00	5.00	6.00	5.00
180,000 lb. of castings	0.03	0.01	0.03	0.03	0.03
1,500 cu. yd. concrete, Class 3	5.00	5.00	4.70	5.00	4.80
500 lin. ft. granite curbs	1.20	1.00	1.15	1.15	1.10
300 lin. ft. granite circular curbs	1.60	1.50	1.60	1.40	1.55
4,000 lin. ft. curb reset and redressed	0.25	0.10	0.25	0.15	0.20
2,000 sq. ft. cement walks	0.15	0.15	0.15	0.15	0.14
200 sq. yd. boulder repaving	0.60	0.30	0.60	0.60	0.60
4,000 sq. yd. granite pavement (P. F. & F. C.)	3.00	3.00	2.95	2.87	3.15
100 sq. yd. granite repaving	1.00	0.75	1.00	1.00	0.90
9,500 sq. yd. granite pavement, old blocks redressed	1.60	1.49	1.53	1.60	1.50
260 lin. ft. steel protection plate	1.00	0.90	1.00	1.00	1.00
8 inlets converted to manholes	35.00	35.00	30.00	30.00	30.00

★Fargo, N. D.—Contract for paving with bitulithic awnrded James Kennedy of Fargo at $70,531.

★Kansas City, Mo.—Contracts awarded by County Commissioners for improving 5 miles Woods Chapel Road to Kansas City Construction Co., Kansas City, at $73,952, and for Hiler Road to Davidson Construction Co., Kansas City, at $40,817.

★Missoula, Mont.—Contract awarded by City Council for paving with bitulithic on 4-in. concrete base East Front Street, to J. C. Maguire, Butte, at $22,000. (Bids opened May 10.)

★Austin, Tex.—Contract for paving Eleventh Street about 8,000 sq. yd. awarded Uvalde Rock Asphalt Co., San Antonio, at $1.77⅓.

Dallas, Tex.—Contract awarded by City Commissioners for paving Lucile Street to Standard Engineering Company, Toledo, Ohio, at $11,645.

★Bellingham, Wash.—Contract awarded K. Sauset, Bellingham, at $15,256, for improving Ellis Street with concrete curbs, gutters and sewers. Charles A. Lindbery, City Engineer.

★Contract for paving portions of Indian Street (bids opened May 8 by Board of Public Works), awarded Riddle & Hawkins, Bellingham, at $10,168. Charles A. McLuman, City Comptroller.

★Cathlamet, Wash.—Contract awarded by County Commissioners for constructing Deep River Road to Pacific Dyking Co., Astoria, Ore., at $11,943.

★Everett, Wash.—Contract awarded by County Commissioners for constructing 6 miles of Cascade Scenic Highway from Index to King County line, to Culliton Bros., Everett, at $27,272.

★Olympia, Wash.—Reported contract awarded by County Commissioners for constructing Little Rock-Olympia highway to W. A. Weller, Olympia, at about $8,000.

★Pasco, Wash.—Contract awarded W. A. Morain, Kennewick, Wash., for constructing Permanent Highway No. 4, at $17,000. L. D. Conrad, County Auditor.

Portland, Ore.—Following bids opened by City Council for paving East Glisan Street with (a) asphaltic concrete with stone block, (b) asphaltic concrete with vitrified brick, (c) bitulithic with stone blocks, (d) bitulithic with vitrified brick, (e) Hassam with brick or stone: Montague & O'Reilly, Portland, (a) $34,819, (b) $34,324, (c) $30,740, (d) $30,245; Warren Construction Co., Portland, (a) $37,731, (c) $41,349; Oregon Independent Paving Co., Portland, (b) $32,476, (d) $35,315; Oregon Hassam Paving Co., Portland, (e) $35,320.

East San Diego, Cal.—Lowest bid opened recently by City Trustee for grading and constructing cement curbs, walks, culverts and cobblestone gutters in Mission and Orange Avenues and First, Anna and Steiner Streets was from Olaf Nelson, San Diego, at $11,087.

★Los Angeles, Cal.—Contract awarded California-Arizona Construction Company, 1700 East Washington Street, for 106,520 ft. asphalt pavement, curbs and gutters, etc., on Heliotrope Drive, at $14,487.

★San Francisco, Cal.—Contract awarded by Board of Works for improving portion of Miramar Avenue to Ransome-Crummey, Oakland, at $11,736.

★Ventura, Cal.—Contract for constructing 6.34 miles of concrete pavement on Ventura to La Crosse Road (bids opened May 13 by Board of Supervisors) awarded National Construction Company, Ocean Park. J. B. McCloskey, County Clerk.

★Toronto, Ont.—Contract for paving with asphalt on Clendennan Avenue awarded by Bd. of Control to Ontario Paving Co., Toronto, at $18,790.

STREET CLEANING AND GARBAGE DISPOSAL

PROPOSED WORK.

★Butte, Mont.—Contract for constructing incinerating plant (bids opened April 28) awarded May 10 to DeCarie Incinerator Company, Minneapolis, Minn., at $40,800. A. A. Dockstadler, City Clerk.

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS

PROPOSED WORK.

Ferry Slip, Etc.—New London, Conn.—Geo. K. Crandall, 98 State Street, is engineer for proposed municipal wharf and ferry slip, to cost $32,000; nothing further has been done in the matter. Harry H. Adams, City Clerk.

Flood Protection—Erie, Pa.—Citizens May 16 voted $950,000 bonds to construct flood protection works, recommended in the report of Farley Gannett, Engineer, Telegraph Bldg., Harrisburg.

Flood Protection Work—Erie, Pa.—See "Railroads."

Port Improvements—Philadelphia, Pa.—See "Electric Railways."

Dam—York Haven, Pa.—Farley Gannett, Theodore E. Seelye and Samuel W. Fleming, Jr., Telegraph Building, Harrisburg, engaged by York Haven Water & Power Co. to prepare plans for a dam to be constructed over east channel of Susquehanna River near York Haven, to be 800 ft. long, 7 ft. high; cost about $15,000.

Hydroelectric Plant—Cliffside, N. C.—The Broad River Hydroelectric Power Co., recently incorporated, proposes to build a hydroelectric plant on Broad River.

Port Improvements—Mobile, Ala.—Ford, Bacon & Davis, New Orleans, La., submitted a report on harbor and port improvements, recommends following: Two apron wharves, 40 x 540 ft., cost $114,480; 2 frame warehouses, 50 x 505, $30,300; railroad tracks, bulkhead and connections to Louisville & Nashville and New Orleans, Mobile & Chicago railroads, $17,875; one-mile paved shell roadway, $15,000, and dredging turning basin, $83,500. Overhead runways extending from Dauphin to St. Anthony Street, along Front Street, and extending along St. Francis and St. Louis Streets, cost $92,708, including 1150 lin. ft. overhead runways constructed of concrete, at $45 per foot, cost $51,750. The cost of constructing an ultimate overhead runway and telpherage system for serving wharf houses, all connected to municipal wharves, including cost of conveying apparatus and elevator runways, at $387,884.

Drainage—Crowley, La.—An election is to be held May 31 to vote bonds for constructing drainage improvements in Southwest Louisiana, costing $30,000. Merrill Bernard, Engineer, Crowley.

Sea Wall—New Orleans, La.—The building of a seawall, concrete with a hydraulic fill backing and gravel roadway thereon, extending from west end Lake Shore Park along west shore of Lake Pontchartrain to a point opposite Hammond, La., a distance of 50 miles, is under consideration by Association of Commerce. In addition to this work the drainage of some 50,000 acres of land will be effected. Approximate cost of project, $2,500,000.

Drainage—Des Moines, Ia.—The reclamation of about 20,000 acres of land along Skunk River in Story, Jasper and Polk Counties contemplated. Address County Clerk.

Drainage — Duluth, Minn.—Establishment of Drainage District No. 8, comprising about 15 miles of ditches and costing $10,000 is under consideration by County Board. Address County Clerk.

Ditch—Pipestone, Minn.—It is proposed to construct a judicial ditch to cost $175,000. J. R. Johnson, Engineer, Slaton. T. A. Bailey, County Auditor.

Dam—Sauk Rapids, Minn.—Reported Public Service Co. may build a power dam to cost about $200,000, instead of constructing power plant at St. Cloud Dam.

Dock—Seattle, Wash.—W. T. Donnelly, 17 Battery Place, New York, N. Y. prepared plans for a $200,000 pontoon drydock, 340 x 95 ft., capacity 5000 tons, to be erected by the J. F. Duthie & Company, Shipbuilders & Engineers, 2917 Whatcom Avenue, in the East Waterway, Seattle Harbor.

Jetty Work — Umpqua, Ore.—Contract soon to be let for constructing the proposed Port of Umpqua Jetty and harbor work.

Irrigation—El Centro, Cal.—The Imperial Irrigation District, El Centro (C. M. Berry, Secretary), has purchased the California Development Company system and has sold $500,000 bonds, to be used to protect the Valley against overflows of the Colorado River. All work to be done by the day; no contracts to be let. C. R. Rockwood, Chief Engineer.

Irrigation—Kern County, Cal.—Permission granted to Oscar Granville, Los Angeles, by State Water Commission, to appropriate 5 second feet of water from Cottonwood Creek by rock and concrete dam, including ditch 2½ miles long, for irrigating 375 acres. Cost about $17,500.

Irrigation—McFarland, Cal.—W. F. Laird, McFarland, is reported interested in the forming of a company of the citizens for the purpose of supplying water for irrigation and domestic purposes. Steel tank and tower will be constructed.

Flood Control—Pasadena, Cal.—Plans being prepared by J. W. Reagen, Los Angeles County, Flood Control Engineer, Los Angeles, for arched, concrete gravity dam, with radius of 400 ft., 125 ft. high, 200 ft. long and 20 ft. thick at top, 85 ft. thick at bottom, to be constructed at Devil's Gate, in Arroyo Seco Canyon, on Pasadena property, about ten miles northwest of city. Reservoir formed by dam will have capacity of about 4000 acre-ft. and will become a part of the water system of Pasadena. This work is to be carried out under $3,600,000 bond issue yet to be authorized by voters for flood work.

Wharf—San Diego, Cal.—Southern Reduction Company (D. C. Crouch, Secy.) will erect on city tidelands, between Beardsley and Crosby Streets, a wharf 550 ft. long and a fish cannery to cost $30,000.

Dam—Chandler, Ariz.—See "Bridges."

State Canal Work—Albany, N. Y.—Following are unit figures of the four lowest bids opened May 16 by W. W. Wotherspoon, State Superintendent Public Works, for Contract 23-A, Erie Canal, Section 9, constructing canal from Kings Bend to Lehigh Valley R.R. crossing: (a) Engineer's estimate, $651,703; (b) H. S. Kerbaugh, Buffalo, $630,568; (c) Walsh Construction Co., Davenport, Iowa, $646,161; (d) R. T. Ford Co., Rochester, $651,120; (e) Combined Construction Co., Rochester, $661,144.

	(a)	(b)	(c)	(d)	(e)
1 cofferdam, pumping, bailing and and draining (lump sum)......	$5,600.00	$6,720.00	$6,720.00	$5,600.00	$600.00
7,700 cu. yd. grubbing..................	0.35	0.20	0.35	0.35	0.20
540,700 cu. yd. excavation................	0.45	0.38	0.36	0.41	0.42
94 M ft. sheeting and bracing.......	50.00	60.00	60.00	60.00	50.00
58,200 sq. yd. sodding slopes............	0.20	0.20	0.20	0.22	0.15
108,800 cu. yd. forming embankment.....	0.15	0.10	0.10	0.13	0.01
1,110 cu. yd. lining......................	1.60	1.50	1.60	1.60	1.90
8.6 M ft. sawed lumber (yellow pine).	55.00	55.00	55.00	60.00	50.00
6 M ft. white oak lumber in lock gates, forming and erect'g only	45.00	45.00	45.00	30.00	40.00
44,500 lin. ft. foundation piles...........	0.35	0.285	0.10	0.35	0.20
118,000 sq. ft. ¼-in. steel sheet piling....	0.60	0.75	0.95	0.72	0.72
11,300 sq. ft. ⅜-in. steel sheet piling....	1.00	1.25	1.45	1.20	1.20
14,100 cu. yd. second-class concrete.....	7.00	6.00	7.75	7.30	6.75
24,300 cu. yd. wash wall.................	2.50	2.25	3.00	2.30	2.70
1,070 sq. yd. second-class stone paving.	2.25	2.25	2.70	2.25	2.50
2,290 sq. yd. third-class stone paving..	2.00	2.00	2.45	1.90	2.25
380 sq. yd. cobblestone paving........	1.50	1.50	1.80	1.50	1.50
320 cu. yd. third-class riprap........	2.75	2.75	3.30	2.75	3.25
450 cu. yd. fourth-class riprap.......	2.50	2.50	3.00	2.50	2.90
13,730 lb. structural steel..............	0.05	0.05	0.08	0.06	0.06
41,740 lb. metal reinforcement..........	0.03	0.05	0.036	0.036	0.036
20,480 lb. iron castings, plain...........	0.03	0.04	0.036	0.036	0.036
9,950 lb. iron castings, machined.......	0.05	0.06	0.06	0.06	0.06
960 lb. metal in lock gates, lock valves and buffer beams, furnishing, erecting and painting.	0.05	0.05	0.06	0.06	0.06
228,000 lb. metal in lock gates, lock valves and buffer beams, erecting and painting only..........	0.0125	0.015	0.0125	0.015	0.015
624,000 lb. metal in guard gates.........	0.065	0.135	0.08	0.078	0.078
1,240 lin. ft. wooden fence..............	0.25	0.25	0.25	0.30	0.30
1 storehouse	760.00	700.00	700.00	900.00	760.00
1,660 lb. bronze in bulkhead gates......	0.30	0.40	0.50	0.36	0.36
4 gate hoists.......................	850.00	1,000.00	850.00	850.00	900.00
4 sluice gates, 36 x 36 in., complete in place......................	400.00	500.00	400.00	400.00	450.00
1 repairing fence (lump sum)......	150.00	150.00	150.00	150.00	150.00

Irrigation — Corinne, Utah. — Corinne Drainage District organized for purpose of constructing a drainage district. W. M. Bostaph, Salt Lake City, engaged as chief engineer for this work, which will irrigate about 200,000 acres and about 200 miles of pipe (concrete) will be laid, from 8000 to 10,000 bbl. of cement required.

London, Ont.—Plans to be prepared by H. A. Frazier for construction of a concrete breakwater; cost about $30,000.

Shed—Sarnia, Ont.—Grand Trunk Railway Engineers are preparing plans for freight sheds to be erected on the docks at Sarnia for the Port Huron & Duluth Steamship Company. H. G. Kelly, Grand Trunk Ry., Montreal, Que., will be in charge of the work.

Levee Work—Edmonton, Alta.—City Engineer recommends construction of a levee around power house to cost $25,000.

BIDS DESIRED.

Dredging—Providence, R. I.—Until June 12, by U. S. Engineer Office, Providence, for dredging in Providence Harbor, R. I., advertised in Engineering Record.

Seawall and Filling—Bridgeport, Conn.—Until June 19 by Board Park Commissioners for constructing about 3900 ft. seawall and filling at Seaside Park, advertised in Engineering Record. Alfred H. Terry, City Engineer.

Dredging—Trenton, N. J.—Until June 6, by Department of Commerce & Navigation, State House, for dredging section of proposed inland waterway from Cape May to Bay Head, in Great Channel near Stone Harbor.

Dam—Lock Haven, Pa.—Until June 7, by Allen Sterner, Superintendent Parks & Public Property, Lock Haven, for constructing a portion of storage dam No. 1 on McElhattan Run, Wayne Township, Clinton County, advertised in Engineering Record. H. P. Shoemaker, City Engineer.

Dredging—Philadelphia, Pa.—Until Juns 8 by Bureau Yards and Docks, Navy Dept., Washington, D. C., for dredging at the Navy Yard, Philadelphia. Specification 2232; appropriation, $24.500.

Wharf—New Orleans, La.—Until June 8 by Light House Inuspector, New Orleans, for constructing wharf, etc., at Sabine Pass Light Station, La.

Stone and Willows—New Orleans, La.—Until June 20, by U. S. Engineer, New Orleans, for furnishing and delivering willows for South and Southwest Passes, Mississippi River; also same, separate bids for furnishing and delivering stone at the South and Southwest Passes, Missisippi River, both proposals advertised in Engineering Record.

Levee—Clarksdale, Miss.—Until June 6 by Levee Board (T. G. Dabney, Ch. Engr.) for a plain concrete slab, without reinforcements to be placed at front slope of levee in following localities: On levee Section 34 and 35, 2200 ft. long; Section 54 and 55, 6600 ft. long; Section 64 and 65, 3750 ft. long, and on Section 70, 1000 ft. long. Advertised in Engineering Record.

Irrigation—Balmorhea, Tex.—Until June 24, by Reeves County Irrigation Dist. No. 1 (W. W. Stewart, Secy.), for constructing diversion dam and canal, two earth storage dams with outlet work and canal, in all about 185,000 cu. yd. excav., 185,000 cu. yd. embankment, 22,000 sq. yd. dry paving, etc. V. L. Sullivan, Ch. Engr.

Irrigation — Grandview, Wash.—Until June 5 by Dept. Interior, U. S. Reclamation Service, Washington, D. C., for furnishing and erecting power pumping equipment, to consist of hydraulic turbine pumps, steel pipes, head gates, etc., for the Grandview Irrigation Dist.

Wharf Improvement—Seattle, Wash.—Until 2.30 p. m., June 7, by Port Commission (C. E. Remsberg, Secy.) for excavation, slope revetment and substructure work for extension of Spokane Street Wharf, cost about $17,500.

Jetty Work—Gardiner, Ore.—Until July 3, by Board Commissioners, Port of Umpqua, Gardiner (J. P. Christie, Secy.), for constructing north jetty at mouth of Umpqua River.

Dredging—Port Maitland, Ont.—Until May 30, by R. C. Desrochers, Secy. Dept. Pub. Wks., Ottawa, for dredging required at Port Maitland.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Sea Wall—Boston, Mass.**—Contract for constructing sea wall and paving Condor Street (bids opened May 15 by Commissioner Public Works) awarded Bay State Dredging Company, for Hasham block, at $17,349.

Dredging—Bridgeport, Conn.—Following are bids opened May 15 by U. S. Engineer, New London, for maintenance dredging in Bridgeport Harbor, about 38,300 cu. yds.: J. P. Randerson, 35 Broad Street, Albany, N. Y., 28 cents; Maritime Dredging Company, 80 Broad Street, New York, 14.5 cents.

★**Dredging—New York, N. Y.**—Contract for dredging Staten Island Sound, New York and New Jersey, awarded P. Sanford Ross, Jersey City, N. J., at $280,000. (Bids opened May 4 by U. S. Engineer.)

★**Retaining Wall, Etc.—McKeesport, Pa.**—Contract for constructing retaining wall, bulkhead, etc. (bids opened May 15) awarded E. M. Wickert Company, Pittsburgh, at $24,925. John F. Alderin, City Clerk.

★**Riprap — Wilmington, Del.**—Contract for furnishing and delivering about 14,300 tons of riprap stone and 1500 tons of capstones awarded by U. S. Engineer to Raleigh Granite Co., Raleigh, N. C., at $28,124.

Rip Rap—Washington, D. C.—Only bid opened May 15 by Corps Engineers, U. S. A., for constructing rip rap and seawall foundation, furnishing stone, etc., at Anacostia River, submitted by Columbia Granite & Dredging Corporation, Washington, D. C., at $1.74 for rip rap and $2.25 for building stone. P. Dodge, Chief Clerk of Commissioners.

★**Irrigation — Malta, Mont.** — Contracts awarded Security Bridge Co., Minneapolis, Minn., for structures Schedule 2, Bowdoin Canal system, Milk River irrigation project, Montana, at $12,940.

Guide Wall at Locks—Seattle, Wash.—Following are four lowest bids opened May 12 by U. S. Engineers Office, Burke Building, for constructing an 800-ft. guide wall at Lake Washington Canal Locks: Lester & Monohan, Colman Dock, $17,286; J. A. McEachern Company, $19,485; Cross & Parry Company, $17,494, and Booker Kiehl & Whipple, $19,896. Bidders all of Seattle.

★**Stone for Jetty Work—Portland, Ore.**—Contract for furnishing and delivering 100,000 tons of stone for north jetty at mouth of Mehalem River, awarded by U. S. Engineer Robert Wakefield, Portland, at $1.34 per ton.

Dredging—Los Angeles, Cal.—Following are bids opened May 10 by U. S. Engineer, Los Angeles, for dredging about 515,000 cu. yd. material at San Pedro, Los Angeles Harbor: San Francisco Bridge Co., 1005 Nevada Bank Building, San Francisco, 5.34 cts. per cu. yd, total $27,501; Standard American Dredging Co., 325 Central Building, Los Angeles, 5.87 cts., total $30,230; Los Angeles Dredging Co., 320 Story Building, Los Angeles, 6.45 cts., total $32,217.

ELECTRIC RAILWAYS

PROPOSED WORK.

Philadelphia, Pa.—Citizens May 16 voted $67,000,000 for port and transit development and $47,000,000 for general improvements.

Pottstown, Pa.—The Pottstown & Phoenixville Ry. Co. will spend about $50,000 for improvements. New 86-lb. rails will be laid west of Manatawny Street and east of Montgomery Street.

Baltimore, Md.—Reported United Railways & Electric Company will construct 1-mile extension on Liberty Heights Avenue.

Goldsboro, N. C.—Contract about to be let by Goldsboro Electric Ry. Company for material for construction of 2-mile extension, including three railroad crossings and one complete Y.

Lakeland, Fla.—The Tampa & Eastern Traction Co. received franchise from City Commissioners to construct line in Lakeland. Frank L. Cooper, Sec'y.

Hanson City, La.—Surveys being made for construction of six-mile extension from Hanson City to Rost for Orleans-Kenner Electric Ry. Co., cost $100,000.

Chicago, Ill.—The Metropolitan West Side Elevated Ry. Company contemplates extending Douglas Park Branch to Berwyn.

Kirkwood, Mo.—Bd. of Aldermen granted permit to United Railways Co. to construct a substation at Washington and Fillmore Avenues, Kirkwood.

Martinez, Cal.—The Martinez & Concord Interurban Ry. Co. will construct an electric railway from Martinez to Concord.

Flagstaff, Ariz.—Construction of an electric railway from Flagstaff to Grand Canyon contemplated by M. H. Sherman, Westminster Hotel, Los Angeles.

BIDS DESIRED.

New York, N. Y.—Until June 5 by Public Service Commission, 120 Broadway (James B. Walker, Secy.), for supplying structural steel for use in construction of rapid transit railroad.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**New Haven, Conn.**—Contract for erecting a power house for Connecticut Co. awarded to J. G. White Engineering Cor., 43 Exchange Place, New York, N. Y.

New York, N. Y.—Following are four lowest bids opened May 22 by Public Service Commission, 120 Broadway, for constructing Sect. No. 5 of Route No. 8, a part of the Fourteenth Street Eastern Rapid Transit Railroad: MacArthur Bros. Co., 11 Pine Street, $1,336,950; J. F. Cogan Co., Woolworth Building, $1,364,266; Rodgers & Haggerty, Inc., Hudson River and 152d Street, $1,386,514; The Degnon Contracting Co., 36 East Forty-second Street, $1,433,745.

Lowest bid opened May 23 by Public Service Commission, 120 Broadway, for constructing the Eastern Parkway Rapid Transit R. R., Route 31, submitted by Dennis E. Conners, 64 West Eighty-eighth Street, at $1,356,000.

★**New York, N. Y.**—Following are unit figures of four lowest bids opened May 16 by Public Service Commission for First District, 120 Broadway, for constructing Route 8, Section 4, a 2-track subsurface railroad extending under N. Seventh Street and Metropolitan Avenue, Brooklyn, from Bedford Avenue to Manhattan Avenue: (a) Mason & Hanger Co., Inc., 52 Vanderbilt Avenue, $1,847,174 (awarded contract); (b) John C. Sullivan, 103 Park Avenue, $2,018,804; (c) Rodgers & Hagerty, Hudson River and 152d Street, $2,123,619; (d) The Degnon Contracting Co., 30 E. Forty-second Street, $2,156,691. (Total length of structure 3,590.5 ft.)

Item		*(a)	(b)	(c)	(d)
1	134,000 cu. yd. earth excav. above mean high water..	$2.90	$3.00	$4.25	$3.00
2	80,325 cu. yd. earth excav. below mean high water..	2.90	3.40	4.75	4.75
2A	4,620 cu. yd. earth excav. above and below mean high water, sewers........................	2.90	3.25	3.00	3.00
4	5,300 front ft. (a) underpinning buildings less than 7 stories................................	29.00	40.00	5.00	25.00
4E	730 front ft. maintaining, protecting and securing buildings	28.00	30.00	5.00	20.00
6	34,000 cu. yd. concrete masonry in place...........	7.50	8.50	9.50	9.00
7	7,300 cu. yd. protective concrete masonry outside water pressure..........................	7.50	8.50	9.50	9.00
8	20 cu. yd. rubble stone masonry..................	5.00	6.00	8.00	8.00
8A	20 cu. yd. dry rubble masonry....................	4.00	5.00	5.00	7.00
9	5 cu. yd. brick masonry..........................	12.00	20.00	15.00	16.00
10	30 cu. yd. hollow terra cotta brick masonry.....	12.00	15.00	15.00	20.00
11	100 bbl. grout of Portland cement................	2.50	4.00	3.00	3.50
12	100 lin. ft. timber piles........................	0.50	0.30	0.25	1.00
13	2 M ft. timber foundations......................	50.00	40.00	50.00	75.00
14	25 cu. yd. broken stone or gravel................	2.50	2.00	3.00	3.00
15	44,000 sq. yd. (a) waterproofing, 1 ply.............	0.33	0.45	0.40	0.50
15	100 sq. yd. (b) waterproofing, 2 ply.............	0.54	0.60	0.75	1.00
15	13,570 sq. yd. (c) waterproofing, 3 ply.............	0.82	1.10	1.00	1.25
15	100 sq. yd. (d) waterproofing, 4 ply.............	1.08	1.50	1.40	1.50
15	100 sq. yd. (e) waterproofing, 5 ply.............	1.35	1.80	1.70	1.75
15	50 sq. yd. (f) waterproofing, 6 ply.............	1.62	2.50	2.15	2.00
15	100 sq. yd. (i) waterproofing, dry ply...........	0.22	0.30	0.40	0.40
16	7,040 cu. yd. brick in asphalt mastic..............	20.00	25.00	25.00	25.00
17	50 lin. ft. (a) vitrified drain pipe, 12 in.........	0.90	1.00	0.85	0.80
17	50 lin. ft. (b) vitrified drain pipe, 10 in.........	0.80	0.85	0.70	0.55
17	1,450 lin. ft. (c) vitrified drain pipe, 8 in.........	0.50	0.65	0.55	0.30
17	1,450 lin. ft. (d) vitrified drain pipe, 6 in.........	0.35	0.60	0.50	0.25
17	50 lin. ft. (e) vitrified drain pipe, 4 in.........	0.25	0.50	0.45	0.30
17	50 lin. ft. (g) cast-iron drain pipe, 6 in.........	1.15	1.50	1.25	1.00
17	665 lin. ft. (h) cast-iron drain pipe, 4 in.........	0.70	1.00	0.60	1.00
17	100 lin. ft. (i) cast-iron drain pipe, 10 in.........	2.30	2.50	2.25	1.50
17A	100 lin. ft. (a) cast-iron pipe and fittings, 3 in., extra heavy................................	1.00	1.00	1.25	1.00
17A	100 lin. ft. (b) cast-iron pipe and fittings, 4 in., extra heavy................................	1.15	1.25	1.60	1.00
17A	300 lin. ft. (c) cast-iron pipe and fittings, 6 in., extra heavy................................	1.60	1.50	2.00	1.25
17A	200 lin. ft. (d) cast-iron pipe and fittings, 8 in., extra heavy................................	2.30	2.00	3.00	1.50
17C	100 lin. ft. (a) galvanized wrought-iron pipe and fittings, special, extra heavy, 3 in...........	1.80	0.25	2.00	1.25
17C	100 lin. ft. (d) galvanized wrought-iron pipe and fittings, special, extra heavy, 6 in...........	3.50	0.35	3.50	2.50
18	125,800 duct ft. tunnel ducts......................	0.10	0.14	0.12	0.20
18A	11,200 duct ft. railroad ducts.....................	0.13	0.14	0.16	0.25
19	1,210 ton riveted steel..........................	100.00	100.00	96.00	105.00
20	2,250 ton steel beams and shapes..................	87.00	85.00	85.00	95.00
21	845 ton steel rods and bars......................	84.00	80.00	90.00	85.00
25	37 ton miscellaneous iron castings...............	70.00	100.00	80.00	90.00
25C	1 ton miscellaneous sewer irons.................	100.00	100.00	125.00	100.00
26	9,600 lb. special wire forms.....................	0.12	0.20	0.10	0.15
27B	4,200 lin. ft. 1¾-in. seasoned oak handrail.........	0.35	0.40	0.35	1.00
28	5,375 sq. ft. steel gratings for ventilation...........	1.95	2.00	1.50	2.00
29	1,680 sq. ft. vault lights.........................	1.15	1.50	1.50	1.50
30	4,200 sq. yd. (a) sidewalk restored................	2.00	1.50	1.35	2.00
30	1,400 sq. yd. (e) repavement of roadway, asphalt..	2.70	2.75	3.00	3.25
30	15,450 sq. yd. (f) repavement of road., granite block	2.30	1.00	1.00	2.50
30	150 lin. ft. (i) new bluestone curb...............	1.15	1.00	1.00	1.50
30	100 lin. ft. (k) new 8-in. granite curb............	1.70	2.00	1.50	2.00
32	7,000 lin. ft. (a) electric conduits, ¾ in., w. i......	0.12	0.20	0.20	0.30
32	100 lin. ft. (b) electric conduits, 1½ in., w. i.....	0.24	0.30	0.30	0.45
32	200 lin. ft. (c) electric conduits, 2 in., w. i.......	0.30	0.45	0.35	0.65
32	300 lin. ft. (d) electric conduits, 1 in., w. i......	0.20	0.25	0.25	0.35
33	700 cast-iron outlet boxes.....................	1.15	2.00	1.50	1.00
34	100 lin. ft. (a) cast-iron pipes and fittings, 6 in., extra heavy................................	1.60	1.50	2.00	1.25

Route 8, Section 4 (Continued)

34	100	lin. ft. (b) cast-iron pipes and fittings, 8 in., extra heavy	1.15	1.00	1.50	1.00
37	3,630	lin. ft. vitrified pipe sewer, 12 in	3.00	2.00	3.00	3.60
38	1,300	lin. ft. vitrified pipe sewer, 15 in	3.45	2.25	3.50	4.00
39	850	lin. ft. vitrified pipe sewer, 18 in	3.90	3.00	4.00	4.50
40	370	lin. ft. vitrified pipe sewer, 20 in	4.15	3.50	4.50	6.00
40A	100	lin. ft. vitrified pipe sewer, 22 in	4.70	3.75	6.00	5.50
41	100	lin. ft. vitrified pipe sewer, 24 in	4.95	4.00	6.00	6.00
42	6	ton cast-iron sewer pipe, straight	36.80	40.00	50.00	100.00
43	5	ton cast-iron sewer pipe, specials	73.60	90.00	100.00	120.00
45	300	lin. ft. egg-shaped masonry sewer, 3 ft. 6 in. x 2 ft. 4 in	5.20	7.50	6.60	10.00
47	30	lin. ft. egg-shaped masonry sewer, 4 ft. 0 in. x 2 ft. 8 in	5.75	7.50	7.00	13.00
52B	40	lin. ft. circular sewer, 3 ft. 3 in	3.75	7.50	7.00	8.00
52C	160	lin. ft. circular sewer, 3 ft. 6 in	4.25	10.00	8.00	10.00
53	100	lin. ft. circular sewer, 4 ft. 0 in	4.75	13.00	9.00	12.00
56	100	lin. ft. circular sewer, 5 ft. 0 in	7.25	18.00	14.50	14.00
57	90	lin. ft. circular sewer, 5 ft. 6 in	8.60	20.00	16.50	16.00
60	40	lin. ft. circular sewer, 6 ft. 0 in	10.30	22.00	17.00	18.00
67B	64	lin. ft. twin sewer, 4 ft. 3 in	12.00	25.00	20.00	20.00
75	3,600	lin. ft. (c) maintain. electric overhead trolley.	9.00	8.00	2.00	4.00
79	100	lin. ft. water pipe, 6 in	0.80	0.75	0.50	2.00
82	100	lin. ft. water pipe, 12 in	1.50	2.00	1.00	2.50
83	300	lin. ft. water pipe, 16 in	2.05	8.00	1.50	2.75
84	100	lin. ft. water pipe, 20 in	2.40	4.00	2.00	3.00
85	800	lin. ft. water pipe, 24 in	3.45	6.00	2.50	3.50
86	100	lin. ft. water pipe, 30 in	4.00	7.00	3.00	4.00
88A	50	service connections for water pipe restored	13.80	20.00	25.00	25.00
89	100	lin. ft. gas pipe, 3 in	0.60	0.50	0.50	0.75
90	100	lin. ft. gas pipe, 4 in	0.70	0.60	0.50	1.00
91	500	lin. ft. gas pipe, 6 in	0.80	0.75	0.50	1.50
92	100	lin. ft. gas pipe, 8 in	1.05	1.00	0.75	2.00
93	100	lin. ft. gas pipe, 10 in	1.25	1.25	0.85	2.20
94	100	lin. ft. gas pipe, 12 in	1.50	1.50	1.00	2.30
95	100	lin. ft. gas pipe, 16 in	2.05	3.00	1.50	2.50
96	100	lin. ft. gas pipe, 20 in	2.40	4.00	2.00	8.00
99A	2,000	lin. ft. (a) by-passing pipe, 6 in., w. i	1.75	2.50	3.00	4.00
99A	1,050	lin. ft. (b) by-passing pipe, 8 in., w. i	2.30	3.00	4.00	4.50
99A	100	lin. ft. (d) by-passing pipe, 12-in., w. i	2.90	4.00	6.00	5.00
99A	3,050	lin. ft. (h) by-passing pipe, 4 in., w. i	1.15	2.50	2 60	3.50
99A	1,250	lin. ft. (w) by-passing pipe, 3 in., w. i	0.80	2.00	2.00	3.00
99B	200	lin. ft. (a) by-passing pipe on trestles, 12 in., w. i	2.90	5.00	5.00	4.00
99B	200	lin. ft. (b) by-passing pipe on trestles, 16 in., w. i	3.45	7.50	8.00	5.00
99B	150	lin. ft. (g) by-passing pipe on trestles, 8 in., w. i	2.30	4.00	3.00	3.50
99B	700	lin. ft. (j) cat. trestle for pipes, 16 in. and under	3.45	3.50	2.00	3.50
99B	300	lin. ft. (l) by-passing pipe on trestle, 10 in., w. i	2.60	3.25	4.50	3.75
99D	50	service connections for gas pipes restored	11.50	15.00	25.00	25.00
100	50	ton cast-iron hub and spigot pipe, straight	40.00	46.00	40.00	65 00
101	25	ton cast-iron hub and spigot pipe, specials	80.00	80.00	85.00	100.00
127	575	duct ft. electric ducts and conduits	0.45	0.50	0.65	1.00
127A	100	lin. ft. (a) electric ducts and conduits, 2½-in. w.-i. pipe	0.45	1.00	1.00	1.00
127A	100	lin. ft. (b) electric ducts and conduits, 3-in. w.-i. pipe	0.50	1.00	1.25	1.00
127A	100	lin. ft. (h) Edison conduit, 3 in	0.90	1.00	1.25	1.50
127A	100	lin. ft. (i) Edison conduit, 3½ in	1.05	1 00	1.50	1.75
127C	10	electrical services restored	13.80	25.00	25.00	50.00
127D	100	duct ft. wooden ducts of whatever kind	0.60	1.00	1 25	1.00
127E	100	duct ft. fiber ducts of whatever kind	0.60	1.00	1.25	1.00

New York, N. Y.—Following are unit figures of the four lowest bids opened May 18 by Public Service Commission for First District, 120 Broadway, for constructing Route No. 8, Section 1, a 2-track subsurface railroad extending from East and West Fourteenth Street from west of Sixth Avenue to easterly building line of Irving Place: (a) Booth & Flinn, Ltd., 17 Battery Place, $2,528,618; (b) P. McGovern & Co., 1 Madison Avenue, $2,697,045; (c) MacArthur Brothers, 11 Pine Street, $2,746,028; (d) Oscar Daniels, Woolworth Building, $2,770,431.

Item			(a)	(b)	(c)	(d)
1	80,500	cu. yd. (a) earth excav. above mean high water between existing subways	$5.00	$5.25	$4.10	$5.00
1	1,040	cu. yd. (b) earth excav. above mean high water under existing subways	5.00	7.50	7.50	5.00
2	7,700	cu. yd. (a) earth excav. below mean high water between existing subways	5.00	6.00	4.85	5.00
2	100	cu. yd. (b) earth excav. below mean high water under existing subways	5.00	7.50	9.00	5.00
2A	1,680	cu. yd. earth excav. above and below mean high water	5.00	3.50	3.75	4.00
3	63,000	cu. yd. (a) rock excav. between existing subways	6.00	6.80	6.00	7.00
3	18,500	cu. yd. (b) rock excav. under existing subways	6.00	10.00	12.00	8.00
3A	100	cu. yd. rock excav. for sewer, pipes, ducts, etc	6.00	10.00	7.50	8.00
4	1,650	front ft. (a) underpinning buildings, less than 7 stories	41.00	23.00	75.00	25.00
4	175	front ft. (b) underpinning buildings, from 7 to 12 stories	200.00	23.00	90.00	25.00
4	100	front ft. (c) underpinning buildings, over 12 stories	225.00	70.00	90.00	25.00
4E	750	front ft. maintaining, protecting and securing buildings	40.00	10.00	35.00	25.00
4OO	1	maintaining, protecting and securing Lincoln statue (lump sum)	1,500.00	250.00	2,000.00	2,000.00
4PP	1	maintaining, protect. and securing Washington statue (lump sum)	1,000.00	250.00	2.000.00	1,500.00
5	31,600	cu. yd. tunnel excav., including timbering, etc	8.00	9.25	8.75	9.00
6	28,700	cu. yd. concrete masonry in place.	7.50	10.50	8.50	11.00
7	4,400	cu. yd. protective concrete masonry in place	7.50	10.50	8.50	11.00
8	10	cu. yd. rubble stone masonry in place	3.50	8.00	5.00	15.00
8A	10	cu. yd. dry rubble masry. in place.	2.50	6.00	4.50	7.00
9	30	cu. yd. brick masonry in place	16.00	25.00	14.00	15.00
10	15	cu. yd. hollow terra cotta brick or tile masonry	12.00	20.00	14.00	15.00
11	4,000	bbl. grout in Portland cement	4.00	4 00	2.80	2.50
11A	100	sq. yd. resurfacing old concrete	0.45	1.00	1.25	1.00
12	500	lin. ft. timber piles in place and prepared	0.30	0.50	0.65	0.25
13	2	M ft. timber foundations, placed and fastened	70.00	75.00	56.00	40.00
14	15	cu. yd. broken stone or gravel in place	3.00	3.00	2.50	1.60
15	14,000	sq. yd. (a) 1-ply waterproofing	0.45	1.00	0.35	0.40
15	100	sq. yd. (b) 2-ply waterproofing	0.80	1.10	0.55	0.65
15	8,000	sq. yd. (c) 3-ply waterproofing	1.15	1.25	0.85	0.90
15	100	sq. yd. (d) 4-ply waterproofing	1.50	1 50	1.10	1.25
15	100	sq. yd. (e) 5-ply waterproofing	1.85	2.50	1.40	1.50
15	500	sq. yd. (f) 6-ply waterproofing	2.20	3.00	1.70	1.80
15	100	sq. yd. (i) dry-ply waterproofing.	0.30	0.90	0.25	0.40
16	3,500	cu. yd. waterproofing brick in asphalt mastic	28.00	24.00	21.25	30.00
17	100	lin. ft. (a) 12-in. vitr. or c.-i. pipe.	1.00	1.50	1.00	1.00

Route 8, Section 1 (Continued)

17	100	lin. ft. (b) 10-in. vitr. or c.-i. pipe.	0.75	1.35	0.90	0.80
17	2,000	lin. ft. (c) 8-in. vitr. or c.-i. pipe.	0.60	1.25	0.60	0.70
17	2,000	lin. ft. (d) 6-in. vitr. or c.-i. pipe.	0.50	1.00	0.50	0.50
17	100	lin. ft. (e) 4-in. vitr. or c.-i. pipe.	0.40	0.65	0.30	0.40
17	100	lin. ft. (g) 6-in. c.-i. pipe	1.00	1.00	1.25	1.00
17	5,400	lin. ft. (h) 4-in. c.-i. pipe	0.80	0.90	0.90	0.80
17	676	lin. ft. (i) 10-in. c.-i. pipe	1.75	2.00	2.50	1.50
17A	200	lin. ft. (a) 3-in. c.-i. pipe and fittings, etc	0.80	1.00	1.00	1.00
17A	200	lin. ft. (b) 4-in. c.-i. pipe and fittings, etc	1.00	1.25	1.25	1.50
17A	300	lin. ft. (c) 6-in. c.-i. pipe and fittings, etc	1.40	1.50	1.65	2.50
17A	300	lin. ft. (d) 8-in. c.-i. pipe and fittings, etc	1.90	2.50	2.50	3.00
17C	100	lin. ft. (d) 6-in. galv. w.-i. pipe, fittings, etc	3.00	3.00	3.75	2.00
18	110,000	duct ft. tunnel ducts in place	0.15	0.12	0.10	0.13
19	3,200	ton riveted steel, painted and erected	100.00	90.00	94.00	97.00
19	50	ton (c) cutting out, removal and disposal of old cast iron or steel.	12.00	20.00	63.00	30.00
20	1,700	ton steel beams and shapes, etc..	80.00	85.00	86.00	86.00
20A	1,000	holes, drilling holes in steel	0.50	0.50	0.60	0.75
21	140	ton steel rods and bars built in concrete	60.00	80.00	94.00	90.00
25	35	ton misc. iron casting, manhole heads and covers, etc	70.00	75.00	75.00	70.00
25C	2	ton misc. iron furnishings, etc	80.00	75.00	125.00	70.00
26	1,000	lb. special wire forms in place	0.10	0.10	0.12	0.30
27B	3,000	lin. ft. 1¾-in. seasoned oak or ash handrail	0.40	0.50	0.40	0.50
28	3,700	sq. ft. steel gratings for ventilation in place	1.75	2.25	2.00	1.70
29	170	sq. ft. vault lights in place	1.50	2.00	1.90	1.50
30	1,800	sq. yd. (a) street surface restored within curb lines (sidewalk)	2.00	2.50	2.50	2.50
30	6,900	sq. yd. (e) repav. of r'dways, between curbs, asphalt pavement..	3.00	4.50	3.10	4.00
30	3,000	sq. yd. (f) repav. of r'dways, between curbs, granite block	3.50	4.50	2.80	2.50
30	100	lin. ft. (i) new bluestone curb in place	1.25	1.50	1.25	1.50
30	1,500	lin. ft. (k) new 8-in. granite curb in place	1.50	2.00	1.90	2.50
31	100	sq. yd. park surface restored	2.50	1.00	1.90	1.00
32	7,200	lin. ft. (a) ¾-in. w.-i. electric conduits in place	0.25	0.15	0.12	0.30
32	400	lin. ft. (b) 1½-in. w.-i. electric conduits in place	0.50	0.25	0.25	0.40
32	200	lin. ft. (c) 2-in. w.-i. electric conduits in place	0.60	0.30	0.38	0.50
32	4,200	lin. ft. (d) 1-in. w.-i. electric conduits in place	0.35	0.20	0.20	0.35
33	800	c.-i. outlet boxes in place	0.40	0.60	1.25	1.00
33A	10	c.-i. pull boxes in place	1.50	10.00	2.50	1.50
34	100	lin. ft. (a) 6-in. c.-i. pipe and fittings, etc	1.25	1.50	1.75	2.50
34	100	lin. ft. (b) 3-in. c.-i. pipe and fittings, etc	0.75	1.00	1.25	1.00
37	1,130	lin. ft. 12-in. vitr. pipe sewer	2.35	1.50	3.25	3.00
38	350	lin. ft. 15-in. vitr. pipe sewer	2.70	1.75	4.05	3.50
39	80	lin. ft. 18-in. vitr. pipe sewer	3.15	2.00	4.25	4.00
40	460	lin. ft. 20-in. vitr. pipe sewer	3.50	2.50	4.50	5.00
41	100	lin. ft. 24-in. vitr. pipe sewer	4.30	2.75	5.40	5.00
42	5	ton c.-i. iron sewer pipe (straight pipe) in place	45.00	70.00	40.00	40.00
43	1	ton c.-i. iron sewer pipe (special castings) in place	80.00	85.00	80.00	80.00
45	115	lin. ft. 3 ft. 6 in. x 2 ft. 4 in. egg-shaped brick or concrete sewer..	5.00	4.50	6.25	6.00
49	750	lin. ft. 4 ft. 6 in. x 30 in. egg-shaped brick or concrete sewer..	6.50	8.00	6.90	8.00
54A	30	lin. ft. 4 ft. 6 in. circular sewer	8.50	8.00	8.10	10.00
75	4,100	lin. ft. sq. tr. (a) street surface railroad support, etc., elec. underground trolley	4.00	12.00	8.75	13.00
75	230	lin. ft. sq. tr. (b) street surface railroad support, horse, storage and battery, etc	2.50	10.00	5.00	7.00
76	2	columns (a) elev. railroad cols., supported entirely upon railroad structure (temp. etc.)	900.00	2,000.00	1,250.00	1,500.00
76	2	columns (b) elev. railroad cols. supported partly on or off railroad structure (temp., etc.)	1,400.00	1,500.00	1,250.00	1,500.00
76O	1	support., main. and underpin. B'way-Fourth Avenue Subway (lump sum)	16,000.00	10,000.00	31,250.00	45,000.00
76P	1	support., main. and underpin. Man. and Bronx Subway (lump sum)	75,000.00	10,000.00	125,000.00	15,000.00
76Q	1	support., main. and underpin. Hudson and Man. Subway (lump sum)	20,000.00	10,000.00	62,500.00	45,000.00
79	725	lin. ft. 6-in. water pipe, etc	0.40	1.00	0.90	2.50
82	115	lin. ft. 12-in. water pipe, etc	1.00	1.50	1.65	3.00
84	115	lin. ft. 20-in. water pipe, etc	2.00	2.50	2.60	4.00
87	140	lin. ft. 36-in. water pipe, etc	3.50	5.00	5.00	5.00
88A	25	service connections for water pipes	20.00	25.00	15.00	10.00
90	170	lin. ft. 4-in. c.-i. gas pipe, etc	0.30	0.75	0.90	1.50
91	1,000	lin. ft. 6-in. c.-i. gas pipe, etc	0.40	1.00	1.10	2.50
92	115	lin. ft. 8-in. c.-i. gas pipe, etc	0.60	1.25	1.50	3.00
93	115	lin. ft. 10-in. c.-i. gas pipe, etc	0.80	1.50	1.90	3.00
99A	3,900	lin. ft. (b) 8-in. w.-i. by-passing pipe, etc	4.00	2.50	2.50	4.00
99C	115	lin. ft. (c) 8-in. w.-i. gas pipe, etc.	4.00	1.00	1.90	3.00
99C	115	lin. ft. (d) 10-in. w.-i. gas pipe, etc.	5.00	1.50	2.10	3.50
99D	25	service connections for gas pipes, all sizes, each	20.00	10.00	12.50	6.00
100	10	ton new c.-i. hub and spigot pipe, straight pipe, etc	40.00	50.00	44.00	40.00
100A	115	lin. ft. (c) new 8-in. std. w.-i. gas pipe thread and couplings	4.00	3.00	1.90	2.50
100A	115	lin. ft. (d) 10-in. std w.-i. gas pipe thread and couplings	5.00	3.50	2.20	3.00
101	10	ton new c.-i. hub and spigot pipe, special castings	80.00	80.00	88.00	75.00
101A	100	lb. new malleable iron fittings for w.-i. gas pipe (new)	0.10	0.20	0.15	0.40
103	460	lin. ft. 12-in. high-press. fire system pipes, etc	2.00	2.00	3.75	3.50
107	5	ton new c.-i. spigot and groove pipes, str. pipes, etc	50.00	100.00	44.00	45.00
108	10	ton new c.-i. spigot and groove pipes, special castings	100.00	100.00	88.00	80.00
121	30	lin. ft. 6-in. air pipes, etc	0.50	1.00	1.25	2.50
123	100	lin. ft. new 6-in. air pipes, incl. specials, etc	1.00	2.00	1.25	2.50
127	6,400	duct ft. electric ducts and conduits in place	0.30	0.75	0.50	0.20
127A	275	lin. ft. (a) 2½-in. w.-i. pipes	0.30	0.50	0.50	0.20
127A	3,900	lin. ft. (b) 3-in. w.-i. pipes	0.40	0.75	0.60	0.20
127A	4,200	lin. ft. (c) 3½-in. w.-i. pipes	0.50	0.75	0.60	0.20
127A	115	lin. ft. (g) 2½-in. Edison conduits.	0.30	1.00	0.90	0.20
127A	115	lin. ft. (i) 3¼-in. Edison conduits.	0.50	1.25	1.10	0.20
127A	30	lin. ft. (o) 4-in. Edison conduits..	0.60	2.00	1.40	0.20
127C	15	service connections for electric ducts, each	15.00	25.00	15.00	15.00

Brooklyn, N. Y.—Following are four lowest bids opened May 16 by New York Municipal R. R. Corporation, 85 Clinton Street, Brooklyn, for constructing elevated railroad stations on Jamaica line: P. J. Carlin Construction Company, 1123 Broadway, New York, $480,700; Charles Meads & Company, 38 Park Row, $491,000; Vulcan Rail & Construction Company, 35 Meserole Avenue, $507,000; and John Thatcher & Son, 60 Park Avenue, $511,500.

★**Tampa, Fla.**—Preliminary surveys being made by Tampa & Eastern Traction Co. for proposed line from Tampa to Lakeland, 33 miles. Reported contract for construction of line has been conditionally awarded to Utilities Construction Co., Norristown, Pa. F. L. Cooper, Tampa, Sec'y.

RAILROADS

PROPOSED WORK.

Erie, Pa.—Citizens, May 16, voted $495,000 bonds for elimination of grade crossings, protection of Garrison Run from floods and construction of storm sewers.

York, Pa.—The Pennsylvania R. R. Co. reported planning to spend about $500,000 for improvements in York; 20 additional tracks will be laid. Alex. C. Shand, Ch. Engr., Philadelphia.

Indian Head, Md.—Potomac River & Baltimore Ry. Company has applied for permission to issue capital stock for $1,000,000 to build a railroad between Indian Head, Md., and Newport News, Va.

St. Albans, W. Va.—Contract soon to be let by Chesapeake & Ohio Ry. Co. (F. I. Cabell, Ch. Engr., Richmond, Va.) for constructing a 13-mile extension between Seth and Jarrolds Valley.

Middletown, Tenn.—Receiver W. F. Owen has been authorized by the Federal District Court, Mobile, Ala., to begin construction of the extension of the New Orleans, Mobile & Chicago R. R. from Middletown, Tenn., north to Jackson, 34 miles. Estimated cost of work between $700,000 and $800,000.

Detroit, Mich.—Grand Trunk R. R. (H. R. Safford, Ch. Engr., Montreal, Que.) is to make improvements here, to include freight house in and outbound, with house tracks and paved team tracks; cost $328,000; new classification yard in Hamtramck District, $281,000; second passing track eastward in Milwaukee district, $85,000; rehabilitating of Avery Avenue team tracks and pavements, paving of Twombly Avenue team tracks, paving of team tracks at Ferry Avenue, Farnsworth and Dequindre Streets north of Gratiot Avenue, $120,000; constructing grades on line leading to West Detroit west of Woodward Avenue, $116,000.

Flint, Mich.—Pere Marquette R. R. (A. L. Grandy, Ch. Engr., Detroit) contemplates constructing an additional freight yard which will contain about 7 miles of track and will include a coal dock, water station and 4-stall engine house; cost about $100,000.

Blackfoot Junction, Mont.—Contract will be let, it is reported, some time in June, by Chicago, Milwaukee & St. Paul R. R. (C. F. Loweth, Chief Engineer, Chicago, Ill) for constructing a line from Blackfoot Junction, Mont., east.

Lipscomb, Tex.—Atchison, Topeka & Santa Fe R. R. (C. F. W. Felt, Chief Engineer, Chicago, Ill.) reported contemplates constructing a line through Ochiltree and Lipscomb Counties, Tex.

San Antonio, Tex.—Surveys being made for constructing the San Antonio & North Western R. R. from San Antonio, Tex., northwest through Medina Lake, Bandera, Medina City and Rock Springs, to San Angelo, a distance of 240 miles. Reported company desires to correspond with grading contractors and is in the market for various kinds of equipment. H. H. Fielder, Chief Engineer.

San Diego, Cal.—John D. Spreckles has reported to Railroad Commission, Sacramento, that he will spend $88,270 in rebuilding the San Diego & Southeastern Railroad, recently damaged by the floods.

Ray, Ariz.—Reported Ray Hercules Copper Company will build 6 miles of standard-gage track to connect mine with proposed mill at Kelvin, Ariz. C. E. Addams, Superintendent, Ray.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Grandview, Wash.**—Contract for constructing extension of the Sunnyside branch of Northern Pacific R. R. from Grandview, Wash., to Gibbons, a distance of 12 miles, and extension of the Simcoe Branch, a distance of 9 miles to White Swan, Wash., awarded A. Guthrie & Company, St. Paul, Minn.

★**Kingard, B. C.**—Contract awarded by Great Northern R. R. to A. Guthrie & Company, St. Paul, Minn., for completing line between Kingard, B. C., and Sumas Landing.

PUBLIC BUILDINGS AND SCHOOLS

PROPOSED WORK.

Manchester, N. H.—Edward L. Tilton, 52 Vanderbilt Avenue, New York, N. Y., is architect for the dormitory and chapel to be erected at St. Joseph Boys' Home, to be 2 stories and basement, semi-fireproof, and cost $85,000.

Boston, Mass.—Newhall & Blemis, 9 Park Street, selected to prepare plans for 8-room school to be erected in George Putnam Dist.; cost $81,000, and James E. McLaughlin, 111 Devonshire Street, to prepare plans for 8-room school in Roger Wolcott Dist. Cost $89,000.

Bridgewater, Mass.—A Normal school is to be erected in Bridgewater at a cost of $237,000. Address Secy. School Bd.

Concord, Mass.—Town May 15 appropriated $35,000 for erecting a reinforced concrete vocational school. Address Town Clerk.

North Andover, Mass.—Plans of John Ashton, 477 Essex Street, Boston, selected for the high school to be erected in North Andover at cost of $70,000.

Plymouth, Mass.—Erection of addition to Nathaniel Morton School contemplated at cost of about $50,000. Address Town Clerk.

New Britain, Conn.—It is proposed to erect a 24-room elementary school, fireproof, and cost $125.000. Unkelback & Perry, Archts., New Britain.

West Haven, Conn.—A high school is to be erected at Main and Martin Streets. Address Board of Education.

Brooklyn, N. Y.—Plans filed for erecting an additional story to Kings County Court House and other alterations to cost, complete, $600,000.

Gloversville, N. Y.—A brick 3-story, 18-room school costing $80,000 is to be erected. Specifications not yet completed. F. L. Comstock and Van Dresser, Archts., 31 West Fulton Street. H. Van Voris, Clerk Board Education.

New York, N. Y.—Plans filed for erection of 3-story brick school at Third Avenue and 173d Street, for City of New York: cost $125,000. C. B. J. Snyder, Archt., 500 Park Avenue.

Ogdensburg, N. Y.—Joseph McNaughton bequeathed $100,000 for erection of a public market for Ogdensburg. Address City Clerk.

Bayonne, N. J.—City Commissioners May 16 decided to issue $75.000 bonds for an addition to School No. 3, $146,000 for new school in Fifth Ward and $36,000 for addition to High School.

Jersey City, N. J.—Plans being prepared for School 23, to be erected by Board of Education for the Marion Section of the city. John T. Rowland, Archt., 100 Sip Avenue.

May's Landing, N. J.—Bd. of Freeholders (Samuel Winterbottom, Director) considering erecting new Court house; cost about $100,000.

Morristown, N. J.—Addition of 2 stories, 30 x 50, to be erected to State Hospital for Insane. Address State Charities Commission at Trenton.

New Brunswick, N. J.—City will issue $40,000 bonds for remodeling building on Cogswell Avenue as a municipal building.

Bd. of Freeholders voted to erect a jail to cost $150,000 and a county workhouse to cost $60,000. Address County Clerk.

Newton, N. J.—Citizens May 12 voted $75,000 bonds for erecting school. Address Clerk School Board.

Perth Amboy, N. J.—About $49,900 will be spent by city for improvements to schools.

Secaucus, N. J.—Plans completed by J. Gould, Jersey City, for the proposed addition to School No. 1 estimated to cost $10,000.

Union, N. J.—School bonds for $41.000 will be sold June 5 by Town Council. Emil Bautz, Town Clerk.

Albion, Pa.—Citizens May 11 voted $50,000 bonds for erecting a school., E. U. Arnold, Archt., Battle Creek. D. A. Garfield, Secretary Board Education.

Altoona, Pa.—Erection of a city hall contemplated; cost about $100,000. Address Charles E. Rhodes, Mayor.

Bloomsburg, Pa.—Election soon to be held to vote $70,000 bonds for erecting a school. Address Clerk Board of Education.

Haverford, Pa.—Commissioners of Haverford Township will erect a township hall at Cooperstown and Eagle Rds.; cost about $40,000.

Lewistown, Pa.—Contract soon to be let by Board of Education for erecting high school to cost $100,000. T. L., Brooks, Supt. of Schools.

Philadelphia, Pa.—Plans being considered for a 26-room addition to Northeast High School at Eighth Street and Lehigh Avenue. Address Thomas Shallcross, Chrmn. Property Committee Bd. Education.

Plans being prepared for alterations to old City Hall at Fifth and Chestnut Streets; cost, $50,000. Horace Wells Sellers, Stephen Girard Building, may be able to give information.

Turtle Creek, Pa.—Plans being prepared by George H. Schwan, 307 Fourth Avenue, Pittsburgh, for Union High School to be erected at cost of $200,000.

West Chester, Pa.—Board of Education intends erecting a two-story and basement brick, stone and terra cotta school; cost $100,000. Paul A. Davis, 3d, Archt., 1713 Sansom Street, Philadelphia.

Takoma Park, D. C.—Erection of an 8-room school in Takoma Park is contemplated. Wilmer G. Platt, Pres. School Committee.

Gastonia, N. C.—Plans prepared by J. D. Wheeler of Charlotte, selected by City School Board and Council for two schools, one to be erected in West Gastonia and the other in East Gastonia, costing $25,000 each.

Newnan, Ga.—School improvement and extension bonds for $55,000 have been sold. Address Mayor. J. P. Shockelford, City Clerk.

St. Augustine, Fla.—Plans being prepared for rebuilding Flagler Hospital, which was destroyed by fire May 10. Dr. Andrew Anderson, Pres. Board Trustees.

Columbus, Miss.—P. J Krouse of Meridian engaged to prepare plans for a high school, to be erected in Columbus, at a cost of $50,000

Gulfport, Miss.—Plans accepted by Board of Supervisors for rebuilding on old site of court house destroyed by fire; cost, approximately, $100,000.

McComb, Miss.—School bonds for $30,000 have been sold.

Bristol, Tenn.—Board of Trustees Kings College considering rebuilding school building recently destroyed by fire. Probable cost $200,000.

Springfield, Tenn.—County School Board contemplates erecting three new schools.

Akron, Ohio.—Erection of a Contagious Disease Hospital is contemplated. Address John J. McShane, City Health Officer.

Cleveland, Ohio.—Contract soon to be awarded by William C. Jansen, 403 O'Brien Bldg., for erection of a 4-story brick and steel addition to St. Alexis Hospital, Broadway and McBride Avenue; cost about $150,000.

Dayton, Ohio.—Pretzinger & Musselman engaged to prepare plans for schools to be erected in Ohmer Park and Edgemont. Address Secretary Board of Education.

Eatonton, Ohio.—School bonds for $30-000 will be sold June 15 by City Clerk.

Kenmore, Ohio.—School bonds for $75,000 will be sold June 1 by Board Education (Ira W. Ficus, Clerk).

Kingston, Ohio.—School bonds for $30.-000 will be sold June 7 by N. J. Ford, Clk. Board Education.

West Park, Ohio.—West Park Village voted $65,000 school bonds. Address Village Clerk.

Lafayette, Ind.—Trustees of Purdue Univ. having plans prepared for an armory to cost about $250,000.

Albion, Mich.—Citizens voted $50,000 bonds for erecting school in southwestern section of city. E. W. Arnold of Battle Creek, Archt.

Marquette, Mich.—Preliminary plans being prepared by Charlton & Kuenzli of Marquette for 2-story, 52 x 100 ft., brick and stone jail and sheriff's residence; cost about $75,000.

Carmi, Ill.—Citizens voted $40,000 bonds to erect township high school. Address Township Clerk.

Quincy, Ill.—School bonds for $75,000 will be sold June 1 by Business Manager of Board of Education for erecting the Dewey School. Geo. P. Behrensmeyer, Architect, 930 Main Street, Quincy.

Eau Claire, Wis.—Plans being prepared by George Awsumb, 14 E. Jackson Boulevard, Chicago, Ill., for new auditorium and armory for which $85,000 bonds have been voted. A. R. Garnock, City Engr.

New Richmond, Wis.—Contract will be let between June 15 and July 1 by P. F. Neverman, for erecting a one-story stone school, to cost $25,000. Volkman & Hancock, Architects, Eau Claire.

Citizens voted to erect a $40,000 grade school. Address Clerk School Board.

Gibbon, Minn.—Citizens of Independent School Dist. No. 64 voted to erect a school at cost of $30,000.

Randolph, Minn.—A rural consolidated school is to be erected at Randolph next year at a cost of $25,000. Address Bd. of Education.

St. Paul, Minn.—The City Contract Committee rejected all bids received for erecting McClellan School being in excess of appropriation.

Winnebago, Minn.—Citizens voted $30,000 bonds for erection of brick fireproof high school.

Harper, Kan.—Erection of a high school is contemplated, at a cost of $40,000. Address School Bd.

Crete, Neb.—Citizens voted $40,000 bonds to erect new school. Address Clerk School Board.

Omaha, Neb.—Contract will soon be let for erecting new building of Department of Agricultural Engineering at University of Nebraska, main wing to be 2 story, 76 x 180 ft. and rear wing to be one story, 84 x 140 ft.; cost, including equipment, $150,000.

Grand Forks, N. D.—Plans being considered for an armory for machine gun and infantry companies, N. D. N. G. Capt. L. L. Edkman, Commanding Machine Gun Company.

Butte, Mont.—Contract will be let about June 15 by Trustees School District No. 1 for erecting an 8-room school, including dormitory, one story; one one-story, 4-room, and one two-story, 4-room school; total cost $80,000. W. Wellington Smith, Archt., Butte.

Helena, Mont.—Reported Board of Education is considering erecting 2 schools.

Columbia, Mo.—Contract will be let in July for erecting a grade school and addition to grade school to cost $35,000 and $20,000 respectively. Address Secretary Board of Education.

Kansas City, Mo.—See "Sewerage and Sewage Disposal."

Austin, Tex.—Contract for erecting the State Inst. for the Blind will be let about June 1. The plans accepted provide for an administration 3-story building, power house and superintendent's residence, and 5 cottages. All building to be reinforced concrete and fireproof. Appropriation available $300,000. Atlee B. Ayres, Bedell Bldg., San Antonio, Archt.

Architects engaged to prepare plans for State School for Feeble-Minded to cost $100,000. Cottsge plan will be adopted.

Marshall, Tex.—The School Board will erect a high school; also erect an addition to high school.

McKinney, Tex.—Citizens May 16 voted $25,000 bonds for erecting a school. Sharger & Peters, Archts., Bonham. J. W. Webb, Secy. School Board.

Dewey, Okla.—Citizens of Dewey Township voted $40,000 bonds for erecting high school.

McAlester, Okla.—Citizens voted $40,000 bonds for erecting additions to ward schools. Address Bd. Education.

Magdalena, New Mexico.—Plans contemplated by State Bd. of Education at Santa Fe for county high school to be erected at Magdalena at cost of $20,000.

Seattle, Wash.—J. R. West, Ch. Engr., Port Commission, directed to prepare plans for thirty additional concrete bins to be added to Hanford Street warehouse, cost $70,000. C. E. Remsberg, Secy. Port of Seattle, Bell Street Wharf.

Walla Walla, Wash.—Erection of a field house and city auditorium in city park is contemplated; cost about $75,000. Address Women's Park Club.

San Jose, Cal.—San Jose School Dist. bonds for $100,000 and $50,000 high school district bonds will be sold June 5 by County Board Supervisors. (Henry A. Pfister, Ex-Officio Clk. and County Clk.)

Rexburg, Idaho.—Reported a gymnasium costing $45,000 is to be erected in connection with the Catholic College.

Toronto, Ont.—Plans being prepared by Gordon & Holliwell, Confederation Life Building, Toronto, for a new hospital to cost $125,000 for the Women's College Hospital. J. F. Anderson, Castle Frank Road, Toronto, Secy.

Windsor, Ont.—Citizens voted to spend $95,000 for erection of a collegiate building. Address Secretary-Treasurer, Windsor.

BIDS DESIRED.

Rumford, Me.—Until June 22, by Jas. A. Wetmore, Acting Superv. Archt., Treas. Dept., Washington, D. C., for erecting U. S. post office at Rumford.

Shelburne Falls, Mass.—Until June 7, by Trustees Arms Academy, Edwin Baker, Secy.), for erecting a gymnasium and school building. Separate bids for heating, plumbing, etc. W. B. Reid, Archt., 280 High Street, Holyoke.

Saugus (P. O. East Saugus), Mass.—Until June 1 by Edgar B. Oliver, Chmn. Bldg. Committee, for erecting an addition, brick, to present high school; cost $70,000. William M. Bacon, 27 Kilby Street, Boston.

Brooklyn, N. Y.—Until June 7, by L. H. Pounds, Boro. Pres., for furnishing material and reconstructing and improving, including plumbing, gasfitting, ventilating, etc., Kings County Courthouse, Fulton and Livingston Streets. Security $285,000.

Rochester, N. Y.—Until June 27 by Col. Franklin W. Ward, Secy. State Bd. Armory Commissioners, 158 State Street, Albany, for construction, heating, plumbing, drainage and electric work for armory for Troop H, First Cavalry, N. G. S. S. N. Y., advertised in Engineering Record

Trenton, N. J.—Until June 13, by State House Commission (E. I. Edwards, State Controller), for alterations to exterior of old barracks. For information address Comr. Charities & Corrections, State House, Trenton.

Erie, Pa.—Until June 27, by Board of Education, for erecting a fireproof school to cost $500,000. William B. Ittner, Archts., St. Louis, Mo.

Nesquehoning, Pa.—Until June 1, by Mauch Chunk Township School Dist. in East End School building, for erecting and completing a high school. Clyde S. Adams, 1509 Arch Street, Philadelphia. Separate bids for heating, ventilating, etc.

Pittsburgh, Pa.—Until June 21 by U. S. Engineer Office, Pittsburgh, for building 2 brick lock keepers' houses at Dam No. 1, Monongahela River, advertised in Engineering Record.

Mocksville, N. C.—Until June 1 by County Commissioners (M. C. Ijames, Chmn.) for repairs and reconstructing courthouse at Mocksville. Raleigh James Hughes, Archt., Greensboro.

New Smyrna, Fla.—Until June 9, by C. R. M. Sheppard, Secretary Board Public Instructions of Volusia County for erecting a brick school. Separate bids for heating, plumbing, etc. A. E. Lewis, Miami, Architect.

Gears Mill, La.—Until May 29 by Building Committee for erecting a school and auditorium. J. J. Mixon, Architect, Winnifield, La.

Ashtabula, Ohio.—Until June 3 by Board Education (Alfred Humphrey, Clk.) for furnishing material and erecting a centralized school in Plymouth Township. Clarence V. Martin, Archt., Ashtabula.

Atwater, Ohio.—Until June 9, by H. H. Woolf, Clk. Board Education, for furnishing material and erecting first and second stories and part of basement of high school. L. W. Thomas, Archt., 305 Pythian Temple, Cleveland.

Columbia Station, Ohio.—Until June 15 by C. T. Goodwin, Clk. Board Education, for furnishing material and erecting a fireproof school at Columbia Center. Separate bids for heating, metal work, steel and iron, plumbing, etc. A. C. Bartter, Archt., 1455 W. Clifton Boulevard, Lakewood.

Leesburg, Ohio.—Until June 16 by Board Education (James V. Guthrie, Clk.) for erecting a high and grade school. Separate bids for heating, plumbing, ventilating, etc. Howard & Merriam, Archts., Columbus.

Washington, Ind.—Until June 23 by James A. Wetmore, Acting Supervising Architect, Washington, D. C., for constructing U. S. Post Office, advertised in Engineering Record.

Flint, Mich.—Until May 31, by A. J. Wildanger, Secretary Board Trustees Union School District, for erecting school. Separate bids for heating, plumbing, etc. Malcolmson & Higgenbotham, Architects, and Ammerman & McColl, Engineers, 404 Moffat Building, Detroit.

Washington, Mich.—Until June 3, by Board Education (E. D. Gass, Secretary), for erecting school. Fisher Bros., Architects, Pontiac, Mich.

Grinnell, Iowa.—Until June 26, by Jas. A. Wetmore, Acting Superv. Archt., Treas. Dept., Washington, D. C., for erecting post office at Grinnell.

Knoxville, Iowa.—Until June 22, by T. G. Gilson, Sec. Independent District for erecting a high school, advertised in the Engineering Record.

Lewis, Iowa.—Until June 27, by Consolidated Independent School District (G. E. Weaver, Secy.), for erecting a brick and concrete consolidated school to cost with equipment $53,000. Proudfoot, Bird & Rawson, Archts., Des Moines.

Sheldahl, Iowa.—Reported desired until June 5, by Board Education Consolidated School Dist., for erecting 2-story and basement brick semi-fireproof school. Probable cost $30,000. Sawyer, Watrous & Watrous, Archts., Des Moines.

Canby, Minn.—Until June 5, by Board Education Consolidated School District No. 30 (Ole Ostensoe, Clerk), for erecting a high school, also for remodeling present school. Separate bids on heating, plumbing, etc. Kirby T. Snyder, Archt., 643 Plymouth Bldg., Minneapolis.

Alliance, Neb.—Until June 23, by Jas. A. Wetmore, Acting Superv. Archt., Treas. Dept., Washington, D. C., for erecting (including mechanical equipment and approaches), U. S. post office at Alliance.

Gresham, Neb.—Reported desired until May 31, for furnishing material and erecting high school. Separate bids for heating, plumbing, etc. R. A. Bradley, Architect, Hastings, Mich.

Lincoln, Neb.—Until June 9, by Theo. H. Berg, City Clerk, for erecting Park Pavilion in Auld Annex to Antelope Park. Estimated cost, $25,000. Adna Dobson, City Engr.

Yutan, Neb.—Until June 1, by School Board for erecting a two-story brick school. J. N. Peters, Moderator.

Dunn Center, N. D.—Until June 20, by C. J. Heen, Clerk School Board, for erecting a four-room brick school.

Golden Valley, N. D.—Until May 31, by School Board, at office of L. E. Dreveskracht, Golden Valley, for erecting high school. Separate bids for heating, ventilating, etc. W. D. Gillespie, Archt., Fargo.

Kildeer, N. D.—Until June 21, by School Board (J. R. Luther, Clk.), for erecting a high school. Separate bids for heating, plumbing, etc. W. D. Gillespie, Archt., Fargo, N. D.

Mandon, N. D.—Until June 7, by J. H. Noakes, Secy., Mandan Special School Dist., for erecting a brick high school in connection with present Central school building. Gilbert R. Horton, Archt., Citizens' National Bank Bldg., Jamestown.

Sidney, Mont.—Until June 15, by May E. Smith, Clk. School Board, for erecting an eight-room addition to the Sidney School. Separate bids for heating, plumbing, etc. R. Rivenes, Archt., Miles City, Mont.

Austin, Tex.—Until June 1, by James E. Ferguson, Governor, for erecting a group of eight fireproof two-story buildings for new Blind Institute here. Atlee B. Ayres, Archt., San Antonio.

Ft. Worth, Tex.—Until May 30, by M. L. Waller, Ft. Worth, and J. F. Sanders, Plainview, for erecting three-story school.

Albuquerque, N. M.—Reported desired until June 25, by Board of Regents of University of New Mexico, for erecting a chemistry building and a science building. J. L. LaDirere, Supervising Architect.

Baker, Ore.—Reported desired until June 12, by School Board, for erecting high school. Lawrence & Holford, Archts., Chamber of Commerce Building, Portland. Probable cost, $125,000.

Oxnard, Cal.—Until June 1 (readvertisement) by Dr. H. M. Staive, Clerk Board of Education for erecting a school.

Carlton Point, P. E. I.—Until May 31 by J. W. Puhsley, Secy. Dept. Rys. and Canals, for constructing stations, water tank, engine house, standpipe pit, etc., for the Carlton Point Car Ferry Terminal, Prince Edward Island.

Sarnia, Ont.—Until June 1 by Board Education (George A. Proctor, Chmn.) for erecting an 11-room school. S. R. Coon & Sons, Archts., Ryrie Building, Yonge Street, Toronto.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Boston, Mass.**—Contract for erecting 6-story 70 x 90 ft. brick addition on Blagden Street for Central Library Building awarded to George B. Long at $125,000; for heating and ventilating: to P. J. Sullivan Co. of Boston at $26,874. Jos. McGinniss, 16 Arlington Street, Architect.

★**Woburn, Mass.**—Contract awarded J. P. Keating of Westboro for erecting State armory here, at $52,400. James E. McLaughlin, Supervising Architect, Armory Commission.

Newport, R. I.—Following are four lowest bids opened May 15 by Supervising Architect, Washington, D. C., for constructing U. S. Post Office (a) limestone, (b) sandstone: Frymier & Hanna Co., 75 W. Forty-fifth Street, New York, (b) $296,000; Boyle Robertson Construction Co., Washington, D. C., (a) $254,300, (b) $262,300; W. H. Fissell & Co., New York, N. Y., (a) $253,000, (b) $268,000; M. Yeager & Son, Danville, Ill., (a) $244,996, (b) $263,996; Norman Kerr Co., New York, N. Y., (a) $246,100.

★**Watertown, N. Y.**—Contracts for constructing Jefferson County Tuberculosis Hospital awarded as follows: General contract to Norman B. Hayes of Watertown, at $23,136; G. H. Gleason, Watertown, heating and plumbing, $3,724; to Burns Bros. & Haley, Watertown, for sewer and water system, at $2,634.

★**Washington, N. J.**—Contract for erecting additions and making alterations to school (bids opened May 15) awarded as follows: General contract to S. W. Gardner Co., Belvidere, $34,138; heating and ventilating, Fred. Merkel, Newark, $4,500. L. M. Shrape, District Clerk.

★**Philadelphia, Pa.**—Contract awarded by Board Education for erecting the school at Twenty-sixth and Clearfield Streets to Henry L. Brown, 1714 Sansom Street, $49,607. L. E. Drake, Secy. Commissioner.

★**Elkins, W. Va.**—Contract for constructing U. S. Post Office awarded W. H. Fissell & Co., Marbridge Building, New York, N. Y., at $111,900.

Jacksonville, Fla.—Following are two lowest bids opened May 13 by Bd. of Public Instruction for erecting 8-room school at Twenty-first and Walnut Street, Florida Engineering & Constr. Co. and F. W. Long & Co. of Jacksonville. Rutledge Holmes, Archt., Duval Building.

★**Cincinnati, Ohio.**—Contract awarded by General Hospital Commissioners to Westlake Construction Company of St. Louis, Mo., for erecting medical college; cost $250,000.

★**Arthur, Ill.**—Contract for erecting 2-story school awarded Hagerman & Harshman, Sullivan, Ill.; probable cost, $50,000. I. W. Royer, Archt., Urbana. (Bids opened May 10.)

★**Fayette, Iowa.**—Contract for erecting high school (bids opened May 18) awarded W. Donnell & Co., Waterloo, at $21,323 for heating and ventilating to Cross Hardware Co., Monticello, at $3,329. F. E. Finch, President Independent District, Fayette.

★**Swea City, Iowa.**—Contract for erecting school (bids opened May 15) awarded P. O. Nasvik, St. Paul, Minn., at $41,702. H. N. Kune, Secy. Board Education.

★**Grand Meadow, Minn.**—Contract for erecting high and grade school (bids opened May 18) awarded as follows: General contract, Madsden Brothers, Minneapolis, $31,339; heating, ventilating and plumbing, Garrigan & O'Brien, Faribault, $11,608; electric wiring, Minneapolis Electric & Construction Co., Minneapolis, at $1,054. P. F. Elliott, Clerk.

★**Lindstrom, Minn.**—Contracts for erecting school (bids opened May 12) awarded as follows: General contract, Molin & Rosen, Lindstrom, $27,700; heating and ventilating, Bjorkman Brothers, Minneapolis, $5,306; plumbing, Neil & Co., Superior, Wis., $2,715. M. W. Tuttle, Clerk, Consolidated School District No. 13.

Little Falls, Minn.—Lowest bid for constructing U. S. Post Office submitted by A. W. Lane, 19 S. LaSalle Street, Chicago, Ill., at $53,375 for limestone; and from George W. Stiles Construction Co., Rookery Building, Chicago, Ill., at $57,750 for sandstone (bids opened May 17).

★**Wichita, Kan.**—Contract for erecting brick addition to St. Francis Hospital, at North Emporia Avenue, awarded to H. I. Ellis Construction Co., 412 East Douglas Street, at about $50,000.

★**Williston, N. D.**—Contract awarded E. Link of Williston for erecting $30,000 school to be used as south wing of proposed $100,000 high school.

★**Wichita Falls, Tex.**—Contract for erecting court house awarded Lisle Dunning Construction Co., Oklahoma City, Okla., at $225,000.

★**Seattle, Wash.**—Contract for erecting 2-story addition to Queen Anne High School awarded by School Board to John Larson, 4103 Ainsworth Avenue, at $56,184; heating to Musgrave & Blake, at $13,496, and plumbing to J. A. Scherrer, Seattle, at $10,263.

★**Roseburg, Ore.**—Contract reported awarded by School Board to John Hunter of Roseburg for erecting proposed high school at $57,784. F. Manson White, Archt., Henry Building, Portland.

★**Los Angeles, Cal.**—Contract awarded P. A. Berg, 412 Severance Bldg., for erecting a 3-story reinforced concrete and hollow-tile hospital, 83 x 46 ft., at San Pedro, Los Angeles Harbor, for Sisters of Mercy, San Pedro; cost about $40,000. Charles F. Durr Company, Archts., San Pedro.

★**San Francisco, Cal.**—Contract awarded on revised plans for erecting southeast wing of San Francisco Hospital to McSheehy Bros., 47 Langton Street, at $186,428.

★Contract for erecting Engine House No. 8 on Pacific Avenue awarded O. C. Holt, Twenty-fourth and Bartlett Streets, $22,670, and plumbing, A. Coleman, 706 Ellis Street, $4,998.

★**Taft, Cal.**—Contract awarded to M. T. Kean, Bakersfield, for erecting Union High School, at $54,444. Orville L. Clark, Archt., Bakersfield.

Kimberly, Idaho.—Following are four lowest bids opened May 1 by H. W. Mund, Secretary School District No. 2, for erecting high school: Harding F Allan, Empire Building, $33,833; H. E. Wood, Kimberly, $38,700; H. O. Koeppen, Kimberly, $39,337, and W. G. Reed, Kimberly, $35,907. B. Morgan Nisbet, Twin Falls, Architect.

★**Hyrum, Utah.**—Contract for erecting high school awarded by County Board of Education at Logan to Dahle & Eccles of Logan, at $39,140.

★**Halifax, N. S.**—Contracts for erecting public school (bids opened May 15) awarded Falconer & McDonald of Halifax at $84,900, and for heating and ventilating to Farquhar Brothers of Halifax at $12,460. W. J. Busch, 60 Bedford Row, Halifax, Archt.

PRIVATE BUILDINGS

PROPOSED WORK.

Springfield, Mass.—Work will begin at once on construction of Hooker Street Car House, to be one story, brick and concrete construction, 205 x 190 ft.; cost about $250,000.

Bridgeport, Conn.—Site has been secured and plans will soon be drawn for Y. M. C. A. building. Cost $225,000. Address Secretary.

Dunkirk, N. Y.—Reported the Passionist Fathers contemplate erecting college building at Hemlock Grange; cost about $200,000.

New York, N. Y.—Plans filed for erection of following buildings: 15-story fireproof apartments at 64 East Eighty-sixth Street, for 64 East Eighty-sixth Street Cor., cost $275,000, Schwartz & Gross, Archts. 347 Fifth Avenue, 12-story store and loft at 43 West Thirty-sixth Street, for Nameloc Co., cost $200,000. Wm. H. Birkmire's Sons, Archts., 1133 Broadway. 8-story fireproof show rooms at 122 Pearl Street, for James H. Cruikshank and Wm. D. Kilpatrick, cost $140,000, Wm. H. Paine, Archt., 126 Liberty Street. 5-story brick tenement at 181st Street and Clinton Avenue, for Max Bldg. Co., cost $65,000, Goldner & Goldberg, 391 East 149th Street, Archts. Two 5-story brick stores and tenements at 174th Street and Anthony Avenue, for Moritz Kaudie, cost $130,000, Charles B. Meyers, Archt., 1 Union Square. 6-story addition to 5-story asylum at Lexington Avenue and Sixty-seventh Street, for Institute for Improved Instruction of Deaf Mutes, cost $50,000, Wm. F. Staab, Archt., 30 East Forty-second Street. Alterations to 16-story fireproof stores and offices at 39 Park Row, for Park Co., Inc., cost $60,000, Westinghouse Church, Kerr & Co., Archts., 37 Wall Street.

Plans of Gustav E. Steinbach approved for the church and parochial school to be erected at Broadway and Seventy-first Street for Church of Blessed Sacrament (Rev. Thomas F. Myhan, Pastor); cost about $500,000.

Port Washington, L. I., N. Y.—Carrere & Hastings, 52 Vanderbilt Avenue, New York, N. Y., are architects for the "Dominion of Versailles," which is to be constructed on Manhasset Bay, south of Port Washington. Plans include a chateau 8 stories high, 1200 ft. in length and gardens. About 180 acres in all will be included. Penryn Stanlaws, 33 West Sixty-seventh Street, New York City, is President of the company.

Valley Stream, L. I., N. Y.—The Wayside Home, 356 Bridge Street, Brooklyn, is to erect buildings in Valley Stream and will remove from present location; cost proposed improvements $100,000.

Jersey City, N. J.—The Provost Realty Co., Jersey City, will erect extensions on Thirteenth Street to cost $65,000.

Newark, N. J.—J. H. Mayzel Co., 65 South Munn Avenue, will erect a 5-story apartment house at 31 Walnut Street to cost $75,000.

P. Ballantine & Sons, Freeman Street, will erect a storage building costing $35,000.

Union Hill, N. J.—St. John's Lutheran Church plans erecting a new edifice to cost $40,000. G. A. Hofmann, Chmn. Bldg. Com., Union Hill.

Johnstown, Pa.—Willow Street United Evangelical Congregation will erect a $50,000 church. G. W. Ellenberger, Chmn. Bldg. Com., Johnstown.

McKeesport, Pa.—Plans prepared by Janssen & Abbott, Ninth and Liberty Avenues, Pittsburgh, for a home for Indigent, to be erected on Fifth Avenue, for St. Barnabas Free Home.

Philadelphia, Pa.—Contract soon to be let, according to plana prepared by John T. Windrim, Commonwealth Bldg., for erecting 6-story dispensary building, 190 x 45 ft., at Powelton and Saunders Avenues, for the Presbyterian Hospital.

Plans about completed for a building and garage to be erected at 922 North Broad Street for the Pennsylvania Society for Prevention of Cruelty to Animals; cost $70,000. Carl P. Berger, Archt., South Penn Sq. Bldg.

Plans about completed for one-story stone church, Sunday school and rectory, Tenth Street and Boulevard, for First Christian Church; cost about $125,000. Price & McLanahan, 1418 Walnut Street, Archts.

A 3-story stone, 38 x 102 ft., church and parish house will be erected on Germantown Avenue and High Street by St. Michael's Episcopal Congregation. George Nattress & Son, Archts., 1129 Walnut Street.

Plans being prepared for 7 buildings to be erected on Chestnut Hill for Carson College for Girls; cost about $250,000.

Pittsburgh, Pa.—Sum of $50,000 has been given Western Theological Seminary (J. A. Kelso, President) for erecting new chapel.

Erection of a building at Pride, Reed and Roberts Streets, for New Covenant Mission (Rev. Maurice Reuben, Supt.) is contemplated at cost of $50,000.

The United States Rubber Co. will erect an 8-story warehouse.

Summit, Pa.—Erection of an orphanage at Summit contemplated at cost of about $100,000 for Altoona diocese of Catholic Church (Rt. Rev. Eugene A. Garvey, Bishop, Altoona.)

Sunbury, Pa.—Thomas H. Hamilton, Harrisburg, is architect for stone edifice to be erected on Arch and Second Streets for St. John's Methodist Church; cost $50,000.

Baltimore, Md.—The Parkway Theater Co. plans erecting a theater at Light and Poultney Streets; cost, $150,000. John A. Wheltle is interested.

Wilmington, Del.—A Y. W. C. Asso. building is to be erected on site of present building; cost $200,000. Address Secy. Y. W. C. Asso.

Wilmington, Del.—The Pyrites Co., Ltd., will erect a 5-story, 69 x 76-ft. steel and concrete building; cost, $29,000.

Maysville, W. Va.—Reported the Chesapeake & Ohio R. R. Co. (F. I. Cabell, Ch. Engr., Richmond, Va., will erect a depot in Maysville at a cost of $75,000.

Shreveport, La.—J. M. Comegys, Shreveport, will erect an apartment house to cost $125,000.

Gallatin, Tenn.—Cumberland Telephone Company will erect a telephone exchange building on West Main Street, costing $35,000.

Akron, Ohio.—St. Paul's Episcopal Church contemplating erecting new parish house, costing $50,000. Rev. Franklyn Cole Sherman, Pastor.

Brewster, Ohio.—Reported plans completed for $40,000 Y. M. C. A. building which the Wheeling & Lake Erie Railroad Company (W. L. Rohbock, Chief Engineer, Cleveland) proposes erecting here.

Canton, Ohio.—The Young Women's Christian Asso., 420 Market Avenue South, reported considering erecting a building to cost about $150,000.

Cincinnati, Ohio.—Trustees of the Boys' Home of Cincinnati considering erecting a new building on Pioneer Street near Broadway; cost $200,000. Sketches are being prepared by Trustee Edward T. Dixon, Bell Block, Cincinnati.

Cleveland, Ohio.—The Second Church of Christ Scientist will erect new edifice at Euclid Avenue and East Seventy-seventh Street; cost $200,000. William Striebinger, 1900 Euclid Avenue, Archt.

Cleveland Electric Illuminating Co. (Sam Scovill, Pres.) will spend, during the coming year, $5,500,000 in improvements and extensions, including $150,000 for substation at Central Avenue and East Fifty-fifth Street, and $140,000 for substation at Madison Avenue and Seventy-eighth Street.

New York Central Railroad will erect a freight depot at E. Fortieth Street. Cost $500,000. D. C. Moon, Gen. Mgr., St. Clair Avenue and W. Third Street.

West Side branch of Y. W. C. A., Franklin Avenue and W. Thirty-second Street will spend $50,000 in remodeling dwelling into recreation building. Mrs. Elizabeth Burrows, Secy.

Reported plans to be prepared for edifice, parish house and parochial school for St. Cecilia's Congregation. Rev. John T. Farrelly, Bishop, Cathedral House, Superior Avenue and E. Ninth Street.

Plans being prepared by W. S. Ferguson Co. for a Labor Temple for the Cleveland Federation of Labor (J. Wayne Hart, Pres., 310 Prospect Avenue) to be erected on E. Eighteenth Street. Estimated cost about $250,000.

Reported Ford Motor Car Co., Detroit, Mich., will erect a 2-story brick and steel garage and service station costing about $40,000 on West Sixty-fifth Street and Detroit Avenue.

Reported Cleveland Electric Illuminating Co., 117 Illuminating Building, will erect a 2-story brick substation costing $80,000 at Madison Avenue and West Sixty-fifth Street.

W. J. Hunkin of Hunkin Conkey Construction Co., 321 Cuyahoga Building, will erect a commercial and factory building costing about $75,000 at Superior Avenue and East Thirtieth Street.

Perkins Avenue Realty Co. (F. B. Sanders, 2541 Prospect Avenue) will erect a commercial and apartment house building at Prospect Avenue and East Forty-sixth Street costing $35,000.

Israel Margolin, 7012 Hough Avenue, will erect 2 apartment houses at Churchill Avenue and East 105th Street costing $30,000 each.

Cleveland, Ohio.—Reported T. J. Calkins, 8912 Superior Avenue, will remodel Notre Dame Academy, at Superior Avenue and East Eighteenth Street into apartments; cost about $35,000.

Williamson Co., 115 Williamson Bldg., will erect a 3 or 8-story fireproof building, 100 x 89 ft., at Prospect Avenue and East Twenty-second Street.

Supervising Architects of City Group Plan Commission will soon report on plans prepared for construction of union passenger station.

Cleveland Heights (P. O. Cleveland), Ohio.—Reported George Durell, American Fork & Hoe Co., Swetland Building, Cleveland, will erect a $25,000 residence at Fairmount and Lee Roads, Cleveland Heights.

Hudson, Ohio.—College Board of Presbyterian Church of United States has decided to establish a preparatory school in Hudson and will remodel Western Reserve University and erect a building to cost $130,000. James H. Dempsey, Leader-News Bldg., Cleveland, Trustee.

Lancaster, Ohio.—D. Riebel & Sons, New First National Bank Bldg., Columbus, engaged to prepare plans for edifice for German Lutheran Congregation; cost $40,000.

Norwood Heights, Ohio. — Anthony Kunz, Cincinnati, selected to prepare plans for $450,000 seminary to be erected at Norwood Heights for Mt. St. Mary's Seminary.

Portsmouth, Ohio.—The Norfolk & Western R. R. Co. (J. E. Crawford, Ch. Engr., Roanoke, Va.) will erect a depot in Portsmouth.

Sharonville, Ohio.—A Y. M. C. Asso. Building is to be erected in Sharonville; cost about $25,000. Address A. G. Bookwalter, Secy.

Detroit, Mich.—Plans being prepared by Preston, Brown & Walker for fireproof store and office building to be erected at Woodward Avenue and Montcalm Street, for Hughes & Hatcher; cost complete, about $200,000.

Chicago, Ill.—Plans prepared for erection of a Catholic Seminary to be erected on North Side. Address Archbishop George William Mundelein.

Milwaukee, Wis.—Plans prepared by Martin Tullgren & Sons for erection of a 3-story, 60 x 125 ft. brick and concrete apartment house, to be erected at Prospect Avenue and Kane Place for Arthur Brockman; cost about $60,000.

Contract about to be let by Herbst & Hufschmidt, Juneau Theater Bldg., for erection of a 2-story, 30 x 120 ft. brick and steel bank building at Sixth Avenue and Mitchell Street, for Mitchell Street State Bank; cost about $40,000.

Atlantic, Iowa.—A 4-story hotel is to be erected at Second and Chestnut Streets for M. C. Cardio, Prop. of Cardio Hotel; cost about $50,000.

Des Moines, Iowa.—Alterations to edifice of Cottage Grove Avenue Presbyterian Church contemplated; cost $25,000. Rev. W. E. Sandford, Pastor.

A 5-story apartment house is to be erected at East Seventh and Locust Streets for Frank C. Waterbury; cost $40,000.

Leavenworth, Kan.—The National Hotel Realty Co. (C. S. Emmert, Pres.) considering erecting a hotel in Leavenworth, at a cost of about $100,000.

Bismarck, N. D.—A 3-story brick, 60 x 100 ft. apartment house, is to be erected at Avenue A and Fifth Street, for Andrew Pierson, Pres., Western Bldg. Co.; cost $35,000.

Billings, Mont.—Petrolithic Paving Company, Billings, will erect a warehouse on the Burlington right of way. F. A. Kesselhuth is local representative.

Butte, Mont.—H. Ryan, Northern Bank Building, Seattle, Wash., is architect for $150,000 theater which Jensen & Van Herberg of Seattle, Wash., intend erecting here.

Deer Lodge, Mont.—Plans completed for erection of a 3-story concrete office, store and club building for Deer Lodge Masonic Order; cost about $40,000. A. Whitworth, Pres.

Twin Bridges, Mont.—Reported H. F. Jackson, Twin Bridges, plans erecting a hotel, costing about $50,000.

Beaumont, Tex.—E. L. Wilson Hardware Co. is to erect a warehouse at Main and Washington Streets; cost about $35,000.

Ft. Worth, Tex.—A 6-story Masonic Temple is to be erected in Ft. Worth at cost of about $250,000. W. R. Edrington, Chrmn. Finance Committee. J. L. Stevens of Dallas, Archt.

Beaumont, Tex.—The E. L. Wilson Hardware Co., 339 Pearl Street, will erect a brick or concrete fireproof warehouse costing $35,000. Plans being prepared.

Houston, Tex.—Plans prepared for erection of a warehouse and depot on Willow Street for Southern Pacific R. R. (W. Hood, Ch. Engr., San Francisco, Cal.); cost $500,000.

Paris, Tex.—Methodists propose erecting a $30,000 church.

Wildey Lodge No. 21 I. O. O. F. approved plans for erection of lodge building to cost about $35,000.

Spokane, Wash.—W. T. Day of Day & Hansen Security Co. of Spokane will erect a residence in Cliff Park; cost $50,000.

Tacoma, Wash. — Reported Central Realty Company, Pantages Theater Building, Seattle, will erect for Alex. Pantages a five-story office and theater building on site of Stratton Hotel; cost, $250,000. B. Marcus Priteca, Archt., Pantages Theater Building, Seattle.

Arcadia, Cal.—First National Bank (F. M. Smith, President, contemplates erecting a $25,000 building.

Healdsburg, Cal.—Reported a moving-picture theater is to be erected in Healdsburg at a cost of $40,000. Address Charles E. Naylor, Mgr. Healdsburg Opera House.

Los Angeles, Cal.—Plans being prepared by John J. Frauenfelder, 1116 Story Building, for a 9-story and basement reinforced concrete theater and studio building 120 x 195 ft. to be erected on Third Street and Broadway. Cost $700,000.

San Bernardino, Cal.—F. L. Richmond, lessee of the Barber North Hotel, at El Centro, proposed erecting a $250,000 hotel.

Santa Barbara, Cal.—Plans being prepared by Roland F. Sauter, San Marcos Building, for a brick Presbyterian church to cost $40,000.

Visalia, Cal.—National Bank of Visalia contemplates erecting four or five-story fireproof bank and office building adjoining its present building.

Watts, Cal.—Work will begin at once on erection of a carhouse at Watts for Pacific Electric R.R. Co. (G. E. Pillsbury, Ch. Engr., Los Angeles).

Flagstaff, Ariz.—Reported plans prepared by Trost & Trost, El Paso, selected for the tourist hotel, which is contemplated here, at a cost $250,000.

Phoenix, Ariz.—Reported Methodists of the city are considering erecting a $50,000 hospital. Eugene S. Gaddis, Financial Secy.

George H. S. Luhre, Phoenix, will erect a business block costing $30,000.

Fredericton, N. B. — G. W. Kramer, 1 Madison Avenue, New York, N. Y., will soon let contract for erecting a Sunday school building for St. Paul Presbyterian Church to cost $30,000.

Moncton, N. B.—Reported steps being taken to rebuild the warehouse of the Sumner Wholesale Hardware Company, which was recently destroyed by fire.

Hespelers, Ont. — Roman Catholic Church recently destroyed by fire is to be rebuilt at cost of $30,000, to be brick and stone construction. Rev. Father Meyer, Pastor.

Windsor, Ont.—F. W. Woolworth Co. secured site for a 2-story, 40 x 100-ft. store building.

Winnipeg, Man.—Plans being prepared by Woodman & Carey, Lindsay Building, for a $250,000 printing building for the Stovel Printing Co. to replace burned plant.

Vancouver, B. C.—Reported the Canadian Northern Ry. Co. will erect a hotel at Georgia, Cambie and Hamilton Streets; cost about $500,000. M. H. MacLeod, Ch. Engr., Winnipeg, Man.

BIDS DESIRED.

Portsmouth, Ohio.—Until May 31, by J. F. Sheblessy, Architect, 519 Main Street, Cincinnati, for erecting a $45,000 parochial school for Church of the Holy Redeemer.

Hampton, Iowa.—Reported desired until June 1, by Pastor of Church of Christ, for erecting two-story 56 x 94 ft. brick edifice. Probable cost $25,000. F. A. Harris, Archt., 3915 Fourth Street, Des Moines.

Alexandria, Minn.—Until June 6, by Board Charities of Red River Valley Conference, Swedish Lutheran Church for erecting a two-story and basement brick building 88 x 50 ft. for Home for Aged of said church. A. C. Hanson, Archt., Alexandria.

Toronto, Ont.—Until June 1, by William Steele & Son, 423 Ryrie Bldg., Toronto, for erecting a 12-story terra cotta, reinforced concrete, rolled steel sash, steel partition warehouse for T. Eaton Company; cost $500,000.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Newport, R. I.**—Contract for erecting building for St. Clares Home awarded Norcross Brothers Company, Worcester, Mass.; Trowbridge & Livingston, Archts., 527 Fifth Avenue, New York, N. Y.

★**Hartford, Conn.**—Contract awarded Antonio Montano, 25 Edgewood Street, to erect for the N. Pallotti Estate, at Morgan and Charles Streets, a 208-room apartment house, 147 x 100 ft.; estimated cost $75,000. Daniel A. Guerriero of Hartford, Architect.

★**Cornwall, N. Y.**—Contract for erecting hospital building, cottage and stable at New York Military Academy of Cornwall awarded to Harvey R. Taylor Building Corporation of Cornwall; cost of improvements about $40,000.

★**Altoona, Pa.**—Contract for erecting fireproof apartment house and business building for Welsh Brothers at Eleventh and Union Avenues awarded Stokes & Cassidy of Altoona, at $29,300.

★**Lancaster, Pa.**—Contract for erecting stone edifice for Emanuel Lutheran Church awarded to D. S. Warfel of Lancaster, at $42,083.

★**Philadelphia, Pa.**—Contract awarded D. W. O'Dea, 5219 North Fifth Street, for erecting a chapel at Mascher and Master Streets for Archbishop Prendergast; cost $35,000.

★Contract for erecting 13-story stone, concrete and steel 42 x 167 ft. apartment house, at Thirteenth and Spruce Streets, awarded to John Stafford, 1112 Chestnut Street; cost about $550,000.

★**New Orleans, La.**—Contract for erecting office building for Cumberland Telephone Co. to cost $400,000 awarded George J. Glover, New Orleans.

★**Chattanooga, Tenn.**—Antiseptic Cotton Company awarded contract to Geo. Becking, James Bldg., for erecting a reinforced concrete building.

★**Cincinnati, Ohio.**—Contract awarded by Zettel & Rapp, 607 Johnston Building, architects for the Gennett Corporation, to Roche-Bruner Building Co., Cincinnati, for erecting a four-story brick and concrete store building at 27 W. Fourth Street at $33,000.

★Contract for remodeling the Olympia Theater and installing complete ventilating system awarded H. C. Hazen Contracting Co., 2070 Reading Road. A. C. Kuball, Architect, 611 Lincoln Inn Court, Cincinnati.

★**Cleveland, Ohio.**—American Bridge Co., Cleveland, secured steel contract for $1,000,000 warehouse to be erected on West Ninth Street, near Lakeside Avenue, for Ninth Street Terminal Warehouse Co., Turner Constr. Co., 11 Broadway, New York City, general contractors.

★Contract for steel work for Schauffler Missionary Training School, at 5111 Fowler Avenue, awarded to National Iron & Wire Co., 3901 Hamilton Avenue. Alexander Bros., 316 Williamson Bldg., General Contractors; total cost $65,000.

★Contract for erecting 10-story addition to Gillsy Hotel, at East Ninth Street, awarded by Gill & Murphy to James L. Stuart, Illuminating Bldg., at about $300,000.

★Contract awarded by Packard Cleveland Co. to Crowell Lundoff Little Co., 1951 East Fifty-seventh Street, for erecting an addition to building at 5206 Prospect Avenue costing $100,000.

★**Newburg, Ohio.**—Contract for steel work on Newburg Masonic Temple, Miles Park Avenue, awarded to National Iron & Wire Co., 3901 Hamilton Avenue, Mettler-Gloyd Co., 753 Hippodrome Bldg., Cleveland, general contractors; total cost $65,000.

★**Fort Wayne, Ind.**—Contract for erecting temple at Wayne Street and Fairfield Avenue for Achduth Veshalom Congregation awarded to Bueching & Hagerman of Fort Wayne at $65,000. Charles R. Weatherhogg, Hamilton National Bank Building, Archt.

★**Indianapolis, Ind.**—Contract for erecting a brick office building at Market and Delaware Streets for Leasehold Realty Co. (Thomas B. Fulmer, Pres.) awarded to H. W. Klausmann, 1139 Pythian Building, at about $175,000.

★**Warsaw, Ind.**—Contract for erecting a station and office building for the Winona Railroad awarded E. Burner & Co., of South Bend, at $25,473.

★**Freeport, Ill.**—Contract awarded Anton Zwack of Dubuque, for erecting seven-story and basement reinforced concrete, granite, brick and terra cotta bank building, to be erected at Stephenson and Mechanic Streets, for State Bank; cost, including site, about $200,000. Frank A. Carpenter, Architect, 420 Brown Building, Rockford.

★**Rockford, Ill.**—Contract awarded W. H. Cook, 107 South Main Street, for erecting eighteen-family apartment building at North Main and Whitman Streets for Letta & Bennett; cost about $90,000.

★**Fond du Lac, Wis.**—Contract for erecting a station for Chicago & North Western Ry. Company awarded Gaffin & Gehrl, Fond du Lac. W. H. Finluk.

★**Superior, Wis.**—Contract awarded by Great Northern Railroad Co. to W. F. Hill of Superior for additions to various terminal properties on this division, to cost $40,000.

★**Jamestown, N. D.**—Contract for erecting Masonic Temple in Jamestown awarded to R. B. Maxwell & Son of Jamestown at $28,300. J. A. Shannon, Architect, Devils Lake.

★Contract for erecting depot at Jamestown for Northern Pacific R. R. awarded to E. G. Evensta Construction Co. of Minneapolis, Minn.

★**Beaumont, Tex.**—Contract for erecting 2-story, 120 x 130 ft., concrete building at Park and Washington Streets for Phelan-Josey Grocery Co. awarded to John Heartfield of Beaumont at about $40,000. Cooke & Co. of Houston, Archts.

★**Houston, Tex.**—Contract for erecting concrete and steel warehouse awarded by Anderson, Clayton & Co. to Horton & Horton of Houston, at about $83,000.

★**San Antonio, Tex.**—Contract awarded by San Antonio, Belt & Terminal Company to Thomas & Jones, St. Louis, Mo., for erecting a freight station, brick or reinforced concrete 50 x 300 ft. and a passenger station stone mission type.

★**Seattle, Wash.**—Contract awarded by C. Alfred Brietung, Archt., Walker Building, to William Wills, Crary Building, for erecting three-story and basement, 50 x 116-ft. brick and mill apartment house at Terry Ave. and Terrace Street for Philip Miller; cost, complete, $50,000.

★**Anaheim, Cal.**—Contract for erecting 3-story and basement brick and steel bank and office building for First National Bank awarded Nance Construction Co., 846 Linden Street, Los Angeles, to cost about $50,000. Eugene Durfee, Archt.

★**Los Angeles, Cal.**—Contract for erecting 2-story and basement store and lodge hall for the Masons at San Pedro, Los Angeles Harbor, awarded Kling Company, 1613 East Fifteenth Street, at about $30,000. Thornton Fitzhugh, Archt., Story Building.

★**Pocatello, Idaho.**—Reported Salt Lake Hardware Company, awarded to Lynch Cannon Company, Salt Lake City, Utah, the contract for erecting a 5-story reinforced concrete and brick warehouse, to cost $60,000.

NEW INDUSTRIAL PLANTS

PROPOSED WORK.

Springfield, Mass.—Permit granted to Fiberoid Co. of East Orchard for additions to plant to cost $72,000.

Providence, R. I.—The Spring Ring Manufacturing Co. will erect a 2-story concrete addition, 40 x 60 ft.

The Simons Braid Co., Dexter Street, will erect a 2-story brick factory, 120 x 70 ft.

The American British Manufacturing Co. intends erecting brick and steel addition, 103 x 110 ft., and 42 ft. high.

Bristol, Conn.—Bristol Brass Co. is to build a tube mill, 60 x 300 ft., to cost $35,000.

Ivoryton, Conn.—Plans being prepared by Jenckes & Ballou of Providence, R. I., for a one-story addition, 60 x 100 ft., and 2 one-story additions, 19 x 95 ft., for Comstock-Cheney & Co.

New Britain, Conn.—The Beaton & Caldwell Co. will erect a 6-story factory, 120 x 60 ft., and a separate boiler house, both of brick construction.

Norwich, Conn.—Winchester Woolen Co. of Thamesville is to build a 4-story brick factory, 163 x 83 ft.

Rockville, Conn.—The fishline factory of E. J. Martin & Sons recently destroyed by fire will be rebuilt.

Buffalo, N. Y.—Plans filed for erecting additions to plant of Donner Steel Company, Abbott Road, Buffalo; cost $140,000.

Engel Aeroplane & Motor Co. of Buffalo incorporated with capital of $750,000, and will erect a plant and engage in manufacture of aeroplanes, hydro-planes and motors for same. Headquarters of company 909 D. S. Morgan Bldg., Buffalo. Incorporators, Albert J. Engel and Orson J. Weimert of Buffalo and others.

Rochester, N. Y.—A permit issued to Mandeville-King Co., 187 Main Street East for erection of a 2-story, 233 x 82 ft. factory. Leon Stern, Archt., Chamber Commerce Bldg.

Bayonne, N. J.—Vacuum Oil Co., Constable Hook, contemplates erecting an extension to factory costing $100,000.

Newark, N. J.—American Hair Felt Co., Lockwood Street, will erect a $25,000 factory.

Philadelphia, Pa.—Carl P. Berger, South Penn Square Building, is preparing plans for 2-story factory, 80 x 130 ft., for Belmont Packing & Rubber Co., at Sepiva and Butler Streets.

South Bethlehem, Pa.—Reported an addition is to be erected to Bethlehem Steel Plant at a cost of about $500,000, to be used as a general annealing test and storage plant. Annealing furnace slotting machines and drills will be installed. Charles M. Schwab interested.

Washington, D. C.—International Steel & Plate Co., Quantico, Va., plans to erect a shipbuilding plant for first unit to cost $30,000. Hugh McIsaac, Secy., Munsey Building, Washington, D. C.

Norfolk, Va.—The Two-State Package Cor. organized to erect a plant for manufacture of grape and fruit baskets: Capital $250,000. Among incorporators: Edson Potter of Penn Yan, N. Y., Pres., and Walter S. Smith of Watkins, N. Y., Vice-Pres.

High Point, N. C.—Reported two additions will be built to plant of Piedmont Mills Co., one 4-story, 60 x 126 ft., and other 3-story, 60 x 135 ft.

Cleveland, Ohio.—Forest City Electric Company, 5009 Windsor Avenue, purchased site on Lakeside Avenue and East Fifty-first Street and intends erecting three factory buildings. Plans filed for first building, to be erected at west end, costing $40,000; a second building is to be erected at the north end, and a third when its present lease on Windsor Avenue expires next year; total cost about $150,000.

Reported American Puncture Proof Tire Co. will erect a $50,000 plant on Harvard Avenue, near Belt Line R. R.

Buckeye Ribbon & Carbon Co., 311 St. Clair Avenue, will erect a factory at E. Fifty-fifth Street and Spencer Avenue. Cost $25,000.

Cleveland City Forge & Iron Co., Lakeside Avenue and E. Forty-first Street (R. A. Harman, Pres.), will erect additions to its plants costing about $100,000.

William J. Carter, Illuminating Building, engaged to prepare plans for a warehouse and factory to be erected at Perkins and Hough Avenues for the American Stove Co.; cost about $200,000.

White Sewing Machine Co. will erect a brick, steel and concrete addition, 90 x 250 ft., to plant at St. Clair Avenue and East Seventy-ninth Street; cost $45,000.

Gary, Ind.—The Gary Tube Co. of Gary, incorporated to erect a tube plant in Gary, including ore docks, ore yards, blast furnaces, etc. Robert W. Campbell of United States Steel Co. of Chicago, Ill., is interested.

Cadillac, Mich.—All buildings of the Cadillac Chemical Co. recently destroyed will be rebuilt; cost about $50,000. Charles T. Mitchell, Pres.

Superior, Wis.—An auto truck plant is to be erected for manufacture of auto trucks for J. G. Barnsdale, 1204 Tower Avenue; cost $50,000.

Lyons, Kan.—Main building of plant of Bevis Rock Salt Company, recently destroyed by fire, will be rebuilt.

Duluth, Minn.—Ford Motor Company will erect automobile assembling plant here, to cost about $500,000.

South St. Paul, Minn.—Reported Armour & Co. will build a plant in South St. Paul; cost about $2,500,000.

Ft. Worth, Tex.—Chevrolet Motor Company will erect an assembling plant on Arlington Heights Road. Address W. H. Beck, Agent, Chevrolet Motor Company, Ft. Worth.

Carlsbad, N. M.—Atchison Topeka & Santa Fe R.R. (G. W. Harris, Chief Engr., Los Angeles, Cal.) will build a 100-ton coaling station, a five stall roundhouse and a cinder pit at Carlsbad.

Bakersfield, Cal.—Independent Oil Producers' Assoc. (W. P. Robb, Secy., Union Oil Bldg., Los Angeles) decided to erect a Ritzman process gasoline refinery near Bakersfield and has appropriated $45,000 for the present operations.

San Diego, Cal.—Council has granted leases to tidelands to C. S. Hall, for constructing a chloride reduction plant, and to John Campbell for a ship yard, and to California Iron Works, for a steel and iron works.

Ray, Ariz.—George Bradley, formerly of the firm of Bradley & Bruff, & LaBarth, San Francisco, engaged to prepare plans for a 1000-ton concentrating plant at Kelvin, 6 miles south of Ray, for the Ray Hercules Copper Company (C. E. Adams, Gen. Mgr., Ray).

Smithfield, Utah.—Reported Amalgamated Sugar Company of Logan (Fred G. Taylor, Secretary-Treasurer) contemplates erecting sugar factory west of Smithfield and to make other improvements; total cost about $1,000,000.

San Diego, Cal.—San Diego Fish Company has been authorized by State Corporation Commission to issue stock for building a concrete and tile refrigerating plant to cost $40,000, and 150-ft. wharf.

San Francisco, Cal.—The Automatic Spark Advance Co., incorporated to manufacture mechanical devices to be used as combustion engine device. Capital $30,000. Among incorporators, S. H. Cabot and C. A. Henneuse.

Cottonwood, Idaho. — The Farmers Union Warehouse Co. of Grangeville will erect a 100-bbl. capacity per day flour mill in Cottonwood.

Quebec City, Que.—St. Maurice Mines Company, plans to expend $400,000 on development work in Temiskaming and Abitibi. A. Doucet, Quebec, Engineer.

Chatham, Ont.—Reported American Pad & Textile Company plans erecting additions at rear of plant on Jeffrey Street; cost, about $30,000.

Essex, Ont.—E. C. Dennert, care of Hill Brothers, Essex, is preparing plans for a plant for manufacture of auto tractors; cost $25,000.

London, Ont.—E. Leonard & Sons, York Street, plans erecting an addition to their boiler and engine works and shell factory 70 x 70 ft., brick construction; cost $30,000.

Markham, Ont.—A grain mill is to be erected near Markham Station at cost of $60,000. A. Ward Milne of Markham said to be interested.

Simcoe, Ont.—Planing mill of L. W. Fick & Co. of Simcoe, recently destroyed by fire, will be rebuilt at cost of $25,000, and new machinery bought.

Windsor, Ont.—Maxwell Motor Car Co. will erect a factory in Windsor at cost of $50,000.

BIDS DESIRED.

Port Arthur, Tex.—Until June 15 by City Commissioners for constructing a municipal abattoir, advertised in Engineering Record.

PRICES AND LETTINGS.

★Indicates award of contract.

★Springfield, Mass.—Contract for erecting a 2-story, 126 x 102 ft., office and storage building at 48 Park Street for Milton Bradley Co. awarded to A. E. Stephens Co. of Springfield. H. L. Sprague, Archt., 310 Main Street.

★Waterbury, Conn.—Contract for erecting factory, power house, coaling station and railroad trestle on the Watertown Road for A. H. Wells & Company, Inc., awarded H. Wales Lines Company, Meriden, $23,209, and for steel work, Berlin Construction Company, of Berlin, $6,900. The factory will be 100 x 160 ft., brick with steel truss roof, steel sash and concrete floors. Charles H. Preston, Jr., Architect, Waterbury.

★Buffalo, N. Y.—John W. Cowper Company, Fidelity Building, secured contract to erect additions to plant of Schoellkopf Aniline & Chemical Works, Inc.; cost $1,000,000.

★Long Island City, N. Y.—Contract for erecting four-story reinforced concrete, 80 x 345 ft. factory for Jas. K. Stewart awarded Jacob Zimmerman & Son, Inc., 18 East Forty-first Street, New York, N. Y. Ballinger & Perot, Archts., Methodist Bldg., Philadelphia, Pa.

★Trenton, N. J.—Contracts for erecting a ship-plate shop, 500 x 80 ft., on Delaware River, cost $50,000, awarded American Bridge Co. and Newton A. K. Bugbee & Co., Inc., 206 East Hanover Street.

★Bridesburg, Pa.—Contract awarded James H. Wells, 1215 Filbert Street, for erecting two-story and basement, brick, concrete and terra cotta, 120 x 62 ft. factory for Abrasive Material Company, Stearns & Castor, Architects, Philadelphia.

★Chester, Pa.—Contract awarded Raymond Concrete Pile Company, 140 Cedar Street, New York, N. Y., for concrete piling and reinforced concrete foundations for the machine shops, crane runways and five launching ways for the shipbuilding plant of the Sun Shipbuilding Co. of Philadelphia, Pa.

★Coatesville, Pa.—Contract for erecting machine shop, blacksmith shop and yard runway at Worth plant of Midvale Co. awarded to Irwin & Leighton, 126 N. Twelfth Street, Philadelphia, at $300,000.

★Erie, Pa.—Contract for erecting grain elevator at foot of Holland Street for Erie and Western Transportation Co. awarded to Stevens Engineering Co. of Chicago, Ill., at about $300,000.

★Nicetown (P. O. Philadelphia), Pa.—Contract for erecting Machine Shop No. 7, 217 x 542 ft., at Nicetown Works of Midvale Co., awarded to Barclay, White & Co., 1530 Chestnut Street, Philadelphia, at $320,000.

★Charlotte, N. C.—Contract awarded W. P. Rose & Company of Goldsboro, for erecting a building for plant of J. & D. Rubber & Tire Company, to cost $35,000.

★Cincinnati, Ohio.—Contracts for erecting 5-story, 250 x 250 ft., building at Pearl and Eggleston Avenues for American Tool Works at cost of $250,000 awarded as follows: Concrete work to Ferro Concrete Construction Co., Richmond and Harriott Streets; iron work to L. Schrieber & Sons Co. of Cincinnati.

★Pueblo, Colo.—Contract for constructing for C. F. & O. a 600 by-product coke oven awarded Cooper By-Products Coke Oven Co. of Pittsburgh, Pa.

★Maisonneuve, Que.—Contract awarded A. Gratton, 142 Fifth Avenue, for erecting an addition to factory of Columbus Rubber Company, at 146 Iberville Street; cost $25,000.

★Chatham, Ont.—Chatham Construction Company, Chatham, Ont., awarded contract for storage buildings and a drying plant in connection with new $1,000,000 sugar refinery to be erected at Chatham for the Dominion Refining Company of Wallaceburg, Ont. D. A. Gordon, Manager.

★Galt, Ont.—Contract for erecting power plant for the Goldie McCulloch Co. awarded P. H. Secord & Sons, Brantford, and for the steel work to Hamilton Bridge Co., Hamilton.

★St. Catharines, Ont.—Sherwood & Sherwood, Mail Building, Toronto, secured contract for erecting a reinforced concrete hardware factory for the McKinnon Dash Co. of St. Catharines to cost $75,000.

MISCELLANEOUS

PROPOSED WORK.

Power and Heating Plant—Greenville, Pa.—The Pearson-Erhard & Co., of Boston recently purchased plant of Mercer Light, Heat & Power Co., and is having plans prepared for a central plant to cost about $100,000.

Philadelphia, Pa.—See "Electric Railways."

BIDS DESIRED.

Conduit—Hartford, Conn.—See "Water Works."

Road Roller—Arcadia, Fla.—Until June 1 by George E. Grimes, City Clk., for a 12 to 15-ton gasoline roller, one scarifier, one light road grader and one street sweeper.

Mail Handling Devices—New Orleans, La.—Until July 17, by Jas. A. Wetmore, Acting Superv. Archt. Treas. Dept., Washington, D. C., for mail handling devices, etc., in U. S. post office and courthouse at New Orleans.

Mail Lifts — Cincinnati, Ohio.—Until June 17, by James A. Wetmore, Acting Supervising Architect, Washington, D. C., for installing complete new hydraulic

Elevators—Cincinnati, Ohio.—Until May 31 by Charles F. Hornberger, Dir. Pub. Service, for furnishing material and repairing three elevators (Otis make) in City Hall.

Engine—Richland Center, Wis.—Until June 6, by Reuben Sutton, City Clerk, for simple high-pressure non-condensing heavy-duty Corliss engine.

Elevator—Boone, Iowa.—Until June 12 by James A. Wetmore, Acting Supervising Archt., Treas. Dept., Washington D. C., for installing complete a new hoistway, electric freight elevator, etc., in U. S. Post Office, Boone.

Elevators—Austin, Tex.—Until June 1, James E. Ferguson, Governor, for installing elevators, etc., in State Capitol building.

Smokestack—Olympia, Wash. — Until June 12, by Frank C. Morse, Chmn. State Board Control, for erecting a 66-in. and 150-ft. high concrete smokestack for State Institute for Feeble Minded at Medical Lake.

Cranes—Seattle, Wash.—Reported desired until June 7, by C. E. Remsberg, Secy. Port of Seattle, for a locomotive crane in the Central Waterfront Improvement of the Port of Seattle. Bidders are asked to submit alternate bids on designs of their own. J. R. West, Ch. Engr.

PRICES AND LETTINGS.

★Indicates award of contract.

★Playground Improvements — Boston, Mass.—Mayor has approved contract awarded J. C. Coleman & Sons Company, for grading walks and walls for Ward 19 playground, at $38,592.

Conduit System—Union Hill, N. J.—Following are four bids opened May 15 by Council for installing the proposed underground police and fire-alarm system: Central Station Equipment Company, New York, $22,989; Okonite Company, New York, $24,100; Dean Electric Company, Morristown, $25,775, and William H. Straut Company, Haverstraw, $26,800.

★Fence—Philadelphia, Pa. — Contract for constructing wrought iron fence, etc., to improve Stanton Park, awarded Wayne Iron Works, Arcade Building, Philadelphia (bids opened May 15 by Bureau of City Property).

★Road Oiling—Reading, Pa.—Contract awarded Fehr & O'Rourke, Reading, for oiling 500,000 sq. yd. of streets (bids opened May 10), at 21.5 cts. per yd., 3.10 gal. per sq. yd. E. Beilrich, City Engineer.

★Oiling — Cincinnati, Ohio — Contract awarded by County Commissioners for oiling twelve county market roads to Kenton Road Oiling Company, Covington, Ky., at $24,158.

★Crane — Houston, Tex. — Contract awarded Pawling & Harnishfiger of Milwaukee, Wis., for one 20-ton traveling crane for municipal wharf No. 4 at $11,350.

★Steel Towers—Keyport, Wash.—Contract for erecting two 400-ft steel towers for the Naval Radio Station at Keyport, Wash., awarded Martin & Dugan, Seattle, Wash., at $38,055.

★Boilers — Pasadena, Cal. — Contract awarded C. C. Moore & Co., San Francisco, for furnishing and installing Stirling water tube boiler for Municipal Light Department, at $15,345.

Proposals

For Proposals Advertised, See Pages 42a, 42b and 42c.

WATERWORKS.

Bids Close.		See Eng. Record.
May 31.	System, Aberdeen, Wash.	Apr. 29
May 31.	C. I. Pipe and Specials, Morris, Minn. .... Adv. May 13, 20.	May 13
May 31.	Steel Tank, Etc., Westbrock, Minn.	May 27
May 31.	Meters, Medford, Mass...	May 27
Jun. 1.	Water Works, Madison, W. Va.	Apr. 22
Jun. 1.	Filtration Plant, St. Hyacinthe, Que.	May 13
Jun. 1.	Extending System, Ft. Wadsworth, N. Y....... Adv. May 20, 27.	May 20
Jun. 1.	System, Castle Rock, Col.	May 20
Jun. 1.	Reservoir, Garrett, Ind..	May 27
Jun. 2.	Reservoir, Wilmington, Del. .... Adv. May 13.	May 13
Jun. 2.	Waterworks, Mullen, Neb.	May 20
Jun. 3.	Electrical equipment for water plant, El Paso, Tex. .... Adv. May 6 to 20.	May 6
Jun. 5.	Gate Valves, Etc., St. Paul, Minn. .... Adv. May 13 to 27.	May 13
Jun. 5.	Material, St. Paul. Minn. Adv. May 13 to 27.	May 13
Jun. 5.	Castings, Etc., St, Paul, Minn. .... Adv. May 13 to 27.	May 13

Bids Close.		See Eng. Record.
Jun. 5.	C. I. Pipe, Etc., St. Paul, Minn. Adv. May 13 to 27.	May 13
Jun. 6.	Water Works, Everett, Wash. Adv. May 13, 20.	May 13
Jun. 5.	East Troy, Wis.	May 20
Jun. 5.	System, Mount Rainier, Md.	May 20
Jun. 5.	Mains, Cleveland Heights (P. O. Warrensville), Ohio	May 20
Jun. 6.	Extension, Crystal Falls, Mich.	May 27
Jun. 6.	System, Tchula, Miss.	May 20
Jun. 6.	Pumping Units, New Brunswick, N. J. Adv. May 27.	May 27
Jun. 6.	Conduit, Hartford, Conn. Adv. May 27.	May 27
Jun. 9.	Repairs to Wells, Whitewater, Wis.	May 27
Jun. 10.	Water Works, Sheboygan Falls, Wis.	May 27
Jun. 12.	Reservoir, La Porte, Ind. Adv. May 27.	May 27
Jun. 12.	Screens, St. Paul, Minn.	May 27
Jun. 13.	Contract 144, New York, N. Y. Adv. May 20.	May 20
Jun. 15.	Works, Port Arthur, Tex.	May 20
Jun. 15.	System, Oatman, Ariz.	May 20
Jun. 17.	Water Works, Winnemucca, Neb.	May 20
———	Franchise, Williamsburg, Va. Adv. May 27.	May 27

SEWERAGE AND SEWAGE DISPOSAL.

May 29.	Biddeford, Me. Adv. May 13, 20.	May 13
May 31.	Newark, N. J. Adv. May 13, 20.	May 13
May 31.	Fresno, Cal.	Apr. 29
May 31.	Washington, D. C. Adv. May 20.	May 20
May 31.	Binghamton, N. Y.	May 27
Jun. 1.	Marshall, Ill.	May 13
Jun. 1.	Monticello, Wis.	May 13
Jun. 1.	Ft. Wadsworth, N. Y. Adv. May 20.	May 20
Jun. 1.	Akron, Ohio Adv. May 20.	May 20
Jun. 1.	St. Catharines, Ont.	May 27
Jun. 1.	Huntington, Mass.	May 27
Jun. 1.	Bozeman, Mont.	May 27
Jun. 1.	Brentwood, Pa.	May 27
Jun. 1.	Cleveland, Ohio	May 27
Jun. 2.	Cooperstown, N. Y. Adv. May 20.	May 20
Jun. 5.	Neodesha, Kan.	May 27
Jun. 5.	Bedford, Iowa	May 27
Jun. 6.	Alliance, Ohio Adv. May 20.	May 20
Jun. 6.	Johnson City, Tenn.	May 27
Jun. 6.	Shelby, N. C.	May 27
Jun. 6.	Wilson, Conn.	May 27
Jun. 7.	Dayton, Ohio Adv. May 27.	May 27
Jun. 7.	Brooklyn, N. Y.	May 27
Jun. 7.	Waverly, Iowa	May 27
Jun. 8.	Milwaukee, Wis. (2 Props.) Adv. May 20, 27.	May 20
Jun. 9.	Ainsworth, Neb.	May 27
Jun. 14.	Afton, Okla.	May 27
Jun. 15.	Xenia, Ohio	May 20
July 15	Salem, Ill.	May 20
Jun. 15.	Oakesdale, Wash.	May 27
Jun. 20.	McComb, Miss.	May 27

BRIDGES.

May 29.	Rice Lake, Wis. Adv. May 20.	May 20
May 31.	Warren, Pa. Adv. May 13, 20.	May 13
May 31.	Pennsylvania	May 20
May 31.	Fullerton, Cal.	May 20
May 31.	Washington, Pa.	May 27
May 31.	Cleveland, Ohio	May 27
May 31.	Youngstown, Ohio	May 27
May 31.	New Florence, Pa.	May 27
May 31.	Albion, Pa.	May 27
May 31.	Fullerton, Cal.	May 27
Jun. 1.	Hamilton, Ohio	May 6
Jun. 1.	Mansonville, Que.	May 20
Jun. 1.	Adel, Iowa	May 27
Jun. 1.	Joliet, Ill.	May 27
Jun. 2.	Columbus, Ohio	May 20
Jun. 2.	Hartford, W. Va.	May 13
Jun. 2.	Cambridge, Ill.	May 27
Jun. 2.	Illinois	May 27
Jun. 2.	Trenton, N. J.	May 27
Jun. 3.	Cleveland, Ohio	May 27
Jun. 3.	Illinois	May 27
Jun. 5.	Cumberland, Md.	Apr. 22
Jun. 5.	Bushnell, Fla.	May 20
Jun. 5.	Newcastle, Ind.	May 20
Jun. 5.	Aberdeen, Wash.	May 20
Jun. 5.	New Orleans, La.	May 20
Jun. 5.	Barbourville, Ky.	May 27
Jun. 5.	Hettinger, N. D.	May 27
Jun. 5.	Stillwater, Okla.	May 27
Jun. 5.	Duluth, Minn.	May 27
Jun. 5.	Jones, Okla.	May 27
Jun. 5.	Stillwater, Okla.	May 27
Jun. 5.	Muskogee, Okla.	May 27
Jun. 5.	West Allis, Wis.	May 27
Jun. 5.	Defiance, Ohio	May 27
Jun. 6.	Hayti, S. D.	May 13
Jun. 6.	Brookings, S. D.	May 20
Jun. 6.	Montrose, S. D.	May 20
Jun. 6.	Huron, S. D.	May 20
Jun. 6.	Wabash, Ind.	May 20
Jun. 6.	Macon, Miss.	May 20
Jun. 6.	Flora, Miss.	May 27
Jun. 6.	Brainerd, Minn.	May 27
Jun. 6.	Little Falls, Minn.	May 27
June 6.	Woonsocket, S. D.	May 27
June 6.	Indiana	May 27
Jun. 6.	Canton, Miss.	May 27
Jun. 8.	El Dorado, Kan.	Apr. 8
Jun. 8.	Ft. Lauderdale, Fla.	May 20
Jun. 8.	London, Ky.	May 27
Jun. 9.	Salem, N. J.	May 27
Jun. 9.	Madison, Wis.	May 27
Jun. 13.	Philadelphia, Pa. Adv. May 20.	May 20
Jun. 13.	Modesto, Cal.	May 27
Jun. 20.	Illinois	May 27
Jun. 26.	Clintwood, Va.	May 20

PAVING AND ROADS.

May 29.	Ft. Collins, Colo. Adv. May 20.	May 20
May 29.	Greenwich, Conn. Adv. May 20, 27.	May 20
May 29.	Roller, Wellington, Mass.	May 27
May 30.	Cold Springs, Tex.	May 13
May 30.	Sheperd, Tex.	May 13
May 30.	Birmingham, Ala.	May 20
May 31.	Wooster, Ohio	May 20
May 31.	Riverside, Cal.	May 20
May 31.	Billings, Mont.	May 27
May 31.	Wilkes-Barre, Pa.	May 27
May 31.	Wilmington, Del.	May 27
May 31.	Des Moines, Iowa	May 27
May 31.	Mount Ayr, Iowa	May 27
May 31.	Columbus, Ohio	May 27
May 31.	Illinois	May 27
May 31.	West Hoboken, N. J.	May 27
May 31.	Kansas City, Mo.	May 27
May 31.	Corry, Pa.	May 27
May 31.	Massachusetts.	May 27
Jun. 1.	Hamilton, Ohio	May 6
Jun. 1.	Washington, D. C. Adv. May 6.	May 6
Jun. 1.	Crestline, Ohio	May 13
Jun. 1.	Galion, Ohio. Adv. May 13.	May 13
Jun. 1.	Escanaba, Mich.	May 20
Jun. 1.	Decatur, Ill.	May 20
Jun. 1.	Newark, N. J.	May 27
Jun. 1.	Minneapolis, Minn.	May 27
Jun. 1.	Elyria, Ohio	May 27
Jun. 1.	Dubuque, Iowa	May 27
Jun. 1.	Louisville, Ky.	May 27
Jun. 1.	Gilford, Mich.	May 27
Jun. 1.	Indianapolis, Ind.	May 27
Jun. 1.	Lincoln, Neb.	May 27
Jun. 1.	Ft. Wayne, Ind.	May 27
Jun. 2.	Great Falls, Mont.	Apr. 22
Jun. 2.	Portland, Me.	May 20
Jun. 2.	Neenah, Wis.	May 20
Jun. 2.	Inglewood, Cal.	May 20
Jun. 2.	Alliance, Ohio	May 27
Jun. 2.	Norman, Okla.	May 27
Jun. 3.	Bucyrus, Ohio	May 20
Jun. 3.	Steubenville, Ohio.	May 20
Jun. 3.	Cumberland, Md Adv. May 27.	May 27
Jun. 5.	Columbus, Miss.	Apr. 29
Jun. 5.	Gate City, Va.	May 13
Jun. 5.	Indiana	May 13
Jun. 5.	Port Jervis, N. Y. Adv. May 13, 20.	May 13
Jun. 5.	Cleveland Heights (P. O. Warrenville), Ohio	May 13
Jun. 5.	Everett, Wash.	May 13
July 5.	Terrabonne, La. Adv. May 13.	May 13
Jun. 5.	Charleston, Miss.	May 20
Jun. 5.	Albany, N. Y. Adv. May 20. 27.	May 20
Jun. 5.	Bloomfield, N. J.	May 20
Jun. 5.	Waterville, Wash.	May 20
Jun. 5.	Blaine, Wash.	May 20
Jun. 5.	Larimore, N. D.	May 20
Jun. 5.	Hackensack, N. J. Adv. May 20, 27.	May 20
Jun. 5.	New Orleans, La.	May 20
Jun. 5.	Indiana	May 20
Jun. 5.	Union Hill, N. J.	May 20
Jun. 5.	Columbus, Ohio	May 27
Jun. 5.	Hanford, Cal.	May 27
Jun. 5.	Clarkston, Wash.	May 27
Jun. 5.	Goldendale, Wash.	May 27
Jun. 5.	Seattle, Wash.	May 27
Jun. 5.	Sedalia, Mo.	May 27
Jun. 5.	Asotin, Wash.	May 27
Jun. 5.	Union Hill, N. J.	May 27
Jun. 5.	Elmira, N. Y. Adv. May 27.	May 27
Jun. 5.	Indiana	May 27
Jun. 6.	Indiana	May 13
Jun. 6.	Vincennes, Ind. Adv. May 20.	May 20
Jun. 6.	Billings, Mont.	May 20
Jun. 6.	Papillion, Neb.	May 20
Jun. 6.	South Bend, Wash.	May 20
Jun. 6.	New Orleans, La.	May 20
Jun. 6.	Indiana	May 20
Jun. 6.	Stockton, Cal.	May 20
Jun. 6.	Shelby, N. C.	May 27
Jun. 6.	Vancouver, Wash.	May 27
Jun. 6.	Ephrata, Wash.	May 27
Jun. 6.	Fort Worth, Tex.	May 27
Jun. 6.	Johnson City, Tenn.	May 27
Jun. 6.	New Wilmington, Pa.	May 27
Jun. 6.	Dayton, Ohio Adv. May 27.	May 27
Jun. 6.	Georgetown, Del. Adv. May 27.	May 27
Jun. 6.	Indiana	May 27
Jun. 6.	Paterson, N. J.	May 27
Jun. 6.	Kalamazoo, Mich Adv. May 27.	May 27
Jun. 7.	Sultan, Wash.	May 13
Jun. 7.	Palatka, Fla. Adv. May 6 to 20.	May 6
Jun. 7.	Albany, N. Y. Adv. May 20, 27.	May 20
Jun. 7.	Cedarville, Ohio	May 20
Jun. 7.	Indiana	May 20
Jun. 7.	Ann Arbor, Mich	May 27
Jun. 7.	Morrison, Ill.	May 27
Jun. 7.	Columbus, Ind.	May 27
Jun. 7.	Indiana	May 27
Jun. 8.	Tallahassee, Fla.	May 20
Jun. 8.	Kiefer, Okla.	May 20
Jun. 8.	Bakersfield, Cal.	May 20
Jun. 8.	Glenwood Springs, Col.	May 20
Jun. 8.	Indiana	May 27
Jun. 9.	Cincinnati, Ohio	May 27
July 10.	Caldwell, Tex.	Apr. 22
Jun. 10.	Wichita, Kan.	May 13
Jun. 10.	Sanford, Fla.	May 27
Jun. 12.	Jefferson, Ohio	May 20
Jun. 12.	Euclid, Ohio	May 20
Jun. 12.	New Orleans, La.	May 27
Jun. 12.	Washington	May 27
Jun. 12.	Indiana	May 27
Jun. 12.	Milburn, N. J.	May 27
Jun. 13.	Dunn, N. C. Adv. May 20, 27.	May 20
Jun. 13.	Janesville, Wis.	May 27
Jun. 13.	Pennsylvania Adv. May 27.	May 27
Jun. 14.	Eaton, Ohio Adv. May 20, 27.	May 20
Jun. 15.	Greenfield, Ohio	May 20
Jun. 15.	Zanesville, Ohio	May 27
Jun. 15.	Fowler, Cal.	May 27
Jun. 16.	Indiana	May 27
Jun. 17.	Dolgeville, N. Y. Adv. May 27.	May 27
Jun. 20.	Rockville Center, Wis. Adv. May 27.	May 27
Jun. 21.	Charleston, Miss.	May 27
Jun. 21.	Sebring, Fla.	May 27
Jun. 21.	Vernon, Ala.	May 27
Jun. 25.	Indiana	May 27
Jun. 27.	Salt Lake City, Utah	May 13
Jun. 29.	New Martinsville, W. Va. Adv. May 27.	May 27
July 10.	Greenwood, Miss.	May 20
July 1.	Maumee, Ohio	May 27
July 1.	Mobile, Ala.	May 27

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS.

May 29.	Drainage, Bloomfield, Ia. Adv. Apr. 29, May 6.	Apr. 29
May 29.	Drainage, Tallahassee, Fla. Adv. Apr. 29 to May 13.	Apr. 29
May 29.	Flood Protection Wall, Portsmouth, Ohio (2 Props.) Adv. May 20, 27.	May 20
May 30.	Dredging, Port Maitland, Ont.	May 27
May 31.	Dredging, Etc., Seattle, Wash.	May 13
May 31.	Levee Work, New Orleans, La.	May 20
Jun. 1.	Dredging, Tarrytown, N. Y. Adv. May 6 to 27.	May 6
Jun. 1.	Drainage, Oskaloosa, Iowa Adv. May 13, 20.	May 13
Jun. 1.	Levee, Port Allen, La.	May 20
Jun. 1.	Dock Repairs, Albany, N. Y.	May 20
Jun. 1.	Repairs to Wharf, Tompkinsville, N. Y. Adv. May 20.	May 20
Jun. 2.	Breakwater, Indiana Harbor, Ind. Adv. May 6 to 27.	May 6
Jun. 3.	Ditch, Caledonia, Mich.	May 20
Jun. 3.	Dredging, Greenville, Ohio Adv. May 20, 27.	May 20
Jun. 3.	Dredging, Philadelphia, Pa.	May 27
Jun. 5.	Fill, Seattle, Wash.	May 20
Jun. 5.	Irrigation, Grandview, Wash.	May 27
Jun. 6.	Dredging, Trenton, N. J.	May 27
Jun. 7.	Cleaning Channel, Newark, Ohio	May 20
Jun. 7.	Dam, Lock Haven, Pa. Adv. May 27.	May 27
Jun. 7.	Wharf Improv., Seattle, Wash.	May 27
Jun. 8.	Rip rap, Tompkinsville, N. Y.	May 20
Jun. 8.	Wharf, New Orleans, La.	May 27
Jun. 8.	Levee, Clarksville, Miss. Adv. May 27.	May 27
Jun. 10.	Flood Protection, Ray, Ariz. Adv. May 13. 20.	May 13
Jun. 10.	Dredging, Michigan City, Ind. Adv. May 20. 27.	May 20
Jun. 12.	Dredging, Philadelphia, Pa. Adv. May 20.	May 20
Jun. 12.	Dredging, Providence, R. I. Adv. May 27.	May 27
Jun. 15.	Irrigation, Payson City, Utah Adv. May 6.	May 6
Jun. 15.	Irrigation, Hermiston, Ore. Adv. May 13.	May 13
Jun. 15.	Dredging, Baltimore, Md. Adv. May 20, 27.	May 20
Jun. 15.	Improv. Creek, Belleville, Ill.	May 20
Jun. 15.	Water Power Lease, Joliet, Ill. Adv. May 20. 27.	May 20
Jun. 20.	Stone, New Orleans, La. Adv. May 27.	May 27
Jun. 20.	Willows, New Orleans, La. Adv. May 27.	May 27
Jun. 22.	Irrigation, Malta, Mont. Adv. May 13.	May 13
Jun. 24.	Irriga., Balmorhea, Tex.	May 27
Jul. 3.	Jetty, Gardiner, Ore.	May 27
Jul. 19	Seawall, Bridgeport Conn. Adv. May 27.	May 27

PUBLIC BUILDINGS AND SCHOOLS.

May 29.	Gears Mills, La.	May 27
May 30.	Plainview, Tex.	May 20
May 30.	Fort Worth, Tex.	May 27
May 31.	Ronceverte, W. Va.	May 20
May 31.	Washington, D. C. Adv. May 13.	May 13
May 31.	Golden Valley, N. D.	May 27
May 31.	Carlton Point, P. E. I.	May 27
May 31.	Gresham, Neb.	May 27
May 31.	Flint, Mich.	May 27
Jun. 1.	Lowellville, Ohio	May 13
Jun. 1.	Washington, D. C. Adv. May 13.	May 13
Jun. 1.	Fillmore, Utah.	May 13
Jun. 1.	Youngstown, Ohio	May 20
Jun. 1.	Sioux City, Iowa	May 20
Jun. 1.	Sarnia, Ont.	May 27
Jun. 1.	Mockville, N. C.	May 27
Jun. 1.	Nesquehoning, Pa.	May 27
Jun. 1.	Yutan, Neb.	May 27
Jun. 1.	Oxnard, Cal.	May 27
Jun. 1.	Austin, Tex.	May 27
Jun. 1.	Saugus, Mass.	May 27
Jun. 2.	Washington, D. C. Adv. May 13.	May 13
Jun. 2.	Lebanon, Ohio	May 13
Jun. 2.	Connellsville, Pa.	May 20
Jun. 3.	Kirkerville, Ohio	May 20
Jun. 3.	Ashtabula, Ohio	May 27
Jun. 3.	Washington, Mich.	May 27
Jun. 5.	Belton, Tex.	May 6
Jun. 5.	Lake Charles, La.	May 13
Jun. 5.	Beattyville, Ky.	May 20
Jun. 5.	Hettinger, N. D.	May 20
Jun. 5.	Sheldahl, Iowa	May 27
Jun. 5.	Canby, Minn.	May 27
Jun. 6.	Waynesville, N. C.	May 13
Jun. 6.	Geneva, Ill.	May 13
Jun. 6.	Chambersburg, Pa.	May 20
Jun. 6.	North Arlington, N. J.	May 20
Jun. 6.	Leoti, Kan.	May 20
Jun. 6.	Red Cloud, Neb.	May 20
Jun. 7.	Portland, Me.	May 6
Jun. 7.	Early, Iowa	May 20
Jun. 7.	Mandan, N. D.	May 27
Jun. 7.	Brooklyn, N. Y.	May 27
Jun. 7.	Shelburne Falls, Mass.	May 27
Jun. 8.	Pineville, W. Va.	Apr. 29
Jun. 8.	Marysville, Tenn.	May 6
Jun. 8.	Waynesville, N. C.	May 6
Jun. 8.	Manistique, Mich.	May 20
Jun. 8.	Beloit, Ohio	May 20
Jun. 9.	Atwater, Ohio	May 27
Jun. 9.	Lincoln, Neb.	May 27
Jun. 9.	New Smyrna, Fla.	May 27
Jun. 10.	Irvington, Ind.	May 13
Jun. 10.	Hanover, Ohio	May 20
Jun. 12.	Newell, Iowa	May 20
Jun. 12.	Elmira, N. Y. Adv. May 20, 27.	May 20
Jun. 12.	Baker, Ore.	May 27
Jun. 13.	Trenton, N. J. Adv. May 20, 27.	May 20
Jun. 13.	Illinois	May 20
Jun. 13.	New York, N. Y. Adv. May 20.	May 20
Jun. 15.	South Boston, Va.	May 20
Jun. 15.	Sidney, Mont.	May 27
Jun. 15.	Columbia Station, Ohio.	May 27
Jun. 16.	Middletown, Ohio	May 13
Jun. 16.	Leesburg, Ohio	May 27
Jun. 19.	Neenah, Wis. Adv. May 13, 20.	May 13
Jun. 20.	Putnam, Conn.	May 20
Jun. 20.	Springdale, Iowa	May 20
Jun. 20.	Dunn Center, N. D.	May 27
Jun. 21.	Douglas, Ariz.	May 20
Jun. 21.	Kildeer, N. D.	May 27
Jun. 21.	Pittsburgh, Pa. Adv. May 27.	May 27
Jun. 22.	Minden, La.	May 20
Jun. 22.	Rumford, Me.	May 27
Jun. 23.	Washington, Ind. Adv. May 27.	May 27
Jun. 23.	Alliance, Ohio	May 27
Jun. 25.	Albuquerque, N. M.	May 27
Jun. 26.	Redfield, S. D. Adv. May 20, 27.	May 20
Jun. 26.	Grinnell, Iowa	May 27
Jun. 27.	Lewis, Iowa	May 27
Jun. 27.	Erie, Pa.	May 27
Jun. 27.	Rochester, N. Y. Adv. May 27.	May 27

PRIVATE BUILDINGS.

May 30.	Windsor, Ont.	May 20
Jun. 1.	Warren, Pa.	May 20
Jun. 1.	Kansas City, Mo.	May 20
Jun. 1.	Hampton, Iowa	May 27
June. 1.	Toronto, Ont.	May 27
Jun. 6.	Alexandria, Minn.	May 27
Jun. 13.	Chicago, Ill.	May 13
Jun. 31.	Cincinnati, Ohio	May 27
July 1.	New Orleans, La.	May 20
July 1.	Grand Island, Neb.	May 20

NEW INDUSTRIAL PLANTS.

Jun. 15.	Port Arthur, Tex. Adv. May 27.	May 27

MISCELLANEOUS.

May 31.	Elevator, Cincinnati, O.	May 27
Jun. 1.	Design for Sign, Springfield, Ill.	May 6
Jun. 1.	El. Rys., New York, N. Y.	May 20
Jun. 1.	Road Roller, Arcadia, Fla.	May 27
Jun. 1.	Elevator, Austin, Tex.	May 27
Jun. 3.	Dredge, Vallejo, Cal.	May 6
Jun. 5.	Steel, New York, N. Y.	May 27
Jun. 6.	Engine, Richland Center, Wis.	May 27
Jun. 6.	Conduit, Hartford, Conn. Adv. May 27.	May 27
Jun. 7.	Cranes, Seattle, Wash.	May 27
Jun. 9.	Steamer, Washington, D. C. Adv. May 13 to 27.	May 13
Jun. 10.	Stairs, etc., Lockport, Ill.	May 20
Jun. 12.	Coal, Norfolk, Va. Adv. May 13.	May 13
Jun. 12.	Platform, Minneapolis, Minn.	May 12
Jun. 12.	Mail Lifts, Cincinnati, O.	May 27
Jun. 12.	Elevator, Boone, Iowa	May 27
Jun. 12.	Smokestack, Olympia, Wash.	May 27
Jun. 14.	Boilers for Ice Boat, Baltimore, Md. Adv. May 27.	May 27
Jun. 30.	Mechanical Mail Handling Appar., New York, N. Y.	May 12
July 17.	Mail Handling Device, New Orleans, La.	May 27
———	El. Rys., New York, N. Y. Adv. Apr. 29 to May 13.	Apr. 29

SEARCHLIGHT SECTION

Bids open June 13, 1916.

PAVING

DUNN, N. C.

Sealed proposals will be received by the Mayor and Board of Commissioners of the Town of Dunn, N. C., at the Town Hall in Dunn, N. C., until 5 p. m., June 13, 1916, for street improvements.

The work will consist of about:

17,000 sq. yd. of brick, asphalt, bitulithic or other pavement.

3000 lin. ft. of concrete curb and gutter.

1000 sq. yd. of sidewalk.

And the necessary drainage, etc.

Proposals must be marked, "Proposals for Street Improvement."

All bids must be upon blank forms provided in the Proposal and Contract and Specifications.

Each bid must be accompanied by a certified check for $2,000 as evidence of good faith.

Plans and specifications will be on file at the Clerk's Office in Dunn, and at the office of the Engineer in Durham, N. C., and copies of the specifications, form of proposal, etc., will be mailed upon application to the Engineer at Durham, N. C., when accompanied by a check for ten dollars to insure their return within thirty days after the letting.

The right is reserved to reject any or all bids.

J. W. TURNAGE, Mayor.
H. S. McKAY, Clerk.
Engineer:
GILBERT C. WHITE,
Durham, N. C.

Bids open June 13, 1916.

STATE HIGHWAY

PENNSYLVANIA STATE HIGHWAY DEPARTMENT,

HARRISBURG, PA.

Sealed proposals will be received at said office until 10 a. m., June 13, 1916, when bids will be publicly opened and scheduled, and contracts awarded as soon thereafter as possible, for the reconstruction of 14,635 lin. ft. of either reinforced cement concrete or bituminous and reinforced cement concrete pavement, 16 ft. wide, being a portion of State Highway Route 131, situated in Birmingham Township, and 4250 lin. ft. of vitrified block pavement 16 ft. wide, situated in Nether Providence Township, both in Delaware County; 17,795 lin. ft. of either reinforced cement concrete or bituminous and reinforced cement concrete pavement, 16 ft. wide, situated in Pennsbury and Kennett Townships, and 21,035 lin. ft. of either reinforced cement concrete or bituminous and reinforced cement concrete pavement, 16 ft. wide, situated in East Nottingham and West Nottingham Townships, both in Chester County, being portions of State Highway Route 131; 5275 lin. ft. of vitrified block pavement, 22 ft. wide, situated in Rochester Township, Beaver County, being a portion of State Highway Route No. 77, and 4290 lin. ft. of bituminous pavement, 16 ft. wide, situated in Whitemarsh Township, Montgomery County. Plans and specifications may be seen at office of State Highway Department, Harrisburg; 1001 Chestnut Street, Philadelphia, and 903 Hartje Building, Pittsburgh, Pa. Full particulars and information on application to JOSEPH W. HUNTER, First Deputy State Highway Commissioner.

Bids open June 6, 1916.

STREET PAVING $100,000

DAYTON, OHIO.

Sealed bids will be received for paving Main Street in the City of Dayton, Ohio, up to 12 o'clock (noon) of June 6, 1916. Construction, 3½-in. wood block on 6-in. concrete foundation, curbing and other work incidental thereto.

J. E. BARLOW,
Director of Public Service.
F. O. EICHELBERGER,
City Engineer.

Official Proposal Announcements

Price, $2.40 an inch.—Copy can be received until Thursday 10 a. m. for issue mailed the next morning

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Bids open June 6, 1916

PROPOSAL FOR ROAD MACHINERY

HACKENSACK, N. J.

Sealed proposals will be received by the Board of Chosen Freeholders of the County of Bergen, N. J., on Monday, June 5th, 1916, at 11 a. m., at the office of the Clerk, Court House, Hackensack, N. J., for the following equipment and machinery:

Sand distributing wagon.
One-ton automobile truck.
Reversible road grader, heavy type.
Street sweeper.
Asphalt kettle with stone dryer.
Scarifier.
Platform spring gear sprinkling wagon.
Two dump carts.
500 gallon gasoline tank.

Specifications may be inspected at the office of the Supervisor of Roads or County Engineer, Court House, Hackensack, N. J.

Bids to be addressed to said Board of Chosen Freeholders and endorsed "Proposal for Road Machinery."

Bids must be enclosed in sealed envelopes, bearing the name and address of bidder on the outside.

The right to reject any or all bids is expressly reserved.

By order of The Committee on Roads.
JAMES M. HARKNESS,
Clerk.

Bids open June 29, 1916.

NOTICE TO CONTRACTORS.

ROADS

NEW MARTINSVILLE, W. VA.

Bids will be received until 12 o'clock noon, Thursday, June 29, 1916, by the County Court of Wetzel County, West Virginia, for the construction of approximately fifteen (15) miles of improved roads in Church District of said Wetzel County.

A certified check for three (3%) per cent of the amount of the bid must accompany each bid. Successful bidders will be required to furnish a bond substantially in wording and figures of the form attached to specification and contract.

Plans for this work may be seen at the office of the County Clerk, New Martinsville, W. Va.; at the First National Bank, Hundred, W. Va., and at the office of the Engineer, J. Russell Wilson, First National Bank Building, Mannington, W. Va.

The Court reserves the right to reject any and all bids.

S. MYERS,
Clerk of the County Court of Wetzel County.

Bids open May 29, 1916.

CONCRETE PAVEMENT

GREENWICH, CONN.

Sealed proposals for about 43,500 sq. yd. of reinforced concrete pavement will be received by the Highway Commission of the Town of Greenwich, Conn., at the Borough Court Room, in the Town Hall, until 3 p. m., on Monday, May 29, 1916.

The work will be given out in two or three contracts, as the Highway Commission may determine.

Specifications, general and detail plans can be seen and blank form of proposal obtained at the office of the Engineer, Room 5, Greenwich Trust Co. Building, Greenwich, Conn. The right is reserved to reject all bids.

LUKE VINCENT LOCKWOOD,
Chairman;
WILLIAM F. DECKER,
ROBERT L. CHAMBERLAIN,
JOHN MAHER,
F. HARRIS NICHOLS,
NATHANIEL A. KNAPP,
Highway Commission.
May 15, 1916.

Bids open June 8, 1916.

OFFICIAL NOTICE NO. 18.

PUBLISHED BY AUTHORITY OF THE SEWERAGE COMMISSION OF THE CITY OF MILWAUKEE

Sealed proposals for the construction of extensions to the Intercepting Sewer System for the City of Milwaukee, Wisconsin, will be received by the Sewerage Commission of said city at its offices in the City Hall until 2:00 p. m., the 8th day of June, A. D. 1916, at which time and place during the session of the said Commission, the proposals will be publicly opened and read.

The work to be done embraces the building of the following work:

30 in. inverted siphon of cast-iron pipe about 215 ft. in length to be built under Menomonee River, with two manholes, including sluice gates, and other appurtenances.

2970 lineal feet of 48-in. reinforced concrete sewer.

5116 lineal feet of 42-in. reinforced concrete sewer.

1850 lineal feet of 30-in. concrete sewer.

2610 lineal feet of 24-in. terra cotta pipe sewer.

1406 lineal feet of 12-in. terra cotta pipe sewer.

Together with all manholes, timber and pile foundation and other appurtenances.

The time allowed for the completion of this contract shall be twelve (12) months from the date of the engineer's notice to begin work.

The liquidated damages for not completing the work within the time above stated shall, for each day in excess thereof, be an amount equal to one-half of one per centum of the aggregate cost of the work embraced in the contract.

Each proposal submitted must be accompanied by a cash deposit of, or, in lieu thereof, by a certified check drawn upon a National or State bank or trust company, and to the order of the "Sewerage Commission of the City of Milwaukee" to the amount of thirty thousand dollars ($30,000.00).

All cash deposits or certified checks deposited by bidders to whom the contract is not awarded will be returned upon application to the Secretary of the Sewerage Commission after the contract has been awarded, or after the rejection of all bids. The cash deposit or certified check which has been deposited by the successful bidder will be returned to him as soon as the contract is properly executed and approved by the City Attorney and Sewerage Commission.

Specifications and blank forms of proposals can be obtained, and detailed plans examined, at the office of the Sewerage Commission in the City Hall and a full set of plans will be sent to any contractor upon receipt of five dollars ($5.00). This sum to be returned upon surrender of the plans in good condition.

The Sewerage Commission of the City of Milwaukee reserves the right to reject any and all bids submitted.

JOHN H. FOWLES,
Secretary.
Countersigned:
LOUIS M. KOTECKI,
Comptroller.

FRANCHISE FOR CAR LINE, LIGHT, POWER, SEWERAGE AND WATER

The City of Williamsburg, Virginia, invites bids for franchises for electric-car line, light and power, sewerage and water.

For information write

W. L. JONES,
President City Council,
Williamsburg, Va.

Bids open June 8, 1916.

OFFICIAL NOTICE NO. 17.

PUBLISHED BY AUTHORITY OF THE SEWERAGE COMMISSION OF THE CITY OF MILWAUKEE

Sealed proposals for the construction of extensions to the Intercepting Sewer System for the City of Milwaukee, Wis., will be received by the Sewerage Commission of said city at its offices in the City Hall, until 2 p. m., the 8th day of June, A. D., 1916, at which time and place during the session of the said Commission, the proposals will be publicly opened and read.

The work to be done embraces the building of the following work:

30-inch inverted siphon of cast-iron pipe about 240 ft. in legth, to be built under the South Menomonee Canal, together with two shafts, including valves, sluice gates, cast-iron pipe and specials and other appurtenances.

1852 lin. ft. of 54-in. concrete sewer in tunnel.

3447 lin. ft. of 54-in. concrete sewer in open cutting.

2255 lin. ft. of 18-in. terra cotta pipe sewer.

400 lin. ft. of 12-in. terra cotta pipe sewer.

Together with all manholes, timber and pile foundation and other appurtenances.

The time allowed for the completion of this contract shall be twelve (12) months from the date of the Engineer's notice to begin work.

The liquidated damages for not completing the work within the time above stated shall, for each day in excess thereof, be an amount equal to one-half of 1 per centum of the aggregate cost of the work embraced in the contract.

Each proposal submitted must be accompanied by a cash deposit of, or in lieu thereof, by a certified check drawn upon a national or State bank or trust company and to the order of the "Sewerage Commission of the City of Milwaukee" to the amount of thirty-two thousand dollars ($32,000.00).

All cash deposits or certified checks deposited by bidders to whom the contract is not awarded will be returned upon application to the Secretary of the Sewerage Commission after the contract has been awarded, and after the rejection of all bids. The cash deposit or certified check which has been deposited by the successful bidder will be returned to him as soon as the contract is properly executed and approved by the City Attorney and Sewerage Commission.

Specifications and blank forms of proposals can be obtained, and detailed plans examined, at the office of the Sewerage Commission in the City Hall, and a full set of plans will be sent to any contractor upon receipt of five dollars ($5.00). This sum to be returned upon surrender of the plans in good condition.

The Sewerage Commission of the City of Milwaukee reserves the right to reject any and all bids submitted.

JOHN H. FOWLES,
Secretary.
Countersigned:
LOUIS M. KOTECKI,
Comptroller.

Bids open June 7, 1916.

PROPOSALS FOR 9 FT. STORM SEWER

DAYTON, OHIO.

Sealed bids will be received by the Director of Public Service until 12 o'clock (noon) on Wednesday, June 7, 1916, for furnishing all materials and labor required for installing approximately 4700 ft. of 9 ft. storm sewer and appurtenances; the excavation on said work being about 47,000 cu. yd. Plans may be seen and forms of proposal and specifications may be obtained at the office of the City Engineer.

F. O. EICHELBERGER,
City Engineer.
J. E. BARLOW,
Director of Public Service.

Prospects Excellent for Financing Public Construction Work This Summer, Say Bankers

Demand from Private Investors for Good Public Securities, Which Has Made Strong Bond Market for a Year, to Continue, Is General Opinion—Late Season, Labor Situation and Prices Hold Back Some Construction

FOR THE next few months, at any rate, and probably even after the close of the present war, American bonds will continue a favored form of investment, in the opinion of a number of prominent bankers and bond dealers in different parts of the country who have outlined their estimate of the situation in response to requests from the Engineering Record.

Slightly rising money rates in response to the foreign trade situation, and the high prices, or low rates of return, at which bonds have been selling, due to the great reserves accumulated in 1915, might be expected to curtail the demand for bonds at recent prices. Further, uncertainty as to the future might be considered a factor which would cause both banks and private investors to keep their funds available in more liquid form than is afforded by bonds. Moreover, the opinion has been held that after the war European Government and investment securities of all kinds would sell so low, because of a pressing need for more capital than could be obtained in Europe, that American capital would desert home securities to take up foreign ones.

On the first point, the general opinion is that private investors and, to a considerable extent, banks will continue to absorb good bond issues as rapidly as during the past year. It is held that, while there has been some rise in money rates and some tendency, mainly on the part of banks, to show a preference for short time loans, these factors have not and will not curtail the market for good public or industrial issues. The active demand which has been manifest for such securities is, therefore, expected to continue.

With regard to the attractiveness of European issues after the close of the war, none of the bankers whose opinions were requested seem to think that any large proportion of American investors will prefer such securities. It is pointed out that greater interest concessions than those already offered on the loans of foreign governments are hardly to be looked for, and that the American investor is likely to keep the most of his money at home, both from a desire to aid in the development of this country and because conditions after the war are apt to render European investments uncertain. In this connection it is said that money is looking for high-grade, well-secured public and private bonds as an investment least likely to be disturbed by any uncertain conditions.

It seems safe to conclude there will be abundant funds to absorb forthcoming issues of bonds covering construction work at least as long as the present war lasts, and probably afterward, even allowing something for a period of readjustment on the declaration of peace.

There is a great deal of talk in the East of labor troubles and high prices having affected construction work. While this may be true of building work, especially in New York City, and while this deduction is strengthened by the failure of the Eastern lumber market to show marked strength or increased sales, it is not true of the country as a whole. Even in the case of structural steel, which has shown the greatest advance in the building field, a large share of the demand to-day, according to the *Iron Age*, is made up of requirements for industrial plant extensions. The lumber men confidently expect prices and sales to improve from now on. Other materials than steel are not, as a rule, selling at greatly advanced prices, and it may be that the backward, rainy season has had as much to do with slackness in small building operations as anything. It is thought that top prices in most lines, especially steel, have already been reached on the one hand, and that, on the other hand, conditions will not bring about any general recession for some time.

Steel Products.—While very prosperous conditions are practically certain to continue, according to the *Iron Age*, for the next year, there have not been any advances of note in the last month, and none are expected except in the pipe market. Prices of certain steel products, per 100 lb. f.o.b. Pittsburgh, are as follows:

	Immediate delivery	Minimum, future delivery	Warehouse
Structural material	$3.00	$2.60	$3.10 to $3.50
Plates	4.00	3.75	4.00 to 4.50
Steel bars	3.00	2.60	3.10 to 3.50
Iron bars	2.50	2.50	3.10 to 3.50
Rivets. ½ in. up	4.00	4.00	

Sheets.—Domestic demand continues very heavy, and a heavy foreign demand can be counted on to sustain the market for a long time. The reduction in the price of galvanized sheets is due to the greatly increased production of zinc. Prices are as follows, per 100 lb. f.o.b. Pittsburgh:

	Bessemer	Open Hearth
No. 28 black	$2.90 to $3.00	$3.00 to $3.10
No. 28 galvanized	4.75 to 4.85	4.90 to 5.00

Cast-Iron Pipe.—The market for cast-iron pipe is dull, and prices have remained unchanged. Class A and gas pipe are $31.50 per ton, tidewater, and Class B and heavier $30.50 on the same basis.

Steel and Iron Pipe.—Discounts on pipe are unchanged, though some mills are unable to deliver in less than thirty-two to thirty-six weeks, and prices are very firm with considerable talk of an advance in June. Prices in carload lots per ton, f.o.b. Pittsburgh, are as follows:

	Black	Galvanized
Steel, lap-welded, 2½ to 6 in.	$64	$103
Iron, lap-welded, 2½ to 6 in.	86	126

Lead.—Prices on lead have been shading off recently, after an advance, and the leading interest is quoting at $7.50 per 100 lb. New York, and $7.425, East St. Louis.

Cement.—Cement prices have remained practically unchanged. Prices per bbl. to consumers without containers, f.o.b. the points mentioned, are given below:

Boston	$1.52	Memphis	$1.74
New York	1.32	Detroit	1.55
Pittsburgh	1.41	Milwaukee	1.58
Atlanta	1.64	St. Paul	1.73
Jacksonville	1.60	Duluth	1.66
Tampa	1.79	Peoria	1.54
Cleveland	1.54	Cedar Rapids	1.65
Indianapolis	1.59	Davenport	1.55
Nashville	1.52	Denver	2.02

Brick.—Both Hudson and Raritan common brick in cargo lots, wholesale, are now $8.25 per thousand in New York.

Crushed Stone, Gravel, Sand.—Prices in large lots per cu. yd. are as follows:

	Alongside dock, New York	F.o.b. Denver
Crushed rock, 1½-in.	$0.90	$1.65
Gravel, 1½-in.	.80	1.15
Crushed rock, ¾-in.	1.00	
Gravel, ¾-in.	.85	
Gravel passing subway specifications	.95	
Sand, washed and screened	.40	.90

Lumber.—The lumber situation is thought to be improving. Western mills are making much larger shipments than last year by water on the Pacific Coast, and export trade is also growing. Lack of ships and the closing of the Panama Canal have prevented marketing any quality of fir from the states in the East. While the real demand on the Southern mills is thought not yet to have begun, owing to the lateness of the season, stocks are not very large, the car situation is much improved and the export trade continues to take all the lumber that can be transported. Prices wholesale in New York per 1000 ft. b. m. are as follows:

Yellow pine, 8 to 12-in., 16 to 20 ft.	$28.00 @ $35.50
Yellow pine, 14 to 16-in.	35.00 @ 37.50
Hemlock, base price	24.00
Spruce, 2 x 4 to 8 x 8-in., 18 and 20 ft.	30.00

Buildings

Low bids amounting to $207,000 were received at Quincy, Mass., for erecting school buildings. The steel for a $250,000 industrial plant at Peoria, Ill., has been contracted for. The construction of apartment buildings to cost $396,000 has been contracted for at Detroit. Bids are desired June 27 for erecting a high school to cost $200,000 at Erie, Pa.

The following table gives an idea of the size and distribution of proposed work noted in this issue:

Location	Kind of building	Estimated Cost
New York City	Commercial building	$1,500,000
Brooklyn	Electric plant	1,000,000
Harrisburg, Pa.	High school	1,000,000
Chester, Pa.	School buildings	500,000
Baltimore, Md.	Chemical plant	1,500,000
Huntington, W. Va.	School buildings	300,000
Brunswick, Ga.	Pulp factory	200,000
Hattiesburg, Miss.	Box factory	750,000
Cleveland, Ohio	Orphan asylums	1,500,000
Cleveland, Ohio	Factory	500,000
St. Paul, Minn.	Athletic club	650,000
St. Paul, Minn.	Gas plant	2,000,000
Virginia, Minn.	High school	338,000
Fargo, N. D.	Fireproof building	400,000
Seattle, Wash.	Manufacturing plant	300,000

Bridges and Roads

The construction of a $51,000 concrete arch bridge has been contracted for at Newton, Mass. A contract for the Hydes Ferry bridge across the Cumberland River at Nashville, Tenn., has been awarded at $228,000. Bids will be opened at Hartford, Conn., June 20 by the State Highway Commission for constructing a five-span concrete arch bridge 465 ft. long.

The following table includes the principal road and paving work noted in this issue:

Poughkeepsie, N. Y., contract awarded	$64,229
Trenton, N. J., bids desired	52,800 sq. yd.
Reading, Pa., proposed work	$124,000
Jackson, Tenn., bids desired	54,000 sq.yd.
South Pittsburgh, Tenn., contract awarded	$80,911
Ohio, bids opened	$1,000,000
Gary, Ind., proposed work	$175,000
Princeton, Ill., contract awarded	$90,000
Evanston, Ill., bids opened	$102,551
Duluth, Minn., contract awarded	$225,919
Duluth, Minn., proposed work	$100,000
St. Paul, Minn., proposed work	$108,832
Grand Forks, N. D., bids desired	50,000 sq. yd.
Texarkana, Ark., proposed work	$430,000
Osceola, Ark., proposed work	180 mi.
Greenwood, Ark., proposed work	$200,000
Fort Smith, Ark., proposed work	$217,000
De Queen, Ark., proposed work	$125,000
Amarillo, Tex., contract awarded	$117,000
Bakersfield, Cal., proposed work	$100,000

Waterworks and Sewers

The lowest bid received May 25 for work in connection with the Passaic Valley sewer at Newark, N. J., was $74,800. Bids have been opened at Chicago for constructing an intercepting sewer to cost $562,000, and another section of the Milwaukee intercepting sewer has been awarded at $470,000. A contract has been awarded in St. Louis for furnishing and laying 5 mi. of 3-ft. steel water pipe. A contract for sewer and waterworks construction has been awarded at $54,000 by Rector, Ark.

Bids are desired at Logansport, Ind., for sewer work to cost $292,000. Milwaukee will receive bids June 22 for further extensions to the intercepting sewer system. Bids are desired June 26 at Tucson, Ariz., for constructing 20 miles of sewers. A waterworks contract amounting to $225,000 will be let in August at Madison, Wis. Sewer bonds amounting to $200,000 have been voted at Oklahoma City, Okla. Greenville, Tex., has voted $100,000 for sewers and disposal plant.

Miscellaneous

A $100,000 railroad contract has been awarded at Security, Md. Plans have been prepared for a $156,000 canal improvement at New Iberia, La. Plans for a $1,000,000 power dam at Pactola, S. D., are being considered. A company has received a franchise at Helena, Mont., to construct a $250,000 heating plant. Two irrigation projects, one costing $6,000,000 and the other $400,000, are reported respectively from Fresno and Red Bluff, Cal.

CONTRACTING NEWS

Of Special Interest to Engineers, Contractors, Builders and Manufacturers of Engineering and Building Supplies

WATERWORKS

PROPOSED WORK.

Foxboro, Mass.—Water Commissioners have been authorized to extend water mains at a cost of $11,000.

Batavia, N. Y.—Plans being prepared for filtration plant and installation of new electrical machinery at the municipal pumping station.

Dublin, Ga.—Election to be held July 24 to vote on constructing filtration plant to cost $30,000 and have a capacity of 1,000,000 gal. M. J. Guyton, City Engineer.

Havana, Fla.—Citizens voted $20,000 bonds for water works and electric light plant. Address Town Clerk.

Canton, Ohio.—Council adopted report of Water Committee appropriating $30,000 for erection of a sub-pumping station on city land in Sixteenth Street.

Deshler, Ohio.—Citizens voted $33,000 bonds for water works and $22,000 for electric light plant. Address City Clerk.

Flushing, Mich.—James R. Fitzpatrick, 106 Michigan Trust Building, Grand Rapids, engaged to prepare a map of the water system proposed for the village. Address Village Clerk.

East Moline, Ill.—Rumored installation of an intake pipe is contemplated to provide water for the factory district. Address City Clerk.

Madison, Wis.—Contract will be let about August for water supply and pumping station to cost about $225,000. E. E. Parker, City Engineer; D. W. Mead, Consulting Engineer, 530 State St.

Odebolt, Iowa.—Extensions to water mains to cost $12,000 is under consideration. Address City Clerk.

Volga City Iowa.—Installation of water works is under consideration. Address City Clerk.

Chaska, Minn.—City is considering installing water works and sewer system. Address City Clerk.

Rochester, Minn.—Citizens May 25 voted $175,000 bonds for constructing water works. A. F. Wright, City Clerk.

Minneola, Kan.—City contemplates installing water works and electric light system to cost $25,000. Address City Clerk.

Newton, Kan.—City Commission voted to build a pipe line from Newton to Mission water works station between Newton and Halstead; cost $50,000.

Dunn Center, N. D.—H. Schmidt, Proprietor of Dunn Center flour mill, has submitted a proposal to the city to install a water works system.

Hinsdale, Mont.—Election will probably be held to vote bonds for constructing water works and lighting plant. Address City Clerk.

Walnut Ridge, Ark.—City considering constructing water works and sewers. Address City Clerk.

Mineola, Tex.—City considering constructing water works. E. L. Dalton, engineer, Dallas.

Oklahoma, Okla.—Citizens May 20 voted $1,500,000 bonds for new water supply. Guy V. McClure, City Engineer.

Centralia, Wash.—City Commissioners ordered extensions of water mains on Chehalis Avenue and Summa and West Sixth Streets, at a cost of $12,000. C. W. Anderson, City Engineer.

Northport, Wash.—City Council considering constructing light and water works plant, cost about $25,000.

Seattle, Wash.—City Council voted to install water mains in Hudson Street from Thirty-seventh Avenue South to Forty-sixth Avenue South. L. B. Youngs, Supt. Water Works.

Contract about to be let for construction of water tower at Fountain Street and Beacon Avenue; cost $16,000. Address C. D. Bagley, Secy. Bd. of Public Works.

Finance and City Utilities Committee of City Council considering issuing $60,000 bonds for constructing a 1,000,000-gal. reservoir at Green Lake. L. B. Youngs, Supt. Water Works.

Tacoma, Wash.—Contract will soon be let for constructing small reservoir and 12,000 ft. of 101 in. wood stave pipe line, extending from county farm to the spring recently purchased. cost $10,000. D. H. White, County Engineer. Thomas N. Norris, County Auditor.

Wenatchee, Wash.—All bids opened May 22 for laying complete concrete pipe, etc., rejected. Lowest bid submitted was $50,863. W. T. Knapp, Secretary Drainage District.

Oregon City, Ore.—Contract will soon be let by City Council for extensions to water works to include construction of reservoir and pipe line; cost about $30,000. Rands & White, Oregon City, Engrs.

Roseburg, Ore.—Reported the Douglas County Light & Water Co. (William Pollman, Gen. Mgr.) contemplates laying a water main between Roseburg and Winchester; cost about $50,000.

Coalinga, Cal.—City Trustees may call an election to vote bonds for water works improvements, including $12,500 for 150,000-gal. steel tank and tower booster pump and motor and $6,000 for 6-in. fire main.

San Dimas, Cal.—San Dimas Water Company contemplates constructing a reservoir north of Eucalyptus Avenue.

BIDS DESIRED.

Massachusetts.—Until June 9, by Metropolitan Water & Sewerage Board, 1 Ashburton Place, Boston, for furnishing 418 tons 12 and 16-in. special castings to be delivered at Arlington Heights Station, on the Boston & Maine Railroad, and 100 tons 10-in. and 20 tons 12-in. flexible jointed pipe, 8 tons 12-in. and 20-in. special castings to be delivered at the Clarende Hill Station on N. Y., N. H. & H. R. R.; 75 tons 20, 24, 30, 36 and 48-in. special castings to be delivered at Brookline Station on the Boston & Albany Railroad.

Irvington, N. J.—Until June 7, by Board of Town Commissioners, for pumping equipment at playground to consist of one horizontal centrifugal solid shell pump with ½ horsepower, 300 R.P.M., 110 volts, 60 cycle, single phase repulsion motor with hand starter, capacity 60 gal. per min. Pump to be delivered f.o.b. Irvington. John W. Wehman, Town Clk.

Pittsburgh, Pa.—Until June 12 (readvertisement), by City Controller, for furnishing water meters and water meter fittings and parts for year 1916. About $100,000 is to be spent.

Washington, D. C.—Until June 23, by Commissioners D. C. for furnishing and delivering f.o.b. cars 7000 ⅝-in. water meters for use in the Water Department.

By Bureau Supplies and Accounts, Navy Department, Washington, D. C., for Sch. 9711, 6750 lb. lead pipe, and Sch. 9716, Brooklyn, N. Y., f. o. b. Works, 19,000 ft. lap-welded steel pipe.

Jasper, Ind.—Reported desired until June 15, by S. A. Berger, City Clerk, for installing and equipping a pressure filtration plant.

Waukegan, Ill.—Until June 5, by A. L. Rogers, Secy. Board Local Improvements, for 6180 ft. 16-in. water pipe, including valves, hydrants, etc.; cost $16,260. M. J. Douthitt, City Engr.

Ft. Madison, Iowa.—By Citizens Water Company, for constructing pumping plant, filtration plant and intake pipe.

Platte Center, Neb.—Reported desired until June 5, for extending water mains. S. B. Allen, Village Clerk.

Staplehurst Neb.—Until June 15, by J. P. Dahl, Village Clerk, for constructing water works estimated to cost $12,990. Grant & Fulton, Engineers, Bankers' Life Building, Lincoln.

Ellendale, N. D.—Until June 5, by city, for a 100,000 gal. tank on 80-ft. tower, and motor-driven triplex pump, 240 gal. Cost $9,000. H. S. Rusco, City Engineer.

Harlowton, Mont.—Until June 15, by Fred W. Barron, Mayor, for water works and sewers, advertised in Engineering Record.

Aberdeen, Wash.—Reported desired until June 7, by P. F. Clark, City Clerk, for proposed Wishkah gravity water system. L. D. Kelsey, City Engineer.

Sierra Madre, Cal.—Until June 8, by C. H. Perry, City Clerk, for furnishing 1750 lin. ft. 4-in. riveted steel pipe and 620 lin. ft. standard 2-in. screw pipe, trenching, gates, etc. Wm. F. Bixby, City Engineer, 502 Mason Building Los Angeles.

Panama.—Until June 16, by Maj. Earl I. Brown, Corps Engineers, U. S. A., General Purchasing Officer the Panama Canal, Washington, D. C., for Cir. 1047 siphons, flush pipes, pipe fittings, valves, etc. Also separate bids until June 26, same place, for Cir. 1048, steel pipe, pipe fittings, valves, etc.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Salem, Mass.—Following are three lowest bids opened May 23 by city for laying about 4100 lin. ft. 38 in. water pipe across Danvers and North Rivers: W. R. Farrell, 2 Webster Street, Allston, $32,990; John R. Park, Quincy, $39,740, and George T. Rendel, 28 School Street, Boston, $53,713. W. S. Johnson, 10 Tremont Street, Boston, consulting engineer.

★**McKeesport, Pa.**—Contract for work at Monongahela Intake, including intake pipe, retaining wall and a superstructure awarded E. M. Wichert Company, Hartje Building, Pittsburgh, at $24,200.

★**Ironton, Ohio.**—Contract for constructing water works (bids opened May 18) awarded as follows: For constructing reservoir, to Merydeth Construction Co., Marietta, Ohio, at $79,617; for constructing filtration plant, to New York Continental Jewell Filtration Co., 15 Broad Street, New York, at $103,357.

Lowest bid on Division I, brick pumping station, pumping well, intake, etc., The Foundation Co., Pittsburgh, Pa. $70,288. Division II, force and supply main, A. E. Miller Construction Co., Portsmouth, $46,581, and Division V, pumping machinery, to John W. Danforth Co., Buffalo, N. Y., $53,993.

★**Ottawa, Ill.**—Contract awarded American C. I. Pipe Company, Kansas City, Mo., for furnishing water mains including 74 tons of 4 and 6-in. pipe.

★**St. Louis, Mo.**—Contracts awarded as follows by St. Louis Water Division for 26,960 lin. ft. 36-in. x 5/16-in. Lock-Bar steel water pipe (bids opened May 19): Furnishing East Jersey Pipe Corporation, 50 Church Street, New York, N. Y., and laying Inland Construction Company, St. Louis, Mo. Charles A. Cheney, Secy. Diversion Division.

Rector, Ark.—See "Sewerage and Sewage Disposal."

★**San Diego, Cal.**—Contract for furnishing and laying approximately 23,700 lin. ft. 36 in. continuous wood stave pipe line between Harvey Diverting Dam and connecting with pipe line from Upper Otay reservoir including ten 6 in. blowoffs, etc. (bids opened May 17), awarded Pacific Pipe & Tank Company, San Francisco. They bid for delivery in 100 days $51,513 and in 75 days $52,780. Allen H. Wright, City Clerk.

★**Hailey, Idaho.**—Reported contract awarded Utah Construction Company of Salt Lake City, Utah, by Pacific Water & Colonizing Company to construct a water storage reservoir on Fish Creek, costing about $75,000.

SEWERAGE AND SEWAGE DISPOSAL

PROPOSED WORK.

Cambridge, Mass.—City has sold $10,000 sewer and $90,000 hospital bonds. Address City Clerk.

Binghamton, N. Y.—Council ordered sewers on Saratoga Avenue, Mozart and Dickson Streets. W. Earl Weller, City Engineer.

Catskill, N. Y.—George H. Warber, 438 Main Street, Catskill, engaged by Board of Trustees as engineer for the proposed sewerage system as required by State Department of Health.

Long Island City, L. I., N. Y.—All bids opened May 10 by Maurice E. Connolly, President Queens Borough, for constructing sewers in Jamaica and Woodhaven Avenues rejected. New bids to be asked at once.

Olean, N. Y.—City Council considering reconstructing West State Street sewer, estimated cost $11,000.

Bernardsville, N. J.—Reported plans to be prepared by Clyde Potts, Morristown, for sewage disposal system to be constructed for the towns of Bernardsville, Basking Ridge and Far Hills. Election will be held on the question.

Oakhurst, Pa.—See "Paving and Roads."

Pottsville, Pa.—The State Bd. of Health directed Pottsville to construct sewage disposal plant. Address City Clerk.

Hagerstown, Md.—J. [illegible] Ferguson selected as chief engineer of Sewerage Committee to work out plans for proposed sewerage system; cost about $750,000.

Portsmouth, Ohio.—Council is reported considering issuing $42,000 bonds for constructing proposed Hill Top sanitary sewer.

Escanaba, Mich.—Contract soon to be let for constructing sewage disposal plant according to plans prepared by W. J. Hodson, City Engineer.

Chester, Ill.—Phillips & Phillips, St. Louis, Mo., are engineers for the proposed sewer system. G. Beare, City Clerk.

DePue, Ill.—City has appropriated $133,000 for municipal improvements, including $70,000 for new sewer system and $10,000 for paving.

La Salle, Ill.—See "Water Works."

Traer, Iowa.—Contract soon to be let for 4640 ft. branch sewers. T. F. Stoakes, Town Clerk.

Brainerd, Minn.—City Council has ordered an election June 17 to vote $45,000 bonds for constructing a sewer. Address City Clerk.

Spooner, Minn.—All bids opened May 22 for constructing sewerage system and sewage disposal plant rejected and new bids to be asked. A. M. Robertson, Village Clerk.

St. Paul, Minn.—Council adopted a resolution to construct sewers in Payne, Lake, Como and Phalen Avenues, Edgerton, Nebraska and other streets, at an estimated cost of $29,566.

Kearney, Neb.—Mayor and City Council has adopted plans and estimates submitted by City Engineer for storm sewer system.

Liberty, Mo.—Sewer bonds for $20,000 will be sold June 2 by city. Work includes 17,000 ft. 18-in. sewer and will probably be done under supervision of E. K. Carter, City Engineer, by city forces.

Walnut Ridge, Ark. — See "Water Works."

Gainesville, Tex.—N. Ernskold, Dallas, engaged as consulting engineer for sewage disposal plant.

Greenville, Tex.—City voted $100,000 bonds for about 12 miles of sewer extensions and disposal plant. Address City Clerk.

Farmersville, Tex.—City contemplates installing sewer system. C. W. Bickley, Mayor.

Longview, Tex.—Plans being prepared for new sewage disposal plant capacity 150,000 gal. daily. H. M. Roberts, City Engineer.

Mineola, Tex.—City considering sewer system and disposal plant. N. Ernskold, Engineer, Dallas.

Plainview, Tex.—Construction of new sewage disposal plant daily capacity 200,000 gal. is contemplated. Address City Clerk.

Quanah, Tex.—City contemplates constructing sewer system. R. V. Crowder, Mayor.

Schulenberg, Tex.—Estimates prepared for sewer system and sewage-disposal plant. Gus Ruseck, Mayor.

Whitewright, Tex.—Four miles of 6 to 10 in. sewers and sewage disposal plant will be constructed. Bonds have been voted. O'Neill & Sons, Dallas, Engineers; P. M. Eckels, Mayor.

Oklahoma, Okla.—Citizens, May 20, voted $200,000 bonds for constructing a main sanitary sewer. Guy V. McClure, City Engineer.

Seattle, Wash.—City Council voted to construct sewers on Wallingford Avenue from West Green Lake Way to North Eighty-fifth Street and on Norman Street from Twenty-seventh Avenue South to Twenty-ninth Avenue South.

Bakersfield, Cal.—City Council directed Robert B. Ray, City Engineer, to prepare plans and specifications for a pump and motor to be installed at Myrtle sewage pumping station.

Chico, Cal.—Improvements to sewer system recommended by State Board of Health. Address City Clerk.

BIDS DESIRED.

Binghamton, N. Y.—Until June 7, by Board Contract & Supply, for sewers on Saratoga Avenue, S. Mozart and Dickson Streets.

Brooklyn, N. Y.—Until June 7, by L. H. Pounds, Borough President, for constructing sewers, with all incidentals and appurtenances, in Howard and Ralph Avenues. Engineer's estimate 2146 lin. ft. 42 and 30-in. sewers, with manholes, basins, etc., $23,805. Security, $10,000. In Saratoga Avenue, 1004 lin. ft. 42, 30 and 12-in. sewers, with manholes, basins, etc., $8,852; security, $4,000. In Rockaway Ave., 1625 lin. ft. 30, 24 and 18-in. sewer, with manholes, basins, etc., $12,390; security, $6,000, and in West Eleventh Street, including 10,399 lin. ft. 6 to 36-in. pipe, 36, 42, 60 and 66-in. combined sewer, 36, 72, 78, 102 and 114-in. storm sewer, with basins, manholes, etc., engineer's estimate, $139,510; security, $60,000.

Little Falls, N. J.—Until June 19, by Township Committee for constructing sewers and sewage disposal plant, advertised in Engineering Record. H. J. Harder, Engr., 140 Market Street, Paterson. Harry Eike, Chmn. Township Committee.

Lodi, N. J.—Until June 15, by John J. Geoghegan, Mayor and Council of Borough, for furnishing material and constructing sewer system and sewage disposal plant. Bowe & Wessels, Engrs., Rutherford, N. J.

Newark, N. J.—Until June 13 by Passaic Valley Sewerage Commission, Newark, for constructing Section 22 of the Lawrence Street branch intercepting sewer in the city of Paterson.

Point Pleasant, N. J.—Until June 13 by W. T. Newbury, Borough Clerk, for extensions to sewer system, advertised in Engineering Record.

Richmond, Va.—Until June 15, by Board of Administration, for constructing five sections of a concrete sewer along Baker Quarter branch, a distance of about 5200 ft. Chas. E. Bolling, City Engr.

Logansport, Ind.—Until June 6 by William Pickett, City Clerk, for constructing sewer system in southeast section of city, to cost $292,000. About 12 miles 12 to 30-in. vitr. block, 3 to 6 ft. C. L. Clausen, Engineer, 139 North Clark Street, Chicago, Ill.

Michigan City, Ind.—Until June 20, for constructing vitrified sewers in eleven streets. Address City Clerk.

Milwaukee, Wis.—Until June 22, by Sewerage Commission, for Notice No. 19 extensions to Intercepting sewer system, advertised in Engineering Record.

Lincoln, Kan.—Reported desired until June 8 by C. H. Berry, City Clerk, for constructing sewer system. Probable cost, $47,000. To consist of 10½ miles of sewers. W. B. Rollin & Co., Engrs., 439 Midland Building, Kansas City, Mo., Engrs.

Mitchel, S. D.—Until June 5 (readvertisement,) by Thomas Eastcott, City Auditor, for constructing trunk sewers.

Columbus, Mont.—Until June 19 by George Westover, City Clerk, for 4530 ft. 8 to 12-in. pipe sewer and disposal plant including septic tank, capacity 17,000 gal. George N. Cardozo, City Engineer.

Harlowton, Mont.—See "Water Works."

Redondo Beach, Cal.—Until June 12 by C. C. Mangold, City Clerk, for ten carloads of sewer pipe, 4 to 18 in.

Tucson, Ariz.—Until June 26 by City Clerk, for constructing 17 miles of 8 to 20-in. lateral sewers and 3 miles outfall sewers, 30 in., advertised in Engineering Record. C. K. Clarke, City Manager.

Toronto, Ont.—Until June 6, by registered post only, address to T. L. Church (Mayor), Chmn. Board Control, for constructing sewers in Condor Avenue, Dorval Road, Hanover Place, and other streets and paving on St. Lawrence, Tennis, and Crescent Streets with asphalt, and concrete walks on Fernwood Park Avenue.

The Pas, Man.—Until June 22, by H. H. Elliott, M.D., City Secy.-Treas. for supply and delivery of sewage lift pumps, and constructing sewage lift chamber. Murphy & Underwood, Engrs., Consulting Engrs., Saskatoon.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Boston, Mass.**—Following are three lowest bids opened by Metropolitan Water & Sewerage Board, 1 Ashburton Place, for extending outfall sewers at Deer Island, Boston Harbor: Roy H. Beattie, Inc., Fall River, $39,838 (awarded contract); T. A. Scott, New Haven, Conn., $62,212, and George M. Byrne, 166 Devonshire Street, Boston, $73,400.

★Contract for constructing sewerage works in Perham Street (bids opened May 22) awarded Antony Gefalo, 316 Belgrade Avenue, at $11,738. W. J. McGlurcky, Supervisor of Contracts.

★**Hartford, Conn.**—Contracts awarded by Board Contract & Supply as follows: To W. T. Ryan Construction Company, Park Terrace and Capitol Avenue for Section "A" of the Uphill sewer system, at $30,000, and Section "B" to D'Onfro Brothers, Fitchburg, Mass., at $35,992.

★**Binghamton, N. Y.**—Following are four bids opened May 24 by Board Contract and Supply for constructing Section No. 1 of intercepting sewer: Sewage Disposal & Water Plant Company, Schenectady, $166,071; James F. Lear Construction Company, $213,386; F. M. Cariucci, $234,441, and D. M. Rosser, $248,930. Contract awarded May 27 to Sewage Disposal & Water Plant Company, Schenectady, at $142,000, eliminating portion of sewer on south side.

Long Island City, N. Y.—Lowest bid opened May 29, by Maurice E. Connolly, President Queens Borough, for constructing sewer in Maure Avenue, submitted by Ernest A. Weiss, Times Building, New York, at $51,892, and by H. J. Mullen Contracting Company, Long Island City, at $66,774, for constructing sewer in Woodhaven Avenue.

★**Montclair, N. J.**—Contract for constructing sewers in Upper Mountain Avenue (bids opened May 22) awarded Cestone Construction Company, Montclair. Harry Tuppert, Town Clerk.

★**Jacksonville, Fla.**—Contract for constructing Division No. 8 outfall sewers awarded by Bd. of Bond Trustees to Dysard Construction Co. of Atlanta, Ga., at $17,751.

Chicago, Ill.—Following are unit figures of four lowest bids opened May 18 by Trustees Sanitary District of Chicago for constructing Calumet Intercepting Sewer—(I) total for concrete alternate, (II) total for brick and concrete alternate: (a) Newman & Co., 19 N. Curtis Street, (I) $562,020, (II) $694,770; (b) Nash Brothers, 10 S. La Salle Street, (I) $636,184, (II) $670,936; (c) U. S. Dredge & Dock Co., Chicago, (I) and (II) $630,323; (d) T. J. Froschner Contracting Co., Lemont, Ill., (I) $660,354, (II) $693,228.

		(a)	(b)	(c)	(d)
1	3,400 lin. ft. concrete sewer, shallow cut	$43.83	$52.00	$53.00	$52.00
1a	3,400 lin. ft. brick and concrete sewer, shallow cut	58.61	56.00	53.00	57.00
2	5,288 lin. ft. concrete sewer, deep cut	65.18	72.00	73.00	74.00
2a	5,288 lin. ft. brick and concrete sewer, deep cut	80.81	76.00	73.00	77.00
3	6 manholes on concrete sewer, shallow cut	44.00	30.00	56.00	48.00
3a	6 brick manholes, shallow cut	33.00	30.00	56.00	48.00
4	8 manholes on concrete sewer, deep cut	50.00	50.00	96.00	72.00
4a	8 brick manholes, deep cut	39.00	50.00	96.00	72.00
5	Connection at Stony Island Avenue (lump sum)	1,027.00	500.00	310.00	3,500.00
6a	Crossing under Pullman R.R. Co., required for constructing sewer (lump sum)	8,657.00	6,000.00	5,900.00	20,000.00
6b	Crossing under Pullman R.R. Co., optional with railroad (lump sum)	4,921.00	5,000.00	5,429.00	4,000.00
7	Rebuilding intake of Pullman Co. (lump sum)	8,474.00	6,000.00	26,400.00	7,500.00
8a	Crossing under Cottage Grove Avenue and I. C. R.R. in open cut (lump sum)	13,369.00	15,000.00	7,180.00	30,000.00
8b	Crossing under I. C. R.R. in open cut, optional with railroad (lump sum)	8,800.00	22,000.00	8,400.00	5,000.00
8c	Crossing under Cottage Grove Avenue and I. C. R.R. in tunnel (lump sum)	18,097.00	40,000.00	9,400.00	33,000.00
9	200 lin. ft. laying 15-in. tile pipe	2.25	1.50	1.75	0.75
10	400 lin. ft. laying 12-in. tile pipe	1.85	1.25	1.40	0.50
11	200 lin. ft. laying 9-in. tile pipe	1.75	1.00	1.00	0.40
12	4 manholes on tile pipe sewers	27.00	35.00	40.00	50.50
13	5 catchbasins	39.00	40.00	40.00	90.00
14	2 c.-i. manhole covers and frames	21.00	8.00	20.00	20.00
15	2 c.-i. catchbasin covers and frames	19.00	8.00	20.00	20.00
16	110 M ft. plank roadway along 103d Street	60.00	40.00	45.00	40.00
17	100 lin. ft. relaying water service pipes	3.20	1.00	1.40	1.00
18	100 lin. ft. relaying 6-in. sewer house connections	1.75	0.50	10.00	1.25
19	40 connections, tile pipe for future connections, 18 in.	2.80	5.00	3.00	2.00
20	300,000 lb. reinforcing steel	0.05	0.05	0.05	0.05
21	30,000 lb. structural steel	0.04	0.05	0.06	0.055
22	500 lin. ft. additional piling furnished	0.17	0.25	0.15	0.25
23	500 lin. ft. additional piling driven	0.75	0.50	0.60	0.25
24	5 M ft. cribwork on piling	75.00	50.00	60.00	60.00
25	5 M ft. plank foundations	25.00	25.00	25.00	25.00
26	5 cu. yd. additional excavation, earth, open cut	0.75	0.75	0.75	0.75
27	5 cu. yd. additional excavation, earth, tunnel	3.00	3.00	3.00	3 00
28	5 cu. yd. additional excavation, rock	3.00	3.00	3.00	3.00
29	5 cu. yd. additional concrete, Class A	9.00	9.00	9.00	9.00
30	5 cu. yd. additional concrete, Class B	7.50	7.50	7.50	7.50
31	5 cu. yd. additional concrete, Class C	7.00	7.00	7.00	7.00
32	5 cu. yd. additional brickwork	9.00	9.00	9.00	9.00

Newark, N. J.—Following are unit figures of the four bids opened May 25 by Passaic Valley Sewerage Commission for constructing outfall sewerage works, part of Section 4, bulkhead, flushing intake and sludge main: (a) Arthur McMullen Co., 149 Broadway, New York, N. Y., $74,800; (b) C. B. Clark & Co., Baltimore, Md., $79,930; (c) B. J. & N. J. Construction Co., Newark, N. J., $80,800, and (d) Mason, Hilton & Co., 17 Battery Place, New York, N. Y., $107,500.

	(a)	(b)	(c)	(d)
Earth excavation and dredging in Newark Bay for timber bulkhead, etc. (lump sum)	$200.00	$300.00	$2,600.00	$3,000.00
Earth excavation and refill for flushing intake tide gate chamber, etc. (lump sum)	13,000.00	13,500.00	21,000.00	27,000.00
Rock excavation in open excavation	1.00	4.00	0.01	3.00
Concrete masonry with Portland cement mortar in place	7.50	7.25	5.50	8.00
Brick masonry laid with Portland cement mortar and appurtenant work	10.00	16.00	20.00	15.00
Riprap in place	1.25	1.25	1.25	1.60
Timber piles in place	0.21	0.30	0.30	0.25
Steel for concrete reinforcement floor plate frames, etc.	0.04	0.05	0.06	0.05
Broken stone road surfacing	0.75	0.80	0.40	1.00
20-in. c.-i. sludge main, valves, hydrants, pipe specials, etc. (lump sum)	4,000.00	3,820.00	6,000.00	7,000.00
Four timber tide gates with metallic fittings, complete (lump sum)	2,000.00	1,000.00	1,200.00	2,000.00
Timber bulkhead, complete (lump sum)	18,000.00	15,500.00	14,000.00	21,000.00
10,000 cu. yd. regrading areas back of bulkheads and elsewhere	0.30	0.75	0.20	0.60
1,200 cu. yd. gravel surfacing for roadway and open areas	1.25	1.60	1.00	2.50

★**Cincinnati, Ohio.**—Contract awarded by Wm. E. Harmon & Co., Gwynne Building, for sewering a number of new streets in the Hyde Park East subdivision to John B. McLane, 520 East Fourth Street; estimated cost $36,000.

★**Milwaukee, Wis.**—Contract for constructing extension to intercepting sewer (bids opened May 25), official Notice No. 16 awarded John F. Casey Company, Pittsburgh, Pa., at $472,422.

★**Anoka, Minn.**—Contract for constructing sewage treatment plant consisting of settling tank, sludge bed and appurtenances and 38,629 lin. ft. 8 to 20-in. sanitary sewer (bids opened May 18) awarded O'Neil & Preston, St. Paul, at $61,700. L. P. Wolff, Consulting Engineer, St. Paul.

★**Park River, N. D.**—Contract for constructing sewer system awarded Carroll Brothers, Grand Forks, at $20,132.

★**Rector, Ark.**—Contract for constructing sewers and water works awarded Sullivan, Long & Hagerty of Bessemer, Ala., at $54,000. Frank L. Wilcox, Syndicate Trust Bldg., St. Louis, Mo., Engr.

★**Stuttgart, Ark.**—Contract for laying sewer pipe in Sewer Dist. No. 2 awarded to Mobley Constr. Co. of Argenta at $31,000.

Houston, Tex.—Lowest bid opened May 19 by city for constructing storm sewer in Welch Street was from Texas Construction Company, Houston, at $21,663.

Lowest bid opened May 19 by city for constructing sewer in Paige Street, submitted by Texas Construction Company, Houston, at $54,410.

BRIDGES

PROPOSED WORK.

Utica, N. Y.—All bids opened by Bd. of Contract and Supply for constructing 8-ft. culvert from Rutger Street to present culvert on Mill Street rejected; according to reports new bids are to be received.

Reading, Pa.—Reported contract soon to be let by Pennsylvania R. R. (Alex. C. Shand, Ch. Engr., Philadelphia) for constructing five-span concrete bridge over Schuylkill River at foot of Chestnut Street. Probable cost, $200,000.

South Bethlehem, Pa.—The City Council voted to appropriate $250,000 for erection of a bridge between Bethlehem and South Bethlehem, Bethlehem to contribute $25,000 and Philadelphia & Reading Ry. Co., Lehigh R. R. Co. and other railroads to contribute $275,000 of cost.

Raleigh, N. C.—City Commissioners will construct 848 ft. concrete viaduct for extension of Martin Street to Boylan Heights. Estimated cost $26,800. Address City Clerk.

Leesburg, Ga.—See "Public Buildings."

Marksville, La.—Police Jury has voted appropriation for constructing two concrete bridges. Address Secretary Police Jury.

Yazoo City, Miss.—Contract will soon be let by Bd. Supervisors for constructing iron bridges over Short Creek and wooden bridges on Vaughn Pike and Tcheva Creek. S. S. Griffin, Clerk.

Cincinnati, Ohio.—County Commissioners approved plans and specifications for bridge to be built by Chesapeake & Ohio Railroad (F. I. Cabell, Ch. Engr., Richmond, Va), eliminating grade crossing at Werk Road. Cost $13,450; will be built under the supervision of the Chief Engineer C. & O. R. R., Richmond, Va. Bids will be advertised shortly.

Indianapolis, Ind.—Bridge bonds for $100,000 will be sold June 27 by Leo K. Fesler, County Auditor.

Chippewa Falls, Wis.—City will rebuild this summer Spring Street bridge over Duncan Creek, to be concrete 2 spans of 50 ft. each; probably arch construction. J. T. Hurd, City Engineer.

Des Moines, Iowa.—Engineering Department has been directed to submit plans by June 5 for a concrete bridge to be constructed at North Street over Des Moines River, to have six spans 120 ft. to 150 ft. long each, and about 600 ft. of viaduct and earth fill approaches. K. C. Kastberg, City Engineer; Horace Susong, City Clerk.

Contract soon to be let for constructing a three-span reinforced concrete deck girder highway bridge over Four Mile Creek at intersection with Avenue Frederick Hubbell. Albert Susong, City Clerk.

Plans being prepared by W. W. Morehouse, County Engineer, for four small highway bridges, to cost $9,500.

Minneapolis, Minn.—Bonds for Third Avenue Bridge amounting to $100,000 sold. Address City Clerk.

Wichita, Kan.—Arkansas Valley Interurban Ry. Co. (W. O. Van Arsdale Ch. Engr., Wichita) contemplates constructing concrete bridge over Sand Creek.

Texarkana, Ark.—See "Paving and Roads."

Spokane, Wash.—County Commissioners considering construction of 200-ft. steel bridge across Spokane River, opposite Liberty Lake, to cost $20,000. J. W. Strack, County Engineer.

Modesto, Cal.—Contract will be let in June by Board of Supervisors for constructing a concrete and steel bridge across Tuolumne River at Modesto; cost, $115,000. Leonard & Day, Engineers, Rialto Building, San Francisco.

BIDS DESIRED.

Connecticut.—Until June 20 by State Highway Commissioner, Room 27, Capitol, Hartford, for constructing a concrete highway bridge over Housatonic River between Derby and Huntington, advertised in Engineering Record.

Perry, N. Y.—Until June 22, by C. N. Read, Town Clerk, for reinforced concrete viaduct in Borden Avenue, advertised in Engineering Record. C. F. Fisher, Engr., 526 Flower City Park, Rochester.

Utica, N. Y.—See "Proposed Work."

Plainfield, N. J.—Until June 12 by Commissioners of Union and Somerset Counties for constructing a steel beam and concrete bridge over Green Brook, between Union and Somerset Counties, plate girder bridge over Green Brook at Westervelt Avenue. Joshua Doughty, Jr., Engineer Somerset County, at Somerville. Jacob L. Bauer, Engineer Union County, at Elizabeth.

Lewisburg, Pa.—Until June 17, by County Commissioners, for constructing reinforced concrete girder bridge over Rapid Run, West Buffalo Township.

Lock Haven, Pa.—Until June 8, by Board County Commissioners for wood block floor on steel stringers on Susquehanna River bridge, 458.4 ft. long and 16 ft. roadway, also wood block floor on steel stringers on bridge over Fishing Creek, Salona, in Lamar Township; bridge 93 ft. long and 14-ft. roadway.

West Chester, Pa.—Until June 8, by County Commissioners for constructing a concrete and steel I-beam bridge over middle branch of White Clay Creek, London Grove Township. Isaac Y. Ash, County Controller.

Cumberland, Md.—Until June 15, by Mayor and City Council, for constructing reinforced concrete bridges, advertised in Engineering Record.

Richmond, Va.—Reported desired until June 6, by County Clerk, for constructing 22 ft. reinforced concrete bridge over brook 3½ miles from Richmond.

Marlinton, W. Va.—Until Jun 12, by County Court, Marlinton, for constructing five bridges. A. D. Williams, Chief Road Engineer, Library Building, Morgantown.

Clarkesville, Ga.—Until June 9, by J. A. Robertson, Ordinary, for furnishing material (except floor joists, lumber and steel in two beams, span 33 ft. long), for highway bridge over Soque River near Habershan Mills, to be an 80-ft. steel span to center of end bearings, taking down, hauling and erecting two steel spans 33 ft. building concrete piers and abutments, etc.

Indianapolis, Ind.—Until June 20, by County Commissioners, for constructing bridges and retaining walls. Leo F. Fesler, County Auditor.

Petersburg, Ind.—Until June 6, by County Commissioners, for constructing ten bridges.

Beaverton, Mich.—Until June 19, by A. T. Brown, Jr., City Clerk, for constructing a 200-ft bridge over Tobacco River at Pleasant Street, advertised in Engineering Record. Bids for $4,500 bonds to construct bridge at Pleasant Street will be sold June 19 by A. T. Brown, Jr., City Clerk, advertised in Engineering Record.

Benton Harbor, Mich.—Until June 19, by City Council, for constructing bridge across Paw Paw River at North Shore Drive, a flat top reinforced concrete viaduct at Edwards Avenue, and a single-span reinforced concrete arch bridge at Britain Avenue, all these proposals advertised in Engineering Record.

Carlyle, Ill.—Until June 10, by J. T. Goldsmith, County Superintendent of Highways, Carlyle, for constructing a steel bridge on reinforced concrete abutments in Meridian Township, Clinton County; estimated cost, $2,995.

Fond du Lac, Wis.—Until June 7, by County Highway Commissioners (W. J Ryan, Secretary), for constructing two concrete bridges, known as Luco and Taycheedah bridges.

Des Moines, Iowa.—Reported desired until June 5 by Horace Susong, City Clerk, for constructing a concrete bridge 130 ft. long on concrete pillars across Four Mile Creek on Avenue Frederick Hubbell, cost $10,000.

Humboldt, Iowa.—Until June 8, by J. G. Devine, County Auditor, for constructing bridges 97-V, Section 14, Vernon Township, span 65 ft. steel pony truss on concrete abutments; cost, $5,200; and bridge No. 6-R, over West Branch of Des Moines River, Section 34, Rutland Township; cost, $2,000.

Seneca, Kan.—Reported desired until until June 6 by W. L. Kauffman, County Clk., for constructing 13 bridges. Fred. Lukert, Co. Engr.

Linton, N. D.—Reported desired until June 19, for constructing following bridges: 24-ft. span, 18-ft. roadway, concrete abutments, in Sects. 19 and 30; a 20-ft span steel bridge with 18-ft. roadway, concrete abutments, in Sects. 10 and 15; a 16-ft. span steel bridge, concrete abutments and 18-ft. roadway, together with a number of smaller bridges throughout the county. John R. Snyder, Co. Aud.

Wahpeton, N. D.—Reported desired until June 12, for constructing steel bridge across Sheyenne River in Cass and Richland Counties. F. A. Burton, Co. Aud.

Castlewood, S. D.—Reported desired until June 6, for constructing all bridges, abutments, approaches, etc., and repairs to all bridges in Hamlin County for ensuing six months. David Sour, Chmn. Board County Commissioners.

Madison, S. D.—Reported desired until June 6, by M. E. McGillivary, County Auditor, for ten concrete bridges and two steel bridges.

Mitchell, S. D.—Until June 6, by J. M. Crampton, Co. Aud., for constructing a 30-ft. concrete girder bridge over north branch of Firesteel Creek in Township 104.

Plankington, S. D.—Until June 6, by Erland Johnson, Co. Aud., for constructing a 60-ft. steel truss bridge, reinforced concrete abutments, plank floors, in Township 104; 36-ft. steel truss reinforced concrete abutments, Township 101; a 24-ft. beam steel bridge, Township 105, reinforced concrete abutments and floor, and a number of small bridges.

Salem, S. D.—Until June 6, by Board County Commissioners, for constructing concrete bridges throughout the county, to consist of a 30-ft. span, 18-ft. roadway, in Ramsey Township; 16-ft., 18-ft. roadway, in Greenland Township, and a number of smaller bridges.

Sheridan, Wyo.—Until June 19 (readvertisement), by F. A. Morris, City Clerk, for constructing bridge over Big Goose Creek.

Chandler, Okla.—Reported desired until June 6, by J. C. Prigey, County Clerk, for constructing seven bridges and culverts.

Las Cruces, N. M.—Until June 20, by State Engineer, Santa Fe, for constructing 5 bridges, all in Dona Ana County, four wood and one steel.

Mt. Vernon, Wash.—Until June 6, by W. V. Alexander, County Auditor, for constructing 200 ft. trestle bridge over Freshwater Slough. A. L. Strong, County Engineer.

Dallas, Ore.—Reported desired until June 8, by Asa B. Robinson, Jr., County Clk., for constructing reinforced concrete bridges in Polk County. C. R. Canfield, Co. Engr.

San Luis Obispo, Cal.—Until June 6, by Board County Supervisors, for constructing 150 ft. steel bridge across Salinas River, about seven miles from Santa Margarita, also for a 40-ft. reinforced concrete beam and girder bridge across Pozo Creek; 60-ft. reinforced concrete arch bridge across Pico Creek, 48-ft. concrete arch over Arroyo del Puerte, and two 50-ft. spans over Toro Creek.

★**Nashville, Tenn.**—Following are unit figures of four lowest bids opened May 23 by W. M. Pollard, County Judge, for constructing Hydes Ferry Bridge: (a) Engineer's estimate, $235,746; (b) Gould Contracting Co., Nashville, $228,236 (awarded contract); (c) Toledo Bridge & Crane Co., Dorr Street and Lake Shore R.R., $241,658; (d) Foster & Creighton Co., Nashville, $246,985; (e) Pennsylvania Steel Co., Morris Block, Philadelphia, Pa., $252,268. (Freeland & Klyce Engineering Co., Nashville, Engineers.)

	(a)	*(b)	(c)	(d)	(e)
4,650 lin. ft. concrete piles	$1.50	$1.40	$1.41	$1.41	$1.41
1,240 cu. yd. stone masonry	12.10	12.00	17.93	17.93	17.93
935 cu. yd. Class B concrete	7.40	7.25	10.15	10.16	10.16
1,920 cu. yd. Class A concrete	13.15	13.00	13.25	13.25	13.25
1,450 ton structural steel	111.00	106.00	107.20	110.00	116.00
135 ton reinforcing steel	86.00	80.00	64.50	64.50	64.50
1,750 lin. ft. handrail	2.00	2.60	3.10	3.07	2.70
2,770 sq. yd. brick paving	2.00	2.25	3.02	3.02	3.02
Credit allowed on old steel:					
107.7 tons 246 ft. span	....	1,000.00	700.00	400.00	1,000.00
154 tons two 197-ft. spans	....	1,600.00	1,000.00	600.00	1,600.00
70.6 tons 180-ft. span	....	700.00	600.00	200.00	700.00
84 tons joist	....	800.00	600.00	420.00	1,200.00

★**Newton, Mass.**—Following are unit figures of the four lowest bids opened April 11 by Metropolitan Park Commission, 14 Beacon Street, Boston, for constructing a reinforced concrete bridge over Charles River from Commonwealth Avenue, Newton, and South Avenue, Weston: (a) T. Stuart & Son Co., Newton, $51,131 (awarded contract); (b) Rowe Contracting Co., Boston, $53,404; (c) P. McGovern & Co., Boston, $56,852, and (d) Hugh Nawn Contracting Co., Roxbury, $57,379.

	*(a)	(b)	(c)	(d)
One concrete bridge and approaches	$35,000.00	$37,342.00	$39,500.00	$39,000.00
15,000 cu. yd. filling material	0.55	0.60	0.70	0.75
1,700 lin. ft. concrete piles	2.50	2.25	2.00	2.00
490 sq. yd. roadway surfacing	1.75	1.00	0.80	2.25
130 lin. ft. concrete curb	1.00	2.00	2.00	1.50
200 sq. yd. granolithic walks	1.60	1.50	1.50	2.00
625 lin. ft. galvanized iron fence	3.75	3.50	4.00	3.25

Bakersfield, Cal.—Until June 8, by Board County Supervisors, for grading and constructing bridges and culverts about 11 miles of Bakersfield Mohave Road, between Mohave and Cameron Division.

Paris, Ont.—Reported desired until June 5, by Henry Maus, Clerk South Dunfries Township, for constructing a steel and concrete bridge. Jackson & Lee, Engrs., Temple Bldg., Brantford.

Russell, Man.—Until June 15, by C. W. Thom, City Secy.-Treas., for constructing concrete bridges and culverts as follows: Two 16-ft. span reinforced concrete bridges near Russell, one 14 and one 16 ft., near Binscarth, and concrete culvert near Millwood.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Albany, N. Y.—See "Hydraulic Construction and River Improvement."

★**Atlanta, Ga.**—Contract awarded by Bridge Committee for constructing reinforced concrete bridge over tracks of Southern Ry. and leading from Piedmont Park to North Boule., to Case & Cothran, Chandler Bldg., at $24,450. (Bids opened May 19.)

★**Dayton, Ohio.**—Contract awarded Toledo Bridge & Crane Co., Dorr & Lake Shore R. R., at $33,900, for constructing steel bridge superstructure for bridge No. 174, Jefferson Township, known as West Carrollton bridge (bids opened May 22 by Co. Commissioners at Dayton).

Indianapolis, Ind.—American Construction Co., 1201 E. Georgia Street, submitted lowest bid to Board of Public Works, at $17,900, for constructing bridge over Pleasant Run at Villa Avenue. Address City Clerk.

★**Sioux City, Iowa.**—Contract awarded Ward & Weighton, Sioux City, for one 60-ft. steel span, concrete floor and abutments; one 24-ft and one 16-ft. I-beam, concrete floor and abutments; one 20-ft. concrete slab bridge; one 32-ft. skew, I-beam bridge; 23 box culverts; at a total cost of $23,800. J. C. McLean, County Engineer.

★**Mankato, Minn.**—Contracts reported awarded Widell Company, Mankato, for constructing 12 bridges on Great Northern R. R. between St. Paul and Duluth, on what is known as the lake district; also contract for constructing 8 bridges on the Omaha Railway.

Everett, Wash.—Following bids opened by Mae Weatherbee, County Auditor, for constructing Smith Island bridge across Snohomish River from Eighteenth Street to Smith Island: Everett Construction Co., Everett, $40,977; American Pile Driving Company, Everett, $41,066; H. S. Wright, Everett, $41,287; H. K. Owens, Everett $41,990.

★**Indpendence, Ore.**—Contract for constructing a concrete bridge at Independence awarded Snook & Traver, Salem, at $4,802. (Bids opened May 24, by A. B. Robinson, County Clerk).

★**Los Angeles, Cal.**—Contract awarded Andrew Holloway, 471 South Broadway, Pasadena, by Board of Supervisors, for constructing reinforced concrete viaduct 242 ft. long and 20 ft. wide over the ravine Pacific Electric Ry. tracks and Ionia Avenue at Western Avenue at $17,561.

★**Santa Cruz, Cal.**—Two lowest bids opened recently for constructing a 240-ft. steel bridge over Rodes Gulch, 3 miles from Santa Cruz, submitted by Tieslau Brothers, San Francisco, at $16,400 (awarded contract) and C. E. Colton, San Francisco, at $15,841.

PAVING AND ROADS

PROPOSED WORK.

Agawam, Mass.—Town appropriated $8,000 for macadamizing Meadow Street in Feeding Hills. J. H. Clark, First Selectman. State Highway Commission, Boston, appropriated $10,000 additional toward this improvement.

Northampton, Mass.—City appropriated [illegible] 000 for permanent paving of several streets. W. P. Latham, Superintendent of Streets.

Providence, R. I.—City Planning Committee recommends constructing a new street parallel to Allen's Avenue to cost about $1,000,000.

Malone, N. Y.—Street paving bonds for $33,000 have been sold. It is proposed to pave with brick one street. S. A. Howard, County Superintendent of roads. George A. Willson, Deputy Clerk.

Audubon, N. J.—Macadam and concrete will be used in paving Merchant and Pine Streets. John J. Albertson, Engineer, Magnolia. Conway Bennett, Clerk.

Hoboken, N. J.—Sale of $205,000 street improvements bonds is postponed indefinitely. D. A. Haggerty, City Clerk.

Mays Landing, N. J.—Freeholders authorized preparing of plans for paving 16 ft. wide the county road from Absecon to Camden County line near Hammonton; a portion of the White Horse Pike route to Philadelphia. Cost, $400,000.

New Brunswick, N. J.—County Commissioners sold $40,000 road and bridge bonds. Address County Clerk.

Trenton, N. J.—County Engineer submitted to State Road Dept. plans for repairs to following roads in Mercer County: Lawrenceville-Princeton Road, cost $110,000; Trenton-Lawrenceville Road, cost $25,000; Nottingham Way Road, cost $90,000; and Trenton-Hopewell Road, cost $42,000. See "Bids Desired."

Clearfield, Pa.—Election will be held on June 20 to vote $75,000 bonds for street improvements.

Meadville, Pa.—Citizens May 16 voted $38,000 bonds for street improvements. B. F. Miller, Jr., Engineer, Meadville; Fred C. Klebort, City Clerk.

Oakhurst, Pa.—Contract will be let about June 30 for 4 miles of brick paving or macadam paving to cost $50,000. O. P. Thomas, Engineer, Leader Building, Johnstown; H. G. Orner, Secy.-Treas.

Citizens voted $18,000 bonds for constructing sewers and for pavements. Address Borough Clerk.

Philipsburg, Pa.—Citizens voted $15,000 paving bonds.

Reading, Pa.—City Council will award paving contracts during summer amounting to $124,000.

Windber, Pa.—Citizens voted $100,000 bonds for street improvements. Address City Clerk.

West Taylor Townshin voted $45,000 bonds for improvements to roads from city limits of Windber to Laurel Run Dam. Address Clerk of the Township at Windber.

Rockville, Md.—County Commissioners will improve following roads: 4½ miles Dawsonville-Poolesville Road, $48,000; 3 miles Glenmont-Colesville Road, $24,000; 3½ miles Seneca-Darnestown Road, $36,000; 5½ miles Dickerson-Martinsburg Road, $38,000; 4½ miles Old Germanstown-Dawsonville Road, $36,000; 4 miles Germanstown-Darnestown, $66,000; 2¾ miles Wheaton-Four Corners, $15,800; 6¼ miles Muncaster Mill Road, $27,500; 6½ miles Derwood-Mt. Zion Road, $33,000; 5½ miles Loney-Laytonsville Road, $44,000. Address County Clerk.

Harrisonburg, Va.—Street and other improvement bonds for $75,000 will be sold June 16. Address Ward Swank, City Clk.

Norton, Va.—Road improvement bonds for $16,000 will be sold. Address T. M. Cherry, Chmn. Street Committee.

Rustburg, Va.—Road improvements bonds for $240,000 will be sold June 5 by S. C. Coggins, Clk. County Board Supervisors.

Spencer, W. Va.—Spencer District Road Improvement bonds for $240,000 will be sold June 23, by W. A. Carpenter, Clk. County Court, Roane County.

Leesburg, Ga.—See "Public Buildings and Schools."

Bradentown, Fla.—Special Road and bridge District bonds for $75,000 will be sold June 10, by Board County Commissioners (M. G. Rushton, Chmn.).

Titusville, Fla.—Citizens of the county voted $300,000 bonds for road improvements in Fourth Road and Bridge District. A. F. Harley, Consulting Engineer, P. O. Box 873, 136 East Bay Street, Jacksonville, engaged as engineer on the work. Contract will probably be let in July.

Coushatta, La.—Good Road bond issue for District No. 3 voted May 17 for building road from Coushatta to Crichton; approximate cost, $30,000. Address President Police Jury.

Canton, Miss.—City has sold $56,000 bonds, about $40,000 to be used for street paving, including 4000 sq. yd. paving, 6 miles of graveled streets and concrete curbs and gutters, for which Walter G. Kirkpatrick, Birmingham, Ala., is Engineer. Contract will be let about July 1.

Biloxi, Miss.—County Board of Supervisors contemplate constructing a highway from Biloxi to Pass Christian. Address Clerk of Board, Biloxi.

Hopkinsville, Ky.—County Commissioners sold $400,000 road bonds. Address County Clerk.

Newport, Ky.—It is proposed to pave 4 miles water works road with brick concrete curb to cost $17,000. J. E. Ratcliffe, County Engineer, Mentor.

Charden, Ohio.—Road bonds for $33,000 reported to be sold June 5, by A. A. Fowler, Co. Aud.

Chillicothe, Ohio.—City Council passed ordinance authorizing paving of Bridge Street at a cost of $17,000.

Cincinnati, Ohio.—County Commissioners ordered County Surveyor Wm. Boeh to prepare plans and specifications for a retaining wall on Five Mile Road, for resurfacing Harrison Pike east of Miami River Road, and for re-surfacing Muddy Creek Road.

Dayton, Ohio.—County Commissioners sold $33,500 improvement road bonds. Address County Clerk.

Upper Sandusky, Ohio.—Paving bonds for $17,000 will be sold June 8, by Charles U. Read, Village Clk.

Warren, Ohio.—Road bonds for $27,000 will be sold June 19, by Board County Commissioners (W. L. Hoffman, Clk.).

Paving bonds for $22,000 will be sold June 10 by City Auditor.

West Park, Ohio.—Paving bonds for $30,853 will be sold June 27 by Fred Feuchter, Village Clerk.

Zanesville, Ohio.—Contract will be let latter part of July for brick paving on concrete foundation. W. W. Roach, Director Public Service; C. R. Spencer, City Engineer.

Gary, Ind.—Board of Public Works passed resolutions adopting plans and specifications for resurfacing 2 miles of Broadway, 66 ft. wide, with sheet asphalt or wooden block; cost $175,000. W. P. Cottingham, Asst. City Engr.

DeKalb, Ill.—Contract soon to be let for 14,000 sq. yd. brick and 3000 sq. yd. concrete pavement, with concrete curb. A. R. Russell, Public Engineer. G. N. Blackman, City Clerk.

DePue, Ill.—See "Sewerage and Sewage Disposal."

La Salle, Ill.—Bd. of Local Improvements voted to construct 2½ miles of brick pavements. E. J. Byrne, City Engineer.

Milan, Ill.—Village intends laying 38,614 lin. ft. concrete sidewalks 4½ ft. wide and 666 ft. 9½ ft. wide. Wallace Toelchler, Engineer, Rock Island; F. H. Harris, Village Clerk.

Peoria, Ill.—Board of Local Improvements passed resolutions for improving various streets in Bacon-Summer Streets paving district, probable cost $75,563.

Riverdale, Ill.—County Bd. of Supervisors approved plans for 1½ miles of concrete road, 18 ft. wide, near Riverdale.

Rock Island, Ill.—Board Local Improvements recommended paving with brick on portions of Railroad Ave., Forty-fifth and Tenth Ave. at a cost of $23,400.

Couderay, Wis.—About $40,000 will be spent for constructing roads. Address City Clerk.

Duluth, Minn.—The paving of 2 miles of Superior Street is contemplated; cost about $100,000. F. E. Culver, Secy. Works Division.

County Commissioners appropriated $31,900 for road improvements in following districts: First, $9,100; Fourth, $14,000; Fifth, $5,800, and Sixth, $5,800.

McKinley, Minn.—Citizens voted May 14, $34,000 bonds for street improvement and water works. Peter Holand, Village Clerk.

St. Paul, Minn.—City Council adopted a resolution to pave Van Buren Street, from Hamline to Fairview Aves., together with sewer and water connections; cost $57,486.

Council has adopted a resolution to pave West Minnehaha Street and Fairview Avenue at a cost of $108,832.

Minot, N. D.—Contract will soon be let for paving Eastwood Park addition, East Central Avenue and other streets. Estimated cost $100,000. Address City Clerk.

Denton, Mont.—A. C. Birkland, City Engineer, Lewistown, Mont., has been retained by City Council to prepare plans for constructing concrete sidewalks in business and residential section and estimate cost of constructing municipal water system.

Kansas City, Mo.—About $150,000 is to be spent by Park Bd. (Thomas Harrington, Secy.) for grading and paving and erecting a small building.

De Queen, Ark.—Plans prepared by Hugh R. Carter, State Highway Engineer at Little Rock, for construction of gravel roads in new district to be formed; about $125,000 available for improvement.

Ft. Smith, Ark.—Hugh R. Carter, State Highway Commissioner, State Capitol, Little Rock, prepared plans and estimate of cost for construction of 17-mile road from Ft. Smith to Greenwood; cost $217,000.

Surveys completed for the cement roadway to be constructed between Fort Smith and Mansfield. George Singel of Greenwood, Ark., may be able to give information.

Greenwood, Ark.—Commissioners of Sebastian County, Greenwood Dist., will construct 29 miles concrete shale roads; cost $200,000.

Murfreesboro, Ark.—Pike County Road Improvement Dist. No. 1 plans to construct 15 miles of roads. Address County Judge.

Osceola, Ark.—Construction of 30 miles of asphalt roads in Burdett Dist. in Mississippi County and construction of 150 miles of roads in other districts of same county being considered. Address Hugh R. Carter, State Highway Engineer, State Capitol, Little Rock.

Stuttgart, Ark.—About 6 miles of paving contemplated. Address Fred Towl, City Engineer.

Texarkana, Ark.—Commissioners of Miller County Road and Bridge Improvement Dist. No. 1 considering constructing 60 miles of roads and a bridge over Red River. Bonds amounting to $430,000 to be issued. Address County Judge.

Athens, Tex.—Citizens of Chandler Precinct, Henderson County, voted $60,000 bonds for improving roads in said district. Address County Clerk.

Hallettsville, Tex.—County Commissioners sold $50,000 improvement road bonds. Address County Clerk.

Lipscomb, Tex.—Citizens of county voted $75,000 bonds for road improvements. Address County Clerk.

San Saba, Tex.—Commissioners Court voted $75,000 bonds for highway improvements and city streets; this is in addition to $50,000 recently spent for similar improvements. J. T. Hartley, County Judge; S. J. Bross, Chief Engineer, San Saba.

Asotin, Wash.—County Commissioners will improve a mile of road near Silcoot Cutoff. Estimated cost $10,000. V. G. Shellman, County Engineer.

Blaine, Wash.—Contract will soon be let for paving Adelia Street with (a) one-course concrete, $16,825, (b) two-course concrete, $17,125, (c) asphalt, $18,165. Choice of pavement has not been made.

Contract will soon be let by City Council for paving D and Twelfth Streets, one-course concrete, estimated at $15,600; asphalt, $16,835, and two-course concrete, $15,885. E. E. Pruner, City Clerk.

Seattle, Wash.—City Council will pave 15,000 ft. of East Marginal Way with brick block and 2000 ft. with 3½-in. creosoted wood blocks. Probable cost $128,000. Address City Clerk.

Walla Walla, Wash.—County Commissioners plan hard surfacing McDonald Road south of city, also road between Prescott and Waitsburg. Grove Cookerly, County Engineer.

Pendelton, Ore.—Citizens defeated $1,000,000 road bonds. Address County Clerk.

The Dalles, Ore.—Election will soon be held to vote $260,000 road improvement bonds. Address County Clerk.

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Tillamook, Ore.—Reported City Council passed resolutions for improving Eighth Street at $11,480, and Fifth Street, $27,571, by grading, constructing concrete pavement and curbs, catch basins and draining.

Bakersfield, Cal.—Robert B. Ray, City Engineer, directed by City Council to prepare plans and specifications for paving 2 miles of Seventeenth Street; probable cost $100,000. Plans also to be prepared for grading, tamping and oiling approximately 10 miles of streets in the East Bakersfield section. Contract will probably be let in August.

Los Angeles, Cal.—Contract will be let in July by Board of Supervisors (A. M. McPherrin, Clerk), for grading and constructing a 5-in. concrete and bituminous pavement, including five reinforced concrete culverts, etc., on Mesa Drive Road, Improvement District No. 95.

Taft, Cal.—Election will probably be held to vote $40,000 bonds for street paving. Address F. Curtis, City Clerk.

Boise, Idaho.—County Commissioners plan constructing 54 miles of gravel roads in Ada County. Bonds for this purpose were recently voted.

BIDS DESIRED.

Boston, Mass.—Until June 5, by Edw. F. Murphy, Comr. Pub. Wks., for laying sheet asphalt, Topeka or bitulithic pavement in Bardwell, Halifax, Moraine Streets, Dunster and Parkton Roads, West Roxbury.

Massachusetts.—Until June 6, by State Highway Commission (Wm. D. Sohier, Chmn.), for surfacing a section of State highway about 4300 ft. long in town of Tewksbury, and city of Lowell. Also separate bids for State highway about 9700 ft. in town of Methuen.

Brooklyn, N. Y.—Until June 7, by L. H. Pounds, Borough Pres., for paving with permanent asphalt on concrete foundation portions of Canarsie Lane, East Twenty-first Street, Kenmore Place and other streets, in all about 44,200 sq. yd. asphalt, together with curbs, gutters, etc. Total security, $42,700.

Until June 17 by Bureau of Yards and Docks, Navy Department, Washington, D. C., for paving at Navy Yard, Brooklyn, N. Y.

Buffalo, N. Y.—Until June 9, by Department Public Works (Arthur W. Kreinheder, commissioner), for paving Howlett, St. Ernst, East Glenwood Avenues and other streets.

Long Island City, L. I., N. Y.—Until June 7, by Maurice E. Connelly, Pres. Queens Borough, for regulating, grading, curbing, laying sidewalks and paving with asphaltic concrete portions of Fresh Pond Road, Lefferts Avenue, Burnside Ave. and other streets, in all about 46,100 lin. ft. cement sidewalks, 9450 sq. yd. sheet asphalt, together with curbs, etc. Total security, $18,100.

Malone, N. Y.—Until June 12 by George A. Willson, Deputy Village Clerk, for brick paving on East Main Street, advertised in Engineering Record.

Monticello, N. Y.—Until June 17, by Charles Ebinger, Village Clerk, for paving, advertised in Engineering Record.

Montclair, N. J.—Until June 12, by Harry Trippett, Town Clerk, for asphaltic concrete paving. Advertised in Engineering Record.

Paterson, N. J.—Until June 14, by Road Committee of Board Chosen Freeholders (Geo. W. Botbyl, Clerk), for paving with bituminous concrete portions of Madison, Haledon Avenues and other streets, and with asphalt on concrete base Bloomfield and Vreeland Avenues.

Trenton, N. J.—Until June 13, by Board Chosen Freeholders (Frank McCullough, Clk.) for resurfacing Lawrenceville-Princeton Road in Townships of Lawrence and Princeton, in Mercer County, in all about 52,800 sq. yd. Theo. Tobish, Co. Engr.

Bedford, Pa.—Until June 6, by County Commissioners (Geo. R. Shucks, Clk.) for reconstructing 1.6 miles of road in Woodbury Township, a part of the old Pattonville Turnpike with limestone macadam.

Cresson, Pa.—Until June 19, by Borough (Frank A. Kerner, Secy.) for paving with vitr. brick on concrete base or with two-course pavement of concrete portions of Keystone Avenue, Ashcroft Avenue, Second, Third and other streets. D. W. Dillman, Engr., 47-49 Altoona Trust Building, Altoona.

Manheim, Pa.—Until June 6, by E. M. Ensminger, Secy. of Council, for 17,000 sq. yd. concrete street paving in city.

McKees Rocks, Pa.—Until June 5, by Borough Clerk, for improving portions of Clay, Charles, Derby and other streets, in all about 12,000 sq. yd., 2650 lin. ft. curbing, etc. Geo. H. McGinness, Borough Engr.

Washington, Pa.—Until June 26, by T. J. Underwood, County Controller, for improving roads and culverts as follows: Cecil Venice Road, a distance of 1.8 miles; Pike Run Road, 1600 ft.; Cannonsburg-Thomas Road, 1.3 miles: Westland Road, 1 mile; Claysville-Burnsville Road, 1 mile; Donora-Eldora Road, 1.2 miles; Gastonville Road, 1.02 miles, and Marianna Road, 6100 ft.

Baltimore, Md.—Until June 7, by Board of Awards for paving nortions of Homestead, Polk, Montpelier, and Taylor Streets, in all about 8500 sq. yd.

Hagerstown, Md.—Until June 15 by County Commissioners for building about 3½ miles of State aid road from Lappans Cross Roads to Mill Point.

Rustburg, Va.—Until June 12, at 41 Medical Building, Lynchburg, for constructing about 24 miles bituminous macadam road and 9 miles water-bound macadam road in Campbell County. G. P. Coleman, State Highway Commissioner, Richmond. See "Proposed Work."

Kingwood, W. Va.—Later official reports state bids desired until June 12 by Preston County Court (E. C. Everly, Clk.) for paving approximately 32 miles of road in Portland Dist. and 18 miles in Kingwood Dist. Bids desired on following materials: Cement, cement with asphalt, 8, 9, 12 and 14-ft. widths, macadam according to standard specifications of State Bureau of West Virginia, of above widths, Telford base, 8 in. and 6 in. thick, with limestone and native stone surface, both water and bituminous bound by penetration and mixing methods. Rich. R. Feller, Dist. Engr., Terra Alta.

Bay Minette, Ala.—Until July 1 by Board of Revenue and Road Commissioners at Bay Minette for constructing that part of Delta Highway in Baldwin County. J. M. Garrett, County Engineer.

Houma, La.—Until July 5, by Police Jury, for furnishing material and constructing 11.7 miles of sand, clay, gravel roads. Address President Jury.

Louisville, Miss.—Until June 5, for 54 miles of grading in Winston County. Address Gus. E. Hauser, Jr., Municipal and Highway Engineer, Columbus, Miss.

Jackson, Tenn.—Until June 27, H. M. Harris, Commissioner Streets, for constructing paving on Highland Avenue, Royal and Poplar Streets, approximately 54,000 sq. yd., advertised in Engineering Record.

Madisonville, Tenn.—Reported desired until June 6 by County Commissioners for improving county roads, for which $325,000 were recently voted. R. J. Love, Sweetwater, Engr.

Madisonville, Tenn.—Until Jnue 9, by Board Pike Commissioners (L. A. Hunt, Secy.), for improving approximately 73 miles grading and 90 miles of macadam and chert.

Cincinnati, Ohio.—Until June 12, by Parke S. Johnson, Secy. Dir. Public Service, for oiling streets in First, Third, Fourth and Fifth Macadam Districts.

Cuyahoga Falls, Ohio.—Until June 19, by W. F. Williston, City Clerk, for about 32,000 sq. yd. brick pavement on Broad Street and Northampton Avenue, and about ½ mile of sanitary sewer in Northampton Avenue. E. D. Barstow, Village Engineer, Cuyahoga Falls.

Frankfort, Ky.—Reported desired until June 6, by S. B. Smith, Road Engr., for constructing one mile of new turnpike.

Defiance, Ohio.—Reported desired until June 5 by County Commissioners, for grading and macadamizing Section E of Bryant-Ft. Wayne Road, known as Road Improvement No. 7.

Steubenville, Ohio.—Until June 8, by Board Control (Thos. M. Loup, Clerk), for grading, curbing, paving and constructing sidewalks on Slack, South and other streets.

Van Wert, Ohio.—Until June 16 by W. T. Mitchener, Director Public Service, for paving with brick, asphalt, concrete or other material on portion of West Main and East Main Streets, and with water-bound macadam with tarvia top on East Ridge Street. Four proposals advertised in Engineering Record.

Indiana.—By County Commissioners, for constructing roads as follows:

Until June 6:

Wabash, for creosoting wood block floors on two bridges. Frank P. Kircher, County Auditor.

Angola, constructing road in Pleasant Township. F. C. Dewey, County Auditor.

Lebanon, roads in Washington and Jefferson Townships. Cleve Goodwin, County Auditor.

Delphi, gravel or macadam roads in Adams Township. H. D. Good, County Auditor.

June 7:

Peru, for road in Peru Township. Frank K. McElheny, County Auditor.

June 8:

New Albany, for 5050 ft. roadway in New Albany Township. Emile Dupaquier, County Auditor.

Indianapolis, two roads in Center Township. Leo K. Fesler, County Auditor.

June 10:

Danville, for 13,342 ft. of road in Lincoln Township. Chas. H. Havens, County Auditor.

June 12:

Brazil, for gravel and stone roads in Sugar Creek Township, and stone and gravel road between Perry Lewis and Harrison Townships. Wm. O. Graeser, County Auditor.

Evansville, rock road in Center Township. C. P. Beard, County Auditor.

June 30:

Rushville, county line road with bound macadam 26,845 ft. in length. Glen Zell, County Auditor. Macadam road in Anderson Township, 14,650 ft. long. Allen R. Holden, County Auditor.

July 5:

Mount Vernon, 1800 ft. rock road on line between Posey and Vanderburg Counties. Jos. R. Haines, County Auditor.

Indianapolis, Ind.—Until June 7, by Board Public Works (Jos. P. Tirk, Clk.) for paving roadway of Laurel St., Lexington Avenue and Prospect Street.

Madison, Ind.—Until June 8, by city, for 19,700 sq. yd. brick, asphalt, concrete, or wood block paving on Main and Walnut Streets. Cost $39,400. R. F. Lee, Engineer, Madison.

Winamac, Ind.—Until June 12, by Clarence Barnett, City Clerk, for 32,350 sq. yd. paving and 19,000 ft. combined curb and gutter.

Freeport, Ill.—Until June 12 by Board Local Improvements for brick paving on concrete foundation curbing, etc., advertised in Engineering Record.

Illinois.—Until June 7, by State Highway Department, Springfield, for constructing following roads:

Riverdale, Cook County, 7,368 ft. Sect. K, concrete. Engineer's estimate, $17,405.

Henderson, Knox County, Sect. B, 36,615 ft. oiled earth. Engineer's estimate, $18,007.

Breese, Clinton County, Sect. B, oiled earth, 13,500 ft. Engineer's estimate, $5,629.

Trenton, Clinton County, Sect. C, oiled earth, 9204 ft. Engineer's estimate, $3,535.

Chatsworth, Livingston County, Sect. D, 30,000 ft. oiled earth. Engineer's estimate, $12,141.

Macomb, McDonough County, Sect. E, seven bridges. Engineer's estimate, $4,090.

Sterling, Ill.—Until June 7 (readvertisement) by Roy Baer, Town Clerk, for 26,803 sq. yd. brick paving on Lincoln Highway. V. N. Taggett, County Superintendent of Highways, Morrison.

Madison, Wis.—Reported desired until June 7, by E. E. Parker, City Engr., for laying 6000 sq. yd. creosoted block pavement.

Cedar Rapids, Iowa.—Until June 26 by city for 10,000 yd. brick block paving and 24,000 yd. asphaltic concrete paving. Address City Clerk.

Knoxville, Iowa.—Until June 6, (readvertisement), by Paul M. Black, City Clerk, for 15,500 sq. yd. paving and 10,800 ft. curb.

Traer, Iowa.—Until June 19, by T. F. Stoakes, Town Clerk, for 15,500 sq. yd. paving.

Papillion, Neb.—Reported desired until June 6, for concrete walks and culverts for year 1916. G. F. Oliver, City Clerk.

Grand Forks, N. D.—Reported desired until June 5 for paving 50,000 sq. yd. paving. Address City Clerk.

Huron, S. D.—Until June 5, by S. S. Oviatt, City Auditor, for approximately 9000 sq. yd. paving. Bids to be submitted on brick, bitulithic, reinforced concrete, asphaltic concrete, sheet asphalt, and creosoted wood block. J. B. Sullivan, City Engineer.

Dillon, Mont.—Until June 7, by H. G. Rodgers, City Clerk, for furnishing material and labor for constructing cement walks, curbs, etc., that may be ordered for a period of 2 years. Bid to include 5-year guarantee.

Carthage, Mo.—Reported desired until June 15 for 12,000 sq. yd. asphalt macadam paving. F. B. Newton, City Clerk.

Jefferson City, Mo.—Until June 5, at 8 P. M., by City Clerk, for 3,100 sq. yd. brick paving, on Madison Street, 8,450 sq. yd. on High Street and Monroe Street, 3500 sq. yd. asphalt.

Kansas City, Mo.—Until June 6, by Board Public Works (J. Pearce Kane, Secretary), for constructing artificial stone sidewalks on both sides of Agnes Avenue, Fifty-fifth, Thirtieth and other streets, and paving with sheet asphalt on Thirty-third Street and Portland cement concrete on Agnes Avenue, Fifty-third and other streets. Also constructing creosoted wood block pavement on Thirteenth Street and Portland cement concrete on Quincy Avenue.

St. Louis, Mo.—Reported desired until June 13 by Board Public Service (E. R. Kinsey, Pres.) for improving Broadway, Cherokee, Compton and a number of other streets.

Everett, Wash.—Until June 12 by M. Weatherbee, County Auditor, for constructing concrete pavement on Permanent Highway No. 26. W. C. Bickford, County Engineer.

Until 1:30 P. M., Juns 12, by Mae Weatherbee, County Auditor of Snohomish County, for paving road through Granite Falls. Proposition No. 32. W. C. Bickford, County Engineer.

Reported desired until June 19, by May Weatherbee, Co. Aud., for constructing roads as follows: Permanent Highway No. 10, Arlington to Sylvania, 5 miles, $70,500; Stanwood to Island County, 1 mile, $12,500; Snohomia north limit via Avenue D to Front Street, 9 miles, $11,250; Arlington to east limits, 5 miles, $6,500. One-course concrete specified. W. C. Bickford, County Engr.

Montesano, Wash.—Reported desired until June 19, by W. D. Campbell, Co. Aud., for constructing Permanent Highway No. 13, involving 10,000 sq. yd. of concrete pavement, 5000 cu. yd. grading, etc. Probable cost, $15,000. Geo. D. Robertson, Co. Engr.

North Yakima, Wash.—Reported desired until June 12, R. V. Hopper, City Clk., for paving North Sixth, Lincoln and Adams Avenue., and South Fifth Street. N. A. Gilman, City Engr.

Seattle, Wash.—Reported desired until June 19, by Bryon Phelps, Clk. Board County Commissioners, for grading, gravelling, etc., 6.7 miles of road, No. 8, between Black Diamond and Maple Valley. Probable cost, $55,000. A. P. Denton, County Engr.

Sultan, Wash.—Reported desired until June 6 by City Clerk, for 7500 sq. yd. paving on Main Street.

Tacoma, Wash.—Reported desired until June 16 (Thos. N. Norris, County Auditor) for paving Permanent Highway No. 7, known as the Summer Buckley Highway, a distance of 3.709 miles, asphalt 2 in. thick, and 1 in. binder, Warrenite 2 in. thick, bitulithic 2 in. thick, bituminous macadam 3 in. thick, and bicurete 2 in. thick. D. H. White, Tacoma, County Engineer.

Bakersfield, Cal.—Until June 8, by Board of Supervisors for grading and constructing bridge on 11 miles of Mohave to Cameron Road, Division 10, Section 10, involving about 64,000 cu. yd. excav., 123 M ft. creosoted lumber, etc.; also for grading, concrete paving about 66,680 sq. yd. and bridge on 7.56 miles of Taft to Fellows Road, Division 6, Section 2.

Los Angeles, Cal.—Until June 5, by Bd. Supervisors (A. M. McPheerin, Clk.), for constructing macadam and concrete pavement and cement curbs on 1.24 miles of Road Improvement Dist. No. 78, in all 14,934 sq. yd. concrete, 6550 lin. ft. shaping roadbed, together with curbing, etc. Probable cost, $12,000.

Riverside, Cal.—Until June 7, by Board County Supervisors (A. B. Plichm, Clk.), for 2.86 miles Beaumont Morena grade, approximately 15,095 lin. ft. shaping roadbed, 2988 cu. yd. in pavement, etc.

Selma, Cal.—Until June 5, by O. E. Dillon, City Clerk, for 20,997 sq. yd. paving on W. Front Street, concrete 5 in. thick. Cost, $24,335. Also for 4 crossing culverts (260 ft. long and two 80 ft. long), and 8 manholes. W. H. Shafer, City Engineer.

Sausalito, Cal.—Until June 5, by Board Town Trustees, for macadamizing portions of several streets, including North, West and other streets. W. Z. Tiffany, Town Clerk.

Phoenix, Ariz.—Until June 6, by V. G. Thompson, City Clerk, for paving on N. Central Avenue, also on W. Roosevelt Street. Bids to be considered on various kinds of pavements.

Toronto, Ont.—See "Sewerage and Sewage Disposal."

PRICES AND LETTINGS.

★Indicates award of contract.

★Massachusetts. — Contract awarded Central Construction Company, Boston, for constructing 13,800 ft. road in Mashpee and Barnstable (bids opened May 23 by Massachusetts Highway Commission, Boston).

★Albany, N. Y.—Contract awarded by Board of Contract and Supply for improving portions of Lancaster, West Lawrence and Wilbur Streets to Michael Dollard, Albany, at total of $17,395.

★Poughkeepsie, N. Y.—Following are four lowest bids opened May 18 by E. W. Sylvester, Superintendent of Public Works, for paving with Bessemer brick on Parker Avenue and N. Clinton Street: Schenectady Construction Company, Schenectady, $64,229 (awarded contract); Franklin Contracting Company, 52 Vanderbilt Avenue, New York, N. Y., $64,382; Langan Construction Company, Albany, $66,610; A. M. Harper, Newburgh, $75,740.

Waterloo, N. Y.—Lowest bid submitted to Board of Trustees for paving West Main and Virginia Streets by McMahon & Farrington, Binghamton, at $44,762.

★Grantwood, N. J.—Following are three bids opened May 8 by Louis J. Rentler, Borough Clerk, Cliffside Park, for surfacing with bituminous and tar on macadam foundation Palisade Avenue: E. C. Humphrey, Hackensack, $45,932 (awarded contract); Bergen Contracting Company, Cliffside, $49,697, and O'Connell & Lansdell Construction Company, Hackensack, $51,063.

★Paterson, N. J.—Contract to pave River Street with granite blocks (bids opened May 16 by Board Public Works) awarded Louis A. Cramer, 99 Ward Street, at $32,000. H. J. Harder, City Engineer.

★Washington, Pa.—Contract awarded by County Commissioners for improving with brick a portion of Washington-Bethany Road to John W. Hallam, Washington, at $16,607. (Bids opened May 17.)

★Wilson, N. C.—Contract awarded for paving about 100,000 sq. yd. of streets (bids opened May 11 by Mayor and Board of Commissioners) to R. G. Lasalter & Co., Oxford.

★Louisville, Ky.—Contract awarded by Fiscal Court for paving with asphalt about 4 miles of Eighteenth Street road to G. W. Gosnell, Louisville, at $14,156.

★South Pittsburg, Tenn.—Following are four bids opened May 12 by J. E. Moreland, County Engineer, for constructing macadam roads costing about $100,000: G. S. Williams & Company, Dayton, Tenn., $80,911 (awarded contract); Boyd Williams, McMinnville, $84,592; Freeman & Robbins, Knoxville, $87,000; Bennett & Maloney, Chattanooga, $95,806.

★Canton, Ohio.—Contracts awarded by County Commissioners as follows (bids opened May 19): Canton-Lisbon Road, to Garaux Brothers, Canton, at $39,191, and Massillon-Akron Road, Philip Diefenbacher & Sons, Massillon, at $65,786. W. C. Schick, Clerk of Board.

★Cincinnati, Ohio.—City Board of Control awarded the contract for improving Pearl Street from Broadway to Martin Street, 13,500 sq. yd. granite, to Evan Evans, 1226 Ida Street, at $39,134, and for improving Lincoln Avenue from Stanton Avenue to Alma Place, 8225 sq. yds. bitulithic pavement, to Paul N. Kingsley, 5125 Kenmore Avenue, Chicago, Ill., at $17,676.

★Fayette, Ohio.—Contract awarded Minick Construction Company, New Castle, Ind., for paving, using Medal wire lug cut block stone curb, 6-in. stone concrete foundation, at $18,000. George Champe, Engineer, 610 The Nasby, Toledo. (Bids opened May 23 by C. D. Hause, Village Clerk.)

Middletown, Ohio. — Following bids opened by City Council for improving with concrete Linden, Edgewood and Arlington Avenues in Arlington Square: Bigler Bros., Franklin, $11,647; Arpp & Simpson Company, Middletown, $12,876, and Strodtbeck Bros., Middletown, $12,322.

Ohio—Following are lowest bids, opened May 19 by Clinton Cowen, State Highway Commission, Columbus, for constructing state aid roads:

Athens County, Logan-Athens Road, 1.5 miles with brick, Wilson & Beckler of Lancaster, $29,606.

Auglaize County, Kenton-Wapakoneta Road, 1 mile, with water-bound macadam, Lowell A. Harvey of Lakeview, $9,982.

Auglaize County, Celina-Kossuth Road, 1.01 mile, with water-bound macadam, Putnam & Shingledecker of Van Wert, $10,395.

Columbiana County, Salem-Alliance Road, 4.12 miles, with brick, Jones Construction Co. of Mt. Vernon, $81,500.

Defiance County, Hicksville-Defiance Road, 3.94 miles, with concrete, Clemmer-Johnson Co. of Hicksville, $53,617.

Fulton County, Toledo-Auglaize Road, 2.32 miles, with water-bound macadam, Jonathan Nofziger of Wauseon, $20,990.

Fulton County, Wauseon-Napoleon Road, 1.63 miles, with macadam, R. C. Roach of Waterville (3 bids), $13,770 to $17,770.

Guernsey County, McConnellsville-Cambridge Road, 1.08 miles, grading and constructing bridges, Oliver G. Shafer of Caldwell, $6,394.

Guernsey County, National Road, 7.48 miles, with lignin liquor and oil-surface treated macadam, W. H. Young of Columbus, $105,541.

Hancock County, Lima-Sandusky Road, Section 1, 6.48 miles, with concrete and brick, Barnett & Christian of Rockford with concrete $94,942, and Heystek-Baker Constr. Co. of Kalamazoo, Mich, with brick monolithic, $113,961.

Hancock County, Lima-Sandusky Road, Sect. 2, 3.48 miles, with concrete or brick, E. A. Freshwater & Sons of Chester, W. Va., $51,888, with concrete, William E. Dorsey of Findlay with brick, $61,687, and with semi-monolithic, $43,182.

Huron County, Barberton-Greenwich Road, 1.26 miles, with brick, F. L. Rice & Sons of Shelby, $23,175.

Huron County, Bellevue-Norwalk Road, .9 mile, with brick and concrete, G. E. Scott of Norwalk, $16,948.

Knox County, Columbus-Wooster Road, .98 mile, with brick, Lee Griggs & Anderson of Millersburg, $17,254.

Lake County, Painesville-Warren Road, .71 miles, with concrete, Farrell Engineering & Constr. Co. of Cleveland, $14,646.

Licking County, Newark-Lancaster Road, 2.12 miles, with bituminous macadam, Vogelmeir Bros. of Newark, $23,489.

Madison County, Washington-London Road, .81 mile, with water-bound macadam, Theodore Vogelsburg of London, $10,498.

Muskingum County, Zanesville-Dresden Road, 1.47 miles, with bituminous macadam, Adams Bros. of Zanesville, $18,671.

Richland County, Mansfield-Mt. Vernon Road, 1.5 miles, with bituminous macadam, C. H. Au & Son of Mansfield, $25,848.

Richland County, Belleville-Lexington Road, 1.5 miles, with bituminous macadam, Lee Griggs & Anderson, Millersburg, $17,717.

Ross County, Cincinnati-Chillicothe Road, 1.85 miles, with concrete and water-bound macadam, McCoy & Keller of Jackson, $17,400.

Sandusky County, Fremont-Bowling Green Road, 6.01 miles, with concrete, A. G. Trippeer of Peru, Ind., $84,758.

Summit County, Akron-Canton Road, 2.06 miles, with brick, McGarry & Stows of Akron, $44,862.

Trumbull County, Chagrin Falls, Greenville Road, 3.09 miles, with treated macadam, Jordan & Walters of West Austintown, $29,915.

Union County, Marysville-Marion Road, 34 miles, with brick, W. H. Ringwald & Sons Co. of Chillicothe, $14,871.

Washington County, Marietta-McConnellsville Road, 1.09 miles, with bituminous, macadam and brick, McElfresh, Danford & Glover of Caldwell, macadam and brick, $24,396, and asphalt, $24,751.

Wayne County, Wooster-Canal Dover Road, 1.98 miles, of brick, McGarry & Stowe, Akron (2 bids), $24,857 and $28,658.

Williams County, Bryan-West Unity and Bryan-Wauseon Road, 4.69 miles, with macadam, C. U. Acker and J. A. Elder of Bryan, bituminous macadam (tar), $48,200 bituminous macadam (asphalt), $50,900, water-bound macadam, $41,000.

Williams County, Bryan-Edgerton Road, 6.75 miles, with macadam, Kelly Constr. Co. of Bryan bituminous macadam (tar), $76,116, bituminous macadam (asphalt), $80,674, and water-bound macadam, $65,614.

Wyandot County, Forest-Upper Sandusky Road, 1.02 miles, with brick, Modern Constr. Co. of Fremont, $20,800.

★Brazil, Ind.—Contract awarded by County Commissioners to Carpenter Construction Company, Terra Haute, for paving Keater Road in Brazil Township with brick at $54,400.

Evanston, Ill.—Four lowest bids opened May 15 by I. C. Brower, Commissioner Public Works, for paving Lincoln and Rosalie Streets, Dewey, Ashland, Jackson and Asbury Avenues and Boomer Place, in all 19,850 sq. yd. paving: M. Foley Company, Evanston, $32,516, Mexican pavement; J. A. McGarry Company, 189 W. Madison Street, Chicago, $35,497, Bermudez; H. G. Goelitz, Oak Park, $36,759, Trinidad; Contracting & Material Company, 110 S. La Salle Street, Chicago, $39,199, Mexican.

Four lowest bids opened same time and place as above for paving Foster Street from West Railroad Avenue to Darrow Avenue, 5450 sq. yd.: M. Foley Company, Evanston, $14,285, Barr brick; H. G. Goslitz, Oak Park, $15,191, Albion brick; Contracting and Material Company, 110 South LaSalle Street, Chicago, $15,310, Purrington brick; J. A. McGarry Company, 189 West Madison Street, Chicago, $16,276, Barr brick.

Evanston, Ill.—Following are unit figures of the four lowest bids, opened May 15 by I. C. Brower, Commissioner Public Works for paving portion of Dodge and Dewey Avenues, Greenwood and Lake Streets, etc.: (a) H. G. Goelitz, Oak Park, $102,551, using Albion shale; (b) M. Foley Company, Evanston, $104,133, Barr brick; (c) Contracting & Material Company, 10 S. La Salle Street, Chicago, $106,715, Purington Brick; (d) J. A. McGarry Company, 189 W. Madison Street, Chicago, $112,265.

	a	b	c	d
29,200 ft. curb........	0.58	0.60	0.58	0.62
19,978 cu. yd. grading.	0.30	0.22	0.45	0.30
40,000 sq. yd. paving..	1.89	1.95	1.90	2.09
500 ft. sewer........	0.80	0.80	0.75	1.00
6 manholes...........	28.00	25.00	30.00	30.00
90 catch basins......	34.00	32.50	35.00	34.00
90 catch basins adjusted..............	3.00	6.00	9.00	7.00
49 manholes adjusted	2.00	3.00	4.00	3.00
27 valve chambers adjusted...........	2.00	3.00	4.00	3.00

Illinois.—Following are lowest of bids opened May 17 by State Highway Commission, Springfield, for state aid road work: Franklin County, concrete, Section C, 6416 ft. (engineer's estimated cost $8,460, H. R. Khal, Oblong, $8,252; Carroll County, gravel, Section B, 8400 ft., cost $14,236; Ogle County, concrete, Section C, 4200 ft., $17,394, Gund Grahm Co., Freeport, $14,091 and $17,233 respectively; Iroquois County, bitulithic macadam, Section C, 12,085 ft., and Section D, 9600 ft., cost $19,017 and $17,692 respectively, Andrew Ward & Son, Chicago Heights, $17,383, and J. A. McGarry & Co., Chicago, $15,661 respectively. Lowest combined bid, M. H. Lewis, Hoppeston, at $34,215. Will County, concrete, Section C, 9600 ft., $25,993, Hanna & McDonald, Chicago, $25,195; Winnebago County, concrete, Section C, 9150 ft. (estimated $19,057), Hubbard & Co., $15,955; Peoria County, concrete and brick, Section C, 11,274 ft. (estimate $32,660), Ajax Construction & Engineering Co., Gary, Ind., $28,991; Grundy County, concrete and bituminous macadam, Section B, 3100 ft., and Section C, bituminous macadam, 5261 ft., lowest combined bid, Beeth Nicholson & Gilchrist, Gardner, $14,687.

★Marshall, Ill.—Contract for 23,460 sq. yd. vitr. brick paving (bids opened May 22 by Board of Local Improvement) awarded H. Pfizenmayer Construction Company, Terra Haute, Ind., at $42,421. John W. Lewis, Mayor.

★Peru, Ill.—Contract for 1½ miles of brick paving awarded by city to Trompeter & Son of Peru at $53,000.

★Princeton, Ill.—Contract awarded by city to John Cherry of Jacksonville for laying several miles of paving at $90,000.

★Two Rivers, Wis.—Contract for paving certain streets with asphalt macadam awarded Murphy Constr. Co. of Manitowoc at $9,752.

★Duluth, Minn.—Contracts for paving with brick awarded by city as follows: Grand Avenue, to Olson & Johnson, Duluth, at $162,662, and First Street, to Rogers & McLean, 422 Lyceum Building, at $63,257.

St. Paul, Minn.—Following are bids opened May 15 by City Purchasing Agent for 100,000, more or less, paving blocks: Barber Asphalt Company, 7 S. Dearborn Street, $19.50, and Purington Paving Brick Company, Galesburg, Ill., $21.50, sizes 3⅝ x 4 x 8½.

★Lindsborg, Kan.—Contract for 21,000 lin. ft. combined curb and gutter, etc. (bids opened May 20) awarded Glidden & Hobbs, Laurence, Kan., at $14,763. Next three bidders: Ericson Bros., Lindsborg, $15,077; Strubble & Mitchell, Pauls Valley, Okla., $15,174; and A. R. Stinson, Topeka, Kan., $15,883. H. A. Rowland, Engineer, McPherson, Kan.

★Independence, Mo.—Contract awarded by County Court to Davidson Brothers, Kansas City, Mo., at $52,965, for constructing 3¼ miles of road.

★Kansas City, Mo.—Public Improvement Committee of the Upper House of Council has voted in favor of confirming contract awarded J. E. Welch, Kansas City, to lay concrete pavement on Prospect Avenue, from Swope Parkway to Seventy-third Street. Probable cost, $116,000.

★Sikeston, Mo.—Contract for paving with asphalt New Madrid Street, etc. (bids opened May 15), awarded Murray & Williams, Sikeston, at $13,823. Earl J. Malone, Jr., City Clerk.

★Amarillo, Tex. — City Commission awarded contract for 15,000 yd. paving to Bert Hahn Construction Company, Paris, at $1.94 per sq. yd., and 55,000 yd. to Western Paving Company, Oklahoma, Okla., at $1.61 per yd.

★Bellingham, Wash.—Reported contract awarded by Board of Public Works for paving with asphalt a portion of Alabama Street to J. Lich, Bellingham, at $13,929.

Centralia, Wash.—See "Proposed Work."

★Colfax, Wash. — Reported contract awarded by County Commissioners for constructing with crushed rock surfacing Permanent Highway No. 9A and 9B to Washington Paving Co., L. C. Smith Building, Seattle, at $46,633.

★Olympia, Wash.—Reported contract awarded by County Commissioners for constructing 1 mile of cncrete road, east of Olympia, connecting with Fourth Street, to Albers & Sons, Chehalis, at $14,600. W. H. Yeager, County Engr.

★Pasco, Wash.—Reported contract awarded by County Commissioners for constructing 4 miles of permanent highway at Kahlotus to W. H. Murmade, Prosser, at $17,000.

★Seattle, Wash.—Contract awarded by County Commissioners for grading 8 miles of road between Franklin and Black Diamond, to Sloan Bros., Pacific Block, at $49,423.

★Spokane, Wash.—Reported contract awarded by City Council for paving Grand Boulevard with Spokane bituminous No. 2, to Standard Asphalt Paving Co., Spokane, at $31,046.

★Spokane, Wash.—Contracts awarded by County Commissioners for paving with 5-in. bituminous, 3-in. base and 2-in. wearing surface 3 miles of Apple Way to Spokane Bitu-Mass Paving Co., Spokane, at $26,151, and for redressing present 3-in. macadam pavement on Mead Road to Standard Asphalt Paving Co., Spokane, at $12,916.

★Tacoma, Wash.—Reported contract awarded by County Commissioners for paving with 2-in. Warrenite on 5-in. crushed rock base. Helmold-Bowman Road to Warren Bros., Tacoma, at $10,217.

★Winlock, Wash.—Reported contract awarded by City Council for paving two districts to W. F. Meismer, Transportation Building, Seattle, at a total of $21,100.

Monmouth, Ore.—Lowest bid submitted to City Council for constructing concrete pavement was from Dennis Construction Co., Portland Ore., at $9,102.

★Portland, Ore.—Following bids opened by County Commissioners for surfacing with asphaltic concrete Fairview-Greshan Road: Montague-O'Reilly, Portland, $33,377; Oskar Huber, Portland, $30,859; Warren Bros., Portland, $30,193 (awarded contract). John B. Coffee, County Clerk.

★Contract awarded by City Council for paving Broadway from Larrabee Street to Union Avenue to Oregon Independent Paving Co., Portland, at $45,000. Philip Dater, City Engr.; A. L. Barbur, City Auditor.

★Bakersfield, Cal.—Following are four lowest bids opened recently by Board of Supervisors for grading, paving, etc., on 11.12 miles of Wasco Lost Hills Road Division 3, Seection 1, involving approximatly 46,504 ft. shaping roadbed, 78,692 sq. ft. concrete pavement, with bituminous wearing surface, etc.: W. C. Price & Co., San Francisco, $64,764 (awarded contract); Coast Construction Co., Los Angeles, $65,031; W. A. Dontanville, Pasadena, $65,492, and Marin Rock Co., $66,345.

★Oakdale, Cal.—Contract for grading and constructing asphalt and concrete pavement on F Street awarded Raisch Improvement Company, San Francisco, at $10,625.

★Riverside, Cal.—Contract awarded by Board of Supervisors to C. L. Hyde Construction Company, 333 Spreckles Building, San Diego, for grading and concrete paving on 2.75 miles of Route 12, extending from San Diego County line, involving approximately 3000 cu. yd. excav., 14,165 lin. ft. shaping roadbed, 2800 cu. yd. B concrete in pavement, etc., at $11,016. Other bidder, Isbell Construction Company, at $11,110.

★Idaho Falls, Idaho.—Reported contract awarded by City Council for constructing 5 miles of concrete sidewalks to Charles H. Helmer, Idaho Falls, at 13.6 cts. per sq. ft. and 55 cts. per cu. yd. for excavation and fill, total $23,611.

★Orofino, Idaho.—Reported contract awarded by City Council for paving with concrete 4 blocks on Johnson Avenue to C. M. Payne, Spokane, Wash., at $10,907.

STREET CLEANING AND GARBAGE DISPOSAL

PROPOSED WORK.

Lakewood, Ohio.—Garbage disposal bonds for $25,000 will be sold June 12, by city. B. M. Cooke, Director of Finance.

Fargo, N. D.—Construction of garbage incinerator being considered by City Commission.

Santa Ana, Tex.—City contemplates constructing incinerator or garbage disposal plant. Lewis M. Robertson, Mayor.

BIDS DESIRED.

Orange, N. J.—Reported desired until June 6, for collection and disposal of garbage. Address City Commission.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Elizabeth, N. J.—Following bids opened May 25 by John Kerah, City Clerk, for disposal of garbage and refuse: Matthew Wade, 409 South Street, $90,000, and Thomas Viscount, 868 Flora Street, $69,000.

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS

PROPOSED WORK.

Breakwater—Boston, Mass.—A bill has been signed by Governor providing for construction of breakwater at Gun Rock Cove. Address Secretary State Board Harbor Commissioners.

Dam—Sharon, Pa.—Chester & Fleming, Pittsburgh, engaged to prepare plans for the dam which the Sharpsville Improvement Association will construct on Shenango River.

Hydro Electric Plant—Spartanburg, S. C.—Interborough Power Company will build a $300,000 hydro-electric plant on Tyger River 16 miles south of Spartansburg to develop 4000 hp. for lighting and power transmission.

Bradentown, Fla.—Gamble Creek Special Drain District bonds for $130,000 will be sold June 17 by Board County Commissioners (Robt. H. Roesch, Clk.).

Seawall—Lemon City, Fla.—Biscayne Front Realty Co. plans spending $250,000 for improving Bay Front land to include seawall, sewers, water supply, sidewalks and road construction.

Water Power Development—Mobile, Ala.—W. D. Owens, Atmore, is reported interested in organization of a company for the purpose of developing water on Perdido River, near Mobile.

Drainage—Burtville, La.—Citizens voted $20,000 bonds for constructing drainage system. It is proposed to dredge out old Bayou for drainage estimated at 65,000 to 70,000 cu. yd. G. W. Sitman, President Bayou Paul Drainage District, Burtville.

Canal Improvement—New Iberia, La.—Plans prepared for navigable canal connecting Bayou Teche and Grand Lake are being considered by City and Parish Commissioners; estimated cost, Route No. 1, exclusive of locks and piling, $156,000; Route No. 2, $162,000. Address Clerk Parish Jury.

Seawall—Biloxi, Miss.—Board of Mayor and Aldermen considering constructing a seawall.

Dam—Dayton, Ohio.—The repair of the Steel Dam at a cost of $20,000 is under consideration. Address City Manager.

Dam—Stevens Point, Wis.—Wisconsin River Pulp & Paper Company will construct a concrete dam 2500 ft. long and 18 ft. high to cost $75,000.

Drainage—Boone, Iowa.—Contract soon to be let for constructing Drainage District No. 136, estimated to cost $15,600. J. R. Curry, County Auditor, Boone.

Drainage—Madrid, Iowa.—Plans completed for the improvement to Drainage District No. 112, estimated to cost $48,000. J. R. Curry, County Auditor, Boone.

Drainage—Slater, Iowa.—Plans completed for the Boone Story counties joint drainage district No. 7, estimated to cost $31,300. H. A. Chambers, Drainage Engineer, 408 Boone National Bank Building, Boone. Address County Auditor.

Bemidji, Minn.—All bids opened May 19, by County Auditor, for constructing Judicial Ditch No. 25 rejected. New bids to be asked. Engineer's estimate $406,770. J. L. George, may be able to give information.

Dam—St. Cloud, Minn.—The Public Service Company (A. G. Whitney, President) will construct the Sauk Rapids dam and construct a plant. A new steam turbine and boilers will be installed in the steam plant at the dam, a new 400-hp. hydro-electric unit placed in one of water-power plants.

Drainage—St. Paul, Minn.—E. V. Willard, Old Capitol Bldg., St. Paul, is engineer for the Big Stone Lake reservoir improvement. The plan is to build a dike one mile long and a spillway to divert the Whetstone River· so that Big Stone Lake may serve as a reservoir to control the water in section involved.

Dam—Pactola, S. D.—Dakota Power Co., of Rapid City, considering plans for a power dam on Rapid Creek at Pactola, cost about $1,000,000. Flood waters of creek will be used to produce 5000 hp. for electric current and to irrigate 40,000 acres of land.

Hydro Electric Plant—Guernsey, Wyo.—A dam and hydro electric plant is to be constructed over Platte River near Guernsey; cost about $250,000. C. A. Guernsey of Guernsey interested.

Drainage—Helena, Ark.—The Circuit Court at Helena has been petitioned to establish a drainage district between White and Mississippi River comprising about 125,000 acres. Construction of a levee 30 miles long to keep White River in its channel will be necessary. About 10,000,000 cu. yd. material will be used. Total cost of improvement $2,000,000. Elliott & Harman Engineering Co. of Peoria, Ill., and C. B. Bailey of Wynne recommended as consulting and resident engineers respectively.

Hyroelectric Plant—Heber Springs, Ark.—Arkansas Hydro-Electric Development Co. incorporated with $50,000 capital to construct a hydroelectric plant to generate electricity for transmission to Little Rock, Memphis, etc.

Fill—Seattle, Wash.—The Park Commissioners, Central Bldg., considering filling of Union Bay Shore lands and constructing a 3000-ft. bulkhead to reclaim 30 acres of land.

Irrigation—Grandview, Ore.—By Suttle Lake Irrigation District, Grandview, will sell June 6 $600,000 bonds. George S. Young, Project Engineer, Suttle Lake Irrigation District, First Natl. Bank Building, Bend, Ore.

Irrigation—Medford, Ore.—Citizens voted in favor of Ashland-Talent District which comprises about 15,000 acres. O. A. Manning, Director of Irrigation District.

Flood Prevention Work—Cucamonga, Cal.—Reported $80,000 bonds for flood prevention work has been authorized by voters. Address City Clerk.

Irrigation, Fresno, Cal.—Five irrigation districts taking water from Kings River have agreed to organize to construct a reservoir and dams in Pine Flats region near head waters of Kings River, Fresno County, to conserve flood waters. Probable cost $6,000,000. W. F. Chandler, of Fresno, may be able to give further information.

Irrigation—Red Bluff, Cal.—A. L. Conard, of Red Bluff, and others have applied to State Water Commission for permission to appropriate 130 sec. ft. of waters of Red Bank Creek in Tehama County for use of an irrigation project which it is proposed constructing, to include a concrete arched masonry dam 130 ft. high, 400 ft. at top and 60 ft. at bottom; a reservoir to impound 30,000 acre ft., work proposed to cost $400,000.

Drainage—Riverside, Cal.—Board of Supervisors (A. B. Pilch, Clerk) voted to construct 25 miles of channels and ditches in vicinity of Brownlands, for Drainage Dist. No. 2. Work will consist chiefly of widening and deepening channel of San Jacinto River, cost about $92,015. Reuben Q. Brown, 530 California Building, Los Angeles, Supt. of Construction.

Hydroelectric Plant—Orilia, Ont.—A by-law will be voted on shortly to spend $100,000 in re-equipping present electric plant and system for hydro power.

BIDS DESIRED.

Drainage, Concord, N. H.—Reported desired until June 5, for drainage improvement, 6 miles dredge ditches, 104,000 cu. yd.

Wharf Addition—Fort Constitution, N. H.—Until June 10, for constructing addition to wharf. A. G. Fouch, Second Lieutenant C. A. C.

Dredging—Wareham, Mass.—Until June 7, by Board Harbor and Land Commissioners (Wm. S. McNeary, Chmn.), State House, Boston, for dredging a channel in Wareham River at Wareham, requiring the removal of about 135,000 cu. yd.

Pier—New London, Conn.—Reported desired until June 8 by Rivers, Harbors & Terminals Commission of Connecticut for pier shed at New London requiring 600 tons of steel.

Dredging—Baltimore, Md.—Until June 30, by U. S. Engineer, Office, Baltimore, for dredging in Elk and Little Elk Rivers, Md., advertised in Engineering Record.

Drainage—Monroe, Ga.—Until June 6 by Board Drainage Commissioners (J. A. Prickly, Clk.) for drainage improvement on Alcova Drainage Dist., to consist of approximately 6¼ miles of dredge ditches on Alcova River, about 297,340 cu. yd.; Beaver Dam Lateral about 5 miles long, 93,459 cu. yd.; Bay Creek Lateral, 5 miles long, 87,553 cu. yd.; Maple Creek Lateral, 76 stations, 21,758 cu. yd., etc.

Drainage—New Orleans, La.—Until June 18 by Water Board, Room 503 City Hall Annex, for riveted steel pipe for drainage system (Contract 78-D).

Levee—Vicksburg, Miss.—Until June 10, by Third Mississippi River District, P. O. Box 404, Vicksburg, for constructing about 243 cu. yd. new levee, advertised in Engineering Record.

Ditch—Winamac, Ind.—Until June 16, by C. E. Paul, Construction Commissioner, Winamac, for constructing A. M. Leach ditch and three branches, main ditch 42,288 ft. long, 12 ft. slope 1 to 1, maximum depth 15 feet, suitable for floating dredge or dry land machine, Branch Nos. 1, 2 and 3 respectively; length 12,800 ft., 16,839 cu. yd.; 8900 ft. long, 8924 cu. yd.; length 12,816 ft., 23,689 cu. yd. Separate bids June 17 for Hill Ditch, 38,870 ft. long, containing 39,729 cu. yd. earth and 4534 cu. yd. solid rock moved.

Breakwater—Chicago, Ill.—Until June 10, by U. S. Engineers, 508 Federal Building, Chicago, for repairing superstructure on Exterior breakwater at Chicago Harbor, Ill.

Drainage—Algona, Iowa.—Reported desired until June 6 by E. H. Beardsley, County Auditor, for constructing subdrain No. 5 in Drainage District No. 3.

Drainage—Estherville, Iowa.—Reported desired until June 6, by Charles A. Root, County Auditor, for drainage work in Drainage District No. 94, and Drainage District Nos. 96 and 98. C. P. Smith, County Engr.

Drainage—Benson, Minn.—Reported desired until July 1, for constructing 48 miles drainage ditch and 250 miles 6 to 30-in. tile. F. B. Gardner, Engr.

Ditches—Morris, Minn.—Until June 16, by C. R. Wollthan, County Auditor, for constructing County Ditch No. 23, main ditch 12,800 ft. 6 to 24 in. tile, 1600 ft. open ditch; Branch No. 1, 4700 ft. 10 and 14 in. tile; Branch No. 2, 9581 ft. 7 to 14 in. tile; Branch No. 3, 2200 ft. 6 to 10 in. tile. Estimated cost $17,778. Separate bids for County Ditch No. 24, 6559 ft. 8, 10, 14 and 18 in. tile. Estimated cost $4,202. C. R. Wollthan, County Auditor.

Levee—Perry, Kan.—Reported desired until June 5, by John Shotall, Treas. Elm Creek Drainage Dist., for constructing levees.

Irrigation—Grandview, Wash.—Later official reports state bids desired by Dept. Interior, U. S. Reclamation Service, Washington, D. C. (A. P. Davis, Ch. Engr.), until June 15, furnishing and erecting power and pumping equipment for Grandview Irrigation Dist., involving pumps, hydraulic turbines, head gates, etc., as per Spec. No. 338.

Dyke—Oretown, Ore.—Until noon, June 15, by Little Nestucca Drainage Dist., Tillamook County (L. J. Redberg, Secy.), for construction of dike in connection with proposed reclamation project. Plans on file in office of J. C. Holden, County Clerk, Tillamook.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★Hydro Electric Plant—Rumford, Me.—Contract awarded H. P. Cummings Construction Company, Ware, Mass., for constructing hydroelectric plant for Rumford Falls Power Company.

★State Canal Work—Albany, N. Y.—Contract awarded H. S. Kerbaugh, Inc., Buffalo, for excavation and construction work on state canal, at $630,000.

State Canal Work—Albany, N. Y.—Lowest bid opened May 23 by W. W. Wotherspoon, State Superintendent Public Works, Albany, for constructing bridge across Hudson Canal, at Northumberland submitted by Holler & Shepard, Fort Edward, New York, at $76,486, and for bridge at Freemans, near Schenectady, hy Foundation Company, 233 Broadway, New York, at $87,390.

Pier Improvement—Philadelphia, Pa.—Edwin H. Vare, Betz Building, submitted lowest bid for furnishing and placing filling of the Moyamensing group of municipal piers now under construction at 40c. per cu. yd., about 150,000 cu. yd.; George Dobbin & Co. submitted lowest bid for rebuilding observation tower on Race Street pier, at $7,980.

★Dock—Canton (P. O. Baltimore), Md.—Contract awarded Sanford & Brooks, Baltimore, for constructing a reinforced concrete dock 77 ft. wide and 600 ft. long with wharf on side carried back 400 ft., dock and pier for Canton Company. Cleveland Dock Engineering Company, Cleveland, Ohio, Engineers.

★Levee — Davenport, Iowa.—Contract for material to be used in building levee between Harrison and Perry Streets awarded by Levee Commission as follows: To Builders' Sand & Gravel Company of Davenport, 4800 cu. yd. riprap at $6,700; 3250 cu. yd. crushed stone, $2,925; 3600 bbl. Portland cement, $5,200; 75,000 cu. yd. sand fill, $26,250 and 300 yd. crushed rock, $3.45, to Purington Paving Brick Company of Galesburg, Ill., 430,000 beveled paving brick at $7,142.

Irrigation—Fort Laramie, Wyo.—Lowest bid opened May 22 by U. S. Reclamation Service, Fort Laramie, for constructing tunnels and concrete canal lining on Fort Laramie Canal, North Platte project, submitted by MacArthur Bros. Co., 11 Pine St., New York City, $242,032.

★Levees — Stamps, Ark. — Contract awarded by Long Prairie Levee Dist. for constructing 4 miles 10 to 13 ft. levee to R. H. and G. A. McWilliams, 1111 McCormick Bldg., Chicago, Ill., at 17½ cts. per yd.

Jetty Works—Port Aransas, Tex.—Following are two bids opened May 15 by U. S. Engineer, Galveston, for jetty work at Port Aransas: Charles Clarke & Company, Galveston, $19,825; David M. Picton & Company, Port Aransas, $20,580.

★Fill — Seattle, Wash. — Contract for constructing hydraulic fill on Duwamish Waterway, Bond Road No. 11, awarded by Commissioners to Holt & Jeffrey, Transportation Bldg., at $25,128. A. P. Denton, County Engineer.

Weir — Sacramento, Cal. — Lowest bid opened May 23 by Frank C. Miller, City Engineer, for constructing weir, also bridges, submitted by Teicher & Ambrose, Sacramento, at $336,640.

★Crib Work, Etc.—Toronto, Ont.—Contract for crib work and concrete wall awarded by Harbor Commissioners to R. R. Wedell & Company, Spadina Avenue, and the Dredging & Dock Company, 307 Logan Avenue.

ELECTRIC RAILWAYS

PROPOSED WORK.

Springfield, Mass.—See "Private Buildings."

Chester, Pa.—Charter granted to Chester & Eddystone St. Ry. Co. to construct a railway 2 1/3 miles long in Delaware County. Capital $15,000. Van Horn Ely of Haverford, Pres.

Cumberland, Md. — The Cumberland Electric Ry. Co. will extend line 1 mile on Green Street Road.

Alexandria, La.—Work will soon begin by Alexandria Municipal Ry. Co. on construction of an extension to connect all depots in city.

Covington, Ky.—The Cincinnati, Newport & Covington Ry. Co. contemplates making several extensions in Newport and surrounding country.

Gary, Ind.—Plans being considered by Gary & Interurban R. R. Co. for rehabilitation of lines to Gary and construction of a line on Buchanan Street, Gary; cost, about $300,000.

Harrisburg, Ill.—The Southern Illinois Ry. & Power Co. will extend line to Marion, Herrin and Benton, also construct a loop from Benton to Herrin via Duquoin.

Des Moines, Ia.—The Des Moines City Ry. Co. will rehabilitate 3 miles of track in business district.

San Francisco, Cal.—Reported Bd. of Supervisors passed a bill directing plans and specifications be prepared for construction of municipal railway through Twin Peaks Tunnel; estimated cost, $275,000. Address Secretary Bd. of Public Works.

Pocatello, Idaho.—Plans being prepared for construction of an electric railway from Pocatello to Idaho Falls via Blackfoot, about 5 miles. Charles E. Harris of United States Land Office may be able to give further information.

PRICES AND LETTINGS.

★*Indicates award of contract.*

New York, N. Y.—Following are unofficial totals of four lowest bids opened May 25, by Public Service Commission for First District, 120 Broadway, for constructing Section 2 of the Fourteenth Street subway, extending from Irving Place to Avenue B in Borough of Manhattan: Degnon Contracting Company, 30 E. Forty-second Street, $1,972,000; MacArthur Brothers Company, and Mason & Hanger, Inc., 120 Broadway, $1,996,000; Oscar Daniels Company, Woolworth Building, $2,188,000; J. F. Cogan Company, 280 Broadway, $2,207,000.

Following are unofficial totals of the four lowest bids opened May 25 by Public Service Commission for First District, 120 Broadway, for station finish on Lexington Avenue subway from Forty-third to 106th Street, John B. Roberts, 3 West Twenty-ninth Street, $266,000; Thomas Dwyer, 216th Street and Broadway, $286,000; Emerson Building Company, 103 Park Avenue, $290,812, and Daniel Roggs, 51 Chamber Street, $293,324.

★Contract awarded by Interborough Rapid Transit Company to Snare & Triest Company, Woolworth Bldg., for connecting Second Avenue elevated line in Manhattan with new elevated lines in Queens to Astoria and Corona, at $55,760.

★**Clarksburg, W. Va.**—Contract awarded by Monongahela Valley Traction Co. of Fairmount to Keely Bros. of Clarksburg for construction of an extension of line along Limestone Creek; cost about $18,000.

★**Murphysboro, Ill.**—Contract awarded by Rapid Transit Co. for construction of railway from East St. Louis to Mt. Vernon via Chester and a spur from Steeleville to Murphysboro to William Martin of St. Louis, Mo. D. P. Roberts, East St. Louis, Ill., is interested.

RAILROADS

PROPOSED WORK.

Vestal, N. Y.—J. H. De Frees, Warren, Pa., is interested in the building of a narrow-gage railroad from Vestal, N. Y., to Silver Lake, Pa., a distance of 11 miles, for the Rogers Lumber Company.

Pittsburgh, Pa.—The Pittsburgh & Lake Erie R. R. Co. contemplates making improvements to its system, to include construction of additional tracks on main line, extend branches and erect depots.

Man, W. Va.—Chesapeake & Ohio R. R. (F. I. Cabell, Ch. Engr., Richmond, Va.) will construct a 10-mile extension from Man, Logan County, to Gilbert, Mingo County.

Wheeling, W. Va.—The Wheeling and Eastern R. R. Co. of Wheeling received a charter to construct a railroad from Wheeling to Majorville, in Marshall County. Capital $300,000.

Wheeling, W. Va.—The Wheeling & Eastern Ry. Co. plans constructing a railroad from McCann's Ferry, Pa., on Monongehela River to Wheeling and a branch line to Millsboro, Pa.; estimated cost of construction $5,000,000.

Bemidji, Minn.—Reported Jens J. Opsahl, of Bemidji, is interested in the railroad which it is proposed constructing in Bemidji and adjacent counties.

Williston, N. D.—Reported Great Northern R. R. (A. H. Hogeland, Ch. Engr., St. Paul, Minn) will construct a railroad through northwestern section of Williams County.

Baker, Mont.—The Beaver Valley Railroad Co. filed with Secretary of State at Helena articles of incorporation for construction of a railroad from Baker to Ekalaka, distance 45 miles. Capital, $100,000. Incorporators: W. M. Peck, George A. Baker and A. H. Webster of Ekalaka.

Great Falls, Mont.—Reported Great Northern Ry. Company (A. H. Hogeland, Ch. Engr., St. Paul, Minn.) will construct an 8-mile extension to Choteau Bynum branch in Teton County.

North Yakima, Wash.—Plans being prepared for a railroad to be constructed from North Yakima through Yakima and Klickitat Counties. Address S. S. Bullis of North Yakima Short Line.

Spokane, Wash.—A. Worth Belden, Spokane; Charles McKinnie, Kellogg, Idaho, and R. D. Miller, care Exchange Natl. Bank of Spokane, will construct a continuation of the Big Blackfoot branch of the Chicago, Milwaukee & St. Paul Ry. into Canada and tap coal fields. Fifty miles of road will be built from McGilvray on Canadian Pacific R.R. through Flathead Valley of British Columbia to boundary line between U. S. and Canada.

Medford, Ore.—Citizens voted a subsidy of $300,000 toward construction of a standard-gage railroad into Blue Ledge Mining Dist. Address Elmer T. Foss, Recorder.

Prineville, Ore.—Reported City Council has authorized sale of $100,000 bonds June 6 for constructing municipal railroad to connect Oregon-Washington trunk line.

Roseburg, Ore.—Construction of a railroad from Roseburg to Rock Creek, into timber belt about 24 miles distant contemplated. Bonds amounting to $300,000 voted for same. R. L. Whipple, City Recorder.

Ogden, Utah.—Promontory Development & Transportation Co., incorporated with a capital of $100,000 for construction of a narrow-gage railway about 6½ miles in length from Promontory Point, Utah, to zinc and lead mines on west side of Promontory Mountain. H. M. Rowe, Pres., 614 Eccles Bldg.

★**New York, N. Y.**—Following are four lowest bids opened May 22 by Public Service Commission, 120 Broadway, for constructing Section No. 5 of Route 8, a part of the Fourteenth Street Eastern Rapid Transit Railroad: (a) MacArthur Bros. Co., 11 Pine Street, $1,336,950 (awarded contract); (b) J. F. Cogan Co., Woolworth Building, $1,364,266; (c) Rodgers & Haggerty, Inc., Hudson River and 152d Street, $1,386,514; (d) The Degnon Contracting Co., 36 East Forty-second Street, $1,433,745.

Item		*(a)	(b)	(c)	(d)
1	170,800 cu. yd. earth excav. above m. h. w.	$2.85	$3.30	$3.30	$3.25
2A	6,980 cu. yd. earth excav. above and below m. h. w., sewers	2.50	3.00	3.00	3.25
4	2,920 lin. ft. (a) underpinning buildings	22.00	15.00	1.00	1.00
4E	2,040 lin. ft. maintaining, protecting and securing buildings	22.00	5.00	1.00	1.00
6	26,700 cu. yd. concrete masonry	8.90	8.00	10.20	9.00
7	2,810 cu. yd. protective concrete masonry	8.00	8 00	10.20	9.00
8	20 cu. yd. rubble stone masonry	5.50	4.00	6.00	8.00
8A	20 cu. yd. dry rubble masonry	5.00	3.00	3.50	7.00
9	20 cu. yd. brick masonry	13.00	15.00	15.00	16.00
10	65 cu. yd. hollow terra cotta brick or tile masonry	13.00	15.00	15.00	20.00
11	100 bbl. grout of Portland cement	2.50	2.00	3.00	3.50
12	100 lin. ft. timber piles	0.50	0.25	0.50	0.50
13	2 M ft. timber foundations	60.00	40.00	60.00	50.00
14	25 cu. yd. broken stone or gravel	2.00	2.00	3.00	3.00
15	6,060 sq. yd. (a) waterproofing, 1 ply	0.38	0.40	0.30	0.50
	100 sq. yd. (b) waterproofing, 2 ply	0.64	0.45	0.60	1.00
	18,400 sq. yd. (c) waterproofing, 3 ply	0.97	1.00	0.95	1.25
	100 sq. yd. (d) waterproofing, 4 ply	1.28	1.05	1.25	1.75
	100 sq. yd. (e) waterproofing, 5 ply	1.60	1.10	1.60	2.25
	50 sq. yd. (f) waterproofing, 6 ply	1.92	1.25	2.05	2.75
	100 sq. yd. (i) waterproofing, dry ply	0.25	0.40	0.25	0.40
16	1,000 cu. yd. brick laid in asphalt mastic	19.50	15.00	25.00	25.00
17	50 lin. ft. (a) 12-in. vitr. drain pipe	0.95	0.85	0.60	0.80
	50 lin. ft. (b) 10-in. vitr. drain pipe	0.85	0.70	0.45	0.55
	50 lin. ft. (c) 8-in. vitr. drain pipe	0.55	0.40	0.40	0.30
	50 lin. ft. (d) 6-in. vitr. drain pipe	0.40	0.30	0.35	0.25
	50 lin. ft. (e) 4-in. vitr. drain pipe	0.30	0.25	0.25	0.30
	50 lin. ft. (g) 6-in. c.-i. drain pipe	1.00	1.00	0.65	1.00
	50 lin. ft. (h) 4-in. c.-i. drain pipe	0.70	0.85	0.50	1.00
	100 lin. ft. (i) 10-in. c.-i. drain pipe	2.30	1.50	1.70	1.50
17A	50 lin. ft. (a) 3-in. c.-i. pipes and fittings (heavy)	1.00	0.75	0.90	1.00
	125 lin. ft. (b) 4-in. c.-i. pipes and fittings (heavy)	1.15	1.00	1.20	1.00
	7,350 lin. ft. (c) 6-in. c.-i. pipes and fittings (heavy)	1.50	1.50	0.10	1.25
	600 lin. ft. (d) 8-in. c.-i. pipes and fittings (heavy)	2.30	2.00	2.70	1.50
17C	100 lin. ft. (d) galvanized w.-i. pipes and fittings (heavy)	3.50	4.75	3.30	2.50
18	137,300 lin. ft. tunnel ducts	0.10	0.10	0.12	0.20
19	1,070 ton riveted steel	94.00	100.00	104.00	105.00
20	1,810 ton steel beams and shapes	82.00	90.00	91.00	95.00
21	160 ton steel rods and bars	84.00	80.00	94.00	85.00
25	25 ton miscellaneous iron castings	70.00	75.00	85.00	90.00
25C	1 ton miscellaneous furnishings for sewers	100.00	75.00	125.00	100.00
26	590 lb. special wire forms	0.12	0.10	0.10	0.15
27B	5,450 lin. ft. 1¾-in. seasoned oak handrail	0.35	0.35	0.30	1.00
28	5,490 sq. ft. steel grating	1.95	1.75	1.50	2.00
29	2,660 sq. ft. vault lights	1.25	1.50	1.10	1.50
30	3,940 sq. yd. (a) sidewalk restored, incl. curb	1.80	1.75	1.35	2.00
	10,790 sq. yd. (e) roadway restored, asphalt	2.70	2.50	2.15	3.25
	6,440 sq. yd. (f) roadway restored, granite block	2.00	1.50	1.10	2.50
	150 lin. ft. (i) new bluestone curb	1.15	1.00	1.00	1.75
	100 lin. ft. (k) new 8-in. granite curb	1.70	1.25	1.50	2.50
32	2,950 lin. ft. (a) ¾-in. w.-i. electric conduits	0.15	0.10	0.15	0.30
	250 lin. ft. (b) 1½-in. w.-i. electric conduits	0.30	0.15	0.25	0.45
	100 lin. ft. (c) 2-in. w.-i. electric conduits	0.40	0.20	0.35	0.65
	4,850 lin. ft. (d) 1-in. w.-i. electric conduits	0.20	0.17	0.20	0.33
33	500 c.-i. outlet boxes, each	1.15	1.00	1.00	1.00
33A	10 c.-i. pull boxes, each	2.30	1.50	1.25	1.00
34	275 lin. ft. (a) 6-in. c.-i. pipe and fittings (extra heavy)	1.50	1.25	1.50	1.25
	200 lin. ft. (b) 3-in. c.-i. pipe and fittings (extra heavy)	1.00	0.75	1.00	1.00
37	4,460 lin. ft. 12-in. vitr. pipe sewer	2.00	2.50	2.75	3.50
38	580 lin. ft. 15-in. vitr. pipe sewer	3.15	3.00	3.30	4.00
39	1,290 lin. ft. 18-in. vitr. pipe sewer	3.15	3.50	3.80	4.50
41	100 lin. ft. 24-in. vitr. pipe sewer	4.00	5.00	5.00	6.00
42	2 ton c.-i. pipe sewer, straight	40.00	40.00	50.00	100.00
43	1 ton c.-i. pipe sewer, special	80.00	80.00	85.00	120.00
45	150 lin. ft. 3 ft. 6 in. x 2 ft. 4 in. egg-shaped sewer	5.75	6.00	6.25	10.00
75C	3,050 lin. ft. electric overhead trolley	5.00	3.00	5.00	4.00
79	100 lin. ft. 6-in. c.-i. water pipe in place	0.80	0.50	0.40	2.00
80	100 lin. ft. 8-in. c.-i. water pipe in place	1.20	0.75	0.60	2.25
82	100 lin. ft. 12-in. c.-i. water pipe in place	1.50	1.00	0.75	2.50
83	100 lin. ft. 16-in. c.-i. water pipe in place	2.00	1.50	1.00	2.75
84	100 lin. ft. 20-in. c.-i. water pipe in place	2.40	2.00	1.20	3.00
85	300 lin. ft. 24-in. c.-i. water pipe in place	3.50	2.50	1.80	3.50
86	1,300 lin. ft. 30-in. c.-i. water pipe in place	4.30	3.00	2.40	4.00
88A	50 service connections for water pipe restored, each	14.00	15.00	25.00	25.00
89	100 lin. ft. 3-in. c.-i. gas pipe in place	0.60	0.30	0.35	0.75
90	100 lin. ft. 4-in. c.-i. gas pipe in place	0.70	0.40	0.40	1.00
91	100 lin. ft. 6-in. c.-i. gas pipe in place	0.80	0.50	0.45	1.50
92	100 lin. ft. 8-in. c.-i. gas pipe in place	1.00	0.75	0.65	2.00
95	100 lin. ft. 16-in. c.-i. gas pipe in place	2.00	1.50	1.00	2.50
96	100 lin. ft. 20-in. c.-i. gas pipe in place	2.50	2.00	1.20	3.00
97	100 lin. ft. 24-in. c.-i. gas pipe in place	3.75	2.50	1.80	3.50
99	100 lin. ft. 36-in. c.-i. gas pipe in place	5.50	3.50	3.00	4.00
99A	2,900 lin. ft. (a) 6-in. w.-i. by-passing gas pipes	2.10	2.50	2.60	4.00
	1,200 lin. ft. (d) 12-in. w.-i. by-passing gas pipes	3.50	4.00	5.40	5.00
	3,700 lin. ft. (h) 4-in. w.-i. by-passing gas pipes	1.65	2.00	1.90	3.50
99B	600 lin. ft. (a) 12-in. w.-i. by-passing pipe on trestle	4.00	4.00	3.50	4.00
	300 lin. ft. (b) 16-in. w.-i. by-passing pipe on trestle	5.00	5.00	4.60	5.00
	850 lin. ft. (c) 20-in. w.-i. by-passing pipe on trestle	8.00	6.00	5.90	6.00
	200 lin. ft. (d) 24-in. w.-i. by-passing pipe on trestle	12.00	7.50	7.40	7.00
	350 lin. ft. (f) 6-in. w.-i. by-passing pipe on trestle	2.25	2.50	1.90	3.00
	250 lin. ft. (h) trestle	3.50	2.00	1.80	3.00
	350 lin. ft. (i) cat. trestle for pipes over 16 in.	5.00	3.00	1.20	4.00
	1,100 lin. ft. (j) cat. trestle for pipes 16 in. and under	3.25	2.50	1.20	3.50
99D	50 gas service connections restored, each	15.00	15.00	25.00	25.00
100	90 ton new c.-i. hub and spigot pipe, straight	40.00	40.00	35.00	65.00
101	80 ton new c.-i. hub and spigot pipe, special	80.00	80.00	75.00	100.00
127	1,000 duct ft. electrical ducts and conduits	0.45	0.50	0.60	0.50
127A	100 lin. ft. (c) 3½-in. pipe, elec. ducts and conduits	0.60	0.50	1.00	1.00
127C	10 service connections for elec. ducts restored, each	15.00	15.00	25.00	50.00
127D	1,000 duct ft. wooden elec. ducts of whatever kind	0.60	0.75	1.00	0.50
127E	100 duct ft. fiber electric ducts and conduits	0.60	0.75	0.60	0.50

New York, N. Y.—Following are unofficial totals of the four lowest bids opened May 23 by Public Service Commission for First District, 120 Broadway, New York, for constructing part of Eastern Parkway Rapid Transit Railroad, Route 31, a two-track elevated railroad in Borough of Brooklyn, extending from President Street to New Lots Avenue, along East Ninety-eighth Street and Livonia Avenue: (a) Dennis R. Conners, 64 W. Eighty-eighth Street, $1,376,122; (b) Kaufman & Garcey, $1,386,365; (c) Oscar Daniels Co., Woolworth Building, $1,408,462; (d) Rodgers & Hagerty, Inc., Hudson River and 152d Street, $1,412,369.

Item		(a)	(b)	(c)	(d)
1B	21,000 cu. yd. column excavation	$1.90	$1.70	$2.20	$1.00
6	8,000 cu. yd. concrete masonry	6.50	7.50	7.00	3.00
9	10 cu. yd. brick	15.00	15.00	10.00	15.00
9D	60 cu. yd. removal of old masonry	10.00	20.00	8.00	10.00
12	2,000 lin. ft. timber piles	0.40	0.30	0.10	0.50
13	2 M ft. timber foundations	60.00	80.00	50.00	60.00
17	400 lin. ft. (e) 4-in. vitrified pipe	0.30	0.50	0.10	0.25
19	15,100 ton riveted steel	80.50	80.50	81.50	82.00
20	600 ton steel beams and shapes	79.00	80.50	81.50	82.00
21	5 ton steel rods and bars	84.00	100.00	50.00	100.00
25	45 ton miscellaneous iron castings	70.00	50.00	40.00	60.00
30	4,500 sq. yd. (h) street surface restored	1.50	2.50	1.00	2.50
	1,600 lin. ft. (o) old curb restored	0.25	0.50	0.30	0.25
75	3,900 lin. ft. sing. tr. (c) electric (overhead trolley) R.R.	0.70	1.50	0.70	1.25
79	100 lin. ft. 6-in. water pipe	0.60	1.00	0.50	0.05
80	100 lin. ft. 8-in. water pipe	0.70	1.00	0.50	0.05
82	100 lin. ft. 12-in. water pipe	0.80	1.00	0.50	0.05
83	100 lin. ft. 16-in. water pipe	0.90	1.00	0.50	0.05
85	100 lin. ft. 24-in. water pipe	1.20	1.00	0.50	0.05
88A	45 service connections for water pipes, each	20.00	10.00	8.00	1.00
90	100 lin. ft. 4-in. gas pipe	0.40	1.00	0.50	0.05
91	100 lin. ft. 6-in. gas pipe	0.50	1.00	0.50	0.80
94	100 lin. ft. 12-in. gas pipe	0.60	1.00	0.50	0.05
98	100 lin. ft. 30-in. gas pipe	2.00	1.00	0.50	0.05
99D	45 service connections for gas pipes, each	10.00	10.00	10.00	1.00
100	2 ton new c.-i. hub and spigot straight pipe	80.00	40.00	40.00	35.00
101	5 ton new c.-i. hub and spigot special pipe	100.00	60.00	50.00	80.00
127	325 dct. ft. electric ducts	0.16	1.00	0.10	0.75
127A	100 lin. ft. (b) 2-in. w.-i. pipe	0.50	1.00	0.10	1.00
136	5 electric ground connections, each	30.00	50.00	80.00	50.00

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Hagerstown, Md.**—Contract for constructing 4.5 miles of single track line from Hagerstown to Security awarded by Baltimore & Ohio R. R. Co. to H. S. Kerbaugh, Inc., of Buffalo, N. Y., at about $100,000.

★Contract awarded Maons, Hanger & Company, Lexington, Ky., for double-tracking Western Maryland Railway from Clear Spring to Big Pool and Clayborne, Johnson Company contract for double-tracking road from Hagerstown to Security.

★**Security, Md.** — Contract reported awarded by Baltimore & Ohio R. R. to H. S. Kerbaugh, Inc., 6 Church St., New York, N. Y., for constructing 4½ miles of single track line from Hagerstown to Security Cement & Lime Company's plant. Approximate cost $100,000.

New Orleans, La.—Louisville & Nashville R. R. Company (W. H. Courtenay, Ch. Engr., Louisville, Ky.), will make terminal improvements costing $300,000.

Middleton, Tenn. — Reported New Orleans, Mobile & Chicago R. R. (E. D. Hogan, Gen, Supt., Laurel, Miss.), will be extended from Middleton to Jackson, a distance of 40 miles, at a cost of $1,225,000.

★**Great Falls, Mont.**—Reported contract awarded by Great Northern R. R. to Grant Smith & Company, Henry Building, Seattle, Wash., for grading 8 miles of roadbed on the Choteau Bynum branch in Montana, to cost about $90,000.

★**Helena, Mont.**—Reported Great Northern R. R. (A. H. Hoageland, Ch. Engr., St. Paul, Minn.) will construct 25 miles of new Rochford cut-off this year westerly from Lambert in Richland County.

Los Angeles, Cal.—Reported San Pedro, Los Angeles & Salt Lake Railway Company (A. Maguire, Ch. Engr., Los Angeles), will install a direct current impulse automatic block signal system on 280 miles of its line; probable cost, $400,000.

PUBLIC BUILDINGS AND SCHOOLS

PROPOSED WORK.

Bennington, Vt.—Plans prepared for Henry W. Putman Memorial Hospital, to be two-stories, 188 x 100 ft., and of brick construction; about $140,000 available.

Cambridge, Mass.—See "Sewerage and Sewage Disposal."

Lunenburg, Mass.—A committee of three has been appointed with School Committee to act in investigating the need of additional school facilities.

Providence, R. I.—Committee on Public Baths reported considering erecting two bath houses, to cost $85,000.

Thompsonville, Conn.—All bids opened recently for erecting grade school on Enfield Street rejected as being in excess of $27,500 appropriation.

Westport, Conn. — The Town Board having plans prepared for two schools to cost $33,000 each.

Bath, N. Y.—All bids opened recently for erecting the school rejected by Board of Education, as they exceeded the appropriation, which is $30,000. Otis Dockstader, Elmira, Architect.

Binghamton, N. Y.—Bd. of Supervisors considering several sites for county tuberculosis hospital to be erected at cost of $70,000. E. F. Ronan, Chmn. of Committee.

Bd. of Education considering rebuilding following buildings: Jarvis Street School, on site near Mygatt Street; on site near Glenwood Avenue, the Oak Street School; on new site, the Clinton Street School; appropriation available for 3 structures is $425,000.

Common Council considering a bond issue of $116,000 for improvements to schools as follows: Addition to Fairview School, cost $31,000; addition to Rossville School, $50,000; addition to Bevier Street School, $34,000. S. O. Lacey, Phelps Building, Architect; Archibald Howard, Security Mutual Building, Chmn. Building Committee.

Ilion, N. Y.—Citizens, May 19, voted to issue $48,000 bonds for erecting addition to North Side School. Address Board of Education.

Bridgeton, N. J.—Board of Education considering erecting high school; cost $125,000.

Hightstown, N. J.—John J. Jackson, 1328 Broadway, New York, is architect for the 4-story brick dormitory and school building to be erected at Peddie Institute at a cost of $80,000.

West Orange, N. J.—Board of Education contemplates erecting fireproof school at Eagle Rock Avenue and Valley Way, to cost $58,800.

Chester, Pa.—Board of Education engaged Clyde S. Adams, 1233 Arch Street, Philadelphia, to prepare plans for high school and additions to 2 primary schools to cost a total of $500,000.

Enola, Pa.—Citizens voted $40,000 bonds for erecting 12-room school. Address Bd. of Education.

Harrisburg, Pa.—Board of Education planning to erect high school, to cost $1,000,000.

Lititz, Pa.—High School bonds amounting to $95,000 sold by School Board.

Nesquehoning, Pa.—Plans being prepared by Clyde S. Adams, 1233 Arch Street, Philadelphia, for a 2-story high school, brick and stone, 154 x 82 ft.

Norristown, Pa.—Preliminary plans being prepared by Edward T. Boggs, 136 South Fourth Street, Philadelphia, for Charity Hospital administration building. $300,000 available for buildings.

Paterson, N. J.—School Board authorized to issue $75,000 bonds to erect addition to Botany School No. 7 and $125,000 bonds to erect addition to Clifton High School.

Philadelphia, Pa.—Plans being prepared by Board of Education for 3-story stone school to be erected for the Northeast High School and contain 26 classrooms. J. Horace Cook, Architect, City Hall.

Pittsburgh, Pa.—Erection of a nurses' home for St. Margaret Memorial Hospital contemplated; cost $25,000.

Russell, Pa.—Erection of two-story, eight-room brick school, to cost approximately $25,000, contemplated. Address Clerk School Board.

Sewickley, Pa.—H. D. Gilchrist, Frick Building, Pittsburgh, selected to prepare plans for borough library; cost $50,000. Address Borough Clerk.

Simpson, Pa.—Guy W. Osterhout, Connell Building, Scranton, engaged by Board of School Directors to prepare plans for two-story, brick high school to be erected here for Fell Township; cost not to exceed $40,000.

Williamsburg, Va.—Board of Visitors of William and Mary College have decided to erect a dormitory to consist of four units; cost complete $60,000.

Clarksburg, W. Va.—E. F. Stevens, 9 Park Street, Boston, Mass., is architect for the hospital which Mason Hospital Co. will erect.

Huntington, W. Va.—Contract will probably soon be let for erecting schools to cost about $50,000 each. Bond issue of

Leesburg, Ga.—Court house bonds for $50,000, road improvements bonds for $25,000 and bridge bonds for $5,000 will be sold June 6 by Clerk Board County Commissioners.

Shreveport, La.—School bonds for $150,000 sold. Address Clerk of School Board.

Vinton, La.—Citizens voted $30,000 bonds to erect a brick school. Address Clerk of School Board.

Ansonia, Ohio.—School bonds for $35,000 will be sold June 10, by J. C. Poling, Clk. Board Education.

Cambridge, Ohio.—School improvement bonds for $35,000 will be sold June 6 by County Commissioners (James R. Jones, Treas.).

Canton, Ohio.—School bonds amounting to $168,000 sold. Address Clerk School Board.

Chillicothe, Ohio.—Plans completed for the memorial building to be erected for Ross County, at a cost of $75,000. Address County Clerk.

Cincinnati, Ohio.—Tietig & Lee, 901 Fourth Natl. Bank Building, preparing plans for the brick Harriet Beecher Stowe School to be erected by Board of Education on West Fifth Street, and include 25 rooms, gymnasium, manual training and domestic science departments; cost $250,000. Samuel Hannaford & Sons, Sixth and Vine Streets, preparing plans for a brick Hoffman School to be erected on Bloody Run Boulevard by the Board of Education, to contain 17 rooms, gymnasium, manual training and domestic science departments, and cost about $175,000. Contracts for both schools will be let in about a month.

Bausmith & Drainie, 901 Gerke Building, commissioned by Board of Education to prepare plans for an addition to the McKinley School, on Eastern Avenue, and A. Lincoln Fechheimer, 1534 Union Trust Building, plans for an addition to Whittier School, Woodlawn Avenue.

Gallipolis, Ohio.—Citizens voted $80,000 bonds to erect new high school and repair and enlarge present schools. Address Board of Education.

Perrysburg, Ohio. — School bonds amounting to $41,000 sold May 20 by Board of Education proceeds to be used to erect addition to high school.

Wellsville, Ohio.—Citizens voted $95,000 bonds to erect new high school. Address Board of Education.

Weston, Ohio.—Contract will be let about June 25 by J. M. Cook, Clerk Village School Board, for erecting a brick and concrete 2-story and basement school to cost $45,000.

Zanesville, Ohio.—Ways and Means Committee of Council reported in favor of erecting new market house to cost approximately $60,000.

Huntington, Ind.—Hospital bonds for $40,000 will be sold June 28 by Huntington County. Ovid E. Aviston, County Auditor.

Perrysville, Ind.—Erection of a high school in Highland Township, at Perrysville, costing $30,000 is under consideration. Address Clerk Board Education.

South Bend, Ind.—Contract will soon be let for erecting Sample Street School; cost $100,000. E. B. Rupel, 821 South Michigan Street, member School Board.

Mendon, Ill.—Board of Education, June 28, will sell $30,000 bonds for school improvements. D. H. Myers, President.

Berlin, Wis.—Reported city will rebuild high school recently destroyed by fire. Address Clerk Board Education.

La Crosse, Wis.—Erection of an armory for Company M and La Crosse Hospital Corps, units of Wisconsin National Guard, contemplated; cost about $70,000.

Legrand, Iowa.—Citizens voted $28,000 school bonds. Address Clerk School Board.

Parnell, Iowa.—Citizens voted $35,000 bonds for schools. Address School Board.

West Bend, Iowa.—Citizens voted $32,500 bonds for erecting school. Address Clerk Board Education.

Albert Lea, Minn.—Hoffman & Company of Rochester engaged to prepare plans and specifications for eight-room school, to cost about $40,000. Address School Board.

Duluth, Minn.—Directors of St. Luke's Hospital (Dr. A. W. Ryan, Pres.) considering erecting an east wing; cost $125,000.

Fergus Falls, Minn.—Citizens voted $25,000 bonds for erecting school. Address Clerk Board Education.

Hibbing, Minn.—Holstead & Sullivan, Palladio Building, Duluth, engaged to prepare plans for addition to library; cost $55,000. Samuel Scott, Chmn. Library Board.

Plans being prepared by J. J. Wangenstein, Torrey Building, Duluth, for a court house; cost $90,000. Address County Clerk.

Minneapolis, Minn.—Bd. of Education plans erecting an addition to Horace Mann School, Thirty-fourth Street and Chicago Avenue; cost $50,000.

Nicollet, Minn.—Citizens voted $40,000 bonds for erecting schools. Address Clerk Board Education.

Proctor, Minn.—Plans completed and contract soon to be let for erecting high school at cost of $50,000. Address Bd. of Education.

Staples, Minn.—Citizens voted $65,000 bonds for erection of fireproof high school; cost $90,000. Address Secy. Bd. Education.

Thief River Falls, Minn.—Sanatorium Commission of Pennington, Marshall and Roseau Counties selected site north of city for a sanatorium to cost $40,000. Address Secy. Sanatorium Commission.

Virginia, Minn.—Plans of Carl Nystrom of Duluth approved by School Board for Technical High School; cost $338,000.

Hazen, N. D.—Reported school costing $35,000 is to be erected. Address Clerk Board Education.

Clear Lake, S. D.—Election will soon be held to vote $75,000 bonds for erecting court house. Address County Clerk.

Laredo, Tex.—C. H. Page & Brother, Austin National Bank Building, Austin, engaged by School Trustees to prepare plans for three schools; total cost about $90,000.

Seattle, Wash.—Contract about to be let for two-story brick and concrete addition to Madrona Grade School; cost about $75,000. Reuben W. Jones, Secretary School Board. Edgar Blair, Architect, 1426 Jackson Street.

Riverside, Cal.—Election will probably be held to vote $40,000 bonds for erecting one or two schools. Address Bd. of Education.

Visalia, Cal.—Citizens voted $105,000 bonds for erecting three schools. Address Clerk School Board.

Rossland, B. C.—School Board contemplates erecting a $50,000 school. J. A. McLeod, Secretary.

BIDS DESIRED.

East Cambridge, Mass.—Until June 10, by County Commissioners, Cambridge, for furnishing material, additions, repairs, heating, etc., to a group of county buildings at East Cambridge.

Ithaca, N. Y.—Until June 15, by E. L. Williams, Comptroller Cornell University, Ithaca, for erecting sheep barn, together with heating, underground conduit, etc., for New York State College of Agriculture, Cornell University. Lew. F. Pilcer, State Architect, Capitol, Albany.

Waterloo, N. Y.—Until June 20, by Jas. A. Wetmore, Acting Superv. Archt. Treas. Dept., Washington, D. C., for erecting complete U. S. post office at Waterloo.

New Brunswick, N. J.—Until June 12, for erecting a two-story and cellar brick and terra cotta jail for city. A. J. Gebhardt, Chairman, County Building Committee. W. H. Boylan, Architect, National Bank Building, New Brunswick. Also same time and place for steel cells.

Dayton, Ohio.—Until June 20, by Montgomery County Agricultural Board (I. L. Holderman, Secy.) for erecting an educational hall, public comfort station, and addition to secretary's office, etc., on Montgomery Fair Grounds, at Dayton. Gus. A. Niehus, Archt., 26 Callahan Blk.

Erie, Pa.—Until June 27, by Board Directors School District for erecting the Erie Academy High School, advertised in Engineering Record. W. J. Flynn, Business Manager; William B. Ittner, Archt., St. Louis, Mo.

Lewistown, Pa.—Until June 5, by Board Education (H. H. Laub, Chmn. Building Committee), for erecting a high school. Separate bids for heating, ventilating, plumbing, etc.

Pennsylvania.—Until June 13, by Samuel R. Rambo, Superintendent of Public Grounds and Buildings, Harrisburg, for reconstructing laundry building and power house and equipment destroyed by the recent fire at State Institution for Feeble Minded of Western Pennsylvania at Polk.

Pottstown, Pa.—Until June 26, by Jas. A. Wetmore, Acting Superv. Archt. Treas. Dept., Washington, D. C., for erecting U. S. post office at Pottstown.

Quincy, Pa.—Until June 24, by Geo. B. Beatty, Secy., S. B. Bell Phone 915-6, for plans for new high and grade school. J. W. Woltz, Waynesboro, Archt.

Gulfport, Miss.—Reported desired until June 7, by Chancery Clerk, for erecting county courthouse. Probable cost $100,000. N. W. Overstreet, 1 Majestic Theater Building Jackson, Architect.

Ansonia, Ohio.—Until June 22, by Weber, Werner & Adkins, Archts., 1206 Mercantile Library Building, Cincinnati, for erecting school costing about $35,000. See "Proposed Work."

Cheshire, Ohio.—Until June 10, by Weber, Werner & Adkins, Archts., 1206 Mercantile Library Building, Cincinnati, for erecting a public school, estimated cost $35,000.

Coalton, Ohio.—Reported desired until June 7 by W. F. Darling, Clk. Board Education, for erecting high school. Frank L. Packard, Archt., Columbus.

Grand Rapids, Ohio.—Reported desired until June 9 by R. J. Shull, Clk. Board Education, for erecting a fireproof high and grade school. Howard & Merriam, Archts., 8 E. Broad Street, Columbus.

Hanover, Ohio.—Reported desired until June 10 by A. D. Jones, Clk. Board of Education, for erecting high school. William B. Patton, Archt., 15½ South Park Place, Newark.

Leesburg, Ohio.—Until June 16, by Board Education (James V. Guthrie, Clk.), for furnishing material and erecting high and grade school. Separate bids for heating, plumbing, etc. Howard & Merriam, Archts., 8 East Broad Street, Columbus.

Spencerville, Ohio.—Reported desired until June 8 by B. L. Barger, Secy. State Armory Board, Columbus, for completion of contract for armory.

Sulphur Grove, Ohio.—Until June 19, by Board Education Wayne Township, for erecting school. Schenck & Walker, Archts., Dayton.

Huntington, Ind.—Until June 8, by John H. Sells, Trus. of Warren Township, Huntington County, for erecting a school.

New Albany, Ind.—Until June 28, by County Commissioners, for county infirmary building for Poor Farm. Emile Duquaquier, Co. Aud.

Lake Linden, Mich.—Until June 26, by Geo. W. Orr, Secy. Board Education, for erecting new high school and boiler house to be built at Lake Linden. Separate bids for heating, plumbing, etc.

Belleville, Ill.—Reported desired until June 6, by Board Education, for erecting gymnasium building for township high school. Probable cost $35,000.

Benton, Wis.—Reported desired until June 6, by J. G. Beck, City Clk., for erecting a municipal building. H. Kleinhammer, Archt., Platteville.

Rockwell City, Ia.—Reported desired until June 10, by W. J. Dixon, Chairman Board Trus. Women's Reformatory, for erecting three story, heating plant, store house and administration building to accommodate 200.

Wall Lake, Ia.—Reported desired until June 15, by City Clerk, for erecting fire station and city hall.

Scott City, Kan.—Reported desired until June 10 by County Clerk for erecting county high school. Holland & Son, Archts., Topeka.

Ewing, Neb.—Reported desired until June 6, by W. H. Graver, Secy. School Board, for erecting 3-story brick school.

Osmond, Neb.—Until June 12, by Chairman and Board of Trustees of Village for furnishing material and erecting a town hall. J. P. Guth, Archt., 516-17 Paxton Block, Omaha.

Red Cloud, Neb.—Until June 6, by School Board Dist. No. 2 (C. J. Pope, Secy.), for furnishing material and erecting high school. Separate bids for heating, plumbing, etc. R. A. Bradley & Co., Archts. Exchange National Bank Bldg., Hastings.

Richards, Mo.—Until June 12, for furnishing material and erecting a school. J. H. Felt & Co., Archts., Kansas City, Mo.

Webb City, Mo.—Until July 1, by County Board of Tuberculosis Hospital Commissioners, Keystone Building, for erecting Jasper County Tuberculosis Hospital building, advertised in Engineering Record. Rose & Peterson, Archts., Kansas City, Mo.

Houston, Tex.—Until June 6, by J. W. Lyle, County Superintendent of Schools, Houston, for erecting a two-story brick school at Port Houston and a brick addition to Magnolia Park School. F. S. Glover & Son, Archts., 612 Binz Bldg., Houston.

Seattle, Wash.—Reported desired until June 14, by C. E. Remsberg, Secy. Port of Seattle, for constructing a 25 x 350-ft. extension to Bell Street transit shed and for the construction of an 85 x 300-ft. transit shed at Smith Cove. Cost, $30,000 and $11,000 respectively J. R. West, Ch. Engr.

Avalon, Cal.—Until June 9, by F. W. Elder, City Clerk, for furnishing material and erecting a two-story city hall and jail at Avalon. Separate bids for heating, plumbing, etc. C. C. Rittenhouse, Archt., 310 Wilcox Bldg., Los Angeles.

Wasco, Cal.—Until June 12, by Board Trustees of High School District for erecting a one-story and basement brick and concrete school to cost about $30,000. Ernest J. Kump, Archt., 226 Rowell Bldg., Fresno; F. M. Gordon, Clerk of Board.

Ford City, Ont. — Until June 10, by Board Education (Frank Foster, Secretary, Detroit), for erecting a two-story and basement school costing $40,000 with equipment. J. C. Pennington, Architect, La Belle Building, Windsor.

Hamilton, Ont.—Until June 7, Chester S. Walters, Mayor, Chairman Board Control, for erecting nurses' home for Mount Hamilton Hospital. S. H. Kent, City Clk.

London, Ont.—Until June 8, by River, Harbor and Bridge Commission, at office of W. E. Clarke, Resident Engineer, for erecting pier house, warehouse and accessories, containing about 250,000 sq. ft. floor space.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Quincy, Mass.—Following are four lowest bids opened May 3 by Commissioner Public Works for erecting two schools one at Quincy Point and the other at Norfolk Downs: McGahey & O'Connor, Cambridge, $171,044; Cunningham & Sons, 7 Water Street, Boston, Mass., $172,000; C. D. R. McKillop, 137 West Brookline Street, Boston, $172,785; Kennedy & Peterson, 7 Water Street, Boston, $173,000. Lowest for heating and plumbing, Dame & Sons, 40 Portland Street, Boston, at $31,148 and $15,167 respectively. Cleveland & Godfrey, Architects, 15 Beacon Street, Boston.

★**Rochester, N. Y.**—Contract awarded by County Commissioners to W. F. Martens Company, Cutler Building, for erecting a boiler house and laundry building 30 x 100 ft., one and two stories, on East Henrietta Road, to cost $28,000.

★**Morristown, N. J.**—Contract for erecting All Soul's Hospital awarded P. F. Kenny Company, 33 Old Broadway, New York, N. Y., at $104,500.

★**West New York, N. J.**—Contract awarded by Board of Education to Frederick Haerter, West New York, for erecting auditorium at School No. 6, at $25,200.

★**Bethlehem, Pa.**— Following are bids opened by Bd. of Education for erecting school at Calyso and Tenth Streets: F. F. Speck, Bethlehem, $50,719; John Nagle, Allentown, $42,246 (awarded contract); Butz & Calder, $46,209, and Shamokin Lumber Co., $49,600.

★**Derby, Ohio.**—Contract awarded J. D. Van Gundy, Lancaster, for erecting centralized school to cost $25,000.

★**Gilbert, Minn.**—Contract awarded by Board of Education of Independent School District No. 19, for erecting school, to R. J. Cheney & Company of St. Paul, at $59,288.

★**Topeka, Kan.**—Contract for erecting Lincoln Junior High School awarded to James Cuthbert & Sons, Topeka, at $70,829.

Downey, Cal.—Lowest bid opened May 23, by School Board for erecting 10-room one-story and basement school submitted by M. H. Bowman & Company, Hollingsworth Building, Los Angeles, at $26,111. John C. Austin, Archt., 1125 Baker Detwiler Building, Los Angeles.

★**Ft. Huachuca, Ariz.**—Contracts for erecting buildings at this post awarded Kelly & Beahls, Leavenworth, Kan., at $91,000.

PRIVATE BUILDINGS

PROPOSED WORK.

Worcester, Mass.—Louis Rosenfsky, Millbury Street, has purchased site at 41-45 Millbury Street and will erect a 3-story marble face brick building. Cost $75,000.

Providence, R. I.—A 6-story brick, concrete, marble, terra cotta and steel, 80 x 168 ft., theater with wing 100 x 43 ft. will be erected for E. F. Albee. A. E. Westover, Archt., Keith's Theatre Bldg., Philadelphia, Pa.

Providence R. I.—York & Sawyer, 50 East Forty-first Street, New York, N. Y., preparing plans for an addition to Rhode Island Hospital Trust Company's building on Westminster Street, Washington Row and Exchange Place.

Albany, N. Y.—Trustees of Albany Law School propose erecting new building to cost $75,000. Amasa J. Parker, President Board of Trustees.

Lancaster, N. Y.—Depew, Lodge No. 823, F. & A. M., will erect 40 x 100 ft. stone and terra cotta Masonic Temple at East Main and Church Streets; cost approximately $25,000. Ralph Young chairman Building Committee.

New York, N. Y.—H. Craig Severance and William Van Alen, 4 West Thirty-seventh Street, are architects for 21-story commercial building to be erected at Thirty-seventh Street and Seventh Avenue; cost about $1,500,000.

Plans filed for erecting following buildings: Five-story brick apartments at 561 West 140th Street, for Dayton Building Company, Inc.; cost, $50,000, Sass & Springsteen, Archts., 32 Union Square. 17-story fireproof, brick, terra cotta and tile apartment house at 550 Park Avenue, for Park Avenue Corporation; cost, $600,000, J. Edwin R. Carpenter, Archt., 681 Fifth Avenue. 6-story brick apartment building at 834 Riverside Drive, for Gustavius Construction Company; cost, $65,000, Samuel Katz, Archt., 405 Lexington Avenue. 14-story fireproof apartments at 251 West End Avenue, for 255 West End Avenue Corporation; cost $260,000, Schwartz & Gross, Archts., 347 Fifth Avenue. 5-story brick apartments at St. Nicholas Avenue and 191st Street, for Mose Goodman Corporation; cost, $60,000, George F. Pelham, Inc., Archt., 30 East Forty-second Street. Four 5-story brick apartments at Academy Street and Post Avenue, for John Mahony; total cost, $300,000, Robert Dreyfuss, Archt, 1 West 103d Street. 6-story fireproof store, office and show room building at 22 East Forty-second Street for Defiance Manufacturing Company; cost, $50,000, Harry Leslie Walker, Archt., 103 Park Avenue. 5-story brick store and apartment building at St. Nicholas Avenue and 173d Street for Seco Realty Corporation; cost, $85,000, Sass & Springsteen, Archts., 32 Union Square. 1-story fireproof bank building at 2363 Eighth Avenue, for Provident Loan Society of New York; cost, $50,000, Renwick, Aspinwall & Tucker, Archts., 8 West Fortieth Street. 7-story fireproof settlement house at 27 Barrow Street, for Greenwich House; cost, $40,000, Delano & Aldrich, Archts., 4 East Thirty-ninth Street. 5-story brick tenement at 167th Street and Woodycrest Avenue for Bagot Realty Company; cost, $90,000; Wortham & Braun, Archts, 114 East Twenty-eighth Street.

White Plains, N. Y.—Sketches being prepared for one- and two-story tile and stucco church to be erected for First Church of Christ (Scientist); cost approximately $40,000.

Bayonne, N. J.—St. Vincent De Paul R. C. Church will erect a parish school and hall to cost $50,000. Rev. Mark A. Duffy, Pastor.

Elizabeth, N. J.—Lodge of Elks will spend $25,000 to alter lodge building on Westfield Avenue.

Newark, N. J.—Plans prepared by William J. Fitzsimmons, 207 Market Street, for the brick and terra cotta Lithuanian Church of Holy Trinity to be erected at Adams and Warrick Streets and cost $75,000.

New Brunswick, N. J.—Alexander Merchant of New Brunswick preparing plans for German Reformed Church, 1 and 2 stories, stone, 38 x 125 ft.

Orange, N. J.—Plans completed for two new stations to be erected in connection with elimination of grade crossings by Delaware, Lackawanna & Western R. R. Co. (George J. Ray, Ch. Engr., Hoboken), main station to be located between Essex and Lincoln Avenues and Highland Avenue station between Freeman and Stetson Streets.

Altoona, Pa.—Lafferty & Tobias, 1010 Chestnut Avenue, plan erecting a 4-story office building at 1012 Chestnut Street.

Beaver Falls, Pa.—Congregation of St. Mary's Roman Catholic Church will erect a parochial school and rebuild present edifice; cost $35,000.

Bryn Mawr, Pa.—Charles Willing and Furness, Evans & Co., Provident Building, preparing plans for 2 farm buildings, 1 and 2 stories, brick and stone, 86 x 50 ft., with wings, 21 x 76 ft., for E. B. Howard.

Chester, Pa.—Mowbray & Uffinger, 56 Liberty Street, New York, N. Y., are preparing plans for an 8-story brick, stone and marble and concrete office building for John P. Crozer.

Congregation of Providence Avenue Methodist Church will erect an edifice; cost $25,000.

Harrisburg, Pa.—M. I. Kast, 222 Market Street, is preparing plans for a five-story concrete and brick storage building to be erected at Strawberry and Dewberry Streets, for Dives Pomeroy & Stewart Department Store at a cost of $45,000.

Lancaster, Pa. — Emanuel Lutheran Church, Walnut and Pine Streets, will erect a $50,000 edifice.

Lock Haven, Pa.—Architects engaged to prepare plans for new St. Elizabeth's Home, to be erected on Pen Lucy Avenut; estimated cost about $150,000.

Nicetown (P. O. Philadelphia), Pa.—Plans being prepared by A. A. Richter, Sixth and Court Streets, Reading, for a Sunday school building for Nicetown Baptist Church.

Philadelphia, Pa.—Stewarson & Page, 316 Walnut Street, Philadelphia, have about completed plans for the parish building and sexton house to be erected for Church of St. James at Falls of Schuylkill.

Plans completed by William Steele & Sons, 1600 Arch Street, for erecting an 8-story building at Eleventh and Girard Avenues for Girard Estate.

Charles E. Oelschlager, Harrison Building, is architect for ten-story 137 x 180 ft. brick, steel, reinforced concrete and terra cotta service building to be erected at Broad and Cherry Streets for Gomery, Schwartz & Company.

Pottsville, Pa.—Pulaski Lodge, No. 216, Free and Accepted Masons, contemplate erecting $50,000 temple.

Wilmington, Del.—St. Andrew's Church will erect a $30,000 church.

Baltimore, Md.—Otto G. Simonson, Maryland Casualty Tower Building, is architect for 14-story Southern Hotel to be erected at Light and German Streets.

Parkersburg, W. Va.—R. H. Adair, Parkersburg, is architect for the three-story brick apartment house to be erected at a cost of $30,000.

Cincinnati, Ohio.—Weber, Werner & Adkins, 1206 Mercantile Library Building, commissioned by Alexander Klein to prepare plans for a $40,000 residence of old English type, to be erected at Vista Avenue and Pinehurst Lane.

Sumner M. Cross of the Columbia Life Insurance Co. of Cincinnati is receiving sketches for a new $25,000 residence to be built in Holly Lane.

Cleveland, Ohio.—Reported the Independent Order of B' Nai B' Rith considering erecting a Jewish Orphan Asylum in Cleveland; also one in another city; total cost of improvement about $1,500,000. Address Dr. Carl Vetsburg, International Life Building of St. Louis, Mo.

Marion, Ohio.—Plans prepared for $40,000 edifice to be erected here for Emanuel Lutheran Church.

Grand Rapids, Mich.—A $50,000 parish house is to be erected for St. Mark's Procathedral.

Chicago, Ill.—Plans prepared by John Aschlager & Son, Ashland Block, for ten-story fireproof family hotel which the Lott Hotel Company intends erecting on Lincoln Park West and Garfield Avenue; cost about $550,000.

Chicago diocese contemplates erecting an Episcopal cathedral, costing about $250,000. Rev. Charles P. Anderson, Bishop, may be able to give information.

Peru, Ill.—Contract about to be let for erecting edifice in St. Mary's parish; cost $35,000. George Staudubar, Archt., Rock Island.

Appleton, Wis.—Reported De Long & Son of Appleton are architects for eight-story building to be erected on College Avenue; probable cost $100,000.

Ashland, Wis.—Knights of Columbus (A. D. McDonald, Chmn.) considering erecting a building; cost $75,000.

Milwaukee, Wis.—Reported Alfred Ries, 183 Third Street, and Otto Meister, 2103 Lloyd Street, propose erecting two-story moving picture theater at 185 Third Street; cost $75,000.

Somerset, Wis.—St. Ann Roman Catholic Church will erect a new brick and stone edifice, to cost $45,000.

Fonda, Iowa.—Plans being prepared by W. L. Steele, United Bank Building, Sioux City, for brick parochial school to be erected here at cost of about $25,000.

Duluth, Minn.—The Orpheum Singing Society (Renholdt Berg, Pres.) will erect a club house at Twenty-sixth Avenue W. and Third Street; cost $30,000.

St. Paul, Minn.—Reported a building costing $1,100,000 is to be erected on St. Peter and Sixth Streets. Address S. S. Thorpe, 1106 Mount Curve Avenue, Minneapolis.

A fireproof hotel is to be erected at Main and Fifth Streets at cost of $120,000. Jonas Rosenberg, 240 Marquette Street, Minneapolis.

Contract for erecting a building for St. Paul Athletic Club soon to be let; cost $650,000.

Leslie Paper Co., Third & Wabash Streets, will erect a 6-story office building at Ninth and Sibley Sts.; cost $66,400.

Virginia, Minn.—Local lodge of Odd Fellows engaged G. K. Shand of Virginia to prepare plans for a lodge building; cost $25,000.

Fargo, N. D.—Erection of 8-story fireproof office building on site of Old Walker Theater contemplated; cost $400,000. A. M. Baker is interested.

Butte, Mont.—Jesse M. Warren, 216 Daly Bank Building, engaged to prepare plans for edifice to be erected for Church of Christ (Scientist) of brick and terra Cotta construction, costing $50,000.

St. Louis, Mo.—Polish Sisters of Perpetual Help, 340 Gasconade Street, will erect a two-story, 100 x 49-ft. convent addition, costing $35,000.

Gurdon, Ark.—The Iron Mountain R. R. Company (E. A. Hadley, Chief Engineer, St. Louis, Mo.), will erect a depot in Gurdon; cost $30,000.

Sherman, Tex. — Sherman Masonic Lodge will erect a temple; cost about $30,000.

Enumclaw, Wash.—Reported plans completed by Frederick Shaw of Tacoma for three-story and basement tile hospital which Dr. P. W. Sweet of Selleck intends erecting here at cost of $25,000.

Pullman, Wash.—Plans being prepared by Northern Pacific Ry. Co., for a brick depot; cost $40,000.

Salem, Ore.—George M. Post of Salem engaged to prepare plans for 4-story 33 x 102 ft. addition to Hotel Marion; cost approximately $50,000.

Fresno, Cal.—Directors of the Einstein Investment Company reported will erect an office building probably ten stories high at Mariposa and J Streets. Address Berton Einstein, Vice-president Bank & Trust Company of Central California.

Los Angeles, Cal.—John Parkinson, Security Building, engaged to prepare plans for a three-story and basement reinforced concrete building, 65 x 155 ft., to be erected at Twelfth and Figueroa Streets, for Firestone Tire & Rubber Company. A. T. Smith, Local Agent.

Preliminary plans being prepared by Arthur G. Lindley, Hollingsworth Building, for fifty-room hotel, which Leslie Cranbourne and associates propose erecting at Culver City.

San Francisco, Cal.—Southern Pacific Company, Flood Building, will erect a ten-story building with a four-story tower on Market and Stewart Streets.

Ottawa, Ont.—W. Shenkman, 360 Friel Street, is preparing plans for a $30,000 apartment house.

Welland, Ont.—S. L. Lambert of Welland having plans prepared for a steel truss skating rink to cost $35,000.

BIDS DESIRED.

Sturgeon Bay, Wis.—Until July 10, by H. L. Peterson, cashier, Door County State Bank, for erecting a bank building. Foeller & Schober, Archts., Green Bay.

Ellendale, N. D.—Until June 15, by Board Directors Ellendale State Bank, for erecting new bank. Kirby T. Snyder, 643 Plymouth Bldg., Minneapolis.

Fullerton, N. D.—Until June 15, by Marshall & McCartney Co., Oakes, for furnishing material and erecting a bank building at Fullerton.

Parshall, N. D.—Until June 6, by N. E. Rullen, at Hoffman, for erecting a brick bank and store building at Parshall, and brick bank building at Douglas.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Holyoke, Mass.**—Contract awarded Lalibertie Brothers, Holyoke, for erecting two-story, brick, granite and sandstone school for Immaculate Conception Parish in Ward 1, at $49,990.

★**Pittsfield, Mass.**—Contract for erecting parish home in rear of St. Stephen's Church awarded Tracy Brothers of Waterbury, Conn.; cost $30,000.

★**Harrisburg, Pa.**—Contract awarded Augustus Wildman, Harrisburg, for erecting a five-story brick apartment house at 711 North Second Street for J. Hervey Patton, to cost $50,000. M. I. Kast, Harrisburg, Architect.

★**Philadelphia, Pa.**—Contract awarded Ketcham & McQuade, 1029 Brown Street, for erecting four-story, stone parochial school at Fifth Street and Girard Avenue for St. Peter's Roman Catholic Church; cost $90,000.

★Contract awarded William R. Dougherty, 1008 Sanson Street, for erecting two and three-story, brick, stone and terra cottage store building at Front and Dauphin Streets for Armin A. Frankel. Magaziner & Potter, Archts., 603 Chestnut Street.

★G. J. Reich, Broad and Windrim Streets, secured contract to erect a three-story stone and brick dwelling for Francis E. Hennessey to cost $78,000.

★Contract awarded Philip Haibach Contracting Company, 1261 North Twenty-sixth Street, for erecting two-story, 60 x 52 ft., brick and concrete addition to bakery of New York Pie Baking Company; cost $25,000.

★Contract awarded Barclay, White & Company, 1530 Chestnut Street, for erecting two additional stories to warehouse of Frankford Grocery Company, Penn and Unity Streets; cost, $35,000.

★**Pittsburgh, Pa.**—Contract for erecting 30 fireproof dwellings on Bedford Avenue and Kirkpatrick Street awarded to L. E. Ruby of Butler at $134,000. D. A. Crone, Archt., Oliver Building.

★**Athens, Ga.** — Contract awarded Southern Ferro Concrete Company, Atlanta, for erecting the exchange building for Southern Bell Telephone & Telegraph Company, to be 3-story and basement, reinforced concrete foundations, floors and roof and brick and white terra cotta exterior. P. Thornton Marye, Archt., Atlanta.

★**Miami, Fla.**—Contract for remodeling Beers Building recently purchased by Fidelity Bank & Trust Company awarded to St. John Construction Company, Miami; cost, about $50,000.

★**Cleveland, Ohio.**—Contract for erecting 2-story concrete and brick commercial and apartment building for B. Mahler, 711 Electric Building, on Cedar Road near Surrey Road, awarded to National Concrete Fire Proofing Co., 1315 Citizens Building; cost $100,000. Richardson & Yost, Rockefeller Building, Archt.

★**Detroit, Mich.**—Contract for erecting 4 apartment buildings in Detroit for International Realty & Mortgage Co. of New York awarded to C. E. Crump, Wade Building, Cleveland, Ohio; cost $396,000.

★**Omaha, Neb.**—Bankers' Realty Investment Company, Bee Building, reported architects and contractors for St. Regis Apartment House, which the Metropolitan Realty Company intends erecting at Thirty-seventh and Jones Streets; cost, $200,000.

★**Great Falls, Mont.**—Contract for erecting a 20-stall brick and concrete roundhouse at Great Falls for Great Northern Railway Company awarded Grant, Smith & Company, Henry Building, Seattle, Wash., at about $75,000.

★**St. Louis, Mo.**—John Elfert, Oregon Avenue, secured contract to erect a wholesale bakery and store building at Shaw Avenue and Thurman Boulevard for William Saussele, 3900 Shenandoah Avenue; total cost, about $25,000.

★**Olympia, Wash.**—Contract awarded by James Martin for erecting a two-story, brick and concrete business block to L. Larson of Olympia; cost $40,000.

★**La Grande, Ore.**—Contract awarded by Oregon-Washington R.R. & Navigation Co. of Portland for construction of a brick roundhouse to M. J. Hursen Co., Globe Building, Seattle, Wash., at $40,000.

★**Brandon, Man.**—Contract awarded A. E. Bullock, 202 Thirteenth Street, for erecting a general store for Doing, Rankin & Robertson, to cost $50,000.

★**Walkerville, Ont.**—Contract awarded W. Link, Leamington, Ont., for erecting dairy buildings to cost $80,000 for Hiram Walker & Sons.

NEW INDUSTRIAL PLANTS

PROPOSED WORK.

Cranston, R. I.—United Lace Works, Wellington, Conn., will erect a $50,000 addition to plant.

Brooklyn, N. Y.—Edison Electric Illuminating Company of Brooklyn, 360 Pearl Street, has purchased site of Royal Theater at Pearl and Willoughby Streets and intends spending $1,000,000 on extending plant.

Norwich, N. Y.—Contract soon to be let by Charles Kiehm, Gardner Building, Utica, Architect and Engineer, for erecting a 4-story and basement factory, 50 x 137 ft., for the Norwich Pharmacal Company. Cost, '$40,000.

Schenectady, N. Y.—Contract soon to be let by Henry Lindencole, manager American Locomotive Works, North Jay Street, for erecting a one-story 100 x 175-ft. addition to foundry, to cost $30,000.

East Rutherford, N. J.—The Fuchs & Lang Mfg. Company, East Rutherford, intends erecting an addition to their plant on Central Avenue.

Jersey City, N. J.—The Mutual Chemical Co., West Side Avenue, will erect a factory on West Side Avenue; cost $29,000.

The North American Copper Co. (Harold Roberts, Vice-Pres.), 52 Vanderbilt Ave., New York, N. Y., purchased site on Newark Meadows near Jersey City on which to erect a plant for export metal product.

The H. Koppers Co. of Pittsburgh, Pa., has secured site on Newark Meadows near Jersey City as site for a plant.

Blairsville, Pa.—Plant of Brown Packing Co., recently reported destroyed by fire, will be rebuilt.

Philadelphia, Pa. — Harry Parker, Drexel Building, preparing plans for 2-story brick and steel factory, 60 x 100 ft.

Philadelphia, Pa.—Contract soon to be let for erecting four-story, 50 x 100 ft., brick and reinforced concrete factory at Wayne Junction for Leeds & Northrup. Morris & Erskine, Archts., Crozer Building.

Contract will soon be let by A. G. Fisher, 4947 Fairmount Avenue, for erection of a 2-story shop and garage, cost $40,000.

Hess Machine Works, 2512 Callowhill Street, will erect a 2-story machine shop, 52 x 130 ft., at Fifteenth Street and Lancaster Avenue.

Baltimore, Md. — Reported Davidson Chemical Company, Garrett Building, intends erecting a $1,500,000 addition to plant at Curtis Bay.

Charlotte, N. C.—Johnston Manufacturing Company, Charlotte, intends erecting addition and installing 5000 spindles with accompanying equipment; cost complete about $100,000.

Gastonia, N. C.—Seminole Cotton Mills, incorporated with C. B. Armstrong of Gastonia and others, and will build a 6500-spindle mill.

Lumberton, N. C.—Lumberton Cotton Mills will erect a 92 x 72 ft. addition and install 5000 spindles with accompanying machinery.

Brunswick, Ga.—Yaryan Rosin & Turpentine Co., Brunswick, will build a wood pulp factory to cost $200,000.

Plaquemine, La.—W. A. Holloway, Plaquemine, reported interested in organization of a company to construct a $100,000 sugar refinery.

Hattiesburg, Miss.—George R. Wright, Pres. Louisiana Fiber Board Co. of Bogalusa, La., will erect a plant for manufacture of box fiber and paper boxes at a cost of $750,000.

Cincinnati, Ohio.—Harry Hake, Telephone Building, engaged to prepare plans for several brick and steel additions to be erected at the plant of the Cincinnati Iron & Steel Co. on Freeman Avenue.

Plans being prepared by Tait & Nordmeier Engineering Co., St. Louis, Mo., for reinforced concrete plant for the French Brothers-Bauer Co. to be erected at Canal and Plum Streets and cost $300,000. Contract will be let in about six weeks.

Samuel Hannaford & Sons, Sixth and Vine Streets, preparing plans for 3-story concrete and steel, 25 x 94-ft. addition to the Sullivan Printing Works Co., 1054 Gilbert Avenue.

Cleveland, Ohio.—Reported Arthur G. McKee & Co., 1301 Rockefeller Building, will erect a factory at St. Clair Avenue and E. 177th Street; cost about $500,000.

Shelby, Ohio.—Reported improvements costing $500,000 to be made to plant of Ohio Seamless Tube Company.

Toledo, Ohio.—Haughton Elevator & Machine Company, Huron and Lafayette Streets, intends erecting new factory, probably on Spencer Street.

St. Clair Heights, Mich.—Albert Kahn, 58 Lafayette Avenue, Detroit, and Ernest Wilby, are associate architects for plant which the Michigan Stamping Company will erect on Mack Avenue.

★**Peoria, Ill.**—Contract for steel required for three buildings to be erected at plant of Keystone Steel & Wire Company awarded Decatur Bridge Company of Decatur; cost about $250,000.

Des Moines, Iowa.—Reported a factory is to be erected on Grand Avenue for the Ford Motor Co.

St. Paul, Minn.—H. Koppers Company, Pittsburgh, Pa., will erect a coke and gas plant here, costing about $2,000,000.

Argenta, Ark.—The McLean Hardwood Lumber Co. of Buffalo, N. Y., will erect a hardwood lumber mill at Argenta, to be of concrete construction and cost $100,000.

Dallas, Tex.—Cottonseed Oil Co. of Texas will erect in Dallas a cottonseed oil mill with capacity of 150 tons of seed per day; cost $100,000.

Olympia, Wash. — City Council has granted Washington Cement Stave Silo Co. of Olympia permission to erect a factory on Stevens Street.

Seattle, Wash.—Reported Linde Air Products Company, Forty-second Street Building, New York, N. Y., has purchased site at Eighth Avenue South and Henrietta Street, and intends erecting plant of brick and concrete construction, costing about $300,000.

Tacoma, Wash.—Reported pattern plant of Puget Sound Iron & Steel Works, recently destroyed by fire, will be rebuilt.

Portland, Ore.—Reported American Can Company, Failing Building, is having plans prepared for a factory to be erected on east side of Willamette River, in Portland, to take the place of present plant at Front and Thurman Streets.

Portland Woolen Mills (E. L. Thompson, President, Chamber of Commerce Building) intends enlarging plant to include a 2-story, 100 x 80 ft., concrete loom building and a 30 x 100 ft. warehouse.

Oroville, Cal.—Olive Products Company, incorporated with capital of $100,000, and intends erecting olive processing plant. W. P. Hammon, Mining Insurance Exchange Building, reported interested.

San Francisco, Cal.—Reported plant of Rudgear-Merle Company, San Francisco, recently merged with the Simmons Company of Kenosha, Wis., will be enlarged extensively.

★**Twin Falls, Idaho.**—Contract awarded C. F. Dinsmore & Son of Ogden, Utah, for erecting bins, trestles and sheds at plant of Amalgamated Sugar Company; cost about $55,000.

Toronto, Ont.—The Canadian Cycle & Motor Co. (T. A. Russell, Mgr.) will erect additional factory buildings at a cost of $100,000.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Hartford, Conn.**—Contract awarded by J. M. Ney Company, 265 Asylum Street, to Torrington Building Company, 197 Water Street, Torrington, for erecting a brick, 78 x 174½ ft., building on Elm and West Streets, estimated to cost $60,000. Ford Buck & Sheldon, Hartford, Architects.

★**Philadelphia, Pa.**—Contract for erecting a 3-story brick addition to plant of Pringle Electric Co., 1906 North Sixth Street, awarded to Harry Gill, Jr., 2505 Germantown Ave.

★Contract awarded by Electric Storage Battery Company to William Steele & Sons Company, 1600 Arch Street, for erecting 7-story and mezzanine brick and reinforced concrete factory, 115 x 146 ft., on Nineteenth Street and Allegheny Avenue, at a cost of $225,000.

★**Baltimore, Md.**—Contract awarded by Maryland Steel Company of Sparrows Point to Raymond Concrete Pile Company, 140 Cedar Street, New York, for placing concrete piles, reinforced concrete foundations and concrete floors for their No. 3 machine shop at Sparrows Point.

★**Washington, D. C.**—P. F. Gormley Construction Co., 7th and K Streets, N. W., secured contract to erect nine-story, brick, reinforced concrete and steel building at G and Seventeenth Streets, N. W., for Department of Labor.

★**Clinton, Tenn.**—Contract awarded McMurray & LaRue of Knoxville for erecting two-story and basement reinforced concrete, brick and steel addition to plant of Magnet Knitting Mills.

★**Cincinnati, Ohio.**—Contracts awarded as follows for constructing a one-story steel foundry building and four-story re-inforced concrete pattern building for Lunkenheimer Co., Knox & Beekman Streets: Concrete piling, Cranford Construction Co., 407 Gerke Building, Cincinnati; steel, L. Schreiber & Sons Co., Ivanhoe & Montgomery Avenues, Norwood, Ohio; general construction work, Roos Brothers, 2814 Stanton Avenue, Cincinnati. Total cost $75,000. Bert L. Baldwin & Co., mechanical engineers, 72 Perin Building, Cincinnati, will supervise work.

★**Bakersfield, Cal.**—Contract for erecting school awarded M. T. Kean of Bakersfield at $24,320.

★**St. Thomas, Ont.**—Contract for erecting factory for St. Thomas Pure Milk Co. (David Frejd, Mgr.) awarded to Alexander Anderson of St. Thomas at about $50,000. Creamery and pasteurizing equipment to be purchased.

MISCELLANEOUS

PROPOSED WORK.

Transmission Line—Wallingford, Conn.—A 3-phase 11,000-volt transmission line is to be constructed in Wallingford. About 18 miles of No. 6 B. & S. bare copper wire insulators, two 150 kva. transformers, etc., to be purchased. A. L. Pierce, Supt.

Conduit—Bayonne, N. J.—Plans submitted by City Engineer to City Commissioners for a municipally owned conduit system, estimated to cost $40,000.

Conduits—Princeton, N. J.—Public Service Corporation and Bell Telephone Company will place all wires underground.

Lighting Hanover Bridge—Baltimore, Md.—All bids opened May 23 for lighting Hanover Bridge rejected by State Roads Commission, Garrett Building, Baltimore (William L. Marcy, Secretary).

Transmission Line — Benton, Tenn. — The Tennessee Power Co. of Chattanooga contemplates extending transmission line to Benton.

Lamp Post System—Huntington, Ind.—Bonds for $16,900 will be sold June 10 by H. I. Young, City Clerk, for installing lamp post system.

Heating Plant—Helena, Mont.—City Council granted franchise to Gerharz-Jaqueth Engineering Co., Helena, for installation and operation of a central heating plant to cost $250,000.

Causeway—Galveston, Tex.—Board of Causeway Engineers May 23 decided in favor of adopting plans for rehabilitating the causeway prepared by J. L. Harrington of Kansas City, Mo., which provide for a structure of reinforced concrete girders supported by solid concrete piers, approximately 5900 ft., cost $1,500,000.

Transmission Line—Bancroft, Idaho.—Utah Power & Light Company of Salt Lake City, Utah, granted permission to extend electric transmission lines in Southeastern Idaho to serve towns of Alexander and Bancroft.

BIDS DESIRED.

Road Oil—Boston, Mass.—Until June 5, by Department of Supplies (D. Frank Doherty, Supt.), for furnishing to the Public Works Department, Street Cleaning and Oil Service, 200,000 gal., more or less, of emulsified road oil for coming year.

Underpass—Connecticut.—Until June 20 by State Highway Commission, Room 27, Capitol, Hartford, for relocation of an under pass beneath the tracks of the N. Y., N. H. & H. R. R. in town of Windsor, advertised in Engineering Record.

Elevator—New York, N. Y.—Until June 9, by Marcus M. Marks, Pres. Manhattan Borough, for furnishing material and installing electric elevator and equipment in court house, located 170 East 121st Street, Manhattan Borough. Security, $1,500.

Road Oil—Greendale, Ind.—Until June 6, by J. F. Abraham, Town Clerk, for 10,000 gal. road oil.

Chemical Engine and Hose Cart—Butte, Mont.—Until June 21 by A. A. Dockstader, City Clerk, for a motor propelled combination chemical engine and hose car, advertised in Engineering Record.

Elevator—Corpus Christi, Tex.—Until June 22 by James A. Wetmore, Acting Supervising Architest, Washington, D. C., for an electric passenger elevator in U. S. Post Office and Court House at Corpus Christi and also in U. S. Post Office and Court House at Opelika, Fla.

Elevators — Los Angeles, Cal. — Until June 12, by Board Supervisors (A. M. McPherrin, Clerk), for furnishing and installing two electric passenger and two electric freight elevators and three electric dumbwaiters in County Hospital.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Foundation for Power House—New Orleans, La.**—Contract for constructing foundations for Alabama Power Company's new power house on Warrior River awarded Jefferson Construction Company of New Orleans at $45,000.

★**Cement and Sand—Davenport, Iowa.**—Contract awarded Builders Sand & Gravel Company, of Davenport, by Levee Improvement Commission for sand and cement needed during season for levee improvements; cost $32,910.

Stadium—Billings, Mont.—Piper Construction Company, Billings, submitted to County Commissioners lowest bid for constructing the stadium at $66,000.

Proposals

For Proposals Advertised, See Pages 63, 64, 65, 66 and 67

WATERWORKS.

Bids Close.		See Eng. Record.
Jun. 5.	Gate Valves, Etc., St. Paul, Minn. .... Adv. May 13 to 27.	May 13
Jun. 5.	Material, St. Paul, Minn. Adv. May 13 to 27.	May 13
Jun. 5.	Castings, Etc., St. Paul, Minn. .... Adv. May 13 to 27.	May 13
Jun. 5.	C. I. Pipe, Etc., St. Paul, Minn. .... Adv. May 13 to 27.	May 13

Bids Close.		See Eng. Record.
Jun. 5.	Water Works, Everett, Wash. Adv. May 13, 20.	May 13
Jun. 6.	System, Tchula, Miss.	May 20
Jun. 6.	Pumping Units, New Brunswick, N. J. Adv. May 27.	May 27
Jun. 6.	Conduit, Hartford, Conn. Adv. May 27.	May 27
Jun. 7.	Pump, Irvington, N. J.	Jun. 3
Jun. 7.	Gravity System, Aberdeen, Wash.	Jun. 3
Jun. 8.	Pipe, etc., Sierra Madre, Cal.	Jun. 3
Jun. 9.	Repairs to Wells, Whitewater, Wis.	May 27
Jun. 9.	Pipe, etc., Massachusetts.	Jun. 3
Jun. 10.	Water Works, Sheboygan Falls, Wis.	May 27
Jun. 12.	Reservoir, La Porte, Ind. Adv. May 27, June 3.	May 27
Jun. 12.	Screens, St. Paul, Minn.	May 27
Jun. 12.	Meters, Pittsburgh, Pa.	Jun. 3
Jun. 13.	Contract 144, New York, N. Y. Adv. May 20.	May 20
Jun. 15.	Works, Port Arthur, Tex.	May 20
Jun. 15.	System, Oatman, Ariz.	May 20
Jun. 15.	Water Works, Harlowton, Mont. Adv. Jun. 3.	Jun. 3
Jun. 15.	Filtration Plant, Jasper, Ind.	Jun. 3
Jun. 15.	Water Works, Staplehurst, Neb.	Jun. 3
Jun. 16.	Pipe, Panama	Jun. 3
Jun. 17.	Water Works, Winnemucca, Neb.	May 20
Jun. 23.	Meters, Washington, D. C.	Jun. 3
Jun. 26.	Pipe, etc., Panama	Jun. 3
———	Franchise, Williamsburg, Va. Adv. May 27, June 3.	May 27

SEWERAGE AND SEWAGE DISPOSAL.

Bids Close.		See Eng. Record.
Jun. 6.	Alliance, Ohio Adv. May 20.	May 20
Jun. 6.	Johnson City, Tenn.	May 27
Jun. 6.	Shelby, N. C.	May 27
Jun. 6.	Wilson, Conn.	May 27
Jun. 6.	Logansport, Ind.	Jun. 3
Jun. 6.	Toronto, Ont.	Jun. 3
Jun. 7.	Dayton, Ohio Adv. May 27, June 3.	May 27
Jun. 7.	Brooklyn, N. Y.	May 27
Jun. 7.	Waverly, Iowa	May 27
Jun. 7.	Brooklyn, N. Y.	Jun. 3
Jun. 8.	Milwaukee, Wis. (2 Props.) Adv. May 20 to June 3.	May 20
Jun. 8.	Lincoln, Neb.	Jun. 3
Jun. 9.	Ainsworth, Neb.	May 27
Jun. 12.	Redondo Beach, Cal.	Jun. 3
Jun. 13.	Point Pleasant, N. J. Adv. Jun. 3.	Jun. 3
Jun. 13.	Newark, N. J.	Jun. 3
Jun. 14.	Afton, Okla.	May 27
Jun. 15.	Xenia, Ohio	May 20
July 15.	Salem, Ill.	May 20
Jun. 15.	Oakesdale, Wash.	May 27
Jun. 15.	Lodi, N. J.	Jun. 3
Jun. 15.	Harlowton, Mont. Adv. Jun. 3.	Jun. 3
Jun. 15.	Richmond, Va.	Jun. 3
Jun. 19.	Columbus, Mont.	Jun. 3
Jun. 19.	Little Falls, N. J. Adv. Jun. 3.	Jun. 3
Jun. 20.	McComb, Miss.	May 27
Jun. 20.	Michigan City, Ind.	Jun. 3
Jun. 22.	Milwaukee, Wis. Adv. Jun. 3.	Jun. 3
Jun. 22.	The Pas, Man.	Jun. 3
Jun. 26.	Tucson, Ariz. Adv. Jun. 3.	Jun. 3

BRIDGES.

Bids Close.		See Eng. Record.
Jun. 5.	Des Moines, Iowa	Jun. 3
Jun. 6.	Hayti, S. D.	May 13
Jun. 6.	Brookings, S. D.	May 20
Jun. 6.	Montrose, S. D.	May 20
Jun. 6.	Huron, S. D.	May 20
Jun. 6.	Wabash, Ind.	May 20
Jun. 6.	Macon, Miss.	May 20
Jun. 6.	Flora, Miss.	May 27
Jun. 6.	Brainerd, Minn.	May 27
Jun. 6.	Little Falls, Minn.	May 27
June 6.	Woonsocket, S. D.	May 27
June 6.	Indiana	May 27
Jun. 6.	Canton, Miss.	May 27
Jun. 6.	Chandler, Okla.	Jun. 3
Jun. 6.	Mt. Vernon, Wash	Jun. 3
Jun. 6.	Castlewood, S. D.	Jun. 3
Jun. 6.	Madison, S. D.	Jun. 3
Jun. 6.	San Luis Obispo, Cal.	Jun. 3
Jun. 6.	Richmond, Va.	Jun. 3
Jun. 6.	Seneca, Kan.	Jun. 3
Jun. 6.	Plankinton, S. D.	Jun. 3
Jun. 6.	Petersburg, Ind.	Jun. 3
Jun. 6.	Salem, S. D.	Jun. 3
Jun. 6.	Mitchell, S. D.	Jun. 3
Jun. 7.	Macomb, Ill.	Jun. 3
Jun. 7.	Fond du Lac, Wis.	Jun. 3
Jun. 8.	El Dorado, Kan.	Apr. 8
Jun. 8.	Ft. Lauderdale, Fla.	May 20
Jun. 8.	London, Ky.	May 27
Jun. 8.	Humboldt, Iowa	Jun. 3
Jun. 8.	Bakersfield, Cal.	Jun. 3
Jun. 8.	Loch Haven, Pa.	Jun. 3
Jun. 8.	Westchester, Pa.	Jun. 3
Jun. 8.	Dallas, Ore.	Jun. 3
Jun. 9.	Salem, N. J.	May 27
Jun. 9.	Madison, Wis.	May 27
Jun. 9.	Clarksville, Ga.	Jun. 3
Jun 10.	Carlyle, Ill.	Jun. 3
Jun. 12.	Wahpeton, N. D.	Jun. 3
Jun. 12.	Plainfield, N. J.	Jun. 3
Jun. 13.	Philadelphia, Pa. Adv. May 20.	May 20
Jun. 13.	Modesto, Cal.	May 27
Jun. 15.	Cumberland, Md. Adv. June 3.	Jun. 3
Jun. 15.	Russell, Man.	Jun. 3
Jun. 17.	Lewisburg, Pa.	Jun. 3
Jun. 19.	Linton, N. D.	Jun. 3
Jun. 19.	Benton Harbor, Mich. (3 Props.) Adv. Jun. 3.	Jun. 3
Jun. 19.	Beaverton, Mich. Adv. Jun. 3.	Jun. 3
Jun. 19.	Bonds, Beaverton, Mich. Adv. Jun. 3.	Jun. 3
Jun. 19.	Sheridan, Wyo.	Jun. 3
Jun. 20.	Illinois	May 27
Jun. 20.	Las Cruces, N. M.	Jun. 3
Jun. 20.	Indianapolis, Ind.	Jun. 3
Jun. 20.	Connecticut Adv. Jun. 3.	Jun. 3
Jun. 22.	Perry, N. Y. Adv. Jun. 3.	Jun. 3
Jun. 26.	Clintwood, Va.	May 20

PAVING AND ROADS.

Bids Close.		See Eng. Record.
Jun. 6.	Port Jervis, N. Y. Adv. May 13, 20.	May 13
Jun. 6.	Cleveland Heights (P. O. Warrenville), Ohio	May 13
July 5.	Terrabonne, La. Adv. May 13.	May 13
Jun. 6.	Albany, N. Y. Adv. May 20 to June 3.	May 20
Jun. 6.	Hackensack, N. J. Adv. May 20, 27.	May 20
Jun. 6.	Elmira, N. Y. Adv. May 27, June 3.	May 27
Jun. 6.	Kalamazoo, Mich. Adv. May 27, June 3.	May 27
Jun. 6.	Boston, Mass.	Jun. 3
Jun. 6.	Indiana	May 13
Jun. 6.	Vincennes, Ind. Adv. May 20.	May 20
Jun. 6.	Billings, Mont.	May 20
Jun. 6.	Papillion, Neb.	May 20
Jun. 6.	South Bend, Wash.	May 20
Jun. 6.	New Orleans, La.	May 20
Jun. 6.	Indiana	May 20
Jun. 6.	Stockton, Cal.	May 20
Jun. 6.	Shelby, N. C.	May 27
Jun. 6.	Vancouver, Wash.	May 27
Jun. 6.	Ephrata, Wash.	May 27
Jun. 6.	Fort Worth, Tex.	May 27
Jun. 6.	Johnson City, Tenn.	May 27
Jun. 6.	New Wilmington, Pa.	May 27
Jun. 6.	Dayton, Ohio Adv. May 27, June 3.	May 27
Jun. 6.	Georgetown, Del. Adv. May 27.	May 27
Jun. 6.	Indiana	May 27
Jun. 6.	Paterson, N. J.	May 27
Jun. 6.	Papillion, Neb.	Jun. 3
Jun. 6.	Madisonville, Tenn.	Jun. 3
Jun. 6.	Frankfort, Tenn.	Jun. 3
Jun. 6.	Sultan, Wash.	Jun. 6
Jun. 6.	Phoenix, Ariz.	Jun. 6
Jun. 6.	Manheim, Pa.	Jun. 3
Jun. 6.	Bedford, Pa.	Jun. 3
Jun. 6.	Massachusetts	Jun. 3
Jun. 6.	Indiana	Jun. 3
Jun. 6.	Kansas City, Mo.	Jun. 3
Jun. 7.	Sultan, Wash.	May 13
Jun. 7.	Palatka, Fla. Adv. May 6 to 20.	May 6
Jun. 7.	Albany, N. Y. Adv. May 20, 27.	May 20
Jun. 7.	Cedarville, Ohio	May 20
Jun. 7.	Indiana	May 20
Jun. 7.	Ann Arbor, Mich.	May 27
Jun. 7.	Morrison, Ill.	May 27
Jun. 7.	Columbus, Ind.	May 27
Jun. 7.	Indiana	May 27
Jun. 7.	Brooklyn, N. Y.	Jun. 3
Jun. 7.	Long Island City, L. I., N. Y.	Jun. 3
Jun. 7.	Sterling, Ill.	Jun. 3
Jun. 7.	Illinois	Jun. 3
Jun. 7.	Baltimore, Md.	Jun. 3
Jun. 7.	Riverside, Cal.	Jun. 3
Jun. 7.	Dillon, Mont.	Jun. 3
Jun. 7.	Indianapolis, Ind.	Jun. 3
Jun. 7.	Indiana	Jun. 3
Jun. 7.	Madison, Wis.	Jun. 3
Jun. 7.	McConnellsville, Ohio	Jun. 3
Jun. 8.	Tallahassee, Fla.	May 29
Jun. 8.	Kiefer, Okla.	May 20
Jun. 8.	Bakersfield, Cal.	May 20
Jun. 8.	Glenwood Springs, Col.	May 20
Jun. 8.	Indiana	May 27
Jun. 8.	Madison, Ind.	Jun. 3
Jun. 8.	Indiana	Jun. 3
Jun. 8.	Steubenville, Ohio	Jun. 3
Jun. 8.	Bakersfield, Cal.	Jun. 3
Jun. 9.	Cincinnati, Ohio	May 27
Jun. 9.	Buffalo, N. Y.	Jun. 3
Jun. 9.	Madisonville, Tenn.	Jun. 3
July 10.	Caldwell, Tex.	Apr. 22
Jun. 10.	Wichita, Kan.	May 13
Jun. 10.	Sanford, Fla.	May 27
Jun. 10.	Bradentown, Fla.	Jun. 3
Jun. 10.	Indiana	Jun. 3
Jun. 12.	Jefferson, Ohio	May 20
Jun. 12.	Euclid, Ohio	May 20
Jun. 12.	New Orleans, La.	May 27
Jun. 12.	Washington	May 27
Jun. 12.	Indiana	May 27
Jun. 12.	Milburn, N. J.	May 27
Jun. 12.	Dunn, N. C. Adv. May 20 to June 3.	May 20
Jun. 12.	Everett, Wash.	Jun. 3
Jun. 12.	Rustburg, Va.	Jun. 3
Jun. 12.	Kingwood, W. Va.	Jun. 3
Jun. 12.	Freeport, Ill. Adv. Jun. 3.	Jun. 3
Jun. 12.	North Yakima, Wash.	Jun. 3
Jun. 12.	Marlinton, W. Va.	Jun. 3
Jun. 12.	Montclair, N. J. Adv. Jun. 3.	Jun. 3
Jun. 12.	Malone, N. Y. Adv. Jun. 3.	Jun. 3
Jun. 12.	Indiana	Jun. 3
Jun. 12.	Cincinnati, Ohio	Jun. 3
Jun. 12.	Winamac, Ind.	Jun. 3
Jun. 13.	Janesville, Wis.	May 27
Jun. 13.	Pennsylvania Adv. May 27, June 3.	May 27
Jun. 13.	St. Louis, Mo.	Jun. 3
Jun. 13.	Trenton, N. J.	Jun. 3
Jun. 14.	Eaton, Ohio Adv. May 20, 27.	May 20
Jun. 14.	Paterson, N. J.	Jun. 3
Jun. 15.	Greenfield, Ohio	May 20
Jun. 15.	Zanesville, Ohio	May 27
Jun. 15.	Fowler, Cal.	May 27
Jun. 15.	Carthage, Mo.	Jun. 3
Jun. 15.	Hagerstown, Md.	Jun. 3
Jun. 16.	Indiana	May 27
Jun. 16.	Van Wert, Ohio Adv. (4 Props.) Jun. 3.	Jun. 3
Jun. 16.	Tacoma, Wash.	Jun. 3
Jun. 17.	Dolgeville, N. Y. Adv. May 27, June 3.	May 27
Jun. 17.	Brooklyn, N. Y.	Jun. 3
Jun. 17.	Monticello, N. Y. Adv. Jun. 3.	Jun. 3
Jun. 19.	Cresson, Pa.	Jun. 3
Jun. 19.	Montesano, Wash.	Jun. 3
Jun. 19.	Seattle, Wash.	Jun. 3
Jun. 19.	Cuyahoga Falls, Ohio	Jun. 3
Jun. 19.	Everett, Wash.	Jun. 3
Jun. 19.	Traer, Iowa	Jun. 3
Jun. 20.	Rockville Center, Wis. Adv. May 27.	May 27
Jun. 21.	Charleston, Miss.	May 27
Jun. 21.	Sebring, Fla.	May 27
Jun. 21.	Vernon, Ala.	May 27
Jun. 25.	Indiana	May 27
Jun. 26.	Washington, Pa.	Jun. 3
Jun. 26.	Cedar Rapids, Iowa	Jun. 3
Jun. 27.	Salt Lake City, Utah	May 13
Jun. 27.	Jackson, Tenn. Adv. Jun. 3.	Jun. 3
Jun. 29.	New Martinsville, W. Va. Adv. May 27, June 3.	May 27
Jun. 30.	Indiana	Jun. 3
July 1.	Maumee, Ohio	May 27
July 1.	Mobile, Ala.	May 27
July 1.	Bay Minette, Ala.	Jun. 3
July 5.	Indiana	Jun. 3
July 5.	Houma, La.	Jun. 3
July 10.	Greenwood, Miss.	May 20

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS.

Bids Close.		See Eng. Record.
Jun. 6.	Dredging, Trenton, N. J.	May 27
Jun. 6.	Drainage, Monroe, Ga.	Jun. 3
Jun. 6.	Levee, Clarksville, Miss. Adv. May 27, June 3.	May 27
Jun. 6.	Drainage, Algona, Iowa.	Jun. 3
Jun. 6.	Drainage, Estherville, Ia.	Jun. 3
Jun. 7.	Cleaning Channel, Newark, Ohio	May 20
Jun. 7.	Dam, Lock Haven, Pa. Adv. May 27, June 3.	May 27
Jun. 7.	Wharf Improv., Seattle, Wash.	May 27
Jun. 7.	Dredging, Wareham, Mass.	Jun. 3
Jun. 8.	Rip rap, Tompkinsville, N. Y.	May 20
Jun. 8.	Wharf, New Orleans, La.	May 27
Jun. 8.	Pier, New London, Conn.	Jun. 3
Jun. 10.	Flood Protection, Ray, Ariz. Adv. May 13, 20.	May 13
Jun. 10.	Dredging, Michigan City, Ind. Adv. May 20 to June 3.	May 20
Jun. 10.	Levee, Vicksburg, Miss. Adv. Jun. 3.	Jun. 3
Jun. 10.	Wharf Addition, Fort Constitution, N. H.	Jun. 3
Jun. 10.	Breakwater, Chicago, Ill.	Jun. 3
Jun. 12.	Dredging, Philadelphia, Pa. Adv. May 20.	May 20
Jun. 12.	Dredging, Providence, R. I. Adv. May 27, June 3.	May 27
Jun. 16.	Irrigation, Payson City, Utah Adv. May 6.	May 6
Jun. 15.	Irrigation, Hermiston, Ore. Adv. May 13.	May 13
Jun. 15.	Dredging, Baltimore, Md. Adv. May 20 to June 3.	May 20
Jun. 15.	Improv. Creek, Belleville, Ill.	May 20
Jun. 16.	Water Power Lease, Joliet, Ill. Adv. May 20 to June 3.	May 20
Jun. 16.	Irrigation, Grandview, Wash.	Jun. 3
Jun. 15.	Dike, Oretown, Ore.	Jun. 3
Jun. 16.	Ditch, Morris, Minn.	Jun. 3
Jun. 16.	Ditch, Winamac, Ind.	Jun. 3
Jun. 17.	Ditch, Winamac, Ind.	Jun. 3
Jun. 19.	Seawall, Bridgeport, Conn. Adv. May 27, June 3.	May 27
Jun. 20.	Stone, New Orleans, La. Adv. May 27, June 3.	May 27
Jun. 20.	Willows, New Orleans, La. Adv. May 27, June 3.	May 27
Jun. 22.	Irrigation, Malta, Mont. Adv. May 13.	May 13
Jun. 24.	Irriga., Balmorhea, Tex.	May 27
Jun. 30.	Dredging, Baltimore, Md. Adv. June 3.	Jun. 3
July 1.	Drainage, Boston, Mass.	Jun. 3
Jul. 3.	Jetty, Gardiner, Ore.	May 27

PUBLIC BUILDINGS AND SCHOOLS.

Bids Close.		See Eng. Record.
Jun. 6.	Waynesville, N. C.	May 13
Jun. 6.	Geneva, Ill.	May 13
Jun. 6.	Chambersburg, Pa.	May 20
Jun. 6.	North Arlington, N. J.	May 20
Jun. 6.	Leoti, Kan.	May 20
Jun. 6.	Red Cloud, Neb	May 20
Jun. 6.	Leesburg, Ga.	Jun. 3
Jun. 6.	Houston, Tex.	Jun. 3
Jun. 6.	Benton, Wis.	Jun. 3
Jun. 6.	Red Cloud, Neb.	Jun. 3
Jun. 6.	Ewing, Neb.	Jun. 3
Jun. 6.	Belleville, Ill.	Jun. 3
Jun. 7.	Portland, Me.	May 6
Jun. 7.	Early, Iowa	May 20
Jun. 7.	Mandan, N. D.	May 27
Jun. 7.	Brooklyn, N. Y.	May 27
Jun. 7.	Shelburne Falls, Mass.	May 27
Jun. 7.	Coalton, Ohio	Jun. 3
Jun. 7.	Gulfport, Miss.	Jun. 3
Jun. 7.	Hamilton, Ont.	Jun. 3
Jun. 8.	Pineville, W. Va.	Apr. 29
Jun. 8.	Marysville, Tenn.	May 6
Jun. 8.	Waynesville, N. C.	May 6
Jun. 8.	Manistique, Mich.	May 20
Jun. 8.	Beloit, Ohio	May 20
Jun. 8.	Spencerville, Ohio	Jun. 3
Jun. 8.	London, Ont.	Jun. 3
Jun. 8.	Huntington, Ind.	Jun. 3
Jun. 9.	Atwater, Ohio	May 27
Jun. 9.	Lincoln, Neb.	May 27
Jun. 9.	New Smyrna, Fla.	May 27
Jun. 9.	Grand Rapids, Ohio	Jun. 3
Jun. 9.	Avalon, Cal.	Jun. 3
Jun. 10.	Irvington, Ind.	May 13
Jun. 10.	Hanover, Ohio	May 20
Jun. 10.	Hanover, Ohio.	Jun. 3
Jun. 10.	Cheshire, Ohio	Jun. 3
Jun. 10.	Scott City, Kan.	Jun. 3
Jun. 10.	Ford City, Ont.	Jun. 3
Jun. 10.	Rockwell City, Iowa	Jun. 3
Jun. 10.	East Cambridge, Mass.	Jun. 3
Jun. 12.	Newell, Iowa	May 20
Jun. 12.	Elmira, N. Y. Adv. May 20 to June 3.	May 20
Jun. 12.	Baker, Ore.	May 27
Jun. 12.	Wasco, Cal.	Jun. 3
Jun. 12.	New Brunswick, N. J.	Jun. 3
Jun. 12.	Osmond, Neb.	Jun. 3
Jun. 12.	Richards, Mo.	Jun. 3
Jun. 13.	Trenton, N. J. Adv. May 20 to June 3.	May 20
Jun. 13.	Illinois	May 20
Jun. 13.	New York, N. Y. Adv. May 20.	May 20
Jun. 13.	Pennsylvania	Jun. 3
Jun. 14.	Seattle, Wash.	Jun. 3
Jun. 15.	South Boston, Va.	May 20
Jun. 15.	Sidney, Mont.	May 27
Jun. 15.	Columbia Station, Ohio	May 27
Jun. 15.	Ithaca, N. Y.	Jun. 3
Jun. 15.	Wall Lake, Iowa	Jun. 3
Jun. 16.	Middletown, Ohio	May 13
Jun. 16.	Leesburg, Ohio	May 27
Jun. 19.	Neenah, Wis. Adv. May 13, 20.	May 13
Jun. 19.	Sulphur Grove, Ohio	Jun. 3
Jun. 20.	Putnam, Conn.	May 20
Jun. 20.	Springdale, Iowa	May 20
Jun. 20.	Dunn Center, N. D.	May 27
Jun. 20.	Dayton, Ohio	Jun. 3
Jun. 20.	Waterloo, N. Y.	Jun. 3
Jun. 21.	Douglas, Ariz.	May 20
Jun. 21.	Kildeer, N. D.	May 27
Jun. 21.	Pittsburgh, Pa. Adv. May 27, June 3.	May 27
Jun. 22.	Minden, La.	May 20
Jun. 22.	Rumford, Me.	May 27
Jun. 22.	Ansonia, Ohio	Jun. 3
Jun. 23.	Washington, Ind. Adv. May 27, June 3.	May 27
Jun. 23.	Alliance, Ohio	May 27
Jun. 24.	Quincy, Pa.	Jun. 3
Jun. 25.	Albuquerque, N. M.	May 27
Jun. 26.	Redfield, S. D. Adv. May 20, 27.	May 20
Jun. 26.	Grinnell, Iowa	May 27
Jun. 26.	Pottstown, Pa.	Jun. 3
Jun. 26.	Lake Linden, Mich.	Jun. 3
Jun. 27.	Lewis, Iowa	May 27
Jun. 27.	Erie, Pa. Adv. June 3.	May 27
Jun. 27.	Rochester, N. Y. Adv. May 27.	May 27
Jun. 28.	New Albany, Ind.	Jun. 3
July 1.	Webb City, Mo. Adv. Jun. 3.	Jun. 3

PRIVATE BUILDINGS.

Bids Close.		See Eng. Record.
Jun. 6.	Alexandria, Minn.	May 27
Jun. 6.	Parshall, N. D.	Jun. 3
Jun. 10.	Sturgeon Bay, Wis.	Jun. 3
Jun. 13.	Chicago, Ill.	May 13
Jun. 15.	Ellendale, N. D.	Jun. 3
Jun. 15.	Fullerton, N. D.	Jun. 3
Jun. 31.	Private Bldg., Cincinnati, Ohio	May 27
July 1.	New Orleans, La.	May 20
July 1.	Grand Island, Neb.	May 20

NEW INDUSTRIAL PLANTS.

Bids Close.		See Eng. Record.
Jun. 7.	Philadelphia, Pa.	Jun. 3
Jun. 15.	Port Arthur, Tex. Adv. May 27.	May 27

MISCELLANEOUS.

Bids Close.		See Eng. Record.
Jun. 5.	Road Oil, Boston Mass.	Jun. 3
Jun. 6.	Engine, Richland Center, Wis.	May 27
Jun. 6.	Conduit, Hartford, Conn. Adv. May 27.	May 27
Jun. 6.	Garbage Disposal, Orange N. J.	Jun. 3
Jun. 6.	Road Oil, Greendale, Ind.	Jun. 3
Jun. 7.	Cranes, Seattle, Wash.	May 27
Jun. 9.	Steamer, Washington, D. C. Adv. May 13 to June 3.	May 13
Jun. 9.	Elevator, New York, N. Y.	Jun. 3
Jun. 10.	Stairs, etc., Lockport, Ill.	May 20
Jun. 12.	Coal, Norfolk, Va. Adv. May 13, June 3.	May 13
Jun. 12.	Platform, Minneapolis, Minn.	May 12
Jun. 12.	Mail Lifts, Cincinnati, O.	May 27
Jun. 12.	Elevator, Boone, Iowa	May 27
Jun. 12.	Smokestack, Olympia, Wash.	May 27
Jun. 12.	Elevators, Los Angeles, Cal.	Jun. 3
Jun. 14.	Boilers for Ice Boat, Baltimore, Md. Adv. May 27, June 3.	May 27
Jun. 20.	Underpass, Connecticut Adv. Jun. 3.	Jun. 3
Jun. 21.	Chemical Engine, etc., Butte, Mont. Adv. Jun. 3.	Jun. 3
Jun. 22.	Elevator, Corpus Christi, Tex.	Jun. 3
Jun. 30.	Mechanical Mail Handling Appar., New York, N. Y.	May 12
July 17.	Mail Handling Device, New Orleans, La.	May 27
———	El. Rys., New York, N. Y. Adv. Apr. 29 to May 13.	Apr. 29

Price Advances Not So Serious a Handicap to Construction As Steel Market Has Caused Many to Think

Considered in Connection with Total Consumption of Each Material and Proportion of Material Cost to Entire Cost of Projects, Increases Shrink in Importance—Cement Statistics to 1916 Show Industry Has Been Normal

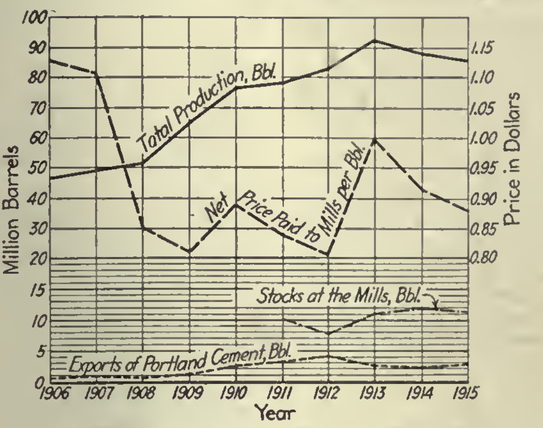
AN ESTIMATE of the real meaning of the price advances of several important construction materials during the past few months indicates that the rise in material prices alone probably has not increased the cost of construction projects even as much as 10 per cent above the low levels at which materials were sold a year ago, even under the assumption that all materials for a given project are bought at top prices. It is a question as to whether such an advance would have any effect, in times of abundant money and a good market for manufactured products, in curtailing construction. It appears, therefore, that the labor situation, uncertainty as to the effect of the conclusion of the war on conditions in this country, and, to a large extent at present, political uncertainty, are factors which have relatively far more to do with the current volume of building work than the market for construction materials.

In order to appreciate the meaning of percentage increases in market prices it is necessary to consider the relative quantities used in construction work of the materials whose prices have changed. In the accompanying table are given the absolute prices one year ago and at the present time, with the absolute per cent of change, for certain important construction materials for which statistics are available. In order to form an estimate of the per cent by which these price advances have increased the cost of the materials for any given project, it is necessary to weight the percentage of change for each according to the cost of each commodity in relation to the total material cost of the project. As it is not possible to do this directly, the percentages have been weighted in accordance with the average monthly value of the total output of each commodity sold for construction purposes in this country. While government statistics provide more or less accurate figures for a number of these monthly values, several of them, including structural steel and lumber, are estimates. These, however, are thought to be close enough for purposes of comparison.

	Price June, 1915	Price June, 1916	Per Cent Change	Mill Value of One Month's Consumption at 1915 Prices
Structural steel, per 100 lb., Pittsburgh..	$1.20	$2.60	+117	$3,600,000
No. 28 black sheets, per 100 lb., Pittsburgh..	1.90	3.00	+58	....
Black steel pipe, per ton, Pittsburgh.....	44.00	64.00	+45	....
Cast-iron pipe, per ton, tidewater	22.50	30.50	+35	....
Cement, average five leading cities.......	1.15	1.47	+28	10,800,000
12-in. sewer pipe, per ft., New York......	.20	.27	+35	1,200,000
Common brick, per 1000, New York.....	6.00	8.25	+37	3,700,000
Crushed stone, per cu. yd., New York......	.95	.90	—6	2,500,000
Gravel, per cu. yd., New York..........	.85	.80	—7	750,000
Pine and fir..........	...	...	+20	10,000,000

If the percentage of change in unit price for structural steel, cement, sewer pipe, brick, gravel, crushed stone and lumber be weighted in proportion to the monthly consumption of each at 1915 prices, it will be found that the cost of a hypothetical project which used each of these commodities in this proportion, and which required no other materials, would be increased (in respect only to the cost of materials) by 33 per cent. Material costs, however, are only a part of the cost of construction projects. On some projects, for instance, land values and other expenses of the promoters will amount to 35 per cent of the total project. Another 35 per cent of the total cost will be made up of labor, tools and overhead expenses in connection with the construction. The materials used would thus represent only 30 per cent of the total cost. On this basis, the entire cost of the project would be increased by these price advances somewhat less than 10 per cent.

It will be noted that two commodities in this list, of each of which three times as much is consumed as of any of the other materials, have advanced but little in price as compared with structural steel. Of these two, cement has for some time been selling at a very low figure, as is illustrated by the diagram published herewith, which figures issued this week by the U. S. Geological Survey have made it possible to bring up to Jan. 1 of this year. The other important material, lumber, the total value of which used monthly in construction work is probably in excess of the figure given, cannot be said to command an abnormal price at present. While the lumber price situation is much confused by freight rates and embargoes, lack of water transportation and other cross currents, it is the general opinion that prices are below the level of 1912, which is usually considered the last year in which the lumber industry as a whole was able to make a profit.



THE CEMENT INDUSTRY FOR PAST TEN YEARS

Points on the vertical lines show average or total for the year. Curves connect these points, but do not show the trend within the year.

In addition to the conclusion that the actual increase in cost of materials for construction projects is considerably below what is indicated by surface conditions, it is evident that prices on the whole have not advanced unduly above the normal line. Everyone will admit that this normal line lies considerably above the low material prices which have ruled since the outbreak of the war. It appears likely, therefore, that material prices should not curtail the volume of construction work, in view of the present favorable financial conditions. Moreover, if the political situation is cleared up in such a way as to indicate a return of the Republican party to power, new construction work is likely to be limited only by the supply of labor. That this is being anticipated is shown by building permits for May exceeding those of 1913, 1914 and 1915.

Buildings

The more important projects in a large volume of building noted in this issue are summarized in the following table:

	Kind of Building	Value
Contracts awarded:		
Newport, R. I........	Post office..........	$224,996
Lincoln Park, N. J....	Factory buildings...	2,000,000
Poughkeepsie, N. Y...	Railroad station.....	340,000
Baltimore, Md........	Country house......	300,000
Chester, Pa..........	Office building......	350,000
Cleveland, Ohio.......	Hospital	435,000
Seattle, Wash........	Department store...	1,000,000
Sherbrooke, Que......	Cathedral	175,000
Cote des Neiges Quest, Que...............	College building	200,000
Winnipeg, Man.......	Bank building.......	600,000
Bids desired:		
London, Ont..........	School building.....	300,000
Proposed work:		
New York City.......	Hospital	200,000
New York City.......	Brick tenements.....	600,000
Brooklyn, N. Y.......	Factory building....	200,000
Cleveland, Ohio.......	Library	2,000,000
Portsmouth, Ohio.....	Railroad station.....	450,000
Chicago, Ill..........	Club building.......	500,000
Woodriver, Ill........	Cannery	1,000,000
New Orleans, La......	Theater	200,000
Joplin, Mo...........	School	300,000
St. Paul, Minn........	Packing plant.......	500,000
Avalon, Cal..........	Amusement park....	400,000

Bridges and Roads

A bridge contract has been awarded at $116,000 at Warren, Pa. A concrete viaduct superstructure contracted for at Des Moines, Iowa, will cost $49,000. Engineers have been engaged to design a $300,000 bridge at Harrisburg, Pa. The sum of $725,000 for trafficway and viaduct construction has been voted at Kansas City. Engineers have been engaged to design a $250,000 concrete arch bridge at Salem, Ore.

Important road and paving work noted in this issue is summarized below:

	Kind	Value or Quantity
Contracts awarded:		
Hartford, Conn.......	Paving	$500,000
Carbondale, Pa.......	Brick	150,000
Charleston, Ill.......	Highways	254,000
Harrisburg, Ill.......	Paving	157,000
Amarillo, Tex........	Paving	117,600
Tacoma, Wash.......	Paving	95,950
Bids desired:		
Greenwich, Conn.....	Concrete	43,500 sq. yd.
New York State......	Highways	20 mi.
Perth Amboy, N. J....	Asphalt block....	34,000 sq. yd.
Ohio	Highways	$1,355,402
Pine Bluff, Ark.......	Macadam	289,600
Minot, N. D..........	Paving	85,000
Proposed work:		
Connecticut..........	Highways	350,000
Elizabeth, N. J.......	Paving	297,469
Buffalo, N. Y.........	Paving	103,000
Cincinnati, Ohio......	Granite block.......	432,000
Somerset, Ky.........	Highways	300,000
Lakeland, Fla........	Highways	2,500,000
Yazoo, Mich	Highways	625,000
Jennings, La.........	Highways	500,000
Monroe, La..........	Highways	500,000
Medford, Ore.........	Highways	300,000
Coquille, Ore.........	Highways	362,000
Los Angeles, Cal......	Highways	468,970
Montreal, Que........	Asphalt	250,000
Toronto, Ont.........	Highways	150,000

Waterworks and Sewers

Bids have been opened in Long Island City, N. Y., for two sections of sewer work to cost $114,000. Two contracts amounting to $167,000 have been awarded on the Passaic sewer at Newark, N. J. Bids are desired for constructing a waterworks system at Harrison, Ark. A filtration plant costing $55,000 will be let June 28 at St. Hyacinth, Que. A sewage disposal plant to cost $400,000 will come up for letting June 23 at Houston, Tex.

Engineers have been engaged for water supply and sewage systems to cost $3,000,000 at Chappaqua, N. Y. Improvements to the waterworks of Savannah, Ga., are estimated to cost $300,000. Sewer construction proposed at Grand Rapids, Mich., will cost $160,000. Plans have been prepared at Emmetsburg, Iowa, for a $100,000 storm sewer. Permission has been applied for to improve the Sweetwater reservoir at San Diego, Cal., at a cost of $100,000. Waterworks construction costing $230,000 is contemplated at St. John, N. B.

Miscellaneous

Contracts for two subway sections and for station finish have been awarded in New York City at a total of $3,626,000, and bids have been opened on another station-finish contract to cost $316,000. A contract for improving 283 miles of railroad, including the elimination of grade crossings, has been awarded at Asheville, N. C. A drainage contract amounting to $167,000 has been awarded at Billings, Mont. The construction of a $1,750,000 railway line has been contracted for at Fredericton, N. B.

Bids are desired in New York City for pier work on which $136,000 security will be required. A contract for drainage work to cost $275,000 will soon be let at Paducah, Ky. It is reported that railroad improvements costing $500,000 are planned at Richmond, Ind. Another report of proposed railroad work concerns improvements costing $2,000,000 to the Chicago, Burlington & Quincy. The construction of a branch railroad costing $200,000 is proposed at Pendry, Mont. Surveys are being made, it is said, for 150 miles of electric railway near Porterville, Cal. Plans are being prepared at Windsor, Ont., for a $175,000 dock.

CONTRACTING NEWS

Of Special Interest to Engineers, Contractors, Builders and Manufacturers of Engineering and Building Supplies

WATERWORKS

PROPOSED WORK.

Lawrence, Mass.—Filter plant to be constructed in this city at a cost of $60,000 will be built by the city with day labor under direction of John F. Finnegan, Director of Engineering. A. D. Marble, City Engineer.

Pittsfield, Mass.—Council passed ordinance appropriating $15,000 for water main extensions and $10,000 for sewer extensions. Address City Clerk.

Salem, Mass.—All bids opened May 23, by Public Works Department, for laying pipe across Danvers and North Rivers have been rejected. New proposals to be asked. W. S. Johnson, 10 Tremont Street, Boston, Engineer.

Lawrence, R. I.—City Council voted $60,000 bonds for improvements to filtering plant. Address City Clerk.

Chappaqua, N. Y.—Hansen & Coulter, 2 Rector Street, New York, engineers for the water supply and sewerage and sewage disposal systems, to cost $3,000,000.

Elmira, N. Y.—Contract soon to be let for a 7,500,000 gal. capacity pump, propelled by electricity to be installed in the pumping station. Harry M. Beardsley, General Manager Water Board.

Mount Vernon, N. Y.—Governor Whitman has signed a bill permitting towns of Westchester County to acquire their own piping system and connect with the New York water supply. Mount Vernon is taking steps to acquire a system and make connections. Address Mayor.

Red Creek, N. Y.—Contract will be let about July by J. M. Jones, Village Clerk, for constructing water works to cost $30,000, to include two triplex pumps 200,000 gal. each in 24 hours, elevated tank 100,000 gal., 38 hydrants, etc. H. C. Kittredge, Engineer, Rochester.

Syracuse, N. .Y.—Contract will let about end of June for hydrants and valves. Address Board of Contract & Supply. G. F. Browning, Engineer, Syracuse.

Yonkers, N. Y.—Water bonds for $160,000 will be sold June 15 by Jos. Miller, City Comptroller.

Mount Holly, N. J.—Township Committee is in favor of purchasing the plant of the Mount Holly Water Company for municipal ownership and installing an artesian water system. Address Township Clerk.

Curwensville, Pa. — Farley Gannett, Theodore E. Seelye and Samuel W. Fleming, Jr., Telegraph Bldg., Harrisburg, engaged by Borough, to report on water system and prepare preliminary plans for improving system.

Monessen, Pa.—Chester & Fleming, Pittsburgh, preparing plans and specifications for extensive additions to distribution system of local water company.

Pennsylvania.—Following permits issued by Department of Health, Harrisburg:

Franklin City.—Additional supply from new wells.

Elizabeth (Monongahela Valley W. Co.).—Plans for improvements at existing filtration plant and requiring provision for additional capacity.

Meadville.—Additional supply from new well.

S. Middleton Twp., Cumberland Co., (J. C. Bucher).—Extension of distributing system.

Tri-Cities Water Co., (Charleroi & Donora).—Plans for additional sedimentation at filtration plant.

Mercer, (Mercer W. Co.).—Plans for filtration works.

Aliquippa.—Additional supply from new wells and requiring plans for disinfection during emergencies.

Ashland.—Plans for storage reservoir, filtration plant and fire service pumping station.

Belle Vernon, (Belle Vernon W. Co.).—Plans for temporary germicidal treatment and requiring plans for permanent purification works.

Johnsonburg, (Johnsonburg W. Co.).—Outline plans for filtration works.

Lewisburg, (Lewisburg W. Co.).—Requiring filtration.

Milton, (Mountain W. Co.).—Requiring filtration.

Point Marion, (Springhill Water Co.).—Requiring germicidal treatment of present supply and either plans for filtration of same or development of new safe supply.

Somerset.—Plans for storage reservoir and additional drilled well supply.

Watsontown, (Watsontown W. Co.).—Requiring filtration.

Wellsboro, (Wellsboro W. Co.).—For temporary germicidal treatment and requiring studies for permanent safe supply.

Ringtown, Pa.—Contract soon to be let by Borough Council for constructing a reservoir and one mile of pipe; cost about $20,000. Mark C. Krouse, Engineer, Williamsport.

Williamsport, Pa.—Farley Gannet, Telegraph Building, Harrisburg, engaged to estimate cost of plant of Williamsport Water Co. City considering purchasing plant.

Elloree, S. C.—City Council considering water works. Address City Clerk.

Athens, Ga.—Water works bonds for $40,000 sold. Address City Clerk.

Miami, Fla.—Ocean Beach Realty Company will lay 3½ miles of water and sewer mains at a cost of $20,000.

St. Augustine, Fla.—Election will probably be held to vote on water works improvements. Address Secretary City Commissioners.

St. Augustine, Fla.—C. S. Coe, Engr. M. of W. of the Florida East Coast Ry., St. Augustine, has been appointed chairman of Water Works Advisory Board to prepare and submit designs for adequate water supply for city.

Bloomington, Ky.—Water works improvements bonds for $62,000 have been sold. Address City Clerk.

Canton, Ohio.—Water works bonds for $50,000 will be sold June 26, by Sam'l E. Barr, City Aud.

Cleveland, Ohio.—City Utilities Dept. will soon purchase about $50,000 worth cast-iron pipe for relaying water mains. Charles Jaeger, City Water Commissioner.

Constantine, Mich.—A. H. Smith Company, Toledo, Ohio, engaged as engineers for water works improvements contemplated here, to include wells, etc. Arnold E. Tracy, City Clerk.

Monroe, Mich.—Chester & Fleming, Pittsburgh, engaged to investigate water works for Local Water Company.

La Salle, Ill.—City plans to enlarge water works and light equipment and extend sewer system. Martin Kurkowski, City Clerk.

Stroud, Ill.—Citizens voted $30,000 bonds for water works and electric light plant. Address City Clerk.

Utica, Ill.—Extensions to water works contemplated; estimated cost $19,000. L. N. Sabo, Village Clerk.

Wyanet, Ill.—Citizens will vote June 20, $8,000 bonds for water works. Address City Clerk.

Kellogg, Iowa.—Citizens voted $10,000 bonds for water works. Address City Clerk.

Albert Lea, Minn.—City proposed constructing reservoir and installing pump at water station. William Barneck, City Engineer.

Biwabik, Minn.—Contract soon to be let for water works improvements. W. J. Hadja, of Virginia Village, Engr.

Mankato, Minn.—City Council sold $15,000 reservoir bonds.

Topeka, Kan.—F. M. Newland, Water Commissioner, is investigating the construction of a concrete reservoir, equipped with an aerating fountain and centrifugal pump.

Blue Hill, Neb.—City Council approved plans for a municipal water and electric light plant to cost $7,000.

Glendive, Mont.—Bonds for filtration plant and other improvements, costing $65,000, will be sold June 20 by August Colin, Clerk; Burns & McDonald, Engineers, Kansas City, Mo.

Terry, Mont.—Security Bridge Company, Billings, Mont., estimates cost of constructing water works and sewer system at $30,000 each. Address Town Clerk.

Brookfield, Mo.—Plans being considered for the installation of a municipal water works and electric light plant. Address City Clerk.

Joplin, Mo.—State has ordered this city to construct a filtration plant to be in operation by April, 1917. W. A. Stone, Mayor.

Mount Vernon, Mo.—Plans completed for improvements to water works and electric light plant, to cost $15,000. Albert C. Moore, Engineer, Frisco Building, Joplin, Mo. Probably no further action will be taken until fall.

Pocahontas, Ark.—Plans prepared by J. B. McCrary Co. of Atlanta, Ga., for water works to be constructed in Pocahontas; cost $46,000.

Snyder, Tex.—Plans being prepared by Water Committee of City Council for improvements to water system. Address Mayor.

McLoud, Okla.—Construction of water works is under consideration. Address City Clerk.

Clovis, N. M.—Water and light bonds for $30,000 have been sold. Address City Clerk.

Fort Stanton, N. M.—A 1,000,000 gal. concrete reservoir equipped with electric pump and pipe line to the Marine Sanitarium at Ft. Stanton on Rio Bonito in Lincoln County will be constructed. Address Superintendent Marine Sanitarium.

Springer, N. M.—Water bonds for $32,000 and sewer bonds for $5,000 have been sold. Address City Clerk.

Canby, Ore.—Citizens authorized Council to issue $18,000 bonds for constructing or purchase of a municipal water works. Address City Clerk.

Silverton, Ore.—Citizens, May 13, voted $15,198 bonds to construct water works. Mark Paulson, City Recorder.

Coalinga, Cal.—Increasing the water supply pressure for fire protection, at a cost of $25,000, is under consideration by City Council. Address City Clerk.

San Bernardino, Cal.—See "Bridges."

San Diego, Cal.—Sweetwater Water Co. (H. N. Savage, Chief Engineer, San Diego) applied to State Water Commission, Sacramento, for approval of plans for reconstructing and improving Sweetwater Reservoir; cost about $100,000.

Flagstaff, Ariz.—Construction of a high pressure water system at cost of $15,000 contemplated by Town Council. About 3 miles of 6-in. pipes required. Alex. Johnson, City Clerk.

Williams, Ariz.—Town Council considering installing municipal water and light plant.

McCammon, Idaho.—Contract soon to be let by Public Utilities Commission for constructing water works to cost $22,000, including a steel tank, $60,000 gal. capacity, 90-ft. tower, water mains, etc. Bonds have been sold.

Pocatello, Idaho.—City Council voted to purchase plant of the Pocatello Water Company. Address City Clerk.

St. John, N. B.—City Council contemplates additions to water works system costing $230,000.

Sarnia, Ont.—City has received a recommendation from Provincial Board of Health that a 30-in. pipe be laid under the bed of the river to a point 200 ft. from the shore, where a crib will be erected about 40 ft. above the bottom of the river. An automatic chlorine machine will be installed to purify the water.

Tacoma, Wash.—Contract soon to be let for constructing 3½ miles of pipe line from South Tacoma wells to Hood Street reservoir. W. D. Nickeus, City Clerk; L. A. Nicholson, City Engineer.

BIDS DESIRED.

Washington, D. C.—By Bureau Supplies and Accounts, Navy Dept., Washington, D. C., for Sch. 9736, Mare Island, Cal., miscellaneous malleable iron, galvanized pipe fittings, and cast and wrought iron galvanized pipe fittings, and 1312 lb. malleable galvanized iron unions.

Middletown, Ohio.—Until July 6, by City Commissioners, for constructing pump house, reservoir, laying pipe, etc., advertised in Engineering Record. John Kunz, City Clerk; Seabury G Pollard, Consulting Engineer, Cincinnati.

Carrollitown, Ill.—Until June 20, by A. H. Johnson, City Clerk, for constructing one pumping unit consisting of triplex pump (250 g.p.m) kerosene engine, air compressors, and all fittings and connections.

Cicero, Ill.—Until June 12, by Board Local Improvements (James S. Rylans, Secy.), for water supply and water service pipes in West Thirty-second, South Fifty-eighth, South Fifty-ninth and other streets.

Sheboygan Falls, Wis.—Until June 12, by Board Public Works, for constructing water works system, to consist of 16,555 ft. 4 to 10-in. pips, 32 hydrants, valves, etc. Frank Kroeger, City Clerk.

Seward, Neb.—Reported desired until June 15, for constructing water works. Grant & Fulton, Engrs., Lincoln.

Harrison, Ark.—Until June 26, by W. F. Gordon, Chmn. Board Commissioners of Water Improvement District No. 1 at Harrison for constructing water works, advertised in Engineering Record. W. O. Galbreath, Consulting Engineer, Harrison.

St. Hyacinthe, Que.—Until June 28 by City Clerk for mechanical filtration plant to cost $75,000, capacity 4,000,000 gal. Plant to include pumps—four 2,000,000 gal. per day, one 5,000,000 gal. per day, one 2,000,000 gal. per day and one 4,000,000 gal. per day—coagulation basins, filtered water reservoirs, filters and building. Frederick E. Field, Montreal, Que., Filtration Engineer.

Vancouver, B. C.—Reported desired until June 28, by Jas. Stuart, City Purchasing Agent, for 75,000 lin. ft. 6, 8 and 12-in. lap-welded steel pipe.

Victoria, B. C.—Reported desired until June 12, by W. Galt, City Purchasing Agent, for 3900 ft. 12 and 8-in. pipe, together with valves, hydrants, etc.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Perry, N. Y.**—Following are four lowest bids opened May 27 by Village Trustees for constructing slow sand filter, pure water reservoir, appurtenances: Dessichario & Suttler, Rochester, $21,197 (awarded contract); Webster Construction Co., Linwood, N. Y., $23,481; Suburban Engineering Co., New York, $23,891; Warsaw Construction Co., Warsaw, $23,915. O. N. Bolton, Village Clerk.

★**Plainfield, N. J.**—General contract for constructing pumping station for Middlesex Water Company awarded John C. Abbott, Carlton Avenue, at about $14,000.

★**Erie, Pa.**—Contract awarded by Board Water Commissioners to R. D. Wood & Company, Philadelphia, for 7,000 feet of c.-i. pipe at approximately $28,000.

★**Mercer, Pa.**—Chester & Fleming, Pittsburgh, Pa., are supervising engineers for the addition to pumping station of the Local Water Company. Contracts for pumping machinery awarded as follows: Wash pump, Goulds Manufacturing Company, 71 West Fall Street, Seneca Falls, N. Y.; belt-driven low service pump, Lawrence Pump & Engine Company, Lawrence, Mass., and gas engine driven low service pump, Harris Pump & Supply Company, Pittsburgh, Pa.

Mercer, Pa.—See "Proposed Work."

Washington, D. C.—Lowest bid opened May 29 by Commissioners D. C. for furnishing 2 water tube boilers for District of Columbia submitted by Carroll Electric Co., Washington, D. C., at $14,673.

★Contract awarded by Commissioners D. C. for furnishing c.-i. water pipe and specials for use in District for the next fiscal year to Glamorgan Pipe & Foundry Co., Lynchburg, Va., and for 50 sets of castings for 8-in. 2-way gate valves to S. R. Carr & Co., Washington, D. C., and for 20 sets castings for 6-in. 4-way gate valves to Steacy Schmidt Co., Washington, D. C.

★**Coshocton, Ohio.**—Contract awarded Epping Carpenter Pump Company, Pittsburgh, Pa., for a 3,000,000-gal. pumping engine. Chester & Fleming, Engineers, Pittsburgh, Pa. The engineers are also preparing plans for new pump pit and suction main, which will be installed in a few months at the local water works.

Middletown, Ohio.—Following have been recommended for award: Two 3,000,000-gal. low service pumps to Dravo-Doyle Company, Indianapolis, Ind., at $4,588 per pump; c. i. pipe, U. S. Cast Iron Pipe & Foundry Company, Kansas City, Mo., at $15,406; 4,000,000-gal. pump, Hooven & Owens, Rentschler Co., of Hamilton, $15,136.

★**Blairstown, Iowa.**—Contract for constructing water works (bids opened May 29) awarded C. W. Roland Company, Des Moines, at $13,175. Charles I. Vail, Town Clerk.

★**Fort Madison, Iowa.**—Contract awarded Cameron, Joyce Company, of Keokuk, for constructing reservoir for Citizens' Corporation.

★**Vinton, Iowa.**—Westinghouse Electric Manufacturing Company of Pittsburgh, Pa., secured the contract at $12,550 for machinery for water works and light plant (bids opened May 26), including turbines, generators and switchboard. W. E. Klingmann, City Clerk.

★**St. Paul, Minn.** — City Contracting Committee awarded contract for $7,420 to Lauer Bros., foot of Chestnut Street, to build addition to McCarron Pumping Station.

★**Westbrook, Minn.**—Contract for 33,500 gal. steel tank on 80 ft. tower awarded Des Moines Bridge & Iron Co., Des Moines, Iowa, at $2,800. James Budish, Town Clerk.

★**Newton, Kan.**—Contracts for constructing pipe line between Newton and Mission Water Works station awarded by City Commission as follows: Pipe line to U. S. Cast Iron & Pipe Company, Kansas City, Mo., at $64,985; constructing work to Henry Bickel Company, Louisville Ky., at $25,700.

★**Wakeeney, Kan.**—Contracts for extensions to water works (bids opened May 22) awarded as follows: Engine and pump and motor, Charles Steinberger, Wakeeney, $6,904, and two generators and switchboards to Westinghouse Electric Mfg. Company, of Pittsburgh, Pa., at $2,300. J. H. Heckman, City Clerk.

★**Jefferson City, Mo.**—Contract for furnishing elevated storage tank, capacity 65,000 gal. and 100 ft. high for Water Company, awarded U. S. Wind Engine & Pump Company, Batavia, Ill. Chester & Fleming, Engineers, Pittsburgh, Pa.

★**Welsh, Okla.**—Contract for constructing water works awarded McIntosh Walton Company, Oklahoma, at $22,000. S. M. Beston, City Clerk.

★**Los Angeles, Cal.**—Contract for furnishing and installing approximately 32,000 ft. 4-in. and 12,600 ft. 6-in. Class "B" c.-i. pipe, foundations for pump, raising tank on tower, installing derrick, etc., in Los Angeles County Water Works District No. 1, San Fernando Valley, awarded Municipal & Industrial Equipment Co., 715 Story Building, at about $26,000.

★**Riverside, Cal.**—Later reports state contract for constructing 55,000 gal, reinforced concrete reservoir, 160,000 gal. oil lined earth reservoir, two pump houses, 4480 ft. irrigation pipe line and 2420 ft. domestic water pipe line for State Citrus Experiment Station, awarded to Cresmer Mfg. Co. of Riverside at $8,814. Lester H. Hibbard and H. B. Cody, Architects, Marsh-Strong Building, Los Angeles.

★**St. Joseph d'Alma, Que.**—Contract for water works extensions to cost $70,000 will be made by A. Aubin, St. Jerome. E. La Pointe, Baie St. Paul, Engineer.

SEWERAGE AND SEWAGE DISPOSAL

PROPOSED WORK.

New Britain, Conn.—William B. Fuller, New York, N. Y., in a report to Mayor George A. Quigley, estimates cost of constructing sewage disposal plant (recommending activated sludges system) at $118,000.

Hobart, N. Y.—Hansen & Coulter, 2 Rector Street, New York, engaged as engineer for the proposed improvements to sewage disposal plant.

Hopewell, N. J.—Reported Borough contemplates constructing a sewer system costing $35,000. Address Borough Clerk.

Millville, N. J.—Contract soon to be let by city for constructing the sewage pumping station at Sassafras and Buck Streets. Newton B. Wade, City Engineer.

Skillman, N. J.—State intends constructing a sewage disposal plant here costing $35,000. George S. Drew, State Architect, Trenton.

Westfield, N. J.—New bids to be asked for constructing the relief sewer. C. Clark, Town Clerk.

Altoona, Pa.—City reported considering sewage disposal problem, as directed by State Board of Health. Citizens recently voted down a $150,000 bond issue for this improvement. J. W. Shields, City Engineer.

Easton, Pa.—Construction of sewers at a cost of $11,000 is under consideration. J. H. Warner, City Clerk.

Ferndale, Pa.—C. B. Collins & Company, Johnstown, engaged as engineer for the proposed sanitary sewer system. H. A. Hamer, President Borough Council.

James City, Pa.—Plans to be prepared by Chester & Fleming, Pittsburgh, for a sewage disposal works. Address City Clerk.

Kennywood Park, Pa.—Contract soon to be let by Chester & Fleming, Engineers, Pittsburgh, for constructing a sewage disposal plant consisting of Imhoff tanks, sprinkling filters, and chloride disinfection plant.

Linwood, Pa.—Township Commissioners considering the constructing of a sewage disposal plant for Linwood and Linwood Heights as directed by the State Board of Health.

Williamsport, Pa.—City engaged Farley Gannett, Telegraph Bldg., Harrisburg, to prepare preliminary plans for sewage purification. John B. Otto, City Engineer.

Annapolis, Md.—County Commissioners have directed E. T. Hayman, County Engineer, to have a map prepared of Brooklyn, Curtis Bay, Masonville and Fairfield in the Fifth District, to be used in establishing a proper sewerage system for that district.

West Point, Va.—See "Water Works."

Greensboro, N. C.—About $75,000 will be spent for constructing sewers in Greensboro. J. G. Foushee, Jr., Commissioner Public Works.

Cincinnati, Ohio.—City Council approved estimate of Frank S. Krug, City Engineer, for constructing sewer in Maag Street at $32,980.

City Council approved City Engineer Frank S. Krug's estimate of $14,330 as cost of sewering Highland Avenue, Cumber Street and Liberty Street between Ringgold and Spring Streets.

Leetonia, Ohio.—Citizens voted to construct a sewage disposal plant. Address Village Clerk.

Michigan City, Ind.—Board Public Works considering the building of a trunk sewer.

Grand Rapids, Mich.—Construction of Imhoff tank system for sewage disposal being considered. W. S. Moore, City Engineer.

Muskegon Heights, Mich.—Plans not yet completed for the proposed sewer system which will include 8 to 24-in. pipe sewers and probably some concrete sewer. Hoad & Decker, Engineers, Ann Arbor.

Elkhart Lake, Wis.—Citizens voted $15,000 bonds for sewer improvements. Address City Clerk.

Fort Madison, Iowa.—Burns & McDonald, Kansas City, Mo., engaged to prepare plans for the proposed sanitary sewer system. A system of about 15 miles is contemplated(probable cost $3,500 per mile. Address City Clerk.

Oxford Junction, Iowa.—A plan authorized prepared for a sewer system. Address City Clerk.

Claremont, Minn.—J. F. Druer, St. Paul, engaged to prepare plans for sewers and disposal plant.

Mapleton, Minn.—J. F. Druar, St. Paul, engaged to prepare plans and specifications for a disposal tank for creamery wastes for the Farmers' Creamery Company.

Chetopa, Kan.—Preliminary plans completed for the sewer system estimated to cost $30,000. Nothing further has been done about the construction. A. C. Moore, Engr., Frisco Building, Joplin, Mo.

Cottonwood Falls, Kan.—E. T. Archer & Company, Kansas City, Mo., engaged to make a preliminary survey for sewer improvements. An election will be held to vote on the question. W. J. Gresham, City Clerk.

Billings, Mont.—City Council reported considering constructing trunk sewers. F. M. Sneckenberger, City Engineer.

Harlowton, Mont.—Sewer bonds for $25,000 have been sold S. K. Campbell, Town Clerk.

Kansas City, Mo.—See "Bridges."

Coleman, Tex.—Henry Exall Elrod, Southwestern Life Building, Dallas, engaged as consulting engineer in matter of proposed purchase and extension of present privately owned sewer system.

Greenville, Tex.—The sewer system is to be 18 miles of 6 to 15 in. pipe and include Imhoff tank, contact beds, etc.; will be constructed by city force under City Engineer A. D. Duck.

Itasca, Tex.—Sewer bonds for $15,000 have been sold. Address Mayor.

Port Arthur, Tex.—City Commission reported considering improving sewer system. Address Secretary of Commission.

Sherman, Tex.—Election to be held June 24 to vote following bond issue: Extending sewers and installing disposal plant, $50,000; paving and improving the streets, $50,000; improving city water works and building a 1,000,000 gal, reservoir, $30,000; municipal fire alarm system, $1,000; parks, $10,000. Address Mayor.

Kiowa, Okla.—Construction of a sewerage system contemplated. Address Secretary Commercial Club.

San Bernardino, Cal.—See "Bridges."

Toronto, Ont.—Harbor Commissioners recommended the following improvements: Sewers, $46,000; granite block paving, $32,000; brick, asphalt and concrete paving, $18,000.

BIDS DESIRED.

Boston, Mass.—Until June 12, by Edward F. Murphy, Commissioner Public Works, for constructing pipe sewers and drains in portions of Gaffney Street, and outlet in Brighton and in Harvest and Train Streets, Dorchester and Rutledge Road, Hyde Park.

Greenwich, Conn.—Until June 29, by Joint Sewerage Commission of Borough of Greenwich and Town of Greenwich, for furnishing material and constructing sewage disposal works and pumping station for Borough of Greenwich and Sewer District No. 6, including necessary piping, grading, etc. Clyde Potts, Engineer, 30 Church Street, New York, N. Y.

Hartford, Conn.—Until June 20, by Board Contract and Supply, for constructing 1240 ft. 30, 33 and 42-in. sewer and 4303 ft. 10 to 18-in. tile sewer in Tower Avenue and other streets. Roscoe N. Clark, City Engr.

Brooklyn, N. Y.—Until June 14, by L. H. Pounds, Borough Pres., for constructing sewers and appurtenances in Fifteenth, Sixty-third, and Twenty-second Streets, and in Avenue J and Avenue Q. Total security $8,950.

New York, N. Y.—Until June 12, by Marcus M. Marks, Borough Pres., for alterations and improvements to sewers, in Green, South, Ninetieth, and Fifty-third Streets, and for receiving basins in Park Row, Claremont, Park Avenues, Chatham Square, and other streets. Total security $17,550.

New York, N. Y.—See "Paving and Roads."

Camden, N. J.—Until June 19, by A. B. Sparks, Chmn. of Committee of Streets and Highways, for furnishing material and constructing sewers in Ninth, Point, Fremont and other streets.

Fairview, N. J.—Until June 12, by Mayor and Council, for laying 36-in. vitri. drain in Ninth Street; cost $10,000. McClave & McClave, Borough Engineer.

Little Ferry, N. J.—Until June 15, by Oswald C. Mehrhof, Mayor and Borough Council, for laying and constructing 36-in. and 24-in. storm water drain in Borough with necessary sluice gates, inlets, tributaries, catch basins, manholes, etc. A. W. Williams, Boro. Engr., Hackensack.

Brentwood, Pa.—Until June 15, by Borough Council, for constructing sanitary sewer system in Dist. No. 1, to consist of 24,090 lin. ft. terra cotta pipe, 265 lin. ft. c.-i. pipe, manhole, etc. Address Douglas & McKnight, Engrs., 1315 Union Bank Bldg., Pittsburgh.

Philadelphia, Pa.—Until June 21, by Department Public Works (Geo. E. Dateman, Dir.), for Sch. A branch sewers, Sch. B intercepting sewer along Frankford Creek, storm water sewers from Frankford Creek, south of Leiper Street to Hunting Park Avenue and O Street, thence to a grit chamber to be located north of Lycoming Street and west of O Street. Sch. C, reconstruction of old sewers, etc.

Westfield, Pa.—Until June 20, by H. B. Strang, Clerk Borough, for sewers and sewage disposal plant, advertised in Engineering Record. Henry E. Taylor, Engineer, 100 State Street, Albany, N. Y.

Miami, Fla.—Until June 15, by City Council, for constructing Section 2 of Storm Sewer Districts 1 and 2, in all about 6348 ft. 12 to 24-in. vitr. brick, together with manholes, inlets, etc.

Cincinnati, Ohio.—Until June 12, by Charles F. Hornberger, Public Service Director, for constructing Avondale Relief sewer No. 4. Frank S. Krug, City Engineer.

Frankfort, Ind.—Until June 30, by R. H. Boynton, City Engineer, for East End District Sanitary Sewer, requiring 6 to 18 in. pipe and cost $28,220.

South Bend, Ind.—Reported desired until June 13, by Board Public Works, for constructing pipe sewers. Probable cost $12,000.

Ann Arbor, Mich.—Reported desired until July 1, by Ross Granger, City Clerk, for constructing two storm sewers in Jefferson Street and Madison Street. Manly Osgood, Engr., City Hall.

Escanaba, Mich.—Until June 15, by Board Public Works (Carl E. Anderson, Clk.), for furnishing material and constructing a sewage disposal plant. Estimated cost $30,570. Walter J. Hodson, City Engr.

Spooner, Minn.—Until June 19 (readvertisement), by A. M. Robertson, Village Clerk, for furnishing material and constructing sewer system and disposal works. Bids will be considered together or separately on system and disposal plant. Duluth Engineering Co., Palladio Bldg., Duluth.

Thief River Falls, Wis.—Until June 27, by A. H. Fasel, City Clerk, for constructing sewers, to consist of 3490 lin. ft. sewers, manholes, wells, etc.

Oskaloosa, Iowa.—Until June 19, by T. H. Carlin, City Clerk, for constructing sewers and sewage disposal plant, advertised in Engineering Record. H. C. Hawkins, City Engineer; Black & Veatch, Consulting Engineers, Kansas City, Mo.

Waterloo, Iowa.—City Council is considering the construction of a sewer system for Galloway, Westfield and Hagerman additions. Address City Clerk.

Pawnee City, Neb.—Until June 15, by City (D. E. Wherry, Mayor), for extending water works and sewer system. E. T. Archer & Co., Engrs., 514 New England Bldg., Kansas City, Mo.

Devils Lake, N. D.—Reported desired until June 15, for constructing sewage disposal plant. M. J. Cowley, City Aud.

Mohall, N. D.—Reported desired until June 15, for constructing sewer system. Tollef Syverson, City Aud.

Manhattan, Mont.—Until June 12, by E. A. Peterson, Deputy Clerk, for constructing a sewer system. Fred M. Brown, Engineer, Bozeman.

St. Louis, Mo.—Until June 20, by City, for constructing Russell Place Joint Sewer Dist. and branches.

Galveston, Tex.—Until June 15, by Board of Commissioners of Streets and Public Property (H. O. Sappington, Comr.), for constructing 4500 lin. ft. 12 and 15-in. vitr. pipe and appurtenances, in Avenue H, and 900 lin. ft. concrete drain on Forty-first Street, together with manholes, basins, etc.

Houston, Tex.—Until June 23, by Ben Campbell, Mayor, for constructing a sewage disposal and pumping plant advertised in Engineering Record. Approximate cost $400,000. E. E. Sands, City Engineer.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Biddeford, Me.**—Contract awarded F. A. Rumery Company, Portland, for constructing main sewer in Summer Street. at $16,628.

★**Boston, Mass.**—Contract for constructing pipe sewers and drains in Perham Street and Vermont and Dent Street brook conduit awarded Antony Cefalo, Boston, at $11,738.

Long Island City, N. Y.—Following are unit figures of H. J. Mullen Contr. Co., Fulton Street, Jamaica, lowest bidder for sewer in Woodhaven, Brandon, Jamaica and Manor Avenues (bids opened May 29 by Maurice E. Connolly, Boro President): 1488 lin. ft. 5 ft. 3 in. reinforced concrete sewer, $79.50; 451 lin. ft. 3 ft. 9 in. plain concrete, $12; 406 lin. ft. 3 ft. 6 in. plain concrete sewer $12; 703 lin. ft. 3-ft. plain concrete, $7; 250 lin. ft. 2 ft. 6 in. plain concrete, $7; 688 lin. ft. 24-in. vitr. pipe, $5; 250 lin. ft. 22-in. vitrified pipe, $3; 486 lin. ft. 20-in. vitrified pipe, $4; 498 lin. ft. 18-in. vitrified pipe, $4; 511 lin. ft. 15-in. vitrified pipe, $3; 699 lin. ft. 12-in. vitrified pipe, $3; 46 manholes complete, $60; 1 junction chamber at Woodhaven Avenue and Jamaica Avenue complete $400; 1 junction chamber at Manor Avenue and Jamaica complete, $400; 1 junction chamber at Woodhaven Avenue and Bandon Avenue complete, $400; 69 lin. ft. 12-in. vitrified pipe for basin connection spurs, $1; 198 6-in. spurs 24 in. long on concrete sewer, $1; 55 6-in. spurs on 24-in. vitrified pipe sewer, $1; 20 6-in. spurs on 22-in. vitrified pipe sewer, $1; 40 6-in. spurs on 20-in. vitrified pipe sewer, $1; 38 6-in. spurs on 18-in. vitrified pipe sewer, $1; 37 6-in. spurs on 15-in. vitrified pipe sewer, $1; 56 6-in. spurs on 12-in. vitrified pipe sewers, $1; 4533 lin. ft. 6-in. pipe for house connection drains, $1; 50 cu. yd. concrete, Class "A," not shown on plan, 1 ct.; 4000 lb. reinforcing steel, 1 ct.; 100M ft. timber for sheeting and bracing, 1 ct.; total, $66,775; totals of next three lowest bidders: Ernest A. Weiss, Times Bldg., New York City. $66,936; Joseph Kelly, Brooklyn, $67.938; Peace Bros., Flushing, L. I., $68,249.

Long Island City, L. I., N. Y.—Following are unit figures of Ernest A. Weiss, Times Building, New York, lowest bidder for sewers in Maure, Jamaica and Ridgewood Avenues (bids opened May 29 by Maurice E. Connolly, Borough President): 252 lin. ft. 6-ft. 6-in. reinforced concrete, $20; 668 lin. ft. 5-tt. 9-in. reinforced concrete, $15; 802 lin. ft. 4-ft. reinforced concrete, $9; 1000 lin. ft. 3-ft. 6-in. plain concrete, $6; 412 lin. ft. 3-ft. 3-in. plain concrete, $5.30; 972 lin. ft. 2-ft. 9-in. plain concrete, $4.30; 270 lin. ft. 22-in. wtr. pipe, $2.50; 253 lin. ft. 20-in. vitr. pipe, $2.25; 302 lin. ft. 18-in. vitr. pipe, $1.90; 346 lin. ft. 15-in. vitr. pipe, $1.60; 1002 lin. ft. 12-in. vitr. pipe, $1; 44 manholes complete, $60; 27 single receiving basins complete, $145; 1 double receiving basin complete, $225; 800 lin. ft. 12-in. vitr. pipe for basin connections, $1; 20 lin. ft. 10-in. vitr. pipe for basin connections, $1; 256 6-in. spurs, 24 in. long, on concrete sewers, 85 cts.; 2 6-in. spurs on 22-in. vitr. pipe sewer, $3; 16 6-in. spurs on 20-in. vitr. pipe sewer, $2.75; 18 6-in. spurs on 18-in. vitr. pipe sewer, $1.90; 20 6-in. spurs on 15-in. vitr. pipe sewer, $1.40; 75 6-in. spurs on 12-in. vitr. pipe sewer, $1; 4515 lin. ft. 6-in. vitr. pipe for house connections, 90 cts.; 1 junction chamber at Wisner Place and Maure Avenue complete, $370; 1 junction chamber at Ridgewood and Maure Avenues complete, $370; 1 junction chamber at Jamaica and Maure Avenues (south side) complete, $370; 1 junction chamber at Jamaica and Maure Avenues (north side) complete, $370; 1 junction chamber at Metropolitan and Maure Avenues complete, $370; 1 junction chamber at Jamaica and Villa Avenues complete, $370; 25 M ft. timber for bracing and sheet piling, $27; 50 cu. yd. concrete, Class "A," not shown on plan, $5; 4000 lb. reinforcing steel, not shown on plan, 5 cts.; total $51,892. Next three lowest bidders: Frank L. Paino, 67 Bay Forty-seventh Street, Brooklyn, $53,198; Stanhope Contracting Co., 404 Stanhope Street, Brooklyn, $53,751; H. J. Mullen, Fulton Street, Jamaica, L. I., $63,539.

★**Newark, N. J.**—Contract for constructing Outfall sewerage works, part of Section 4, bulkhead, flushing intake and sludge main (bids opened May 25) reported awarded by Passaic Valley Sewerage Commission to Arthur McMullen Company, 149 Bway., New York, at $74,800.

★**Johnstown, Pa.**—Contracts for constructing lateral sewers awarded by City Council as follows: Sect. No. 1, to George W. Clark of Johnstown at $7,148; Sect. No. 2, to E. Arthur James of Johnstown at $8,170 and Sect. No. 3, to Ressler & Robertson of Johnstown at $7,033.

Pittston, Pa.—Davis & Parry Construction Company, Luzerne, submitted lowest bid for constructing sewer in Baltimore Avenue, at $14,054.

★**West Pittston, Pa.**—Contract for constructing part of the Ninth District sewer awarded Davis & Perry Construction Company of Luzerne at $17,462.

★**Durham, N. C.**—Contract for constructing sewers awarded as follows (bids opened by Mayor and Bd. of Aldermen, May 25), to Obenshein Constr. Cor. of Roanoke, Va., 6½ miles of 24 in., at $24,962, and to S. N. Slade of Durham, 4 miles of 10 in., at $7,699.

★**Newark, N. J.**—Following are bids opened May 31 by Passaic Valley Sewerage Commission, Newark, for constructing the Van Buren Street sewer:

Tunnel method—(a) Charles A. Haskin, Boston, Mass., $92,280 (awarded contract); (b) Old Colony Construction Co., Inc., New York, N. Y., $144,800; (c) William J. Caughlin, Jersey City, $174,650.

	*(a)	(b)	(c)
270 lin. ft. excavation in compressed air tunnel for 54-in. circular brick sewer	$34.00	$50.00	$70.00
1,700 lin. ft. excavation in compressed air tunnel for 64-in. circular brick sewer	34.00	52.00	70.00
200 cu. yd. concrete masonry made with Portland cement mortar	8.00	12.00	12.00
1,600 cu. yd. brick masonry in tunnel lining and in shafts, manholes, etc.	12.00	20.00	18.00
10,000 lb. steel for concrete reinforcement in place	0.05	0.07	0.05
Jackson Street sewer connection and appurtenant work (lump sum)	4,000.00	7,800.00	5,050.00

Open Trench Method—(a) William J. Caughlin, Jersey City, $91,940; (b) Harrison & Craig Co., Newark, $94,640.

	(a)	(b)
270 lin. ft. earth excavation and refill in trench for 54-in. circular brick sewer	$32.00	$36.00
1,700 lin. ft. earth excavation and refill in trench for 64-in. semi-elliptical sewer	32.00	37.00
50 cu. yd. rock excavation in trench	3.00	0.01
1,800 cu. yd. concrete masonry with Portland cement mortar	12.00	8.50
100 cu. yd. brick masonry and appurtenant work	16.00	20.00
12,000 lb. steel for concrete reinforcement in place	0.05	0.06
Jackson Street sewer connection and appurtenant work (lump sum)	5,050.00	4,000.00

★**Milwaukee, Wis.**—Following are unit figures of four lowest bids opened May 25 by Sewerage Commission for constructing extensions to intercepting sewer system, Official Notice No. 16: (a) John F. Casey Co., Pittsburgh, Pa., $470,422 (awarded contract); (b) James Ferry & Son, Baltimore, Md., $482,055; (c) F. H. Nakiekli, A. J. Hewitt and James S. Prange, Milwaukee, $530,443 (combined bid); (d) James Kennedy, Fargo, N. D., $548,688.

	*(a)	(b)	(c)	(d)
1 siphon under the Milwaukee River	$122,880.00	$155,000.00	$184,327.00	$212,429.00
1 valve chamber at Bway. and Detroit	5,872.00	6,900.00	7,260.00	12,000.00
350 lin. ft. 72 and 48-in. combined sewer	122.03	81.95	65.00	76.20
2,052 lin. ft. 48-in. concrete sewer	34.03	37.65	35.00	34.10
2,666 lin. ft. 42-in. concrete sewer	30.06	31.00	32.00	28.50
2,742 lin. ft. 36-in. concrete sewer	27.42	21.00	28.00	26.30
2,047 lin. ft. 30-in. concrete sewer	16.70	17.50	24.00	21.00
509 lin. ft. 18-in. terra cotta and concrete sewer	11.75	12.40	10.00	12.00
416 lin. ft. 15-in. terra cotta and concrete sewer	12.13	12.25	10.00	10.00
1,042 lin. ft. 12-in. terra cotta and concrete sewer	11.80	10.40	7.50	10.00
20 vert. ft. drop manholes	7.87	10.00	7.00	7.00
950 vert. ft. standard manholes	6.61	7.00	5.00	6.00
57 c.-i. manhole frames and covers	15.00	15.00	20.00	15.00
2,000 lin. ft. piles in place	0.60	0.30	0.50	0.50
5 M ft. 4 x 4-in. piles	60.00	50.00	45.00	50.00
50 M ft. plank foundation	50.00	40.00	35.00	30.00
10 M ft. timber caps	50.00	35.00	50.00	30.00
5,000 lin. ft. underdrain	0.25	0.30	0.70	0.50

Houston, Tex.—Following are unit figures of the four lowest bids opened May 19 by city for constructing storm sewer in Paige Street with laterals on Rice and Williams Streets: (a) Texas Construction Co., $54,410; (b) Horton & Horton, $56,562; (c) W. Waldo, $57,634; (d) Houston Construction Co., $63,947 (bidders all of Houston). All bids rejected.

	(a)	(b)	(c)	(d)
200 cu. yd. extra excavation	$0.60	$1.00	$1.00	$0.75
70 ton-mile hauling	0.25	0.30	0.40	0.20
300 man-hour extra work, labor	0.27	0.30	0.35	0.20
200 team-hour extra work, teams	0.50	0.70	0.65	0.60
15 M ft. timber in foundations	25.00	25.00	22.00	30.00
260 M ft. timber ordered left in trenches	17.00	16.00	18.00	18.00
3 cu. yd. extra, Class I, concrete	7.50	15.00	10.00	8.00
35 cu. yd. extra, Class II, concrete	8.50	11.00	12.00	10.00
2 cu. yd. extra, Class III, concrete	12.00	15.00	15.00	12.00
5 cu. yd. extra brick masonry	10.60	20.00	16.00	15.00
200 lb. extra castings	0.05	0.05	0.10	0.05
1,000 lb. extra reinforcing steel	0.06	0.10	0.10	0.07
200 cu. yd. road gravel	1.75	2.00	2.50	2.00
200 cu. yd. road shell	1.75	1.25	1.50	1.80
23 standard manholes, Type "A," each	47.60	45.00	50.00	35.00
56 lin. ft. extra depth manhole, Type "A"	5.50	6.00	5.00	6.00
12 standard manholes, Type "B," each	40.00	60.00	65.00	40.00
130 lin. ft. extra depth manhole, Type "B"	5.50	8.00	8.00	7.00
45 supplying and setting catchbasin, "A," each	25.00	30.00	28.00	28.00
48 supplying and setting standard inlet, "B," each	24.00	24.00	23.00	22.00
5 supplying and setting standard inlet, "C," each	55.00	60.00	63.00	55.00
560 lin. ft. 48-in. sewer, 20-22 ft. deep	6.80	6.30	6.00	7.05
950 lin. ft. 48-in. sewer, 18-20 ft. deep	6.10	6.00	5.80	6.90
1,300 lin. ft. 48-in. sewer, 16-18 ft. deep	5.60	6.15	5.65	7.40
900 lin. ft. 48-in. sewer, 14-16 ft. deep	5.25	6.30	5.45	6.50
600 lin. ft. 48-in. sewer, 12-14 ft. deep	5.25	5.00	5.30	6.30
100 lin. ft. 48-in. sewer, 10-12 ft. deep	5.25	4.65	5.10	6.11
100 lin. ft. 48-in. sewer, 8-10 ft. deep	4.90	4.35	4.90	5.30
100 lin. ft. 48-in. sewer, 6-8 ft. deep	4.90	4.00	4.75	5.20
200 lin. ft. 48-in. sewer, 0-6 ft. deep	4.20	3.85	4.65	5.00
580 lin. ft. 42-in. sewer, 12-14 ft. deep	4.00	4.35	4.20	5.20
100 lin. ft. 42-in. sewer, 10-12 ft. deep	4.00	4.00	4.00	5.00
60 lin. ft. 33-in. sewer, 14-16 ft. deep	8.00	3.75	3.60	3.75
440 lin. ft. 33-in. sewer, 12-14 ft. deep	3.00	3.50	3.50	3.50
580 lin. ft. 33-in. sewer, 10-12 ft. deep	3.00	3.30	3.25	3.50
310 lin. ft. 30-in. sewer, 10-12 ft. deep	2.75	2.85	2.65	3.45
340 lin. ft. 30-in. sewer, 8-10 ft. deep	2.75	2.65	2.50	3.40
420 lin. ft. 24-in. sewer, 8-10 ft. deep	2.10	2.65	2.95	2.60
720 lin. ft. 24-in. sewer, 6-8 ft. deep	2.05	2.40	2.80	2.40
200 lin. ft. 24-in. sewer, 0-6 ft. deep	1.95	2.20	2.70	2.20
420 lin. ft. 18-in. sewer, 12-14 ft. deep	1.85	2.10	2.20	2.75
640 lin. ft. 18-in. sewer, 10-12 ft. deep	1.65	1.90	2.05	2.25
120 lin. ft. 18-in. sewer, 8-10 ft. deep	1.65	1.75	1.85	2.00
100 lin. ft. 18-in. sewer, 6-8 ft. deep	1.50	1.60	1.75	1.85
325 lin. ft. 18-in. sewer, 0-6 ft. deep	1.50	1.40	1.50	1.70
925 lin. ft. 15-in. sewer, 6-8 ft. deep	1.15	1.20	1.15	1.30
925 lin. ft. 15-in. sewer, 0-6 ft. deep	1.15	1.10	1.10	1.20
450 lin. ft. 12-in. sewer, 6-8 ft. deep	1.15	0.95	0.85	1.00
450 lin. ft. 12-in. sewer, 0-6 ft. deep	0.90	0.90	0.80	0.90
1 24-in. joint in manhole	5.00	4.50	5.00	4.00
1 18-in. joint in manhole	3.00	2.75	3.20	3.00
1 15-in. joint in manhole	3.00	1.95	2.50	1.50
1 12-in. joint in manhole	2.00	1.35	2.00	1.50

Time to complete, 90 days.

★**Graysville, Ill.**—Contract for constructing sanitary sewer system, (bids opened May 29), awarded Shockley & Irons, Fairfield, Ill., at $17,850. Other bidder D. E. Nipp, Flora, Ill., at $19,153. Paul R. Blood, Public Engineer, Graysville.

★**Joliet, Ill.**—Contract awarded E. Sherman Baer Company, Streator, Ill., for constructing a sewage disposal plant at $18,538.

★**Monticello, Wis.**—Contract for constructing sewers and disposal plant awarded Scully & Koontz, 5029 Sunnyside Avenue, Chicago, Ill.

★**Fairmont, Minn.**—Contract for constructing sewers, including 5174 ft. 8 and 10 in. pipe, awarded J. W. Turner Improvement Company, Des Moines, at $10,596. H. B. Tuttle, City Clerk; Frank O. Jones, Engineer, Fairmont.

★**Greybull, Wyo.**—Following are four lowest bids opened May 19 by city for constructing main and lateral sanitary sewers: Lundstrom & Owen, Billings, Mont., $28,747 (awarded contract); Gordon & Taylor, Denver, $28,904; J. S. Schwartz, Colorado Springs, Col., $29,437; and E. T. Sykes Company, Minneapolis, Minn., $28,615. H. O. Dunn, Consulting Engineer, Denver, Col.

★**Marengo, Iowa.**—Following are four lowest bids opened recently for constructing (a) mains and lateral sewers, (b) pumping plant outlet: G. G. Herrich, Des Moines (a) $48,453 (awarded contract); Independent Construction Company, Davenport (a) $50,897, (b) $10,000 (awarded contract); C. R. McNamara Company, Dubuque (a) $56,892; Michael McElliott, Evanston, Ill. (a) $58,947, (b) $11,697; Moore-Seig Construction Company, Waterloo (b) $10,251; Dearborn Construction Company, Waterloo (b) $10,750. W. R. MacGregor, City Clerk.

★**Houston, Tex.**—Following is the unit figures of Texas Construction Co., Houston, the successful bidder for constructing storm sewer in Welch Street, from Albany to Converse Street (bids opened May 19):

50 cu. yd. extra excavation	$0.50
500 ton-mile hauling	0.25
200 man-hour extra work, labor	0.25
100 team-hour extra work, teams	0.60
1 M timber in foundations	25.00
70 M timber ordered left in trenches	17.00
6 cu. yd. extra, Class I, concrete	7.50
20 cu. yd. extra, Class II, concrete	8.00
5 cu. yd. extra, Class III, concrete	9.00
5 cu. yd. extra brick masonry	9.00
100 lb. extra castings	0.05
1000 lb. extra reinforcing steel	0.06
50 cu. yd. road gravel	1.75
250 cu. yd. road shell	2.25
5 standard manhole, Type A (each)	39.00
32 lin. ft. extra-depth manhole, Type A.	4.60
8 standard manhole, Type B (each)	42.50
18 lin. ft. extra-depth manhole, Type B.	5.50
10 supplying and setting catch basin A (each)	25.00
39 supplying and setting std. inlet B (each)	23.50
2 supplying and setting std. inlet C (each)	60.00
60 lin. ft. 60-in. sewer, 10-12 ft. deep	7.00
50 lin. ft. 60-in. sewer, 12-14 ft. deep	7.00
620 lin. ft. 60-in. sewer, 14-16 ft. deep	7.00
60 lin. ft. 54-in. sewer, 10-12 ft. deep	6.25
280 lin. ft. 54-in. sewer, 12-14 ft. deep	6.25
210 lin. ft. 51-in. sewer, 10-12 ft. deep	5.60
330 lin. ft. 51-in. sewer, 12-14 ft. deep	6.50
130 lin. ft. 45-in. sewer, 8-10 ft. deep	4.25
370 lin. ft. 45-in. sewer, 10-12 ft. deep	4.25
250 lin. ft. 36-in. sewer, 8-10 ft. deep	3.15
60 lin. ft. 36-in. sewer, 10-12 ft. deep	3.15
200 lin. ft. 30-in. sewer, 6-8 ft. deep	2.60
160 lin. ft. 30-in. sewer, 8-10 ft. deep	2.50
140 lin. ft. 30-in. sewer, 10-12 ft. deep	2.50
410 lin. ft. 24-in. sewer, 6-8 ft. deep	2.20
50 lin. ft. 24-in. sewer, 0-6 ft. deep	2.20
50 lin. ft. 18-in. sewer, 6-8 ft. deep	1.60
50 lin. ft. 18-in. sewer, 8-10 ft. deep	1.60
300 lin. ft. 15-in. sewer, 0-6 ft. deep	1.15
300 lin. ft. 15-in. sewer, 6-8 ft. deep	1.15
50 lin. ft. 15-in. sewer, 8-10 ft. deep	1.50
200 lin. ft. 12-in. sewer, 0-6 ft. deep	0.90
200 lin. ft. 12-in. sewer, 6-8 ft. deep	1.00
1 30 in. joint in manhole	4.50
1 24-in. joint in manhole	4.00
1 18-in. joint in manhole	3.50
1 15-in. joint in manhole	3.00
1 12 in. joint in manhole	2.00
4 std. san. manhole (each)	45.00
75 lin. ft. 8-in. vit. pipe san. sewer siphon	1.35
1548 lb. 8-in. c.-i. soil pipe san. sewer	0.08

Total, $21,663. Total of next three lowest: W. Waldo, Houston, $22,229; Horton & Horton, Houston, $22,543, and Davis Brothers, Houston, $23,362.

★**Bellingham, Wash.**—Contract for constructing sewers and bulkhead on G Street awarded by City Council to Riddle & Hawkins of Bellingham at $13,136. W. H. Worth, City Engr.

★**Myrtle Point, Ore.**—Contract for constructing sewerage system (bids opened May 22), awarded Edward Sandeberg, Portland, at about $14,567. E. A. Dodge, City Recorder.

San Francisco, Cal.—Karl Ehrhart submitted lowest bid for constructing sewer system at $19,517. M. M. O'Shaughnessy, City Engineer; F. Shurchell, Secretary Board Public Works.

BRIDGES

PROPOSED WORK.

Danville, Pa.—Commissioners of Montour County contemplate constructing a 40-ft. concrete bridge over Chilisquaque Creek.

Erie, Pa.—Chester & Fleming, Pittsburgh, engaged to prepare plans for a sewage disposal works to treat sanitary sewage from local mill of Hammermill Paper Company.

Cambridge View, Pa.—See "Electric Railways."

Harrisburg, Pa.—City Council engaged Greiner & Whitman of Baltimore, Md., to prepare plans for bridge over railroad tracks at Walnut Street; cost $300,000.

Johnstown, Pa.—Farris Engineering Co. of Pittsburgh engaged by City Council to estimate cost of repairs and improvements to city bridges.

Montgomery, Pa.—County Commissioners at Williamsport were authorized to construct bridge across west branch of Susquehanna River. Estimated cost $150,000.

Pennsylvania.—Following work authorized by State Water Supply:

Baltimore & Ohio Railroad Company to construct fills along right bank of Youghiogheny River, between Greens Junction and Indian Creek; place a fill along right, or north, bank of Youghiogheny River, at Laurel, Run, both in Westmoreland County.

Borough of Ashland, to increase height of No. 2 Dam and alter Dam No. 1 across Little Mahanoy Creek, Butler Township, Schuylkill County.

York Haven Water & Power Company, construct a dam across channel of Susquehanna River between Three Mile Island and the Dauphin County shore, at a point about 1.1 miles below upper end of said island, in Londonderry Township, Dauphin County.

Clearfield Bituminous Coal Corporation, to reconstruct Sample Run Dam, on Sample Run, in Cherry Hill Township, Indiana County.

Supervisors Horton Township, Elk County, construct bridge across Little Toby Creek, about 200 feet east of Hellons' Mills Station, on P. S. & N. R. R.

Supervisors of Limirick Township, Montgomery County, construct bridge across Lodel or Landis Brook, at a point four miles northeast of Hoyersford, on the township line road.

Commissioners of Montgomery County, construct two-span reinforced concrete bridge across Little Neshaminy Creek, on a road leading from the County Line Road, or Bristol Road, to Gwynedd Meeting, being about 2.6 miles from North Wales, in Montgomery Township.

Supervisors of Lawrence Township, Clearfield County, to construct concrete bridge across Lick Run, at a point four miles north of Clearfield, on Upper Goshen road.

Commissioners of Union County, construct reinforced girder bridge across Rapid Run, at a point about three miles from where said stream empties into Buffalo Creek, in West Buffalo Township.

Supervisors of Catherine Township, Blair County, to construct new concrete culvert, in place of a small wooden bridge across Fox Run, being part of northeastern line of Huntingdon and Blair counties, between the townships of Morris, in Huntingdon, and Catherine, in Blair County.

Commissioners of Blair County, construct reinforced concrete culvert across Roaring Run, at a point on the road leading from Mt. Etna to Huntingdon Pike, in Catherine Township.

Pennsylvania Railroad Company, construct a 5-foot reinforced conduit under main track to take the place of Bridge No. 39.76, across Zerby Run, Bellefonte Branch (old 22), in Penn Township, Center County; make change in single-track, two-span deck girder bridge, No. 114, across the Schuylkill River, 6005 feet northwest from Auburn Passenger Station, in Schuylkill County; make change in present three-span, half through girder bridge, No. 111, over Pine Creek, 1685 ft. south of Auburn Passenger Station, in Schuylkill County; make change in present one-span, half through girders and six-span deck girders bridge 106 over Schuylkill River, at a point in the Borough of Hamburg, Berks County.

Supervisors of Sandy Township, Clearfield County, construct bridge over Sandy Lick Creek, 1.0 mile east of Du Bois.

Commissioners of Franklin County, construct bridge over an unnamed tributary of Back Creek, 0.25 mile north of Williamson, St. Thomas Township.

New York Central Railroad Company, construct fill along right bank of French Creek, from a point 2800 ft. west of the Franklin Borough line, in Venango County.

Johnstown Water Company, a temporary dam across Laurel Run, in West Taylor Township, Cambria County.

Pittsburgh, Pa.—Councilmanic Public Service and Surveys Committee and Director of Public Works considering building a bridge at Greenfield Avenue. A concrete bridge is estimated to cost $125,000, and if provision is made for street cars $135,000; a steel bridge at $75,000 and $85,000 respectively.

New Orleans, La.—Trans-Mississippi Bridge Company, New Orleans, has applied to the State for permission to construct a bridge across Mississippi River at New Orleans.

Louisville, Ky.—Plans and specifications approved for the 40-ft. concrete bridge to be constructed in Cherokee Park, but nothing further has been done about the matter. Stonestreet & Ford, Engineers, Louisville. Harry S. Smith, Secy. Park Bd.

Chicago, Ill.—Bonds for $5,100,000 for 19 bridges were voted favorably June 5. The $2,500,000 for criminal court denied.

White Rock, Kan.—Commissioners of Jewel and Republic Counties will construct a bridge across Republic River near here, to cost $15,000.

Kansas City, Mo.—Following improvements bonds sold June 1 by city: Sewers, $100,000; bridge and viaduct, $200,000; Twelfth Street Trafficway, $200,000; public parks and parkways, $200,000; Twenty-third Street Trafficway, $250,000; Workhouse and House of Correction, $75,000, and Blue River sewer, $100,000.

St. Joseph, Mo.—St. Joseph & Grand Island Ry. (W. A. Parker, Chief Engr., St. Joseph, Mo.), will rebuild the bridge across Missouri River near here, at a cost of $350,000.

Deming, N. M.—State Engineer approved plans for a bridge to be constructed over Mimbres west of Deming, on Deming-Silver City road, to have 100-ft. steel span, with an approach of 60 ft. on concrete piers.

Grants, N. M.—State Engineer, Santa Fé, is considering constructing a bridge over San José River near here.

Logan, N. M.—Surveys being made by State Engineer, Santa Fé, for the bridge to be constructed across Canadian River at Logan.

Wenatchee, Wash.—Great Northern Ry. Co. (A. H. Hogeland, Ch. Engr., St. Paul, Minn.) will replace 13 wooden bridges with steel and concrete structures in Crab Creek Country east of Wenatchee.

Salem, Ore.—R. R. Clark, 416 Selling Building, Portland, is one of the consulting engineers for Poke County concrete arch bridge to be constructed at a cost of $250,000.

Chico, Cal.—The Northern Electric Ry. Co. is to reconstruct bridges over American and Feather Rivers; cost about $70,000.

Los Angeles, Cal.—The bridge to be constructed across Los Angeles River near Ivanhoe Station is to be a wooden pile trestle 1400 ft. long 25 ft. wide and cost $15,000. R. W. Stewart, Engineer Bridges and Structures, City Hall.

Bridge over Santa Margarita River, between Los Angeles and San Diego is to be steel, consisting of four 105-ft. spans. G. W. Harris, Los Angeles, Engineer.

City Council directed Pacific Electric Ry. Co., to construct a viaduct over Arroyo Seco. Approximately 300 ft. wide.

Riverside, Cal.—Election to be held Aug. 29 to vote bonds for constructing bridges; probably $150,000 bonds will be issued. S. B. Pilch, Clerk Board Supervisors.

San Bernardino, Cal.—Election will be held July 25 to vote $44,000 bonds for constructing three steel bridges, $16,000 for three levees, $40,000 for storm drain and pavement, $20,000 for street repairs, $17,000 for fire protection, and $3,500 for fill, pavement and spillway. Address City Engineer.

Phoenix, Ariz.—Preliminary surveys being made for a 900-ft. bridge to be constructed across Gila River, near Arlington, by the Board of Supervisors. Surveys include 15 miles of proposed road connecting bridge site with Phoenix-Yuma Highway.

Salt Lake City, Utah.—City and county will construct concrete bridge across Jordan River at Twelfth South Street. Estimated cost $9,000. Address County Clerk.

BIDS DESIRED.

Hollidaysburg, Pa.—Until June 14, by County Commissioners, for constructing several concrete bridges.

Media, Pa.—Until June 19, by County Commissioners at Media, for constructing a bridge on Morton Avenue over Ridley River, between Chester Ridley Township and Eddystone Borough, advertised in Engineering Record. Orion L. Davis, County Comptroller.

Philadelphia, Pa.—Until June 20, by William H. Connell, Chief of Bureau of Highways, Department of Public Works, for Schedule "A," repairs to Rhawn Street Bridge over Pennypack Creek, to cost $16,000.

Wilkes-Barre, Pa.—Until June 19, by F. R. Hendershot, County Controller, for constructing following bridge, reinforced concrete slab, over Campbell's Creek, and one over Kahler's Creek, both in Nescopeck County; reinforced concrete bridge over Bear Swamp and reinforced concrete slab bridge over Laurel Creek in Ross Township; reinforced concrete slab bridge over Sutton Creek branch in Exeter Township, and similar bridges and concrete culverts in Butler and Dorrance Townships.

Rehoboth, Del.—Until July 6, by Morgan T. Gunn, County Road Engineer, Georgetown, for constructing superstructure of bridge across U. S. Canal, to cost $12,000.

Richmond, Va.—Reported desired until June 16, by State Highway Commissioners (G. P. Coleman, Comr.) for constructing concrete bridge, 20 x 22 ft., over brook.

Rome, Ga.—Reported desired until June 12, by County Commissioners, for constructing two bridges. W. C. Spiker, Candler Bldg., Atlanta.

Brewton, Ala.—Reported desired until July 3, by County Commisioners, for constructing 100 ft. low steel truss highway bridge, riveted on concrete foundations. Separate bids for steel span.

Dayton, Ohio.—Until June 30, by Board County Commissioners (Walter H. Aszling, Clk.), for constructing concrete substructure to replace substructure of Bridge 76, Randolph Township, over Stillwater River, known as Upper Union Bridge. Also separate bids for concrete substructure to replace substructure of Bridge No. 38, Harrison Township, over Stillwater River, and known as Shoup's Mill Bridge.

Tiffin, Ohio.—Reported desired until June 17, by County Commissioners, for Wolfe Creek bridge No. 6, in Hopewell Township, concrete abutments for Buskirk Bridge No. 111, in Clinton Township, rebuilding northeast wing wall, new floor beams and steel joists, etc. J. E. Herahberger, Co. Aud.

Monmouth, Ill.—Until June 17, by C. L. McClanahan, County Superintendent of Highways, Monmouth, for constructing a steel bridge on reinforced concrete abutments in Sumner Township, Warren County; span 100 ft.; cost $7,975.

Peoria, Ill.—Until June 14, by Highway Commissioners Richwood Township, at office of Superintendent of Highway, Peoria, for constructing reinforced concrete bridge, 13-ft. span with 20-ft. roadway, on Knoxville Avenue.

Richland Center, Wis.—Reported desired until June 12, by Board Public Works, for constructing wall and abutments for East Bridge across Pine River.

Litchfield, Minn.—Reported desired until June 14, by County Commissioners, for constructing a standard reinforced concrete culvert 24 ft. long. A. O. Palmquist, Co. Aud.

Owatonna, Minn.—Reported desired until June 13 for constructing 28 ft. span and abutments reinforced concrete, bridge in town of Summit. Also for two 20-ft. span and abutments concrete bridges in Owatonna. A. J. Prior, Engr., Courthouse, Owatonna.

Ainsworth, Neb.—Until July 3, by Commissioners of Brown and Keya Counties, for constructing a steel bridge 125 ft. long across Niobrara River at site of old McLain Bridge.

O'Neill, Neb.—Reported desired until June 30, by S. A. Richardson, County Clerk, for constructing bridges across the Niobrara River four miles southeast of town of Lynch.

Stanley, N. D.—Until June 19, by H. P. Duggan, Co. Aud., for constructing highway bridge across a dry coulee one mile north of Sanish. Proposals will be accepted on any design of bridge built of any kind of material; also for a fill across coulee instead of bridge. Bridge to be 160 ft. long and 18 ft. wide.

Seattle, Wash. — See "Paving and Roads."

California.—Until June 26, by State Highway Commission, Sacramento, for constructing two reinforced concrete bridges for Shasta County, one 120 ft. structure across Sale Creek and the other 541 ft. across Sacramento River. The bridges located between Baird and Antler.

Napa, Cal.—Reported desired until June 20, by N. W. Collins, Co. Clk., for masonry and reinforced concrete bridge on Wild Horse Valley Road.

San Jose, Cal.—Reported desired until June 19, by Henry A. Pfister, Clk. Board County Supervisors, for constructing reinforced concrete culvert on Phipps Hill Avenue and reinforced concrete single span slab type culvert on Foot Hill Avenue.

Levis, Que.—Until June 17, by J. W. Pugsley, Secy. Dept. Railway & Canals, Ottawa, Ont., for constructing a viaduct, station and train shed at Levis. Ross & McDonald, Archts., Montreal.

Dauphin, Man.—Until June 17, by J. A. Gorby, Secy.-Treas., Rural Municipality, for furnishing material (gravel and piles excepted, which last named material will be supplied at site of the bridges by Municipality free of charge) and labor for constructing concrete foundation and approaches over Valley River Township 26.

Virden, Man.—Until June 17, by William Whiteford, Secy.-Treas., for furnishing material and constructing reinforced concrete bridge and culverts.

Westbourne, Man.—Reported desired until June 13, by P. St. Clair McGregor, Secy. Treas., Gladstone, for constructing two reinforced concrete bridges.

Saskatoon, Sask.—"See Paving and Roads."

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Woonsocket, R. I.**—Following are three lowest bids opened May 23 by city for constructing two concrete bridges (a) at Cumberland Street, (b) at Social Street: Hynes Construction Company, Springfield, Mass. (a) $4,480. (b) $6,574 (awarded contract for both bridges); G. Ferullo & Company, Boston, Mass. (a) $5,436, (b) $7,937; Cenedella & Company, Millford, Mass. (a) $7,147, (b) $9,700.

★**Bayonne, N. J.**—Contract awarded by Central R. R. of New Jersey to McClintic Marshall Construction Company, 15 Park Row, New York, N. Y., for constructing a bridge over Morris Canal, calling for about 350 tons of steel.

★**Trenton, N. J.**—Contract for constructing stone bridge and three box culverts on New River Road awarded Utility Constr. Co. of New Brunswick, at $8,080.

★**Albany, N. Y.**—Following are unit figures of the four lowest bids opened May 23 by W. W. Wotherspoon, State Superintendent Public Works, for Contract 128, Champlain Canal, Section 2, constructing substructure, superstructure and approaches of highway bridge over Hudson River at Northumberland: (a) Engineer's estimate, $77,751; (b) Holler & Shepard, 220 E. & B. Building, Rochester, $76,487 (awarded contract); (c) Troy Public Works, 67 City National Bank Building, Utica, $78,826; (d) Great Lakes Dredge & Dock Co., Albany, $79,748; (e) Flood & Van Wurt Co., Hudson Falls, $81,996.

	(a)	*(b)	(c)	(d)	(e)
12,300 cu. yd. excavation	$0.55	$0.40	$0.45	$0.55	$0.65
291 cu. yd. lining	1.50	1.50	1.50	1.60	1.50
1,980 cu. yd. second-class concrete	8.00	7.60	8.00	7.90	8.00
719 cu. yd. fourth-class riprap	2.50	2.30	2.50	2.50	2.50
73.3 M ft. sawed lumber	60.00	60.00	60.00	60.00	55.00
698 lin. ft. wooden fence	0.25	0.25	0.25	0.25	0.25
719,000 lb. structural steel	0.05	0.056	0.055	0.055	0.0586
6 oil signal lamps, each	15.00	15.00	15.00	15.00	15.00
1 cofferdam, pumping, bailing and draining (lump sum)	10,000.00	7,500.00	9,500.00	9,000.00	10,000.00
1 maintaining navigation (lump sum)	300.00	200.00	10.00	300.00	300.00
1 maintaining highway traffic (lump sum)	2,000.00	2,000.00	1,500.00	1,600.00	500.00

Albany, N. Y.—Following are unit figures of the four lowest bids opened May 23 by W. W. Wotherspoon, State Superintendent Public Works, for Contract 129, Erie Canal, Section 2, constructing substructure, superstructure and approaches of Freeman's bridge over Mohawk River, near Schenectady: (a) Engineer's estimate, $80,976; (b) The Foundation Co., 233 Broadway, New York, $87,391; (c) Frank L. Cohen, 49 Niagara Falls Street, Buffalo, $89,451; (d) Lupfer & Remck, Buffalo, $96,624; (e) Charles Faith Co., 1029 Illuminating Building, Cleveland, Ohio, $97,839.

	(a)	(b)	(c)	(d)	(e)
9,540 cu. yd. excavation	$0.60	$0.50	$0.60	$0.72	$0.65
329 cu. yd. lining	1.60	1.40	1.60	1.80	1.80
533 cu. yd. concrete in pier below el. 199	20.00	22.00	20.00	24.00	21.00
2,010 cu. yd. second-class concrete	10.00	9.90	11.10	12.00	11.00
66.5 M ft. sawed lumber	60.00	60.00	60.00	72.00	60.00
17 M ft. wooden sheet piling	60.00	65.00	60.00	72.00	60.00
3,390 lin. ft. foundation piles	0.30	0.25	0.30	0.36	0.35
790 lin. ft. wooden fence	0.25	0.30	0.25	0.30	0.30
474 lin. ft. lattice railing	2.00	3.45	2.00	2.40	3.50
783,000 lb. structural steel	0.046	0.0538	0.054	0.0545	0.0625
13,100 lb. cast-iron pipe	0.035	0.03	0.035	0.042	0.03
10 oil signal lamps, each	15.00	20.00	15.00	18.00	17.00
1 removing existing buildings (lump sum)	100.00	1.00	100.00	120.00	75.00
1 maintaining navigation (lump sum)	100.00	1.00	100.00	120.00	75.00

★**Pottstown, Pa.**—Contract for erecting four-track plate girder bridge, steel and concrete construction, over Kelm Street awarded as follows: Substructure, P. J. Campion of Mahanoy City; superstructure to American Bridge Co., 30 Church Street, New York, N. Y., and waterproofing to Drelensen Paving Co. of Philadelphia, Pa.

★**Warren, Pa.**—Contract awarded Chas. Falk & Company, Cleveland, Ohio, for constructing a concrete bridge over Allegheny River, at $116,900 (bids opened May 31): Other bidder: Hackedorn Construction Company, Indianapolis, Ind., $123,900. Addison White, Commissioners Clerk.

★**Washington, Pa.**—Contract for constructing Troy Bridge in Finleyville (bids opened May 31 by F. J. Underwood, County Controller); awarded as follows: Substructure, S. Forsythe, Finleyville, and superstructure, F. S. Wilson, Kittanning.

★**Warren, Ohio.**—Contract awarded by County Commissioners for constructing concrete bridge over Allegheny River to replace suspension bridge to Charles Fath Co., Cleveland, at $117,900.

★**Chicago, Ill.**—Contract awarded to N. Melzer of Glenview for constructing reinforced concrete bridge at McEldowney, in Bloom Township, Cook County, at $4,500. George A. Quinlan, County Highway Engineer.

★**Illinois.**—Contract for constructing Spangler Bridge, in Jackson Township, Will County, awarded by State Highway Commission, Springfield, to Peter McCully Construction Company, Mackinaw, at $11,154. C. Older, Bridge Engineer, Springfield.

★**Corydon, Iowa.**—Contract awarded Akin & Flutter, Corning, Iowa, for constructing several beam spans and concrete box culverts (bids opened May 18), at $7,219. R. C. Craig, County Engineer.

Des Moines, Iowa.—Lowest bid opened May 25 by Council (A. H. Davidson, Secy.) for constructing superstructure of concrete viaduct over Court Avenue submitted by Koss Construction Company of Des Moines at $49,519.

★**Kearney, Neb.**—Contract awarded by Commissioners of Kearney and Buffalo Counties for constructing, 1056 ft. long and 16 ft. wide, concrete bridge over Platte River to Omaha Structural Steel Co., Omaha, at $44,350. (Bids opened May 23.)

★**Gainesville, Tex.**—Contract awarded by Chamber of Commerce to Canadian Valley Bridge Company, Oklahoma, Okla., for constructing a wagon bridge several hundred feet long, over Red River, 8 miles north of Gainesville at Sacra's Ferry.

★**Harrisburg, Tex.**—Contract for constructing lift bridge over Brays Bayou at Harrisburg awarded by Commissioners Court at Houston, to E. B. Van De Greyn of Houston, at $35,797. Other bidders, W. L. Pearson & Co. (concrete bridge), $25,250, Midland Bridge Co., Kansas City, Mo., $40,000, and Blodgett Constr. Co., Kansas City, Mo., $47,000.

★**Centralia, Wash.**—Contract awarded Stanley Reinforced Concrete Company of Centralia for concrete culverts for Northern Pacific R. R., to cost $16,000.

Lowest bid submitted to Board of Public Works for steel and iron work for two Howe truss spans by Minneapolis Steel & Machinery Co., 427 Plymouth Bldg., Minneapolis, Minn., at $10,723.

★**Seattle, Wash.** — Reported contract awarded by County Commissioners for constructing Falls City bridge to A. Levengreen, 3826 Eastern Avenue, at $36,845 (bids opened May 22).

★**Seattle, Wash.**—Contract awarded by Board of Public Works for regrading approach to Fifteenth Avenue bridge to B. H. Petley, Seattle, at $13,291.

★County Commissioners rescinded former action of awarding contract for construction of Fall City steel and concrete bridge, "Type C," and has awarded contract to Butler Contracting Co., Central Bldg., at $36,900.

★**Portland, Ore.** — Reported contract awarded by Oregon-Washington R. R. Navigation Co., Portland, for constructing sub-structures for four bridges to Robert Wakefield, Worcester Bldg., at about $18,000.

PAVING AND ROADS

PROPOSED WORK.

Lowell, Mass.—Contract soon to be let by Municipal Council for furnishing 340,000 granite paving blocks.

Milford, Mass.—Selectmen intend rebuilding West Congress, Grant Purchase and School Streets, at a cost of $27,000.

East Aurora, N. Y.—Citizens voted $13,000 bonds for paving portion of Pine Street. Address City Clerk.

Rochester, N. Y.—Ordinance has passed Council providing for paving with asphalt and constructing sewer in Howell Street at a cost of $21,000 and Marshall Street at a cost of $26,000; also Crossman Terrace at a cost of $11,500.

Camden, N. J.—It is proposed to pave with asphalt on Morton, Linden, Twenty-seventh, Erie and Pine Streets. Address City Clerk.

Elizabeth, N. J.—Board Public Works intends improving Cross Avenue at a cost of $24,000. Board is also considering improving Elizabeth Avenue, First, S. Broad, Marshall Streets and Magnolia Avenue at a cost of $297,469.

Newark, N. J.—The Board of Public Works will pave Front Street with granite block pavement on concrete foundation.

Bradford, Pa.—City Council has been petitioned to pave Bank and Clarence Streets with vitrified brick. B. A. Wise, City Engineer.

Paving of North Kendall Avenue with brick is under consideration. B. A. Wise, City Engineer.

Pittsburgh, Pa.—Council passed ordinance authorizing paving and curbing of a portion of Perrott Avenue at a cost of $20,000.

Baltimore, Md.—Contracts soon to be let by Board of Awards to pave portions of Schroeder and Baltimore Streets and Brantley Avenue.

Beckley, W. Va.—County Commissioners sold $835,000 road bonds. Address County Clerk.

Parkersburg, W. Va.—Contract will be let late in summer for 15,000 sq. yd. brick and 9,000 sq. yd. concrete paving. T. L. Higgs, City Engineer.

Troy, Ala.—Contract about to be let by city for 20,000 sq. yd. pavement on Three Notch Street. L. E. Gellerstedt, Mayor.

Jennings, La.—Citizens of the county voted $500,000 bonds for constructing good roads. Address Clerk Paris Police Jury, Jennings.

Monroe, La.—Citizens, May 29, voted $500,000 bonds for constructing roads in Ouachita Parish. Address Clerk Police Jury, Monroe.

Brookhaven, Miss.—Reported an election will be held to vote $200,000 bonds for road improvements in Lincoln County. Recent election declared void.

Durant, Miss.—Holmes County Commissioners engaged Snowden & Hauser, Columbus, Miss., as engineers for the 45 miles of highway, surveys for which are now being made. Contract to be let at July meeting of Board.

Winona, Miss.—Snowden & Hauser, Columbus, Miss., engaged as engineers for the proposed 25 miles of road which Commissioners of Montgomery County at Winona propose constructing. Surveys are now being made. Contract will be let at July meeting of Board.

Yazoo, Miss.—Citizens of County voted $625,000 bonds for constructing roads. Address County Clerk.

Erwin, Tenn.—Road bonds for $100,000 will be sold June 17 by R. M. Barry, Chmn. County Court.

Madisonville, Tenn.—County Commissioners sold $150,000 road bonds. Address County Clerk.

Marysville, Tenn.—Pike road bonds for $200,000 will be sold June 15 by County Court of Revenue. (W. H. Willard, Secy.)

Albany, Ky.—Road and bridge bonds for $50,000 will be sold June 13 by J. G. Sloan, Clk. County Court.

Bedford, Ky.—Citizens, May 27, voted $90,000 bonds to construct roads. W. L. Harmon, Engineer, Bedford. Address County Judge, Bedford.

Bowling Green, Ky.—State Division Engineer announces that about $30,000 worth or more of State Aid Road work in Warren County will be let within the next month. See "Bids Desired." M. H. Crump, Road Engineer, Warren County, Room 24, Court House, Bowling Green.

Lexington, Ky.—Paving bonds for $10,000 will be sold June 20. Address County Clerk.

Somerset, Ky.—Road bonds for $300,000 will be sold June 9 by R. F. Jasper, County Judge.

Akron, Ohio.—Road improvements bonds for $68,017 will be sold June 10. U. G. High, Clk. Board County Commissioners.

Alliance, Ohio.—Paving bonds for $24,023 will be sold June 20 by Chas. O. Silver, City Auditor.

Cincinnati, Ohio.—City Council taking steps to pave with granite on Fairbanks Avenue and Quebec Road at $202,000 and $230,000 respectively. Frank S. Krug, City Engineer.

Council approved City Engineer's estimate for improving Hickory Street with brick and including 6-in. water main at $15,045, and for improving right-of-way from Third to Martin Streets at $12,200.

City Council approved City Engineer Frank S. Krug's approximate estimate of $22,564 as cost of improving Dayton Street from Freeman Avenue to Whiteman Street with granite and 8-in. water main. Contract soon to be let.

County Board of Commissioners has under consideration improvement of First Avenue from Addyston to Price Hill. County Surveyor William Boeh's estimate of the work is $19,000.

Defiance, Ohio.—Paving bonds for $28,000 will be sold June 19 by Roger Daoust, Co. Aud.

East Liverpool, Ohio.—Paving bonds for $52,000 will be sold June 20 by James A. Kenny, City Auditor.

McConnelisville, Ohio.—Paving bonds for $17,000 will be sold June 7. John Whitney, Co. Aud.

New Philadelphia, Ohio.—Paving bonds for $17,000 will be sold July 1 by Attie I. B. Williams, City Aud.

Norwalk, Ohio.—Paving bonds for $379,300 will be sold June 21 by Charles E. Bloomer, Co. Aud.

Painesville, Ohio.—Paving bonds for $24,000 will be sold June 19 by C. T. Mehaffey, Township Clerk.

Washington C. H., Ohio.—Ordinance. passed City Council to issue $25,000 bonds for paying city's portion of paving certain streets. Address City Clerk.

Youngstown, Ohio.—Paving bonds for $38,150 will be sold June 19 by County Commissioners. Frank V. Hogan, Clk.

Terre Haute, Ind.—Road improvement bonds for $41,210 sold by County Treasurer.

Springfield, Ill.—Board of Local Improvements will resurface with mineral rubber asphaltic concrete Walnut Street, from Lawrence Avenue to S. Grand Avenue. Estimated cost $12,650. Address City Clerk.

Davenport, Iowa.—Reported about $16,000 is to be spent by city for street improvements. A. R. Boudinot, City Engineer.

Marshalltown, Iowa.—Plans prepared for 32,000 yd. concrete paving and about 20,000 yd. clay gravel road work. W. H. Steiner, City Engineer.

Clinton Falls, Minn.—Construction of cement highways over the hills contemplated by farmers of Clinton Falls Township, cost about $75,000; farmers to pay $36,000. County Clerk at Owatonna may be able to give information.

Robbinsdale, Minn. — Citizens voted $13,000 bonds for paving Crystal Lake Avenue about 1 mile. Address City Clerk.

Girard, Kan.—County Commissioners petition to construct about 11 miles of hard surface roads in this county.

Liberty, Mo.—Election to be held June 24 in the county to vote $1,250,000 bonds for road improvements. Address County Clerk.

Conway, Ark.—Construction of 2 roads contemplated, one 8 miles long and the other 14 miles. W. M. Taylor of Conway, County Judge.

DeWitt, Ark.—State Highway Department (H. R. Carter, Engineer), Little Rock, intends constructing 7 miles of macadam road and 9 miles of grading in Arkansas County at a cost of $48,000.

Pine Bluff, Ark.—A macadam road is to be constructed between Pine Bluff and Altheimer, distance of 40 miles, and other is to be construeted to Lonoke County Line, distance of 20 miles; total cost $289,000. Hugh Humphrey, Pine Bluff, County Engineer.

Athens, Tex.—Henderson County Road District No. 4 bonds for $60,000 will be sold June 12 by C. D. Owen, County Judge.

Cleveland, Tex.—County Commissioners authorized $60,000 bond issue for constructing and improving roads. Address County Clerk.

Edinburg, Tex.—Attorney General has approved $250,000 Hidalgo County Road District bonds.

Albuquerque, N. M.—City is considering paving 10 blocks, probably with Tarvia. Address City Clerk.

Aberdeen, Wash.—Contract will soon be let for paving Second Street; cost, with concrete, $14,000, and asphalt, $16,000. L. D. Kelsey, City Engineer. P. F. Clark, City Clerk.

Centralia, Wash. — Concrete sidewalks throughout city will be constructed at $20,000 by day labor. L. M. Lee, City Clerk; C. W. Anderson, City Engineer.

Ellensburg, Wash.—City Council recommends paving with concrete Sprague, Seventh, Anderson, Chestnut and other streets. F. M. Carter, City Engineer; Reuben Crimp, City Clerk.

Sedro Wooley, Wash.—City Engineer will prepare plans for paving with concrete Third and State Streets. C. S. Smith, City Clerk.

Coquille, Ore.—Contract will soon be let for improving district from Courthouse east by grading, planking, 5-ft. cement sidewalks, culverts and bulkheading. Estimated cost, $30,335. Address City Clerk.

Road improvement bonds for $362,000 to be sold July 5 by County Clerk. Citizens, May 19, voted in favor of this issue of bonds. James Matson, County Judge.

Portland, Ore.—Plans filed with City Council for paving East Thirty-second and Ankey Streets. Estimated cost, $10,000. A. L. Barbur, City Auditor; Philip H. Dater, City Engineer.

Pasadena, Cal.—Surveys being made for the proposed automobile road to be constructed by the state across the mountains into Antelope Valley. Address State Highway Engineer, Sacramento.

San Bernardino, Cal.—See "Bridges."

Vallejo, Cal.—Contract to be let by City Council soon after June 16 for following work in Northwest Paving District: 24,414 cu. yd. excavation (all classes), 126 cu. yd. sand fill and adobe cut under sidewalk 6 in., 15,165 lin. ft. 7½ x 14 in. concrete curb; 576 lin. ft. curb armor; 258,144 sq. ft. 4-in. concrete base for pavement; 12,000 sq. ft. concrete brick pavement 2½-in. concrete base; 258,144 sq. ft. asphaltic concrete surface 1 in. thick; 40 cu. yd. reinforced concrete retaining wall 3 ft. high; 400 lin. ft. reinforced concrete guard rail; 7376 sq. ft. concrete sidewalk, 3½ in. 40 lin. ft. corrugated iron culverts, part circle, 6 x 18 in., 986 lin. ft. 8 x 18 in., 138 lin. ft. 8 x 24 in., 20 lin. ft., circular, 8 in. diam.; 15 c. i. culvert manholes, 16 x 18 in., 2 18 x 24 in. 712 lin. ft. head board 4 x 8 in., and 483 lin. ft. house lateral sewers 4 in.

Tucson, Ariz.—Contract soon to be let by Board of Supervisors for constructing 28 miles of highway between Tucson and Ajo. Bertram L. Hitch, Clerk of Board.

Board of Supervisors rejected bids opened recently for constructing 7 miles of Nogales Patagonia Road and will do work by force account. Cost, about $13,000.

Montreal, Que.—Contract soon to be let by P. Mercier, City Engineer, for asphalt and block pavements, to cost $250,000.

Toronto, Ont.—York County Higbway Commission is preparing plans for road improvements to cost $150,000. E. A. James, Engineer, 57 Adelaide Street.

BIDS DESIRED.

Boston, Mass.—Until June 12, by Edward F. Murphy, Commissioner Public Works for granite block or Hassam block pavement on Alexander Street, Dorchester.

Massachusetts.—Until June 13, by State Highway Commission, State House, Boston, for surfacing section of highway about 9800 ft. long, in town of Duxbury.

Greenwich, Conn.—Until June 17, by Highway Commission, for about 43,500 sq. yd. reinforced concrete pavement, advertised in Engineering Record.

Albany, N. Y.—Until June 25, by Edwin Duffey, State Highway Commissioner, for constructing highways, also repair of highways, and for broken stone for maintenance work on Road No. 766 and 5187, known as Broken Stone Contract No. 70 Essex County, advertised in Engineering Record.

New York, N. Y.—Until June 14, by Douglas Mathewson, Pres. Bronx Boro., for paving with sheet asphalt portions of St. Mary's St., Wales Ave., in all about 1900 sq. yd., and with bituminous concrete portions of W. 180th St., Harrison Ave., Walton Ave. and other streets, in all about 14,285 sq. yd.; constructing sewers in Hone Ave., Crotona Parkway and other streets; also for erecting fire escapes in Municipal Court Bldg., 162d St. Total security, $23,650.

Until June 14, by Marcus M. Marks, President Manhattan Boro. for paving and repaving, etc., portions of Madison Ave., Park Ave., Broadway, 96th and other streets, in all about 100,800 sq. yd. asphalt; 15,940 sq. yd. concrete, together with sewer manholes, etc. Total security, $68,750.

Norwich, N. Y.—Until June 13, by Common Council for paving Rexford Street, in all about 3350 sq. yd. bituminous macadam penetration method, and 2600 lin. ft. combined curb and gutter. C. E. Harris, City Engr.

Jersey City, N. J.—Until June 13, by City Commissioners, for paving with asphalt block on Rose Avenue and with Belgian block on Seventeenth Street. M. I. Fagan, City Clerk.

New Brunswick, N. J.—Until June 12, by Asher W. Bissett, Clerk, for laying asphalt block on concrete foundation, about 34,000 sq. yd.

Pennsgrove, N. J.—Until June 12, by Borough Officials, for paving with macadam on Broad and Maple Avenues, 15,484 sq. yd. W. D. Snyder, Borough Clerk; H. B. Keasbey, Borough Engineer.

Perth Amboy, N. J.—Reported desired until June 12, for 34,000 sq. yd. asphalt block paving on concrete foundation. Alvin D. Fox, Co. Engr., New Brunswick.

South Orange, N. J.—Until June 12, by Streets and Highway Committee of Board of Village Trustees (Geo. H. Becker, Chmn.), for resurfacing with bituminous surface Valley Street, Irvington, Montrose and Vose Avenues, in all about 40,800 sq. yd.

Trenton, N. J.—Until June 13, by Board Freeholders, Trenton, for resurfacing with bituminous dressing Trenton-Hopewell Road from Trenton to Hopewell.

Apollo, Pa.—Until June 27, by Sterling G. McNees, Secretary Borough, for approximately five blocks of paving and curbing, advertised in Engineering Record.

Ebensburg, Pa.—Until June 23, by County Commissioners, for constructing two miles of roads on Cresson Pike, Cambria Township, with vitrified fire clay paving brick on concrete base. Probable cost, $25,000.

Philadelphia, Pa.—Until June 15, by William H. Connell, Chief Bureau of Highways, Department of Public Works, for the following: Schedule "A," grading, cost $19,300; Schedule "B," asphalt paving, $122,450; Schedule "C," vitr. block paving, $6,950; Schedule "D," granite block paving, $15,500; Schedule "E," asphalt repaving, $43,500; Schedule "F," vitr. block repaving, $11,400; Schedule "G," granite block repaving, $65,700; Schedule "H," wood block repaving, $6,000; Schedule "I," resurfacing asphalt, $13,200; Schedule "J," surfacing water-bound macadam, $21,050; Schedule "K," painting and repairing bridges, $6,500.

Pittsburgh, Pa.—Until June 13, by City Controller, for repaving portions of Forbes Street, Butler, Eleventh and numerous other streets.

Sharpsville, Pa.—Until June 20, by Wm. A. Graber, Borough Secretary, for paving Mercer Avenue, with such material as Council may select, in all about 6865 sq. yd.

Baltimore, Md.—Until June 14, by Board of Awards, care City Register, for grading, curbing and paving with sheet asphalt, wood block, granite, block vitr. block, portions of Brantley Avenue, Baltimore and Schroeder Streets, in all about 18,830 sq. yd. Also same time and place for paving with concrete a number of alleys.

Charleston, W. Va.—Until June 15, by B. A. Wise, City Manager, for grading, curbing and paving certain streets advertised in Engineering Record. About 26,000 sq. yd.

Kingwood, W. Va.—Until June 26 (change of date), by Preston County Court (E. C. Everly, Clk.), for grading and surfacing, complete, of approximately 32 miles of road in Portland Dist., and approximately 18 miles in Kingwood Dist. Bids desired on following types, concrete, cement and asphalt, 8, 9, 12 and 14 ft. widths, macadam, according to standard specifications of the State Road Bureau, of above widths, Telford base 8 in. and 6 in. thick, with limestone surface and with native stone surface both water and bituminous bound by penetration and mixing methods. Rich. R. Feller, Dist. Engr., Terra Alta, W. Va.

Miami, Fla.—Until June 15, by City Council, for grading and paving with asphaltic concrete, with binder course on concrete foundation, with necessary curbing, etc., under Highway Improvement Nos. 45 to 51, inclusive, being approximately 60,000 sq. yd. pavement.

Anniston, Ala.—Until June 22, by city for repairing and surface treatment of about 28,000 sq. yd. pavements. C. W. Cooper, City Engr.

Canton, Miss.—Until June 12, by W. L. Dinkins, Mayor, for approximately 5300 sq. yd. either concrete, brick, wood block or asphalt pavement, 4 miles gravel macadam, 2½ miles concrete curb and gutter, and 2600 ft. pipe storm sewers, 12 to 36 in. Walter G. Kirkpatrick, Engineer, Birmingham, Ala.

Bowling Green, Ky.—Until June 15, by State Division Engineer, Frankfort, for State Aid Highway work in Warren County. M. H. Crump, Road Engineer, Warren County, Room 24, Court House, Bowling Green.

Carlisle, Ky.—Until June 17, by Fiscal Court, at Court House, Carlisle, for improving 6.12 miles of county road known as Carlisle Lower Jackson Turnpike. R. C. Terrell, State Commissioner Public Roads, Frankfort.

Lexington, Ky.—Until June 14, by Theo. Lewis, Co. Clk., for constructing county roads. Bids desired on Kentucky rock asphalt wearing surface, penetration asphalt macadam, tar concrete (mixed method), asphaltic concrete, and on Warrenite with various types of shoulders and on macadam base.

Wickliffe, Ky.—Until June 16, by Fiscal Court at the Court House, Wickliffe, Ballard County, for grading and surfacing 55 miles of road, including 98,715 cu. yd. earth, 112,379 cu. yd. gravel, 2,616.2 cu. yd. concrete, 55 miles shaping, and laying 1804 ft. corrugated pipe. R. C. Terrell, Commissioner Public Roads, Frankfort.

Cincinnati, Ohio.—Until June 23, by County Commissioners (Albert Rheinhardt, Clk.), for repairing Cleve and Warsaw Pike in Green Township. Also separate bids for resurfacing Harrison Pike in Colerain Township.

Cleveland, Ohio.—Until June 17, by Board County Commissioners (E. G. Krause, Clk.), for repairing Noble Road. Also separate bids for repairing Lorain and East Lake Roads. W. A. Stinchcomb, County Surveyor.

Columbus, Ohio.—Reported desired until June 13, by Board of Purchase (Louis J. Guthke, Secy.), for furnishing city with street repair material, to include 200,000 old-style street paving blocks, 500 tons paving pitch, 20,000 gals. bituminous material for surface treatment, brick sewer, sewer pipe, Portland cement, etc.

Dayton, Ohio.—Until June 13, by James E. Barlow, Director Public Service, for paving portions of several streets, including Salem Avenue, Miami Chapel Road, etc.

Dayton, Ohio.—Until June 15, by Clinton Cowen, State Highway Commissioner, Columbus, for Sect. L of the Dayton-Indianapolis Road, I. C. H. No. 28, for constructing bridges and culverts and paving with brick, 10,600 ft. Estimated cost $45,834. Section L, Dayton-Covington Road, I. C. H. No. 63, Harrison Township, constructing bridges, culverts and paving with brick, 8416 ft. Estimated cost $42,943. Sect. H, Dayton-Greenville Road, I. C. H. No. 62, Harrison Township, constructing bridge, culverts and paving with brick, 7630 ft. Estimated cost $31,353.

Lisbon, Ohio.—Until June 21, by County Commissioners, for improving with water-bound slag about 6099 ft. on East Liverpool, Warren, Public Road, Midleton Township. Cost $11,349. H. R. Dickey, County Clerk.

Mt. Gilead, Ohio.—Reported desired until June 15, by C. O. Higgins, Co. Aud., for grading and paving with dry macadam, 5 miles of Beech Grove Road in Canaan Township.

Ohio.—Until June 15, by Clinton Cowen, State Highway Commissioner, Columbus, for constructing state roads as follows, including bridges and culverts:

Ashland County, Sect. A, Jeromeville-Sullivan Road, Jackson Township, with bituminous macadam and reinforced concrete. Length 3.01 miles. Estimated cost $47,854. Alternate bids with brick, same length. Estimated cost $49,676. Sect. F, Ashland-Oberlin Road, Sullivan Township, with bituminous macadam. Length 1.45 miles. Estimated cost $20,456. Alternative bids with brick, same length. Estimated cost $20,270. Sect. G, Ashland-Oberlin Road, Sullivan Township, with bituminous macadam, 0.43 miles. Estimated cost $5,800. Alternative bids with brick. Estimated cost $5,735. Sect. B, Jeromeville-Sullivan Road, Jackson Township, with bituminous macadam. Length 1.37 miles. Estimated cost $19,555. Alternative with brick, same length. Estimated cost $19,365.

Clermont County, Sect. I, Bethel-Chilo Road, Franklin Township, paving with water-bound macadam. Length 1.25 miles. Estimated cost $9,921. Sect. H. Cincinnati-West Union Road, Tate Township, water-bound macadam. Length 1.05 miles. Estimated cost $9,421. Sect. L, Milford-Hillsboro Road, Miami and Stonelick Townships, paving with water-bound macadam. Length 1.04 miles. Estimated cost $7,734.

Coshocton County, Sect. A, Walhonding-Newark Road, New Castle and Perry Townships, with water-bound macadam and surface-treated macadam. Length 2.37 miles. Estimated cost $7,480.

Delaware County, Sect. D, Columbus-Wooster Road, Berkshire Township, with either tar-bound macadam or asphalt-bound macadam. Length 1.80 miles. Either cost of tar, $23,717; asphalt, $25,202.

Erie County, Sect. O, Milan-Elyria Road, in Berlin Township, with water-bound macadam. Length 2.23 miles. Estimated cost $18,947. Sect. N. Milan-Elyria Road, Florence Township, with water-bound macadam, 0.72 miles. Estimated cost $9,018. Alternative bids with concrete, same length. Estimated cost $10,304.

Fairfield County, Sect. C, Cincinnati-Zanesville Road, Amanda Township, with water-bound macadam. 2 miles. Estimated cost $17,154. Sect. A, Lancaster-Kirkesville Road, Liberty Township, with water-bound macadam, or bituminous macadam. Length 2.06 miles. Estimated cost $21,733 with waterbound; with bituminous macadam, $29,281.

Fayette County, Sect. K, Hillsboro-Washington Road, in Concord and Union Townships, with bituminous macadam. Length 1.87 miles. Estimated cost $17,334. Sect. A, Cincinnati-Zanesville Road, in Concord, Jasper and Union Townships, with bituminous macadam. Length 7.25 miles. Estimated cost $58,065.

Gallia County, Sect. E, Jackson-Gallipolis Road, in Gallipolis and Green Townships, with water-bound macadam. Length 1.04 miles. Estimated cost $9,594.

Geagua County, Sect. H, Cleveland-Meadville Road, Munson Township, with concrete and brick. Length 5.64 miles. Estimated cost $71,482.

Harrison County, Sect. N, Cadiz-Carrolltown Road, Archer and Rumley Townships, with water-bound macadam. Length 3.01 miles. Estimated cost $34,373.

Hocking County, Sect. I, Chillicothe-Logan Road, Perry Township, constructing with water-bound gravel. 3.04 miles. Estimated cost $16,867.

Knox County, Sect. J, Columbus-Wooster Road, Liberty Township, with water-bound macadam and reinforced concrete. Length .94 mile. Estimated cost $16,911.

Logan County, Sect. E, Bellefontaine-Richwood Road, in Bokes Creek and Rush Creek Townships, with water-bound macadam. Length 1.32 miles. Estimated cost $11,960.

Lorain County, Sect. M. Cleveland-Sandusky Road, Sheffield and Avon Lake Townships, with bituminous macadam, bituminous concrete, or reinforced concrete. Length 8.93 miles. Estimated cost bituminous concrete (tar), $155,294; bituminous concrete (asphalt), $157,806; reinforced concrete, $163,570; bituminous macadam, $125,386.

Madison County, Sect. E, Urbana-London Road, in Union and Summerford Townships, with reinforced concrete and brick. Bids desired on three separate contracts. Contract No. A, 3.07 miles; No. B, 0.21 mile; No. C, 0.21 mile. Estimated cost $48,495, $8,590, $3,199 respectively.

Marion County, Sect. K, Marion-Waldo Road, Pleasant and Waldo Townships, with water-bound macadam. Length 3.10 miles. Estimated cost $29,544.

Medina County, Sect. M, Medina-Norwalk Road, Litchfield Township, with concrete. Length 1 mile. Estimated cost $11,543.

Meigs County, Sect. L, Pomeroy-Marietta Road, Salisbury Township, with brick. Length 1.13 miles. Estimated cost $24,102. Sect. M, Middleport-McArthur Road, Salisbury Township, with reinforced concrete, 1.33 miles. Estimated cost $21,805.

Montgomery County, Sect. L, Dayton-Indianapolis Road, Madison and Jefferson Townships, with brick. Length 2.01 miles. Estimated cost $45,834. Sect. H, Dayton-Greenville Road, Harrison Township, with brick, 1.44 miles. Estimated cost $31,633. Sect. I, Dayton-Covington Road, Harrison Township, with brick. Length 1.59 miles. Estimated cost $42,943.

Morgan County, Sect. G, McConnelsville-Athens Road, in Marion and Pence Townships, with water-bound macadam. Length 2.37 miles. Estimated cost $32,763.

Muskingum County, Sect. K, Zanesville-Cincinnati Road, Springfield and Newton Townships, with bituminous macadam. Length 1.45 miles. Estimated cost $18,359.

Perry County, Sect. Q, New Lexington-Athens Road, in Monroe and Pleasant Townships, with reinforced concrete. Length 4.26 miles. Estimated cost $99,046. Alternate bids for paving with brick same length. Estimated cost $89,305.

Portage County, Sect. R, Cleveland-Kent Road, Franklin Township, with plain concrete, 2.63 miles. Estimated cost $28,190.

Preble County, Sect. A, Eaton-Greenville Road, Monroe Township, with bituminous macadam, 4.48 miles. Estimated cost $46,860. Sect. F-2, Eaton-Richmond Road, Jackson Township, for truing up the roadway and paving with surface-treated macadam. Length 1 mile. Estimated cost $7,070.

Seneca County, Sect. A, Fremont-Tiffin Road, in Clinton and Pleasant Townships, with water-bound macadam. Length 4.37 miles. Estimated cost $44,267. Alternative bids with bituminous macadam, same length. Estimated cost $54,927.

Shelby County, Sect. D, Sidney-Wapakoneta Road, Franklin Township, with water-bound macadam, 3.75 miles. Estimated cost $38,083.

Wyandot County, Sect. A, Kenton-Upper Sandusky Road, Crane Township, with brick. Length 1.01 miles. Estimated cost $22,253.

Maintenance and Repairs:

Franklin County, Sect. A. & L, of Columbus-Marysville Road, Perry Township, for repairing, extending bridges, culverts, etc., resurfacing with bituminous macadam (alternative bid for solid, natural lake asphalt). Length 2.87 miles. Estimated cost bituminous macadam $22,042, solid natural lake asphalt $23,931.

Lucas County, Sect. A, Toledo-Elmore Road, Oregon Township, patching holes and applying bituminous surface treatment. Length 1.13 miles. Estimated cost $3,144. Sects. A, B and C, Toledo-Lancing Road, Sylvania and Washington Townships, for patching applying surface treatment to all but .75 mile and surfacing with bituminous macadam .75 mile. Length 6.03 miles. Estimated cost $6,395. Sects. A and B, Holland-Sylvania Road, surfacing with bituminous treatment. Length 3.74 miles. Estimated cost $1,854. Sect. A, Toledo-Ann Arbor Road, Washington Township, for patching and applying surface treatment. Length 2.66 miles. Estimated cost $1,713.

Portage County, Sect. A, Aurora-Warren Road, Hiram Township, constructing bridges, etc., and resurfacing with bituminous macadam. Length 2.6 miles. Estimated cost $24,260.

Preble County, Sect. F, Dayton-Indianapolis Road, Washington, Twin and Lanier Townships, constructing bridges, etc., and surfacing with bituminous macadam. Length 4.45 miles. Estimated cost $28,668.

Ross County, Sect. O, Portsmouth-Columbus Road, Scioto Township, constructing bridges and culverts, etc., and paving with water-bound macadam. Length 1.02 miles. Estimated cost $6,496.

Wayne County, Sect. A, Cleveland-Wooster Road, Wayne Township, constructing bridges, culverts, etc., resurfacing with bituminous macadam 1.03 miles. Estimated cost $9,225.

Painesville, Ohio.—Until June 15 (readvertisement), by H. P. Linnings, County Engineer, for paving road in Kirkland Township.

Upper Sandusky, Ohio.—Reported desired until June 12, by Chas. U. Read, Village Clerk, for grading, curbing and paving Hazel, Bigelow, Walker and Johnson Street.

Elkhart, Ind.—Until June 16, by L. M. Russell, City Engineer, for paving Beardsley Court, Jefferson Street, about 7900 sq. yd., to cost $16,000.

Frankfort, Ind.—Until June 23, by R. H. Boynton, City Engineer, for paving portion of South Street, length 3550 ft.; cost $24,625, including 27,100 sq. ft. cement sidewalk, 6000 lin. ft. cement curb, 9400 sq. yd. roadway, etc. Catterlin Street, 1525 ft., cost $13,880, including 17,600 sq. ft. cement sidewalk, 2300 lin. ft. cement curb, 4600 sq. yd. roadway, 3000 cu. yd. grading, etc. East and Green Streets, 15,260 sq. yd. cement sidewalk, cost $12,120.

Indiana.—By County Commissioners for constructing county roads as follows:

Until June 23:

Indianapolis, for reconstructing two roads in Franklin Township. Leo K. Fesler, Co. Aud.

Until June 30:

Warsaw, for constructing county line road for Kosciusko, Fulton and Marshall Counties. V. D. Mock, Co. Aud.

Illinois.—Until June 14, by State Highway Commission, Springfield, for following State aid road work:

Putnam County, Section C, gravel road, 1750 ft. long; cost $2,531; nearest Post Office, McNabb.

Crawford County, Section C, concrete, 2200 ft.; cost $7,154; nearest Post Office, Flat Rock.

Oshkosh, Wis.—Reported desired until June 17 by Board Public Works for paving Fifteenth Street and Grand Avenue with macadam. G. H. Randall, City Engr.

Stevens Point, Wis.—Reported desired until June 15, by Board Public Works (W. L. Bronson, Clk.), for paving 10 blocks. A. T. Thompson, Engr., Chippewa Falls, Wis.

Britt, Iowa.—Until June 15, by Town Clerk, for 36,000 sq. yd. pavement and 24,000 lin. ft. combined curb and gutter; bids will be considered on Portland cement concrete, one and two course; asphaltic concrete, Topeka and course aggregate; brick, or brick block, 17, 18 and 22 per cent abrasion, 3 in. vertical fire-brick, bituminated concrete, grouted macadam, sheet asphalt. Bids will also be considered on reinforcing concrete pavement and armoring curb and expansion joints. Theodore S. Delay, Engineer, Creston.

Marshalltown, Iowa.—Until June 26, by S. S. Wilson, City Clerk, for about 33,000 sq. yd. of concrete paving, 28,000 lin. ft. curb and 23,540 sq. yd. clay gravel road, advertised in Engineering Record. W. H. Steiner, City Engr.

Waterloo, Iowa.—Until June 20, by C. T. Wilson, City Engineer, for 26 blocks of paving. Bids on asphalt, wood block and brick block, with asphaltic filler, will be considered.

Kearney, Neb.—Until June 19, by T. N. Hartzell, City Clerk, for paving in Paving District No. 10, including 9030 sq. yd., estimated cost: Repressed brick, block asphalt filler, $20,317; fibre brick, 3-in. block asphalt filler, $18,963; monolithic fibre brick, 3-in. block, $17,608; concrete, one course, $13,545; concrete, two courses, $15,351; asphalt concrete, 6-in., $15,351, and sheet asphalt, 5-in. brick base.

Omaha, Neb.—Reported desired until June 12, by T. J. O'Connor, City Clerk, for paving on 13 streets.

Grand Forks, N. D.—Until about June 21, by W. G. Alexander, City Auditor, for 18,500 sq. yd. cement concrete pavement on Belmont, Vernon Avenues and other streets, including 1900 ft. circular curbing. Cost $40,000. J. J. Smith, Engineer, Grand Forks.

Minot, N. D.—Reported desired until June 19, for 25,000 sq. yd. paving. Probable cost, $85,000. E. J. Thomas, City Engr.

Illmo, Mo.—Until June 12, by City Council for paving with concrete part of Second, Hickory, Maple and Fifth Streets, advertised in Engineering Record. M. S. Murray, City Engr. E. L. Purcell, City Clerk.

Kansas City, Mo.—Until June 13, by Bd. Public Works (J. Pearce Kane, Secy.), for paving with creosoted wood block, portions of Baltimore Avenue, asphaltic concrete on Washington Avenue, Portland cement concrete on Independence Avenue, and sheet asphalt pavement on Wyandotte Street. Artificial stone sidewalks on McGee and Wornall Road.

Kansas City, Mo.—Until June 14, by Board Park Commissioners (T. C. Harrington, Secy.), for constructing with bituminous macadam pavement portions of Forty-seventh Street and Mill Creek Parkway.

Cold Springs, Tex.—Until June 12, by William McMurray, County Judge, for constructing approximately 18 miles of sand clay roads in Road District No. 1. L. S. Bryant, Engineer, Cold Springs.

Galveston, Tex.—Until June 15, by Board of Commissioners of Streets and Public Property (H. O. Sappington, Comr.), for paving on portions of Thirty-fifth, Thirty-seventh Streets, Avenue H and other streets. A. T. Dickey, City Engr.

Houston, Tex.—Until June 12, by H. L. Washburn, County Auditor, for paving Lynchburg-Cedar Bayou Road.

Colfax, Wash.—Until June 12, by A. R. Metz, Co. Aud., for grading, draining and bridging Permanent Highway No. 12, approximately 12 miles long, between La Crosse and Dusky.

North Bend, Wash.—Reported desired until June 27, by E. E. Maybee, City Recorder, for paving streets with gravel, bitulithic crushed rock or sheet asphalt, all on concrete base.

Seattle, Wash.—Reported desired until June 20, by Bryon Phelps, Co. Aud., for grading, graveling, etc., 1.2 miles of Highway No. 6 A. involving construction of two 76-ft. concrete spans and ¼ mile of concrete pavement. Probable cost $35,000. Also same place, until June 26, for grading, graveling and constructing culverts on 3 miles of Permanent Highway No. 12 A. Probable cost $50,000. A. P. Denton, Co. Engr.

McMinnville, Ore.—Until June 13 (readvertisement), by A. C. Chandler, City Recorder, for 21,000 sq. yd. asphaltic concrete pavement. Lowest bid opened May 22, was $31,103.

California.—Reported desired until June 26, by State Highway Commission, Sacramento, for constructing following three State Highways:

Ventura County—About 5.6 miles with concrete.

San Mateo County—About 4.2 miles with concrete.

Humboldt County—About 4.3 miles with concrete.

Hemet, Cal.—Until June 19, by C. M. Fitterick, City Clerk, for paving with hydraulic concrete on Florida Avenue.

Vallejo, Cal.—See "Proposed Work."

Tucson, Ariz.—Reported desired until June 15, by Board County Supervisors, for constructing the Ajo Road, a distance of about 28 miles, to consist of 244,074 sq. yd. waterbound macadam, 244,074 sq. yd. waterbound gravel, 100,108 cu. yd. excav., etc.

Salt Lake City, Utah.—Reported desired until June 13, by City Commissioners, for paving with sheet asphalt portions of Eight East Street, Fourth South, and Extension 116. Gordon Snow, City Recorder.

Saskatoon, Sask.—Until June 15, by C. J. Yorath, City Commissioner, for paving the Traffic Bridge with wood block.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Maine.**—Following are four lowest bids opened May 31 by State Highway Commission, Augusta, for road improvement:

★Town of Palmyra, 2.56 miles gravel surface: A. Williams Company, 27 Lowell Street, Boston, $15,353 (awarded contract); D. D. Pietro, Boston, $16,149; Bradbury Smith, West Sullivan, $16,706; and E. T. Mitchell, Oakland, $19,296.

★Detroit.—2.85 miles gravel surface: H. A. & S. G. Day, Bangor $15,878 (awarded contract); Bradbury Smith, West Sullivan, $16,593; A. Williams Company, Boston, $18,332; and D. D. Pietro, Boston, $20,216.

★**Boston, Mass.**—May 20 the Mayor approved contract awarded Austin Ford & Son, 114 First Street, Cambridge, for furnishing edgestone, corners, etc., at $116,817.

★**Massachusetts.**—Following are three lowest bids, opened May 31, by Massachusetts Highway Commission, Boston, for building a section of macadam road in town of Great Barrington: G. Ferullo & Company, 31 North Square, Boston, $35,488 (awarded contract); S. W. Menguale, Stockbridge; $36,559, and R. F. Hudson, Melrose, $37,684.

Massachusetts.—Following are three lowest bids opened June 6, by Massachusetts Highway Commission, Boston, for building section of State Highway:

Town of Methuen—Davie & Brook, Canton, $37,004; J. H. Ferguson, Dorchester, $37,058, and D. J. Sheehan & Company, Lynn, $37,856.

★Town of Tewksbury—Fred E. Ellis, Melrose, $13,575 (awarded contract); James E. Watkins, Amesbury, $14,245; and R. F. Hudson, Melrose, $14,365.

★**Hartford, Conn.**—Contract awarded by City to Warren Brothers, Providence, R. I., for about $500,000 worth of paving, about 40 miles of streets.

Albany, N. Y.—Following are lowest bids, opened June 5 by State Highway Department, Albany, for State Aid Road work:

Road No. 1163, Putnam County Line-Stonehouse, Dutchess County, 6.18 miles. Four lowest bidders, Wm. J. Kidd, New York City, $74,776; De Graaf & Hogeboom, Inc., Kingston, $87,486; Sam'l Beskin, Beacon, N. Y., $89,672; Cairnie-St. George, Inc., Albany, $89,741.

Road No. 1312, Barrytown-Red Hook-Rock City, Dutchess County, 6.81 miles. Four lowest bidders, Wm. J. Kidd, New York City, $57,655; Sam'l Beskin, Beacon, $77,000; John A. Jova, Inc., Newburg, $80,239; Mascetti & Holley, Torrington, Conn., $86,792.

Road No. 525 B, Lawton-Gowanda-Erie County, 0.28 miles. Wm. R. Kimmey, Albany, $4,254.

Road No. 5600, Farnham-Irving, Erie County, 2.10 miles. Three bidders, Frank L. Cohen, Buffalo, $28,889; F. J. Munn Contracting Co., Inc., Buffalo, $32,877; Walter F. Shaw & Co., Jamestown, $35,227.

Road No. 1348, New Baltimore Station-Coeymans, Greene County, 3.98 miles. One bid, E. S. Sickles, New Baltimore, $41,766.

Road No. 1364, Lexington-Prattsville, Part I, Greene County, 6.02 miles. Three bidders, De Graaf & Hogeboom, Inc., Kingston, $66,954; Geo. H. McEvoy, Creek Locks, $71,246; Geo. D. Rappleyea, Prattsville, $72,353.

Road No. 1367, Ballantyne Bridge-Genesee Valley Park, Monroe County, 1.72 miles. Four lowest bidders, Thos. Hucknall, Albion, $20,573; Greece Constr. Co., Rochester, $21,657; Frank T. Murray, Rochester, $21,948; Rocco Co., Inc., Rochester, $21,975.

Road No. 1357, Rome-Ava, Part 2, Oneida County, 4.87 miles. Three bids, J. G. Hayes & Co., Inc., Rome, $47,378; F. H. Rhodey, Albion, $48,426; Rich. Hopkins, Troy, $48,695.

Road No. 1352, Rushville Potter Middlesex-Overacker-Corner, Yates County, 9.63 miles. Four lowest bidders, Atlanta Constr. Co., Atlanta, $89,424; Hovey Benedict, Williamsport, Pa., $91,067; J. G. Hayes & Co., Inc., Rome, $96,669; Wm. H. Madden, Rochester, $97,146.

Repair Contr. No. 910, Road No. 177, Albany County, 3.86 miles. Two bids, W. L. Lawton, Glen Falls, $24,439; Flood & Van Wert Co., Hudson Falls, $25,181.

Repair Contr. No. 953, Road No. 598, Chenango County, 2.25 miles. The Franklin County, Syracuse, $9,978.

Repair Contr. No. 941, Delaware County. No bids received.

Repair Contr. No. 931, Road No. 223, Dutchess County, 1.80 miles. Thos. J. Martin, Beacon, $8,284.

Repair Contr. 877, Roads 86, 372, 645, 1034, Erie County, 12.59 miles. No bids received.

Repair Contr. No. 946, Road No. 423, Jefferson County, 3.21 miles. Edward Styring, Syracuse, $9,915.

Repair Contr. No. 949, Road No. 820, Franklin County, 2.60 miles. W. T. Thayer & Co., Chayeaugay, $12,759.

Repair Contr. No. 934, Roads No. 43 and 113, Orange County, 3.10 miles. De Graaf & Hogeboom, Inc., Kingston, $17,151.

Repair Contr. No. 939, Road No. 392, Orleans County, 1.46 miles. Fred H. Rhodey, Albion, $7,297.

Repair Contr. No. 915, Road No. 197, Rensselaer County, 3.33 miles. Flood & Van Wirt Co., Hudson Falls, N. Y., $18,095.

Repair Contr. No. 933, Road No. 9000, Rockland County, 0.85 miles. J. F. Gallagher & Co., Inc., Kingston, $4,065.

Repair Contr. No. 925, Road No. 5112, Suffolk County, 2.14 miles. Edw. F. Monahan, Manhattan Beach, $13,886.

Repair Contr. No. 926, Road No. 1018, Suffolk County, 4.60 miles. Edw. F. Monahan, Manhattan Beach, $13,452.

Repair Contr. No. 956, Road Nos. 6168 and 5289, Tioga County. Steuben Constr. Co., Hornell, $11,376.

Repair Contr. No. 954, Road No. 483, Tompkins County, 1.82 miles. Steuben Constr. Co., Hornell, $7,970.

Road No. 1358, Rome-Ava, Part 3, Oneida County, 8.26 miles. Three bids, J. G. Hayes & Co., Inc., Rome, $69,772; Thos. Grady, Rochester, $70,426; F. H. Rhodey, Albion, $72,154.

Road No. 1347, Gilboa-Conesville, Schoharie County, 4.43 miles. Two bids, De Graaf & Hoghboom, Inc., Kingston, $47,728; George S. McEvoy, Greek Locks, $59,543.

Road No. 1233, Alpone-Cayuta, Part 1, Schuyler County, 0.99 miles. Steuben Constr. Co., Hornell, $8,747.

Road No. 1101, Risingville-Campbell, Part 1, Steuben County, 5.21 miles. Four lowest bidders, Atlanta Constr. Co., Atlanta, $42,861; J. G. Hayes & Co., Inc., Rome, $44,774; J. G. Bradley & Co., Corning, $44,938; Hendrickson McCabe Constr. Co., Spencerport, $45,875.

Road No. 1103, Hartsville-Canisteo, Steuben County, 5.58 miles. Four lowest bidders, Atlanta Constr. Co., Atlanta, $38,934; P. H. Murray, Rochester, $39,535; Steuben Constr. Co., Hornell, $41,145; J. G. Hayes & Co., Inc., Rome, $41,395.

Road No. 5234-A, Liberty County Line, Part 2, Sullivan County, 8.51 miles. Two bids, Abner M. Harper, Newburg, $55,747; John J. Guinan Contr. Co., Brooklyn, $68,289.

Road No. 5601, Saugerties Village, Ulster Co., 1.86 miles. Four lowest bidders, Wagner & Braum, Brooklyn, $50,488; Joseph Heisler & Frank Guiliot, Schenectady, $56,123; Jos. L. Cuozzo, Yonkers, $56,461; Abner M. Harper, Inc., Newburg, $58,006.

Road No. 5599-A, Kingston-Port Ewen (bridge abutments), Ulster County. Four lowest bidders, H. K. Corbin Co., Inc., New York City, $61,360; Abner M. Harper Co., Inc., Newburg, $61,850; Ward & Tully, Brooklyn, $65,532; Lupfer & Remick, Buffalo, $65,874.

Road No. 1349, Varysburg-Warsaw, Part 2, Wyoming County, 4.73 miles. Four lowest bidders, F. J. Munn Contr. Co., Inc., Buffalo, $48,309; Cold Springs Constr. Co., Buffalo, $51,168; Frank J. Foote, Nunda, $53,373; F. E. Gross & Son, Yonkers, $57,812.

Repair Contr. No. 952, Road Nos. 700 and 795, Sullivan County, 4.95 miles. Two bids, Nathan E. Young, Cooks Falls, $29,964; John J. Guinan Contr. Co., Brooklyn, $37,242.

★**Cohoes, N. Y.**—Contract awarded by Board of Estimate and Apportionment for paving with vitrified brick to Langan Construction Corporation, Albany, at $16,683. Other bidders were: Thomas F. Gratton, Co., Cohoes, $17,202; James P. Kelly, Cohoes, $17,785, and Edward Walsh, Troy, $19,270.

★**Rochester, N. Y.**—Contracts awarded by Board of Contract & Supply for paving as follows: To James Passero, 175 Fifth Street, for Merchants Road and Garson Avenue, at $20,969; Ribsteim Holter Company, 16 State Street, Virginia Avenue, asphalt, at $19,717, and Oliver Costich Company, Exchange Place Bldgs., for Sykes Street brick pavement, at $9,434.

★**Elizabeth, N. J.**—Contracts awarded by Board of Freeholders to C. H. Winans Co., 207 Broad Street, for paving Springfield Avenue, at $13,422, and Edgar Road $16,389.

★**Freehold, N. J.**—Contract awarded Ralph Shreffler, Long Branch, for resurfacing first section of Keyport-Amboy Road with amiesite, at $17,329.

★**Hoboken, N. J.**—Contract awarded by City Commissioners to W. T. S. Critchfield, 64 Fifth Street, Hoboken, for resurfacing all asphalt streets where needed.

Newark, N. J.—Following are totals of bids opened May 25 by Board Street and Water Commissioners for grading, curbing, flagging and paving with bitulithic 8800 sq. yd. on North Ninth Street from Bloomfield Avenue to City Line: Standard Bitulithic Company, Newark, $29,446; Northern Construction Company, Newark, $29,860, and Glenfield Construction Company, 141 South Eighth Street, Newark, at $30,350.

Standard Bitulithic Company, Essex Building, submitted lowest bid same time as above for paving 4000 sq. yd. with bitulithic on Clinton Place at $16,442.

★Contract awarded Standard Oil Company, Essex Building, at 21.5 cts. per sq. yd. for 100,000 sq. yd. liquid asphalt and for scarifying and rolling 5.5 cts. per sq. yd. Other bidder: Northern Construction Company, Newark, 23.5 cts. per sq. yd. for asphalt and 5.5 cts. for scarifying and rolling. Amos B. Pierce, Clerk.

Following are lowest bids, opened June 1 by Board Street & Water Commissioners, for paving: Cliff street, with asphalt block on 6-in. concrete foundation, Maher & McNicholas, Harrison, $12,975; Halstead Street, with asphalt block on 6-in. concrete, Glenfield Construction Company, Newark, $17,370; Willoughby Street, with bitulithic on 6-in. concrete, Standard Bitulithic Company, Newark, $13,207; Dayton Street, asphalt on 6-in. concrete, Standard Bitulithic Company, Newark, $13,362.

★**Carbondale, Pa.**—Contract awarded John Booth Carbondale and Boland Brothers, Carbondale, for brick paving at about $1.90 per sq. yd.; about $150,000 will be spent. Bids opened May 29). H. Y. Likaley, City Clerk.

★**Hazleton, Pa.**—Contracts for paving (bids opened May 20 by B. E. Youngman, City Engr.) awarded by City as follows: Diamond Avenue, State Paving Company, Wilkes-Barre, amiesite, 12,436 sq. yd. white haven curb, at $1.80 per sq. yd.; total $26,276; Broad Street, Cedar to Linden, Hassam Paving Company, Worcester, Mass., 15,730 sq. yd., Hassam bo-comac, at $1.65 per sq. yd., total $26,944. Broad Street, Hazle to East, John Leffler, Hazleton, 4000 sq. yd., $1.04 per sq. yd. B. E. Youngman, City Engineer.

★**Reading, Pa.**—Contracts for paving awarded by City Commission as follows: Macadam, to Hassam Paving Co. of Worcester, Mass., at $88,057, and wood block and brick to Fehr & O'Rourke of Reading at $30,378.

Union City, Pa.—Lowest bid submitted May 25 to City Council for paving South Street by Thomas McDonnell, Union City, at $10,579 for concrete curb, and $10,706 for stone curb.

★**Union City, Pa.**—Contract awarded Joseph McCormick & Brother, Erie, for paving South Street with Jamestown (N. Y.) brick block (bids opened May 25) at $11,080. R. V. Haas, Borough Engineer.

★**Towson, Md.**—Contract awarded by County Commissioners for constructing with concrete 1.3 miles of Paper Mill Road to Thomas Mullan, 4001 Greenmount Avenue, Baltimore, at $21,000. State Roads Commission recommended to County Commissioners contract for improving 8 miles of Reistertown Road to Fisher & Carozza, 305 East Preston Street, Baltimore, at $95,000.

Washington, D. C.—Lowest bid opened June 1 by Commissioners for resurfacing 30,000 sq. yd. with asphalt by Warner-Quinlan Company, Syracuse, at $1.51 per square yard under 2-yr. contract and at $1.49 under 5-yr. contract.

★**Birmingham, Ala.**—Contract awarded by City Commission for constructing asphalt boulevard on Claremont Avenue and Forty-second Street, to B. A. Pepperman, 1401 Avenue J, at $22,921.

★**Louisville, Ky.**—Contract awarded by Board of Public Works for paving with vitrified brick, F, Brandeis and other streets and Grand Avenue, to J. H. Cahill, Louisville, at $37,000.

★**Loundville, Ohio.**—Contract awarded by City Council to George B. Herring & Sons, Mansfield, for paving portions of Spring, Water, Main and Union Streets at $12,850, $2,786, $6,577 and $11,179 respectively. (Bids opened May 23.)

★**Marion, Ohio.**—Contract for paving with block on cement filler awarded Brady & Diak, Marion, for Davids Street at $62,497, and Avondale Avenue at $12,179, and to Asphalt Block Paving Company, Toledo, for 2½ in. asphalt block pavement on Bain Avenue, Carhart and Forest Streets, at a total of $25,760. Edward S. Ault, City Engineer.

★**Tiffin, Ohio.**—Following contracts for paving awarded by Board of Control: To John E. King, Tiffin, East Perry Street, on stone foundation, at $14,337, and Louis Segauder, Tiffin, Apple Street, at $11,041, and Doughias Street at $6,036. Trimble block to be used.

★**Wooster, Ohio.**—Contract for paving with brick on South Beaver Streets (bids opened May 21), awarded Midland Construction Company, Wooster, at $18,000. George C. Brown, City Clerk.

★**Newport, Ind.**—Contract for constructing extension to Centenary Road of concrete awarded by Board County Commissioners to R. L. Fist of Clinton, Ind., at $19,995.

Following bids opened by County Commissioners for improvements to roads as follows: (a) Bunsen Road, with brick; (b) Shew Road, with brick. Heber & Ingram of Newport (a) $39,197; (b) $22,549, and Sella & Kollar of Clinton at (a) $42,450 and (b) $24,850.

★**Balden, Mich.**—Contract for paving North and South Bridge Street (bids opened May 24) awarded A. H. Prange, Grand Rapids, at $36,973. Other bidders: Johnson Construction Company, Chicago, $37,259, and C. E. Williams, Grand Rapids, $38,103. F. E. Conant, City Clerk.

★**Grand Rapids, Mich.**—Contract for paving with concrete on Burr Oak Street and Eatrous Avenue, etc., awarded John Klvote & Son, Grand Rapids. Cost, $15,000. William G. Moore, City Engineer.

★**Hudson, Mich.** — Contract awarded June 2 to H. P. Streicher Company, Inc., Toledo, Ohio, for 23,000 sq. yd. resurfacing opened May 31 by T. JQ. Underwood, **PUBLIC—Proposed**

★**Bartonville, Ill.** — Board of Trustees awarded contract for paving to Canterbury Bros. of Bartonville at $18,788.

★**Charleston, Ill.**—Contracts for constructing State aid roads in Coles County reported awarded as follows: To Powell Garard & Co. of Chicago, at $40,857; C. H. Coffin & Co. of Chicago, $40,501; H. C. Speer & Sons of Chicago, $40,680; Hanchett Bond Co. of Chicago, $40,860; Cummins, Prudens & Co. of Toledo, Ohio, $40,913, and Little & Hayes Investment Co. of St. Louis, Mo., $40,015.

★**Decatur, Ill.**—Contract awarded File & Alexander, Decatur, for grading, curbing and paving with brick block, North Monroe Street, etc. (bids opened June 2) at $29,102; next three lowest bids: S. A. Tuttle, Decatur, $29,401; McCalman Construction Company, Decatur, $29,621, and Pronger & Fletcher, Blue Island, $29,659. Jerome J. Heger, City Clerk.

★Contract for constructing state aid road in Macon County awarded Benjamin F. Harrison of Decatur, at $27,151.

★**Harrisburg, Ill.**—Contract awarded C. H. Degenhardt, Alton, for constructing 48,215 sq. yd. paving at $112,112, and to C. M. Hanes, Jerseyville, for 419,415 sq. ft. concrete sidewalk, at $45,300. Bonds for both of these improvements have been purchased by Madison Bond Company, Cheaney L. Parish, Manager Purchasing Department, 524 Boatmen's Building, St. Louis, Mo.

★**Illinois.**—Contracts awarded by State paving as follows:

★May 24—Lake County, Section B, type concrete to Anton Didek, North Chicago, at $12,507; Marshall County, Section D, type oiled macadam, Ajax Construction and Engineering Company, Gary, Ind., $11,291; Section "B" and "C," Clinton, Section "C," Crawford County; Section "C," Putnam County and Section "E," McDonough County opened May 24, readvertised.

★May 31—Christian County, Section "A," type oiled macadam, Hannan McDonald Company, Ashland Block, Chicago, $8,147; Alexander County, Section "B," type gravel, W. T. Bland, Cairo, $18,114; Macon County, Section "A," type oiled earth, Ben F. Harrison, Decatur, $27,120; and Ford County, Section "B," type gravel, Cameron, Joyce & Company, Keokuk, $16,178.

★**Moline, Ill.**—Contract awarded D. J. Ryan Construction Company, Davenport, Iowa, for paving with asphalt on Ninth and Thirteenth Streets, at $15,722 and $30,796 respectively. Other bidders: F. B. Caughlin Construction Company, Humboldt & North Avenue, Milwaukee, Wis., $16,330 and $31,856, and McCarthy Improvement Company, Davenport, Iowa, $15,737 and $31,375.

★**Polo, Ill.**—Contracts awarded by Albert Sweet, Town Clerk, as follows for constructing macadam roads in Pine Creek Township (Bids opened May 25): 3 miles (Section I) to Young & Finney, Oregon, Ill., about 4800 cu. yd., at $1.85 per cu. yd., and to John Devine & Son, Dixon, for 6400 cu. yd. (Section II) at $1.65 per cu. yd., requiring crushed rock.

★**Marshalltown, Iowa.**—Contract for paving on West, State and Doty Streets and Twelfth Avenue (bids opened May 24 by S. S. Wilson, City Clerk) awarded Western Construction Company, Sioux City, at following unit figures: 44,850 sq. yd. concrete paving, 30 ft. and 24 ft. wide, $1.285; 2370 sq. yd. brick, 30 ft. wide, $2.28; 25,450 lin. ft. curbing, 32 cts; 2500 cu. yd. extra grading, 40 cts; 12,250 sq. yd. concrete paving, 16 ft. wide, $1,265. W. H. Steiner, City Engineer.

★**Fairmont, Minn.**—City Council awarded contract for paving as follows with creosoted blocks and bitulithic pavement to Fielding & Shepley of St. Paul, and concrete paving to F. D. Gould of Fairmont, about 50 blocks in all.

★**Minneapolis, Minn.**—Contract awarded Purington Paving Brick Company, Galesburg, Ill., at $1.06 per sq. yd., f. o. b. Minneapolis, for furnishing 30,000 sq. yd. vitr. paving blocks.

Lowest bids, opened May 26 by County Commissioners, as follows, for road improvements: About one mile, in village of Wayata, connecting Superior Boulevard with North Shore Road, by Ganley Construction Company, Minneapolis, at $47,226; and about one mile through Robbinsdale, by Schagun Brothers, Minneapolis, at $21,400.

★**Fremont, Neb.**—Contract awarded by City Council for paving in three districts as follows (price given per square yard): To Ford Paving Co., Red Oak, Iowa, for one district, at $1.86 for vertical fibre brick with asphalt filler, and A. D. Sears, Fremont, at $1.29 for Clarkson Avenue, and to Roberts Construction Co., Lincoln, for third district, two last paved with concrete. Paving bonds for $20,000 for this work have been sold.

★**Grand Forks, N. D.**—Contract awarded by County Commissioners for graveling 32 miles of road to George Duis, Fargo, at $9,900.

★**Billings, Mont.**—See "Hydraulic Construction and River Improvements."

★**Amarillo, Tex.**—Contract awarded by City Commission for paving 55,000 sq. yd. to Western Paving Co., Oklahoma, Okla., at $1.61 per sq. yd. and 15,000 sq. yd., to Bert Hahn Construction Co., Paris, at $1.94 per sq. yd.

Houston, Tex.—Following are bids opened recently by City for paving (a) portion of Capitol Avenue and (b) Jackson Street: Eureka Paving Company, Houston, sheet asphalt, (a) $12,224; (b) $10,881; asphaltic concrete, (a) $12,224; (b) $10,881; vertical fiber brick, (a) $15,043; (b) $13,163; 3-in. creosoted wood block, (b) $14,942; 3½-in. creosoted wood block, (b) $15,715. Horton & Horton, Houston, Uvalde rock asphalt, (a) $13,943; (b) $12,270.

★County Commissioners Court awarded contract for improving Chocolate Bayou Road as follows: Furnishing gravel to Lake Shore Milling Company, at $21,600, and grading and placing gravel to Couch & Hoelinger, Houston, at $15,512.

★**Fort Collins, Colo.**—Contract for paving College and Laporte Avenues (bids opened May 29), awarded G. Fred Roberts Construction Company, Denver, Colo., at $28,239; next three lowest, A. F. Hewitt, Denver, $28,719; Thomas Phillips, Denver, $20,039, and Petry Moulton Construction Company, Cheyenne, Wyo., $29,807. Frank P. Gorder, City Engineer.

★**Bellingham, Wash.**—Reported contract awarded by City Council for paving with asphalt Irving and A Streets, to H. L. Dickinson, Bellingham, at $17,517.

★**Dayton, Wash.**—Following are four lowest bids opened May 27 by County for constructing 5 miles of Permanent Road No. 2A: H. L. Wilson Company, Walla Walla, $16,895 (awarded contract); C. L. Graves, Spokane, $17,250; Ralph Tribon, Walla Walla, $18,536, and L. Lanning, Walla Walla, $21,000. J. H. Clancey, County Auditor.

★**Everett, Wash.**—Contract awarded by County Commissioners to O. H. Gunthus, Everett, for Proposition No. 8, Permanent Highway, at $15,987. Also contract for paving through town of Sultan, to M. S. Templeton, Everett, at $22,269.

★**Tacoma, Wash.**—Contract for paving with bitucrete on concrete base on Permanent Highway No. 3-B (bids opened May 26) awarded Henry J. Kaiser, Everett, at $95,970. D. H. White, County Engineer.

Portland, Ore.—Lowest bid submitted to City Council for paving East Glisan Street by Montague-O'Reilly Co., Portland, at $30,345.

★**Redondo Beach, Cal.**—Contract awarded California-Arizona Construction Company, 1700 East Washington Street, Los Angeles, for 126,000 sq. ft. concrete base and oil and gravel surface pavement, 34,000 sq. ft. cement walk, 6700 lin. ft. cement curb, etc., at $28,810.

★Contract for 200,700 sq. ft. concrete base and asphaltic surface pavement, 17,460 sq. ft. cement walk, 3700 lin. ft. cement curb, etc., on Opal Street, awarded. Highway Construction Company, Highlands, Cal., at $23,852. (Bids opened May 23).

★**Ventura, Cal.** — Contract awarded Braun, Bryant & Austin, Venice, for asphaltic concrete pavement on Venice Boulevard and Wolgrove Avenue (bids opened May 13). Probably 6.34 miles. C. Y. Burns, City Clerk.

★**Willowbrook, Cal.**—Contract awarded by Board of Supervisors for 19,083 lin. ft. shaping roadbed, 34,466 ft. cement curb, 100,014 sq. ft. concrete gutter; 138,883 sq. yd. cement walks to Fred Hoffman, 111 East Twelfth Street, Long Beach, at $28,100.

★**Ogden, Utah.**—Contract awarded J. P. O'Neil, 423 Twenty-fifth Street, for paving Twenty-sixth Street from Washington to Madison Avenues, at $29,658. P. J. Moran, Salt Lake City, bid $29,867.

★**Moncton, B. C.**—Contract for 14,200 sq. yd. bitulithic pavement on concrete foundation awarded Warren Brothers, Paving Company, Toronto, Ont.

STREET CLEANING AND GARBAGE DISPOSAL

PROPOSED WORK.

Newport, R. I.—Tribus & Massa, 86 Warren Street, New York, N. Y., engaged as consulting engineers to advise on refuse disposal problem.

Rochester, N. Y.—Council has authorized $40,000 for improvements to the incinerating plant. Address Commissioner Public Works.

Spokane, Wash.—Contract soon to be let by city for a garbage crematory building or buildings. F. K. McBroom, Commissioner Department Public Affairs.

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS

PROPOSED WORK.

Harbor Improvement—Buffalo, N. Y.—Major L. V. Frazier, District Engineer, of Buffalo, has recommended to Chief of Engineers of the U. S. A. at Washington, D. C., the shoals in Buffalo Harbor be rsmoved and a large area dredged to a depth of 23 ft. at mean lake level; cost, Syosset.

Drainage—Syosset, L. I., N. Y.—Hansen & Coulter, 2 Rector Street, New York, engaged as engineers for the land drainage on the estates of Philip Goodwin of Syosset.

Pier Improvements—Philadelphia, Pa.—Plans being prepared for extension of the municipal pier at Allegheny Avenue; construction of three new piers, one at foot of Cherry Street, one at Lemilworth Street, and one at Jackson Street. Cost, about $4,000,000. Address Director Department Wharves, Docks & Ferries.

Dam — Sharpsville, Pa. — Chester & Fleming, Pittsburgh, engaged to prepare plans for concrete dam to be constructed in Shenango River by Sharpsville Improvement Association to replace wooden state dam.

Drainage—Crowley, La.—Citizens of the Parish voted $30,000 bonds for drainage improvements. Address Clerk of Parish.

Drainage—Paducah, Ky.—Board Drainage Commissioners will soon let contract for drainage of Matfield Creek, estimated to cost $275,000.

Flood Protection—Indianapolis, Ind.—City sold $68,000 bonds for completion of the flood prevention work.

Hydro Electric Plant—Grand Rapids, Mich.—The Universal Power Co. will construct electric transmission line 80 miles long to connect towns of Mecosta and Montcalm Counties; power plant to be erected near Croton; hydro electric plant to be constructed near Howard City. James E. Tobin of Gladwin, President, and J. M. Donahue of Grand Rapids, Secy.

Drainage—Emmetsburg, Iowa.—Board of Supervisors established drainage district project No. 80, which involves straightening Des Moines River a distance of about 25 miles through Palo Alto County; estimated cost $135,000. T. R. Martin, County Engineer.

Drainage—Villisca, Iowa.—Supervisors of Adams and Montgomery Counties have created Nodaway Drainage District No. I and propose straightening East Nodaway River from the C. B. & Q. Bridge south, a distance of 3 miles. Cost, $18,000. Contracts will be let in June.

Drain—Waterloo, Iowa.—County Board considering constructing 1800-acre drainage project one mile from Waterloo; cost $15,000. N. B. Barber, County Engineer.

Levee—Kansas City, Mo.—Contract will be let about June 20 for constructing a levee 10.73 miles long on Clay County side of Missouri River, near Kansas City, by the Birmingham Drainage District Trustees. Estimated cost, $350,000. Brooks & Jacoby, Engineers, 512 Shukert Building, Kansas City, Engineers.

Diversion of Flood Waters—Kansas City, Mo.—Surveys made by I. E. Hutchinson, Gen. Mgr., Frisco Road, at Springfield, Mo., and W. E. Williams, Gen. Mgr., Missouri, Kansas & Texas R. R., at Parsons, for diverting flood waters of Turkey Creek through tunnel in Greystone Heights into Kaw River.

Drainage—Little Rock, Ark.—Faulkner's Lake Drainage Dist. formed to reclaim 6000 acres, estimated cost $70,000. Charles Jacobson, State Bank Bldg., in charge of improvements.

Levee Work—Ft. Worth, Tex.—Contract will be let about last of July or early in August for constructing the levee to protect Trinity bottoms from flood damages. Cost $85,000. Robert G. Johnson, Chairman Board Supervisors.

Irrigation—Carlsbad, N. M.—L. E. Foster, Project Manager, has been petitioned by water users of Carlsbad Reclamation project to have improvements made to the system, including enlargement of spillway at McMillan dam, Eddy County, N. M. Approximate cost $200,000.

Port Improvemvents—Kennewick, Wash.—No immediate port improvements contemplated here. A comprehensive plan has been prepared by Paul P. Whitham, Consulting Engineer, 424 New York Block, Seattle, for contempiated improvements, the first unit to cost $50,000, and several others to be constructed later. W. R. Weisel, Secy. Port Commission, Kennewick.

Dock—Tacoma, Wash.—A dock and warehouse 1000 x 175 ft. is to be erected in Tacoma by Chicago, Milwaukee & St. Paul Ry. Co. (C. F. Loweth, Ch. Engr., Chicago, Ill.); cost $300,000. Work to be done by day labor.

Jetty Work—Bandon, Ore.—Port of Bandon has agreed to appropriate $33,000 toward restoring submerged jetty in the harbor. The U. S. Government will appropriate $33,000, making cost $66,000.

Irrigation — Fresno, Cal. — Walter F. Weir, Drainage Engineer of University of California, Berkley, preparing plan to drain and irrigate about 1500 acres of alkali land on Kearney farm owned by university. Construction of tile drainage pipes and pumping plants will be chief items of construction; cost about $75 per acre.

Irrigation, Hanford, Cal.—Guarantee & Investment Company, Hanford, applied to State Water Commission for permission to appropriate 250 second feet of water of Cross Creek, Kings County, to irrigate about 4000 acres. The Lake Land Canal & Irrigation Company proposed constructing the canal. Cost, $15,000.

Irrigation—Maxwell, Cal.—Construction of an irrigation system in District D, for irrigation of 90,000 acres contemplated. L. C. Taylor, Cashier Maxwell Bank, interested.

Irrigation—Richvale, Cal. — Property owners of Drainage District 100 voted $150,000 bonds for constructing drainage system. About 79 miles of ditches will be included in the work. Frank Robinson, Engineer for District.

River Improvement—Sacramento, Cal.—U. S. House passed Mississippi and Sacramento Rivers Flood Control Bill authorizing expenditure of $5,600,000 for improving Sacramento River and $45,000 for Mississippi River. Address Chief Corps Engineers, U. S. A., Washington, D. C.

Levees — San Bernardino, Cal. — See "Bridges."

Irrigation—Ventura, Cal.—Board Supervisors appointed Ernest E. Everett, Walter Duval and G. Thurmond a committee to prepare preliminary plans for constructing ditches and storm water protection work in the Mound District; probable cost, $20,633.

Irrigation—Visalia, Cal.—Guarantee & Investment Company, Visalia, reported to have applied to State Water Commission for permission to appropriate 250 second feet of water from Cross Creek for purpose of irrigating rice, alfalfa and other crops. It is proposed to construct a canal about 4 miles long, costing $15,000.

Irrigation—Salt Lake City, Utah.—St. George & Santa Clara Bench Irrigation Company is planning constructing a storage reservoir. Amos Gabbott, State Capitol, Salt Lake City, may be able to give information.

Canal—Montreal, Que.—Council contemplates spending $100,000 on new headgates for Lachine canal. Address Department of Public Works, Montreal.

BIDS DESIRED.

Dredging—Boston, Mass.—Until June 15, by Directors of Port of Boston (Robt. E. Barrett, Act. Ch. Engr.), for dredging in Mystic River, between Chelsea and Malden Bridges, to consist of about 1,750,000 cu. yd.

Breakwater—Hyannisport, Mass.—Until June 14, by Board Harbor & Land Commissioner, State House, Boston, for additions of capstones to and the extension of present breakwater at Hyannisport, advertised in Engineering Record. William F. Williams, Chief Engineer.

State Canal Work—Albany, N. Y.—Until June 27, by W. W. Wotherspoon, Supt. Water Works, for improving Cayuga and Seneca Canals, as follows: Contract A-1 for making repairs and constructing a fish ladder around Dam No. 1, near Cayuga, Contract No. 59-A, constructing sewer from Genesee Valley Park, to a point 100 ft. south of Court Street bridge, Rochester, length 2.914 miles. Contract No. 72-B, Champlain Canal, widening the canal prism in Hudson River from mouth of the Hoosick River, to south end of Gres Island, a distance of 0.74 mile.

Wharf—Governors Island, N. Y.—Until June 17, by Department Quartermaster, for reconstructing wharf and ferry slip at Governors Island Ferry, N. Y., advertised in Engineering Record.

Pier—New York, N. Y.—Until June 15, by R. A. C. Smith, Comr. Docks, for Contract No. 1519, for repairing pier at foot of West Fifty-fifth Street, North River, Borough of Manhattan, and building a freight shed on the pier and the bulkhead adjacent with appurtenances, including heating and plumbing. Security $136,000.

Dredging—Baltimore, Md.—Until July 11, by U. S. Engineer's Office, Baltimore, for dredging in Susquehanna River, Md., advertised in Engineering Record.

Dredging—Washington, D. C.—Until June 24, by Bureau Yards & Docks Navy Dept., Washington, D. C., for dredging 10,000 cu. yd. at Washington Navy Yard.

Levee—Greenville, Miss.—Reported desired until June 12, by Mississippi Levee Commission W. L. Thompson, Ch. Engr), for 500,000 cu. yd. levee work.

Drainage—Corning, Iowa.—Until June 15, by Boards Supervisors of Adams and Montgomery Counties at Corning for constructing ditch approximately 2.37 miles long, requiring approximately 124,000 cu. yd. earth and constituting one section. F. W. Yeadon, Auditor Adams County, Corning. Peter Ostrom, Auditor Montgomery County, Red Oak.

Ditches — Long Prairie, Minn.—Until June 15, by E. M. Berg, County Auditor, for constructing Ditch No. 29, to consist of 22,909 cu. yd. excav., corrugated culverts, etc. Also separate bids for constructing County Ditch No. 30, to consist of 2345 cu. yd. excav., corrugated culverts, etc.

Ditch—Owatonna, Minn.—Until June 17, by Nicholas Thomney, Co. Aud. Steel County, at St. Cloud, for constructing Judicial Ditch No. 4, Steel and Waseca Counties, to consist of 84,464 cu. yd. excav., 280 metal culverts, etc. Estimated cost $11,856. Geo. A. Ralph, Engr., Fulton Blk., St. Paul. Eugene Boss, Co. Aud. Waseca County, Wadena.

Drainage—Windom, Minn.—Until June 28, by S. A. Brown, Auditor Cottonwood County, Windom, for constructing Judicial Ditch No. 18 of Cottonwood and Murray Counties, including 211,410 ft. 5 to 26 in. tile, estimated cost $151,880, open work, estimated at $278.80.

Drainage—Armour, S. D.—Until June 16 (readvertisement), by Charles F. Meyer, County Auditor, for constructing open ditch for Simpson Lake Drainage District.

Drainage—Greybull, Wyo.—By Commissioners Bench Canal Drainage District, for constructing 18.4 miles of closed drains; also will sell $101,000 bonds for said work. G. W. Zorn of Greybull, engineer.

Levee—Kansas City, Mo.—Until June 27, by Board Supervisors Birmingham, Drainage District, Kansas City, for 10.78 miles of levee, 1,200,000 cu. yd. embankment, 51,120 sq. yd. rock paving, Brooks & Jacoby, Engineers, 513 Shukert Building, Kansas City. John H. Powell, Secy. of District, 312 Reliance Building, Kansas City.

Wharf—Seattle, Wash.—Reported desired until June 21, by C. E. Remsberg, Secy. Port Commission, Seattle, for extension of wharf 150 ft. and track by Central Waterfront Improvement. Probable cost $30,000. J. R. West, Port Engr.

★Irrigation—Tulare, Cal.—Alpaugh Irrigation District reported to have awarded contract to McClenehan Kraner Carter Company, San Francisco, for drilling five wells and constructing ditches and pipe lines to cost $165,000.

Dam—Dundas, Ont.—Until June 17, by J. E. McGinty, Dundas, for constructing solid concrete dam 18 x 80 ft.

Drainage—Hamilton, Ont.—Reported desired until June 17, by City Council, for constructing a drainage system. Probable cost $35,000.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★Sea Wall, Etc.—Boston, Mass.—Mayor May 20 approved contract awarded Bay State Dredging & Contracting Co., Boston, for sea walls and granite block or Hassam block pavement in Condor Street, East Boston, at $17,349.

★Seawall, Etc. — Boston, Mass. — Contract for grading, constructing seawall, grand stand and dredging on North End Beach, (bids opened May 26), awarded by Park & Recreation Department to J. C. Coleman & Sons Company, 1620 Tremont street, Roxbury, at $12,960.

★Dam — Waterbury, Conn.—Contract for constructing diversion dam and tunnel in connection with Wigwam Brook awarded by Bd. Public Works to William T. Ryan of Hartford at $33,275.

State Canal Work—Albany, N. Y.—See "Bridges."

★Dam—Brocton, N. Y.—Contract for constructing earth dam (bids opened May 18) awarded Shipman, Lincoln & Welch, Gowanda, N. Y., at $17,806. A. M. Fleming, Village Clerk.

★Dredging—Buffalo, N. Y.—Contract for dredging in Lake Erie entrance to Black Rock Harbor and Erie Basin and in Black Rock Canal, Buffalo, awarded H. S. Kerbaugh, Telephone Building, at $23,030 (bids opened May 10 by U. S. Engineers, Buffalo).

★Dam—Rockwood, N. Y.—Contract awarded Hydraulic Construction Company, Watertown, for constructing dam for the Rockwood Leather Manufacturing Company, at $32,000. Morrell Vrooman, Engineer, Gloversville.

★Filling at Pier—Philadelphia, Pa.—Contract awarded Edwin H. Vare, Lincoln Building, for furnishing and placing filling at Moyamensing group of piers. He bids 40 cents per cubic yard on Items 1, 2 and 3; total about $75,000.

★Dredging — Baltimore, Md.—Contract for reclaiming 400,000 cu. yd. water front on Chesapeake Bay adjoining Bay Shore Park and dredging channel 100 ft. wide and 10 ft. deep awarded by Harry B. Wolf to Maryland Dredging & Contracting Co., Fidelity Bldg. A pier is to be constructed later.

★Dock — Jacksonville, Fla. — Contract awarded Dougherty Conn. Construction Company, Atlanta, Ga., for improvements and additions to municipal docks to cost $40,000.

★Levee Work—New Orleans, La.—Contract for 610,000 cu. yd. levee work in Cypress Creek Levee awarded Fred. E. Bearance, Seattle, Wash., at 25 3/10 cts. per cu. yd. G. W. Lawes, Secy. Board State Engineers.

★Channel Improvement—Maple Park, Ill.—Contract for deepening and widening channel (bids opened May 20) awarded McWilliams Bros., Chicago, Ill., at $29,400. M. M. O'Brien, Clerk, Comrs. Union Drainage Dist. No. 3.

★Drainage—Oskaloosa, Iowa.—Contract awarded Lane Construction Company, Council Bluffs, for constructing sections 1, 2 and 3 of South Skunk Drainage Ditch and in South Skunk River Drainage District No. 3, about 970 cu. yo. at 7.18 cts. per cu. yd. Roy E. Rowland, County Auditor.

★Irrigation — Powell, Wyo. — Security Bridge Company, Minneapolis, Minn., secured the contract for Schedule 1 of the first unit of Frannie Division Shoshone Project, Wyo., at $15,736. Bids on Schedule II rejected and work will be done by Government forces. Bids opened May 3 by U. S. Reclamation Service, Powell.

★Drainage—Billings, Mont. — Contract for constructing drainage work and surfacing 47 miles of public highway awarded C. H. Green of Spokane, Wash., at $167,009. F. E. Williams, County Clerk.

Irrigation—St. Ignatius, Mont.—Following are lowest bids, opened May 25, by U. S. Reclamation Service (E. T. Tabor, Project Manager), for constructing canals and Structures on Flathead Project, Mont.; Schedule I, Percy M. Ross, Polson, Mont., $8,040; Schedule II, C. B. Long, Polosm, $4,947, and Schedule III, E. D. Covell, Ronan, $19,615.

★Drainage—Angleton, Tex.—Contracts awarded by Angleton Drainage District for $80,000 worth of drainage work as follows: Construction to Texas Construction Company, Houston and for cement work to M. C. Dougherty of Angleton.

★Irrigation—Grand Junction, Col.—Lowest bid opened May 23 by U. S. Reclamation Service, Grand Juncton, for constructing about 3950 lin. ft. wood stave pipe for Grand Valley Junction Project submitted by Pacific Tank & Pipe Company, San Francisco, Cal., at $18,510. H. H. Minn, Project Manager.

★Irrigation—East Las Vegas, N. M.—Reported R. C. Storrie, San Francisco, has signed an agreement to complete the Las Vegas irrigation project, started some years ago. Estimated cost of project $400,000.

Dredging — Seattle, Wash. — Following are two bids opened May 31 by U. S. Engineer Office, for dredging, etc., a portion of Lake Washington Canal: Erickson Construction Company, Seattle, $14,025, and Butler & Parry, Seattle, $26,281.

★Guide Wall—Seattle Wash.—Contract for constructing guide walls in Lake Washington at the locks awarded Lester & Monahan, Colman Block, at $17,285.

Irrigation—Wenatchee, Wash.—Following are bids opened May 23, by Wenatchee Reclamation District, (W. T. Knapp, Secy.), for a 63-in. concrete pipe: Peerless Bridge Company, Seattle, $50,863; Harrington Peters Company, Seattle, $61,978; Coast Contract Company, Seattle, $73,098, and Pacific Lock Joint Pipe Company, Tacoma, $75,009.

Irrigation—Fort Laramie, Wyo.—Following are four lowest bids opened May 22 by U. S. Reclamation Service, Fort Laramie, for constructing tunnels and concrete canal lining on Fort Laramie Canal, North Platte Project: (a) Engineer's estimate, $266,552; (b) MacArthur Brothers Co., 11 Pine Street, New York, N. Y., $242,032; (c) Reynolds Ely Construction Co., Springville, Utah, $245,877; (d) Winston Brothers Co., Minneapolis, Minn., $255,726; (e) Twohy Brothers Co., Portland, Ore., $267,708.

	(a)	(b)	(c)	(d)	(e)
600 lin. ft. excavation, Type A	$31.50	$25.50	$20.00	$28.40	$30.00
400 lin. ft. excavation, Type B	31.50	26.25	22.70	28.40	29.00
2,900 lin. ft. excavation, Type C	22.50	24.90	22.70	28.40	22.75
950 lin. ft. excavation, Type D	27.00	28.80	33.00	28.40	30.00
2,250 cu. yd. excav. and trimming for appurtenances	0.60	0.80	0.50	0.50	0.50
625 M ft. permanent timbering	42.50	44.00	45.00	36.00	34.00
10,700 cu. yd. concrete in tunnel, approaches	9.00	6.90	8.00	7.50	10.40
1,250 cu. yd. concrete canal lining	12.00	6.75	7.00	7.50	5.00
163,000 lb. placing reinforcing steel	0.01	0.015	0.014	0.012	0.006
500 sq. yd. 18-in. dry paving	2.00	2.00	1.50	2.50	2.00
500 sq. yd. 14-in. grouted paving	2.00	2.50	1.75	2.50	3.00
400 cu. yd. backfill (except tunnel)	0.30	0.50	0.25	0.50	0.50
2 placing drain valves and appurtenances	10.00	100.00	5.00	40.00	25.00

Weir—Sacramento, Cal.—Following are unit figures of the four lowest bids opened May 23 by Frank C. Miller, City Engineer, for constructing a weir, also bridges: (a) Teicher & Ambrose, Sacramento, $336,640; (b) Howard & Williams, San Francisco, $357,034; (c) Clark & Henery Construction Company, Sacramento, $364,560; (d) Ross Construction Company, Sacramento, $373,395.

	(a)	(b)	(c)	(d)
42,000 cu. yd. excav. for abutmts., piers and weir.	$0.26	$0.183	$0.26	$0.38
50,000 cu. yd. embkmt. for railroad approaches (borrow)	0.22	0.233	0.26	0.28
22,000 lin. ft. rein. concrete piling for bridge piers	1.02	1.178	1.20	1.25
28,500 lin. ft. rein. concrete sheet piling under weir	1.22	1.219	1.30	1.35
6,190 cu. yd. rein. concrete abutments, wings, piers and footings (lump sum)	46,500.00	54,334.00	56,600.00	60,000.00
8,125 cu. yd. rein. concrete weir, aprons, water cushion, guide walls (lump sum)	78,000.00	77,880.00	80,000.00	83,000.00
2,160 cu. yd. rein. concrete highway bridge (lump sum)	44,000.00	50,545.00	46,500.00	52,000.00
45 spans 41 ft. 3 in. steel railroad bridge (lump sum)	62,000.00	59,522.00	68,000.00	63,000.00
48 openings, 38 ft., needle beams, needles, cables, hinges, timbers, etc. (lump sum)	10,600.00	12,500.00	7,000.00	8,000.00
24 floats, rods and triggers, each	40.00	40.00	35.00	40.00
7,200 lin. ft. removing, storing and replacing R. R. track (lump sum)	12,000.00	17,400.00	16,000.00	9,000.00
1 barge (lump sum)	2,500.00	1,800.00	1,000.00	1,000.00
1-5 19 ft. spans overhead temporary highway bridge (lump sum)	350.00	1,200.00	1,000.00	400.00
Moving and resetting anchors for hop vines (lump sum)	300.00	900.00	250.00	100.00

★**Drainage — Anderson, Cal.**—Contract awarded by directors of Anderson Cottonwood Irrigation District for furnishing metal for flumes to Pacific Pipe & Steel Company, San Francisco, at $20,000.

★**Dredging—Los Angeles, Cal.**—Contract awarded by U. S. Engineer to San Francisco Bridge Co., 1005 Nevada Bank Building, San Francisco, for dredging in Los Angeles Harbor, Cal., at $27,501.

★**Dam—Modesto, Cal.**—Contract awarded Tibbetts Pacific Company, San Francisco, for completion of construction of Dam No. 1 (bids opened May 25) at $82,487. O. S. Abbott, Secy., Modesto Irrigation District.

★**Lock Gates and Equipment—Ottawa, Ont.**—Contract awarded by Department Public Works, Ottawa, to Riger Miller & Sons, Lumsden Building, Toronto, for lock gates and equipment at East River Locks.

ELECTRIC RAILWAYS

PROPOSED WORK.

Providence, R. I.—The Rhode Island Co. voted to spend $45,000 for constructing sub-station in Burrillville on Pascoag-Woonsocket line and $45,000 for a substation in Harmony section of Smithfield for the Providence-Chepachet line.

Allentown, Pa.—The Lehigh Valley Transit Co. (Harrison R. Fehr, Pres.) plans to spend $1,000,000 a year for next five years for improvements of system. The Philadelphia Division is to be double-tracked from Allentown to Sixteenth and Market Streets. It is also planned to build a line from Bethlehem to Cooperstown or Quakerstown.

Cambridge View, Pa.—An electric railway is to be constructed between Cambridge View and Venango, distance of 3.6 miles. Contract for grading same awarded to L. V. Metz of Erie. Two bridges are to be constructed in connection with line, one 40-ft. and one 50-ft. girder span. James Briggs, Ch. Engr. Northwestern Connecting Ry., interested.

St. Cloud, Fla.—Central Florida Interurban Ry. Co. applied for a Charter for construction of an electric railway from St. Cloud to Sanford, Dunnellon and Tampa, also through Volusia County to point on Atlantic Coast, also through Osceola and Brevard Counties to a point on Atlantic Coast, about 300 miles in all. Incorporators, Carl E. Carlton and William S. Alyea.

Mendota, Ill.—Preliminary surveys for Aurora, Mendota & Western Electric Railway being made.

Beaumont, Tex.—The Beaumont Traction Co. will spend about $100,000 for improvements to lines. Reconstruction and paving of 1½ miles of track on Magnolia Avenue will cost about $68,000, reconstructing and paving tracks on Emmet Avenue about $11,000, and 1½ mile extension to Magnolia refinery cost $20,000.

Corpus Christi, Tex. — The Corpus Christi Traction Company has started construction of a 12-mile electric railway from Corpus Christi to Ward Island and within the next 12 months will start construction on a 15-mile line from Corpus Christi to Bishop. J. H. Caswell, Corpus Christi, General Manager.

San Antonio, Tex.—Work is about to begin by San Antonio & Austin Interurban Ry. Co. on constructing electric railway from San Antonio to Austin, distance of 78 miles. W. B. Tuttle, Ch. Engr., San Antonio.

Pasadena, Cal.—Pacific Electric Ry. Co. of Los Angeles estimates cost of constructing loop in business district at $35,000.

Porterville, Cal. — Reported Southern Pacific R. R. Co. (W. Hood, Chief Engineer, San Francisco) has started surveys at Porterville for 150 miles of electric railway lines in Tulare County. The electrification of Porterville & Northeastern from Porterville to Springville is included in the plan for immediate construction. The entire work will cost about $100,000.

San Francisco, Cal.—Surveys being made for construction of a system of interurban railways subsidiary to the Southern Pacific Co., to be constructed through mining section and into orchard areas.

PRICES AND LETTINGS.

★*Indicates award of contract.*

New York, N. Y.—Following are totals of four lowest bids opened June 1 by Public Service Commission for First District, 120 Broadway, for constructing station finish on Sections 12 to 19 inclusive, Route No. 5, a part of the Lexington-Seventh Avenue subway, from 106th to 157th Streets: A. W. King & Company, 1511 Bryant Avenue, $316,091; Thomas Dwyer, 216th Street and Broadway, $327,031; John D. Roberts, 3 West Twenty-ninth Street, $334,735; and Serber-Stander Company, 1123 Broadway, $342,667.

★Contract awarded Dennis E. Conners, 64 West Eighty-eighth Street, for constructing Route 31 of Livonia Avenue elevated extension of the Eastern Parkway, in Brooklyn, at $1,376,122. To Degnon Contracting Company, 30 East Forty-second Street, for Route 8, Section 2, part of Fourteenth Street subway, from Irving Place to Avenue B, at $1,972,349, and to John B. Roberts, 3 West Twenty-ninth Street, for station finish on Lexington-Seventh Avenue subway, from Forty-third to 106th Street, at $278,183.

New York, N. Y.—Following are unofficial totals of the bids opened June 5 by Public Service Commission for First District, 120 Broadway, for furnishing structural steel for use in the construction of various portions of the Dual System of Rapid Transit: (a) American Bridge Company, 30 Church Street; (b) McClintic, Marshall Company, 21 Park Row, and (c) Pennsylvania Steel Company, 30 Church Street:

Route 8—Section 2 (subway section in Manhattan (a) $269,768, (b) $277,419.

Route 8—Section 6 (elevated section in Brooklyn, Fourteenth Street Eastern Line), (a) $1,394,957; (b) $1,468,140; (c) $1,578,950.

Route 31—(Livonia Avenue Line in Brooklyn), (a) $1,135,827; (b) $1,097,166).

Route 27—Mott Avenue connection (a) $11,675; (b) $11,499; (c) $11,102.

Route 35—Queensboro Subway extension to Times Square (a) $110,865; (b) $121,496.

Route 26—Completion of Queensboro subway at Grand Central Station (a) $6,234; (b) $6,780.

Route 45—Section 1, Nassau Street subway (a) $201,032; (b) $213,831.

Route 45—Section 2, Nassau Street subway (a) $215,021; (b) $236,540.

Route 12—Section 1-B, Eastern Parkway subway in Brooklyn (a) $146,316; (b) $168,852; (c) $183,746.

Route 18—239th Street yard (a) $146,316; (b) $135,255; (c) $139,671.

Route 26—Jackson Avenue station on Queensboro subway (a) $21,150; (b) $21,681; (c) $22,534.

Contract No. 1—Mott Avenue station on first subway (a) $53,984; (b) $58,631; (c) $57,429.

Cambridge View, Pa.—See "Proposed Work."

RAILROADS

PROPOSED WORK.

Lebanon, Pa.—About $25,000 will be spent by Cornwall & Lebanon R. R. Co. in improvements, including double-tracking main line between Twelfth and Cumberland Streets, constructing bridge over Quittapahilla Creek at Cumberland Street, etc. A. D. Smith, Gen. Supt., Lebanon.

Meridian, Miss.—The Meridian & Memphis R. R. Co. (S. A. Neville, Vice-Pres.), is to extend line to Illinois Central at Canton or Jackson.

★**New York, N. Y.**—Following are unit figures of the four lowest bids opened May 25 by Public Service Commission for First District, 120 Broadway, for station finish on Lexington-Seventh Avenue subway from Forty-third Street to 106th Street: (a) John B. Roberts, 3 West Twenty-ninth Street, $278,183 (awarded contract); (b) the Charles Meades Company, 38 Park Row, $290,285; (c) Emerson Building Company, 103 Park Avenue, $292,831; (d) A. W. King & Company, 551 Bryant Avenue, $294,186.

Item		*(a)	(b)	(c)	(d)
501	33,400 sq. ft. tile w. g. 3 ft. x 6 in. (a) straight	$0.56	$0.53	$0.56	$0.60
	120 sq. ft. (b) 1 in. r. comb.	1.52	1.30	1.16	1.69
	1,440 sq. ft. (c) 2½ in. r. comb.	1.49	1.44	1.49	1.57
	50 sq. ft. (d) 20 in. r. comb.	1.00	1.44	0.86	1.06
502	42,660 sq. ft. tile w. g. 4¼ x 4¼ in. (a) straight	0.56	0.53	0.56	0.60
	125 sq. ft. (b) 1 in. r. comb.	1.16	1.30	1.16	1.36
	1,275 sq. ft. (c) 2½ in. r. comb.	1.48	1.44	1.48	1.66
	115 sq. ft. (d) 20 in. r. comb.	1.02	1.44	0.86	1.23
503	20,175 sq. ft. tile w. g. 6 x 6 in. (a) straight	0.575	0.53	0.57	0.60
	30 sq. ft. (b) 1 in. r. comb.	1.05	1.44	0.81	1.26
	675 sq. ft. (c) 2½ in. r. comb.	1.45	1.44	1.46	1.63
	50 sq. ft. (d) 20 in. r. comb.	1.02	1.44	0.86	1.23
509	45 lin. ft. tile bead, 1 in. rad.	0.25	0.60	0.13	0.32
511	6,100 sq. ft. tile vitr. or semi-vitr. weatherproof (a) straight	1.10	1.10	1.08	1.08
	60 sq. ft. (b) 1 in. r. comb.	1.10	1.36	1.13	1.30
	90 sq. ft. (c) 2½ in. r. comb.	1.12	1.36	1.13	1.30
	60 sq. ft. (d) 20 in. r. comb.	1.15	1.36	1.13	1.30
513	13,600 sq. ft. mosaic and tile bands (colored)	1.47	1.20	1.30	1.49
614	1,820 sq. ft. mosaic and tile tablets (col'd).	1.58	1.30	1.24	1.61
515	490 plaques, mosaic and tile (a) station wall, each	5.00	1.56	5.13	5.64
516	100 sq. ft. tablets, destination (mosaic and tile)	1.54	1.56	1.24	1.71
521	23,850 sq. yd. plastering (b) arched surfaces on concrete	0.59	0.60	0.79	0.78
522	8,000 sq. yd. plastering flat surfaces (a) brick or hollow tile	0.38	0.60	0.54	0.58
	12,000 sq. yd. (b) concrete	0.70	0.60	0.65	0.70
	25 sq. yd. (c) metal lath	0.65	1.50	0.86	0.70
522A	1,100 sq. yd. hydrolithic plastering, brick or concrete, arched or flat	0.54	1.20	2.81	2.25
523	9,720 sq. ft. cement work (a) wainscots or bases	0.215	0.20	0.16	0.12
	125,900 sq. ft. (c) 3 in. floor finish	0.11	0.11	0.1025	0.14
	13,630 sq. ft. (d) finish on concrete, brick, or hollow tile	0.11	0.12	0.09	0.1150
	50 sq. ft. (e) panels for signs	0.11	0.50	0.22	0.15
524	900 cu. ft. concrete work (a) copings	1.13	0.96	0.54	1.15
	20 cu. yd. (b) foundations	8.10	9.50	7.56	8.50
	150 cu. ft. (c) reinforced	1.08	0.72	0.54	0.55
	1,000 cu. ft. (d) protective	0.88	0.72	0.65	0.50
	435 cu. ft. (e) street landings	0.35	0.48	0.43	0.30
525	50 cu. yd. cinder fill	0.80	2.40	1.08	0.60
526	3,160 lin. ft. concrete stairs, etc. (a) self-supporting stairs	1.08	1.60	1.08	1.40
	175 sq. ft. (b) self-supporting landings	0.64	0.96	0.54	0.70
	7,600 lin. ft. (c) supported stairs	0.595	0.80	0.81	0.90
	3,220 sq. ft. (d) supported landings	0.165	0.48	0.43	0.35
	65 cu. ft. (e) supporting columns	1.35	0.96	0.81	0.50
	8,150 sq. ft. (f) non-slip treads	0.76	1.00	0.76	0.77
	2,470 lin. ft. (g) cement bases	0.215	0.24	0.24	0.23
	440 lin. ft. (h) exposed cement finish on stairs	0.08	0.24	0.19	0.14
	860 sq. ft. (i) cement finish on street landings	0.085	0.24	0.11	0.12
527	6,170 cu. ft. brick masonry (c) common brick	0.50	0.60	0.51	0.47
528	1,160 cu. ft. hollow tile masonry (a) 2 in. hollow tile	0.86	1.00	0.81	0.87
	22,300 cu. ft. (b) 3 in. hollow tile	0.60	0.70	0.63	0.49
	5,900 cu. ft. (c) 4 in. hollow tile	0.58	0.80	0.54	0.47
	110 lin. ft. (d) 4½ x 13 in. flue	0.35	1.00	0.47	0.25
	290 cu. ft. (e) 6 in. hollow tile	0.50	1.00	0.45	0.45
528A	1,800 weepholes in h. t. side walls, each	0.10	0.40	0.22	0.20
628B	12,000 strap anchors (galv.), each	0.16	0.20	0.27	0.25
529	50 sq. yd. metal lath (a) without furring	0.54	1.00	0.81	0.50
	50 sq. yd. (b) with metal furring	1.08	2.00	1.40	1.00
530	6 ticket booths (b) Type "B," each	850.00	1,080.00	1,050.00	1,025.00
	6 (e) Type "E," each	905.00	1,200.00	1,195.00	1,125.00
532	4 doors (a) Type "A," each	77.80	0.70	91.25	103.00
	4 (b) Type "B," pair	146.00	140.00	155.25	148.00
	6 (bb) Type "BB," pair	151.20	190.00	125.28	154.00
	50 (d) Type "D," each	72.90	0.72	72.36	80.00
	4 (e) Type "E," each	85.60	80.00	70.20	82.00
	2 (ee) Type "EE," each	81.00	120.00	91.80	99.00
	50 (f) Type "G," pair	70.20	60.00	75.00	56.00
	7 (g) Type "J," each	89.50	100.00	80.00	90.00
	300 sq. ft. (h) Type "K"	7.55	4.80	4.35	5.08
	4 (i) Type "Q," each	48.50	36.00	32.40	47.00
	15 sq. ft. (l) Type "L"	7.65	4.80	4.35	4.98
	4 (m) Type "M," each	77.80	70.00	86.00	90.00
	2 (o) Type "P," each	37.80	36.00	40.50	30.00
533	90 sq. ft. windows (a) double hung	4.30	3.60	2.70	4.40
	30 sq. ft. (g) hinged	4.30	3.60	2.20	3.95
534	25 additional hardware (a) door checks, each	4.35	4.80	4.35	5.00
	65 (b) door stops, each	3.02	3.60	3.00	3.30
	20 (c) rubber-covered chains, each	1.95	2.40	1.95	2.30
	25 (d) push plates, each	3.25	3.60	3.25	3.50
	25 (e) door pulls, each	4.50	4.80	4.36	5.15
	25 (f) kick plates, pair	9.95	8.40	9.75	11.20
536	1,225 lin. ft. railings (a) Type "FS," incl. posts	3.67	4.80	3.68	3.35
	215 sq. ft. (c) Type "GS," incl. posts	0.54	0.60	0.54	0.55
	200 lin. ft. (e) Type "LS," incl. posts	3.94	4.80	4.50	3.45
	365 sq. ft. (f) Type "BS," incl. posts	0.64	1.00	0.80	0.62
	20 lin. ft. (g) pipe rail	1.51	2.50	1.55	1.275
537	160 lin. ft. gates, etc. (a), low sliding	9.63	10.80	9.75	9.12
	10 lin. ft. (c), folding	4.26	6.00	4.35	3.61
	10 lin. ft. (d), swing	3.67	5.00	3.80	3.02
	20 (f) single gate controls, each	20.00	25.00	20.52	25.00
	15 (h) additional c.-i. floor boxes, each	7.72	8.00	6.00	6.50
	500 lin. ft. (l) 1¼-in. galv. w.-i. pipe (gate ropes)	0.33	0.40	0.25	0.29
	20 lin. ft. (m) 1-in. ☐ steel tubing (gate ropes)	0.60	1.00	0.59	0.50
	25 (p) c.-i. gate posts, etc., per gate	56.70	48.00	54.00	57.50
	2 opening (r) steel gate posts, etc.	27.90	48.00	30.25	23.35
538	875 sq. ft. grilles (b) c.-i. grille and frame in vent. shaft	2.76	2.40	2.23	2.25
539	6 c.-i. vent. posts, each	136.00	180.00	136.00	173.00
540	3 sign posts, etc. (a) illuminated sign post, street level, each	297.00	192.00	167.50	302.00
	60 sq. ft. (d) frames for enam. sign on low railing	2.43	2.65	2.50	2.06
	25 sq. ft. (e) frames for enam. sign in high-low grille	1.83	2.15	1.86	1.56
	235 lin. ft. (f) enam. reflectors and frames station approaches	2.10	2.40	2.20	1.81
	600 sq. ft. (g) enameled sign plates	0.41	0.48	0.43	0.32
	10 sq. ft. (k) frames for enam. direction signs	1.57	5.00	1.57	1.36
542	775 lin. ft. street railings (b) Type K	8.15	7.20	8.25	7.85
543	10,000 lb. steel ladders, etc. (e) steel lintel shapes	0.045	0.08	0.04¾	0.04⅝
	6,000 lb. (f) miscell. steel shapes (no connections	0.0675	0.08	0.06	0.05⅛
	35 (g) ladders, platform to track-floor, each	11.90	12.00	11.35	10.00

543A	1,000	lb. miscellaneous iron castings	0.055	0.10	0.06	0.05¼
543B		Stairway-ladder and curtain wall in East 56th St. emergency shaft, lump sum	1,530.00	2,500.00	1,700.00	1,800.00
544	3,370	lin. ft. handrails	0.55	0.60	0.69	0.50
546	4,550	sq. ft. platform edge construction (a) non-slip treads, etc	1.60	1.72	2.37	0.80
	1,100	lin ft. (d) wooden facia	0.13	0.48	0.24	0.25
	1,150	(e) drilling holes in facia angle, per hole	0.25	0.40	0.26	0.40
547		Rough plumbing (a) 7 stations, lump sum	8,650.00	7,600.00	9,900.00	9,600.00
548	45	plumbing fixtures (a) w. c. bowls, each	48.60	66.00	45.36	45.00
	26	(b) lavatories in station, each	34.60	42.00	29.16	46.00
	4	(c) lavatories in signal tower, etc., each	34.60	36.00	22.68	44.00
	25	(d) urinals, each	76.70	96.00	86.40	85.00
	1	(f) slop sinks against pipe chm.-toilets	69.25	77.00	73.44	67.00
	10	(g) slop sinks in closets, each	68.00	77.00	73.44	75.00
	45	(h) floor drains, each	13.00	15.00	6.48	13.00
549	560	lin. ft. supply pipe, 1 in., enclosures between stations	0.22	0.40	0.29	0.24
550	1,200	sq. ft. structural glass (aa) ¾ in., wainscoting	1.57	1.80	1.62	1.65
	1,850	sq. ft. (b) ¾-in. pipe chamber partition	1.78	1.95	1.89	1.85
	720	sq. ft. (c) ¾-in. shelves	1.62	1.90	1.62	1.75
	1,140	sq. ft. (d) ¾-in. stall partitions	1.89	2.15	1.89	2.15
	100	sq. ft. (e) 1-in. floor slabs	3.24	2.90	4.32	3.25
	380	lin. ft. (f) curved corners and angles.	1.57	1.70	1.62	1.70
551	125	c.-i. work (toilet rooms) (a) posts, each	11.90	11.00	11.88	10.70
	350	lin. ft. (b) top rails	1.24	1.20	0.92	1.30
	7	(c) wall flanges, each	1.78	2.20	1.08	1.50
	30	(d) register faces, each	11.90	11.00	9.72	11.25
	15	(e) c.-i. vent. louvres, each	14.58	12.00	12.42	13.50
552	9,750	lb. steel supporting sections	0.07	0.10	0.07	0.07½
554	1,400	lin. ft. electric conduits, (a) ¾ in	0.145	0.18	0.21	0.14¼
	2,750	lin. ft. (b) 1 in	0.165	0.22	0.29	0.18
	1,675	lin. ft. (c) 1½ in	0.225	0.30	0.36	0.23
	1,675	lin. ft. (d) 2 in	0.29	0.36	0.41	0.33
	100	lin. ft. (e) 2½ in	0.415	0.48	0.63	0.45
	100	lin. ft. (f) 3 in	0.52	0.60	0.79	0.62
	950	lin. ft. (g) ¾ in. flexible	0.15	0.20	0.19½	0.15¼
554A	50	conduit fittings (special with removable covers), each	2.59	1.00	1.10	0.80
555	925	c.-i. outlet boxes, each	0.65	0.60	0.70	0.52
556	25	c.-i. pull boxes (a) 6 x 6 x 6 in., each	1.10	2.50	3.35	1.57
	31	(b) 12 x 12 x 6 in., each	2.60	4.80	10.64	5.00
	19	(c) 18 x 12 x 6 in., each	4.00	7.50	13.25	7.70
	6	(d) 24 x 18 x 6 in., each	8.10	11.00	27.25	9.50
	9	(e) 12 x 6 x 4 in., with hinged covers and locks, each	1.76	10.00	10.55	9.00
	30	(f) 6 x 6 x 4 in., each	1.62	1.70	3.05	2.15
	6	(g) 12 x 6 x 4 in., each	2.60	4.00	4.86	4.50
	12	(h) 4 x 4 x 4 in., each	0.98	1.20	1.30	1.25
557	40	c.-i. heater boxes (incl. register faces, each	11.45	13.50	14.05	11.00
558	7	steel panel-board boxes, (b) 25 x 6 x 49 in. to 60 in., each	15.10	24.00	13.00	22.50
	6	(i) 25 x 6 x 37 in. to 48 in., each	13.00	24.00	10.25	20.50
	7	(j) 50 x 6 x 49 in. to 60 in., each	17.30	36.00	22.75	30.00
561	39,750	sq. ft. painting (a) 2-coat work, iron or steel	0.02⅕	0.025	0.02⅕	0.02½
	126,900	sq. ft. (b) 3-coat work, iron or steel.	0.0325	0.03	0.03	0.03
	398,500	sq. ft. (c) 2-coat work, plaster and cement panels	0.019	0.018	0.02	0.01⅞
	830	(d) letters and numerals, each	0.10	0.20	0.11	0.11
	500	sq. ft. (f) existing gratings	0.10	0.20	0.11	0.10

★**New York, N. Y.**—Following are unit figures of the four lowest bids opened May 25 by Public Service Commission for First District, 120 Broadway, for constructing Route 8, Section 2, part of the Fourteenth Street subway, from Irving Place to Avenue B: (a) Degnon Contracting Co., 30 East Forty-second Street, $1,972,349 (awarded contract); (b) MacArthur Brothers & Mason & Hanger Co., 120 Broadway, $1,996,770; (c) Oscar Daniels Co., Woolworth Building, $2,180,737; (d) The J. F. Cogan Co., 280 Broadway, $2,207,394.

Item			*(a)	(b)	(c)	(d)
1	132,000	cu. yd. earth excav. above m. h. w.	$3.50	$3.57	$2.50	$4.25
2	41,500	cu. yd. earth excav. below m. h. w.	3.50	4.00	5.00	6.00
2A	11,800	cu. yd. earth excav. above and below m. h. w.	3.50	2.92	3.00	4.00
3	11,100	cu. yd, rock excav.	5.00	5.84	8.00	5.00
3A	100	cu. yd. rock excav. for sewers, etc.	5.00	5.84	6.00	5.00
4	2,890	lin. ft. (a) underpinning less than 7 stories	1.00	15.00	20.00	40.00
	50	lin. ft. (b) underpinning more than 7 stories	1.00	40.00	30.00	50.00
4E	2,890	lin. ft. maintaining, protecting buildings.	1.00	15.00	10.00	20.00
6	29,550	cu. yd. concrete masonry	9.00	9.50	10.00	9.00
7	5,620	cu. yd. protective concrete masonry	9.00	9.50	6.00	9.00
8	2,850	cu. yd. rubble stone masonry	8.00	4.80	6.00	5.00
8A	10	cu. yd. dry rubble masonry	6.00	4.20	5.00	4.00
9	50	cu. yd. brick masonry	20.00	12.00	17.00	15.00
10	70	cu. yd. hollow terra cotta or tile	20.00	12.00	17.00	15.00
11	1,000	bbl. grout of Portland cement	2.00	2.70	1.00	4.00
12	1,000	lin. ft. timber piles	1.00	0.60	0.40	0.50
13	2	M ft. timber foundations	50.00	54.00	50.00	40.00
14	10	cu. yd. broken stone or gravel	3.00	2.40	2.00	2.00
15	26,900	sq. yd. (a) waterproofing, 1 ply	0.50	0.40	0.60	0.45
	100	sq. yd. (b) waterproofing, 2 ply	0.85	0.65	0.85	0.75
	18,150	sq. yd. (c) waterproofing, 3 ply	1.25	0.95	1.10	1.00
	100	sq. yd. (d) waterproofing, 4 ply	1.60	1.30	1.35	1.25
	100	sq. yd. (e) waterproofing, 5 ply	1.90	1.60	1.60	1.50
	800	sq. yd. (f) waterproofing, 6 ply	2.50	1.90	1.80	2.00
	100	sq. yd. (i) waterproofing, dry ply	0.40	0.25	0.90	0.40
16	4,300	cu. yd. brick in asphalt mastic	20.00	20.40	38.75	20.00
17	50	lin. ft. (a) drain pipes, 12 in., vitr.	0.80	0.95	1.00	0.80
	50	lin. ft. (b) drain pipes, 10 in., vitr.	0.60	0.85	0.90	0.60
	50	lin. ft. (c) drain pipes, 8 in., vitr.	0.50	0.50	0.80	0.50
	2,860	lin. ft. (d) drain pipes, 6 in., vitr.	0.40	0.35	0.70	0.40
	50	lin. ft. (e) drain pipes, 4 in., vitr.	0.30	0.25	0.60	0.30
	50	lin. ft. (g) drain pipes, 6 in., cast iron.	1.50	1.20	2.50	1.00
	9,360	lin. ft. (h) drain pipes, 4 in., cast iron.	1.00	0.80	0.60	0.80
	50	lin. ft. (l) drain pipes, 10 in., cast iron.	2.00	2.40	4.00	2.00
17A	200	lin. ft. (a) c.-i. pipe, extra heavy, 3 in.	1.00	0.95	1.50	0.80
	150	lin. ft. (b) c.-i. pipe, extra heavy, 4 in.	1.25	1.20	3.00	1.00
	460	lin. ft. (c) c.-i. pipe, extra heavy, 6 in.	1.75	1.55	3.50	1.40
	350	lin. ft. (d) c.-i. pipe, extra heavy, 8 in.	2.00	2.40	3.75	1.90
17C	100	lin. ft. (a) galvanized w.-i. pipe and fittings, 3 in.	2.00	1.80	2.00	0.80
	100	lin. ft. (d) galvanized w.-i. pipe and fittings, 6 in.	2.50	3.60	3.00	1.75
18	131,560	ft. tunnel ducts	0.20	0.11	0.16	0.10
19	1,920	ton riveted steel	102.00	90.00	103.00	100.00
20	1,930	ton steel beams	92.00	78.00	100.00	90.00
21	160	ton steel rods	85.00	80.00	93.00	80.00
25	20	ton miscellaneous iron castings	85.00	72.00	50.00	80.00
25	2	ton (c) miscellaneous iron for sewers	85.00	120.00	90.00	70.00
26	1,130	lb. special wire forms	0.15	0.12	0.60	0.10
27B	4,260	lin. ft. 1¾-in. oak handrail	1.00	0.35	0.85	0.30
28	4,740	sq. ft. steel gratings	2.00	2.05	3.75	2.00
29	1,400	sq. ft. vault lights	1.50	1.50	3.75	2.00
30	2,970	sq. ft. (a) street surface restored, sidewalk	2.00	2.10	1.00	2.00
	9,310	sq. ft. (e) street surface restored, asphalt pavement	3.00	3.00	2.75	3.00
	7,100	sq. ft. (f) street surface restored, granite block	3.00	2.40	2.50	2.25
	300	sq. ft. (ff) street surface restored, belgian block	3.00	2.40	2.50	1.75
	850	ft. (l) street surface restored, bluestone curb	2.00	1.20	2.00	1.25
	550	sq. yd. (j) street surface restored, wooden block	3.00	2.40	4.00	3.00
	850	ft. (k) street surface restored, granite curb	2.50	1.80	3.00	1.75
32	6,100	ft. (a) w.-i. conduit, ¾ in	0.25	0.15	0.30	0.15
	300	ft. (b) w.-i. conduit, 1½ in	0.45	0.30	0.40	0.25
	200	ft. (c) w.-i. conduit, 2 in	0.60	0.40	0.50	0.30
	5,000	ft. (d) w.-i. conduit, 1 in	0.35	0.20	0.35	0.20
33	800	c.-i. outlet boxes for stations	0.60	1.20	2.00	1.00
33A	10	c.-i. pull boxes for stations	1.00	2.40	5.00	2.00
34	100	lin. ft. (a) c.-i. pipe and fittings, 6 in.	1.50	1.70	3.50	1.00
	100	lin. ft. (b) c.-i. pipe and fittings, 3 in.	1.00	1.20	1.50	1.00
37	980	lin. ft. vitr. pipe sewer, 12 in	4.00	2.35	2.50	2.50
38	420	lin. ft. vitr. pipe sewer, 15 in	4.50	2.40	5.00	2.75
39	1,250	lin. ft. vitr. pipe sewer 18 in	5.00	3.00	8.00	3.50
40	375	lin. ft. vitr. pipe sewer, 20 in	5.50	3.60	8.50	3.75
40A	360	lin. ft. vitr. pipe sewer, 22 in	6.00	4.20	9.00	4.25
41	600	lin. ft. vitr. pipe sewer, 24 in	6.50	4.80	9.50	5.00
42	8	ton c.-i. sewer pipe	100.00	38.00	70.00	45.00
43	4	ton c.-i. sewer pipe, special cast	120.00	76.00	90.00	80.00
45	1,550	lin. ft. egg-shaped sewer, 3 ft. 6 in. x 2 ft. 4 in.	9.00	3.60	12.00	6.00
47	660	lin. ft. egg-shaped sewer, 4 ft. 0 in. x 2 ft. 8 in.	10.00	4.20	13.00	7.50
53	160	lin. ft. circular sewer, 4 ft. 0 in.	11.00	4.80	20.00	8.00
56	160	lin. ft. circular sewer, 5 ft. 0 in.	12.00	6.25	22.00	10.00
75	8,430	(a) single-track electric surface railroad.	12.50	15.00	10.00	7.50
	260	(b) single-track horse surface railroad.	2.50	15.00	1.00	7.50
76	16	(b) elevated railroad col. support	1,000.00	900.00	5,000.00	1,500.00
79	115	lin. ft. water pipe, 6 in	0.50	0.85	2.00	0.50
82	3,140	lin. ft. water pipe, 12 in	0.75	1.60	2.50	1.50
87	2,500	lin. ft. water pipe, 36 in	2.00	4.80	4.00	5.00
88	115	lin. ft. water pipe, 48 in	5.00	8.50	6.00	8.00
88A	70	lin. ft. water pipe, service connections.	20.00	15.00	10.00	25.00
90	1,605	lin. ft. gas pipe, 4 in	0.40	0.85	1.00	0.50
91	5,400	lin. ft. gas pipe, 6 in	0.50	1.10	1.50	0.75
92	660	lin. ft. gas pipe, 8 in	0.60	1.30	2.00	1.00
94	115	lin. ft. gas pipe, 12 in	0.75	1.60	2.50	1.25
95	115	lin. ft. gas pipe, 16 in	1.00	2.20	3.50	1.50
95A	230	lin. ft. gas pipe, 18 in	1.10	2.40	4.00	2.00
96	230	lin. ft. gas pipe, 20 in	1.25	2.50	4.50	2.60
97	230	lin. ft. gas pipe, 24 in	1.50	4.20	5.00	3.00
99A	7,475	lin. ft. (b) w.-i. by-passing pipe, 8 in.	6.00	2.40	5.00	4.00
99B	210	lin. ft. (a) w.-i. by-passing pipe, 12 in.	6.00	3.50	8.00	4.50
	780	lin. ft. (b) w.-i. by-passing pipe, 16 in.	6.50	4.80	9.00	7.50
	200	lin. ft. (c) w.-i. by-passing pipe, 20 in.	7.50	8.00	10.00	8.50
	410	lin. ft. (d) w.-i. by-passing pipe, 24 in.	8.00	11.00	11.00	10.00
	210	lin. ft. (k) w.-i .by-passing pipe, 18 in.	7.00	7.20	9.50	8.00
	140	lin. ft. (w) Type "A" cable support	7.00	4.20	15.00	5.00
	215	lin. ft. (x) Type "B" cable support	7.00	4.20	10.00	5.00
	135	lin. ft. (y) Type "C" cable support	10.00	9.00	20.00	5.00
	135	lin. ft. (z) Type "D" cable support	8.00	4.80	15.00	5.00
99C	115	lin. ft. (c) w.-i. gas pipes, 8 in	2.25	1.80	3.00	5.00
	115	lin. ft. (d) w.-i. gas pipes, 10 in	2.50	2.10	4.00	2.50
99D	70	w.-i. gas pipes, service connections	20.00	15.00	10.00	3.50
100	176	ton new c.-i. hub and spigot straight pipe	35.00	40.00	50.00	25.00
100A	115	lin. ft. (c) w.-i. gas pipe, 8 in	2.00	1.80	2.00	40.00
	115	lin. ft. (d) w.-i. gas pipe, 10 in	3.00	2.10	2.50	2.50
101	51	ton new c.-i. hub and spigot pipe	60.00	84.00	80.00	3.50
101A	115	lb. new malleable iron fittings	0.10	0.12	0.50	80.00
103	145	lin. ft. high-pressure water pipe, 12 in.	5.00	2.40	2.50	0.15
106	115	lin. ft. high-pressure water pipe, 24 in.	6.00	5.00	3.00	4.00
107	14	ton new c.-i. spigot and groove pipe	35.00	48.00	50.00	7.50
108	10	ton new c.-i. spigot and groove pipe	60.00	96.00	75.00	50.00
121	260	lin. ft. air pipe, 6 in	1.00	1.20	1.50	100.00
123	115	lin. ft. new 6-in. air pipes	1.00	1.20	1.50	1.00
127	16,100	ft. electric ducts and conduits	0.50	0.50	0.25	1.00
127A	175	lin. ft. (a) w.-i. pipe, 2½ in	1.00	0.50	0.30	0.50
	3,705	lin. ft. (b) w.-i. pipe, 3 in	1.00	0.55	0.40	0.40
	165	lin. ft. (c) w.-i. pipe, 3½ in	1.00	0.60	0.40	0.80
127B	1,450	ft. (b) Johnston ducts	4.00	3.00	0.25	0.90
127C	140	service connections for electric ducts	40.00	15.00	10.00	0.50
						25.00

Richmond, Ind.—Reported Pennsylvania R. R. Co. (R. Trimble, Chief Engineer, M. W., Northwest System, Pittsburgh, Pa.), plans improvements here costing $500,000.

Alida, Minn.—Red Lake Northern Railway and Construction Company of Bemidji incorporated by Jens J. Opsahl, Leo J. Opsahl of Bemidji, and others, for the purpose of constructing a railroad from Alida in a northern direction to the Canadian boundry line near Lake of the Woods and southerly to Twin Cities.

St. Paul, Minn.—Reported Chicago, Burlington, Quincy R. R. Co. (W. L. Breckinridge, Engineer, M. of W., Chicago, Ill.) intends making improvements on line between Omaha, Denver and Billings through Central Wyoming. Cost $2,000,000.

Huron, S. D.—State Railroad Commission is reported to have granted permission to the Duluth, Huron & Southern R. R. to construct a line from Huron northeasterly through counties of Beadle, Clark and Codington, Day and Roberts, to the state line. W. E. Morrow of Huron is one of the promoters.

Bynum, Mont.—Great Northern R.R. (A. H. Hogeland, Ch. Engr., St. Paul, Minn.) will construct a branch line from Bynum to Pendroy.

Pendroy, Mont.—Great Northern R. R. (A. H. Hogeland, Chief Engineer, St. Paul, Minn.). Intends building a spur from Bynum to Pendroy to cost $200,000.

North Yakima, Wash.—Reported Northern Pacific Ry. Company (W. L. Darling, Chief Eng., St. Paul, Minn.) will construct a line 10½ miles long beyond Harrah to White Swan on Yakima Indian Reservation.

Portland, Ore.—Eliminating of grade crossings in Sullivan's Gulch by viaducts is under consideration by city, Oregon-Washington R. R. & Navigation Company (R. L. Huntley, Ch. Engr., Omaha, Neb.), and Portland Ry. Light & Power Company. Total cost, $600,000.

BIDS DESIRED.

McConnellsburg, Pa.—By McConnellsburg & Fort Loudon R. R. Company, McConnellsville, for following construction: 160,000 cu. yd. earth excav., rubble stone masonry, ballasting with crushed rock track laying work covers 11 miles. Plant required: Small revolving steam shovels, small cars, light rail and a few teams.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Asheville, N. C.** — Contract for strengthening lines of Southern Ry. Co. (B. Herman, Chief Engineer, Washington, D. C.) from Salisbury to Asheville, N. C., and to Knoxville, distance of 283 miles, including construction of 81 structures and eliminating grade crossings, awarded Consolidated Engineering Co., 243 Calvert Building, Baltimore, Md.

★**Ironton, Ohio.**—Contract for excavation of east side of new Russell yards awarded Boggess & Steele of Ashland, Ky., at $65,000.

★**Fredericton, N. B.**—Contract awarded Nova Scotia Construction Company, 159 Upper Water Street, Halifax, for railway between Gagetown and Westfield for St. John Valley Ry. Company, at $1,750,000.

PUBLIC BUILDINGS AND SCHOOLS

PROPOSED WORK.

Brockton, Mass.—Finance Committee of City Council voted to recommend an appropriation of $90,000 for erecting addition to Winthrop School.

Chicopee, Mass.—George E. Haynes of Pittsfield, engaged by School Committee to prepare plans for proposed high school to be erected on Front St.

Medford, Mass.—Supreme Court May 19 dismissed the bill in equity brought by taxpayers against Mayor Benjamin F. Haines and the City Treasurer to restrain defendants from carrying into effect an order passed by Board of Aldermen Jan. 25, 1916, to build a new city hall; probable cost $200,000.

Springfield, Mass. — School bonds amounting to $140,000 sold, May 31, by Fred A. Bearse, County Treasurer, proceeds to be used for erecting Hampden County Training School.

Providence, R. I.—Plans being prepared by William R. Walker & Son, 17 Custom House Street, for a 4-room brick school to be erected on Broadway and Fort Avenue.

Albany, N. Y.—Governor Whitman signed bill appropriating $65,000 to erect new laboratory for State Department of Health on New Scotland Avenue to replace present building on Yates Street. Dr. Herman M. Biggs, State Health Commissioner.

Lockport, N. Y.—Steps being taken by Building Committee of County Board of Supervisors to erect proposed tuberculosis hospital for which $100,000 bonds were recently voted.

The Board of Education has taken over the work of completing the high school by day labor under the supervision of L. C. Wille, Architect, Lockport.

New York, N. Y.—Har Moriah Hospital, 138 Second Street (Bernard Turkel, President), intends erecting a hospital in Fourteenth Street, east of Third Avenue, to cost $400,000.

Board of Estimate, May 19, appropriated $5,900,239 for Board of Education, to be used in altering and equipping old school buildings, acquiring new sites and erecting new schools.

Plans filed for erecting following buildings: 4-story fireproof hospital on Fifth Avenue and 100th Street for Mt. Sinai Hospital; cost $200,000; Arnold W. Brunner, Archt., 101 Park Avenue. 3½-story brick laboratory at 105th Street and Central Park West, for General Memorial Hospital; cost $35,000; Palmer, Hornbostel & Jones, Archts., 63 William Street.

Plans being prepared for five-story addition to New York Post-Graduate Medical School and Hospital, 303 East Twentieth Street, to be used as a babies' ward.

Rochester, N. Y.—Council voted $400,000 bonds for school buildings. Board of Education intends erecting 2 new schools and addition to another and a junior high school.

Pittsford, N. Y.—School bonds for $59,000 will be sold June 16 by Board Education.

Yonkers, N. Y.—Hospital bonds for $57,000 will be sold June 15 by Jos. Miller, City Comptroller.

Belleville, N. J.—School bonds for $41,000 will be sold June 13 by Town Clerk, proceeds to be used to erect an addition to Little Silver School.

Newark, N. J.—Reported school is to be erected on Speedway Ave. at cost of $50,000. Address Secy. Bd. of Education.

Plainfield, N. J.—Site being selected for proposed armory for which $25,000 has been appropriated.

A city hall is to be erected at cost of $80,000. Address City Clerk.

Vineland, N. J.—Plans being prepared by Paul A. Davies, 3d, 1713 Sansome Street, Philadelphia, Pa., for new two-story brick and stone school and an addition to old school.

Altoona, Pa.—Commission appointed by Governor, of which S. S. Reighard, 2319 Broad Avenue, Altoona, is a member to seek a site on which to erect the Western State Hospital for Insane, and for which there is $50,000 available.

Carlisle, Pa.—Citizens of East Pennsboro Township voted $40,000 school improvement bonds. Address Township Clerk.

Lititz, Pa.—Contract soon to be let by School Board for erecting high school to cost $90,000.

Midland, Pa.—Citizens voted $40,000 bonds for erecting eight-room school. Address Secretary Board Education.

Ridley Park, Pa.—Plans being prepared by Paul A. Davies, 3d, 1713 Sansome Street, Philadelphia, for two-story brick and stone high school; cost $85,000.

Wilkes-Barre, Pa.—Site at Andover and Poplar Streets purchased for proposed school to cost $100,000. Address Board of Education.

Wilkinsburg, Pa.—School bonds amounting to $250,000 sold. Address Board of Education.

Highlandtown, Md.—Smith & May, 1133 Calvert Bldg., Baltimore, are architects for the new school at Highlandtown and for additions to schools in Govans and Mount Winans.

Wyoming, Del.—Reported contract soon to be let for erecting two-story, 90 x 68 ft., brick school. Address Board of Education.

Bethany, W. Va.—Plans being prepared for $30,000 gymnasium to be erected for Bethany College (T. E. Cramblett, President).

Newnan, Ga.—Haralson, Bleckley, Third National Bank Building, Atlanta, are architects for the proposed school improvements.

Lake Charles, La.—Citizens voted $30,000 bonds for erecting brick school. Address Secretary Board Education.

Biloxi, Miss.—See "Paving and Roads."

Drew, Miss.—City will erect a $25,000 school. R. B. Spencer, Architect, Jackson. Address City Clerk.

Poplarville, Miss.—Reported plans being prepared by N. W. Overstreet, Jackson, for the new court house contemplated at a cost of $40,000. Address County Clerk.

Walthall, Miss.—Citizens of Webster County voted $75,000 to erect a court house and jail. X. A. Kramer, Archt., Magnolia, Miss. Address County Clerk.

Covington, Tenn.—Citizens voted $25,000 school bonds. Address Clerk Board of Education.

Berea, Ky. — Reported Berea College intends erecting a women's dormitory as a memorial to Mrs. D. Willis James of New York, N. Y.; probable cost $40,000.

Alliance, Ohio.—School bonds for $100,000 will be sold June 15 by Board of Education (James H. Anderson, Clk.).

Bowling Green, Ohio.—State Building Commission at Columbus approved plans for science department building to be erected for Bowling Green Normal School; estimated cost $100,000.

Bratenahl (P. O., Cleveland), Ohio.—Election will be held June 14 to vote $35,000 bonds for erecting town hall at New York Central R. R. and East 105th Street. Abram Garfield, 915 Garfield Bldg., Cleveland, Archt.

Bucyrus, Ohio. — Centralized Rural School District voted $35,000 bonds to erect centralized school.

Canton, Ohio.—Market House and auditorium bonds for $25,000 will be sold June 26 by Samuel E. Barr, City Auditor.

Cleveland, Ohio.—H. C. Gabode, 1900 Euclid Avenue, preparing plans for a 2-story addition to St. Ann's Maternity Hospital, 3409 Woodland Avenue; cost $35,000.

Trustees of Public Library will soon engage an architect to prepare plans for the Kain library to be erected on Superior Avenue and East Third Street, to cost $2,000,000. Carl Lorenz, Kinney & Levan Building, Secy. Board.

Girard, Ohio.—Plans completed and contracts soon to be let for erecting two eight-room schools. Address School Board.

Hamilton, Ohio.—Erection of new city hall, to cost $200,000, contemplated. Address City Clerk.

Lakewood, Ohio.—Board Education considering erecting a high school to cost $300,000. Election to be held in the fall.

Massillon, Ohio.—State Building Commission at Columbus approved plans for erecting cottage building at Massillon State Hospital; estimated cost $50,000.

Pleasant City, Ohio.—School bonds for $40,000 will be sold July 1 by Board Education, Pleasant City Special School Dist.

Urbana, Ohio.—Jackson Township voted $25,000 bonds to erect centralized school. Address Township Clerk.

Indianapolis, Ind.—Rubush & Hunter, American Central Life Building, engaged to prepare plans for proposed high school to be erected on Winona Technical Institute grounds to relieve the congested conditions in the high schools; cost about $35,000. Address School Board.

New Albany, Ind.—Board of County Commissioners accepted plans prepared by Arthur Smith, Norton Building, Louisville, Ky., for three-story and basement brick and stone poor asylum to replace asylum destroyed by fire; estimated cost $35,000.

Detroit, Mich.—Board of Education (George W. Auch, Chmn.) contemplates erecting a technical school costing $500,000. W. G. Malcolmson, Archt., 404 Moffat Street.

Grand Rapids, Mich.—Tentative plans prepared by Henry H. Turner, Grand Rapids, for three-story school to be erected for Fountain District; approximate cost, $90,000.

Chicago, Ill.—See "Bridges."

Princeton, Ill.—The Julia Rackley Perry Memorial Hospital will cost $50,000. H. H. Priestly is member of Board of Directors.

Venice, Ill.—Citizens, May 20, voted $50,000 bonds to erect high school. Address School Board.

Berlin, Wis.—The high school is to be 2-story brick, 150 x 200 ft., and cost $75,000. Architect not yet selected. E. K. Cunningham, Clerk Board Education.

Green Bay, Wis.—Tentative plans prepared by Foeller & Schober of Green Bay, for proposed East High School, of brick and stone construction; probable cost $290,000. Address School Board.

Madison, Wis.—Sigma Nu Fraternity, at the University of Wisconsin, will erect a three-story brick building at 621 North Henry Street, costing $29,000.

Prairie du Chien, Wis.—Parkinson & Dockendorff, La Crosse, are architects for proposed $60,000 high school, to be erected here, of brick and fireproof construction.

Manchester, Iowa.—Citizens voted $35,000 school bonds. Address Clerk School Board.

Muscatine, Iowa.—Citizens voted $75,000 bonds for constructing high school.

Fairmont, Minn.—George Pass & Sons, Mankato, engaged to prepare plans for brick school; cost about $25,000. Address School Board.

Moorhead, Minn.—Election will probably be held to vote $125,000 bonds for improvements to schools. Address Secretary Board of Education.

Omaha, Neb.—Board of Education approved recommendation of Buildings and Grounds Committee for purchasing site on Chicago and Twenty-third Streets for proposed High School of Commerce.

Clear Lake, S. D.—Citizens voted $75,000 bonds to erect a court house, to be 2 stories, steel and concrete. J. M. Wold, County Auditor.

Webster, S. D.—Contract will be let in July for erecting the 2-story brick and stone school to cost $65,000. Oscar Grue, Clerk Board Education; Holmes & Flinn, Archts., 8 Dearborn Street, Chicago, Ill.

Joplin, Mo.—Plans being prepared by Smith, Rea & Lovitt, Finance Building, Kansas City, Mo., for a high school, cost $300,000.

Kansas City, Mo.—See "Bridges."

Laredo, Tex.—Attorney General has approved the $80,000 school bonds. Address Secretary Board of Education.

Plainview, Tex.—The Attorney General approved bond issue of $50,000 for Plainview Independent School Dist.

Port Arthur, Tex.—The Attorney General approved a $250,000 bond issue for erection of high school.

Dewey, Okla.—Contract will soon be let for erecting a fireproof high school costing $40,000. Hawk & Parr, Archts., Oklahoma, Okla.

Tucumcari, N. M.—Citizens voted $50,000 bonds to erect two schools.

Wasco, Ore.—Citizens voted $25,000 school bonds. Address Clerk School Board.

Anaheim, Cal.—Election will be held June 13 to vote $35,000 bonds for erecting additions to high school.

Los Angeles, Cal.—Contract soon to be let by Board Supervisors for erecting five-story and basement reinforced concrete service building on grounds of County Hospital on Mission Road; cost $85,000. J. Schulz, Engineer, 305 Wright & Callender Building.

Potrero, Cal.—Reported Board of Supervisors at San Diego propose erecting Daniel Webster School in Potrero at a cost of $145,000.

Visalia, Cal.—Swartz & Swartz, Fresno engaged to prepare plans for 3 school buildings. Bonds for $105,000 have been voted. Address Clerk School Board.

Twin Falls, Idaho.—Reported School Board will soon let contract for erecting $75,000 school for which plans are being prepared by The Distinctive Homes Building Company, Leary Building, Seattle, Wash.

Simcoe, Ont.—Chapman & McGiffin, Toronto, engaged to prepare plans for 2 brick schools to cost $50,000. Guy Marston, Chairman Board Education.

Calgary, Alta.—City Engineer is Chairman of Committee appointed to secure plans for a municipal auditorium to cost $150,000.

BIDS DESIRED.

Lee, Mass.—Until June 15 (readvertisement) by Town Clerk for erecting a high school to cost $35,000. William T. Towner, Archt., 366 Fifth Avenue, New York.

East Orange, N. J.—Until June 19, by Board Education (Warren A. Clapp, Secy.), for furnishing material and erecting addition to Elmwood School on Burnett Street, near Elmwood Avenue. Separate bids for heating, plumbing, etc. Guilbert & Betelle, 665 Broad Street, Newark, Archts.

Freehold, N. J.—Until June 19, by Charles H. Burcher, Town Clerk, for erecting a municipal building, including heating, plumbing, etc.

Kearny, N. J.—Until June 9, by City, for improving School No. 5, to cost $25,000. Address Clerk School Board.

Penns Grove, N. J.—Reported desired until June 15 by Moffett & Stewart, Archts., 30 N. Third Street, Camden, for erecting two-story, 90 x 60 ft. school. Probable cost $40,000. J. T. Layton, Secy. Board Education.

Pompton Lakes, N. J.—Until June 26, by Board of Education, for general construction of school. Rasmussen & Wayland, Archts., 1133 Broadway, New York, N. Y.

Trenton, N. J.—Until June 15, for erecting New Jersey State Hospital, boiler house, one-story brick, stone and concrete, 43 x 54 ft., pump house, one story, 30 x 70 ft. Geo. S. Drew, Archt., Trenton.

Allison Park, Pa.—Until June 15, by School Dist., McCandless Township (Harry G. Kell, Secy., Allison Park, R. F. D. No. 1), for erecting a school. Seperate bids for heating, plumbing, ventilating, etc. Jones & Fisher, Architects, 1014 Westinghouse Bldg., Pittsburgh.

Arden, Pa.—Until June 15 (readvertised), by County Commissioners at Washington, for erecting a two-story brick hospital and ward building at the County Home. Lowest bids opened May 20 totaled about $50,000.

Butler, Pa.—Until June 14 by Butler Township School Board for erecting a two-story brick school. W. Kline, Archt., Butler.

Lilly, Pa.—Until June 19 by School Board (W. L. McGough, Secy.) for erecting high school. Separate bids June 19 for heating, electrical work, etc. J. E. Adams, Archt., Room 402, Lincoln Bldg., Johnstown.

New Castle, Pa.—Until June 13, by School District (H. M. Marquis, Secy.), for re-erecting the Highland Avenue School. Separate bids for heating, plumbing, etc. H. M. Wirsing, New Castle, Archt.

Wilson, Pa.—Until June 12 by Board Education, School Dist., for furnishing material and erecting school. Separate bids for heating, ventilating, etc. A. G. Wickersham, Archt., 517 McClure Street, Homestead.

Newark, Del.—Reported desired until June 13, by Trustees Delaware College, for extensive alterations to college building. Day & Klauder, Archts., 925 Chestnut St., Phila.

Leesburg, W. Va.—Until June 21, by S. B. Paxton, Clk. School Board, for erecting high school. John B. Crawford, Archt., Hamilton, Va.

Romney, W. Va.—Until June 13, by J. Sloan Kuykendall, Pres. Board Education, for addition and alterations to school. Separate bids for heating, ventilating, etc. Holmbow & Lafferty, Archt., Clarksburg.

Mocksville, N. C.—Until June 12 (change of date), for repairs and reconstructing the court house. M. C. James, Chmn. County Commissioners.

Jacksonville, Fla.—Reported desired until June 17, by F. A. Hathaway, County Superintendent Public Instructions, 415 Masonic Temple, for erecting a 16-room school at South Jacksonville. Marks & Sheftall, Archts., Jacksonville.

New Orleans, La.—Until June 22, by Lighthouse Inspector, for constructing Timballer Light Station on the Gulf of Mexico.

Clarksdale, Miss.—Until June 13, by City Clerk, for erecting a city hall.

Chillicothe, Ohio.—Reported desired until July 20, by Karl I. Best, Archt., 215 Hayden Bldg., Columbus, for erecting 2-story, 70 x 200 ft. memorial hall and armory for state. Probable cost $65,000.

Until July 6, by R. D. Alexander, Secretary Commission, North Paint Street, Chillicothe, for erecting the Sixth Inter-County District Tuberculosis Hospital. Estimated cost $35,000. Frank L. Packard, Archt., Columbus.

Grand Rapids, Ohio.—Until June 23 by Board Education (R. J. Shull, Clk.) for furnishing material and erecting a high school. Separate bids for heating, plumbing, etc. Howard & Merriam, Archts., 8 E. Broad Street, Columbus.

Harpster, Ohio.—Until June 26, by Board Education, Adda J. Benton, Clk.), for erecting high school at Harpster. Separate bids for heating, etc. Stribling & Lum, Archts., Columbus.

Sciotoville, Ohio.—Reported desired until June 17 by W. B. Halstead, Clk. Board Education, for erecting two-story and basement high school. Probable cost $25,000. Ritter & Bates, 45 First National Bank Building, Portsmouth, Ohio, Archts.

Seville, Ohio.—Until June 21 (readvertisement), by E. R. Alexander, Clerk Board Education, for erecting a school.

National Military Home, Ind.—Until June 13, by E. B. White, Superintendent of Post Funds, Marion Branch N. H. D. V. S., National Military Home, for furnishing material and erecting a one-story and basement brick library.

New Albany, Ind.—Until June 28, by County Auditor, for erecting a concrete asylum costing $35,000. Arthur R. Smith & W. Earle Otis, Norton Building, Louisville, Ky.

South Bend, Ind.—Until June 20, by E. B. Rupel, Secy. Board School Trustees, for erecting a brick and cement fireproof school costing $125,000, including equipment. Freyermuth & Maurer, Archts., South Bend.

Ann Arbor, Mich.—Until June 20, by Shirley W. Smith, Secy. of Regents of University of Mich., for erecting library on the campus at Ann Arbor. Albert Kahn, Trussed Concrete Bldg., Detroit.

Plymouth, Mich.—Until June 24, by Dr. J. J. Travis, Pres. Board Education, for erecting school. Separate bids for heating, plumbing, etc. R. A. Le Roy, Archt., 122 Pratt Bldg., Kalamazoo.

Dunning, Ill.—Reported desired until June 27, by Frank D. Whipp, State Fiscal Supervisor, Springfield, Ill., for erecting an amusement hall at Chicago State Hospital, Dunning. James B. Dibelka, State Archt., 130 North Fifth Avenue, Chicago.

Macomb, Ill.—Until June 19, at office of James B. Dibelka, State Archt., 130 North Fifth Avenue, Chicago, for furnishing material and erecting an Art Building on Campus of Western Illinois Normal School. Separate bids for heating, plumbing and electric wiring.

Mendota, Ill.—Until June 27, by W. R. Foster, County Supt. of Schools, Board Education, for erecting high school. Probable cost $75,000. Grant C. Miller, Fullenweilder & Dowling, Archts., 6 North Michigan Boulevard, Chicago.

Des Moines, Iowa.—Reported desired until June 23, by A. I. Clinte, Secy. Independent School Dist., for erecting new Lucas School. Also separate bids until June 12, same place, for erecting addition to Willard School a new Urbandale school, and a new prevocational school. Smith & Kaffer, Archts., Des Moines.

Knoxville, Iowa.—Reported desired until June 22, by G. G. Gilson, Secy. School Dist. for erecting high school.

Meriden, Iowa.—Reported desired until June 14, by Independent School Dist., for erecting school. Wm. L. Steele, Archt.. United Bank Bldg., Sioux City.

Detroit, Minn.—Until June 12, by E. K. Bestick, City Clk., for furnishing material and erecting a city hall and fire station. Separate bids for heating, plumbing, etc. Bell & Bentley, Archts., 518 Security Bldg., Minneapolis.

Duluth, Minn.—Until June 13, by State Board Control, at office in State Capitol Bldg., St. Paul, for erecting an Institute Hall at Northeast Demonstration Farm and Station, Duluth. C. H. Johnson, Archt., 715 Capital Bank Bldg., St. Paul.

Hebron, Minn.—Until June 22, by School Board Consolidated School Dist. No. 75 (C. P. Chapman, Clk.), for erecting a school. Separate bids for heating, plumbing, etc.

Stillwater, Minn.—Until June 13 by State Board Control, State Capitol Bldg., St. Paul, for erecting Women's Building State Prison. Separate bids for heating, ventilating, etc. C. H. Johnson, Archt., 715 Capital Bank Bldg., St. Paul.

St. Paul, Minn.—Until June 15, by Board of Control (Oliver J. Tong, Secy.), St. Paul, for erecting a building at City and County Hospital, including heating, plumbing, etc.

Osawatomie, Kan.—Until June 14, by Clerk Board Education, for erecting a school to cost $43,000, citizens, May 9, voted bonds. T. D. Williamson & Company, Archts., Topeka.

Kearney, Neb.—Reported desired until June 23, by A. L. Caviness, Secy. State Board Education, for erecting two-story gymnasium on State Normal Grounds. Probable cost $60,000.

Wayne, Neb.—Reported desired until June 23, by A. L. Caviness, Secy. Board Education, for erecting a two-story, 89 x 129 ft. industrial building. Probable cost $65,000. J. H. Craddock, Archt., 504 First National Bank Bldg., Omaha.

Edmore, N. D.—Until June 30, by Jas. A. Connolly, Clk. School Board, for erecting a school. J. A. Shannon, Archt., Devils Lake.

Edmund, N. D.—Until June 23, by E. S. Dodge, Clk. Arrowwood School Dist., No. 9, for erecting a two-story and basement school, together with mechanical equipment, etc. Gilbert R. Horton, Archt. Citizens Natl. Bank Bldg., Jamestown.

Fessenden, N. D.—Until June 19, by C. M. Brinton, Secy. Fessenden Auditorium, for furnishing material and erecting business block and auditorium. A. H. Fast, Archt., Elbow Lake.

Hillsboro, N. D.—Reported desired until June 12, for erecting court house. Separate bids for heating, plumbing, etc. N. G. Nyhus, City Aud.

Joplin, Mo.—Until July 1, by A. H. Waite, Chmn. Commission, First Natl. Bank, for erecting a tuberculosis hospital.

Vancouver, Wash.—Until July 14, by Jas. A. Wetmore, Acting Supervising Archt., Treas. Dept., Washington, D. C., for erecting U. S. post office at Vancouver.

Portland, Ore.—Until Aug. 7, by James A. Wetmore, Acting Supervising Architect, Washington, D. C., for constructing (except mechanical equipment) of the U. S. Post Office, advertised in Engineering Record.

Culver City, Cal.—Until June 15, by Trustees Palms School Districts (J. A. Hathaway, Clk.), for erecting a school. Separate bids for heating, plumbing, electric wiring, etc. Oliver P. Dennis, Archt., 618-19 Fay Bldg., Los Angeles.

London, Ont.—Until June 12 (extension of date), by R. M. McElheran, City Hall, for erecting a technical school to cost $200,000.

Parry Sound, Ont.—Until June 12, by J. D. Broughton, Secy. Treas. Public School Board, for erecting a 6-room school. Angus & Angus, Archts., Angus Blk., North Bay.

PRICES AND LETTINGS.

★Indicates award of contract.

Augusta, Me.—Following are four lowest bids opened May 31 for renovating second male wing at Augusta State Hospital: E. C. Hodgins, Bangor, $83,722; Noyes & Campbell, Augusta, $98,859; F. A. Rumery, Portland, $105,000; Otto Nelson, Bangor, $105,066.

★Bennington, Vt.—Contract for erecting Putnam Memorial Hospital awarded McDermott & Hanigan, 103 Park Avenue, New York, N. Y., at $80,500.

★Feeding Hills, Mass.—John J. O'Neill Company, of Holyoke, secured contract to erect three-story brick training school on Brown Farm site, at $91,500.

★Springfield, Mass. — Contracts for erecting Howard Street School awarded as follows: General contract, W. A. Newton Company, $62,980; heating and ventilating, George H. McClean Company, $16,000; plumbing, Donahue Brothers, $5,385; electrical work, Collins Electric Company, $3,752 (bidders all of Springfield).

★Newport, R. I.—Contract for erecting U. S. Post Office awarded M. Yeager & Son, Danville, Ill., at $244,996.

★Kenmore, N. Y.—Contract for erecting addition to High School awarded Morris & Allen, Builders' Exchange Building, Buffalo, at $35,222, and plumbing to Ebling-Heiss Company of Kenmore.

★Freehold, N. J.—Contract awarded G. W. Henderson, Avon, for erecting addition to court house, at $39,500. Other bidders: W. H. Fissell, 1328 Broadway, New York, $46,700; and I. D. Emery, Oceanic, $48,900.

★Arnold, Pa.—Contract awarded Work Brothers, New Kensington, for erecting two-story brick addition to high school on Victoria Avenue, at $32,823.

★Carnegie, Pa. — Contract awarded Harry Lewis of Carnegie for erecting one-story and basement fireproof school for Green Tree Borough; cost $26,000.

★Forty Fort (P. O. Kingston), Pa.—Contract for erecting grammar school on Fort Street awarded as follows: General contract, Herman J. Mailander, Wilkes-Barre, $32,160; heating and ventilating, B. G. Carpenter, Wilkes-Barre, $3,995; plumbing, James H. Campbell, South Washington Street, Wilkes-Barre, $3,350. Newberry & Fostor, Archts., Miners Bank Building, Wilkes-Barre.

★Philadelphia, Pa.—Contract awarded Melody & Keating, 1322 Race Street, for erecting three-story, 63 x 74 ft., stone and concrete school at Twenty-third and Cambria Streets; cost $59,000.

★McComb, Miss.—Contract for erecting brick high school (bids opened May 16) awarded H. H. Houis & Son, Vicksburg, Miss., at $25,620. ★. A. Kramer, Archt., Magnolia.

★Canton, Ohio.—Contract for constructing remaining units of Daniel Worley Grade School, being erected on Twenty-third Street, N. W., awarded Indiana Engineering & Construction Company of Ft. Wayne, Ind., at $76,275. Total cost of building $124,000.

★Cleveland, Ohio.—Contract awarded C. E. Crump, Wade Building, for a hospital to be erected on Prospect Avenue and East Thirtieth Street for Co-operate Hospital Assoc.; cost $435,000. A. C. Edwards, 615 Union Bldg., Archt.

★Crowell Lundoff Little Company, 1951 East Fifty-seventh Street, awarded contract to erect a 3-story addition to Laurel School, at 10,001 Euclid Avenue; cost $40,000.

★Kent, Ohio—Contract for erecting women's dormitory at State Normal School awarded Robert H. Evans Company, Columbus Savings & Trust Building, Columbus, at $113,264. Wilbur T. Mills Company, Archts., 49 North High Street, Columbus.

★Lordstown, Ohio (P. O. Warren).—Contract for erecting centralized school here awarded Kratt & Agnew of Lorain, Ohio, at $27,000. Robert J. Keich, Archt., Room 409 Western Reserve Bank Bldg., Warren.

★Evansville, Ind.—Contract for alterations, etc., to U. S. Post Office awarded Christ Kanzler & Sons, Evansville, at $134,000.

★Kokomo, Ind.—Contract for erecting Howard Township consolidated school awarded W. Z. Morgan Company of Kokomo, at $30,694, and heating and plumbing to Liege Heating & Ventilating Company of Auburn, at $8,899.

Chicago, Ill.—Lowest bids opened May 23 by City for erecting a fire house at 430 West 104th Street submitted as follows: General construction, Butler & Company, Stock Exchange Building, $26,693; plumbing, Barrett & McCall, 158 West Randolph Street, $1,693; heating, A. F. Walsh, 7536 Bond Avenue, $1,350. Charles W. Kaljal, City Architect.

★Quincy, Ill.—Contracts for erecting two 16-room schools, one in Ward 2 and one in Ward 6, awarded as follows: General construction, Kennedy & Peterson, Boston, Mass., $173,000; heating and ventilating, Stone, Underhill & Company, Boston, Mass., $25,698; plumbing, M. A. Dame & Company, Lynn, Mass., $15,167; electrical work, Puritan Electric Company, Quincy, $12,482.

Antigo, Wis.—Weinberg Construction Company of Grand Rapids, Wis., submitted lowest bid for erecting high school, at $93,224.

★Williams Bay, Wis.—Contract for erecting one-story and basement, 90 x 144 ft. school awarded M. Rewald of Burlington; cost about $35,000. Chandler & Park, Archts., Racine.

★Sioux City, Iowa.—Contract for erecting St. Vincent Hospital on Seventh and James Streets awarded Ingeman Company, St. Paul, at $102,000.

★Little Falls, Minn.—Contract for erecting U. S. Post Office awarded A. W. Lane, 19 South La Salle Street, Chicago, Ill., at $53,375, using limestone.

★Minneapolis, Minn.—General contract for erecting one-story Hiawatha School on Minnehaha Avenue and Forty-fifth Street awarded Rose & Marshall, Minneapolis, at $54,135.

★Hazen, N. D.—Chase & Westlin of Hazen secured contract to erect high school at about $30,690.

★Bowman, S. D.—Contracts for erecting school (bids opened May 27), awarded by Board of Education (J. M. Folsom, Clerk) as follows: General contract, to Reed McDonald Brewster, Minneapolis, Minn., $38,592; heating and ventilating, F. S. Spencer, Minneapolis, Minn., $6,889.

★Great Falls, Mont.—Contract awarded Olson & Johnson, Inc., Missoula, for erecting four-story stone and brick addition to Montana Deaconness Hospital; cost $69,000.

★Austin, Tex.—Contracts in connection with erection of the State Blind Institute awarded as follows: Walsh & Burney, San Antonio, general contract, at $219,414; plumbing, Donnelly & White, Austin, $21,096; heating, Kinnison Brothers, Dallas, $32,790; electrical work, Wright Brothers, San Antonio, $19,443.

★Tahoka, Tex.—Contract for erecting 4-story fireproof court house (bids opened May 22) awarded Charles Z. Rigens, Tahoka. P. H. Northcross, Clerk County and District Courts.

Seattle, Wash.—W. T. Butler Contracting Company, Central Building, submitted lowest total bid for erecting Political Science and Commerce Building, on Campus of University of Washington at $97,900. Lowest bids submitted on sections of the work, including the following: Carpentry, A. Levergreen, 3826 Eastern Avenue, $18,470; terra cotta, Denny Renton Clay & Coal Company, Hoge Building, $21,250; sheet metal and roofing, A. Gerhi, Seattle, $7,995; masonry, Snider & Holstrom, Seattle, $20,499; marble, tile and terrazzo, Art Marble Company, Seattle, $6,172.

Wenatchee, Wash.—Lowest bid opened May 19 by James A. Wetmore, Acting Supervising Architect, Washington, D. C., for erecting U. S. Post Office was from Bird & Hobson, Wenatchee, at $79,000 for limestone and $78,618 for sandstone.

Los Angeles, Cal.—Lowest bid opened May 25 by Board of Education for erecting 6-room one-story and basement brick and reinforced concrete school on Marengo Heights submitted by Willard Brent Company, Baker Detwiler Building, at $25,705. Richard C. Farrell, Architect, 1437 San Pedro Street.

Riverside, Cal.—Following are four lowest bids, opened May 24 by Board Regents, University of California, Union League Building, Los Angeles, for erecting a 2-story and basement brick and hollow-tile office laboratory auditorium and library building, a residence, barns and garage, at State Citrus Experiment Station: Cresmer Mfg. Company, Riverside, $119,500; Hancock & Waldman, Riverside, $123,000; Merchants Realty & Investment Company, 808 Van Nuys Building, Los Angeles, $136,145, and W. C. Crowell, Chamber of Commerce Building, Pasadena, $139,132. Lester H. Hibbard & H. B. Cody, Archts., 1200 Marsh Strong Building, Los Angeles.

★Salt Lake City, Utah.—Following are four lowest bids opened May 29, by L. P. Judd, Clerk Board Education, for erecting Liberty School: Burg & Lundquist, $40,680 (awarded contract); J. H. Angell, $45,387; Alston & Hoggan, $46,000, and Rudine & Chytraus, $46,776. L. P. Judd, Clerk Board Education.

★Windsor, Ont..—Eells & Gray of Windsor, it is reported, will erect a collegiate institute costing $175,000, including equipment.

PRIVATE BUILDINGS

PROPOSED WORK.

Boston, Mass.—Plans being prepared by A. H. Bowditch, 44 Bromfield Street, for a fireproof building for the automobile trade which Albert Geiger, Jr., intends erecting.

Boston University Law School, Ashburton Street, intends erecting a brick law school building costing $50,000. Kil-

Oliver Ditson Co., 150 Tremont Street, will erect a 10-story marble business block to cost $300,000. Townsend, Steinle & Haskell, Archts., 1328 Broadway, New York, N. Y.

Springfield, Mass.—Plans being prepared for 6-story fireproof office building to be erected on Vernon Street, by Lyman Besse, Besse Place.

Springfield, Mass.—Albert Corporation, Springfield, intends erecting a brick apartment house on Pearl Street to cost $85,000.

Afton, N. Y.—See "'Railroads."

Alexandria Bay, N. Y.—St. Cecelia's Roman Catholic Church contemplates erecting new edifice on Walton Street; probable cost $100,000. Rev. M. E. Fogarty, Pastor.

Binghamton, N. Y.—Contract for erecting Kalurah Temple for Shriners awarded to Jones, Beers Co., Binghamton. Cost, about $100,000.

Brooklyn, N. Y.—Plans completed by F. J. Dassau, 1373 Broadway for four-story brick and limestone apartment building to be erected on Washington and Willoughby Avenues for Mona Realty Company; cost $75,000.

New York, N. Y.—Henry Ford, Detroit, Mich., is reported to have secured a site at Broadway and Fifty-fourth Street on which to erect a building 12 to 16 stories high.

New York, N. Y.—Plans filed for erecting following buildings: 13-story fireproof apartment building at 75 East Eighty-first Street for Alice Miller, cost $300,000, George and Edward Blum, Archts., 605 Fifth Avenue; 6-story brick tenement house at 315 West Twenty-fourth Street for Superior Contracting Company, Inc., cost $55,000, Goldner & Goldberg, Archts., 391 East 149th Street; two 6-story apartment buildings at 654-660 West 160th Street, for Natwil Holding Company, total cost $80,000, Samuel Katz, Archt., 405 Lexington Avenue; 6-story brick store and apartment building at 120 Sullivan Street, for Victor & Louis Casazza, cost $50,000, George J. Casazza, Archt., 1133 Broadway; three 5-story brick tenements on Grand Concourse and 183d Street for 183d Street & Concourse Corporation, total cost $206,000, George P. Pelham, Inc., Archt., 30 East Forty-second Street; 5-story brick tenement at Washington Avenue and 171st Street for Avenue St. John and Fox Street Corporation, cost $65,000, Charles B. Meyers, Archt., 1 Union Square; three 6-story brick tenements at Creston Avenue and 192d Street for 173d Street Realty Company, total cost $195,000, Kreymborg Architectural Company, Archts., 1029 East 163d Street; two 6-story brick tenements at 188th Street and Marion Avenue for L. M. C. Realty Company, Inc., total cost $100,000, Kreymborg Architectural Company, Archts., 1029 East 163d Street.

Bayonne, N. J.—Celia Napelbaum, Bayonne, plans erecting a 3-story brick apartment house at Sixteenth Street and Hudson Boulevard, to cost $65,000.

Bayonne, N. J.—H. H. Frieder, Bayonne, plans erecting a moving picture theater on Broadway to cost $31,400.

Elizabeth, N. J.—Julius Schmitt, 1140 East Jersey Street, will erect a theater in East Jersey Street; cost $30,000.

The Polish Falcons will erect a club house at Third and South Park Streets; cost $60,000. J. Ben Beatty, Archt., 57 Broad Street.

Perth Amboy, N. J.—Charles Sontag, Hoffman House, South River, will erect a $35,000 hotel on Main and Ferry Streets.

Smith Street Realty Company will erect a theater on Smith Street to cost $100,000.

New Brunswick, N. J.—Erection of Y. M. C. A. building, costing $100,000, is contemplated. Address Secretary Y. M. C. Assoc.

Philadelphia, Pa.—Plans being prepared by Simon & Bassett, 1112 Chestnut Street, for alterations and additions to West Side Presbyterian Church; cost $40,000.

Sharon, Pa.—First Presbyterian Church intends erecting $80,000 edifice.

Lewistown, Pa.—Erection of a Y. M. C. A. building contemplated here; probable cost $75,000.

Guilford, Md.—St. Ignatius' Catholic Church contemplates erecting new edifice here to cost $400,000. Rev. William J. Ennis, Pastor.

McDonogh, Md.—E. Stanley Gary, President Board Trustees McDonogh School, 720 Equitable Building, Baltimore, reports that a $40,000 school is to be erected here.

Wilmington, Del.—Contract soon to be let for erecting eight-story, 80 x 150 ft. Y. W. C. A. building here. Edward C. May, Archt., Wilmington.

Fork Union, Va.—McLaughlin & Johnson, Lynchburg, are architects and Wiley & Wilson, Lynchburg, engineers for the 3 and 4-story dormitory which is to be erected at Fork Union Military Academy (C. E. Crosland, Pres.) at a cost of $40,000.

Huntington, W. Va.—Trinity Episcopal Church will erect parish house, church and rectory; total cost $100,000. The parish house is to be erected first at cost of $25,000.

Salisbury, N. C.—First Methodist Church planning to erect new edifice on present site, to cost $50,000.

Atlanta, Ga.—Plans and specifications being prepared for new Brookwood Station, to be erected by Southern Railway Company (W. H. Wells, Ch. Engr., Washington, D. C.); cost about $75,000.

Selma, Ala.—Southern Bell Telephone & Telegraph Co. will erect an exchange building at Selma; cost $90,000.

Alexandria, La.—Alexandria Municipal Railway Company (Ira W. Sylvester, Ch. Engr., Alexandria) intends erecting a 53 x 108 ft. brick carhouse at Tenth and Lee Streets.

New Orleans, La.—Plans being prepared by Favrot & Livaudais, Perrin Building, for two-story, terra cotta, concrete and steel moving picture theater, to be erected at Baronne and Gravier Streets, by De Soto Building Company; cost $200,000.

Corinth, Miss.—Steps being taken by Southern Railway Company (W. H. Wells, Ch. Engr., Washington, D. C.) to erect proposed freight station; cost approximately $40,000.

Tupelo, Miss.—D. A. Hankey, Tupelo, will erect a $30,000 garage.

Memphis, Tenn.—Plans for 7-story building, to be erected at Second Street and Gayoso Avenue, are to be prepared by C. O. Pfeil, Tennessee Trust Building.

Memphis Motor Car Company (F. N. Fisher, President), 157 Monroe Street, contemplates erecting $35,000 building at Union Avenue and Dudley Street.

Nashville, Tenn.—Plans completed by Marr & Holman, Stahlman Building, for five-story reinforced concrete store and doctors' office building, with floors of tile and wainscoting white marble, which J. O. Leake and associates intend erecting on Sixth Avenue and Capitol Boulevard; cost complete about $85,000. Contract for foundation and excavation has been let.

Crab Orchard, Ky.—Reported Louisville & Nashville Railroad Company (W. H. Courtenay, Ch. Engr., Louisville) will erect a new depot here.

Lexington, Ky.—Van Deren Company, Lexington, has purchased a site 110 x 96 ft. on Merino and Water Streets, and contemplates erecting a warehouse.

Louisville, Ky.—Plans prepared by Brinton B. Davis, Inter-Southern Building, for proposed $150,000 training school to be erected on present site of Baptist Women's Missionary Union Training School, 334 East Broadway. Mrs. Samuel E. Woody, Chairman Building Committee.

Cleveland, Ohio.—Ralph Hulett, Erie Bldg., East Ninth Street and Prospect Avenue, preparing plans for a $25,000 residence to be erected on Lake Avenue for Frank Cohen, Akron.

Bethlehem Steel Company, 1266 Ontario Street, secured site on Marquette Street and Lakeside Avenue, on which to erect a $200,000 warehouse.

Reported Aetna Fireproof Storage Company, 2041 East 105th Street, will erect a 5-story addition, 100 x 200 ft., costing $100,000.

George W. Herbster, 10,419 St. Clair Avenue, reported planning erecting a 3-story store and apartment house to cost $35,000, to be erected on St. Clair Avenue and East 106th Street.

M. L. Narosny, 2733 East Fifty-first Street, will erect an apartment house at 2041 East Ninety-third Street to cost $30,000.

The Willys-Overland Co., Euclid Avenue and East Sixty-sixth Street, will erect a service building at Washington Boulevard and West Twenty-eighth Street, at cost of $75,000.

Dr. R. H. Bishop, 2605 Euclid Avenue, will erect a residence at cost of about $30,000 in Chagrin River Valley.

East Cleveland, Ohio.—Reported Mrs. E. S. Britton, 33 Holyoke Avenue, will erect a $25,000 residence at 13,834 Grand View Avenue.

Norwood, Ohio.—Anthony Kunz, Jr., 955 West Court Street, Cincinnati, preparing plans for school and chapel for Mount St. Mary's Theological Seminary, Moeller Avenue, Norwood Heights; cost, $450,000.

Portsmouth, Ohio.—Plans prepared by Norfolk & Western R. R. Co. (J. E. Crawford, Ch. Engr., Roanoke, Va.), for depot to be erected on Chillicothe Street, before spring of 1917; cost $450,000.

Van Wert, Ohio.—Erection of a Y. M. C. A. building costing $100,000 contemplated. Address Chairman Building Committee.

South Bend, Ind.—Plans being prepared by Sidney R. Badgley, 6408 Euclid Avenue, Cleveland, Ohio, for an edifice and manse to be erected in South Bend for Congregation of Trinity Presbyterian Congregation; cost $50,000. D. D. Munro, 810 East Washington Avenue, Chairman Committee in Charge.

Adrian, Mich.—Plans approved for Masonic Temple to be erected at Maumee and Broad Streets; estimated cost $60,000.

Chicago, Ill.—Sum of $70,000 has been bequeathed to Chicago Orchestral Association, 216 South Michigan Street, for establishing a School of Music in Chicago.

Tentative plans prepared by Pond & Pond, 64 East Van Buren Street, for eight-story club building which the Chicago Woman's Club intends erecting on Eleventh Street and Michigan Avenue; cost $500,000. Miss Grace E. Temple, Chairman Building Committee.

A new building for Harvard School, 4651 Drexel Building, is to be erected at 4731 Ellis Avenue; cost about $80,000.

Plans prepared by S. N. Crowen, 30 North La Salle Street, for seven-story and basement building which Jacob Birk will erect at Lake and Jefferson Streets for W. D. Allen Manufacturing Company; cost approximately $110,000.

Harder's Fireproof Storage & Van Company, 3958 Calumet Avenue, has purchased site on Stony Island Avenue and Sixty-eighth Street and intends erecting a fireproof bank and warehouse building to cost about $80,000.

Peoria, Ill.—Farrell Estate (F. O. Wilson, Manager) will erect a 14-story building costing about $100,000.

Fennimore, Wis.—Plans being prepared by Parkinson & Dockendorff, La Crosse, for parochial school to be erected for St. Mary's Parish; cost $25,000.

Albert Lea, Minn.—Plans about completed for the Methodist Episcopal Church, to cost $35,000. Address Board Trustees.

Duluth, Minn.—Contract soon to be let for erecting three or four-story, terra cotta, brick, concrete and steel, fireproof addition to Elks Lodge building; cost about $70,000. Kelly & Williams, Archts., First National Bank Building.

Minneapolis, Minn.—Northrop, King & Co., 26 Hennepin Avenue, will erect warehouse at Irving Street and Sixteenth Avenue, s. e.; cost $45,000.

A bank building will be erected at Second Avenue south and Sixth Street; cost $450,000. Address Cashier Metropolitan Bank.

J. C. Murphy, 525 Eleventh Avenue, S. E., will erect a 3-story brick and fireproof apartment house at 1500 Park Avenue; cost $40,000.

The Institute of the Incarnation intends erecting an edifice at Thirty-eighth Street and Pleasant Avenue; cost $25,000. Address Secretary Bd. of Trustees.

B. Lifchitz, 619 Tremont Avenue North, Samuel Fleischer, 1234 Knox Avenue North, and Jerome Dworsky, 614 Seventh Avenue North, will erect 3 fireproof apartment buildings at Nineteenth Street and Park Avenue; cost $50,000.

Ortonville, Minn.—C. J. Brown, Security Building, Minneapolis, is reported architect for the hotel which the Bonanza Mineral Springs Company of which M. E. Russell of Minneapolis is a director, intends erecting at Big Stone Lake at a cost of $50,000.

Rochester, Minn.—Plans completed for proposed Congregational Church to be erected at cost of $35,000.

Valley City, N. D.—Valley City Grocery Company (L. Patterson, President), intends erecting a brick fireproof business building to cost $30,000.

Miles City, Mont.—Reported plans being prepared by Wolff Company, St. Paul, Minn., for six-story hotel to be erected for Commercial Bank.

St. Louis, Mo.—Finance & Mortgage Company, incorporated with a capital of $750,000, proposes erecting 14-story building at Eighth and Olive Streets. W. J. Holbrook, President of Holbrook-Blackwelder Real Estate Trust Company, 812 Olive Street, reported interested.

Hot Springs, Ark.—Plans prepared by Mann & Stern of Little Rock for a concrete, 180 x 65 ft., bath house, to be erected for D. F. Platt of New York; cost $100,000. Contract for erecting will be let in about 60 days.

Little Rock, Ark.—A 4-story 54 x 140 ft. concrete store building is to be erected by Ike Kemper & Sons, at a cost of $45,000. Mann & Stern, Architects, Little Rock.

Beaumont, Tex.—Capt. W. C. Tyrrell and J. Cooke Wilson, having plans prepared by F. W. Steinman & Son, Beaumont, for a business building to be erected at Fannin and Orleans Streets at a cost of $30,000.

Dallas, Tex.—Plans filed by George A. Sprague, President Dallas Storage & Warehouse Company, for a reinforced concrete 3-story warehouse to cost $30,000.

Fort Worth, Tex.—Plans prepared by W. F. Schulz, Chief Engineer of the Tsxas & Pacific R. R., for the remodeling of the passenger station and the construction of a subway under the tracks of the company at Main Street have been approved by the Company.

Houston, Tex.—Sisters of St. Joseph Infirmary intend erecting a 4-story addition.

Seattle, Wash.—Reported contract will be let about June 10 for erecting 5-story 55 x 120 ft. brick and concrete addition to Summit Avenue and Columbia Street for Swedish Hospital Association (J. A. Soderberg of the Index Granite Company, Alaska Building, President); cost $65,000.

Portland, Ore.—Reported plans being prepared by Emil Schacht & Son, Commonwealth Building, for four-story apartment building to be erected on Glisan and Twenty-fourth Streets for A. A. Ausplund and H. O. Triplett; cost, $60,000.

Reported Loyal Order of Moose, Local Lodge No. 291, plans erecting $100,000 temple at Fourth and Taylor Streets. P. L. Proctor, Secretary Building Committee.

Coronado Beach, Cal.—Harrison Albright, 532 Laughlin Bldg., Los Angeles, engaged to prepare plans for 2-story concrete, 372 x 211 ft., bank, theater, garage, stores and apartment building, to be erected at Loma and Orange Avenues, for J. B. and A. B. Spreckles Securities Co.

Long Beach, Cal.—Preliminary plans being prepared by L. F. S. Syndicate, Los Angeles Investment Co. Bldg., Los Angeles, for a 4-story, 100 x 100 ft. brick apartment and store building, to be erected at Ocean Front and Collins Way, for C. E. Newberry and Albert Mercer, 415 Black Bldg., Los Angeles; cost about $80,000.

Monrovia, Cal.—Preliminary plans prepared for a tourist hotel to be erected on site of old La Vista Hotel, for Fred M. Smith of Los Angeles. Probable cost $100,000.

Pomona, Cal.—Pomona Valley Telephone Company, contemplates erecting a fireproof building costing $25,000.

Visalia, Cal.—Plans completed by Ernest J. Kump, 226 Rowell Building, Fresno, for a five-story and basement, brick and steel hotel to be erected at Main and Church Sts., by J. Sub Johnson, Visalia. Cost, $135,000.

Whittier, Cal.—H. M. Patterson, 324 O. T. Johnson Building, Los Angeles, engaged to prepare plans for a brick and artificial stone church to be erected on Philadelphia Street and Washington Avenue, for the Friends Congregation; probable cost $55,000.

Salt Lake City, Utah.—Eber W. Hall, 164 S. W. T. Street, plans erecting a $30,000 mortuary chapel at 243 East Second South Street.

Montreal, Que.—J. C. Duffield, Pres. City Gas Company, London, Ont., reported interested in Canadian Theater Company which contemplates erecting a theater to cost $250,000.

Winnipeg, Man.—Over & Jordan, Winnipeg, preparing plans for a 3-story addition to grain exchange to cost $150,000.

BIDS DESIRED.

Canton, Ohio.—Reported desired until June 15, by Starke County Agricultural Assoc. (Ed. S. Wilson, Secy.), for erecting mechanics hall and grand stand.

Waukegan, Ill.—Reported desired until June 12, by Charles A. Raught, Secy. Bldg. Committee of First M. E. Church, for erecting edifice. Separate bids for heating, ventilating, etc. Edmund B. Funston, Archt., Racine, Wis.

Benson, Wis.—Reported desired until June 15, for erecting edifice for Roman Catholic Church. E. L. Masqueray, Archt., 595 Endicott Bldg., St. Paul, Minn.

Marshfield, Wis.—Reported desired until June 12, for erecting church, school and rectory, for the Sacred Heart Catholic Congregation. Separate bids for heating, plumbing, etc. Rev. H. J. Stehling, Pastor, 201 West B Street. Probable cost $50,000. E. Breilmaier & Sons, Archts., 11 Mason Street, Milwaukee.

Kingston, Ont.—Until June 14, by R. C. Desrochers, Secy. Department Public Works, Ottawa, for erecting riding school Royal Military College. Messrs. Power & Sons, Archts., Kingston.

PRICES AND LETTINGS.

★Indicates award of contract.

★Providence, R. I.—Contract awarded Famiglietti Bros., 166 Broadway, Providence, for erecting 4-story brick and terra cotta, 40 x 62 ft., addition to Hotel Dreyfus, Mathewson and Washington Streets.

★Brooklyn, N. Y.—Contract awarded F. J. Feigenhauer, 4 Court Square, for erecting two-story, 50 x 100 ft., brick and terra cotta sub-station on Sixth and Berry Streets, for New York Municipal Railway Coropration; cost $85,000.

★Buffalo, N. Y.—Contract awarded Metz Bros., 1295 Fillmore Avenue, for erecting a 3-story reinforced concrete oil storage building for Jacob Dold Packing Company, William Street and New York Central R. R. N. P. Henschein, Archt., 37 West Van Buren Street, Chicago, Ill.

★Kingston, N. Y.—Contract awarded Buckley & Schryver, Kingston, for erecting a laboratory, office building, store house and 8 out buildings, 1 story, brick, frame and corrugated iron, for Nitrated Chemical Company; Gerard W. Betz, Archt., 51 John Street.

★Poughkeepsie, N. Y.—Reported contract awarded Wells Brothers, 33 West Forty-second Street, New York, for erecting new station at Main Street and Davies Place for New York Central Railroad; estimated cost about $340,000.

★Perth Amboy, N. J.—Contract for mason work on 5-story Floersch Hotel, on Smith Street, awarded to C. H. & R. C. Peckworth, 529 Hudson Street, New York, N. Y., at $24,000.

★Bloomfield, Pa.—Contract for erecting James B. Clark motion picture theater on Liberty Avenue and Mathilda Street awarded Golden & Crick, 3512 Fifth Avenue, Pittsburgh. Cost, including equipment, $60,000.

★Coatesville, Pa.—Contract for erecting two-story brick and stucco depot for Reading Railway Co. at First and Main Streets awarded Edward F. Fonder, Land Title Building, Philadelphia.

★Chester, Pa.—Reported contract awarded John H. Parker Company, 315 Fourth Avenue, New York, N. Y., for erecting Crozier Building at Fifth and Market Streets, to cost $350,000.

★Philipsburg, Pa.—Contract awarded William Linker Company, Heed Building, Philadelphia, for erecting a 3-story reinforced concrete and brick fireproof building at Front and Pine Streets, for Moshannon National Bank; cost $75,000. Dennison & Hirons, Archts., 475 Fifth Avenue, New York.

★Contract for constructing five-story concrete commercial building at Sixteenth and Arch Street for Monarch Realty Co., awarded to Warren Moore & Co., Commercial Trust Building; cost $50,000.

★Contract awarded Isaac T. Shoemaker, Juniper and Walnut Streets, for erecting fer Derbyshire Brothers a three-story, reinforced concrete and brick warehouse at 2406 Hope Street, costing $30,000, and a six-story, slow-burning construction store building at 2418 North Front Street, costing $35,000. Andrew J. Sauer & Company, Archts., 908 Chestnut Street.

★Contract awarded W. J. McShane, 417 South Thirteenth Street, for erecting a three-story, 50 x 74 ft. stone and concrete rectory at Diamond and Twenty-eighth Streets, for E. F. Prendergast; cost $30,400.

★Philadelphia, Pa.—Contract awarded John McShain, 1610 North Street, for erecting three-story, 94 x 118 ft., stone and concrete parochial school at Forty-ninth and Chestnut Streets, for West Philadelphia Catholic High School; cost $85,000.

★Contract reported awarded Cramp & Company, Denckla Building, by Gomery Schwartz & Company, for erecting a 10-story brick, steel and reinforced concrete and terra cotta service building at Broad and Cherry Streets.

★Baltimore, Md—Contract awarded West Construction Company, Knickerbocker Building for erecting buildings for Linde Air Products Company at Montebelle Avenue and Twenty-fifth Street to cost about $100,000.

★Contract awarded G. Walter Tovell, Eutaw and McCulloh Streets, for erecting a granite residence for Mrs. Mary Kennedy at Charles Street Boulevard and Millbrook Avenue cost, $40,000. George R. Callis, Jr., Archt., Knickerbocker Building.

★Contract awarded Consolidated Engineering Company, 243 Calvert Building, for erecting a 3-story garage and salesroom at 12 East Mount Royal Avenue. Smith & May, 1133 Calvert Building, Archts.

★Contract for erecting the Owosso Apartment house on Lake Drive awarded John F. Kunkel, 29 South Linwood Street, at $25,000. Clyde U. Friz, Archt., 1523 Munsey Building.

★Contract for erecting the Tudor country house for C. Wilban Miller in Worthington Valley, awarded Gladfelter & Chambers, Thirty-sixth and Roland Avenue; cost $300,000.

★Guilford, Md.—Contract for erecting residence on Greenway at Guilford awarded by Julian S. Carter, 18 East Lexington Street, Baltimore, to J. Henry Smith, 1426 Light Street, Baltimore, at about $30,000. Louis H. Rush, Archt., 130 South Fifteenth Street., Philadelphia, Pa.

★Laurinburg, N. C.—W. D. Tucker of Laurinburg secured contract to erect a church at Main and Church Streets; cost approximately $33,000.

★Memphis, Tenn.—Contract awarded Fred B. Young, Memphis Trust Building, at $45,000, for erecting a 4-story brick mill constructed building for the International Harvester Company, Calhoun Avenue and Tennessee Street.

★Contract for erecting two-story, 75 x 163 ft., brick and terra cotta building at

Monroe Avenue and Lauderdale Street, for Memphis Overland Company, awarded S. Malkin, 716 Exchange Building, at $55,000.

★**Cincinnati, Ohio.**—Contract awarded James Griffith & Sons Company, Reading Road and Twelfth Street, for erecting a brick residence on Grandin Road for Samuel F. Pogue, to cost $27,500. G. C. Burroughs, Archt., 1301 Union Trust Bldg.

★**Cincinnati, Ohio.**—Harry Hake, Architect, Telephone Building, awarded following contracts for erecting new North Exchange Building of the Cincinnati & Suburban Bell Telephone Company at Woodburn Avenue and Locust Street, estimated cost, $90,000: Carpentry, Mc-Miller & Taft, 16 Hulbert Block; brick and granite, David Hummel Building Co., 2629 Spring Grove Avenue; plumbing, Murdock Plumbing Co., 343 West Fourth Street excavation, re-inforcing and cement, Rooe Brothers, 2814 Stanton Avenue; iron, Southern Ohio Iron Works Co., 458 East Second Street.

★**Ravenna, Ohio.**—Contract for erecting new edifice for Methodist Episcopal Church awarded P. L. Frank Construction Company, Ravenna, at $50,678.

★**Monmouth, Ill.**—Contract for erecting National Bank building, brick and stone construction, awarded Monmouth Galesburg Construction Company, Galesburg. Cost $40,000.

★**Oshkosh, Wis.**—C. R. Meyer & Sons Company of Oshkosh, has secured contract to erect two-story and basement fireproof garage at Jefferson Avenue and Merritt Street, for Thom Automobile Company; cost about $45,000. F. F. Dreger, Archt., Oshkosh.

★**Rochester, Minn.**—General contract for erecting Masonic Temple awarded G. Schwarts & Company, Rochester, at $59,790; heating, Mehring & Hanson, Minneapolis, at $4,650; wiring and ventilating, Foster Electric Company, Rochester, $1,696; plumbing, Maass & McAndrew, Rochester, at $1,850.

★**Salina, Kan.**—Contract for erecting St. Johns Lutheran Church, bids opened May 16, awarded Nelson Building Company, Salina. B. R. Lantz, Pastor, Chmn. Bldg. Committee.

★**Great Falls, Mont.**—Reported C. H. Johnson of Great Falls, secured general contract for erecting Brown-Dunn Block, at $46,300.

★Contract reported awarded by Henry Hall Johnson, Archt., Great Falls, to Van Gorder Construction Company, Great Falls, for erecting business building for Great Falls Dairy Products Company; cost $50,000.

★**Hope, Ark.**—Contract awarded Brown Construction Company of Texarkana, for erecting four-story brick bank building at Main and Second Streets for Hope National Bank; cost approximately $60,000. Witt, Seibert & Company, Archts., Texarkana.

★**Pullman, Wash.**—Reported Northern Pacific Ry Company awarded contract to Sound Construction & Engineering Company, Lowman Building, Seattle, for erecting a depot to cost about $40,000.

★**Seattle, Wash.**—Warrack Construction Company, Downs Block, secured contract to erect two-story, 120 x 120 ft., reinforced concrete, brick and terra cotta garage and salesroom on Pike Street, for Winton Motor Car Company; cost $65,000. H. Ryan, Archt., Northern Bank Building.

★Contract reported awarded by Frederick & Nelson Company, for erecting proposed 5 and 7-story, 250 x 250 ft., steel, reinforced concrete and terra cotta department store building at Pine Street and Sixth Avenue, to Black Construction Company, St. Louis, Mo.; cost $1,000,000. The Pacific Coast Steel Company and Hoflus Steel & Equipment Company will furnish the steel. John Graham, Archt., Green Building.

★Contract awarded by Webster & Ford, Archts., Green Building, to MacRae Brothers, Empire Building, for erecting three-story, 40 x 100 ft., reinforced concrete and brick garage at Summit Avenue and East Pine Street, for Mitchell Auto Company; cost $50,000.

★**Cote des Neiges Ouest, Que.**—Contract awarded Montreal Terra Cotta Company, Board of Trade Building, Montreal, for erecting a $200,000 building for the Corporation of Notre Dame College at Cote des Neiges.

★**Montreal, Que.**—Contract awarded L. Beaudry, 2420 Hutchinson Street, for erecting school for Roman Catholic School Board to cost $150,000.

★Contract awarded Fleischmann Construction Co., 7 W. Forty-fifth Street, New York, N. Y., for erecting a theater on St. Catherine Street to cost $1,000,000. Marcus Loew, Owner, 143 Broadway, New York.

★**Sherbrooke, Que.**—Contract awarded Montreal Terra Cotta Company, Board of Trade building, Montreal, for erecting a cathedral for St. Michael's congregation to cost $175,000.

★**St. Laurent, Que.**—Contract awarded F. Grother, 6 St. Cuthbert Street, Montreal, for erecting an office building for Canada Stove & Furniture Company; cost $60,000.

★**Toronto, Ont.**—Contract awarded Jackson Lewis Company, Bell Telephone Bldg., for remodeling theater for E. L. Ruddy, 11 Wellington Street E., at a cost of $75,000.

★Contract awarded Canadian Bridge Company of Walkerville for 5000 tons of steel for $3,000,000 union station under construction.

★**Walkerville, Ont.**—Contract awarded W. Link of Leamington for erecting dairy buildings for Hiram Walker & Sons to cost $80,000.

★**Winnipeg, Man.**—Contract awarded by Bank of Hamilton (headquarters Hamilton, Ont.) to Foundation Company of Canada, for foundations for a new building to cost $600,000. Contract for main work will be awarded soon.

NEW INDUSTRIAL PLANTS

PROPOSED WORK.

Pawtucket, R. I.—Crown Manufacturing Company, Pawtucket, intends erecting an addition.

Buffalo, N. Y.—Larkin Company, 663 Seneca Street, secured additional ground at Seneca and Van Rensselaer Streets, and is having plans prepared for extensions.

Johnson City (Broome County), N. Y.—Endicott, Johnson & Company of Endicott plans erecting five-story concrete and steel shoe factory here.

Jersey City, N. J.—Colgate & Company, 105 Hudson Street, Jersey City, will erect a 5-story tank house on Grand Street to cost $60,000.

Keyport, N. J.—Aeromarine Plane & Motor Company, Avondale, will erect a factory 100 x 300 ft., to cost $25,000.

Newark, N. J.—Berkowitz, Goldsmith & Spiegel, 34 New York Avenue, will erect a 70 x 100-ft. addition to cost $25,000.

John F. Schrink & Son, 532 Mulberry Street, will erect a 3-story brick, 30 x 100-ft factory at 164 Emmett Street, to cost $25,000.

New Brunswick, N. J.—Forty Four Cigar Company, 15 Spring Street, will erect a factory at Church and Jelin Streets, to cost $70,000.

Franklin, Pa.—The Cambria Steel Co. will erect two open-hearth furnaces at Franklin at a cost of about $400,000. E. E. Slick, Gen. Mgr., Johnstown.

Harrisburg, Pa.—Pennsylvania Milk Products Co. (Martin R. Nissley, Mgr.), Harrisburg, will erect a 4-story concrete, brick and steel building, 60 x 100 ft., at Fourth and Macaly; cost $50,000.

Lebanon, Pa.—Lebanon Valley Iron & Steel Co. (John C. Brown, Gen. Mgr.) contemplates erecting addition to plant at cost of $50,000.

Manheim, Pa.—Bond Foundry & Machine Company, Manheim, planning erecting a 100 x 95 ft. addition to plant.

Reading, Pa.—Simon & Sherman, packers, 135 Grape Street, plan erecting a $100,000 abattoir.

Durham, N. C.—Austin-Heaton Company, Durham, will erect a flour mill; daily capacity, 600 bbl., and to cost $100,000.

Winston-Salem, N. C.—Contract soon to be let for erecting five-story, 135 x 250 ft. reinforced concrete tobacco factory for R. J. Reynolds. J. E. Sirrine, Archt., Greenville.

Lenoir City, Tenn.—Lenoir Car Works reported contemplating enlarging plant.

Lorain, Ohio.—Reported National Tube Company will add five blast furnaces to plant here.

Memphis, Tenn.—Buckeye Cotton Oil Company, Raleigh Road and Scott Avenue, will erect a feed mill of reinforced concrete, and to cost $100,000.

Elyria, Ohio.—Forest City Engineering Company, Cleveland, 512 Hippodrome Building, engaged to prepare plans for $70,000 factory group to be erected here for American Lace Company.

Norwood, Ohio.—Tietig & Lee, 901 Fourth National Bank Building, Cincinnati, preparing plans for two brick additions to the United States Can Co.'s plant.

Grand Rapids, Mich.—Brown & Sheler Company, Ionia Avenue, contemplates erecting five-story brick factory at Ionia Avenue and Cherry Street, S. W.; cost about $40,000.

Woodriver, Ill.—International Shoe Company, Fifteenth and Washington Streets, St. Louis, Mo., has purchased site near here for purpose of erecting a $1,000,000 tannery.

Kenosha, Wis.—American Brass Co., Kenosha, plans extending and rebuilding plant, to include erection of rolling mills, casting shops and an office building; total cost about $2,000,000.

Gaylord, Minn.—Mueller Bros. will erect a garage, machine shop and machinery display building; cost $30,000. Walter D. McLeith, American Bank Building, St. Paul, Archt.

St. Paul, Minn.—Willys-Overland Automobile Company contemplates erecting a manufacturing plant here. The erection of a distributing plant adjoining present branch at Eustis Street and University Avenue is also contemplated. F. N. Coats, Local Manager.

South St. Paul, Minn.—Reported J. T. McMillan Company, St. Paul, St. Clair and Spring Streets, will erect a $500,000 packing plant adjoining plant of Armour & Company.

Fargo, N. D.—Bristol & Sweet Harness Company, Fargo, will erect on Fourth Avenue and Fifth Street N., a 5-story brick and fireproof factory costing $40,000.

Galveston, Tex.—E. R. Hanff of St. Louis, Mo., intends erecting here a cold storage and ice plant costing approximately $50,000.

Oakland, Cal.—Reported Oakland Textile Manufacturing Co., recently organized, will build a $500,000 plant to manufacture woolen and worsted goods.

Ottawa, Ont.—Plans being prepared for a factory for Grant, Holden & Graham, Ottawa, shell manufacturers; cost $30,000.

Simcoe, Ont.—Hall Glove Company, Jersey City, N. J., contemplates erecting a textile factory to cost $25,000.

Welland, Ont.—Canada Forge Company intends erecting addition to factory to cost $50,000.

Vancouver, B. C.—Plans of New England Fish Company, recently damaged by fire, is to be rebuilt and new machinery installed.

Vancouver, B. C.—Grain elevator of the Alberta Pacific Grain Elevator Company, destroyed by fire, is to be rebuilt and modern equipment installed.

BIDS DESIRED.

Bridgeport, Conn.—Until June 17, by Board Contract & Supply for municipal ice and storage buildings, inclusive of insulation and elevator, also same time and place separate bids for equipment for a municipal ice making and cold storage plant, both proposals advertised in Engineering Record.

West Allis, Wis.—Reported desired until July 15, for an 80 x 500 ft. and 40 x 193 ft. foundry for Electric Steel Casting Co., L. G. Smith, Pres.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Buffalo, N. Y.**—Contract awarded John W. Cowper Company, Fidelity Building, for erecting 1-story chemical building 100 x 525 ft with 4-story tower, concrete foundations, steel frame, reinforced concrete, brick curtain walls, asbestos protected concrete roof, at plant on Buffalo River and Lake Shore for Contact Process Company. Cost $135,000. Contract for structural steel awarded Ferguson Steel & Iron Company, Buffalo, 400 tons.

★**Burlington, N. J.**—Contract for erecting addition to plant of Burlington Silk Mills awarded B. U. Taylor of Olean, N. Y.; cost about $40,000.

★**Lincoln Park, N. J.**—Vacuum Oil Company awarded general contract to H. D. Best Company, 52 Vanderbilt Avenue, New York, for erecting a group of buildings along Delaware River at Lincoln Park, including foundries, machine shops, warehouse, factory, etc., and cost reported at $2,000,000.

★**Newark, N. J.**—Contract for erecting 3-story 80 x 125 ft. addition to factory of American Hair Felt Co., Lockwood Street, awarded to Edward M. Walton, at about $50,000. McMurray & Pulis, 31 Clinton Street, Archts.

★**Philadelphia, Pa.**—Contract for erecting 2-story brick factory at Broad and Brown streets for George Miller awarded Warren, Moore & Co., Commercial Trust Building; cost $50,000.

★Contract for erecting factory at James and Fraley streets for Abrasive Material Company awarded to James H. Wells, Heed Building; cost $30,000.

★**Baltimore, Md.**—Contract awarded by Southern Stevedoring Company, to Consolidated Engineering Company, 243 Calvert Building, for a power house to be erected in Canton. Meade Morrison Mfg. Company, Engineers, 820 Equitable Bldg.

★**Ardmore, Okla.**—Contract awarded I. M. Putnam, Ardmore, for constructing car house and shops of fireproof construction one and two stories, for Ardmore Railway Company.

Seattle, Wash.—Following are bids opened by Port of Seattle Commissioners for refrigeration of the apple storage warehouse (bidders all of Seattle): Vilter Mfg. Company, $71,292; Securities Construction Company, $73,352; Harrington Peters Company, $78,680, and York Mfg. Company, $79,920. T. R. West, Chief Engineer of Commissioners.

★**Spokane, Wash.**—Contract awarded Hurley-Mason Company, Worcester Building, Portland, Ore., for erecting 4-story packing plant for Carstens Packing Company; cost $50,000.

★**Newton, Utah.**—Contract awarded Dyer Construction Company, 2031 Euclid Avenue, Cleveland, Ohio, for erecting a 500-ton daily capacity sugar factory in the Alta District, between Newton and Trenton. John A. Hendrickson of Logan reported interested.

★**Bagotville, Que.**—Contract awarded J. G. White Engineering Company, 43 Exchange Place, New York, N. Y., for constructing paper-pulp plant for the Ha Ha Baie Sulphite Company of Chiccutimi, Quebec. Mill buildings to be of brick, concrete and steel. Harry S. Ferguson, Engineer, 200 Fifth Avenue, New York, N. Y.; J. E. A. Dubuc, President of North American Pulp and Paper Company and General Manager of Chiccutimi Pulp & Paper Company, will be head of this enterprise.

★**Cap de la Madelaine, Que.**—Contract awarded Raymond Concrete Pile Company, Ltd., Montreal, Que., for the foundations of the St. Maurice Paper Company's plant at Cap de la Madelaine; about 400 to 500 piles will be needed. George A. Fuller Company, Ltd., general contractors.

★**Lindsay, Ont.**—Contract awarded Horn & Brothers, Woolen Mills, for erecting a factory for H. T. Hickey of Peterboro, to cost $35,000.

★**Medicine Hat, Alberta.**—Contract awarded by Lake of the Woods Milling Company, to Halls Aldinger & Company, 1010 Union Bank Building, Winnipeg, Man., for erecting a $250,000 flour mill.

MISCELLANEOUS

PROPOSED WORK.

Transmission Line—Ware, Mass.—Connecticut Transmission Co. of Worcester is planning to erect a 22,000-volt transmission line from sub-station in Ware to Palmer.

Park Bonds—Haddonfield, N. J.—Borough Commissioners sold $15,000 parkway bonds.

Parks—Harrisburg, Pa.—The State Board of Public Grounds and Buildings of Pennsylvania authorized Samuel B. Rambo, Supt., to make a survey of Capitol Park Extension Dist., which is to be improved at a cost of several million dollars.

Transmission Line—Gaffney, S. C.—Southern Power Co. of Charlotte secured right of way into Gaffney for construction of transmission line. Site for substation secured. Transmission line to be constructed between Gaffney and Rutherford, N. C., via Forest City Caroleen, where company proposes to supply electricity to operate mills.

Subway—Cleveland, Ohio.—Contract will soon be let by County Commissioners for constructing subway approaches under Euclid and Detroit Avenues and West Twenty-fifth Street, to new high-level bridge over Cuyahoga River; estimated cost $850,000. W. A. Stinchcomb, County Engineer.

Parks — Kansas City, Mo. — See "Bridges."

Flume — Spokane, Wash. — Reported O'Neil, Irving Company, Old National Bank Building, Spokane, will construct a 12-mile flume for logging in Mica Creek District of Idaho. Cost reported at about $150,000.

BIDS DESIRED.

Mixer—Revere, Mass.—Until June 15, by Carl G. Richardson, Supt. Public Works, for furnishing one concrete street paving mixer.

New York, N. Y.—See "Paving and Roads."

Road Oil—Newark, N. J.—Until June 19, by Committee on Roads of the Board of Freeholders, for furnishing non-asphaltic oil on highways of Essex County. Frederick A. Reimer, County Engineer.

Sprinkling System—Pittsburgh, Pa.—Until June 15, by Geo. W. Gerwig, Secy. Board Education, for furnishing and installing sprinkling systems in 21 schools.

Fire Escapes—Tunica, Miss.—Reported desired until July 3, by Trustees Tunica County Agricultural High School, at office of L. C. Canon, Supt., for erecting fire escapes to school.

Elevator—National Military Home, Ind.—Until June 13, by E. B. White, Supt. Post Funds, for furnishing and installing two electric passenger elevators.

Smokestack—Princeton, N. D.—Until June 15, by Ira G. Stanley, Secy. Water, Light & Power Building Commission, for constructing either brick or reinforced concrete 90 ft. high, above grade, 42 in. diam., smokestack at power house.

Crane—Seattle, Wash.—Until July 1, at U. S. Engrs. Office, for one gantry cantilever crane and equipment.

Crane, Etc.—Seattle, Wash.—Until June 26, by Alaska Engineering Commission, Bell Street Dock (C. E. Dole, Purchasing Agent), for furnishing a railway motor car, locomotive crane, 20 Fresno scrapers, 40 slip scrapers, etc. Circular 188.

Guard Rails—Birden, Man.—Until June 17, by Wm. Whiteford, Secy.-Treas., for furnishing material and constructing 5228 lin. ft. guard rails.

PRICES AND LETTINGS.

★Indicates award of contract.

★Road Oil—Boston, Mass.—May 20 the Mayor approved contract awarded Island Petroleum Co., Neville Island, Pittsburgh, Pa., for 200,000 gal. nonasphaltic road oil for street cleaning and oiling service of Department of Public Works at 7½ cts. per gal.; total $15,000.

Cement—Denver, Col.—Two lowest bids opened May 25 by U. S. Reclamation Service, Denver, for furnishing 115,000 bbl. Portland cement submitted by Iola Portland Cement Co., Iola, Kan., and United States Portland Cement Co., Concrete, Col., bidding the same, at $1.40 per bbl.

★Cranes—Vallejo, Cal. — Contract for furnishing 2 ship building cranes at Navy Yard, Mare Island, Cal., awarded McMyler Interstate Co., Bedford, Ohio, at $40,374.

Proposals

For Proposals Advertised, See Pages 45, 46, 47 and 48.

WATERWORKS.

Bids Close.		See Eng. Record.
Jun. 12.	Reservoir, La Porte, Ind. Adv. May 27, June 3.	May 27
Jun. 12.	Screens, St. Paul, Minn..	May 27
Jun. 12.	Meters, Pittsburgh, Pa...	Jun. 3
Jun. 13.	Contract 144, New York, N. Y. Adv. May 20.	May 20
Jun. 15.	Works, Port Arthur, Tex.	May 20
Jun. 16.	System, Oatman, Ariz...	May 20
Jun. 15.	Water Works, Harlowton, Mont. Adv. Jun. 3, 10.	Jun. 3
Jun. 15.	Filtration Plant, Jasper, Ind.	Jun. 3
Jun. 15.	Water Works, Staplehurst, Neb.	Jun. 3
Jun. 15.	Water Works, Seward, Neb.	Jun. 10
Jun. 16.	Pipe, Panama	Jun. 3
Jun. 17.	Water Works, Winnemucca, Neb	May 20
Jun. 19.	Pipe Line, Trinidad, Col. Adv. Jun. 10.	Jun. 10
Jun. 20.	Water Works, Carrollton, Ill.	Jun. 10
Jun. 23.	Meters, Washington, D. C.	Jun. 3
Jun. 26.	Pipe, etc., Panama	Jun. 3
Jun. 26.	Water Works, Harrison, Ark. Adv. Jun. 10.	Jun. 10
Jun. 28.	Filtration Plant, St. Hyacinthe, Que.	Jun. 10
Jun. 28.	Pipe, Vancouver, B. C...	Jun. 10
Jul. 5.	Reservoir, Middletown, Ohio Adv. Jun. 10.	Jun. 10
———	Franchise, Williamsburg, Va. Adv. May 27, June 3.	May 27

SEWERAGE AND SEWAGE DISPOSAL.

Bids Close.		See Eng. Record.
Jun. 13.	Point Pleasant, N. J.... Adv. Jun. 3, 10.	Jun. 3
Jun. 12.	Newark, N. J.	Jun. 3
Jun. 13.	South Bend, Ind.	Jun. 10
Jun. 14.	Afton, Okla.	May 27
Jun. 14.	Brooklyn, N. Y.	Jun. 10
Jun. 16.	Xenia, Ohio	May 20
July 16.	Salem, Ill.	May 20
Jun. 15.	Oakesdale, Wash.	May 27
Jun. 15.	Lodi, N. J.	Jun. 3
Jun. 16.	Harlowton, Mont. Adv. Jun. 3, 10.	Jun. 3
Jun. 16.	Richmond, Va.	Jun. 3
Jun. 15.	Pawnee City, Neb.	Jun. 10
Jun. 15.	Escanaba, Mich.	Jun. 10
Jun. 15.	Miami, Fla.	Jun. 10
Jun. 15.	Little Ferry, N. J.	Jun. 10
Jun. 15.	Galveston, Tex.	Jun. 10
Jun. 15.	Mohall, N. D.	Jun. 10
Jun. 15.	Devils Lake, N. D.	Jun. 10
Jun. 15.	Brentwood, Pa.	Jun. 10
Jun. 19.	Columbus, Mont.	Jun. 3
Jun. 19.	Little Falls, N. J. Adv. Jun. 3.	Jun. 3
Jun. 19.	Spooner, Minn.	Jun. 10
Jun. 19.	Oskaloosa, Iowa Adv. Jun. 10.	Jun. 10
Jun. 19.	Camden, N. J.	Jun. 10
Jun. 20.	McComb, Miss.	May 27
Jun. 20.	Michigan City, Ind.	Jun. 3
Jun. 20.	Hartford, Conn.	Jun. 10
Jun. 20.	St. Louis, Mo.	Jun. 10
Jun. 20.	Westfield, Pa. Adv. Jun. 10.	Jun. 10
Jun. 21.	Philadelphia, Pa.	Jun. 10
Jun. 22.	Milwaukee, Wis. Adv. Jun. 3, 10.	Jun. 3
Jun. 22.	The Pas, Man.	Jun. 3
Jun. 23.	Houston, Tex. Adv. Jun. 10.	Jun. 10
Jun. 26.	Tucson, Ariz. Adv. Jun. 3, 10.	Jun. 3
Jun. 27.	Thief River Falls, Minn..	Jun. 10
Jun. 30.	Frankfort, Ind.	Jun. 10
Jul. 1.	Ann Arbor, Mich.	Jun. 10

BRIDGES.

Jun. 13.	Philadelphia, Pa. Adv. May 20.	May 20
Jun. 13.	Modesto, Cal.	May 27
Jun. 13.	Owatonna, Minn.	Jun. 10
Jun. 13.	Westbourne, Man.	Jun. 10
Jun. 14.	Hollidaysburg, Pa.	Jun. 10
Jun. 14.	Litchfield, Minn.	Jun. 10
Jun. 14.	Peoria, Ill.	Jun. 10
Jun. 15.	Cumberland, Md. Adv. Jun. 3, 10.	Jun. 3
Jun. 15.	Russell, Man.	Jun. 3
Jun. 16.	Richmond, Va.	Jun. 10
Jun. 17.	Lewisburg, Pa.	Jun. 3
Jun. 17.	Dauphin, Man.	Jun. 10
Jun. 17.	Virden, Man.	Jun. 10
Jun. 17.	Levis, Que.	Jun. 10
Jun. 17.	Tiffin, Ohio	Jun. 10
Jun. 17.	Monmouth, Ill.	Jun. 10
Jun. 18.	Wilkes-Barre, Pa.	Jun. 10
Jun. 19.	Linton, N. D.	Jun. 3
Jun. 19.	Benton Harbor, Mich.... (3 Props.) Adv. Jun. 3, 10.	Jun. 3
Jun. 19.	Beaverton, Mich. Adv. Jun. 3.	Jun. 3
Jun. 19.	Bonds, Beaverton, Mich.. Adv. Jun. 3.	Jun. 3
Jun. 19.	Sheridan, Wyo.	Jun. 3
Jun. 19.	San José, Cal.	Jun. 10
Jun. 19.	Media, Pa. Adv. Jun. 10.	Jun. 10
Jun. 19.	Stanley, N. D.	Jun. 10
Jun. 20.	Illinois	May 27
Jun. 20.	Las Cruces, N. M.	Jun. 3
Jun. 20.	Indianapolis, Ind.	Jun. 3
Jun. 20.	Connecticut Adv. Jun. 3.	Jun. 3
Jun. 20.	Napa, Cal.	Jun. 10
Jun. 22.	Perry, N. Y. Adv. Jun. 3, 10.	Jun. 3
Jun. 26.	Clintwood, Va.	May 20
Jun. 26.	California	Jun. 10
Jun. 29.	Greenwich, Conn.	Jun. 10
Jun. 30.	O'Neill, Neb.	Jun. 10
Jun. 30.	Dayton, Ohio	Jun. 10
Jul. 3.	Brewton, Ala.	Jun. 10

PAVING AND ROADS.

Jun. 12.	Dunn, N. C. Adv. May 20 to June 3.	May 20
Jun. 12.	Freeport, Ill. Adv. Jun. 3, 10.	Jun. 3
Jun. 12.	Montclair, N. J. Adv. Jun. 3.	Jun. 3
Jun. 12.	Malone, N. Y. Adv. Jun. 3.	Jun. 3
Jun. 12.	Ilimo, Mo. Adv. Jun. 10.	Jun. 10
Jun. 13.	Janesville, Wis.	May 27
Jun. 13.	Pennsylvania Adv. May 27, June 3.	May 27
Jun. 13.	St. Louis, Mo.	Jun. 3
Jun. 13.	Trenton, N. J.	Jun. 3
Jun. 13.	Albany, Ky.	Jun. 10
Jun. 13.	Massachusetts	Jun. 10
Jun. 13.	Salt Lake City, Utah....	Jun. 10
Jun. 13.	Omaha, Neb.	Jun. 10
Jun. 13.	Columbus, Ohio	Jun. 10
Jun. 13.	Norwich, N. Y.	Jun. 10
Jun. 13.	Jersey City, N. Y.	Jun. 10
Jun. 13.	McMinnville, Ore.	Jun. 10
Jun. 13.	Pittsburgh, Pa.	Jun. 10
Jun. 13.	Dayton, Ohio	Jun. 10
Jun. 13.	Kansas City, Mo.	Jun. 10
Jun. 14.	Eaton, Ohio Adv. May 20, 27.	May 20
Jun. 14.	Paterson, N. J.	Jun. 3
Jun. 14.	Baltimore, Md.	Jun. 10
Jun. 14.	Kansas City, Mo.	Jun. 10
Jun. 14.	New York, N. Y.	Jun. 10
Jun. 14.	Lexington, Ky.	Jun. 10
Jun. 14.	Illinois	Jun. 10
Jun. 15.	Greenfield, Ohio	May 20
Jun. 15.	Zanesville, Ohio	May 27
Jun. 16.	Fowler, Cal.	May 27
Jun. 15.	Carthage, Mo.	Jun. 3
Jun. 15.	Hagerstown, Md.	Jun. 3
Jun. 16.	Mount Gilead, Ohio	Jun. 10
Jun. 15.	Stevens Point, Wis.	Jun. 10
Jun. 16.	Ohio	Jun. 10
Jun. 15.	Marysville, Tenn.	Jun. 10
Jun. 16.	Painesville, Ohio	Jun. 10
Jun. 16.	Dayton, Ohio	Jun. 10
Jun. 16.	Galveston, Tex.	Jun. 10
Jun. 16.	Miami, Fla.	Jun. 10
Jun. 16.	Charleston, W. Va. Adv. Jun. 10.	Jun. 10
Jun. 16.	Philadelphia, Pa.	Jun. 10
Jun. 15.	Britt, Iowa	Jun. 10
Jun. 16.	Saskatoon, Sask.	Jun. 10
Jun. 16.	Bowling Green, Ky.	Jun. 10
Jun. 16.	Tucson, Ariz.	Jun. 10
Jun. 16.	Indiana	May 27
Jun. 16.	Van Wert, Ohio Adv. (4 Props.) Jun. 3, 10.	Jun. 3
Jun. 16.	Tacoma, Wash.	Jun. 3
Jun. 16.	Elkhart, Ind.	Jun. 10
Jun. 16.	Minot, N. D.	Jun. 10
Jun. 17.	Dolgeville, N. Y. Adv. May 27, June 3.	May 27
Jun. 17.	Brooklyn, N. Y.	Jun. 3
Jun. 17.	Monticello, N. Y. Adv. Jun. 3, 10.	Jun. 3
Jun. 17.	Greenwich, Conn. Adv. Jun. 10.	Jun. 10
Jun. 17.	Cleveland, Ohio	Jun. 10
Jun. 17.	Erwin, Tenn.	Jun. 10
Jun. 17.	Oshkosh, Wis.	Jun. 10
Jun. 19.	Cresson, Pa.	Jun. 3
Jun. 19.	Montesano, Wash.	Jun. 3
Jun. 19.	Seattle, Wash.	Jun. 3
Jun. 19.	Cuyahoga Falls, Ohio...	Jun. 3
Jun. 19.	Everett, Wash.	Jun. 3
Jun. 19.	Traer, Iowa	Jun. 3
Jun. 19.	Hemett, Cal.	Jun. 10
Jun. 19.	Kearney, Neb.	Jun. 10
Jun. 19.	Evanston, Ill. Adv. Jun. 10.	Jun. 10
Jun. 20.	Rockville Center, Wis.... Adv. May 27.	May 27
Jun. 20.	Sharpsville, Pa.	Jun. 10
Jun. 20.	Waterloo, Iowa	Jun. 10
Jun. 20.	Lexington, Ky.	Jun. 10
Jun. 20.	Seattle, Wash.	Jun. 10
Jun. 20.	Philadelphia, Pa.	Jun. 10
Jun. 21.	Charleston, Miss.	May 27
Jun. 21.	Sebring, Fla.	May 27
Jun. 21.	Vernon, Ala.	May 27
Jun. 21.	Grand Forks, N. D.	Jun. 10
Jun. 21.	Lisbon, Ohio	Jun. 10
Jun. 22.	Anniston, Ala.	Jun. 10
Jun. 23.	Ebensburg, Pa.	Jun. 10
Jun. 23.	Cincinnati, Ohio	Jun. 10
Jun. 23.	Indianapolis, Ind.	Jun. 10
Jun. 23.	Frankfort, Ind.	Jun. 10
Jun. 25.	Indiana	May 27
Jun. 26.	Washington, Pa.	Jun. 3
Jun. 26.	Cedar Rapids, Iowa	Jun. 3
Jun. 26.	Marshalltown, Iowa Adv. Jun. 10.	Jun. 10
Jun. 26.	Albany, N. Y. Adv. Jun. 10.	Jun. 10
Jun. 26.	Seattle, Wash.	Jun. 10
Jun. 26.	Kingwood, W. Va.	Jun. 10
Jun. 26.	California	Jun. 10
Jun. 27.	Salt Lake City, Utah....	May 13
Jun. 27.	Jackson, Tenn. Adv. Jun. 3.	Jun. 3
Jun. 27.	North Bend, Wash.	Jun. 10
Jun. 27.	Apollo, Pa. Adv. Jun. 10.	Jun. 10
Jun. 29.	New Martinsville, W. Va. Adv. May 27 to Jun. 10.	May 27
Jun. 30.	Indiana	Jun. 3
Jun. 30.	Indiana	Jun. 10
July 1.	Maumee, Ohio	May 27
July 1.	Mobile, Ala.	May 27
July 1.	Bay Minette, Ala.	Jun. 3
July 6.	Indiana	Jun. 3
July 6.	Houma, La.	Jun. 3
July 10.	Greenwood, Miss.	May 20

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS.

Jun. 12.	Dredging, Philadelphia, Pa. Adv. May 20.	May 20
Jun. 12.	Dredging, Providence, R. I. Adv. May 27, June 3.	May 27
Jun. 12.	Levee, Greenville, Miss...	Jun. 10
Jun. 14.	Breakwater, Hyannisport, Mass. Adv. Jun. 10.	Jun. 10
Jun. 16.	Irrigation, Payson City, Utah Adv. May 6.	May 6
Jun. 15.	Irrigation, Hermiston, Ore. Adv. May 13.	May 13
Jun. 15.	Dredging, Baltimore, Md. Adv. May 20 to Jun. 10.	May 20
Jun. 15.	Improv. Creek, Belleville, Ill.	May 20
Jun. 15.	Water Power Lease, Joliet, Ill. Adv. May 20 to Jun. 10.	May 20
Jun. 16.	Irrigation, Grandview, Wash.	Jun. 3
Jun. 15.	Dike, Oretown, Ore.	Jun. 3
Jun. 15.	Dredging, Boston, Mass..	Jun. 10
Jun. 15.	Ditches, Long Prairie, Minn.	Jun. 10
Jun. 15.	Pier, New York, N. Y...	Jun. 10
Jun. 15.	Drainage, Corning, Iowa..	Jun. 10
Jun. 16.	Ditch, Morris, Minn.	Jun. 3
Jun. 16.	Ditch, Winamac, Ind.	Jun. 3
Jun. 16.	Drainage, Armour, S. D..	Jun. 10
Jun. 17.	Ditch, Winamac, Ind.	Jun. 3
Jun. 17.	Dam, Dundas, Ont.	Jun. 10
Jun. 17.	Ditch, Owatonna, Minn..	Jun. 10
Jun. 17.	Drainage, Hamilton, Ont.	Jun. 10
Jun. 17.	Wharf Reconstruction, Governors Island, N. Y..	Jun. 10
Jun. 18.	Drainage Pipe, New Orleans, La.	Jun. 10
Jun. 19.	Seawall, Bridgeport, Conn. Adv. May 27, June 3.	May 27
Jun. 20.	Stone, New Orleans, La. Adv. May 27 to Jun. 10.	May 27
Jun. 20.	Willows, New Orleans, La. Adv. May 27 to Jun. 10.	May 27
Jun. 21.	Wharf, Seattle, Wash...	Jun. 10
Jun. 22.	Irrigation, Malta, Mont. Adv. May 13.	May 13
Jun. 24.	Irriga., Balmorhea, Tex..	May 27
Jun. 24.	Dredging, Washington, D. C.	Jun. 10
Jun. 27.	Canal Work, Albany, N. Y.	Jun. 10
Jun. 27.	Levee, Kansas City, Mo.	Jun. 10
Jun. 28.	Drainage, Windom, Minn..	Jun. 10
Jun. 30.	Dredging, Baltimore, Md. Adv. Jun. 3, 10.	Jun. 3
July 1.	Drainage, Boston, Mass.	Jun. 3
July 3.	Jetty, Gardiner, Ore.....	May 27
Jul. 11.	Dredging, Baltimore, Md. Adv. Jun. 10.	Jun. 10

PUBLIC BUILDINGS AND SCHOOLS.

Bids Close.		See Eng. Record.
Jun. 12.	Elmira, N. Y. Adv. May 20 to June 3.	May 20
Jun. 12.	Wilson, Pa.	Jun. 10
Jun. 13.	Trenton, N. J. Adv. May 20 to June 3.	May 20
Jun. 13.	Illinois	May 20
Jun. 13.	New York, N. Y. Adv. May 20.	May 20
Jun. 13.	Pennsylvania	Jun. 3
Jun. 13.	National Military Home, Ind.	Jun. 10
Jun. 13.	Stillwater, Minn.	Jun. 10
Jun. 13.	Romney, W. Va.	Jun. 10
Jun. 13.	New Castle, Pa.	Jun. 10
Jun. 13.	Duluth, Minn.	Jun. 10
Jun. 13.	Clarksdale, Miss.	Jun. 10
Jun. 13.	Newark, Del.	Jun. 10
Jun. 14.	Seattle, Wash.	Jun. 3
Jun. 14.	Butler, Pa.	Jun. 10
Jun. 14.	Vancouver, Wash.	Jun. 10
Jun. 14.	Osawatomie, Kan.	Jun. 10
Jun. 14.	Meriden, Iowa	Jun. 10
Jun. 15.	South Boston, Va.	May 20
Jun. 15.	Sidney, Mont.	May 27
Jun. 15.	Columbia Station, Ohio..	May 27
Jun. 15.	Ithaca, N. Y.	Jun. 3
Jun. 15.	Wall Lake, Iowa	Jun. 3
Jun. 15.	Arden, Pa.	Jun. 10
Jun. 15.	Penns Grove, N. J.	Jun. 10
Jun. 15.	Pittsburgh, Pa.	Jun. 10
Jun. 15.	St. Paul, Minn.	Jun. 10
Jun. 15.	Trenton, N. J.	Jun. 10
Jun. 15.	Culver City, Cal.	Jun. 10
Jun. 16.	Middletown, Ohio	May 13
Jun. 16.	Leesburg, Ohio	May 27
Jun. 17.	Sciotoville, Ohio	Jun. 10
Jun. 17.	Jacksonville, Fla.	Jun. 10
Jun. 19.	Macomb, Ill.	Jun. 10
Jun. 19.	Neenah, Wis. Adv. May 13, 20.	May 13
Jun. 19.	Sulphur Grove, Ohio	Jun. 3
Jun. 19.	Lilly, Pa.	Jun. 10
Jun. 19.	Freehold, N. J.	Jun. 10
Jun. 19.	Fessenden, N. D.	Jun. 10
Jun. 19.	East Orange, N. J.	Jun. 10
Jun. 20.	Putnam, Conn.	May 20
Jun. 20.	Springdale, Iowa	May 20
Jun. 20.	Dunn Center, N. D.	May 27
Jun. 20.	Dayton, Ohio	Jun. 3
Jun. 20.	Waterloo, N. Y.	Jun. 3
Jun. 20.	South Bend, Ind.	Jun. 10
Jun. 20.	Ann Arbor, Mich.	Jun. 10
Jun. 21.	Douglas, Ariz.	May 20
Jun. 21.	Kildeer, N. D.	May 27
Jun. 21.	Pittsburgh, Pa. Adv. May 27 to Jun. 10.	May 27
Jun. 21.	Leesburg, W. Va.	Jun. 10
Jun. 21.	Seville, Ohio	Jun. 10
Jun. 22.	Minden, La.	May 20
Jun. 22.	Rumford, Me.	May 27
Jun. 22.	Ansonia, Ohio	Jun. 3
Jun. 22.	New Orleans, La.	Jun. 10
Jun. 22.	Knoxville, Iowa	Jun. 10
Jun. 22.	Hebron, N. D.	Jun. 10
Jun. 23.	Washington, Ind. Adv. May 27, June 3.	May 27
Jun. 23.	Alliance, Ohio	May 27
Jun. 23.	Grand Rapids, Ohio	Jun. 10
Jun. 23.	Des Moines, Iowa	Jun. 10
Jun. 23.	Kearney, Neb.	Jun. 10
Jun. 23.	Wayne, Neb.	Jun. 10
Jun. 23.	Edmund, N. D.	Jun. 10
Jun. 24.	Quincy, Pa.	Jun. 3
Jun. 24.	Plymouth, Mich.	Jun. 10
Jun. 25.	Albuquerque, N. M.	May 27
Jun. 26.	Redfield, S. D. Adv. May 20, 27.	May 20
Jun. 26.	Grinnell, Iowa	May 27
Jun. 26.	Pottstown, Pa.	Jun. 3
Jun. 26.	Lake Linden, Mich.	Jun. 3
Jun. 26.	Harpster, Ohio	Jun. 10
Jun. 26.	Pompton Lake, N. J.	Jun. 10
Jun. 27.	Lewis, Iowa	May 27
Jun. 27.	Erie, Pa. Adv. June 3.	May 27
Jun. 27.	Rochester, N. Y. Adv. May 27 to Jun. 10.	May 27
Jun. 27.	Mendota, Ill.	Jun. 10
Jun. 27.	Dunning, Ill.	Jun. 10
Jun. 28.	New Albany, Ind.	Jun. 3
Jun. 28.	New Albany, Ind.	Jun. 10
Jun. 30.	Edmore, N. D.	Jun. 10
July 1.	Webb City, Mo. Adv. Jun. 3, 10.	Jun. 3
July 1.	Joplin, Mo.	Jun. 10
July 6.	Chillicothe, Ohio	Jun. 10
July 20.	Chillicothe, Ohio	Jun. 10
Aug. 7.	Portland, Ore. Adv. Jun. 10.	Jun. 10

PRIVATE BUILDINGS.

Jun. 13.	Chicago, Ill.	May 13
Jun. 14.	Kingston, Ont.	Jun. 10
Jun. 15.	Ellendale, N. D.	Jun. 3
Jun. 15.	Fullerton, N. D.	Jun. 3
Jun. 16.	Canton, Ohio	Jun. 10
Jun. 15.	Benson, Wis.	Jun. 10
Jun. 31.	Private Bldg., Cincinnati, Ohio	May 27
July 1.	New Orleans, La.	May 20
July 1.	Grand Island, Neb.	May 20

NEW INDUSTRIAL PLANTS.

Jun. 15.	Port Arthur, Tex. Adv. May 27.	May 27
Jun. 17.	Bridgeport, Conn. (2 Props.) Adv. Jun. 10.	Jun. 10
July 15.	West Allis, Wis.	Jun. 10

MISCELLANEOUS.

Jun. 12.	Coal, Norfolk, Va. Adv. May 13, June 3.	May 13
Jun. 13.	Elevator, Etc., National Military Home, Ind.	Jun. 10
Jun. 13.	Examine Gas Rates, Peoria, Ill. Adv. Jun. 10.	Jun. 10
Jun. 14.	Boilers for Ice Boat, Baltimore, Md. Adv. May 27, June 3.	May 27
Jun. 15.	Concrete Mixer, Revere, Mass.	Jun. 10
Jun. 16.	Smoke Stack, Princeton, N. D.	Jun. 10
Jun. 15.	Sprinkling System, Pittsburgh, Pa.	Jun. 10
Jun. 17.	Guard Rails, Virden, Man.	Jun. 10
Jun. 19.	Road Oil, Newark, N. J..	Jun. 10
Jun. 20.	Underpass, Connecticut.. Adv. Jun. 3.	Jun. 3
Jun. 21.	Chemical Engine, etc., Butte, Mont. Adv. Jun. 3.	Jun. 3
Jun. 22.	Elevator, Corpus Christi, Tex.	Jun. 3
Jun. 26.	Cranes, Scrapers, Etc., Seattle, Wash.	Jun. 10
Jun. 30.	Mechanical Mail Handling Appar., New York, N. Y.	May 12
July 1.	Cranes, Seattle, Wash...	Jun. 10
July 3.	Fire Escapes, Tunica, Miss.	Jun. 10
July 17.	Mail Handling Device, New Orleans, La.	May 27
———	El. Rys., New York, N. Y. Adv. Apr. 29 to May 13.	Apr. 29

In a Period of Business Expansion Contractors Should Prefer Work in Lines Not Overextended

Conditions Have Largely Confined Present Activity to Industrial Construction, Which Further Promotion May Cause to Become Less Attractive from Contractor's Point of View Than Railroad or Public Work

NEW FACTORY building, according to reliable statistics, has shown unprecedented activity for the past six months. In former years this class of construction averaged one-sixth the volume of residential building. To-day it averages more than one-third. The activity in this line and the relative slackness in the construction of buildings for rent, coupled with rising wages in most of the industries producing construction materials, explain the unusual conditions in the contracting field of high prices, with some firms extremely busy, but with others slack. Although, as was pointed out in this journal last week, price advances have not been so general nor so great as is popularly supposed, it is usual, by the time any substantial advance has been recorded, for contractors and construction equipment to be busily occupied. However, the bearing on this question of building and railroad construction must be recognized, as without activity in both these lines, everyone cannot be kept busy. While plan filings have been large, in the case of buildings constructed for rent, many of the projects have not gone forward. The shadow of the eight-hour-day demand hangs heavy over the railroads and makes them hesitate to begin large-scale improvements, in spite of the fact that earnings are more satisfactory than for some years.

On the other hand, men do not hesitate to build factories when a market for their product is in actual existence. Hence it is not surprising that under the sunshine of active domestic and abnormal foreign demand May incorporations in the Eastern states alone exceeded $30,000,000, and established a new record for the month.

The present increase in construction activity, then, may still be characterized as limited to projects for the production of commodities to satisfy the existing demand, and this expansion seems to continue in the belief that the existing demand will be prolonged. General development work, the building of properties for rent and the construction of transportation facilities—with the striking exception of highway building—are below normal for a time of business expansion.

Now, with the political situation satisfactorily resolved, there is danger of developing overconfidence in the future market for manufactured products. While our trade with neutral countries has increased at a greater ratio then even our European trade, we may before long be fighting powerful competition to hold that increase. While Europe is buying from us in large volume, opinion is divided as to the continuance of this business after the close of the war. At least there is no guarantee that it will continue. While we ourselves are buying record-breaking quantities of foreign goods and absorbing a large domestic output at the same time, our ability to continue doing so may suddenly be found to depend on the volume of our sales abroad.

Whatever may be said of construction work, general business is in a period of great prosperity. However good our present banking system, overexpansion and a decline will follow such a period sooner or later. Insurance against too rapid extension and a serious check in business affairs is to be looked for in constructive efforts to keep down costs, improve commercial facilities and serve our foreign markets so well as to hold them after the war. On the part of the contractor in managing construction work and in expanding on certain kinds of contracts, as well as on the part of men in other lines of business, domestic extravagance is to be avoided. The time is coming, if the present rate of promotion keeps up, when to have railroad and public work in hand will be more of an asset to a contractor than to have industrial work.

In view of these considerations, the fact that commodity and building-material prices are stationary and tend to softness is favorable, if it does not induce too great speculation in manufacturing enterprises. Another favorable fact is that crops are nearly normal, indicating that while, with last year's surplus, there will be enough to hold our business, there will not be enough to depress the market. It is a good thing also that uncertainty as to the extent of further liquidation of foreign-held American securities is keeping down stock speculation. Any factor that tends to prevent excessive speculation is, in the long run, favorable. A great increase in the promotion of manufacturing enterprises would be unfavorable, as would a further great increase in imports.

Waterworks and Sewers

The lowest bid received at Hartford, Conn., for constructing a sewer conduit was $66,000. A sewer system to cost $315,000 has been contracted for at Logansport, Ind. Bids have been opened on two large waterworks contracts at St. Paul, one to cost $136,000 and one $315,000. The lowest bid received for waterworks construction at Everett, Wash., was $473,000.

Bids are desired for constructing sewage-disposal works at Greenwich, Conn. Lexington, Ky., will receive bids June 20 for constructing outfall sewers. Clinton, Okla., Lansing, Mich., and Ft. Worth, Tex., are considering waterworks extensions costing respectively $225,000, $165,000 and $100,000.

Buildings

Important new building work noted in this issue includes:

Contracts awarded:	Kind of Building	Cost
Cincinnati, Ohio	Y. M. C. A. building	$500,000
San Antonio, Tex.	State institution	219,000
Tacoma, Wash.	Theater	300,000
Bids opened:		
Oklahoma City, Okla.	Post office	240,800
Bids desired:		
Brooklyn, N. Y.	Court house	600,000
Proposed work:		
West Springfield, Mass.	Manufacturing plant	300,000
New York City	Apartment house	400,000
New York City	Club house	400,000
Parkersburg, W. Va.	Freight house	300,000
Birmingham, Ala.	Public buildings	2,500,000
Lima, Ohio	Factory	250,000
Chicago, Ill.	Office buildings	325,000
Chicago, Ill.	Park buildings	200,000
Chicago, Ill.	School buildings	477,000
Minneapolis, Minn.	Cold storage building	350,000
Los Angeles, Cal.	Hospital buildings	500,000

Bridges and Roads

A contract has been awarded at Ottawa, Ont., for the superstructure of a bridge to cost $84,000. Bids are desired for constructing a small drawbridge at Georgetown, Del. Three bridges on which bids will be opened July 6 at Spokane, Wash., will cost $262,000. A contract will be let June 19 for building a concrete arch bridge 200 ft. long at Toronto, Ont. A proposed bridge across the Platte River at Wahoo, Neb., will cost $97,000.

The larger paving contracts noted in this issue are summarized in the following table:

Contracts awarded:	Kind of Paving	Cost or Quantity
Columbus, Ohio	Macadam	$66,000
Vincennes, Ind.	Concrete	114,000
South Bend, Ind.	Asphalt	146,000
Salina, Kan.	Brick	30,000 sq. yd.
Bids opened:		
Albany, N. Y.	State aid highways	$1,187,000
Bids desired:		
Brooklyn, N. Y.	Paving	45,000 sq. yd.
Long Island City, N. Y.	Asphalt	65,000 sq. yd.
Seymour, Ky.	Concrete roads	6 mi.
Georgetown, Ky.	Highways	32 mi.
Cuyahoga Falls, Ohio	Brick	32,000 sq. yd.
Lisbon, Ohio	Highways	$566,000
Harvard, Ill.	Asphalt	83,000
St. Louis, Mo.	Paving	63,000
Minot, N. D.	Paving	85,000
Proposed work:		
Elizabeth, N. J.	Paving	286,000
Monroe, Ga.	Highways	500,000
Lexington, Ky.	Highways	300,000
Georgetown, Ky.	Macadam	100,000
Holly Springs, Miss.	Concrete	20 mi.
Alexander City, Ala.	Highways	45 mi.

CONTRACTING NEWS

Of Special Interest to Engineers, Contractors, Builders and Manufacturers of Engineering and Building Supplies

WATERWORKS

PROPOSED WORK.

Boston, Mass.—War Department has granted permission to the city to erect a high pressure fire service pumping station on Boston Shore of Charles River Basin.

Foxboro, Mass.—About 9800 ft. 4, 6 and 8-in. pipe will be laid to extend water mains; cost $11,000. W. R. Lewis, Clerk.

Auburn, N. Y.—City considering construction of filtration plant. Address City Clerk.

Batavia, N. Y.—George W. Fuller, 170 Broadway, New York, reported in favor of the plans of Chester & Fleming, of Pittsburgh, Pa., for improvements proposed to water works.

Huntington, L. I., N. Y.—The construction of a municipal plant for the Huntington Bay and Harbor sections is reported under consideration. Huntington Association may be able to give information.

Jamaica, N. Y.—Hansen & Coulter, 2 Rector Street, New York, engaged as consulting engineers in connection with the installation of an iron removal plant for the Jamaica Water Supply Co. of Jamaica.

Irvington, N. J.—Citizens voted in favor of water mains. E. W. Terhune, Engineer, Irvington; Joseph A. Murphy, Village Clerk.

Stone Harbor, N. J.—Election will be held to vote on purchasing water works, at cost of $56,000, and sewage disposal plant, at cost of $35,000.

Trenton, N. J.—Council is reported considering filtration plant; cost $10,000. Address City Clerk.

West Wildwood, N. J.—The West Wildwood Water & Power Co. formed to supply water for Middle Township, Cape May. George Flint interested.

Meadville, Pa.—Citizens May 16 voted $10,000 bonds for water works. B. F. Miller, Jr., Engineer, Meadville. Address City Clerk.

West Point, Va.—Citizens voted $30,000 bonds for extensions to water works, sewers and paving.

Salisbury, N. C.—It is proposed to develop new supply, pipe line, filter, reservoir and new pumping plant. J. L. Ludlow, Engineer, Winston-Salem; J. W. Neave, Superintendent of Water Works.

Greenville, S. C.—W. F. B. Haynsworth, City Engineer, writes that no water works improvements are contemplated in this city. The purchase of the water works system owned by the American Pipe Company is contemplated, but no improvements will be necessary.

Athens, Ga.—The Superior Court validated $40,000 bond issue for extensions and improvements to water works. Bonds have been sold. Address City Clerk.

Savannah, Ga.—E. R. Conant, Chief Engineer, Savannah estimates cost of rehabilitating city's water works at $300,000.

Monroe, Ga.—City is considering improvements to water works. Walter G. Kirkpatrick, Engineer, Jackson, Miss.

Havannah, Fla.—It is proposed to construct water works costing $15,000 to $20,000. J. H. Turner, Clerk; J. B. McCrary, Engineer, Atlanta, Ga.

Birmingham, Ala.—Purchasing plant of Birmingham Water Works Co. or constructing new plant being considered by City Commission; $4,500,000 bonds issued for same.

Oakdale, La.—Bonds for $18,000 will be sold June 28 for constructing waterworks. Hon. S. A. Pitman, Secretary Board Aldermen. See "Bids Desired."

Greenville, Tenn.—Improvements to water works costing $7,000, including 300,000-gal. stand pipe, contemplated. C. E. Caile, City Engineer.

Chardon, Ohio.—City Council considering granting franchise to F. R. Gravatt and T. W. Morgan of Barberton for constructing water works; probable cost $57,604.

East Palestine, Ohio.—Water bonds for $35,000 will be sold July 10 by O. L. Butts, Village Clerk.

Salem, Ohio.—City Council is reported considering constructing this summer a 1,000,000-gal. reservoir. Address City Clerk.

Wooster, Ohio.—City will develop an improved water supply from wells in the Killbuck Valley west of the city. It is the intention to abandon the present sources of supply when the new works are completed. The W. J. Sherman Company, Engineers, the Nasby, Toledo.

Bloomington, Ind.—City sold $62,000 water works improvement bonds. Address City Clerk.

South Bend, Ind.—Reported desired until June 18 by E. M. Morris, Chmn. Board Public Works, for water and sewer connections on Eddy Street and Misbwaka Avenue.

Lansing, Mich.—Election to be held June 28 to vote $165,000 bonds for constructing reservoir and extensions to water works. Ernest G. Eddy, City Engineer; W. B. Kirby, Secretary Board Water & Electric Light Commissioners.

Gibson City, Ill.—City Council authorized plans prepared for water works and electric light plant. Address City Clerk.

Glasford, Ill.—Contract soon to be let for pumping plant and tank and tower Fuller-Coult Company, Engineers, St. Louis, Mo. D. A. Howard, Village Clerk.

LaMoille, Ill.—Citizens voted to construct water works costing $20,000. A well 250 ft. deep will be sunk and a kerosene engine installed to drive pump. Address Village Clerk.

Waukegan, Ill.—Plans under consideration for filtration plant. Address Commissioner Davis.

Normal, Ill.—Citizens, May 27, voted $22,000 bonds for water works and for building a septic tank. Bonds will be sold July 3. G. C. Broyhill, Engineer, Normal; T. H. Keys, City Clerk.

Waukegan, Ill.—Installation of water meters is under consideration. Address City Clerk.

Clermont, Iowa.—Citizens June 6 voted $18,000 bonds for water works. E. T. Scott, Clerk.

Jennings, Kan.—City is considering installing water works and electric light plant.

Blue Hill, Neb.—Plans approved by City Council for municipal water works and electric light plant.

Winnebago, Neb.—Citizens voted $10,000 bonds for improving water works. A. M. Smith, Clerk.

Madison, S. D.—Equipment of the water works is to be improved. Address Mayor.

Sheridan, Mont.—Citizens voted to construct water works costing $38,000. Address City Clerk.

Chaffee, Mo.—Frank L. Wilcox, St. Louis, Mo., engaged to prepare plans and specifications for water works and sewer system.

El Paso, Tex.—City contemplates purchasing turbine engine for water works; cost about $109,000. Address City Clerk.

Fort Worth, Tex.—Reported extensions to water works and sewerage system are contemplated; probable cost $100,000. Address City Clerk.

Galveston, Tex.—M. E. Sjay, City Commissioner of Water and Sewerage, is reported in favor of the city building a reservoir of 20,000,000 gal. capacity.

Kenedy, Tex.—See "Sewerage and Sewage Disposal."

Van Alstyne, Tex.—The city will construct a brick pumping station for water works; also lay mains and other improvements.

Clinton, Okla.—Election will soon be held to vote $225,000 bonds for water works. Engineers, Benham Engineering Company, Oklahoma.

McLoud, Okla.—Benham Engineering Company of Oklahoma engaged by city to prepare plans and specifications for water supply; about $15,000 available for improvement.

New Wilson, Okla.—All bids opened May 8 for constructing water works and electric light plant have been rejected. The city will construct the plants under supervision of Benham Engineering Co., Oklahoma.

Oklahoma, Okla.—Water bonds for $1,500,000 and sewer bonds for $200,000 will be sold June 20, it is reported. Address Mike Donnelly, Commissioner.

Prague, Okla.—Election soon to be held to vote on leasing the municipal water works and electric light plant to W. E. Ambrister.

Las Cruces, N. M.—Bonds for improvements to water works for $12,000 and $7,000 for sewer improvements will be sold July 5 by J. B. Durand, Clerk; T. H. Todd, Engineer, El Paso.

North Yakima, Wash.—County Commissioners considering constructing independent light and water plant.

Puyallup, Wash.—J. L. La Plante, City Clerk, reports Council plans installation of pumping plant to supply Puyallup Heights. George D. Ball, City Engineer.

Seattle, Wash.—Lake Forest Light, Water & Power Company, of Seattle, has applied to King County Commissioners for a 25 year franchise to construct, maintain and operate a system of water pipe in Lake Forest, Second and Third Additions.

It is proposed to lay 3940 ft. 8-in. c. i. pipe at a cost of $6,890, in North Fifty-ninth Street and other streets. O. A. Piper, City Engineer.

Puyallup, Wash.—Contract will soon be let for constructing a concrete pumping station and pipe line at Maplewood Springs to connect with city water system; cost about $8,000. George D. Ball, City Engineer. J. L. La Plante, City Clerk.

Fresno, Cal.—The U. S. Forestry Dept. will install about 8000 ft. water pipe and a 10,000-gal. tank near Huntington Lake this summer. Address M. A. Benedict, Supervisor of Sierra National Forest, Fresno.

Los Angeles, Cal. — Construction of Chatsworth reservoir is contemplated. Address Public Service Commission.

Pasadena, Cal.—Contract soon to be let by City Commission for constructing cement lining for new Northside reservoir. Address Samuel B. Morris, Chief Engineer Water Department.

Santa Monica, Cal.—Citizens voted May 26 in favor of $712,000 bond issue for purchase of water works. M. K. Barretto, Commissioner of Finance.

Taft, Cal.—City Trustees contemplate constructing extensions to fire pressure mains; cost, $3,600. Address City Clerk.

Woodland, Cal.—Citizens voted $55,000 bonds for municipal water works. Address City Clerk.

Las Vegas, Nev.—The San Pedro, Los Angeles & Salt Lake R.R. Co. (A. Maguire, Ch. Engr., Los Angeles, Cal.) will improve water system at Las Vegas.

Chloride, Ariz.—O. H. Henning of Los Angeles, Cal., planning to construct electric light, power plant and water works.

Flagstaff, Ariz.—Plans for converting a crater near San Francisco peaks north of Flagstaff into a 350,000,000-gal. reservoir have been prepared for R. A. Morely, President of Williams Water & Electric Co., of Williams, Ariz., to include building of a retaining wall around one side of the rim of the crater which now has an estimated capacity of 135,000,000 gal., and construction of pipe lines to Flagstaff, William and Grand Canyon. The reservoir is to be used to supply the Santa Fe R. R. system with water.

Oatman, Ariz.—Letting of contracts for material or supplies required for water and sewerage system contemplated by Mohave Oatman Water Company, will be delayed for some time owing to strikes.

Wickenburg, Ariz.—Election will be held July 1 to vote $5,000 for remodeling water works.

Faust, Utah.—The San Pedro, Los Angeles & Salt Lake R.R. Co. (A. Maguire, Ch. Engr., Los Angeles, Cal.) will construct a woodstave pipe line at Faust; cost $40,000.

Lofgreen, Utah.—The San Pedro, Los Angeles & Salt Lake R.R. Co. (A. Maguire, Ch. Engr., Los Angeles, Cal.) will construct a 150,000-gal. reservoir at Lofgreen.

Marysvale, Utah.—Citizens voted $15,000 bonds to install water works. George T. Eayrs, Town Clerk.

Salt Lake City, Utah.—Utah-Idaho Sugar Company, in which Charles W. Nibley, Templeton Block, is interested, intends constructing a storage reservoir costing $2,000,000.

St. Pierre de Lace, Que.—Council contemplates installing water works costing $15,000. J. H. Langlais may be able to give information.

Winnipeg, Man.—City Comptroller has decided to recommend to Council purchase of a new motor to drive the 5,000,000-gal. pump at McPhillips Street water works plant to replace motor in use.

Moose Jaw, Sask.—Water works improvement contemplated. Address City Clerk.

BIDS DESIRED.

Washington, D. C.—Until July 10, for furnishing and delivering 297 tons of c. i. water pipe, 56 tons c. i. water pipe specials. Oliver P. Newman, Chmn., Commissioners, D. C., 509 District Bldg.

Oakdale, La.—Until June 28, by Town, for furnishing material and constructing water works, to include oil engines, pumps, steel towers, hydrants, valves, etc. Xavier A. Kramer, Consulting Engineer, Magnolia.

Barnesville, Ohio.—Until June 30, by Board Trustees Public Affairs, for an elevated steel tank, rapid sand filters and appurtenances and a pumping station for water works, advertised in Engineering Record. Morris Knowles, Engineer, Pittsburgh, Pa.

Cleveland, Ohio.—Until June 21, by Commissioners Purchases and Supplies for disk water meters for the Department of Public Utilities division of water.

Greenwich, Ohio.—Reported desired until June 22, by F. H. Daniels, City Clerk, for water works improvements to include 1200 ft. 10-in. c. i. pipe, etc., installing pump, reservoir, etc. Probable cost $15,000.

Crystal Falls, Mich.—Until June 19 (re-advertisement) by W. J. Gribble, City Clerk, for constructing water works extensions.

Detroit, Mich.—Reported desired until June 19, by Geo. J. Flinn, Secy. Fire Commissioners, for furnishing material and laying pipe line to include 4000 ft. 6-in. c. i. pipe, together with 400 gate boxes, 400 gate valves, etc.

Menominee, Mich.—Until June 29, by H. H. Blunden, Secy. Board Public Works, for constructing filtration plant and other improvements. Burns & McDonnell, Engineers, 402 Interstate Building, Kansas City, Mo.

Dunning, Ill.—Until June 27 by Board Administration, office of Capitol building (Frank D. Whipp, Fiscal Superv.) for furnishing and installing extension to water mains to and from new power plant, Chicago State Hospital at Dunning.

Oak Park, Ill.—Reported desired until June 19 by C. H. Hill, Village Pres., for water mains in Congress, Maple and Seventy-second Avenues. W. F. Sargeant, Village Engr.

Shawano, Wis.—Until June 27 by City Clerk for constructing dam and power house, advertised in Engineering Record. Engineers, Power Engineering Company, Minneapolis, Minn. B. Royer, Chairman Water Works Commission.

Ankeny, Iowa.—Until June 30, by A. L. Stebleton, Town Clerk, for water works, advertised in Engineering Record.

Pottsville, Iowa.—Until June 26 by Wm. Sheppard, Town Clerk, for approximately 3325 ft. of 4-in. main, hydrants and gate valves. Marr, Green & Co., Sanitary Engrs., 17 N. La Salle Street, Chicago, Ill.

Panama.—Until June 23, by Maj. Earl I. Brown, Corps Engrs., U. S. A., General Purchasing Officer Panama Canal, Washington, D. C., for Cir. 1053 c. i. pipe, etc.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Windsor, Pa.**—Contracts for constructing water works awarded by Borough Council as follows: Concrete work, including reservoir to Samuel A. Arnold of Windsor, at $3,240, for excavation work, furnishing c. i. pipe fittings, valves, hydrants, to G. A. & F. M. Wagman Co. of Dallastown, and pumps and motors to Burrows Mfg. Co., at $1,352.

★**Wilmington, Del.**—Williams & Kinnamon of Baltimore, Md., reported to have secured the contract to construct the reservoir at Ridney and Eighth streets.

★**Shreveport, La.**—Contract for furnishing cast-iron pipe, lead pipe, valves, hydrants, castings, etc., awarded by city to E. H. Vordenbaumen, at $14,528.

★**Cleveland, Ohio.**—Contract for automatic control oiling system for engines and turbines at Water Works Division Avenue Pumping Station awarded to National Valve & Mfg. Co., 608 New England Bldg., at $10,440.

★**Farmersville, Ohio.**—Contract for constructing water works (bids opened June 3) awarded George A. Harrop, South Bend, Ind., at $13,038. Midland Engineering Company, Fort Wayne, Ind., at $13,099. A. F. Gilbert, Clerk Board Public Affairs.

★**Maywood, Ill.**—Contract for constructing 900,000-gal. storage reservoir (bids opened May 29) awarded R. C. Wood & Company, Chicago, Ill., at $17,320. E. J. Thelin, Village Clerk.

★**Sheboygan Falls, Wis.**—Following are four bids opened June 2 by Bd. Public Wks. for constructing water works: Second Ward Savings Bank, Milwaukee, $36,768 (awarded contract); Bank of Sheboygan, Sheboygan, $35,770; C. H. Coffin, Chicago, Ill., $35,721, and Powell Garard & Company, Chicago, Ill., $35,707. Frank R. Kroeger, City Clerk.

Morris, Minn.—Following are bids opened May 31 by city for furnishing, f.o.b. cars Morris, 5300 ft. 10-in. and 2000 ft. 4-in. c.-i. main: U. S. Cast Iron Pipe & Foundry Company, 71 Broadway, New York, N. Y., 10-in., $32.70 per ton, and 4-in., $35.70; total $7,003. American Cast Iron Company of Birmingham, Ala., 10-in., $34.10; 4-in., $37.10; total $7,298.

St. Paul, Minn.—Following are unit figures of the four lowest bids opened June 5 by August Hohenstein, Purchasing Agent, for constructing coagulation basis: (a) Engineer's estimate, $144,328 (not including contractor's bond); (b) W. J. Hoy & Co., St. Paul, $135,961; (c) Siems, Helmus & Shaffner, St. Paul, $137,874; (d) Deeks-Deeks & Smith, 716 New York Life Building, $144,358; (e) Winston Brothers Co., 801 Globe Building, Minneapolis, $162,660.

			(a)	(b)	(c)	(d)	(e)
1	0.1	acre clearing and grubbing	$100.00	$60.00	$80.00	$500.00	$250.00
2	23,300	cu. yd. earth excavation	0.20	0.22	0.27	0.22	0.31
3	3,825	cu. yd. clay blanket under basins	0.35	0.80	0.70	0.90	1.20
4	1,532	ton-mile sprinkling and rolling foundation and embankment	0.25	0.25	0.35	1.50	1.25
5	16,800	cu. yd. earth embankment and fill over structures	0.25	0.55	0.50	0.70	0.81
6	1.25	acres seeding	33.00	75.00	40.00	80.00	48.00
7	4.200	sq. yd. sodding	0.19	0.20	0.22	0.30	0.23
8	1,276	cu. yd. concrete inverted groined arches, coagulation basins	7.75	8.50	7.25	10.50	11.20
9	424	cu. yd. concrete inverted barrel arches, coagulation basins	7.75	8.50	7.25	10.50	11.20
10	86	cu. yd. concrete inverted barrel arches, mix. chamber	7.75	8.50	7.25	12.00	11.20
11	43	cu. yd. concrete columns, footings and piers	7.50	10.00	7.75	10.00	11.20
12	638	cu. yd. bottoms meter chamber and center passages	7.50	7.00	7.25	9.75	11.20
13	1,257	cu. yd. concrete in flat slab construction	11.00	11.15	11.50	10.50	11.20
14	2,023	cu. yd. concrete in walls	10.50	9.00	10.25	10.00	11.20
16	850	cu. yd. concrete columns, beams and corbels	25.00	15.50	11.50	10.00	11.20
16	34	cu. yd. manhole curbs and sumps	18.00	10.00	12.00	12.00	11.20
17	42	cu. yd. concrete weirs and Venturi meters	20.00	25.00	12.00	20.00	11.20
26	1,095	sq. yd. concrete special finishing on floors	1.25	0.60	1.00	2.25	0.60
27	99,454	lb. steel reinforcement, ⅜ in. square	0.05	0.038	0.044	4.43	0.053
	120,195	lb. steel reinforcement, ½ in. square	0.049	0.038	0.044	4.24	0.05
	211,913	lb. steel reinforcement, ⅝ in square	0.0425	0.038	0.044	4.16	0.045
	369,622	lb. steel reinforcement, ¾ in. square	0.043	0.038	0.044	4.10	0.043
	3,636	lb. steel reinforcement, ⅞ in. square	0.042	0.038	0.044	4.34	0.043
	9,858	lb. steel reinforcement, 1 in. square	0.042	0.038	0.044	4.34	0.043
28	28,700	lb. miscellaneous steel and wrought-iron work	0.05	0.12	0.11	0.116	0.135
31	13	setting sluice gates, 48 x 60 in., spigot end. in concrete	50.00	40.00	50.00	40.00	41.00
	6	setting sluice gates, 36 x 60 in., spigot end. in concrete	50.00	40.00	50.00	40.00	35.00
	2	setting sluice gates, 48 x 48 in., spigot end. in concrete	50.00	40.00	50.00	40.00	35.00
	8	setting sluice gates, 42 x 42 in., spigot end. in concrete	40.00	35.00	40.00	40.00	30.00
	34	setting 12-in. cir. flanged	6.00	20.00	15.00	5.00	2.50
32	2	setting gate valves 12-in. flanged ends	2.00	20.00	16.00	50.00	2.50
	2	4-in. hub ends	1.25	3.00	5.00	30.00	2.00
33	40	ton laying and erecting c.-i. pipe and specials, 4 to 20 in., specials	10.00	9.00	20.00	11.00	10.00
	38	ton laying and erecting c.-i. pipe and specials, 4 to 20 in., pipe	7.00	9.00	15.00	8.00	10.00
	11	ton laying and erecting c.-i. pipe and specials, 24 to 48 in., specials	8.00	8.00	20.00	12.00	7.50
	18	ton laying and erecting c.-i. pipe and specials, 24 to 48 in., pipe	6.00	8.00	15.00	9.00	7.50
34	2	erecting and placing 48 x 24 Venturi meter	50.00	150.00	150.00	125.00	125.00
35	137	ton furnishing and erecting c.-i. baffle wall and stop plank grooves	100.00	85.00	75.00	76.00	100.00
36	8,063	lb. furnishing and erecting miscellaneous castings	115.00	0.05	0.05	0.05	0.05
37	1,250	lin. ft. furnishing and erecting electrical work, ½-in. conduit	0.07	0.11	0.12	0.15	0.09
37	400	lin. ft. furnishing and erecting electrical work, ¾-in. conduit	0.09	0.14	0.15	0.18	0.10
	100	outlet boxes	0.20	0.50	1.00	0.65	0.25
	10	pull in boxes	3.00	2.00	4.00	2.20	3.40

St. Paul, Minn.—Following are unit figures of the four lowest bids opened June 5 by August Hohenstein, Purchasing Agent, for constructing a high service reservoir, "Schedule B": (a) Engineer's estimate, $304,519 (does not include contractor's bond); (b) Siems, Helmus & Shaffner, St. Paul, $314,948; (c) W. J. Hoy & Co., 700 Metropolitan Building, $316,225; (d) Deeks-Deeks & Smith, 716 New York Life Building, $332,964; (e) Pearson Construction Co., New York Building Seattle, Wash., $334,314.

		(a)	(b)	(c)	(d)	(e)
1	4.25 acres clearing and grubbing	$50.00	$80.00	$30.00	$50.00	$200.00
2	90,620 cu. yd. earth excavation	0.20	0.27	0.20	0.20	0.26
3	14,500 cu. yd. clay blanket under reservoir	0.35	0.70	0.85	0.75	1.10
4	10,552 ton-mile sprinkling and rolling foundations and embankments	0.35	0.35	0.22	1.25	0.10
5	99,800 cu. yd. earth embankments and fill over structures	0.25	0.50	0.45	0.60	0.24
6	4⅓ acres seeding	0.33	40.00	75.00	90.00	50.00
7	12,800 sq. yd. sodding	0.19	0.22	0.20	0.20	0.15
18	4,633 cu. yd. concrete inverted groined arch floor	7.75	7.00	8.00	9.72	7.40
19	3,831 cu. yd. concrete groined, cloistered and barrel arch roof	12.00	11.20	13.00	9.72	14.50
20	2,680 cu. yd. concrete flat slab footings for outside walls	7.50	6.80	7.00	9.50	7.90
21	3,049 cu. yd. concrete outside wall slabs and buttresses	14.00	10.00	10.00	10.00	14.50
22	2,734 cu. yd. concrete division or center wall	7.25	7.50	7.60	9.25	9.90
23	1,503 cu. yd. concrete columns	17.50	11.50	14.00	9.60	15.30
24	317 cu. yd. concrete conduits and sumps	7.00	11.00	10.00	12.00	15.30
25	617 cu. yd. concrete inlet and outlet gate chambers and aerator	10.90	8.50	13.00	16.50	11.10
26	95 sq. yd. concrete special finishing or floors	1.25	1.00	0.60	2.00	1.35
27	Steel Reinforcement:					
	27,567 lb., ½-in. square rods	0.049	0.043	0.038	4.24	0.05
	154,383 lb., ⅝-in. square rods	0.0435	0.043	0.038	4.16	0.045
	579,332 lb., ¾-in. square rods	0.043	0.043	0.038	4.10	0.04
	124,267 lb., ⅞-in. square rods	0.042	0.043	0 038	4.34	0.04
	204,380 lb., 1-in. square rods	0.042	0.043	0.038	4.34	0.04
28	16,510 lb. miscellaneous steel and wrought-iron work	0.05	0.11	0.10	0.11	0.10
29	1,267 lb. copper and asphalt expansion joints, copper	0.53	0.60	0.40	2.50	0.30
30	19,300 lin. ft. wooden expansion joints in footings	0.03	0.03	0.06	0.06	0.03
31	8 setting sluice gates, 48-in. circular flanged	50.00	50.00	40.00	0.30	50.00
	2 48 x 48-in. spigot in concrete	50.00	50.00	35.00	40.00	50.00
32	1 Setting gate valves, 48-in. double hub gate valve	75.00	50.00	25.00	30.00	50.00
	1 24-in. flanged gate valve	20.00	20.00	20.00	20.00	35.00
	4 6-in. double hub gate valves	2.00	5.00	4.00	12.50	20.00
33	1 ton laying and erecting c.-i. pipe and specials, specials 6 to 20 in	10.00	20.00	9.00	20.00	15.00
	5 ton pipe, 6 to 20 in	7.00	15.00	9.00	10.00	15.00
	37 ton laying and erecting c.-i. pipe and specials, specials 24 to 48 in	8.00	20.00	8.00	12.00	15.00
	105 ton pipe, 24 to 48 in	5.00	15.00	8.00	10.00	15.00
35	1 ton furnishing and erecting c.-i. stop plank grooves	100.00	85.00	110.00	296.87	125.00
36	6,250 lb. furnishing and erecting miscellaneous castings	115.00	0.05	0.09	0.0475	0.09

★**Morris, Ill.**—Contract for installing centrifugal pump in pumping station awarded by City Council to American Well Works of Aurora at $3,417.

St. Paul, Minn.—Following are four lowest bids opened June 5 by August Hohenstein, Purchasing Agent, for furnishing sluice gates. Engineer's estimate $21,320, with $450 additional for sluice gate motor: Coldwell-Wilcox Company, Newburgh, N. Y., $21,371; Chapman Valve Mfg. Company, of Chicago, Ill., $24,943; Flower-Stephens Mfg. Company, Detroit, Mich., $25,315; Coffin Valve Company, Neponset, Boston, Mass., $29,309.

Following is lowest bid opened same time and place as above for furnishing 4-in. gate valve hub ends rising stem. Engineer's estimate, $3,995: James B. Clow & Sons, Chicago, Ill., $3,671.

Following are two bids opened June 5 by August Hohenstein, Purchasing Agent for furnishing (a) 363.32 tons 4, 12, 20, 24, 30, 36 and 48 in. c. i. pipe, Classes A and B for coagulation basins, and (b) 727.18 tons 6, 24 and 48 in. c. i. pipe, Classes A and B for high service reservoir: U. S. Cast Iron Pipe & Foundry Co., 122 South Michigan Avenue, Chicago, Ill., (a) $11,826, (b) $23,114, R. D. Wood & Co. of Philadelphia, Pa., (a) $13,602, (b) $26,549.

Bids opened same time and place for furnishing special castings: U. S. Cast Iron Pipe & Foundry Co., 122 South Michigan Avenue, Chicago, Ill., bid on Schedule A and B as a whole at a total of $11,283, and R. D. Wood of Philadelphia, Pa., on part of work on Schedule A and B. at total of $6,138.

★**Ellendale, N. D.**—Contract for 100,000-gal. tank on 80-ft. tower, etc. (bids opened June 5) awarded Minneapolis Steel & Machinery Company, Minneapolis, Minn., at $6,589. H. S. Rusco, City Engineer.

★**Commerce, Okla.**—Contract for constructing 75,000-gal. tower and drilling well awarded by Bd. of Trustees to N. S. Sherman Iron Wks. of Oklahoma at about $20,000.

★**Everett, Wash.**—Following are four lowest bids opened June 5 by Louis Lesh, City Clerk, for constructing water works—(a) headworks and dam, (b) 20 miles wood pipe, (c) 23,000 ft. Matheson steel pipe: Washington Paving Co., L. C. Smith Building, Seattle, (a) $158,937, (b) $192,252, (c) $121,943 (contract reported awarded at a total of $473,000); Sound Construction & Engineering Co., Seattle, (b) $197,630, (c) $120,000; Hans Pederson, Seattle, (a) $104,900; Holt & Jeffery, Seattle, (a) $151,000; Pearson Construction Co., Seattle, (a) $198,920; Pacific Coast Pipe Co., Seattle, (a) $159,500; Nettleton Bruce Eachbach, Seattle, (b) $194,650, (c) $119,130; Harrington Peters Co., Seattle, (a) $163,500; Booker, Keihl & Whipple, Seattle (a) $212,335. Burns & McDonnell, Engineers, Kansas City, Mo.

SEWERAGE AND SEWAGE DISPOSAL

PROPOSED WORK.

Providence, R. I.—The Joint Committee appointed to confer with Special Committee of Cranston relative to proposed sewerage system along Mashapaug Brook, in a report to Common Council recommends constructing sewer, through Robert and Alexander Streets and in Rutherglen Avenue and Narragansett Avenue, to low point in Rutherglen Avenue; estimated cost $46,480.

Syosset, L. I., N. Y.—Contract to be let about July 1 by Hausen & Coulter, Engineers, 2 Rector Street, New York, N. Y., for drainage work on estates of Phillip Goodwin and Victor Morawets, to cost $10,000.

Hoboken, N. J.—Board of Commissioners will enlarge and rebuild sewers and construct additional and relieving sewers in city between Fourth and Eleventh Streets and Hudson River.

Newark, N. J.—Election will be held in Union Township to vote on connecting sewage district with trunk sewer.

Albion, Pa.—A sewerage system and sewage disposal plant is to be constructed in Albion. Address Borough Clerk.

Pennsylvania.—Following permits issued by Board of Health, Harrisburg, for sewer improvements:

Altoona—District sanitary sewer system.

Carbondale—Lateral sanitary sewers and temporary outlet and requiring revision of sewage treatment plans.

Rosslyn Farms—Sanitary sewer extensions and requiring comprehensive sanitary sewerage plans and joint disposal studies.

Washington — Comprehensive sanitary sewer system tributary to existing disposal plant.

Mifflin Township, Allegheny Co. (Pittsburgh-Kennywood Park Co.) — Sewage treatment.

Braddock—Preliminary plans for comprehensive sanitary sewer system and change of temporary outlet.

North Braddock—For comprehensive sanitary sewer system and change of temporary outlet.

Philadelphia—Lateral sewer extensions.

Thomson, Ga.—Issuing of $15,000 bonds for constructing sewerage system is under consideration. Address City Clerk.

Johnson City, Tenn.—The construction of 6450 ft. 6 to 12 in. sewer with manholes, etc. (bids for which were to have been opened June 6) has been postponed indefinitely.

Marysville, Tenn.—Construction of a sewer system at a cost of $55,000 is under consideration. Address City Clerk.

Akron, Ohio.—Construction of a trunk sewer system is contemplated. Address City Engineer.

Cincinnati, Ohio.—City Council approved approximate estimate of $210,300 submitted by City Engineer Frank S. Krug as the cost of constructing sewers in the Madisonville District, under Contract No. 4.

Indianapolis, Ind.—Mayor Bell has submitted a report to Council recommending the construction of a sewage disposal plant.

Lafayette, Ind.—Sewer bonds for $20,000 have been sold. Address City Clerk.

Grand Rapids, Mich.—Board of Works estimates cost of extending the East Side trunk sewer from Lyons Street and Canpau Avenue to Coldbrook Street, N. W., as $160,000.

Lansing, Mich.—Election to be held June 28 to vote on issue of $14,100 bonds for extensions to sewer system and $56,000 for paving and $15,000 for repaving Michigan Avenue. Ernest G. Eddy, City Engineer.

Cairo, Ill.—Contract soon to be let for rebuilding sewerage system, cost $21,509. Address City Clerk.

DePue, Ill.—Probably nothing will be done for a year to construct a sewer system.

Westfield, Ill.—Plans prepared for sewerage system, about 5.3 miles pipe, 6 to 15 in. sedimentation tank required, cost about $24,000. W. R. Page, Terre Haute, Ind., Engineer.

Waukesha, Wis.—Contract will soon be let by Board Public Works for 4,964 ft., 8 and 10-in. sewer.

Burlington, Iowa.—Construction of a sewer system is under consideration. Plans have not yet been prepared. C. E. Waterhouse, City Engineer.

Emmetsburg, Iowa.—City Council received plans of proposed storm sewer. Cost estimated at $100,000. Address City Clerk.

Panora, Iowa.—Plans soon to be prepared for sewer improvements costing $25,000. Bruce & Standeven, Engineers, Omaha, Neb. Address City Clerk.

Primghar, Iowa.—Plans prepared for sewer system; cost, $20,000. Bruce & Standeven, Engineers, Omaha, Neb. Address City Clerk.

Spooner, Minn.—City has decided to postpone for present installation of a sewer system and disposal plant, as the bond issue was voted down. A. M. Robertson, Clerk.

Neodesha, Kan.—All bids opened June 5 by J. J. Canall, City Clerk, for constructing intercepting sewer and sewage disposal plants rejected.

Florence, Neb.—Construction of a sewer system costing $20,000 under consideration. Address City Clerk.

Belle Fourche, S. D.—Election soon to be held to vote bonds for constructing sewer system costing $23,000. Bruce & Standeven, Engineers, Omaha, Neb. Address City Clerk.

Brookings, S. D.—E. K. Mather of Mitchell engaged to prepare plans for sanitary sewer.

Dallas, Tex.—City Commission has made appropriation for constructing flood gates to the municipal sewage disposal plant. Address A. C. Cason, Commissioner.

Hillsboro, Tex.—Plans completed by City Engineer for the proposed sewage disposal plant. Address Mayor.

Huntsville, Tex.—Citizens June 3 voted $22,500 bonds for sewer construction and $7,500 for street improvements. G. B. Oliphius, City Secretary.

Kennedy, Tex.—Citizens voted $26,000 bonds for construction of water works and $6,000 for sewers. Address City Clerk.

Mineral Wells, Tex.—Citizens voted $23,000 bonds for extension to sewer system and disposal plant. Address City Clerk.

Oklahoma, Okla.—See "Water Works."

Seattle, Wash.—Cost of constructing sewers, paving; etc., in West McGraw and other streets has been estimated at $109,366. A. H. Dimock, City Engineer.

Sumner, Wash.—W. P. Wood, City Engineer, directed by City Council to prepare plans for trunk sewer in South Sumner.

Ashland, Ore.—Reported sewer is to be constructed in Laurel and other streets at a cost of about $12,000. C. H. Gillette, City Recorder.

San Francisco, Cal.—Contract about to be let for constructing sewer on Sloat Boulevard, between Twenty-fourth and Thirty-first Streets; estimated cost, $21,000. Address Secy. Bd. of Public Works.

Windsor, Ont.—Plans being prepared for sewers and concrete paving; cost, $30,000. Address City Clerk.

Fernie, B. C.—The sewer system proposed here will be 9,232 ft. long of 10, 12 and 15-in. pipe and cost about $14,000. Election to be held in July or August. City will probably construct system by day labor. William Samsey Engineer, Fernie; Arthur K. Moffatt, City Clerk.

BIDS DESIRED.

Boston, Mass.—Until June 19 by Edw. F. Murphy, Commissioner Public Works, for constructing pipe sewers and drains in Patten Street and outlet West Roxbury. Also separate bids for pipe sewers and drains in Cuffling Street, Brighton.

Greenwich, Conn.—Until June 29, by Joint Sewerage Commission of Borough of Greenwich and Town of Greenwich, for furnishing material and constructing a sewage disposal works and pumping station for Borough of Greenwich and Sewer District No. 6, including piping, grading, etc., advertised in Engineering Record. Clyde Potts, Consulting Engineer, 30 Church Street, New York.

Yonkers, N. Y.—See "Paving and Roads."

Jersey City, N. J.—Until June 27 by City Commissioners for laying an 18-in. vitr. pipe sewer in Jackson Avenue and in Wade Street to connect with the Rutgers Avenue sewer.

Plainfield, N. J.—Until July 3 by James T. MacMurray, City Clerk, for sewage pumping station and 44,077 ft. 8 to 24-in. vitr. pipe and 4944 ft. 8 to 18-in. c. i. pipe sewer, manholes, etc., advertised in Engineering Record.

Trenton, N. J.—Until June 21, for constructing sewer in West State Street. Leon D. Hirsch, City Clerk.

Johnsonburg, Pa.—Until July 5 by E. N. Wallis, Borough Secretary, for constructing sewage disposal plant, and laying trunk line sewers, advertised in Engineering Record.

Gainesville, Fla.—Until July 3, by Board Public Works (H. E. Taylor, Chairman) for constructing an extension to the sanitary sewer system.

Lexington, Ky.—Until June 20 by Board Commissioners for constructing outfall sewers, advertised in Engineering Record. See advertisement on last page of this **sheet**. Plans and specifications on file in office of Engineering Record, 239 W. Thirty-ninth Street, New York. James J. O'Brien, City Clerk.

Lorain, Ohio.—Until June 27, by Director Public Service for furnishing material and improving Broadway Main Sewer, District No. 1, and Penfield Main Sewer, District No. 4, extending main storm water sewer therein and extending three lateral storm sewers, approximate quantities Penfield Avenue storm sewer 2965 lin ft., 60, 42, 30 and 12-in. sewer, manholes, etc. C. M. Osborn, City Engr.

Portsmouth, Ohio.—Reported desired until July 1, for constructing sanitary sewer system. Probable cost $41,476. Ralph Calvert, Dir. Pub. Service.

Salem, Ohio.—See "Paving and Roads."

Youngstown, Ohio.—Until June 22 by Director Public Service (Dan J. Jones, Clk.) for furnishing material and constructing sewers in Worthington and Thurman Streets.

Evansville, Ind.—Reported desired until June 20 by Board Public Works (E. N. Frisse, Clk.) for constructing the Blankenburg sewer. Probable cost $40,000.

Bouton, Iowa.—Until June 26, by M. F. Parks, Town Clerk, for furnishing 11,040 ft. 15 to 8-in. sewers and 26 intakes.

Charter Oak, Iowa.—Until July 15, by city for constructing sewer to cost $25,000. Bruce & Standeven, Engineers, Omaha, Neb. Address City Clerk.

Mapleton, Iowa.—Until July 15, by city for sewer system to cost $30,000. Address City Clerk.

Spencer, Iowa.—Until July 7, by City Council for constructing sewers in West Fourth, Sioux, West Third and other streets. E. O'Keefe, City Clerk.

Traer, Iowa.—See "Paving and Roads."

Wadena, Minn.—Until July 10, by C. Murray, Village Recorder, for constructing a sewage settling tank, with sludge beds, etc., and approximately 33,300 ft. 6 to 12-in. sewers with manholes, etc.

Jamestown, N. D.—Until June 23, as a whole or separately, by City Council, for constructing sewage treatment plant for certain main sewers and also for furnishing and installing a motor-driven air compressor. Sewage treatment plant to consist of settling tank 30 ft. in diameter, two sludge beds, each 24 ft. wide, piping, etc.; main double trunk sewer 7948 ft. long, etc., and 3784 ft. 15-in. sanitary sewers, etc. J. M. Hansen, City Engr. C. E. McElroy, City Aud.

Houston, Tex.—Until June 19, by E. B. Bonney, City Secretary, for constructing storm sewer on Montrose Boulevard from Main Boulevard to County Farm Road, estimated cost $10,000, and a 42" cast iron sewer from Pumping Station to new North Side Disposal plant, a distance of 14,470 feet. E. E. Sands, City Engineer.

Hartford, Conn.—Following are unit figures of the four lowest bids opened June 6 by Board Contract and Supply for constructing Gully Brook Conduit: (a) O'Neil Brothers, Hartford, $66,027; (b) Antonio Lambo, Waterbury, Conn., $66,402; (c) Charles H. Slocomb & Co., Hartford, $82,766; (d) Long Brothers, Hartford, $87,426. R. N. Clark, City Engineer.

	(a)	(b)	(c)	(d)
840 ft. 9-ft. 6-in. x 8-ft. 9-in. conduit open cut..........	$32.00	$30.00	$33.00	$32.00
90 ft. 9-ft. 6-in. x 8-ft. 9-in. conduit tunnel..............	50.00	40.00	41.00	60.00
176 ft. 8-ft. 8-in. x 8-ft. 6-in. conduit, Sta. 9 + 30 to 11 + 05..........	22.00	33.00	34.00	32.00
1675 ft. 8-ft. 8-in. x 8-ft. 6-in. conduit, Sta. 11 + 05 to 23 + 20 and 23 + 60 to 28 + 20..........	14.00	15.00	23.00	26.00
40-ft. reconstructed conduit in Pliny Street..............	9.00	6.00	12.00	20.00
Connecting 36-in. sewer at Sta. 2 + 35..................	50.00	100.00	100.00	160.00
60 ft. 6-in. and 12-in. drains in present culvert..........	60.00	75.00	60.00	100.00
3 surface water inlets replaced and connected to new conduit in Mather Street and Garden Street........	15.00	150.00	80.00	30.00
Connecting 2 catchbasins in Albany Avenue..............	60.00	180.00	60.00	50.00
2 40-in. inverted siphons in Brook Street rebuilt to grade	300.00	160.00	250.00	250.00
1 inverted siphon in Albany Avenue rebuilt at grade....	1,300.00	500.00	500.00	600.00
1 inverted siphon at Garden Street rebuilt at grade.....	200.00	75.00	100.00	200.00
2000 lin. ft. tile underdrain..............................	0.20	0.40	0.25	0.25
6 manholes in conduit..................................	30.00	50.00	35.00	50.00
1 manhole on Mather Street sewer and 28 ft. of 12-in. tile	160.00	95.00	125.00	150.00
15 house connections connected to new conduit.........	6.00	15.00	5.00	10.00
16 capped 8-in. or 10-in. slants........................	0.50	1.00	1.00	1.00
60 capped 6-in. slants.................................	0.30	0.60	0.50	1.00
100 cu. yd. crushed stone foundation..................	3.00	1.65	4.00	3.00
40 M ft. lumber left in place by order of engineer.......	16.00	35.00	30.00	10.00
50 cu. yd. extra concrete, "A".........................	9.00	10.00	9.00	10.00
4000 lb. reinforcing steel (extra).......................	0.06	0.05	0.06	0.06
Grouting Albany Avenue crossing.......................	600.00	600.00	300.00	300.00

Days, bids at $5 per day: (a) 200, (b) 175, (c) 300, (d) 160.

Toronto, Ont.—Until June 20, by T. L. Church (Mayor), Chmn. Board Control, for constructing sewers in Benson Avenue, Rushton Road and Lane First Street, and paving with asphalt concrete portions of Isabella Street, with bitulithic portions of Moore Avenue, and brick block portions of Lane First Street and concrete walks on Stibbard Avenue and Spruce Hill.

PRICES AND LETTINGS.

★Indicates award of contract.

★Windsor, Conn.—Contract for constructing sewers in Wilson Station section of city awarded A. Lambo of Waterbury at $23,419. Other bidders: F. A. Barnes & Co., Hartford, $29,419, and E. F. Kavanaugh, Wallingford, $38,725.

Brooklyn, N. Y.—Following are four lowest bids opened June 7 by L. H. Pounds, President Borough, for sewer in W. Eleventh Street, estimated to cost $139,510 (bid is on percentage basis): Ward & Fulker, Inc., Brown's Station, N. Y., 104.75 per cent; Ernest A. Weiss, Times Building, New York, 106 per cent; Joseph Kelly, 215 Montague Street, Brooklyn, 118 per cent; J. F. Cogan Company, Woolworth Building, New York, N. Y., 123 per cent.

Following are two bids opened June 7 by L. H. Pounds, Borough President, for constructing superstructure of the sewage pumping station at Morgan and Maspeth Avenues, Section 2 of storm sewer and sanitary sewers in Maspeth and other avenues: Frymier & Hanna Company, 25 West Forty-fifth Street, New York, $60,700; James McArthur Company, Brooklyn, N. Y., $89,353.

★Cooperstown, N. Y.—Contract for constructing sewerage system awarded by Board of Trustees to Chapman & Parshall of Cooperstown, at $18,161.

Newark, N. J.—Following are totals of four lowest bids opened June 13 by Passaic Valley Sewerage Commission, Newark, for Lawrence Street branch intercepting sewer: Culp Company, Inc., Paterson, $48,587; Cenedella & Company, Passaic, $49,556; Harrison & Craig Company, Newark, $49,911, and Carrington Construction Company, Passaic, $61,659.

★Monaca, Pa.—Following are four bids opened recently for constructing sewers: J. B. Reed & Company, Coraopolis, $18,390 (awarded contract); Burns Brothers, $20,040; R. V. Baldwin, $21,077, and J. L. Connor, $25,061.

Dayton, Ohio.—Thomas P. Streck, Cincinnati; Welling & Franz, Cincinnati, and Duff Construction Company, Cleveland, are three lowest bidders on the Dry Hollow Creek sewer requiring 4700 ft. sewer. Engineer's estimate, $103,000.

★East Palestine, Ohio.—Contract for 15 miles of sewers awarded Consolidated Engineering Co., 243 Calvert Building, Baltimore, Md., on a commission basis; estimated cost $150,000.

★Logansport, Ind.—Contract for constructing sewer system in southeast section of city (bids opened June 6) awarded Independent Construction Company, Terre Haute, at $314,987. Other bidders: Inland Construction Company, St. Louis, Mo., $317,156, and M. H. McGovern, Chicago, Ill., $318,519. William Pickett, City Clerk.

Chicago, Ill.—Following are lowest bids opened June 8 by Sanitary Dist. Chicago Trustees for constructing Calumet intercepting sewer: Concrete alternative, Byrne Brothers Dredging & Engineering Company, 208 S. La Salle Street, Contract No. 5, $652,450, and Contract No. 6, $644,306; brick and concrete alternative, Marquette Construction Company, 133 W. Washington Street, Contract No. 5, $700,106, and Contract No. 6, $696,866.

★Lincoln, Kan.—Contract for constructing sewer systems (bids opened June 8) awarded Gordon & Taylor, Denver, Col., at $44,797. Next three bidders: Inter Mountain Bridge & Construction Company, Tecumseh, Neb., $45,414; E. M. Reed, Elgin, Ill., $45,427, and J. A. Pringle, Topeka, $46,724. C. H. Berry, City Clerk.

★Mitchell, S. D.—Contract for constructing trunk sewers (bids opened June 5) awarded J. H. Giese, Mitchell, at $9,847. Thomas Eastcott, City Auditor.

St. Catharines, Ont.—Following are four lowest bids opened June 1 by W. P. Near, City Engineer, for constructing sewer, in all about 5140 ft. (bids opened June 1): John Maguire, Toronto, $64,598; Connolly Agnew Construction Company, Toronto, $66,992; Godson Contracting Company, Toronto, $68,881, and J. H. McKing Construction Company, Toronto, $70,708.

BRIDGES

PROPOSED WORK.

Hartford, Conn.—It is proposed to construct a reinforced concrete bridge across Park River, to cost $18,000. R. N. Clark, City Engineer.

Albany, N. Y.—The state and Delaware & Hudson Co. will replace bridge over Delaware & Hudson Co.'s tracks near Duanesburg with steel and concrete bridge 18 ft. wide. Estimated cost $12,000.

Geneva, N. Y.—Board of Public Works granted permission to Lehigh Valley R. R. Co. (E. B. Ashby, Ch. Engr., 143 Liberty Street, New York, N. Y.) to construct span iron bridge across North Street.

Philadelphia, Pa.—Plans being prepared for bridge to replace present structure across Schuylkill River at South Street. Estimated cost $300,000. The bridge will be of plate girder construction with double leaf bascule span, 80 ft. wide.

Renovo, Pa.—Pennsylvania R. R. (A. C. Shand, Ch. Engr., Philadelphia) reported will construct steel overhead bridge with filled approach at west end of railroad yards in West Ward.

Williamsport, Pa.—City Council and Loyalsock Township Trustees considering constructing concrete bridge over Grafius Run at Rural Avenue Crossing. Address George K. Harris, Supt. Pub. Improv., Williamsport.

Baltimore, Md.—Four bridges are to be constructed by city and Baltimore & Ohio R. R. Co. over Key Highway at Clement Street, Wells Street, Winder Street and at Riverside roundhouse in South Baltimore.

Richmond, Va.—Plans completed by Richmond, Fredericksburg & Potomac Ry. for new 2292-ft. Belt Line bridge. Estimated cost $400,000.

Pascagoula, Miss.—Board of Supervisors will sell July 3 $50,000 bonds for constructing a bridge and trestle across West Pascagoula River and Lake Lowry. Fred Taylor, Chancery Clerk.

Akron, Ohio.—County Commissioners plan constructing concrete viaduct over canal at West Exchange Street. Probable cost $40,000. Address County Clerk.

Cincinnati, Ohio.—County Commissioners approved plans and specifications for bridge over Millcreek on Springfield Pike, in Woodlawn. The State is to pay one-half of the cost, which is estimated at $49,780. The improvement is on Springfield Pike, which is to be part of the Dixie Highway.

Board County Commissioners also approved plans for reconstructing C. H. & D. Railroad bridge over Springfield Pike at Hartwell; estimated cost, $85,000.

Cincinnati, Ohio.—M. B. Case, resident engineer of Arkansas & Memphis Ry. & Bridge Terminal Co., Memphis, Tenn., reported engaged to make preliminary surveys for bridge across Ohio River.

Miamisburg, Ohio.—County Commissioners at Dayton plan constructing 640-ft. three-span bridge at Miamisburg; estimated cost $75,000.

Springfield, Ohio.—Bridge bonds for $41,000 will be sold July 3 by Board County Commissioners. J. M. Pierce, County Auditor.

Terre Haute, Ind.—Reported the Evansville & Indianapolis Ry. Co. contemplates spending about $250,000 in improvements, including roundhouse and bridges; also terminals in Terre Haute.

Saginaw, Mich.—City Council voted to issue $33,000 bonds for Mackinaw bridge. Address City Clerk.

Wahoo, Neb.—It is proposed to construct a five 300-ft. span bridge, steel on concrete foundations, over Platte River, to cost $97,000. Nothing further will be done until appropriation is made by Legislature. Superstructure of bridge may not be contracted for until May, 1917. George E. Johnson, State Engineer, Lincoln.

Dillon, Mont.—Reported Commissioners for Beaverhead and Silverbow Counties will build steel bridge across Big Hole River near Ralston. Estimated cost, $12,000. W. T. George, Engineer of Beaverhead County, at Dillon; Charles M. Feeney, Engineer of Silverbow County, at Butte.

Kansas City, Mo.—Kansas City Terminal Co. (John V. Hanna, Ch. Engr.) will construct viaduct on Holmes Street from Nineteenth to Twenty-first Streets. Estimated cost $135,000.

Pendleton, Ore.—Contract soon to be let by County Commissioners for constructing 2 steel bridges across Umatilla River at Thorn Hollow and Mission, at $27,999. Williard Bradley, County Engineer.

Los Angeles, Cal.—City Council contemplates constructing flood control work and bridges in San Fernando Valley, recently annexed to city; cost about $482,000. Address City Clerk.

San Diego, Cal.—Plans being prepared by George Cromwell, City Engineer, for replacing Thirtieth Street bridge.

Visalia, Cal.—County Bd. of Supervisors directed Byron O. Lovelace, County Surveyor, Visalia, to prepare plans for a 140-ft. bridge over Tule River near Success.

Ottawa, Ont.—The Ottawa Electric Ry. Co. plans to construct a concrete and steel bridge at Rockliffe Park; cost about $6,000.

BIDS DESIRED.

Gorham, Me.—Until June 20, by Board of Selectmen (J. P. Clements, Chmn.) for constructing three concrete bridges known as Strout Bridge, Sanborn Bridge, and Hodgdon Bridge. J. R. Worcester & Co., Engrs.

Holyoke, Mass.—Until June 30, by Board Public Works, for constructing steel and concrete foot bridge crossing the B. & M. R. R. and connecting Dwight Street with Bowers Street and replacing present steel structure advertised in Engineering Record. Oscar C. Ferry, Asst. Clerk.

Easton, Pa.—Reported desired until June 27 by County Commissioners for strengthening and relaying new floor on bridge over Monocacy Creek at Bethlehem. Probable cost $5,620.

Johnstown, Pa.—Until July 5 by Superintendent of Highways for constructing a concrete bridge over Stonycreek River at Central Avenue, connecting Eighth and Seventeenth Wards, advertised in Engineering Record.

Rehoboth, Del.—Until July 11, by Clerk of Peace, Georgetown, for constructing a draw bridge, a concrete pier on pile foundations and a 30-ft. trestle approach over U. S. Canal at Rehoboth, advertised in Engineering Record. Morgan T. Gun, County Road Engineer, Georgetown.

Maryland.—See "Paving and Roads."

Rome, Ga.—Reported desired until June 26, by County Commissioners for constructing two bridges, each 3-span, concrete arch, and about 400 ft. long. W. C. Spiker, Engr., Candler Bldg., Atlanta.

Macon, Miss.—Until July 5 (readvertisement) by John A. Tyson, Clk. Bd. of Co. Comrs., for constructing 2 bridges and some concrete work.

Haddix Station, Ky.—Until June 20 by Alfred Russell, County Clerk, for constructing a bridge over North Fork of Kentucky River at Haddix Station on L. & E. R. R. Bids to be on either a one 150-ft. span and three 70-ft. spans, wooden joists, wooden floor, 16-ft. roadway and concrete substructure; or on a 300-ft. span bridge, L. & N. R. R., and one 60-ft. highway span, wooden floor system and concrete substructure; bids also to be submitted in connection with last proposition on the taking down of the L. & N. R. R. span and loading same on cars and re-erecting same at proposed site.

Columbus, Ohio.—Until July 7, by Board County Commissioners (John Scott, Clk.) for constructing concrete culverts as follows: O'Rourke concrete culvert on Harbor Road, in Sharon and Blendon Townships, on Indianola Avenue in Clinton Township, paving the roadway on superstructure of the Agler bridge over Alum Creek, Miflin Township, Plan A; also same work under Plan B.

Defiance, Ohio.—Reported desired until June 19, by County Commissioners, for constructing two reinforced concrete bridges. R. Daoust, Co. Aud.

Wauseon, Ohio.—Until June 26 by W. W. Ackerman, Co. Aud., for constructing steel bridge on Delta Santee Road over Big Bear Creek in Amboy and Royalton Township, and constructing culverts in German, Gorham and Dover Townships.

Plymouth, Ind.—Until July 5 by County Commissioners for Woods, Downing, Snyder and Albright bridges, all monolithic reinforced concrete, flat top I beam, 10 to 24-ft. spans; also repair of Beltz bridge, monolithic flat top I beam, reinforced concrete, 20-ft. span, and for Rorer box culvert, wire mesh, reinforcing. For further information address Arthur W. Thomson, County Engineer, Plymouth.

El Paso, Ill.—Reported desired until June 22, at the Town Hall, for constructing 11 concrete bridges and culverts in Green Township. A. B. Hurd, County Superintendent of Highways, El Paso.

Geneseo, Ill.—Until June 21 by James H. Reed, County Superintendent of Highways, Cambridge, for constructing 2 reinforced concrete highway bridges at Geneseo, requiring about 38,285 lb. reinforcing steel and 253.5 cu. yd. concrete.

Rockford, Ill.—Reported desired until June 22, by A. R. Carter, County Superintendent of Highways, for constructing several reinforced concrete bridges in Rockford Township.

Salem, Ill.—Reported desired until June 20 by Jos. G. Hayes, Chmn. County Comrs., for constructing bridges and retaining walls.

Granite Falls, Minn.—Reported desired until June 23 for constructing a 40-ft. reinforced concrete deck girder span, 18-ft. roadway on concrete abutments, Norman Township. G. H. Wilson, Co. Aud.

Little Falls, Minn.—Until July 10 (readvertisement), by B. Y. McNally, County Auditor, for constructing bridge in Pierz Township.

Morris, Minn.—Reported desired until July 3 for constructing 40-ft. steel truss span, 18-ft. roadway, reinforced concrete floor, in Peperton Township. C. W. Andert, Town Clerk.

St. Paul, Minn.—Until June 19 by August Hohenstein, Purchasing Agent for reconstructing two north spans of Mississippi Street bridge over Great Northern Ry.

La Moure, N. D.—Reported desired until June 30 for constructing a 2100-ft. span steel bridge, 16-ft. approach at each end, concrete floors. O. C. Temple, Co. Aud.

Martin City, Mo.—Until June 22, by Edw. M. Stayton, County Surveyor, and ex-Officio Highway Engr., Independence, for constructing a 120 ft. reinforced concrete girder bridge, including piers and abutments, about ¾ miles north of Martin City.

Dallas, Tex.—Until June 21 by city for constructing east approach to Commerce Street viaduct. Address R. A. Ferris, Dallas.

Gunnison, Col.—Reported desired until June 24 for constructing a steel bridge 110 ft. long, 16 ft. roadway, over Gunnison River at Sapinero. Roy L. Loddell, County Clerk.

Las Cruces, N. M.—Reported desired until June 20, by James A. French, State Engr. Santa Fe, for constructing five bridges in Dona Ana County.

Spokane, Wash.—Until July 6 by Leonard Funk, Commissioner of Public Works, for constructing bridges, advertised in Engineering Record.

California.—See "Paving and Roads."

San Martin, Cal.—Reported desired until June 19, by Board Supervisors (Harry A. Pfister, Clk.) for constructing reinforced concrete bridge on Columbus Ave.

Santa Barbara, Cal.—Until July 3 by Board of Supervisors for constructing reinforced concrete bridge across Gaviota Creek at Station 148 of State Highway, Fourth Road District; probable cost $15,000. C. A. Hunt, Clerk of Board.

Ventura, Cal.—Until June 28, by County Board Supervisors (J. B. McCloskey, Clk.) for constructing bridges across Sespe Creek, near Fillmore, consisting of 15 30-ft. spans of concrete trestle with timber deck, etc.

Visalia, Cal.—Until July 3, by Board County Supervisors, for constructing reinforced concrete and steel bridges as follows: A bridge 550 ft. long over Kings River south of Kingsburg, estimated cost $29,500; Rockyford Bridge, 160 ft. long, over Tule River, west of Porterville, $10,-

300; a 71-ft. bridge over Elk Bayou, south of Tulare, on State Highway, $4,400, and a bridge 28 ft. long over canal of Elk Bayou Ditch Co., south of Tulare, to cost $1,350. Byron O. Lovelace, County Surveyor.

Toronto, Ont.—Until June 19 by Frank Barber, County Engr., 57 Adelaide Street, East Toronto, for constructing reinforced concrete bridge, consisting of three arches, one 82 ft., and two 62-ft. spans, with 20-ft. roadway, over Humbert River at Catherine Avenue.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Flemington, N. J.**—Contract awarded by Freeholders of Somerset and Hunterdon Counties for constructing line bridge over Lemington River, to Whittaker & Diehl, Harrisburgh, Pa., at $6,497.

★**Irvington, N. J.**—Contract for constructing bridge over Rahway River at Chancelton Avenue awarded by Sixth District Bridge Committee of the Board of Freeholders at Newark to Averill-Matthews Company, 31 Clinton Street, Newark, at $12,879.

★**Lock Haven, Pa.**—Contract for wood block floor on steel stringers on Susquehanna River and Lower Island bridges (bids opened June 8 by County Commissioners) awarded Groton Bridge Co., Groton, N. Y. Bridge across Fishing Creek, near Salona, Pa., awarded T. F. Hungeville of Smethport. W. L. Van Dyke, County Clerk.

★**Canton, Miss.**—Contract awarded by Supervisors of Madison and Yazoo Counties for constructing a steel and concrete bridge across Big Black River, near Flora, to W. T. Young Bridge Co., Nashville, Tenn., at $8,950.

★**Hamilton, Ohio.**—Contract awarded by County Commissioners for constructing concrete bridge at Smith-Stevens farm, Reily Township, to John Conrad, Jr., Hamilton, at $4,900.

Columbus, Ind. — See "Paving and Roads."

★**Kalama, Wash.**—Reported contract awarded by County Commissioners for constructing two bridges near Kelso to Portland Bridge & Iron Co., Portland, at $10,500.

★**Montesano, Wash.**—Contract awarded by County Commissioners for constructing 189-ft. steel span bridge over Humptulips River, with two concrete piers and 2300-ft. pile approach to William Monson, Portland, Ore., at $16,582.

★**Renton, Wash.**—Reported contract awarded by City Council for constructing trestle to D. W. Rutherford, 624 S. M Street, Tacoma, at $8,814.

★**La Grande, Ore.**—Reported contract awarded by Oregon-Washington R.R. & Navigation Co., Portland, for constructing three steel bridges near La Grande to Robert Wakefield, Portland.

★**Roseburg, Ore.**—Contract awarded by County Court for constructing Happy Valley bridge to Portland Bridge Co., Portland, at $11,700.

★**Bakersfield, Cal.** — Following bids opened by Bd. Supervisors June 8 for constructing bridges and culverts on 11 miles of Mohave-Cameron Road, Div. 10, Sect. 10, involving 64,000 cu. yd. excav., 126 cu. yd. concrete, 123 M. ft. creosoted lumber, etc.: Robt. Sherer & Co., 650 Pacific Electric Building, Los Angeles, $27,818 (awarded contract); Mesmer & Rice of Los Angeles, $29,318; George S. Benson & Son of Los Angeles, $29,533; and Coast Constr. Co. of Los Angeles, $43,387.

Following bid opened same time and place as above for constructing concrete pavements, bridges and culverts on 7.56 miles of Taft-Fellows Road, Div. 6, Sect. 2, about 23,500 cu. yd. excav., 39,860 lin. ft. shaping roadbed, 66,680 sq. yd. concrete pavements, 36 M. ft. creosoted lumber and timber required: Coast Constr. Co., 1419 E. Twenty-ninth Street, Los Angeles, $44,766 (awarded contract); George S. Benson & Son of Los Angeles, $49,801, and A. C. McLean Constr. Co. of Bakersfield, $50,548.

★**San Diego, Cal.**—Contract awarded William Ledbetter Company, Pacific Electric Building, Los Angeles, for constructing four pile and steel bridges on San Diego and Arizona Ry. near Tia Juana, one about 75 ft., one 300 ft. and two 200 ft. each.

Montreal, Que.—L. G. Mouchel, Mail Building, Toronto, preparing plans for reinforcing La Salle Bridge over Lachine Canal, Montreal, estimated cost, $94,000 (Hennibique system).

★**Ottawa. Ont.**—Contract for constructing superstructure of Pietoria Avenue Bridge awarded Dominion Bridge Co., Montreal, Que., at $84,158, less $7,680 for automatic gates. Other bidders: Canadian Bridge Co. of Walkersville, $89,857, and Hamilton Bridge Company, Hamilton, at $92.232. H. L. Howe, Secy. Board Control.

★**Arden, Man.**—Contract for constructing concrete bridge over White Mud River awarded Brown Construction Co., Winnipeg, at $5,500. M. E. Broughton, Secy.-Treas.

PAVING AND ROADS

PROPOSED WORK.

Lewiston, Me.—It is proposed to pave on Lisbon and Middle Streets by day labor with 4050 sq. yd. granite block cement and 3940 sq. yd. bitulithic pavement. About 12,000 sq. yd. macadam will also be laid. John A. Jones, City Engineer.

Kittery, Me.—Town plans spending $15,000 for constructing water-bound macadam road. James Walker, Chairman Board of Selectmen.

Biloxi, Mass.—Harrison County to issue $200,000 bonds for roads, $125,000 for Mississippi Centennial Exposition, $100,000 for court house, and $75,000 for high school. Address County Clerk.

Connecticut—Contract soon to be let by State for constructing roads costing $350,000. Address Charles J. Bennett, State Highway Commissioner, Hartford.

Brooklyn, N. Y.—Board of Estimate authorized paving New Utrecht Avenue from Thirty-ninth to Eighty-first Street. Estimated cost $150,000.

Buffalo, N. Y.—Council adopted resolution providing for a bond issue of $103,000 for paving and repaving streets. Address Commissioner Public Works.

Atlantic City, N. J.—City Commissioners will spend about $150,000 for paving number of streets. Address City Clerk.

Burlington, N. J.—Road bonds for $12,000 for Chester Township will be sold June 21 by William H. Rogers, Township Treasurer, Croswicks.

Elizabeth, N. J.—City will pave Elm Street from Morris Avenue to Cherry Street with asphalt concrete, and also is considering resurfacing with this material on various other streets.

Contract about to be let by Bd. of Works for repaving South Broad, Market and South Streets and Madison and Elizabeth Avenues; cost, $286,043.

Contracts will soon be let by Bd. Freeholders for repairs to roads in Fanwood Township and Borough, town of Westfield, Boroughs Garwood and Mountainside, Clark Township, City of Rahway, Borough Roselle and Townships of Linde and Hillside.

Hoboken, N. J.—Street improvement bonds for $65,000 will be sold June 21 by City Commissioners. L. A. Haggerty, City Clk.

Jersey City, N. J.—Reported Hudson County Boulevard Commission, Jersey City, considering the repairing of the boulevard at a cost of $110,000.

Plans to be prepared by Thomas J. Wasser, County Engineer, for improving Paterson Plank Road from Homestead to Secaucus and contract will be let about July 13.

Montclair, N. J.—Bd. of Freeholders, Newark, voted to spend $144,000 for improving Valley Road in Montclair.

New Providence, N. J.—Union County Freeholders will resurface with water-bound macadam road on Springfield Avenue; cost $13,422.

Paterson, N. J.—About $90,000 will be spent for improving Paterson-Hamburg Turnpike and Wanaque Road, in Passaic County. Address County Clerk.

Board of Public Works will repave with gfiranite block on concrete base River Street, from Bridge Street to Erie Railroad tracks. Probable cost $24,000.

Passaic, N. J.—City Commissioners considering sale of $105,000 street improvement bonds.

Trenton, N. J.—Street paving bonds for $72,000 sold. Address City Clerk.

Boyertown, Pa.—About $25,000 is to be spent by city for pavements. Address City Clerk.

Butler, Pa.—County Commissioners plan reconstructing 4 miles of Saxonburg Road to state line with brick pavement.

Cresson, Pa.—Contract soon to be let by County Comptroller Johnstown, for constructing brick paving on highway between Cresson and Edensburg. Cost $25,000.

Huntingdon, Pa.—Reported election will be held soon to vote bond issue for street improvements. Address Borough Clerk.

Johnstown, Pa.—County Supervisors, West Taylor Township, will reconstruct approximately 2½ miles of Laurel Run Road from Johnstown city line. Address C. P. Thomas, Engr., Leader Bldg., Johnstown, Pa.

Spangler, Pa.—Citizens June 9 voted $42,000 bonds for street improvements.

Wilmington, Del.—Reported Street and sewer Dept. considering a bond issue of $200,000 for street paving. About 11 blocks of Market Street to be paved at cost of $60,000.

Cumberland, Md.—Road bonds for $30,000 will be sold July 3 by County Commissioners. Angus Ireland, Clerk County Commissioners.

Princess Anne, Va.—Citizens of Kempsville District voted $130,000 road bonds. Address Clerk of Kempsville District.

Charleston, W. Va.—Citizens of Big Sandy District, Kanawha County, voted $170,000 bonds for road improvements.

New Cumberland, W. Va.—County Road bonds for Clay District will be sold June 10 by Clerk County Court, New Cumberland.

Mt. Airy, N. C.—Citizens of Stewart's Creek Township voted $25,000 road bonds. Address Clerk of Stewart's Creek Township at Mt. Airy.

Warrenton, N. C.—Road bonds for $30,000 will be sold July 3 by Board County Commissioners. P. M. Stallings, Chairman.

Americus, Ga.—City Council authorized the paving of about 9500 sq. yd. with concrete on Lee Street. Address City Clerk.

Atlanta, Ga.—Contracts soon to be let by County Commissioners for paving roads with concrete. Address County Clerk.

Monroe, Ga.—Citizens voted May 28 to issue $500,000 bonds for road improvements. L. R. Waddey, Secy. Chamber of Commerce.

Jacksonville, Fla.—Board of Public Works plans grading and paving Buchanan Street, at $22,680, and Plymouth Avenue, $16,500. Address City Clerk.

Lakeland, Fla.—Citizens voted $2,500,000 bonds for constructing 217 miles of road. Address County Clerk.

Alexander City, Ala.—Contract soon to be let by County Commissioners, Dadeville, for 45 miles of 26-ft. graded highway. W. W. Robinson, County Highway Engineer, Alexander City.

Selma, Ala.—W. O. Crisman of Selma selected engineer for street pavements in Selma. Contract will soon be let for pavements.

Alexandria, La.—Good Road bonds for Rapides Road District No. 6 will be sold July 18 by Police Jury at the Court House, Alexandria.

Corinth, Miss.—Paving bonds for $65,000 will be sold by Board of Supervisors in July. Address Clerk of Board.

Greenville, Miss.—Citizens of county voted $950,000 permanent road bonds. W. P. Kretschmar, Road Commissioner.

Holly Springs, Miss.—It is proposed to pave about 1600 ft. with cement; cost $10,000. Address City Clerk.

District No. 1 Marshall County, will build 20 to 30 miles concrete roads. Contract will not be let before fall or early spring. C. R. Ames, Chairman Highway Commissioners. Walter G. Kirkpatrick, Engineer, Birmingham, Ala.

Pascagoula, Miss.—Board of Supersivors of Districts Nos. 3 and 4 of Jackson County will July 3 sell $40,000 highway improvement bonds. Fred Taylor, Chancery Clerk.

Dyersburg, Tenn.—Contract will be let about the last of June for paving portions of Roberts, Central and Bruce Avenues, Peabody and Fair Streets with concrete, Troy and St. John Avenues and Tucker, Gordon Oak Church and East Church Streets with asphalt concrete or with brick on concrete base, and including storm drainage and concrete curb and gutter, in all about 15,000 ft. curbing and gutter, and 16,000 sq. yd. paving. L. E. Carne, Mayor. Address City Engineer.

Johnson City, Tenn.—The 13,652 sq. yd. asphalt paving and 11,000 ft. curb and gutter (bids for which were to have been opened June 6) has been indefinitely postponed.

Lenoir City, Tenn.—City Council passed ordinances authorizing paving principal streets. Address City Clerk.

Savannah, Tenn.—Citizens June 3 voted $100,000 bonds for highway construction. L. L. Hurburt, County Court Clerk.

Catlettsburg, Ky.—The Fiscal Court sold $100,000 bonds for road improvements.

Georgetown, Ky.—About 35 miles of water bound macadam road will be constructed this year out of the $100,000 bonds recently issued. Joseph B. Ward, County Judge; R. P. DuValle, Engineer in charge, Georgetown.

Lexington, Ky.—Fayette Road Commission will construct 20 miles of improved roadway on four of principal pikes out of Lexington. Bids will be asked on different kinds of paving material. Road improvement bonds for $300,000 were voted last November. Address County Clerk.

Ashland, Ohio.—Paving bonds for $100,000 will be sold July 10 by Board County Commissioners (Henry Greshner, Chmn.).

Batavia, Ohio. — County Engineer instructed to survey county roads as to cost of repairing. Address County Clerk.

Bell Center, Ohio.—Street improvement bonds for $58,000 have been sold. Address Village Clerk.

Cadiz, Ohio.—Paving bonds for $10,000 will be sold July 8 by W. H. Lucas, Village Clerk.

Chardon, Ohio.—County Commissioners sold $35,000 bonds for constructing 5-mile strip of highway across Munson Township. Address County Clerk.

Cincinnati, Ohio.—City Council will shortly authorize issue of $200,000 bonds for resurfacing of Eastern Avenue with granite.

Cleveland, Ohio.—Paving, resurfacing and extensions to streets contemplated by city during 1917, county and property owners, total $11,500,000. Election to be held in city Aug. 8 on issuing $3,500,000 bonds for extending and opening streets. Harry L. Davis, Mayor.

Crooksville, Ohio.—Road improvements bonds for $17,610 will be sold June 26, by Chas. A. Deaver. Village Clk.

Columbus, Ohio.—County Commissioners sold $81,500 Scioto and Darby Road improvement bonds. Address County Clerk.

Defiance, Ohio.—Paving bonds for $59,500 will be sold July 8 by Chester O. Ensign, Co. Aud.

East View, Ohio.—Paving bonds for $29,678 will be sold July 17 by Charles F. Vlk, Village Clerk.

Lima, Ohio.—City Council authorized paving of South Elizabeth, Hughes, Calumet, Lincoln, Ewing, Holly and Liberty Streets, and for repairing asphalt pavements on number of streets. Address City Clerk.

Lorain, Ohio.—Paving bonds for $143,000 will be sold June 29 by County Commissioners (F. L. Ellenberger, Clerk).

Milford, Ohio.—County Commissioners sold $100,000 road bonds.

New Philadelphia, Ohio.—Paving bonds amounting to $44,000 sold. Address City Clerk.

Painesville, Ohio.—Paving bonds for $38,000 will be sold June 22 by Board County Commissioners (W. Albert Davis, Secy.).

Toledo, Ohio.—County Commissioners sold $63,400 road improvement bonds. Address County Clerk.

Vincennes, Ind.—Contract will be let about July 1 by H. T. Watts, City Engineer, for paving S. Seventh Street with asphalt at a cost of $20,000.

Wauseon, Ohio.—Paving bonds for $25,000 will be sold June 27 by County Commissioners. W. W. Ackerman, Co. Aud.

West Alexandria, Ohio. — Street improvement bonds for $23,500 have been sold. Address City Clerk.

Bloomington, Ind. — County Commissioners sold $17,000 road bonds. Address County Clerk.

New Albany, Ind.—City Engineer preparing estimate of cost for paving with creosoted wood blocks Pearl Street from Main to Spring Streets. Address City Clerk.

Winchester, Ind.—County Commissioners sold $26,500 road improvement bonds. Address County Clerk.

Charlotte, Mich.—It is proposed to pave with brick on McClure and Cochran Streets and with cement on Washington Street, including cement combination curb and gutter. Cost $15,000 to $20,000. Claude Chapple, Engineer, Charlotte; Charles R. Youngs, City Clerk.

Lansing, Mich.—See "Sewerage and Sewage Disposal."

Fairfield, Ill.—It is proposed to pave on Main and First Streets with brick about 20,000 sq. yd. at a cost of $57,666. A. Cox, Engineer, Carbondale; E. E. Robertson, City Clerk.

Peoria, Ill.—City Council considering paving 33 blocks; estimated cost $75,563.

Kenosha, Wis.—Citizens of Somers and Pleasant Townships voted $210,000 bonds for improving Sheridan Road. Address Clerks of Somers and Pleasant Townships at Kenosha.

Emmetsburg, Iowa.—City Council ordered construction of 19 blocks of paving, curbing and building gutters. Address City Clerk.

Minneapolis, Minn.—Bonds for $600,000 for the Minnehaha Avenue paving will be sold probably June 21 by Council Ways and Means Committee.

St. Paul, Minn.—The paving of Como Avenue from Great Northern Bridge to Rice Street, including sewer, water and gas connections is contemplated at an estimated cost of $48,985, and also Rice Street from University Avenue to Northern Pacific Ry. Bridge, including sewer, water and gas connections; estimated cost $73,963.

Beatrice, Neb.—Citizens May 31 voted $30,000 bonds for paving. John L. Hershey, Beatrice, Engineer.

Lincoln, Neb.—Plans being prepared for paving with brick East O Street for 2½ miles out of city; width of pavement, 22 ft. Address City Clerk.

Contract to be let by County about July 9 for paving in District No. 15 with brick 18 ft. wide, about 9400 sq. yd. in all; also for paving with brick in District No. 16, about 2 miles, 20 ft. wide. Arthur H. Edgren, County Surveyor.

Pittsburg, Kan.—It is proposed to pave Olive Street and Webster Avenue on concrete foundation. Material for paving not decided upon. L. E. Curfman, City Engineer; Leonard Boyd, City Clerk.

Kalispell, Mont.—Board of County Commissioners will construct trunk highway from Whitefish to Somers, through Kalispell. Probable cost $10,000. A. L. Saunders, County Engineer.

Batesville, Tex.—County Road District No. 3 bonds for $25,000 have been approved by Attorney General.

Corpus Christi, Tex.—Election to be held July 8 to vote on $150,000 bonds for street pavements and completing bluff improvement work.

Kansas City, Mo.—Park Board (T. Harrington, Secy.) voted to construct a double roadway on Swope Parkway, distance of 18 blocks.

Beaumont, Tex.—The Commissioners Court rejected all bids received for constructing following roads: Nome to Liberty County Line, Nome to Hardin County Line, China to Nome and the Beaumont-Port Arthur Highway. Address County Clerk.

Comanche, Tex.—City Council considering paving streets at a cost of $20,000.

San Antonio, Tex.—Road bonds for $250,000 for the construction of the Falfurrias Edinburg link of the "diamond loop" have been submitted to the Attorney General for approval. The greater part of the road from Laredo to Brownsville yet to be constructed. W. H. Gossage, County Judge of Hidalgo County, may be able to give information.

Sinton, Tex.—Election to be held July 8 to vote $100,000 bonds for improving roads in Precinct No. 1, San Patricio County.

Texarkana, Tex.—E. F. Paterson, of Muskegon, Okla., engaged as engineer for paving of 50 blocks in residence district.

Wichita Falls, Tex.—Citizens voted $40,000 bonds for paving. Address City Clerk.

Calvin, Okla.—Citizens, May 27, voted $35,000 bonds for road improvements. Bonds sold. A. J. Johnson, County Clerk. Stuart Township also, May 27, voted $25,000 road improvement bonds.

Aberdeen, Wash.—City Council authorized $25,000 for street paving.

Bellingham, Wash.—Reported County Commissioners passed resolution providing for concrete paving on three miles of Blaine-Ferndale Road. C. M. Adams, County Engineer.

Everett, Wash.—Contract will soon be let for paving with 16-ft. concrete 7-in. thick at crown and 6-in. thick at sides portion of Norton Avenue. Estimated cost $11,135. Hans Mumm, Jr., City Engr.

Contract about to be let by city for paving with concrete and drainage system on Cedar Street, between Hewitt Avenue and Thirty-third Street. Hans Mumm, City Engineer.

Oakville, Wash.—City Council reported considering hardsurfacing Main Street from east and west limits at a cost of $14,403. Lester A. Hughes, City Clerk.

Seattle, Wash.—A. H. Dimock, City Engineer, estimates cost of paving in Bell and Denny's Addition and A. A. Denny's Addition at $21,023, and for concrete curbs on Ranier Avenue at $35,347.

Plans filed for sewers, paving, etc., to be constructed in West McGraw and other streets, at a cost of $109,366. C. Bagley, Secy. Board Public Works.

Contract will soon be let by County Commissioners for paving and graveling about 2 miles of extension of Bond Road No. 20. Estimated cost $12,000. A. P. Denton, County Engineer.

Tacoma, Wash.—All bids opened May 27 by County Commissioners for improving Permanent Highway No. 8 rejected; new bids to be asked. D. H. White, County Engineer.

City Council will pave 2 miles of Pacific Highway, present road will be used as base and will be surfaced with asphalt or some patented paving. Estimated cost $24,000.

Medford, Ore.—Citizens, May 23, voted $300,000 bonds for road construction. Elmer T. Foss, City Clerk.

Portland, Ore.—Plans filed by City Commissioner for paving East Oak Street, from East Water Street to Union Avenue. Estimated cost, $18,486. Address City Clerk.

Roseberg, Ore.—All bids opened recently for paving Edenbower Road have been rejected. New bids to be asked. Frank Cain, County Engineer.

Los Angeles, Cal.—Board of Supervisors propose paving Lexington and Gallitin Road 3.6 miles, Artesia Avenue 2.7 miles and Mint Canyon Road 22 miles; earth excavation 193,000 cu. yd.; in all about 232,993 sq. yd. concrete. Cost $468,970. F. H. Joyner, Engineer, 1104 Hall of Records.

Contract will be let about July 1 for paving with Warrenite on Yucca Street, with asphalt on Ceres Avenue; concrete pavements on Sunset Drive; cement walks on Monroe Street and Vestal Avenue.

Contract will be let about Aug. 1 for asphalt pavements on Oliveria, Sanchez and Arcadia Streets and Boyle Avenue, about eight blocks. Homer Hamlin, City Engineer.

Bd. of Supervisors directed F. H. Joyner, Road Commissioner, to complete specifications for construction first section of Harbor Truck Boulevard from Los Angeles to Compton, about 10 miles, to be 24 ft. wide, 8-in. broken granite rock foundation and 8-in. concrete base and a paved wearing surface; cost about $145,000.

Merced, Cal.—City Council directed C. D. Martin, City Engineer, to prepare plans and specifications for paving about 15 blocks of streets and 40 blocks of alleys with concrete base and bituminous wearing surface.

Pasadena, Cal.—Reported Pacific Electric Ry. will pave N. Lake and B. Fair Oaks Avenue, 2 or 3 miles on its right-of-way.

Placerville, Cal.—Citizens voted $30,000 bonds for paving Main St. Address City Clerk.

Santa Paula, Cal.—About 25 blocks will probably be paved this summer. Address Edward M. Lynch, City Engineer, Glendale.

Tulare, Cal.—City Council voted to pave about 20 blocks with concrete base and Topeka surface; contract to be let about August.

Flagstaff, Ariz.—J. W. Weatherford granted permission by U. S. Dept. of Agriculture to construct a scenic highway from Flagstaff to summit of San Francisco peaks, 14,000 ft. high. Road to be 14 miles 900 ft. long, constructed of bedded decomposed granite.

Tucson, Ariz.—City Council considering paving on Ott, Alameda, Court and Myers Streets, at cost of $12,000. L. O. Cowan, City Clerk.

Winslow, Ariz.—Work will begin about June 25 on construction of Winslow-Long Valley Highway. Address O. N. Powell, Highway Engineer, U. S. Forest Service, Albuquerque, N. M.

Buhl, Idaho.—Buhl Road District plans macadamizing fifty or sixty miles or road after grading and constructing concrete bridges and culverts. Address Clerk of Buhl Road District at Buhl.

Burley, Idaho.—William F. Long, Engineer with Portland Cement Association submitted report to City Council for paving with reinforced concrete certain city streets at estimated cost of $42,623.

Ingersoll, Ont.—W. R. Smith, Ingersoll, will prepare plans and award contract for reinforced concrete pavement to cost $35,000.

Lindsay, Ont.—Council contemplates laying asphalt and concrete pavements to cost about $30,000.

Edmonton, Alta.—City Engineer A. Haddow will purchase plank for sidewalk purposes, to cost $20,000.

BIDS DESIRED.

East Hartford, Conn.—Until June 21 by Frank Roberts, 1st Selectman, for macadamizing Forbes and Silver streets, Hillstown Road and Naubuc Avenue. C. Henry Olmsted, Borough Engineer.

Albany, N. Y.—Until June 19 by Board Contract & Supply (Isidore Washman, Secy.) for paving portions of Lark Street, portions of Broadway and Pruyn Street with redressed granite blocks on concrete foundation, and portions of Morris Street with vitr. shale blocks on concrete foundation, Krank Street with old granite blocks. Total cost approximately $29,000.

Brooklyn, N. Y.—Until June 21, by L. H. Pounds, Borough President, for paving portions of Bay Thirty-first, Center, Congress and numerous other streets, in all about 38,475 sq. yd. asphalt, 2435 sq. yd. asphalt block, 4500 sq. yd. granite, together with curbing, sidewalks, etc. Total security, $51,800.

Long Island City, L. I., N. Y.—Until June 22 by Maurice E. Connolly, Pres. Queens Borough, for regulating, recurbing and repaving with asphalt concrete portions of Sixth Avenue, Second Street and Tenth and other streets, in all about 47,620 sq. yd., and with sheet asphalt portions of Jerome Avenue, about 17,800 sq. yd. and laying sidewalks Woodbine Street, Banks Avenue and other streets. Total security, $92,000.

Malone, N. Y.—Until June 26 (readvertisement) by George A. Willson, Deputy Village Clerk, for brick paving on East Main Street, advertised in Engineering Record.

New York, N. Y.—Until June 20, by Douglas Mathewson, Pres. Bronx Borough, for paving with bituminous concrete foundations portions of Harrison Avenue, with curbs, etc., to consist of 11,295 sq. yd. bituminous concrete pavement, 6570 lin. ft. curb, etc. Security $7,300.

Yonkers, N. Y.—Until June 19 by Board Contract and Supply (Edw. P. Walsh, Secy.) for improving portions of North Broadway; also for constructing sidewalks, etc., in First Avenue. Also same time and place for constructing sewer in Fairview Avenue.

Newark, N. J.—Until June 27, by Board of Freeholders for paving with Warrenite Broad Street, Bloomfield, Springfield Avenue in South Orange Township, and Millburn and Morris Turnpike, Millburn. Freeholders will sell $75,000 bonds to pay half the cost of paving and the State will pay the other half.

Princeton, N. J.—Until July 5, by Mayor and Council for reconstructing Nassau Street with 2 in. asphalt block surface upon a 6 in. concrete foundation about 19,940 sq. yd. George M. Brown, Engineer, Princeton. V. B. Cook, Borough Clerk.

Jersey City, N. J.—Until June 20 by Board Chosen Freeholders for improving portion of Newark Turnpike; cost $20,000.

Woodbury, N. J.—Until June 29, by Arthur Starr, City Clerk, for street improvements, advertised in Engineering Record.

Beaver Falls, Pa.—Until July 10 by Borough Clerk for paving Seventh Avenue; approximate cost $25,000.

East Vandergrift, Pa.—Until June 31 by borough (Marcus B. Nadler, Secy.) for improving McKinley Avenue; cost approximately $15,000. L. G. Anderson, Boro. Engr., Vandergrift.

Easton, Md.—Until June 27 by County Commissioners (Jos. B. Harrington, Clk.) for constructing a section of State Aid Highway in Talbot County, along Peachblossom Road, a distance of about 2 miles. Frank W. Seth, County Road Engr.

Maryland.—Until June 27 by State Roads Commission, 601 Garret Building, Baltimore, for constructing 5 sections of state highway aggregating 21.4 miles, also until July 5 for 8 sections aggregating 28.83 miles; both proposals advertised in Engineering Record.

Greenville, N. C.—Until July 6 by Mayor and Board of Aldermen for street improvements advertised in Engineering Record. Engineer, Gilbert C. White, Durham, N. C.; J. C. Tyson, City Clerk.

Canton, Miss.—Until June 22 (extension of date from June 12, for about 5300 sq. yd. paving, 4 miles gravel macadam, 2 miles concrete curb and gutter and ½ mile storm sewers. Walter G. Kirkpatrick, Engineer, Birmingham, Ala.

Lexington, Miss.—Until July 3 for constructing 27 miles of macadam roads in Durant District. Snowden & Hauser, Engineers, Jackson.

Louisville, Miss.—Until July by Board of Supervisors for building 100 miles of roadway, steel 1000 ft. more or less, 5000 lin. ft. concrete for bridges and culverts and 25 M ft. lumber for bridges, piping for culverts, etc. Carl B. Bathea, Secy.

Winona, Miss.—Until July 5 for constructing 18 miles of road. Snowden & Hauser, Engineers, Jackson, Miss.

Rogersville, Tenn.—Reported desired until July 6 by County Road Commission for improving about 90 miles of road, to consist of 500,000 cu. yd. excav. road of limestone macadam, and to include concrete and steel bridges and culverts: estimated cost $450,000. S. C. Cornell, Chief Engineer.

Covington, Ky.—Until June 22 by Fiscal Court, Court House, Covington, for improvement of Covington and Lexington Turnpikes, State Aid Road in Kenton County, advertised in Engineering Record. John B. Dillon, County Clerk.

Danville, Ky.—Until July 4, for paving, advertised in Engineering Record. J. M. Wallace, Mayor.

Georgetown, Ky.—Until June 20 by W. H. Gates, County Clerk, Georgetown, for constructing State Aid Roads Nos. 105A1, 105B1, 105C1, 105D1, 105E1, 105F1, and 105G1, in Scott County, as follows: Georgetown and Cincinnati, 8.75 miles, 14,015 cu. yd.; Stamping Ground and Owenton, 4.5 miles, 5868 cy. yd.; Georgetown and Frankfort, 5.75 miles, 10,494 cu. yd.; Georgetown and Lexington, 3.44 miles, 6278 cu. yd.; Georgetown and Paris, 4 miles, 7300 cu. yd.; Georgetown and Old Oxford, 4.22 miles, 4199 cu. yd.; and Depot, 1.75 miles, 1521 cu. yd. R. C. Terrell, Commissioner Public Roads, Frankfort.

Louisville, Ky.—Until July 3 (readvertisement) by County Clerk for grading in Winston County.

Seymour, Ky.—Reported desired until July 3 by County Commissioners for improving three roads with concrete, two with waterbound macadam, and one with gravel. A total of 12 miles is included in the specifications. Two miles of concrete highway will include city streets. These roads, with three other concrete roads, are estimated to cost $225,000.

Cincinnati, Ohio.—Until July 7, by County Commissioners (Albert Reinhardt, Clerk), on improvement of Reading Road through the village of Reading. County Surveyor William Boeh submitted following estimates: Warrenite paving, $83,925; asphaltic concrete, $89,99. ; concrete, $71,532.86. The material to be selected after the bids are received.

Cleveland, Ohio.—Until June 28 by County Commissioners for improving Sect. A of the Cleveland-Elyria Road in Rockport Township, length 1.25 miles; estimated cost $3,976. Also separate bids same time and place for improving Sect. B of the Cleveland-Massillon Road, Independence Township, length 3000 ft.; estimated cost $13,348. Also for repairing Sect. B of the Rocky River-Berea Road, in West Park and Missleburg Townships, length 2500 ft.; cost $11,665. .. ..

Cuyahoga Falls, Ohio.—Reported desired until June 19 by W. F. Williston, City Clerk, for 32,000 sq. yd. brick pavement on Broad Street and Northampton Avenue and about ½ mile of sewers in Northampton Avenue.

Elmore, Ohio.—Reported desired until June 19 by Wm. Haley, Village Clerk, for improving Augusta and Lytle Sts.

Galion, Ohio.—Until June 19, by Director Public Service for paving Erie and Gill Streets.

Jefferson, Ohio.—Until June 19, by Board County Commissioners (R. E. Brainard, Clk.) for improving portions of Wayne Road, Main Market Road and Williamsfield Road No. 1.

Lisbon, Ohio.—By County Commissioners for paving as follows: Until June 20 for about 13 miles, costing $217,447; until June 21, about 20 miles, costing $251,786, and until June 22, about 10 miles, cost $96,167, advertised in Engineering Record. H. C. Armstrong, County Surveyor and Highway Superintendent; L. H. Johnson, Clk. County Highway Dept.

Marysville, Ohio.—Reported desired until June 22 (I. T. Southard, Village Clk.) for improving portions of Cottage Street, Wall Alley and Ash Street.

Salem, Ohio.—Until June 27, by Director Public Service, for paving East Seventh Street, with vitr. brick on concrete base, all about 4534 sq. yd. brick paving, 3030 lin. ft. drain tile, 2820 cu. yd. excav. together with curbing, etc. Also separate bids same time and place for constructing sewers in Green Street.

Youngstown, Ohio.—Until June 26 by County Commissioners (Frank V. Hogna, Clerk) for improving Sect. No. 1 of Jacobs Road with brick, a distance of 5735 ft. Bids desired separately on material.

Indiana.—By County Commissioners for constructing county roads as follows:

Until June 24:

Muncie, for constructing two macadam roads in Center Township. F. M. Williams, Co. Aud.

Until June 29:

Winchester, constructing roads in Green and West River Townships. C. E. Tilson, Co. Aud.

Evansville, constructing two roads in Union Township. C. P. Beard, Co. Aud.

Until July 3:

Jeffersonville, road in Jeffersonville Township. Geo. W. Stoner, Co. Aud.

Greencastle, road in Washington Township. Joe M. Allen, Co. Aud.

Franklin, constructing road in White River Township. John C. Gregg, Co. Aud.

Kentland, constructing three macadam roads in Beaver Township and one road in Jefferson Township. S. R. Sizelove, Co. Aud.

Until July 5:

Mt. Vernon, constructing roads in Posey and Vanderburg Townships. Jos. R. Haines, Co. Aud.

Plymouth, Ind.—Until July 5 by County Commissioners, for Road No. 1 in North Township, length 7.151 miles, engineer's estimate $31,209, and Road No. 2, North Township, length 5.538 miles, cost $20,946; both gravel roads. Arthur W. Thomson, County Engineer.

Winchester, Ind.—Until July 1 by County Commissioners for repairing and constructing 11 bridges. Charles E. Tilson, Co. Aud.

Harvard, Ill.—Until June 26 by C. J. Hendricks, President Board Local Improvements, for paving with asphalt concrete on North Ayer Street, 38,800 sq. yd., cost $73,607: 3750 sq. yd. on South Ayer Street, to cost $6,106; cement concrete on Alleys 6 to 12 and Alleys 5 to 13, cost $1,786 and $1,745 respectively, advertised in Engineering Record.

Burlington, Wis.—Reported desired until June 30, for 7600 sq. yd. macadam, 8300 yd. asphaltic concrete, 7800 yd. grading, etc. Address City Clerk.

Racine, Wis.—Reported desired until June 20, by James Mutter, County Highway Commissioner, for 15,167 sq. yd. of concrete pavement, in Caledonia.

Fremont, Mich.—Until June 19 by city for paving with reinforced concrete portions of Division and Merchants Avenues, approximately 10,000 sq. yd., with curbing, etc. Jas. R. Rumsey, Engr., Grand Rapids.

Gladwin, Mich.—Reported desired until June 22, by D. W. Hunter, Secretary County Road Commissioner, for surfacing 6 miles of Meridian Trunk line highway with crushed stone, also 24 miles of Meridian trunk line highway with clay and sand.

Grand Ledge, Mich.—Until June 23 by R. N. Nott, City Clerk, for paving.

Ypsilanti, Mich.—Until June 19 by Sumner Damon, City Clerk, for paving portions of Forest Avenue with 5-in. concrete and 2-in. asphalt.

Avoca, Iowa.—Until June 26 for ten blocks paving and curbing. Bids on both brick and concrete. J. H. Mayne, Engineer, Merriam Block, Council Bluffs, Iowa.

Des Moines, Iowa.—Reported desired until June 21, by Horace Susong, City Clerk, for 17,752 sq. yd. pavement on portions of Washington Avenue, West Fifty-third, Ninth, and other streets, bids to be submitted on sheet asphalt, bitulithic and asphaltic concrete.

Muscatine, Iowa.—Reported desired until June 22 by City Engineer, for street paving, probable cost $145,000.

Traer, Iowa.—Until June 26 by T. F. Stoakes, Town Clerk, for paving, including 6938 lin. ft. combined curb and gutter, 15,800 sq. yd. paving, etc.; also until June 27, separate bids for 4640 lin. ft. 6 to 10-in. vitr. pipe sewer, 10 manholes, etc.

Kansas City, Kan.—Reported desired until June 26, by Frank Holcomb, Co. Clk., for paving portions of Twenty-first Street and Steele Road.

Peabody, Kan.—Until June 20 by city for 20,000 sq. yd. brick, asphaltic concrete or concrete paving. G. L. McLane, Consulting Engineer, Hutchinson, Kan.

Minot, N. D.—Reported desired until June 19 for 25,000 sq. yd. paving. Probable cost $85,000. E. J. Thomas, City Engr.

Fulton, Mo.—Until July 6, by city, for approximately 2000 sq. yd. bituminous macadam and 1450 lin. ft. concrete curb. F. E. Baker, City Engineer.

Independence, Mo.—Until June 21, by County Surveyor Edw. M. Stayton, for grading, draining and macadamizing Kentucky Avenue, in all about 20,840 sq. yd. macadam, 17,400 cu. yd. excav., 1800 sq. yd. riprap, etc.

Kansas City, Mo.—Until June 20 by Board Public Works (J. Pearce Kane, Secy.) for paving with sheet asphalt portions of Prospect Avenue, Forest Avenue; with Portland cement concrete portions of Eighth, State streets; asphaltic concrete on Chestnut, Wayne avenues and Tenth Street, and artificial stone sidewalks on Fifty-ninth and other streets.

St. Louis, Mo.—Reported desired until June 27 by Board of Public Services, for improving portions of Gilmore Avenue, West Park Avenue, Forest Avenue, and other alleys. Estimated total cost, approximately, $63,703.

Fort Worth, Tex.—Until June 20 (extension of date), by M. R. Harwood, Jr., City Secretary, for paving about one mile of streets.

Houston, Tex.—Until June 19, by E. B. Bonney, City Secretary, for paving Montrose Boulevard, from Richmond Street to Main Boulevard with sheet asphalt, asphaltic concrete, Portland cement concrete, bitulithic or Uvalde rock asphalt, approximately 16,800 sq. yd. E. E. Sands, City Engineer.

Everett, Wash.—Until 10 a. m., June 26, by Mae Weatherbee, County Engineer, for constructing five highways; road from Monroe to Sultan West, cost $17,000; road from Arlington to Cooper Spur, cost $9,000 included.

Pullman, Wash.—Until June 20 by M. F. Gannon, City Clerk, for 6500 sq. yd. bituminous macadam paving on Grand Street. L. V. Edwards, Engineer, State College.

California.—Until June 26, by State Highway Commission, 515 Forum Building, Sacramento, for constructing roads as follows and paving with Portland cement concrete unless otherwise stated:

San Mateo County, from Beresford to Redwood City, about 4.2 miles. Engineer's estimate 2790 lin. ft. cor. metal pipe, 31,000 cu. yd. excav. without classification, 6850 cu. yd. Portland cement concrete, Class A (pavement), 1000 lin. ft. guard rail, etc.

Ventura County, from Springville to Santa Clara River, about 5.6 miles. Engineer's estimate 27,330 cu. yd. excav., 5510 cu. yd. pavement (Class B), etc.

Contra Costa County, from southerly county boundary to Richmond, about 2.5 miles, with Portland cement concrete base and asphalt wearing surface. Engineer's estimate 11,000 cu. yd. excav. without classification, 4400 cu. yd. pavement (Class C), 31,500 sq. yd. asphalt surface, etc.

Humboldt County, from Loleta to Beatrice, about 4.3 miles. Engineer's estimate 8500 cu. yd. excav., 4750 cu. yd. pavement (Class B).

Shasta County, between Baird and Antler, a reinforced concrete bridge about 120 ft. long, across Salt Creek, and a reinforced concrete bridge about 541 ft. long across Sacramento River.

Los Angeles, Cal.—Until July 3 by Board of Supervisors for grading and paving Section G of Mint Canyon Road, 11.82 miles, approximate quantities: 91,225 cu. yd. excav., 59,783 sq. yd. concrete pavement, 10,950 lb. reinforcing steel, 27,800 ft. guard fence, etc. Estimated cost $91,613. A. M. McPherrin, Clerk of Board.

Ventura, Cal.—Until June 27, by Board County Supervisors (J. B. McCloskey, Clk.) for grading, constructing concrete pavement 8.57 miles on Div. 10, Oxnard to Camirillo, approximately 19,000 cu. yd. excav., 45,263 lin. ft. shaping, 8956 cu. yd. concrete pavement, etc. Also separate bids for grading and culverts on 8 miles of Div. 9, Moorpark to Simi, approximately 42,000 cu. yd. excav., etc.

Phoenix, Ariz.—Until June 20 (by V. A. Thompson, Supt. Streets) for paving N. Second Avenue, McKinley, Filmore, Portland streets and Fifth Avenue.

Salt Lake City, Utah.—Reported desired until July 5, by Board Public Works (J. W. Layne, Secy.) for paving 21,000 sq. yd. with vitr. brick, resurfacing 12,000 sq. yd. old macadam with modified sheet asphalt, 10,000 lin.ft. curb. C. R. Horn, Salt Lake City.

Toronto, Ont.—See "Sewerage and Sewage Disposal."

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Bangor, Me.**—Contract for bituminous macadam on Main Street, to cost about $29,000, awarded Small & Ingalls, Bar Harbor, and Murtagh Hughes, Bangor.

Albany, N. Y.—Following are new bids opened June 7 by State Highway Commission, 55 Lancaster Street, for improving by State aid public highways:

Road No. 1366, Van Scoters Corners-Canaseraga-Garwoods, Allegany County, 6.88 miles (4 lowest bids): T. H. Gill Co. of Binghamton, $70,460; Bison City Engineering & Contracting Co. of Buffalo, $71,775; Wm. H. Madden of Rochester, $72,933; Cold Spring Construction Co. of Buffalo, $74,303.

Road No. 1368, Summer Hill-Cortland, Part 3, Cortland County, 2.08 miles (two bids submitted), Rossney Contr. Corp. of Buffalo, $22,183; Hendrickson-McCabe Constr. Co. of Spencerport, $23,040.

Road No. 1369, Truxton-Apulia, Part 1, Cortland County, 2 miles (three bids submitted), F. L. Breese of Elmira, $21,000; Hendrickson-McCabe Constr. Co. of Spencerport, $22,846, and Rossney Contracting Corp. of Buffalo, $22,981.

Road No. 5549, Wappingers Falls Village, Main Street, Dutchess County, .88 mile (3 bids submitted), Jos. Heisler & Frank Guillott of Schenectady, $34,816; Fallkill Constr. Co. of Poughkeepsie, $35,605, and Sewage Disposal & Water Plant Co. of Schenectady, $39,139.

Road No. 5580, Amenia-Pine Plains, Part 1, Dutchess County, 6.97 miles (two bids submitted), John De Michael & Bro. of Torrington, Conn., $86,477, and Mascetti & Holley of Torrington, Conn., $87,795.

Road No. 5523, Wells-Speculator, Part 2, Hamilton County, 6.74 miles (3 bids submitted), Hovey Benedict of Williamsport, Pa., $93,937; John B. Dower of Ballston Spa, $106,974; and Hassam Paving Co. of Worcester, Mass., $145,911.

Road No. 1362, Vanhornesville-Starkville, Herkimer County, 5.84 miles (only bidder), John B. Dower of Ballston Spa, $67,602.

Road No. 1255, Cape Vincent-Clayton, Jefferson County, 14.05 miles (4 lowest bids), Henry P. Burgard of Buffalo, $145,895; Pathfinder Constr. Co. of Fulton, $147,185; F. H. Rhodey of Albion, $152,140, and Mascetti & Holley of Torrington, Conn., $153,311.

Road No. 1350, Nunda-Dalton, Livingston County, 3.42 miles (4 bids submitted), Wm. H. Madden of Rochester, $39,948; Cold Spring Constr. Co. of Buffalo, $40,961; Frank J. Foote of Nunda, $43,181, and Thomas Grady of Rochester, $43,716.

Road No. 1360, Munnsville-Pratts Hollow-Pine Woods, Madison County, 6.54 miles (one bid), Paddeford & King of Sherburne, $67,332.

Road No. 800, Youngstown-Lockport, Part 1, Niagara County, 7.79 miles (3 bids submitted), Rich Constr. Co., Inc., of East Aurora, $111,382; Wm. F. Fulton of Buffalo, $111,803; and J. F. Mumm Contr. Co. of Buffalo, $119,693.

Road No. 95A, Middletown-Goshen, Orange County, .11 mile (lowest bid), Schunnemunk Constr. Co. of Highland Mills, $1,532.

Road No. 499, Middletown-Montgomery, Orange County, 9.18 miles (3 bids submitted), Frank Salvucci of West Hurley, $101,370; Edward P. Arbogast of Stroudsburg, Pa., $105,037; and John A. Jova, Inc., of Newburgh, $114,842.

Road No. 1329, Goshen Village, Orange County, 3.7 miles (4 bids), Wm. J. Kidd of New York City, $47,270; John S. Turner of Mt. Vernon, $53,938; Abner M. Harper, Inc., of Newburgh, $54,684; and Schunnemunk Constr. Co. of Highland Mills, $57,334.

Road No. 1340, Grant Corner-Rundall Corner-Bailey Corner-State Line, Westchester County, 4.25 miles (no bids received).

Road No. 1341, Weaver Street, Westchester County, .35 mile (lowest bid), Wm. F. McCabe Constr. Co., Inc., White Plains, $3,720.

Road No. 1309, Peekskill-Putnam County Line, Westchester County, 6.63 miles (only bidder), William J. Kidd, New York City, $66,079.

Rep. Con. No. 950, Roads Nos. 476 and 651, Clinton County, 5.81 miles (4 bidders), Spellman-Oliver Co. of Chateaugay, $29,316; Keeseville Roads Co. of Keeseville, $30,389; Flood & Van Wirt Co. of Hudson Falls, $30,981, and James Conway of Plattsburg, $33,661.

Rep. Con. 945, Road No. 362, Fulton County, .59 mile (lowest bid), John P. Dugan of Amsterdam, $3,753.

Rep. Con. 940, Road No. 586, Genesee County, 1.04 miles (lowest bid), Sweeney & Boland of Rochester, $3,638.

Rep. Con. No. 922, Road Nos. 886, 997 and 5491, Greene County, 15.5 miles (lowest bid), John T. O'Neil of Troy, $6,106.

Rep. Con. No. 957, Roads Nos. 100 and 101, Monroe County, .84 mile (4 lowest), Whitmore, Rauber & Vincinius of Rochester, $35,108; Schroeder-Hicks Co. of Rochester, $35,325; Michael H. Ripton of Rochester, $35,345; Sewage Disposal & Water Plant Co. of Schenectady, $38,667.

Rep. Con. No. 938, Road No. 399, Monroe County, 1.43 miles (lowest bid), Crouch Bros. of Rochester, $7,847.

Rep. Con. No. 944, Road No. 107, Montgomery County, 3.64 miles (4 lowest bids), Richard Hopkins of Troy, $15,415; Brady-Oltarsh Constr. Co., 49 West 140th Street, New York City, $15,455; D. I. Snell & Co. of Canajoharie, $15,638, and Alfred H. Flinn of Albany, $15,983.

Rep. Con. No. 942, Road No. 120, Montgomery County, 4.14 miles (lowest bid), H. D. Lavery of Fort Plains, $6,607.

Rep. Con. No. 937, Roads Nos. 434, 435 and 547, Nassau County, 1.27 miles (no bids received).

Rep. Con. No. 943, Road No. 3, Oneida County, 1.25 miles (no bids received).

Rep. Con. No. 958, Roads Nos. 139 and 271, Oneida County, 4.59 miles (4 bids submitted), Richard Hopkins of Troy, $24,819; Flood & Van Wirt Co. of Hudson Falls, $25,171; Charles O. Macomb of Syracuse, $25,266, and J. H. Weidman of Syracuse, $25,535.

Rep. Con. No. 948, Road No. 521, St. Lawrence County, .6 mile (only bidder), Richard Hopkins of Troy, $11,481.

Rep. Con. No. 951, Road No. 5086, Schoharie County, 5.02 miles (4 lowest bids), Gleason & Davitt of Albany, $25,856; H. A. Murphy of Albany, $27,217; Richard Hopkins of Troy, $27,636, and C. S. Mathusa of Albany, $28,921.

Rep. Con. No. 955, Road No. 5208, Schuyler County, 1.48 miles (lowest bidder), McGreevey, McGuigan & Baum Constr. Co. of Elmira, $8,502.

Rep. Con. No. 936, Road No. 907, Steuben County (4 bids submitted), McGreevey, McGuigan & Baum Constr. Co. of Elmira, $20,766; Dale Engineering Co. of Utica, $21,590; Kennedy Constr. Co. of Albany, $22,111, and Steuben Constr. Co. of Hornell, $22,349.

Rep. Con. No. 935, Roads Nos. 906 and 5254, Steuben County, 2 miles (lowest bid), McGreevey, McGuigan & Baum Constr. Co. of Elmira, $11,584.

★**Batavia, N. Y.**—Contract awarded by City Council for paving Ellicott Street with brick to Thomas Holahan, Rochester, at $51,156.

Rome, N. Y.—Warren Bros. Company, Boston, submitted to Bd. Pub. Wks. following bids for paving with bitulithic: W. Park Street, $11,573; Parry Street, $7,185; E. Bloomfield Street, $7,113; Roberts Street, $10,263; W. Bloomfield Street, $5,417; W. Thomas Street, $10,197; E. Thomas Street, $9,260.

Troy, N. Y.—Following bids opened by Board of Contract and Supply for paving Excelsior Avenue with (a) Hassam bicomac, (b) concrete, (c) asphalt, (d) bituminous concrete, (e) vitrified brick: Hassam Paving Co., Worcester, Mass., (a) $7,727, (e) $11,807; John W. Davitt, Troy, (b) $9,309, (c) $10,533, (d) $1,117; Edward Walsh, Troy, (b) $8,061, (e) $12,821.

★**Morristown, N. J.**—Following are four lowest bids opened June 7 by Board of Freeholders for improving 3 miles of Hanover-Whippany Road: Miles Tigue Company, Easton, Pa., $46,202; Gray Construction Company, Morristown, $51,462; Osborn Marseilles Company, Montclair, $58,336; and S. B. Twining, $74,136.

Harrisburg, Pa.—Lowest bids opened recently by W. H. Lynch, Commissioner of Streets, for year's supply of asphalt for city's repair plant submitted by Atlantic Refining Company, 3144 Passyunk Avenue, Philadelphia, at $17,377 per ton.

★**Manheim, Pa.**—Following are three bids opened June 6 by Town Council (H. M. Ensminger, Secretary) for 17,000 sq. yd. concrete paving: J. B. Shreives & Company, Manheim, $22,007 (awarded contract); J. N. Fritchey & Son, Lancaster; $27,387, and T. Miller Eshleman, Landesville, $35,500.

★**New Wilmington, Pa.**—Contract for paving eleven sections of streets (bids opened June 6) awarded E. A. Freshwater & Sons, Chester, W. Va. William M. Elwee, Jr., Borough Secretary.

★**Pennsylvania.**—Contracts awarded by State Highway Department, Harrisburg, for paving (bids opened June 13) as follows:

★One mile of vitr. block pavement in Rochester Township, Beaver County, 22 ft. roadway: J. G. McGuire Company, New Brighton, $28,744 (awarded contract); Ridge Brothers Company, Pittsburgh, $32,170; R. D. Hunter & Co., Beaver, $37,819, and W. C. Simpson, Punxsutawney, $37,456.

★State Highway Route No. 131, Delaware and Chester Counties, Old Baltimore Pike Section 4, Birmingham Township, Delaware County, 14,535 ft., lowest on various materials The Juniata Company, Philadelphia, reinforced cement concrete, $47,566 (awarded contract); Newton Paving Company, Trenton, N. J., sheet asphalt, $50,266; Paul J. Snyder & Company, Philadelphia, amiesite, $50,886, and William C. Evans, Ambler, filbertine, $59,846.

Section 5, in Chester County, 17,795 ft., lowest on various materials: Neff Horn & Company, Slatington, reinforced cement concrete, $59,973; Dwyer & Company, Philadelphia, Warrenite, $72,488; Newton Paving Company, Trenton, N. J., sheet asphalt, $63,301; Paul J. Snyder & Company, Philadelphia, amiesite, $62,289.

★Section 9, Chester County, 21,035 ft. reinforced cement concrete pavement: Sutton & Corson, Ocean City, $61,040 (awarded contract); Juniata Company, Philadelphia, $61,475; John C. Bentley, Elizabeth, $63,282; and Souder Construction Company, Inc., Lancaster, $64,759.

Montgomery County, Whitemarsh Township, for a 16 ft. roadway, 4390 ft.: Eastern Paving Company, Philadelphia, sheet asphalt, $17,055; Wm. G. Evans, Ambler, filbertine, $16,986; Dwyer & Company, Philadelphia, Warrenite, $19,934, and Paul J. Snyder & Company, Philadelphia, amiesite, $15,502.

No bids received on vitrified block pavement, 4250 ft., in Nether, Providence Township, Delaware County.

Wilmington, Del.—Lowest bid opened by Directors of Street and Sewer Department for paving 123,000 sq. yd. submitted by Union Paving Company, Schenectady, N. Y., as follows (price given is per sq. yd.): $1.62 for sheet asphalt; $1.67, asphaltic concrete; $2.85, asphalt block; $2.63, Hastings vitrified block; $2.73, Westport; $1.70, Hillside, concrete gutters; $2.63, vitrified block gutters; $2.80, vitrified block along rails; $2.90, Hillside.

★**Shelby, N. C.**—Contract for 26,000 yd. asphalt concrete Lake asphalt (bids opened June 6) awarded Ely Constr. Co. of Chattanooga, Tenn., at $1.47½ per sq. yd. J. T. Gardner, Mayor.

★**Savannah, Ga.**—Contract awarded by City Council for 325,000 asphalt paving blocks to Chapman-Clark Company, Savannah, at $22,327.

★**New Orleans, La.**—Contract for constructing 13.4 miles of gravel road in Bossier Parish (bids opened June 5) awarded by State Highway Department to Texas Grading Company, Houston, Tex., at $53,070.

★**Columbus, Miss.**—Contract for constructing 3½ miles of highway awarded to Owen Construction Company of Brooksville.

★**Greenwood, Miss.**—Contract for approximately 12,000 sq. yd., asphaltic concrete pavement including curbing and guttering and drainage, awarded Memphis Asphalt & Paving Company, Memphis, Tenn.

★**Cleveland, Ohio.**—Contract awarded by City Board of Control to Rieley Brothers, 348 The Arcade, for paving Pittsburgh Avenue, from East Twenty-seventh to East Thirty-fourth streets, at $18,366.

★**Columbus, Ohio.**—Contract for constructing, grading, draining and macadamizing Darby Road (bids opened June 5) awarded by County Commissioners to W. O. Jewett, Worthington, at $66,087. John Scott, County Clerk.

★**Defiance, Ohio.**—Contract for grading and macadamizing 9939 ft. road (bids opened June 5 by County Commissioners) awarded Clemmer & Johnson, Hicksville, at $17,080. Roger Davis, County Auditor.

★**East Cleveland, Ohio.**—Contracts for paving about 3½ miles of Euclid Avenue with 2-in. asphalt, 1-in. filler and 8-in. concrete base, awarded by County Commissioners at Cleveland to Cleveland Trinidad Paving Co., 420 Lakeside Avenue, Cleveland, at $91,755, and to Pace Brothers Co., 608 Marshall Building, Cleveland, at $83,954.

★**Galion, Ohio.**—Brook Construction, Fort Wayne, Ind., awarded contract for paving with asphalt on Grove Avenue.

★**Columbus, Ind.**—Contract awarded by County Commissioners for constructing macadam highway with tar binder and concrete bridge across Haw Creek at Twenty-fifth Street to Albert Harman, Columbus, at $47,848.

★**Muncie, Ind.**—Contracts awarded by County Commissioners for constructing roads as follows. To J. M. Snyder, Frankfort, at $7,800, for graveling 3 miles of Hensley Road in Mt. Pleasant Township; 3 miles of Pence Road, Monroe Township, at $9,400; 2½ miles of Kirklin Road, Monroe Township, at $7,140; with brick, Thomas Road, Center Township, $10,500; 2 miles Johnson Road, Center Township, $43,495; and to A. F. Cohoe, Frankfort, with concrete, Dow Road, Center Township, at $31,311. (Bids opened May 27.)

★**New Albany, Ind.**—Contract awarded by County Commissioners for constructing Silver Hills Road to Samuel T. Games, Louisville, Ky., at $11,899.

★**Newport, Ind.**—Contracts awarded by County Commissioners to Heber & Ingram, Newport, for paving 1 mile with brick and 2 miles with concrete of Pinson Road, Clinton Township, at $39,097, and with brick Shew Road, Clinton Township, at $22,649.

★**Plymouth, Ind.**—Contracts for county roads awarded A. W. O'Keefe, Plymouth, for Senour Road at $11,178 and for Ruby Road at $14,908. Arthur W. Thomson, County Engineer.

★**South Bend, Ind.**—Contract awarded W. B. Brady Construction Company, J. M. S. Building, for paving Mishawaka Avenue, with Trinidad Lake asphalt at $146,295, about 45,443 sq. yd. asphalt, and between car tracks with brick, about 25,146 sq. yd.

Vincennes, Ind.—Following are four lowest bids opened June 6 by County Commissioners for constructing the Ewing, Simpson, Cantwell concrete roads, about 75,136 sq. yd. paving and grading: Engineer's estimate, $127,752; Arkansas Construction Company, Mount Vernon, Ind., $114,382; R. E. M. Construction Company, Evansville, $115,344; S. R. Adams Company, Princeton, $119,493, and Burns-Shields, Linton, Ind., $121,890. W. H. Reel, County Engineer, Vincennes.

Warsaw, Ind.—No bids received May 26 by Commissioners Kosciusko County for constructing Heckman Road—2 miles of gravel road—in Scott Township; estimated cost $11,335.

★Contract for constructing Anglin Road in Scott Township of concrete awarded Concrete Construction Company of Nappanee at $16,175.

★**Grand Rapids, Mich.**—Contract awarded by Board of Public Works to D. W. Boyes, Grand Rapids for paving portions of Hall Street and Garfield Avenue at $14,921 and $6,151 respectively.

★**Bloomington, Ill.**—Contract awarded by Board of Public Works for paving Center Street with Danville brick to I. D. Lain, Bloomington, at $37,000. Address City Clerk.

★**Galesburg, Ill.** — Contract awarded Cameron Joyce Co., Keokuk, for improving 7 miles of Knox County road at $17,891.

★**Morrison, Ill.** — Following are four bids opened June 7 by V. N. Taggett, County Superintendent of Highways, for 26,803 sq. yd. brick paving on Lincoln Highway. Kelly Bros., Morrison, $50,960 (awarded Contract); M. B. Ridge, Sterling, Ill., $52,868; H. P. Johnston, Sterling, $52,900, and Sell & Kollar, Pana, Ill., $53,980.

★**Sterling, Ill.**—Contract for paving Sterling Township roads, about 14,198 ft. sections of Lincoln Highway, awarded Kelley Brothers, Morrison, at $50,960. Next three lowest: N. B. Ridge, Sterling, $52,868; H. John Sterling, $52,900, and Sell & Kollar, Pana, $53,980.

★Contract awarded Conducive Paving Co., Forest Park, for paving Second and Sixth avenues and Second and Third streets at $107,502.

★**Neenah, Wis.**—Contract for concrete pavement on Ninth Street and Nicolet Avenue (bids opened June 2 by Board of Public Works) awarded Miner Construction Company, Richland Center, at $23,796. Other bids on concrete: C. R. Meyer & Sons, Oshkosh, $25,287; C. Johnson, Oshkosh, $26,706; White Construction Company, Milwaukee bid on asphalt, $26,898. H. S. Zemboik, City Clerk.

★**Knoxville, Iowa.**—Contract for 15,500 sq. yd. paving and 10,800 ft. curbing awarded James Horrabin, Des Moines, at $36,535 (bids opened June 6 by Paul M. Black, City Clerk).

★**Salina, Kan.**—Contract for 30,000 sq. yd. 3-in. fiber brick on 5-in. concrete base awarded to A. R. Young & Co. of Lawrence. P. G. Wakenhut, City Engineer.

★**Wichita, Kan.**—Contract awarded by City Commissioners for paving with brick portion of Mead Avenue to Harry L. Miles, 1343 Lawrence Street, at $2.14 per sq. yd.; total $32,000.

★**Billings, Mont.**—Following are lowest bids on various materials opened June 6 by E. M. Sneckenberger, City Engineer, for paving in Improvements District No. 10: Frank Savarsey, Billings, gravel bithulitic $31,740 (awarded contract), wood block $43,922; one course concrete, $19,928; two courses concrete, $21,460; bituminous, Type A, $29,187; concrete, Type B, $30,208, and Montana Pavement & Construction Company, Billings, $24,464.

★**Jefferson City, Mo.**—Contract for 31,000 sq. yd. on Madison Street and 10,500 sq. yd. on High Street (bids opened June 5 by J. Frank Morris, City Clerk) awarded to Joseph Pope, Jefferson City.

★**Cuero, Tex.**—Contract awarded Eureka Paving Company, 1215 Carter Building, Houston, for road building in Precincts Nos. 2 and 3, for which $50,000 and $35,000 bond issue has been voted. C. W. Jackson of Yoakum has contract for concrete bridges and culverts on the work.

★**Dallas, Tex.**—Contract for furnishing city with creosoted wood blocks for paving repairs awarded by City Commission to Long Bell Lumber Company, Kansas City, Mo., at $1.56 and $1.78 per yd., according to size of blocks.

★**Shepherd, Tex.**—Contract for about 24 miles of sand, clay and gravel roads in Road District No. 1 (bids opened May 30 by William McMurray, County Judge) awarded N. A. Dawson, care of William McMurray, County Judge, Shepherd State Bank.

★**Everett, Wash.** — Reported contract awarded by City Council for paving Cedar Street to M. J. Templeton, Everett, at $10,709.

★**Seattle, Wash.**—Contract for paving Harrison Street awarded by Board of Public Works to Ferguson Construction Company, White Building, Seattle, at $14,009.

★**South Bend, Wash.**—Contract for constructing Permanent Highway No. 5-A (bids opened June 6) awarded by County Commissioners to T. H. Cochran & Sons, St. Johns, Portland, Ore., at $20,900. Other bidders: Willapa Construction Co., Raymond, Wash., $23,500, and Cascade Construction Co., $24,992. W. E. Lovering, County Auditor.

★**Spokane, Wash.**—Contract awarded by County Commissioners for constructing, paving Grand Avenue Boulevard to Standard Asphalt Paving Co., Spokane, at $28,200.

★**Winlock, Wash.**—Contract awarded by City Council for hard surfacing First Street to W. F. Meismer, Seattle, at $20,965.

★**Myrtle Point, Ore.**—Contract for paving portion of Spruce, Maple and Sixth Streets and Railroad Avenue with 6-in. concrete, awarded Longston Construction Company, Coquille, at about $22,942. E. A. Dodge, Recorder.

Portland, Ore.—Following bids opened by City Council for paving East Thirty-second and East Ankey Streets with (a) bitulithic, (b) asphaltic concrete: Warren Construction Co., Portland (a) $12,039, (b) $11,242; Oskar Huber, Portland (a) $9,942.

★**Hermosa Beach, Cal.**—Contract for 39,000 sq. ft. concrete pavement, concrete and timber curbs, cement walks and gutters, etc., on Eighth Street, awarded California Arizona Construction Company, 1700 East Washington Street, Los Angeles, at $17,825, including $6,400 for constructing concrete and timber viaduct.

Los Angeles, Cal.—Lowest bid opened June 7 by Board of Supervisors for macadamizing and concrete pavement on 1.24 miles of Texas Roy and Craig streets, Arroyo Park, submitted by E. A. Baker, 407 H. W. Hellman Building, at $10,855,

★**Ontario, Cal.**—Contract for 400,000 sq. ft. grading, oiling, graveling, constructing concrete curbs and gutters and culverts on Campus Avenue awarded Heinauer & Kyle of Watts at $26,934. Next three lowest bidders: S. C. Contr. Co. of Los Angeles, $27,184; Lon Fleming of Pomona, $33,418, and George Oswald of Los Angeles, $33,929.

★**Richmond, Cal.**—Contract for Paving San Pablo Avenue awarded by City Council to Municipal Improvement Company, San Francisco, at $31,054.

★**Selma, Cal.**—Contract for constructing concrete pavements on Simpson Street awarded Thompson Bros. of Fresno, at $16,640.

★**Reno, Nev.**—Contract for 100,000 sq. ft. asphalt resurfacing in Virginia and First Streets awarded John W. McDonald Company, San Francisco. Cost 17,000. J. R. Parry, City Clerk.

★**Wallace, Idaho.**—Contract awarded by City Council for paving unimproved portions of city to Oregon Engineering & Construction Co., Portland, Ore., at $76,281.

STREET CLEANING AND GARBAGE DISPOSAL

PROPOSED WORK.

Bridgeport, Conn.—A 3-story addition of concrete blocks is to be constructed to garbage plant at a cost of $50,000.

Brownsville, Tex.—City is in the market for a garbage incinerator with a capacity for burning 1 ton of garbage per hour. Address City Manager.

Port Arthur, Tex.—Construction of garbage incinerator being considered by city; probable cost $7,500.

BIDS DESIRED.

Brooklyn, N. Y.—By the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., at Brooklyn Navy Yard, as follows: Sch. 9755, garbage incinerator, and Sch. 9780, miscellaneous composition pipe fittings.

Rochester, N. Y.—Until June 21, by Board Contract and Supply (F. X. Pifer, Secy.) for furnishing and installing two Decarie or other steel rubbish incinerators and accessories complete. Also separate bids for installing one Heenan or other approved high temperature regenerator rubbish destructor and accessories complete.

Minot, N. D.—Until June 26, by A. D. Hagenstein, City Aud., for furnishing, f.o.b. Minot, one motor propelled combined sprinkler and power flusher, advertised in Engineering Record.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Fargo, N. D.**—Contract awarded Northern Incinerator Company, Minneapolis, Minn., for a 10-ton unit incinerator.

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS

PROPOSED WORK.

Wharf—New Bedford, Mass.—Preliminary steps taken by Holmes Coal Company, of New Bedford, for the construction of a wharf.

Dam — Westminster, Mass. — Citizens voted granting Crocker, Burbank Co. of Fitchburg permission to construct dam and reservoir in eWatminster.

Docks—Troy, N. Y.—Mayor Cornelius F. Burns appointed Harbor and Dock Commission, of whom Albert E. Cluett, James H. Morrissey and William W. Loomis are members, to supervise improvements to docks and river front.

Piers—Chester, Pa.—Permit granted to Sun Shipbuilding Co. of Philadelphia to construct bulkheads, piers and shipways; cost, $500,000. J. Howard Pew of Sun Co., Philadelphia, interested.

Flood Improvements—Erie, Pa.—Contract will be let in about three months for flood improvements in Mill Creek, to cost $950,000. Bonds will be sold in July. Farley Gannett, Engineer, Harrisburg.

Drydock—Philadelphia, Pa.—See "New Industrial Plants."

Wharf — Augusta, Ga. — City Council granted franchise to Savannah River Terminal Co. to cross certain streets in constructing rail and wharf terminal at river front.

Drainage—Baldwin, Fla. — Preliminary plans completed by Isham Randolph Company, of Jacksonville, for drainage work in Baldwin District, comprising between 60,000 and 80,000 acres.

Drainage—Florida—Report has been submitted by Isham Randolph Company, Jacksonville for the drainage work contemplated in the Lake Ashby district comprising about 43,000 acres to be drained. Address the Engineers.

Pier—Monterey, Fla.—Pacific Improvement Company plans improvements costing $150,000, including a pier and bathing pavilion at Pebble Beach on Carmel Bay.

Port Improvements—Mobile, Ala.—No immediate improvements contemplated in this city on port improvements, report on which has been submitted by Ford, Bacon & Davis, of New Orleans.

Breakwater, Chicago, Ill.—Contract soon to be let for constructing municipal breakwater to protect south side of municipal pier; cost about $300,000. William R. Moorehouse, Comr. of Public Works.

Drain—Colfax, Ill.—Contract soon to be let for constructing tile drain in Lawndale and Cropsey Drainage District 1 1-3 miles in length, 12 to 18 in. tile will be used. A. M. Hester, Attorney, Colfax.

Dike—Hillsdale, Ill.—Highway Commissioners of Canoe Creek Township voted to construct a dike along Rock River. J. F. Butzer of Hillsdale, Chairman of Board.

Levees—Illinois City, Ill.—Petition filed in County Court by Drury Drainage Dist. for $65,000 bond issue for levee repairs necessitated by overflow of Mississippi River. Charles Speckler of Illinois City, Secy.

Drainage—Council Bluffs, Iowa.—Survey completed for the Mosquito Creek Drainage District to cost $80,000. Contract will be let about July 15. J. D. Hannan, County Auditor.

Ditch—Falls City, Neb.—Surveys completed by J. F. Reif, County Engineer, for constructing drainage ditch 8½ miles long, to improve Muddy Creek lands.

Dam—Rapid City, S. D.—The Dakota Power Co., Rapid City, received from State Engineer permit to construct dam on Rapid Creek near Pactola. It is proposed to irrigate 40,000 acres and furnish power.

Drain—Crowley, Wyo.—Construction of a drainage system to drain 10,000 acres in Crowley is contemplated. Address R. A. Hart, Engineer, Salt Lake City, Utah.

Drain—Germania, Wyo.—Construction of a drainage system in Germania is contemplated. Address R. A. Hart, Engineer, Salt Lake City, Utah.

Drainage—Clinton, Mo.—All litigations to prevent constructing of the Pioneer Drainage Ditch have been removed, and it is reported steps will be taken at once to construct said ditch. C. E. Jacoby, City Engineer.

River Improvements—Kansas City, Mo.—The Lower House voted $100,000 bonds for improvements to Blue River and construct parks.

River Improvements—St. Louis, Mo.—City Plan Commission is considering the straightening of the channel of the River des Peres and enclosing it in a conduit through Forest Park to Lindenwood and from there to the Mississippi, a distance of 5 miles. It is proposed to construct an open cut 19 feet deep and 100 ft. wide, lined with concrete. The extending of the municipal belt railway is also under consideration and the construction of a boulevard immediately south of the belt line.

Dams—Heber Springs, Ark.—It is proposed to construct in connection with the improvements on Little Red River two dams, No. 1 containing 150,000 cu. yd. concrete and No. 2 25,000 cu. yd.; installation of 25,000 kw. and 17,000 kw.; 160 miles of high tension transmission line to Little Rock and Memphis. Construction plans not completed yet. Guy A. Watkins, Secy. Arkansas Hydro-Electric Development Company.

Wharf—Dallas, Tex.—Election soon to be held to vote bonds for building municipal wharf at Lake Charles. About $15,000 will be needed. Address City Clerk.

Pier—Galveston, Tex.—Reported William Gammon, Hoskins Foster and J. E. Pearce contemplate erecting a double-deck amusement pier, 775 ft. long, with a pavilion 125 x 125 ft. Concrete piling to be used.

Ditches—Aberdeen, Wash.—City Council authorized $12,000 for constructing drainage ditches.

Irrigation—North Yakima, Wash.—L. M. Holt, Superintendent of Irrigation, will immediately prepare plans and specifications for a diversion dam across Yakima River at the intake of Wapto Canal, and reconstruction of the present distributing system, and an extension system to cover 120,000 acres, including Wapto project. Preliminary estimates place cost at $78,000 for dam, $3,000,000 for irrigation and drainage systems and extensions.

Irrigation—Otis Orchards, Wash.—About $125,000 will be spent for improvements to Otis Orchards Irrigation Dist. Address Secy. of District.

Fill—Seattle, Wash.—A. H. Dimock, City Engineer, estimates cost of constructing sanitary fill in Denny and Hoyt's Addition at $12,559.

Dry Dock—Seattle, Wash.—Harry Whitney Treat, Seattle, and others reported interested in the construction of a 200 x 800 ft. fresh-water dry dock in Salmon Bay, Seattle, to cost approximately $200,000.

Dredging—Tacoma, Wash. — Contract will soon be let by Hylebos Waterway Commission, Tacoma, for dredging a channel from Eleventh Street through grass lands and district controlled by commission; cost about $250,000.

Irrigation—Wenatchee, Wash.—All bids opened recently by Wenatchee Reclamation District (W. T. Knapp, Secy.) for furnishing 63-in. concrete pipe, rejected and new bids will be asked. Lowest bid opened was $50,863.

Reclamation Work — Astoria, Ore. — Olof Anderson, City Auditor, reports Council is considering undertaking the third reclamation unit, including territory from Twenty-third to Thirty-seventh Streets.

Irrigation—Anderson, Cal.—All bids opened for main gates, side gates and drops for Anderson Cottonwood District rejected by the directors of the district. No action yet taken on Church Creek siphon or on the dam bids.

Irrigation—Coyote, Cal.—Duryea Haehl & Gilman, Humboldt Bank Building, San Francisco, are engineers for Laguna Seca reclamation District near Coyote, about 12 miles from San Jose, Santa Clara County, embracing about 1200 acres of lands. Drainage canals about 4 miles in length to be constructed; work embraces about 100,000 cu. yd. of earth excavation; also bridges, gates, culverts, etc. Contract will be let in July.

Seawall—Long Beach, Cal.—Leeds & Barnard, Consulting Engineers, Central Building, Los Angeles, enaged to pass on plans of City Engineer for a combined concrete stepped face seawall, sidewalk and ornamental lights, an improvement contemplated between Chestnut Place and Golden Avenue.

Flood Protection—Los Angeles, Cal.—See "Bridges."

Drainage—Richvale, Cal.—No date yet set for receiving bids for constructing drainage system to cost $150,000. Frank S. Robinson, 842 Second Street, Chico, Engineer.

Dam—San Diego, Cal.—Construction of a diverting dam, a road and pipe line on Jamul Ranch to tap the Morena Reservoir, being considered by City Council.

Power Plant—San Francisco, Cal.—M. M. O'Shaughnessy, City Engineer, selected site at Early intake for the temporary power plant to be constructed to supply current for the dam building and aqueduct work. Plans will cost about $100,000 and will be about 12 mies from site of main dam.

Dredging—Santa Ana, Cal.—Survey being made by Capt. C. T. Leeds, 701 Central Building, Los Angeles, for establishing a harbor at Newport Bay. Dredging and constructing jetties and wharves are contemplated. Address Orange County Harbor Commission.

Flood Control—Santa Ana., Cal.—Bd. of Supervisors approved petitions to form the United Flood Control Dist., comprising lands in vicinities of Anaheim and Garden Grove; also Fullerton-Orangethorpe Dist.

Bulkhead—Venice, Cal.—City Trustees have voted to construct a bulkhead along the shore between Vista and Salt Air Streets. Probable cost $100,000. Address City Clerk.

Canal—Phoenix, Ariz.—City Commission instructed City Attorney to take immediate action toward removal of Salt River Valley Canal by means of enlarging Maricopa Canal and diverting water around the city. Preliminary estimate of cost, $52,649, including 80,000 cu. yd. excavation, purchase of 6600 ft. 36-in. pressure pipe, etc.

Irrigation—Abraham, Utah.—T. C. Hickman, Frank Bros., and others of San Diego have taken over Richland Irrigation project west of Abraham and will begin construction work probably in July on a canal system; cost about $60,000.

Hydro-Electric Plant—Warwick, Ont.—Nathaniel Herbert, Waterford, Ont., may be able to give information regarding hydro-electric power plant which Council of Warwick Township contemplates constructing.

Dock—Windsor, Ont.—Detroit & Windsor Ferry Company preparing plans for a steel and concrete dock to cost $175,000.

BIDS DESIRED.

Dam—Marshall, N. C.—Until June 20, at 78 Patton Avenue, Asheville, for constructing a masonry dam for the Capitola Manufacturing Company of Marshall, dam to be constructed over French Broad River in Madison County, to be of cyclopean concrete, approximately 515 ft. long and 10 ft. high, together with abutments and gate sections, etc. Chas. E. Waddell, Consulting Engineer, 78 Patton Avenue, Asheville.

Pier—Sarasota, Fla.—Until July 10, by City Council, for constructing a reinforced concrete municipal and recreation pier, advertised in Engineering Record. Robert C. Bruce, Commissioner Public Works.

Breakwater — Cleveland, Ohio. — Until July 11, by U. S. Engineer Office, Cleveland, for constructing stone superstructure on breakwater, Cleveland Harbor, Ohio, advertised in Engineering Record.

Levee—Sullivan, Ind.—Until July 1, by Bd. Commissioners, Gill Township Levee, Sullivan County, at office of Haya & Hays, Attorneys, Sherman Bldg., Sullivan, for constructing concrete facing (3 in. thick) on river side of slope of present levee, etc., advertised in Engineering Record. G. C. Graeter, Engr., Briggs Bldg., Sullivan.

Levee Work—Jonesboro, Ill.—Until June 21, by E. S. Alden, Secretary, Preston Levee Drainage District, for constructing 6400 ft. of levee, estimated to contain 52,266 cu. yd. of earth, also one 18-in. concrete culvert. No clearing. Henry C. Sifford, Circuit Clerk, Jonesboro; Thos. G. Dunn, Engineer, Gorham, Ill.

Drainage—Bouton, Iowa.—Until June 26, by M. F. Parks, Town Clerk, for constructing drainage system including 13,039 lin. ft. 8, 10, 12 and 15 in. drain tile, one concrete bulkhead, and 26 storm intakes. R. C. Lutze, Engineer, 1404 Paul Street, Perry, Iowa.

Drainage—Webster City, Iowa.—Until June 19, by Joint Board Supervisors, of Wright and Hamilton Counties, at office of County Aud., at Webster City, for constructing Joint Drain 133 Wright, and No. 188 Hamilton Counties, of salt-glazed vitr. clay tile only; cost $35,452. Geo. L. Mechem, Engr., Clarion.

Ditch—Blue Earth, Minn.—Until July 7 (readvertisement), by J. L. Herring, County Auditor, for constructing Ditch No. 34.

Ditches—Crookston, Minn. — Reported desired until June 23, by H. J. Welte, Co. Aud., for constructing Ditch 98, consisting of 85,308 cu. yd. Probable cost $9,289. Also separate bids for repairing Ditch No. 15, about 99,691 cu. yd; cost $12,598.

Tunnel for Power Plant—Loveland, Col.—Until July 3, by Georgia C. Rist, City Clerk, for constructing a tunnel for the proposed hydroelectric power plant, advertised in Engineering Record.

Drainage—Riverside, Cal.—Until July 10, by Board County Supervisors (A. B. Pilch, Clk.) for work in Drainage Improv. Dist. No. 2, excavating and enlarging about 25 miles of channel, to extend from San Jacinto Valley through Lake View Valley into Perris Valley, which will give a channel capacity of about 30,000 to 40,000 miners inches of water, total excavation about 450,000 cu. yd., of which 359,727 cu. yd. should be done by a machine of the Austin type or drag line or clamshell, and balance by scraper or teams. Estimated cost $92,525. W. E. Pedley, Engr., Riverside.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Dredging—Wareham, Mass.—Following are lowest bids opened by Bd. Harbor and Land Commissioners at Boston on June 7 for 135,000 cu. yd. of dredging in Wareham River (price given per cu. yd.): Item 1, Charles M. Cole, 80 Belmont Street, Fall River, 31 cts.; Item 2, J. S. Packard Dredging Co. of Providence, R. I., 34 cts.; and Item 3, Boston Dredging Co., 40 Central Street, Boston, $9.50.

Dredging—Philadelphia, Pa.—Following are bids opened June 3 by Dept. Yards and Docks, Navy Department, Washington, D. C., for dredging at Navy Yard, Philadelphia: Maryland Dredging & Constructing Company, 1515 Fidelity Building, Baltimore, Md., $22,550, and American Dredging Company, 308 Chestnut Street, Philadelphia, $32,865.

★**Drainage—Monroe, Ga.**—Contract for drainage improvements on Alcova Drainage District, about 6⅛ miles dredge ditches (bids opened June 6) awarded Karr & Moore, Salisbury, N. C., at $38,780. John A. Prickly, Clk. Drainage Commissioners.

Levee—New Orleans, La.—Following are bids opened by Orleans Levee Board for rebuilding and enlarging Third District Rear Protection Levee: (a) Section 1—350,000 cu. yd. earth; (b) Section 2—250,000 to 300,000 cu. yd., and (c) Section 3—140,000 cu. yd.; Hampton Reynolds, Metaric Ridge and Seventeenth Street, Canal (a) 9.72 cts.; (b) 8.72 cts.; (c) 9.22 cts. Picard, Buckmaster & Weil, (a) 23.76 cts.; (b) 15.84 cts.; (a) and (b) combined, 18.35 cts.; Bancroft & Ross, (a) and (b) 24⅜ cts.; Victor Lambou, 625 Poland Street, ((a) and (b) combined, 17 cts. Grasser Constr. Co., 912 Hennen Bldg., (a) and (b) combined, 16.48 cts.; Black-Laird Constr Co., (c) 14.5 cts.; Jahncke Navigation Co., 814 Howard Street, 14 cts. and A. M. Shaw, 2604 Calhoun Street (c) 8 cts.

★**Levee—Clarksdale, Miss.** — Contract for concrete work in connection with the levee work improvement (bids opened June 6) awarded W. R. Ellis, Clarksdale, at $50,350. T. G. Dabney, Chief Engineer Levee Board.

★**Dredging—Greenville, Ohio.**—Contract for dredging about 7.97 miles of Stillwater Creek (bids opened June 3) awarded Edward Bodette, Toledo, Ohio; estimated cost, $43,664. G. H. Garrison, County Auditor.

★**Flood Wall—Portsmouth, Ohio.**—Contract awarded by City Board of Control as follows Flood wall extension and Scioto Point repair work to S. Monroe & Son Co., Portsmouth, at $75,905 and $4,416 respectively; reservoir restoration to Curtis & Shumway, Portsmouth, at $25,045 (bids opened May 29).

Breakwater—Indiana Harbor, Ind.—Bid of Great Lakes Dredge & Dock Company, Monroe Building, Chicago, Ill., at $1.37 per ton for furnishing and placing all stone and constructing the breakwater at Indiana Harbor, Ind., has been recommended for award (bids opened June 2 by U. S. Engineer, Chicago, Ill.)

★**Drainage — Estherville, Iowa.**—Contract for constructing drainage work in Drainage District No. 94 (bids opened June 6) awarded Clarke Construction Company, Clinton, Iowa, for Section No. 1 at 24.85 cts. per cu. yd. and to Graettinger Tile Works, Graettinger, Iowa, for Section 2, at $7,288. Charles A. Root, County Auditor.

★**Levee—England, Ark.**—Contract for repairing and enlarging levee near England awarded by Plum Bayou Levee Board to Brown & Froley, Argenta, at about $15,000.

★**Wharf—Beaumont, Tex.**—Contract for completing the municipal wharf awarded McKenzie Construction Company of San Antonio.

★**Jetty Work—Galveston, Tex.**—Contract for jetty work at Aransas Pass, Tex., awarded Charles Clarke & Company, Galveston, at $19,825.

Seattle, Wash.—Lowest bid opened by Port of Seattle Commission (C. E. Remsber, Secy., Bell Street Wharf) for piling, capping, decking and laying rails on extension of Spokane Street Wharf submitted by W. T. Butler Contr. Co., Central Building, at $11,247. J. R. West, Ch. Engr. Port Commission.

★**Dredging—Tacoma, Wash.**—Contract awarded by Hylebos Waterway Commission, Tacoma, for dredging the Hylebos Waterway from deep water to Eleventh Street to Tacoma Dredging Co. of Tacoma, at about $150,000.

★**Dam—Modesto, Cal.**—Contract for completing Dam No. 1 at Dallas reservoir awarded by Modesto Irrigation Directors to Tibbitts Pacific Company, San Francisco, at $82,487.

ELECTRIC RAILWAYS

PROPOSED WORK.

Morristown, N. J.—The Morris County Traction Co. will erect a transformer station 20 x 50 ft. at bottom of Mine Hill. A 500 kw. rotary transformer will be installed.

Hershey, Pa. — Preliminary surveys being made by Hershey Traction Co. for a 16-mile extension in Lebanon and Lancaster Counties.

Pittsburgh, Pa.—The West Penn Traction Co. contemplates constructing an electric railway to Dunbar via South Connellsville.

Gastonia, N. C.—Surveys being made by Piedmont & Northern Ry. Co. for extension from Gastonia to Spartanburg, S. C., about 50 miles long.

Clinton, S. C.—Carolina Rapid Transit Co. incorporated to construct a line from Spartanburg to Clinton. Among incorporators, J. F. Jacobs of Clinton, W. C. Gray of Laurens.

Atlanta, Ga.—Plans being considered by Georgia Railway & Power Co. to construct a double track along present Lakewood line, extending line in form of a loop into the fair grounds.

Birmingham, Ala.—Surveys completed by Birmingham Interurban Development Co. for line to be constructed from Warrior River at Nicholas Fishtrap, to Jasper via Dora, Cordova and Flat Creek, about 28 miles. Company proposes constructing line from Birmingham to Jasper, about 50 miles. W. W. Shortridge of Birmingham, Secy.

Newport, Ky.—Reported the Cincinnati, Newport & Covington Ry. Co. of Covington contemplates constructing several extensions in vicinity of Newport.

Dayton, Ohio.—Ohio Electric Ry. Co. received franchise to construct 1 mile of single track on Fourth Street from Main to Jefferson St.

Peckham, Okla.—The Oil Fields Short Line Electric Ry. Co. of Oklahoma City incorporated to construct a line from Peckham to Braman, distance of 16 miles. Capital $200,000. Incorporators, J. A. Frates, Sr., and J. H. Grant,

Grand Junction, Colo.—Construction of an electric railway from Grand Junction to Vernal, Utah, and the Uinta Basin contemplated. Address Alonzo M. Schmidt, Pres. Western Slope Ry. Development & Investment Co.

Tulsa, Okla.—The Tulsa Interurban Ry. Co. will construct an electric railway from Tulsa to Wagoner, distance of 37 miles. H. D. Pattee is interested.

Brea, Cal.—Surveys will soon be made by Pacific Ry. Co. of Los Angeles for extension from Brea to Fullerton.

Winnipeg, Man.—Work will begin at once by Winnipeg Electric Ry. Co. for double tracking line from city limits to Kildonan Park.

BIDS DESIRED.

New York, N. Y.—Until June 26, by Public Service Commissioners, 120 Broadway, for construction of the 180th Street yard of Route 18, part of White Plains Road Rapid Transit Railroad, an elevated railroad, consisting of embankment, with masonry walls, etc., in Borough of Bronx.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Washington, Ga.**—Contract for grading 3 miles of Washington & Lincolnton R. R. awarded to H. B. Hoppenbeitcel Co. of Macon. The railway to be constructed between Lincolnton and Washington.

RAILROADS

PROPOSED WORK.

Afton, N. Y.—Delaware & Hudson R. R. Co. (James MacMartin, Ch. Engr., Albany), considering eliminating grade crossing at this place by putting roadway under tracks. Construction of station is also contemplated.

Trenton, N. J.—Plans being prepared by Samuel T. Wagner, Ch. Engineer, Philadelphia, Pa., for improvements to grade crossings for Philadelphia & Reading R. R. Co.; cost about $250,000.

Modena, Pa.—Reported the Philadelphia & Reading Ry. Co. (Charles H. Ewing, Gen. Mgr., Reading Terminal, Philadelphia, Pa.) considering increasing trackage of freight yards in Modena.

Baltimore, Md.—Reported the Pennsylvania R. R. Co. (Alex. C. Shand, Ch. Engr., Broad Street Station, Philadelphia, Pa.) plans erecting a station at Edmondson Avenue and provide for a grade crossing at Lafayette Ave.

Baltimore, Md.—Potomac River & Baltimore R. R. Co. applied to Maryland Commission for permission to construct railroad from District of Columbia Line to a point on Potomac River in Charles County, 27 miles long, also issue $1,500,000 securities. Plans include construction of an 8000-ft. bridge. George W. Williams, Attorney, 816 Law Bldg., Baltimore, interested.

Central S. C.—Double tracking of the Southern Ry. from Central S. C. to Cornelia, Ga., about 56 miles, will require 155,000 cross ties, approximately. B. Hermen, Ch. Engr., M., W. & Structures, Washington, D. C.

Memphis, Tenn.—Board City Commissioners passed ordinance directing N. C. & St. Louis R. R. Company and Union Railway Company to build an underpass there to their tracks crossing Lamar Boulevard, the entire expense to be borne by railroad companies. The structure when built will be reinforced concrete, with abutment 60 ft. apart, each approximately 170 ft. long, with columns on sidewalk and curb line.

Cleveland, Ohio.—Reported plans being prepared by Pennsylvania R. R. Co. (Robert Trimble, Chief Engineer M. of W., Western Division, Pittsburgh, Pa.) for elimination of grade crossing on East Side. Seven Nickel Plate R. R. Co.'s grade crossings are also to be abolished. Total cost of improvements $4,500,000; city's share of cost $1,600,000. Robert Hoffman, City Engineer.

Indianapolis, Ind.—Public Service Commission directed Big Four R. R. Co. (C. A. Paquette, Ch. Engr., Cincinnati, Ohio) to reconstruct trestle on Indiana side leading to steel bridge over Wabash River below Vincennes.

Wild Rose, N. D.—Reported Great Northern R. R. (A. Hogeland, Chief Engineer, St. Paul, Minn) will make improvements in North Dakota at a cost of $900,000, including the extension of the White Rose branch from White Rose a distance of 36 miles.

Kansas City, Mo.—Reported Union Pacific Ry. Co. will spend $1,000,000 on improvements to Kansas City-Denver line. Ballasting of line between Kansas City and Limon, Colo., 550 miles, cost $300,000; steel bridges on line, cost $125,000; laying 90-lb. rail on line between Kansas City and Colorado terminals, cost $200,000.

San Benito, Tex.—Construction work will soon begin on extension of San Benito & Rio Grande R. R. Co. (G. H. Winsor, Gen. Supt., San Benito) from present terminal at Los Indios to Harlingen pumping plant.

Chehalis, Wash.—The Chehalis-Cowlitz & Cascade Ry. Co. filed articles of incorporation with Secretary of State for taking over Chehalis & Cowlitz Ry. and extending line to Salkum, about 22 miles.

Olympia, Wash.—The Oregon-Washington Railroad & Navigation Co. will build 5 miles of spur tracks to O. P. Smith Mill in Olympia.

Eugene, Ore.—Reported Marion & Linn County R. R. Company, a subsidiary of the Southern Pacific Ry. Company, will construct an 11-mile extension of the Corvallis & Eastern Ry. beyond Hoover Station.

Marshfield, Ore.—See "New Industrial Plants."

Portland, Ore.—Contract soon to be let for elimination of grade crossing on line of Oregon-Washington Railway & Navigation Company (M. J. Buckley, Gen. Supt., Portland) from head of Sullivan Gulch to city limits; cost about $600,000. Portland R. R. Co. will pay $48,000 of cost, the Oregon-Washington Railway & Navigation Company $312,000, the city and the property holders in vicinity each $120,000.

California.—Western Pacific Ry. Co. incorporated and plan constructing about 334 miles of extensions, including from Lathrop to Porterville, 180 miles; Niles to Los Gatos, via San Jose, 28 miles; Lodi to Isleton, 20 miles; Stockton to Byron, 18 miles; Sacramento to Newcastle via Fairoaks and Orangedale, 28 miles; Hawley to Boca, Nev., 20 miles, and Carbona to Tesla, 20 miles. Principal office to be in San Francisco. Lyman Rhodes, Vice.-Pres. and Treasurer, San Francisco.

Los Angeles, Cal.—The San Pedro, Los Angeles & Salt Lake R. R. Co. (A. Maguire, Ch. Engr., Los Angeles) plans to reballast several divisions of main line with crushed rock.

Modesto, Cal.—Reported Western Pacific Ry. and Tidewater Southern Electric Ry. will construct an extension from Modesto to Turlock, about 10 miles, and construct a bridge over Tuolumne River.

Niagara Falls, Ont.—International Railway Company, (E. G. Connette, President Ellicott, Sq., Buffalo, N. Y.), has been directed by the Ontario Government Railway Board to make changes on its line costing $50,000, including heavier rails, new concrete culverts safety switches guard rails, etc.

★**New York, N. Y.**—Following are unit figures of four lowest bids opened June 1 by Public Service Commission for First District, 120 Broadway, New York, for constructing station finish on Section 12 to 13, inclusive, of Route No. 5, a part of Lexington-Seventh Avenue subway, from East 106th to 157th Street: (a) A. W. King & Co., 1511 Bryant Avenue, $316,091 (awarded contract); (b) Thomas Dwyer, 216th Street and Broadway, $327,031; (c) John D. Roberts, 3 West Twenty-ninth Street, $334,735, and (d) Serber-Stander Co., 1123 Broadway, $342,667.

Item		*(a)	(b)	(c)	(d)
501	48,530 sq. ft. tile (w. g.) 3 x 6 in. (a) straight	$0.61	$0.60	$0.62	$0.63
	400 sq. ft. (b) 1 in. r. comb.	1.375	1.10	1.37	1.38
	2,420 sq. ft. (c) 2½ in. r. comb.	1.47	1.60	1.48	1.49
	120 sq. ft. (d) 20 in. r. comb.	1.18	1.20	1.21	1.21
503	39,120 sq. ft. tile (w. g.) 6 x 6 in. (a) straight	0.62	0.60	0.635	0.64
	175 sq. ft. (b) 1 in. r. comb.	1.325	1.50	1.37	1.38
	1,740 sq. ft. (c) 2½ in. r. comb.	1.47	1.40	1.48	1.49
	60 sq. ft. (d) 20 in. r. comb.	1.43	1.00	1.48	1.49
509	50 lin. ft. tile bead (w. g.) (a) 1 in. r. comb.	0.41	0.50	0.44	0.44
510	4,375 sq. ft. tile semi-vitr. Col. (h. m.) not. w. p. (a) straight	1.21	1.05	1.20	1.21
	15 sq. ft. (c) 2½ in. r. comb.	1.25	1.05	1.20	1.21
511	6,330 sq. ft. tile w. p. (h. m.) vitr. or semi-vitr. (a) straight	1.18	1.10	1.20	1.21
	20 sq. ft. (b) 1 in. r. comb.	1.18	1.50	1.20	1.21
	70 sq. ft. (c) 2½ in. r. comb.	1.18	1.50	1.20	1.21
	60 sq. ft. (d) 20 in. r. comb.	1.18	1.50	1.20	1.21
513	12,320 sq. ft. mosaic and tile bands	1.45	1.40	1.48	1.49
514	1,050 sq. ft. tablets—mosaic and tile	1.72	1.40	1.76	1.76
515	370 plaques col., mosaic and tile (a) station walls, each	1.95	2.00	1.93	1.93
	45 (b) station columns, each	1.95	2.00	1.93	1.93
516	60 sq. ft. tablets, destination, mosaic and tile (col.)	1.76	1.60	1.76	1.76
518	385 sq. ft. faience (a) plaques	8.25	8.00	8.25	8.25
521	27,300 sq. yd. plastering (arched surf.) (b) concrete	0.55	0.55	0.56	0.67
522	7,000 sq. yd. plastering (flats.) (a) brick or h. t.	0.39	0.50	0.39	0.67
	11,200 sq. yd. (b) concrete	0.73	0.60	0.74	0.67
	50 sq. yd. (c) metal lath	0.66	1.00	0.66	1.20
523	22,000 sq. ft. cement work (a) wainscots	0.10	0.20	0.24	0.22
	156,000 sq. ft. (c) 3-in. floor finish	0.105	0.11	0.11	0.115
	22,800 sq. ft. (d) finish on brick or h. t.	0.06	0.07	0.11	0.09
	60 sq. ft. (e) sign panels	0.06	0.30	0.11	0.12
524	70 cu. ft. concrete work (a) copings	0.80	0.60	1.15	1.15
	10 cu. yd. (b) foundations	7.70	8.00	8.50	9.60
	630 cu. ft. (c) reinforced	0.44	0.75	1.10	0.88
	200 cu. ft. (d) protective	0.53	0.55	1.00	1.10
	500 cu. ft. (e) street landings	0.33	0.30	0.36	0.36
525	5 cu. yd. cinder fill	0.85	5.00	0.80	1.00
526	5,850 lin. ft. concrete stairs, etc. (a) self-supporting stairs	0.94	1.10	1.10	1.10
		0.55	0.75	0.67	0.83
	450 sq. ft. (b) self-supporting landings	0.94	0.90	0.75	0.83
	6,100 lin. ft. (c) supported stairs	0.22	0.50	0.30	0.44
	4,250 sq. ft. (d) supported landings	0.55	1.00	1.30	1.56
	350 cu. ft. (e) supporting columns	0.69	0.70	0.77	0.85
	7,250 sq. ft. (f) non-slip treads	0.14	0.25	0.26	0.22
	2,300 lin. ft. (g) cement bases				
	1,150 lin. ft. (h) exposed cement finish stairs	0.13	0.25	0.09	0.10
	1,000 sq. ft. (i) cement finish street landings	0.11	0.12	0.09	0.10
527	16,740 cu. ft. brick masonry (c) common brick	0.48	0.45	0.51	0.61
		0.83	0.60	0.86	0.89
528	40 cu. ft. hollow tile (a) 2 in.	0.48	0.45	0.61	0.64
	19,130 cu. ft. (b) 3 in.	0.47	0.40	0.58	0.51
	6,360 cu. ft. (c) 4 in.	0.22	0.50	0.35	0.65
	125 lin. ft. (d) 4½ x 13 in. flue	0.12	0.25	0.20	0.12
528A	1,440 weep-holes, h. t. walls, each	0.18	0.10	0.20	0.15
528B	9,700 strap anchors, galv., each	0.65	0.75	0.55	0.50
529	60 sq. yd. metal lath (a) without fur'g.	1.10	1.25	1.10	2.00
	25 sq. yd. (b) with furring	864.00	875.00	815.00	1,000.00
530	9 ticket booths (b) Type "B," each	985.00	940.00	920.00	1,200.00
	2 (e) Type "E," each	520.80	800.00	470.00	475.00
	1 (h) Type "K," each	101.30	75.00	91.00	92.00
532	11 doors (a) Type "A," each	139.80	140.00	130.00	130.00
	11 (b) Type "B," pair	126.50	150.00	126.50	127.00
	1 (c) Type "C," pair	78.70	65.00	73.70	74.00
	75 (d) Type "D," each	78.20	70.00	68.20	68.00
	12 (e) Type "E," each	50.00	65.00	45.10	45.00
	47 (f) Type "G," pair	87.00	80.00	91.25	78.00
	5 (g) Type "J," each	4.98	7.00	4.60	4.50
	250 sq. ft. (h) Type "K"	40.70	20.00	49.00	52.00
	1 (i) Type "Q," each	5.48	7.00	5.50	5.50
	30 sq. ft. (l) Type "L"	76.50	70.00	71.50	72.00
	9 (m) Type "M," each	38.00	35.00	33.00	33.00
	2 (o) Type "P," each	4.54	4.00	4.30	4.30
533	1,240 sq. ft. windows (a) double hung	7.87	4.00	7.58	7.60
	67 sq. ft. (b) casement	3.80	3.00	3.80	3.80
	40 sq. ft. (g) hinged				
534	20 additional hardware (a) door checks, each	4.40	6.00	4.45	4.46
		3.08	2.50	3.08	3.10
	100 (b) door stops, each	1.98	2.00	1.98	2.00
	45 (c) rubber covered chains, each	2.30	3.00	3.25	3.30
	20 (d) push plates, each	4.55	4.00	4.65	4.65
	20 (e) door pulls, each	10.12	8.00	10.10	10.10
	20 (f) kick plates, pair				
536	1,620 lin. ft. railings (a) Type "FS," incl. posts	3.45	4.25	3.73	3.60
		0.50	0.70	0.55	0.50
	620 sq. ft. (c) Type "GS," incl. posts	3.57	5.00	4.00	3.60
	620 lin. ft. (e) Type "LS," incl. posts	0.57	1.00	0.66	0.58
	1,430 sq. ft. (f) Type "BS," incl. posts	1.40	2.00	1.54	1.40
	42 lin. ft. (g) pipe	8.93	10.00	9.79	9.00
537	140 lin. ft. gates, etc. (a) low sliding	12.00	15.00	13.60	11.75
	27 lin. ft. (b) high sliding	3.97	9.00	4.35	3.85
	8 lin. ft. (c) folding	18.70	30.00	20.30	18.25
	14 (f) single gate controls, each	7.15	6.00	7.85	7.16
	3 (h) additional c.-i. floor boxes				
	250 lin. ft. (l) 1¼ in. w.-i. galv. pipe, gate ropes	0.32	0.50	0.34	0.32
		0.55	1.00	0.60	0.50
	70 lin. ft. (m) 1 in. A steel tubing				
	27 (p) c.-i. gate posts and appurtenances, per gate	52.25	50.00	57.75	52.50
	1 opening (r) steel gate post and appurtenances	25.68	50.00	28.60	26.00
538	1,630 sq. ft. grilles and frames, vent.	2.20	2.50	2.80	2.55
	opening (b) c.-i. in vent. shafts	110.00	100.00	138.00	112.00
539	2 c.-i. vent. posts, each				
540	2 sign posts, etc. (a) ill. sign post at street level, each	277.00	150.00	300.00	276.00
	48 (c) ill. sign frame (suspended), each	106.70	90.00	116.50	108.00
	85 sq. ft. (d) frames (enam. signs) on low railing	2.26	2.50	2.47	2.25
	10 sq. ft. (e) frames (enam. signs), in (high-low grille)	1.71	2.20	1.87	1.70
	275 lin. ft. (f) sta. approach reflectors and frames	2.00	2.20	2.15	2.00
		0.35	0.55	0.415	0.40
	1,675 sq. ft. (g) enameled sign plates				
	27 sq. ft. (k) frames for enam. direction signs	1.49	3.00	1.59	1.46
		7.37	9.00	8.20	7.55
542	165 lin. ft. street railings (a) Type "K".	7.63	8.00	8.20	7.56
	240 lin. ft. (b) Type "K"				
543	175 lin. ft. steel ladders, etc. (a) ladders bet. stations	2.01	1.70	2.20	2.05
		3.30	3.00	3.55	3.32
	100 sq. ft. (b) ladder platforms, bet. sta.	0.045	0.05	0.0475	0.05
	7,900 lb. (c) steel lintel shapes	0.0575	0.07	0.055	0.06
	1,200 lb. (f) miscellaneous shapes	11.00	18.00	12.00	11.00
	44 (g) ladders, track to platform, each.	0.06	0.07	0.0575	0.06
543A	2,000 lb. miscellaneous iron castings	0.44	0.50	0.60	0.60
544	3,800 lin. ft. handrails, oak	0.75	0.70	1.60	0.95
546	6,950 lin. ft. platform edge construction (a) non-slip treads				
	300 (e) drilling holes in facia angle, per hole	0.33	0.30	0.30	0.23
547	Rough plumbing work (a) six stations, lump sum	9,800.00	12,000.00	9,250.00	12,000.00
	(b) enclosures bet. stations, lump sum	1,545.00	3,000.00	975.00	1,500.00
548	50 plumbing fixtures (a) water closet bowls, each	49.50	56.00	49.60	50.00
		27.50	45.00	27.50	27.50
	22 (b) lavatories, station, each	22.00	40.00	22.00	22.00
	11 (c) lavatories, signal towers, etc., each	82.50	90.00	82.50	86.00
		66.00	80.00	71.50	72.00
	20 (d) urinals, each	8.25	17.00	8.25	8.25
	11 (g) slop sinks in closet, each				
	45 (h) floor drains, each				
549	1,540 lin. ft. supply pipe, 1 in. to enclosures	0.22	0.30	0.22.	0.22
550	1,000 sq. ft. structural glass and slate (glass) (aa) ¾-in. wainscoting	1.69	1.70	1.60	1.60
		1.82	2.00	1.81	1.82
	1,660 sq. ft. (b) ¾-in. pipe chm. partition.	1.65	1.75	1.65	1.65
	460 sq. ft. (c) ¾-in. shelves	1.92	2.00	1.92	1.93
	1,070 sq. ft. (d) ¾-in. stall partitions	3.30	4.00	3.30	3.30
	150 sq. ft. (e) 1-in. floor slabs	1.60	1.60	1.60	1.60
	300 lin. ft. (f) curved corners and angles	0.83	1.50	0.75	0.85
	30 sq. ft. (slate) (m) wainscoting	0.82	1.50	0.75	0.85
	225 sq. ft. (n) pipe chmn. partitions	0.83	1.50	0.75	0.85
	80 sq. ft. (o) shelves	0.82	1.60	0.70	0.85
	135 sq. ft. (p) stall partitions	1.10	1.60	0.70	0.85
	30 sq. ft. (g) floor slabs	1.00	1.50	1.00	0.85
	20 lin. ft. (r) curved corners and angles	10.67	12.00	12.10	10.70
551	115 c.-i. work (a) posts, each	1.10	1.00	1.26	1.10
	300 lin. ft. (b) top rails	1.65	2.00	2.81	1.65
	10 (c) wall flanges, each	10.75	11.00	12.10	10.75
	25 (d) register faces and frames, each.				
	17 (e) c.-i. vent louvres in walls, toilet, each	13.20	10.00	14.85	13.20
		0.0725	0.10	0.07	0.075
552	7,600 lb. steel supporting shapes	0.135	0.15	0.1325	0.18
554	11,000 lin. ft. electric conduits (a) ¾ in.	0.185	0.20	0.18	0.20
	1,600 lin. ft. (b) 1 in.	0.235	0.25	0.26	0.26
	2,575 lin. ft. (c) 1½ in.	0.35	0.35	0.35	0.36
	550 lin. ft. (d) 2 in.	0.50	0.50	0.57	0.68
	100 lin. ft. (e) 2½ in.	0.66	0.60	0.71	0.70
	100 lin. ft. (f) 3 in.	0.1675	0.17	0.165	0.18
	1,000 lin. ft. (g) ¾ in. flexible				
554A	50 special conduit fittings, removable covers, each	0.90	1.00	0.90	1.00
		0.43	0.50	0.43	0.50
555	500 c.-i. outlet boxes, each	1.38	2.00	1.35	1.45
556	5 c.-i. pull boxes (a) 6 x 6 x 6 in., each	4.15	4.50	4.15	4.50
	5 (b) 12 x 12 x 6 in., each	6.05	6.00	6.05	6.60
	5 (c) 18 x 12 x 6 in., each	9.35	8.00	9.35	9.35
	2 (d) 24 x 18 x 6 in., each				
	18 (e) 12 x 6 x 4 in., hinged cover and lock, each	7.16	8.00	7.15	8.00
		1.26	2.00	1.25	1.35
	60 (f) 6 x 6 x 4 in., each	2.20	4.00	3.20	3.45
	5 (g) 12 x 6 x 4 in., each	0.83	2.00	0.81	0.85
	6 (h) 4 x 4 x 4 in., each	11.00	11.00	11.00	12.00
557	50 c.-i. heater boxes, each				
558	8 steel panel board boxes, (h) 25 x 6 x 49 in. to 60 in., each	17.60	16.00	17.60	17.60
		16.25	16.00	16.50	16.50
	8 (i) 25 x 6 x 37 in. to 48 in., each	33.00	30.00	33.00	33.00
	6 (j) 50 x 6 x 49 in. to 60 in., each				
561	44,300 sq. ft. painting work (a) 2 coat work, iron or steel	0.025	0.025	0.022	0.025
		0.03	0.035	0.0325	0.0226
	112,800 sq. ft. (b) 3 coat work, iron or steel				
	397,200 sq. ft. (c) 2 coat work, plaster and cement	0.02	0.025	0.02	0.0225
		0.11	0.15	0.10	0.15
	2,140 (d) numerals, each				
561A	170,000 sq. ft. painting existing steel structural work (Sec. 219)	0.045	0.035	0.035	0.045
601C	Paneled concrete wall Gerard and River Avenues (Sec. 219), lump sum.	4,636.00	5,000.00	1,600.00	2,600.00
601D	700 sq. yd. tooling and dressing paneled concrete wall (Sec. 219)	1.10	0.55	1.25	0.30
601E	Restoration of sta. fin. Mott Avenue Sta. (Sec. 219), lump sum	2,733.00	3,000.00	5,200.00	4,000.00
601F	Constructing switch-tower Mott Avenue Sta. (Sec. 219), lump sum	867.00	1,000.00	1,490.00	1,500.00

Vancouver, B. C.—Reported $500,000 bonds will be issued to construct a terminal railway to connect Kitsalano reserve with new Dominion elevator and a terminal railway for North Shore. The line will be under control of Harbor Commissioners.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Coshocton, Ohio.**—Reported contract awarded to Crosson Construction Co. of Philadelphia, Pa., for grading 50,000 yd. of gravel bed at Coshocton for Pennsylvania R. R. Co.

★**Pendroy, Mont.**—Contract for extending Great Falls & Teton Company Railway from Bynum to Pendroy, a distance of 9 miles, awarded A. Guthrie & Company, St. Paul, Minn. A. H. Hogeland, Chief Engineer, St. Paul, Minn.

★**Snoqualmie, Wash.** — The Snoqualmie Falls Lumber Co. (W. W. Warren, 1119 White Building, Seattle, Mgr.) awarded contract for constructing 6-mile logging road out of Snoqualmie to Bruce, Nettleton & Eschbach of Seattle.

PUBLIC BUILDINGS AND SCHOOLS

PROPOSED WORK.

Augusta, Me.—All bids recently opened for renovating second male wing at Maine Insane Hospital rejected by the Governor and Council as being too high.

Brunswick, Me.—Sum of $27,000 has been given Bowdoin College to erect an infirmary, to be known as the Dudley Coe Memorial Infirmary.

Livermore Falls, Me.—Town meeting May 29 voted to erect new high school on Park Street, to cost $40,000. Address Town Clerk.

Belchertown, Mass.—The State has acquired 900 acres in Belchertown as a site for the new Feeble-Minded School. Address State Board of Insanity, Boston.

Medford, Mass.—Plans prepared for Junior High School to be erected at Park and Washington Streets at cost of $125,000. Address Board of Education.

Springfield, Mass.—Henry H. Alderman, Holyoke, is architect for the county Training School. Address County Clerk.

Walpole, Mass.—Contract will be let last of June by County for erecting county agricultural school, brick and terra cotta, costing $45,000. William Chapman, Architect, 16 Ashburton Place, Boston.

Worcester, Mass.—Plans prepared by Frost & Chamberlain, Slater Building, 390 Main Street, for three-story, cement, brick and steel chemical laboratory, which the Trustees of Clark University propose erecting; cost about $30,000.

Norwich, Conn.—Contract soon to be let for erecting building for Norwich State Hospital costing $100,000, to be three and four-story, fireproof, brick, steel, limestone and terra cotta, 50 x 265 ft. Cudworth & Thompson, Architects, 148 Main Street, Norwich.

Blackwell's Island, N. Y.—Plans filed for nine-story building to be erected on west side of Blackwell's Island, opposite foot of Sixtieth Street, for Department of Public Charities, New York City; cost $500,000. Benjamin W. Levitan, Architect, 20 West Thirty-first Street, New York.

Dunkirk, N. Y.—Citizens voted $90,000 bonds for purchase of site and erecting new school in First Ward to replace School No. 10, condemned by state authorities.

Endicott, N. Y.—Election to be held June 23 to vote on issue of $40,000 bonds for additions and improvements to Broad Street School.

Rome, N. Y.—Building Committee in report to Board of Education recommends issuing $74,200 bonds for purchasing site, erecting and equipping a new school.

Lyndhurst, N. J.—Erection of a school costing $55,000 contemplated. Address Secy. Bd. of Education.

Jersey City, N. J.—Contract soon to be let by city for erecting addition to City Hospital and for a nurses' home.

New Brunswick, N. J.—Board of Freeholders June 6 sold $150,000 county jail bonds and $60,000 workhouse bonds.

Union, N. J.—Town sold $25,000 school bonds.

Beaver, Pa.—Boyd & Stewart, Century Building, Pittsburgh, are architects for school to cost $35,000. Address Bd. of Education.

Lemoyne, Pa.—The consolidation of high schools of East Pennsboro Township, West Fairview, Wormleysburg, Camp Hill, Shiremanstown, Lemoyne, Lower Allen Township and New Cumberland contemplated and the erection of a $100,000 building under consideration.

Salt Lake City, Utah.—State School Buildings Commission intends erecting several schools at different places to include the following: School at Ferron, costing $27,000; a $30,000 school at Hurricane, and a $60,000 school at Hyrum.

Middleburg, Pa.—Citizens voted to erect a high school. Address Secy. Board of Education.

Philadelphia, Pa.—A 100 x 175-ft. addition is to be erected to Rush Hospital for Consumptives, Thirty-fourth Street and Lancaster Avenue.

A building is to be erected for North eastern Hospital; cost $100,000.

Robesonia, Pa.—Citizens May 29 voted $27,000 bonds to erect a school. E. C. Scholl, Architect, North Sixth Street, Reading. Richard M. Moll, Secy. Board of Education.

Scranton, Pa.—Charles S. Weston donated $30,000 to city to erect a field house on municipal athletic field. Address City Clerk.

Sheridan, Pa.—Bd. of Public Education engaged MacClure & Spahr, 320 Fourth Avenue, Pittsburgh, to prepare plans for high school.

Baltimore, Md.—Reported contract soon to be let for erecting $100,000 addition to School No. 47, Eastern and Linwood Avenues. Address Board of Education.

Walter M. Gieske, 65 Gunther Building, is architect for the Hahnemann General Hospital to be erected at Mount Street and Riggs Avenue; cost, $200,000.

Cambridge, Md.—A Commission appointed by the Governor of whom Capt. Howard Hurst of Cambridge is a member to have charge of erecting an armory for Company C., cost about $35,000.

Hyattsville, Md.—A Commission appointed by Governor with William P. Magruder of Hyattsville a member for erecting an armory for Company F, cost about $35,000.

Westminister, Md.—Joseph N. Shriver of Westminister is a member of Commission appointed by Governor to have charge of erecting an armory for Company H., cost about $35,000.

Huntington, W. Va.—School building bonds for $300,000 will be sold July 1 by Board of Education of Independent District of Huntington.

Chester, S. C.—Urquhart & Johnson of Columbia engaged to prepare plans for two-story domestic arts building, to be erected on College Street school grounds.

Augusta, Ga.—Building Committee of Board of Education approved plans of G. Lloyd Preacher, Augusta, for proposed 17-room, fireproof Houghton School; appropriation, $50,000. Contract for construction will be let about July 1.

Birmingham, Ala.—Citizens on June 5 voted $2,000,000 bonds for erecting and repairs to schools and $500,000 for auditorium.

Florence, Ala.—Richards G. Deacon and Knight & Quale, both of Chattanooga, Tenn., engaged to prepare plans for the high school, to cost $42,000.

Tylertown, Miss.—Bd. of Supervisors will issue $50,000 bonds for erecting courthouse and jail. J. C. Luter, County Clerk.

Chattanooga, Tenn.—Site on Main Street selected for proposed Junior High School, to cost about $40,000. Address Clerk School Board.

Jacksboro, Tenn.—School bonds for $60,000 will be sold June 30 by Wm. Allen, County Judge.

Knoxville, Tenn.—An annex to Park City High School, to include an auditorium, swimming pool, six to twelve grade rooms and manual training shop being considered; cost about $30,000. Address Board of Education.

Shelbyville, Ky.—Citizens voted $50,000 bonds to erect new high school. Address School Board.

Bethel, Ohio.—Dittoe, Fahnestock & Ferber, 103 Carew Building, Cincinnati, engaged to prepare plans for a two-story high school with six class rooms and an auditorium, to cost $35,000.

Cincinnati, Ohio.—County Commissioners June 6 sold $300,000 Longview Hospital bonds.

Cleveland, Ohio.—Finance Committee of City Council considering ordinance to erect a recreation and community building at 4700 Broadway; cost, $60,000. Richard Collins, City Clerk.

Circleville, Ohio.—School bonds for $130,000 sold. Address Secy. Bd. of Education.

Dayton, Ohio.—School bonds for $39,500 will be sold July 1, by Board Education Van Buren Township, Rural School Dist. Wm. Dean, Clerk Board, R. F. D. No. 12, Dayton.

Fredericktown, Ohio.—Citizens May 26 voted in favor of erecting new school to cost approximately $39,000. Address School Board.

Hilliards, Ohio.—Frank L. Packard, Hayden Building, Columbus, engaged to prepare plans for school to cost $60,000. Address Board of Education.

Jefferson, Ohio.—School bonds amounting to $36,000 sold by Village Board of Education.

Lakewood, Ohio (not Warren as previously stated).—School bonds for $400,000 will be sold July 11 by Board Education (P. T. Harrold, Clk.).

Pleasant City, Ohio.—School bonds for $40,000 will be sold July 1 by Board Education (Dr. Wm. Stranahan, Clerk).

Reily, Ohio.—Bonds amounting to $30,000 for erecting new school sold. Address Secretary Board of Education.

St. Paris, Ohio.—School bonds for $25,000 will be sold July 1 by Board Education Jackson Rural School District (Francis M. Apple, Clerk) at Grafton Schoolhouse.

Huntington, Ind.—Hospital bonds for $40,000 will be sold June 28 by Huntington County. O. E. Aviston, Co. Aud.

J. E. Allport, 653 East 105th Street, Cleveland, Ohio, engaged to prepare plans for proposed two-story and basement, brick and fireproof hospital. Address County Clerk.

Detroit, Mich.—Plans being prepared by Alvin E. Harley, Bowles Building, for a Coliseum, 300 x 400 ft., to be erected by Michigan State Fair Association; cost, $160,000.

Amboy, Ill.—Citizens voted $50,000 bonds for township high school. Address Clerk Township, Amboy.

Chicago, Ill. — Building and Grounds Committee of Board of Education appropriated $285,000 for new elementary school to be erected at Grace Street and Sixtieth Avenue, $110,000 for addition to Lawson School and $82,000 for addition to Spalding School for crippled children.

James B. Dibelka, 29 South La Salle Street, is preparing plans for improvements for new Austin Park, bounded by Central and Austin Avenues, Adams and Harrison Streets, to consist of a community building, for social and educational purposes; combination stadium and natatorium, two-story, 160 x 40 ft.; service building, including a stable for ten horses and accommodations for automobiles; shelter houses and athletic field; cost between $200,000 and $300,000.

Eureka, Ill.—Sum of $50,000 has been given to Eureka College to erect a science hall.

Ottawa, Ill.—Election will probably be held in fall to vote on erecting a tuberculosis hospital at cost of $40,000.

Woodriver, Ill.—Plans being prepared for eight-room school to cost $30,000. Address Clerk School Board.

Lancaster, Wis.—Citizens June 6 voted $50,000 bonds for erecting city hall. Nothing further has been done about the matter. John M. Stone, City Clerk.

Sheboygan, Wis.—Enlargement of First Ward School at cost of $30,000 contemplated. Address Secretary Board of Education.

Des Moines, Iowa.—Reported twelve additional Carnegie libraries will be erected here this year at a cost of $106,000. Address Julia A. Robinson, Secretary Iowa Library Association.

Dumont, Iowa.—Citizens voted $54,000 bonds for school improvements. C. R. Martin, Secretary Board of Education; M. L. Pedicord, Engineer, Iowa Falls.

Eddyville, Iowa.—Erection of a $25,000 high school contemplated. Address School Board.

Irwin, Iowa.—A school costing $50,000 is to be erected. Address Board of Education.

Jefferson, Iowa.—Citizens voted $80,000 bonds to erect new high school on present site. Address School Board.

Oskaloosa, Iowa.—Board of Trustees of Penn College considering plans for rebuilding administration building recently destroyed by fire.

Red Oak, Ia.—Citizens voted $115,000 high school bonds. Address Secretary Board of Education.

Vinton, Iowa.—Miller, Fullenwider & Dowling, Chicago, Ill., are architects for a 2-story fireproof brick school. W. E. Bickel, Secretary School Board.

Barnesville, Minn.—Citizens May 29 voted $30,000 bonds to erect municipal hospital. E. Aamvitt, City Clerk.

Eveleth, Minn.—Revised plans prepared by W. T. Bray of Duluth for proposed school to be erected at estimated cost of $150,000. Address Clerk School Board.

Arkansas City, Kan.—Election will soon be held to vote $60,000 bonds for erecting city hall and municipal building.

Harper, Kan.—Citizens voted $40,000 bonds to erect new high school. Address School Board.

Iola, Kan.—Citizens voted $100,000 bonds for erecting high school.

Wichita, Kan.—Citizens voted $65,000 bonds for erecting schools in Wichita Independent District. W. W. Brown, Secretary Board Trustees.

Plattsmouth, Neb.—Contract will be let about July by School Board (E. H. Westcott, Secy.), for erecting a 2½-story brick school costing $50,000. Berlinghof & Davis, Archts., Lincoln, Neb.

Minot, N. D.—Plans being prepared by W. E. Hulse & Company, Hutchinson, Kan., for proposed high school to be erected here at cost of $125,000.

Laramie, Wyo.—Reported Edward Ivinson has signed an agreement with County Commissioners to give a site and furnish money for erecting a 36-room hospital as a memorial to his wife to be known as Ivinson Memorial Hospital and cost $50,000. Address County Clerk.

Beaumont, Tex.—Election will probably be held to vote $300,000 school improvement bonds. Address Clerk of School Board.

Ennis, Tex.—Contract about to be let for erecting brick and stone high school; cost about $80,000. Address Board of Education.

Attorney - General approved $80,000 school bonds.

Fort Worth, Tex.—Reported a hospital is to be erected in Fort Worth in connection with Texas Christian University Medical College. Probable cost $1,000,000. Address Secretary Board Trustees Texas Christian University.

Election to be held July 6 to vote $250,000 bonds for erecting a high school; also $15,000 for sinking 11 artesian wells.

Rockdale, Tex.—Plans being prepared for high school to cost about $30,000.

Wichita Falls, Tex.—Citizens voted $65,000 bonds for schools. Address Board of Education.

Sapulpa, Okla.—H. O. Valem & Company, Phoenix, Ariz., selected as architect for the proposed Carnegie Library. W. H. Harkison, Chairman Building Committee.

Durango, Colo.—All bids opened May 18 by James A. Wetmore, Acting Supervising Architect, Washington, D. C., for erecting U. S. Post Office rejected.

Gunnison, Col.—Site at Pine Street and Virginia Avenue purchased for proposed city hall. Address City Clerk.

Los Angeles, Cal.—Six fireproof reinforced concrete buildings are to be erected at the county hospital at a cost of $500,000. Address Board Supervisors, Los Angeles. John Schulz, Engineer, Wright & Callender Building, Los Angeles.

Martinez, Cal.—Plans prepared for proposed school to be erected at cost of $50,000. Election will soon be held to vote bonds.

Merced, Cal.—Citizens June 1 voted $150,000 bonds for erecting new high school. Address Board of Education.

Ripon, Cal.—Citizens June 1 voted $27,000 bonds to erect Union High School. Address School Board.

Riverside, Cal.—Citizens voted $40,000 bonds for erecting schools. Address Secy. Bd. of Education.

Bisbee, Ariz.—Election to be held July 11 to vote $75,000 bonds for erecting schools in Warren District. A. C. Karger, Clerk Supervisors, Tombstone.

Parowan, Utah.—Plans completed by Cannon & Fetzer, Templeton Building, Salt Lake City, for $40,000 school to be erected here.

Beamsville, Ont.—High school is to be erected at a cost of $50,000. Address W. D. Fairbrother, of Beamsville.

Brandon, Man.—Provincial Government, Winnipeg, is having plans prepared for a telephone exchange building to cost about $60,000.

Dauphin, Man.—The town is having plans prepared for a telephone exchange building; estimated cost $35,000.

BIDS DESIRED.

Boston, Mass.—Until June 23 by Schoolhouse Commissioners (Jos. P. Lomasney, Chmn.) for erecting an addition to the Hyde Park High School.

Brooklyn, N. Y.—Until June 21 (readvertisement) by L. H. Pounds, Borough President, for furnishing material and erecting, including electrical work, for reconstruction and improvement of Kings County Court House at Fulton and Livingston Streets; security $250,000. For furnishing all labor and material, plumbing and gasfitting, etc.; security $10,000. For heating, ventilating, etç.; security, $25,000. See "Prices and Lettings."

Weehawken, N. J.—Until June 21 by Board Education for additions and repairs to numerous schools. A. V. Briesen, Secretary.

Nesquehoning, Pa.—Reported desired until June 19, by Board Education, for erecting two-story stone 164 x 82 ft. school. Clyde S. Adams, Archt., 1233 Arch Street, Philadelphia.

Wernersville, Pa.—Reported desired until July 3 for erecting three-story brick and stone slate roof, 80 x 396-ft. building for Asylum for Chronic Insane. A. A. Richter, Archt., Reading.

Wilkinsburg, Pa.—Until June 26, by James G. Sansom, Secy. School Board, for erecting the Horner School. Ingham & Bird, Archts., 323 Fourth Avenue, Pittsburgh.

Washington, D. C.—Until July 6 by Office of the Constructing Quartermaster, U. S. Soldiers' Home, Washington, D. C., for erecting nurses' home and additions to present hospital at this place.

Reidsville, N. C.—By Committee Reidsville Graded School Dist. for erecting a school. Advertised in Engineering Record. W. G. Rogers, Archt., Charlotte, N. C.

Atlanta, Ga.—Until June 27 by Eugene C. Wachendorff, Archt., 827 Empire Building, for erecting a reinforced concrete skeleton frame and other work in connection therewith for Nurses' Home, Grady Hospital, Atlanta.

Deer Park, Ohio.—Until June 26 by Board Education (W. Mittendorf, Clk.) for erecting addition to school. Bausmith & Drainie, Archts., 901-905 Gerke Building, Cincinnati.

Jefferson, Ohio.—Reported desired until June 27, by C. B. Hamm, Board of Education, for erecting 2-story and basement school addition. Probable cost $31,000. Frank L. Packard, The Hayden, Columbus, Archt.

Scioto, Ohio.—Reported desired until June 20, by W. B. Halstead, Clk. Board Education, Porter Township, Rural School Dist., for erecting addition to high school. Ritter & Bates, Archts., Portsmouth.

Albion, Ind.—Reported desired until June 26 by Board Trustees of Public Library, Nellie B. Smith, Secy., for erecting library.

Solsberry, Ind.—Repórted desired until June 23, by J. R. Sullivan, Trus. Beach Creek Township, and Ulysses R. Price, Trus. Center Township, for erecting high school. J. W. Gaddis, Archt., Vincennes.

Grand Rapids, Mich.—Until July 3 by H. N. Morrill, Business Manager Board of Education, for erecting an addition to the Union High School, including plumbing, heating, wiring, etc., advertised in Engineering Record. H. H. Turner, Archt., 234 North Division Avenue.

Plymouth, Mich.—Until June 24 by Dr. F. J. Travis, Pres. Board Education, for furnishing material and erecting a school. Separate bids for heating, plumbing, etc. R. A. Le Roy, Archt., 122 Pratt Building, Kalamazoo.

Oshkosh, Wis.—Until about July 15, by State Board of Regents, Madison, for erecting a reinforced concrete 3-story 140 x 143 ft. normal school library, to cost $165,000. Van Ryn & DeGelleke, Archts., Caswell Blk., Milwaukee; John S. H. Keith, Superintendent, Oshkosh.

Superior, Wis.—Reported desired until June 23 for erecting normal training school. Address State Chief Engineer, Madison.

Knoxville, Iowa.—Until July 6 (extension of time) by T. G. Gilson, Secy. Independent District, for erecting a high school, advertised in Engineering Record.

Muscatine, Iowa.—Reported desired until July 1 by Eckland, Fugard & Knapp, Chicago and Moline, for erecting 3-story, 78 x 125-ft. high school addition. Probable cost $75,000.

Rockwell City, Iowa.—Until June 26 by Board Control State Institute for furnishing material and erecting four buildings for the Iowa Industrial Reformatory for Females at Rockwell City. Separate bids for heating, plumbing, etc. H. F. Liebbe & Proudfoot, Bird & Rawson, Archts., 810 Hubbell Building, Des Moines.

Byron, Minn.—Until June 22 by School Board (C. J. Webb, Secy.) for erecting a consolidated school in Dist. No. 41. Separate bids for heating, electric work, etc. G. J. Hoffman & Co., Archts., Rochester, Minn.

Good Thunder, Minn.—Until June 21 by Village Council, for furnishing material and erecting a jail.

Keewatin, Minn.—Reported desired until June 20 by P. A. McEachin, Clk. School Board, for erecting high school. W. T. Bray, Archt., 1200 Fidelity Building, Duluth.

Proctor, Minn.—Until June 24 by Board Education (H. J. Barncard, Clk. Independent School Dist. No. 1) for erecting a brick school. Separate bids for heating, plumbing, wiring, etc. Vernon D. Price & Co., Archts., Duluth.

Red Wing, Minn.—Until about July 1, by Red Wing School District (Andrew Lindgren, Clerk), for erecting a two and three story high and grade school costing $160,000, including equipment. Bell & Bentley, Archts., Minneapolis.

White, S. D.—Until June 23 by W. G. Willett, Secy. Board Education, for furnishing material and erecting a school. Separate bids for heating, plumbing, etc. A. H. Schoultz, Archt., Watertown, S. D.

Annapolis, Md.—Reported desired until June 23, by S. H. Linthicum, Chairman Building Committee, care of County School Superintendent, Annapolis, for erecting Heights Shipley public school.

Carthage, Mo.—Reported desired until July 1 by County Commissioners for erecting a two-story tuberculosis sanitarium; probable cost $50,000. Rose and Peterson, Archts., Barker Block, Kansas City, Kan.

McAllen, Tex.—Reported desired until June 24, by M. K. L. Waller, Architect, Ft. Worth, for erecting a two-story reinforced concrete and brick school.

Placentia, Cal.—Until June 24 by Board School Trustees (D. W. Chase, Clerk) for erecting a 6-room concrete school to cost about $25,000. F. H. Eley, Archt., Register Building, Santa Ana.

Kingsville, Ont.—Until June 20 by G. J. Desbarats, Deputy Minister of Naval Service, Ottawa, for constructing a fish hatchery and dwelling at Kingston.

Selkirk, Ont.—Reported desired until June 24 by J. E. Hoover, Secy.-Treas. School Board, for erecting school. A. W. Peene, Archt., 108 Clyde Block.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Sangus (P. O. East Sangus), Mass.**—Following are four lowest bids opened June 2, by Building Committee (Edgar B. Oliver, Chairman), for erecting addition to high school: Charles E. Currier Company, Boston, $54,608 (awarded contract); Whiton & Haynes Company, Boston, $55,430; C. S. Cunningham & Sons Company, Boston, $56,400; and Dexter & Crosby, Beverly, $56,413.

Brooklyn, N. Y.—Following are four lowest bids opened June 7 by L. H. Pounds, President Borough, for reconstructing the Kings County Court House: General contract, Charles Meads & Company, 38 Park Row, New York, $574,000; P. J. Carlin Construction Company, 1123 Broadway, New York, $577,000; North Eastern Construction Company, 225 Fifth Avenue, New York, $589,400, and Thomas Dwyers, 216th Street and Broadway, New York, $597,000. Plumbing: Cranford Brothers, 291 Flatbush Avenue, $25,775; P. F. Kenny Company, 31 Old Broadway, New York, $25,950; Christopher Nally, 710 Columbus Avenue, New York, $27,710, and Wills & Newton Company, Avenue B and Seventeenth Street, New York, $27,931. Heating: Callahan Kingsley Company, $69,774; Adams Britz Company, 1761 Park Avenue, New York, $74,981; James H. Merritt & Company, 48 Cliff Street, New York, $74,968; Wells & Norton Company, Avenue B and Seventeenth Street, New York, $75,941.

★**Connellsville, Pa.**—Contract for erecting 12-room Central Grade School on Seventh Street, West Side, awarded George Schenck & Company of Butler at $45,252. Harry W. Altman, Archt., Uniontown.

★**East Pittsburgh, Pa.**—Contract for erecting a four-story, brick and hollow tile municipal building awarded George M. Hall Co. of Homestead; cost $33,000.

★**Elwood City, Pa.**—Contract reported awarded August Weber & Company, Pittsburgh, for erecting grade school in Fourth Ward at about $30,000.

★**Lewistown, Pa.**—Contract for erecting high school (bids opened June 5) awarded Shamokin Lumber Mfg. Company, Shamokin, at $92,110. Other bidder, W. D. Steinbach's Sons, Lewistown, $108,562. H. H. Laub, Jr., Chairman Building Committee.

★**Luzerne, Pa.**—Contract for erecting school awarded M. L. Roth of Wilkes-Barre at $30,288.

★**Pittsburgh, Pa.**—Contract for erecting three-story, 125 x 140-ft. building for St. Francis Hospital awarded to Cuthbert Bros Co., Bessemer Building. Sidney F. Heckert, Bessemer Building.

★**Sharon, Pa.**—W. Wishart & Sons, Sharon, secured contract for school to be erected in connection with the Prospect Heights School; cost about $69,000.

Waynesville, N. C.—Lowest bids opened June 6 by James A. Wetmore, Acting Supervising Architect, Washington, D. C., for constructing U. S. Post Office submitted by Algernon Blair, Montgomery, Ala., at $52,780, for limestone and by W. H. Fissell & Company, Marbridge Building, New York, at $56,000 for sandstone.

★**Chester, S. C.**—Contract for erecting Pryor Hospital, four-story and basement, awarded DuPre-Kennedy Contracting Company of Columbia; cost about $60,000.

★**Newnan, Ga.**—Contract awarded A. C. Knight of Albany for erecting ten-room brick and granite school on Jackson

★**Lake Charles, La.**—Contract for erecting high school awarded to C. O. Eure, Street at $35,000.

Hattiesburg, Miss., at $89,955; heating and plumbing, Craft & Rushworth, Lake Charles, at $9,393.

★**Millington, Tenn.**—J. E. Hollingsworth & Company, 308 Scimitar Building, Memphis, secured contract to erect two-story and basement, 207 x 58 ft. community school at $53,887. Hanker & Cairns, Archts., Scimitar Building, Memphis.

★**Cleveland, Ohio.**—Contract for erecting one-story, 50 x 126 ft., addition to Portland School awarded by Board of Education to C. A. Carson Company, 6408 Euclid Avenue, at $26,000.

★**Lebanon, Ohio.**—General contract for erecting infirmary building for Warren County awarded to Covell Construction Co., Ionia, Mich., at $57,000. Architects, Weber, Werner & Adkins, 1206 Mercantile Library Building, Cincinnati.

★**Lowellville, Ohio.**—Contract for erecting school in Poland Township (bids opened June 1) awarded Anderson & Filey, New Castle, at $29,500. W. H. Aubel, New Castle, secured contract for erecting school in North Side, at $28,423 (bids opened June 5). W. J. Maurice, Clerk.

★**Ft. Wayne, Ind.**—Contracts for erecting addition to Hamilton School awarded as follows: General construction, J. M. Henry, Fort Wayne, $27,548; heating, Lige Heating Company, Auburn, $5,084; plumbing and electric work, P. B. Arnold Company, Fort Wayne, $3,108.

★**Northville, Mich.**—Contract for erecting school (bids opened June 5) awarded Corell Construction Company, Ionia, Mich., at $56,800. Next three bidders: Pigott Healy Construction Company, Detroit, $59,600; Byers Brothers Construction Company, Kalamazoo, $66,484, and W. J. Laming, Northville, $78,300. Charles A. Dolph, Secy., Northville.

★**Antigo, Wis.**—Contract for erecting high school awarded Immel Construction Co. of Fond du Lac; estimated cost $100,000.

★**Boone, Iowa.**—Contract for erecting courthouse awarded Boyd Construction Company, German Life Building, St. Paul, Minn., at $155,948, and plumbing to Van Dyke Heating Company of Des Moines, at $15,460.

★**Duluth, Minn.**—Contract for erecting addition to Merritt School (bids opened May 27) awarded Frank L. Johnson & Company, 115 East Seventh Street, Duluth, at $23,977, including heating, plumbing, etc. Charles A. Bronson, Clerk Board Education.

David City, Neb.—Ohlsen & Son of David City submitted lowest bid for erecting high school at $71,063, and Western Heating & Plumbing Company for heating and plumbing at $24,810.

★**Yutan, Neb.**—Contract for erecting two-story brick school (bids opened June 1) awarded J. W. Schlesiger of Yutan.

Belton, Tex.—Lowest bid opened June 5 by James A. Wetmore, Acting Supervising Architect, Washington, D. C., for constructing U. S. Post Office, Tom Lovell Sons, Weatherford, Tex., $50,722 for limestone; W. G. Carter Company, Chicago, Ill., $54,495 for sandstone.

★**Fort Stockton, Tex.**—Contract for erecting high school (bids opened June 5) awarded Edward H. Harrell Company, Houston, at $43,350. M. L. Waller, Archt., Fort Worth.

★**San Antonio, Tex.**—Contract for erecting building at State Blind Institution awarded to Walsh & Burney of San Antonio at $219,414.

★**Chickasha, Okla.**—Contract for erecting Junior High School awarded Price & Campbell of Oklahoma City at $52,993.

Oklahoma, Okla.—Following are four bids opened June 1 by James A. Wetmore, Acting Supervising Architect, Washington, D. C., for constructing U. S. Post Office William F. Fissell & Company, New York, $245,700; Algernon Blair Montgomery, Ala., $243,000; William F. Maxwell, Lakeside, Wash., $241,800, and Dieter & Wenzel Construction Company, Wichita, Kan., $240,800.

★**Seattle, Wash.**—Following lowest bids opened by Port of Seattle Commission (C. E. Remsberg, Bell Street Wharf, Secy.) for extending the Spokane Street Transit Shed substructure, including crane, etc.: 66,570 ft. creosoted piling, J. M. Colman Co. of Seattle, $23,314, and Pacific Creosoting Co., Seattle, $23,313; locomotive crane, Hoflus Steel & Equipment Co. of Seattle, $11,007; excavation, Puget Sound Bridge & Dredging Co. of Seattle, $6,370; riprap, Puget Sound Bridge & Dredging Co. of Seattle, $10,800. J. R. West, Port Engineer.

★**Wenatchee, Wash.** — Contract for erecting U. S. Post Office awarded Bird & Hobson, Wenatchee, at $78,618.

★**Downey, Cal.**—Contract awarded Willard Brent Company, Baker Detwiler Building, Los Angeles, for erecting brick school at $28,782. John C. Austin, Architect, Baker Detwiler Building, Los Angeles.

Inglewood, Cal. — Two lowest bids opened June 2 by School Board for erecting brick auditorium at high school submitted by H. M. Boward & Sons, 621 Black Building, Los Angeles, at $27,296, and John Simpson & Company, Los Angeles, at $29,493. Norman F. Marsh and H. C. Howard, Archts., 214 Broadway Central Building, Los Angeles.

★**Los Angeles, Cal.**—Contract for erecting one-story six-room brick and concrete school on Marengo Heights awarded as follows: General contract to Willard-Brent Co., Baker Detwiler Building, $25,705; plumbing to Crowell & Sutton, Los Angeles, $3,173; and heating to John J. Brady, Los Angeles, at $1,974. R. C. Farrell, Archt. Bd. Education.

★**Oxnard, Cal.**—Contract for erecting school (bids opened June 1) awarded as follows: General construction to F. O. Engstrom, Alhambra, $35,948; heating, Hoagland Lakin, Los Angeles, $4,190, and plumbing, Cooney & Winterbottom, Alhambra, $2,408.

★**Ottawa, Ont.**—Contract for rebuilding the Parliamentary buildings recently destroyed by fire, awarded Peter Lyall & Sons Construction Company, 120 St. James Street, Montreal, Que., at $6,000,000.

PRIVATE BUILDINGS

PROPOSED WORK.

Waterbury, Conn.—Waterbury & Milldale Tramway Company (W. G. Smith, Ch. Engr., Waterbury) will erect a 150 x 35 ft. carhouse at Meriden and Frost Roads. A workshop is also contemplated.

Brooklyn, N. Y.—Plans being prepared by Kallich & Lubroth, 215 Montague Street, for five four-story brick and limestone apartment houses to be erected on Bay Twenty-second Street for Franko Construction Company; total cost, $137,000.

Morris Whinston, 459 Stone Street, is architect for two-story and basement, 40 x 95 ft., brick synagogue to be erected on Sheffield and Sutter Avenues for Congregation Neachness of East New York, Inc. (Harris Cohen, 377 Williams Avenue, President); cost about $30,000.

Simeon Eisendrath, 500 Fifth Avenue, engaged to prepare plans for two-story 50 x 100 ft. brick and limestone synagogue to be erected at Fourth Avenue and Fiftieth Street for Congregation Bual Israel; cost about $30,000. A. Fischlowitz, 550 Forty-eighth Street, Chairman Building Committee.

Long Island City, L. I., N. Y.—Site on Queens Boulevard and Hill Street purchased by Packard Motor Car Company, Broadway and Sixty-first Street, New York, on which a ten-story building is to be erected. Plans have also been prepared for an eight-story addition to their building on Van Dam Street and Queens Boulevard, to cost about $350,000.

The Degnon Terminal & Realty Improvement Company, Hunterspoint Avenue, will erect for Marcus Ward & Company a four-story concrete building on Pearson and Creek streets, to cost $250,000.

Plans being prepared by Edward Hahn, Bridge Plaza, for three five-story brick apartment houses to be erected on Crescent Street and Freeman Avenue, for H. & H. Building Company; total cost $105,000.

Newburgh, N. Y.—Italian Reformed Church, Mill Street, considering plans for a new edifice, to cost about $25,000. Rev. Petro S. Moncada, pastor.

New York, N. Y.—Plans being prepared by George F. Pelham, 30 East Forty-second Street, for alterations to New York Athletic Club Building at Central Park South and Sixth Avenue; esimated cost about $40,000.

Plans filed for erecting following buildings: Eight-story fireproof apartment house at 139 East Sixty-sixth Street, for 129 East 66th St. Co., Inc.; cost $185,000; Walter B. Chambers, Archt., 109 Broad Street. Two 5-story brick tenements at Broadway and 150th Street, for Academy Construction Company; total cost, $95,000; Gronenberg & Leuchtag, Archts., 305 Fifth Avenue. Two 6-story brick apartment buildings at 646 West 160th Street, for Kinshel Engineering Company, Inc.; total cost, $90,000; Irving Morgan, Archt., 370 East 149th Street. Five-story brick apartment house at Fort Washington Avenue and 171st Street, for Namreh Building Company; cost $75,000; Kreymborg Architectural Company, Archts., 1029 East 163d Street. Twelve-story fireproof apartment house at 407 Park Avenue, for Gresham Realty Company, Inc.; cost $400,000; Emery Roth, Archt., 119 West Fortieth Street. Five-story brick apartment house on Hawthorne Street and Vermilyea Avenue, for Edelo Realty Corporation; cost $50,000; Arthur Lobo, Archt., 105 West Fortieth Street. Five-story fireproof clubhouse at 360 Park Avenue and 77 East Fifty-second Street, for Racquet and Tennis Club; cost $400,000; McKim, Mead and White, Archts., 101 Park Avenue. Five-story fireproof day nursery at 249 East Thirtieth Street, for Bethlehem Day Nursery; cost $45,000; Frederic P. Kelley, Arhct., 437 Fifth Avenue. Fourteen-story fireproof hotel at 48 West Forty-seventh Street, for Esthold Realty Company; cost $175,000; Emery Roth, Archt., 119 West Fortieth Street. Six-story brick store, office and restaurant building at 62 East Thirty-fourth Street, for Edward N. Dickerson; cost $50,000; Rouse & Goldstone, Archts., 38 West Thirty-second Street. Two-story fireproof electric transformer station at 115 East 103d Street, for New York Edison Company; cost $50,000; W. Weissenberger, Jr., Archt., 32 Union Square. Four and five-story fireproof museum at 3741 Broadway, for the Museum of the American Indian; cost $195,000; Charles P. Huntington, Archt., 15 West Eighty-first Street. One five-story and two six-story brick tenement houses on Courtlandt Avenue and 158th Street for Cedar Construction Company; total cost, $150,000; Charles Schaefer, Jr., Archt., 401 Tremont Avenue. Two five-story brick tenement houses on 173d Street and Anthony Avenue, for Steenson Realty Company; total cost, $100,000 Charles Schaefer, Jr., Archt., 401 Tremont Avenue. Two five-story brick tenement houses on Burnside and University Avenues, for 1930 University Ave. Corporation; total cost, $130,000; Kreymborg Architectural Company, Archts., 1029 East 163d Street. For alterations and extensions to department store at 137 East Fifty-ninth Street and 990 Third Avenue, for Samuel J. Bloomingdale; cost $500,000; Buchman & Fox, architects, 30 East Forty-second Street.

James Gamble Rogers, 470 Fourth Avenue, is architect for eight-story brick and terra cotta parish house with two basements, to be erected for Madison Avenue Presbyterian Church, at Seventy-third Street; cost, $150,000.

Bayonne, N. J.—Reported Daniel Scala, 302 Avenue B, will erect a three-story apartment house on West Fifty-fourth Street; cost, $36,000.

Jersey City, N. J.—Elinora V. Crichfield, Jersey City, will erect a 4-story brick apartment house at Bergen and Virginia Avenues, to cost $50,000.

Montclair, N. J.—Plans filed by F. M. Soule, 80 Undercliff Road, for 5 houses on Undercliff Road and South Mountain Avenue; cost $45,000 to $50,000 each.

Newark, N. J.—Columbia Steam Laundry Co., 278 South Twelfth Street, will erect a 2-story addition; cost $25,000. D. C. Newman Collins, Archt., 29 Broadway, New York.

Plans prepared by William E. Lehman, 738 Broad Street, for two buildings to be erected on Broad Street for Fairchild-Baldwin Co., 786 Broad Street; cost, $70,000.

Trenton, N. J.—Trinity Episcopal Church will be improved at a cost of $50,000.

West New York, N. Y.—C. M. Halpen, West New York, will erect a 4-story brick apartment house at Sixteenth Street and Buchanan Place, to cost $32,000.

Altoona, Pa.—D. G. Puderbaugh, Hutchison Building, is architect for new Sixth Avenue Brethern Church, to be erected on Fifth Street, of brick and stone construction; cost $40,000.

Bakerstown, Pa.—Contract will soon be let for erecting two and three-story fireproof building for St. Barnabas' Free Home for Crippled Children. Janssen & Abbott, Archts., Century Building, Pittsburgh.

Bethlehem, Pa.—Moravia Church will erect a $25,000 Archives Building.

Carlisle, Pa.—Board of Trustees of Dickinson School of Law contemplates erecting new building, to cost $50,000.

Chester, Pa.—Plans being prepared by John T. Windrim, Commonwealth Building, Philadelphia, for a powerhouse, to be erected here for Philadelphia Electric Company; cost, with equipment, about $2,500,000.

Greensburg, Pa.—Plans prepared by George S. Orth & Brothers, Farmers' Bank Building, Pittsburgh, for a $60,000 residence, to be erected here for Col. Richard Coulter.

Harrisburg, Pa.—Plans being prepared by M. I. Kast, 222 Market Street, for five-story, 75 x 65 ft., warehouse, of slow-burning construction, to be erected on South Tenth Street for Capitol City Junk Company.

Contract about to be let for erecting 3-story school for Harrisburg Academy. Aantzinger, Borie & Medary of Philadelphia, Archts. Vance C. McCormick, Bergener Building, Pres. Bd. of Trustees.

Harrisburg Country Club will erect a club house at cost of $80,000. Address John Weiss, member Board Governors.

Hecktown, Pa.—Dryland Reformed and Lutheran Congregation will erect an edifice at a cost of $30,000.

Lancaster, Pa.—Plans being prepared by David Riebel & Sons, First National Bank Building, Columbus, Ohio, for new edifice to be erected on East Mulberry Street for Emanuel Lutheran Church; probable cost, $50,000.

Newmanstown, Pa.—Sum of $50,000 has been bequeathed for the erection of a church near Newmanstown, to be known as the I. S. Long Independent Memorial Church for use of Lutheran and Reformed denominations.

Philadelphia, Pa.—Plans being prepared by Scofield Engineering Company, Commercial Trust Building, and De Armond, Ashmead & Bickley, Architect, for the 12-story office building to be erected for the Franklin Trust Company. A power house is also to be constructed. Specifications will be ready about June 20.

Plans completed by George E. Savage, Witherspoon Building, for a one-story stone, 68 x 100-ft. edifice and Sunday school building for congregation of Orthodox Methodist-Episcopal Congregation of Frankford.

Plans completed by George E. Savage, Witherspoon Building, for a one-story stone, 52 x 52-ft. edifice for Congregation of Providence Methodist Episcopal Congregation, Front Street and Allegheny Avenue.

Plans prepared by Sheen & Gill, 450 N. Wilton Street, for a one-story stone edifice 50 x 73 ft. for Overbrook Baptist Church.

Plans being prepared by E. Allen Wilson, 1208 Chestnut Street, for a 3-story storage building to be erected at Forty-first Street and Lancaster Avenue.

Pittsburgh, Pa.—W. C. Burry Company, 113 N. Diamond Street, is having plans prepared for a $50,000 bakery, to be erected at Arch and Erie streets.

E. B. Lee, 345 Fourth Avenue, is architect for apartment house to be erected on Craig Street, Bellefield, for Mrs. Margaret Gray; cost about $25,000.

Contract to be let at once by Baltimore & Ohio R. R. (F. L. Stuart, Ch. Engr., Baltimore, Md.) for erecting a steel frame 35 x 350-ft. freight house at Thirty-third Street, costing $50,000.

Woodlawn, Pa.—Plans being prepared for proposed $45,000 National Servian Home, to be erected on Hopewell Avenue. Rev. Popovich, pastor of the Servian Church, may be able to give information.

York, Pa.—First United Brethren Congregation plans erecting a chapel on West Philadelphia Street costing $25,000. Address Board Trustees.

Baltimore, Md.—See "Railroads."

Baltimore, Md.—A. Lowther Forrest, 314 Law Bldg., preparing plans for remodeling Arcadia Building on North Avenue and Charles Street into a theater. Estimated cost $100,000.

Walter M. Gieske, 65 Gunther Building, is architect for a warehouse to be erected at 12 North Poca Street.

E. H. Glidden, Garrett Building, is preparing plans for a 5-story apartment house to be erected on Lake Drive.

Rosenbloom & Levy, 716 West German Street, will erect a 4-story brick warehouse at 12 North Paca Street. Walter M. Gieske, 65 Gunther Bldg., Archt.

Chesapeake & Potomac Telephone Co., 6 Light Street, will erect an exchange in Park Manor.

Plans being prepared by Edward H. Glidden, Garrett Bldg., for a 5-story apartment house on Lake Front, for Joseph Castleberg, 322 West Baltimore Street.

Plans being prepared by Parker, Thomas & Rice, Union Trust Building, for a residence to be erected at Riderwood; cost $25,000.

Plans being prepared by Parker, Thomas & Rice, Union Trust Building, for a 5-story, 24 x 74 ft. clubhouse and office building, to be erected at 606 North Broadway.

Louis Levi, Munsey Building, preparing revised plans for a 6-story building to be erected on German Street for Sun Life Insurance Co.; cost $150,000.

Union Protestant Infirmary plans erecting a general hospital building at Thirty-third and Calvert Streets.

Plans being prepared by Otto G. Simons, Maryland Casualty Tower, for a warehouse for Gomprecht & Benesch at Mulberry and Jasper Streets; cost $50,000.

Parkersburg, W. Va.—Baltimore & Ohio R. R. (Francis L. Stuart, Ch. Engr., Baltimore, Md.) will make freight facility improvements here costing $300,000, including freight station, transfer platform, team tracks, and offices for the diversion freight and agency forces. Building is to be at Fourth and Avery Streets, of brick construction, 500 x 35 ft.

Jacksonville, Fla.—Steps to be taken at once to prepare detailed plans and specification for the new union station. J. E. Willoughy, Ch. Engr., of Atlantic Coast Line, Wilmington, N. C., Chairman of the Committee having matter in charge.

Lafayette, La.—Plans of G. B. Knapp of Lafayette accepted for Masonic Lodge and club house. Address Secy. Masonic Lodge.

New Orleans, La.—Board of Directors of New Orleans Cotton Exchange have decided to erect a 14-story building to replace the old exchange building at Carondelet and Gravier Streets; cost about $1,000,000.

Knoxville, Tenn.—Erection of a Masonic Temple costing $25,000 contemplated.

Louisville, Ky.—Louisville Auditorium Association (John W. Sanders, secretary), 517 Atherton Building, approved selection of site on Broadway, between Brook and Floyd streets, for proposed auditorium.

Barberton (P. O. Fairlawn), Ohio.—High Street Church Official Board has appointed a committee to select a site for new $25,000 edifice.

Bratenahl (P. O. Cleveland, Ohio.)—Plans completed by Meade & Hamilton, Garfield Building, Cleveland, for $50,000 residence to be erected for Henry W. Corning, president of Standard Sewing Machine Company.

Cincinnati, Ohio.—Plans prepared for $50,000 edifice to replace Trinity Methodist Church on West Ninth Street, destroyed by fire. Rev. S. Clark Riker, Pastor.

Harry Hake, Telephone Building, preparing plans for rebuilding warehouse of the Adams Express Co., Butler Street, recently destroyed by fire. The new work will cost $60,000.

Cleveland, Ohio.—Lederer Furniture Company, Rose Building, will erect a four-story tile building at Euclid Avenue and E. Sixty-first Street; cost about $150,000.

Reported Fries & Schuele Company, 1958 West Twenty-fifth Street, will erect a 2-story addition, 40 x 165 ft., costing $40,000.

Reported Jacob Babin, 709 Williamson Building, will erect a 2-story store and apartment house at Superior Avenue and East 115th Street, costing $25,000.

F. K. Book, Lake Shore Boulevard, is architect for a store and apartment house to be erected at 14,601 St. Clair Avenue. J. B. Fox; cost $26,000.

Joseph Novogroder, 1791 East Sixty-third Street, will erect an apartment house at 1838 East Nineteenth Street, costing $32,000.

Reported Schmidt Realty & Investment Co., Detroit, and Hird Avenues will erect a three-story addition to present structure; cost, $25,000.

West End Business Men's Association plans to erect a $30,000 store and club building at Lorain Avenue and West Ninety-fifth Street. Address Frank J. Inch, 8906 Lorain Avenue.

Theodore Corner, 414 Erie Building, preparing plans for an addition to Hotel Del Prado, 4203 Euclid Avenue; estimated cost $200,000. H. Clark, 1525 Williamson Building, Owner.

Elyria, Ohio.—Contract will soon be let for enlarging and improving St. Andrews' Episcopal Church; estimated cost $30,000.

Mount Healthy, Ohio.—Anton Rieg, 2554 Vine Street, Cincinnati, commissioned to prepare plans for a brick parsonage for the Assumption Church.

Portsmouth, Ohio.—Trustees of First Baptist Church decided to erect a brick and terra cotta edifice at Gallia and Waller Streets; cost $25,000.

Detroit, Mich.—Henry Kohner, 803 Kresge Building, is architect for three-story and basement brick and steel building to be erected for Fidelity Realty Company at Brush Street and Custer Avenue, to be known as the L. Zox apartment.

Holland, Mich.—Reported Holland Heating Company (George E. Kollen, President) will erect a 100 x 300 ft. building, costing $25,000.

Chicago, Ill.—R. T. Race, 4156 Irving Park Building, plans erecting a fireproof store, office, theater and apartment building at Irving Park Boulevard and Crawford Avenue; cost about $325,000.

Milwaukee, Wis.—Plans prepared by George W. Adams Building Company, 330 Caswell Block, for an eighteen-apartment building which Dr. J. A. Bach intends erecting on Lake Drive and Lafayette Place; cost about $130,000.

Lodge No. 2, Odd Fellows, has purchased a site adjacent to Ivanhoe Temple, Tenth Street and Grande Avenue, and will erect a four-story clubhouse. Address Chairman Building Committee.

Franklin Lodge, Knights of Pythias, propose erecting a three-story club house at Twenty-eighth Street and Fond du Lac Avenue; probable cost $25,000.

Sioux City, Iowa.—Plans being prepared for fireproof garage and automobile salesroom building which H. A. Wetmore of Sioux City contemplates erecting on old Hutchins Homestead site; cost $40,000.

Omaha, Neb.—Parkvale Presbyterian Church intends erecting new edifice on Thirty-second Avenue and Martha Street; cost, $25,000.

Fargo, N. D.—Western Newspaper Union has purchased site at Fourth Avenue and Fourth Street and will erect a two-story, 75 x 90-ft. concrete mill construction building. C. A. Radford, manager of Fargo branch.

Butte, Mont.—Reported contract will be let about July 1 for three-story brick business block which Martin Meyer, of Butte, intends erecting at Main and East Park streets; cost $40,000.

Helena, Mont.—Reported Richard Lockey, 112 E. Sixth Avenue, and associates, purpose erecting a four-story, fireproof theater and business block, to cost $150,000.

Kansas City, Mo.—W. B. Weaver, 304 Commerce Street, contemplates erecting a 175-room hotel.

St. Louis, Mo.—Klipstein & Rathmann, Chemical Building, are architects for building which August A. Busch intends erecting at Gravois and Morgan Ford roads, to be used for restaurant purposes; approximate cost $100,000.

Abilene, Tex.—Work will soon begin by Texas & Pacific R. R. Co. (J. H. Elliott, Genl. Supt., Fort Worth) on construction of a two-story brick 50 x 200 ft. freight depot in Abilene.

Dallas Tex.—The First Methodist Church, Trinity Methodist and University Place Methodist Church intend consolidating, and will erect a building downtown and a Highland Park Church costing $500,000.

Dallas Trust & Savings Bank of Dallas intends erecting a 4-story banking building cost approximately $250,000.

Contract will be let in July for erecting the Union Terminal Station to cost, according to reports, $5,000,000. Address Union Terminal Station Company, Dallas.

Houston, Tex.—Plans being prepared for five-story, 95 x 100 ft., fireproof office building, to be erected on Travis Street for estate of George Hermann. Address Trustees.

Sweetwater, Tex.—Contract soon to be let by Texas & Pacific Ry. (C. H. Chamberlin, Ch. Engr., Dallas) for erecting a freight depot and remodeling the passenger depot here, costing $60,000.

Tacoma, Wash.—Contract will soon be let by P. C. Creso, care of Creso Apartments, for erecting six-story, brick and tile apartment house at South Ninth and E streets; cost $75,000.

Pendleton, Ore.—Portland Mausoleum Company, Portland Ehite Building, Portland, will erect a 100 crypt mausoleum, concrete, marble and bronze, in Pendleton, costing $53,000. Lawrence & Holford, Archts., Chamber of Commerce Building, Portland.

Avalon, Cal.—Permission granted Santa Catalina Island Co., Pacific Electric Bldg., Los Angeles, by State Corporation Commission, to issue bonds of which $400,000 worth will be for reconstructing burned resort city on Catalina Island.

Los Angeles, Cal.—Plans being prepared by Edelman & Barnett, 727 Black Building, for a two-story and basement reinforced concrete loft building, 50 x 140 ft., to be erected at Tenth and Los Angeles Streets, for E. A. Featherstone.

Watts, Cal.—A. H. Memmler, 621 Lissner Building, Los Angeles, engaged to prepare plans for a brick church for the Macedonia Baptist Congregation.

Kingman, Ariz.—Plans being prepared by Royal W. Lescher and John Rinker Kibbey, Bank of Arizona Bldg., Phoenix, for one-story concrete mercantile building, for Lovin & Withers Co., of Kingman; cost about $40,000. Contract to be let about July 1.

Pocatello, Idaho.—Catholics of Pocatello contemplate erecting a hospital on site adjoining St. Anthony's Roman Catholic Church, to cost about $60,000. Rev. A. J. Glorieux, Bishop of the Diocese of Boise, may be able to give information.

Ottawa, Ont.—Peter Lyall & Son, contractors for repairing burned Parliament building, will construct a workshop to cost $35,000.

BIDS DESIRED.

Harrisburg, Pa.—Reported desired until June 20 by C. Harry Kain, Archt., 37 Chestnut Street, for erecting 5-story and basement, 106 x 96-ft. hotel and store building for Geo. L. and Chas. A. Doehne. Probable cost $125,000.

Lebanon, Pa.—Reported desired until June 20 by A. A. Ritcher, Sixth and Court Streets, Reading, for erecting two-story 47 x 125-ft. club building for Lodge No. 631, B. P. O. E. Address Harry Louser, 742 Cumberland Street, Lebanon.

Sunbury, Pa.—Until July 1 by T. H. Hamilton, Patriot Building, Harrisburg, for erecting a brick and stone edifice for Congregation of St. John's Methodist Church at Second and Arch Streets; cost $60,000.

Arcadia, La.—Until July 1 by J. E. Green, Architect, 119 S. Sixty-first Street, Birmingham, Ala., for erecting the Baptist Church, to cost about $[illegible]0,000.

Cincinnati, Ohio.—By King Lumber Company, Charlottesville, Va., as advertised in Engineering Record, on structural and reinforcing steel, ornamental iron, ornamental terra cotta cut stone, reinforced concrete frame, painting, plastering, mill work, marble, tile glazing, roofing and sheet metal work required in erection of the nine-story 100 x 172 ft. reinforced concrete frame Y. M. C. A. Building at Elm and Canal Streets; contract for erection awarded to this company; cost of $500,000. Elzner & Anderson, Archts., Cincinnati, Ohio.

Midland, Mich.—Until June 27, by Russell L. McCann, Keeper of Records and Seal of Midland Lodge No. 169, Knights of Pythias, for erecting the K. of P. temple at Midland. Separate bids for heating, etc. Cowles & Mutscheller, Archts., Saginaw.

Vancouver, B. C.—Reported desired until June 20, by Canadian Northern Pacific Railway, for erecting a fireproof station at False Creek.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Greenwich, Conn.**—Contract awarded George Mertz' Sons of Port Chester, N. Y., for erecting a stone and concrete residence for William C. Squiers, 3d, at Hillcrest; cost about $200,000.

★**New Haven, Conn.**—Contract awarded Matthews Constr. Co. of Princeton, N. J., to erect a department store.

★**Brookville (P. O. Glen Head), L. I., N. Y.**—Contract awarded Milton W. Young, Philadelphia, Pa., for erecting three-story, 60 x 100-ft. brick residence, stable, garage and farmer's cottages here for David Dows, 45 Wall Street, New York. Horace Trumbauer, Land Title Building, Philadelphia, Pa., and Fred Olmstead, Brookline, Mass., Archts.

★**Lancaster, N. Y.**—Contract for erecting Masonic Temple here awarded Frank G. Hanssel, White Building, Buffalo; cost $35,000.

★**Troy, N. Y.**—Contract awarded C. P. Boland & Company, New Telephone Building, 96 Fourth Street, for erecting two-story, 130 x 50 ft., addition to St. Vincent's Female Orphan Asylum on Eighth Street; estimated cost $30,000.

★**Ambridge, Pa.**—Contract for erecting auditorium for Presbyterian Church awarded R. B. McDaniel Company, New Brighton, at $23,250, not including heating, lighting and plumbing.

★**Malvern, Pa.**—Contract for erecting Roman Catholic Church here awarded Joseph Maguire, of Wayne; cost about $35,000.

★**Marcus Hook, Pa.**—Contract awarded William Provost, Jr., of Chester, for erecting two-story, 73 x 108 ft., brick and concrete power house for Viscoe Company. Ballinger & Perrot, Archts., Methodist Building, Philadelphia.

★**Philadelphia, Pa.**—Contract awarded Harry Gill, Jr., 2515 Germantown Avenue, for erecting five-story, brick, slow burning construction warehouse and office building at 950 North Hancock Street, for Bell Company.

★Contract awarded George E. Savage, Witherspoon Building, for erecting one and two-story, stone and concrete, 54 x 42-ft. edifice, with wing 75 x 43 ft., at Fifty-seventh Street and Washington Avenue, for Ninth Presbyterian Church; cost $50,000.

★Contract awarded E. J. Kreitzburg, Broad and Arch streets, for erecting three-story and basement, 60 x 75 ft., brick, stone, concrete and terra cotta store building at Thirteenth and Commerce streets; cost $30,000. Charles E. Oelschlager, Archt., Harrison Building.

★Contract awarded R. C. Ballinger & Company, 218 West Thirteenth Street, by Society for Prevention of Cruelty to Animals, for a group of buildings to cost $15,000. Carl P. Berger, Archt., Penn Square Building.

★Contract for erecting nine-story brick and concrete commercial building at Thirteenth and Spring Streets for L. A. Belmont awarded to Cramp & Co., Denckla Building, at about $185,000.

★Contract for erecting five-story brick and concrete, 60 x 468 ft. freight house for Pennsylvania R. R. Co. at Washington Avenue and Front Street awarded Turner Concrete Steel Co., 1713 Sansom Street, at about $304,266.

★Contract for erecting a bakery and store building to cost about $42,000 for Bakers Baking Co., Inc., awarded Bailey-Lush Co., Abbott Building.

★Contract for erecting a $1,000,000 residence at Chestnut Hill for E. T. Stotesbury awarded to George A. Fuller Co., Morris Building.

★Contract awarded by George E. Savage, Archt., Witherspoon Building, to E. E. Hollenback, Inc., 200 North Fifteenth Street, for erecting stone edifice at Fifty-sixth Street and Girard Avenue for Palatinate Reformed Church; cost about $25,000.

★**Pittsburgh, Pa.**—Contract awarded James L. Stuart, McCreery Building, for erecting a residence, garage, chauffeur's house and conservatory, on Beechwood Boulevard, Squirrel Hill, for H. H. McClintic; total cost $110,000.

★**West Chester, Pa.**—Contract for erecting Methodist Episcopal Church at Barnard and High streets awarded Joseph M. Burns, West Chester; cost about $60,000.

★**Wind Gap, Pa.**—Contract awarded John Stiles of Bangor for erecting Reformed Lutheran Church in Plainfield Township, near Wind Gap, at $24,678.

★**Baltimore, Md.**—Contract for erecting 5-story business building at 220 N. Howard Street awarded Edward Brady & Sons, 1113 Cathedral Street; cost $30,000. Baldwin & Pennington, 601 Profession Building, Archts.

★Contract for erecting a fraternity house at 606 N. Broadway for Phi Chi Medical Fraternity, 520 N. Broadway, awarded to Gladfelter & Chambers, Thirty-sixth Street and Roland Avenue, at about $25,000. Parker, Thomas & Rice, Archts., 1109 Union Trust Bldg.

★**Hagerstown, Md.**—Contract for erecting apartment house on Washington Street for J. O. Jamison, Sr., awarded to Consolidated Engineering Co., 243 Calvert Building, Baltimore; cost $30,000.

★**Washington, D. C.**—H. D. Watts Company, Riggs Building, are contractors for two-story, reinforced concrete, terra cotta, granite, marble and brick, fireproof salesroom and service station, to be erected at 1128 Connecticut Avenue, for Harper-Overland Automobile Company; estimated cost $55,000.

★Contract awarded by Southern Railway Company to McClintic-Marshall Company, Oliver Building, Pittsburgh, for 850 tons of steel for the Washington office building.

★**Clarksburg, W. Va.**—Reported contract awarded by Monongahela Valley Traction Company to E. Elford, Hayden Clinton Bank Building, Columbus, Ohio, to erect interurban station, 77 x 82 ft., three stories and basement, concrete and brick, composition roof and concrete slab floors; cost $70,000. Wilbur J. Watson, Architect, Cleveland, Ohio.

★**Moundsville, W. Va.**—Contract awarded Thomas Shrimp & Son of Moundsville, for erecting edifice at Seventh Street and Jefferson Avenue for St. Xavier's Roman Catholic Church; cost approximately $100,000.

★**Augusta, Ga.**—Contract for erecting Modjeska Theater at 815 Broad Street awarded Palmer-Spivey Construction Company, Augusta; cost approximately $35,000.

★**Akron, Ohio.**—Contract awarded McClintic-Marshall Company, Oliver Building, Pittsburgh, Pa., for 960 tons of steel for the terminal building of Northern Ohio Traction Company.

★**Cincinnati, Ohio.**—General contract for erecting three-story brick and concrete department store building at Fourth and Race Streets, for Browning, King & Co., clothiers, awarded Ferro Concrete Construction Co., Richmond and Harriet Streets, at $80,000.

★Contract for erecting $30,000 residence of Harry M. Levy, Madison and Observatory Roads, awarded James Griffith & Sons Co., Reading Road. Architect, Moritz Sax, Fourth National Bank Building.

★Contract for erecting additions to the Little Sisters of the Poor Home for the Aged, Riddle Road, was awarded to J. H. Brockmann & Sons, 1608 Logan Street.

★General contract for constructing model dairy building for George Dater on Queen City Avenue awarded W. H. Forbes, Handman and Doberrer Avenues. Architect, A. C. Kuball, 611 Lincoln Inn Court.

★**Cleveland, Ohio.**—Contract awarded American Bridge Company, Pittsburgh, Pa., for steel required in the 12-story hotel to be erected on the Public Square by Cleveland & Youngstown R. R., Marshall Building. Crowell Lundoff Little Company, 1951 East Fifty-seventh Street, general contractors.

★Contract awarded by Neal Fireproof Storage Company, 7208 Euclid Avenue, to Bolton Pratt Company, 802 Columbia Building, to erect a 6-story, 61 x 59 ft., reinforced concrete addition, to cost about $30,000. Christian, Schwartzenberg & Gaede, 1900 Euclid Avenue, Archts.

★Contract for erecting Mall motion picture theater on East Third Street and Superior Avenue, awarded Walther Engineering Company, 1941 East Sixty-sixth Street; estimated cost $125,000. Louis H Becht, 306 Superior Avenue, owner.

★Contract for erecting 2-story addition to building of Fries & Schuele Company, 1958 West Twenty-fifth Street, awarded C. N. Griffin Company, 3111 Carnegie Avenue; cost $40,000.

★**Fort Wayne, Ind.**—Contract awarded John Hagemann, 1404 Fletcher Street, for erecting school and church hall for St. Paul's Roman Catholic Church, at about $26,000.

★**Muskegon, Mich.** — Contract awarded George Lather of Traverse City to erect Swedish Mission Church here; cost $30,000.

★**Peru, Ill.**—Contract awarded Peru Construction Company, Peru, for erecting brick church for St. Mary's Parish; cost, about $35,000. Rev. P. O'C. Culleton, Pastor.

★**Hampton, Iowa.**—Contract for erecting edifice for Church of Christ (bids opened June 1) awarded George E. Sargent, Hampton, at $22,500. George H. Nicol, Chairman Building Committee.

★**Sioux City, Iowa.**—Contract for erecting hospital for Benedictine Sisters (bids opened June 1) awarded B. E. Short, Sioux City, at $107,022. A. L. Stone, Architect, Sioux City.

★**Granger, Tex.**—Contract for erecting edifice for Roman Catholic Congregation awarded George Sexton of Waco at about $32,000. E. H. Reed, Waco, Architect.

★**Tacoma, Wash.**—Reported B. Marcus Priteca, Architect, Pantages Building, Seattle, awarded contract for erecting 6-story reinforced concrete and steel, brick and terra cotta theater and office building on Commerce and Broadway Streets, to Central Realty Company, Pantages Building, Seattle; cost $300,000.

★**Huntington, Ore.**—Reported contract for erecting roundhouse for Oregon-Washington Railroad & Navigation Co., Portland, awarded to M. J. Hursen Co., Globe Blk., Seattle, Wash., at about $40,000.

★**Los Angeles, Cal.**—Contract awarded C. J. Kubach Company, 701 Merchants National Bank Building, for erecting 3-story reinforced concrete warehouse, 81 x 175 ft., and a one-story brick warehouse, 50 x 200 ft., at Wilmington, Los Angeles Harbor, for Los Angeles Harbor Warehouse Company, at $47,768. Maybetty & Parker, Engineers, 472 Pacific Electric Building.

★**San Diego, Cal.**—Contract reported awarded R. P. Shields & Son, American Natl. Bank Building, for erecting 11-story addition to American National Bank Building, Fifth Street and Broadway, for which plans are being prepared by John L. Bacon, American National Bank Building.

★**Toronto, Ont.**—Contract for erecting edifice and Sunday school for Pauline Avenue Methodist Congregation awarded to J. R. Page, 18 Toronto Street; cost $40,000.

★Contract awarded by Board of Control to R. Chalkley & Son, 34 Victoria Street, for erecting car barns; cost, $30,000.

★Contract awarded Wm. Cowlin & Son, Mail Building, Toronto, for erecting $200,000 office building for the Trust & Guarantee Co. of Toronto.

NEW INDUSTRIAL PLANTS

PROPOSED WORK.

Boston, Mass.—Quincy Market Cold Storage & Warehouse Company, 133 Commercial Street, planning erecting a 9-story cold storage plant.

Pittsfield, Mass.—Kinney Worsted Yarn Company reported incorporated, with Henry R. Russell of Pittsfield as President, and contemplates erecting a mill to consist of 4000 spindles.

West Springfield, Mass. — Contract about to be let for erecting $300,000 addition to plant of Gilbert & Barker Company, West Springfield.

Brooklyn, N. Y.—Contract will soon be let for erecting six-story, 100 x 100 ft. reinforced concrete factory at Eleventh and Berry Streets for McKesson & Robbins, 91 Fulton Street, New York; cost, $90,000. William Higginson, Archt., 13 Park Row, New York.

Brooklyn, N. Y.—Plans filed for seven-story concrete building to be erected on Grand and Flushing Avenues, for Ralph Leininger, and leased to Pathe Freres Phonograph Company, for manufacture of phonographs and records; cost $200,000. Helmle & Corbett, Archts., 190 Montague Street.

College Point (P. O. Flushing), L. I., N. Y.—American Hard Rubber Company will erect a three-story, 53 x 203-ft., brick and fireproof addition to its plant at Third Avenue and Fifth Street; cost $66,000.

New York, N. Y.—Philip Hano & Company, 806 Greenwich Street, will erect a six-story factory addition at Greenwich and West Twelfth Street.

Bayonne, N. J.—Reported Irving T. Bush of Brooklyn, N. Y., considering erecting a $2,000,000 terminal on New York Bay shore front.

Camden, N. J.—Reported Victor Talking Machine Company will erect a 4-story 91 x 274 ft. factory according to plans prepared by Ballinger & Parrot, Seventeenth and Arch Streets, Philadelphia, Pa.

Delawanna, N. J.—Minwax Company, 18 East Forty-first Street, New York, N. Y., has purchased site on the Delaware, Lackawanna & Western Railroad, at Delawanna, and intends erecting a plant 100 x 100 ft., of steel and brick construction.

Port Murray, N. J.—National Fireproofing Company, Port Murray, will double capacity of plant and will install two new boilers in power house.

Mt. Union, Pa.—General Refractories Co. will erect a one-story steel, 81 x 74-ft. brick plant. Durham Bros., Archts., Reed Building, Philadelphia.

Mohrville, Pa.—Plans being prepared for a 62 x 157-ft. mill to be erected for James Wagner & Company of Mohrville.

Philadelphia, Pa.—William Cramp Ship and Engine Company, Beach and Ball Streets, has secured ground on Petty's Island and will at once construct a drydock and wharves in connection with their shipbuilding plant.

Contract soon to be let for erecting four-story, brick and stone, slow-burning construction, 41 x 250 ft. factory on Janney and Weikel Streets for Ferris Shoe Co. of St. Louis, Mo. W. S. Groves, St. Louis, Mo., and Charles E. Oelschlager, Harrison Building, associate architects.

Reported contract will soon be let for one-story, 200 x 1000 ft., brick and concrete automobile factory, to be erected on Front Street and Erie Avenue, for S. S. E. Company (V. L. Emerson, Genl. Mgr., 2300 Chestnut Street).

Plans being prepared by Charles W. Denny, Hale Building, for four-story, 48 x 94 ft. addition to factory of National Drug Company, 4679 Stenton Avenue.

Plans being prepared by Charles W. Bolton & Son, Witherspoon Building, for a 6-story factory building to be erected for Warner & Co., Willow and Marshall Streets.

Pittsburgh, Pa.—Plans being prepared by W. G. Wilkins Company, Westinghouse Building, for five-story fireproof warehouse and factory building, to be erected on Chartiers Avenue, for National Casket Company; cost about $60,000.

Cumberland, Md.—Plans and specifications prepared for an addition to South Cumberland shops of Baltimore & Ohio Railroad (F. L. Stuart, Ch. Engr., Baltimore); cost approximately $100,000.

Washington, D. C.—The House has passed a bill appropriating $11,000,000 for a Government armor plate plant.

Leaksville, N. C.—The Thread Mills Company of Spray has secured a site here for its proposed knitting mill.

Rocky Mount, N. C.—Rocky Mount Mills will improve plant, including a two-story addition to be equipped with new opening, carding and spinning machinery; total cost about $100,000.

Jacksonville, Fla.—Southern States Paint Manufacturing Company reported organized with A. C. Shannon, 716 Main Street, as general manager, and intends erecting a plant for manufacture of paint.

Mobile, Ala.—Louisville & Nashville R. R. (H. C. Williams, Ch. Engr., Louisville, Ky.) is having plans prepared by their engineers for the enlargement of the shops here.

Cincinnati, Ohio.—Martin Fisher, 2156 Central Avenue, is preparing plans for an office building and other additions to the plant of the Triumph Manufacturing Co., Spring Grove Avenue and Sassafrass Street.

Cleveland, Ohio. — Damascus Manufacturing Company, 3447 East Fifty-second Street, has purchased site on Cassius Avenue and the Wheeling & Lake Erie Railroad, and intends erecting a three-or four-story factory building, to cost $75,000.

One story addition, 80 x 440 ft., and additions to forge, machine and erecting shops of Kuhlman plant of J. G. Brill Car Co. at Adams Avenue and New York Central R. R. contemplated.

Hubbard, Ohio.—Reported Youngstown Sheet & Tube Company will improve plant here at cost of $100,000.

Lima, Ohio.—Apex Skirt Company, 211 East Young Street, will erect a $250,000 factory here.

Grand Rapids, Mich.—Reported plant of Valley City Chair Company recently destroyed by fire will be rebuilt.

Taylorville, Ill.—Reported Peabody Coal Company, 332 South Michigan Avenue, Chicago, planning erecting a factory near Taylorville, costing $100,000.

Green Bay, Wis.—Green Bay Stock Yards & Packing Co. contemplate erecting a packing plant; cost $150,000.

Milwaukee, Wis.—Plans prepared by Leenhouts & Guthrie, 424 Jefferson Street, for two-story, 83 x 380 ft. factory, to be erected at House of Correction; estimated cost $100,000.

Minneapolis, Minn.—Western Crucible Steel Company, 2843 Grand Street, intends erecting a $50,000 addition to their plant. A. F. Reitzel, Secretary.

Wyman, Partridge & Co., First Avenue, North and Fourth Street, will erect a factory and cold storage building at Fifth Street and Second Avenue; cost about $350,000.

St. Paul, Minn.—Maendler Bros., 42 East Third Street, will erect a $30,000 factory at Ninth and Robert Street.

Great Falls, Mont.—Reported Royal Milling Company, Ford Building, will erect a 2500-barrel flour mill, first unit to be erected this year, to consist of a six-story, 40 x 126-ft. mill and a 40 x 100-ft. fireproof warehouse; total cost $150,000. Charles Larson engineer in charge of construction.

El Paso, Tex.—Reported Robert Ligon, of Iowa Park, plans erecting a $50,000 independent oil refinery here.

Spokane, Wash.—Reported Northwestern Mines Development Company of Spokane, owners of the smelter at Keller, plans remodeling plant and converting it into an electro-chemical plant. Cost, $70,000.

Hamilton, Ont.—Reported F. F. Dalley Company, Hughson Street, is planning to erect a $100,000 plant on Burlington and Gage streets.

Port Arthur, Ont.—Grain Growers' Grain Company of Winnipeg, Man., reported contemplating erecting a 300,000-bushel capacity elevator here.

BIDS DESIRED.

Bridgeport, Conn.—Until June 24 (extension of date from June 17), by Board Contract & Supply for municipal ice and storage buildings, inclusive of insulation and elevator, also same time and place separate bids for equipment for a municipal ice making and cold storage plant, advertised in Engineering Record.

Davenport, Iowa.—Reported desired until July 1 by Claussen & Kruse, Archts., for erecting 3-story, 80 x 80-ft. cold storage building for Kohrs Packing Co. Probable cost $40,000.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Bristol, Conn.**—Contract for erecting casting shop, 120 x 180 ft., for Bristol Brass Co. awarded to Samuel Austin Co. of Bridgeport; cost $35,000.

★**Plainfield, N. J.**—Contract for erecting addition to plant of Niles-Bement-Pond Co. awarded to L. A. Robb Co. of Philadelphia, Pa., at $25,000.

★**Kingston, Pa.**—Contract awarded John Curtis & Company, Wilkes-Barre, for shop extension for Adder Machine Company, to cost $35,000. Sturdevant & Poggi, Coal Exchange Building, Wilkes-Barre, Archts.

★**Lancaster, Pa.**—Contract for erecting addition to silk mill of Follmer, Clogg & Company at Manor and Laurel Streets awarded Ferguson & Company, Paterson, N. J.

★**Baltimore, Md.**—Contract for erecting a grain elevator at Curtis Bay for Curtis Chemical Co. awarded to James Stewart & Co, 30 Church Street, New York, N. Y., cost about $150,000.

★**Rockingham, N. C.**—Contract awarded T. C. Thompson & Brothers, Charlotte, for erecting a 300 x 175 ft. weave shed, of slow burning construction for Steele's Mills.

★**Indianapolis, Ind.**—Contract awarded Charles J. Wacker, 207 Chamber of Commerce Building, for erecting a $25,000 addition to plant of Oakes Company, Roosevelt Avenue and Wheeler Street.

★**Medicine Hat, Alta.**—Sub-contracts in connection with $250,000 flour mills to be erected for Lake of the Woods Milling Co. awarded Fegle Engineering Co., 209 North Archibald Street, Fort Williams.

MISCELLANEOUS

PROPOSED WORK.

Transmission Line—West Buxton, Me.—The Cumberland County Power & Light Co. of Portland is securing right-of-way for construction of a transmission line from West Buxton to Hiram Falls.

Transmission Line—Bridgeton, N. J.—Bridgeton Electric Co. is planning to construct 18 miles of transmission line from Bridgeton to Woodstown.

Transmission Line—Washington, Pa.—The Brooke Electric Co. of Warwood (P. O. Wheeling, W. Va.), granted a permit to construct a transmission line from plant of American Gas & Electric Co. at Beech Bottom, W. Va., to Washington, Pa.

Park Bonds—Bradentown, Fla.—City Park bonds for $20,000 will be sold July 10 by L. D. Simmons, Mayor, and Council. L. H. Hine, City Clerk.

Park Bonds—Lorain, Ohio.—Park bonds for $55,000 will be sold July 11 by George N. Damon, City Auditor.

Subway—Bloomington, Ill.—The Illinois Central R. R. Co., the city, the Bloomington & Northern Ry. Co. (D. W. Snyder, Supt.) and East Side Improvement League agreed tentatively to construct a subway under Illinois Central R. R. tracks on East Washington Street; cost about $132,500. E. E. Jones, Mayor.

Park Improvements—Kansas City, Mo.—See "Hydraulic and River Improvements."

BIDS DESIRED.

Wall—Gorham, Me.—Until June 21, for constructing a wall about 400 ft. along two sides of the Old Cemetery at Gorham. Henry N. Sweetser, Supt. Gorham Cemetery Assoc.

Sand, Gravel, Etc.—New York, N. Y.—Until June 22, by F. J. H. Kracke, Comr. Plant & Structures, for furnishing and delivering sand and gravel to Queensboro Bridge. Also separate bids same time and place for delivering wood paving blocks, light-oil treatment and heavy-oil treatment, also cement.

Excavation and Concrete Work—New York, N. Y.—The Conners Bros. Co., 64 W. 88th Street, New York, has 20,000 yd. excavation and 8000 yd. of concrete to be let.

Elevator—Troy, N. Y.—Until July 5, by James A. Wetmore, Acting Supervising Archt., Treasury Dept., Washington, D. C., for installation complete of new electric passenger elevator, etc. in U. S. Postoffice and court house at Troy.

Fire Escapes—Pittsburgh, Pa.—Until June 19, by Geo. W. Gerwig, Secy. Board Public Education, for fire escapes on the Holmes School, and general work on the Osceola, Fort Pitt, J. M. Logan, Finview, Ind., and Minersville schools.

Wire, Wire Cables, Etc. — Memphis, Tenn.—Until July 3 by U. S. Engineer Office, Custom House, Memphis, Tenn., for wire, wire strand, wire cables, etc., advertised in Engineering Record.

Tunnels, etc.—Geneva, Ill.—Until June 27, by State Board Administration at Capitol Bldg., Springfield, for constructing concrete service tunnel and installation of steam and hot water piping, pipe conduit, etc., at State Training School for Girls. James B. Dibelka, State Archt., 130 North Fifth Avenue, Chicago.

Steel Sash—Los Angeles, Cal.—Until June 20 by Department of Public Service (James P. Vroman, Secy.) for furnishing a quantity of steel sash.

Subway—Toronto, Ont.—Until June 20, by registered post only, addressed to T. L. Church, Mayor, Chairman Board Control, for constructing concrete abutments, roof slabs, floors, etc., in Ashdale Avenue, Pedestrian Subway under G. T. R. tracks.

Oil, Asphaltum, etc.—Panama.—Until June 29, by Earl I. Brown, Corps. Engrs., U. S. A., General Purchasing Officer, Panama Canal, Washington, for Cir. No. 1054, iron fence railings, pitch, asphaltum, and creosote oil.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Dumping Machine—Port Reading, N. J.—Reported Port Reading R. R. Co. awarded contract to McMyler Interstate Co. of Cleveland, Ohio, for constructing steam and electrically-controlled car-dumping machine and appurtenances at company's yards here at $159,570. Work includes a 100-ton car dumper, 600 hp. steam plant and vessel-hauling machine. Work to be finished in seven months.

★**Fire Alarm and Police Alarm System—Union, N. J.**—Council June 6 awarded contract to Central Station Equipment Company, 114 Liberty Street, New York, N. Y., for installing the new fire and police alarm system at $22,989.

★**Grand Stand—Windsor, Ont.**—Engineer A. J. Rattray, Stair Bldg., Toronto, awarded contract for $100,000 grand stand to Hepburn & Disher, Van Horne St., Toronto, for steel and to C. W. Cadwell, 261 Ouellette Street, Windsor, for concrete.

Proposals

For Proposals Advertised, See Pages 59, 60, 61, 62 and 63.

WATERWORKS.

Bids Close.		See Eng. Record.
Jun. 19.	Pipe Line, Trinidad, Col. Adv. Jun. 10.	Jun. 10
Jun. 20.	Water Works, Carrollton, Ill.	Jun. 10
Jun. 21.	Meters, Cleveland, Ohio.	Jun. 17
Jun. 22.	Improvements, Greenwich, Ohio	Jun. 17
Jun. 23.	Meters, Washington, D. C.	Jun. 3
Jun. 23.	Pipe, Panama	Jun. 17
Jun. 26.	Pipe, etc., Panama	Jun. 3
Jun. 26.	Water Works, Harrison, Ark. Adv. Jun. 10, 17.	Jun. 10
Jun. 26.	Mains, Hydrants, Valves, Etc., Postville, Iowa	Jun. 17
Jun. 27.	Dam, Shawano, Wis. Adv. Jun. 17.	Jun. 17
Jun. 27.	Mains, Dunning, Ill.	Jun. 17
Jun. 28.	Filtration Plant, St. Hyacinthe, Que.	Jun. 10
Jun. 28.	Pipe, Vancouver, B. C.	Jun. 10
Jun. 28.	System, Oakdale, La.	Jun. 17
Jun. 30.	Filter, Etc., Barnesville, Ohio Adv. Jun. 17.	Jun. 17
Jun. 30.	Water Works, Ankeny, Iowa Adv. Jun. 17.	Jun. 17
Jul. 5.	Reservoir, etc., Middletown, Ohio Adv. Jun. 10, 17.	Jun. 10
Jul. 10.	Pipe, Etc., Washington, D. C.	Jun. 17
———	Franchise, Williamsburg, Va. Adv. May 27, June 3.	May 27

SEWERAGE AND SEWAGE DISPOSAL.

Bids Close.		See Eng. Record.
Jun. 19.	Little Falls, N. J. Adv. Jun. 3.	Jun. 3
Jun. 19.	Oskaloosa, Iowa Adv. Jun. 10.	Jun. 10
Jun. 19.	Boston, Mass.	Jun. 17
Jun. 20.	McComb, Miss.	May 27
Jun. 20.	Michigan City, Ind.	Jun. 3
Jun. 20.	Hartford, Conn.	Jun. 10
Jun. 20.	St. Louis, Mo.	Jun. 10
Jun. 20.	Westfield, Pa. Adv. Jun. 10, 17.	Jun. 10
Jun. 20.	Toronto, Ont.	Jun. 17
Jun. 20.	Lexington, Ky. Adv. Jun. 17.	Jun. 17
Jun. 21.	Philadelphia, Pa.	Jun. 10
Jun. 21.	Trenton, N. J.	Jun. 17
Jun. 22.	Milwaukee, Wis. Adv. Jun. 3 to 17.	Jun. 3
Jun. 22.	The Pas, Man.	Jun. 3
Jun. 22.	Youngstown, Ohio	Jun. 17
Jun. 23.	Houston, Tex. Adv. Jun. 10.	Jun. 10
Jun. 23.	Jamestown, N. D.	Jun. 17
Jun. 26.	Tucson, Ariz. Adv. Jun. 3, 10.	Jun. 3
Jun. 26.	Bouton, Iowa	Jun. 17
Jun. 27.	Thief River Falls, Minn.	Jun. 10
Jun. 27.	Lorain, Ohio	Jun. 17
Jun. 27.	Jersey City, N. J.	Jun. 17
Jun. 27.	Traer, Iowa	Jun. 17
Jun. 30.	Frankfort, Ind.	Jun. 10
Jul. 1.	Ann Arbor, Mich.	Jun. 10
Jul. 1.	Portsmouth, Ohio	Jun. 17
Jul. 3.	Gainesville, Fla.	Jun. 17
Jul. 3.	Plainfield, N. J. Adv. Jun. 17.	Jun. 17
Jul. 5.	Johnsonburg, Pa. Adv. Jun. 17.	Jun. 17
Jul. 7.	Spencer, Iowa	Jun. 17
Jul. 10.	Wadena, Minn.	Jun. 17
Jul. 15.	Mapleton, Iowa	Jun. 17
Jul. 20.	Evansville, Ind.	Jun. 17

BRIDGES.

Bids Close.		See Eng. Record.
Jun. 19.	Benton Harbor, Mich. (3 Props.) Adv. Jun. 3, 10.	Jun. 3
Jun. 19.	Beaverton, Mich. Adv. Jun. 3.	Jun. 3
Jun. 19.	Bonds, Beaverton, Mich. Adv. Jun. 3.	Jun. 3
Jun. 19.	Media, Pa. Adv. Jun. 10.	Jun. 10
Jun. 20.	Illinois	May 27
Jun. 20.	Las Cruces, N. M.	Jun. 3
Jun. 20.	Indianapolis, Ind.	Jun. 3
Jun. 20.	Connecticut Adv. Jun. 3, 17.	Jun. 3
Jun. 20.	Napa, Cal.	Jun. 10
Jun. 20.	Salem, Ind.	Jun. 17
Jun. 20.	Haddix Station, Ky.	Jun. 17
Jun. 20.	Las Cruces, N. M.	Jun. 17
Jun. 20.	Gorham, Me.	Jun. 17
Jun. 21.	Dallas, Tex.	Jun. 17
Jun. 21.	Geneseo, Ill.	Jun. 17
Jun. 22.	Perry, N. Y. Adv. Jun. 3, 10.	Jun. 3
Jun. 22.	Martin City, Mo.	Jun. 17
Jun. 22.	El Paso, Ill.	Jun. 17
Jun. 22.	Rockford, Ill.	Jun. 17
Jun. 23.	Granite Falls, Minn.	Jun. 17
Jun. 24.	Gunnison, Col	Jun. 17
Jun. 26.	Clintwood, Va.	May 20
Jun. 26.	California	Jun. 10
Jun. 26.	Rome, Ga.	Jun. 17
Jun. 26.	Wauseon, Ohio	Jun. 17
Jun. 27.	Bethlehem, Pa.	Jun. 17
Jun. 28.	Ventura, Cal.	Jun. 17
Jun. 29.	Greenwich, Conn.	Jun. 10
Jun. 30.	O'Neill, Neb.	Jun. 10
Jun. 30.	Dayton, Ohio	Jun. 10
Jun. 30.	La Moure, N. D.	Jun. 17
Jun. 30.	Holyoke, Mass. Adv. Jun. 17.	Jun. 17
Jul. 1.	Winchester, Ind.	Jun. 17
Jul. 3.	Brewton, Ala.	Jun. 10
Jul. 3.	Morris, Minn.	Jun. 17
Jul. 3.	Visalia, Cal.	Jun. 17
Jul. 3.	Santa Barbara, Cal.	Jun. 17
Jul. 5.	Maryland Adv. Jun. 27.	Jun. 17
Jul. 5.	Plymouth, Ind.	Jun. 17
Jul. 5.	Macon, Miss.	Jun. 17
Jul. 5.	Johnstown, Pa. Adv. Jun. 17.	Jun. 17
Jul. 6.	Spokane, Wash. Adv. Jun. 17.	Jun. 17
Jul. 7.	Columbus, Ohio	Jun. 17
Jul. 10.	Little Falls, Minn.	Jun. 17
Jul. 11.	Rehoboth, Del. Adv. Jun. 17.	Jun. 17

PAVING AND ROADS.

Bids Close.		See Eng. Record.
Jun. 19.	Cresson, Pa.	Jun. 3
Jun. 19.	Montesano, Wash.	Jun. 3
Jun. 19.	Seattle, Wash.	Jun. 3
Jun. 19.	Cuyahoga Falls, Ohio	Jun. 3
Jun. 19.	Everett, Wash.	Jun. 3
Jun. 19.	Traer, Iowa	Jun. 3
Jun. 19.	Hemett, Cal.	Jun. 10
Jun. 19.	Kearney, Neb.	Jun. 10
Jun. 19.	Evanston, Ill. Adv. Jun. 10.	Jun. 10
Jun. 19.	Yonkers, N. Y.	Jun. 17
Jun. 20.	Rockville Center, Wis. Adv. May 27.	May 27
Jun. 20.	Sharpsville, Pa.	Jun. 10
Jun. 20.	Waterloo, Iowa	Jun. 10
Jun. 20.	Lexington, Ky.	Jun. 10
Jun. 20.	Seattle, Wash.	Jun. 10
Jun. 20.	Philadelphia, Pa.	Jun. 10
Jun. 20.	Fort Worth, Tex.	Jun. 17
Jun. 20.	New York, N. Y.	Jun. 17
Jun. 20.	Georgetown, Ky.	Jun. 17
Jun. 20.	Phoenix, Ariz.	Jun. 17
Jun. 20.	Lisbon, Ohio	Jun. 17
Jun. 20.	Jersey City, N. J.	Jun. 17
Jun. 20.	Peabody, Kan.	Jun. 17
Jun. 20.	Pullman, Wash.	Jun. 17
Jun. 20.	Kansas City, Mo.	Jun. 17
Jun. 20.	Lisbon, Ohio Adv. Jun. 17.	Jun. 17
Jun. 20.	Racine, Wis.	Jun. 17
Jun. 21.	Charleston, Miss.	May 27
Jun. 21.	Sebring, Fla.	May 27
Jun. 21.	Vernon, Ala.	May 27
Jun. 21.	Grand Forks, N. D.	Jun. 10
Jun. 21.	Lisbon, Ohio	Jun. 10
Jun. 21.	Brooklyn, N. Y.	Jun. 17
Jun. 21.	Independence, Mo.	Jun. 17
Jun. 21.	Lisbon, Ohio Adv. Jun. 17.	Jun. 17
Jun. 21.	East Hartford, Conn.	Jun. 17
Jun. 21.	Des Moines, Iowa.	Jun. 17
Jun. 22.	Anniston, Ala.	Jun. 10
Jun. 22.	Marysville, Ohio	Jun. 17
Jun. 22.	Covington, Ky. Adv. Jun. 17.	Jun. 17
Jun. 22.	Long Island City, L. I., N. Y.	Jun. 17
Jun. 22.	Painesville, Ohio	Jun. 17
Jun. 22.	Lisbon, Ohio Adv. Jun. 17.	Jun. 17
Jun. 22.	Canton, Miss.	Jun. 17
Jun. 22.	Muscatine, Iowa.	Jun. 17
Jun. 22.	Gladwin, Mich.	Jun. 17
Jun. 23.	Ebensburg, Pa.	Jun. 10
Jun. 23.	Cincinnati, Ohio	Jun. 10
Jun. 23.	Indianapolis, Ind.	Jun. 10
Jun. 23.	Frankfort, Ind.	Jun. 10
Jun. 23.	Grand Ledge, Mich.	Jun. 17
Jun. 24.	Indiana	Jun. 17
Jun. 25.	Indiana	May 27
Jun. 26.	Washington, Pa.	Jun. 3
Jun. 26.	Cedar Rapids, Iowa	Jun. 3
Jun. 26.	Marshalltown, Iowa Adv. Jun. 10.	Jun. 10
Jun. 26.	Albany, N. Y. Adv. Jun. 10, 17.	Jun. 10
Jun. 26.	Seattle, Wash.	Jun. 10
Jun. 26.	Kingwood, W. Va.	Jun. 10
Jun. 26.	California.	Jun. 10
Jun. 26.	Kansas City, Kan.	Jun. 17
Jun. 26.	Harvard, Ill. Adv. Jun. 17.	Jun. 17
Jun. 26.	Everett, Wash.	Jun. 17
Jun. 26.	Avoca, Iowa	Jun. 17
Jun. 26.	Youngstown, Ohio	Jun. 17
Jun. 26.	Malone, N. Y. Adv. Jun. 17.	Jun. 17
Jun. 26.	California	Jun. 17
Jun. 26.	Traer, Iowa.	Jun. 17
Jun. 27.	Salt Lake City, Utah	May 13
Jun. 27.	Jackson, Tenn. Adv. Jun. 3.	Jun. 3
Jun. 27.	North Bend, Wash.	Jun. 10
Jun. 27.	Apollo, Pa. Adv. Jun. 10, 17.	Jun. 10
Jun. 27.	Newark, N. J.	Jun. 17
Jun. 27.	St. Louis, Mo.	Jun. 17
Jun. 27.	Maryland Adv. Jun. 17.	Jun. 17
Jun. 27.	Easton, Md.	Jun. 17
Jun. 27.	Ventura, Cal.	Jun. 17
Jun. 27.	Salem, Ohio.	Jun. 17
Jun. 28.	Cleveland, Ohio	Jun. 17
Jun. 29.	New Martinsville, W. Va. Adv. May 27 to Jun 17.	May 27
Jun. 29.	Lorain, Ohio	Jun. 17
Jun. 29.	Indiana	Jun. 17
Jun. 29.	Woodbury, N. J. Adv. Jun. 17.	Jun. 17
Jun. 30.	Indiana	Jun. 3
Jun. 30.	Indiana	Jun. 10
Jun. 30.	Burlington, Wis.	Jun. 17
Jun. 31.	Vandergrift, Pa.	Jun. 17
July 1.	Maumee, Ohio	May 27
July 1.	Mobile, Ala.	May 27
July 1.	Bay Minette, Ala.	Jun. 3
Jul. 3.	Cumberland, Md.	Jun. 17
Jul. 3.	Louisville, Ky.	Jun. 17
Jul. 3.	Seymour, Ky.	Jun. 17
Jul. 3.	Lexington, Miss.	Jun. 17
Jul. 3.	Los Angeles, Cal.	Jun. 17
Jul. 3.	Indiana	Jun. 17
Jul. 4.	Danville, Ky. Adv. Jun. 17.	Jun. 17
July 5.	Indiana	Jun. 3
July 6.	Houma, La.	Jun. 3
Jul. 5.	Princeton, N. J.	Jun. 17
Jul. 6.	Salt Lake City, Utah	Jun. 17
Jul. 5.	Maryland Adv. Jun. 17.	Jun. 17
Jul. 5.	Plymouth, Ind.	Jun. 17
Jul. 5.	Indiana	Jun. 17
Jul. 5.	Winona, Miss.	Jun. 17
Jul. 6.	Greenville, N. C. Adv. Jun. 17.	Jun. 17
Jul. 6.	Fulton, Mo.	Jun. 17
Jul. 6.	Rogersville, Tenn.	Jun. 17
Jul. 7.	Cincinnati, Ohio	Jun. 17
Jul. 8.	Defiance, Ohio	Jun. 17
Jul. 10.	Ashland, Ohio	Jun. 17
July 10.	Greenwood, Miss.	May 20
Jul. 10.	Beaver Falls, Pa.	Jun. 17
Jul. 17.	East View, Ohio	Jun. 17

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS.

Bids Close.		See Eng. Record.
Jun. 19.	Seawall, Bridgeport, Conn. Adv. May 27, June 3.	May 27
Jun. 20.	Stone, New Orleans, La. Adv. May 27 to Jun. 17.	May 27
Jun. 20.	Willows, New Orleans, La. Adv. May 27 to Jun. 17.	May 27
Jun. 20.	Dam, Marshall, N. C.	Jun. 17
Jun. 21.	Wharf, Seattle, Wash.	Jun. 10
Jun. 21.	Levee Work, Jonesboro, Ill.	Jun. 17
Jun. 22.	Irrigation, Malta, Mont. Adv. May 13.	May 13
Jun. 23.	Ditches, Crookston, Minn.	Jun. 17
Jun. 24.	Irriga., Balmorhea, Tex.	May 27
Jun. 24.	Dredging, Washington, D. C.	Jun. 10
Jun. 24.	Irrigation, El Paso, Tex.	Jun. 17
Jun. 26.	Drainage, Bouton, Iowa	Jun. 17
Jun. 27.	Canal Work, Albany, N. Y.	Jun. 10
Jun. 27.	Levee, Kansas City, Mo.	Jun. 10
Jun. 28.	Drainage, Windom, Minn.	Jun. 10
Jun. 30.	Dredging, Baltimore, Md. Adv. Jun. 3 to 17.	Jun. 3
July 1.	Drainage, Boston, Mass.	Jun. 3
Jul. 1.	Levee, Sullivan, Ind. Adv. Jun. 17.	Jun. 17
July 3.	Jetty, Gardiner, Ore.	May 27
Jul. 3.	Tunnel, Loveland, Col. Adv. Jun. 17.	Jun. 17
Jul. 10.	Drainage, Riverside, Cal.	Jun. 17
Jul. 10.	Pier, Sarasota, Fla. Adv. Jun. 17.	Jun. 17
Jul. 11.	Dredging, Baltimore, Md. Adv. Jun. 10, 17.	Jun. 10
Jul. 11.	Breakwater, Cleveland, Ohio Adv. Jun. 17.	Jun. 17

PUBLIC BUILDINGS AND SCHOOLS.

Bids Close.		See Eng. Record.
Jun. 19.	Neenah, Wis. Adv. May 13, 20.	**May 13**
Jun. 20.	Putnam, Conn.	**May 20**
Jun. 20.	Springdale, Iowa	**May 20**
Jun. 20.	Dunn Center, N. D.	**May 27**
Jun. 20.	Dayton, Ohio	Jun. 3
Jun. 20.	Waterloo, N. Y.	Jun. 3
Jun. 20.	South Bend, Ind.	Jun. 10
Jun. 20.	Ann Arbor, Mich.	Jun. 10
Jun. 20.	Keewatin, Minn.	Jun. 17
Jun. 20.	Kingsville, Ont.	Jun. 17
Jun. 20.	Scioto, Ohio	Jun. 17
Jun. 21.	Douglas, Ariz.	**May 20**
Jun. 21.	Kildeer, N. D.	**May 27**
Jun. 21.	Pittsburgh, Pa. Adv. May 27 to Jun. 17.	**May 27**
Jun. 21.	Leesburg, W. Va.	Jun. 10
Jun. 21.	Seville, Ohio	Jun. 10
Jun. 21.	Weehawken, N. J.	Jun. 17
Jun. 21.	Brooklyn, N. Y.	Jun. 17
Jun. 21.	Good Thunder, Minn.	Jun. 17
Jun. 22.	Minden, La.	**May 20**
Jun. 22.	Rumford, Me.	**May 27**
Jun. 22.	Ansonia, Ohio	Jun. 3
Jun. 22.	New Orleans, La.	Jun. 10
Jun. 22.	Knoxville, Iowa	Jun. 10
Jun. 22.	Hebron, N. D.	Jun. 10
Jun. 22.	Byron, Minn.	Jun. 17
Jun. 23.	Washington, Ind. Adv. May 27, June 3.	**May 27**
Jun. 23.	Alliance, Ohio	**May 27**
Jun. 23.	Grand Rapids, Ohio	Jun. 10
Jun. 23.	Des Moines, Iowa	Jun. 10
Jun. 23.	Kearney, Neb.	Jun. 10
Jun. 23.	Wayne, Neb.	Jun. 10
Jun. 23.	Edmund, N. D.	Jun. 10
Jun. 23.	White, S. D.	Jun. 17
Jun. 23.	Superior, Wis.	Jun. 17
Jun. 23.	Solesberry, Ind.	Jun. 17
Jun. 23.	Boston, Mass.	Jun. 17
Jun. 23.	Annapolis, Md.	Jun. 17
Jun. 24.	McAllen, Tex.	Jun. 17
Jun. 24.	Quincy, Pa.	Jun. 3
Jun. 24.	Plymouth, Mich.	Jun. 10
Jun. 24.	Selkirk, Ont.	Jun. 17
Jun. 24.	Proctor, Minn.	Jun. 17
Jun. 24.	Plymouth, Mich.	Jun. 17
Jun. 24.	Placentia, Cal.	Jun. 17
Jun. 25.	Albuquerque, N. M.	**May 27**
Jun. 26.	Redfield, S. D. Adv. May 20, 27.	**May 20**
Jun. 26.	Grinnell, Iowa	**May 27**
Jun. 26.	Pottstown, Pa.	Jun. 3
Jun. 26.	Lake Linden, Mich.	Jun. 3
Jun. 26.	Harpster, Ohio	Jun. 10
Jun. 26.	Pompton Lake, N. J.	Jun. 10
Jun. 26.	Wilkinsburg, Pa.	Jun. 17
Jun. 26.	Rockwell City, Iowa	Jun. 17
Jun. 26.	Albion, Ind.	Jun. 17
Jun. 26.	Deer Park, Ohio	Jun. 17
Jun. 27.	Lewis, Iowa	**May 27**
Jun. 27.	Erie, Pa. Adv. June 3.	**May 27**
Jun. 27.	Rochester, N. Y. Adv. May 27 to Jun. 17.	May 27
Jun. 27.	Mendota, Ill.	Jun. 10
Jun. 27.	Dunning, Ill.	Jun. 10
Jun. 27.	Atlanta, Ga	Jun. 17
Jun. 27.	Jefferson, Ohio	Jun. 17
Jun. 28.	New Albany, Ind.	Jun. 10
Jun. 30.	Edmore, N. D.	Jun. 10
July 1.	Webb City, Mo. Adv. Jun. 3, 10.	Jun. 3
July 1.	Joplin, Mo.	Jun. 10
Jul. 1.	Carthage, Ohio	Jun. 17
Jul. 1.	Red Wing, Minn.	Jun. 17
Jul. 1.	Muscatine, Iowa	Jun. 17
Jul. 3.	Grand Rapids, Mich. Adv. Jun. 17.	Jun. 17
Jul. 3.	Wernersville, Pa.	Jun. 17
July 6.	Chillicothe, Ohio	Jun. 10
Jul. 6.	Washington, D. C.	Jun. 17
Jul. 6.	Knoxville, Iowa Adv. Jun. 17.	Jun. 17
Jul. 7.	Ditch, Blue Earth, Minn.	Jun. 17
Jul. 10.	Jacksboro, Tenn.	Jun. 17
July 20.	Chillicothe, Ohio	Jun. 10
Aug. 7.	Portland, Ore. Adv. Jun. 10, 17.	Jun. 10
———.	Reidsville, N. C. Adv. Jun. 17.	Jun. 17

PRIVATE BUILDINGS.

Bids Close.		See Eng. Record.
Jun. 20.	Vancouver, B. C.	Jun. 17
Jun. 20.	Lebanon, Pa.	Jun. 17
Jun. 27.	Midland, Mich.	Jun. 17
Jun. 20.	Harrisburg, Pa.	Jun. 17
Jun. 30.	Private Bldg., Cincinnati, Ohio	May 27
July 1.	New Orleans, La.	**May 20**
July 1.	Grand Island, Neb.	**May 20**
Jul. 1.	Arcadia, La.	Jun. 17
Jul. 1.	Sunbury, Pa.	Jun. 17
———.	Cincinnati, Ohio Adv. Jun. 17.	Jun. 17

NEW INDUSTRIAL PLANTS.

Bids Close.		See Eng. Record.
Jun. 24.	Bridgeport, Conn. Adv. Jun. 17.	Jun. 17
Jul. 1.	Davenport, Iowa	Jun. 17
July 15.	West Allis, Wis.	Jun. 10

MISCELLANEOUS.

Bids Close.		See Eng. Record.
Jun. 20.	Underpass, Connecticut Adv. Jun. 3, 17.	Jun. 3
Jun. 20.	Subway, Toronto, Ont.	Jun. 17
Jun. 20.	Steel Sash, Los Angeles, Cal.	Jun. 17
Jun. 21.	Chemical Engine, etc., Butte, Mont. Adv. Jun. 3.	Jun. 3
Jun. 21.	Garbage Incinerator, Rochester, N. Y.	Jun. 17
Jun. 21.	Wall, Gorham, Me.	Jun. 17
Jun. 22.	Elevator, Corpus Christi, Tex.	Jun. 3
Jun. 22.	Sand, Gravel, Etc., New York, N. Y.	Jun. 17
Jun. 26.	Cranes, Scrapers, Etc., Seattle, Wash.	Jun. 10
Jun. 26.	El. Rys., New York, N. Y.	Jun. 17
Jun. 26.	Sprinkler System, Etc., Minot, N. D. Adv. Jun. 17.	Jun. 17
Jun. 26.	Generator Sets for Fog Station Signal, Detroit, Mich. Adv. Jun. 17.	Jun. 17
Jun. 27.	Tunnels, Etc., Geneva, Ill.	Jun. 17
Jun. 29.	Oil, Etc., Panama	Jun. 17
Jun. 30.	Mechanical Mail Handling Appar., New York, N. Y.	**May 12**
July 1.	Cranes, Seattle, Wash.	Jun. 10
Jul. 1.	Heating Plant in Mun. Bldg., Shanghai, China Adv. Jun. 17.	Jun. 17
July 3.	Fire Escapes, Tunica, Miss.	Jun. 10
Jul. 3.	Wire Cables, Etc., Memphis, Tenn. Adv. Jun. 17.	Jun. 17
Jul. 5.	Elevator, Troy, N. Y.	Jun. 17
July 17.	Mail Handling Device, New Orleans, La.	**May 27**
———	**El. Rys., New York, N. Y.** **Adv. Apr. 29 to May 12.**	**Apr. 29**

SEARCHLIGHT SECTION

Official Proposal Announcements

Price, $2.40 an inch.—Copy can be received until Thursday 10 a. m. for issue mailed the next morning

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Bids open June 27, 1916.

NOTICE OF BIDS FOR CONSTRUCTION OF DAM AND POWERHOUSE FOR THE CITY OF SHAWANO, WISCONSIN

Notice is hereby given that sealed bids endorsed "Bid on Dam and Power House" will be received by the City Clerk of the City of Shawano, Wis., up to 7.30 p. m., on June 27, 1916. The work for which said bids shall be made is the construction of a concrete dam with a 230-ft. spillway, brick power house, two concrete flumes, wing walls, core walls, apron for dam, all of reinforced concrete, excavation and dyking, all as per plans and specifications on file at the office of the City Clerk or at the office of the Power Engineering Company, consulting engineers, Minneapolis, Minn.; also including the electrical equipment, water wheel, and governor with their connections for their operation and installing them as per plans and specifications on file, also for the erection and construction of poles and wires and furnishing of materials, with the exception of poles, which will be furnished by the city, to conduct such current from the dam to the City of Shawano, in accordance with the plans and specifications on file.

There will be required for the completion of this work approximately the following amounts of material, excavations, etc.:

Total concrete, cu. yd.	3,500
Total excavation, cu. yd.	2,500
Reinforcing steel bars, ½ to 1-in.	103,000
Structural steel	66,000
7-in. Lackawanna steel piling (second hand)	234,000
Common brick	45,000
Colonial sand mould brick	26,000
Tile, 5 x 8 x 12 in.	6,000

That the City of Shawano will furnish a rock crusher and the City of Shawano has now about six hundred cords of field rock on the site, and will furnish the necessary rock to be used in the construction, which is to be taken into consideration in the amount of the bid offered.

Notice is hereby given that the Electric Light and Water Commission will also receive bids separately for the material to be used in the construction of the dam and power house and for conveying the current to the City of Shawano and for the labor in building the dam and constructing a power house and equipment and lines for conveying the current according to the plans and specifications, to wit:

A separate bid on approximately 4000 barrels sack cement to be delivered from time to time in carload lots as needed, f.o.b. Shawano, Wis., during the construction of the dam and power house; cement to be of such quality as is satisfactory to the Power Engineering Co. or the officials of the City of Shawano.

Also 103,000 lb. of reinforcing steel deformed bars, ½ to 1 in.

66,000 lb. of structural steel.

234,000 lb. of No. 7 Lackawanna steel piling (second hand), or any other steel piling as good as Lackawanna steel, subject to approval of the Power Engineering Co. or the city officials of the City of Shawano.

Also sealed bids will be received for 45,000 common bricks, and

26,000 Colonial sand mould brick, and

6000 tiles, 5 x 8 x 12 in.

Sealed bids will also be received for the electrical equipment, water wheel and governor and lines for conveying the current from the power house to the City of Shawano, according to the plans and specifications on file with the City Clerk of the City of Shawano or the Power Engineering Co. of Minneapolis, Minn., excepting the poles, which will be furnished by the city.

Separate bids will also be received for the work and labor, outside of the material, in constructing such dam and power house and necessary equipment and erecting the poles to convey the current from the dam to the city of Shawano.

All bids shall be accompanied by cash or a certified check made payable to the City Treasurer, drawn on some responsible bank, to the amount of five per cent of the bid, and the successful bidder shall be required to execute an approved bond in the sum of the total amount of the bid. That a form of the bond has been prepared and is now on file in the office of the City Clerk.

The right is reserved by the city to reject any or all bids.

Dated this 8th day of June, A. D. 1916.

Electric Light and Water Works Commission of the City of Shawano, performing the duties of the Board of Public Works.

B. ROYER,
LOUIS ROLLMANN,
HENRY E. SCHUSTER,
J. A. LIEG,
R. A. UPHAM.

Bids open June 30, 1916.

NOTICE TO CONTRACTORS.

WATER WORKS SYSTEM

ANKENY, IOWA.

Bids Received.

Sealed bids will be received by the Town Clerk until 2 p. m., on the 30th day of June, 1916, for furnishing all labor, materials and tools, and the construction of a water works system for the Town of Ankeny, Iowa. Bids must be made upon the blanks in the specifications, provided for that purpose.

Money Available.

For the construction of the portion of the waterworks specified below there is available to contractors about $10,000. The bonds have been sold to Geo. M. Bechtel & Company, of Davenport, Iowa.

Work Included and Certified Check.

The work will be divided into the following sections and with each bid will be required a certified check as follows:

	Certified Check
Section No. 1, tower and tank	$300.00
Section No. 2, distribution system	500.00
Section No. 3, pumping machinery	150.00

The checks will be payable to the Town of Ankeny, Iowa, and will be drawn upon some responsible bank. Checks of unsuccessful bidders will be returned to them within one week from the date the contracts are awarded. Checks of the successful bidders will be held two weeks from the date of the awards of the contracts for them to enter into contract and furnish acceptable bonds. The certified checks will then be returned. In case a successful bidder fails to properly enter into contract with the Town of Ankeny and furnish acceptable bond within two weeks from the above date, the certified check or checks will be forfeited to the Town of Ankeny as previously agreed liquidated damages.

Securing Plans and Specifications.

All bidders must call for plans and specifications before the day of the letting. They may be secured of A. L. Stebleton, Town Clerk, Ankeny, Iowa. Plans and specifications will be furnished only to parties intending to bid upon the work. A charge of $5 will be made but will be refunded if the plans and specifications are returned in good shape within one week from the date of the letting.

Bonds.

Bonds will be returned in the following amounts:

Section No. 1	$4,000.00
Section No. 2	4,000.00
Section No. 3	1,200.00

Right Reserved.

The Town of Ankeny reserves the right to reject any and all bids.

F. E. SPIERS,
Mayor.

A. L. STEBLETON,
Town Clerk.

Bids open June 30, 1916.

FILTER, PUMP STATION AND ELEVATED TANK

BARNESVILLE, OHIO.

Separate sealed bids will be received by the Board of Trustees of Public Affairs of the Village of Barnesville, State of Ohio, at the office of said Board, until 12 o'clock, noon, on the 30th day of June, 1916, for furnishing the necessary labor and materials and performing the necessary work for the erection and construction of an elevated steel tank, rapid sand filters and appurtenances and a pumping station for the water works of said village, according to the plans and specifications for the same on file in said office.

The elevated steel tank will have a capacity of 100,000 gallons on towers 55 ft. high.

The rapid sand filters will have a capacity of 500,000 gallons daily.

The pumping station will be a brick or concrete structure 40 ft. wide by 46 ft. long and 22 ft. high.

Said bids shall be separately and respectively indorsed "Proposal for Stand Pipe," "Proposal for Rapid Sand Filter Plant and Appurtenances," "Proposal for Pumping Station," and shall be made upon printed forms which will be furnished upon the terms set out below. Each bid must contain the full name of every person or company interested in the same and be accompanied by a certified check in the amount set forth in said specifications.

Plans and specifications and printed forms for bids may be seen at the office of the said Board in the said Village of Barnesville, or copies obtained at the office of Morris Knowles, consulting engineer, Pittsburgh, Pa., upon the payment of ten dollars, which will be refunded if plans and specifications are used in filing bona fide bids.

The right is reserved to reject any and all bids.

J. K. PORTERFIELD,
F. L. HASBROUCK,
C. P. DOBBINS,
Board of Trustees of Public Affairs,
Barnesville, Ohio.

J. W. WHITE,
Clerk.

June 7, 1916.

Bids open July 1, 1916.

CONCRETE LEVEE FACING, CONCRETE FOOTINGS AND EARTH ENLARGEMENT

SULLIVAN, IND.

Sealed proposals will be received by the Board of Commissioners, Gill Township Levee, Sullivan County, Ind., until 2 p. m., July 1, 1916, at the office of Hays & Hays, attorneys, Sherman Building, Sullivan, Ind., for the construction of concrete facing (3 in. thick) on river side slope of present levee, concrete footing at the toe of slope and for repairing and enlarging the present earth levee, in accordance with the plans and specifications on file at the County Surveyor's Office, Sullivan, Ind.

The proposed work is located in Gill Township, Sullivan County, Ind., on the left bank of the Wabash River below Riverton, Ind. There will be approximately 70,000 sq. yd. of concrete facing, 880 cu. yd. of concrete footing and 85,000 cu. yd. of earth work.

Each proposal must be accompanied by a certified check for five hundred ($500.00) dollars.

The right is reserved to reject any or all bids.

G. C. GRAETER, Engineer,
Briggs Building,
Sullivan, Ind.

Bids open June 26, 1916.

WATER WORKS SYSTEM

HARRISON, STATE OF ARKANSAS,
COUNTY OF BOONE.

Notice is hereby given that sealed proposals will be received by the Chairman of the Board of Commissioners of Water Improvement District No. 1, of Harrison, Ark., up to 3 p. m., of the 26th day of June, 1916, for furnishing the materials and constructing a system of water works for said city.

The work will consist of approximately the following:

(a) A power house.
(b) One triplex power pump.
(c) One oil engine or electric motor.
(d) One reinforced concrete reservoir.
(e) Pipe lines, hydrants, valves, etc.
(f) Resetting old machinery and renewing old pipe.

Bids will be received for furnishing any of the materials above, or for constructing the works complete.

Proposals must be addressed to the Chairman of the Board of Commissioners, at Harrison, Ark., and must contain a certified check made payable to the said Chairman, in an amount equal to 5 per cent of the amount of the bid.

The plans may be seen, and blank form of proposal procured, at the office of the Consulting Engineer, Mr. W. O. Galbreath, Harrison, Ark.

The right is reserved to reject any and all bids.

W. F. GORDON,
Chairman, Board of Commissioners,
Water Improvement District No. 1.

Bids open June 27, 1916.

NOTICE TO CONTRACTORS.

STATE OF MARYLAND, STATE ROADS COMMISSION

601 GARRETT BUILDING,
BALTIMORE, MD.

Sealed proposals for building five section of State Highway aggregating about 21.40 miles in length, as follows:

Contract No. A. A. 8—Anne Arundel County: One section of State Road between Mt. Zion and Hills Bridge, about 6.00 miles in length. (Gravel or concrete.)

Contract No. B-23—Baltimore County: One section of York Road from Verona to Hereford, about 3.07 miles in length. (Macadam resurfacing, oil bound.)

Contract No. F-18-A—Frederick County: One section of Emmittsburg Pike from Thurmont to beginning of Section "B," about 4.00 miles in length. (Macadam resurfacing, oil bound.)

Contract No. T-9—Talbot County: One section of State Road between Stumptown and Trappe, about 5.00 miles in length. (Concrete roadway.)

Contract No. Wo-14—Worcester County: One section of State Road between Pocomoke and the Virginia State line, about 3.33 miles in length. (Concrete roadway.) —will be received by the State Roads Commission, at its offices, 601 Garrett Building, Baltimore, Maryland, until 12 m. on the 27th day of June, 1916, at which time and place they will be publicly opened and read.

Bids must be made upon the blank form contained in the book of specifications. Specifications and plans will be furnished by the Commission upon application and cash payment of $1.00, as hereafter no charges will be permitted.

No bids will be received unless accompanied by a certified check for the sum of five hundred ($500) dollars, payable to the State Roads Commission.

The successful bidder will be required to give bond and comply with the Acts of the General Assembly of Maryland respecting contracts.

The Commission reserves the right to reject any and all bids.

By order of the State Roads Commission this 9th day of June, 1916.

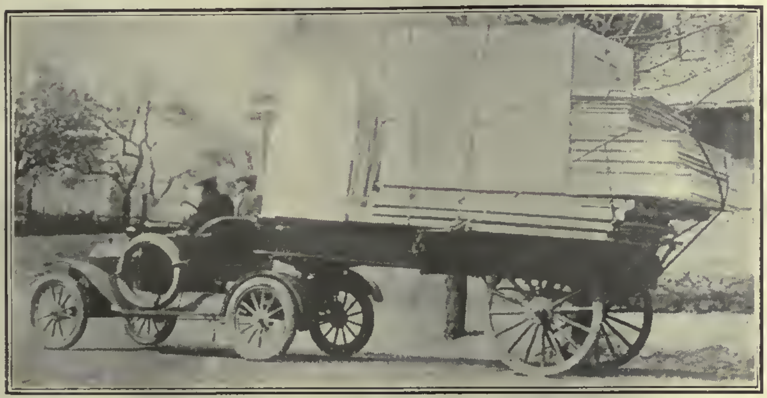
F. H. ZOUCK, Chairman.
WM. L. MARCY, Secretary.

Lettering-Pen Patent Sustained

A decision has been rendered in the U. S. Circuit Court of Appeals in favor of the Keuffel & Esser Company, upholding the validity of the patent on the Payzant lettering pen. A decision was handed down against the distributors of the Shepard pen and a decree for an injunction and accounting has been granted.

Adding Semi-Trailer Converts Roadster Into Truck

By the addition of the semi-trailer, illustrated herewith, a Ford passenger car is claimed to be readily converted into a 1½-ton motor truck. By this method the full drawing power of the automobile is said to be utilized. The combination of the Ford and the semi-trailer makes a vehicle little longer overall than the usual type of motor truck. It is claimed that it can be backed and handled in narrow places in the same manner as a team and wagon, and with equal facility. The semi-trailer is manufactured by the Martin Rocking Fifth Wheel Company of Springfield, Mass.



COMBINATION CAN BE HANDLED IN SAME MANNER AS HORSE AND WAGON

Effectively Compare Red and White Pencils on Blueprints

To emphasize the advantage of using Dixon's white 352 pencil for writing on blueprints a blue circular is being distributed on which red and white writings are reproduced. The Joseph Dixon Crucible Company believes the contrast between the red on blue and the soft white on blue to be enough in favor of Dixon's white to "sell" all who see the folder.

Motor Trucks Haul Heavy Load 140 Miles in 29½ Hours

Five 5½-ton Mack trucks, pulling three 5-ton trailers and operating in military convoy fashion, recently made a trip from New York City to Hartford, Conn., with 44 tons of metal in 29½ hours. The length of the trip totaled 140 miles. The trucks, which are the property of the Heavy Haulage Company, of New York City, started from the custom house at New York at 5.30 p. m. one day and arrived at their destination at Hartford at 11 p. m. the following day. The load consisted of unfinished ball bearings, for which, owing to the existing freight congestion, no other means of transportation could be obtained.

Horse-Drawn Wagons Converted Into Motor Trucks

By equipping them with motor-contained front wheels and the necessary handling apparatus, the National Fireproofing Company's fleet of horse-drawn wagons for use in the New York City territory is rapidly being converted into a motor-truck fleet operated by storage battery. The construction results in a front-wheel drive, and has given satisfactory service. By adopting it the company was saved the necessity of discarding its large number of wagons. It has also resulted in a saving in tire bills, the rear wheels being steel rimmed. The motor-contained wheels are manufactured by the Couple-Gear Wheel Company, of New York City.

Business Notes

The Barber Asphalt Company's $100 prize offered to students of highway engineering at Columbia University has been awarded to Mortimer L. Neinken, of Brooklyn, for an exhaustive paper on the comparison and selection of roads and pavements.

The Asbestos Protected Metal Company, of Pittsburgh, will hereafter be represented in Cincinnati and surrounding territory by E. G. Irwin, with offices in the Union Trust Building.

Charles Johnston has been made district manager of the General Fireproofing Company's recently opened branch at Philadelphia.

G. H. Stephens, manager of the New York office of the Stephens-Adamson Manufacturing Company, of Aurora, Ill., has resigned on account of ill health.

The Ransome Concrete Machinery Company has secured a show room in the loop district in Chicago at which the various Ransome products will be exhibited.

W. B. Lazear, who has been connected with the New York office of the Stephens-Adamson Manufacturing Company, of Aurora, Ill., for the past year, has been made manager of that office, succeeding G. H. Stephens, resigned.

Charles H. White, formerly of the firm of Anderson & White, New York City, agents for the Iowa Valve Company of Oskaloosa, Iowa, has re-entered the employ of the Fairbanks Company, New York City, with whom he was connected some few years ago. Mr. White will have charge of the waterworks department and will make his headquarters at the main office, Broome and Elm Streets, New York City.

The Layne & Bowler Company, water-supply contractor, has moved its general offices from Houston, Tex., and its sales office from Kansas City, Mo., to combine them at Memphis, Tenn. The largest factory of the company is also in Memphis. Branch offices will be maintained in the West and South.

The Excavating & Screening Machinery Company, Minneapolis, has removed its office to the Security Building.

Charles F. Ames, special representative of the Epping-Carpenter Pump Company, of Pittsburgh, has been transferred to New York City.

W. A. Phillis, formerly connected with the National Tube Company, has been made advertising manager of the Borden Company, of Warren, Ohio.

The Consolidated Pipe Company, Los Angeles, has removed its offices to 2440 East Ninth Street.

R. H. Wilson has been made manager of the new special steel-piling department of the Walter A. Zelnicker Supply Company, St. Louis.

F. T. Crowe & Company, Seattle, have removed their offices to 1103 First Avenue.

Trade Publications

The following companies have recently issued trade literature:

Turbine Sewer-Machine Renovating Company, Milwaukee. Catalog, 7 x 10 in., 32 pages. Shows turbine sewer machines; describes and illustrates their use. Letters from users and diagrams of operation in sewer.

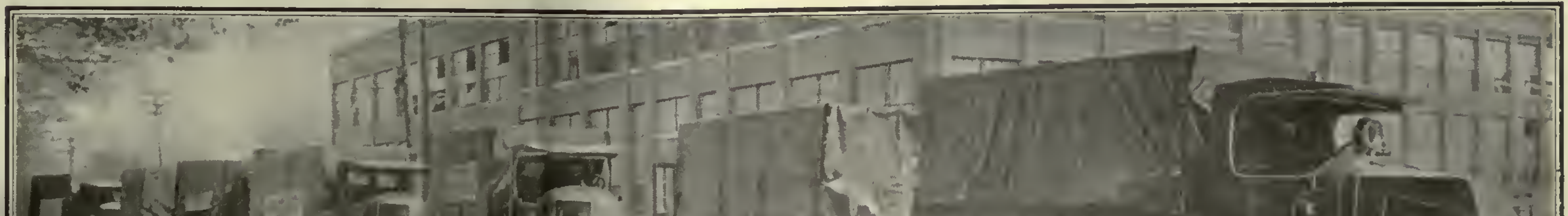
E. I. du Pont de Nemours Company, Wilmington, Del. Du Pont products book bound in Fabrikoid, 5 x 8 in., 111 pages. More than 250 products of that company listed and explained.

H. W. Clark Company, Mattoon, Ill. Circulars and folders describing Clark meter boxes and valve housings.

Waterloo Cement Machinery Corporation, Waterloo, Iowa. Catalog, 8 x 11 in., 24 pages. Describes new models of Wonder mixers with and without folding track loaders. Contains table of dimensions.

The Texas Company, New York City. Booklet, 6 x 9 in., 32 pages. Gives complete information about Texaco Crater compound—what it is and how used.

Lidgerwood Manufacturing Company, New York City. Bulletin 16, 9 x 12 in., 10 pages. Devoted to contractors' standard types of gasoline hoists.



FIVE TRUCKS WITH THREE TRAILERS LEFT NEW YORK CITY AT 5.30 P. M. ONE DAY AND ARRIVED IN HARTFORD AT 11 P. M. THE NEXT DAY

Mexican Crisis Is Not Expected to Check Business

Mobilization of National Guard Takes More Men Out of American Industry Than Were Added to It by Net Immigration in Any Month Since October, 1913—Railroads in Better Shape as to Idle Cars

UNDER DIFFERENT circumstances our unsettled relations with Mexico, terminating this week in a virtual ultimatum and active preparations. for a war that now seems unavoidable, might have had a very serious effect on the business of this country. As it is not expected, however, that the difficulties in sight can tax seriously the financial resources of the government, or that the number of men or the volume of material which may be required can be great enough to cause anything that might be referred to as an industrial reorganization, the country as a whole is confident that business will move along much as if no difficulty had arisen. This attitude is reflected in the slight depression and rapid recovery of the New York Stock Exchange following the publication of the order mobilizing the National Guard. The drastic note to the de facto Mexican government, appearing later, had already been discounted.

If such a war comes, however, it is likely to operate to prolong the present prosperity in so far as it induces conservatism. In the end it would be a boon to the American contractor, since it would open to reconstruction for American enterprise a very rich territory which has been closed to development for years, and whose transportation and public facilities require considerable rebuilding to restore them even to their original state. The Southwest, where business has long suffered from the unrest in Mexico, and is even now behind that of other sections, would be a large gainer by a restorstion of stable conditions below the boundary. How much it would cost to accomplish this restoration by the war which seems imminent is problematical. However, the cost of the withdrawal from production of the 100,000 National Guardsmen called out, of the 50,000 to 200,000 additional men that may be added to our regular land and naval forces, and of the materials needed could not be expected to reach the proportions of a drain on our resources.

Improvement in Rail Delivery Till Fall

Contractors need not be reminded in a year of serious railroad congestion that the summer months are the only ones in which they may expect prompt shipments. The net surplus of idle cars had increased on May 1 only to 30,000, a figure 25 per cent below that for the same date of the busy year of 1913, and only from one-quarter to one-ninth that at the corresponding time of 1910, 1911, 1912, 1914 and 1915. Statistics show that by October of each year at the latest the number of idle cars is greatly reduced. In 1912, with a surplus of 130,000 in May, a net shortage developed in September. Further railroad congestion is, then, to be expected when the crops begin to move, in spite of recent additions to rolling stock. Contractors and material dealers would be wise to take advantage of any improvement in the freight situation this summer to move everything the condition of their business will warrant purchasing at the present time.

Bridges and Roads

Bids have been opened for the construction of a bridge at Philadelphia to cost $200,000. A bridge contract amounting to $120,000 has been awarded at Sacramento, Cal. A bridge at New London, Conn., which will be contracted for in August, will cost $75,000. A contract will be let about the same time at Aurora, Ill., for two bridges to cost $70,000. An engineer has been engaged for a reinforced-concrete arch bridge to be built at Rice Lake, Wis. The sum of $311,500 has been voted at Spokane, Wash., to cover the cost of eight bridges, contracts for which will be let this summer.

Road work is active, especially the financing of new construction, as was to be expected from conditions. The work noted this week includes:

Contracts awarded:	Kind	Cost or Quantity
Palatka, Fla.	Brick	$179,000
Vincennes, Ind.	Paved roads	114,000
Pittsburgh, Pa	Resurfacing	286,000
Bids opened:		
Trenton, N. J.	Highway	124,000
Montclair, N. J.	Asphalt	72,000
New Orleans, La	Four highways	334,000
Bids desired:		
Albany, N. Y.	State highways, mi.	250
Bayonne, N. J.	Granite, etc., sq. yd.	35,500
Arcadia, Fla.	Paved highways, sq. yd.	560,000
Proposed work:		
Urbana, Ill.	Brick highways	$82,000
Madison, Ind.	Concrete road	77,000
Mena, Ark.	Highways, mi.	60
San Luis Obispo, Cal.	Highways, mi.	50
Work being financed:	Status	
Cambridge, Mass.	Appropriation considered	$289,000
Harrisonville, W. Va.	Bonds sold	242,000
Lewisburg, W. Va.	Bonds for sale	243,000
Somerset, Ky.	Bonds for sale	300,000
Belzonia, Miss.	Bonds voted	950,000
Lexington, Miss.	Bonds for sale	475,000
Bay City, Tex.	Bonds sold	300,000

Waterworks and Sewers

A $66,000 sewer contract has been awarded at Hartford, Conn. Dayton, Ohio, has awarded a contract for constructing a storm sewer to cost $97,000. The lowest bid received at Chicago for constructing the Calumet intercepting sewer was $653,000. A bid of $225,000 was submitted for constructing waterworks at Aberdeen, Wash. Low bids of $268,000 and $248,000 were received for constructing two sections of the intercepting sewer at Milwaukee. Another section of this sewer has been readvertised and will be let June 29. Bids are also desired at Freeport, La., for constructing sanitary sewers, and at Great Falls, Mont., for constructing a waterworks system.

Boston, Mass., will spend $165,000 improving the high-pressure water service. An $80,000 sewer is to be built at Westville, Conn. Sewer extensions and repairs under consideration at St. Joseph, Mo., will cost $550,000. Wichita, Kan., has been directed to construct a $250,000 sanitary sewer.

Buildings

Industrial plants continued to bulk large in building construction, especially in new proposed work. The more important building work noted in this issue is included in the following table:

Contracts awarded:	Kind of Building	Cost or Size
New Bedford, Mass.	Concrete warehouse	8-story
Syosset, L. I.	Residence	$200,000
Ogden, Utah	Packing plant	300,000
Lewiston, Mont	Bank building	250,000
Bids opened:		
Philadelphia, Pa	School buildings	251,000
Bids desired:		
Yonkers, N. Y.	Manufacturing plant	100,000
Proposed work:		
New York City	Apartment house	600,000
New York City	Hotel	400,000
New York City	Hotel	350,000
New York City	Addition to office building	250,000
Syracuse, N. Y.	Factory	500,000
West Hoboken, N. J.	Town hall	175,000
Trenton, N. J.	Y. M. C. A. building	250,000
Philadelphia, Pa	Machine shop	320,000
Chester, Pa	Power house	1,000,000
Baltimore, Md	University building	200,000
Norfolk, Va	Grain elevator	1,000,000
Roanoke, Va	Silk mill	1,000,000
Cleveland, Ohio	Engineers' club	400,000
Chicago, Ill.	Apartment house	250,000
Chicago, Ill.	Apartment hotel	350,000
St. Paul, Minn	Athletic club	650,000
Kansas City, Mo	Mercantile building	250,000
Dallas, Tex.	University building	200,000
San Gabriel, Cal	Cotton mill	300,000
Seattle, Wash.	Theater	250,000
Portland, Ore.	School building	200,000

Miscellaneous

The lowest bid received at New York City for constructing the Fifty-fifth Street pier was $337,000. A contract has been awarded in Brooklyn, N. Y., at $280,000, for constructing twelve elevated railroad stations. An irrigation contract amounting to $242,000 has been awarded at Fort Laramie, Wyo. Dredging work to cost $200,000 will be let July 1 at Tacoma, Wash.

The abolition of grade crossings at a cost of $500,000 has been ordered at St. Joseph, Mo. An engineer has been engaged for irrigation work to cost $300,000 at Maxwell, Cal. A railroad with offices at Los Angeles, Cal., plans to spend $771,000 for bridges and improvements. The sum of $1,400,000 has been voted for an irrigation district at Lindsay, Cal.

CONTRACTING NEWS

Of Special Interest to Engineers, Contractors, Builders and Manufacturers of Engineering and Building Supplies

WATERWORKS

PROPOSED WORK.

Boston, Mass.—City Council June 13 voted $165,000 to be spent in erecting new high-pressure service station and completing present service. Following were also approved: $12,000 for improving Carolina Avenue playground, Jamaica Plain; $300,000 for laying out and constructing new streets; $500,000 for widening radial highways, including widening Charles Street at Beacon Street; $175,000 for Hyde Park Avenue; $100,000 for Chelsea Street, Charlestown; $125,000 for Norfolk Street, Dorchester; $100,000 for Belgrade Avenue, West Roxbury.

Providence, R. I.—About $1,000,000 water bonds to be sold by city. Address City Clerk.

Yonkers, N. Y.—Water bonds for $160,000, hospital $57,000 and fire bureau equipment bonds for $48,000 sold. Address City Clerk.

Erie, Pa.—J. N. Chester of Pittsburgh, in a report to city on improvements to water works, recommends construction of a 10,000,000-gal. reservoir on heights south of city, extension of water mains, removal of pump at station and installation of two pumps.

Media, Pa.—City Council passed on first reading bond ordinance of $70,000 for improvements to water works, authorized by voters at recent election.

Philadelphia, Pa.—Reported about $25,000 will be spent by city for installation water meters.

Wilmington, Del.—Reported Chief Engineer of the Water Commissioners has been directed to ask bids for three 8,000,000-gal. turbine ribbon centrifugal pumps in connection with the new reservoir.

Dunn, N. C.—Gilbert C. White, Durham, engaged as engineer for improvements to be made to city's water and light plant.

Plant City, Fla.—The H. S. Jaudon Engineering Co., Savannah Bank & Trust Bldg., Savannah, Ga., in a report to City Council, estimates cost of constructing a combined electric light and pumping plant as follows: Brick building, $18,000; two Nordberg steam engines of from 350 to 400 hp. each; two 150 hp. boilers, two generators of 150 kw. each, new pumping station, installation, etc., at a total of $91,000.

Scottsboro, Ala.—The City Board will spend about $5,000 for an extension to water system.

West Monroe, La.—Citizens voted June 12, $450,000 bonds for constructing filtering plant. Address Mayor.

Lima, Ohio.—One hundred and fifty thousand dollar water and $100,000 paving bonds sold. Address City Auditor.

Huntington, Ind.—Contract soon to be let by city for deepening 13 wells for the city water supply. John W. Moore, Engineer, 47 Union Trust Building, Indianapolis.

New Castle, Ind.—City will soon let contract for drilling a 12-in. well, approximately 120 ft. deep, for city water supply. John W. Moore, Engineer, 47 Union Trust Building, Indianapolis.

Little York, Ill.—Construction of water works contemplated. City Engineer of Monmouth in charge of plans.

Winslow, Ill.—The citizens voted bonds for constructing water works.

Ankeny, Iowa.—Citizens voted $12,000 bonds for water works. Lawrence W. Cox, Engineer, Des Moines; A. L. Stebleton, Town Clerk.

St. Paul, Minn.—All bids opened June 12 by August Hohenstein, General Purchasing Agent, for furnishing 2 rotary screens at McCarron Pumping Station rejected as being too high. Lowest bid $12,500 water department design, and $10,500 Sanitary Corporation design.

Elkhart, Kan.—Water works improvements to cost $8,000 contemplated. Address County Clerk.

Wetmore, Kan.—Plans being prepared for construction of water works and sewerage system. Address City Clerk.

Doland, S. D.—Water works bonds for $6,000 will be sold July 5 by P. L. Brown, City Auditor.

Hinsdale, Mont.—Reported Hinsdale Special Water and Light Improvement District has been created by the Board of Valley County Commissioners at Glasgow and that bids will be called for shortly for construction of waterworks system, including pumping plant, reservoir, lines and water mains, and for a lighting system and light plant. W. H. Mann, County Engr., Glasgow.

Sheridan, Mont.—Citizens May 29 voted $26,000 bonds for water works, said bonds to be sold July 14 by Frank Carey, Town Clerk.

Chaffee, Mo.—Citizens will vote June 29 on issuing bonds for installation of water works and sewers. Frank L. Wilcox, Engineer, St. Louis.

Kansas City, Mo.—The Fire & Water Board, Burton Lowthen, Chief Engineer, is investigating the water system with a view to increase the supply.

Paris, Mo.—Construction of a filtration system contemplated; cost about $12,600. Address City Clerk.

Marvell, Ark.—City desires to grant franchise for water and light plant to supply 1000 inhabitants. Address J. M. Farrar.

Stuttgart, Ark.—City Council granted franchise to F. G. Prout to construct water works.

Kingsville, Tex.—Agreement reached between the Texas Southern Electric Co. and the city whereby the city will purchase the water works of the company. An election is to be held June 24 to vote on $150,000 bonds for said purpose.

Port Arthur, Tex.—See "Sewerage and Sewage Disposal."

Broken Bow, Okla.—See "Sewerage and Sewage Disposal."

Aberdeen, Wash.—On June 14 the Council decided to reject all bids opened May 31 for constructing the Wishkah water system, and to do the work themselves by day labor. P. F. Clark, City Clerk

Seattle, Wash.—Council adopted a resolution providing for laying water mains in North 59th St., from Phinney to Whitman Aves., and in McClellan St. from 21st South to 31st Ave. South. L. B. Youngs, Superintendent of Water.

County Commissioner (Byron Phelps, Clerk) granted 25-year franchise to Lake Forest Light, Water & Power Company of Lake Forest Park. Work to be done by day labor.

Bandon, Ore.—Perhaps during the summer or early fall the city will consider a $40,000 bond issue for a new intake.

Bouse, Ariz.—New La Pax Gold Mining Company reported planning constructing a reservoir 1,750,000 gal. capacity and is sinking two 16-in. wells near Colorado River to supply same.

Idaho Falls, Idaho.—City is considering installation of a filtration plant. Address City Clerk.

BIDS DESIRED.

Salisbury, N. C.—Until July 12, by Board Water Commissioners, for constructing new filtration plant and new source of water supply, advertised Engineering Record. J. L. Ludlow, Engineer, Winston-Salem.

Clarksdale, Miss.—Until July 3, by Yazoo and Mississippi Delta Levee Board (T. C. Dabney, Ch. Engr.) for furnishing and equipping a pumping plant as follows: One 22,500-gal per minute low-head centrifugal pump, a 115-hp. horizontal return tubular boiler with steel casing, one surface condenser suction and discharge pipe, 400 ft. long, one concrete and frame pumping station, concrete piers for pipes, etc. Thos. H. Allen, Consulting Engr., 205 Bank of Commerce Building, Memphis.

Columbus, Ohio.—Reported desired until July 7 for 25,000,000-gal. steam turbine centrifugal pump. G. A. Borden, Pres. Board Purchases.

Michigan City, Ind.—Until July 6, by Board Public Works, for furnishing water pipe and necessary specials advertised in Engineering Record. Alexander Spychalski, City Clerk.

Rock Island, Ill.—Until July 1 by Wallace Treichler, Engineer, for a 100,000-gal. tank and 125-ft. tower.

Biwabik, Minn.—Until June 27 by H. E. Greene, Village Clerk, for constructing water works. W. J. Hadja, Engineer, Virginia.

Great Falls, Mont.—Until July 10, by W. H. Harrison, City Clerk, for furnishing material and constructing water works, advertised in Engineering Record. Burns & McDonnell, Interstate Building, Kansas City, Mo., Engineera.

Los Angeles, Cal.—Until July 10 by Board of Supervisors (A. M. McPherrin, clerk) for erecting 40,000-gal. water tank with tower in Los Angeles County Water District 1, San Fernando Valley; also separate bids for furnishing steel water pipe for irrigation purposes for the Los Angeles Water District 2, San Fernando Valley.

Lovelock, Nev.—Until July 15 by County Commissioners at Winnemucca for constructing distributing reservoir and distributing pipe system at Lovelock, work to include 600' bbl. Portland cement, 2 compartment distributing reservoirs, 1,000,000 gal. capacity, lined with concrete and roofed with lumber and corrugated iron, with accessories; 20,190 lin. ft. 4, 6 and 8-in. c.-i. pipe or lap weld pipe, two 8-in., eight 6 and 36 4-in. gate valves, 6 fire hydrants and 225 corporation cocka. L. H. Taylor, Engineer, Lovelock. J. W. Davey, Clerk of Board.

Toronto, Ont.—Until July 4, by the Mayor, for furnishing all 8-in. water meters required.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★Massachusetts.—Contract for furnishing 418 tons of 12 and 16-in. special castings (bids opened June 9) awarded Standard C. I. Pipe & Foundry Co., Philadelphia, Pa., at $21,000. W. N. Davenport, Secy. Mass. Water and Sewer Board, Boston.

Batavia, N. Y.—Reported desired until June 28, by I. J. Carmichael, City Clk., for water pumping station and filter plant, sewage pump, electric generators, equipment, etc. Chester & Fleming, Engrs., Union Bank Bldg., Pittsburgh, Pa.

★Oswego, N. Y.—Contract for constructing about one mile water main awarded by Dept. of Water as follows; To M. B. Crawford & Son, 44 West Bridge Street, for pipe, at $1,614, and to Vincent Tesariero & Batti, for trenching, 21 cts. per lin. ft. and $6 per yd. for rock excavation.

★New Brunswick, N. J. — Contract awarded New York Continental Jewell Filtration Co., 15 Broad Street, New York, N. Y., for motor-driven centrifugal pumps or Kingsford Pumps-G. E. motors, at $8,550 for one 3,000,000-gal. pump and two 6,000,000-gal. pumps. Asher Atkinson, City Engineer.

Pittsburgh, Pa.—Following are bids opened June 12 by Department of Supplies for furnishing water meters and water fittings: Gamon Meter Company of Newark, N. J., Group A, $75,160; B, $16,411. Pittsburgh Meter Company of Pittsburgh, A, $80,509; B, $17,454; C, $12,871, and D, $1,632. F. P. Booth, Director.

★La Porte, Ind.—Contract awarded by Board Public Works for constructing 3,180,000-gal. reservoir to Larson & Danielson Construction Co., La Porte, at $17,014. Ralph E. Kanney, Secretary to City Engineer.

★Sheboygan Falls, Wis.—Contract for constructing water works awarded by Bd. of Public Works, June 12, as follows: Excavation and labor on distributing system, 16,555 ft. to E. M. Scheflow of Elgin, Ill., $7,963; for c. i. pipe, to James B. Clow & Son of Chicago, Ill., $12,419; drilling well, to Kispert & McCarthy of Kaukauna, $2,021; for tank, to Chicago Bridge & Iron Wks. of Chicago, Ill., at $4,100, and Keystone Drilling Co. of Chicago, Ill., for pump, at $2,060. J. Donohue, Sheboygan Falls, Engr.

McKinley, Minn.—Reported desired until June 29, by Peter Holland, Village Clerk, for constructing 75,000 gal. steel water tank on 125 ft. tower.

St. Paul, Minn.—See "Proposed Work."

★St. Paul.—Contract awarded W. J. Hov & Co., 700 Metropolitan Building, St. Paul, for constructing the low service reservoir at McCarron's Lake at $135,960.

★Miller, Neb.—Contract for constructing water works (bids opened June 2) awarded Alamo Engine & Supply Company, Omaha, Neb., $10,152. C. M. Barnebey, Village Clerk.

Galveston, Tex.—Following bids opened by Board of Commissioners for 3400 ft. c.-i. water pipe for water main on Avenue H from Thirty-fifth to Forty-sixth Street (price given is per ton): U. S. Cast Iron Pipe Foundry Co., 122 South Michigan Avenue, Chicago, Ill., $30.50; R. D. Wood & Co., Philadelphia, Pa., $32; American C. I. Pipe Co., $31.50 and $30.50.

Aberdeen, Wash.—Reported Harrington Perters Co., Oriental Building, Seattle, submitted lowest bid for constructing Wishkah water works at about $225,000.

★Roseburg, Ore. — Reported contract awarded C. E. Bade, Portland, by Douglas County Light & Water Company of Roseburg, to lay 4½ miles of new 16-in. water mains between Roseburg and Winchester.

★Kaysville, Utah.—Contract for construction of concrete storage reservoir, 100,000 gal. capacity, awarded to Wheelwright Bros. of Ogden.

★Niagara on the Lake, Ont.—Contract for pumps and filtration plant awarded Storey Pump & Equipment Company, Toronto. Cost about $10,000. N. R. Gilson, Engineer, Niagara Falls.

SEWERAGE AND SEWAGE DISPOSAL

PROPOSED WORK.

Westerly, R. I.—Citizens voted to construct a sewerage system at a cost of $200,000. Address City Clerk.

Bridgeport, Conn.—Recommendation for sewer system at an initial cost of $500,000 and total cost of $1,500,000 has been approved by the Paving and Sewer Commission. A. H. Terry, City Engineer.

Westville, Conn.—Reported work will soon begin on constructing sewer in Westville school district. Bond issue of $80,000 approved. Address City Engineer.

Syracuse, N. Y.—Common Council voted to construct sewer in Seventeenth Ward.

Dover, N. J.—Reported Sewerage Commissioners of Dover considering constructing a sewage disposal plant near Dickerson's Bridge in Rockaway; probable cost $10,000.

Somerville, N. J.—Council will extend sewer system by laying public sewer along Doughty Avenue.

Westfield, N. J.—New bids will be asked early in the new year for the construction of the relief sewer. A. W. Nars, Town Engineer.

Chester, Pa.—The Board of Commissioners Lower Chichester Township voted to construct sewerage system and sewage disposal plant. William McVey, President.

Ferndale (P. O. Johnstown), Pa.—The construction of a sewer system, costing $25,000 to $30,000, under consideration, but will probably not be constructed this year. Terra cotta pipe will be used. C. P. Collins & Company, Engineer, Johnstown; H. M. Hanner, President of Council, Ferndale, P. O. Box 495, Johnstown.

Lansdale, Pa.—State Commissioner of Health directed Lansdale to construct sewerage system. Address City Clerk,

McKeesport, Pa.—The City Council voted to construct sewerage system in Ninth and Eleventh Wards; estimated cost $36,000.

Pittsburgh, Pa.—State Health Commissioner directed City Council to construct sanitary sewer and storm-water sewer.

Scranton, Pa.—Reported plans approved by State Dept. of Health for constructing sewer system in Seventeenth Sewer Dist. of Twelfth and Twenty-first Ward. Address John G. Hayes, Director Public Works.

Windber, Pa.—Plans being prepared by C. P. Collins & Co. of Johnstown for construction of sewerage system and sewage disposal plant in Windber.

Charlotte, N. C.—Gilbert C. White, Consulting Engineer, Charlotte, prepared report on outfall sewer and sewage disposal plant. Address City Clerk.

Hamilton, Ohio.—Sewer bonds for $18,046 will be sold July 14 by Ernest E. Erb, City Auditor.

Council passed ordinance authorizing constructing of sewers in Lindenwald Sanitary Sewer District No. 1, which is to cost $53,000.

Springfield, Ohio.—Construction of a drainage and sewer system for North Side contemplated. Address City Manager.

Youngstown, Ohio.—Bids will soon be received by city for constructing Mill Creek Dist. sewer. Frank Little, City Engineer.

Charles City, Iowa.—Election to be held July 10 to vote $75,000 bonds for sewers. W. S. Beattie, City Engineer.

St. Paul, Minn.—City Council voted to construct sewers on Standish Street from Raymond Avenue to Northern Pacific tracks and a sewer on Belvidere Avenue from South Robert to Oakdale Street.

Concordia, Kan.—See "Water Works."

Hardin, Mont.—Special election will be held July 10 to vote bonds for constructing complete sewer aystem. A. L. Mitchell, Mayor.

Chaffee, Mo.—See "Water Works."

Harrisonville, Mo.—Election to be held July 6 to vote $15,000 sewer bonds.

St. Joseph, Mo.—City Council is considering submitting to a vote issuing bonds for following improvements: Extension and repair of public sewers, $550,000; new city workhouse, $25,000. Joel E. Gates, City Clerk; Carl P. Hoff, City Engineer.

Houston, Tex.—Reported City Council contemplates constructing sanitary sewer main from Willow Street pumping plant to North Side disposal plant; cost, $145,000.

Broken Bow, Okla.—Construction of water works and sewerage system contemplated. Address City Clerk.

Aberdeen, Wash.—The City Commission authorized a bond issue of $33,193 for construction of Murphy sewer. F. G. Whaley, City Engineer.

Everett, Wash.—Reported Hans Mumm, Jr., City Engineer, instructed by City Council to revise plans for the Delta District sewer system to provide for 18-in. concrete pipe instead of 48-in. pipe; estimated cost, $27,000. Louis Lesh, City Clerk.

BIDS DESIRED.

Agawam, Mass.—Until July 1, by Durkee, White & Towne, 17 Hampton Street, Springfield, for vitr. pipe sewer system Contract No. 1, to consist of 13,104 ft. 6 to 20-in. vitr. pipe, with T's, Y's, etc., and Contract 2, 14,237 lin. ft. pipe aewers.

Bridgeport, Conn.—Until July 20, by Paving & Sewer Commission, Room 22, City Hall, for constructing about 9400 ft. 60, 66 and 72 in. sewer, average cut about 24 ft., advertised in Engineering Record. Alfred H. Terry, City Engineer.

New York, N. Y.—Until June 28, by Marcus M. Marks, Pres. Manhattan Borough, for improving and altering, etc., receiving basins in Park Row, Park Avenue, Seventy-second Street and other streets. Security $7,050. Also same time and place for receiving basins in Bway., Grand, Delancey and other streets. Security $13,150.

Oswego, N. Y.—Until July 7, by Department of Works for constructing sewers, advertised in Engineering Record. Charles W. Linsley Commissioner.

Columbia, S. C.—Until June 27 by John McNeal, City Engr., for 120,000 lin. ft. vitr. sewer pipe and specials 8 to 18 in., inclusive. R. C. Keenan, Council Supt. of Engineering.

Chicago, Ill.—Following are unit prices of four lowest bids opened June 8 by Trustees Sanitary District of Chicago for constructing Calumet intercepting sewer, Contract 5—(I) total concrete alternate, (II) total alternate concrete and brick: (a) Byrne Brothers Dredging & Engineering Co., 208 S. La Salle Street, (I) $653,450, (II) $745,643; (b) Marquette Constructing Co., 133 W. Washington Street, (1) $667,284, (II) $700,106; (c) T. J. Forschner Contracting Co., Lamont, Ill., (I) $716,321, (II) $797,951; (d) Nash Dowdle Co., 28 S. La Salle Street, (I) $727,531, (II) $756,271.

Item			(a)	(b)	(c)	(d)
1	8,163	lin. ft. (a) concrete sewer, 17.5 ft. diam.	$73.00	$76.00	$80.00	$81.50
1	8,163	lin. ft. (b) brick and concrete sewer, 17.5 ft. diam.	84.00	80.00	90.00	85.00
2	14	(a) manholes on concrete sewer	60.00	70.00	75.00	50.00
2	14	(b) manholes on brick and concr. sewer.	85.00	75.00	75.00	55.00
3		(a) change of section on 104th Street, concrete, lump sum	50.00	500.00	200.00	400.00
3		(b) change of section on 104th Street, brick and concrete, lump sum	100.00	600.00	200.00	500.00
4		Crossing at 111th Street, lump sum	2,500.00	475.00	2,000.00	1,000.00
5		Connection at South Park Avenue and 104th Street, lump sum	100.00	150.00	500.00	500.00
6		Connection at 106th Street, lump sum	100.00	100.00	125.00	300.00
7		Connection at 107th Street, lump sum	100.00	100.00	125.00	300.00
8		Connection at 109th Street, lump sum	100.00	100.00	125.00	300.00
9		Connection at 110th Street, lump sum	100.00	100.00	125.00	300.00
10		Connection at 111th Street, lump sum	100.00	150.00	125.00	300.00
11		Connection at 113th Street, lump aum	100.00	100.00	250.00	300.00
12		Connection at 114th Place, lump sum	100.00	100.00	125.00	300.00
13		Sewer crossing at 105th Street, lump sum	500.00	480.00	600.00	600.00
14		Sewer crossing at 107th Street, lump sum	500.00	480.00	600.00	600.00
15		Sewer crossing at 111th Street, lump sum	500.00	725.00	1,500.00	800.00
16		Sewer crossing at 113th Street, lump sum	500.00	480.00	600.00	600.00
17	1,400	lin. ft. laying 12-in. tile pipe	2.00	1.25	1.25	1.75
18	1,200	lin. ft. laying 10-in. tile pipe	1.50	1.20	1.25	1.50
19	600	lin. ft. laying 9-in. tile pipe	1.50	1.00	1.00	1.25
20	28	manholes on tile pipe sewer	40.00	35.00	60.00	35.00
21	24	catchbasins	50.00	40.00	60.00	50.00
22	5	additional c.-i. manhole covers and frames	10.00	10.00	20.00	10.00
23	5	additional c.-i. catchbasin covers and frames	10.00	10.00	20.00	10.00
24	600	lin. ft. relaying 6-in. sewer house connections	1.00	1.00	1.25	1.00
25	20	connections, tile pipe for future connections, 18 in.	10.00	3.00	2.50	3.00
26	40	connections, water service connections	12.00	5.00	15.00	3.00
27	600	lin. ft. relaying water service pipes	1.50	1.00	1.25	1.00
28	900,000	lb. reinforcing steel	0.045	0.0375	0.05	0.05
29	500	lin. ft. additional piling, furnished	0.20	0.20	0.30	0.50
30	500	lin. ft. additional piling, driving	0.20	0.25	0.30	0.75
31	5	M ft. cribwork on piling	40.00	60.00	50.00	60.00
32	5	M ft. sheeting, shoring and bracing left in place	20.00	20.00	20.00	20.00
33	5	M ft. plank foundations	25.00	25.00	25.00	25.00
31	5	cu. yd. additional excav. in open cut	0.75	0.75	0.75	0.75
35	5	cu. yd. rock excav	3.00	3.00	3.00	3.00
36	5	cu. yd. additional concrete, Class B	7.50	7.50	7.50	7.50
37	5	cu. yd. additional concrete, Class C	7.00	7.00	7.00	7.00
38	5	cu. yd. additional brickwork	9.00	9.00	9.00	9.00

Newark, N. J.—Following are unit figures of the four lowest bids opened June 13 by Passaic Valley Sewerage Commissioners for Lawrence Street branch intercepting sewer—Section 22, Paterson; (a) Culp-Co., Inc., Paterson, $48,587; (b) Cenedella & Co., Passaic, $49,556; (c) Harrison & Craig Co., Newark, $49,911; (d) Carrington Construction Co., Passaic, $61,659.

	(a)	(b)	(c)	(d)
350 lin. ft. earth excavation and refilling in trench for 36-in. concrete sewer	$8.40	$4.75	$6.70	$9.95
2,215 lin. ft. earth excavation and refilling in trench for 30-in. concrete sewer	8.00	4.50	7.60	9.25
670 lin. ft. earth excavation and refilling in trench for 15-in. vitrified pipe sewer	5.00	4.00	4.90	7.30
390 lin. ft. earth excavation and refilling in trench for 12-in. vitrified pipe sewer	4.00	4.00	2.60	6.85
340 lin. ft. earth excavation and refilling in trench for 8-in. vitrified pipe sewer	3.00	2.90	2.35	6.25
1,200 cu. yd. concrete masonry in trench, Portland cement mortar	8.00	12.00	9.00	9.00
250 cu. yd. brick masonry in manhole, Portland cement mortar and appurtenant work	0.01	20.00	18.00	16.00
50 cu. yd. rock excavation in trench	6.00	6.00	6.00	4.00
Excavation and refill, etc., for insertion of special structures in local sewer, etc. (lump sum)	7,910.00	8,500.00	6,575.00	8,500.00
Furnishing and installing one set of sewage regulating apparatus	560.00	600.00	550.00	600.00
Furnishing and erecting back water gates in several local sewers, etc	2,625.00	3,625.00	4,000.00	3,400.00

Chicago, Ill.—Following are unit figures of four bids opened June 8 by Trustees Sanitary District of Chicago for constructing the Calumet intercepting sewer—Contract No. 6, (I) total concrete, (II) total concrete and brick: (a) Byrne Brothers Dredging & Engineering Co., 208 S. La Salle Street, (I) $644,306, (II) $795,346; (b) Marquette Construction Co., 133 W. Washington Street, (I) $663,976, (II) $696,366; (c) T. J. Forschner Contracting Co., Lamont, (I) $706,784, (II) $742,959; (d) Ready & Callaghan Coal Co., 28 S. La Salle Street, (I) $1,005,715, (II) $1,037,064.

Item		(a)	(b)	(c)	(d)
1	7,235 lin. ft. (a) concrete sewer, 17.5 ft. diameter	$71.00	$77.00	$60.00	$114.38
1	7,235 lin. ft. (b) brick and concrete sewer, 17.5 ft. diameter	90.00	81.00	65.00	118.72
2	1,740 lin. ft. (a) concrete sewer, 54 in. diameter	8.00	9.50	9.00	6.85
2	1,740 lin. ft. (b) brick sewer, 54 in. diameter	14.00	10.50	9.00	8.85
2	1,740 lin. ft. (c) vitr. segmental block sewer, 54 in. diameter	13.20	10.50	12.00	10.65
2	1,740 lin. ft. (d) reinforced concrete pipe sewer, 54 in. diameter	12.00	11.50	12.00	10.50
3	1,070 lin. ft. (a) concrete sewer, 42 in. diameter	22.50	15.00	15.00	30.00
3	1,070 lin. ft. (b) brick sewer, 42 in. diameter	25.00	17.00	15.00	30.00
3	1,070 lin. ft. (c) vitr. segmental block sewer, 42 in. diameter	26.00	17.00	17.00	33.00
3	1,070 lin. ft. (d) reinforced concrete pipe sewer, 42 in. diameter	26.00	18.00	17.00	32.50
4	770 lin. ft. laying 15-in. tile pipe	2.00	2.00	1.50	1.93
5	3,600 lin. ft. laying 12-in. tile pipe	2.60	1.75	1.25	1.75
6	1,250 lin. ft. laying 9-in. tile pipe	1.50	1.00	1.25	2.00
7	14 (a) manholes on 17.5-ft. sewer, concrete	60.00	70.00	75.00	65.00
7	14 (b) manholes on 17.5-ft. sewer, brick	85.00	75.00	75.00	62.50
8	6 (a) manholes on 54-in. sewer, concrete	40.00	35.00	30.00	65.00
8	6 (b) manholes on 54-in. sewer, brick	50.00	35.00	30.00	62.50
9	5 (a) manholes on 42-in. sewer, concrete	75.00	35.00	65.00	100.00
9	5 (b) manholes on 42-in. sewer, brick	85.00	35.00	65.00	100.00
10	43 manholes on tile pipe sewers	40.00	35.00	50.00	65.00
11	crossing at 115th St. (lump sum)	2,500.00	475.00	2,500.00	5,000.00
12	(a) crossing, C. & W. I. R.R., required for constructing sewer (lump sum)	2,000.00	8,000.00	12,000.00	12,000.00
12	(b) crossing, C. & W. I. R.R., optional with R.R. (lump sum)	10,000.00	1,500.00	1,500.00	15,000.00
13	(a) crossing Ill. C. R.R., required for constructing sewer (lump sum)	1,000.00	600.00	5,000.00	5,000.00
13	(b) crossing, Illinois Central R.R., optional with railroad (lump sum)	2,500.00	600.00	500.00	6,000.00
14	connection at 116th St. (lump sum)	100.00	150.00	150.00	150.00
15	connection at 123d St. (lump sum)	100.00	150.00	300.00	250.00
16	connection at 124th Pl. (lump sum)	100.00	150.00	400.00	350.00
17	sewer crossing at 120th Place (lump sum)	500.00	725.00	700.00	2,000.00
18	66 catchbasins	50.00	40.00	60.00	65.00
19	6 additional cast iron manhole covers and frames	10.00	10.00	20.00	17.00
20	6 additional cast iron catchbasin covers and frames	10.00	10.00	20.00	17.60
21	500 lin. ft. relaying 6-in. sewer house connections	1.00	1.00	1.25	0.85
22	200 replacing 6-in. house slant in 54-in. and 42-in. sewer	0.75	1.00	1.25	0.85
23	10 connections tile pipe for future connections 18-in.	10.00	3.00	2.50	2.00
24	70 connections water serv. connections	12.00	5.00	15.00	30.00
25	2,200 lin. ft. relaying water service pipes	1.50	1.00	1.25	2.00
26	800,000 lb. reinforcing steel	0.045	0.0375	0.05	0.055
27	200,000 lb. structural steel	0.06	0.06	0.06	0.06
28	500 lin. ft. additional piling furnished	0.20	0.20	0.30	0.22
29	500 lin. ft. additional piling driven	0.20	0.25	0.30	0.90
30	5 M ft. cribwork on piling	40.00	50.00	60.00	90.00
31	5 M ft. sheeting, shoring, bracing or other timbering left in place	20.00	20.00	20.00	20.00
32	5 M ft. plank foundations	25.00	25.00	25.00	25.00
33	5 cu. yd. additional excav. in open cut	0.75	0.75	0.75	0.75
34	5 cu. yd. additional excav. in tunnel	3.00	3.00	3.00	3.00
35	5 cu. yd. rock excavation	3.00	3.00	3.00	3.00
36	5 cu. yd. additional concrete, class B.	7.50	7.60	7.50	7.60
37	5 cu. yd. additional concrete, class C.	7.00	7.00	7.00	7.00
38	5 cu. yd. additional brickwork	9.00	9.00	9.00	9.00
39	1,000 cu. yd. stripping black soil	1.00	1.00	0.35	0.85

Shreveport, La.—Until July 3, by City Commissioners, for constructing sanitary sewers in south and west district, advertised in Engineering Record. John B. Hawley, Consulting Engineer, City Hall.

Bellaire, Ohio.—Until June 27, by Marie E. Gartner, Clk. Director Public Service, for furnishing material and contructing sewers in Fourth Sewer Dist.

Cleveland, Ohio.—Until June 29, by Division of Purchases and Supplies, for constructing sewers in West Fortieth and Fifty-fifth and East 154th Street.

Terre Haute, Ind.—Reported desired until June 20, by Board Public Works for constructing pipe sewers in several streets, including catch basins, manholes, etc.

Chippewa Falls, Wis.—Until June 26, by L. J. Felix, City Clk., for constructing sewers on Spruce and Oak Streets.

Milwaukee, Wis.—Until June 29 (readvertisement), by Sewerage Commission, for constructing Section 19 of the Kinnickinnic Valley Intercepting Sewer, advertised in Engineering Record.

Kalispell, Mont.—Until July 3, by R. E. Rollins, City Clerk, for constructing sewers in Special Improvements Dist. Nos. 170 and 171.

Whitefish, Mont.—Until July 3, by R. H. Wiedman, City Clerk, for constructing sewer, together with manholes, etc., in Sewer Dist. No. 27, and Sewer Dist. No. 28.

Canadian, Tex.—Until June 30 by Coswell Hudson, Mayor, for constructing sanitary sewerage system and disposal plant. Henry E. Elrod, Engineer, Dallas.

Houston, Tex.—Until July 3 by H. L. Washburn, County Auditor, for approximately 1600 ft. 36-in. sewer in Harrisburg Road.

Hiawatha, Kan.—Reported desired until June 26, by J. W. Llevengood, City Clk., for constructing sewer system and sewage disposal plant. Black & Veatch, Engrs., 507 Inter-State Bldg., Kansas City, Mo.

Los Angeles, Cal.—Until June 29, by Trustees of Cienaga School Dist. (J. A. Nikrent, Clk.), for constructing a septic tank. Train & Williams, Archts., 226 Exchange Bldg.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Boston, Mass.**—Contract awarded William Barrett & Company of Boston for sewerage works in Canal and Sunbury Streets, city proper, at $11,373.

★**Hartford, Conn.**—Contract for constructing Gully Brook Conduit awarded O'Neil Bros. of Hartford, at $66,027.

★**New York, N. Y.**—Contract awarded Lawrence Construction Company, 96 Broadway, for altering sewer in South Street and Marquette Slip, at $9,800, and for altering sewer at Green Street and Washington Place at $1,800 (bids opened June 12 by Marcus M. Marks, president Manhattan Borough).

★**Montclair, N. J.**—Contract for constructing storm sewers in Pine Street (bids opened June 12) awarded Joseph Creston of Montclair at $9,749. Edgar S. Closson, Town Engineer.

★**Point Pleasant, N. J.**—Contract for constructing addition to sewer system (bids opened June 13) awarded J. E. Harrigan, Point Pleasant, at $20,449. W. T. Newbury, Borough Clerk.

★**Akron, Ohio.**—Following are unit figures of the successful bidder DeGroodt & Cochran, Cleveland, for sanitary and storm sewers, bids opened June 1 by Coventry Land & Improvement Company, 403 Ohio Building: Section 1, 5100 cu. yd. excavation, $2; 1343 lin. ft. laying 42 in. c. i. pipe sewer, $2.60; 1343 lin. ft. laying 10-in. subdrain, 20 cts.; 72 lin. ft. brick manholes, $4; 4300 lin. ft. wooden piles, 60 cts.; 20.4 M ft. lumber in grillage, $50; 25 cu. yd. plain concrete, $8.50; 230 cu. yd. screened gravel, $2.60; 15 sq. yd. pavement relaid, $2; total, $18,532 (pipe furnished by company). Section 2—13,200 cu. yd. excavation, $1.875; 776 lin. ft. laying 42-in. c. i. pipe, $2.50; 557 lin. ft. laying 42-in. concrete pipe, $1.50; 1419 lin. ft. 30-in. concrete pipe, $1.25; 500 lin. ft. 30-in. concrete pipe, $1.25; 500 lin. ft. 18-in. vitr. pipe, 35 cts.; 306 lin. ft. 15-in. vitr. pipe, 30 cts.; 2762 lin. ft. 10-in. vitr. pipe, 20 cts.; 306 lin. ft. 8-in. vitr. pipe, 20 cts.; 500 lin. ft. 6-in. pipe, 20 cts.; 146 lin. ft. brick manholes, $4; 1129 lin. ft. wooden piles, 60 cts.; 6.6 M ft. lumber in grillage, $50; 25 cu. yd. plain concrete, $8.50; 60 cu. yd. screened gravel, $2.50; total, $31,237. Other bidders: P. T. McCourt, of Akron, Section 1, $35,099 and Section 2, $34,044, and Keeley Brothers, Parkersburgh, W. Va., Section 1, $34,044 and Section 2, $51,776. E. A. Kemmler, Chief Engineer.

Cincinnati, Ohio.—Three lowest bids opened by Public Service Director for constructing Avondale Relief Sewers, Contract No. 4, were as follows: Michael McCarthy, 2910 Woodburn Avenue, $30,442; Thomas P. Strack, Goodall Bldg., $30,534; Welling & Franz, Ninth and Plum Streets, $31,126; estimated cost $36,272. Frank S. Krug, City Engineer.

★**Dayton, Ohio.**—Contract for constructing storm water sewer along Dry Hollow Creek (bids opened June 6), awarded J. H. Cahill, Louisville, Ky., at $97,199.

★**Milwaukee, Wis.**—Following are totals of bids opened June 8 by Sewerage Commission for constructing Sections 1 and 2 of the Menomonee Low-Level Intercepting Sewer, and contract was awarded June 15 as follows: (a) Section 1, (b) Section 2: Wisconsin Tunnel & Construction Company, Milwaukee, (a) $268,173 (awarded contract); (b) $278,623; James Kennedy, Fargo, N. D., (a) $309,510; (b) $248,439 (awarded contract); James Ferry & Sons, Baltimore, Md., (a) $312,876; Joseph Hanreddy, Chicago, Ill., (a) $381,606; (b) $496,452; J. H. McKnight Construction Company, Ltd., Toronto, Ont., (b) $297,291.

★**St. Paul, Minn.**—Contract for constructing sewer on Wellesly Avenue from Cretain to Cleveland Avenue awarded to O'Neil & Preston, Ashland and Syndicate Streets, at $34,196. Other bidders: E. T. Webster, 437 Beacon Avenue, $37,190; Thornton Bros., Scandinavian American Bank Bldg., $38,793, and J. J. Connolly, St. Paul, $46,497.

★**Ainsworth, Neb.**—Contract for constructing sewer system (bids opened June 9) awarded A. Caniglia & Company, Omaha, at $16,295. Other bidder: H. J. Petersen, Omaha, $17,840. Fred Jay, City Clerk.

★**Manhattan, Mont.**—Contract for constructing sewer system (bids opened June 12) awarded Nordstrom & Williamson, Butte, at $14,686. Walter White, City Clerk.

★**Ennis, Tex.**—Contract for constructing sewage disposal plant awarded Roach Manigan Company, Fort Worth, at about $15,000.

★**Afton, Okla.**—Contract for constructing sanitary main and lateral sewers awarded Municipal Excavator Co., Oklahoma, at $23,758. Next three bidders: W. F. Power, Guthrie, $24,971; Joseph T. Lantry, Tulsa, $25,880, and Everett & Burt, Hutchinson, Kan., $26,937. Benham Engineering Co., Engineers, Oklahoma.

★**Ingersoll, Ont.**—Contract for constructing storm sewers awarded by city to McRae & Campaigne of Niagara Falls, at $26,653.

BRIDGES

PROPOSED WORK.

New London, Conn.—Contract will probably be let in August for constructing the bridge over Niantic River, to have five spans about 50 ft. each, one steel bascule span and four concrete spans, and to cost $75,000. Yates & Yates, Consulting Engineers, 120 Broadway, New York, N. Y.

Lewisburg, Pa.—All bids opened June 17 by F. T. Buhl, Commissioner's Clerk, for constructing concrete girder bridge over Rapid Run rejected.

Jasper, Ind.—See "Prices and Lettings."

Aurora, Ill.—Contract will be let in August for constructing 2 bridges costing about $70,000, each bridge consisting of three 51-ft. skew reinforced concrete arches with 34-ft. roadway and two 9-ft. sidewalks. Standish & Allan, 220 S. State Street, Chicago, are engineers and have completed plans. Myron J. Tarble, City Engineer.

Morris, Ill.—Construction of a 150-ft. bridge between South Wilmington and Brooklyn Township contemplated; cost $6,000. Address County Bd. Supervisors.

Rice Lake, Wis.—J. H. A. Brahtz, Mankato, Minn., engaged to prepare plans and specifications for a 270-ft. reinforced concrete arch bridge to be constructed by the city on Main Street across Red Cedar River. Contract to be let about July 1.

Kansas City, Kan.—Kaw Valley Drainage Board has requested Wyandotte County Commissioners to rebuild Twelfth Street bridge leading to Argentine. The Board desires the approach removed and a span built to replace approach.

Kansas City, Mo.—Harrington, Howard & Ash, 1012 Baltimore Avenue, Kansas City, Mo., engaged to prepare plans and supervise building of Missouri end of the Twenty-third Street viaduct and bridge over Kaw River between Kansas City, Kan. and Kansas City, Mo.

Plans being prepared for proposed James Street viaduct connecting Kansas City, Mo., with Kansas City, Kan.

Las Cruces, N. M.—Citizens June 14 voted $30,000 bonds to construct 5 county bridges. C. O. Bennett, County Clerk.

Spokane, Wash.—Citizens, June 6, voted $311,500 bridge improvement bonds. Contracts will be let before August for construction and reconstruction of 8 bridges, as follows: Division Street, concrete, $35,000; Olive Street, steel and concrete, $100,000; Post Street, concrete, $40,000; Washington Street viaduct (repair), $10,000; East Boone Avenue, $6,500; Green Street, torn down and rebuilt; bridge from Fort Wright to Natatorium Park, rebuilt; Trent Avenue, new structure. Morton MacCartney, city engineer, preparing plans. G. W. Duffy, City Clerk.

BIDS DESIRED.

Connecticut.—See "Paving and Roads."

Hastings-on-Hudson, N. Y.—Until June 27, by Town Board of Greenburgh, Tarrytown, for painting Warburton Avenue viaduct south of Main Street, at Hastings-on-Hudson, advertised in Engineering Record. Ward Carpenter & Company, Inc., Engineers, 95 Franklin Street, Tarrytown.

Portageville, N. Y.—Reported desired until June 30, by Town Clerk, for constructing bridge over Genesee River, to consist of superstructure, 120 ft., 20-ft. roadway, substructure to consist of two concrete piers with gravel floor, etc. Geo. E. Shaefer, Co. Supt. of Highways, Geneseo, N. Y.

Dover, N. J.—Until July 3, by Board of Freeholders, for constructing 50-ft. span plate girder bridge over Papakating Creek, at Pellettown. R. Lee Slater, Clerk.

Pittsburgh, Pa.—Until July 7, by County Commissioners Allegheny and Beaver Counties, Pittsburgh, for constructing a joint county bridge over Reardon Run, of reinforced concrete, at Allegheny-Beaver County Line. John P. Moore Co., Controller, Pittsburgh.

Charleston, W. Va.—Until July 6th by County Court, Charleston, for constructing a steel highway bridge, with masonry foundations, across Elk River, near Queen Shoals, between Kanawha and Clay Counties. F. G. Burdett, County Road Engineer, Kanawha County, Charleston.

Clarksburg, W. Va.—Reported desired until July 1 by G. M. Harbert, County Road Engr., for constructing several reinforced concrete bridges.

Middlebourne, W. Va.—Until July 10, by County Clerk, for constructing a reinforced concrete arch bridge over Middle Island Creek.

Jasper, Ala.—Until July 3, by County Commissioners, for constructing a concrete bridge 170 ft. long, 18 ft. roadway across Payoka River, on Jasper Huntingburg Highway, near site of Briarfield Bridge.

Pascagoula, Miss.—Until Aug 1, by Chancery Clerk, Pascagoula, for constructing bridge across West Pascagoula River to have four 100 ft. steel spans. David U. Harris, Engineer, Box 476, Mobile, Ala.

Akron, Ohio.—Until July 10 by U. G. High, Clerk, County Commissioners, for constructing a bridge at Station 25, 40 South Main Street extension, in Tract 3, Coventry Township. Bidders may submit own plans.

Cleveland, Ohio.—Until July 1, by County Commissioners, by Clinton Cowen, State Highway Commissioner, for constructing a concrete arch bridge over Cahoon Creek, clear span 70 ft., roadway 40 ft.; estimated cost $14,054.

North Vernon, Ind.—Until July 2, by County Commissioners, for constructing a concrete bridge, 4 spans, each 40 ft., at Saw Ford, over Muscatuch River; estimated cost $6,900.

Illinois.—Until July 5, by State Highway Department, Springfield, for following bridge: Fulton County, Kessner Bridge, steel span 100 ft., reinforced steel 7500 lb., cost $6,910.

Morrison, Ill.—Until June 29, by V. N. Taggett, County Superintendent of Highways, Morrison, for constructing Forth Bridge in Fenton Township.

Chippewa Falls, Wis.—Reported desired until July 5 by Board Public Works for constructing a 90-ft. arch concrete bridge with creosoted block floor. T. J. Hurd, City Engr.

Stevens Point, Wis.—Reported desired until June 28, by Board Public Works (R. K. McDonald, Chmn.), for constructing reinforced concrete bridge over Rocky Run and pony steel truss bridge over Rocky Run.

Morris, Minn.—Reported desired until July 3 by C. W. Amberg, Town Clerk, for constructing a 40-ft. steel truss span bridge with reinforced concrete floors and abutments.

Larned, Kan.—Reported desired until July 5, by W. C. Ware, Co. Clk., for constructing two reinforced concrete double arch bridges 200 ft. long, over Pawnee River.

Russell, Kan.—Reported desired until July 3, by Wm. J. Roe, County Clerk, for constructing bridge over Smoky Hill River near Dorrance, including three 110-ft. steel spans, concrete floor and abutments or concrete arch over Coal Creek, near Wilson; separate bids on substructure and superstructure.

Ainsworth, Neb. — Reported desired until July 3 by County Commissioners for constructing a 125-ft. steel bridge.

Lynch, Neb.—Until June 30 by Holt and Boyd County Boards at O'Neill for constructing state aid bridge over Niobrara River at Lynch.

Columbus, Mont.—Until July 3, by County Commissioners, for constructing 3 steel highway bridges, one 32 ft., one 36 ft. and one three-span bridge, 160 ft. long. Lloyd B. Barley, County Clerk. R. W. Barr, County Surveyor.

Tulsa, Okla.—Until July 3 by Board County Commissioners for furnishing material and constructing 17 steel bridges as follows: A 90 x 16-ft. bridge located Township 17 North; 80 x 16-ft. between Sect. 30 and 31, Township 20 North; a 60 x 16-ft. between Sects. 30 and 31, Township 20 North; a 70 x 16-ft. in Sect. 31, Township 17 North; 50 x 16-ft. between Sects. 7 and 12, Township 17, and the remaining bridges ranging from 45 ft. to 16 ft. Lewis Cline, Co. Clk.

McMinnville, Ore.—Until July 1, by County Court, Yamhill County, Vine W. Pearce, Judge, for erecting following bridges: Fairdale bridge, at Fairdale; Cole's dam bridge, 1 mile east of Fairdale; Muddy Bridge, northeast of Bellevue and Baumgardner Bridge, south of Bellevue. H. W. Herring, County Engineer.

California.—Until July 10, by State Highway Commission, Sacramento, for concrete bridge 100 ft. long, and 1 mile of concrete paving at Walker Creek, Glen County, and concrete bridge, 36 ft. span, about 1 mile east of Camarillo, Ventura County.

Ventura, Cal.—Until July 7, by Board Supervisors (J. B. McCloskey, Clerk), for constructing La Crosse bridge, a combined steel and timber span 150 ft. long, two concrete piers, 96 ft. of concrete pile and trestle, also for Casitas bridge over Ventura River, near Canet Station, consisting of one steel span 200 ft. long (county has purchased, will supply all structural steel).

Holbrook, Ariz.—Until July 1, by Dee M. Moss, County Clerk, for constructing bridges, advertised in Engineering Record.

Salt Lake City, Utah.—Reported desired until June 28 by Gordon Snow, City Recorder, for constructing a reinforced concrete deck girder bridge of four 40-ft spans.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★Enfield, N. H.—Contract awarded June 16 by the town to United Construction Cmpany, Albany, N. Y., for constructing a 3-span concrete girder bridge costing about $8,000. Storrs & Storrs, Engineers, Concord.

★Plainfield, N. J.—Contracts for constructing steel beam and concrete bridges awarded as follows by the County Board of Freeholders: Westervelt Avenue and Raymond Avenue bridges, to A. E. Smith, Plainfield, at $7,480 and $2,865 respectively, and Terrell Road bridge, to Logan Construction Co., 18 Park Row, New York, at $5,886. Joshua Doughty, Jr., County Engineer, Somerville (bids opened June 12).

Salem, N. J.—All bids opened June 9 by Bd. of Freeholders for constructing draw span at Penns Neck Bridge rejected, being in excess of appropriation. New bids are to be received. Lowest bid was $72,146.

★Woodbury, N. J.—Contract for concrete bridge between Hurffville and Glassboro awarded by Freeholders to Whittaker & Diehl, Harrisburg, Pa.

★Hollidaysburg, Pa.—Contracts for constructing bridges awarded by County Coms. as follows (bids opened June 16): To G. W. Ensign, Inc., Harrisburg, reinforced concrete arch bridge over Little Juniata River at Hensheytown, Antis Township, span 90 ft.; to Loomis & King, Altoona, reinforced concrete culvert over Yingling Run near General Refractories plant at Sarah Furnace, Greenfield Township, and reinforced concrete girder bridge over Plum Creek near Erb Station, Taylor Township; to George I. Thompson & Company, Clearfield, reinforced concrete bridge over Mill Run at Broad Avenue and Thirty-first Street, Altoona; to E. H. Brua, Hollidaysburg, reinforced concrete addition to bridge over Mill Run near Altoona Driving Park, Logan Township; to Joseph P. Harney, Altoona, reinforced concrete girder bridge over Sugar Run at Altoona City Intake, Allegheny Township, and to B. L. McKillip, Hollidaysburg, reinforced concrete culvert over Roaring Run, at Mt. Etna. Catherine Township; total amount of contracts about $16,562. C. H. Edwards, County Clerk.

Philadelphia, Pa.—Following are four lowest bids opened June 13 by George E. Datesman, Director Department of Public Works, Bureau of Surveys, for Schedule "A," bridge on line of Bensalem Avenue over Pennypack Creek, including concrete waterproofing, lamps, grading, balustrades, etc. (bidders all of Philadelphia): Day & Zimmerman, $200,608; McNichol Paving & Constructing Company, $239,636; Peoples Brothers, Inc., $294,617; and M. J. B. McHugh, $300,977.

★Reading, Pa.—Contract awarded by County Commissioners to David Sutton, Riegelsville, for constructing arch bridge over Branch Creek at Sellersville.

★Cumberland, Md.—Contract for constructing the Baltimore Street Bridge and Valley Street Bridge (bids opened June 15 by Mayor and City Council), awarded Vang Construction Company, Cumberland, at about $25,865 and $25,992 respectively. B. H. Davis, Consulting Engineer, Whitehall Building, New York, N. Y.

★Albany, Ky.—Contract for constructing bridge across Spring Creek, 100-ft. span, awarded Oregonia Bridge Company, Lebanon, Ohio, at $5,994. J. G. Slocum, County Clerk.

★Boonville, Ind.—Contract awarded by County Commissioners for constructing 19 steel and concrete bridges to Vincennes Bridge Company, Vincennes, at $19,094.

Jasper, Ind.—Bids opened by County Commissioners for constructing bridge across Patoka Creek in Patoka Township rejected. Following are bids submitted: Vincennes Bridge Company, Vincennes, $9,975, and M. P. Construction Co., $11,900.

★Monticello, Ind.—Contract awarded by County Commissioners for constructing bridge in Monon Township to East St. Louis Bridge Co., East St. Louis, Ill., at $6,480.

Illinois.—See "Paving and Roads."

★Madison, Wis.—Contract awarded George Nelson, Madison, for constructing reinforced concrete arch bridge at Rutledge Street (bids opened June 9 by E. E. Parker, City Engineer) at $10,497. Other bidders: J. F. Icke, Madison, $11,450, and Wilber & Gay, Madison, $12,300.

★Des Moines, Iowa.—Contract for constructing concrete bridge over Four Mile Creek (bids opened June 5 by Horace Susong, City Clerk) awarded N. M. Stark Company, Des Moines, at $11,393.

★Sacramento, Cal.—Contract for constructing three 200-ft. span riveted truss bridge on concrete foundations across American River, awarded Missouri Valley Bridge & Iron Company, Leavenworth, Kan., at about $120,000.

★San Luis Obispo, Cal.—Contracts for bridges awarded as follows (bids opened June 6 by Board of Supervisors): 220-ft. steel span over San Juan River near Shandon, 150-ft. span over Salinas River on Rinconada Las Pilitas Road and 154-ft. span over Hyerhyero Creek, all three to Gutleben Brothers, San Francisco, at $18,458, $12,343 and $12,981 respectively; to Theodore Maino, two 90-ft. concrete spans over Toro Creek, at $6,100, and to Cole Construction Company, a 50-ft. concrete arch over Pico Creek, near Cambria, to Cole Construction Company, at $5,449, and an 80-ft. steel span near Reed Station to Midland Bridge Company, Kansas City, Mo., at $5,445.

PAVING AND ROADS

PROPOSED WORK.

Cambridge, Mass. — Appropriations amounting to $289,000 were reported for street construction to the Finance Committee, principal items being Green Street, granite block, $18,850; Western Avenue, granite block, $21,125; Kirkland Street, macadam, $8,700; Cambridge Street, wooden block, $55,000; Prospect Street, wooden block, $13,000.

Malden, Mass.—Common Council June 13 authorized a $20,000 bond issue for paving Pleasant Street, from Western Avenue station tracks to Medford line.

Rochester, N. Y.—Ordinance adopted by Council for paving with asphalt on Willmont Street at $38,000, University Avenue $10,000.

Common Council adopted ordinances for improving Genesee Boulevard from Genesee Street to Brooks Avenue, cost $88,000, and from Brooks Avenue to Chili Avenue, cost $92,000. Address City Clerk.

Bayonne, N. J.—Contract soon to be let by City Commissioners for repaving Fifth, Eighth and Twenty-second Streets.

Kearney, N. J.—Contract soon to be let by E. A. Stevens, State Commissioner of Public Roads, Trenton, for repairing Newark Turnpike in town of Kearney with bituminous macadam on a macadam foundation requiring 46,128 sq. yd.

Somerville, N. J.—Bd. of Freeholders will improve Mt. Bethel, Oppenheim, South Branch and York Roads and Rock Avenue and New Jersey Turnpike.

Woodbury, N. J.—Freeholders sold $12,500 turnpike road bonds.

Scranton, Pa.—Ordinance passed by Council providing for grading, curbing and paving with sheet asphalt and stone blocks on a concrete base on Wyoming Avenue, at a cost of about $21,837.

Harrisonville, W. Va.—Bonds for $242,600 for road improvement in county have been sold. It is proposed to pave North West Pike, 11 miles, roads north and south from Punxboro, 4 miles, with concrete and brick. D. D. Britt, Engineer in Charge, Clarksburg. Address Clerk County Court.

Lewisburg, W. .Va.—Road improvement bonds for $243,500 will be sold July 8, by County Court. (Jos. S. Crawford, Clk.)

Miami, Fla.—Isham, Randolph & Co., Jacksonville, and Klyce & Kackley and John W. King, both of Miami, have submitted a report to County Commissioners on the building of a causeway across Biscayne Bay.

Belzonia, Miss.—Citizens of the County voted June 10, $950,000 bonds for permanent road throughout the county.

Corinth, Miss—Corinth to the Gulf Road District bonds for $65,000 will be sold July 5 by O. M. Hinton, Clerk Board Supervisors.

Lexington, Miss.—Paving bonds for $475,000 will be sold July 3 by Clerk Board County Supervisors.

Natchez, Miss.—Election to be held June 30 to vote $35,000 bonds for good roads in Franklin County.

Pascagoula, Miss.—It is proposed to construct a road 12,000 ft. long across the Marsh. David U. Harris, Engineer, Box 476, Mobile, Ala. Address Chancery Clerk, Pascagoula.

Yazoo City, Miss.—Good Road bonds for $350,000 will be sold June 28 by Board of Supervisors. S. S. Griffin, County Clerk.

Natchitoches, La.—Election to be held July 27 to vote $250,000 bonds for building link of Jefferson Highway.

Albany, Ky.—Contracts soon to be let for constructing turnpikes. J. G. Slocum, County Clerk.

Hazard, Ky.—It is proposed to pave Main and High Streets, in all about 20,791 sq. yd., with two course reinforced concrete at a cost of $50,784. D. E. Harris, City Engineer.

Newport, Ky.—Paving bonds for $100,000 will be sold July 7 by Fiscal Court. Chris. Milius, Co. Clk.

Somerset, Ky.—Road bonds for $300,000 will be sold June 23 by Fiscal Court. R. F. Jasper, Judge.

Armstrong Mills, Ohio.—Paving bonds for $10,000 will be sold July 14 by N. K. Pugh, Clerk Washington Township, Armstrong Mills.

Cadiz, Ohio.—Paving bonds for $50,000 will be sold July 11 by County Commissioners. E. P. Hines, Co. Aud.

Dayton, Ohio.—Paving bonds for $29,500 will be sold July 12 by County Commissioners (Walter H. Aszling, Clk.)

Lisbon, Ohio.—Paving bonds for $48,500 will be sold July 10 by Board County Commissioners (H. R. Dickey, Clk.).

London, Ohio.—Paving bonds for $30,164 will be sold July 3 by Board County Commissioners. Allen R. Blacker, Co. Aud.

Mt. Gilead, Ohio.—Paving bonds for $10,976 will be sold June 30 by County Commissioners. C. O. Higgins, Co. Aud.

Cleveland Heights (P. O. Warrensville), Ohio.—Paving bonds for $38,220 will be sold July 17 by H. H. Canfield, Village Clerk.

Xenia, Ohio.—Resolutions passed to pave East Main, Roger, Monroe, Collier Streets with brick, asphalt, asphaltic concrete on concrete foundation, including concrete curb. Cost, $70,000. Contract will probably be let in August. J. P. Shumaker, City Engineer.

Brazil, Ind.—Bonds for $63,000 for improving Kaster brick paved road have been sold. T. W. Swinehart, County Treasurer.

New Albany, Ind.—No bids received June 8 by County Commissioners for constructing 5050 ft. road in New Albany Township. Emil Dupaquier, County Auditor.

Fairfield, Ill.—It is proposed to pave with brick on concrete foundation, on Main and First Streets, in all about 30,000 sq. yd. E. A. Cox, Carbondale, Engineer; W. L. McFarland City Engineer.

Ottawa, Ill.—Two roads are to be improved by County Bd. of Supervisors, one leading from Streator, cost $19,422, and other leading from Seneca, cost $23,896.

Urbana, Ill.—Supervisors of Champaign County voted to construct hard roads, extend three brick roads out of Urbana and Champaign. About $82,000 to be spent by County for road improvements.

Arkansas City, Kan.—About $27,245 paving bonds to be sold by city.

Erie, Kan.—City will issue $47,694 street improvement bonds. Address City Clerk.

Kansas City, Kan.—Bd. of Commissioners voted to pave with concrete Fourteenth and Eighteenth Streets.

Butte, Mont.—Reported City Council plans constructing boulevard along South Main Street, including concrete viaduct, two reinforced concrete bridges and three earth fills. Estimated cost $50,000.

Great Falls, Mont.—Reported City Council rejected all bids for paving First Avenue and will ask new bids. L. B. Emerson, City Engr.

Graham, Mo.—Plans prepared for 8800 yd. of 9 to 7-in. concrete pavement 20 ft. wide in Hughes Township, Nodaway County. C. R. Lieffer, County Auditor; Leslie Barnes Engineering Co., St. Louis, Mo., Engineers.

Greenfield, Mo.—County road bonds for $25,000 sold. Address County Clerk.

Kansas City, Mo.—Paving of Southwest Boulevard from Main to Twenty-fourth Street, about ten blocks, with creosoted wood block on 8-in. Portland cement under consideration; also Eighteenth Street from Main Street to Woodland Avenue, about eigheeen blocks, with creosoted wood block. Curtis Hill, City Engineer.

City Engineer directed to prepare a plan for widening of Thirteenth Street, from Wyandotte to Benton Boulevard.

Arkadelphia, Ark. — Twenty-five mile highway to connect Arkadelphia and Malvern to be constructed. S. C. Harley, Arkadelphia, county judge.

Huntsville, Tex.—See "Sewerage and Sewage Disposal."

Longview, Tex.—Election will be held July 27 to vote $200,000 road improvement bonds. Address County Clerk.

Sulphur Springs, Tex.—Contract will soon be let for 40 miles of road to be constructed under $400,000 bond issue. Address County Clerk.

West, Tex.—Attorney General approved $10,000 street improvement bonds.

Woodville, Tex.—Citizens voted $73,000 road improvement bonds. Address County Clerk.

Albuquerque, N. M.—It is proposed to pave about 19,000 sq. yd. on West Central Avenue with Tarvia X with concrete curb and gutter. A. E. Hutchinson, Engineer, Albuquerque; Thomas Hughes, City Clerk.

Bellingham, Wash.—Contract will soon be let by County Commissioners for paving Marietta Road. C. M. Adams, County Engineer; Will D. Wallace, County Auditor.

Colfax, Wash.—Two bids opened June 12 by County Auditor for constructing Permanent Highway No. 12 rejected. New bids to be asked.

Bakersfield, Cal.—County Commissioners sold $500,000 highway improvement bonds. Address County Clerk.

Fowler, Cal.—Contract will be let about last of July for paving Eighth Street with concrete base and oil and screenings surface at a probable cost of $16,000. Address City Clerk.

Los Angeles, Cal.—Contract will be let about July 15 by Board of Supervisors (A. M. McPherrin, Clerk) to construct 5-in. concrete pavement, 20 ft. wide, with expansion joints and bituminous wearing surface, 17 reinforced-concrete culverts, concrete curtain wall, together with grading, etc., on Artesia Avenue west from Somerset Avenue, a distance of 18,912 ft. in Road District 102.

Sacramento, Cal.—It is proposed to pave about 4,500,000 sq. ft. with Topeka surface 1½ in. on 4-in. concrete base at a cost of $200,000. J. E. Tempest, Engineer, 3112 T Street Court. George B. Welch, Clerk Street Improvements.

Taft, Cal.—City Trustees contemplate spending about $60,000 for street pavements.

Sandpoint, Idaho.—City Council passed ordinance for improving Second, Church, Third, Oak and Main Streets. Estimated cost $21,000.

Manitoba. — Manitoba Good Roads Board, Winnipeg, approved 20 miles of road for Woodland municipality, part of which will be gravel, costing $26,000 and for constructing 11 permanent bridges in Lorne municipality, at $17,250.

BIDS DESIRED.

Boston, Mass.—Until June 30, by Park and Recreation Department (John H. Dillon, Chmn.) for laying a bituminous pavement or a pavement in accordance on Commonwealth Avenue with specifications submitted by bidders.

Corinth, Mass.—Until July 6, for constructing 15 miles gravel roads, for Corinth to the Gulf Road Dist. Address W. C. Sweat, City Attorney. See "Proposed Work.'

Massachusetts.—Until June 27, by Massachusetts Highway Commissions, State House, Boston, for repaving Hanover, Main and Webster Streets, in Town of Hanover.

Bristol, Conn.—Until July 5 for paving with granite block Main Street. Carlton W. Buell, City Engineer.

Connecticut.—Until July 6, by Charles J. Bennett, State Highway Commissioner, Hartford, for constructing following state highway improvements:

Town of Newtown constructing 40-ft. span reinforced concrete "T" beam bridge.

Town of Clinton, about 2400 lin. ft. 5-in. trap-rock macadam construction.

Town of East Hartford, 7300 lin. ft. 7-in. trap-rock macadam.

Town Lebanon, 6919 lin. ft. 7-in. native stone macadam.

Town of Stratford, 6800 lin. ft. 6-in. native stone rock road.

Town of Windsor Locks, 3300 ft. reinforced concrete or 3-in. tar bituminous macadam pavement.

Wallingford, Conn.—Until July 5 by W. A. MacKenzie, City Engineer, for 4000 sq. yd. reinforced concrete or Hassam pavement.

Albany, N. Y.—Until July 10, by State Commission of Highways, 55 Lancaster Street, for constructing highways in various counties, also until July 12 for highways in other counties, and until July 14 highways in other counties, also for repair of various roads, advertised in Engineering Record. Edwin Duffey, Commissioner of Highways.

Brookhaven, N. Y.—Until July 8, by Clarence E. Dare, Town Superintendent of Highways, Patchogue, for constructing 5 sections of concrete pavements in town of Brookhaven, advertised in Engineering Record. Edward A. May, Engineer, Patchogue.

Buffalo, N. Y.—Until June 30 by Arthur W. Kreinheder, Commissioner Public Works, for paving portions of Choate Avenue, Florida, Churchill and Barthel Streets.

Long Island City, L. I., N. Y.—Until June 28, by Maurice E. Connolly, Pres. Borough of Queens, for regulating, grading, paving, etc., portions of Lambertsville Road, Lefferts Avenue, Moore and a number of other streets, in all about 8650 sq. yd. sheet asphalt, together with curbing, etc. Security $25,400.

New York, N. Y.—Until June 20, by Marcus M. Marks, Pres. Manhattan Borough, for paving on portions of Lexington Avenue with sheet asphalt, in all about 5800 sq. yd. outside railroad area, 1[illegible]0 yd. in railroad area, etc., with wood block pavement, on portions of Center Street and Grand Street, about 2820 sq. yds. outside railroad area, together with curbing, etc., and portions of Third Avenue with granite block, about 34,000 sq. yd., outside railroad area, and 3500 sq. yd. granite block pavement in railroad area. Total security, $58,000.

Bayonne, N. J.—Until July 11, by Board City Commissioners, for reimprovement of portions of Twenty-second Street, in all about 12,000 sq. yd. granite block pavement, including base and excavation, 4000 sq. yd. block pavement excluding base and excav., and 12,000 sq. yd. Belgian block pavement to be removed, portions of Eight Street, in all about 5300 sq. yd. bituminous concrete pavement on old macadam foundation, curbing, etc., Fifth Street, in all about 10,000 sq. yd. bituminous concrete pavement on old macadam foundation, curbing, etc., and portions of Avenue C, in all about 4100 sq. yd. asphalt pavement on concrete base, with curbing, etc.

Bloomfield, N. J.—Until July 3, by Raymond F. Davis, Town Clerk, for Improv. No. 263, paving portions of Columbus Street, 1600 sq. yd. bitulithic pavement on concrete foundation; Improvement No. 264, portions of Edison Street, 1960 sq. yd. bitulithic pavement on 6-in. concrete base, and Improvement No. 262, portions of Alva Street, 1500 sq. yd. bitulithic pavement on 6-in. concrete base.

Harrison, N. J.—Until June 28, by Town Council, for paving portions of Kearney Avenue, and also for 300 gals. road oil.

Kearney, N. J.—Until June 28 by Department of Public Roads, Trenton, for 46,128 sq. yd. bituminous macadam, resurfacing on Newark Turnpike, to cost $26,000. T. J. Wasser, Engineer, Jersey City.

Montclair, N. J.—Until July 1, by State Board Education, Trenton, for grading and making brick and macadam walks, drives and for providing drainage on premises of New Jersey State Normal School at Montclair.

New Brunswick, N. J.—Reported desired until June 29 by Board Freeholders for repair of section 3 Cranbury Turnpike from Dayton to Plainsboro-Jamesburg Road, with bituminous concrete on rebuilt macadam base. Asher W. Bissett, County Clerk.

Trenton, N. J.—Until July 1, for resurfacing Nottingham Way (Trenton-Hopewell Road) and Trenton-Lawrenceville Road. Address Bd. of Freeholders.

Bradford, Pa.—Until July 3, by E. C. Charlton, City Clerk, for approximately 8000 sq. yd. brick paving and 7000 lin. ft. curb, advertised in Engineering Record.

Glassport, Pa.—Reported desired until June 26, by C. C. Davis, Borough Clk., for 10,000 sq. yd. vitr. brick pavement on Indiana Avenue.

Ebensburg, Pa.—Reported desired until June 29 for constructing 2 miles brick paving and for 690,000 paving bricks. O. P. Thomas, Co. Engr., Leader Building, Jamestown, Pa.

Baltimore, Md.—Until June 28 by Board Awards, care of City Register, for grading and paving with cement-concrete a number of alleys.

Frederick, Md.—Until July 8 by County Commissioners (H. L. Gaver, Clk.) for constructing a section of State Aid Highway in Frederick County along the Burkittsville-Knoxville Road for a distance of about 1.04 miles; also for building a section of State Aid Highway in Frederick County along the Monrovia-Hyattstown Road, a distance of about 1.52 miles.

Washington, D. C.—Until July 3 by Board County Commissioners for constructing 1½ to 2 miles of concrete road. W. E. Swindell, Chmn. County Commissioners.

Elkins, W. Va.—Until July 1, by County Court Elkins, for constructing approximately 19 miles of improved roads and streets in Leadsville District. Bids will be considered on concrete, macadam tarvia, warrenite and asphaltic concrete. Chaney & Armstrong, Engineers, Fairmont; P. B. Bloomfield, Road Engineer, Elkins.

Wheeling, W. Va.—Until July 5 by County Commissioners, Wheeling, for paving with brick on concrete National Road from Wheeling Park to a point near Park View Lane; also for resurfacing portions of Wheeling, West Liberty and Bethany Pike, G. C. & P. Road near Clinton, Peter's Run Road, West Union and Roney's Point Road, etc., with bitominous macadam penetration method. George W. Oldham, County Clerk.

Wheeling, W. Va.—Until July 7 by County Commissioners at Wheeling for good hard stone limestone ready for piling and crushing, about 6500 cu. yd. in all. George W. Steenrod, County Road Engineer.

Henderson, N. C.—Until June 29, by G. W. Adams, City Clerk, for paving about 35,000 ft. concrete curb and gutter, necessary storm drainage, etc. Anderson & Christie, Inc., Consulting Engineers, Charlotte, N. C.

Tarboro, N. C.—Until July 3 by Board County Commissioners (H. S. Bunn, Clk.) for constructing about 10 miles sand clay roads.

Arcadia, Fla.—Until July 3 by County Commissioners (A. L. Durrance, Clk.) for work in Special Road and Bridge Dist. No. 5, approximately 561,749 sq. yd. sand asphalt, brick, rocmas, sand clay, bituminous macadam, or other pavement.

Lake City, Fla.—Reported desired until July 5 by Board Public Works (J. W. Layne, Secy.) for 21,000 sq. yd. brick paving; also for 12,000 sq. yd. of resurfacing old macadam with modified sheet asphalt.

Dadeville, Ala.—Reported desired until July 10 by County Commissioners for constructing 12 miles of roads, including steel bridges. Also separate bids for 95 miles public roads under three contracts.

Troy, Ala.—Until June 28, by Lawrence E. Gellerstedt, Mayor, for 17,000 to 20,000 yd. of paving to be brick, bitulithic or wood block, advertised in Engineering Record.

Macon, Miss.—Reported desired until July 2 by John Tyson, Chancery Clk., for furnishing Noxubee County with asphaltum and tarvia for dressing rock roads.

Williamsburg, Ky.—Until June 26, by County Fiscal Court at Williamsburg, for 19,180 cu. yd. sandstone for base, 10,820 cu. yd. limestone for top course, and 24,640 cu. yd. straight limestone construction, from Williamsburg to Corbin. Robert C. Terrell, Commissioner Public Roads, Frankfort.

Ashland, Ohio.—Reported desired until June 26 by W. O. Mason, Mayor, for improving Arthur and Sandusky Streets. R. R. Conn, City Engr.

Cincinnati, Ohio.—Until July 3, by Chas. F. Hornberger, Public Service Director, for improvement of Glenmore Avenue, from Werk Road to Bridgetown Pike, with brick. City Engineer, Frank S. Krug's estimate, $16,550, and improvement of Louis Avenue, from Vine Street to Eden Avenue, with bituminous macadam. City Engineer's estimate, $13,314.

Cleveland, Ohio.—Until July 5, by Division of Purchases and Supplies, for paving Bulkey Boulevard.

Columbus, Ohio.—Until June 30 by Board County Commissioners (John Scott, Clk.) for constructing the following roads: Engineer's estimate No. 292 for applying a surface treatment of Tarvia "B" upon the roads enumerated in said Engineer's estimate No. 292; Engineer's estimate No. 293, applying a surface treatment of Trinidad liquid asphalt "A"; Engineer's estimate 260, improving and macadamizing the Jewell Road, in Truro Township.

Reported desired until July 5, by Public Service Director, for improving eighteen streets.

Elyria, Ohio.—Until June 28 by M. M. Wilcox, Director Public Service, for 2020 sq. yd. brick pavement on Williams Street and 9430 sq. yd. repairing with brick on Winckles, Taylor and Olive streets. C. M. Theobold, City Engineer.

Lima, Ohio.—Until June 28, by A. L. Metheany, Director Public Service, for 45,000 sq. yd. brick, sheet asphalt, bitulithic, asphalt block or asphaltic concrete on concrete foundation on 13 streets. C. H. Bryson, City Engineer.

Logan, Ohio.—Reported desired until June 27, by Fred Allen, Village Clerk, for paving Grahamsville Avenue and High Street with brick.

Marysville, Ohio.—Until June 29 by County Commissioners at Marysville for grading, bridging and macadamizing Holloway Road in York and Liberty Townships. H. W. Husted, County Auditor.

Painesville, Ohio.—Reported desired until July 1 for grading and paving 2½ miles with brick. Probable cost $15,000. C. N. Cummings, Co. Engr.

Smithville, Ohio.—Until July 15, by D. D. Hartzler, City Clerk, for paving with bituminous macadam on North Summit and Milton Streets; cost $10,000. Philip Markley, Engineer, Wooster.

Indiana.—By County Commissioner at following places for constructing roads:

Until June 29:

At Rushville, constructing of bound macadam county line road, 26,845 ft. Allen R. Holden, County Auditor.

Until June 30:

Rushville, macadam road in Anderson Township, 14,650 ft.; county line road of gravel, 15,761 ft.; 3315 ft. roadway in Washington Township, and 5118 ft. line between Ripley and Posey townships. Allen R. Holden, County Auditor.

Until July 1:

Muncie, four gravel roads in Mount Pleasant Township; 4 macadam roads in Center Township, and 2 brick roads in Center Township. F. M. Williams, County Auditor.

Connersville, gravel road in Connersville Township. Glen Zell, County Auditor.

Rensselaer, stone road on line between Newton and Marion townships. Joseph P. Hammond, County Auditor.

Fowler, road in Oak Grove Township. Warren Manley, County Auditor.

Decatur, macadam road in Washington Township. T. H. Baltzell, County Auditor.

Brownstown, 2 macadam roads in Jackson and Vernon Townships; 2 concrete roads in Jackson Township; one gravel road in Redding Township, and one concrete and gravel road in Hamilton Township. Albert Leudike, County Auditor.

Jasper, constructing roads in Patoka Township. Jacob H. Seng, County Auditor.

Versailles, constructing macadam roads in Adams, Johnson and Laughery townships. J. Francis Lochard, County Auditor.

Portland, constructing 3 bridge roads in Richland Township; stone roads in Noble, Green, Wabash and Pike townships, and 2 gravel roads in Noble and Green townships. John Bonifas, County Auditor.

Tipton, constructing gravel roads in Cicero and Madison townships. Oscar Vanness, County Auditor.

Lawrenceburg, constructing macadam road in Center Township. Harry E. Lutherbeck, County Auditor.

Paoli, constructing gravel or macadam road on line between French Lick and Orangeville townships. E. A. Palmer, County Auditor.

Brookville, constructing macadam road. C. G. Reifel, County Auditor.

Franklin, gravel roads in Nineveh and Union townships, 15,230 and 4696 ft. John C. Gregg, County Auditor.

Until July 5:

Kokomo, 2 gravel roads, 13,205 and 7000 ft. William L. Benson, County Auditor.

Vincennes, constructing 5040 ft. gravel road in Johnson Township. J. Nuentzer, County Auditor.

Lafayette, 2.56 miles of gravel road in Perry Township. George W. Baxter, County Auditor.

Kokomo, 8624 ft. asphaltic concrete road. William L. Benson, County Auditor.

Columbus, constructing concrete road, W. H. Scott, County Auditor.

Goshen, constructing brick or other pavement on road in Elkhart Township. A. R. Bemenderfer, County Auditor.

Crawfordsville, Ind., constructing gravel roads in Brown Township. W. F. Batman, County Auditor.

Columbia City, constructing brick and concrete road. Thomas A. McLaughlin, County Auditor.

Valparaiso, constructing 2 gravel roads in Westchester Township, 0.86 and 1.04 miles. C. A. Blachly, County Auditor.

Mount Vernon, 1800 ft. of rock road on county line. Joseph R. Haines, County Auditor.

Rochester, constructing 5 gravel roads in Rochester Township and 2 in Henry Township. Ernest A. Smith, County Auditor.

Shelbyville, 2 gravel roads in Moral Township and 1 in Jackson Township, 14,025, 14,900 and 17,400 ft. Frank W. Fagel, County Auditor.

Until July 6:

Indianapolis, constructing 3 gravel roads in Center Township. Leo K. Fesler, County Auditor.

Until July 7:

Mount Vernon, for 2 gravel roads, 14,024 and 15,710 ft. Joseph R. Haines, County Auditor.

Until July 10:

Peru, constructing gravel and concrete roads. F. K. McElheny, County Auditor.

Until July 11:

Frankfort, constructing gravel road in Johnson Township and 2 gravel roads in Union Township. Edward Spray, County Auditor.

Indianapolis, constructing gravel road in Center Township. Leo K. Fesler, County Auditor.

Grand Rapids, Mich.—Until July 10 by Frank Sherman, County Auditor for constructing County Road No. 169 (Pengilly-Goodland Road).

North Vernon, Ind.—Until July 3, by Common Council, for brick paving, about 16,300 sq. yd. Charles W. Miles, City Engineer.

De Kalb, Ill.—Until July 3 by city for 14,000 yd. brick and 3000 yd. concrete pavement, with concrete curb and gutter, advertised in Engineering Record. A. R. Russell, City Engineer.

Illinois.—Until June 28, by State Highway Department, Springfield, for constructing following roads:

Tuscola, Douglas County, Sect. D, 2640 ft. brick. Engineer's estimate $5,340.

Arcola, Douglas County, Sect. E, 3800 ft. brick. Engineer's estimate $8,136.

Galena, Jo Daviess County, Sect. C, concrete, 2525 ft. Engineer's estimate $4,814.

Elizabeth, Jo Daviess County, Sect. D, 3550 ft. concrete. Engineer's estimate $5,144.

Milledgeville, Whiteside County, Sect. D, gravel, 14,070 ft, $13,916.

Rock Falls, Whiteside County, Sect. E, 8015 ft., gravel, $12,661.

Litchfield, Montgomery County, Sect. D, 23,925 ft., earth, $6,679.

Springfield, Sanganon County, Sect. I, 3550 ft., brick. Engineer's estimate, $13,242.

Park Ridge, Ill.—Until July 5, by Board Loal Improvements (A. W. Lorenz, Secy.), for 9000 sq. yd. asphaltic concrete, on Ashland Boulevard.

Paris, Ill.—Until July 5, by A. Allen Brubaker, City Clerk, for about 7150 sq. yd. reinforced concrete pavement, advertised in Engineering Record. O. F. Wold, City Engineer.

Peoria, Ill.—Until June 26 by Board Local Improvements (Sherman W. Eckley, Pres.) for paving with brick portions of Peoria Avenue, in all about 6180 sq. yd. brick pavement, 2100 cu. yd. excav., etc.

Springfield, Ill.—Reported desired until Aug. 11 for curbing and paving with brick. Probable cost $75,000. W. D. Seeley, City Engr.

Springfield, Ill.—Until June 28 by Frank H. Hamilton, President Board Local Improvements, for brick pavement, 27 ft. wide, with cement grout filler, on 5-in. concrete foundation, with combined curb and gutter in State Street.

Portage, Wis.—Until July 5, by Fred. F. Goss, Acting City Clerk, for furnishing and placing 10,300 lin. ft. concrete curb and gutter, relay 7000 sq. yd. old vitr. brick pavement, and construct 15,000 sq. yd. new pavement, vitr. brick, concrete and asphaltic concrete will be considered, and to lay 2600 lin. ft. vitr. pipe storm sewer.

Cedar Rapids, Iowa.—Reported desired until June 26, by City Clerk, for constructing 10,000 sq. yd. brick and 24,000 sq. yd. asphaltic concrete pavement.

Eldora, Iowa.—Until June 27, by E. W. Dunn, County Engineer, for grading and incidental work on 14½ miles of county road, approximately 90,000 cu. yd. earth excav.

Oskaloosa, Iowa.—Until June 26, by T. H. Carlin, City Clerk, for paving portions of Ninth Street, G Avenue, A Avenue and other streets, in all about 5360 sq. yd. concrete paving, on 4-in. base, 3350 lin. ft. combined curb and gutter, etc.

Spencer, Iowa.—Until July 7, by A. W. Chamberlain, County Auditor, for grading 20 miles of road in Clay County; Engineer's estimate 70,000 cu. yd. Walter Barber, County Engineer.

Independence, Mo.—Until June 28 by Edw. M. Stayton, Co. Surveyor and Ex-Officio Highway Engineer, for 4890 sq. yd. macadam pavement, 4294 cu. yd. solid rock excav., etc.

Kansas City, Mo.—Until June 27, by Bd. Public Works (J. Pearce Kane, Secy.), for vertical fibre brick pavement on portions of Twenty-fifth and Twelfth Streets, with asphaltic concrete on portions of Thirtieth Street, Tracy Avenue and other streets, and with concrete on portions of Twenty-fourth Street and artificial stone sidewalks on Woodland Avenue.

Concrete, Wash.—Until July 11, by G. L. Leonard, City Clerk, for paving with one course concrete on Mill, Division and Garden Streets.

Ephrata, Wash.—Until July 6, by County Commissioners Grant County, for surfacing 6½ miles of permanent highway near Quincy. E. H. Stradling, County Engineer.

Everett, Wash.—Reported desired until July 3, by Mae Weatherbee, Co. Aud., for constructing Bond Road, No. 29, from Snohomish to Three Lakes, to cost $16,000; Bond Road, No. 25, from Forty-first Street to Everett Street, west limit, cost $10,000; Bond Road, No. 14 East Stabdwood to Cedarhorne, cost $8,000; Bond Road, No. 5, Edmonds to North Trunk Highway, cost $11,000. Also separate bids, until June 26, same time and place, for constructing five highways, as follows: Proposition No. 22, Monroe to Sultan, west limits, $17,000; Proposition No. 24, Sultan, east limits, to Gold Bar, east limits, $8,000; Proposition No. 18, Arlington to Cooper Spur, $9,000; Permanent Highway No. 21, and Permanent Highway No. 26. W. C. Bickford, Co. Engr.
Until July 10, by the County Commissioners, for following road work: Hanford to Granite Falls, cost $8,000; proposition 21, Stanwood north to Florence, $5,000; proposition 15, Beverly Park to Edmonds, $13,000. W. C. Bickford, County Engineer.

Seattle, Wash.—Until July 11, by Board of King County Commissioners (Byron Phelps, Clerk) for 6560 ft. of paving with brick, monolithic type No. 2-C., between Hollywood and Woodinville, 18 ft. wide. Estimated cost $20,000. Until July 10, for 2098 ft. of one-course concrete paving on Section 2 of bond road near Richmond Beach, and for 1444 ft. of grading and graveling on same highway. Improvement will be 18 ft. wide with 4-ft. cobble gutters, involving difficult drainage problems and construction of many concrete culverts and drains. Cost between $12,000 and $15,000. A. P. Denton, County Engr.
Until June 30, by Board of Public Works, C. B. Bagley, secy., for paving California Avenue; cost about $50,000.

Tillamooke, Ore.—Reported desired until June 27, by Ira C. Smith, City Recorder, for hard-surfacing a number of streets with concrete, including curbs, gutters, etc., for part of Project 3, involving portions of Eighth Street, Fifth Avenue, Fifth Street and Third Avenue.

Anaheim, Cal.—Until July 13 by E. O. Stewart, City Clerk, for constructing about 372,219 sq. ft. 4½-in. concrete base and 1½-in. sheet asphalt surfaced pavement on Broadway.

California.—Until June 10, by State Highway Commission, Sacramento, for constructing 6 miles of concrete paving, Larkspur to Sausalito, Marin County.

Los Angeles, Cal.—Until July 3 by Board of Supervisors (A. M. McPherson, Clerk) for constructing macadam pavement, reinforced concrete culverts, etc., in 2.62 miles, on Vine Street, Covina Road District No. 55, involving approximately 13,585 cu. yd. excavation, 13,844 lin. ft. shaping roadbed, etc.; probable cost $21,900.
Until June 29, by Board Education (Wm. Sheldon, Secy.), for constructing sidewalks at a number of schools.

Riverside, Cal.—Until June 27 by H. C. Cree, City Clerk, for 7½ blocks of macadam pavement, cement curb, gutters and walks in Fairmount Boulevard.

Phoenix, Ariz.—Until July 10, for paving on North Fourth Street, in all about 12,200 yd., and 5700 ft. curbing. Robt. A. Craig, City Manager.

North Bay, Ont.—Until June 28, by H. J. McAuslan, Town Engineer, for constructing approximately 60,000 sq. ft. permanent sidewalks.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Norway, Me.—Lowest bid opened June 16 by Town for 13,000 sq. yd. concrete pavement and drainage system submitted by Small & Ingalls of Bar Harbor. Stephen Litchfield, Engineer, Brunswick.

Boston, Mass.—Lowest bid opened June 13 by Edward P. Murphy, Commissioner Public Works, for granite block paving on Alexander Street, submitted by James Doherty, 32 Calumet Street, Roxbury, at $7,472.

Massachusetts.—Following are bids opened June 13 by Massachusetts Highway Commission, Boston, for constructing bituminous macadam roadway in towns of Duxbury, Marshfield and Scituate: W. T. Loud & Son, Quincy, $19,282, and Antonio Carchia, East Weymouth, $22,444.

Long Island City, N. Y.—Following bids submitted June 7 to Maurice E. Connolly, Borough Queens Pres., for regulating, grading, curbing and laying sidewalks in Fresh Pond Road from Woodbine Street to Flushing Avenue, Ridgewood, by Denis McCarthy, 10 Audubon Avenue, at $25,496, and for regulating and paving with sheet asphalt Lefferts Avenue, from Liberty Avenue to Rockaway Boulevard, Woodhaven, by Cleveland Trinidad Paving Co., Cleveland, Ohio, at $21,409.

New York, N. Y.—Following are totals of the three lowest bids opened June 14 by President Bronx Borough for laying sidewalks, regulating curbs, etc., on West 180th Street, from Loring Place to University Avenue, including 13,200 cu. yd. earth excavation, 9350 sq. ft. two-course concrete sidewalk, including maintenance, etc.: E. V. Handy, 106 Field Place, Bronx, $16,534; Spadaro Contracting Co., 827 217th Street, $16,746; M. DiMenna Contracting Co., 2319 Crotona Avenue, $17,917.
Following is unit figures of Uvalde Asphalt Paving Company, 1 Broadway, for repaving, etc., with sheet asphalt west side of Broadway from 110th to 121st Streets and east side from Ninety-second to 121st Streets: 8839 lin. ft. 6-in. granite curbing, $1.45; 610 lin. ft. 6-in. granite corner curbing, $2; 50 lin. ft. old curb redressed, 50 cts.; 300 sq. ft. concrete sidewalk Class A, 30 cts.; 10 lin. ft. granite headers, $1; 10 lin. ft. temporary headstones, $1; 6980 cu. yd. concrete outside of railroad area, $5.25; 39,050 sq. yd. sheet asphalt pavement outside of railroad area, $1.34; 290 sq. yd. sheet asphalt pavement in approaches, $1.34; 20 sewer manhole heads and covers complete, $15; 7 covers for sewer manholes, $5; 7 rings for sewer manholes, $5; 5 cu. yd. brick masonry, $15; 40 water manhole heads and covers complete, $15; 10 lin. ft. platform flag, cut to line, 50 cts. In Railroad Area—410 cu. yd. concrete, $5.25; 2400 sq. yd. sheet asphalt pavement, $1.34; total, $109,937. Next three lowest: Barber Asphalt Paving Company, Woolworth Building, $111,679; Asphalt Construction Company, 206 Broadway, $113,930, and Aztec Asphalt Paving Company, 90 West Street, $126,626.
Unit figures of Barber Asphalt Paving Company, Woolworth Building, lowest bid opened same time and place as above for paving Park Avenue from Seventy-second to Ninety-sixth Streets: 11,800 lin. ft. new 6-in. granite curbstone, $1.45; 3000 lin. ft. new 6-in. granite corner curbstone, $1.95; 260 lin. ft. old curb redressed, 35 cts.; 11,500 sq. ft. concrete sidewalk Class A, 20 cts.; 10 lin. ft. granite headers, $1.10; 10 lin. ft. temporary header stone, 60 cts.; 8860 cu. yd. concrete outside of railroad area, $5; 48,600 sq. yd. sheet asphalt pavement outside railroad area, $1.33½; 580 sq. yd. sheet asphalt pavement in approaches, $1.50; 50 sewer manhole heads and covers complete, $16; 15 covers for sewer manholes, $4.50; 15 rings for sewer manholes, $3.50; 3 cu. yd. brick masonry, $15; 60 water manhole heads and covers complete, $17; 80 lin. ft. platform, flag cut to line, 60 cts.; 40,000 old paving blocks to be removed to Corporation Yard at Ninetieth Street and Avenue A, $12; 50 cu. yd. concrete for coping around parkways, $10; 10 cu. yd. concrete, $5; 70 sq. yd. sheet asphalt pavement, $1.33½; total, $137,855. Total of next three lowest Asphalt Construction Company, 206 Broadway, $141,039; Uvalde Asphalt Paving Company, 1 Broadway, $149,650, and Sicilian Asphalt Paving Company, 41 Park Row, $150,203.

★**Troy, N. Y.**—Contract awarded by Board of Contract and Supply for grading streets in Lindenwood Park to Martin Murray Construction Co., Fourteenth and Hutton Streets, at $19,242.

New Orleans, La.—Following are unit figures of four lowest bids opened June 12 by Highway Department of State Board of Engineers for constructing highways in De Sota Parish:

Section I—21.86 miles: (a) J. N. George & Sons, Shreveport, $56,985; (b) Caddo Construction Co., Shreveport, $57,322; (c) Smith Brotrers, Coushatta, $58,050; (d) Texas Grading Co., Houston, $63,290.

	(a)	(b)	(c)	(d)
40,000 cu. yd. borrowed earth	$0.16	$0.165	$0.165	$0.1575
2,000 cu. yd. lateral ditches	0.16	0.165	0.165	0.1575
38,000 cu. yd. earth excavation	0.15	0.165	0.165	0.1575
860 cu. yd. concrete bridges	16.75	.16.50	17.00	17.50
360 cu. yd. concrete culverts	16.75	16.50	15.00	16.50
35,000 cu. yd. gravel (placing, etc.)	0.65	0.65	0.67	0.75
6,900 cu. yd. binder	0.20	0.18	0.20	0.50

Section II—29.03 miles: (a) J. N. George & Sons, Shreveport, $54,867; (b) Smith Brothers, Coushatta, $59,685; (c) Texas Grading Co., Houston, $63,317; (d) Catto Construction Co., Shreveport, $64,389.

	(a)	(b)	(c)	(d)
37,000 cu. yd. borrowed earth	$0.175	$0.165	$0.1575	$0.175
30,000 cu. yd. lateral ditches	0.17	0.165	0.1575	0.175
37,000 cu. yd. earth excavation	0.17	0.165	0.1675	0.175
350 cu. yd. concrete bridges	16.75	17.00	17.50	17.00
110 cu. yd. concrete culverts	17.00	15.00	16.50	17.00
46,000 cu. yd. gravel (placing, etc.)	0.70	0.82	0.85	0.90
8,300 cu. yd. binder	0.20	0.20	0.50	0.18

Section III—14.93 miles: (a) Texas Grading Co., Houston, $53,408; (b) J. N. George & Sons, Shreveport, $54,099; (c) Smith Brothers, Coushatta, $55,016; (d) Worthington Construction Co., Brookhaven, Miss., $66,577.

	(a)	(b)	(c)	(d)
18,400 cu. yd. borrowed earth	$0.1575	$0.18	$0.165	$0.24
2,000 cu. yd. lateral ditches	0.1575	0.18	0.165	0.24
20,000 cu. yd. earth excavation	0.1575	0.18	0.165	0.24
490 cu. yd. concrete bridges	17.50	16.75	17.00	21.90
380 cu. yd. concrete culverts	16.50	17.00	15.00	18.50
24,000 cu. yd. gravel (placing, etc.)	1.20	1.30	1.39	1.59
4,800 cu. yd. binder	0.50	0.20	0.20	0.20

Section IV—65.82 miles (includes Sections 1, 2 and 3): (a) J. N. George & Sons, Shreveport, $169,486; (b) Hampton Reynolds, New Orleans, $176,865; (c) Caddo Construction Co., Shreveport, $178,496; (d) Worthington Construction Co., Brookhaven, Miss., $208,127.

	(a)	(b)	(c)	(d)
95,400 cu. yd. borrowed earth	$0.1775	$0.1575	$0.165	$0.225
7,000 cu. yd. lateral ditches	0.17	0.1575	0.165	0.225
95,000 cu. yd. earth excavation	0.1775	0.1575	0.165	0.225
1,700 cu. yd. concrete bridges	17.00	17.50	17.00	18.25
850 cu. yd. concrete culverts	17.00	16.50	15.00	15.75
105,000 cu. yd. gravel (placing, etc.)	0.83	0.88	0.955	1.10
20,000 cu. yd. binder	0.20	0.48	0.20	0.19

★**Rome, N. Y.**—Contract awarded Warren Brothers Company, Boston, Mass., for paving with bitulithic on portions of West Park, West Thomas, West Bloomfield, East Bloomfield and East Thomas, Robert and Parry Streets at a cost of $60,911 (bids opened May 31 by Board of Public Works, B. F. Coleman, Clerk).

★**Elizabeth, N. J.**—Contract awarded C. H. Winans Company, 207 Broad Street, for repairing Westfield and Elizabeth Avenues at $33,512. Other bidders were: Weldon Construction Company, $35,368; M. Irving Demorest, $35,289; J. C. Bentley, $37,767. Contract for repairing Terrill road, from Plainfield to Fanwood, awarded Weldon Company at $25,007. C. H. Winans bid $27,460.

Montclair, N. J.—Following are four lowest bids opened June 12 by Edgar S. Closson, Town Engineer, for asphalt concrete pavement on Upper Mountain and Bloomfield Avenues and other streets: F. C. Humphrey, Hackensack, $72,987; Continental Public Works Co., New York, N. Y., $82,916; Osborne & Marsellis Co., Montclair, $89,223, and Union Paving Co., Schenectady, N. Y., $89,810.

New Brunswick, N. J.—Following bids opened by Bd. of Freeholders for constructing section 4 of Woodbridge-New Brunswick Turnpike: Thomas F. Dunigan, Woodbridge, $106,284, and Liddle & Pfeiffer of Perth Amboy, $109,654.

★**Pennsgrove, N. J.**—Following are three bids opened June 12 by W. D. Snyder, Borough Clerk, for 15,484 sq. yd. macadam pavement on Broad and Maple Streets: Joseph F. Burke Company, Plainfield, $36,018 (awarded contract); Joseph M. Kelly, Camden, $37,317, and C. H. Winans, Elizabeth, $37,275.

Trenton, N. J.—Following are 4 lowest bids opened June 13 by Bd. of Freeholders for constructing Lawrenceville-Princeton Road: Highway Improvement Repair Co. of Wilmington, Del., $124,853; T. H. Riddle of New Brunswick, $129,880; John Ginder of Trenton, $130,580; Edward L. Bader, New York, N. Y., $136,398.

★**Palatka, Fla.**—Contract for 120,000 sq. yd. brick paving (bids opened June 7 by County Commissioners), awarded to Georgia Engineering Company, Augusta, Ga., at $1.49½ per sq. yd. C. Stallings, Engineer, Palatka.

★**Lewisburg, Pa.**—Contract for 7500 sq. yd. paving on Market Street awarded W. H. Lyons, Sunbury, at $2.12 per sq. yd. H. M. Showalter, City Clerk.

★**Pittsburgh, Pa.**—Contract awarded by County Commissioners to Thomas Cronin Company, Pittsburgh, for 1½ miles of Bitoslag pavement
★Contracts awarded by County Commissioners to Booth & Flinn, Ltd., 1942 Forbes St., for resurfacing and reconstructing 16 roads, as follows: Lowries Run and Mt. Nebo Road, $25,606; Perrysville No. 1 Road, $23,462; Scaife Road, $19,447; Thompaon Run Road, $17,379; Troy Hill Road, $15,591; Millerstown and Culmerville Road, $34,633; Freeport No. 3 Road, $17,617; Unity and Trestle Road, $12,180; Saltsburg Road, $15,239; Crab Hollow Road, $25,751; Library Road, $28,109; McCoy Road, 12,518; Beaver Grade Road, $24,559; Coraopolia and Carnot Road, $15,341; Steubenville Pike and Enlow Road, $18,739 For furnishing 29,000 tons of ballast and screenings, as follows: For stone, to Clydesdale Stone Company, Oliver Bldg., $15,068, and J. M. McGuire & Company, Commonwealth Bldg., at $7,707, and for slag to Duquesne Slag Products Company, Pittsburgh, at $7,191.

★**Wilkes-Barre, Pa.**—Contract for constructing county highway leading from Hillside to Huntley (bids opened May 31 by F. R. Hendershot, Comptroller), awarded P. J. Boyle, Wilkes-Barre, at $54,378 for trap rock amiesite. N. M. Creaae, Clerk to Comptroller.

★**Baltimore, Md.**—Contract awarded by Board of Awards for paving with sheet asphalt portions of Homestead, Polk, Montpelier and Taylor Streets to P. Flanigan & Sons, Bloomington and Calvert Streets, at $19,936 (bids opened June 7).
Following bids opened June 14 by Board of Awards for paving with sheet asphalt portions of Baltimore, Brantley and Schroeder Streets and Arlington Avenue, from Baltimore Asphalt Block & Tile Company, Monroe and Lorman Streets, at $1.62 per sq. yd., and P. Flanigan & Sons, 120 East Lexington Street, at $1.67.

★**Washington, D. C.**—Contract awarded by Commissioners District of Columbia for resurfacing asphalt roadways to Warner-Quinlan Asphalt Company, Syracuse, at $1.51 per sq. yd.

★**Rustburg, Va.**—Following contracts for road improvements in Campbell County have been recommended for award by Division Engineer State Highway Department, Lynchburg: 5 miles, to Virginia Construction Company, Waynesboro, Va., $54,875; McKinney Brothers, Inc., Lynchburg, 5½ miles, 64,104; J. R. Ford Company, Lynchburg, 1¾ miles, $17,025; Belts & Boice, Harrisonburg, 13½ miles, $128,229 (all bituminous macadam), and Vaughan Construction Company, Shumansville, 9 miles (waterbound macadam), $89,929.

★**Dunn, N. C.**—Contract awarded by Mayor and Board of Aldermen to F. J. McGuire, Norfolk, Va., for sheet asphalt paving aggregating about $40,000. Gilbert C. White, Engineer, Durham. (Bids opened June 13.)

New Orleans, La.—Lowest bid opened June 12 by Department of Highways of the Board of State Engineers for constructing 12 miles of earth roadway in Grant Parish, submitted by Smith Brothers, Coushatta, at $12,875.

★**Cincinnati, Ohio.**—Following are four lowest bids opened recently by County Commissioners for constructing Caldwell Drive: John Ruebel Construction Company, Colerain and Virginia Avenues, $33,673 (awarded contract); James A. Byrnes, 209 Piedmont Street, $36,054; John Funks, 2466 West McMicken Avenue, $37,298, and Henkle & Sullivan, 3047 Glenview Avenue, $38,420. Albert Reinhardt, Clerk to Commissioners.
★Four lowest bids opened by Public Service Director Chas. F. Hornberger, for improvement of Elland Avenue from Erkenbrecher Avenue to Burnet Avenue, with wood block were as follows: Henkel & Sullivan, 710 Mercantile Library Building, $22,344.70; Kirchner Construction Co., 221 West Ninth Street, $22,532 (recommended for award); Thomas Evans, 3515 Mooney Avenue, $23,848.10; Thomas P. Strack, Goodall Building, $23,928.80. City Engineer Frank S. Krug estimates cost at $23,936.

★**Goshen, Ind.**—Contract awarded by County Commissioners for constructing two brick roads to Cripe & Seaman, Goshen, at $51,800 (bids opened June 6).

★Warren, Ohio.—Contracts awarded by Board of Control for brick pavement as follows (bidders of Warren unless otherwise stated): To James McGlashen, for 17,964 sq. yd., including between car tracks, on Ohio and Summit Streets; to Smith Engineering & Construction Co., 1547 sq. yd. on Seneca Street; Dennis & Daugherty, 3650 sq. yd. on Prospect Street and 1575 sq. yd. on Waverly Street; Victor Oleson Construction Co., Youngstown, 16,452 sq. yd., including car tracks, on South Pine Street. H. S. McKibben, City Engineer.

★Brazil, Ind.—Contract awarded by County Commissioners for Keller stone and gravel road in Perry, Lewis and Harrison Townships to C. A. Rhodes, Brazil, at $12,132. (Bids opened June 12.)

★Huntington, Ind.—Contract awarded by County Commissioners for road in Polk Township to Samuel H. Palmer, Hammond, at $12,500 (bids opened June 6).

★Indianapolis, Ind.—Contract for paving with asphalt and granite curb on Holmes Avenue awarded American Construction Company, St. Louis, Mo., at $25,109, and asphalt on Southeastern Avenue to Union Asphalt Construction Company, 234 American Central Life Bldg., at $15,419.

Madison, Ind.—Following are four bids opened June 8 by Harry E. Nichols, City Clerk, for 19,700 sq. yd. pavement on Main and Walnut Streets: Amitha & Carter, 3745 Illinois Street, Indianapolis, Ind., $1.90 per sq. yd.; M. A. Fry & Co., Indianapolis, Ind., $1.91; Ewing Shields, Greencastle, $1.95, and Pulse & Porter, Greensburg, $1.96.5.

★Shelbyville, Ind.—Contract awarded by County Commissioners for improving Frank P. McKay Road in Liberty Township to Charles E. Reddington, Greensburg, at $12,715 (bids opened June 7).

★Tell City, Ind.—Contract for constructing 2 miles of link-rock roads in Tobin Township (bids opened June 5 by County Commissioners) awarded Cornelius Paulin Company, Tell City, at $10,722.

★Terre Haute, Ind.—Contract awarded by County Commissioners for constructing H. F. McBrayer Road, Lost Creek Township, of stone and gravel, to Jordan W. Creasey & Son, Terre Haute, at $12,884. Other bids: H. A. Carpenter, Cloverland, $13,195, and Keegan Bros., Brazil, $13,235.

★Vincennes, Ind.—Following are totals of four lowest bids opened June 6 by W. H. Reel, Engineer Knox County, for grading and paving (a) Ewing Road, 28,000 sq. yd. and 14,400 lin. ft.; (b) Simpson Road, 16,876 sq. yd., 8400 lin. ft., and (c). Cantwell Road, 30,410 sq. yd. and 15,250 lin. ft: Arkansas Construction Company, Mt. Vernon, Ind., (a) $47,.354 (awarded contract), (b) $23,937, (c) $43,092 (awarded contract). S. R. Adams Construction Company, Princeton, (a) $49,800, (b) $23,819 (awarded contract), (c) $46,184. Burns & Shields, Linton, (a) $49,800, (c) $47,100. R. E. M. Company, Evansville, (a) $48,160, (b) $24,397, (c) $47,100. Dunlap Dippold Company, St. Louis, Mo., (b) $24,395.

★Warsaw, Ind.—Contract awarded by County Commissioners for constructing gravel road in Etna Township to Thomas E. Sparks, Kirklin, at $38,000.

★Ann Arbor, Mich.—Contract for brick paving on Liberty Street, also on Catharine Street and Miller Avenue (bids opened June 7 by Board Public Works) awarded Barnes & O'Neil, Allegan, at a total of $31,290. Manley Osgood, City Engineer.

★Escanaba, Mich.—Contract for macadamizing from Brampton to County line, 19 miles 16 ft. wide and 6 in. thick (bids opened June 1 by County Commissioners), awarded Delta Contracting Co., Escanaba. R. P. Massan, County Engineer.

★Gilford, Mich.—Contract for constructing 2½ miles of 16-ft. trunk line road (bids opened June 1 by Edward Miller, Highway Commissioner) awarded S. W. Burton, Kaw Kawlin, Mich., at $20,100.

★Illinois.—Contracts awarded by State Highway Commission, Springfield, for constructing state-aid work as follows: Pike County, Section B, macadam to Cameron Joyce & Company, Keokuk, Iowa, at $15,677, and Knox County, Section B, bridges to same company, at $17,891; Livingston County, Section D, oiled earth, L. S. Kuhn, Bloomington, Ill., $12,001; McDonough County, Section E, bridges, Miller & Husband, Springfield, $4,090. McHenry County, Section H, gravel James B. Wright Havard, $11,799, and Cook County, Section K, concrete, Peter Simons, Quincy, $16,484.

★Pekin, Ill. — Contract awarded by County Commissioners for 300,000 gal. of road oil to Indian Refining Co., 17 Battery Place, New York, N. Y., at $4.05 per hundred gal.

★West Allis, Wis.—Contract for paving with one course concrete 6343 sq. yd. (bids opened June 5 by Arthur L. Wichmer, City Clerk), awarded Dean Construction Co., Milwaukee, at $1.37 per square yard.

★Britt, Iowa.—Contract for 36,000 sq. yd. of pavement and 24,000 lin. ft. combined curb and gutter (bids opened June 15 by Town Clerk), awarded J. S. McLaughten & Sons, Red Oak, for sheet asphalt, at $1.79 per sq. yd. Theodore S. DeLay, Engineer, Creston.

★Minneapolis, Minn.—Contract awarded by County Commissioners to General Contracting Company, Minneapolis, for about one mile of bitulithic pavement in vilage of Waysata at $30,834.

★Kansas City, Kan.—Contract awarded by City Park Board for paving with macadam and wood blocks portion of Paseo Street, to E. J. Wetherstrom, Kansas City, Kan., at about $9,000.

★Huron, S. D.—Contract awarded C. H. Atkinson, Watertown, S. D., for 9000 sq. yd. pavement (bids opened June 5 by S. S. Oviatt, City Auditor) at $1.89 per sq. yd.

★Minot, N. D.—Contract awarded Hanlon & Okes, Sioux City, Iowa, for 24,000 sq. yd. bitulithic paving and 2700 sq. yd. creosoted wood block paving. E. J. Thomas, City Engineer.

★Kansas City, Mo.—Contract awarded by Bd. Public Works for 8227 sq. yd. creosoted wood block pavement to A. Jaicks Co., Kansas City, at $3.03 per square yard.

★Contract for paving with bituminous macadam on Forty-seventh and Mill Creek Parkway (bids opened June 14 by Board Park Commissioners), awarded Williston Construction Co., Chicago, Ill. T. C. Harrington, Secy.

★Athens, Tex.—Contract awarded by County Commissioners for constructing 40 miles of road to Cobb & Gregory, Houston, at $60,000.

★Cold Springs, Tex.—Contract awarded by William McMurray, County Judge, for 18 miles of sand-clay roads to A. N. Dawson, Shepherd, Tex. (Bids opened June 12.)

★Bartlesville, Okla.—Contract for asphalt-macadam paving awarded Joe W. Menefee, Sedalia, Mo., at $1.19 a square yard.

★Durant, Okla.—Contract awarded by City Council for paving Main St. to Southwestern Gravel Co., Dallas, at $27,931.

★Cathlamet, Wash.—Contract for surfacing the Cathlamet-Skamokawa Road in Wahkiakum County awarded Sloane Bros., 171 Belmont Avenue, Seattle, at $15,700. Thos. H. Aliman, County Engineer.

★Chehalis, Wash.—Contract for laying 2400 sq. yd. of one-course concrete paving on National Avenue awarded Albers Bros., Chehalis, for $10,260. F. G. Whaley, City Engineer; D. W. Boone, City Clerk.

★Everett, Wash.—Contracts for paving awarded by Commissioners of Snohomish County as follows: Permanent highway 25, to Bancroft & Morgan, Everett, $12,895; number 32, to Securities Construction Company, L. C. Smith Bldg., Seattle, $11,966; proposition 23, to Grant & Irvig, Everett, $10,042. W. C. Bickford, County Engineer.

★Goldendale, Wash.—Contract for constructing two miles of permanent Highway No. 5 (bids opened June 5 by R. M. Spoon, County Auditor), awarded H. L. Wilson Company, Walla Walla, at $18,336. Other bidders: Porter Brothers Company, Portland, Ore., $18,844 and O. N. Patton, Portland, Ore., $18,749. Lyman W. Ward, County Engineer.

★North Yakima, Wash.—Contract reported awarded by City Council for paving two districts with bituminous surface, concrete base, to Washington Paving Company, L. C. Smith Bldg., Seattle, at $1.17 per sq. yd.; total $54,346. N. A. Gilman, City Engr.

★Seattle, Wash.—Contracts awarded by County Commissioners for grading and graveling 3 miles of Woodenville-Duval Road to Henry Brice, Mutual Life Bldg., at $18,499, and for grading Portage-Ellsport Road to Peter Manson, Seattle, at $30,975.

Lowest bid opened by Board of Public Works for grading and constructing concrete walls submitted on Eloise Terrace by Hellenthal & Co., North Bank Bldg., at $9,589.

★Sultan, Wash.—Contract for 7500 sq. yd. paving on Main Street (bids opened June 7, Merton Love, Town Clerk), awarded Grant & Ervig, Everett, at $11,399. Other bidder, Gray's Harbor Construction Company, Hoquiam, $12,591.

★Los Angeles, Cal.—Contract awarded by City Council, Thomas C. Breitenstein, 405 Douglas Street, Pasadena, for grading, rolling and oiling Meridian Avenue and constructing 25,215 sq. ft. cement walk and 12,809 sq. ft. concrete gutter, etc., at $9,275.

★Stockton, Cal.—Contract for asphalt pavement on Miner Avenue, etc., awarded by city to Paul & Caldwell, at $10,959. H. S. Compton, Engineer, Stockton.

★Phœnix, Ariz.—Contract awarded by City Council (bids opened June 6) to California-Arizona Construction Co., Los Angeles, Cal., for 7660 yd. paving and 1340 ft. curbing on N. Central Avenue, at $1.50 per yd. for paving and 95 cts. per ft. for curbing and gutter, and for paving 9860 yd. and 4900 ft. curb and gutter on W. Roosevelt Street at $21,655.

★Tucson, Ariz.—Contract awarded by County Commissioners for paving 26 miles of screened surface road with 6-in. crushed rock base covered with sifted rock to Warren Bros. Co., Boston, Mass., at $99,600.

Sandpoint, Idaho.—Following two bids, opened by City Council, for paving Pine Street: Spokane Bituminous Paving Co., Spokane, $13,308; Spokane Bitumass Paving Company, Spokane, $13,530.

★Lindsay, Ont.—Contract for approximately 10,000 sq. yd. asphaltic concrete pavement on Kent Street West and Glenely Street West awarded Standard Paving Company, Ottawa, Ont.

STREET CLEANING AND GARBAGE DISPOSAL

BIDS DESIRED.

Piqua, Ohio.—Until June 27, by L. E. Chamberlin, Director Public Service for collection and disposal of garbage.

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS

PROPOSED WORK.

Dock—Cohoes, N. Y.—John E. Matton of Waterford is reported to have purchased a site on the East Side on which he intends constructing dry dock and sheds for the building and repairing of barges; cost, including site, about $60,000.

Dock Improvements—Troy, N. Y.—Albert E. Cluett, appointed Chairman of the City Dock Commission, recently appointed by Mayor to report on dock improvements.

Dock—Augusta, Ga.—The City Council granted War Dept. 200 ft. frontage on river bank near east boundary. The Government intends constructing a wharf here costing $70,000. Address U. S. Engineer, Augusta.

Dock and River Improvements—Jacksonville, Fla.—Armour Fertilizer Company, Wilson Toomer Fertilizer Company and the Atlantic Coast Line Company, whose properties adjoin the municipal docks in Jacksonville, will improve their frontage on St. John's River by deepening channel to 24 ft. and filling back of bulkhead for dockage purposes; cost about $100,000.

Dock—Jacksonville, Fla.—Contract soon to be let by Port Commission for constructing dock at foot of Market Street, including a building 76 x 392 ft., wood covered with corrugated iron, to have 2 steel rolling doors in front and 9 vertical and 13 horizontal sliding doors on the side.

Dam—Birmingham, Ala.—Allan R. Gilchrist, City Engineer of Montgomery, Ala., engaged by Alabama Power Co. of Birmingham as chief engineer on the $1,000,000 dam and power station to be constructed on Warrior River.

Wharf—Lake Charles, La.—Contract to be let about August for constructing a municipal wharf costing $15,000, to be pine timber (creosoted), length 400 ft. and width 60 ft. E. L. Gorham, Engineer, Lake Charles.

Levee Work — Hickman, Ky. — Levee bonds for building West Hickman levee amounting to $15,000 have been sold.

Drainage — Paducah, Ky. — Drainage Committee will let contract in the fall for constructing drainage of Mayfield Creek; cost $200,000. John Edward Johnson, Engineer.

Drainage—Muscatine, Iowa.—Citizens of Drury Drainage Dist. of Illinois approved plan to issue $65,000 bonds for reconstructing protecting levee. Address Secy. Drainage Dist.

Drainage—Nevada, Iowa.—Surveys prepared for Highway Drainage District No. 74 which Board of Supervisors of Story County will construct to drain highways in northern Sherman Township and South Lincoln Township; estimated cost $55,000.

Dredging—St. Cloud, Minn.—It is proposed to dredge Sauk River from St. Martin to Cold Spring, at a cost of $71,000. Contract will be let about January. Chute & Bradley, Engineers, St. Cloud.

Drainage—Belvue, Kan.—Contract about to be let by Belvue Drainage Bd. for constructing drainage system, to cost about $70,000.

Drainage—Arkansas City, Ark.—About $700,000 bonds sold for drainage work in Cypress Creek Drainage District in Desha and Chicot Counties. Address County Clerk, Arkansas City.

Drainage—Robstown, Tex. — Reported citizens are considering the construction of the Robstown Drainage District.

Dock, Etc.—Seattle, Wash.—Reported Frank Waterhouse Company, Central Building, plans constructing a freight dock and warehouse buildings on the water front near plant of Holmes Lumber Company.

Flood Protection Work—Chino, Cal.—Chino Creek Protection District (G. C. Waterhouse, Secy.) is considering constructing 2-ft. concrete retaining walls along creek. Probable cost, $18,000.

Flood Control Works—Cucamonga, Cal.—San Bernardino County Board of Supervisors will soon call an election to vote on formation of Mountain View Storm Protection District, embracing about 100 sq. miles in vicinity of Cucamonga, Ontario, Chino, etc., for the purpose of constructing flood control works.

Irrigation—Lindsay, Cal.—Citizens voted $1,400,000 bonds for Lindsay Strathmore irrigation District. E. L. Daniels, Charles Towt and others are members of Board of Directors. Contract is to be let as soon as bonds are sold. John H. Quinton, Engr., Hollingsworth, Los Angeles.

Irrigation—Stratford, Cal.—Voters authorized the formation of the Stratford Irrigation District, embracing about 10,000 acres, on east side of Kings River. Harry McCune, W. N. Stratton and D. C. Jones, directors.

Docks, Etc.—Sarnia, Ont.—See "Railroads."

BIDS DESIRED.

Breakwater—Massachusetts.—Until June 28 by Board of Harbor and Land Commissioners, State House, Boston (William F. Williams, Chief Engineer), for constructing a stone breakwater at Gun Rock Point, requiring about 20,000 tons of stone; at Salters Point, Dartmouth, an extension to stone breakwater, requiring either about 8500 tons or 2500 tons of stone.

State Canal Work—Albany, N. Y.—Until July 18, by W. W. Wotherspoon, State Superintendent of Public Works, for constructing Terminal Contract No. 52 of the State Barge Canal, advertised in Engineering Record.

Dam—Walden, N. Y.—Until July 6, by Alexander Thomson, Jr., Consulting Engineer, 43 Second Street, Newburgh, for reconstructing small dam 300 ft. long by 10 ft. high, belonging to Walden Knife Company, Walden, advertised in Engineering Record.

Drainage—Yemassee, S. C.—Bids desired on several drainage canals involving a total of about 150,000 cu. yd. of excavating, advertised in Engineering Record. Work to be excavated with a dredge which spans ditch. Maximum bottom width 20 ft., maximum depth 6 ft and side slopes ½ to 1. Address Buckfield Stock Farms, Yemassee, S. C.

Drainage—Sanford, Fla.—Until July 3 by E. A. Douglass, Clerk County Commissioners, for excavation and construction of certain ditches, drains and canals in Florida Grove Drainage District. Total yardage 32,988 cu. yd.

Drainage—Burtville, La.—Reported desired until June 29, by Commissioners of Paul Bayou Drainage Dist., for removal of 70,000 cu. yd. earth, between Grenada Lake and Spanish Swamp.

Ditches—Rhodes, La.—Reported desired until June 30 by L. W. Rhodes, Comr. Bayou Paul Drainage Dist., for constructing 8 miles of ditches requiring 17,000 cu. yd. excav.

Dredging—Celina, Ohio.—Until July 1, by H. R. Klysinger, Engineer, Department Public Works, for dredging Indian Lake, costing about $14,000.

Protection Wall—Cincinnati, Ohio.—Until July 7, by Board County Commissioners (Albert Reinhardt, Clk.), for constructing a protection wall in Five Mill Creek, Anderson Township.

Dam—Girard, Ohio.—By David M. Wise, Chief Engineer, 233 W. Wood Street, Youngstown, for constructing a reservoir dam across Squaw Creek Valley, located in Liberty Township, Trumbull County, 1½ miles from Girard and 2½ miles from Niles; dam to be about 800 ft. long and maximum height 55 ft., constructed of stone or concrete masonry, with earth embankments or of masonry, complete with small dyke embankments.

Dam—Hillsboro, Ill.—Until June 27, by O. M. Hampton, City Clerk, for constructing a dam requiring 25,000 cu. yd. earth excav., 700 cu. yd. concrete core wall and 500 cu. yd. concrete spillway. Charles Weber, Commissioner.

Lease Power at Dam—Joliet, Ill.—Until July 17 (readvertisement) by Canal Commissioners at office of Governor at Springfield for water power lease at Dam No. 1, advertised in Engineering Record.

Retaining Wall—Milwaukee, Wis.—Until June 26, by Lighthouse Inspector, for constructing sea and retaining wall.

Drainage Ditch—Fremont, Neb.—Until July 10, by John O'Connor, County Clerk, for constructing 2 drainage ditches, estimated 51,321 cu. yd., cost 12 and 15 cts. per cu. yd., dry level land.

Canal Work—St. Ignatius, Mont.—Until July 18 by Department of Interior, U. S. Reclamation Service, St. Ignatius, Mont., for constructing canal structures on the Flathead Project involving about 2560 sq. yd. paving, laying 3570 lin. ft. concrete pipe, 70,500 lb. structural and reinforcing steel, etc. Located from 6 to 8 miles west of Ronan.

Drainage—Urich, Mo.—Until July 11, by Brooks & Jacoby, 514 Shukert Bldg., Kansas City, Mo., for constructing main ditch and laterals, including approximately 528,000 cu. yd. excav. on main ditch and 50,000 yd. on laterals, etc. H. A. Stewart, Secy., Pioneer Drainage Dist.

Levee—Yazoo City, Miss.—Until July 3 by Board of Supervisors for constructing levee on Buzzard Slough and bridge across Tan Yard Branch, including 5 year maintenance guarantee. S. S. Griffin, County Clerk.

Dredging — Tacoma, Wash. — Reported desired until July 1, by Commissioners Waterways, Dist. No. 1, 208 National Bank of Tacoma, for dredging and dike construction in Commercial Waterway No. 1. Probable cost $200,000.

Irrigation—Lindsay, Cal.—Until July 7 by C. W. Wright, Secy. Lindsay-Strathmore Irrigation Dist., for irrigation work to consist of 37 wells and well pumping plant, 3¼ miles 60-in. reinforced concrete pipe, 12 miles concrete lined ditch, 85 miles riveted steel pressure pipe, two high-head pumping plants, etc. Stephen E. Kieffer, Ch. Engr., 57 Post Street, San Francisco.

Dredging—Tiburon, Cal.—Until July 8, by Bureau Yards and Docks, Navy Dept., Washington, D. C., for dredging at the Naval Coal Station (California City Point), Tiburon, as per Spec. No. 2248.

Canal—Bryce, Ariz.—Until July 10 by R. D. Lamoreaux, Secy. Graham Consolidated Canal Co., for constructing 15 miles of canal, 14 ft. wide at bottom.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Dredging—Boston, Mass.—The following are the bids opened June 14 by Harbor & Land Commissioners, Boston, for dredging 38,000 cu. yd. material of Cuttyhunk Harbor, Mass.: J. S. Packard Dredging Co., Providence, R. I., 29.97 cts.; Bay State Dredging & Construction Co., Boston, 30.8 cts.; John R. Burke, Quincy, 33⅝ cts.

Dredging—Boston, Mass.—Following are four bids opened June 15 by Directors of the Port of Boston, for dredging Mystic River, between Chelsea and Walden Bridge: About 1,750,000 cu. yd. (a) dredging and disposing of material at sea, (b) disposing of material at East Boston, (c) total material deposited at sea: Maryland Dredging & Contracting Company, Baltimore, Md., (a) 15.95 cts., (b) 12.95 cts., (c) $279,125; Bowers Southern Dredging Company, Dallas, Tex. (a) 17.1 cts., (b) 14.1 cts., (c) $299,250; P. O'Riorden Dredging Company, Charlestown, Mass., (a) 20.7 cts., (b) 17.7 cts., (c) $362,250; Bay State Dredging & Contracting Company, Boston, (a) 21 cts., (b) 18 cts., (c) $367,500.

★**Capstones and Extension of Breakwater—Hyannisport, Mass.**—Contract for additions to capstones and extension of present breakwater at Hyannisport (bids opened June 14) awarded by Board Harbor & Land Commissioners, Boston (W. G. Williams, Chief Engineer) to Bay State Dredging Company, Boston, at $28,163. Other bidder, E. S. Belden & Sons, Hartford, Conn., $27,695.

Pier Improvement—New York, N. Y.—Following are unit figures of the four lowest bids opened June 15 by R. A. C. Smith, Commissioner of Docks and Ferries, Pier A, Battery, for repairing pier at foot of W. Fifty-fifth Street and North River, Borough Manhattan, constructing freight shed on pier and bulkhead adjacent, with appurtenances, including heating, plumbing, etc.—(a) Class 1, repairing pier and for laying concrete surface and constructing shed foundations on both the pier and the adjacent bulkhead, (b) Class 2, building a freight shed with appurtenances (except heating and plumbing) on W. Fifty-fifth Street and the adjacent bulkhead, (c) Class III, laying an asphalt pavement over the concrete deck of the pier and over the concrete layer on the bulkhead 4865 sq. yd., (d) total for I, II and III, (e) installing a heating system within the freight shed, (f) installing plumbing within the freight shed: Snare & Triest Co., 233 Broadway, (a) $48,000, (b) $284,400, (c) $1.10, (d) $337,751; Ernest A. Weiss, Times Building, (a) $43,000, (b) $293,500, (c) $1, (d) $341,365; Post & McCord, 101 Park Avenue, (a) $48,000, (b) $289,000, (c) $1.21, (d) $342,887; McHarg-Barton Co., 171 Madison Avenue, (a) $60,000, (b) $290,000, (c) $1.20, (d) $356,728; William J. Olvany, 177 Christopher Street, (e) $9,314; Wells-Newton Co. of New York, Avenue B and Seventeenth Street, (e) $9,868; Thomas E. O'Brien, Inc., 6311 Fifth Avenue, Brooklyn, (f) $6,843; Christopher Nally, 710 Columbus Avenue, (f) $7,250; John F. Koop, 1469 Amsterdam Avenue, (f) $7,280; J. S. Murphy, 353 E. Seventy-eighth Street, (f) $7,395.

Irrigation—Provo, Utah.—Following are unit figures of two bids opened June 15 by U. S. Reclamation Service, Provo, for constructing Division 10 of the high line canal, Strawberry Valley Project, Utah: (a) Reynolds Ely Construction Co., Springville, Utah, Schedule I $41,642, Schedule II $44,210, Schedule III $44,660, grand total three schedules $130,517; (b) H. G. Gilkerson, 524 Newhouse Building, Schedule I $48,215, Schedule II $55,626, grand totals two schedules $103,814.

Schedule I—Laterals 31, 32-B, 32-C, 32-D, 32-E, 32-F and 32-G.

Items		(a)	(b)
1	11,000 cu. yd. excavation, Class 1	$0.17	$0.50
2	2,800 cu. yd. excavation, Class 2	0.28	0.50
3	1,200 cu. yd. excavation, Class 3	1.25	2.00
4	100 yd. stas. overhaul	0.02	0.02
5	1,000 cu. yd. rolled embankment	0.10	0.15
6	1,200 cu. yd. excavation for str., Class 1	0.50	1.00
7	100 cu. yd. excavation for str., Class 2	0.70	1.00
8	50 cu. yd. excavation for str., Class 3	1.50	2.00
9	500 cu. yd. concrete in str	18.00	18.00
10	30,000 lb. placing reinf. steel	0.015	0.02
11	1,200 cu. yd. backfill	0.50	0.50
12	10 cu. yd. rockfill	1.00	2.50
13	10 sq. yd. paving	1.50	3.50
14	25 lin. ft. laying 12-in. vitr. pipe	0.35	0.35
15	500 lin. ft. laying 18-in. vitr. pipe	0.60	0.50
16	500 lin. ft. laying 24-in. vitr. pipe	1.00	0.75
17	40 lin. ft. laying 14-in. steel pipe	0.25	0.35
18	20 M ft. lumber in place	20.00	50.00
19	1,200 lin. ft. 1-ft. 11-in. metal flume in place	0.15	0.20
20	860 lin. ft. 3-ft. 2¼-in. metal flume in place	0.20	0.25
21	250,000 sq. ft. concrete canal lining	0.10	0.10

Schedule 2—Lateral 34 (Stas. 29 to 207) and Laterals 34-B, 34-C, 34-D, 34-E and 34-F.

Items		(a)	(b)
22	30,000 cu. yd. excavation, Class 1	$0.18	$0.50
23	4,700 cu. yd. excavation, Class 2	0.30	0.50
24	1,300 cu. yd. excavation, Class 3	1.25	1.50
25	250 yd. stas. overhaul	0.02	0.02
26	7,000 cu. yd. rolled embankment	0.10	0.15
27	1,000 cu. yd. excavation for str., Class 1	0.50	0.70
28	100 cu. yd. excavation for str., Class 2	0.70	0.70
29	50 cu. yd. excavation for str., Class 3	1.50	2.00
30	400 cu. yd. concrete in structures	18.00	18.00
31	25,000 lb. reinforcing steel	0.015	0.02
32	1,000 cu. yd. backfill	0.50	0.40
33	10 cu. yd. rockfill	1.00	1.50
34	10 sq. yd. paving	1.50	2.00
35	100 lin. ft. laying 12-in. vitr. pipe	0.35	0.25
36	1,200 lin. ft. laying 18-in. vitr. pipe	0.60	0.35
37	200 lin. ft. laying 24-in. vitr. pipe	1.00	0.60
38	140 lin. ft. laying 14-in. steel pipe	0.25	0.25
39	10 M ft. lumber in place	20.00	45.00
40	540 lin. ft. 5-ft. 8¾-in. metal flume	0.25	0.40
41	250,000 sq. ft. concrete canal lining	0.10	0.10

Schedule 3—Lateral 34 (Stas. 207 to 614).

Items		(a)
42	11,000 cu. yd. excavation, Class 1	$0.18
43	6,500 cu. yd. excavation, Class 2	0.30
44	1,000 cu. yd. excavation, Class 3	1.25
45	150 yd. stas. overhaul	0.02
46	3,000 cu. yd. rolled embankment	0.10
47	800 cu. yd. excavation for str., Class 1	0.50
48	100 cu. yd. excavation for str., Class 2	0.70
49	100 cu. yd. excavation for str., Class 3	1.50
50	600 cu. yd. concrete in structures	18.00
51	25,000 lb. placing reinf. steel	0.015
52	800 cu. yd. backfill	0.50
53	10 cu. yd. rockfill	1.00
54	10 sq. yd. paving	1.50
55	25 lin. ft. laying 12-in. vitr. pipe	0.35
56	300 lin. ft. laying 18-in. vitr. pipe	0.60
57	25 lin. ft. laying 24-in. vitr. pipe	1.00
58	40 lin. ft. laying 14-in. steel pipe	0.25
59	120 M. ft. lumber in place	20.00
60	240 lin. ft. 3-ft. 2¼-in. metal flume	0.20
61	9,140 lin. ft. 4-in. 5¼-in. metal flume	0.25
62	200,000 sq. ft. concrete canal lining	0.11

Items 18, 39 and 59 refer to erection of lumber only. Items 19, 20, 40, 60 and 61 refer to erection of flume only.

★**Dredging—Baltimore, Md.**—Contract for dredging in Patapsco River, about 300,000 cu. yd., awarded Maryland Dredging & Contracting Company, Baltimore, at 8.75 cts. per cu. yd.; other bidders: Coastwise Dredging Company, Norfolk, Va., 11.9 cts. per cu yd., and Sanford & Brooks Company, Baltimore, 15 cts. Bids opened June 15 by U. S. Engineer, Custom House, Baltimore.

★**Drainage—Monroe, Ga.**—Contract for drainage of Alcovy River awarded by Bd. Drainage Comrs. (bids opened June 6), to Karr & Moore of Salisbury, N. C. Work includes construction of 6½ miles dredge ditches. Beaver Dam lateral about 5 miles long and Bay Creek lateral 5 miles.

Pier—Mobile, Ala.—Southern Ry. (B. Herman, Ch. Engr., M. W., Washington, D. C.) has appropriated $40,000 for improving pier No. 4 on river front at Beauregard Street.

★**Leeves—New Orleans, La.**—Contracts awarded by Orleans Levee Bd. for constructing levee in Third Dist. to Hampton Reynolds, Metoric Ridge and Seventeenth Street Canal, for 700,000 cu. yd. of earth for Sects. 1 and 2, at 8.72 cts. and 9.72 cts. per cu. yd., and to A. M. Shaw, 2604 Calhoun Street, for 140,000 cu. yd. earth in Sect. 3, at 8 cts. per cu. yd.

★**Levee Work—Greenville, Miss.**—Contract for 500,000 cu. yd. levee work (bids opened June 12) awarded as follows: To Burt Bond & McMurray, Beulah, Miss., $20,458; John G. Sessions, Memphis, Tenn., $24,802; Roach & Stansell, Memphis, Tenn.; $42,480, and S. R. Hughes Construction Co., Vicksburg, Miss., $11,600. W. L. Thompson, Chief Engineer Board Mississippi Levee Commissioners.

★**Breakwater — Indian Harbor, Ind.**—Contract for constructing rubblemound breakwater awarded Great Lakes Dredge & Dock Company, Chicago, Ill., at $110,000. Bids opened June 2 by U. S. Engineers, Chicago, Ill.

★**Drainage—Caledonia, Minn.**—Contract for constructing Judicial Ditch No. 1, Houston County, awarded R. H. & G. A. McWilliams, Chicago, Ill. Work includes excavation of one main ditch 20 miles long, 50 to 72-ft. bottom average, depth 11 ft.; total cost, $128,000; work to be done with large floating dredge. George A. Ralph, Engineer, St. Paul.

★**Irrigation — Polson, Mont.**—Contract for earthwork and structures on the Pablo Division of the Flathead Irrigation Project, Mont., awarded by U. S. Reclamation Service as follows: Schedule I, earthwork, to Percy M. Rose, Polson, at $18,040; Schedule II, structures, Clarence B. Long, Polson, $14,948, and Schedule III, Mendenall Bird & Company, Springville, Utah, at $29,800. The work involves about 220,000 cu. yd. of excavation, 870 cu. yd. reinforced concrete, 3250 sq. ft. pavement, 7650 sq. ft. canal lining, manufacturing and laying 6230 ft. concrete pipe, 210 cu. yd. dry rubble wall, and placing of 4 M ft. lumber and 110,000 lb. structural and reinforcing steel.

★**Irrigation—Ft. Laramie, Wyo.**—Contract awarded by U. S. Reclamation Service to MacArthur Bros. Co., 11 Pine Street, New York, N. Y., for constructing tunnels, 1 and 2, Ft. Laramie, North Platte Project, at $242,032, approximately 4,850 lin. ft. tunnel excav., and 12,000 cu. yds. concrete.

★**Irrigation—Ft. Laramie, Wyo.**—Contracts awarded by U. S. Reclamation Service, Ft. Laramie, as follows, for earthwork: Stations 830 to 1280, Ft. Laramie Canal, Ft. Laramie, Unit, North Platte Project, Nebraska - Wyoming: Schedule I, MacArthur Brothers Company, New York, $38,225; Schedule II, Winston Brothers Company, Minneapolis, Minn. $29,180, and Schedules III and IV, to J. M. Hilton, Billings, Mont., at $54,320. Work involves a total approximately 8½ miles of main canal Ft. Laramie, Unit, involving about 800,000 cu. yd. of material.

★**Ditch—North Yakima, Wash.**—Contract awarded by County Commissioners to Hans Pederson, Alaska Building, Seattle, for constructing 1⅛ miles of open ditch in Sub-District No. 5 and Drainage Improvement District No. 3 at $10,430.

★**Fill—Seattle, Wash.**—Contract awarded by County Commissioners to P. Manson, 2407 Boylston Avenue, North, for constructing a hydraulic fill between Portage and Ellisport, at $30,975. Other bidders: Puget Sound Bridge & Dredging Co., Seattle, $34,794; J. A. McEachern Co., Seattle, $35,800, and M. C. Lindorf, Seattle, $36,500.

★**Shed—Seattle, Wash.** — Contract awarded by Port Commission to Puget Sound Bridge & Dredging Company, Central Building, for constructing extension to Salmon Bay Transit Shed at $11,345 for substructure; $6,370 for excavating and $10,800 for riprap; total, $28,515. J. R. West, Chief Engineer Commissioners.

★**Irrigation—Wenatchee, Wash.**—Contract for furnishing 400,000 ft. of staves for Wenatchee Reclamation District awarded Pacific Creosoting Company, Seattle, at $5,100 per M.

Irrigation—Herminston, Ore.—Following is detail of the lowest bid, Newport Land & Construction Company, Herminston, opened June 15 by U. S. Reclamation Service, Herminston, for enlargement of feed canal Umatilla Project, Ore.: Excavation Class 1, 163,000 cu. yd., 15.75 cts.; Class 2, 5100 cu. yd., 49 cts.; Class 3, 500 cu. yd., 95 cts., and concrete, 370 cu. yd., $9.75; total, $32,254. Total of other bids: George P. Wright, 602 Providence Building, Tacoma, Wash., $38,512, and H. D. Willis, 1410 Harrison Building, Boise, Idaho, $42,810. Engineer's estimate $37,100.

★**Weir — Sacramento, Cal.** — Contract awarded June 12 by City Commission for constructing the weir to Teichert & Ambrose, Sacramento, at $336,640 (bids opened May 23), unit figures in June 10 issue. Frank Miller, City Engineer.

ELECTRIC RAILWAYS

PROPOSED WORK.

New York, N. Y.—Public Service Commission of First District, 120 Broadway, has submitted to Board Estimate and Apportionment requisition for an appropriation of $25,000 to provide for construction of a duct line on Queens Boulevard Viaduct in Queens Borough along line of new Corona Rapid Transit R. R.

Baltimore, Md.—Plans being prepared by United Railways & Electric Co. for constructing a substation on Belvedere Avenue, two or three 1500-kw. rotary converters with necessary transformers, switchboards and auxiliary apparatus to be installed.

Russellville, Ky.—The Tennessee & Kentucky Interurban R. R. Co. received franchise from City Council to construct a line into Russellville. The company plans to construct a line from Nashville to Russellville. Paul D. Denton of Nashville, Secy.

Pontiac, Mich.—Detroit Construction Company, Detroit, Mich. (P. M. Lau, Engineer) engaged to prepare plans and construct an electric railway here, to be built under the franchise voted William H. Osmun.

Columbus, Kan.—City has offered Oklahoma, Kansas & Missouri Interurban Company $10,000 bonus to build line through Columbus to Pittsburgh.

Baker, Mont.—Beaver Valley Electric Ry. Co. plans to construct an electric railway from Baker to Ekalaka via Webster, 50 miles.

Marlin, Tex.—Surveys being made for construction of Temple & Marlin Interurban Ry. from Marlin to Temple. S. D. urban Promotion Co., interested.

Martinez, Cal.—Reported Trustees have granted Martinez Concord Interurban R. R. franchise to construct first unit of main line linking two cities; cost of this unit $25,000.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Brooklyn, N. Y.**—Contract awarded by N. Y. Municipal Ry. Corporation to P. J. Carlin Construction Co., 1123 Broadway, New York, for constructing 12 stations on Jamaica Avenue extension of Broadway Elevated in Borough Brooklyn, at $280,700, approved by Public Service Commission.

RAILROADS

PROPOSED WORK.

Newark, N. J. — Permission has been granted New York Bay and Pennsylvania Railroad companies to lay six tracks at grade across Avenue R in Newark.

Trenton, N. J. — Samuel T. Wagner, Chief Engineer Philadelphia & Reading R. R., writes that no definite plans have been made for grade crossings in this city.

Marysville, Pa.—Reported a section of the Newport & Sherman Valley R.R. (David Gring, Pres., Newport, Pa.) is to be made into a standard gage.

Sparta, N. C.—Citizens June 10 voted $60,000 additional bonds for Elkins and Allegheny Ry. improvements. C. B. Penny, Engineer, Ellrain, N. C. S. F. Thompson, Clerk Superior Court.

Cleveland, Ohio.—Committee of City Council is reported considering an ordinance directing New York Central R. R. Co. (G. W. Kittredge, Ch. Engr., New York City) to abolish all grade crossings from Cuyahoga River to East 105th Street; total cost to both city and railroad about $2,600,000.

Troy, Ohio.—Construction of a tunnel under tracks of Cincinnati, Hamilton & Dayton R. R. (F. L. Stuart, Ch. Engr., Baltimore, Md.) on East Canal Street contemplated.

Omaha, Neb.—City and the Missouri Pacific R. R. Co. (E. A. Hadley, Ch. Engr., St. Louis, Mo.), are reporte [illegible] sidering the eliminating of grade [illegible] ings.

Cincinnati, Ohio.—Following are the unit figures of the four lowest bids opened recently by Pennsylvania Railroad for track elevation in grade crossing elimination from Delta to Stanley Avenue: (a) Engineer's estimate, $133,593; (b) Bates & Rogers Construction Co., Chicago, Ill., $105,554; (c) Henkel & Sullivan, 710 Mercantile Library Building, $106,673; (d) D. P. Foley, Park Avenue, $108,468; (e) Walsh Construction Co., Davenport, Iowa, $110,004.

	(a)	(b)	(c)	(d)	(e)
250,000 cu. yd. excav.	$1.20	$0.45	$0.60	$0.525	$0.65
6,175 cu. yd. concrete masonry	6.00	5.05	5.00	4.95	4.95
5,550 lin. ft. concrete piles	1.50	1.30	1.20	1.25	1.40
1,784 lin. ft. concrete fence	3.60	2.60	3.80	3.50	3.60
250,000 lb. steel rods	0.05	0.055	0.05	0.05	0.04
10 long tons rails in concrete	1.00	7.00	2.00	2.00	40.00
3,110 sq. yd. tar paint waterproofing	0.30	0.20	0.11	0.20	0.30
310 sq. yd. Barrett's waterproofing	1.00	1.85	1.00	3.00	0.80
650 lin. ft. 6-in. drain	0.30	0.25	0.50	0.80	0.12
20 T branches, 6 x 4 in.	0.60	1.00	0.20	0.80	0.70
230 lin. ft. pipe railing	1.00	1.50	1.25	1.50	1.50
1,975 cu. yd. concrete, Class 2	4.00	3.35	3.50	3.50	3.50
825 lin. ft. protected concrete curb	1.00	1.00	0.60	0.80	0.70
2,630 lin. ft. granite curb	1.00	1.20	1.10	1.00	1.15
1,600 lin. ft. granite curb reset	0.50	0.25	0.20	0.40	0.30
6,350 sq. yd. granite paving, No. 1, cement filler	3.00	3.00	2.90	3.40	2.85
3,250 sq. yd. granite paving, old block redressed	1.50	1.75	1.60	1.75	1.60
110 sq. yd. granite paving, cement filler	1.00	1.05	1.00	1.00	0.90
2,950 sq. yd. brick paving, cement filler	1.50	1.70	1.40	1.42	1.50
500 sq. yd. macadam paving, bituminous	1.75	1.50	1.00	1.35	1.70
3,535 sq. yd. cement sidewalks	1.25	1.10	1.00	0.80	0.99
500 lin. ft. drains, 12-in. pipe	1.00	0.60	1.25	0.85	0.80
7 manholes	50.00	40.00	50.00	45.00	50.00
8 manholes readjusted	25.00	20.00	5.00	5.00	25.00
5 inlets, gutter type, A and B	35.00	40.00	30.00	35.00	40.00
6 inlets, No. 1	50.00	35.00	35.00	30.00	50.00
6 inlets, No. 3	50.00	40.00	40.00	30.00	50.00
550 lin. ft. lowering water pipes	1.00	1.50	0.40	0.50	1.00
500 sq. yd. sodding	1.00	0.40	0.20	0.25	0.90

New Rockford, N. D.—Reported Great Northern R. R. (A. H. Hogeland, Ch. Engineer, St. Paul, Minn.) is considering constructing a line from New Rockford to Lewiston late this year.

St. Joseph, Mo.—State Public Service Commission ordered abolition of dangerous grade crossings in St. Joseph, in vicinity of Union Station, and the construction of a subway, estimated cost about $5,000,000.

Dallas, Tex.—The Texas & Pacific R. R. Co. (C. H. Chamberlain, Ch. Engr., Dallas) having plans prepared for grade crossings in Dallas; cost, about $1,000,000.

The construction of 8 miles of steam railway from Denton to Krum, is reported under consideration. Address Chamber of Commerce.

Nowata, Okla.—Surveys being made by Missouri Pacific R. R. Co. (E. A. Hadley, Ch. Engr., St. Louis, Mo) for constructing line from Nowata through Bartlesville to western part of Osage County.

Los Angeles, Cal.—San Pedro, Los Angeles & Salt Lake Railway, 1916 improvement budget, recently prepared by General Manager H. C. Nutt, includes $547,000 for new rails, $260,000 for bridges and $511,000 for miscellaneous improvements. A. Maguire, Ch. Engr., Los Angeles.

Phoenix, Ariz.—Tucson, Cornelia & Gila Bend R.R. Co. (M. Curley, Gen. Supt., Gila Bend, Ariz.) plans spending $100,000 for improvements. J. B. Rawlings, Purchasing Agent, Warren.

Sarnia, Ont.—The Michigan Central R. R. (G. H. Webb, Ch. Engr., Detroit, Mich.) is reported considering making Sarnia the terminal of the St. Clair branch, and building docks and wharves at north end of upper bay.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Bearden, Ark.**—Contract awarded P. C. Cottrell, Bearden, to build three-mile extension for Bearden & Ouachita River Railroad, including 12 timber bridges.

PUBLIC BUILDINGS AND SCHOOLS

PROPOSED WORK.

Boston, Mass.—State Board of Insanity preparing to ask bids for erecting buildings at various State institutions, including two buildings at Danvers, two at Foxboro, one each at Boston, Wrentham, Waverly and Gardner.

Binghamton, N. Y.—A bond issue of $116,000 for repairs to three of the city schools has been approved. Address Board of Education.

Rome, N. Y.—A. L. Brockway, Bank Building, Syracuse, engaged as architect for the school to be erected on South James Street.

Bayonne, N. J.—Plans being prepared by S. E. Gage and D. G. Anderson, 28 East Forty-ninth Street, for three-story brick school to be erected in Fifth Ward; cost about $146,000. D. Boyd, Secretary Board of Education.

Cape May, N. J.—An addition is to be erected to high school at cost of $33,000. Address Secy. of School Board.

Freehold, N. J.—Court house bonds for $55,000 have been sold. Address Clerk Board Freeholders.

[illegible]onfield, N. J.—Erection of a li[illegible] costing $[illegible],000, contemplated.

New Brunswick, N. J.—See "Prices and Lettings."

West Hoboken, N. J.—Cost of erecting town hall estimated at about $175,000. Address Town Clerk.

Ebensburg, Pa.—Erection of a brick school costing $65,000 is under consideration. W. S. Powell, Architect, Title Trust Building, Johnstown, Pa. Address Secretary School Board.

Haverford, Pa.—Plans being prepared by Baily & Bassett, 421 Chestnut Street, Philadelphia, for a science hall for Haverford College, to be three stories and basement, 70 x 110 ft., stone and fireproof construction, with slate roof.

New Castle, Pa.—Plans prepared by C. C. and A. L. Thayer of New Castle for addition to courthouse. Address County Clerk.

Charleston, W. Va.—Citizens at election June 12 voted $125,000 bonds for erecting school. Bonds will be sold in July. W. O. Daum, Secretary School Board.

Atlanta, Ga.—Plans completed by J. C. Battle and A. Barili, Grant Building, for two-story and basement granite and tile school to be erected in Peachtree Heights Park, at Battle Avenue and Rivers Road.

Jacksboro, Tenn.—School bonds for $100,000 will be sold June 30 by William Allen, County Judge.

Bratenahl (P. O. Cleveland), Ohio.—Citizens, June 14, defeated bond issue for $35,000 for erecting town hall.

Delaware, Ohio.—Henry Hornbostel, 63 William Street, New York, N. Y., selcted to prepare plans for a group of buildings for the Ohio Wesleyan University.

Fredericktown, Ohio.—School bonds for $39,000 will be sold July 12 by Board Education (Ernest V. Ackerman, Clerk).

New Straitsville, Ohio—Matheny, Allen & Mounts, Harrison Building, Columbus, are architects for proposed school to cost about $55,000.

West Park, Ohio.—School bonds for $65,000 will be sold July 17 by W. J. Featherstone, Clk. Board Education.

Youngstown, Ohio.—Steps being taken to erect Carnegie Library on the South Side; cost about $90,000.

Greencastle, Ind.—DePauw University has received $100,000 with which to erect a woman's dormitory and $50,000 toward an administration building.

Normal, Ill.—Improvements at State Normal School contemplated as follows: Men's gymnasium, cost $60,000; science hall, cost $125,000; south wing to women's residence hall, $60,000. David Felmley, Pres.

Princeton, Ill.—Reported election will be held in fall on erecting a county court house. Address County Supervisors.

Urbana, Ill.—An eight-story clinical building is to be erected as the first unit of a group of buildings proposed for University of Illinois.

Berlin, Wis.—The high school is to be brick and concrete, fireproof, and cost $100,000. Parkinson & Dockendorff, La Crosse, Archts. E. K. Cunningham, Clerk of Board of Education.

Milwaukee, Wis.—Courthouse Committee authorized by County Board to secure plans for new courthouse to be erected on Kneeland site.

Clarinda, Iowa.—Citizens voted $60,000 bonds to erect a new junior high school. Bonds will be sold June 26 by Earl Peiros, Secretary School Board.

Osage, Iowa.—It is proposed to erect a 2-story school costing $6[illegible]00. A. E. Knoulton, Secretary School Board. J. F. Leitha, Archt., Waverly.

Sidney, Iowa.—Contract will be let about July 1 by Board of Education for erecting a two-story and basement, 56 x 78 ft. brick school to cost $30,000.

Bemidji, Minn.—State Board of Control at St. Paul considering plans for Normal School to be erected here for which Legislature appropriated $2[illegible]00 for preliminary work.

St. Paul, Minn.—All bids opened recently for erecting William Lindeke School on Como Heights rejected and the work will be done by force account by the Commissioner of Parks, Playgrounds and Public Buildings.

Arkansas City, Kan.—Citizens voted $60,000 bonds for erecting city hall and auditorium.

Harper, Kan.—Plans prepared by S. S. Voigt, Fourth National Bank Building, Wichita, for high school to cost $40,000.

Ottawa, Kan.—George P. Washburn & Son, Ottawa, are architects for the high and grade school. H. W. Chaffee, Clerk Board Education.

Omaha, Neb.—John Latenser & Son, Bee Building, engaged to prepare plans for proposed High School of Commerce to be erected at Twenty-second and Chicago Streets.

Plans being prepared for a $120,000 grade school two stories, 174 ft. square. Address Clerk School Board. Erection of six or seven other schools reported under consideration.

Lincoln, Neb.—Contract soon to be let by Board of Regents of State University for erecting an agricultural engineering building at State Farm.

Minot, N. D.—Citizens voted $30,000 bonds to erect high school. Address School Board.

Huntsville, Mo.—Citizens of Randolph County voted $30,000 bonds for erecting a County Infirmary.

Austin, Tex.—Board Regents of the State University considering extensive building improvements and additions from plans of Cass Gilbert, 11 East Twenty-fourth Street, New York, costing from $150,000 to $200,000.

Dallas, Tex.—Executive Committee of the Board of Trustees has authorized erection of a woman's dormitory at Southern Methodist University, costing $200,000. Dr. R. S. Hyer, president.

Gainesville, Tex.—City Council passed ordinance to erect a school in Fifth Ward costing about $30,000. Address Clerk Board of Education.

Sherman, Tex.—Plans completed for another fireproof building at Austin College costing $100,000.

Oklahoma, Okla.—All bids opened June 1 by James L. Wetmore Supervising Architect, Washington, D. C., for constructing U. S. Post Office rejected as being in excess of the appropriaton.

Seattle, Wash.—Contract about to be let for constructing a concrete comfort station under Public Library at Madison Street and Fourth Avenue at cost of $27,000. W. Marbury Somervell, White Bldg., Archt. C. B. Bagley, Secy. Bd. Public Works.

La Canada, Cal.—School bonds for $25,000 sold. Address Clerk Board.

Palma, Cal.—School bonds amounting to $55,000 sold. Address School Board.

Phoenix, Ariz.—Erection of a city hall and court house being considered. Robert A. Craig, City Manager; Frank Luke, Chairman Maricopa County Board of Supervisors, Phoenix.

Nampa, Idaho.—Reported School Board has rejected all bids opened for proposed high school. New bids will soon be asked on revised plans.

Galt, Ont.—Contract will be let about June 28 to July 12 by city for erecting a 2-story brick and stone school costing with equipment $40,000. John Evans, Architect, N. Water Street, Galt. W. S. McKay, 57 Main Street, Galt, may be able to give information.

Winnipeg, Man.—A five-room school is to be erected on McPhillips Street at cost of $27,500. Address Clerk School Board.

Contracts will soon be let by Provincial Department of Public Works for completing Parliament buildings at cost of $3,000,000.

BIDS DESIRED.

Brandon, Vt.—Reported desired until July 1, by Trustees School Dist., for erecting two-story and basement 115 x 70 ft. school. Probable cost $40,000. Elmer Smith Bailey, Archt., 33 Cornhill Street, Boston, Mass.

Boston, Mass.—Until June 28, by Richard H. Lynch, Supt. Public Buildings, for erecting municipal building at Ashland corner of Washington Street, Roslindale, Boston.

Newburyport, Mass.—Until Aug. 1, by James A. Wetmore, Acting Supervising Architect, Washington, D. C., for construction of the U. S. Post Office.

Springfield, Mass.—Until June 29, by Committee on City Property (Giles Blague, Chmn.), for alterations and addition to Worthington Street school. Separate bids for heating, ventilating, plumbing, etc. Pellissier & Dibble, Engrs. and Archts., Springfield.

Pittsford, N. Y.—Until July 5, by Board of Education of Union Free School District No. 6, for erecting a school advertised in Engineering Record. Gordon & Madden, Archts., 300 Sibley Block, Rochester.

Belleville, N. J.—Until June 30 by Board Education for furnishing material and erecting School No. 4 on Magnolia Street, Silver Lake. Separate bids for heating, plumbing, etc. John Noble Pierson, Archts., 130 Smith Street, Perth Amboy.

Cedar Grove, N. J.—Until June 29 by Board Education for furnishing material and erecting school. Separate bids for heating, plumbing, etc. John Noble Pierson & Son, Archts., 130 Smith St., Perth Amboy.

New Brunswick, N. J.—Until June 30 (readvertisement), by Board of Freeholders, for erecting county jail and also for 40 cells instead of 80. William H. Boylan, Architect, New Brunswick.

Monarch, Pa.—Until July 1, by Andrew P. Cooper, Archt., 704 First National Bank Bldg., Unionport, for erecting a brick school. F. C. Smith, Secy. School Board, School Dist. Dunbar Township.

Quincy, Pa.—George B. Beatty, Secretary School Board, for erecting a high and grade school. J. W. Woltz, Architect, Waynesboro.

Yardley, Pa.—Until June 29, by Board Education, for erecting a one-story brick, 110 x 148 ft., school. Heacock & Hokanson, Archts.

Charlotte, N. C.—Reported desired until July 3 by County Board Education for erecting 14-room school and auditorium. Hunter & Gordon, Archts., Charlotte.

New Orleans, La.—Until Aug. 2, by James A. Wetmore, Acting Supervising Architect, Washington, D. C., for remodeling U. S. Custom House, also separate bids for constructing complete (including equipment) of the 3 interior safety vaults of reinforced concrete in U. S. Custom House.

Cincinnati, Ohio.—Until June 30, by Director Public Service (Parke S. Johnson, Secy.), for erecting a public comfort station.

Until July 27, by New Court House Building Commission (James A. Green, President), for furnishing material and installing interior marble and stone work in the new county jail and court house (now being erected). Rankin, Kellogg & Crane, Archts., 1012 Walnut Street, Philadelphia, Pa. P. W. Durr, County Clerk.

Jefferson, Ohio.—Until June 27 by Board of Education for erecting addition and enlarging grade school to cost $41,000 with equipment. F. L. Packard, Architect, Hayden Building, Columbus.

Lockbourne, Ohio.—Until July 14, by Board Education (W. F. Hunter, Pres.), for erecting a school. Frank L. Packard, Archt., Columbus.

Martins Ferry, Ohio.—Reported desired until July 13 by City Clerk for erecting a city building; probable cost $46,000.

Massillon, Ohio.—Until July 14 by Board Administration (C. C. Philbrick, Pres.) for furnishing material and erecting Cottage No. 4 at Massillon State Hospital. Richards, McCarty & Bulford, Hartman Building, Columbus, Archts.

Perrysburg, Ohio.—Until July 14, by C. H. Van Norman, Clerk Board Education, for erecting a two-story fireproof school, costing $41,000.

Van Buren, Ohio.—Until July 14, by George W. Connell, Clerk Board Education, Allen Township, Van Buren, for erecting a centralized school. McLaughlin & Hulsken, Architects, Lima.

Hubbard, Iowa.—Reported desired until July 10 by R. R. Swallum, Secy. School Board, for erecting school. Probable cost $42,000.

Manchester, Iowa.—Until June 28, by Independent School District, for erecting two tile and brick schools. M. J. Yoran, Secy. Board. R. R. Mayberry, Archt., Cedar Rapids, Iowa.

Waterloo, Iowa.—Reported desired until July 1, by J. E. Dempster, Secy. Board Education, for erecting three-story reinforced concrete, 48 x 100 ft. school. Probable cost $40,000. J. G. Ralston, Archt., Waterloo.

West Side, Iowa.—Reported desired until July 1 by J. E. Dempster, Secy. School Board, for erecting school. Probable cost, $40,000. J. G. Ralston, Archt., Syndicate Building, Waterloo.

Havelock, Neb.—Reported desired until June 30 by F. B. Young, Secy. Board Education, for erecting a 2-story high school. W. G. Gernandt, Archt. Keeline Building, Omaha.

Boulder, Mont.—Reported desired until July 1, by A. M. Alderson, State Board Examiners, for erecting a dormitory at State School for Deaf, Blind and Backward Children at Boulder. Geo. H. Carsley, Archt., Power Block, Helena.

Flat River, Mo.—Until June 27 by Board Education (C. E. Norwine, Secy.) for erecting a two-story brick school with auditorium.

Kansas City, Mo.—Until July 6, by Bd. Directors School Dist. for furnishing material and erecting addition to library at Ninth and Locust Streets. Charles A. Smith, Archt., 602 Finance Bldg., Kansas City, Mo.

Port Angeles, Wash.—Reported desired until June 29, by Madge H. Nailor, Clk. School Dist., for erecting a school. Harold H. Ginnold, Archt., Northern Bank Bldg., Seattle.

Seattle, Wash.—Until July 30 by C. B. Bagley, Secy. Board of Public Works, for erecting a concrete comfort station at Fourth Avenue and Madison Street to cost $27,000. Daniel Huntington, City Architect.

Nampa, Idaho.—Reported desired until June 29, by Board of Education, for erecting high school. Probable cost $50,000.

Pembroke, Ont.—Until June 30, by W. C. Keighley, Box 508, Pembroke, for erecting a fireproof school to cost $45,000.

Sudbury, Ont.—Until June 30 by Board Education for erecting a school on College Street. Victor L. Morgan, Architect, Wilson Greenwood Block, Cedar Street.

Toronto, Ont.—Until June 28, by Chairman Toronto Electric Commissioners, for extension to Front Street sub-station.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Portland Me.—Only bid opened June 7 by Supervising Architect, Washington, D. C. for constructing a steerage barracks and storehouse at U. S. Quarantine Station, Portland, submitted by James Miller & Son Co., Worcester, Mass., at $67,870.

★**Thompsonville, Conn.**—H. Wales Lines Co., Meriden, has secured contract to erect school for which $27,500 has been voted.

★**Buffalo, N. Y.**—Contract awarded Morris & Allen, Builders Exchange, for erecting two-story and basement, 114 x 50 ft. brick and stone recreation building for Deaf Mute Institute, Main Street and Dewey Avenue.

★**Ilion, N. Y.**—Jerry Gleason, Ilion, has general contract at $34,296, and Cornelius Dwyer the heating at $6,464, for the addition to the North Side School. Fuller & Robinson Company, Architects, Albany; H. M. Schwartz, Superintendent Schools.

★**Jersey City, N. J.**—Contract for erecting School No. 16 awarded W. H. & F. W. Cane, Woolworth Bldg., New York, at $133,300.

New Brunswick, N. J.—Lowest bids opened June 12 by County Building Committee for erecting the county jail and cells submitted by Frank J. Flegenhauer Company, Brooklyn, at $90,312, and for cells by Pauly Jail Building Company, St. Louis, Mo., at $56,394. Bids were rejected and new bids asked. See "Bids Desired."

★**Penns Grove, N. J.**—Following are four bids opened June 15 for erecting a school at Riverview: McCloskey & Bahla, Hale Building, Philadelphia, $30,998 (awarded contract); Henry L. Brown, 1719 Sansom Street, Philadelphia, $31,833; G. W. Shaner & Sons, Palmyra, N. J., $32,633, and Frank Turner, 828 Broadway, New York, $34,150. Moffett & Stewart, Inc., Archts, 30 N. Third Street, Camden, N. J.

★**Arden, Pa.**—Contracts for erecting addition to County Home at Arden, to be used as a hospital for the insane, awarded as follows by County Commissioners at Washington (bids opened June 15): General construction, J. U. Bumgarner, Washington, $31,276; plumbing, Buekle Plumbing Company, Pittsburgh, $3,650; heating, W. M. Foley, Pittsburgh, $2,736; electric work. W. H. Ochiltree Company, Pittsburgh, $1,250.

★**Lititz, Pa.** — Contract for erecting school awarded Andrew Breslin of Summitt Hill, at $68,292.

★**Lilly, Pa.** — Contract for erecting school awarded Edmund Overdorff of Morrellville, at $26,480.

★**New Castle, Pa.**—Contract for rebuilding Highland School, destroyed by fire, awarded as follows: General contract, A. J. Wishart & Sons of Sharon, $41,484; plumbing, Ernest M. Withers Company, New Castle, $5,600; heating, Barnes & Clark, New Castle, $2,095; wiring, G. A. Webster Company, Youngstown, $1,850.

Philadelphia, Pa.—Lowest bid recently opened for erecting school at Fourth and Porter Streets submitted by Melody & Keating, Bailey Building, at $189,599.

William R. Dougherty, 1008 Sansom Street, submitted lowest bid for erecting school at Fifty-eighth and Media Streets, at $61,527.

★**Abingdon, Va.** — Contract awarded John P. Pettyjohn & Company of Lynchburg for erecting the dormitory at the Stonewall Jackson Institute, at $35,000.

★**Clarksdale, Miss.**—Contract for erecting city hall (bids opened June 13) awarded R. H. Byrd & Company, Birmingham, Ala., at $31,521, including plumbing and wiring. A. C. Tuttle, City Clerk.

Maryville, Tenn.—Following are three lowest bids opened June 8 by Supervising Architect, Washington, D. C., for constructing U. S. Post Office, Algernon Blair, Montgomery, Ala., limestone, $54,327; pink marble, $59,327, and George W. Stiles Construction Company, Rookery Building, Chicago, Ill., sandstone $54,280.

★**Irvington, Ind.**—Following are four lowest bids opened June 10 by Marion County Commissioners for erecting two-story fireproof concrete and brick Children's Guardians' Home at Irvington: John A. Schumacher Company, Indianapolis, $44,740 (awarded contract); State Construction Company, Indianapolis, $44,787; A. W. Stoolman, Champaign, Ill., and Chiron C. Pierson, Indianapolis, both bid $45,839; William P. Jungclaus Company, Indianapolis, $45,950. Heating—W. H. Johnson & Son, Indianapolis, $4,562; plumbing, E. A. Strong & Son, Indianapolis, $4,950. Herbert Foltz, Archt., Indiana Pythian Building, Indianapolis. Joseph G. Hayes, Chmn. Comrs.

★**Sullivan, Ill.**—Contract for erecting school (bids opened June 8) awarded English Brothers, Champaign, at $77,500. Bids on heating and plumbing rejected, new bids to be opened June 29. H. W. Wright, Secretary Board Education.

★**Ripon, Wis.**—C. R. Meyer & Sons Company, Oshkosh, has secured contract to erect municipal opera house, armory and city hall; cost about $30,000.

★**Newell, Iowa.** — Contract awarded Shannon & Son, Sioux City, for erecting high school; cost $25,000. Beuttler & Arnold, Archts., Security Building, Sioux City.

★**Concordia, Kan.**—Contract for erecting St. Joseph's Hospital awarded Nelson Building Company of Salina, at $50,736.

★**Osawatomie, Kan.**—Contract awarded F. H. Crites, Kansas City, Mo., for erecting brick and stone high school, at $35,387. Williamson & Company, Archt., Topeka.

★**Great Falls, Mont.**—Contract awarded Rude & Searles, Great Falls, for erecting Franklin School at $38,202.

★**Laramie, Wyo.**—Contract for erecting memorial hospital (Ivinson Memorial Hospital) awarded Archie Allison, Cheyenne, at $38,000. W. A. Hitchcock, Architect, Laramie.

★**Plainview, Tex.**—Contract for erecting high school awarded J. B. Maxey of Plainview; cost approximately $50,000.

★**Seattle, Wash.**—Contract awarded by D. P. Eastman, Archt., Northern Bank Building, to Hendrickson & Company, Globe Block, for erecting three-story, 55 x 80 ft., brick addition to Swedish Hospital at Summit Avenue and Columbia Street; cost $60,000.

★**Inglewood, Cal.**—Contracts for erecting auditorium building (bids opened June 2) awarded by Ingewood Union High School Trustees (George M. Green, Secretary) awarded as follow: General contract, Borward & Sons, 621 Block Building, Los Angeles, $27,726; heating, Hoagland Larken, $988; Robertson & Packard, electric wiring $1,245.

★**Lewiston, Idaho.**—Reported contract for erecting Attix Clinic Hospital awarded Stanton & Smith of Lewiston, at $35,000.

PRIVATE BUILDINGS

PROPOSED WORK.

Westbrook, Me.—Jackson & Solomonson, 36 Bromfield Street, Boston, Mass., are architects for $30,000 theater to be erected on Main and Central Streets for Star Amusement Co.

Hartford, Conn.—Plans prepared by J. Sarsfield Kennedy, 157 Remsen Street, Brooklyn, N. Y., for a $60,000 residence to be erected on Prospect Avenue for Mrs. Lewis E. Gordon, 948 Asylum Avenue.

Brooklyn, N. Y.—Plans completed by Charles M. Straub, 147 Fourth Avenue, for 6-story brick apartment house to be erected on Bedford Avenue and South First Street for Solomon Kaplan, 750 Driggs Avenue, cost $50,000.

Johnson City, N. Y.—Baptist Church is considering erecting a $35,000 edifice. Rev. L. E. Ford, Pastor.

New York, N. Y.—Plans filed for erecting following buildings: 13-story fireproof apartment house at 255 West Seventy-fourth Street for Paterno Construction Company, cost $[illegible]50,000, Schwartz & Gross, Archts., 347 Fifth Avenue; 13-story fireproof apartment house at 150th Street and Edgecombe Avenue for Candler Holding Corporation, cost $600,000, Schwartz & Gross, Archts., 347 Fifth Avenue; 6-story brick apartment house at 158th Street and Riverside Drive for Langhorne Construction Corporation, cost $175,000, George F. Pelham, Inc., Archt., 30 East Forty-second Street; three 6-story brick apartment houses at 115-137 West Sixteenth Street for 115-137 West Sixteenth Street Company, Inc., total cost $300,000, George A. & Henry Boehm, Archts., 7 West Forty-second Street; two 6-story brick apartment houses at Broadway and 150th Street for S. D. Davis Construction Company, total cost $100,000, Samuel Cohen, 32 Union Square, and Mitchell Bernstein, 131 East Twenty-third Street, associate architects: 14-story fireproof hotel at 228 West Seventy-first Street, for Gresham Realty Company, Inc., cost $400,000, Emery Roth, Archt., 119 West Fortieth Street; 14-story fireproof hotel at 246 West 103d Street for 250 West 103d Street Corporation, cost $350,000, Rouse & Goldstone, Archts., 38 West Thirty-second Street; 3-story fireproof public garage at 312 West Sixty-eighth Street for William Bradley, cost $100,000, E. H. Jones, Archt., 124 West Forty-fifth Street, two 5-story brick tenement houses on Boston Road for Ivor Realty Company, total cost $150,000, William Koppe, Archt., 830 Westchester Avenue; 3-story addition to exchange and office building at 126 Orchard Street for New York Telephone Company, cost $60,000, McKenzie, Voorhees & Gmelin, Archts., 1123 Broadway; 2-story addition and alterations to 16-story fireproof storage and office building at 25 West Thirty-ninth Street for United Engineering Societies, cost $250,000, Henry G. Morse, Archt., 101 Park Ave.

Plans completed by William H. McElfatrick, 701 Seventh Avenue, for 12-story apartment house on Ninety-sixth Street, and a theater on Ninty-fifth Street, to be be erected for B. F. Keith Company.

Schenectady, N. Y.—Carl Co., 256 State Street, has secured site and will erect a three-story and basement reinforced concrete building.

West New York (P. O. Weehawken), N. J.—Hyman Pollah, West New York, will erect on Eighth Street a 4-story brick building costing $25,000.

New Jersey Title Guarantee & Trust Company plans erecting a branch bank building at Bergenline Avenue and Sixteenth Street, to cost about $40,000.

Samuel H. Rubine, West New York, will erect two apartment houses at Broadway and Thirteenth Street.

Elizabethtown, Pa.—Masons contributed $100,000 for erecting additional buildings at Masonic Home.

Erie, Pa.—The sum of $190,000 for construction of a fireproof building has been bequeathed to Y. W. C. Association.

Pittsburgh, Pa.—J. C. Dilworth of Dilworth, Porter Company, Fourth and Bingham Streets, will erect a $30,000 residence.

Griswold Hotel is to be rebuilt at a cost of $70,000.

Hackmeister Lind Chemical Company, 1910 Forbes Street, plans erecting a four-story garage building with seven-story addition in rear.

Rutan & Russell, Magee Building, are architects for eight-story apartment house to be erected at Forbes and Dithridge Streets, for F. F. Nicola; probable cost $300,000.

Baltimore, Md.—Plans prepared by Herbert J. Jory, Munsey Building, for a 6 and 7 story building to be erected for William F. Hempel at North Avenue and Tenth Street, Walbrook; cost $50,000.

Plans being prepared by Smith & May, 1133 Calvert Building, for guild house, probably three stories, to be erected at Columbia Avenue and Collender Street for St. Paul's Protestant Episcopal Church; cost approximately $25,000.

Fairmont, W. Va.—First Presbyterian Church will erect a $50,000 edifice.

Huntington, W. Va.—Plans of Meanor & Sweeney, Huntington, approved by Rev. P. J. Donahue, Bishop of Wheeling, for St. Francis Hospital, contemplated, at Thirteenth Avenue and Twelfth Street, to cost $200,000; first unit to be erected this year at cost of about $90,000.

St. Petersburg, Fla.—St. Petersburg Yacht Club planning to erect a $25,000 clubhouse.

Monroe, La.—Contract soon to be let for erecting Masonic Temple; cost $60,000.

Nashville, Tenn.—Plans prepared for rebuilding Woodland Street Presbyterian Church, destroyed by fire; cost approximately $45,000.

Lexington, Ky.—Richards, McCarty & Bulford, Hartman Building, Columbus, Ohio, engaged to prepare plans for proposed new Broadway Christian Church to be erected at Second Street and Broadway; cost approximately $110,000. Roger Smith, Chairman Building Committee.

La Salle, Ill.—Standard Oil Co. reported considering erecting a concrete and brick warehouse and garage in La Salle at cost of about $30,000. Alan Jackson, of Joliet, District Secretary.

Rock Island, Ill.—Congregation of First Baptist Church decided to erect edifice costing about $50,000. Address Pastor.

Streator, Ill.—Plans adopted for $60,000 Park Presbyterian Church.

Benson, Wis.—Contract will be let in about a month for erecting the Roman Catholic Church according to plans by El. Masqueray, 595 Endicott Building, St. Paul, Minn.

Milwaukee, Wis.—John E. DeWolf, 97 Wisconsin Street, and Saxe Bros., 319 Chestnut Street, intend erecting a two-story store and office building at 416 Grand Avenue, cost $50,000.

Des Moines, Iowa.—W. H. Usher, 3942 Cottage Grove Avenue, will erect a three-story, 62 x 73 ft., apartment building at 3519 University Avenue; cost $30,000.

Minneapolis, Minn.—C. C. Bovey, 1512 Harmon Place, will erect a brick and reinforced concrete residence at 400 Clifton Avenue, to cost $50,000.

St. Paul, Minn.—Frankson Avenue M. E. Church having plans prepared for a building to cost $30,000.

Contract will probably be let in September by A. H. Stem, 601 Endicott Building, for erecting the 12-story, reinforced concrete club house for the St. Paul Athletic Club at Fourth and Cedar Streets, to cost $650,000.

Joseph Friedman, 1601 Hague Avenue, will erect a three-story fireproof brick apartment house on Victoria Street and Portland Avenue, to cost $125,000.

Strickland & Doolittle, 139 Endicott Building, will erect a $50,000 building at Eighth and Ribert Streets.

Reported Great Northern (A. H. Hogeland, Ch. Engr., St. Paul) and the St. Paul Railroads will probably erect, this year, the union depot.

Billings, Mont.—Reported Bob Leavens, 921 North Thirty-first Street, plans erecting a 250 x 150 ft. reinforced concrete theater building here.

Helena, Mont.—George M. Harris, Yeon Building, of Portland, Ore., reported interested in Montana Amusement Co., which intends erecting at Main Street and Sixth Avenue a theater building costing $100,000.

Dallas, Tex.—Woerner & Cole, Dallas, are architects for a three-story apartment house to be erected on South Akard Street, to cost $30,000.

Building Committee of Southern Methodist University Board of Trustees instructed to proceed with erecting a $200,000 girls dormitory.

Houston, Tex. — Eagles contemplate erecting a four-story lodge building, to cost $50,000.

Quanah, Tex.—Field & Clarkson of Wichita Falls engaged to prepare plans for bank and office building to cost $25,000.

Tulsa, Okla.—E. L. Fox, 20 West Easton Street, will erect a three-story brick hotel to cost $30,000.

Seattle, Wash.—Samuel Harris, Ackerman & Harris, plans immediate construction of a new theater to cost about $250,000.

Tacoma, Wash.—Reported plans being prepared for four or six-story, fireproof, brick and mill construction business building which James Garvey and P. R. Keith, 117½ South Tenth Street, propose erecting at Twelfth Street and Cliff Avenue; cost about $50,000.

Portland, Ore.—Reported Anton Huth, 504 North Third Street, Tacoma, Wash., will erect a six-story building on Broadway and Adler Street, to cost $200,000.

Long Beach, Cal.—F. L. Lindsay, 306 Elm Avenue, engaged to prepare plans for $40,000 four-story and basement brick apartment house on Magnolia Avenue for D. W. Neet, 106 Magnolia Avenue.

Los Angeles, Cal.—Plans being prepared by Mayberry & Parker, 472 Pacific Electric Building, for a 2-story, 100 x 80-ft. brick and stone building to be erected at 314 E. Third Street for Frank Harrelson.

Montreal, Que.—D. J. Crighton, 282 St. Catharine Street W., preparing plans for a movie theater for J. S. Jacobs to cost $50,000.

Toronto, Ont.—Gutta Percha Rubber Co., Toronto, it is reported, will erect a warehouse to cost $35,000.

Vancouver, B. C.—B. Marcus Pretica. Pantages Building, Seattle, Wash., engaged to prepare plans for reinforced concrete and steel theater building to be erected on Hastings Street for Alex. Pantages, Pantages Building, Seattle, Wash.; cost about $150,000.

BIDS DESIRED.

Miami, Fla.—Tentative plans for the First Baptist Church, a concrete, brick or hollow tile church. Probable cost $60,000. For further information address J. H. Tatum, Chmn., of Baptist Church.

Ghent, Ky.—Until June 27 by R. Scott Williams, Secy. Building Committee, Carroll Lodge No. 45, I. O. O. F., for erecting two-story brick building.

Birmingham, Mich.—Reported desired until July 1, for furnishing material and erecting a brick church with stone trimmings 68 x 90 ft. W. E. N. Hunter, Archt., 1306-7 Chamber of Commerce, Detroit.

Royal Oak, Mich.—Reported desired until July 10, for furnishing material and erecting a brick church 100 x 224 ft. in Royal Oak. W. E. N. Hunter, Archt., 1306-7 Chamber of Commerce, Detroit.

Fremont, Neb.—Reported desired until July 1, by F. E. Pratt, Member Bldg. Committee, Fremont Hotel Co., for erecting a six-story 88 x 125 ft. hotel. Probable cost $175,000. A. H. Dyer & Co., Archts., Fremont.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**New Bedford, Mass.**—Contract for constructing a reinforced concrete eight-story 500 x 100-ft. cotton warehouse awarded Turner Construction Company, 11 Broadway, New York, N. Y. C. R. Makepeace & Company, Engineers, 430 Butler Exchange, Providence, R. I.

★**Worcester, Mass.**—E. D. Ward, 82 Foster Street, has secured contract to erect, one-story, 200 x 45 ft., brick freight house on Franklin Street, for Boston & Albany Railroad; cost $50,000.

★**Hartford, Conn.**—Contract awarded D. C. Weeks & Son, 1123 Broadway, New York, for erecting parish house on Church Street for Christ Church; estimated cost $150,000.

★**Buffalo, N. Y.**—Contract awarded by Willys-Overland Company of Toledo, Ohio, to Frank T. Ley Company, Springfield, Mass., for erecting four-story and basement, 132 x 235 ft. service building and showroom at Main and Bryant Streets.

★**Kew (P. O. Jamaica), L. I., N. Y.**—Contract awarded David Hill, Ozone Park, L. I., for erecting 2½-story, 100 x 80-ft. concrete and stucco club house with two wings for Kew Gardens Country Club; cost about $40,000. Nathaniel Vickers, Archt., 71 Broadway, New York.

★**Syosset, L. I., N. Y.**—Contract awarded Central Building Co., 58 Front Street, Rochester, for erecting a residence and garage at Syosset for James A. Burden; cost $200,000.

★**Tonawanda, N. Y.**—Contract awarded Durolithic Company of North Tonawanda, for erecting 30-room brick hotel on Broad and Delaware Streets, for R. S. Brown Hotel Company, Inc.; cost $25,000.

★**Pittsburgh, Pa.**—Contract for rebuilding St. Stephens Lutheran Church, destroyed by fire, awarded E. Z. Pfeffer of Wilkinsburg; cost about $27,000.

★**Tifton, Ga.**—Contract awarded V. C. Parker & Son of Waycross for erecting 75 x 236-ft. brick and concrete warehouse for Central Grocery Company; cost $25,000.

★**Cincinnati, Ohio.**—Contract awarded H. C. Hazen Contracting Company, 2070 Reading Road, for alterations and additions to building of Adams Express Company, Butler Street; cost about $60,000.

★Contract for superstructure of St. Mary's Roman Catholic Church, Erie Avenue and Shady Lane, awarded M. J. Roche Construction Co., 609 Johnston Building; cost $100,000.

★**Lewistown, Mont.** — Contract awarded Sound Construction & Engineering Co., Lowman Building, Seattle, Wash., for erecting a 6-story, 90 x 100 ft., steel and reinforced concrete bank and office building for the Bank of Fergus County; cost about $250,000. Link & Haire, Archts., Helena.

★**Seattle, Wash.**—Contract for erecting apple storage refrigerating warehouse awarded by Port Commissioners (J. R. West, Chief Engineer) to Vilter Manufacturing Company, Milwaukee, Wis., at $71,292.

★**Coronado Beach, Cal.** — Contract awarded Wurster Construction Co., Spreckles Bldg., San Diego, for erecting two-story and basement reinforced concrete and brick building, 372 x 211 ft., at Loma Avenue and Orange Street, for J. B. and A. B. Spreckles Securities Co., Spreckles Bldg., San Diego. Harrison Albright, Archt., Laughlin Bldg., Los Angeles.

★**Los Angeles, Cal.**—Contract awarded C. J. Kubach Co., 701 Merchants' National Bank Building, for erecting a 6-story and basement, reinforced concrete loft building at Tenth and Los Angeles Streets for E. A. Featherstone. Edelman & Barnett, Archts., 729 Black Building.

★**Toronto, Ont.**—Contract awarded by Bowles Lunch Company, Ltd., to W. J. Joy, 86 High Park Ave., for erecting $30,000 bakery.

★**Winnipeg, Man.**—Contract awarded John Dolmer, 406 Lansdowne Avenue, for erecting brick and concrete picture theater for Hyde Brothers, 705 McIntyre Block; cost $45,000.

NEW INDUSTRIAL PLANTS

PROPOSED WORK.

North Chelmsford, Mass.—Lowell Textile Company, North Chelmsford, will erect a two-story factory.

Hartford, Conn.—Plans being prepared by William T. Marchant, First National Bank Building, for a 3-story mill constructed, 48 x 80 ft. factory to be erected on Park Avenue by Skat Manufacturing Co.

Elmhurst (P. O. Flushing), L. I., N. Y.—Norma Company of America, 1790 Broadway, New York, has secured site on Queens Boulevard and intends erecting a $500,000 plant, first unit to be 70 x 350 ft., of reinforced concrete construction, costing about $200,000; machinery and equipment to cost an additional $200,000. Engineers, Francisco & Jacobus, 200 Fifth Avenue, New York.

Syracuse, N. Y.—Reported steps being taken by Semet-Solvay Company, Milton Avenue, to erect a plant for manufacture of aniline dyes.

Jersey City, N. J.—Plans completed for proposed addition to plant of Joseph Dixon Crucible Company on Wayne Street.

Matawan, N. J.—Factory of Wason Piano Company, destroyed by fire, will be rebuilt at a cost of $50,000.

Paterson, N. J.—Paterson Industrial Development Co. will erect a 4-story factory building, 75 x 310 ft. on Gray Street; cost about $205,000.

Pennsgrove, N. J.—Salem & Pennsgrove Traction Co. to construct car shops and office building, one-story brick, concrete and steel construction. Address Stern & Silverman, Engrs., Land Title Building, Philadelphia, Pa.

Mauch Chunk, Pa.—Plans prepared for two-story, 120 x 52-ft., steel and brick building to replace plant of Mauch Chunk Iron Works destroyed by fire.

Philadelphia, Pa.—Midvale Steel Company has plans for 540 x 220 ft. brick, steel and reinforced concrete ordinance machine shop to cost $320,000.

Baltimore, Md.—Reported grain elevator of Pennsylvania R.R. destroyed by fire. A. C. Shand, Chief Engineer, Philadelphia, Pa.

Reported Pennsylvania R. R. (Alex Shand, Chief Engineer, Philadelphia) will replace above elevator with a reinforced concrete elevator.

Baltimore Enamel & Novelty Company will erect a factory at Clement and Woodall Streets, to cost $130,000.

Norfolk, Va.—The Norfolk & Western Ry. Co. (J. E. Crawford, Chief Engineer, Roanoke) planning to erect a $1,000,000 grain elevator in Norfolk.

Roanoke, Va.—Reported Vicose Co. of Marcus Hook will erect a $1,000,000 mill for silk manufacture at Roanoke.

Weirton, W. Va.—Phillips Sheet & Tin Plate Company plans erecting an additional 10-inch strip steel mill to the 16-inch strip steel mill now under construction.

Erwin, Tenn.—E. J. Owen of Sisterville, W. Va., plans erecting a $75,000 pottery at Erwin.

Louisville, Ky.—Louisville Cooperage Co., Twenty-ninth Street and Broadway, plans to erect a $50,000 cooperage plant.

Cleveland, Ohio. — Sanitary Tinning Company, 2365 Canal Road (A. J. Miller, President), has secured site on East Ninety-third Street on which it is proposed erecting a factory costing $50,000.

Jackson, Mich.—Reported Michigan Central Railroad Company (George H. Webb., Ch. Engr., Detroit) will erect a $250,000 addition to its shops at Jackson Junction.

Decatur, Ill.—Contract soon to be let by Staley Starch Manufacturing Co., Decatur, for erecting a 7-story building at plant.

Peoria, Ill.—Reported the Distilling Co. of America will spend about $100,000 for improvements to Peoria Malting plant. Adolph Woolner, Gen. Mgr.

Ellis, Kan.—Reported Union Pacific Railroad (R. L. Huntley, Ch. Engr., Omaha, Neb.) will spend $500,000 for shops, roundhouse and power house, to be erected here.

Kathryn, N. D.—J. H. A. Brahtz, Mankato, engaged as engineer to prepare plans and specifications and supervise construction of the fireproof grain elevator of the "Brahtz Perfection" type, 50,000 bu. capacity; fireproof flour mills, 50,000 bbl. capacity; electric power station for Kathryn Farmers Mutual Elevator Company. Contract to be let about July 10. A. E. Micjelsen, Secretary, Sheyenne Valley Bank, Kathryn.

Port Arthur, Tex.—All bids opened June 15 for constructing city abattoir rejected.

Marshfield, Ore.—Reported W. J. Wilsey of Portland, Ore., represents a corporation which plans constructing a pulp and paper mill, a hydroelectric power plant, a by-product plant, creosoting plant, woodenware plant, etc., in Marshfield. Corporation also plans to construct a railway from Roseburg and Coos Bay.

Claremont, Cal.—Paul F. Higgs, First National Bank Bldg., Pomona, engaged to prepare plans for a large packing house to be erected for the College Heights Orange Growers' Assoc.

Los Angeles, Cal.—R. W. Pridham Co., 112 N. Center Street, paper box manufacturers, will erect a fireproof factory in Vernon Industrial Dist.; cost, $100,000.

Plans completed by H. E. Bean, Central Bldg., for two-story and basement reinforced concrete and brick factory building, 147 x 60 ft., to be erected in the Vernon district for California Food Products Co.

San Gabriel, Cal.—T. M. Farrell, 430 Chamber of Commerce Building, Los Angeles, is reported interested in company which is having plans prepared for 9-story reinforced concrete and frame building for a cotton mill to be erected 2 miles east of San Gabriel; probable cost $300,000.

Humboldt, Ariz. — The Consolidated Arizona Smelting Co. (D. M. Colvocoressess, Manager) will rebuild mill and ore bins recently destroyed by fire; cost $50,000.

Brantford, Ont.—Royal Paper Box Company plans erecting a factory costing $25,000.

Ojibway, Ont.—Reported Canadian Steel Company will erect mills, wharves and warehouses to cost $20,000,000.

Toronto, Ont.—Harris Abattoir Co., Toronto, is preparing plans for additions to plant to cost $50,000.

New Westminster, B. C.—Canadian Products Company of Ladner, B. C., is planning erecting an evaporating plant here to cost $35,000.

BIDS DESIRED.

Torrington, Conn.—Until June 26 for erecting 4-story, 309 x 54 ft. factory for Standard Co., Laurel Avenue.

Buffalo, N. Y.—By D. D. Martin, Secy. Buffalo Potteries, for erecting a three-story reinforced concrete addition to its plant at Hayes Place and Pennsylvania R. R.

Groton, N. Y.—By Gibb & Waltz, Archts., Ithaca, for erecting a 4-story and basement factory building, 162 x 50 ft., for the Corona Typewriter Co., 141 West Forty-second Street, New York City.

Niagara Falls, N. Y.—By Thornton Chard, Archt., 101 Park Avenue, New York, for erecting a 2-story factory, 50 x 100 ft., at Union and Iroquois Streets, for the Hydrol Co., 125 Front Avenue, New York City.

Yonkers, N. Y.—By the Fletcher-Thompson Engineering Co., Bridgeport, Conn., for erecting a 2 and 3-story addition, 200 x 300 ft., to manufacturing plant of the Habershaw Electric Cable Co. Probable cost $100,000. Edwin W. Moore, Pres., 10 East Forty-second Street, New York City.

PRICES AND LETTINGS.

★*Indicates award of contract.*

★**Holyoke, Mass.**—Contract awarded J. H. Fowles & Son, Holyoke, for erecting plant of Elmwood Cleaning & Dye Works on South Main Street, to consist of three two-story buildings; estimated cost about $50,000.

★**Bristol, Conn.**—Contract awarded by Wallace Barnes Co. to Torrington Building Co., 197 Water Street, Torrington, for erecting 2 additions, 144 x 60 ft. and 163 x 80 ft., to Bristol and Forestville plants.

★**Hartford, Conn.**—Contract awarded by Philbrick-Booth Foundry Co., 26 State street, to Robert Porteous, 13 Forest Street, for erecting a foundry, heavy mill construction, on Homestead Avenue, 52 x 124 ft. Johnson & Burns, Archts., 26 State Street.

★**Auburn, N. Y.**—Contract awarded by Auburn Button Company for erecting one-story, 45 x 200 ft. shoe factory, to Luke Williams, 19 Green Street.

★**Brooklyn, N. Y.**—Contract awarded Turner Construction Co., 11 Broadway, New York, N. Y., for erecting a 4-story reinforced concrete, 125 x 50 ft. factory with an L 25 x 54 ft. for the Doehler Die Casting Co., at Court and Huntington Streets.

★**Cortland, N. Y.**—Contract for erecting foundry and machine shop for Cortland Forging & Machine Works awarded Groton Bridge Company, Groton; cost $35,000.

★**Bramell Point, N. J.**—Contract awarded Turner Construction Co., 11 Broadway, New York, N. Y., for erecting a reinforced concrete acid tank shed, 1 story, 57 x 46 ft.; also an acid pan house, 1 story, 103 x 65 ft., for the Vacuum Oil Co., Bramell Point, N. J.

★**Camden, N. J.**—Contract awarded Loose & Dothard, Commercial Trust Building, Philadelphia, Pa., for alterations and additions to plant of B. F. Boyer. Ballinger & Perrot, Archts., Methodist Building, Philadelphia, Pa.

★Contract awarded Irwin & Leighton, 126 North Twelfth Street, Philadelphia, Pa., for six-story factory building for Victor Talking Machine Company.

★**New Brunswick, N. J.** — Contract awarded Turner Construction Co., 11 Broadway, New York, N. Y., for erecting a 1-story, 482 x 68 ft., reinforced concrete building for the Newkraft Manufacturing Co. Ballinger & Perrot, Archts., Methodist Building, Philadelphia, Pa.

★**Sunbury, Pa.**—Contract awarded Reimard Brothers of Bloomsburg for erecting five-story, 250 x 175-ft. steel and brick addition to plant of Susquehanna Silk

★**Woolrich, Pa.**—Contract reported awarded Hughes & Foulkrod Company, Commonwealth Building, Philadelphia, for erecting four-story, 81 x 100 ft., brick, contract and steel factory for John Rich & Brothers.

★**Seattle, Wash.**—Contract for constructing first unit of Fishers Flour Mills on Harbor Island, awarded to Grant Smith & Co., Henry Bldg., structure to be of concrete construction, 54 x 180 ft., 80 ft. high, containing 30 large tanks; cost $75,000.

★**Ogden, Utah.**—James Stewart & Co., of Salt Lake City, secured contract to erect additions to plant of Ogden Packing and Provision Co. Cost, including machinery, about $300,000.

★**Vancouver, B. C.**—Cotton Company of False Creek, B. C., secured contract to rebuild wharves and plant of New England Fish Company, recently destroyed by fire.

MISCELLANEOUS

PROPOSED WORK.

Coal Handling Plant—Providence, R. I.—Darrow Mann Company, coal dealers, Boston, Mass., have leased a part of the harbor sea wall and will install a coal-handling plant. About $300,000 will be spent, including $50,000 for equipment.

Conduits—Rochester, N. Y.—Ordinance adopted by Council requesting Rochester Railway & Light Company to install conduit system in Clarissa and Lowell Streets and in Clinton Avenue.

Wall for Playground—Jersey City, N. J.—Harry Moore, Commissioner of Parks, has had plans prepared for a reinforced concrete wall, 7 ft. high, 250 x 250 ft., to be constructed around reservoir playground.

Tunnel—Salt Lake City, Utah.—The Salt Lake Power & Water Company will construct a tunnel 15,000 ft. long, costing $800,000. Fred H. Vahrenkamp, General Manager of the Boston Development Company, may be able to give information.

BIDS DESIRED.

Screens—Ft. H. G. Wright, N. Y.—Until June 27, by Quartermaster at Ft. H. G. Wright, for furnishing, installing and repairing screens, doors and windows, advertised in Engineering Record.

Tunnel for Steam Mains—Rome, N. Y.—Until July 3 by Frank Blake, President Board Managers, N. Y. State Custodial Asylum, Rome, for construction work of tunnel for steam mains to dormitory building at the said asylum. Lewis F. Pilcher, State Architect, Albany.

Road Oil—Harrison, N. J.—See "Paving and Roads."

Elevator—Newark, N. J.—Until July 5 by Committee on Public Buildings of the Common Council (Thomas J. Lee, Jr., Chairman) for new electric elevator for northwest wing of City Hospital, on Camden Street, Newark. Frederick A. Phelps, Architect and Engineer, 9 Clinton Street.

Fire Escapes—Summit, N. J.—Until July 3, by Board Education (Caroline B. Hindman, Secy.) for erecting fire escapes, etc., in School No. 1 on Springfield Avenue.

Elevator — New Orleans, La. — Until August 2 by James A. Wetmore, Acting Supervising Architect, Washington, D. C., for installing complete an electric freight elevator and remodeling 2 electric passenger elevators in U. S. Custom House.

Spreader, Etc.—Mason, Miss.—Reported desired until July 3 by Board County Supervisors (John A. Tyson, Clk.) for furnishing spreader heater and road sweeper, for spreading oil, asphaltum and other rock road dressing.

Swimming Pool—Cleveland, Ohio.—Until July 5, by Division of Purchases and Supplies for constructing concrete swimming pool, in Garfield Park.

Air Compressor—Orange, Cal.—Until July 6, by F. Bell, City Clerk, for furnishing steam-driven air compressor, capacity 1000 cu. ft. per minute.

Shed—Seattle, Wash.—Until July 5 by Port of Seattle Commissioners, Bell Street Wharf (J. R. West, Chief Engineer) for constructing the superstructure of the extension of Salmon Bay Transit shed, to be 90 x 100 ft., 20 ft. high, mill construction. Alternate bids, including bidder's own plan, will be considered. Cost estimated at $50,000.

Brick, Etc.—Seattle, Wash.—Until June 30 by Alaska Engineering Commission, Bell Street dock, Seattle, (C. E. Dole, purchasing agent,) for 15,000 fire brick, 30,000 common brick, 500 sq. ft. lagging, 5,000 lb. asbestos cement and 500 lb. water-mixed furnace paint, as per circular No. 192.

Fire Escapes—Los Angeles, Cal.—Until June 29, by Board Education (Wm. A. Sheldon, Secy.), for furnishing material and constructing fire escapes on the Berendo Street school. Also separate bids same time and place, for fire escapes on the Fourteenth Street school.

Asphalt—Winnipeg, Man.—Until July 4, by M. Peterson, Secy. Board Control, Winnipeg, for 250 tons of refined asphalt. Advertised in Engineering Record.

PRICES AND LETTINGS.

★*Indicates award of contract.*

Elevators—Los Angeles, Cal.—Following are bids opened by Co. Comrs. for elevators in the County Hospital: Otis Elevator Co., $14,245; Baker Iron Works, Los Angeles, $14,344; Llewellyn Iron Works, Los Angeles, $16,000.

Proposals

For Proposals Advertised, See Pages 46, 47, 48 and 49.

WATERWORKS.

Bids Close.		See Eng. Record.
Jun. 26.	Water Works, Harrison, Ark. Adv. Jun. 10 to 24.	Jun. 10
Jun. 27.	Dam, Shawano, Wis. Adv. Jun. 17.	Jun. 17
Jun. 27.	Mains, Dunning, Ill.	Jun. 17
Jun. 27.	Water Works, Biwabik, Minn.	Jun. 24
Jun. 28.	Filtration Plant, St. Hyacinthe, Que.	Jun. 10
Jun. 28.	Pipe, Vancouver, B. C.	Jun. 10
Jun. 28.	System, Oakdale, La.	Jun. 17
Jun. 28.	Pumping Station, Batavia, N. Y.	Jun. 24
Jun. 29.	Tank and Tower, McKinley, Minn.	Jun. 24
Jun. 30.	Filter, Etc., Barnesville, Ohio Adv. Jun. 17, 24.	Jun. 17
Jun. 30.	Water Works, Ankeny, Iowa Adv. Jun. 17.	Jun. 17
Jul. 1.	Tank and Tower, Rock Island, Ill.	Jun. 24
Jul. 3.	Pumps, Etc., Clarksdale, Miss.	Jun. 24
Jul. 4.	Meters, Toronto, Ont.	Jun. 24
Jul. 5.	Reservoir, etc., Middletown, Ohio Adv. Jun. 10, 17.	Jun. 10
Jul. 6.	Pipes, Etc., Michigan City, Ind. Adv. Jun. 24.	Jun. 24
Jul. 7.	Centrifugal Pumps, Columbus, Ohio	Jun. 24
Jul. 10.	Pipe, Etc., Washington, D. C.	Jun. 17
Jul. 10.	Water Works, Great Falls, Mont. Adv. Jun. 24.	Jun. 24
Jul. 10.	Pipe, Tank, etc., Los Angeles, Cal.	Jun. 24
Jul. 12.	Filtration Plant, Salisbury, N. C. Adv. June 24.	Jun. 24
Jul. 15.	Water Works, Lovelock, Nev.	Jun. 24
———	Franchise, Williamsburg, Va. Adv. May 27, June 3.	May 27

SEWERAGE AND SEWAGE DISPOSAL.

Bids Close.		See Eng. Record.
Jun. 26.	Tucson, Ariz. Adv. Jun. 3, 10.	Jun. 3
Jun. 27.	Thief River Falls, Minn.	Jun. 10
Jun. 27.	Lorain, Ohio	Jun. 17
Jun. 27.	Jersey City, N. J.	Jun. 17
Jun. 27.	Traer, Iowa	Jun. 17
Jun. 27.	Columbia, S. C.	Jun. 24
Jun. 27.	Bellaire, Ohio	Jun. 24
Jun. 28.	New York, N. Y.	Jun. 24
Jun. 29.	Milwaukee, Wis. Adv. Jun. 17.	Jun. 24
Jun. 29.	Cleveland, Ohio	Jun. 24
Jun. 29.	Los Angeles, Cal.	Jun. 24
Jun. 30.	Frankfort, Ind.	Jun. 10
Jun. 30.	Canadian, Tex.	Jun. 24
Jun. 30.	Terra Haute, Ind	Jun. 24
Jul. 1.	Ann Arbor, Mich	Jun. 10
Jul. 1.	Portsmouth, Ohio	Jun. 17
Jul. 1.	Agawam, Mass.	Jun. 24
Jul. 3.	Gainesville, Fla.	Jun. 17
Jul. 3.	Plainfield, N. J. Adv. Jun. 17.	Jun. 17
Jul. 3.	Shreveport, La. Adv. Jun. 17.	Jun. 24
Jul. 3.	Whitefish, Mont.	Jun. 24
Jul. 3.	Westfield, N. J.	Jun. 24
Jul. 3.	Kalispell, Mont.	Jun. 24
Jul. 3.	Houston, Tex.	Jun. 24
Jul. 5.	Johnsonburg, Pa. Adv. Jun. 17, 24.	Jun. 17
Jul. 7.	Spencer, Iowa	Jun. 17
Jul. 7.	Oswego, N. Y. Adv. Jun. 24.	Jun. 24
Jul. 10.	Wadena, Minn.	Jun. 17
Jul. 14.	Hamilton, Ohio	Jun. 24
Jul. 15.	Charter Oak, Iowa	Jun. 17
Jul. 15.	Mapleton, Iowa	Jun. 17
Jul. 20.	Evansville, Ind.	Jun. 17
Jul. 20.	Bridgeport, Conn. Adv. Jun. 24.	Jun. 24

BRIDGES.

Bids Close.		See Eng. Record.
Jun. 27.	Bethlehem, Pa.	Jun. 17
Jun. 27.	Hastings on Hudson, N. Y. Adv. Jun. 24.	Jun. 24
Jun. 28.	Ventura, Cal.	Jun. 17
Jun. 28.	Salt Lake City, Utah	Jun. 24
Jun. 28.	Stevens Point, Wis.	Jun. 24
Jun. 29.	Greenwich, Conn.	Jun. 10
Jun. 29.	Morrison, Ill.	Jun. 24
Jun. 30.	O'Neill, Neb.	Jun. 10
Jun. 30.	Dayton, Ohio	Jun. 10
Jun. 30.	La Moure, N. D.	Jun. 17
Jun. 30.	Holyoke, Mass. Adv. Jun. 17.	Jun. 17
Jun. 30.	O'Neill, Neb.	Jun. 24
Jun. 30.	Portageville, N. Y.	Jun. 24
Jul. 1.	Winchester, Ind.	Jun. 17
Jul. 1.	Clarksburg, W. Va.	Jun. 24
Jul. 1.	McMinnville, Ore.	Jun. 24
Jul. 1.	Holbrook, Ariz. Adv. Jun. 24.	Jun 24
Jul. 1.	Cleveland, Ohio	Jun. 24
Jul. 3.	Brewton, Ala.	Jun. 10
Jul. 3.	Morris, Minn.	Jun. 17
Jul. 3.	Visalia, Cal.	Jun. 17
Jul. 3.	Santa Barbara, Cal.	Jun. 17
Jul. 3.	Ainsworth, Neb.	Jun. 24
Jul. 3.	Morris, Minn.	Jun. 24
Jul. 3.	Dover, N. J.	Jun. 24
Jul. 3.	Tulsa, Okla.	Jun. 24
Jul. 3.	Russell, Kan.	Jun. 24
Jul. 3.	North Vernon, Ind.	Jun. 24
Jul. 5.	Maryland	Jun. 17
Jul. 3.	Columbus, Mont.	Jun. 24
Jul. 3.	Jasper, Ala. Adv. Jun. 27.	Jun. 24
Jul. 5.	Plymouth, Ind.	Jun. 17
Jul. 5.	Macon, Miss.	Jun. 17
Jul. 5.	Johnstown, Pa. Adv. Jun. 17, 24.	Jun. 17
Jul. 5.	Chippewa Falls, Wis.	Jun. 24
Jul. 5.	Illinois	Jun. 24
Jul. 5.	Larned, Kan.	Jun. 24
Jul. 6.	Spokane, Wash. Adv. Jun. 17, 24.	Jun. 17
Jul. 6.	Charleston, W. Va.	Jun. 24
Jul. 7.	Columbus, Ohio	Jun. 17
Jul. 7.	Ventura, Cal.	Jun. 24
Jul. 7.	Pittsburgh, Pa.	Jun. 24
Jul. 10.	Little Falls, Minn	Jun. 17
Jul. 10.	Middlebourne, W. Va.	Jun. 24
Jul. 10.	Akron, Ohio	Jun. 24
Jul. 10.	California.	Jun. 24
Jul. 11.	Rehoboth, Del. Adv. Jun. 17.	Jun. 17
Aug. 1.	Pasagoula, Miss.	Jun. 24

PAVING AND ROADS.

Bids Close.		See Eng. Record.
Jun. 26.	Marshalltown, Iowa Adv. Jun. 10.	Jun. 10
Jun. 26.	Albany, N. Y. Adv. Jun. 10 to 24.	Jun. 10
Jun. 26.	Harvard, Ill. Adv. Jun. 17, 24.	Jun. 17
Jun. 26.	Malone, N. Y. Adv. Jun. 17.	Jun. 17
Jun. 27.	Salt Lake City, Utah	May 13
Jun. 27.	Jackson, Tenn. Adv. Jun. 3.	Jun. 3
Jun. 27.	North Bend, Wash.	Jun. 10
Jun. 27.	Apollo, Pa. Adv. Jun. 10, 17.	Jun. 10
Jun. 27.	Newark, N. J.	Jun. 17
Jun. 27.	St. Louis, Mo.	Jun. 17
Jun. 27.	Maryland Adv. Jun. 17, 24.	Jun. 17
Jun. 27.	Easton, Md.	Jun. 17
Jun. 27.	Ventura, Cal.	Jun. 17
Jun. 27.	Salem, Ohio.	Jun. 17
Jun. 27.	Kansas City, Mo.	Jun. 24
Jun. 27.	Tillamooke, Ore.	Jun. 24
Jun. 27.	Massachusetts	Jun. 24
Jun. 27.	Riverside, Cal.	Jun. 24
Jun. 27.	Eldora, Iowa.	Jun. 24
Jun. 27.	Logan, Ohio.	Jun. 24
Jun. 28.	Cleveland, Ohio	Jun. 17
Jun. 28.	Troy, Ala. Adv. Jun. 24.	Jun. 24
Jun. 28.	Elyria, Ohio	Jun. 24
Jun. 28.	North Bay, Ont.	Jun. 24
Jun. 28.	Illinois	Jun. 24
Jun. 28.	Baltimore, Md.	Jun. 24
Jun. 28.	Long Island City, L. I., N. Y.	Jun. 24
Jun. 28.	Lima, Ohio	Jun. 24
Jun. 28.	Cedar Rapids, Iowa	Jun. 24
Jun. 28.	Independence, Mo.	Jun. 24
Jun. 28.	Kearney, N. J.	Jun. 24
Jun. 28.	Springfield, Ill.	Jun. 24
Jun. 28.	Harrison, N. J.	Jun. 24
Jun. 29.	New Martinsville, W. Va. Adv. May 27 to Jun 17.	May 27
Jun. 29.	Lorain, Ohio	Jun. 17
Jun. 29.	Indiana	Jun. 17
Jun. 29.	Woodbury, N. J. Adv. Jun. 17.	Jun. 17
Jun. 29.	New Brunswick, N. J.	Jun. 24
Jun. 29.	Henderson, N. C.	Jun. 24
Jun. 29.	Ebensburg, Pa.	Jun. 24
Jun. 29.	Marysville, Ohio	Jun. 24
Jun. 29.	Indiana	Jun. 24
Jun. 29.	Los Angeles, Cal.	Jun. 24
Jun. 30.	Indiana	Jun. 10
Jun. 30.	Burlington, Wis.	Jun. 17
Jun. 30.	Columbus, Ohio	Jun. 24
Jun. 30.	Boston, Mass.	Jun. 24
Jun. 30.	Mount Gilead, Ohio	Jun. 24
Jun. 30.	Buffalo, N. Y.	Jun. 24
Jun. 30.	Indiana	Jun. 24
Jun. 30.	Seattle, Wash.	Jun. 24
Jun. 30.	New York, N. Y.	Jun. 24
Jun. 31.	Vandergrift, Pa.	Jun. 17
July 1.	Maumee, Ohio	May 27
July 1.	Mobile, Ala.	May 27
July 1.	Bay Minette, Ala.	Jun. 3
Jul. 1.	Elkins, W. Va.	Jun. 24
Jul. 1.	Painesville, Ohio	Jun. 24
Jul. 1.	Trenton, N. J.	Jun. 24
Jul. 2.	Macon, Miss.	Jun. 24
Jul. 1.	Monclair, N. J.	Jun. 24
Jul. 1.	Indiana	Jun. 24
Jul. 3.	Cumberland, Md.	Jun. 17
Jul. 3.	Louisville, Ky.	Jun. 17
Jul. 3.	Seymour, Ky.	Jun. 17
Jul. 3.	Lexington, Miss.	Jun. 17
Jul. 3.	Los Angeles, Cal.	Jun. 17
Jul. 3.	Indiana	Jun. 17
Jul. 3.	Lexington, Miss.	Jun. 24
Jul. 3.	Everett, Wash.	Jun. 24
Jul. 3.	Tarboro, N. C.	Jun. 24
Jul. 3.	Arcadia, Fla.	Jun. 24
Jul. 3.	Washington, N. C.	Jun. 24
Jul. 3.	Bloomfield, N. J.	Jun. 24
Jul. 3.	Bradford, Pa. Adv. Jun. 24.	Jun. 24
Jul. 3.	De Kalb, Ill. Adv. Jun. 24.	Jun. 24
Jul. 3.	Cincinnati, Ohio	Jun. 24
Jul. 3.	Indiana	Jun. 24
Jul. 3.	Los Angeles, Cal.	Jun. 24
Jul. 3.	North Vernon, Ind	Jun. 24
Jul. 4.	Danville, Ky. Adv. Jun. 17.	Jun. 17
July 5.	Indiana	Jun. 3
July 5.	Houma, La.	Jun. 3
Jul. 5.	Princeton, N. J.	Jun. 17
Jul. 5.	Salt Lake City, Utah	Jun. 17
Jul. 5.	Maryland Adv. Jun. 17, 24.	Jun. 17
Jul. 5.	Plymouth, Ind.	Jun. 17
Jul. 5.	Indiana	Jun. 17
Jul. 5.	Winona, Miss.	Jun. 17
Jul. 5.	Bristol, Conn.	Jun. 24
Jul. 5.	Lake City, Fla.	Jun. 24
Jul. 5.	Columbus, Ohio	Jun. 24
Jul. 5.	Park Ridge, Ill.	Jun. 24
Jul. 5.	Wheeling, W. Va.	Jun. 24
Jul. 5.	Cleveland, Ohio	Jun. 24
Jul. 5.	Indiana	Jun. 24
Jul. 5.	Portage, Wis.	Jun. 24
Jul. 5.	Wallingford, Conn.	Jun. 24
Jul. 5.	Paris, Ill. Adv. Jun. 24.	Jun. 24
Jul. 6.	Greenville, N. C. Adv. Jun. 17, 24.	Jun. 17
Jul. 6.	Fulton, Mo.	Jun. 17
Jul. 6.	Rogersville, Tenn.	Jun. 17
Jul. 6.	Corinth, Miss. Adv. June 24.	Jun. 24
Jul. 6.	Connecticut	Jun. 24
Jul. 6.	Ephrata, Wash.	Jun. 24
Jul. 7.	Cincinnati, Ohio	Jun. 17
Jul. 7.	Newport, Ky.	Jun. 24
Jul. 7.	Wheeling, W. Va.	Jun. 24
Jul. 7.	Indiana	Jun. 24
Jul. 7.	Spencer, Iowa.	Jun. 24
Jul. 8.	Defiance, Ohio	Jun. 17
Jul. 8.	Lewisburg, W. Va.	Jun. 24
Jul. 8.	Frederick, Md.	Jun. 24
Jul. 8.	Brookhaven, N. Y. Adv. Jun. 24.	Jun. 24
Jul. 10.	Ashland, Ohio	Jun. 17
July 10.	Greenwood, Miss.	May 20
Jul. 10.	Beaver Falls, Pa.	Jun. 17
Jul. 10.	Dadeville, Ala.	Jun. 24
Jul. 10.	Grand Rapids, Minn	Jun. 24
Jul. 10.	Albany, N. Y. Adv. Jun. 24.	Jun. 24
Jul. 10.	Lisbon, Ohio	Jun. 24
Jul. 10.	Everett, Wash.	Jun. 24
Jul. 10.	Indiana	Jun. 24
Jul. 10.	Phoenix, Ariz.	Jun. 24
Jul. 10.	Seattle, Wash.	Jun. 24
Jul. 10.	California.	Jun. 24
Jul. 11.	Indiana	Jun. 24
Jul. 11.	Concrete, Wash.	Jun. 24
Jul. 11.	Bayonne, N. J.	Jun. 24
Jul. 11.	Seattle, Wash.	Jun. 24
Aug. 11.	Springfield, Ill.	Jun. 24
Jul. 12.	Dayton, Ohio	Jun. 24
Jul. 12.	Albany, N. Y. Adv. Jun. 24.	Jun. 24
Jul. 13.	Anaheim, Cal.	Jun. 24
Jul. 14.	Albany, N. Y. Adv. Jun. 24.	Jun. 24
Jul. 15.	Smithville, Ohio	Jun. 24
Jul. 17.	Cleveland Heights (P. O. Warrensville), Ohio	Jun. 24
Jul. 17.	East View, Ohio	Jun. 17

HYDRAULIC CONSTRUCTION AND RIVER IMPROVEMENTS.

Bids Close.		See Eng. Record.
Jun. 27.	Canal Work, Albany, N. Y.	Jun. 10
Jun. 27.	Levee, Kansas City, Mo.	Jun. 10
Jun. 27.	Dam, Hillsboro, Ill.	Jun. 24
Jun. 28.	Drainage, Windom, Minn.	Jun. 10
Jun. 28.	Breakwater, Massachusetts	Jun. 24
Jun. 29.	Drainage, Burtville, La.	Jun. 24
Jun. 30.	Dredging, Baltimore, Md. Adv. Jun. 3 to 24.	Jun. 3
Jun. 30.	Ditches, Rhodes, La.	Jun. 24
July 1.	Drainage, Boston, Mass.	Jun. 3
Jul. 1.	Levee, Sullivan, Ind. Adv. Jun. 17, 24.	Jun. 17
Jul. 1.	Dredging, Tacoma, Wash.	Jun. 24
Jul. 1.	Dredging, Celina, Ohio	Jun. 24
July 3.	Jetty, Gardiner, Ore.	May 27
Jul. 3.	Tunnel, Loveland, Col. Adv. Jun. 17, 24.	Jun. 17
Jul. 3.	Levee, Yazoo City, Miss.	Jun. 24
Jul. 3.	Drainage, Sanford, Fla.	Jun. 24
Jul. 6.	Dam, Walden, N. Y. Adv. Jun. 24.	Jun. 24
Jul. 7.	Protection Wall, Cincinnati, Ohio	Jun. 24
Jul. 7.	Irrigation, Lindsay, Cal.	Jun. 24
Jul. 8.	Dredging, Tiburon, Cal.	Jun. 24
Jul. 10.	Drainage, Riverside, Cal.	Jun. 17
Jul. 10.	Pier, Sarasota, Fla. Adv. Jun. 17, 24.	Jun. 17
Jul. 10.	Canal, Bryce, Ariz.	Jun. 24
Jul. 10.	Pipe, Los Angeles, Cal.	Jun. 24
Jul. 10.	Drainage Ditch, Fremont, Neb.	Jun. 24
Jul. 11.	Dredging, Baltimore, Md. Adv. Jun. 10, 17.	Jun. 10
Jul. 11.	Breakwater, Cleveland, Ohio Adv. Jun. 17, 24.	Jun. 17
Jul. 11.	Drainage, Urich, Mo.	Jun. 24
Jul. 18.	Canal Work, St. Ignatius, Mont.	Jun. 24
Jul. 18.	Terminal Cont. No. 52, Albany, N. Y. Adv. Jun. 24.	Jun. 24
———	Drainage Canal, Yemassee, S. C. Adv. Jun. 24.	Jun. 24

PUBLIC BUILDINGS AND SCHOOLS.

Bids Close.		See Eng. Record.
Jun. 26.	Redfield, S. D. Adv. May 20, 27.	May 20
Jun. 27.	Erie, Pa. Adv. June 3.	May 27
Jun. 27.	Lewis, Iowa	May 27
Jun. 27.	Rochester, N. Y. Adv. May 27 to Jun. 24.	May 27
Jun. 27.	Mendota, Ill.	Jun. 10
Jun. 27.	Dunning, Ill.	Jun. 10
Jun. 27.	Atlanta, Ga	Jun. 17
Jun. 27.	Jefferson, Ohio	Jun. 17
Jun. 27.	Jefferson, Ohio	Jun. 24
Jun. 27.	Flat River, Mo.	Jun. 24
Jun. 27.	Cincinnati, Ohio	Jun. 24
Jun. 28.	New Albany, Ind.	Jun. 10
Jun. 28.	Boston, Mass.	Jun. 24
Jun. 28.	Springfield, Mass.	Jun. 24
Jun. 28.	Toronto, Ont.	Jun. 24
Jun. 29.	Nampa, Idaho.	Jun. 24
Jun. 29.	Port Angeles, Wash	Jun. 24
Jun. 29.	Cedar Grove, N. J.	Jun. 24
Jun. 29.	Yardley, Pa.	Jun. 24
Jun. 30.	Edmore, N. D.	Jun. 10
Jun. 30.	Hackaboro, Tenn.	Jun. 24
Jun. 30.	Belleville, N. J.	Jun. 24
Jun. 30.	Havelock, Neb.	Jun. 24
Jun. 30.	Cincinnati, Ohio	Jun. 24
Jun. 30.	Seattle, Wash	Jun. 24
Jun. 30.	Pembrooke, Ont.	Jun. 24
Jun. 30.	New Brunswick, N. J.	Jun. 24
Jun. 30.	Sudbury, Ont.	Jun. 24
July 1.	Webb City, Mo. Adv. Jun. 3, 10.	Jun. 3
July 1.	Joplin, Mo.	Jun. 10
Jul. 1.	Carthage, Ohio	Jun. 17
Jul. 1.	Red Wing, Minn	Jun. 17
Jul. 1.	Muscatine, Iowa	Jun. 17
Jul. 1.	Boulder, Mont.	Jun. 24
Jul. 1.	Monarch, Pa.	Jun. 24
Jul. 1.	West Side, Iowa	Jun. 24
Jul. 1.	Waterloo, Iowa	Jun. 24
Jul. 1.	Brandon, Vt.	Jun. 24
Jul. 3.	Grand Rapids, Mich Adv. Jun. 17.	Jun. 17
Jul. 3.	Wernersville, Pa.	Jun. 17
Jul. 3.	Charlotte, N. C.	Jun. 24
Jul. 5.	Pittsford, N. Y. Adv. Jun. 24.	Jun. 24
July 6.	Chillicothe, Ohio	Jun. 10
Jul. 6.	Washington, D. C.	Jun. 17
Jul. 6.	Knoxville, Iowa Adv. Jun. 17.	Jun. 17
Jul. 6.	Kansas City, Mo.	Jun. 24
Jul. 7.	Ditch, Blue Earth, Minn.	Jun. 17
Jul. 10.	Jackaboro, Tenn.	Jun. 17
Jul. 10.	Hubbard, Iowa	Jun. 24
Jul. 13.	Martins Ferry, Ohio	Jun. 24
Jul. 14.	Lockbourne, Ohio	Jun. 24
Jul. 14.	Massillon, Ohio	Jun. 24
Jul. 14.	Van Buren, Ohio	Jun. 24
Jul. 14.	Perrysburg, Ohio.	Jun. 24
July 20.	Chillicothe, Ohio	Jun. 10
Aug. 1.	Newburyport, Mass.	Jun. 24
Aug. 2.	New Orleans, La.	Jun. 24
Aug. 7.	Portland, Ore. Adv. Jun. 10, 17.	Jun. 10
———.	Reidsville, N. C. Adv. Jun. 17.	Jun. 17

PRIVATE BUILDINGS.

Bids Close.		See Eng. Record.
Jun. 26.	Torrington, Conn.	Jun. 24
Jun. 27.	Midland, Mich.	Jun. 17
Jun. 27.	Ghent, Ky.	Jun. 24
Jun. 30.	Harrisburg, Pa.	Jun. 17
Jun. 30.	Private Bldg., Cincinnati, Ohio	May 27
July 1.	New Orleans, La.	May 20
July 1.	Grand Island, Neb.	May 20
Jul. 1.	Arcadia, La.	Jun. 17
Jul. 1.	Sunbury, Pa.	Jun. 17
Jul. 1.	Birmingham, Mich.	Jun. 24
Jul. 1.	Fremont, Neb.	Jun. 24
Jul. 10.	Royal Oak, Mich.	Jun. 24
———.	Cincinnati, Ohio Adv. Jun. 17.	Jun. 17

NEW INDUSTRIAL PLANTS.

Bids Close.		See Eng. Record.
Jul. 1.	Davenport, Iowa	Jun. 17
July 15.	West Allis, Wis.	Jun. 10

MISCELLANEOUS.

Bids Close.		See Eng. Record.
Jun. 26.	Sprinkler System, Etc., Minot, N. D. Adv. Jun. 17.	Jun. 17
Jun. 26.	Generator Sets for Fog Station Signal, Detroit, Mich. Adv. Jun. 17.	Jun. 17
Jun. 27.	Tunnels, Etc., Geneva, Ill.	Jun. 17
Jun. 27.	Garbage Disposal, Piqua, Ohio	Jun. 24
Jun. 27.	Screens, Ft. H. G. Wright, N. Y. Adv. Jun. 24.	Jun. 24
Jun. 29.	Oil, Etc., Panama	Jun. 17
Jun. 29.	Fire Escapes, Los Angeles, Cal.	Jun. 24
Jun. 30.	Mechanical Mail Handling Appar., New York, N. Y.	May 12
July 1.	Cranes, Seattle, Wash.	Jun. 10
Jul. 1.	Heating Plant in Mun. Bldg., Shanghai, China Adv. Jun. 17, 24.	Jun. 17
July 3.	Fire Escapes, Tunica, Miss.	Jun. 10
Jul. 3.	Wire Cables, Etc., Memphis, Tenn. Adv. Jun. 17, 24.	Jun. 17
Jul. 3.	Spreader, etc., Mason, Miss.	Jun. 24
Jul. 3.	Fire Escape, Summit, N. J.	Jun. 24
Jul. 4.	Asphalt, Winnipeg, Man. Adv. Jun. 24.	Jun. 24
Jul. 5.	Elevator, Troy, N. Y.	Jun. 17
Jul. 5.	Elevator in Hospital, Newark, N. J.	Jun. 24
Jul. 5.	Shed, Seattle, Wash.	Jun. 24
Jul. 6.	Air Compressor, Orange, Cal.	Jun. 24
Jul. 5.	Swimming Pool, Cleveland, Ohio	Jun. 24
July 17.	Mail Handling Device, New Orleans, La.	May 27
Aug. 2.	Elevator, New Orleans, La.	Jun. 24
———	El. Rys., New York, N. Y. Adv. Apr. 29 to May 13.	Apr. 29

SEARCHLIGHT SECTION

Official Proposal Announcements

Price, $2.40 an inch.—Copy can be received until
Thursday 10 a. m. for issue mailed the next morning

Bids open July 10, 12 and 14, 1916.

OFFICE OF THE STATE COMMISSION OF HIGHWAYS

ALBANY, N. Y.

Sealed proposals will be received by the undersigned at their office, No. 55 Lancaster Street, Albany, N. Y., at 1 o'clock p. m., on Monday, the 10th day of July, 1916, for the construction of highways in the following counties:

Albany (two highways—0.17 and 0.88).
Cattaraugus (approx. 4.73).
Cayuga (approx. 4.39).
Chautauqua (approx. 4.33).
Chemung (approx. 4.14).
Chenango (approx. 7.09).
Clinton (approx. 10.46).
Dutchess (approx. 0.56).
Essex (approx. 1.76).
Fulton (approx. 5.13).
Greene (approx. 2.39).
Herkimer (approx. 5.10).
Madison (approx. 6.54).
Monroe (approx. 2.92).
Nassau (approx. 5.24).
Oneida (approx. 6.15).
Otsego (approx. 8.13).
Saratoga (approx. 6.10).
Wayne (approx. 3.67).
Westchester (approx. 1.74).
Also for the repair of the following:
Erie (one contract—surface treatment).
Fulton (one contract—resurfacing).
Nassau (one contract—resurfacing).
St. Lawrence (one contract—resurfacing)
Ulster (one contract—resurfacing).

Sealed proposals will also be received at 1 o'clock p. m., on Wednesday, the 12th day of July, 1916, for the construction of the following highways:

Albany (two highways—3.23 and 5.62).
Cattaraugus (approx. 2.17).
Cayuga (approx. 3.89).
Chautauqua (approx. 0.74).
Chenango (approx. 2.91).
Essex (approx. 4.95).
Fulton (two highways—2.90 and 1.10).
Genesee (approx. 7.60).
Madison (approx. 5.65).
Monroe (approx. 7.93).
Nassau (approx. 3.09).
Oneida (approx. 5.74).
Oswego (approx. 0.36).
St. Lawrence (two highways—0.44 and 4.60).
Steuben (approx. 5.76).
Wayne (two highways—3.97 and 2.25).
Also for the repair of the following:
Dutchess (one contract—resurfacing).
Erie (one contract—resurfacing).
Monroe (one contract—resurfacing).
Niagara (one contract—resurfacing).
Westchester (one contract—resurfacing).

Sealed proposals will also be received at 1 o'clock p. m., on Friday, the 14th day of July, 1916, for the construction of the following highways:

Albany (approx. 2.93).
Chautauqua (two highways—5.65 and 3.90).
Chenango (approx. 0.82).
Fulton (two highways—2.80 and 3.74).
Genesee (approx. 7.94).
Herkimer (approx. 5.67).
Madison (approx. 0.91).
Monroe (two highways—3.69 and 5.27).
Nassau (approx. 3.38).
Niagara (approx. 2.38).
Onondaga (approx. 5.55).
Oswego (approx. 2.04).
Otsego (approx. 7.87).
St. Lawrence (approx. 11.16).
Ulster (approx. 2.73).
Wayne (two highways—1.88 and 6.41).
Westchester (approx. 2.74).
Also for the repair of the following:
Cattaraugus (one contract—resurfacing and surface treatment).
Delaware (one contract—surface treatment).
Erie (one contract—resurfacing).
Nassau (one contract—resurfacing).

Maps, plans, specifications and estimates may be seen and proposal forms obtained at the office of the Commission in Albany, N. Y., and also at the office of the division engineers in whose division the roads are to be improved. The addresses of the division engineers and the counties in which they are in charge will be furnished on request.

The especial attention of bidders is called to "GENERAL INFORMATION OF BIDDERS" on the itemized proposal, specifications and contract agreement.

EDWIN DUFFEY,
Commissioner.
I. J. MORRIS,
Secretary.

Bids open July 5, 1916.

NOTICE TO CONTRACTORS.

STATE OF MARYLAND, STATE ROADS COMMISSION

601 GARRETT BUILDING,
BALTIMORE, MD.

Sealed proposals for building eight sections of State Highway aggregating about 28.83 miles in length and three bridges, as follows:

Contract No. A-13—Allegany County: One section of National Pike between Green Ridge and west side of Polish Mountain, about 5.00 miles in length. (Macadam construction, oil bound.)

Contract No. B-25—Baltimore County: One section of Liberty Road from north branch of Patapsco River to Harrisonville, about 3.00 miles in length. (Concrete roadway.)

Contract No. Co-17—Caroline County: One section of State Road through Preston, about 0.47 of a mile in length. (Concrete roadway.)

Contract No. Ch-13—Charles County: One section of State Road between Wayside and Faulkner, about 5.66 miles in length. (Gravel construction.)

Contract No. D-10—Dorchester County: One section of State Road between Linkwood and Salem, about 4.40 miles in length. (Concrete or macadam.)

Contract No. Ho-10—Howard County: One section of Clarksville Pike from city limits of Ellicott City to improved section, about 2.00 miles in length. (Macadam resurfacing, oil bound.)

Contract No. Ho-11—Howard County: Bridges: Re-erecting on new concrete abutments two steel bridges and the construction of one new concrete bridge, all located on the Clarksville Pike between Ellicott City and Elioak.

Contract No. F-18-B—Frederick County: One section of Emmitsburg Pike from end of Section "A" to Emmitsburg, about 4.50 miles in length. (Macadam resurfacing, oil bound.)

Contract No. S-7—Somerset County: One section of State Road between Westover and Pocomoke, about 3.80 miles in length. (Concrete roadway.)
—will be received by the State Roads Commission, at its office, 601 Garrett Building, until 12 m. on the 5th day of July, 1916, at which time and place they will be publicly opened and read.

Bids must be made upon the blank form contained in the book of specifications. Specifications and plans will be furnished by the Commission upon application and cash payment of $1.00, as hereafter no charges will be permitted.

No bids will be received unless accompanied by a certified check for the sum of five hundred ($500) dollars, payable to the State Roads Commission.

The successful bidder will be required to give bond and comply with the Acts of the General Assembly of Maryland respecting contracts.

The Commission reserves the right to reject any and all bids.

By order of the State Roads Commission this 9th day of June, 1916.

F. H. ZOUCK, Chairman.
WM. L. MARCY, Secretary.

Bids open June 27, 1916.

NOTICE TO CONTRACTORS.

STATE OF MARYLAND, STATE ROADS COMMISSION

601 GARRETT BUILDING,
BALTIMORE, MD.

Sealed proposals for building five section of State Highway aggregating about 21.40 miles in length, as follows:

Contract No. A. A. 8—Anne Arundel County: One section of State Road between Mt. Zion and Hills Bridge, about 6.00 miles in length. (Gravel or concrete.)

Contract No. B-23—Baltimore County: One section of York Road from Verona to Hereford, about 3.07 miles in length. (Macadam resurfacing, oil bound.)

Contract No. F-18-A—Frederick County: One section of Emmittsburg Pike from Thurmont to beginning of Section "B," about 4.00 miles in length. (Macadam resurfacing, oil bound.)

Contract No. T-9—Talbot County: One section of State Road between Stumptown and Trappe, about 5.00 miles in length. (Concrete roadway.)

Contract No. Wo-14—Worcester County: One section of State Road between Pocomoke and the Virginia State line, about 3.33 miles in length. (Concrete roadway.)
—will be received by the State Roads Commission, at its offices, 601 Garrett Building, Baltimore, Maryland, until 12 m. on the 27th day of June, 1916, at which time and place they will be publicly opened and read.

Bids must be made upon the blank form contained in the book of specifications. Specifications and plans will be furnished by the Commission upon application and cash payment of $1.00, as hereafter no charges will be permitted.

No bids will be received unless accompanied by a certified check for the sum of five hundred ($500) dollars, payable to the State Roads Commission.

The successful bidder will be required to give bond and comply with the Acts of the General Assembly of Maryland respecting contracts.

The Commission reserves the right to reject any and all bids.

By order of the State Roads Commission this 9th day of June, 1916.

F. H. ZOUCK, Chairman.
WM. L. MARCY, Secretary.

Bids open July 4, 1916.

TENDERS FOR SUPPLY OF ASPHALT

WINNIPEG, MAN., CANADA.

Sealed tenders, addressed to the Chairman, Board of Control, will be received at the office of the undersigned up to 10 a. m. on Tuesday, July 4, 1916, for the supply of 250 tons of refined asphalt.

Specifications and form of tender, together with conditions governing tenders as prescribed by by-law, may be obtained at the office of the City Engineer, 223 James Avenue.

The lowest or any tender not necessarily accepted.

M. PETERSON,
Secretary.

Board of Control Office, Winnipeg, June 15, 1916.

Bids open July 6, 1916.

GRAVEL ROAD

CORINTH, MISS.

Corinth to the Gulf Road District will, on July 6, 1916, at 2 o'clock p. m., at Corinth, Miss., let contract for building 15 miles of gravel road. Address

W. C. SWEAT, Attorney.

Bids open June 26, 1916.

OFFICE OF THE STATE COMMISSION OF HIGHWAYS

ALBANY, N. Y.

Sealed proposals will be received by the undersigned at their office, No. 55 Lancaster Street, Albany, N. Y., at 1 o'clock p. m., on Monday, the 26th day of June, 1916, for the construction of highways in the following counties:

Hamilton (one highway—approx. 4.22 mi.).
Otsego (one highway—approx. 12.66 mi.).
Wyoming (one highway—approx. 3.52 mi.).

ALSO FOR THE REPAIR OF THE FOLLOWING

Albany (two contracts—concrete pavement and resurfacing).
Cayuga (two contracts—resurfacing).
Cortland (two contracts—resurfacing).
Delaware (one contract—resurfacing).
Essex (one contract—surface treatment).
Herkimer (one contract—resurfacing).
Livingston (one contract—resurfacing).
Montgomery (two contracts—resurfacing and surface treatment).
Niagara (one contract—resurfacing).
Oneida (one contract—resurfacing).
Onondaga (six contracts—resurfacing and surface treatment).
Rensselaer (two contracts—resurfacing).
Sullivan (one contract—resurfacing).
Westchester (one contract—surface treatment).

And also for the furnishing and delivering of broken stone for maintenance work on Road No. 766 and 5187, known as BROKEN STONE ÇONTRACT No. 70, Essex County.

Maps, plans, specifications and estimates may be seen and proposal forms obtained at the office of the Commission in Albany, N. Y., and also at the office of the Division Engineers in whose division the roads are to be improved. The addresses of the division engineers and the counties in which they are in charge will be furnished on request.

The special attention of bidders is called to "GENERAL INFORMATION FOR BIDDERS" in the itemized proposal specifications and contract agreement.

EDWIN DUFFEY,
Commissioner.
I. J. MORRIS,
Secretary.

Bids open July 6, 1916.

STREET IMPROVEMENTS

GREENVILLE, N. C.

Sealed proposals will be received by the Mayor and Board of Aldermen of the Town of Greenville, N. C., at the Town Hall, in Greenville, N. C., until 3 p. m., July 6, 1916, for street improvements.

The work will consist of about:
30,000 sq. yd. of brick, asphalt, bitulithic, or other pavement.
25,000 lin. ft. of granite curb.
20,000 lin. ft. of concrete gutter.
1,000 sq. yd. of sidewalk.
And the necessary drainage, etc.

Proposals must be marked, "Proposal for Street Improvement."

All bids must be upon blank forms provided in the proposal and contract and specifications.

Each bid must be accompanied by a certified check for $2,000 as evidence of good faith.

Plans and specifications will be on file at the Clerk's office in Greenville, and at the office of the Engineer in Durham, N. C.; and copies of the specifications, form of proposal, etc., will be mailed upon application to the Engineer of Durham, N. C.

The right is reserved to reject any or all bids.

ALBION DUNN, Mayor.
J. C. TYSON, Clerk.
Engineer:
GILBERT C. WHITE,
Durham, N. C.

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